Documents of the World Maritime Administrative Radio Conference (WMARC-74)

(Geneva, 1974)

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INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 101-E
26 February 1974
Original : French
English
Spanish

PLENARY MEETING

Note by the Secretary-General

IMPLEMENTATION OF THE PROVISIONS OF RESOLUTION No. MAR 8 OF THE WORLD ADMINISTRATIVE MARITIME RADIO CONFERENCE, GENEVA, 1967, RELATING TO THE NOTIFICATION OF SHIP STATION FREQUENCIES USED FOR NARROW-BAND DIRECT-PRINTING TELEGRAPH AND DATA TRANSMISSION SYSTEMS

Annexed hereto is a copy of a memorandum prepared by the International Frequency Registration Board for submission to the Maritime Conference.

M. MILI

Secretary-General

Annex : 1

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ANNEX

MEMORANDUM
BY THE INTERNATIONAL FREQUENCY REGISTRATION BOARD

Implementation of the provisions of Resolution No. Mar 8 of the World Administrative Maritime Radio Conference, Geneva, 1967, relating to the notification of ship station frequencies used for narrow-band direct-printing telegraph and data transmission systems.

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1. In Resolution No. Mar 8, the World Administrative Maritime Radio Conference, Geneva, 1967, decided that, pending a decision by a future Conference to regulate the use of frequencies in the HF bands which it had reserved for the transmission of direct-printing telegraph signals by ship stations, the frequencies to be used by ship stations participating in that service should be notified to the I.F.R.B. for recording in the Master International Frequency Register. It specified that the notices concerning frequencies used for reception by coast stations would not be subject to technical examination by the I.F.R.B. and that the assignments notified would be recorded in the Master Register for information only, bearing no date in Column 2, but with a suitable remark in the Remarks Column referring to Resolution No. Mar 8.

2. This procedure does not appear to have posed any difficulty for administrations. The Board, recalling that Resolution No. Mar 8 applies solely to the bands reserved for ship stations, has no particular comment to make to the Conference on the subject.

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3. The bands which were reserved for these systems by the 1967 Maritime Conference were released on 1 July 1969 and administrations were invited to transfer existing systems to these new bands as from that date and not later than 31 October 1969 (see Resolution No. Mar 12 and I.F.R.B. Circular-letter No. 216 dated 9 June 1969).

4. On 31 December 1973 the Master Register contained 318 entries relating to frequencies used for reception by coast stations in the bands in question recorded on behalf of 19 administrations.

5. A relevant extract from the Master Register will be made available to the Conference.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 102-E
26 February 1974
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PLENARY MEETING

Note by the Secretary-General

IMPLEMENTATION OF RESOLUTIONS Nos. MAR 10, MAR 11 AND MAR 12 OF THE WORLD ADMINISTRATIVE MARITIME RADIO CONFERENCE, GENEVA, 1967, RELATING TO THE IMPLEMENTATION OF THE NEW ARRANGEMENT OF RADIOTELEGRAPH AND RADIOTELEPHONE BANDS BETWEEN 4 000 AND 27 500 kHz ALLOCATED TO THE MARITIME MOBILE SERVICE

Annexed hereto is a copy of a memorandum prepared by the International Frequency Registration Board for submission to the Maritime Conference.

M. MILI
Secretary-General

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ANNEX

MEMORANDUM BY THE INTERNATIONAL FREQUENCY REGISTRATION BOARD

Implementation of Resolutions Nos. Mar 10, Mar 11 and Mar 12 of the World Administrative Maritime Radio Conference, Geneva, 1967, relating to the implementation of the new arrangement of radiotelegraph and radiotelephone bands between 4000 and 27 500 kHz allocated to the Maritime Mobile Service.

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1. In Resolution No. Mar 12, the World Administrative Maritime Radio Conference, Geneva, 1967, fixed a time schedule for implementation of the measures it had adopted in connection with the rearrangement of the HF bands allocated exclusively to the Maritime Mobile Service.

2. In Resolutions Nos. Mar 10 and Mar 11, the 1967 Maritime Conference specified the procedure to be applied by administrations and by the I.F.R.B. to the frequency assignments affected by these decisions. This procedure required that notices of such frequency changes should reach the Board within a period not exceeding 90 days.

3. To help administrations implement the decisions of the Conference as fully as possible and within the prescribed time limits, the Board has sent several Circular-letters, as each stage approached, giving the required details on the various operations to be carried out (see I.F.R.B. Circular-letters Nos. 232 and 235 of 10 January 1970 and 10 February 1970 respectively.

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4. Generally speaking, the Board considers that the various stages in the rearrangement of the frequency bands listed in Appendix 15 to the Radio Regulations have proceeded satisfactorily and that the result may be regarded as a success for the Union. Thus, for the bands affected by Resolutions Nos. Mar 10 and Mar 11, the Board received notices of the transfer of about 95% of the assignments entered in the Master Register. In spite of the despatch of quite a number of reminders, there were on 31st December 1973, 193 assignments recorded on behalf of 14 administrations which still appeared in the Master Register and whose transfer has not been notified to the Board: 51 on behalf of 9 administrations in the bands covered by Resolution No. Mar 10 and 142 on behalf of 12 administrations in the bands covered by Resolution No. Mar 11. In accordance with the provisions adopted by the Conference (see paragraphs 5 and 7 of Resolution No. Mar 10 and paragraphs 7 and 9 of Resolution No. Mar 11), those assignments which bore dates in column 2a, had had their date transferred to column 2b, and all bear the symbols RES MAR 10 or RES MAR 11 in the Remarks Column. The Board was only able to arrive at these satisfactory results by allowing, in the interest of all Members of the Union, a slight extension of the time limits fixed by the Conference; otherwise almost half of the assignments concerned would have lost their previous status.

5. In applying the provisions on the rearrangement of frequency bands, the Board encountered a few difficulties :

5.1 The U.S.S.R. Administration, referring to Resolution No. Mar 10, sent the Board notices of the transfer of the frequency assignments used in the U.S.S.R. and Ukraine by fixed

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service stations under the terms of Nos. 209, 211 and 213 of the Radio Regulations. It will be noted, however, that in Resolution No. Mar 10 the 1967 Maritime Conference was concerned with the rearrangement of bands allocated exclusively to the Maritime Mobile Service and did not envisage the transfer of stations belonging to other services.

5.1.1 After a thorough study of the question, the Board came to the conclusion that the transfer of the other stations operating in these bands, particularly the fixed service stations which may use relatively high powers under the terms of No. 213 of the Regulations, could only contribute to the success of the rearrangement of the frequency bands allocated exclusively to the Maritime Mobile Service as decided by the 1967 Conference.

5.1.2 In view of this, the Board agreed that a procedure analogous to the one described in paragraph 4 of Resolution No. Mar 10 for coast radiotelegraph stations should be applied to notices of the transfer of assignments to fixed service stations, and it took the necessary steps to deal in this way with the 51 notices received from the U.S.S.R. Administration concerning the transfer of frequency assignments to fixed stations in the U.S.S.R. and Ukraine. A few of the notices related to assignments operating in accordance with No. 115 of the Regulations. However, in so doing, the Board had to take account of the special case of those frequency assignments which are in the 8, 12 and 16 MHz bands, since the portions of the spectrum mentioned in No. 213 of the Regulations do not include those to which the coast radio-

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telegraph stations operating in the 8, 12 and 16 MHz bands were transferred in pursuance of Resolution No. Mar 10. The Board, however, noted that the general situation in these bands would be improved if the total bandwidth in which the fixed service is authorized in each of the 8, 12 and 16 MHz bands were considered to be divided up as follows :

8 MHz band (200-kHz)	:	8459.5 - 8476 kHz, 8615 - 8728.5 kHz and 8745 - 8815 kHz
12/13 MHz band (275-kHz)	:	12688.5 - 12711 kHz, 12925 - 13107.5 kHz and 13130 - 13200 kHz
16/17 MHz band (200 - kHz)	:	16917 - 16952 kHz, 17160 - 17255 kHz and 17290 - 17360 kHz.

5.1.3 The Board concluded that a distribution of this kind would not change the situation for either of the services concerned. As a conservatory measure, it therefore maintained in the Master Register the status already granted to the assignments which the U.S.S.R. Administration had notified in these bands under No. 213 of the Radio Regulations and the transfer of which it had notified with reference to Resolution No. Mar 10.

5.1.4 Nevertheless, the Board considers that it would be advisable for the provisions of No. 213 of the Radio Regulations to be considered by the Conference.

5.2 As mentioned in paragraph 4 above, 51 frequency assignments to coast radiotelegraph stations in the portions of the spectrum covered by Resolution No. Mar 10 were retained in the Master Register on their former frequencies because their transfer in accordance with that Resolution had not been notified by the administrations concerned. The provisions in paragraphs 5 and 7 of Resolution No. Mar 10 with regard to these assignments are identical with the provisions in para-

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graphs 7 and 9 of Resolution No. Mar 11 concerning coast radiotelephone stations. These provisions require the transfer, where necessary, to Column 2b of the date entered in Column 2a for the original entry which has not been transferred and the insertion in the Remarks Column of the Master Register of a special remark, indicating, interalia, that any finding originally reached, is not valid any more. It should be noted, however, that the case of frequency assignments to coast radiotelegraph stations is substantially different from that of coast radiotelephone stations. The latter continue to operate in a band reserved for them by virtue of No. 448 of the Regulations, but they are not in conformity with Appendix 17, whereas frequency assignments to coast radiotelegraph stations which have not been transferred in accordance with Resolution No. Mar 10 operate outside the bands reserved for them under No. 453 of the Regulations.

The Board therefore feels that it should draw the attention of the Conference to the need to define more exactly the status of these assignments in the Master Register.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 103-E
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English
Spanish

PLENARY MEETING

Note by the Secretary-General

IMPLEMENTATION OF THE PROVISIONS OF RESOLUTION No. MAR 14 OF THE WORLD ADMINISTRATIVE MARITIME RADIO CONFERENCE, GENEVA, 1967, RELATING TO THE CHANNEL SPACING OF TRANSMITTING FREQUENCIES FOR THE BAND 156 - 174 MHz FOR RADIOTELEPHONY IN THE INTERNATIONAL MARITIME MOBILE SERVICE

Annexed hereto is a copy of a memorandum prepared by the International Frequency Registration Board for submission to the Maritime Conference.

M. MILI
Secretary-General

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ANNEX

MEMORANDUM BY THE INTERNATIONAL FREQUENCY REGISTRATION BOARD

Implementation of the provisions of Resolution No. Mar 14 of the World Administrative Maritime Radio Conference, Geneva, 1967, relating to the channel spacing of transmitting frequencies for the band 156 - 174 MHz for radiotelephony in the International Maritime Mobile Service.

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1. In Resolution No. Mar 14, the World Administrative Maritime Radio Conference, Geneva, 1967, fixed a time schedule for the transition from 50 kHz spacing between the radiotelephone channels listed in Appendix 18 to the Radio Regulations to 25 kHz spacing with a view to bringing into service on an international basis as from 1 January 1983 the new channels 15, 17 and 60 to 88 in Appendix 18 to these Regulations. The time schedule, comprising two major stages, extends from 1 January 1972 to 1 January 1983.

2. The date 1 January 1973 represented a decisive stage in the schedule since by that date administrations should have taken in particular the necessary steps to complete the modification of coast and ship station transmitters enabling them to operate with a maximum deviation of ± 5 kHz. In its Circular-letter No. 281 of 20 November 1972 the Board gave administrations detailed information on the various measures to be taken by 1 January 1973 in order to comply with the decisions of the Conference, particularly those

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set out in Resolution No. Mar 14. It stated further that, in view of the changes introduced in the stations in implementation of the Resolution, it considered that the information recorded in Column 7 of the Master International Frequency Register opposite entries relating to the transmitting and receiving frequencies of coast stations should be replaced by the symbol "16F3" (necessary bandwidth: 16 kHz).

3. To date, however, very few administrations have notified the Board of these modifications. As it does not, therefore, have sufficient information to inform the Conference of the progress made in implementing the decisions, the Board has undertaken an enquiry to ascertain how matters actually stand.

4. Two administrations have already notified the bringing into use of frequency assignments in the new channels with 25 kHz spacing (60 to 88). These have been recorded in the Master International Frequency Register with the symbol "RES MAR 14" in the Remarks Column.

INTERNATIONAL TELECOMMUNICATION UNION
MARITIME CONFERENCE
GENEVA, 1974

Document No. 104-E
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English
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PLENARY MEETING

Note by the Secretary-General

IMPLEMENTATION OF THE PROVISIONS OF RESOLUTIONS Nos. MAR 19 AND MAR 20 OF THE WORLD ADMINISTRATIVE MARITIME RADIO CONFERENCE, GENEVA, 1967, CONCERNING THE USE OF FREQUENCY BANDS DESIGNATED FOR OCEANOGRAPHIC DATA TRANSMISSIONS

Annexed hereto is a copy of a memorandum prepared by the International Frequency Registration Board for submission to the Maritime Conference.

M. MILI
Secretary-General

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ANNEX

MEMORANDUM BY THE INTERNATIONAL FREQUENCY REGISTRATION BOARD

Implementation of the provisions of Resolutions Nos. Mar 19 and Mar 20 of the World Administrative Maritime Radio Conference, Geneva, 1967, concerning the use of frequency bands designated for oceanographic data transmissions.

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1. In Resolution No. Mar 20, the World Administrative Maritime Radio Conference, Geneva, 1967, invited the Intergovernmental Oceanographic Commission (I.O.C.) and the World Meteorological Organization (W.M.O.) to develop jointly, in consultation with the I.F.R.B. and in consultation with administrations of the Members and Associate Members of the Union, as appropriate, a coordinated plan designed to meet existing and future requirements of all interested Members and Associate Members. Such a plan is intended to permit stations in the collection of data relating to oceanography in a world-wide system to operate within the framework of provisions made by the Conference. It further invited the I.O.C. and the W.M.O. to assume jointly the responsibility, in consultation with the I.F.R.B., for keeping such a plan current, in the light of changing requirements for data relating to oceanography. Finally, the Conference decided that the aforementioned plan should be considered at the next Administrative Radio Conference competent to deal with matters relating to the Maritime Mobile Service, to determine what changes, if any, appear necessary to improve its effectiveness.

2. Pursuant to this resolution, the Intergovernmental Oceanographic Commission and the World Meteorological Organization set up a Joint Group of Experts on Telecommunications to establish the plan envisaged by the Maritime Conference of 1967.

3. This Group, in the work of which the I.F.R.B. has closely participated, held two meetings, the first in Geneva in September 1968 and the second in Paris in January 1969. The report containing the recommendations by this Group was submitted in February 1969 to a joint session, held in Geneva, of the I.O.C. Working Committee for an Integrated Global Ocean Station System and the W.M.O. Executive Committee Panel on Meteorological Aspects of Ocean Affairs.

4. The conclusions reached at the joint I.O.C./W.M.O. session can be summed up as follows:

4.1 The joint session recognized that it was not yet possible to establish a long-term coordinated plan, as such a plan should be based on requirements which were not yet known in full and, on the other hand, the development of detailed technical characteristics should also be awaited.

4.2 Consequently, the joint session examined the broad outline of the basic principles to serve in the preparation of a coordinated plan which were proposed by the Joint I.O.C./W.M.O. Group of Experts on Telecommunications, but considered that before any final conclusion could be reached on the basic principles, some time was necessary to enable the countries, Members of the I.O.C. and of the W.M.O., to study them and to submit comments thereon.

4.3 The joint session recognized further that it was essential in the meantime to establish a procedure which, during the interim period, would enable countries which so wished to use frequencies in the bands designated for oceanographic data transmissions as soon as they became available, i.e. from 1 July 1969.

4.4 For this purpose, it adopted a provisional procedure under which the countries wishing to use the frequencies in question should first notify their requirements to the I.O.C. and W.M.O. Secretariats which were responsible for coordinating requirements amongst the countries concerned. It was not until they had been informed by these bodies that coordination had been successfully effected that the countries concerned could bring the frequencies into use and notify them to the I.F.R.B. for recording in the Master Register.

5. In its Circular-letter No. 217 of 13 June 1969 the I.F.R.B. brought these conclusions to the attention of the Members of the I.T.U. The Board had previously reminded administrations that the frequency bands which the Maritime Conference of 1967 had decided to designate for oceanographic data transmissions would become available on 1 July 1969 (see I.F.R.B. Circular-letter No. 216 of 9 June 1969).

6. The Joint I.O.C./W.M.O. Group of Experts on Telecommunications held two further meetings, in the spring of 1970 and at the end of 1972, at which it considered the progress made in the use of bands and reviewed the activities of the I.O.C. and W.M.O. Secretariats concerning the coordinated use, during the interim period, of the frequencies designated for oceanographic data transmissions. It also examined the technical characteristics and principles to serve as a basis for the long-term integrated plan in the light of the comments received from the Member countries of the I.O.C.and W.M.O.

7. In Resolution No. Mar 19, the Maritime Conference, Geneva 1967, instructed the I.F.R.B. to accept for recording in the Master International Frequency Register only the notifications relating to land-based oceanographic stations and which were in conformity with the provisions of Resolution No. Mar 20. Since the I.O.C. and the W.M.O. recognized that for the time being it was impossible to establish a long-term coordinated plan, the Board considered that the notices relating to frequency assignments in the bands concerned, which had been dealt with under the interim coordination procedure described above could, for the purposes of the implementation of Resolution No. Mar 19, be regarded as being in conformity with Resolution No. Mar 20.

8. The Board did not therefore proceed to record such assignments in the Master Register until it had ascertained that they had been the subject of a request addressed to the W.M.O. Secretariat and that their use had been successfully coordinated. These assignments were processed under No. 505 of the Radio Regulations, which is to say that the Board did not consider the question of the probability of harmful interference to the assignments of any administration with which coordination had been effected.

9. It is to be noted that only a few administrations have so far notified to the Board the bringing into use of such frequency assignments although at least nineteen countries have, to its knowledge, sent requests to the I.O.C. and W.M.O. Secretariats under the interim coordination procedure. It is possible that some of the coordinated uses may become effective in a more or less distant future only. However, the relatively small number of notifications received by the I.F.R.B. may be attributable also to inadequate coordination at national level among the competent authorities in the various fields of meteorology, oceanography and telecommunication since the submissions of requests for coordination to the I.O.C. and W.M.O. Secretariats became the responsibility of the national authority for matters connected with oceanography or meteorology, whereas the notification of the bringing into use of a frequency to the I.F.R.B. is the responsibility of the telecommunication administration of the country concerned.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 105-E
28 February 1974
Original : English

Republic of Singapore

PROPOSAL FOR THE WORK OF THE CONFERENCE

FREQUENCY REQUIREMENTS TO BE INCLUDED IN THE REVISED APPENDIX 25 TO THE RADIO REGULATIONS

Singapore's frequency requirements are shown in the annexed Table.

Annex : 1

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ANNEX

PROPOSAL FOR THE WORK OF THE CONFERENCE

FREQUENCY REQUIREMENTS TO BE INCLUDED IN THE REVISED APPENDIX 25 TO THE RADIO REGULATIONS

Frequency Band and Requirement No.	Country or Area in which coast stations will be located	Location of coast station (s)	Locality(ies) or area(s) with which communication is required	Max. length of circuit (km)	Nature of Service	Class of Emission necessary bandwidth and description transmission	Power of Pp.	Maximum hours of operation of the circuit to each locality or area (GMT)	Frequency now in use (Assigned Frequency)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			4 MHz - Two frequency operation						
4 MHz No. 1	Singapore	Singapore	Indian Ocean China Sea	8000	CP	2.8A3A/J 2.8A3H	5 7	24 hrs.	4 366.1 kHz Present frequency
4 MHz No. 2	Singapore	Singapore	Java Sea Indian Ocean China Sea	8000	CP	2.8A3A/J	5	24 hrs.	4 378.8 kHz Present frequency
6 MHz	Singapore	Singapore	Java Sea Indian Ocean China Sea	8000	CP	2.8A3H 2.8A3A/J 2.8A3H	2 5 7	24 hrs.	6 523.2 kHz Present frequency
8 MHz No. 1	Singapore	Singapore	Java Sea Indian Ocean China Sea	8000	CP	2.8A3A/J 2.8A3H	5 7	24 hrs.	8 752.6 kHz Present frequency
8 MHz No. 2	Singapore	Singapore	Java Sea Indian Ocean South China Sea	8000	CP	2.8A3A/J 2.8A3H	5 2	24 hrs.	8 759.0 kHz Present frequency
8 MHz No. 3	Singapore	Singapore	Java Sea Indian Ocean China Sea	8000	CP	2.8A3A/J 2.8A3H	5 7	24 hrs.	8 800.6 kHz Present frequency
12 MHz No. 1	Singapore	Singapore	Java Sea Indian Ocean Red Sea	8000	CP	2.8A3A/J	5	24 hrs.	13 113.9 kHz
12 MHz No. 2	Singapore	Singapore	China Sea Java Sea Indian Ocean	8000	CP	2.8A3H 2.8A3A/J	2 5	24 hrs.	Present frequency 13 190.9 kHz
16 MHz No. 1	Singapore	Singapore	China Sea Indian Ocean Med Sea	10000	CP	2.8A3H 2.8A3H	7 5	24 hrs.	Present frequency 17 294.9 kHz
16 MHz No. 2	Singapore	Singapore	China Sea Indian Ocean Med Sea	10000	CP	2.8A3H 2.8A3A/J	2 5	24 hrs.	Present frequency 17 336.9 kHz
22 MHz	Singapore	Singapore	China Sea Japan Sea Indian Ocean Med Sea	10000	CP	2.8A3H 2.8A3A/J	7 5	24 hrs.	Present frequency 22 672.4 kHz

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 106-E
1 March 1974
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PLENARY MEETING

Belgium

PROPOSALS FOR THE WORK OF THE CONFERENCE

Document No. 22 is withdrawn.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 107-E
8 March 1974
Original : French
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PLENARY MEETING

Note by the Secretary-General

IMPLEMENTATION OF THE PROVISIONS OF RESOLUTION No. MAR 15 OF THE WORLD ADMINISTRATIVE MARITIME RADIO CONFERENCE, GENEVA, 1967, CONCERNING THE USE OF THE NEW HF CHANNELS MADE AVAILABLE TO MARITIME RADIOTELEPHONY FROM 1 MARCH 1970

Annexed hereto is a copy of a memorandum prepared by the International Frequency Registration Board for submission to the Maritime Conference.

M. MILI
Secretary-General

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ANNEX

MEMORANDUM BY THE INTERNATIONAL FREQUENCY REGISTRATION BOARD

Implementation of the provisions of Resolution No. Mar 15 of the World Administrative Maritime Radio Conference, Geneva, 1967, concerning the use of the new HF channels made available to maritime radiotelephony from 1 March 1970.

1. In Resolution No. Mar 15, the World Administrative Maritime Radio Conference, Geneva, 1967, stipulated the conditions governing the use of the new single sideband channels which it had decided to make available to maritime radiotelephony from 1 March 1970. For this purpose, it laid down an interim procedure to be applied by administrations and by the I.F.R.B. until the entry into force of the new allotment plan to be established, as indicated in Recommendation No. Mar 6. It instructed the I.F.R.B. to collect from administrations their requirements for the use of these new channels, to distribute these requirements among the new channels in accordance with the order of priority laid down in the Resolution and to communicate the distribution thus made to administrations at least six months before the channels were made available to maritime radiotelephony.

2. In I.F.R.B. Circular-letter No. 207 of 20 February 1969, the I.F.R.B. therefore requested administrations to submit their requirements, accompanied by all the necessary supporting material, to enable the Board to assess them in accordance with the priority criteria laid down by the Conference.

3. The resulting requirements received from 40 countries were published in I.F.R.B. Circular-letter No. 221 of 11 July 1969. Subsequently, three other administrations submitted requirements, which were also taken into consideration. The Board then proceeded with the distribution of all requirements in keeping with the instructions issued by the Conference in Resolution No. Mar 15, and taking into account the Master International Frequency Register as at 15 July 1969, the detailed material provided by some administrations to explain their requirements, its records on notified cases of harmful interference between coast radiotelephone stations and its studies undertaken since 1959 persuant to Note 2 of Appendix 25. Furthermore, for purposes of general information and guidance, it consulted the Radiocommunication Statistics published under No. 830 of the Radio Regulations and, in cases where they were incomplete, the shipping tonnage statistics in Lloyd's Register of Shipping for 1968 and 1960 (i.e., shortly after the adoption in 1959 of Appendix 25 by the Geneva Administrative Radio Conference).

4. On the whole, and subject to the restrictions indicated below, the Board has managed to meet a high proportion of the requirements submitted. In the first place, it has met the requirements of the few countries covered by the terms of paragraph 4.1 of Resolution No. Mar 15, namely those which, although having no allotment under Appendix 25 nor any frequency assignment recorded in the Master International Frequency Register in the relevant frequency band, were able to demonstrate an urgent need for frequencies for maritime radiotelephony in that band. However, allowing for the relatively small scale of shipping in these countries and for their generally low level of port activity, the Board, in order to ensure the rational use of the new channels, preferred in certain cases to distribute the requirements of a number of countries belonging to one and the same zone within a single channel.

4.1 Generally speaking, in view of their relatively limited number, the requirements which were submitted by countries outside the European and Mediterranean area and which were satisfied were distributed in fairly uncongested channels.

4.2 The large volume of requirements claimed by countries in the European and Mediterranean area, however, caused some difficulties owing to the limited number of channels available. Nevertheless, some of the countries in this area which submitted requests already had frequency assignments recorded in the Master Register in the frequency bands specified in Sections I and II of Appendix 25. After meeting the requirements submitted by some countries without a Plan allotment, the Board then gave satisfaction to the countries covered by paragraph 4.2 of Resolution No. Mar 15, giving first consideration to those whose coast stations had caused or, for some time, had suffered harmful interference, and particularly those whose traffic volume or shipping had substantially increased since 1960, and whose requirements could apparently no longer be met by frequency assignments recorded in the Master Register. Moreover, in the higher bands, in which more channels were available, the Board was able to give some satisfaction to other countries by less strict application of the criteria laid down by the Conference.

4.3 Finally, the Board was unable to meet all the requirements submitted by countries in the European and Mediterranean area. Therefore, for those countries which are listed in Section III of Appendix 25 MOD, a note is inserted drawing the attention of the administrations concerned to the need to conclude advance time-sharing agreements. The Board has taken cognizance of a number of agreements concluded directly by administrations in keeping with the suggestions made in the above-mentioned note. It was also requested by two administrations to assist in the conclusion of such agreements relating to the use of altogether seven radiotelephone channels. The Board has therefore approached the twelve other administrations concerned and the conclusion of the agreements concerned may be said to be in sight.

4.4 With regard to the 6 MHz band, the Board found it difficult to apply the provisions of paragraph 4 of Resolution No. Mar 15, since no reference to this band was contained in Appendices 17 and 25 to the Radio Regulations, Geneva, 1959. Hence, in view of certain opinions expressed at the Maritime Conference, 1967, the Board agreed to consider the single additional channel in the 4 MHz band (in addition to the calling channel) and the two channels in the new 6 MHz band (in addition to the calling channel) as forming a single group of channels, and it lumped together the requirements relating to the two bands by considering only one requirement per country.

4.5 Similarly, in each of the bands 8 MHz and 12 MHz, it was unable to consider more than one requirement per country owing to the limited number of channels available (four in the 8 MHz band and five in the 12 MHz band in addition to the calling channels).

4.6 On the other hand, since there were more channels available in the 16 MHz band and to a certain extent in the 22 MHz band, it was generally possible to give satisfaction to countries requesting more than one channel per band. These are the countries whose frequency assignments had caused or suffered a degree of harmful interference and whose traffic volume or shipping had substantially increased since 1960.

5. With regard to the technical provisions for frequency sharing, the Board largely took as its basis the tables contained in Sections I and II of Appendix 25 as adopted by the administrations in 1959. Concerning the probability of harmful interference between adjacent channels, it should be noted that according to the Technical Standards applied by the Board and in connection with classes of emission A3A and A3J, the receivers which should normally be

employed to receive the single sideband emissions described in Appendix 17A to the Radio Regulations create a discrimination effect of about 33 dB with regard to emissions made in one or other of the adjacent channels.

6. Administrations were informed of this distribution made by the Board in an annex to I.F.R.B. Circular-letter No. 223 of 29 August 1969. The Board subsequently received comments from two administrations which requested it to make some slight changes in the requirements which they had submitted. Further, the Board had in the meantime also received requirement submissions from two administrations which, however, did not reach it in time to be incorporated in the distribution. The Board concluded that it would be possible to satisfy the administrations concerned to a certain extent by a partial rearrangement of the distribution already made without departing from the principles laid down by the Maritime Conference, 1967, in Resolution No. Mar 15 and without any drastic alteration of this distribution. These changes were notified in I.F.R.B. Circular-letter No. 234 of 30 January 1970.

7. The distribution made by the I.F.R.B. is contained in Section III of Appendix 25 MOD to the Radio Regulations. By 31 December 1973 out of the 165 requirements met in the distribution made for 45 countries 115 had been confirmed by notices received from 34 administrations. The entries made in accordance with Section III break down as follows:

Band	Number of requirements met	Number of countries	Number of requirements confirmed	Number of assignments	Number of countries
4	11	10	8	10	7
6	21	19	14	40	12
8	27	27	19	28	19
12	32	30	20	32	19
16	43	34	31	64	23
22	31	28	23	38	21
Total	165		115		

Moreover, 10 administrations had notified the Board of the use of new channels without, however, having submitted requirements in accordance with Resolution No. Mar 15 or to meet requirements which had not been foreseen at the time of submission. These entries break down as follows:

Band	Number of assignments	Number of countries
4	1	1
6	16	6
8	3	2
12	4	3
16	5	4
22	4	3
Total	33	

8. In accordance with the instructions contained in paragraphs 7 and 8 of Resolution No. Mar 15, the Board has processed the notices relating to the frequencies in Section III of Appendix 25 MOD and the associated receiving frequencies under the provisions of Nos. 541 to 551 of the Radio Regulations "insofar as they refer to Section I of Appendix 25" and has determined the dates to be entered in Columns 2a or 2b of the Master Register under the provisions of Nos. 577 to 586 of the Radio Regulations. The frequency assignments made in conformity with the distribution in Section III and assignments relating to the associated receiving frequencies therefore bear the date of 3 December 1951 in Column 2a. Other assignments bear the date of receipt of the notice by the I.F.R.B. in Column 2b.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 108-E
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PLENARY MEETING

Note by the Secretary-General

IMPLEMENTATION OF RESOLUTION No. MAR 6 OF THE WORLD ADMINISTRATIVE MARITIME RADIO CONFERENCE, GENEVA 1967, ON THE INTRODUCTION OF SINGLE SIDEBAND TECHNIQUE IN THE HF RADIOTELEPHONE MARITIME MOBILE SERVICE

Annexed hereto is a copy of a memorandum prepared by the International Frequency Registration Board for submission to the Maritime Conference.

M. MILI
Secretary-General

Annex : 1

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ANNEX

MEMORANDUM BY THE INTERNATIONAL FREQUENCY REGISTRATION BOARD

Implementation of Resolution No. Mar 6 of the World Administrative Maritime Radio Conference, Geneva 1967, on the introduction of single sideband technique in the HF radiotelephone Maritime Mobile Service.

1. In its Resolution No. Mar 6, the World Administrative Maritime Radio Conference, Geneva 1967, defined various stages in the gradual replacement of double sideband by single sideband equipment in coast and ship radiotelephone stations.

1.1 cessation of double sideband emissions in coast stations as from 1 January 1972;

1.2 cessation of double sideband emissions in ship stations as from 1 January 1978. However, new installations of double sideband equipment in ship stations have not been permitted since 1 January 1972.

2. To encourage administrations to implement the decisions of the Conference as fully as possible within the prescribed time-limits, the Board first provided analytical and chronological digests of the main decisions of the Conference in I.F.R.B. Circular-letter No. 195 of 15 August 1968 and subsequently reminded Administrations of the action to be taken as each of these stages approached (see I.F.R.B. Circular-letters No. 211 of 14 March 1969, No. 230 of 22 December 1969 and No. 256 of 4 June 1971). The Board also indicated how administrations should notify the changes to be made to the entries made on their behalf in the Master International Frequency Register so as to reflect the implementation of these decisions (see I.F.R.B. Circular-letter No. 212 of 25 April 1969).

3. The frequency notices received by the Board concerning these changes have been dealt with according to No. 534 or No. 544 of the Radio Regulations, as appropriate. In principle they have not therefore entailed any change in the date recorded against the corresponding entries in Column 2a or Column 2b of the Master Register.

4. The Board believes it is able to indicate to the Conference the extent to which the decisions on the cessation of double sideband emissions in coast HF radiotelephone stations on 1 January 1972 have been applied. In fact, to facilitate the task of administrations in notifying the changes to be made to entries in the Master International Frequency Register in order to reflect the cessation of double sideband emissions in HF coast stations and their replacement by single sideband emissions, the Board sent to each administration concerned a tabulated extract from the Master Register showing all the entries appearing on its behalf relating to coast radiotelephone stations on 1 January 1972 in the frequency bands to which Resolution No. Mar 6 applies. Administrations were asked to return this extract to the Board after it had been duly brought up to date.

4.1 According to the replies which were received from administrations up to 31 December 1973 and which are reflected in the Master Register, the situation stands as shown below:

4.1.1 89 administrations have notified complete cessation of double sideband emissions in their HF coast radiotelephone stations;

4.1.2 34 administrations have not yet notified the Board of the cancellation of their entries concerning double sideband emissions. Several of these administrations have informed the Board that because of delays requested by manufacturers for delivery of the necessary equipment, they would be unable to keep to the time-limits fixed by the Conference for conversion of their stations to single sideband technique.

5. It should be noted in this connection that the Board drew the attention of all the administrations concerned to the fact that as from 1 January 1972, in the technical examination of frequency notices received from administrations, it could no longer regard an entry for class 6A3 in Column 7 with respect to an assignment recorded in the Master International Frequency Register as being in conformity with the provisions of the Radio Regulations and that the provisions of No. 611 would accordingly apply. On 31 December 1973, 742 entries with the symbol 6A3 in Column 7 remained in the Master Register in the bands in question out of a total of 2988, i.e. about 25%.

6. Generally speaking, it may be said that single sideband technique has been very widely introduced in HF coast radiotelephone stations and that this first stage of the schedule fixed by the Conference may be considered a success for the Union.

7. The Board believes it should draw the attention of the Conference to the following problems which have arisen with regard to the interpretation of certain provisions of the Radio Regulations relating to radiotelephony.

7.1 It is stated in No. 1351A of the Regulations that the classes of emission to be used in the Maritime Mobile Service bands are:

"a) class A3 or

b) class A3H, A3A and A3J."

7.1.1 It would therefore appear from these provisions that class of emission A3H should be notified during the transition period in all cases in which a frequency notice concerns single sideband emissions. No. 1351A.2, on the other hand, draws attention to the similar provisions in paragraph 7b of Appendix 17 to the Radio Regulations which concerns these bands and in which it is stated that "Until 1 January 1978, class A3H emissions (in accordance with No. 1351A) are permitted only on those carrier frequencies shown in Section B which are coincident with, or within 100 Hz of, the frequencies shown in Section A".

7.1.2 It follows from these provisions that class of emission A3H should in fact be used only when the carrier frequency of the single sideband emission coincides with the carrier (and centre) frequency of the former double sideband channel.

7.1. When the Board has had to deal with a notice indicating class of emission A3H for a frequency other than those mentioned above, it has drawn the attention of the notifying administration to the provisions of Appendix 17 to the Regulations and pointed out that failing notice to the contrary, it would deal with the notice concerned as if only class A3A and A3J emissions had been notified.

7.2 It is stipulated in No. 1351A.1 of the Radio Regulations that for the use of class A3B emissions in the bands between 4000 and 23,000 kHz, reference should be made to Resolution No. Mar 13, under which "the use of class A3B emissions ...., may continue to be authorized .... subject to agreements between administrations concerned and those whose services may be affected".

7.2.1 When the Board has had to deal with frequency notices mentioning class A3B, before proceeding to record the information in the Master Register,it has approached the administrations concerned for confirmation that the conditions laid down in Resolution No. Mar 14 were in fact met. Processing of the data relating to class A3B emissions was suspended pending receipt of replies from administrations. At present, no symbol A3B is entered in Column 7 of the Master Register in the frequency bands exclusively reserved for HF radiotelephone coast stations.

/KC/JB/sc
17.12.73

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

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PLENARY MEETING

Note by the Secretary-General

IMPLEMENTATION OF RESOLUTIONS Nos. MAR 4 AND MAR 5 OF THE WORLD ADMINISTRATIVE RADIO MARITIME CONFERENCE, GENEVA, 1967, CONCERNING THE INTRODUCTION OF THE SINGLE SIDEBAND TECHNIQUE IN THE RADIOTELEPHONE MARITIME MOBILE SERVICE OPERATING IN THE BANDS BETWEEN 1 605 AND 4 000 kHz

Annexed hereto is a copy of a memorandum prepared by the International Frequency Registration Board for submission to the Maritime Conference.

M. MILI
Secretary-General

Annex : 1

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ANNEX

MEMORANDUM BY THE INTERNATIONAL FREQUENCY REGISTRATION BOARD

Implementation of Resolutions Nos. Mar 4 and Mar 5 of the World Administrative Radio Maritime Conference, Geneva, 1967, concerning the introduction of the single sideband technique in the Radiotelephone Maritime Mobile Service operating in the bands between 1605 and 4000 kHz.

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1. In its Resolution No. Mar 5, the World Administrative Radio Maritime Conference, Geneva, 1967, defined various stages in the gradual replacement of double sideband by single sideband equipment in coast and ship radiotelephone stations. They are as follows:

1.1 complete cessation of double sideband emissions by coast stations as from 1 January 1975.

1.2 cessation of double sideband emissions by ship stations on 1 January 1982. The Conference decided, however, that no new installations of double sideband equipment in ship stations would be permitted as from 1 January 1973.

2. To encourage administrations to implement the decisions of the Conference as fully as possible within the prescribed time-limits, the Board, first provided analytical and chronological digests of the main decisions of the Conference in I.F.R.B. Circular-letter No. 195 of 15 August 1968 and subsequently reminded administrations of the action to be taken as each of these stages approached (see I.F.R.B. Circular-letters No. 201 of 28 November 1968, No. 211 of 14 March 1969 and No. 281 of 20 November 1972).

The Board also indicated how administrations should notify the changes to be made to the entries made on their behalf in the Master International Frequency Register so as to reflect the implementation of these decisions (see I.F.R.B. Circular-letter No. 212 of 25 April 1969).

3. The frequency notices received by the Board concerning these changes have been dealt with according to No. 534 of the Radio Regulations. In principle they have not therefore entailed any change in the date recorded against the corresponding entries in Column 2a or Column 2b of the Master Register.

4. Since 1 January 1975 was fixed as the completion date for the first stage so far as the MF bands were concerned, the information at present at the Board's disposal is not complete enough for it to be used to give the Conference precise indications of the progress made with respect to the frequency bands below 4000 kHz. By 31 December 1973, 44 administrations had sent notices concerning single sideband emissions in the frequency bands in question.

5. The Board believes it should draw the attention of the Conference to the following problems which have arisen with regard to the interpretation of certain provisions of the Radio Regulations relating to radiotelephony.

5.1 It is stated in No. 1322B of the Radio Regulations that the classes of emission to be used in the Maritime Mobile Service bands are:

"a) class A3 or

b) classes A3H, A3A and A3J".

5.1.1 It would therefore appear from these provisions that class of emission A3H should be notified during the transition period in all cases in which a frequency notice concerns single sideband emissions. However, paragraph 2 of Resolution No. Mar 4 specifies "that class A3H emissions shall not be used on single sideband channels in the lower part of previous double sideband channels". The Board likewise notes that No. 200 of the Radio Regulations does not provide for the use of class of emission A3H.

5.1.2 It follows from these provisions that class of emission A3H should, in fact, be used only when the carrier frequency of the single sideband emission coincides with the carrier (and centre) frequency of the former double sideband channel.

5.1.3 When the Board has had to deal with a notice indicating class of emission A3H for a frequency other than those mentioned above, it has drawn the attention of the notifying administration to the provisions of Resolution No. Mar 4 and has pointed out that the use of class of emission A3H on such a frequency could not be regarded as being in conformity with the Radio Regulations.

5.2 There seems to be some confusion in a number of administrations concerning the frequency to be entered in Column 1 of the notices concerning single sideband emissions. The Board has observed that, in many cases it is the carrier frequency of the emissions which has been notified. In the case of assignments in the bands covered by the provisions of Appendix 17 to the Radio Regulations, it was easy for the Board to detect likely errors, since these assignments were not in conformity with the frequencies listed in the table of Section B of that Appendix. On the other hand, in the bands between 1605 and 4000 kHz, the Board was not always in a position to detect such errors, particularly in the case of new assignments. Accordingly, some of the entries at present appearing in the Master Register in the frequency bands in question may not represent accurately the occupancy of the frequency spectrum.

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MARITIME CONFERENCE
GENEVA, 1974

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COMMITTEES 4 AND 5

Argentine Republic

PROPOSALS FOR THE WORK OF THE CONFERENCE

ARTICLE 5

Section IV.

Table of Frequency Allocations - 10 kHz to 275 GHz

ARG/110/1 (Rev) MOD

kHz

<table>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td colspan="3">4 063-4 438
MARITIME MOBILE
208 209 209A</td></tr>
</table>

ARG/110/2 (Rev) ADD 209A In addition to its normal use for call, reply and safety purposes, the frequency 4 136 kHz is used as an alternative radiotelephony frequency for distress purposes in the zone of Region 2 lying between the parallels 5° North and 57° South.

ARTICLE 28

ARG/110/3 (Rev) ADD 987A In the zone of Region 2 lying between the parallels 5° North and 57° South, all ship stations equipped with radiotelephony apparatus to work in the authorized bands between 4 000 and 27 500 kHz shall be able to send or receive class A3H or A3J emissions on a carrier frequency of 4 136 kHz. After 1 January 1978, they may no longer send class A3H emission.

ARG/110/4 (Rev) MOD 997 (1) In the bands between 4 000 and 27 500 kHz, be able to transmit with a carrier frequency of 8 364 kHz using class A2 or A2H emissions. If a receiver is provided for any of these bands, it shall be able to receive class A1, A2 and A2H emissions throughout the band 8 341.75 to 8 728.5 kHz.

(2) In addition, in the zone of Region 2 lying between the parallels 5° North and 57° South, a mobile survival craft station equipped with radiotelephony apparatus to work in the bands between 4 000 and 27 500 kHz shall be able to transmit with a carrier frequency of 4 136 kHz using class A3H or A3J emissions. If a receiver is provided for any of these bands, it shall be able to receive class A3H or A3J emissions on a carrier frequency of 4 136 kHz.

ARTICLE 33

ARG/110/5 (Rev) MOD 1251 In the zone of Region 2 lying between the parallels 5° North and 57° South, when a station is called on 4 136 kHz it should reply on the same frequency.

ARG/110/6 (Rev) ADD 1251B The provisions of Nos. 1249 and 1250 do not apply to communication between ship stations and coast stations using the simplex frequencies specified in Appendix 17, Section C.

ARTICLE 35

ARG/110/7 (Rev) ADD 1323A In the zone of Region 2 lying between the parallels 5° North and 57° South, when no reply is received to a distress message transmitted on the frequency 2 182 kHz, the same message shall be transmitted again on the frequency 4 136 kHz, preceded by emission of the alarm signal and the distress call.

ARG/110/8 (Rev) ADD 1332A In the zone of Region 2 lying between the parallels 5° North and 57° South, all coast stations which form part of the safety service for the zone shall, during their hours of service, maintain a permanent watch on 4 136 kHz.

ARG/110/9 (Rev) MOD 1352.1 In Region 2, the frequency 4 136 kHz is also authorized for common use by coast and ship stations for single sideband radiotelephony on a simplex basis, provided the peak envelope power of such stations does not exceed 1 kW (see also No. 1352A.2).

In the zone of Region 2 lying between the parallels 5° North and 57° South, the frequency 4 136 kHz is used in telephony as the distress frequency. It shall be used for that purpose by ships, coast stations and survival craft equipped with radiotelephony apparatus to work in the bands between 4 000 and 27 500 kHz. A distress call or distress traffic on the frequency 4 136 kHz shall use class A3H or A3J emissions (see 987A).

Reasons : 1) For propagation reasons and in view of the extensive coastline of South America, particularly the lengthy seaboard of Argentina, the frequency 2 182 kHz is inadequate for distress purposes.

2) The frequency 4 136 kHz having been proposed as an alternative frequency for 2 182 kHz for the reason given in 1), its use should not be ruled out for aircraft search and rescue operations. For this reason and because present day aircraft equipments generate frequencies by synthetizers which do not provide for decimal fractions, it is necessary to delete the three hundred Hz (300 Hz).

3) The dimensions of radiating systems using 4 000 kHz are more suitable than those using 2 000 kHz for most small vessels which have to use radiotelephony.

4) The long range equipment used in the maritime mobile service has been shown to give a better performance and have a greater sensitivity at 4 000 kHz than at 2 000 kHz; this is particularly important when considering distress requirements.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

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PLENARY MEETING

Argentine Republic

PROPOSALS FOR THE WORK OF THE CONFERENCE

ARTICLE 5

Section IV.

Table of Frequency Allocations - 10 kHz to 275 GHz

ARG/110/1 MOD

kHz

Region 1	Region 2	Region 3
4 063-4 438 MARITIME MOBILE 208 209 209A		

ARG/110/2 ADD 209A In addition to its normal use for call, reply and safety purposes, the frequency 4 136.3 kHz is used as an alternative radiotelephony frequency for distress purposes in the zone of Region 2 lying between the parallels 5° North and 57° South.

ARTICLE 28

ARG/110/3 ADD 987A In the zone of Region 2 lying between the parallels 5° North and 57° South, all ship stations equipped with radiotelephony apparatus to work in the authorized bands between 4 000 and 23 000 kHz shall be able to send or receive class A3H or A3J emissions on a carrier frequency of 4 136.3 kHz. After 1 January 1978, they may no longer send class A3H emission.

ARG/110/4 MOD 997 (1) In the bands between 4 000 and 27 500 kHz, be able to transmit with a carrier frequency of 8 364 kHz using class A2 or A2H emissions. If a receiver is provided for any of these bands, it shall be able to receive class A1, A2 and A2H emissions throughout the band 8 341.75 to 8 728.5 kHz.

(2) In addition, in the zone of Region 2 lying between the parallels 5° North and 57° South, a mobile survival craft station equipped with radiotelephony apparatus to work in the bands between 4 000 and 23 000 kHz shall be able to transmit with a carrier frequency of 4 136.3 kHz using class A3H or A3J emissions. If a receiver is provided for any of these bands, it shall be able to receive class A3H or A3J emissions on a carrier frequency of 4 136.3 kHz.

ARTICLE 33

ARG/110/5 MOD 1251A In the zone of Region 2 lying between the parallels 5° North and 57° South, when a station is called on 4 136.3 kHz it should reply on the same frequency.

ARG/110/6 ADD 1251B The provisions of Nos. 1249 and 1250 do not apply to communication between ship stations and coast stations using the simplex frequencies specified in Appendix 17, Section C.

ARTICLE 35

ARG/110/7 ADD 1323A In the zone of Region 2 lying between the parallels 5° North and 57° South, when no reply is received to a distress message transmitted on the frequency 2 186 kHz, the same message shall be transmitted again on the frequency 4 186.3 kHz, preceded by emission of the alarm signal and the distress call.

ARG/110/8 ADD 1332A In the zone of Region 2 lying between the parallels 5° North and 57° South, all coast stations which form part of the safety service for the zone shall, during their hours of service, maintain a permanent watch on 4 136.3 kHz.

ARG/110/9 MOD 1352.1 In Region 2, the frequency 4 136.3 kHz is also authorized for common use by coast and ship stations for single sideband radiotelephony on a simplex basis, provided the peak envelope power of such stations does not exceed 1 kW (see also No. 1352A.2).

At the same time, in the zone of Region 2 lying between the parallels 5° North and 57° South, the frequency 4 136.3 kHz is used in telephony as an additional distress frequency. It shall be used for that purpose by ships, coast stations and survival craft equipped with radiotelephony apparatus to work in the bands between 4 000 and 23 000 kHz. A distress call or distress traffic on the frequency 4 136.3 kHz shall use class A3H or A3J emissions (see 987A).

Reasons : There are technical and economic reasons for using this frequency for distress purposes.

1. Technical reasons

1.1 For propagation reasons and in view of the extensive coastline of South America, particularly the lengthy seaboard of Argentina, the frequency 2 182 kHz is inadequate for distress purposes.

1.2 The dimensions of radiating systems using 4 000 kHz are more suitable than those using 2 000 kHz for most small vessels which have to use radiotelephony.

1.3 The long range equipment used in the maritime mobile service has been shown to give a better performance and have a greater sensitivity at 4 MHz that at 2 MHz; this is particularly important when considering distress requirements.

2. Economic reasons

2.1 The Argentine Administration proposes to use this frequency as an additional distress frequency since the majority of its ships have equipment using it for call, reply and safety purposes.

2.2 It will ensure better utilization of equipment without any added expenditure.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 111-E
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PLENARY MEETING

India (Republic of)

PROPOSALS FOR THE WORK OF THE WORLD ADMINISTRATIVE RADIO CONFERENCE FOR MARITIME MOBILE TELECOMMUNICATIONS GENEVA, 1974

ARTICLE 1

Terms and Definitions

Section II. Radio Systems, Services and Stations.

IND/111/1 ADD 21BA Mobile Earth Station : An earth station in the mobile - satellite service intended to be used while in motion or during halts at unspecified points.

Reasons : The term 'mobile earth station' is used, at places, in the text (e.g. No. 84AGA) and hence there is a need to define the same.

IND/111/2 MOD 35 Spa Aircraft Station : A mobile station in the aeronautical mobile service on board an aircraft or an air-space vehicle <u>or a manned balloon</u>.

Reasons : To bring balloons, equipped with radio apparatus within the meaning of the term 'Aircraft Station' to allow such operations to make use of frequencies set apart for aeronautical mobile (R) service. It shall ensure more systematic operation of such stations and promote the safety of life in air.

IND/111/3	ADD	39A	On board communication station: A low power mobile station intended to be used for internal operational communication on board ships, or between such a station and stations on vessels such as life-boats, tugs, launches, tenders, fire-floats; in which messages are restricted to those relating to line-handling and mooring, refuelling, towing, emergency communication relating to safety of persons on or in the vicinity of a ship, training of personnel for handling of portable devices on life boats and other survival crafts and any other communication which administrations may wish to authorise within their territorial waters.
		Reasons:	To define the use of this type of station and its purpose.

Section IIA. Space Systems, Services and Stations.

IND/111/4	MOD	84AG Spa 2	Fixed Satellite Service A radiocommunication service: - between earth stations at specified fixed points when one or more satellites are used;

in some cases this service includes satellite-to-satellite links, which may also be effected in the inter-satellite service;

- for connection between one or more earth stations at specified fixed points and satellites used for a service other than the fixed-satellite service (for example, the ~~mobile-satellite service~~ radio determination - satellite service, broadcasting - satellite service, etc.)

Reasons: Provision in regard to radiocommunication for connection between space station and one or more earth stations at specified fixed points, is covered under No. 84AGA and its reference in No. 84AG is redundant.

IND/111/5 MOD 84AGA Spa 2

Mobile Satellite Service

A radiocommunication service:

- between mobile earth stations and one or more space stations; or between space stations used by this service;

- or between mobile earth stations by means of one or more space stations;

- <u>or between mobile earth stations and one or more earth stations at specified fixed points by means of one or more space stations;</u>

- and if the system so requires, for connection between these space stations and one or more earth stations at specified fixed points.

<u>Reasons:</u> To provide for radiocommunication service between mobile earth stations and earth stations at specified fixed points.

ARTICLE 5

Frequency Allocations[1]

10 kHz to 275 GHz

Section IV. Table of Frequency Allocations - 10 kHz to 275 GHz.

IND/111/129 MOD 201A
Spa 2

The frequencies 2182 kHz, 3023.5 kHz, 5680 kHz, 8364 kHz, 121.5 MHz, 123.1 MHz, 156.40 MHz, 156.8 MHz and 243 MHz may also be used, in accordance with the procedures in force for terrestrial radiocommunication services, for search and rescue operations concerning manned space vehicles.

The same applies to the frequencies 10003 kHz, 14993 kHz and 19993 kHz, but in each of these cases emissions must be confined in a band of ± 3 kHz about the frequency.

Reasons: Consequent to IND/111/7, 8, 20 and 85.

IND/111/6 MOD 287 Mar

The frequency ~~156.8 Mc/s~~ 156.80 MHz is the international ~~Safety~~, Distress and Calling frequency for the maritime mobile VHF radiotelephone service. /Remainder unchanged /

Reasons: Consequent to designation of frequency 156.80 MHz as international distress frequency for radiotelephony.

/IND/111/78 /

It is proposed to delete the word 'Safety' in this provision, as the provisions 1491 gives the frequencies on which safety signal can be passed.

IND/111/7 MOD

108-138 MHz

Allocation to Services		
Region 1	Region 2	Region 3
117.975 - 132	Aeronautical Mobile(R) 201A 273 273A 273B	

IND/111/8 ADD 273B Where a requirement is established for the use of a frequency auxiliary to 121.5 MHz (See No. 273), frequency 123.1 MHz may be used for coordinated search and rescue operations by mobile stations of the maritime mobile service and participating aircraft and land stations.

Reasons: Consequent to the decision taken by the International Civil Aviation Organisation at its VII Air Navigation Conference, Montreal, 1972, provision is made to provide for the usage of frequency 123.1 MHz by the stations of maritime mobile service.

420 - 470 MHz

		Allocation to Services		
		Region 1	Region 2	Region 3
IND/111/9	MOD	450-460	Fixed Mobile 318, 318B, 319A	
IND/111/10	MOD	460-470	Fixed Mobile Meteorological-Satellite (Space-to-earth) 318A 318B, 324 B	

IND/111/11 ADD 318B

The frequencies 457.525, 457.550, 457.575, 467.750, 467.775 and 467.800 MHz may be used by on-board communication stations (see No.39A) as specified in Nos. 991A and 991B.[IND/111 /23&25]

Reasons: To supplement the V.H.F. channels to meet increased usage for operational communications on board ships.

ARTICLE 7

Special Rules Relating to Particular Services

Section IV. Maritime Mobile Service

IND/111/11A NOC 437A-451A

IND/ /12 MOD 451 B Mar

(g) Ship Stations, narrow-band direct-printing telegraph and data transmission systems.

4166	- ~~4172.25~~	4178.25	~~Kc/s~~	KHz
6248	- ~~6258.25~~	6266.25	~~Kc/s~~	KHz
8331.5	- ~~8341.75~~	8355.75	~~Kc/s~~	KHz
12483	- ~~12503.25~~	12508	~~Kc/s~~	KHz
16640	- ~~16660.5~~	16665.5	~~Kc/s~~	KHz
22164	- ~~22184.5~~	22189.5	~~Kc/s~~	KHz

Reasons: There will be an increaseing demand for narrow band direct printing telegraph system. The proposal is to provide additional frequencies for future need both by increasing the band allocated for this purpose and by reducing the channel spacing.

IND/111/13 MOD 452 Mar (h) Ship stations, telegraphy

~~4172.25~~ - ~~4231~~ ~~Kc/s~~
~~6258.25~~ - ~~6345.5~~ ~~Kc/s~~
~~8341.75~~ - ~~8459.5~~ ~~Kc/s~~
~~12503.25~~ - ~~12689.~~ ~~Kc/s~~
~~16660.5~~ - ~~169175~~ ~~Kc/s~~
~~22184.5~~ - ~~22374~~ ~~Kc/s~~

25070 - 25110 ~~Kc/s~~ kHz

4178.25 - 4218.75 kHz
6266 - 6327.5 kHz
8355.75 - 8435.25 kHz
12508 - 12664 kHz
16665.5 - 16892 kHz
22189.5 - 22348.5 kHz

Reasons: Consequent to the proposal for extending the band for ships station narrow-band direct printing telegraph [IND/111/12] and provision for similar band for coast station which was not provided for in the Radio Regulations by WARC Maritime Mobile Service, Geneva, 1967. Except in 4 MHz band, the number of frequency spots available has not decreased by this reduction in the bandwidth since the channel spacing has been reduced in all these bands taking advantage of the technical developments in the direction of better frequency stability and better selectivity of receivers. On the other hand, on the 8, 12, 16 and 22 MHz bands, there is substantial increase in the number of channels available for manual telegraphy as per the proposed scheme.

IND/111/13A NOC 452-1

IND/111/14 MOD 453 (i) Coast stations, wide band and manual telegraphy and facsimile ~~special-and-data-transmission-systems and-direct-printing-telegraph~~ systems.

4231	-	4361	~~Kc/s~~	kHz
6345.5	-	6514	~~Kc/s~~	kHz
8459.5	-	8728.5	~~Kc/s~~	kHz
12689	-	13107.5	~~Kc/s~~	kHz
16917.5	-	17255	~~Kc/s~~	kHz
22374	-	22624.5	~~Kc/s~~	kHz

IND/111/14A NOC 453A

IND/111/15 ADD 453B (j) Coast stations, narrow-band direct-printing telegraph and data transmission systems

4218.75	-	4231	kHz
6327.5	-	6345.5	kHz
8435.25	-	8459.5	kHz
12664	-	12689	kHz
16892	-	16917.5	kHz
22348.5	-	22374	kHz

Reasons: To make provision for exclusive frequency band for coast stations narrow band direct printing telegraph and data transmission systems. Also to enable to provide paired frequency assignment plan for ship/shore for narrow-band direct-printing telegraph operation.

IND/111/15A NOC 453.1 - 457.

IND/111/16 ADD 457A (3) Appendix 15A contains narrow-band direct-printing telegraph and data transmission channels maritime mobile service in the frequency bands specified in Nos. 451B and 453B.

Reasons: Consequent to the proposal to include a table of paired frequency channels for the purpose as proposed in APP 15A

ARTICLE 25

Working Hours of Stations in the Maritime and Aeronautical Mobile Services.

Section II. Coast Stations.

IND/111/17 ADD 921A 1A. For this purpose, they shall check the clock against standard time signals at least once a day to ensure correct timing.

Reasons: To ensure correction of the clock regularly for proper observance of hours of watch and silence periods on international distress frequencies. Indian Administration is of the view that great number of infringement relating to non-observance of silence periods are due to non-regulating of clock.

IND/111/18 ADD 927A c) making a general call to all stations announcing the closing down of the service and advising the time of re-opening if other than its normal hours of service.

Reasons: To make it obligatory for coast stations whose service is not continuous to announce the closing down of the service to attract the attention of mobile stations who may be in the service area of the station and have not been able to indicate their presence before the closing time. The coast stations should also indicate the time of resumption of watch if it is other than the one published in the List of Coast Stations.

ARTICLE 27

Aircraft and Aeronautical Stations.

IND/111/19 MOD 953 (3) However, the ~~frequencies 156.30 Mc/s and 156.80 Mc/s may be used~~ aircraft stations ~~for safety purposes only~~ may use;

- frequency 156.30 MHz for safety purposes only;

- frequency 156.80 MHz for distress, safety and calling purposes only;
- and frequencies 156.375, 156.450, 156.475 and 156.650 MHz for purposes of communications while engaged in rendering assistance to the ship.

Reasons: Consequent to designation of 156.80 MHz as distress frequency [IND/111/78] and to provide for communication by helicopters and light aircraft engaged in back-up of maritime services such as ferrying of ships' crew, transportation of essential stores and equipment to ships while underway or at roadsteads.

ARTICLE 28

Conditions to be observed by Mobile Stations

Section II. Special Provisions regarding Safety.

IND/111/20 MOD 969 (2) For these purposes only, they may use the aeronautical emergency frequency 121.5 ~~Mc/s~~ MHz using Class A3 emissions. Where a requirement is established for the use of a frequency auxiliary to

			<u>121.5 MHz, the frequency 123.1 MHz shall be used.</u> They shall then comply with any special arrangements between the governments concerned by which the aeronautical mobile service is regulated.
		<u>Reasons:</u>	Consequent to addition of No. 273B [IND/111/8]
IND/111/21	ADD	Title	Section IV A. On board Communication Stations.
IND/111/22	ADD	Title	Bands between 156 and 174 MHz and between 450-470 MHz.
IND/111/23	ADD	991A	Equipment for on-board communication stations shall be able to send and receive 16F3^1 emissions on: - 156.750 (channel 15 of Appendix 18) and 156.850 (Channel 17 of Appendix 18) provided the effective radiated power does not exceed 0.1W - 457.525, 457.550, 457.575, 467.750, 467.775 and 467.800 MHz provided the effective radiated power does not exceed 2W.
IND/111/24	ADD	991A.1	However 36F3 emission is permitted in the bands between 156 and 174 MHz for the cases as mentioned in No. 1358A.

IND/111/25 ADD 991B The operation of on-board communication stations whilst within territorial limits of a country shall be subject to rules and regulations of that country.

Reasons: To define the emissions and conditions of usage of frequencies earmarked for on-board communication stations. In UHF usage, maximum power is proposed to be fixed at 2W to avoid interference with other services working in the same band.

ARTICLE 28

Conditions to be Observed by Mobile Stations

SECTION VI. - Survival Craft Stations.

IND/111/26 ADD 998A - in the bands between 156 and 174 MHz, be able to transmit on 156.80 MHz, using 16F3 emission. If a receiver is provided for any of these bands, it shall be able to receive 16F3 emission on 156.80 MHz;

Reasons: Consequent to designation of frequency 156.80 MHz as international distress frequency for radiotelephony.

[IND/111/78].

ARTICLE 28A

International Usage of Selective Calling in the Maritime Mobile Service

IND/111/26A NOC 999A–999D

Frequencies to be used –

IND/111/27 MOD 999E Mar

4. Selective calls should be sent on one or more of the following calling frequencies:

500	~~Kc/s~~	kHz
2182	~~Kc/s~~	kHz
2170.5	~~Kc/s~~[1]	kHz[1]
4136.3	kHz[2]	
4434.9	~~Kc/s~~	kHz
6204.0	kHz[2]	
6518.6	~~Kc/s~~	kHz
8802.4	~~Kc/s~~	kHz
13182.5	~~Kc/s~~	kHz
17328.5	~~Kc/s~~	kHz
22699.0	~~Kc/s~~	kHz
156.8	~~Mc/s~~	MHz

IND/111/27A NOC 999E.1

IND/111/28 ADD 999E.2 2. For the conditions of use of the frequencies 4136.3 and 6204.0 kHz see Nos. 1352B and 1353 respectively.

Reasons: The ship stations are authorised to use frequencies 4136.3 kHz and 6204.0 kHz for calling in radiotelephony (See No. 1352). In addition, in accordance with No.1352B and No. 1353 these frequencies are also designated for call, reply and safety purposes. Accordingly it is desirable that facility of selective calling is also provided on the above two frequencies.

ARTICLE 29

General Radiotelegraph Procedure in the Maritime Mobile and Aeronautical Mobile Services.

Section III. Calls, Reply to Calls and Signals Preparatory to Traffic.

IND/111/28A NOC 1012-1013D Mar

IND/111/29 MOD 1013E Mar (4) When calling a coast station which has indicated a watch[1] on the special calling frequencies 4186.5, 6279.75, 8373, 12559.5, 16746 and ~~22262.5 Kc/s~~ 22247.5 kHz, ship stations do not apply the calling method contained in Nos. 1013B, 1013C and 1013D. In these circumstances the call consists of:

- the call sign of the station called, not more than once;

- the word DE;
- the call sign of the calling station, not more than once.

This call may be transmitted three times at intervals of one minute; thereafter it shall not be repeated until after an interval of three minutes.

Reasons: Consequent to proposal IND/111/119.

ARTICLE 32

Use of Frequencies for Radiotelegraphy in the Maritime Mobile and Aeronautical Mobile Services

Section V. Bands between 4000 and 27500 ~~kc/s~~ kHz

A. General Provisions

IND/111/30 MOD 1145 Mar

17. (1) Mobile radiotelegraph stations equipped to operate in the bands specified in Nos.1174, and 1192 ~~and 1196~~ shall employ only class A1 emissions. In the bands specified in No. 1192, stations may use manual or automatic A1 Morse telegraphy at speeds not exceeding 40 bauds. Survival craft stations may use class A2 or A3H emissions in these bands (see Nos. 994 and 997).

Reasons: Only editorial change due to proposed suppression of No. 1196.

IND/111/30A NOC 1146-1150B

IND/111/31	MOD	1151 Mar	d) a band of working frequencies except in 4 MHz band, for the use of ~~high-traffic-ship-stations~~ A1 Morse telegraphy by ship stations;
IND/11/31A	NOC	1152 Mar	
IND/111/32	MOD	1153 Mar	f) another band of working frequencies for the use of A1 Morse telegraphy by ship stations ~~low traffic-ship-stations~~.
		Reasons:	To make the relevant provisions reflect the band applicable for each type of service and the amendments proposed in Appendix 15.
IND/111/32A	NOC	1154- 1155	
MOD/111/33	MOD	1156 Mar	20(1) Ship stations shall, at the discretion of the administration controlling the station concerned, use either or both of the bands of working frequencies ~~high-traffic band~~ (See Nos. 1151 and 1153) ~~or-the low-traffic-band-(See-No.-1153)~~, ~~depending-on-their-traffic-requirements~~.
		Reasons:	To do away with the provision of distinction between high and low traffic ships.
IND/111/33A	NOC	1157- 1159	

C. Traffic

IND/111/33B NOC 1169-1172

IND/111/34 MOD 1173 Mar

(3) Working frequencies assignable to coast stations using the bands between 4000 and 27500 ~~Kc/s~~ kHz are included within the following band limits:

~~4231~~	4218.75	to	4361	~~Kc/s~~ kHz
~~6345.5~~	6327.5	to	6514	~~Kc/s~~ kHz
~~8459.5~~	8434.25	to	8728.5	~~Kc/s~~ kHz
~~12689~~	12664	to	13107.5	~~Kc/s~~ kHz
~~16917.5~~	16892	to	17255	~~Kc/s~~ kHz
~~22374~~	22348.5	to	22624.5	~~Kc/s~~ kHz

(See also No. 453A)

Reasons: To make provision for increasing the bandwidth allocated for coast station working and assign frequencies, from this band, exclusively for coast station narrow-band direct -printing telegraph and data transmission as indicated in Appendix 15 and 15A and Nos. 453B and 457A proposed by India for addition to the Regulations.

D. Assignment of Frequencies to Mobile Stations

1. Calling Frequencies of Ship Stations

IND/111/35 MOD 1174 Mar 29.(1) The calling frequencies assignable to ship stations are included within the following band limits:

~~4178~~	~~to~~	~~4187~~	~~Kc/s~~
~~6267~~	~~to~~	~~6280.5~~	~~Kc/s~~
~~8356~~	~~to~~	~~8374~~	~~Kc/s~~
~~12534~~	~~to~~	~~12561~~	~~Kc/s~~
~~16712~~	~~to~~	~~16748~~	~~Kc/s~~
~~22222.5~~	~~to~~	~~22267.5~~	~~Kc/s~~
25070	to	25082.5	~~Kc/s~~ kHz
4178.5	to	4186.75	kHz
6271.5	to	6280	kHz
8361.25	to	8373.25	kHz
12542.25	to	12560.25	kHz
16720	to	16747	kHz
22221.25	to	22248.75	kHz

Reasons: Calling bands have been slightly reduced and limits adjusted for better utilisation of the frequency spectrum.

IND/111/36 MOD 1175 Mar

(2) In the ~~band 4178 to 4187 Kc/s,~~ 4, 6 and 8 MHz bands, the calling frequencies are spaced 0.5 ~~Kc/s~~ kHz apart. Extreme frequencies assignable are ~~4178.5 and 4186.5 Kc/s~~ as indicated in Appendix 15.

Reasons: Consequent upon the changes proposed in Appendix 15.

IND/111/37 MOD 1176 Mar

(3) In ~~each of the other maritime mobile service bands between 4000 and 18000 Kc/s, the calling frequencies shall be in harmonic relationship with those in the band 4178 to 4187 Kc/s. In the bands 22222.5 to 22267.5 Kc/s and 25070 to 25082.5 Kc/s the spacing of calling frequencies is 2.5 and 1.5 Kc/s respectively. The extreme frequencies assignable are 22225 and 22265 Kc/s, and 25073.5 and 25081 Kc/s, respectively~~ the 12, 16, 22 and 25 MHz bands spacing of calling frequencies are 0.75, 1.0, 1.25 and 1.5 kHz respectively. Extreme frequencies assignable in these bands are as indicated in Appendix 15.

Reasons: Consequent upon the changes proposed in Appendix 15.

IND/111/38 MOD 1177 Mar

30. The administration to which a ship station is subject shall assign to it a series of calling frequencies including one frequency in each of the bands in which the station is equipped to transmit. Administrations may, however, assign a ~~supplementary~~ an additional series of calling frequencies for use in the event of interference. ~~In the bands between 4000 and 18000 Kc/s the frequencies assigned to each ship station shall be in harmonic relationship.~~ Each administration shall take the necessary steps to assign ~~such harmonic series of~~ calling frequencies to ships in accordance with an orderly system of rotation so as to distribute these frequencies uniformly throughout the calling bands. ~~The same system of uniform distribution shall be applied in the assignment of calling frequencies in the bands 22222.5 to 22267.5 Kc/s and 25070 to 25082.5 Kc/s.~~ Administrations may also assign to their ship stations the special calling frequencies appearing in the footnote indicated by d) in Appendix 15.

Reasons: It is envisaged that same system will be followed for each of the bands and the special mention of 22 and 25 MHz bands is redundant in view of the first sentence of the provision.

IND/111/39 MOD 1178 Mar 31 (1) One calling frequency in each of the calling bands indicated in No. 1174 (except in the 25 ~~Mc/s~~ MHz band) shall be reserved as far as possible for the use of aircraft desiring to communicate with stations of the maritime mobile service. These frequencies are the following: 4182, ~~6273~~ 6273.25, 8364, 12546, 16728 and and 22245 ~~Kc/s~~ kHz.

Reasons: Consequent to the changes proposed in Appendix 15.

IND/111/39A NOC 1179

2. Working Frequencies of Mobile Stations.

a) Channel Spacing and Assignment of Frequencies.

IND/111/39B NOC 1180 - Mar 1180A Mar

IND/111/40 MOD 1180B Mar 32B. The working frequencies for ship stations using narrow-band direct-printing telegraph and data transmission systems are spaced 0.5 Kc/s kHz apart in the 4, ~~6, and 8, Mc/s band and 1.0 Kc/s apart in the~~ 12, 16 and 22 ~~Mc/s~~ MHz bands. The frequencies assignable are shown in Appendix ~~15~~ 15A

IND/111/41 MOD 1181 Mar

33.(1) The working frequencies for ~~high traffic ships~~ ship stations using manual or automatic A1/Morse telegraphy ~~in the band 4172.25 to 4178 Kc/s~~ are spaced 0.5 ~~Kc/s~~ kHz apart in the 4,6 and 8 MHz bands,and 0.75, 1.0, 1.25 and 1.5 kHz apart in 12, 16, 22 and 25 MHz bands.respectively. The extreme frequencies assignable ~~being 4172.5 and 4177.5 Kc/s~~ in each of these bands are as shown in Appendix 15.

Reasons: To reflect the changes proposed in Appendix 15.

IND/111/42 SUP 1182 Mar

IND/111/43 SUP 1183 Mar

IND/111/44 SUP 1184 Mar

IND/111/45 SUP 1185 Mar

IND/111/46 SUP 1186 Mar

IND/111/47 SUP 1187 Mar

Reasons: Consequent on the proposal to modify 1181 Mar.

d) Working Frequencies for Ship Stations using Narrow-Band Direct-Printing Telegraph and Data Transmission Systems.

IND/111/48 MOD 1191D Mar

38D. The working frequencies assignable to ship stations using narrow-band direct-printing telegraph and data transmission systems are included within the following band limits:

4166 to ~~4172.25--Kc/s~~ 4178.25 kHz
6248 to ~~6258.25--Kc/s~~ 6266.25 kHz
8331.5 to ~~8341.75--Kc/s~~ 8355.75 kHz
12483 to ~~12503.25--Kc/s~~ 12508 kHz
16640 to ~~16660.5---Kc/s~~ 16665 kHz
22164 to ~~22184.5---Kc/s~~ 22189.5 kHz

Reasons: To increase the band allocated for this purpose as detailed in Appendix 15.

IND/111/48A NOC 1191E Mar

IND/111/49 MOD Title c) Working frequencies for ~~high traffic~~ ship stations for manual telegraphy.

IND/111/50 MOD 1192 Mar 39. The working frequencies assignable to ~~high-traffic~~ ship stations are included within the following band limits.

~~4172.25 to 4178 Kc/s~~
~~6258.25 to 6267- Kc/s-~~
~~8341.75 to 8356 Kc/s~~
~~12503.25 to 12534 Kc/s~~
~~16660.5 to 16712 Kc/s~~
~~22184.5 to 22222.5 Kc/s~~

4186.75 to 4218.75 kHz
6266 to 6271.5 kHz
6280 to 6327.5 kHz
8355.75 to 8361.25 kHz
8373.25 to 8435.25 kHz
12508 to 12542.25 kHz
12560.25 to 12664 kHz
16665.5 to 16720 kHz
16747 to 16892 kHz
22189.5 to 22221.25 kHz
22248.75 to 22348.5 kHz
25082.5 to 25110 kHz

Reasons: To remove the distinction between high and low traffic ships and also to specify that the band is for telegraphy only. The frequencies assigned from 25 MHz band are also included in this to avoid separate listing of the same.

IND/111/51 MOD 1193 Mar

40.(1) Each administration shall assign to each ~~high-traffic~~ ship station under its jurisdiction ~~two or-more-of-the-series-of~~ working frequencies shown in Appendix 15 and 15A ~~for-vessels-of-this-class~~. The total number of series of frequencies assigned to each ship station should be determined by traffic requirements.

Reasons: Consequent to provisions in Appendix 15 and 15A.

IND/111/52 MOD 1194 (2) Where ~~high traffic~~ ships are assigned less than the total number of working frequencies in the band, the administration concerned shall assign working frequencies ~~to such ships~~ in accordance with an orderly system of rotation which will ensure approximately the same number of assignments on any one frequency.

Reasons: To delete reference to high traffic ships.

IND/111/53 MOD 1195 41. For the exclusive purpose of communication with stations of the maritime mobile service an aircraft station may be assigned one or more series of working frequencies ~~in the high traffic bands~~. These frequencies shall be assigned in accordance with the same system of uniform distribution provided for ~~high traffic~~ ships.

Reasons: In view of removal of distinction between high and low traffic ships.

IND/111/54	SUP	Title	~~f) working frequencies for low traffic ship stations~~.
IND/111/55	SUP	1196 Mar	
IND/111/56	SUP	1197 Mar	
IND/111/57	SUP	1198 Mar	
IND/111/58	SUP	1199 Mar	
IND/111/59	SUP	1200 Mar	
IND/111/60	SUP	1201 Mar	
		Reasons:	To delete reference to low traffic ships and in view of the inclusion of frequencies to be used by all ships in IND/111/50.
IND/111/61	SUP	Title	~~g) working frequencies available for use by ships all categories~~.
IND/111/62	SUP	1202 Mar	
		Reasons:	In view of removal of distinction between high and low traffic ships and inclusion of 25 MHz band in No. 1192 Mar IND/111/50.
IND/111/63	MOD	Title	~~h)~~ f) Abbreviations for the indication of working frequencies.
IND/111/63A	NOC	1203-1204	

IND/111/64 MOD 1205 b) when the calling station does not know the working frequencies of a ~~low-traffic~~ ship, it may request the ship station to reply on its working frequency ~~in-Group-A-or-in-its working-frequency-in-Group-B~~ by transmitting QSW ~~A-or-QSW-B-as-the case-may-be~~ ___________(Frequency):

IND/111/65 MOD 1206 c) in case of poor receiving conditions on the working frequency stated by the ~~low-traffic~~ ship according to No.1205, the coast station may request the ship to change to transmissions on ~~its~~ another ~~supplementary~~ working frequency in the same frequency band. This request is made by the transmission of QSY ~~B-or-QSY-A as-the-case-may-be~~ _______(frequency).

Reasons: To delete reference to low traffic ships and Group A and B frequencies.

ARTICLE 35

Use of Frequencies for Radiotelephony in the Maritime Mobile Service.

SECTION II Bands between 1605 and 4000 ~~Kc/s~~ kHz

E. Watch

IND/111/66 ADD 1331A (1) In order to increase the safety of life at sea and over the sea, all stations of the maritime mobile service normally keeping watch on frequencies in the authorised band between 1605 and 2850 kHz shall, during their hours of service, and as far as possible, take steps to keep watch on the international distress frequency 2182 kHz for three minutes twice each hour beginning at x h.00 and x h.30 Greenwich Mean Time (G.M.T.)

IND/111/67 ADD 1331B (2) During the periods mentioned above, except for transmissions provided for in Article 36, transmission shall cease within the band 2173.5 - 2190.5 kHz.

Reasons: To extend the requirement of silence periods on the international distress frequency 2182 kHz to Region 2 also. This implements Resolution 217 of the VII Assembly of I.M.C.O. Hence the present provisions 1349 and 1350, which are applicable to Region 1 and 3 now, are to be shifted under 'Watch'to make the provisions applicable to all regions of the world.

IND/111/67A	NOC	1332- 1334	
IND/111/68	MOD	1335	7. (1) Ship Stations open to public correspondence should, as far as ~~possible~~-practicable, during their hours of service, keep watch on 2182 ~~Kc/s~~ kHz. Other ship stations should maintain maximum possible watch on 2182 kHz.
	Reasons:		To provide for necessary watch to be maintained by ship stations.
IND/111/69	ADD	1335A	(2) Ship Stations fitted only with radiotelephone equipment shall, during their hours of service, remain on watch on 2182 kHz. Thery are, however, authorised to relinquish this watch:
IND/111/70	ADD	1335B	a) When the receiving equipment is being used for traffic on another frequency and a second receiver is not available; or
IND/111/71	ADD	1335C	b) when such watch is likely to interfere with the safe navigation of the ship.

Reasons: To strengthen listening watch on international distress frequency by ship station fitted with radiotelephone equipment only, in accordance with Regulation 7 of Chapter IV of the Safety of Life at Sea Convention, 1960.

H. Additional Provisions Applying to Regions 1 and 3

IND/111/72	SUP	1349
IND/111/73	SUP	1349.1
IND/111/74	SUP	1350 Mar

Reasons: Consequential to 1331A and 1331B /‾IND /111/66 & 67_7.

SECTION IV - Bands between 156 and 174 ~~Mc/s~~ MHz

IND/111/75	ADD	Title	A. Mode of Operation of Stations.
IND/111/76	ADD	1358A	(1) The Class of emission to be used for radiotelephony in the maritime mobile service band between 156 to 174 MHz shall be F3. In accordance with Resolution No. Mar 14, - from 1st January 1973, all new equipments shall operate on 16F3 emission and not 36F3 emission.

- from 1st January, 1983, all equipments shall operate on 16F3 and 36F3 will no longer be authorized.

Reasons: To define the emission permissible in thebands between 156 and 174 MHz in accordance with Resolution No. Mar 14 which has since come into effect.

IND/111/77 ADD Title B. Distress.

IND/111/78 ADD 1358B (1) The frequency 156.80 MHz is the international distress frequency for radiotelephony in the authorised bands between 156 and 174 MHz; it shall be used for this purpose by stations of the maritime mobile service using frequencies in these bands. It is used for the distress call and distress traffic, for signals of emergency position indicating radiobeacons, for the urgency signal and urgency messages and forthe safety signal. Safety messages shall be transmitted, where practicable, on a working frequency after a preliminary announcement on 156.80 MHz. The class of emission to be used by emergency position indicating radiobeacons shall be as specified in Appendix 20AA, (see also 1476G).

Reasons: In view of the greater usage of VHF communications by stations in the maritime mobile service particularly while within harbour and along the coast line, it is desirable to extend the use of frequency 156.80 MHz for distress to promote safety of line at sea (see also IND/111/108 and 128).

IND/111/79 ADD 1358C (2) However, ship stations which cannot transmit on 156.80 MHz should use 2182 kHz or any other available frequency on which attention might be attracted.

IND/111/80 ADD 1358D ~~(5)~~ (3) All emissions in the band 156.725 - 156.875 ~~Mc/s~~ MHz capable of causing harmful interference to the authorized transmissions of stations of the maritime mobile service on 156.80 ~~Mc/s~~ MHz are forbidden.

IND/111/81 ADD 1358E (4) After 1 January 1983 this band is reduced to 156.7625-156.8375 ~~Mc/s~~ MHz (see Resolution No.Mar 14).

Reasons: Consequential to designation of frequency 156.80 MHz as international distress frequency, the text of Nos. 1363 and 1363.1 is brought under the title 'Distress'.

IND/111/82 ADD 1358F (5) Any coast station using the frequency 156.80 Mhz for distress purposes shall be able to transmit the radiotelephone alarm signal described in No.1465 (see also Nos. 1471, 1472 and 1473).

Reasons: Consequential to designation of frequency 156.80 MHz as international distress frequency. /¯ IND/111/78_7

IND/111/83 ADD 1358G (6) Before transmitting on 156.80 MHz, a station in the mobile service should listen on this frequency for a reasonable period to make sure that no distress traffic is being sent (see No. 1217).

IND/111/84 ADD 1358H (7) The provisions of No.1358G do not apply to stations in distress.

Reasons: Consequent to No.1358B /¯ IND/111/78_7

C. Search and Rescue

IND/111/85 ADD 1358I The frequency 156.40 MHz (Channel 08 of Appendix 18) shall be used for intercommunication between mobile stations at the scene-of-action including those engaged in co-ordinated searchand rescue operations and for communication between these stations and participating land stations. All stations shall avoid harmful interference to communication relating to coordinated search and rescue operations on channel 08.

Reasons: For intercommunication between mobile stations engaged in coordinated search and rescue operations, frequencies 3023.5 kHz and 5680 kHz are earmarked (No.1326C and 1353B refers). There is a nee d to designate a frequency in the international MaritimeMobile V.H.F. band for search and rescue and scene of action operations. Accordingly a channel within Appendix 18 is proposed, for this purpose, to facilitate search and rescue operations.

IND/111/86 MOD Title ~~A-~~ D. Call and Reply ~~and-Safety~~

IND/111/87 MOD 1359 (1) The frequency 156.80 ~~Mc/s~~-MHz ~~is-designated-for-world-wide-use-by the-international-maritime-mobile radio-telephone-service-in-the-band 156-to-174-Mc/s-for-call,-reply-and safety-purposes.~~ It may also be used

			~~for messages preceded by the urgency and safety signals and, if necessary, for distress messages.;~~ a) for call and reply in accordance with the provisions of Article 33:
IND/111/88	MOD	1359A Mar	~~(1A)~~ b) ~~The frequency 156.80 Mc/s may be used~~ by coast stations for selective calls to ships using Class F2 emission (see No. 999E).
IND/111/89	MOD	1360	~~(2)~~ c) ~~This frequency may also be used~~ by coast stations to announce the transmission, on another frequency of their traffic lists and important maritime information (see Nos. 1301 - 1304).
	Reasons:		Consequent to No.1358B [IND/111/78] the text has been re-aligned for clarity and completeness.
IND/111/89A	NOC	1361-1362	
IND/111/90	SUP	1363	
IND/111/91	SUP	1363.1	
	Reasons:		Consequent to shifting of the provisions to Nos.1358B and 1358E [IND/ /80 & 81]
IND/111/92	MOD	Title	B E Watch
IND/111/93	MOD	1364	19.(1) A coast station providing an international maritime mobile service

of radiotelephony in the band 156 to 174 ~~Mc/s~~ MHz ~~should~~ and which forms an essential part of the coverage of the area for distress purposes shall, during the working hours in that band, maintain, ~~as far as possible~~ and efficient aural watch on 156.80 ~~Mc/s~~ MHz

Reasons: Consequent to designation of 156.80 MHz as international distress frequency for radio-telephony, coast stations shall have to maintain continuous watch on this frequency.

IND/111/93A NOC 1365-1367

IND/111/94 ADD 1367.1 (5) Ship stations fitted only with VHF radiotelephone equipment shall when at sea, during their hours of a service, remain on watch on 156.80 MHz. They are however authorised to relinquish this watch:

IND/111/95 ADD 1367.2 a) when the receiving equipment is being used for traffic on another frequency and a second receiver is not available; or

IND/111/96 ADD 1367.3 b) when such watch is likely to interfere with the safe navigation of the ship; or

IND/111/97	ADD	1367.4	c) when there are other compelling circumstances requiring relinquishing of the watch.
	Reasons:		To strengthen listening watch on international distress frequency 156.80 MHz by ship stations fitted with VHF radiotelephone equipment only.
IND/111/97A	NOC	1367A- 1368	
IND/111/98	MOD	Title	C F -Traffic
IND/111/98A	NOC	1369-1379	
IND/111/99	ADD	Title	G. Additional Provisions.
IND/111/100	ADD	1379A	(1) In order to increase the safety of life at sea and over the sea, all stations of the maritime mobile service normally keeping watch on frequencies in the authorised band between 156 and 174 MHz shall, during their hours of service, and as far as possible, take steps to keep watch on the international distress frequency 156.80 MHz for three minutes twice each hour beginning at x h.10 and x h.40 Greenwich Mean Time (G.M.T)

IND/111/101 ADD 1379B (2) During the periods mentioned above, except for the transmission provided for Article 36, transmission shall cease within the band 156.725 - 156.875 MHz. which after 1 January, 1983 shall be reduced to 156.7625 - 156.8375 MHz.

Reasons: Consequent to the proposed designation of frequency 156.80 MHz as international distress frequency, provision for silence periods is made to protect the distress and safety communications. In essence, it shall bring three provisions at par with those of other international distress frequencies i.e. 500 kHz and 2182 kHz.

CHAPTER VIII

IND/111/102 MOD Title Distress, Alarm, Emergency Position-Indicating Radiobeacons, Urgency and Safety

Article 36

IND/111/103 MOD Title Distress Signal and Traffic Alarm, Emergency position-indicating radiobeacon, Urgency and Safety Signals.

Reasons: In view of incorporation of Section VIIIA by the World Administrative Radio Conference to deal with matters relating to the Maritime Mobile Service, Geneva, 1967.

Section I General

IND/111/103A NOC 1380

IND/111/104 ADD 1380A 1A. In the absence of special arrangements, the provisions of this Article, in so far asthey are considered pertinent may be adopted with such modification as necessary, for communications:

- between stations in the maritime mobile satellite service and an earth station at a specified fixed point.
- and between stations on board aircraft and stations of the maritime mobile satellite service or an earth station at a specified fixed point.

Reasons: To extend the procedure in regard to distress, urgency and safety to stations of the mobile-satellite service (other than stations in the land mobile-satellite service). In view of lack of experience in the working of satellitesfor communications relating to distress, this administration is of the view that provisions of Article 36 may serve as a guide to stations of the mobile satellite services for this purpose. Accordingly a general provision is made to enable stations of the mobile-satellite service to make use of relevent provisions of Article 36 with such modifications as are considered necessary. More specific and detailed provisions in the matter may be considered by next W.A.R.C. for maritime mobile telecommunications.

IND/111/104A NOC 1381-1388

IND/111/105 MOD 1388A Mar 5A. Information concerning the characteristics of the emergency position indicating radiobeacon signals is given in Nos. 1476B, 1476C, 1476D and 1476D.1

Reasons: Consequential to IND/ /107

Section VIIIA - Emergency position indicating radiobeacon signals.

IND/111/105A NOC 1476A-1476C

IND/111/106 MOD 1476D b) 1) for very high frequencies i.e. 121.5 ~~Mc/s~~ MHz and 243 ~~Mc/s~~ MHz, the signal characteristics

			shall be in accordance with those recommended by the Organizations mentioned in Resolution No.Mar 7.
IND/111/107	ADD	1476 DA	2) In the case of frequency 156.80 MHz, the signal characteristics shall be in accordance with No.1476C.
IND/111/107A-J	NOC	1476E- 1476J	
IND/111/108	MOD	1476K	(8) Equipment designed to transmit emergency position indicating radiobeacon signals on the carrier frequency 2182 ~~Kc/s~~ kHz and frequency 156.80 kHz shall meet the requirements specified in Appendix 20A and Appendix 20AA respectively.
	Reasons:		Consequent to the authorization of frequency 156.80 MHz for transmitting emergency position indicating radiobeacon signals it is necessary to establish technical requirements to be satisfied by equipment deployed for such purpose. See also IND/111/78 and 128.
IND/111/109	MOD	1476L Mar	(9) Equipment designed to transmit emergency position indicating radiobeacon signals on ~~very-high~~ the frequencies 121.5 MHz and 243 MHz shall be in agreement with the

recommendations and standards recommended by the Organizations mentioned in Resolution No.Mar. 7.

Reasons : Consequent to designation of frequency 156.80 MHz for signals of emergency position indicating radiobeacons.

/‾IND/111/78_7

Section IX. Urgency Signal.

IND/111/110 MOD 1482 Mar (2) The urgency signal and the message following it shall be sent on one of the international distress frequencies (500 ~~Kc/s~~ kHz or 2182 ~~Kc/s~~ KHz or 156.80 MHz) or on one of the frequencies which may be used in case of distress.

Reasons: Consequent to designation of 156.80 MHz as distress frequency.

/‾IND/111 /78_7

IND/111/110A N.B.- Consequent to the action taken by the World Administrative Radio Conference for Space Telecommunications, Geneva, 1971, all frequencies in the Radio Regulations whereever appearing and expressed in cycles(c/s) per second, Kc/s, Mc/s, and Gc/s now, should be expressed in Hertz, kHz, MHz and GHz respectively.

IND/111/111 MOD APPENDIX 3

Mar

Table of Frequency Tolerances

Band: 4 to 29.7 ~~Mc/s~~ MHz

3.Mobile Stations :

a) Ship Stations :

1) Class A1 emissions	-	50
~~Low-traffic-ships-~~	~~200~~	~~200-j)~~
~~high-traffic-ships~~	-	~~50 j)m)~~
2) Emissions other than Class A1	-	50 c)i)k)
~~Power-50-W-or-less~~	~~50-e)~~	~~50-e)i)k)~~
~~Power-above-50-W-~~	~~50~~	~~50-i)k)~~

Reasons: Existing prescribed tolerance of 200 Hz per MHz for low traffic ships is rather large and with the present state of technology transmitters with a frequency tolrence of 50 Hz per MHz are now easily available. With the changes proposed in Article 32 and Appendix 15, there is no necessity for having two distinct categories as high and low traffic ships.

Notes Reffering to Table of Frequency Tolerances

IND/111/112 SUP j)

IND/111/113 SUP m)

Reasons: Consequent to proposal IND/111/111

APPENDIX 11

Mar

Documents with which Ship and Aircraft Stations shall be provided.

(See Articles 18, 20, 21, 23, 28 and Appendix 9)

Section I. Ship Stations for which a Radiotelegraph Installation is Required by International Agreement.

IND/111/114 ADD Item 3 b a) a reference to observance of watch on the international distress frequency during silence periods;

Reasons: Since it is mandatory to keep watch during the silence periods, a positive entry to that effect should be made in the log.

IND/111/115 MOD Item 3 d) service incidents of all kinds including those which may appear to be of importance to safety of life at sea;

Reasons: Clarifies the scope of the provision in conformity with Regulation 16 of Chapter IV of the International Convention for the Safety of life at Sea, 1960.

Section III Ship Stations for which a Radiotelephone Installation is required by International Agreement.

IND/111/116 ADD Item 3 a a) a reference to observance of watch on the international distress frequencies during silence periods;

Reasons: Since it is mandatory to keep watch during the silence periods, a positive entry to that effect should be made in the log.

IND/111/117 MOD Item 3 c) a reference to important service incidents and details of all such incidents which may appear to be of importance to safety of life at sea;

Reasons: Clarifies the scope of the provision in conformity with Regulation 16 of Chapter IV of the International Convention for the Safety of Life at Sea, 1960.

APPENDIX 12

Mar

Hours of Service for Ship Station of the Second and Third Categories.

(See Articles 20 and 25)

IND/111/118 MOD Section I Table.

Zones	Western Limits.	Eastern Limits	Hours of Service (Greenwich Mean Time) (G.M.T.)			
			8 hours (H8)		16 hours (H-16)	
			from	to	from	to
A	No change					
B Western Indian Ocean, Eastern Arctic Ocean.	Eastern Limit of Zone A	Meridian of ~~80°~~ 90°E ~~Western Coast of Ceylon to Adam's Bridge, thence Westward round the coast of India, Meridian 80° E to northwards from the coastline of the U.S.S.R.~~	4h. 8h. 12h. 16h.	6h. 10h. 14h. 18h.	0h. 4h. 12h. 16h. 20h.	2h. 10h. 14h. 18h. 24h.
C D E F	No change					

Reasons: Zones A, B, D, E and F cover areas varying from 50 to 60 degrees while zone C extends over a range of 80 degrees in longitude. This wide disparity could be reduced by enlarging zone B by 10° to extend to 90°E. This results in a width of 70° in case of zone C and 60° in case of Zone B which was earlier only 50°. The proposed re-alignment shall facilitate better utilisation of special maritime services simultaneously broadcast from Coast Stations in the Indian sub-continent.

IND/111/119 MOD APPENDIX 15

Mar

Table of Frequencies to be used by Ship Radio-telegraph Stations in the Bands Between 4 and 27.5 ~~Mc/s~~ MHz Allocated Exclusively to the Martime Mobile Service.

(See Article 32)

In the Table:

a) the assignable frequencies in a given band for each usage are:

- indicated by the lowest and highest frequency, in heavy type, assigned in that band;
- regularly spaced, the number of assignable frequencies and the spacing in ~~Kc/s~~ kHz being indicated in italics.

b) ~~the vertical arrows indicate the harmonic relationship between the frequencies assigned in the different bands.~~

Reasons: 1. Revision of Appendix 15 is proposed consequent upon the changes proposed in Article 7 and 32 providing for extended sub-band(increased number of frequencies) to cater for future larger usages for narrow-band direct printing telegraph and data-transmission system and reduced sub-band for ship station telegraphy and also reducing the spacing of frequencies in both the cases.

2. The proposed amendments to Appendix 3 imposing the frequency tolerance to 50 Hz per MHz results in the actual tolerance figures of 0.2 kHz at 4 MHz, 0.3 kHz at 6 MHz, 0.4 kHz at 8 MHz, 0.6 kHz at 12 MHz, 0.8 kHz at 16 MHz and 1.1 kHz at 22 MHz. Considering these tolerances and the necessity for optimum utilisation of the limited spectrum space, the channel spacing for ship station telegraphy(including calling bands) has been proposed as 0.5 kHz for 4, 6 and 8 MHz bands, 0.75 kHz for 12 MHz band, 1.0 kHz for 16 MHz band and 1.25 kHz for 22 MHz band. While deciding on these channel spacing consideration has been given to (i) the minimum band width of 0.5 kHz necessary to allow for the receiver characteristics/tolerances and (ii) the retention of maximum possible spot frequencies from the existing plan in view of large number of ships' equipment involved.

3. India's experience in the utilisation of the existing band reserved for high traffic ships shows that this band is, in general, very much

underutilised. Further, in future, the ships with high traffic are likely to go in for narrow-band direct printing telegraphy in preference to manual telegraphy. It is, therefore, considered desirable to remove this distinction to enable utilisation of the whole band earmarked for ship station telegraphy by all the ships.

IND/111/119
(contn'd)

Frequencies Assignable to Ship Radiotelegraph Stations Using the Maritime Mobile Service Bands between 4 and 27.5 MHz

(kHz)

Limits	Assignable frequencies for Ship Station narrow band direct printing and data transmission systems.	Limits	Assignable frequencies for Ship Stations b)	Limits	Calling frequencies. d)	Limits	Assignable frequencies for Ship Stations b)	Limits.
1	2	3	4	5	6	7	8	9
4166	4166.5-4178 24 frequencies spaced 0.5	4178.25		4178.25	4178.5-4186.5 17 frequencies spaced o.5	4136.75	4187-4218.5 64 frequencies spaced 0.5	4218.75
6248	6248.5-6265.5 35 frequencies spaced 0.5	6266	6266.25-6271.25 11 frequencies spaced 0.5	6271.5	6271.75-6279.75 17 frequencies. spaced 0.5	6280	6280.25-6326.75 94 frequencies spaced 0.5	6327.5
8331.5	8332-8355.5 48 frequencies spaced 0.5	8355.75	8356-8361 11 frequencies spaced 0.5	8361.25	8361.5-8373 24 frequencies. spaced 0.5	8373.25	8373.5-8434.5 123 frequencies spaced 0.5	8435.25
12483	12483.5-12507.5 49 frequencies. spaced 0.5	12508	12508.5-12541.5 45 frequencies spaced 0.75	12542.25	12543-12559.5 23 frequencies. spaced 0.75	12560.25	12561-12663 137 frequencies spaced 0.75	12664

16640	16640.5-16665 50 frequencies spaced 0.5	16665.5	16666-16719 54 frequencies spaced 1.	16720	16721-16746 26 frequencies spaced 1.	16747	16748-16891 144 frequencies spaced 1	16892
22164	22165-22189 49 frequencies spaced 0.5	22189.5	22190.25-22220.25 25 frequencies spaced 1.25	22221.25	22222.5-22247.5 21 frequencies. spaced 1.25	22248.75	22250-22347.25 79 frequencies spaced 1.25	22348.5

NOC a) - c)

MOD d) The frequencies 4186.5, 6279.75, 8373, 12559.5, 16746 and ~~22262.5 Kc/s~~ 22247.5 KHz may also be assigned as special calling frequencies. Administration should, if possible, abstain from assigning these frequencies as normal calling frequencies (See Nos.1013E and 1013E.1).

(N.B.- No change has been proposed in respect of assignable frequencies for 'wide-band telegraphy, facsimile and special transmission systems', 'Oceanographic data transmission' in 4-22 MHz bands and that for 'Ships of all categories' in the 25 MHz band. As such columns for those services have not been shown.)

IND/111/120 ADD APPENDIX 15 A

Table of Paired Frequencies for Narrow-Band-Printing Telegraph and Data Transmission Systems.

(See Article 32)

Table of Frequencies to be used by Ship and Coast Stations for Narrow-band Direct-printing Telegraph and Data Transmission in the bands between 4 and 27.5 MHz allocated exclusively to the Maritime Mobile Service.

Channelling arrangement for the frequencies to be used by Ship and Coast Stations for narrow-band direct-printing telegraph and data transmission is indicated in Table for facilitating paired working.

Reasons: It is felt that Ships in the maritime mobile service will increasingly use narrow-band direct-printing telegraphy in future. Therefore, provision for duplex working similar to duplex telephony is proposed since this will facilitate quick clearance of heavy traffic between coast and ship stations.

TABLE

kHz

SERIES No.	4 MHz Band		6 MHz Band		8 MHz Band		12 MHz Band		16 MHz Band		22 MHz Band	
	Coast Stat-ion	Ship Sta-tion	Coast Sta-tion	Ship Sta-tion	Coast Sta-tion	Ship Sta-tion	Coast Sta-tion	Ship Sta-tion	Coast Sta-tion	Ship Sta-tion	Coast Sta-tion	Ship Sta-tion
1.	4166.5	4219	6248.5	6328	8332	8435.5	12483.5	12664.5	16640.5	16892.5	22165	22349
2.	4167	4219.5	6249	6328.5	8332.5	8436	12484	12665	16641	16893	22165.5	22349.5
3.	4167.5	4220	6249.5	6329	8333	8436.5	12484.5	12665.5	16641.5	16893.5	22166	22350
4.	4168	4220.5	6250	6329.5	8333.5	8437	12485	12666	16642	16894	22166.5	22350.5
5.	4168.5	4221	6250.5	6330	8334	8437.5	12485.5	12666.5	16642.5	16894.5	22167	22351
6.	4169	4221.5	6251	6330.5	8334.5	8438	12486	12667	16643	16895	22167.5	22351.5
7.	4169.5	4222	6251.5	6331	8335	8438.5	12486.5	12667.5	16643.5	16895.5	22168	22352
8.	4170	4222.5	6252	6331.5	8335.5	8439	12487	12668	16644	16896	22168.5	22352.5
9.	4170.5	4223	6252.5	6332	8336	8439.5	12487.5	12668.5	16644.5	16896.5	22169	22353
10.	4171	4223.5	6253	6332.5	8336.5	8440	12488	12669	16645	16897	22169.5	22353.5
11.	4171.5	4224	6253.5	6333	8337	8440.5	12488.5	12669.5	16645.5	16897.5	22170	22354
12.	4172	4224.5	6254	6333.5	8337.5	8441	12489	12670	16646	16898	22170.5	22354.5
13.	4172.5	4225	6254.5	6334	8338	8441.5	12489.5	12670.5	16646.5	16898.5	22171	22355
14.	4173	4225.5	6255	6334.5	8338.5	8442	12490	12671	16647	16899	22171.5	22355.5
15.	4173.5	4226	6255.5	6335	8339	8442.5	12490.5	12671.5	16647.5	16899.5	22172	22356
16.	4174	4226.5	6256	6335.5	8339.5	8443	12491	12672	16648	16900	22172.5	22356.5
17.	4174.5	4227	6256.5	6336	8340	8443.5	12491.5	12672.5	16648.5	16900.5	22173	22357
18.	4175	4227.5	6257	6336.5	8340.5	8444	12492	12673	16649	16901	22173.5	22357.5

19.	4175.5	4228	6257.5	6337	8341	8444.5	12492.5	12673.5	16649.5	16901.5	22174	22358
20.	4176	4228.5	6258	6337.5	8341.5	8445	12493	12674	16650	16902	22174.5	22358.5
21.	4176.5	4229	6258.5	6338	8342	8445.5	12493.5	12674.5	16650.5	16902.5	22175	22359
22.	4177	4229.5	6259	6338.5	8342.5	8446	12494	12675	16551	16903	22175.5	22359.5
23.	4177.5	4230	6259.5	6339	8343	8446.5	12494.5	12575.5	16651.5	16903.5	22176	22360
24.	4178	4230.5	6260	6339.5	8343.5	8447	12495	12676	16652	16904	22176.5	22360.5
25.			6260.5	6340	8344	8447.5	12495.5	12676.5	16652.5	16904.5	22177	22361
26.			6261	6340.5	8344.5	8448	12496	12677	16653	16905	22177.5	22361.5
27.			6261.5	6341	8345	8448.5	12496.5	12677.5	16653.5	16905.5	22178	22362
28.			6262	6341.5	8345.5	8449	12497	12678	16654	16906	22178.5	22362.5
29.			6262.5	6342	8346	8449.5	12497.5	12678.5	16654.5	16906.5	22179	22363
30.			6263	6342.5	8346.5	8450	12498	12679	16655	16907	22179.5	22363.5
31.			6263.5	6343	8347	8450.5	12498.5	12679.5	16655.5	16907.5	22180	22364
32.			6264	6343.5	8347.5	8451	12499	12680	16656	16908	22180.5	22364.5
33.			6264.5	6344	8348	8451.5	12499.5	12680.5	16656.5	16908.5	22181	22365
34.			6265	6344.5	8348.5	8452	12500	12681	16657	16909	22181.5	22365.5
35.			6265.5	6345	8349	8452.5	12500.5	12681.5	16657.5	16909.5	22182	23366
36.					8349.5	8453	12501	12682	16658	16910	22182.5	22366.5
37.					8350	8453.5	12501.5	12682.5	16658.5	16910.5	22183	22367
38.					8350.5	8454	12502	12683	16659	16911	22183.5	22367.5
39.					8351	8454.5	12502.5	12683.5	16659.5	16911.5	22184	22368
40.					8351.5	8455	12503	12684	16660	16912	22184.5	22368.5

41.	8352	8455.5	12503.5	12684.5	16660.5	16912.5	22185	22369
42.	8352.5	8456	12504	12685	16661	16913	22185.5	22369.5
43.	8353	8456.5	12504.5	12685.5	16661.5	16913.5	22186	22370
44.	8353.5	8457	12505	12686	16662	16914	22186.5	22370.5
45.	8354	8457.5	12505.5	12686.5	16662.5	16914.5	22187	22371
46.	8354.5	8458	12506	12687	16663	16915	22187.5	22371.5
47.	8355	8458.5	12506.5	12687.5	16663.5	16915.5	22188	22372
48.	8355.5	8459	12507	12688	16664	16916	22188.5	22372.5
49.			12507.5	12688.5	16664.5	16916.5	22189	22373
50.					16665	16917		

APPENDIX 18

Mar

Table of Transmitting Frequencies for the Band 156-174 ~~Mc/s~~ ∠MHz for Radiotelephony in the International Maritime Mobile Service

(See No.287 and Article 35)

IND/111/121	MOD	Note 1	For assistance in understanding the Table, see notes a) to ~~j)~~ k) below.
IND/111/122	MOD	Channel Designator 08	Against channel 08, amend frequency '156.400" to read '156.400 k)'
	Reasons:		Consequent to designation of 156.40 MHz as search and rescue scene-of-action frequency. ∠‾IND/111/85_7
IND/111/123	MOD	Channel Designator 16	~~CALLING AND SAFETY~~ Distress, Urgency, Safety and Calling.
	Reasons:		Consequent to designation of 156.80 MHz as distress frequency. ∠‾IND/111/78_7

NOTES REFERRING TO THE TABLE

IND/111/124	MOD		Amend Channel Designators 09, 13, 67 and 69 to read as 091), 131), 671) and 691) respectively.
	Reasons:		Consequent to IND/111/19
IND/111/125	MOD		i) Channels 15 and 17 may also be used ~~for internal operational communications on board ships, provided the effective radiated power does not exceed 0.1 W, and subject to the national~~

~~regulations-of-the-administration concerned-when-these-channels-are used-in-its-territorial-waters.~~ by on-board communication stations (See Nos. 39A 991A, and 991B)

Reasons: Consequent to IND/111/3, 23 & 25

IND/111/126 ADD

may
k) Channel/08 also be used for inter communication between mobile stations for search and rescue operations (See No.1358 I).

Reasons: Consequent to Proposal IND/111/85

IND/111/127 ADD

1) Channels 09, 13, 67 and 69 may also be used for communication by aircraft stations.

Reasons: Consequent to IND/111/19

IND/111/128 ADD

APPENDIX 20 A.A.

Technical characteristics of Emergency Position-indicating Radiobeacons Operating on the frequency 156.80 MHz.

(See Section VIIIA of Article 36)

Emergency position indicating radio-beacons shall fulfil the following conditions:

a) The power radiated by radio-beacons (Type H) shall be of a value necessary to produce at a distance of 15 nautical miles at sea level a field strength greater than 2.0 microvolts per meter.

b) After a period of 24 hours continuous operation the radiated power shall not be less than 40 per cent of the initial power.

c) The radiobeacons shall be capable of class F2 emission, with a depth of modulation between 30 and 100 per cent with a frequency deviation not exceeding ± 1.5 kHz.

d) The audio-frequency tolerance of emissions used for emergency position-indicating radiobeacons (No.1476C) are:

± 20 c/s for the frequency of 1300 c/s.
± 35 c/s for the frequency of 2200 c/s.

e) The emissions from radiobeacons shall be vertically polarised and omnidirectional in the horizontal plane.

f) Equipment shall be designed to comply with relevant C.C.I.R. recommendations.

Reasons: Consequent to IND/111/76 and 108.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Corrigendum to
Document No. 112-E
30 April 1974
Original : English

PLENARY MEETING

State of Israel

PROPOSAL FOR THE WORK OF THE CONFERENCE

Proposal ISR/112/34, first page, should read ADD 1469A (instead of 1338.1).

Note : this proposal should be transferred from WG-5A to WG-6B

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 112-E
8 March 1974
Original : English

PLENARY MEETING

State of Israel*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

ISR/112/34 ADD 1338.1 (3) The characteristics of the "all ships call" in the selective calling system, which is reserved for alarm purposes only, are given in Appendix 20C paragraph 3.

Reasons : To complete listing of alarm signals, consequent to proposal ISR/75/20.

ISR/112/35 ADD 39A INTRA-SHIP STATION : A low power station used for internal communication on board the ship itself or between the ship and its auxiliary vessels such as lifeboats, towing tugs and tenders. Additional communication functions may also be assigned by the respective administrations within their national waters.

Reasons : Ships increasingly require internal communications for their effective and safe operation.

ISR/112/36

ARTICLE 5

Frequency allocations

MHz

450-460	FIXED MOBILE 318 319A 319C

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*) See also Documents 74, 75, 82 and 83.

ISR/112/37 ADD 319C Intra-ship stations may use the frequencies 457 525; 457 612.5; 457 637.5 MHz - with a maximum effective radiated power of 2 watts (see definition 39A).

Reasons : Consequential to proposal ISR/112/35.

ISR/112/38 MOD 737 § 2. A station shall be identified by a call sign or other recognized means of identification. Such recognized means of identification may be one or more of the following necessary for complete identification : name of station, location of station, operating agency, official registration mark, flight identification number, ~~ship-station~~ selective call number of signal, ~~coast-station~~ selective call identification number or signal, characteristic signal, characteristic of emission or other clearly distinguishing features readily recognized internationally.

Reasons : 1) So that selective call numbers or identification numbers can be used as a means of identification for any station utilizing selective calling techniques. The question of ship-to-shore selective calling is under study by the C.C.I.R. Any other radio service may consider the utilization of selective calling techniques.

ISR/112/39 MOD 999B § 2. (1) The call shall consist of :

- the selective call number or signal of the ~~ship~~ station called;
- the identification number or signal of the ~~coast~~ station calling.

However, in VHF the number of the channel to be used for the reply and for traffic may replace the identification number or signal of the coast station calling. The call shall be transmitted twice.

Reasons : To generalize the method of calling for bilateral applications in the maritime mobile service when suitable equipment becomes available.

ISR/112/40 MOD 1235A (8) ~~Coast stations may call ship~~ Stations equipped to receive selective calls may be called in accordance with the provisions of Article 28A.

Reasons : Consequential to ISR/112/38.

INTERNATIONAL TELECOMMUNICATION UNION
MARITIME CONFERENCE
GENEVA, 1974

Document No. 113-E
13 March 1974
Original : French

PLENARY MEETING

France

PROPOSALS FOR THE WORK OF THE CONFERENCE

Item 14 of the agenda : questions relating to the use of frequencies for radiodetermination

F/113/75
(supersedes proposal F/69/34)

DRAFT RESOLUTION

Relating to the operation of maritime radionavigation stations in the MF bands

The World Administrative Maritime Radio Conference (Geneva, 1974),

Considering

a) that Article 5 of the Radio Regulations allocates a not unconsiderable part of the frequency spectrum between 1 605 kHz and 2 850 kHz on a primary and shared basis to various radionavigation services in Regions 2 and 3;

b) that the Regulations allocate to the maritime radionavigation service in Region 1 a bandwidth of only 25 kHz, despite the considerable utility of this service;

c) that various short-range maritime radionavigation systems are undergoing considerable development despite the absence of satisfactory frequency allocations in Region 1 and that these services meet an obvious need, particularly in ensuring highly accurate radionavigation for coastwise shipping;

d) that the band 2 625 kHz to 2 650 kHz, allocated in Region 1 to the maritime radionavigation service, or any other allocation of a similar bandwidth which might be made is not, or would not be, suitable for the various radionavigation systems which require very few frequency assignments with a small bandwidth but wide spacing;

e) that at present the many maritime navigation systems which are nevertheless operating in the band concerned do so under No. 115 of the Regulations;

f) that operation under these provisions is precarious inasmuch as subsequent assignments to the fixed service or the maritime mobile service might make it necessary to rearrange or demolish an existing maritime radionavigation infrastructure;

g) that the single sideband technique which must be used from now on in the maritime mobile service makes it possible to accomodate more usages in the band in question;

h) that the restrictions resulting from the new technical standards imposed on equipment should be compensated in the first place by advantages benefiting the shipping community and enabling it, in particular if it considers necessary, to use in all security the facilities for accurate radionavigation along the coasts;

i) that there are general provisions in the present Regulations (Nos. 951, 953, 1320, 84ATE etc.) which allow stations of a given service, under certain conditions, to make emissions in the bands allocated to another service;

j) that this Conference is not in a position to rearrange the part of the Table of Allocations between 1 605 and 2 850 kHz in order to introduce satisfactory allocations for the maritime radionavigation service in coastal areas;

<u>Decides</u>

pending study of this problem by a forthcoming conference :

1. that the administrations in Region 1 which have regular assignments to stations of the fixed service and the maritime mobile service (coast stations) in the 1 605 - 2 850 kHz band, duly recorded in the Master Register with a favourable finding from the I.F.R.B., may use fractions of the spectrum corresponding to these assignments subject to the following conditions and reservations :

1.1 that the above-mentioned fractions of the spectrum, formerly the subject of assignments to stations in the maritime mobile service (coast stations) may be assigned, as substitutes, to maritime radionavigation stations coming under the same administration;

1.2 that the frequency bands assigned to radionavigation stations used for shipping should be situated entirely within the part of the spectrum occupied by the frequency bands assigned to the stations in the maritime mobile service for which they are substituted;

1.3 that the transmitter power of radionavigation stations used for shipping should be such that these stations do not increase the probability of harmful interference to other stations, compared with the emissions of the stations in the maritime mobile service for which they are substituted;

2. that when such assignments are made in conformity with the above-mentioned conditions, they shall retain, when notified to the I.F.R.B. for recording in the Master Register, the rights and antecedence attached to the assignments for the fixed or maritime mobile stations for which they are substituted. In particular, they shall enjoy an assignment status equivalent to that of the assignments for which they are substituted and the date of entry in the relevant part of column 2 in the Master Register shall be retained.

Reasons : To enable precision radionavigation stations to operate for shipping along the coasts without being subject to the uncertainties inherent in No. 115 of the Radio Regulations.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 114-E
18 March 1974
Original : English

PLENARY MEETING

Sweden*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 2

The provisions for high-frequency radiotelephony.

Pooling systems

The Swedish Administration is of the opinion that the pending revision of Appendix 25 and the new frequencies made available through transition to SSB channelling do not exhaust all possible means of alleviating the present and future congestion problems on the HF coast station radiotelephone channels in the exclusive maritime mobile bands between 4000 and 23000 kHz. Sweden thus proposes that consideration be given to the possibility of establishing regional frequency pooling systems in order to achieve a better utilization of available coast station channels.

The necessary precautions to ensure that emissions will not interfere with transmissions already in progress on a chosen channel will in many cases be unreliable by ordinary monitoring practice, due to the inherent propagation characteristics of HF emissions. Consequently some sort of display system would be required for traffic supervision at each location. Visual display systems as such are already in use on Swedish VHF coast radiotelephone stations, to ensure easy traffic routing.

Frequencies indicated as free from traffic would be at the disposition of any station participating in a regional frequency pool.

The Swedish Administration believes that the difficulties associated with the operation of regional frequency pools in the HF bands could be considerably reduced by the successful technical solution of the above-mentioned monitoring problem.

A proposed recommendation is attached as Annex 1.

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*) See also Documents 115-125.

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ANNEX 1

S/114/1 RECOMMENDATION A

Relating to a More Efficient Utilization of Available Channels for High Frequency Coast Radiotelephone Stations in the Exclusive Maritime Mobile Bands between 4000 and 23000 kHz.

The World Maritime Administrative Radio Conference, Geneva, 1974,

is of the opinion

a) that the future requirements for HF radiotelephone service channels are expected to increase considerably;

b) that very soon such requirements cannot be satisfactorily met within the allocated frequency bands;

c) that, in the light of interference problems, the practicability and efficiency of radiocommunications is, inter alia, dependent on the number of traffic channels in each band at the disposition of the communicating stations;

d) that radio stations could obtain the benefits of a wider choice of communication channels by pooling their assigned frequency resources.

Invites

the C.C.I.R. to study the technical feasibility of regional frequency pools, especially as regards the necessary supervision and control systems, and to furnish their recommendation for consideration by the next World Administrative Radio Conference competent to deal with this matter.

Recommends

1. that administrations explore the possibilities of establishing regional, bilateral or multilateral frequency pools, for the purpose of obtaining a better utilization of allotted frequencies, bearing in mind the operational aspects involved and the mutual right to an equitable and rational use of all channels in a frequency pooling system;

2. that administrations engaged in such operations inform the C.C.I.R. and the I.F.R.B. periodically of the progress achieved.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

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Sweden*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 2 : The provisions for HF radiotelephony.

In accordance with No. 1355 Mar of the Radio Regulations and as indicated in Appendix 17, sections A and B, the transmitting frequencies of the coast stations and of the corresponding ship stations shall, for the conduct of duplex telephony, be associated in pairs. The wording of this paragraph still permits the free combination of transmitting and receiving frequencies, which in practical operation has resulted in heavy crossband traffic, i.e. the use of non-paired frequencies in the same band or in two different bands.

In view of the limited number of available channels and in order to promote the greatest practicable sharing of the maritime mobile radiotelephone bands between 4000 and 23000 kHz the Swedish Administration proposes that the obligatory use of paired frequencies for HF radiotelephony should be provided or by necessary changes in No. 1355 Mar and paragraph 3 of Appendix 17 Mar as indicated in Annex 1 to this document.

With regard to the rising demand for HF radio telephony traffic and in order to avoid harmful interference between different coast stations sharing the same frequency the Swedish Administration is also of the opinion that all possible efforts should be made to reduce unnecessary and inefficient transmissions on the restricted number of channels available for this service. Consequently the emission of automatic calling and identification signals or of a continuous carrier wave should be prohibited when traffic is not on hand. Proposed regulatory provisions to this effect are attached to this document as Annex 2.

Annexes : 2

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*) See also Documents 114, 116-125.

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ANNEX 1

ARTICLE 35

Use of frequencies for radiotelephony in the Maritime Mobile Service

Section III

Bands between 4000 and 23000 ~~kc/s~~ kHz

E. Traffic

S/115/2 **MOD** 1355 § 17. (1) For the conduct of duplex telephony the transmitting frequencies of the coast stations and ship stations shall be associated in pairs, ~~as far as possible,~~ as indicated in Appendix 17, Sections A and B.

APPENDIX 17

Mar 2

Channelling of the Maritime Mobile Radiotelephone Bands between 4000 and 23000 ~~kc/s~~ kHz

(see Article 35)

S/115/3 **MOD** 3 One or more series of frequencies from Sections A or B (with the exception of those frequencies of Section B mentioned in paragraph 5 below) are assigned to each coast station, which uses those frequencies associated~~, as far as possible~~ in pairs; each pair comprises a transmitting and a receiving frequency. The series shall be selected with due regard to the areas served and so as to aviod, as far as possible, harmful interference between the services of different coast stations.

Reasons: To avoid crossband operation.

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A N N E X 2

ARTICLE 33

General radiotelephone procedure in the Maritime Mobile Service

Section I

General provisions

S/115/4 **MOD** 1214 §4. (1) Automatic ~~calling-and-identification devices,-and~~ devices providing for the emission of a signal to indicate that a call is in progress on a channel ~~is-in-use,~~ may be used in this service ~~on-a non-interference-basis-to-the-service-provided-by coast-stations.~~

Reasons: The use of a signal to indicate that a call is in progress on a channel is felt to be necessary.

S/115/5 **ADD** 1214A (1A) Continuous "slip-running" of call signals or other identifications is not permitted.

S/115/6 **ADD** 1214B (1B) Stations of the maritime mobile service shall not radiate a continuous carrier wave between calls or when traffic is not on hand.

Reasons: To reduce mutual interference between the services of different coast stations sharing the same frequency.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

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3 May 1974
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Sweden*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 3 : The provisions concerning distress and safety in the Maritime Mobile Service.

ARTICLE 33

General Radiotelephone Procedure in the Maritime Mobile Service

Section V. Duration and control of Working

S/116/7 **MOD** 1290 § 25. (1) Calling, and signals preparatory to traffic, shall not exceed ~~two minutes~~ one minute when made on the carrier frequency 2182 ~~kc/s~~ kHz or 30 seconds when made on the frequency 156.80 ~~Mc/s~~ MHz, except in cases of distress, urgency or safety to which the provisions of Article 36 apply.

Reasons: To reduce the congestion on the distress frequencies so that their primary safety functions will be protected in support of Resolution No. 217 of the VII Assembly of the IMCO.

In view of the high quality of F3 emissions as regards the perceptibility of speech and the increasing importance of VHF traffic a time limit of 30 seconds is considered adequate for the frequency 156.80 MHz.

S/116/8 **ADD** 1290A (2) In order to facilitate the reception of distress calls, other transmissions than those related to distress urgency, and safety shall be reduced to a minimum on the carrier frequency 2182 kHz and the frequency 156.80 MHz and in any case shall not exceed one minute on 2182 kHz or 30 seconds on 156.80 MHz.

Reasons: In conformity to the procedures in No. 1290 as modified and to Article 32, Section II, No. 1113 of the Radio Regulations.

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*) See also Documents 114, 115, 117-125

ARTICLE 25

Working Hours of Stations in the Maritime and Aeronautical Mobile Services

Section IV Ship Stations

S/116/9 ADD 946A (2A) When such reopening is notified the nearest coast station, the ship station should, by transmitting QUX ?, request the coast station to give urgent navigational warnings or gale warnings in force that may affect the safety of navigation of the vessel concerned.

Reasons : To improve the safety of navigation by introducing a routine procedure for early collection of urgent navigational warnings or gale warnings in force that may affect the vessel concerned. A need for this service has long been felt, especially in view of the great distances covered in some hours' time by late generation vessels and also with regard to the time period between the scheduled transmissions of navigational warnings and gale warnings made by the coast stations.

APPENDIX 13A

Miscellaneous Abbreviations and Signals to be used for Radiocommunications in the Maritime Mobile Service

A. List of Abbreviations in alphabetical order.

After QUW :

S/116/10 ADD

Abbreviation	Question	Answer or Advice
QUX	Do you have any urgent navigational warnings or gale warnings in force that may affect my navigation before your next scheduled transmission of navigational warnings ?	I have the following urgent navigational warnings or gale warnings in force that may now affect your navigation : .....

B. List of Signals according to the Nature of Questions, Answer or Advice.
In sub-section "Meteorology" after QUH :

S/116/11 ADD

Abbreviation	Question	Answer or Advice
QUX	Do you have any urgent navigational warnings or gale warnings in force that may affect my navigation before your next scheduled transmission of navigational warnings ?	I have the following urgent navigational warnings or gale warnings in force that may now affect your navigation : .....

In sub-section "Safety" after QOE :

S/116/12 ADD

Abbreviation	Question	Answer or Advice
QUX	Do you have any urgent navigational warnings or gale warnings in force that may affect my navigation before your next scheduled transmission of navigational warnings ?	I have the following urgent navigational warnings or gale warnings in force that may affect your navigation : .....

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

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Sweden*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 3 : The provisions concerning distress and safety in the Maritime Mobile Service.

ARTICLE 33

General Radiotelephone Procedure in the Maritime Mobile Service

Section V. Duration and Control of Working.

S/116/7 **MOD 1290** § 25. (1) Calling, and signals preparatory to traffic, shall not exceed ~~two minutes~~ one minute when made on the carrier frequency 2182 ~~kc/s~~ kHz or 30 seconds when made on the frequency 156.80 ~~Mc/s~~ MHz, except in cases of distress, urgency or safety to which the provisions of Article 36 apply.

Reasons: To reduce the congestion on the distress frequencies so that their primary safety functions will be protected in support of Resolution No. 217 of the VII Assembly of the IMCO.

In view of the high quality of F3 emissions as regards the perceptibility of speech and the increasing importance of VHF traffic a time limit of 30 seconds is considered adequate for the frequency 156.80 MHz.

S/116/8 **ADD 1290A** (2) In order to facilitate the reception of distress calls, other transmissions than those related to distress urgency, and safety shall be reduced to a minimum on the carrier frequency 2182 kHz and the frequency 156.80 MHz and in any case shall not exceed one minute on 2182 kHz or 30 seconds on 156.80 MHz.

Reasons: In conformity to the procedures in No. 1290 as modified and to Article 32, Section II, No. 1113 of the Radio Regulations.

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*) See also Documents 114, 115, 117-125

ARTICLE 25

Working Hours of Stations in the Maritime and Aeronautical Mobile Services

Section IV. Ship Stations.

S/116/9 ADD 946A (2A) When such reopening is notified the nearest coast station, the ship station should, by transmitting QUX 1, request the coast station to give all relevant information about those warnings that may generally affect the safety of navigation on the intended route as given by the ship station.

Reason: To improve the safety of navigation by introducing a routine procedure for early collection of navigation and safety warnings that may affect the vessel concerned. A need for this service has long been felt, especially in view of the great distances covered in some hours' time by late generation vessels.

APPENDIX 13A

Miscellaneous Abbreviations and Signals to be used for Radiocommunications in the Maritime Mobile Service.

A. List of Abbreviations in alphabetical order.

After QUW:

S/116/10 ADD

Abbreviation	Question	Answer or Advice
QUX	Do you have any warning(s) that may affect my navigation before your next scheduled transmission of navigational warnings?	I have the following warning(s) that may now affect your navigation:.....

B. List of Signals according to the Nature of Questions, Answer or Advice.
In sub-section "Meteorology" after QUH:

S/116/11 ADD

Abbreviation	Question	Answer or Advice
QUX	Do you have any warning(s) that may affect my navigation before your next scheduled transmission of navigational warnings?	I have the following warning(s) that may now affect your navigation:....

In sub-section "Safety" after QOE:

S/116/12 ADD

Abbreviation	Question	Answer or Advice
QUX	Do you have any warning(s) that may affect my navigation before your next scheduled transmission of navigational warnings?	I have the following warning(s) that may now affect your navigation:....

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GENEVA, 1974

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Sweden*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 3.7

The use of auto-alarm signals

Extended use of the two-tone alarm signal

As is well known from recent distress cases, the lack of a reliable alerting system in the maritime field is still a serious problem. Although the aural watch keeping for calls on voice or morse might be considered acceptable for covering the average need in connexion with public correspondence, there is an immediate need for an improved alerting system in cases of distress or urgency.

Since some years will have to pass before the new digital calling and distress system is available for a majority of ships, we believe that an interim solution along the lines proposed in the attached draft resolution would be useful.

The maritime communication is taking place on a number of frequencies in different bands. The introduction of distinct easy recognizable alerting signals preceeding important messages has certainly facilitated the watch keeping to some extent, but has at the same time provided the maritime communicators with a variety of alerting signals such as:

- on 500 kHz: 12 dashes, 4 secs long and with 1 sec space;
- on 2182 kHz: 2 shifting tones, 1300/2200 Hz, each 250 msecs long;

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*) See also Documents 114-116, 118-125

- for the S.S.F.C.(Selcall) system 11 different sequential tones;
- for the EPIRBs one 1300 Hz tone.

Some improvement could be achieved by the standardization of one of the existing alarm signals for a number of services, thus simplifying the training of ships' personnel to recognize the alarm signal wherever it appears.

Studying, from this aspect, the alarm signals listed above, the two-tone radiotelephony signal has preferences over the others, as it is suitable for aural as well as for automatic alerting, and also because it demands low economic investments on the transmitting as well as on the receiving side.

Except serving as a distress alerting signal in all maritime bands, one of its tones - 2200 Hz - could also, transmitted in dots, preceed urgent navigational warnings.

Proposed resolution is attached as Annex 1.

ANNEX

S/117/13 RESOLUTION A

Relating to the Extended Use of the Two-Tone Alarm Signal in the MF, HF and VHF Bands of the Maritime Mobile Services.

The World Maritime Administrative Radio Conference,
Geneva, 1974.

Considering

a) that No. 1465 of the Radio Regulations prescribes a radiotelephone alarm signal, consisting of two tones: 1300/2200 Hz;

b) that No. 1463 of the Radio Regulations prescribes a radiotelegraph alarm signal consisting of 12 dashes, 4 seconds long and with 1 second intervals;

c) that the VHF Channel 16 is being introduced as a distress frequency;

d) that No. 1476B and 1476C of the Radio Regulations prescribes either a position-indicating emergency signal on 2182 kHz, consisting of a keyed tone of 1300 Hz, or the radiotelephone alarm signal followed by other information;

e) that the VIIth Assembly of the I.M.C.O. has adopted Resolutions 205 and 217 dealing with 2182 kHz loudspeaker watch keeping with filtered loudspeakers on board all convention ships;

f) that the present radiotelegraph alarm signal is technically imperfect for automatic decoding;

g) that regulation 9 Chapter IV of the S.O.L.A.S. Conference, 1960, prescribes a modulation frequency between 450 and 1350 Hz;

Noting

- there is need for audible reception of the alarm signal also on 500 kHz;
- there is need for an alarm signal in the HF band;
- there is need for an alarm signal in the VHF band for maritime mobile radiotelephony;
- the alarm signal should be standardized for different maritime bands;
- there is need for a signal preceeding urgent navigational warnings to alert ships who use filtered loudspeakers;
- that the two-tone alarm signal is suitable for aural watch as well as for automatic alarm decoders;
- that the radiotelegraph auto-alarm device will be alerted also if the auto-alarm signal is modulated by the two-tone signal;

Resolves

1. that the two-tone radiotelephone alarm signal shall be used in the MF, HF and VHF bands for the maritime mobile service;

2. that the radiotelegraph auto-alarm signal should be modulated by the two-tone signal;

3. that a series of dots on the audio frequency 2200 Hz shall preceed urgent navigational warnings;

4. that the audio-frequency tolerance of the above-mentioned emissions shall be

± 20 Hz for the frequency of 1300 Hz

± 35 Hz for the frequency of 2200 Hz

5. that the modulation frequency of A2 signals for other purposes than distress or urgency should not be 1300 ± 20 Hz or 2200 ± 35 Hz.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

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PLENARY MEETING

Sweden*)

PROPOSAL FOR THE WORK OF THE CONFERENCE

Agenda Item 4

The VHF provisions generally.

ARTICLE 33

General Radiotelephone Procedure in the Maritime Mobile Service.

Section III. Calls, Reply to Calls and Signals Preparatory to Traffic.

Method of Calling

S/118/14 **ADD 1222A** (1A) However, in the bands between 156 and 174 MHz, the calling procedure described in No. 1222 may, when the conditions of establishing contact are good, be replaced by:

- the call sign of the station called, once;
- the word this is (or DE spoken as DELTA ECHO in case of language difficulties);
- the call sign or other identification of the calling station, twice.

Reason: In accordance with a general effort to ease congestion on the VHF telephone channels by taking advantage of the inherent high quality of frequency modulated transmissions.

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*) See also Documents 114-117; 119-125.

S/118/15 **ADD 1222B** (1B) When calling a VHF coast station serving more than one channel, the ship station should, if calling on a working channel, include the number of the channel employed in the call.

Reason: Traffic is facilitated where a coast station is normally called on two or more working frequencies controlled by one operator only and there are difficulties of locating the calling station on the right channel.

Indication of the Frequency to be Used for Traffic.

C. Bands between 156 and 174 MHz.

S/118/16 **MOD 1258A** (4) However, taking into account the requirements of No. 1290, a brief exchange of traffic concerning the safety of navigation need not be transmitted on a working frequency when it is important that all ships within range receive the transmission.

Reason: Consequential to the proposed changes in No. 1290

Indication of Traffic.

S/118/17 **MOD 1265** § 19. When the calling station wishes to exchange more than one radiotelephone call, or to transmit ~~more than~~ one or more radiotelegrams, it should indicate this when contact is established with the station called.

Reason: To facilitate the immediate routing of radiotelegrams to the telegram department of coast stations.

ARTICLE 34

Calls by Radiotelephony

S/118/18 **ADD 1302A** (3A) However, in the bands between 156 and 174 MHz, the calling procedure described in No. 1302 may, when the conditions of establishing contact are good, be replaced by:

- "Hello all ships" or CQ (spoken as CHARLIE QUEBEC), once;
- the words THIS IS (or DE spoken as DELTA ECHO in case of language difficulties);
- "... Radio", twice;
- "Listen for my traffic list on channel ..."

In no case may this preamble be repeated.

Reason: Consequential to revisions proposed for Article 33 in order to reduce congestion on 156.80 MHz.

S/118/19 **MOD 1303** (4) The provisions of No. 1302 are obligatory when 2182 ~~kc/s~~ kHz is used.

Reason: Consequential to revisions proposed for Article 33 in order to reduce congestion on 156.80 MHz.

S/118/20 **ADD 1308B** (1B) In areas where reliable VHF communication with a called coast station is practicable, the calling station may repeat the call as soon as there is evidence of traffic having been terminated at the coast station.

Reason: To reduce congestion on VHF by allowing greater freedom in the operating procedure, resulting in a more even traffic flow and hence improved utilization of these channels.

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PLENARY MEETING

Sweden*)

PROPOSAL FOR THE WORK OF THE CONFERENCE

Agenda Item 4.3 : The use of selective calling on VHF.

ARTICLE 35

Use of Frequencies for Radiotelephony in the Maritime Mobile Service

Section IV. Bands between 156 and 174 MHz

S/119/21 MOD 1359A (1A) The frequency 156.80 ~~Mc/s~~ MHz may be used only by coast stations for selective calls ~~to ships~~ preceding high priority information for ships.

Reason: In view of the increased importance of channel 16 for distress and safety communications, the transmission of selective calling signals should be prohibited on channel 16 except for high priority information from coast stations.

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*) See also Documents 114-118, 120-125.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

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PLENARY MEETING

Sweden*)

PROPOSAL FOR THE WORK OF THE CONFERENCE

Agenda Item 4 : The use of VHF for communication between helicopters/light aircraft and ships

ARTICLE 27

Aircraft and Aeronautical Stations

S/120/22 **MOD 952** (2) For this purpose stations on board aircraft should use the frequencies allocated to the maritime mobile or maritime mobile-satellite services. However, having regard to interference which may be caused by aircraft stations at high altitudes, maritime mobile frequencies in the bands above 30 MHz shall not be used by aircraft stations ~~in any specific area without the prior agreement of all the administrations of the area in which interference is likely to be caused. In particular, aircraft stations operating in Region I should not use frequencies in the bands above 30 Mc/s allocated to the maritime mobile service by virtue of any agreement between administrations in that Region~~, with the exception of the channels between 156 MHz and 174 MHz specified in the frequency table of Appendix 18 which may be used provided the following conditions are observed:

S/120/23 **ADD 952A** a) the altitude of the aircraft stations shall not exceed 1000 feet, except for reconnaissance aircraft participating in ice-breaking operations where an altitude of 1500 feet is allowed.

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*) See also Documents 114-119, 121-125.

S/120/24 **ADD 952B** b) the effective radiated power of the aircraft station shall not exceed 5 watts.

S/120/25 **ADD 952C** c) aircraft stations shall use the channels designated for their use in Appendix 18.

S/120/26 **ADD 952D** d) aircraft station transmitters shall comply with the technical characteristics given in Appendix 19.

S/120/27 **ADD 952E** e) the communications of an aircraft station shall be limited to operations in which the maritime mobile stations are primarily involved, and where there is a requirement for direct communications of non-public messages between the aircraft and the ship or coast station.

Reason: To provide for communications for the increasing use of helicopters and light aircraft to support maritime operations, such as search and rescue, anti-pollution activities, ice-breaking, ferrying of personnel and reprovisioning at sea.

Restrictions are placed on power and height of the aircraft station transmitters because of the increased range associated with altitude. For reconnaissance aircraft (mainly helicopters) participating in ice-breaking operations an increased range and hence altitude is sometimes considered necessary for communication with the ice-breaking vessel(s).

It is understood that specific channels will be allocated to this services during the Conference in order to protect the conventional intership and ship-shore communications in a revised Appendix 18.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

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Sweden*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 8

Matters relating to the use of direct printing etc

Direct printing communications between ships and coast stations, equipped for this service, are rapidly increasing. Appropriate operating procedures to be used in the international telex service with ships should be included in the Radio Regulation. The following new paragraphs are suggested for inclusion:

S/121/28 ADD

ARTICLE X

1 Establishing connection from ship to coast station.

1.1 The operator of the ship station calls the coast station by means of ordinary Morse telegraphy or by telephony and requests a direct-printing communication, exchanging information regarding frequencies to be used and giving the ship's direct-printing selcall number (according to CCIR Draft Recommendation AB/8).

1.1.1 The coast station proceeds to call the ship using the ship's selcall number on the direct-printing frequency agreed.

or

1.2 The operator of the ship station calls the coast station using the direct-printing equipment and the coast station's selcall number (according to CCIR Draft Recommendation AB/8) on predetermined coast station receive frequency/ics.

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*) See also Documents 114-120, 122-125.

1.2.1 The coast station equipment detects the call and the coast station operator proceeds to answer the call using the direct-printing equipment on the corresponding coast station transmit frequency.

or

1.2.2 The coast station equipment detects the call and answers the call directly on the corresponding coast station transmit frequency.

2 Establishing connection from coast station to land subscriber.

2.1 The coast station operator establishes the land-line connection by means of the regular facilities at his disposal using the information contained in the preamble of the messagereceived from the ship station.

or

2.2 The coast station establishes the land-line connection automatically using the information contained in the preamble of the message received from the ship station.

3 Establishing connection from land subscriber to coast station or directly to ship.

3.1 The land subscriber calls his international telex position presenting his request, which is passed to the relevant coast station by the operator of the international telex position.

or

3.2 The land subscriber calls (subject to bilateral agreement between the Administrations concerned - until internationally agreed) the coast station inquestion directly and presents his request.

or

3.3 The land subscriber calls (subject to bilateral agreement between the Administrations concerned - until internationally agreed) the ship directly using the unique national telex number assigned to the ship.

4 Establishing connection from coast station to ship station.

4.1 The coast station calls the ship station by regular means, e.g. the ordinary traffic lists.

or

4.2 The ship equipment keeps watch on the predetermined coast station transmit frequencies. The coast station calls the ship using the direct-printing equipment and the ship's selcall number (according to CCIR Draft Recommendation AB/8)

4.2.1 The call is received by the ship equipment telling the operator on board to answer the call either immediately by tuning his transmitter to corresponding coast station receive frequency or at later stage using the procedures outlined in para 1 above,

or

4.2.2 The call is detected by the ship equipment which automatically starts the ship's transmitter on the corresponding coast station receive frequency.

5 Message format.

5.1 Traffic may be exchanged

a) in a store-and-forward mode where traffic from the calling subscriber according to paras 1 or 4 above is stored at the coast station until the end subscriber's connection can be established according to paras 2 or 3 above,

b) in a conversational mode where the end subscriber is interconnected directly.

5.2 In the shore to ship direction the format of the messages should conform to ordinary telex network practice.

5.3 In the ship to shore direction the format of the message should conform to ordinary telex network practice with the addition of a preamble as follows

a) in the store-and-forward mode the preamble shall consist of the characters TLXyyzzzzz+ typed in sequence preceded by at least one carriage return, where yy is the country code (according to CCITT) and zzzzz is the land subscriber's telex number,

b) in the conversational mode the preamble shall consist of the characters DIRTLXyyzzzzz+ typed in sequence and preceded by at least one carriage return, where yy is the country code (according to CCITT) and zzzzz is the land subscriber's telex number.

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Sweden*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 8 and Item 13 : Use of Ships Radio Apparatus within harbours.

Sweden proposes that consideration be given to the use of ships radio apparatus within harbours and in territorial waters, particularly in the case of ships equipped for direct printing radiocommunication and for radiocommunication via satellites.

A proposed recommendation is attached as Annex.

Annex : 1

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*) See also Documents 114-121, 123-125.

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ANNEX

S/122/29

DRAFT RECOMMENDATION

Relating to the operation of mobile stations visiting foreign territorial waters and harbours

The World Administrative Radio Conference, Geneva, 1974,

Considering

a) that under the terms on No. 844 of the Radio Regulations, Members and Associate Members of the Union undertake not to impose upon foreign mobile stations which are temporarily within their territorial waters or make a temporary stay in their territory, technical and operating conditions more severe than those contemplated in these Regulations;

b) that, at present, the regulations in force in most countries do not permit ship stations within territorial waters or in harbours to use their radio apparatus, with the possible exception of exchange of communication in cases of distress or in the port operation service;

c) that, at present, there are no technical or operational reasons to prohibit the operation of mobile stations temporarily within territorial waters or in harbours;

d) that the trend is towards larger and more expensive tonnage, the proper economic management of which demands forwarding of messages concerning cargo, change of routes, etc. with less delay possible;

e) that the new means of communication that have become available during the resent years like direct-printing equipment will as such provide for improved communication when regulations so permit;

f) that the introduction of the maritime mobile satellite service will bring about new automated techniques, the efficient use of which demands continuous access to ships radio apparatus.

Recommends

that administrations shall endeavour to include in their national regulations such provisions as will permit foreign mobile stations temporarily within their territorial waters or ports to make use of their radio apparatus.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 123-E
18 March 1974
Original : English

PLENARY MEETING

Sweden*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 10

Problems relating to the maritime services operating in the bands between 1605 kHz and 3800 kHz etc

The preparation of an international channel plan and an appropriate frequency allotment plan for the maritime mobile service operating in the bands between 1605 and 3800 kHz

The present situation in the bands between 1605 and 3800 kHz implies considerable drawbacks in the maritime mobile service, e.g. the lack of a fixed channel spacing as well as a fixed duplex frequency distance. This has resulted in more expensive shipborne equipment than necessary and an in efficient use of the frequency spectrum.

The dicision to introduce single sideband technique is a step towards a more officient use of the above-mentioned frequency bands. This advantage can, however, not be fully utilized in the sense of the optimum use of these bands,until an efficient plan has been created and implemented.

A proposed recommendation for the purpose of a future establishing of the necessary plans and the consequential amending of the involved paragraphs of the Radio Regulations is attached as Annex 1.

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*) See also Documents 114-122, 124, 125

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ANNEX

S/123/30 RECOMMENDATION B

Relating to the Preparation of an International Channel Plan and an appropriate Frequency Allotment Plan for the Maritime Mobile Service operating in the Bands between 1605 and 3800 kHz.

The World Maritime Administrative Radio Conference, Geneva, 1974,

considering

a) that the present distribution of frequencies to stations of the maritime mobile service in the bands between 1605 and 3800 kHz derives its origin from the Plans and Lists adopted by the Extraordinary Administrative Radio Conference, Geneva, 1951, and that later on, in 1959, these were replaced by the Article 9 procedure;

b) that consequently no Plan for implementation of new assignments in the maritime mobile service bands between 1605 and 3800 kHz is now in force;

c) that the present situation in these bands implies considerable drawbacks;

d) that the introduction of signle sideband technique in the maritime mobile radiotelephone service has already started on the basis of the provisions of RES Mar 5 of the World Administrative Radio Conference, Geneva, 1967, and that the conversion from double sideband to single sideband will continue, guided by the timetable and the supplementary technical specifications adopted by that Conference and amended by the present Conference;

e) that the introduction of single sideband technique will only partly remove the existing drawbacks;

f) the desirability of achieving a more effective use of the frequency bands allocated to the maritime mobile service in the bands between 1605 and 3800 kHz by means of:

- the creation of an international channel plan
- the use of pairs of single sideband assigments (with fixed channel spacing)
- the establishment of appropriate world-wide or regional frequency allotment plans;

g) that it was found impracticable for the present Conference to deal with the tasks referred to in f) above, but necessary to have them dealt with by a subsequent competent conference;

h) that it is desirable to have in advance of that conference proposals for the technical bases for the realization of the tasks referred to in f) above;

recommends

1 that the World Administrative Radio Conference to be held in 1978 be empowered:

1.1 to create an international channel plan (with paired frequencies) for the maritime mobile service in the bands between 1605 and 3800 kHz;

1.2 to establish appropriate world-wide or regional frequency allotment plans, or (if this, for practical reasons, cannot be achieved at that conference), recommend that a subsequent conference be convened as soon as possible to prepare such allotment plans;

1.3 to amend the associated provisions of the Radio Regulations;

2 that the 1978 Conference be preceded by a preparatory meeting, in accordance with No. 73 of the Convention;

invites

the Administrative Council to include in the agenda for the 1978 Conference such provisions as will enable the latter to take the necessary decisions in this matter.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 124-E
18 March 1974
Original : English

PLENARY MEETING

Sweden*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 16 ; Article 40 and the associated provisions of the Additional Radio Regulations.

Add the following new paragraph at a suitable place :

S/124/31 ADD The use of the international telephone, telegraph and telex networks shall be allowed to the greatest possible extent in order to facilitate and expedite the handling and routing of traffic in the maritime mobile services.

Reasons : There is a growing need for radio communications in the maritime mobile service, especially for direct contact both on radiotelegraphy and on radiotelephony. The need for direct contact stresses the requirement of establishing contacts as rapidly as practicable using automatic means to the greatest extent available. For this reason, it must be made possible to use the international telephone and telex networks without any restrictions, i.e. any telephone or telex subscriber shall be allowed to exchange traffic to any ship properly equipped through any coast station and vice versa.

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*) See also Documents 114, 123, 125.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Addendum 1 to
Document No. 125-E
15 May 1974
Original : English

COMMITTEE 5

Sweden

PROPOSALS FOR THE WORK OF THE CONFERENCE

Revision of Appendix 25 MOD

The original frequency requirements submitted by Sweden were based on continuously available channels, free from interference.

It has been brought to our attention that the requirements submitted by other countries are based on experiences from the existing sharing situation.

We therefore supply the following revised requirements taking the existing sharing situation into account. The requirements are based on sharing among the Scandinavian countries.

Frequency bands in MHz	4	6	8	12	16	22
Number of SSB channels	6	2	8	8	10	8

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 125-E
18 March 1974
Original : English

PLENARY MEETING

Sweden*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 1 : Revision of Appendix 25 etc.

The frequency requirements of Sweden in the revised Frequency Allotment Plan for Coast Radiotelephone Stations (Appendix 25 to the Radio Regulations) will be as follows :

Frequency Bands in MHz	4	6	8	12	16	22
Number of SSB channels	2	1	2	2	3	2

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*) See also Documents 115 - 124

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Corringendum No. 1 to
Document No. 126-E
10 May 1974

PLENARY MEETING

TEXTS OF C.C.I.R. STUDY GROUP 8

In C.C.I.R. Doc. 8/1019, replace page 23 by the attached page.

Attachment : 1

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ANNEX III

CHARACTERISTICS FOR SSB RADIO EQUIPMENT FOR OPTIMUM PERFORMANCE OF A LINKED COMPRESSOR AND EXPANDER SYSTEM

A linked compressor and expander system can be applied with full advantage to the maritime mobile service using either DSB or SSB systems.

To obtain the full advantages of the linked system when used with SSB radio equipment, the performance of the latter should be in accordance with Recommendation 258-2 and should, in addition, meet the following requirements:

1. The short-term frequency stability of coast station transmitters should be within ±2 Hz over a period of the order of fifteen minutes.

2. The short-term frequency stability of a ship station transmitter should be within ±5 Hz over a period of the order of fifteen minutes.

3. To ensure sufficient overall gain stability of the system, for the duration of a call, facilities should be provided in coast station receivers to keep the end-to-end frequency error within ±2 Hz; similarly, facilities should be provided in ship station receivers to keep the end-to-end frequency error within ±5 Hz.

4. The permitted total amplitude variation in the radio transmitter over the 350-2700 Hz audio-frequency band should be 6 dB and the differential delay should not exceed 3 ms. The receiver should have at least the same standards of performance in these respects.

5. If the pilot carrier of a Type A3A emission is not used to provide a continuous signal for frequency and gain control of the receiver, for example where Type A3J emission is used, the initial tuning procedure will require the transmission for a brief period of a suitable reference tone (e.g. 1 000 Hz ±1 Hz as in Recommendation 477) at a level of, say, -10 dBm0 ±0.5 dB.

6. Where it is desired to use privacy equipment or speech inverters, it should be borne in mind that the upper audio frequency of the speech channel in Annex I of this Recommendation is 2 380 Hz.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 126-E
22 March 1974

PLENARY MEETING

Note by the Secretary-General

TEXTS OF C.C.I.R. STUDY GROUP 8

The Director of the C.C.I.R. has transmitted the texts of C.C.I.R. Study Group 8, annexed hereto, for submission to the Maritime Conference.

M. MILI
Secretary-General

Annex : 1 (per addressee*)

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* Additional copies will be made available to the Conference.

CONTRIBUTIONS
BY THE C.C.I.R.
TO THE
WORLD ADMINISTRATIVE RADIO CONFERENCE FOR MARITIME MOBILE TELECOMMUNICATIONS
(GENEVA, 1974)

INTRODUCTION

By analogy with the provisions of Article 14, paragraph 2(2), (No. 191) of the International Telecommunication Convention (Montreux, 1965) and of Chapter 18 (Nos. 809 and 810) of the General Regulations annexed thereto, the Director of the C.C.I.R. herewith submits the following texts to the WARC (Maritime), 1974. These texts were selected, after consultation with C.C.I.R. Study Group 8 (Mobile Services), which met in Geneva from 5 to 26 February 1974, as representing the most recent C.C.I.R. results on technical subjects to be considered by the Conference.

The texts referred to have been divided into two sections:

1. Maritime Mobile Service (Terrestrial)
2. Maritime Mobile Satellite Service

Within each section two types of C.C.I.R. texts are referred to:

(a) Recommendations, Reports, etc., which appear in Volume VI of the conclusions of the XIIth Plenary Assembly of the C.C.I.R. (New Delhi, 1970) and which therefore are not reproduced here;

(b) Documents identified by their C.C.I.R. serial number (i.e. 8/1...), which are texts agreed by Study Group 8 at its Final Meeting and which have yet to be placed before the XIIIth Plenary Assembly, scheduled to take place in Geneva in July 1974.

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8/1004	Prevention of interference to radio reception on board ships (Recommendation)
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8/1030	Signal-to-interference protection ratios and minimum field strengths required in the mobile services (Report)
8/1024	Use of radio-beacon stations for communications (Recommendation)
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8/1023	Technical characteristics of VHF equipment operating in the international maritime mobile service in channels spaced by 25 kHz (Recommendation)

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* The missing Documents in this series are not of interest to the Maritime Conference.

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8/1064	Automated VHF maritime mobile telephone systems (Report)
1/1011	Frequency tolerance of transmitters (Report) (This Document is submitted to the Maritime Conference at the request of Study Group 1)

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* The missing Documents in this series are not of interest to the Maritime Conference.

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(b) Texts agreed by Study Group 8 at its Final Meeting, 1974

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8/1037	Technical characteristics of systems providing communication and/or radiodetermination using satellite techniques for aircraft and/or ships - Technical feasibility of systems employing space communication (Report)
8/1038	Signal quality and modulation techniques for radiocommunication and radiodetermination satellite services for aircraft and ships (Report)
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* The missing Documents in this series are not of interest to the Maritime Conference.

C.C.I.R. Doc. No.*	
8/1047	Technical characteristics of systems providing communication and/or radiodetermination using satellite techniques for aircraft and/or ships - Noise as a factor affecting the choice of frequency for telecommunications between an aircraft/ship and a satellite (Report)
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8/1054	Technical characteristics of systems providing communication and/or radiodetermination using satellite techniques for aircraft and/or ships - Maritime tests in Band 9 (UHF)

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* The missing Documents in this series are not of interest to the Maritime Conference.

C.C.I.R. Doc. No.*	
8/1055	Technical characteristics of systems providing communication and/or radiodetermination using satellite techniques for aircraft and/or ships - Aeronautical and maritime satellite tests in Band 8 (VHF) (Report)
8/1056	Technical characteristics of systems providing communication and/or radiodetermination using satellite techniques for aircraft and/or ships - Consideration of possible technical characteristics for a maritime satellite system for public correspondence (Report)
8/1057	Technical characteristics of systems providing communication and/or radiodetermination using satellite techniques for aircraft and/or ships - A method of eliminating multipath fading using an omnidirectional antenna diversity system for reception of satellite signals in the maritime mobile satellite service (Report)
8/1060	Technical characteristics of systems providing communication and/or radiodetermination using satellite techniques for aircraft and/or ships - Possible maritime distress system using satellites (Report)

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* The missing Documents in this series are not of interest to the Maritime Conference.

STUDY GROUP 8

The Editorial Committee, after examination of Recommendation 45 presented by Study Group 8, submits the following text to the Plenary Assembly for approval.

DRAFT

RECOMMENDATION 45(Rev.74)

AVOIDANCE OF MUTUAL INTERFERENCE BETWEEN SHIPS' RADAR AND OTHER RADIOCOMMUNICATION APPARATUS ON BOARD

(1951 - 1974)

The C.C.I.R.,

CONSIDERING

(a) that experience has proved that, with well engineered and properly installed radar and radiocommunication apparatus, the possibility of mutual interference occurring in practice is very remote;

(b) that the possibility of interference from radar transmitters on one vessel to radio and direction-finding reception on another vessel or from radiocommunication transmitters on one vessel to radar reception on another vessel, is extremely remote;

(c) that, where mutual interference is experienced between radio and radar equipment on the same vessel, the presence of such interference may readily be detected and identified by listening on the radio receiver or direction-finder, or by observing the radar display, respectively;

(d) that, where mutual interference has been experienced the cause has generally been faulty initial installation;

RECOMMENDS

1. that administrations should ensure that the radiocommunication and radar equipments placed aboard ships are well engineered and installed to good engineering standards, so as not to cause mutual interference. In this regard, particular attention should be paid to the use of line filters, where appropriate, and to proper earthing of the shielding of the installation cables and especially of the radar wave-guide. In each case multiple earthpoints may be necessary;

2. that the absence of mutual interference should be assured, by test procedures of prototypes and by installation inspection procedures, whereby an investigation is made to determine whether or not any noticeable interference exists to ships' radio receivers, direction-finders or the radar, under practical conditions of installation and operation.

STUDY GROUP 8

The Editorial Committee, after examination of Recommendation 218 presented by Study Group 8, submits the following text to the Plenary Assembly for approval.

DRAFT

RECOMMENDATION 218(Rev.74)

PREVENTION OF INTERFERENCE TO RADIO RECEPTION ON BOARD SHIPS*

(1951-1956-1974)

The C.C.I.R.,

CONSIDERING

(a) that the Maritime Regional Radio Conference, Copenhagen, 1948, recommended that the C.C.I.R. study the question of interference to radio reception caused by electrical installations on board ship;

(b) that the International Conference on Safety of Life at Sea, London, 1960 (Chapter IV, Regulation 9), requested that all steps be taken to eliminate, as far as possible, the causes of radio interference from electrical and other apparatus on board ship;

(c) that electrical interference is generally caused by the unwanted excitation of the radio receiving equipment, including the antenna, by fluctuating electromagnetic fields set up by other electrical installations;

(d) that the fluctuation of electromagnetic fields, which gives rise to interference, is caused by abrupt changes in current in the source of interference, and by abrupt changes in the resistance of conductors situated in electromagnetic fields;

---

* The prevention of interference caused by radar is covered by Recommendation 45.

(e) that electrical interference may be transmitted by direct radiation and induction from the source of interference itself, and also by radiation, re-radiation and induction from conductors which carry interfering currents;

RECOMMENDS

1. that the design, construction and installation of electrical equipment on ships should be such that interference is minimized at its source (see No. 959 of the Radio Regulations);

2. that electrical equipment installed in ships should be properly maintained to prevent any increase in the level of interference which it causes;

3. that antennae used for transmission or reception should be erected as far above and as far away as possible from electrical machinery and from parts of the ship's structure such as funnels, stays and shrouds;

4. that the feeders of antennae which are used exclusively for reception should be screened; that the screen should extend continuously from the receiver to a point which is as high as practicable above the ship's structure, and that the screen should be effectively earthed;

5. that the frame or loop antennae used for direction-finding, should be effectively screened against electrostatic interference;

6. that radio receiving equipment should be sited in a room specifically provided for the purpose. This room should be effectively screened and situated as high as practicable in the ship;

7. that where a room cannot be provided specifically for radio equipment then the space provided should be as far away as possible from all sources of interference, situated as high as practicable in the ship;

8. that the radio receiving equipment should be designed so that it is effectively screened and protected against conducted interference;

9. that suppressor filters, intended to reduce to an acceptable level the interference which is propagated, should be fitted at the sources of interference, being preferably built into equipment producing the interference, and that in particular;

9.1 the electrical ignition systems of internal combustion engines, including those which may be installed in life-boats, should be fitted with suppressors;

9.2 the navigational instruments and other electronic equipment, should, if necessary, be fitted with suppressors, be screened, and the screen effectively earthed;

9.3 the necessary degree of suppression should be determined taking into account :

- the susceptibility to interference of the receiver, and
- the coupling between the ship's electrical installation and the receiving antennae;

10. that cables in the vicinity of the receiving antennae or the radio receiving room, and cables within the radio room, should be screened by enclosing them in metal conduits, unless the cables themselves are effectively screened;

11. that "lead" and "return" conductors should be in the same cable to avoid the formation of current loops. The metal structure of the ship should not be used for carrying current;

12. that suppressors should be fitted to cables at their point of entry into the radio receiving room, unless they terminate close to the point of entry in equipment which itself provides adequate screening and suppression;

13. that cables, ducts and pipes which do not terminate in the radio receiving room, should preferably not be routed through the radio receiving room; if it is essential for them to pass through the radio receiving room, the ducts and pipes and the screening of the cables should be effectively earthed;

14. that all radio, electrical and electronic apparatus in the radio receiving room should be effectively connected to the metal structure of the ship in the shortest possible way, and that the screens of all cables in the ship should be properly earthed;

15. that rigging should be either insulated from or bonded to the ship's structure (stays that are subject to considerable tension can more conveniently be bonded);

16. that for smaller vessels, vessels without specific radio receiving rooms, and those constructed of non-conducting materials, the principles recommended should be applied as far as is practicable;

17. that particular care should be taken to minimize interference on the frequency bands used for distress, safety and radio navigation in the maritime service;

18. that administrations should bring the above Recommendations to the attention of naval architects, shipbuilders, those responsible for the construction, installation and maintenance of electrical, electronic and radio equipment and those organizations responsible for the formulation of standards.

C.C.I.R.
XIIIth Plenary Assembly
GENEVA, 1974

Doc. 8/1005-E
25 February 1974

STUDY GROUP 8

The Editorial Committee, after examination of Doc. TEMP./27 presented by Study Group 8, submits the following text to the Plenary Assembly for approval.

DRAFT

RECOMMENDATION

THE INTRODUCTION OF DIRECT-PRINTING TELEGRAPH EQUIPMENT IN THE MARITIME MOBILE SERVICE

Equivalence of terms

(Question 5-1/8)

(1974)

The C.C.I.R.,

CONSIDERING

(a) that the use of direct-printing telegraphy by ship and coast stations is rapidly expanding;

(b) that there is a need for standardizing the designation of the higher and lower frequencies to ensure compatible world-wide operation when using the direct-printing telegraphy system;

RECOMMENDS

that the equivalence of terms as shown in the following table shall be adhered to* :

Frequency of emission	Circuits using teleprinter or punched tape equipment					
	International Telegraph Alphabet No. 2				Emitted 7-unit signal (2)	Telex
Higher frequency	Space	Start	No perforation	A 1)	B	Free line condition
Lower frequency	Mark	Stop	Perforation	Z 1)	Y	Idle circuit condition

(1) on a wire circuit
(2) on a radio channel

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* This Recommendation is in accordance with C.C.I.T.T. Recommendations U.1 and V.1

STUDY GROUP 8

The Editorial Committee, after examination of Doc. 8/188 presented by Study Group 8, submits the following text to the Plenary Assembly for approval.

DRAFT

RECOMMENDATION

FREQUENCY SHARING BETWEEN THE FIXED-SATELLITE SERVICE AND THE RADIONAVIGATION AND RADIONAVIGATION-SATELLITE SERVICES AT FREQUENCIES OF THE ORDER OF 14 GHz

Limits of interfering power flux density and power density to protect space station receivers in the fixed-satellite service

(1974)

The C.C.I.R.,

CONSIDERING

(a) that Earth-to-space transmissions of the fixed-satellite service share the band 14-14.3 GHz with the radionavigation service, and share the band 14.3-14.4 GHz with the radionavigation-satellite service;

(b) that the World Administrative Radio Conference for Space Telecommunications (Geneva, 1971) has asked the C.C.I.R. to study the criteria for frequency sharing in these bands (Recommendation Spa2 - 15, para. 2.14);

(c) that the Radio Regulations (No. 408A) require that the use of these bands by the radionavigation service and the radionavigation-satellite service, respectively, shall be such as to provide sufficient protection to space stations in the fixed-satellite service;

(d) that, in the band 14-14.3 GHz, sufficient protection for geostationary satellites in the fixed-satellite service can be obtained by limiting the power flux density produced at the geostationary satellite orbit by stations of the radionavigation service;

(e) that some kinds of radionavigation device, such as small-ship radars and motor vehicle collision avoidance devices, although generally of comparatively low power, may be used in very large numbers;

(f) that radionavigation satellites transmitting in the band 14.3-14.4 GHz may be coordinated with satellites in the fixed-satellite service receiving in this band so that the interference power produced at the receiver input is limited to a value which provides sufficient protection;

(g) that earth stations in the radionavigation-satellite service may, for example, when interrogating a radio-interferometer space station, transmit and so interfere with space stations of the fixed-satellite service.

RECOMMENDS

1. that in order to provide sufficient protection to space station receivers of the fixed-satellite service, the following provisional limits should apply :

1.1 that where there are few simultaneous interference sources, the maximum value of the peak power flux density produced at any point in the geostationary satellite orbit by any radionavigation transmitter in the band 14-14.3 GHz should not exceed - 150 dB (W/m^2) in any 1 MHz band;

1.2 that where the value of D as defined below, exceeds 2 x 10^{-4} the maximum value of peak power flux density produced at the geostationary satellite orbit by any radionavigation transmitter should not exceed

$$- 187 - 10 \log_{10} D \text{ dB } (\text{W/m}^2)$$

where D is the estimated geographical density of radionavigation transmitters per km^2 simultaneously active in any 1 MHz band, taking into account future needs and averaged over the territory of the Administration concerned or over an area of 10^6 km^2, whichever is less;

1.3 space stations and earth stations in the radionavigation-satellite service transmitting in the band 14.3-14.4 GHz should be coordinated with geostationary satellites in the fixed-satellite service to ensure that the total interference power produced by any such radionavigation satellite and any associated earth stations at the receiver input of any geostationary space station of the fixed-satellite service does not exceed - 153 dBW in any 1 MHz band;

2. that the limits stated in item 1 above are provisional values and should be the subject of further study before the XIV Plenary Assembly.

STUDY GROUP 8

The Editorial Committee, after examination of Doc. 8/322 presented by Study Group 8, submits the following text to the Plenary Assembly for approval.

DRAFT

RECOMMENDATION ...

OPERATIONAL PROCEDURES FOR THE USE OF DIRECT-PRINTING TELEGRAPH EQUIPMENT IN THE MARITIME MOBILE SERVICE

(Question 5-1/8)

(1974)

The C.C.I.R.,

CONSIDERING

(a) that narrow-band direct-printing telegraph services are in operation using equipment as described in Recommendation 476(Rev.72);

(b) that the operational procedures necessary for such services should be agreed upon;

(c) that, as far as is practicable, operational procedures in all frequency bands should be similar;*

RECOMMENDS

that the following operational procedures in the MF and HF bands for the use of narrow-band direct-printing telegraph equipment in accordance with Recommendation 476(Rev.72) in the maritime mobile service should be observed :

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* Different operational procedures may be required in the frequency bands other than the HF and MF bands.

1. Mode A (ARQ)

1.1 Methods used for setting up narrow-band direct-printing telegraph communications between a ship station and a coast station in the ARQ-mode should be on a fully automatic or semi-automatic basis, in so far that a ship station should have direct access to a coast station on a coast station receiving frequency and a coast station should have direct access to a ship station on a coast station transmitting frequency;

1.2 However, where necessary, prior contact by morse telegraphy, radiotelephony or other means is not precluded;

1.3 Through connection to a remote teleprinter station over a dedicated circuit or to a subscriber of the international telex network may be achieved by manual, semi-automatic or automatic means (see note);

1.4 When, by prior arrangement, unattended operation is required for communication from a coast station to a ship station, or between two ship stations, the receiving ship station should have a receiver tuned to the other station's transmitting frequency and a transmitter tuned or a transmitter capable of being tuned automatically to the appropriate frequency and ready to transmit on this frequency;

1.5 For unattended operation a ship station should be called selectively by the initiating coast or ship station as provided for by Recommendation 476(Rev.72). The ship station concerned could have available traffic entered in a store, ready for transmission on the demand of the calling station;

1.6 At the "over" signal, initiated by the calling station any available traffic in the ship's traffic store could be transmitted;

1.7 At the end of message exchange, an "end of communication" signal should be transmitted, whereupon the ship's equipment should automatically revert to the "stand-by" condition;

Note.- Before an international automatic service can be introducted agreement has to be reached on a numbering plan, traffic routing and charging. This should be considered by both C.C.I.T.T. and C.C.I.R.;

2. Mode B (FEC)

2.1 Messages could, by prior arrangement, be sent in the B mode from a coast station or ship to one or more ships where :

2.1.1 a receiving ship station is not permitted or not able to use its transmitter;

2.1.2 communications are intended for more than one ship;

2.1.3 unattended reception of the B mode is required and automatic acknowledgement is not necessary;

In such cases, the ship station receivers should be tuned to the appropriate coast or ship station transmitting frequency;

2.2 All B mode message should start with "carriage return" or "line feed" signals;

2.3 When the ship station receives phasing signals in the B mode, its teleprinter should start automatically and should stop automatically when reception of the emission ceases;

3. The Director, C.C.I.R., is invited to bring this Recommendation to the attention of the Director, C.C.I.T.T.

STUDY GROUP 8

The Editorial Committee, after examination of Recommendation 439(Rev.72) presented by Study Group 8, submits the following text to the Plenary Assembly for approval.

DRAFT

RECOMMENDATION 439(REV.72)

EMERGENCY POSITION-INDICATING RADIO BEACONS OPERATING AT THE FREQUENCY 2182 kHz

(1966-1974)

The C.C.I.R.,

CONSIDERING

(a) Recommendation No. 48 of the International Conference on Safety of Life at Sea, London, 1960;

(b) the Report of the Inter-Agency Working Group, June, 1962, on Coordination of Safety at Sea and in the Air, reproduced in Doc. 393, Geneva, 1963;

(c) the Resolution A.91 (IV), adopted on 27 September 1965 by the Fourth Session of the Assembly of the Inter-Governmental Maritime Consultative Organization (I.M.C.O.) and reproduced in Doc. XIII/71, 1963-1966;

(d) the Report of the Fourth Air Navigation Conference of the International Civil Aviation Organization (I.C.A.O.) (Montreal, 9 November – 3 December, 1965) and reproduced in Doc. XIII/103, 1963-1966;

(e) that there is an urgent need for a radio beacon to indicate the position of survivors and to facilitate search and rescue operations at sea;

(f) that ships compulsorily fitted for radiotelephony are required to keep continuous watch at the frequency 2182 kHz (see Regulation 7, Chapter IV of the International Convention for the Safety of Life at Sea, London, 1960);

(g) that it is desirable for the radio beacon signal to be received on the loudspeakers of the receiver which is equipped with filters for the two-tone alarm signal (1300 Hz and 2200 Hz respectively) and which is used for watch-keeping at 2182 kHz. This alarm signal is described in C.C.I.R. Recommendation 219-1 and Recommendation No. 33 of the International Conference on Safety of Life at Sea, London, 1960;

(h) that the type and sequence of the signal to be transmitted by the radio beacon should facilitate homing by ships as well as by SAR aircraft taking into account their different speeds;

(j) that the signal emitted by the radio beacon should as far as practicable be clearly distinguishable from the radiotelephone alarm signal transmitted by ships still afloat or by portable radio apparatus;

(k) that the signal emitted by the radio beacon should not create harmful interference to other distress calls and messages;

(l) that in the interest of high reliability and minimum expense the electronic and mechanical design of the radio beacon and especially of its keying device should be as simple as possible;

(m) that national and international trials under operational conditions have already been carried out successfully with such radio beacons;

UNANIMOUSLY RECOMMENDS

1. that emergency position-indicating radio beacons operating at the frequency 2182 kHz should be divided into two classes:

1.1 low-power beacons designated " Type L " producing a field strength equal to or less than 10 μV/m at a distance of 30 nautical miles at sea level;

1.2 high-power beacons designated " Type H " producing a field strength greater than 10 μV/m at a distance of 30 nautical miles at sea level;

2. that for both classes of beacon, class of emission A2 or A2H should be used;

3. that for both classes of beacon, the depth of modulation should be between 30% and 90%;

4. that the keying signal for "Type L" radio beacons should consist of a keyed emission modulated by a tone of 1300 Hz (±20 Hz) having a ratio of the period of the emission to the period of silence equal to or greater than 1, and an emission duration between 1 and 5 s*;

5. that the keying signal for "Type H" radio beacons should either consist of the radiotelephone alarm signal (Radio Regulations, No. 1465) or be the same as in § 4 above; if the radiotelephone alarm signal be used, the Morse letter " B " and/or the call sign of the ship to which the beacon belongs, should be included by keying a carrier modulated by a tone of 1300 Hz (±20 Hz) or of 2200 Hz (±35 Hz)* ;

6. that for " Type L " beacons, the keying signal should be transmitted continuously;

7. that for " Type H " beacons, the keying cycle should consist alternately of the keying signal having a duration between 30 and 50 s, followed by a period of silence having a duration between 30 and 60 s;

8. that the keying cycles given in §§ 6 and 7 may be interrupted by speech transmission if Administrations permit such an additional facility;

9. that the minimum initial field strength produced by " Type L " beacons should be 2·5 μV/m at a distance of 30 nautical miles at sea level;

10. that after a period of 48 hours continuous operation the radiated power should not be less than 20% of the initial power;

11. that the radio beacons should be designed for the following temperature ranges:

— when stowed, at least —20° C to +55° C;

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* Beacons carried by ships of the U.S.A. may use, instead of the signals given in §§ 4 and 5, a tone sweeping from 1400 Hz to 300 Hz not faster than twice a second.

— when operating in the open air, at least —10° C to +45° C;
— when operating afloat, at least —3° C to +35° C (water temperature);

Note.—Exceptionally, for radio beacons carried by ships operating in limited areas only, other temperature ranges may, due to special conditions in such areas, be accepted.

12. that if the beacons are designed to come into operation automatically when floating, then overriding facilities should be provided to enable them to be switched on and off manually;

13. that beacons should be tested about every 12 months, care being taken to ensure that false alarms are not caused by radiating the signal;

14. that primary batteries for the beacons should have a minimum storage life of about 2 years, and primary batteries in the beacons should be replaced at intervals of about half the storage life;

15. that the mechanical design of the beacons should be such that it is small, light-weight, floatable, watertight and shock-resistant;

16. that the Administrations be invited to make provision in the Radio Regulations for the operation of emergency position-indicating radio beacons at the frequency of 2182 kHz.

Note 1. — The Director, C.C.I.R., is requested to transmit this Recommendation to the Inter-Governmental Maritime Consultative Organization (I.M.C.O.) and to the International Civil Aviation Organization (I.C.A.O.).

Note 2. — This Recommendation terminates the study of Question 3/8 and cancels Opinion 21.

STUDY GROUP 8

The Editorial Committee, after examination of Recommendation 475(Rev.72) and Doc. 8/338 presented by Study Group 8, submits the following text to the Plenary Assembly for approval.

DRAFT

RECOMMENDATION 475(Rev.74)

IMPROVEMENTS IN THE PERFORMANCE OF RADIOTELEPHONE CIRCUITS IN THE MF AND HF MARITIME MOBILE BANDS

(Question 11/8, Study Programme 11A/8)

(1970 - 1974)

The C.C.I.R.,

CONSIDERING

(a) that there is a need to improve the quality of transmission of MF and HF maritime mobile radiotelephone circuits;

(b) that methods presently used usually employ voice-operated devices to eliminate instability or unwanted retransmission;

(c) that such voice-operated devices frequently degrade the performance of the circuit;

(d) that the use of conventional compressors and expanders on MF and HF circuits is inhibited by the variability of the transmission path loss;

(e) that compressors and expanders may be linked to overcome this variability;

(f) that such a system is already in use by two Administrations*;

(g) that further tests of this system may be necessary, and further systems may be proposed;

(h) that when linked compressor and expander systems are used, it is necessary to ensure the compatibility of the equipment used by coast and ship stations;

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* The United States of America and the United Kingdom.

RECOMMENDS

1. that systems used in the international maritime mobile radiotelephone service should as far as possible maintain optimum modulation of the transmitter despite variations in subscribers' speech volume and line losses;

2. that the speech and any control signals should both be contained within a 2 700 Hz channel;

3. that Administrations should be encouraged to continue their studies, and in the meantime, when it is desired to use a linked compressor and expander system, then in order to ensure compatibility between the sending and receiving stations, the characteristics of the equipment should be in accordance with Annexes I and II; for optimum performance it is desirable that the characteristics of SSB radio equipment be in accordance with the minimum standards of Recommendation 258-2 and those contained in Annex III.

Annex I : Characteristics for ship stations.

Annex II : Characteristics for coast stations.

Annex III : Characteristics of SSB radio equipment.

Annexes : 3

ANNEX I

CHARACTERISTICS OF EQUIPMENT FOR SHIP STATIONS

1. **Transmit side** (Fig. 1*a*)

1.1 *Speech channel*

1.1.1 *Steady-state conditions*

For input levels between +5 dBm0 and —25 dBm0 the output levels should lie within the limits shown in Fig. 2.

The overall amplitude/frequency response for the speech path, under both fixed-gain and controlled conditions, at any level within the range +5 dBm0 to —25 dBm0 should be:

Frequencies	Attenuation relative to response at 800 Hz
Above 300 Hz	
For frequencies in the band 350 Hz to 2300 Hz	—1 to +3 dB
For frequencies in the band 2300 Hz to 2380 Hz	—1 to +6 dB
For frequencies in the band 2510 Hz and above	>50 dB
Below 300 Hz	
Increase in overall gain for frequencies below 300 Hz	⩽1 dB

1.1.2 *Transmit response* (Overall)

Attack time (Fig. 3*a*) (Note 1)	5 to 10 ms
Recovery time (Fig. 3*b*) (Note 1)	15 to 30 ms

1.2 *Control channel*

Frequency-modulated oscillator

Nominal centre frequency	2580 ± 1 Hz
Maximum frequency deviation	+40 to —60 Hz
Change of frequency for each 1 dB change of input levels (Fig. 4)	2 Hz
Input level to transmit side to produce nominal centre frequency	—25 dBm0
Oscillator frequency resulting from an input level of +5 dBm0	2520 Hz
Oscillator frequency resulting from an input level of —45 dBm0	2620 Hz
Oscillator frequency when there is no input to transmit side	⩽2680 Hz
For sudden increases in input that exceed 3 dB the time taken for the oscillator to complete 80% (10% to 90%) of the corresponding change in frequency should be	5 to 10 ms
For sudden decreases in the input that exceed 10 dB the rate of change of the oscillator frequency should lie between	1·5 and 3·5 Hz/ms
Upper limit of output spectrum	2700 Hz
Output level relative to test tone level in the speech channel *	—5 dB

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* When the combined line signal is adjusted in accordance with § 1.2 (control channel) the average power of the combined speech and control channel signals can be considered to be +4 dB relative to the level of the control channel signal by itself. Further, the speech peaks can be considered to be +12 dB relative to the control channel signal.

2. **Receive side** (Fig. 1*b*)

2.1 *Speech channel*

2.1.1 *Fading regulator*

2.1.1.1 *Steady-state conditions*

For input levels between +7 dBm0 and —35 dBm0 the output should be within the limits shown in Fig. 5

2.1.1.2 *Transmit response*

Attack time (Fig. 3*a*) (Note 1)	7 to 13 ms
Recovery time (Fig. 3*b*) (Note 1)	24 to 40 ms

2.1.2 *Expander* (controlled by the discriminator output)

Effective dynamic range	60 dB

2.2 *Control channel*

2.2.1 *Amplitude/frequency and differential-delay characteristics of filter*

Attenuation within the band 2520 Hz to 2640 Hz (relative to that at 2580 Hz)	—1 to +3 dB
Attenuation below 2400 Hz and above 2770 Hz (relative to that at 2580 Hz)	>50 dB
Differential delay within the band 2520 Hz to 2640 Hz	⩽3·5 ms

2.2.2 *Discriminator* (Frequency/amplitude translator)

Characteristics at nominal control-tone level

Changes in the expander output with changes in the frequency of the control tone between 2520 Hz and 2640 Hz should be within the limits shown in Fig. 6

Nominal change in expander loss resulting from each 2 Hz in control-tone frequency	1 dB
Control-tone frequency range over which 2 Hz per dB is maintained	2520 to 2640 Hz
Receive-side output level for control-tone frequencies of:	
2520 Hz	+5 dBm0
2640 Hz	—55 dBm0

2.2.3 *Amplitude range of discriminator*

A tolerance of ±1 dB may be added to the performance requirements of § 2.2.2 for control-tone input level variations of	30 dB
A tolerance of ±2 dB may be added to the performance requirements of § 2.2.2 for control-tone input level variations of	50 dB

2.3 *Overall attack and recovery time*

(A sudden change of 24 Hz in the frequency of the control tone is used to simulate a 12 dB step)

Attack time (Fig. 3*c*)	15 to 30 ms
Recovery time (Fig. 3*d*)	15 to 30 ms

3. Equalization of overall transmission time delay

To avoid the necessity for the coast radio station to vary the amount of time delay equalization to cater for different designs of equipment, the control signal should lag behind the corresponding speech signal:

3.1 at the output of the transmit side by $\leqslant$4 ms

3.2 at the expander (when the speech and associated control signal are simultaneously applied to the receive-side input) by 16 to 24 ms (Note 2)

Note 1.—The definitions of attack and recovery time which are similar to those defined by the C.C.I.T.T. for compandors (Recommendation G.162) are as follows:

- the *attack time* of a compressor is defined as the time between the instant when a sudden increase of 12 dB in input is applied and the instant when the output voltage envelope reaches a value equal to 1·5 times its steady-state value;
- the *recovery time* of a compressor is defined as the time between the instant when a sudden decrease of 12 dB in input is applied and the instant when the ouptut voltage envelope reaches a value equal to 0·75 times its steady-state value.

Note 2.—This delay includes an allowance for the time-constants of the circuits preceding the expander, in addition to that for the band-pass filter itself.

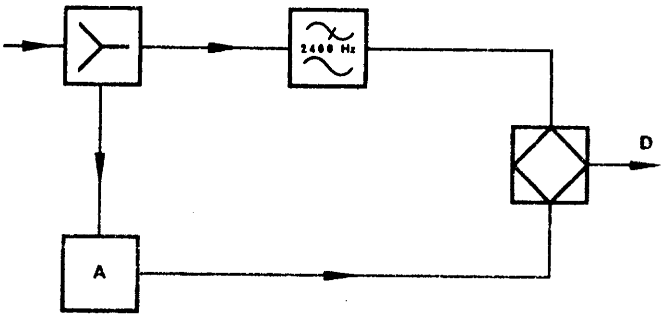


FIGURE 1*a*

Transmit side

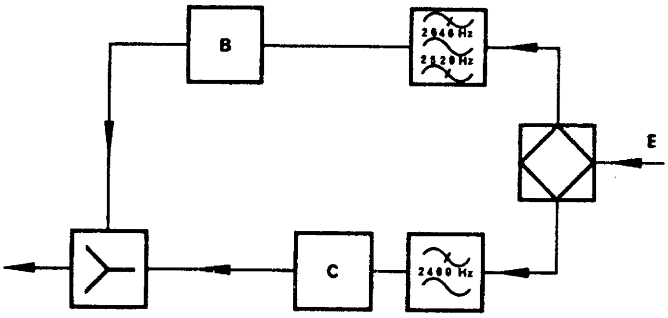
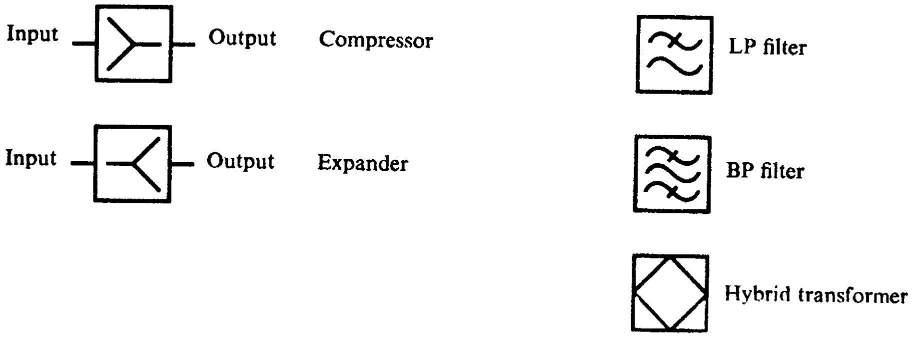


FIGURE 1*b*

Receive side

A: Frequency-modulated oscillator
B: Frequency discriminator
C: Fading regulator (constant volume amplifier)
D: To radio transmitter
E: From radio receiver



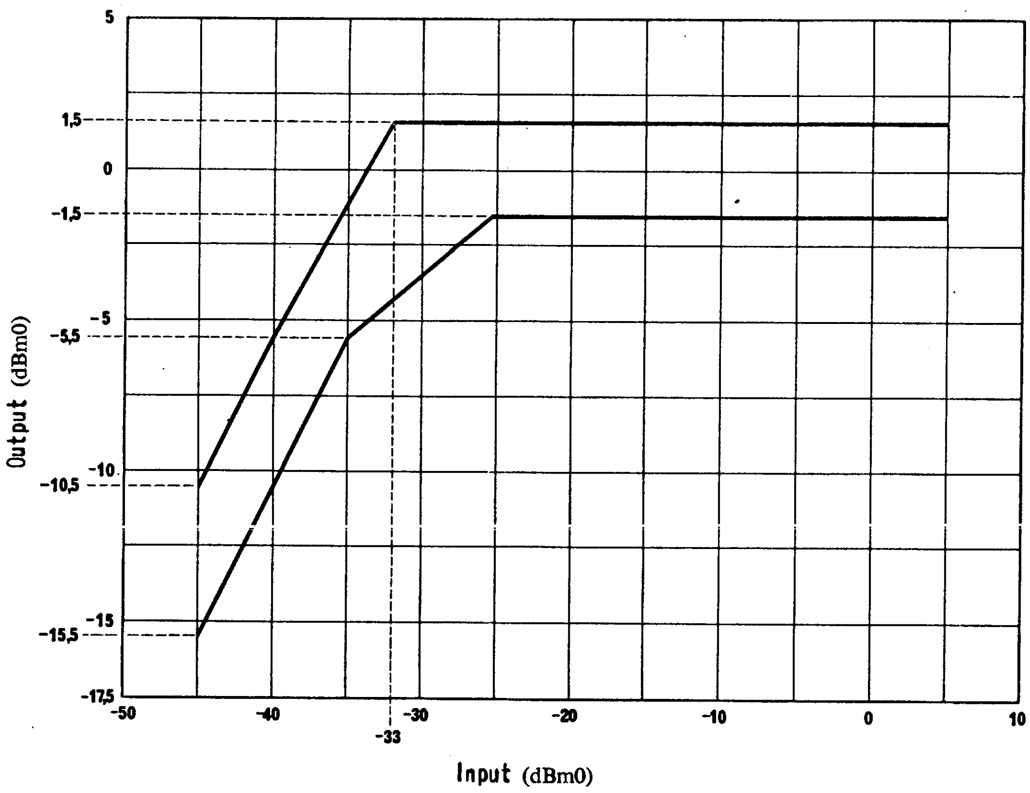


FIGURE 2

Input/output characteristic of transmit side

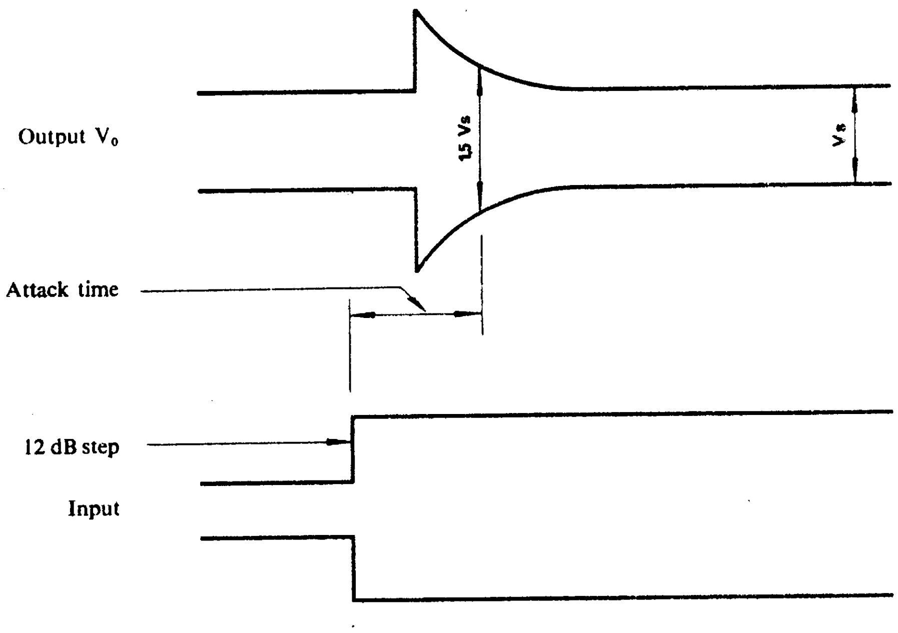


FIGURE 3*a*

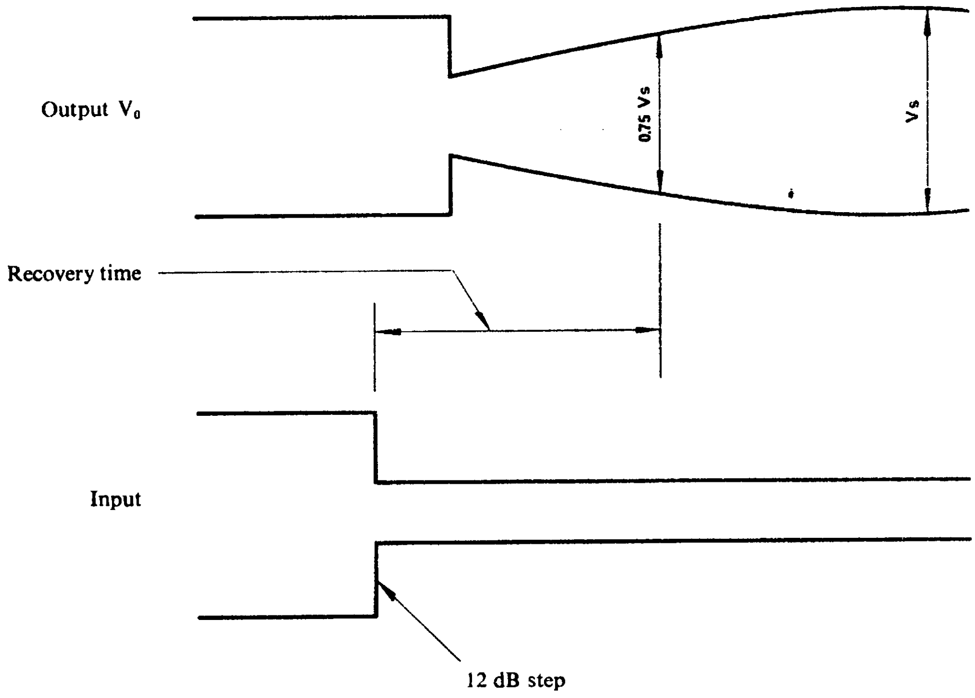


FIGURE 3*b*

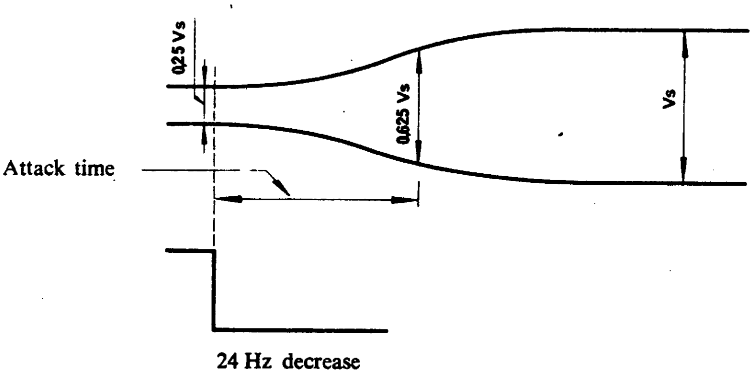


FIGURE 3*c*

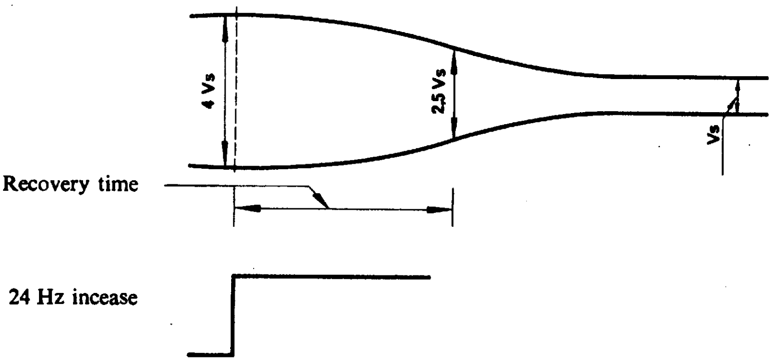


FIGURE 3*d*

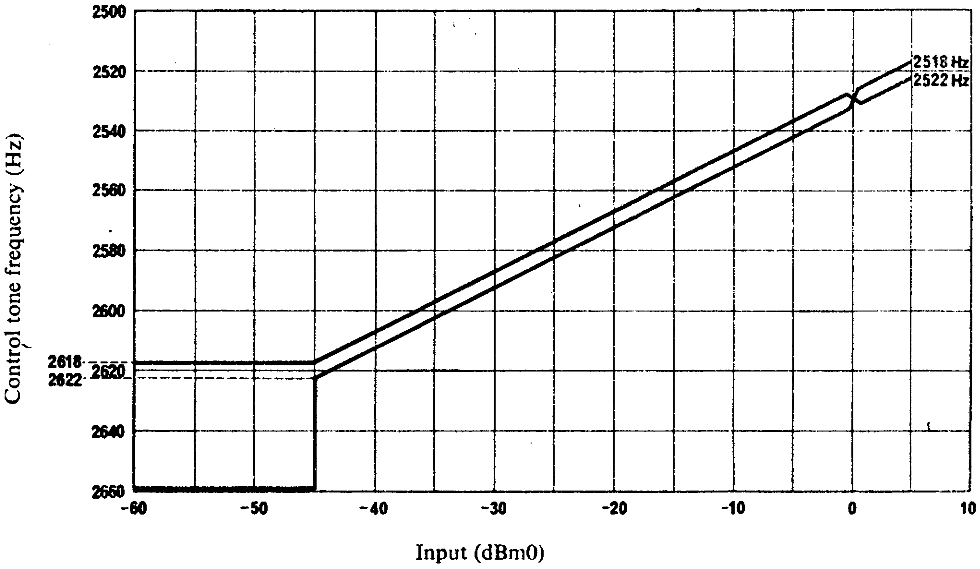


FIGURE 4

Variation of control tone frequency with changes of input level to the transmit side

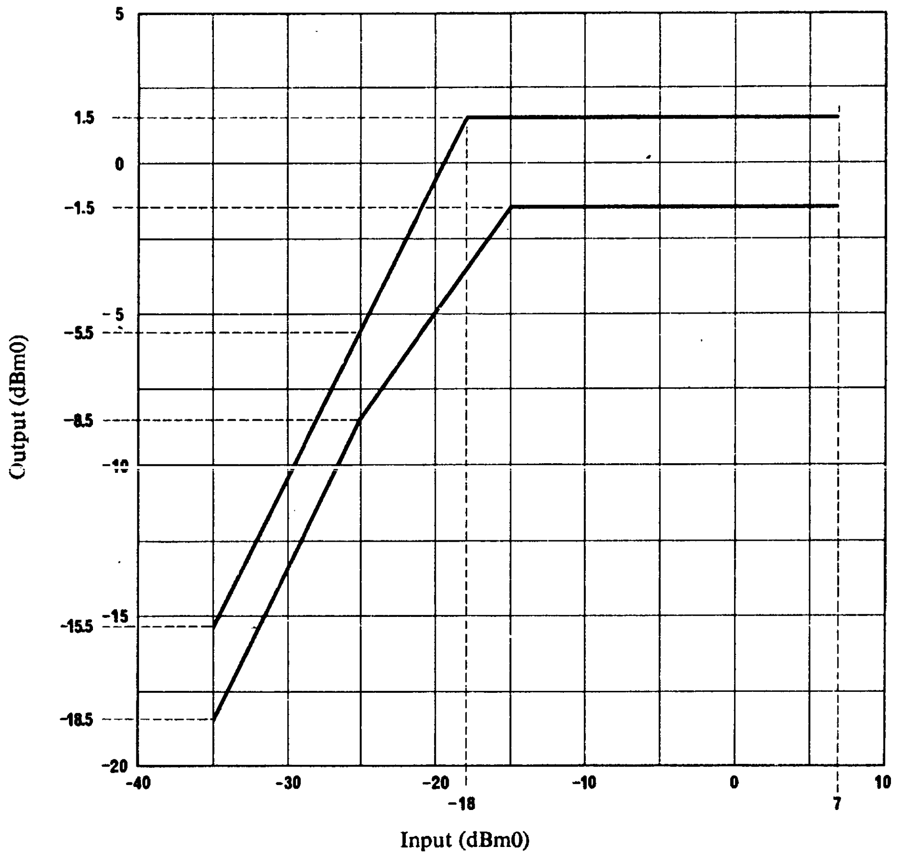


FIGURE 5

Input/output characteristic of fading regulator

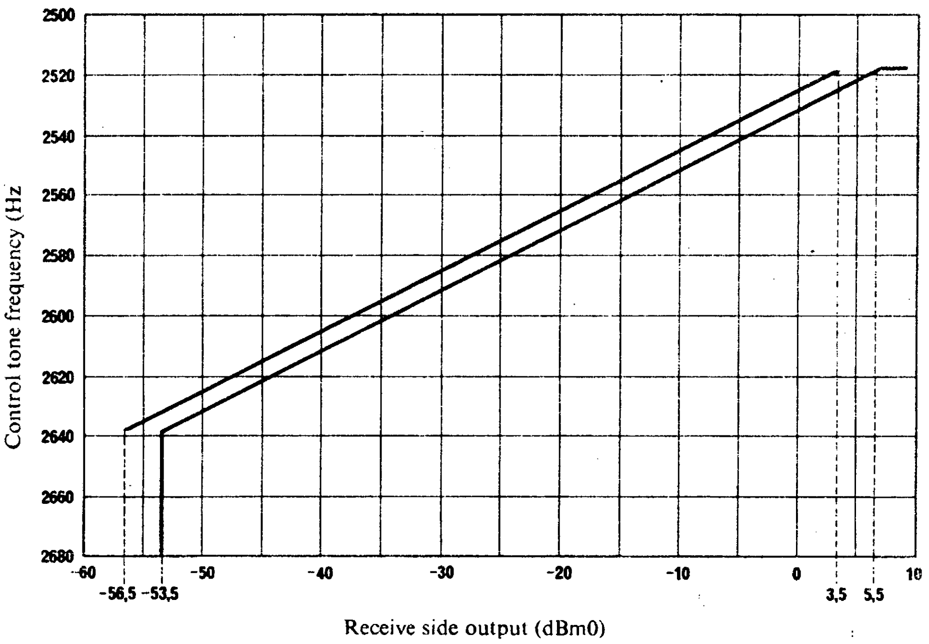


FIGURE 6

Variation of receive side output with changes of control tone frequency

ANNEX II

CHARACTERISTICS OF EQUIPMENT FOR COAST STATIONS

1. **Transmit side** (Fig. 7*a*)

1.1 *Speech channel*

1.1.1 *Steady-state conditions*

For input levels between +5 dBm0 and —35 dBm0 the output should lie between the limits shown in Fig. 8.

The overall amplitude/frequency response for the speech path, under both fixed-gain and controlled conditions, at any level within the range +5 dBm0 to —35 dBm0 should be:

Frequencies	Attenuation relative to response at 800 Hz
Above 300 Hz	
For frequencies in the band 350 to 2300 Hz	—1 to +3 dB
For frequencies in the band 2300 to 2380 Hz	—1 to +6 dB
For frequencies in the band 2510 and above	>50 dB
Below 300 Hz	
Increase in overall gain for frequencies below 300 Hz	⩽1 dB

1.1.2 *Transmit response* (Overall)

Attack time (Fig. 9*a*) (Note 1)	5 to 10 ms
Recovery time (Fig. 9*b*) (Note 1)	15 to 30 ms

1.2 *Control channel*

Frequency-modulated oscillator

Nominal centre frequency	2580 Hz
Maximum frequency deviation	±60 Hz
Change of frequency for each 1 dB change of input level (Fig. 10)	2 Hz
Input level to transmit side to produce nominal centre frequency	—25 dBm0
Oscillator frequency resulting from an input level of +5 dBm0	2520 Hz
Oscillator frequency resulting from an input level of —55 dBm0	2640 Hz
Oscillator frequency when there is no input to the transmit side	⩽2680 Hz
For sudden increases in input that exceed 3 dB the time taken for the oscillator to complete 80% (10% to 90%) of the corresponding change in frequency should be	5 to 10 ms
For sudden decreases in the input that exceed 10 dB the rate of change of oscillator frequency should lie between	1·5 and 3·5 Hz/ms
Upper limit of spectrum	2700 Hz
Output level relative to test tone level in the speech channel	—5 dB

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* **When the combined line signal is adjusted in accordance with § 1.2 (control channel) the average power of the combined speech and control channel signals can be considered to be +4dB relative to the level of the control channel signal by itself. Further, the speech peaks can be considered to be +12 dB relative to the control channel signal.**

2. **Receive side** (Fig. 7*b*)

2.1 *Speech channel*

2.1.1 *Fading regulator*

2.1.1.1 *Steady-state conditions*

For input levels between +7 dBm0 and —35 dBm0 the outputs should be within the limits shown in Fig. 11.

2.1.1.2 *Transmit response*

Attack time (Fig. 9*a*) (Note 1)	7 to 13 ms
Recovery time (Fig. 9*b*) (Note 1)	24 to 40 ms

2.1.2 *Expander* (controlled by the discriminator output)

Effective dynamic range	50 dB

2.2 *Control channel*

2.2.1 *Amplitude/frequency and differential-delay characteristics of filter*

Attenuation within the band 2520 Hz to 2640 Hz (relative to that at 2580 Hz)	—1 to +3 dB
Attenuation below 2400 Hz and above 2770 Hz (relative to that at 2580 Hz)	>50 dB
Differential delay within the band 2520 Hz to 2640 Hz	<3·5 ms

2.2.2 *Discriminator* (Frequency/amplitude translator)

Characteristics at nominal control-tone level

Changes in the expander output with changes in the frequency of the control tone between 2520 Hz and 2620 Hz should be within the limits shown in Fig. 12

Nominal change in expander loss resulting from each 2 Hz change in control-tone frequency	1 dB
Control-tone frequency range over which 2 Hz per dB is maintained	2520 to 2620 Hz
Receive-side output level for control-tone frequencies of:	
2520 Hz	+5 dBm0
2620 Hz	—45 dBm0

2.2.3 *Amplitude range of discriminator*

A tolerance of ± 1 dB may be added to the performance requirements of § 2.2.2 for control-tone input level variations of	30 dB
A tolerance of ± 2 dB may be added to the performance requirements of § 2.2.2 for control-tone input level variations of	50 dB

2.3 *Overall attack and recovery time*

(A sudden change of 24 Hz in the frequency of the control tone is used to simulate a 12 dB step)

Attack time (Fig. 9*c*)	15 to 30 ms
Recovery time (Fig. 9*d*)	15 to 30 ms

3. Equalization (overall) of transmission time

Taking into account § 3 of Annex I for ship-station equipment, sufficient time delay shall be incorporated in the coast-station equipment to ensure that in both directions of transmission, the overall transmission times of the speech and control signals, as measured at the expanders, shall be equalized to within	±8 ms

Note 1.—The definitions of attack and recovery time which are similar to those defined by the C.C.I.T.T. for compandors (Recommendation G.162) are as follows:

- the *attack time* of a compressor is defined as the time between the instant when a sudden increase of 12 dB in input is applied and the instant when the output voltage envelope reaches a value equal to 1·5 times its steady-state value;
- the *recovery time* of a compressor is defined as the time between the instant when a sudden decrease of 12 dB in input is applied and the instant when the output voltage envelope reaches a value equal to 0·75 times its steady-state value.

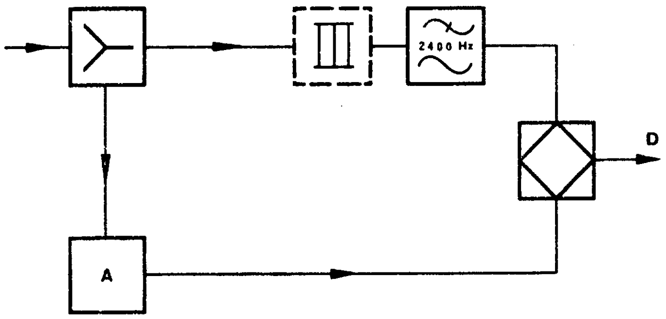


FIGURE 7*a*

Transmit side

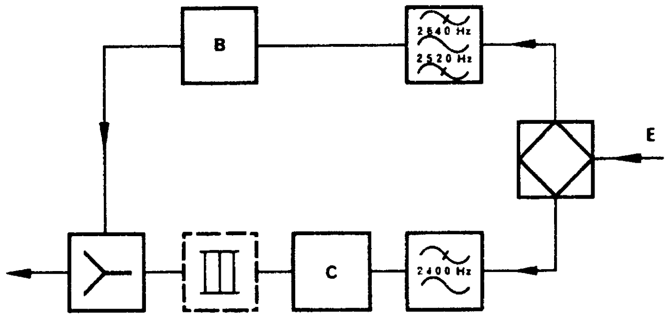
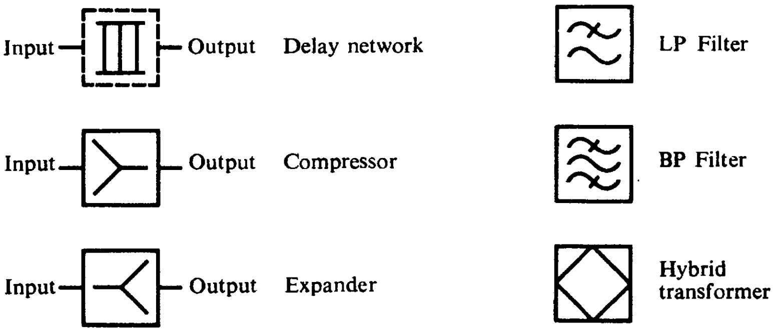


FIGURE 7*b*

Receive side

A: Frequency-modulated oscillator
B: Frequency discriminator
C: Fading regulator (constant volume amplifier)
D: To radio transmitter
E: From radio receiver



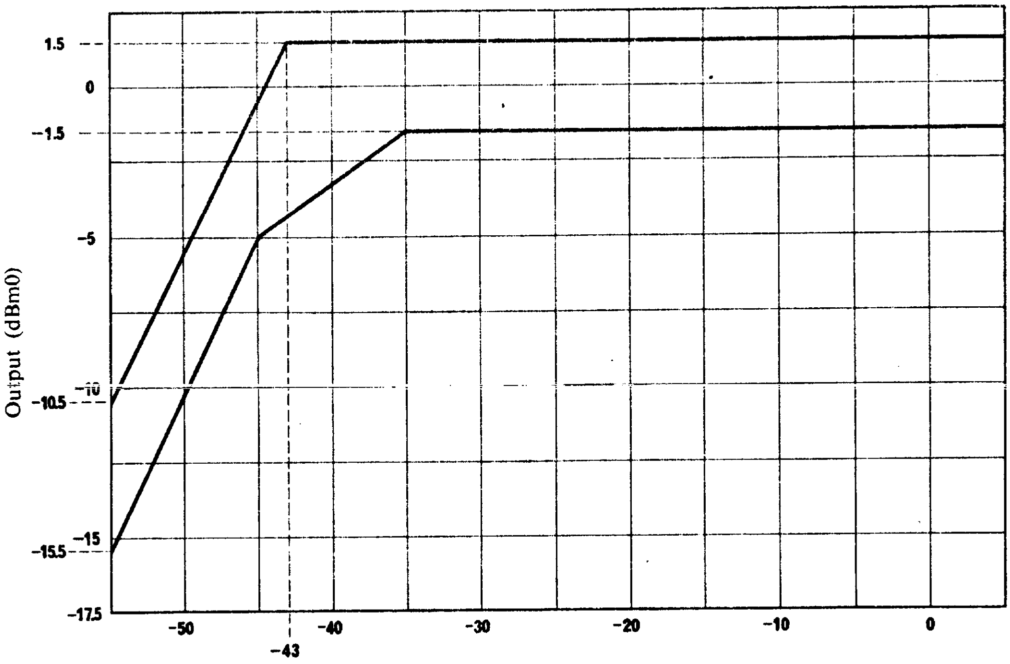


FIGURE 8

Input/output characteristic of transmit side

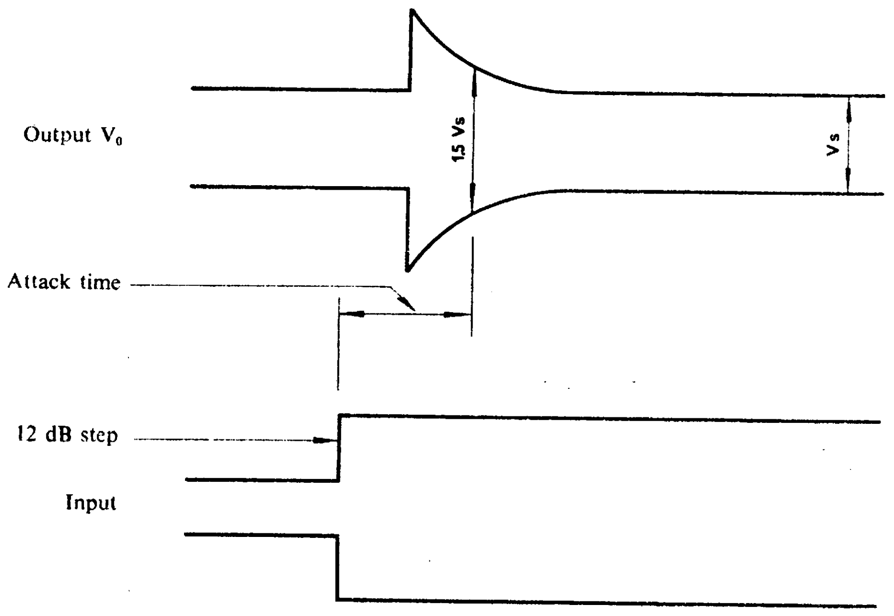


FIGURE 9*a*

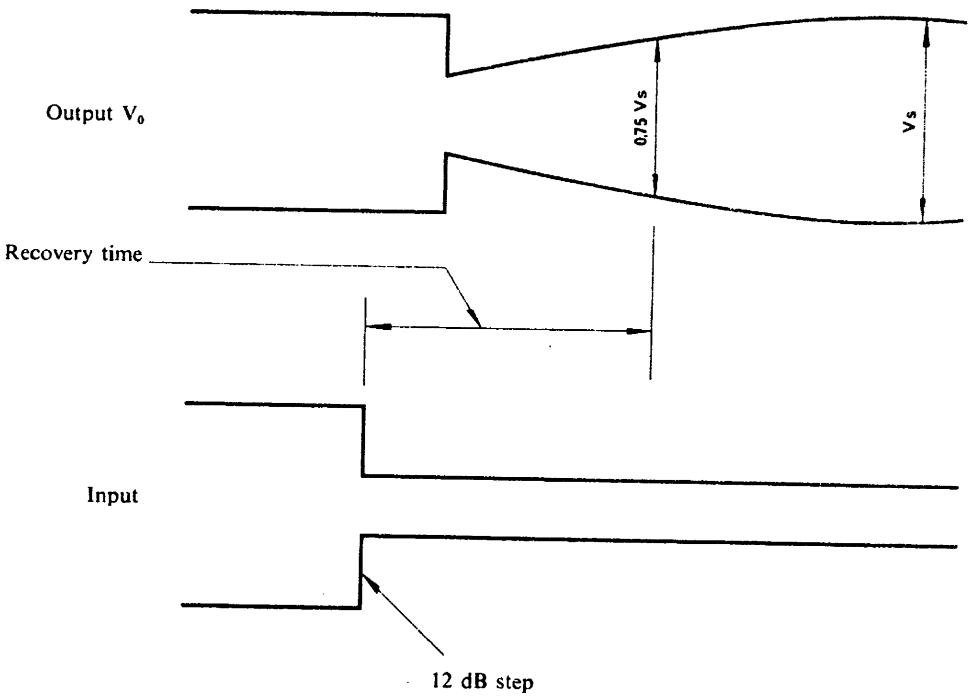


FIGURE 9*b*

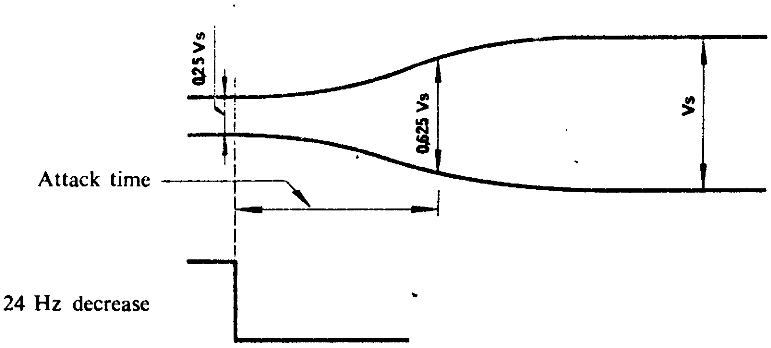


FIGURE 9*c*

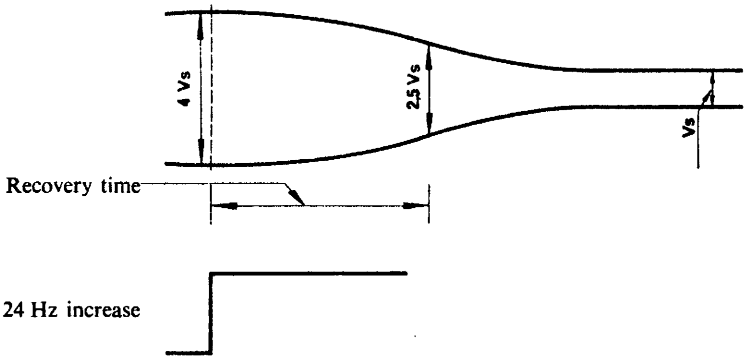


FIGURE 9*d*

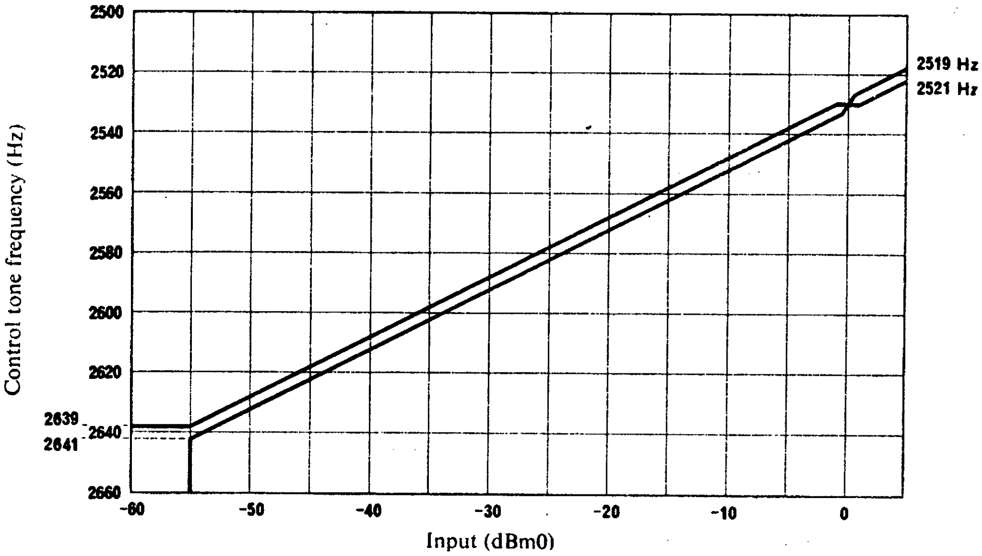


FIGURE 10

Variation of control tone frequency with changes of input level to the transmit side

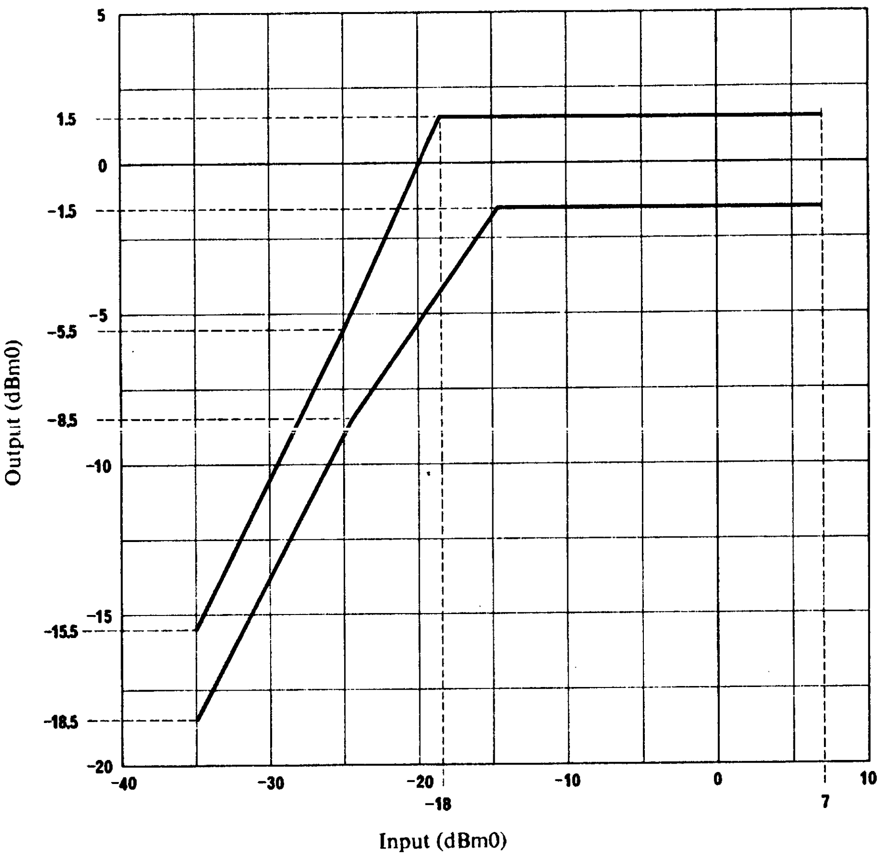


FIGURE 11
Input/output characteristic of fading regulator

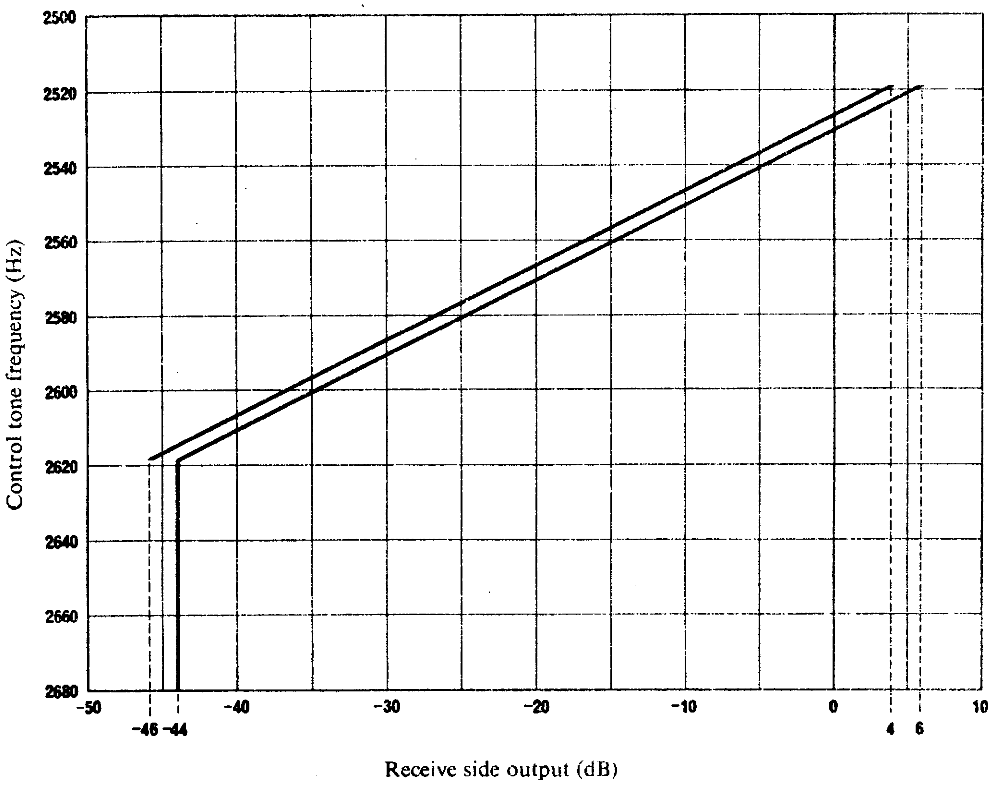


FIGURE 12
Variation of receive side output with changes of control tone frequency

ANNEX III

CHARACTERISTICS FOR SSB RADIO EQUIPMENT FOR OPTIMUM PERFORMANCE OF A LINKED COMPRESSOR AND EXPANDER SYSTEM

A linked compressor and expander system can be applied with full advantage to the maritime mobile service using either DSB or SSB systems.

To obtain the full advantages of the linked system when used with SSB radio equipment, the performance of the latter should be in accordance with Recommendation 258-2 and should, in addition, meet the following requirements:

1. The short-term frequency stability of coast station transmitters should be within ±2 Hz over a period of the order of fifteen minutes.
2. The short-term frequency stability of a ship station transmitter should be within ±4 Hz over a period of the order of fifteen minutes.
3. To ensure sufficient overall gain stability of the system, for the duration of a call, facilities should be provided in coast station receivers to keep the end-to-end frequency error within ±2 Hz; similarly, facilities should be provided in ship station receivers to keep the end-to-end frequency error within ±4 Hz.
4. The permitted total amplitude variation in the radio transmitter over the 300-2700 Hz audio-frequency band should be 6 dB and the differential delay should not exceed 3 ms. The receiver should have at least the same standards of performance in these respects. 6
5. If the pilot carrier of a Type A3A emission is not used to provide a continuous signal for frequency and gain control of the receiver, for example where Type A3J emission is used, the initial tuning procedure will require the transmission for a brief period of a suitable reference tone (e.g. 1 000 Hz ± 1 Hz as in Recommendation 477) at a level of, say, -10 dBm0 ±0.5 dB.
6. Where it is desired to use privacy equipment or speech inverters, it should be borne in mind that the upper audio frequency of the speech channel in Annex I of this Recommendation is 2 380 Hz.

STUDY GROUP 8

The Editorial Committee, after examination of Doc. 8/342 presented by Study Group 8, submits the following text to the Plenary Assembly for approval.

DRAFT

RESOLUTION

TECHNICAL CHARACTERISTICS OF SYSTEMS IN THE MARITIME MOBILE SATELLITE SERVICE

(1974)

The C.C.I.R.

CONSIDERING

(a) that the maritime mobile satellite service will be an international service and will therefore need international agreement on the technical and operating characteristics of systems for this service;

(b) that the question of efficient utilization of the frequency bands allocated by the WARC-ST (Geneva, 1971) in the region of 1.6 GHz is important and needs to be studied prior to final conclusions regarding fundamental technical characteristics of the systems;

(c) that there is a need to supplement the normal procedures of the C.C.I.R. to meet the requirements of the rapidly developing maritime mobile satellite service;

(d) that such considerations may be of interest to any organization concerned with the establishment of a maritime mobile satellite system;

DECIDES

1. that an Interim Working Party should be established to examine further the basic technical and operating problems of an international maritime mobile satellite service taking into account the operational requirements

established by Inter-Governmental Maritime Consultative Organization (I.M.C.O.) and should give particular attention to the items given in the Annex;

2. that the Interim Working Party be composed of members from the Administrations of the following countries and observers from International Organizations and representatives from Recognized Private Operating Agencies:

   Germany (Federal Republic of), Australia, Canada, U.S.A., France, Italy, Japan, Norway, Netherlands, United Kingdom, Sweden, U.S.S.R., C.I.R.M., I.F.R.B., I.M.C.O. and C.T.N.E.;

3. that the coordination of the Interim Working Party be undertaken by the member designated by the Administration of Norway:,

4. that the work of the Party should be conducted in accordance with Resolution 24-2 (Vol. VII, New Delhi, 1970) and as far as possible by correspondence;

5. that the Interim Working Party should report the results of its work to Study Group 8 as draft new texts and/or draft revisions of existing texts;

6. that the Interim Working Party should produce a progress report and furnish any available agreed documents in time for the next Interim Meeting of Study Group 8 and complete its work in time for consideration at the next Final Meeting of the Study Group.

<u>Annex</u>: 1

ANNEX

SUBJECTS REQUIRING STUDY

Particular attention should be given to the study of the following items :

(a) Establishment of a standard method of assessing voice quality.

(b) Quality objectives for voice, teleprinter, facsimile and data circuits.

(c) Comparison of modulation techniques in accordance with (a) and (b) above.

(d) Efficient utilization of the frequency spectrum, in particular the bands allocated by the WARC-ST (Geneva, 1971) to the maritime mobile satellite service in the region of 1.6 GHz.

(e) The value of necessary system margins, resulting from propagation effects such as multipath, fading, etc., to meet the criteria to be established under (b).

(f) Operating characteristics including multiple access techniques and channel assignment methods.

(g) Advantages and disadvantages in the use of both high and low gain ship antennae, including stabilization problems.

(h) Ship antenna characteristics, particulary gain values in directions other than in the main beam (it would be desirable to reach agreement on a reference radiation pattern for interference studies).

(i) Effect of ship structures on antenna radiation patterns.

(j) Technical and operating characteristics of systems for distress alerting and position locating.

(k) Typical link budgets to show the practicability of overall systems, taking into account the results of the foregoing studies.

STUDY GROUP 8

The Editorial Committee, after examination of Doc. 8/343 presented by Study Group 8, submits the following text to the Plenary Assembly for approval.

DRAFT

OPINION 43(Rev.74)

SELF-SUPPORTING ANTENNAE FOR USE ON BOARD SHIPS

Performance at 500 kHz

(1970 - 1974)

The C.C.I.R.

CONSIDERING

(a) that an increasing number of ships are equipped with self-supporting antennae;

(b) that C.C.I.R. has studied the problems concerning self-supporting antennae and has collected data from measurements carried out by Administrations (see Report 502);

(c) that development work is taking place in several countries with the aim of improving the performance of such antennae;

(d) that further study is necessary;

IS OF THE OPINION

1. that the information given in Report 502 demonstrates that the values in the table of metre-amperes in Chapter IV, Regulation 9 (g) of the International Convention for Safety of Life at Sea, London, 1960, are not applicable to self-supporting antennae;

2. that from the results of tests available, the following additions to the above mentioned table of metre-amperes could be made to include self-supporting antennae :

Normal range in nautical miles	Metre-amperes *
200	305
175	215
150	150
125	110
100	85
75	55

3. that this Opinion together with Report 502 should be brought to the attention of the Inter-Governmental Maritime Consultative Organization by the Director of the C.C.I.R.

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* The product of the distance (in metres) from the highest part of the antenna to the deepest load water-line and the current (in amperes) measured at the base of the radiating portion of the antenna.

C.C.I.R.
XIIIth Plenary Assembly
GENEVA, 1974

STUDY GROUP 8

The Editorial Committee, after examination of Doc. 8/345 presented by Study Group 8, submits the following text to the Plenary Assembly for approval.

DRAFT

RECOMMENDATION ...

TECHNICAL CHARACTERISTICS OF VHF EQUIPMENT OPERATING IN THE INTERNATIONAL MARITIME MOBILE SERVICE IN CHANNELS SPACED BY 25 kHz

(Question 10-1/8)

(1974)

The C.C.I.R.

CONSIDERING

(a) that Resolution No. Mar 14 of the W.A.R.C. (Geneva, 1967) stipulates that :

- the channel spacing for international maritime mobile VHF radiotelephone services shall be reduced from 50 kHz to 25 kHz;
- the technical characteristics of equipment for 25 kHz channel spacing in these services shall be in accordance with Appendix 19, Section B, to the Radio Regulations, Geneva, 1968, and that all equipment shall conform to 25 kHz standards by 1 January 1983;

(b) that it is desirable to supplement the list of technical characteristics given in Appendix 19, Section B, to the Radio Regulations in the interests of reduction of interference and of compatibility between equipments;

(c) that Appendix 18 to the Radio Regulations gives a table of transmitting frequencies which is based upon the principle of 25 kHz channel separations for the international maritime mobile service.

(d) that many Administrations have already prepared their national specifications for this type of equipment and consequently it is not possible at the present time to reach international agreement on the detailed specification and measurement of some equipment characteristics.

RECOMMENDS

1. that the following characteristics should be provided for VHF (metric) radiotelephone equipment for the international maritime mobile services operating in the frequencies specified in Appendix 18 to the Radio Regulations, Geneva, 1968.

1.1 General Characteristics

1.1.1 The class of emission shall be F3.

1.1.2 The necessary bandwidth shall be 16 kHz.

1.1.3 Only phase modulation (frequency modulation with a pre-emphasis characteristic of 6 dB/octave) should be used.

1.1.4 Where duplex or semi-duplex systems are in use, the performance of the radio equipment should continue to comply with all the requirements of this Recommendation.

1.1.5 The equipment should be designed so that frequency changes between assigned channels can be carried out within 5 seconds.

1.1.6 Emissions shall be vertically polarized at the source.

1.2 Transmitters

1.2.1 The frequency tolerance for coast station transmitters shall not exceed 5 parts in 10^6, and that for ship station transmitters shall not exceed 10 parts in 10^6.

1.2.2 Spurious emissions on discrete frequencies, when measured in a non-reactive load equal to the nominal output impedance of the transmitter, shall be in accordance with the provisions of Appendix 4 of the Radio Regulations.

1.2.3 The carrier power for coast station transmitters should not normally exceed 50 Watts.

1.2.4 The carrier power for ship station transmitters should not exceed 25 Watts and means shall be provided to readily reduce this to 1 Watt or less for use at short ranges.

1.2.5 The frequency deviation shall not exceed ± 5 kHz. Deviation limiting circuits should be employed such that the maximum frequency deviation attainable should be independent of the input audio frequency.

1.2.6 The upper limit of the audio frequency band shall not exceed 3 kHz.

STUDY GROUP 8

The Editorial Committee, after examination of Doc. 8/320(Rev.1) presented by Study Group 8, submits the following text to the Plenary Assembly for approval.

DRAFT

RECOMMENDATION ...(Rev.74)

USE OF RADIO-BEACON STATIONS FOR COMMUNICATIONS

(Question 15/8)

(1974)

The C.C.I.R.,

CONSIDERING

(a) the (draft Report AA/8) in answer to Question 15/8(Rev.72) on the use of radio beacon stations for communications;

(b) the contents of Annex X to the Chicago Convention on Civil Aviation (July 1972), Vol. I, Part I, § 3.4.6;

(c) that, although I.C.A.O. does not preclude the use of modulation for communications purposes on radio beacons, there are at present no operational requirements in the I.C.A.O. Regional Plans;

(d) that reliable performance of airborne automatic direction-finding equipment (ADF) may be seriously prejudiced if the beacon emission contains modulation by an audio frequency equal or close to the loop switching frequency or its second harmonic;

(e) that aeronautical automatic direction-finding equipment now used in modern high speed jet transport aircraft increasingly employ phase-lock-loop local oscillator techniques, which are severely affected by frequency shift keying of the carrier frequency;

(f) that in some areas maritime beacons are very numerous and have of necessity to be grouped, and operate on a time sharing basis;

(g) that there may be advantages for some users in the transmission of weather and other information, as a secondary modulation of radio beacon emissions and that some Administrations are successfully using such services with A3 emissions;

RECOMMENDS

1. that for radio beacons in the aeronautical radionavigation service any modulation additional to that necessary to provide identification shall be such that airborne automatic direction finder performance is not unacceptably degraded; (see I.C.A.O. Annex X, (July 1972), 3rd edition, Vol. I, Part I, § 3.4.6).

2. that in suitable areas, i.e. where inter-beacon interference can be avoided, use could be made of radio beacons in the maritime radionavigation service for other purposes. In such cases, the methods of modulation used should be such that marine direction finders can continue to be used when signals are emitted other than those proper to the radio beacon itself;

3. that any such additional modulation should not affect the frequency of the carrier.

Note.- The Director, C.C.I.R., is requested to bring this Recommendation to the attention of the International Civil Aviation Organization (I.C.A.O.) and the Inter-governmental Maritime Consultative Organization (I.M.C.O.).

STUDY GROUP 8

The Editorial Committee, after examination of Recommendation AB/8 presented by Study Group 8, submits the following text to the Plenary Assembly for approval.

DRAFT

RECOMMENDATION ...

DIRECT PRINTING TELEGRAPH EQUIPMENT IN THE MARITIME MOBILE SERVICE

(Question 5-1/8)

(1974)

The C.C.I.R.,

CONSIDERING

(a) that, according to Article 19 of the Radio Regulations, a station shall be identified either by a call sign or by other recognized means of identification, such as a ship station selective call number of coast station selective call identification number or signal;

(b) that the two-block call signal described in Recommendation 476 effectively provides a selective-calling system for use with the ARQ equipment;

(c) that this signal is unique for each station and may therefore be used as its identification;

(d) that the use of this signal makes unattended operation of direct printing equipment possible;

(e) that the footnote, Recommendation 476, § 3.1.4, calls for international agreement on the composition of signals used in the phasing procedure;

(f) that it would be convenient if the numbers assigned in accordance with Radio Regulations No. 749A and No. 783H were used for programming the 28-bit (4-character) pattern in the phasing procedure;

(g) that the capacity of this numbering system (see (f) above) will cover the immediate requirements for selective calling, including the direct printing service;

(h) that there is a need for a conversion scheme from numerical identification to the 28-bit (4-character) pattern used in the phasing procedure;

(j) that such a conversion scheme as described in the Annex is already in use in existing direct printing equipment;

RECOMMENDS

1. that, in direct printing systems, the two-block call signal used in the phasing procedure described in Recommendation 476 may be used as identification of a radio station;

2. that for immediate requirements :

2.1 a station equipped with a selective calling system, in accordance with Appendix 20C of the Radio Regulations, and with a direct printing system in accordance with Recommendation 476 and using a two-block call signal should be given the same number for both systems;

2.2 a station, equipped with a direct printing system in accordance with Recommendation 476 and using a two-block call signal, not already assigned a number in accordance with No. 749A and No. 783H of Article 19 of the Radio Regulations, should be assigned such a number for the direct printing service;

2.3 that the conversion from the numerical identification to the 28-bit (4-character) pattern should be performed according to the table in the Annex.

Annex : 1

ANNEX

To translate a number, proceed as follows :

For a 5-digit number let the first digit determine which vertical column in Table I to use. Translate the last four digits to four alphabetic characters as indicated for each digit in the column selected by the intermediary of the table of conversion as given in Table I.

For a 4-digit number Table II should be used.

Examples : The 5-digit number 32610 is transmitted as: Q (RQ) C | X T (RQ)

The 4-digit number 1234 is transmitted as: X (RQ) Q | K M (RQ)

TABLE I

5-digit numbers											
1st digit		0	1	2	3	4	5	6	7	8	9
2nd digit	0	T	V	V	V	T	T	T	V	V	V
	1	B	X	X	X	B	B	B	X	X	X
	2	U	Q	Q	Q	U	U	U	Q	Q	Q
	3	E	K	K	K	E	E	E	K	K	K
	4	O	M	M	M	O	O	O	M	M	M
	5	I	P	P	P	I	I	I	P	P	P
	6	R	C	C	C	R	R	R	C	C	C
	7	Z	Y	Y	Y	Z	Z	Z	Y	Y	Y
	8	D	F	F	F	D	D	D	F	F	F
	9	A	S	S	S	A	A	A	S	S	S
3rd digit	0	V	T	V	V	T	V	V	T	T	V
	1	X	B	X	X	B	X	X	B	B	X
	2	Q	U	Q	Q	U	Q	Q	U	U	Q
	3	K	E	K	K	E	K	K	E	E	K
	4	M	O	M	M	O	M	M	O	O	M
	5	P	I	P	P	I	P	P	I	I	P
	6	C	R	C	C	R	C	C	R	R	C
	7	Y	Z	Y	Y	Z	Y	Y	Z	Z	Y
	8	F	D	F	F	D	F	F	D	D	F
	9	S	A	S	S	A	S	S	A	A	S
4th digit	0	V	V	T	V	V	T	V	T	V	T
	1	X	X	B	X	X	B	X	B	X	B
	2	Q	Q	U	Q	Q	U	Q	U	Q	U
	3	K	K	E	K	K	E	K	E	K	E
	4	M	M	O	M	M	O	M	O	M	O
	5	P	P	I	P	P	I	P	I	P	I
	6	C	C	R	C	C	R	C	R	C	R
	7	Y	Y	Z	Y	Y	Z	Y	Z	Y	Z
	8	F	F	D	F	F	D	F	D	F	D
	9	S	S	A	S	S	A	S	A	S	A
5th digit	0	V	V	V	T	V	V	T	V	T	T
	1	X	X	X	B	X	X	B	X	B	B
	2	Q	Q	Q	U	Q	Q	U	Q	U	U
	3	K	K	K	E	K	K	E	K	E	E
	4	M	M	M	O	M	M	O	M	O	O
	5	P	P	P	I	P	P	I	P	I	I
	6	C	C	C	R	C	C	R	C	R	R
	7	Y	Y	Y	Z	Y	Y	Z	Y	Z	Z
	8	F	F	F	D	F	F	D	F	D	D
	9	S	S	S	A	S	S	A	S	A	A

TABLE II

4-digit numbers		
1st digit	0	V
	1	X
	2	Q
	3	K
	4	M
	5	P
	6	C
	7	Y
	8	F
	9	S
2nd digit	0	V
	1	X
	2	Q
	3	K
	4	M
	5	P
	6	C
	7	Y
	8	F
	9	S
3rd digit	0	V
	1	X
	2	Q
	3	K
	4	M
	5	P
	6	C
	7	Y
	8	F
	9	S
4th digit	0	V
	1	X
	2	Q
	3	K
	4	M
	5	P
	6	C
	7	Y
	8	F
	9	S

STUDY GROUP 8

The Editorial Committee, after examination of Recommendation 476(Rev.72) and Doc. 8/326 presented by Study Group 8, submit the following text to the Plenary Assembly for approval.

DRAFT

RECOMMENDATION 476(Rev.74)

DIRECT PRINTING TELEGRAPH EQUIPMENT IN THE MARITIME MOBILE SERVICE

(Question 5-1/8)

(1970-1974)

The C.C.I.R.,

CONSIDERING

(a) that there is a requirement to interconnect mobile stations or mobile and coast stations, equipped with start-stop apparatus, employing the International Telegraph Alphabet No. 2, by means of radiotelegraph circuits;

(b) that direct printing telegraphy communications in the maritime mobile service can be listed in the following categories:

b.a telegraph service between a ship and a coast station;

b.b telegraph service between a ship and an extended station (ship's owner) via a coast station (leased circuit);

b.c telex service between a ship and a subscriber of the (international) telex network;

b.d broadcast telegraph service from a coast station to one or more ships;

b.e telegraph service between two ships or between one ship and a number of other ships;

(c) that those categories are different in nature and that consequently a different degree of transmission quality may be required;

(d) that the categories given in b.a, b.b and b.c above may require a higher transmission quality than categories b.d and b.e for the reason that data could be handled through the services in the categories b.a, b.b and b.c, while the messages passed through the service of category b.d, and via the broadcast service of category b.e are normally plain language, allowing for a lower transmission quality than those of coded information;

(e) that the service in category b.d and the broadcast service in category b.e cannot take advantage of an ARQ method, as there is in principle no return path;

(f) that for these categories of service which by their nature do not allow for ARQ, another mode, i.e. the forward error correcting (FEC) mode must be used;

(g) that the period for synchronization and phasing should be as short as possible and should not exceed 5 seconds;

(h) that most of the ship stations do not readily permit simultaneous use of the radio transmitter and radio receiver;

(j) that the equipment on board ships should be neither unduly complex nor expensive;

(k) that provision is made in Appendix 20B of the Radio Regulations for direct printing telegraph operation;

RECOMMENDS

1. that when an error-detecting and correcting system is used for direct printing telegraphy in the maritime mobile service, a 7-unit ARQ system or a 7-unit forward acting, error-correcting and indicating, time diversity system, using the same code, should be employed;

2. that equipment designed in accordance with item 1 should meet the characteristics laid down in the Annex.

Annex : 1

ANNEX

1. General (Mode A, ARQ and Mode B, FEC)

1.1 The system is a single channel synchronous system using the 7-unit error-detecting code as listed in § 2 of this Annex.

1.2 The modulation rate on the radio link is 100 bauds.

1.3 The terminal input must be able to accept the 5-unit start-stop C.C.I.T.T. No. 2 code at a modulation rate of 50 bauds.

1.4 The frequency shift on the radio link is 170 Hz.*

---

* With regard to the possible use of frequency synthesized A3J equipment it may be useful to use a multiple of 100 Hz as a centre frequency of the audio spectrum to be offered to the modulator.

2. Table of conversion

2.1 Traffic information signals

	Letter	Figures	International Alphabet No. 2 Code	Emitted 7-unit signal (1)
1	A	-	ZZAAA	BBBYYYB
2	B	?	ZAAZZ	YBYYBBB
3	C	:	AZZZA	BYBBBYY
4	D		ZAAZA	BBYYBYB
5	E	3	ZAAAA	YBBYBYB
6	F		ZAZZA	BBYBBYY
7	G		AZAZZ	BYBYBBY
8	H		AAZAZ	BYYBYBB
9	I	8	AZZAA	BYBBYYB
10	J	Audible signal	ZZAZA	BBBYBYY
11	K	(	ZZZZA	YBBBBYY
12	L	)	AZAAZ	BYBYYBB
13	M	.	AAZZZ	BYYBBBY
14	N	,	AAZZA	BYYBBYB
15	O	9	AAAZZ	BYYYBBB
16	P	0	AZZAZ	BYBBYBY
17	Q	1	ZZZAZ	YBBBYBY
18	R	4	AZAZA	BYBYBYB
19	S	"	ZAZAA	BBYBYYB
20	T	5	AAAAZ	YYBYBBB
21	U	7	ZZZAA	YBBBYYB
22	V	=	AZZZZ	YYBBBBY
23	W	2	ZZAAZ	BBBYYBY
24	X	/	ZAZZZ	YBYBBBY
25	Y	6	ZAZAZ	BBYBYBY
26	Z	+	ZAAAZ	BBYYYBB
27	Carriage return		AAAZA	YYYBBBB
28	Line feed		AZAAA	YYBBYBB
29	Letter shift		ZZZZZ	YBYBBYB
30	Figure shift		ZZAZZ	YBBYBBY
31	Space		AAZAA	YYBBBYB
32	Unperforated tape		AAAAA	YBYBYBB

---

(1) B represents the higher emitted frequency and Y the lower.

2.2 Service information signals

Mode A (ARQ)	Emitted signal	Mode B (FEC)
Control signal 1	BYBYYBB	
Control signal 2	YBYBYBB	
Control signal 3	BYYBBYB	
Idle signal β	BBYYBBY	
Idle signal α	BBBBYYY	Phasing signal 1
Signal reception	YBBYYBB	Phasing signal 2

3. Characteristics

3.1 Mode A (ARQ) (see Figs. 1 and 2)

A synchronous system, transmitting blocks of three characters from an information sending station (ISS) towards an information receiving station (IRS), which stations can, controlled by the control signal 3*, interchange their functions.

3.1.1 The information sending station (ISS)

3.1.1.1 emits blocks of three characters (3 x 7 signal elements) in 210 milliseconds after which a transmission pause of 240 milliseconds becomes effective;

3.1.1.2 numbers the blocks alternately "Block 1" and "Block 2" by a local numbering device, the numbering being interrupted at the reception of: (a) a request for repetition, (b) a mutilated signal, (c) a control signal 3*;

3.1.1.3 emits the information of Block 1 on receipt of the control signal 1*;

3.1.1.4 emits the information of Block 2 on receipt of the control signal 2*;

3.1.1.5 emits a block of three "signals repetition"* on receipt of a mutilated signal;

3.1.1.6 emits the signal information sequence "Figure Shift" "Plus" ("Z"), "Question Mark" ("B") to initiate the change in the direction of the traffic flow;

---

* See § 2.2

3.1.1.7 emits a block containing the signals: "Idle signal β, Idle signal α, Idle signal β" on receipt of a control signal 3.

3.1.1.8 changes subsequently to IRS after the reception of a "signal repetition".

3.1.2 The information receiving station (IRS)

3.1.2.1 emits one of the control signals immediately after the reception of a "Block", after which a transmission pause of 380 milliseconds becomes effective;

3.1.2.2 numbers the received blocks of three characters alternately "Block 1" and "Block 2" by a local numbering device, the numbering being interrupted at the reception of :

- a block in which one or more characters are mutilated,
- a block containing at least one "signal repetition";

3.1.2.3 emits the control signal 2 at the unmutilated reception of a "Block 1" or at the mutilated reception of a "Block 2";

3.1.2.4 emits the control signal 1 at the unmutilated reception of a "Block 2" or at the mutilated reception of a "Block 1";

3.1.2.5 emits the same control signal as at the reception of a block in which one or more characters are mutilated, on receipt of a block containing at least one "signal repetition";

3.1.2.6 emits the control signal 3 :

- when the station wishes to change over to ISS,
- on receipt of a block in which the signal information sequence "Figure shift" - "Plus" - "Question mark" terminates or on receipt of the following block, whether one or more characters in that block are mutilated or not;

3.1.2.7 changes subsequently to ISS after the reception of a block containing the signal sequence "β α β";

3.1.2.8 emits one "signal repetition" as a master station, or a block of three "signals repetition" as a slave station, after being changed into ISS.

3.1.3 Master and slave arrangements

3.1.3.1 the station that initiates the establishment of the circuit (the calling station) becomes the "master" station, and the station that has been called will be the "slave" station.

This situation remains unchanged during the entire time in which the established circuit is maintained.

3.1.3.2 the clock in the master station controls the entire circuit;

3.1.3.3 the master station transmitting time distributor is controlled by the clock in the master station;

3.1.3.4 the master station receiving time distributor is controlled by the transitions of the received signal;

3.1.3.5 the slave station transmitting time distributor is phase locked to the slave station receiving time distributor;

3.1.3.6 the slave station receiving time distributor is controlled by the transitions of the received signal.

3.1.4 Phasing

3.1.4.1 when no circuit is established, both stations are in the "standby" position. In this standby position no ISS or IRS and no master or slave position is assigned to either of the stations;

3.1.4.2 the station desiring to establish the circuit emits the "call" signal. This "call" signal is formed by two blocks of three signals*;

3.1.4.3 - the call signal contains in the first block: "signal repetition" in the second character place and any combination of information signals** in the first and third character place,

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* Some administrations also use a one-block "call" signal, which was an alternative in Recommendation 476(1970).

** The composition of these signals and their assignment to individual ships require international agreement (see § 5 of Question 5-1/8).

- in the second block: "signal repetition" in the third character place preceded by any combination of the 32 information signals* in the first and second character place;

3.1.4.4 on receipt of the appropriate call signal the called station changes from standby to the IRS position and emits the control signal 1 or the control signal 2;

3.1.4.5 on receipt of two consecutive identical control signals, the calling station changes into ISS and operates in accordance with §§ 3.1.1.3 and 3.1.1.4;

3.1.5 Rephasing

3.1.5.1 when reception of information blocks or of control signals is continuously mutilated, the system reverts to the "standby" position after a predetermined time (to be decided by the user)** of continuous repetition; the station that is master station at the time of interruption immediately starts to act according to § 3.1.4.2;

3.1.5.2 the rephasing proceeds along the same lines as laid down in § 3.1.4;

3.1.5.3 however, if, at the time of interruption, the slave station was in the ISS position, it emits, after rephasing, the control signal 3.

3.1.6 Output to line

3.1.6.1 the signal offered to the line output terminal is a 5-unit start-stop signal at a modulation rate of 50 bauds.

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* The composition of these signals and their assignment to individual ships require international agreement (see § 5 of Question 5-1/8).

** A preferable predetermined time would be the duration of 32 cycles of 450 milliseconds.

3.1.7 End of communication

3.1.7.1 when reception of information blocks or of control signals is continuously mutilated, the system reverts to the "standby" position after a predetermined time of continuous repetition,* which causes the termination of the established circuit;

3.1.7.2 the station that wishes to terminate the established circuit transmits an "end of communication signal";

3.1.7.3 the "end of communication signal" consists of a block containing three "Idle Signal α" signals;

3.1.7.4 the "end of communication signal" is transmitted by the ISS;

3.1.7.5 if an IRS wishes to terminate the established circuit it has to change over to ISS in accordance with § 3.1.2.6;

3.1.7.6 the IRS that receives an "end of communication signal" emits the appropriate control signal and reverts to the "standby" position;

3.1.7.7 on receipt of a control signal that confirms the unmutilated reception of the "end of communication signal", the ISS reverts to the "standby" position.

3.2 Mode B (FEC) (see Figs. 3)

A synchronous system, transmitting an uninterrupted stream of characters from a station sending in the B mode (BSS) to one or more stations receiving in the B mode (BRS).

3.2.1 The station sending in the B mode (BSS):

3.2.1.1 emits each character twice; the first transmission (DX) of a specific character is followed by the transmission of four other characters, after which the retransmission (RX) of the first character takes place, allowing for time-diversity reception at 280 milliseconds time space;

---

* A preferable predetermined time would be the duration of 64 cycles of 450 milliseconds.

3.2.1.2 emits signals before and between the broadcast messages; these signals consist of the phasing signal 1* and the phasing signal 2* whereby phasing signal 1 is transmitted in the RX, and phasing signal 2 in the DX position;

3.2.1.3 when desiring to establish a circuit with one particular station, ignores the procedure laid down in § 3.2.1.2, but however begins to emit phasing signals 1 and 2 so that phasing signal 1 is transmitted in the RX and phasing signal 2 in the DX position;

3.2.1.4 emits after the transmission of phasing signals a sequence of four characters that is representative of the number code of the called station. This transmission takes place in the time-diversity mode according to § 3.2.1.1. All signals following the phasing signals are transmitted in a 3B/4Y ratio, i.e. inverted with respect to the signals of § 2 in the column "emitted 7-unit signal".

Consequently, all signals following the selecting characters are also transmitted in the 3B/4Y ratio;

3.2.1.5 emits the service information signal "idle signal β" during the idle time between the messages consisting of traffic information signals. The sequences of "idle time β" are also transmitted in the 3B/4Y ratio.

3.2.2 The station(s) receiving in the B mode (BRS):

3.2.2.1 checks both characters (DX and RX), printing an unmutilated DX or RX character, or printing an error symbol or space, if both are mutilated.

3.2.3 Phasing

3.2.3.1 when no reception takes place, the system is in the "standby" position as laid down in § 3.1.4.1.

3.2.3.2 on receipt of the phasing signal 1 followed by phasing signal 2 (in such a way that the phasing signal 2 determines the DX and the phasing signal 1 the RX position) the system changes from standby to the BRS position and offers continuous stop polarity to the line output terminal until either the signal "carriage return" or "line feed" is received.

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* See § 2.2

3.2.3.3 when started as BRS, the system changes to the "Selectively called receiving station" (SBRS) position on receipt of the inverted characters representing its selective call number.

3.2.3.4 when started as SBRS, the decoder re-inverts all the following signals received to the 3Y/4B ratio, so that these signals are offered to the SBRS in the correct ratio, but they remain inverted for all other stations.

3.2.3.5 the BRS and the SBRS revert to the stand-by position if, during a predetermined time, only mutilated signals have been received.

3.2.4 Output to line

3.2.4.1 the signal offered to the line output terminal is a 5-unit start-stop C.C.I.T.T. No. 2 code signal at a modulation rate of 50 bauds.

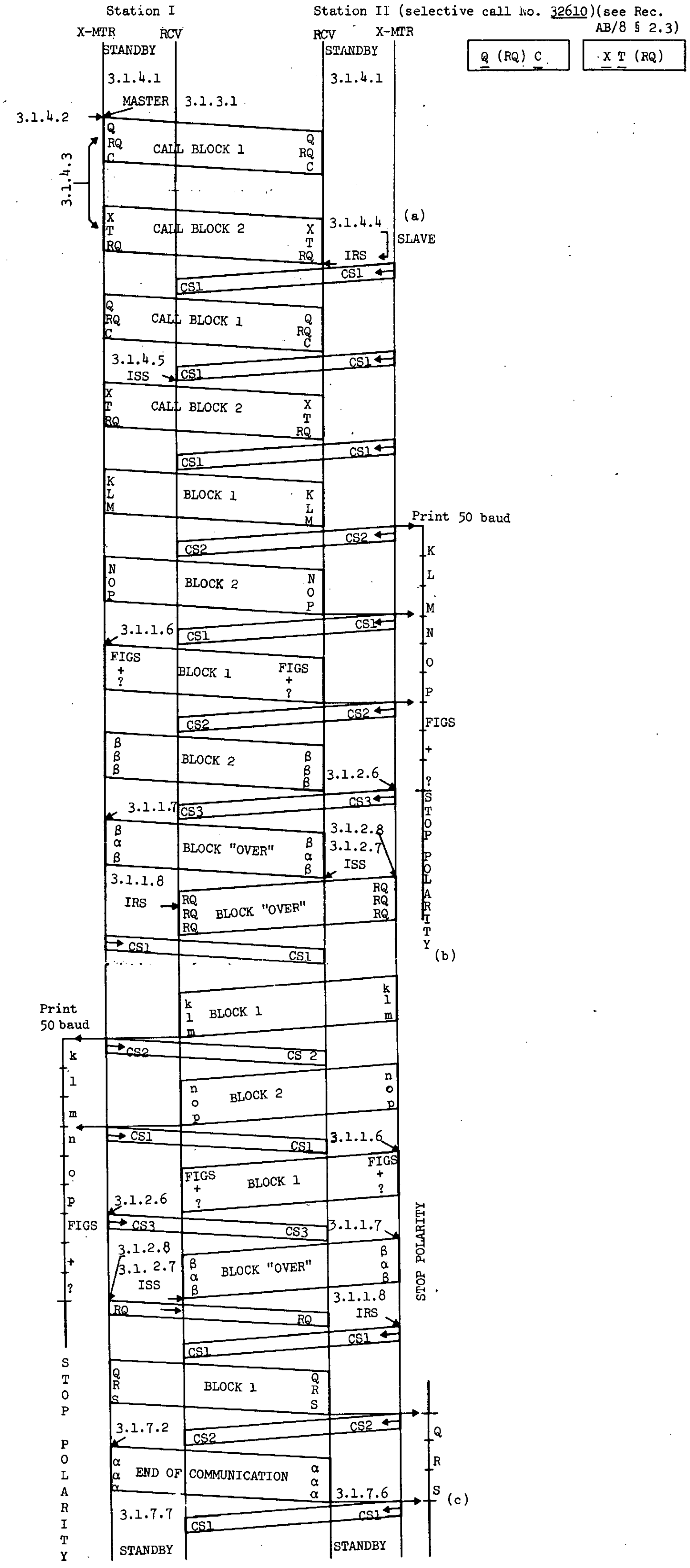


FIGURE 1

MODE-A OPERATION

(a) start of communication

(b) change of the direction of the information flow

(c) end of communication.

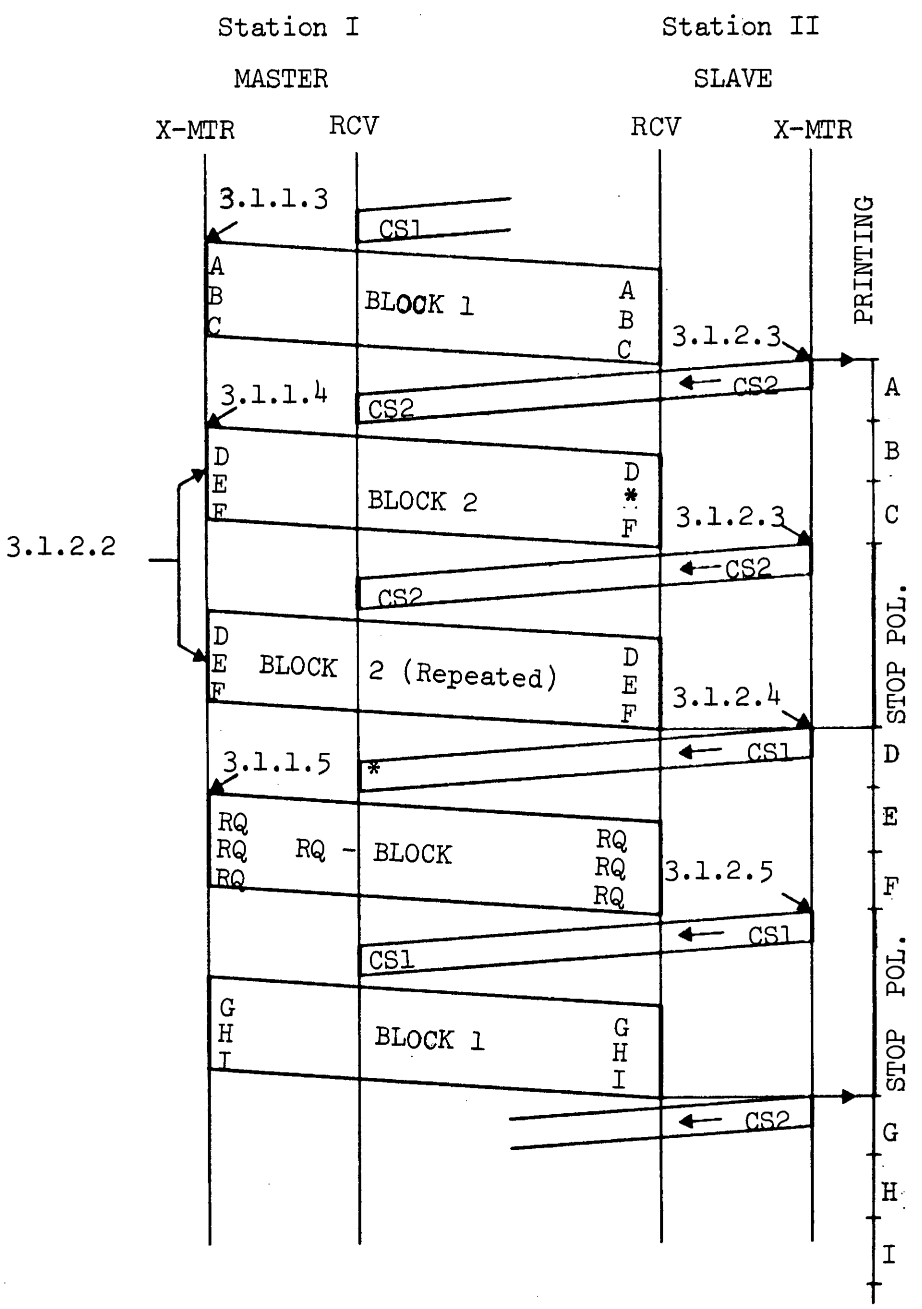
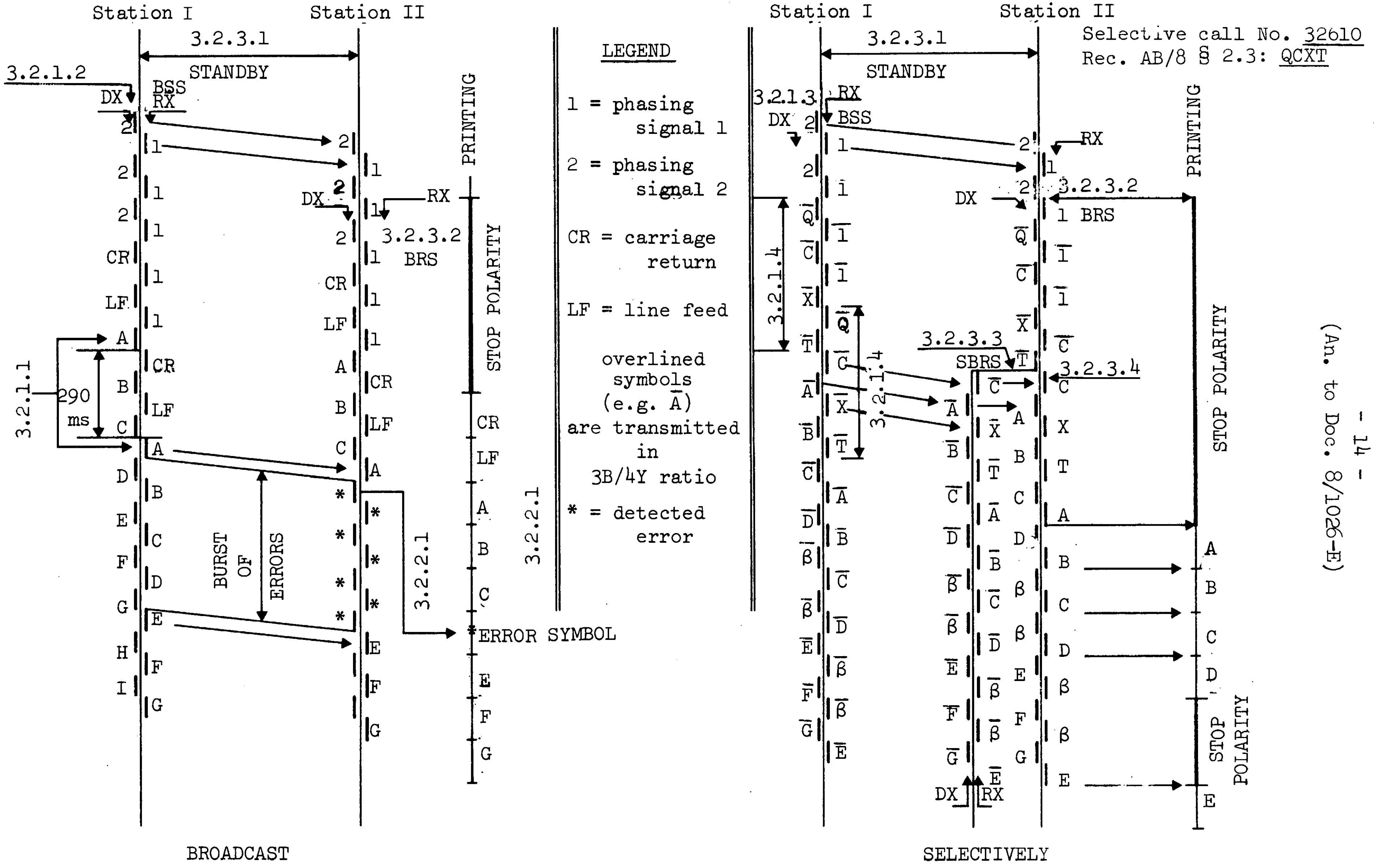


FIGURE 2

Mode A under error receiving conditions.



LEGEND

1 = phasing signal 1

2 = phasing signal 2

CR = carriage return

LF = line feed

overlined symbols (e.g. $\overline{A}$) are transmitted in 3B/4Y ratio

* = detected error

Fig. 3
B-Mode operation

STUDY GROUP 8

The Editorial Committee, after examination of Doc. 8/340 presented by Study Group 8, submits the following text to the Plenary Assembly for approval.

DRAFT

RECOMMENDATION ...

EQUIVALENT POWERS OF DOUBLE-SIDEBAND AND SINGLE-SIDEBAND RADIOTELEPHONE EMISSIONS

(IN THE MARITIME MOBILE SERVICE)

(Question 19/8)

(1974)

The C.C.I.R.,

CONSIDERING

(a) that according to the International Convention for the Safety of Life at Sea, London, 1960, in the 2 MHz band using A3 emissions, it may be assumed that clearly perceptible signals will be obtained by day and under normal conditions and circumstances at 150 nautical miles by a power in the antenna of 15 watts (unmodulated carrier) with an antenna efficiency of 27%;

(b) that clearly perceptible signals are assumed to be received when the r.m.s. value of the field strength produced at the receiver by the unmodulated carrier is at least 25 μV/m;

(c) that in normal operation the transmitter has a peak modulation of at least 70%;

(d) that in the interest of more efficient spectrum utilization Resolution No. Mar 5, Geneva, 1967, of the Radio Regulations requires the conversion by 1 January 1982, of all maritime emissions in the 2 MHz band to SSB except those on 2 182 kHz, which may be A3 or A3H;

(e) that the Safety Convention requires that transmitters use the classes of emission assigned by the Radio Regulations;

(f) that to further improve efficient spectrum utilization all stations are constrained by the Radio Regulations to radiate no more than such power as is necessary to ensure a satisfactory service;

(g) that Inter-governmental Maritime Consultative Organization (I.M.C.O.) is considering an amendment to the Safety Convention to include minimum power requirements for SSB transmitters on board ships;

(h) that SSB transmitters utilize A3A, A3H and A3J emissions;

(j) that there is consequently a need to specify for each of the types of SSB emission, the powers and field strengths equivalent to those in the DSB system at present employed;

(k) that cross-system operation between SSB and DSB equipments will at times be utilized;

RECOMMENDS

1. that the bases for the calculation of the field strengths of A3H, A3A and A3J emissions equivalent to a reference signal, which is an A3 emission for which the unmodulated carrier produces a field strength of 25 μV/m at the receiver, are as follows :

1.1 the signal-to-noise ratios at the output of the demodulator of all cases considered including the reference case are equal;

1.2 for single-tone modulation, the signal-to-noise ratio to be considered is only that of the fundamental component of the modulating tone at the output of the demodulator;

1.3 for class of emission A3, the carrier is modulated by a single modulating tone to depths of 70% or 100%;

1.4 for class of emission A3H, the sideband amplitude for a single modulating tone is 70% or 100% of the carrier amplitude for equivalent 70% or 100% respectively, depths of modulation;

1.5 for class of emission A3A, the amplitudes of the side-band signals corresponding to 70% and 100% modulations are the same as those for A3H in § 1.4 but the carrier level is reduced to 16 dB below peak envelope power corresponding to 100% modulation;

1.6 for class of emission A3J, the amplitudes of the side-band signal corresponding to 70% and 100% modulations are the same as those for A3H in § 1.4 but the carrier level is reduced by at least 40 dB below peak power corresponding to 100% modulation;

2. that under the above conditions the calculated equivalent r.m.s. field strengths for the various classes of emission and for different types of receiving systems, with the types of test signals indicated, are shown in Table I :

TABLE I

Class of emission	Type of receiver	Test signal; remarks	r.m.s. field strength (μV/m) equivalent to the reference signal (see RECOMMENDS 1.) with a modulation depth of	
			70%	100% (2)
A3	DSB	carrier only	25.0	25.0
A3	SSB	carrier only	35.4	35.4
A3H	DSB	carrier only (1)	26.8	29.4
A3H	SSB	carrier only	17.7	17.7
A3A	SSB	carrier and sideband	12.8	18.0
A3J	SSB	sideband only	12.4	17.7

1. Envelope detection of the A3H emission is assumed and this requires the reference field strength of 25 μV/m to be increased by 7% and 18% at 70% and 100% modulation, respectively, to compensate for the reduction in the amplitude of the fundamental component due to harmonic distortion in the detection process.

2. The calculations for 100% modulation are based upon the reference carrier (unmodulated) field strength of 25 μV/m.

3. that the calculated equivalent peak envelope powers into the antenna to achieve the field strengths given in RECOMMENDS 2 are as listed in Table II; these powers are in all cases based upon a modulated signal :

TABLE II

Class of emission	Type of receiver	Peak envelope power (watts) equivalent to the reference signal (see RECOMMENDS 1.) with a modulation depth of	
		70%	100%
A3	DSB	43.4	60
A3	SSB	86.7	120
A3H	DSB	49.7	83.2
A3H	SSB	21.7	30.0
A3A	SSB	5.9	10.6
A3J	SSB	3.7	7.5
The values given in this table are valid irrespective of the type of modulating signal (i.e. single-tone, two-tone, smoothly read text, etc.), provided the same modulation is used for all classes of emission.			

Note. - The Director of C.C.I.R. is requested to bring this Recommendation to the attention of I.M.C.O.

STUDY GROUP 8

The Editorial Committee, after examination of Doc. 8/351 presented by Study Group 8, submits the following text to the Plenary Assembly for approval.

DRAFT

RECOMMENDATION ...

DIGITAL SELECTIVE CALLING SYSTEM FOR USE IN THE INTERNATIONAL MARITIME MOBILE SERVICE

(Question 9/8)

(1974)

The C.C.I.R.,

CONSIDERING

(a) that selective calling in the shore-to-ship, ship-to-ship and ship-to-shore directions would expedite the handling of traffic in the international maritime mobile service;

(b) that the Inter-governmental Maritime Consultative Organization (I.M.C.O.) has urged that a selective calling system should, in particular, have an important function in distress alerting and should also be used for safety purposes*;

(c) that the I.M.C.O. has listed a number of operational requirements that should be taken into account when designing a general purpose selective calling system*;

(d) that neither the selective calling system described in Recommendation 257-1, nor that forming part of the system described in Recommendation 476, can fully meet the I.M.C.O. operational requirements*;

(e) that several Administrations have indicated an urgent need for a general purpose selective calling system;

(f) that several Administrations have been developing different systems;

(g) that it is necessary that a common system be employed in the international maritime mobile service;

---

* The I.M.C.O. views are given in Doc. 8/261 (1974).

(h) that it is desirable that the selective calling system fulfills the requirements of all types of vessels desiring to use it.

RECOMMENDS

that, where there is a need for a general purpose digital selective calling system, which is to meet the operational requirements specified by I.M.C.O., the system shall have operational characteristics according to the Annex of this Recommendation.

Note.- Further consideration of the technical characteristics is necessary and reference may be made to Report 501(Rev...)

Annex : 1

ANNEX

OPERATIONAL CHARACTERISTICS

1. General

1.1 The format of a calling sequence shall be :

address	message 1	message 2	...	end of sequence

2. Address

2.1 The address can be either :

2.1.1 a "distress" call, or

2.1.2 an "all ships" call, or

2.1.3 a selective call directed to an individual ship or a coast station or

2.1.4 a selective call directed to a group of ships, either :

2.1.4.1 in a particular geographical area, or

2.1.4.2 having a common interest.

2.2 The address portion allows :

2.2.1 a numerical address, or

2.2.2 an alphanumerical address

3. Messages

The following messages can form a part of a calling sequence :

3.1 "Category", which indicates the priority of the call and includes :

3.1.1 distress,

3.1.2 urgency,

3.1.3 safety,

3.1.4 routine,

3.1.5 ... (the possibility of adding up to six more categories at a future time).

3.2 "Self-identification" containing the address of the calling station.

3.3 "Distress information" including :

3.3.1 latitude in degrees and minutes, N or S,

3.3.2 longitude in degrees and minutes, E or W,

3.3.3 an indication of the nature of distress.

3.4 "Telecontrol" including :

3.4.1 terminal control functions,

3.4.2 transmitter/receiver control functions,

3.4.3 ... (the possibility for expansion at a future time).

3.5 "Frequency/channel" containing either :

3.5.1 a symbolic channel number, or

3.5.2 an actual frequency in multiples of 100 Hz.

3.6 "Other (including the possibility for messages to be added at a future time).

4. End of sequence

4.1 "End of sequence" terminates a particular calling sequence.

5. Composition of call sequences

5.1 A distress call is composed of :

5.1.1 the address "distress",

5.1.2 the "self-identification" of the ship in distress, 5.1.3 the "distress information",

5.1.4 the "end of sequence".

5.2 Other calls are composed of :

5.2.1 an address,

5.2.2 the "self-identification" of the calling station,

5.2.3 the "category" of the call,

5.2.4 an optional "telecontrol" message,

5.2.5 an optional "frequency/channel" message,

5.2.6 the "end of sequence".

C.C.I.R.
XIIIth Plenary Assembly
Geneva, 1974

Doc. 8/1030-E

STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration:

REPORT 358-1 (Rev. 74)

SIGNAL-TO-INTERFERENCE PROTECTION RATIOS AND MINIMUM FIELD STRENGTHS REQUIRED IN THE MOBILE SERVICES

(Question 1/8)

(1966-1970-1974)

1. The following documents were submitted in reply to Question 1/8 :

1.1 for the period 1963-1966 :

Doc. XIII/25 (United Kingdom)
Doc. XIII/41 (Federal Republic of Germany)
Doc. XIII/88 (Japan)
Doc. XIII/95 (I.F.R.B.)

1.2 for the period 1966-1969 :

Doc. XIII/136 (Federal Republic of Germany)
Doc. XIII/141 (Sweden)
Doc. XIII/146 + Corrigendum 1 (Japan)
Doc. XIII/149 (Japan)
Doc. XIII/157 (I.F.R.B.)

1.3 for the period 1970-1974 :

Doc. 8/17 (U.S.A.)
Doc. 8/57 (United Kingdom)
Doc. 8/218 (U.S.A.)

2. VHF and UHF land and maritime mobile services

2.1 Protection ratios based on internal noise and distortion in the receiver

According to documents of the I.F.R.B. and the C.C.I.R. (for example, Recommendation 447), the radio-frequency protection ratio is the value of the radio-frequency wanted-to-interfering signal ratio to achieve a subjectively defined reception quality. This ratio may have different values according to the type of service desired.

However, in the absence of information submitted to Study Group 8 on subjective measurements made in the VHF and UHF land and maritime mobile services, several Administrations have submitted the results of measurements using an alternative concept of signal-to-interference protection ratio. This is based on electrical measurements, using appropriate test signals, of the degradation of the signal-to-noise ratio of the wanted test signal, when a co-channel interfering signal is superimposed on the latter. A degradation of the initial signal-to-noise ratio of 20 dB to a signal-to-noise + interference ratio of 14 dB is taken as the criterion. This criterion is considered to correspond with the minimum acceptable grade of service.

In the tests described by the various Administrations, the frequency deviations are 70% or 60% of the maximum specified frequency deviations, and for amplitude modulation the modulation percentages are 70% or 60%, for both wanted and unwanted signals. From a study of the documents submitted, it may be deduced that the slight differences in measurement conditions and in the characteristics of the receivers used in the different tests, may result in differences in the measured protection ratios, of up to about ± 3 dB.

Although these protection ratios may be dependent on the passband characteristics of the receivers, the frequency difference between the co-channel wanted and unwanted signals, the frequency deviation, etc., the protection ratios in Table I are proposed as approximate standards for the practical design of mobile systems for a minimum grade of service.

If a higher grade of service is required, a higher protection ratio should be adopted, particularly in the case of amplitude-modulated wanted emissions.

TABLE I

Wanted emission (Note 1)	Unwanted emission (Note 1)	RF protection ratio (dB)
Wide-band F3	Wide-band F3	8
Narrow-band F3	Narrow-band F3	8
Wide-band F3	A3	8
Narrow-band F3	A3	10
A3	Wide-band F3	8-17
A3	Narrow-band F3	(Note 2)
A3	A3	17

Note 1.—Wide-band F3 systems normally employ frequency deviations with a maximum value in the range ±12 kHz to ±15 kHz.

The narrow-band F3 systems considered here normally employ frequency deviations with maximum values of either ±4 kHz or ±5 kHz.

Note 2.—The protection ratio may vary within the range shown dependent upon the difference in frequency between the carriers of the wanted and unwanted emissions and the frequency deviation of the unwanted emission. In general, it will tend towards the higher figure as the frequency deviation of the unwanted emission decreases.

2.2 Man-made noise

Man-made noise degrades the performance of a mobile system. To maintain a desired grade of service in the presence of man-made noise, it is necessary to increase the level of the field strength of the wanted signal. Motor vehicles have been shown, by measurements [U.S. Advisory Committee, 1967] to be the primary source of man-made noise for frequencies above 30 MHz. Other noise sources are fewer in number and usually radiate from fixed locations.

For convenience in evaluating the degradation of performance of a base receiver, the following classifications of noise sources are provided :

- High noise locations - traffic density 100 vehicles/km^2 at any given instant of time.
- Moderate noise locations - traffic density 10 vehicles/km^2 at any given instant of time.
- Low noise locations - traffic density 1 vehicle/km^2 at any given instant of time.
- Concentrated noise sources (hot spots): noise radiated from individual sources or closely spaced multiple sources which are usually located within 500 m of the receiving antenna such as a high concentration of vehicles, manufacturing plant and defective power transmission lines.

Noise data for base stations at high, moderate and low noise locations are presented by a noise amplitude distribution (NAD) (the number of pulses per unit of time exceeding the ordinate) are illustrated in Fig. 1. The amplitude (A) of noise pulses at a rate of 10 pps is expressed as follows :

$$A = C + 10 \log V - 28 \log f$$

where

A = dB above 1 μV/MHz at 10 pps

C = constant (tentative value : 106 dB above 1 μV/MHz)

V = traffic density vehicles/km^2

f = channel frequency, MHz.

Noise data for hot spots can also be presented in the form of a NAD. However, due to a wide variety of noise sources, it is not yet practical to provide a classified list.

The constant C is a function of the suppression applied to vehicles and may also vary with the proportions of the mixture of goods and passenger vehicles if they are not suppressed to the same levels. A tentative value of 106 dB above 1 μV/MHz is shown which may be revised as more information becomes available.

2.3 Minimum values of field strength to be protected in the absence of man-made noise

The minimum values of field strength to be protected are determined either by the internal noise generated in the receiver, or by the man-made noise and natural noise at the locations of the receiver. For the land mobile service, at frequencies above 30 MHz, man-made noise usually predominates. In the maritime mobile service, the level of man-made noise depends on the number and nature of hot spots on the ship. Only limited information is available as to the noise level due to the effect of traffic density (see § 2.4) to make necessary corrections of minimum values.

A convenient measure of the threshold of performance for narrow-band receivers is a specified value of $\frac{S + N + D}{N + D}$ ratio; the conventionally accepted value being 12 dB (see Recommendation 331-2). This defines the minimum usable field strength for any particular installation, in the absence of man-made noise.

The sensitivity of typical receivers is such that an input signal of 0.7μ V e.m.f. (assuming a receiver input impedance of 50 ohms) would result in a 12 dB $\frac{S + N + D}{N + D}$ ratio at the output. A mobile service is characterized by large variations of field strength with location and time. These variations may be represented by a log-normal distribution, for which standard deviations of 8 dB at VHF and 10 dB at UHF are appropriate for terrain irregularities of 50 metres (Recommendation 370-1). To determine the minimum value of median field strenth to be protected, it is necessary to specify the percentage of time for which the minimum usable field strength should be exceeded for different grades of service. For land mobile radiotelephony a high grade of service would require that the value be exceeded for 99% of the time, but for a lower (or normal) grade of service, for 90% of the time.

From the above, the median value of field strength to be protected for any receiving station in the absence of man-made noise may be determined. Such noise will degrade the useful sensitivity and will result in the need for a re-evaluation of the median value of the field strength to be protected.

Typical values of the minimum usable and the median values of field strength are shown for typical base stations, vehicular mobile station and hand-portable stations in Figs. 2, 3 and 4 respectively.

2.4 Minimum values of field strength to be protected taking into account man-made noise

The minimum values of field strength to be protected can also be determined subjectively taking into account man-made noise and multipath propagation. Ignition systems of motor vehicles are usually the most prevalent source of man-made noise. Field strength cancellations due to multipath propagation produce an annoyance somewhat similar to that created by ignition systems. When a mobile unit is moving both of these annoyances occur at the same time. Only the effects of receiver noise and man-made noise remain when the mobile unit is standing still. The separation of motor vehicles is generally less with slow moving or stationary traffic, and under these circumstances, particularly at the lower frequencies the degradation to a mobile unit standing still is greater than when it is moving.

Figs. 5 and 6 / F.C.C., 1973 / can be used to determine the combined degradation effects of man-made noise and multipath propagation for the case of moving vehicles. These figures are based on subjective testing under traffic conditions commonly experienced by most mobile vehicles. Specifically, these conditions are moving in a low noise area, moving in traffic surrounded by other vehicles and standing still surrounded by stationary or moving vehicles.

The tendency for the curves of Figs. 5 and 6 to merge at the higher frequencies is due to the almost constant multipath degradation effect with frequency while the degradation effect of man-made noise decreases with frequency.

Degradation is defined as the increase of desired input signal level needed to restore reception to a particular quality grade which was imposed by the effects of receiver noise only.

Definitions of signal quality are as follows :

Grade	Interfering effect was	
5	Almost nil	Speech understandable but with increasing effort as the grade decreases
4	Noticeable	
3	Annoying	
2	Very annoying	
1	So bad that the presence of speech is barely discernible	

Some information on field strengths can be derived from Recommendation 370-1 and Report 244-2. Additional information can be found in Doc. XIII/146 (Japan), 1966-1969, and in the article "Field strength and its variability in VHF and UHF land mobile radio service", by Okumura, Ohmori, Kawano and Fukada. (Review of the Electrical Communication Laboratory, Nippon Telegraph and Telephone Public Corporation, Tokyo, Vol. 16, 9-10 (1968)).

Information on protection ratios and minimum field strengths may also be found in the "Special Agreement between the Administrations of Belgium, the Netherlands, and the Federal Republic of Germany relating to the use of metric and decimetric waves for fixed and mobile services in border areas, Brussels, 1963", and in the Final Acts of the Special Regional Conference, Geneva, 1960. Similar information may be found in the Agreement between the Telecommunications Administration of Austria, the Federal Republic of Germany, Italy and Switzerland, Vienna, 1969.

Doc. XIII/88 (Japan), 1963-1966, deals with the above questions for signal-to-noise ratios of 30 dB and 40 dB at the receiver output.

3. HF maritime mobile service

In Doc. XIII/95 (1963-1966), the International Frequency Registration Board (I.F.R.B.) gave an extract from the Technical Standards used by it when examining, in accordance with Article 9 of the Radio Regulations, notices concerning coast stations in the high-frequency bands.

Doc. XIII/157 (1966-1969) (I.F.R.B.) brings the above document up to date. The I.F.R.B. states that the purpose of this paper is twofold :

- to enable the C.C.I.R. to consider whether the technical standards used by the Board for the maritime mobile service in the high-frequency bands need to be amended, for example because of receiving conditions on board ships (level of local noise);
- to help Administrations to prepare for the Conference which, according to Recommendation No. Mar 6 of the 1967 Maritime W.A.R.C., is to be held in 1973 to establish a new Frequency Allotment Plan for coast high-frequency radiotelephone stations to replace the one in Appendix 25 to the Radio Regulations.

4. Conclusions

Considerable additional work concerning §§ 2 and 3 is necessary to determine more fully the appropriate protection ratios and the values of the field strengths to be protected, and also to determine and record the measurement methods which should be adopted.

REFERENCES

F.C.C. /August 1973/, Degradation of mobile radio reception at UHF and VHF, Research Division, Report No. R-7302.

U.S. Advisory Committee /1967/, Man-made noise; Report from Working Group 3 of the Advisory Committee for the Land Mobile Radio Services Vol. 2, Part 2, U.S. Government Printing Office : 0-281-851.

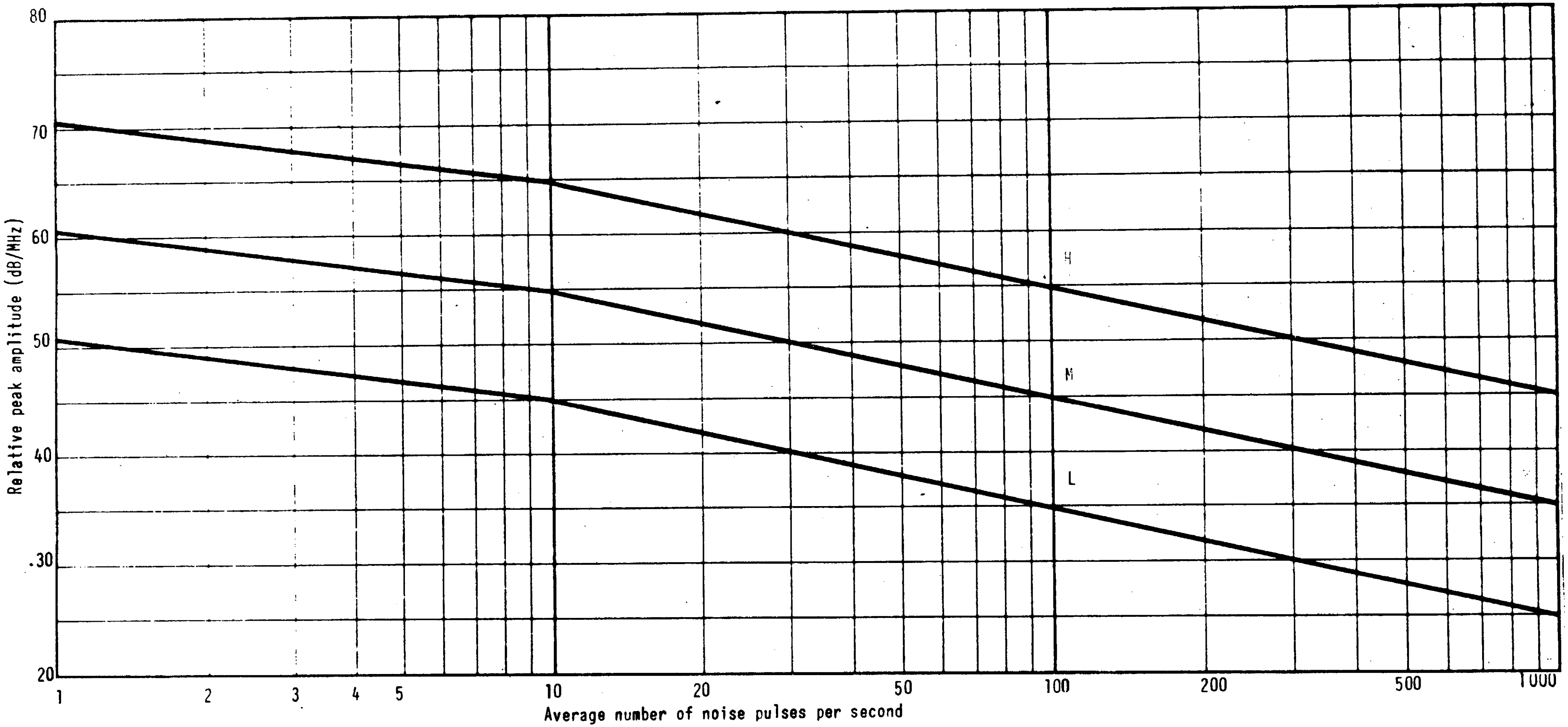


FIGURE 1

RELATIVE NOISE AMPLITUDE DISTRIBUTION AT BASE STATION

A = C + 10 log **V - 28 log f**
where A = dB above 1 μV/MHz at **10 pps**

Curve H high noise location (V = 100)
Curve M moderate **noise location** (V = 10)
Curve L low **noise location** (V = 1)

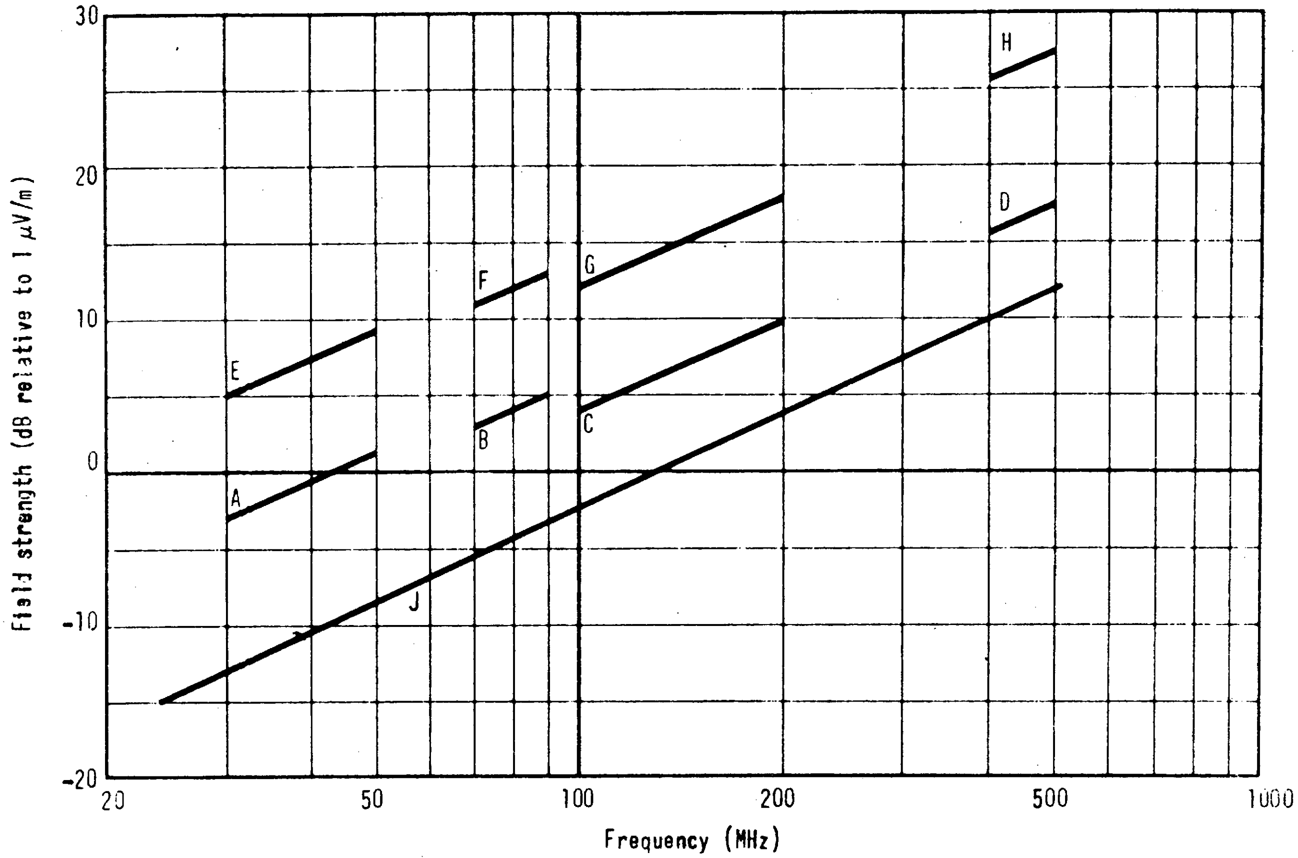


FIGURE 2

MINIMUM USABLE AND MINIMUM MEDIAN FIELD STRENGTHS BASE STATIONS

Based on minimum usable input of 0.7 μV e.m.f., in the absence of man-made noise

Characteristics assumed

	Normal	Grade			High Grade				
	A	B	C	D	E	F	G	H	
Antenna Gain dB	0	3	6	10	0	3	6	10	
Feeder Loss dB	0	1	2	3	0	1	2	3	

J : Minimum usable field strength (dipole antenna)

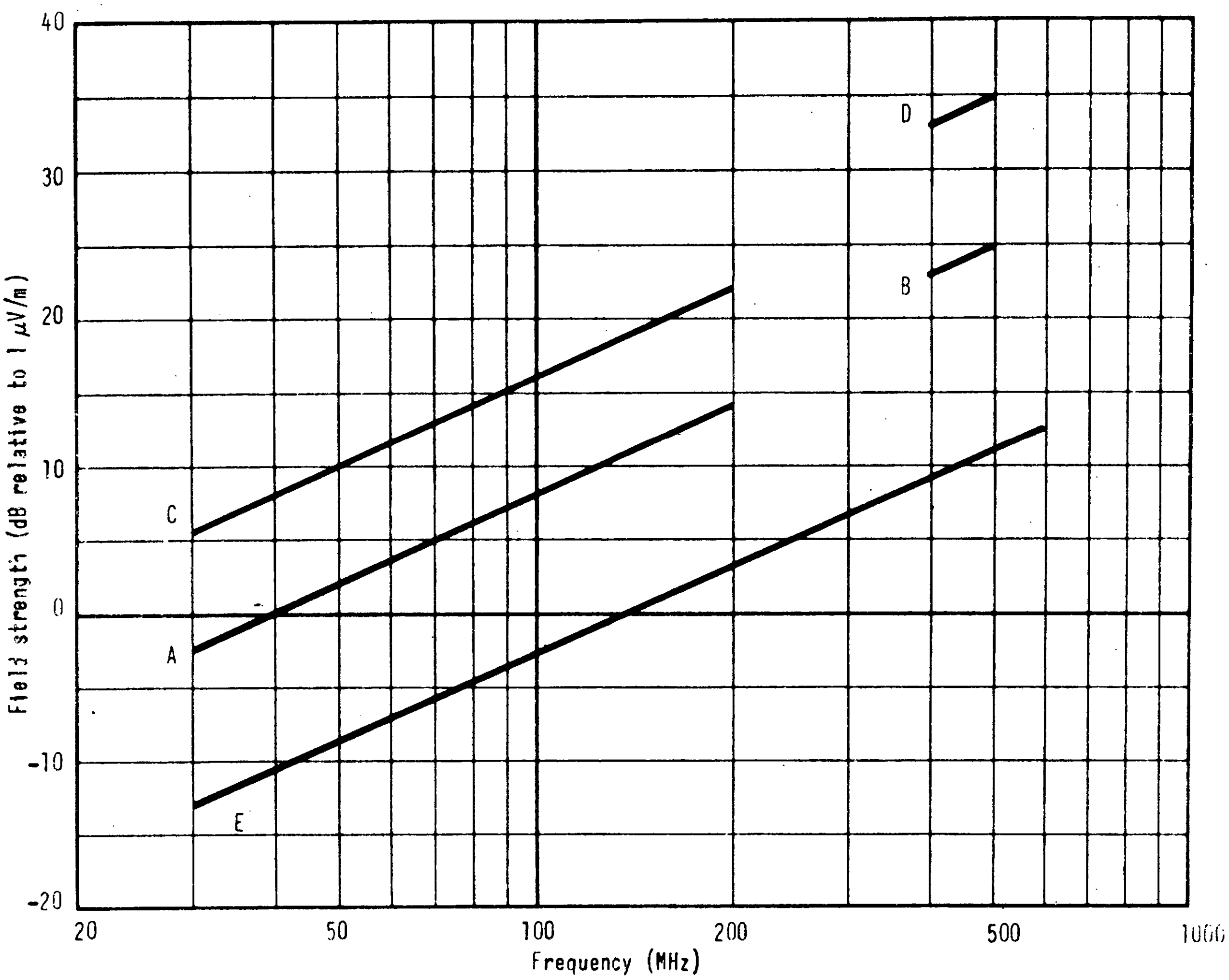


FIGURE 3

MINIMUM USABLE AND MINIMUM MEDIAN FIELD STRENGTHS VEHICULAR MOBILE STATIONS

Based on minimum usable input of 0.7 μV e.m.f., in the absence of man-made noise

Characteristics assumed:

Antenna Gain : 0 dB . Feeder loss ; 0 dB

A,B : Median, Normal Grade

C,D : Median, High Grade

E : Minimum usable field strength (dipole antenna)

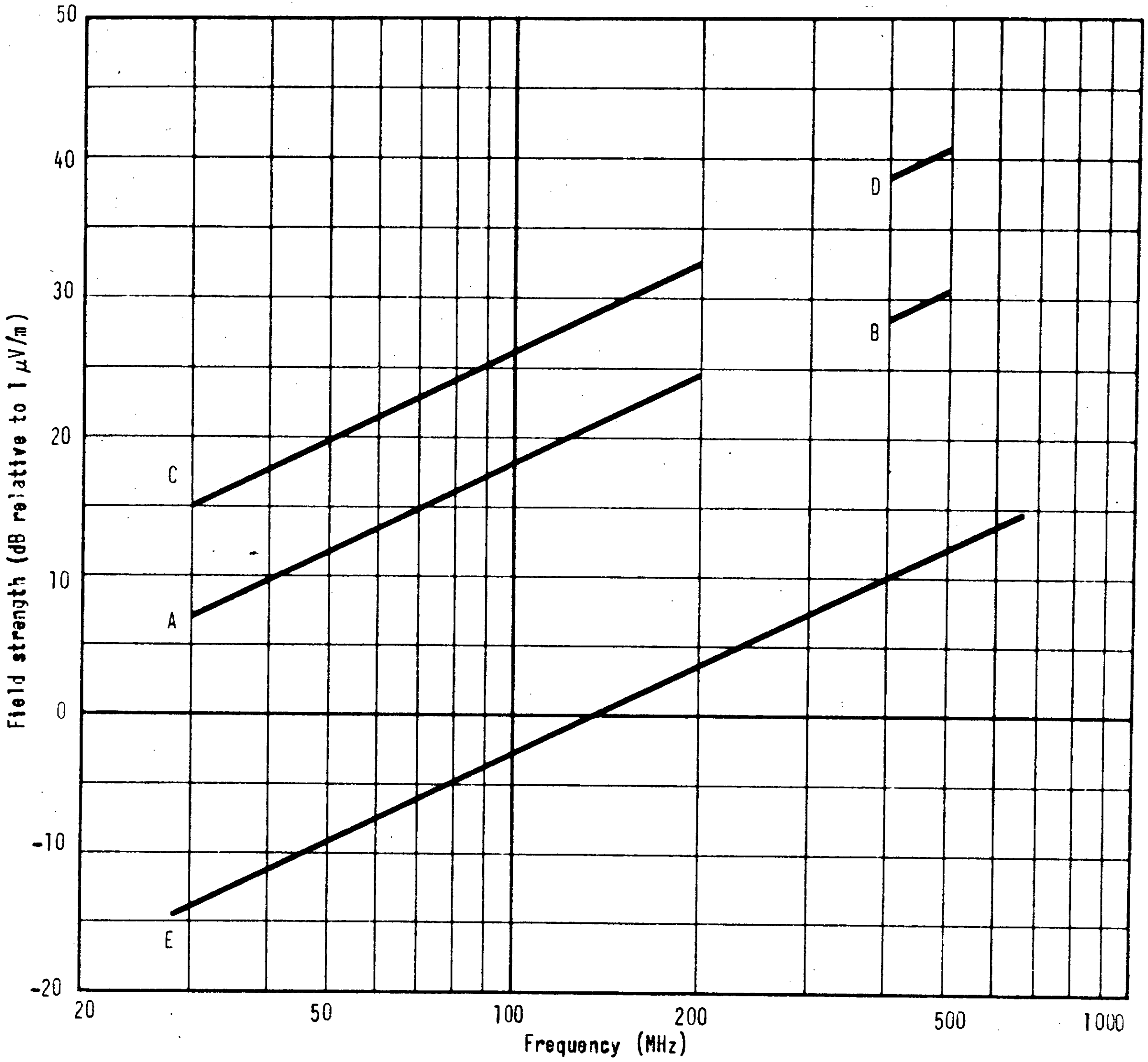


FIGURE 4

MINIMUM USABLE AND MINIMUM MEDIAN FIELD STRENGTHS HAND-PORTABLE STATIONS

Based on minimum usable input of 0.7 μV e.m.f., in the absence of man-made noise

Characteristics assumed

	Curve	
	A and C	B and D
Antenna Gain (dB)	-9	-6

A,B : Median, Normal Grade

C,D : Median, High Grade

E : Minimum usable field strength (dipole antenna)

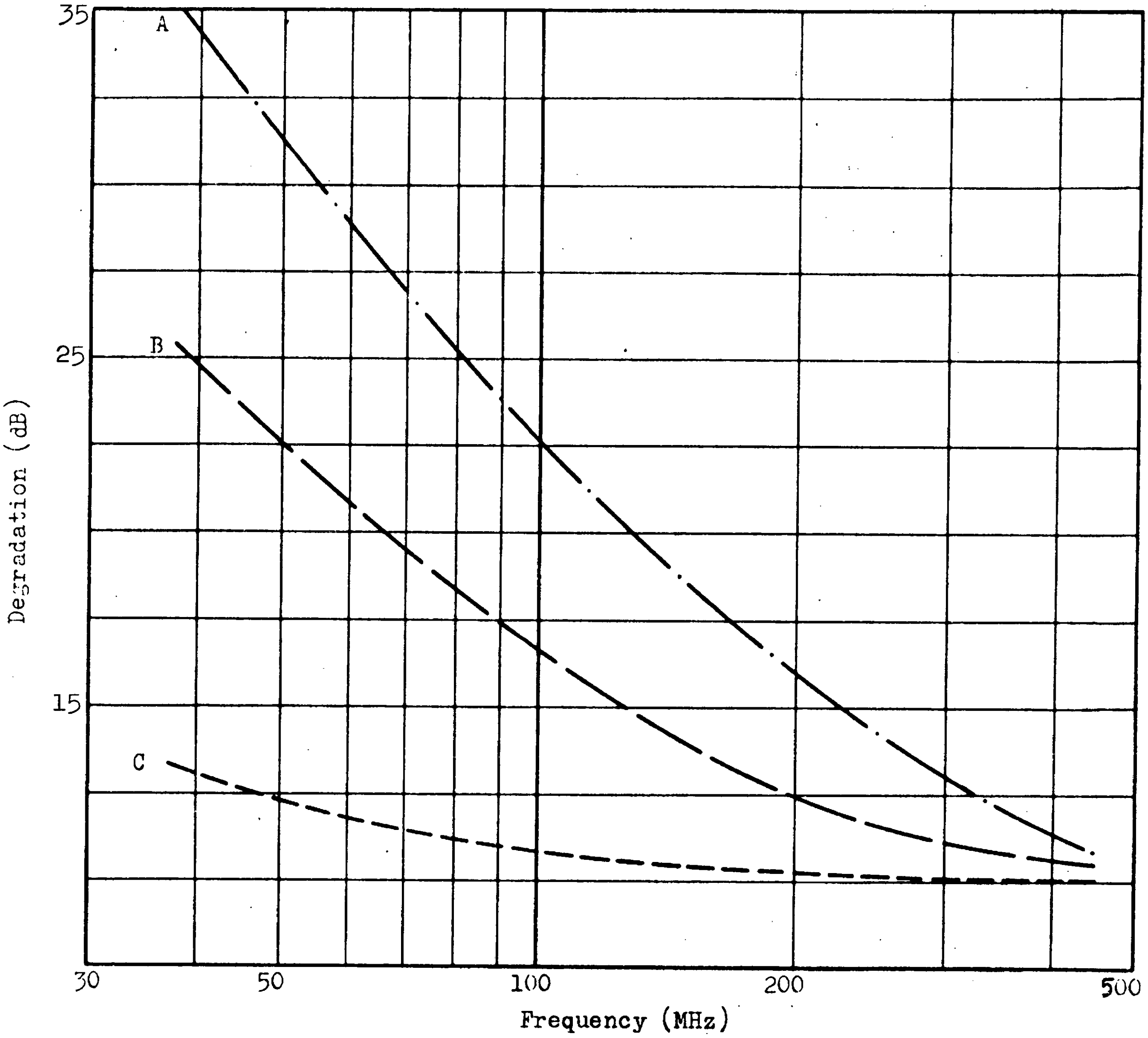


FIGURE 5

DEGRADATION VS. FREQUENCY (GRADE 4)

Degradation for moving vehicles based on median values of received input signal

Receiver sensitivity of 0.7 μV e.m.f.

A: Mobile vehicle standing still in high noise area

B: Mobile vehicle moving in high noise area

C: Mobile vehicle moving in low noise area

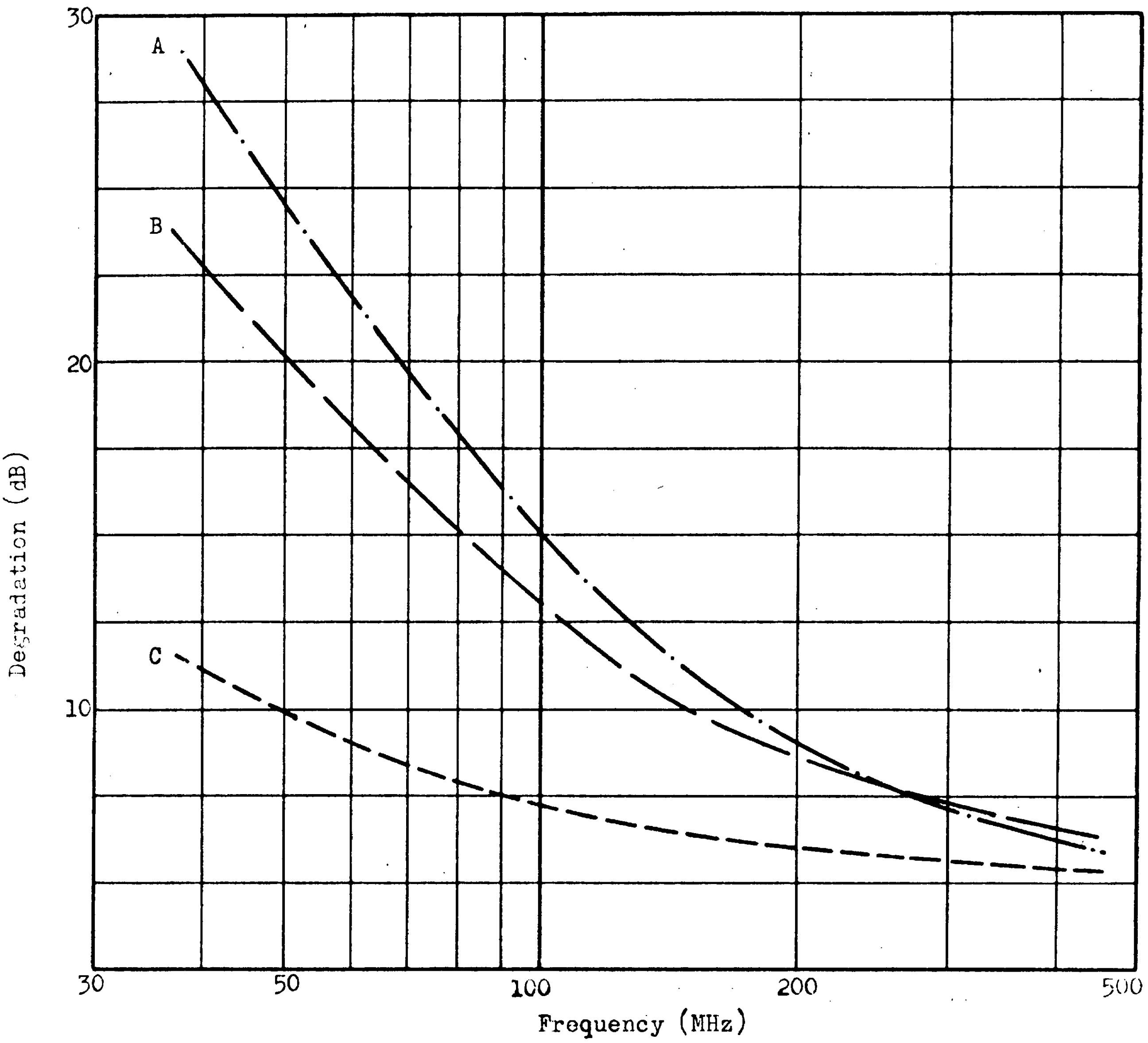


FIGURE 6

DEGRADATION VS. FREQUENCY(GRADE 3)

Degradation for moving vehicles based on median values of received input signal

Receiver sensitivity of 0.7μ V e.m.f.

A: Mobile vehicle standing still in high noise area

B: Mobile vehicle moving in high noise area

C: Mobile vehicle moving in low noise area

C.C.I.R.
XIIIth Plenary Assembly
GENEVA, 1974

Doc. 8/1032-E

STUDY GROUP 8

Study Group .8..., in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration :

REPORT 500 (Rev.74)

IMPROVEMENTS IN THE PERFORMANCE OF RADIOTELEPHONE CIRCUITS IN THE MF AND HF MARITIME BANDS

Linked compressor and expander systems

(Question 11/8, Study Programme 11A/8)

(1970-1974)

1. Introduction

At the Interim Meeting of Study Group XIII in Geneva, 1968, new techniques for improving the maritime radiotelephone service were discussed and as a result a new Question was accepted and was later adopted by correspondence and numbered 11/8. This Question deals with the application to the maritime services of the compandor techniques that have been applied so successfully to the point-to-point services. The system using these techniques has been called " Lincompex ".

The United Kingdom submitted Doc. XIII/80, which indicated that tests had shown that the use of Lincompex in the maritime service would give the same advantages as those obtained on the point-to-point services. Moreover, the ability of the system to suppress interference would be of greater advantage in the maritime services where interference is more frequently the limitation than it is in the point-to-point services. Furthermore, a linked compressor-expander system can be used to improve both DSB and SSB circuits.

It was pointed out in Doc. XIII/80 that the existing design of Lincompex equipment for point-to-point services required an upper limit of 3000 Hz whereas the audio bandwidth of the SSB maritime equipment was limited to 2700 Hz, in accordance with Appendix 17A of the Radio Regulations. The document contained proposals for a modified version of Lincompex specially designed to fit into the maritime channel allocations. In addition, it was considered reasonable to fit as many parts of the equipment as possible at the coast station and the document proposed a rearrangement of the basic parts of the equipment so that the ship station installation would be as cheap and simple as possible.

Equipment has been manufactured conforming to the proposals set out in Docs. XIII/80 and XIII/133 and full duplex tests have been satisfactorily completed in both the MF and HF maritime bands. In addition, extensive use has been made of the equipment fitted earlier on the RMS " Queen Elizabeth 2 ", RMS " Franconia " and RMS " Carmania ".

2. Tests in the MF bands (1·6–3·8 MHz)

Lincompex equipment conforming to the proposals in Docs. XIII/80 and XIII/133 has also been fitted on a passenger liner (SS " Orcades ") sailing between the United Kingdom and Australia, via the Cape of Good Hope.

As the ship steamed down the English Channel, tests were conducted on the MF band using SSB emissions from the coast station at Niton. Test calls * were set up to both engineering and traffic personnel and comparisons were made between Lincompex and the conventional system.

The tests indicated that during daylight a good commercial SSB telephony circuit was obtained over a distance of about 650 miles (off Cape Finisterre) with the Lincompex system, compared with less than 400 miles using the conventional SSB arrangement. During darkness, the advantages appeared to be even greater because interference made the conventional system uncommercial whereas the new system was, in general, satisfactory for commercial communications extended over the inland network.

3. Tests on the HF bands (4–27·5 MHz)

Tests on the HF bands were also made with SS " Orcades " and daily contacts were made. The results fully confirmed the improvement expected with the new system.

4. At the Interim Meeting of Study Group 8 in Geneva, 1972, further considerations concerning the Lincompex system as described in Recommendation 475 for improving the performance of radiotelephone circuits in the MF and HF maritime bands were raised in reply to Question 11/8 and Study Programme 11A/8. The following documents were submitted :

Doc. 8/35 (Federal Republic of Germany), 1970-1973,
Doc. 8/36 (United States of America), 1970-1973,
Doc. 8/37 (United States of America), 1970-1973,
Doc. 8/64 (Canada), 1970-1973.

4.1 The use of Lincompex on radio systems employing A3J emissions is extremely difficult unless some means is provided to ensure "frequency integrity" between transmitter input and receiver output. This problem is not encountered on systems using A3A emissions (Docs. 8/35, 8/36, 8/37, 1970-1973).

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* Tape recordings of the test calls were made, and were demonstrated at the Final Meeting of Study Group XIII, Geneva, 1969.

4.2 The use of class of emission A3A removed the necessity for receiver adjustments upon initial contact, thus eliminating the need for further interventions of the radio operators (Doc. 8/37, 1970-1973).

4.3 Lincompex will provide a satisfactory circuit when a signal-to-noise ratio of about 10 dB exists between the wanted and the interfering signal in the overall channel (Doc. 8/36, 1970-1973), although the control channel is more susceptive to discrete frequency interference than the voice channel (Doc. 8/35, 1970-1973).

4.4 Loss of intelligibility due to reduced audio-bandwidth is found to be negligible; furthermore any penalty incurred through the use of the narrower voice channel is more than offset by the subjective signal-to-noise advantage resulting from the compandor action of the Lincompex system (Docs. 8/35, 8/36, 1970-1973).

4.5 The effect of noise caused by stays could be increased by the presence of the control signal (Doc. 8/35, 1970-1973).

4.6 Tests with the Lincompex system have been carried out with the U.S. Cable-Ship "Long Lines" during August/September 1971 in the 4 to 22 MHz bands under varying propagation conditions, which proved its advantages compared with a conventional system (Doc. 8/37, 1970-1973).

4.7 The initial contact (calling procedure) was generally made using conventional voice terminals, which were then substituted by the Lincompex terminals. In some cases, however, the circuit was initially established in the Lincompex mode (Doc. 8/37, 1970-1973).

4.8 Emphasis is laid on the need to improve ship and shore installations, with particular regard to transmission levels, so that operator attention can be reduced and circuit availability improved (Docs. 8/36, 8/37, 1970-1973).

4.9 The possible use of the compressor section of the linked-compressor-expander (Lincompex) equipment for operating in conjunction with a distant station employing conventional VOGAD-type equipment

(Voice Operated Gain Adjusting Device) was considered. This would require the removal of the control tone and the by-passing of the receive-side expander in the Lincompex equipment. Some modification of compressor time constants might be required (Doc. 8/64, 1970-1973).

4.10 Mention is made of advances in design of receiver AGC systems having rapid attack and long overhang times which, it was considered, would make compatible operation of compandor-equipped and conventional stations much easier (Doc. 8/64, 1970-1973).

5. At the final meeting of Study Group 8, February 1974 the following documents were considered :

Doc. 8/185 United Kingdom

Doc. 8/194 Japan

Doc. 8/195 Japan

Doc. 8/196 Japan

5.1 Doc. 8/185 proposes a number of amendments to Annex III of Recommendation 475(Rev.72) with the aim of relaxing the technical requirements of the associated radio equipment as far as is practically possible without degrading the overall performance of the system beyond commercially acceptable limits. In particular, the relaxation of frequency tolerance from ±4 Hz to ±5 Hz would allow the use of frequency synthesizers, having frequency steps of 10 Hz. The document also outlines suggested basic technical parameters for privacy equipment, with 3 000 Hz inversion frequency, employed in conjunction with Recommendation 475 equipment.

5.2 Doc. 8/194 describes an economical method of providing echo-suppression by making use of the inherent linked compressor and expander feature of the Lincompex (Recommendation 475) equipment itself. The levels of speech signals in the transmit and receive paths are compared in a level comparator, whose output is used to control the frequency of the control-channel oscillator and hence to "open" or "close" the receive path at the distant terminal by controlling the attenuation of its expander. The new system is designed to meet the requirements of C.C.I.T.T. Recommendation G.161. Tests showed that it is fully compatible with conventional echo suppressors and speech quality was satisfactory.

5.3 Document 8/195 describes field tests of Lincompex equipment (Recommendation 475) using both the A3A (pilot carrier) and A3J (suppressed carrier) classes of emission. The receiver employed did not have automatic frequency control and the audio frequency response of the transmitters was in accordance with Radio Regulations Appendix 17A, section 3 (6 dB overall). The reduction in speech bandwidth compared with the point-to-point type equipment (see Recommendation 455, Rev.72) caused no harmful effect and the tests again demonstrated the superiority of the Lincompex system over the VODAS system under conditions of interference. It was found that echo suppressors were desirable at distances greater than about 5,000 km. The tests showed that while the use of either A3A or A3J class of emission was practical the A3A emission made for easier operation.

5.4 Document 8/196 describes a band compression system in which the audio frequency band is limited to 1.8 kHz at the transmitting terminal, the upper part of the audio frequency spectrum being replaced at the receive terminal by harmonics generated from the received 0.3 - 1.8 kHz signal. It is considered that the study of band compression systems applicable to the maritime mobile service to be important from the viewpoint of the limited frequency bands available. In practical tests using the Japanese language the band compression system gave an improvement in overall speech intelligibility compared with the VODAS and unmodified Lincompex (Recommendation 475, Rev.72) systems. The document suggests that the reduced bandwidth of the band compression system would allow either more channels to be provided in the maritime mobile bands or alternatively, an in-channel selective calling facility could be accommodated within the present channel bandwidth.

5.5 Administrations are invited to encourage the extension of the use of the Lincompex system in the maritime mobile service so that advantage can be taken of the improved efficiency and quality of communication offered by this system.

C.C.I.R.
XIIIth Plenary Assembly
Geneva, 1974

Doc. 8/1033-E

STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration:

REPORT 501 (Rev. 74)

SELECTIVE CALLING SYSTEM FOR FUTURE OPERATIONAL REQUIREMENTS OF THE MARITIME MOBILE SERVICE

(Question 9/8)

(1970-1974)

PART A

1. Seven documents concerning selective calling systems for future operational requirements were submitted for consideration during the period 1966–1969.

The documents are: Docs. XIII/47 (Canada), XIII/48 (Canada), XIII/60 (U.S.A.), XIII/61 (U.S.A.) and XIII/77 (Japan) (also related to Question 5-1/8), XIII/122 (Canada), XIII/139 (Federal Republic of Germany).

2. Discussion of these documents revealed that further consideration should be given to basic operational requirements before a technical solution can be realized. It was therefore agreed that it would not be possible to make meaningful recommendations at this time and that further studies are required.

The documents mentioned above could provide guidance in these studies.

3. As a result of the discussion of Doc. XIII/61, it was decided to amend Question 9/8.

This Report summarizes the common views expressed in the other documents on a number of general system parameters to satisfy foreseeable operational requirements for selective calling. Where different views were expressed in the documents, they have been indicated separately in the relevant sections. In addition, opinions expressed during discussion at the Interim Meeting, 1968, have been shown in the relevant sections.

4. Economy

The system should be designed so that the cost is related to the complexity required by the user, without imposing undue cost or complexity upon users with simple requirements.

5. Compatibility

The selective-calling system should be suitable for use:

- with all classes of emission used in the maritime mobile service. (However, Doc. XIII/48 suggests that if a pair of audio frequencies are used to modulate the transmitter they should differ in frequency by 170 Hz and the same pair of frequencies should be recoverable at the receiver);
- in all the maritime mobile bands;
- with radiocommunication equipment on board ships;
- by all categories of users.

Users of the simplest form of signalling and users of the more complicated forms should be able to share the same channel.

A signal, in digital form, with a variable number of characters in the call, and in a start-stop format, would satisfy all types of present and foreseeable requirements:

- with future communication systems;
- with error-control systems.

Normally, narrow-band F1 systems may be used satisfactorily without error correction at signal-to-noise ratios at which radiotelephony could not be accomplished, even with repetitions and experienced operators. From an operational standpoint, however, the effective range of the signalling system should not be substantially greater than that of radiotelephony communications. Error correction would be particularly useful when used with a direct printing service. The signalling system should be designed so that it may be used in conjunction with error-control, as and when required.

One Administration expressed the opinion that from an operational point of view it might be advantageous if the calling system were designed for a particular communication service for which it is intended (e.g. a teleprinting system might have its own characteristic selective-calling system, including error-control function, whereas a radiotelephone system might have a simpler system).

6. Flexibility

The signalling system should provide facilities for identification of the calling station, the working channel, self-identification and acknowledgement (" answer back ").

It should also be suitable for use with direct-printing systems; with unattended receiving stations, with remote monitoring and transponding schemes.

It should also cater for identifying the desired channel when used on multi-channel communication systems.

7. Referring to § 4, economies can be made if modular techniques are used in the construction of equipment so that additional functions can be provided by adding units.

8. The system should have a large identification capacity (not less than 1 000 000), to allow for unique identification of sending and receiving stations, group calling facilities and "all-ships" calls and, if desired, geographically-zoned calling for safety or distress.

9. The necessary bandwidth should be narrow to conserve frequency space and to allow the system to be used on narrow-band telegraph channels. A narrow bandwidth would also facilitate the division of some of the international calling channels into sub-channels, for example, for allocation to routes or areas.

10. Calling signal

The calling signal should:

- be of binary form;
- be of short duration (less than 2·5 s);

- be repeatable automatically on the MF and HF bands;
- be composed of a variable number of characters to provide flexibility for future expansion.

However, Doc. XIII/48 presents the view that all calls should contain the same number of characters;

- be alphanumeric to allow for direct use of the radio call signs of all ships and to provide also for a larger number of calls with a limited number of characters per call; however, Docs. XIII/48, XIII/122 and XIII/139 proposed numeric calls only to facilitate integration with national and international telegraph and telephone networks; Doc. XIII/122 also suggests a possible method of achieving this by converting the ships' call signs to an all numeric code by assigning two numbers to each letter of the alphabet. Discussion showed that some Administrations preferred synchronous transmission to start-stop.

11. Format of calling signal

The format of the call should consist of:

- start information,
- an " address " portion,
- stop information.

The calling signal should also provide for additional successive codes and data as necessary.

Doc. XIII/48 suggested the use of a constant-ratio block code (two out of five) derived from C.C.I.T.T. Alphabet No. 2.

Doc. XIII/77 suggested the use of a one-way error detecting and correcting code based on cyclic codes, previously described in Doc. XIII/16.

Doc. XIII/139 suggested that, when applying selective calling in connection with direct printing, the format of the new calling signal should be such as not to prohibit the automatic establishment of connections, i.e. receiver, transmitter and selective calling equipment should form one functional unit. The document also suggests that some 100 special codes would be sufficient for automatic selection of the requested operating frequency and that a new frequency plan will be required for automatic working.

12. The encoder should accept signals conforming to C.C.I.T.T. Alphabet No. 2 at a modulation rate of 50 bauds.

13. Reliability

The system should be reliable and false calls negligible.

Doc. XIII/139 indicated that if a decision is made to use a binary-coded selective calling system, then due to the need for a high reliability of decoding and immunity against false calls, the use of error detection seems more important than for the direct printing service itself. The document also suggests that the use of earth satellite techniques may ease the technical problems associated with error control in the selective call.

PART B

1. At the Interim Meeting of Study Group 8, held in Geneva, April 1972, four documents were submitted on selective calling systems to meet the future operational requirements of the maritime mobile service. The documents were as follows :

Doc. 8/70 (U.S.A.), 1970-1973;

Doc. 8/72 (Netherlands), 1970-1973;

Doc. 8/73 (Netherlands), 1970-1973;

Doc. 8/93 (Japan), 1970-1973.

2. Doc. 8/70 contains proposals for the operational requirements for future selective calling systems in the maritime mobile service. It is proposed that the selective call signal in the VHF band should employ an 8-element code and in the HF band a 10-element code. In both cases it is proposed that the International Telegraph Alphabet No. 5 should be used. The system is similar to that proposed by the U.S.A. for the aeronautical mobile service.

3. Doc. 8/72 sets out proposals for amending Recommendation 476, so as to include selective addressing on the "B Mode" or "Forward Error Correcting Mode" in conjunction with direct printing telegraphy. The document also proposes that the selective calling features might be adopted to satisfy future requirements for selective calling.

4. Doc. 8/73 reports on successful trials of the system conducted between the M.V. "Trident Amsterdam" and Scheveningen Radio.

5. Doc. 8/93 describes a system of selective calling based on I.T.A. No. 5 and gives results of preliminary tests. It also suggests that the same code be employed in future selective calling systems.

6. It was noted that if I.T.A. No. 5, which is proposed for signalling in Docs. 8/70 and 8/93 is intended to be used also for direct printing telegraphy (as well as for purely selective calling purposes), then the C.C.I.T.T. should be consulted on the probable future use of I.T.A. No. 5 for public correspondence.

7. The use of a selective calling system in the mobile satellite service has received limited consideration. At this time,it is too early to reach a conclusion on the practicability of using one of the existing terrestrial selective calling systems or any of the new systems being proposed. While it is desirable to have a minimum number of such systems in use by aircraft and ships, the particular system or technique to be used in the mobile satellite service could not be established at this time. The method of calling aircraft and ships in the satellite services will develop as the result of studies which are considering the operational, technical and economic aspects of this problem.

8. It was also felt that consideration should be given to including in the future calling system facilities such as :

- individual selective calls,
- distress calls,
- urgency calls,
- safety calls,
- an "all ships" call,
- selective geographic area calls,
- selective group calls,
- priority calls,
- routine calls,
- calling station identification,
- reply frequency indication,
- special coded messages,
- answer back and self identification,
- polling or interrogation,
- automatic channel selection for reply,

- automatic channel selection for further reception,
- turn "on" and "off" teleprinter,
- turn "on" and "off" voice magnetic-tape recorder,
- turn "on" and "off" facsimile recorder,
- indication of "message follows" or "no message follows",
- turn "on"/"off" the radio transmitter,
- transmission of synchronizing signal to precede call (for multi-channel receivers) : "condition signal".

9. It was understood that the calling capacity (which is greater than one million) of the system described in Recommendation 476 could be extended, if required, and further information is needed. So far, the results of operational trials of the system described in Doc. 8/70 (U.S.A.), 1970-1973, have not been reported to the C.C.I.R. and more information on the performance of the system would be desirable. The relative merits of the proposed systems for future selective calling and the results of field tests should be carefully compared. When field tests are carried out, it is considered necessary that sufficient information on the performance and characteristics of the radio channels should be recorded, including the mean value of the error rate, so that the selective calling systems can be compared on a common basis. Reference can also be made to Report 361-1, § 5.1, concerning tests with propagation simulators.

10. It should be borne in mind that the ship's equipment should be unified and rationalized as far as practicable.

11. From the foregoing, therefore, it was considered that it was premature to decide upon the future selective calling system that should be adopted internationally for the maritime mobile (terrestrial and satellite) services; nevertheless every effort should be made to complete the studies sufficiently to be of assistance to the maritime W.A.R.C. planned for 1974.

PART C

1. Introduction

At the Final Meeting of Study Group 8, held in Geneva, February 1974, eleven documents were submitted on selective calling systems to meet the future operational requirements of the maritime mobile service. These documents were as follows :

Doc. 8/190 (Japan), 1970-1973;
Doc. 8/203 (U.S.A.), 1970-1973;
Doc. 8/227 (Netherlands), 1970-1973;
Doc. 8/243 (U.S.A.), 1970-1973;
Doc. 8/244 (U.S.A.), 1970-1973;
Doc. 8/247 (U.S.S.R.), 1970-1973;
Doc. 8/254 (U.S.A.), 1970-1973; (with Addendum)
Doc. 8/258 (U.K.), 1970-1973;
Doc. 8/259 (U.K.), 1970-1973;
Doc. 8/261 (I.M.C.O.), 1970-1973;
Doc. 8/263 (Norway), 1970-1973.

2. Summary of documents

Doc. 8/190 (Japan) expresses an opinion concerning synchronization, error-detecting code and composition of call signals and also introduces field test results between the Choshi coast station and a ship sailing from Tokyo to San Francisco. The system employed International Telegraph Alphabet No. 5, with a 10-unit code including three added check bits, using the B-mode and was based on Recommendation 476. This document can be reviewed in conjunction with Doc. 8/93 (Japan, 1972).

Doc. 8/203 (U.S.A.) reports on a system developed to provide all of the requirements previously set forth in Report 501(Rev.72) and introduces field tests in the Pacific and Atlantic Ocean areas.

HF radiotelephony channels were employed in the Pacific tests, up to about 8,000 N.M. The Atlantic tests were carried out at MF and HF on radiotelegraphy channels and at VHF on radiotelephony channels. The system employed International Telegraph Alphabet No. 5, with an 8-unit code including one parity check bit and a block check polynomial code (C.C.I.T.T. 1972, Recommendation V.41). The modulation rates employed included both 75 and 150 bauds at MF and HF, with 600 and 1200 bauds at VHF.

The fixed format call sequence of this test system consisted of 65 8-bit characters.

Doc. 8/243 (U.S.A.) recommends a system based on the one developed and tested as described in Doc. 8/203, with certain changes in the code arrangement to improve synchronization at HF. A bit rate of 150 bauds is recommended at MF and HF, with 600 bauds recommended at VHF. It is recommended that the selective calling terminal provide for both transmission and reception and the use of alpha-numeric characters, as well as control characters, from International Telegraph Alphabet No. 5.

The two fixed format call sequences of this system consist of 52 8-bit characters for a standard sequence and 84 8-bit characters where optional messages are included.

Doc. 8/244 (U.S.A.) recommends distress calling using a digital selective calling system. It recommends inclusion of the call sign of the vessel in distress, the location of the vessel and its transmission to "all ships" by activation of a single button or switch. Reference is made to the system recommended in Doc. 8/243.

Doc. 8/254 (U.S.A.) with its addendum, reports on tests of a digital selective calling system on an HF fading simulator. The system tested was as described in Doc. 8/203. The synchronization method was then changed and additional tests were performed. These additional tests are reported in the Addendum to Doc. 8/254 and verify that substantial improvements in synchronization were obtained. This modified synchronization method corresponds to the synchronization part of the calling system described in Doc. 8/243.

Doc. 8/227 (Netherlands) recommends a system based on the phasing, or selective calling, part of the direct-printing system in Recommendation 476 and on the principles for transmitting figures in Recommendation AB/8. The system employs International Telegraph Alphabet No. 2 with a 7-unit constant ratio code in the B-mode and the selective calling terminal provides for both transmission and reception, whether or not it is associated with a direct-printing system. Provision is included in the system for distress alerting of all ships and coast stations and the inclusion of the ship's identification, position and nature of the distress. The call and other information transmitted is in numeric form, plus two symbols, + and -, to indicate geographic quadrants in the case of a ship's position.

The length of the calling sequence varied from 42 to 58 seven-bit characters.

Doc. 8/247 (U.S.S.R.) comments on the need to provide facilities for call signals concerned with command of ship radio and terminal equipment as well as calls related to shipping safety and the need to keep calls to short duration. The importance of flexibility is mentioned, or the possibility of using the system with a variety of equipments ranging from the most simple selector acting as a bell or alarm to the complex switching system for ship-borne radio and/or terminal equipment. It is pointed out that much of the information to be transmitted relates to control of the ship-borne equipment and that this information should be concise and reliable. It is suggested that frequencies in all maritime bands be assigned channel numbers, as in Appendix 18 to the Radio Regulations. The same 5-digit numbering scheme as proposed in Recommendations 257 and 476 is favoured. Particular attention is drawn to the need to establish a standard list of command, or telecontrol, signals composed of two figures which would be interpreted by a programmer on board a ship to, for example, turn on a transmitter, tune appropriate frequencies, select mode of emission, etc., in response to just one of the various commands. A number of combination commands are possible. In this system the call sequence consists of 18 characters.

Doc. 8/258 (U.K.) comments on the probable future operational requirements for selective calling for radiotelephony and radiotelegraphy services. Consideration is given to application of SSFC (Radio Regulations, Appendix 20C), the system incorporated in the direct-printing system set forth in Recommendation 476(Rev.72) and to the system required for a future maritime satellite system (see also draft Report AO/8).

Doc. 8/259 (U.K.) reports on tests made on three samples of selective calling devices, one a United Kingdom SSFC equipment (Recommendation 257-1), one a Netherlands digital equipment (Recommendation 476), and a U.S.A. equipment described in Doc. 8/203. The tests were carried out on a "Fading machine" to simulate HF transmission. The efficacy of calling of all three was similar under "one-shot" phasing conditions in the case of the digital systems. The relative merit of one over the other changed to some extent depending on the particular part of the test as it related to "flat" or "selective" fading, or to re-inserted carrier off-set, or sensitivity.

Doc. 8/261 (C.C.I.R.) reports on parts of a draft Recommendation by the Intergovernmental Maritime Consultative Organization (I.M.C.O.) applicable to this Report. It is set forth that the I.M.C.O. Resolution A.283(VIII) states, "The introduction of a general purpose selective calling system, capable of facilitating the transmission and reception of all communications, should be expedited." The I.M.C.O. also considers that the system should, in particular, have an important function in distress alerting and should be used for safety purposes. A list of operational requirements is provided, along with the content of information for distress alerting.

Doc. 8/263 (Norway) reports on HF comparative operational field tests employing the SSFC system (Radio Regulations, Appendix 20C) and the U.S.A. system described in Doc. 8/203. The coast station Rogaland Radio was used with the vessel M/T "Sysla" travelling from Le Verdon via Cape Town to the Persian Gulf. The emission used for both systems was A2H. The normal radio equipment at the coast station and on board the ship were employed.

Under the conditions of the test the SSFC system appeared to give more reliable calling than the digital system but during discussion it was considered that environmental conditions must be borne in mind when making such comparisons.

3. Tests

Tests are reported in Doc. 8/203 at MF (500 kHz band) using 75 and 150 bauds and at VHF using 600 and 1200 bauds. Results indicate only moderate need for error control schemes in these maritime frequency bands.

HF tests are reported in Docs. 8/190, 8/203, 8/254, 8/259 and 8/263 and include 75, 100 and 150 bauds, as well as the use of fading simulators in addition to operational field tests. All tests show the need for error control at HF. Three separate aspects of error control requirements are apparent :

- immunity to false calls
- acceptance of correct calls
- undetected errors in the call sequence.

All tests showed excellent immunity to false calls, none were observed.

Acceptance of correct calls was on the order of 70 to 96.5 per cent. The importance of signal synchronization is brought out in Docs. 8/190 and 8/254. Repetition of the call, particularly for important calls such as distress alerting, may be necessary to achieve a high degree of acceptance of correct calls.

The test reports are not conclusive with regard to undetected errors in the selective call sequence beyond the address portion. Doc. 8/190 indicates that the rate should be very low, however, with the coding and error control system employed.

It was noted that the available test results were not directly comparable because of the absence of sufficient information as to the performance and characteristics of the radio channels.

4. Operational requirements

It was noted that I.M.C.O.'s Sub-Committee on Radiocommunications had provided the following information to Administrations (Doc. 8/261) :

> "The introduction of a general purpose selective calling system, capable of facilitating the transmission and reception of all communications, should be expedited. (Resolution A.283(VIII)).
>
> It is also considered that :
>
> (i) Any introduction of a binary digital system, whilst this is recognized as being the probable future development, should await the outcome of C.C.I.R. studies into the subject;
>
> (ii) a selective calling system should, in particular, have an important function in distress alerting and should also be used for safety purposes;
>
> (iii) operational requirements on which a selective calling system should be based have a direct relationship to an improvement of the safety of life at sea.
>
> Member Governments should take into account :
>
> 1. That the following operational requirements should be included in the system :
>
>   - two-way operation in the direction shore-to-ship, ship-to-shore, and ship-to-ship
>   - individual selective calls
>   - distress alerting and following additional information
>   - urgency calls

- safety calls
- all ships calls
- selective geographic area calls
- selective group calls
- priority calls
- routine calls
- calling station identification
- reply frequency identification
- special coded messages
- answer-back and self-identification
- polling or interrogation
- command functions (unlimited);

2. that the system should be able to serve as an automatic alerting device in distress cases capable of transmitting, receiving and recording an initial alerting signal, followed by additional information such as the identity and position of the ship in distress and the nature of the distress case;

3. that the system should also be employed for urgency and safety traffic, without restrictions on the use of the "all stations" call;

4. that the system should be sufficiently moderate in price to encourage widespread fitting on ships fitted with radio equipment in accordance with the provisions of Chapter IV of the 1960 Safety Convention."

During the Final Meeting (1974) considerable discussion took place regarding the technical methods to implement a selective calling system suitable to fulfil the basic operational requirements.

The Study Group noted that the two complete proposals for general purpose selective calling systems as described in Doc. 8/227 and Doc. 8/243 both would fully satisfy the operational requirements suggested by I.M.C.O. although the operational usage of the telecontrol functions was not fully implemented. Both systems had flexibility to cater for additional future applications.

The results of the discussion which took place are summarized in the following paragraphs.

5. Possible utilization of existing systems

(a) The selective calling system according to Appendix 20C in the Radio Regulations can not in its present form satisfy the operational requirements as set out in Doc. 8/261. An extended system would not be compatible with existing equipment. The bandwidth requirement was also considered to be a serious disadvantage.

(b) The selective calling system used in direct-printing equipment according to Recommendation 476 cannot as such satisfy the operational requirements as set out in Doc. 8/261. The modulation and signalling principles could, however, be used in the future system.

6. Format of calling sequence

The general format of a calling sequence which could satisfy I.M.C.O.'s operational requirements would be as follows :

< address >, (< message 1 > , < message 2 >, ...)< end of sequence >

"Address" would be either a selective call address directed to an individual ship or a coast station or to a group of ships (e.g. ships sailing under a certain flag, ships belonging to a certain shipowner, ships in a specific geographical area) or an all ships call. It was generally agreed that eventually, the ship identification scheme would have to be numerical. Different opinions were expressed regarding the necessary capacity of the numbering system. The estimates ranged from 5 to 7 decimal digits. Some felt that the system should also be able to accept alpha-numerical calls in an interim period until the introduction of the new numerical identities.

"End of sequence" is a function which enables the receiving equipment to recognize the end of a calling sequence.

One or more of the following messages can optionally be a part of a call :

"Category" would indicate the priority level or precedency of the call. The categories would be distress, urgency, safety and routine. It was also agreed that the system should provide for a total of ten different categories. The priority of any message that might follow the call should be considered to be a part of the message as such.

"Self-identification" would be the address of the source.

"Frequency/channel" would be either an actual frequency or a symbolic channel number. The particular application would show whether the indicated frequency/channel should be used for transmission or reception. Six decimal digits are needed for this information.

"Distress information" should include information on position and nature of distress. This would require 4 numerals and 1 North/South indicator for latitude and 5 numerals and 1 East West indicator for longitude and one more digit for indication of the nature of distress.

"Telecontrol" facilities require 2 characters. This would include control of telecommunication terminal functions and receiver/transmitter functions as well as a possibility to cater for future additional requirements. Doc. 247, para. 5, describes one possible method of making operational use of these facilities.

7. Addressing and numbering

It was generally agreed that a new international ship identification system would be necessary when automated telecommunication services were introduced. The new system should be numerical. One possible solution could be to use 7-digit ship identities, where the first digit(s) should be a country prefix according to the C.C.I.T.T. World Numbering Plan. This 7-digit number should be treated as an end subscriber number. The scheme could also be made compatible with the 5-digit numbers presently used with SSFC and direct-printing equipment.

Some administrations felt that where, for national purposes, the capacity of a 7-digit numbering system would not be sufficient, an alpha-numerical identity could be used.

8. Modulation methods

It was agreed that the system should use binary modulation. This would provide bandwidth economy as well as the possibility to utilize the inherent flexibility and economy of digital techniques. It was further agreed that FSK modulation with a frequency shift of 170 Hz* and a modulation rate of 100 bauds should be used on HF/MF channels. It was considered too early to decide on modulation methods and rates tc be used on other frequency bands.

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* One administration noted that the existing frequency tolerances on A3J radiotelephony channels would be inadequate if 170 Hz shift were adopted.

9. Signalling methods

The system should utilize synchronous signalling. Two different propoals were available. Doc. 8/190 (Japan) and Doc. 8/243 (U.S.A.) suggested the use of signalling codes derived from the C.C.I.T.T. No. 5 code while Doc. 8/227 (Netherlands) and Doc. 8/247 (U.S.S.R.) suggested the use of signalling codes derived from C.C.I.T.T. No. 2.

The C.C.I.T.T. No. 2 code uses 5 information-carrying bits thus giving 32 signal combinations. In direct-printing applications two special shift symbols gives a capability of transmitting 58 different symbols thus providing for all commom alpha-numerical characters. The code is used in the international telex network.

The C.C.I.T.T. No. 5 code uses 7 information-carrying bits thus giving 128 signal combinations without the need to use the shift characters. The code is commonly used in modern data communication applications.

While the longer code adds some more flexibility, its length implies longer transmission time and thus channel occupancy.

10. Error-control methods

Three schemes have been proposed :

(a) Doc. 8/190 (Japan)

At bit level : 7-unit code + 3 check bits (the code is a variation of a constant-ratio code where the check bits are given weighting factors of 1, 2 and 4 respectively)

At character level : The address is transmitted three times. Two error-free receptions are necessary. Time spread is 2 x 800 ms.

(b) Doc. 8/227 (Netherlands)

At bit level : 5-unit code with 2 added bits to make it a 7-bit constant-ratio code.

At character level : Each character is transmitted twice. One error-free reception is necessary. Time spread is 280 ms.

(c) Doc. 8/243 (U.S.A.)

At bit level : 7-unit code with 1 parity bit added, to make it an 8-bit code.

At character level : Each address is transmitted twice*. Both transmissions must be received correctly before the call is accepted. An overall block check sequence according to C.C.I.T.T. Recommendation V.41 is employed.

The methods (a) and (b) can be used on a variable-length sequence while method (c) needs a fixed length sequence.

11. Conclusions

It was found possible to reach agreement on a number of basic concepts. There were however two areas where no immediate agreement was achieved :

(a) Should the system use the C.C.I.T.T. No. 2 code or the C.C.I.T.T. No. 5 code?

(b) Which error-control method should be used?

The first question involves a trade-off between calling sequence length and increased flexibility. The flexibility of the longer C.C.I.T.T. No. 5 code can - in equivalent terms - be achieved by increasing the character length from 7 to 10 bits, thus increasing channel occupancy by 40%.

After considerable discussion it was tentatively agreed that the system should be based on a 7-unit code (plus bits added for error control). "Packing" of two decimal digits into one binary 7-bit digit would allow for a high information efficiency when transmitting numerical information. At the same time the code allows transmission of C.C.I.T.T. No. 5 characters.

The selection of an error-control method involves a trade-off between the probability of false calls, acceptance of correct calls and undetected errors in the call sequence.

After discussion it was generally agreed that the error-control method suggested in Doc. 8/227 (Netherlands) applied to a 7-unit code as shown in Doc. 8/93 (Japan) and Doc. 8/190 (Japan) would be preferable.

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* Some information is not transmitted twice.

It was also agreed that a new Draft Recommendation on a digital selective calling system should be drafted. The operational characteristics of the system would be contained in the Annex to the Recommendation.

Since most delegations felt that some further studies were necessary in order to finalize the technical specification, it was agreed that a text containing Provisional Technical Characteristics should be included as an Appendix to this Report.

12. Future work

In order to finally specify all technical characteristics, further consideration should be given to

(a) theoretical studies of the proposed scheme in the following aspects :

  (i) immunity to false calls;

  (ii) acceptance of correct calls;

  (iii) undetected errors in the calling sequence;

  (iv) channel occupancy.

(b) practical tests of the proposed scheme on typical radio circuits according to Part B, para. 9 of this Report.

Administrations are urged to complete these tests in time for the next Interim C.C.I.R. Meeting. The Chairman of Study Group 8 is invited to coordinate the tests to be carried out by the various administrations.

It was also considered important to initiate studies of the operational procedures.

Note.- The Director, C.C.I.R., is invited to bring this report to the attention of the MWARC 1974 and the Intergovernmental Maritime Consultative Organization.

APPENDIX

PROVISIONAL TECHNICAL CHARACTERISTICS

1. General

1.1 The transmission over the radio path should be binary and synchronous.

1.2 The code to be used on the radio path should be a ten-unit code as listed in Table I of this Appendix, and referred to as "signals".

1.3 Each signal should be transmitted twice in a time-spread mode; the first transmission (DX) of a specific signal should be followed by the transmission of four other signals before the re-transmission (RX) of that specific signal takes place, allowing for a diversity reception time of

1.3.1 400 milliseconds for HF and MF channels and

1.3.2 66 2/3 milliseconds for VHF radio channels.

1.4 The class of emission, frequency shift and modulation rate should be as follows :

1.4.1 F1, 170 Hz and 100 baud for use on HF and MF channels and

1.4.2 F2, 850 Hz and 600 baud for use on VHF channels.

1.5 The higher frequency should correspond to the B-state and the lower frequency should correspond to the Y-state of the signal elements.

1.6 The centre frequency of the audio spectrum to be offered to the modulator should be 1 400 Hz on radiotelephone channels.

2. Technical format of the call sequence

The call sequence should be :

2.1 the phasing signals,

2.2 the "format specifying" signal,

2.3 the "address" signals,

2.4 the "message" signals,

2.5 the "end of sequence" signals.

3. Phasing

Bit, character and DX/RX phasing should be established by alternate transmissions of the signals for symbol No. 125 and for symbol No. 101 (see Table I of this Appendix); the signal for symbol No. 125 determines the DX and the signal for symbol No. 101 determines the RX position, so that the signal for symbol No. 101 is a simulated re-transmission of the signal for symbol No. 125.

4. Format specification

The "format specification" signal "F" should indicate the call sequence according to Table II of this Appendix.

5. Address

The address signals should be as follows :

5.1 for a distress call, the symbol No. 115, transmitted four times;

5.2 for an "all ships" call, the symbol No. 116 transmitted four times;

5.3 for a selective call directed to an individual ship or to a coast station, the signals corresponding to the identification assigned to that station, should be either,

5.3.1 the sequence signal 4, signal 3, signal 2, signal 1 according to Table III of this Appendix if the identification is numerical, or

5.3.2 the signals in accordance with the symbols as indicated in Table IV of this Appendix if the identification is alphanumerical;

5.4 for a selective call directed to a group of ships, either,

5.4.1 the signals specified by I.M.C.O. for a particular geographical area or

5.4.2 for calls to ships having a common interest, the symbols corresponding to the identification assigned to that group and in accordance with 5.3.1 or 5.3.2.

6. Messages

6.1 The "category" message should consist of a signal indicating the category according to Table II of this Appendix.

6.2 The "self-identification" message should consist of the signals corresponding to the identification assigned to the calling station and transmitted according to 5.3.

6.3 The "distress information" which is part of a distress call should consist of signals indicating the ship's latitude, longitude and nature of the distress and should be transmitted with symbols to be specified by I.M.C.O.

6.4 The "telecontrol" message should consist of signals indicating the telecontrol functions according to Table II of this Appendix.

6.5 The "frequency/channel" message should consist of 3 signals corresponding to the actual frequency or the channel number according to Table III of this Appendix.

7. The "end of sequence" signal should be the unique signal according to symbol No. 127 given in Table I of this Appendix.

TABLE I

Symbol No.	Emitted signal	Symbol No.	Emitted signal	Symbol No.	Emitted signal
0	BBBBBBBYYY	43	YYBYBYBBYY	86	BYYBYBYBYY
1	YBBBBBBYYB	44	BBYYBYBYBB	87	YYYBYBYBYB
2	BYBBBBBYYB	45	YBYYBYBBYY	88	BBBYYBYYBB
3	YYBBBBBYBY	46	BYYYBYBBYY	89	YBBYYBYBYY
4	BBYBBBBYYB	47	YYYYBYBBYB	90	BYBYYBYBYY
5	YBYBBBBYBY	48	BBBBYYBYBY	91	YYBYYBYBYB
6	BYYBBBBYBY	49	YBBBYYBYBB	92	BBYYYBYBYY
7	YYYBBBBYBB	50	BYBBYYBYBB	93	YBYYYBYBYB
8	BBBYBBBYYB	51	YYBBYYBBYY	94	BYYYYBYBYB
9	YBBYBBBYBY	52	BBYBYYBYBB	95	YYYYYBYBBY
10	BYBYBBBYBY	53	YBYBYYBBYY	96	BBBBBYYYBY
11	YYBYBBBYBB	54	BYYBYYBBYY	97	YBBBBYYYBB
12	BBYYBBBYBY	55	YYYBYYBBYB	98	BYBBBYYYBB
13	YBYYBBBYBB	56	BBBYYYBYBB	99	YYBBBYYBYY
14	BYYYBBBYBB	57	YBBYYYBBYY	100	BBYBBYYYBB
15	YYYYBBBBYY	58	BYBYYYBBYY	101	YBYBBYYBYY
16	BBBBYBBYYB	59	YYBYYYBBYB	102	BYYBBYYBYY
17	YBBBYBBYBY	60	BBYYYYBBYY	103	YYYBBYYBYB
18	BYBBYBBYBY	61	YBYYYYBBYB	104	BBBYBYYYBB
19	YYBBYBBYBB	62	BYYYYYBYBB	105	YBBYBYYBYY
20	BBYBYBBYBY	63	YYYYYYBBBY	106	BYBYBYYBYY
21	YBYBYBBYBB	64	BBBBBBYYYB	107	YYBYBYYBYB
22	BYYBYBBYBB	65	YBBBBBYYBY	108	BBYYBYYBYY
23	YYYBYBBBYY	66	BYBBBBYYBY	109	YBYYBYYBYB
24	BBBYYBBYBY	67	YYBBBBYYBB	110	BYYYBYYBYB
25	YBBYYBBYBB	68	BBYBBBYYBY	111	YYYYBYYBBY
26	BYBYYBBYBB	69	YBYBBBYYBB	112	BBBBYYYYBB
27	YYBYYBBBYY	70	BYYBBBYYBB	113	YBBBYYYBYY
28	BBYYYBBYBB	71	YYYBBBYBYY	114	BYBBYYYBYY
29	YBYYYBBBYY	72	BBBYBBYYBY	115	YYBBYYYBYB
30	BYYYYBBBYY	73	YBBYBBYYBB	116	BBYBYYYBYY
31	YYYYYBBBYB	74	BYBYBBYYBB	117	YBYBYYYBYB
32	BBBBBYBYYB	75	YYBYBBYBYY	118	BYYBYYYBYB
33	YBBBBYBYBY	76	BBYYBBYYBB	119	YYYBYYYBBY
34	BYBBBYBYBY	77	YBYYBBYBYY	120	BBBYYYYBYY
35	YYBBBYBYBB	78	BYYYBBYBYY	121	YBBYYYYBYB
36	BBYBBYBYBY	79	YYYYBBYBYB	122	BYBYYYYBYB
37	YBYBBYBYBB	80	BBBBYBYYBY	123	YYBYYYYBBY
38	BYYBBYBYBB	81	YBBBYBYYBB	124	BBYYYYYBYB
39	YYYBBYBBYY	82	BYBBYBYYBB	125	YBYYYYYBBY
40	BBBYBYBYBY	83	YYBBYBYBYY	126	BYYYYYYBBY
41	YBBYBYBYBB	84	BBYBYBYYBB	127	YYYYYYYBBB
42	BYBYBYBYBB	85	YBYBYBYBYY		

TABLE II

Symbol no	Signals for		
	Format specification	Category	Telecontrol functions
100	*	*	Transmitter on *
101	RX-POSITION PHASING SIGNAL		
102	*	*	Transmitter off *
103	Group call	Routine	*
104	*	*	Receiver on *
105	*	*	Printer on *
106	*	*	Printer off *
107	Geographical area call	Safety	*
108	*	*	*
109	*	*	Direct printing equipment on *
110	*	*	Taperecorder on *
111	*	*	Taperecorder off *
112	*	*	Telephony call *
113	*	*	Morse one way *
114	*	*	*
115	Distress call	Distress	Morse two way *
116	All ships call	Urgency	Data transmitting equipment on *
117	*	*	*
118	*	*	Polling or interrogation *
119	*	*	Identification *
120	*	*	*
121	*	*	*
122	*	*	*
123	Individual call	*	*
124	Alphanumerical format	*	*
125	DX-POSITION PHASING SIGNAL		
126	*	*	*
127	END OF SEQUENCE SIGNAL		

* To be determined later.

TABLE III

Packing table for two decimal digits into one ten-unit signal

The digits for the							
Tens of Millions	Millions	Hundred of Thousands	Tens of Thousands	Thousands	Hundreds	Tens	Units
D2	D1	D2	D1	D2	D1	D2	D1
Signal 4		Signal 3		Signal 2		Signal 1	

The digit sequence D2-D1 vary from 00 t o 99 inclusive in each signal (sign.1 to 4 incl.). The signal that represents a particular two-decimal figure is transmitted as the symbol number (of Table I of this Appendix) that is identical to that particular two-decimal figure.

TABLE IV

Symbol no	I.T.A.5 character	Symbol no	I.T.A.5 character	Symbol no	I.T.A.5 character
0	NUL	43	+	86	V
1	SOH	44	,	87	W
2	STX	45	-	88	X
3	ETX	46	.	89	Y
4	EOT	47	/	90	Z
5	ENQ	48	0	91	
6	ACK	49	1	92	
7	BEL	50	2	93	
8	BS	51	3	94	
9	HT	52	4	95	_
10	LF	53	5	96	
11	VT	54	6	97	a
12	FF	55	7	98	b
13	CR	56	8	99	c
14	SO	57	9	100	d
15	SI	58	:	101	e
16	DLE	59	;	102	f
17	DC 1	60	<	103	g
18	DC 2	61	=	104	h
19	DC 3	62	>	105	i
20	DC 4	63	?	106	j
21	NAK	64		107	k
22	SYN	65	A	108	l
23	ETB	66	B	109	m
24	CAN	67	C	110	n
25	EM	68	D	111	o
26	SUB	69	E	112	p
27	ESC	70	F	113	q
28	FS	71	G	114	r
29	GS	72	H	115	s
30	RS	73	I	116	t
31	US	74	J	117	u
32	SP	75	K	118	v
33	!	76	L	119	w
34	"	77	M	120	x
35		78	N	121	y
36	#	79	O	122	z
37	%	80	P	123	
38	&	81	Q	124	
39	'	82	R	125	
40	(	83	S	126	
41	)	84	T	127	DEL
42	*	85	U		

C.C.I.R.
XIIIth Plenary Assembly
Geneva, 1974

Doc. 8/1034-E

STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration :

REPORT 502 (Rev.74)

SELF-SUPPORTING ANTENNAE FOR USE ON BOARD SHIPS

Performance at 500 kHz

(Study Programme 6A-2/8)

(1970-1974)

1. Part I of this Report sets forth data on the performance of self-supporting antennae, together with illustrations of particular types of such antennae, as compiled by administrations.

Table I is based on Docs. XIII/56 (Norway), XIII/58 (Japan), XIII/132 (U.S.A.), XIII/138 (Federal Republic of Germany), XIII/147 (Japan), and XIII/153(Rev.1) (U.S.S.R.) 1966-1969, in response to Study Programme 6A-1/8. Also, results of measurements carried out by the United Kingdom are included, as contained in Doc. 8/181, 1970-1974.

Table II is based on Docs. 8/45 (U.S.A.), 8/69 (Spain), 8/193 (Japan) and 8/260 (Norway) 1970-1974 in response to Study Programme 6A-2/8, as revised at the Interim Meeting of Study Group 8, Geneva, 1972.

2. Part II of this Report contains results of measurements and calculated metre-ampere values for self-supporting antennae. This part is based on Docs. XIII/79(Rev.1) (U.S.S.R.) 1966-1969, 8/34 (Federal Republic of Germany), 8/181 (United Kingdom), 8/233 (Spain) and 8/265 (France) 1970-1974.

Note.- Three Administrations have submitted documents or commented on wire-antennae on board ships. The documents concerned are Docs. 8/34 (Federal Republic of Germany), 8/180 (United Kingdom) and 8/266 (France), 1970-1974.

3. When presenting further contributions the instructions contained in Study Programme 6A-2/8 should be borne in mind.

PART I

TABLE I

Electrical characteristics, as determined by measurement,

No.	Figure (antenna)	Length of feeder (m) (1)	Overall height (m) (2)	Length of mast (m) (1)	Diameter of top (m) (3)	Current (A) (4)	Current (A) (5)	Capacitance (pF) (6)	Capacitance (pF) (7)	**Antenna** resistance (ohms) (8)	Resonant frequency (kHz) (9)
(a)	(b)	(c)	(d)	(c)	(f)	(g)	(h)	(j)	(k)	(l)	(m)
1	1	9	26·5	16	4·6	5·3	3·9	820	—	5·0	720
2	1	14	26·5	16	4·6	8·0	5·9	730	—	3·0	820
3	1	14	30·5	20	4·6	8·6	6·4	790	—	3·0	910
4	1	4·5	19·3	13	4	5·5	4·1	620	—	3·3	2 850
5	1	13	31	18	4·6	5·7	4·2	705	—	2·5	2 300
6	2	2	15·8	10·5	1·0	6·4	4·7	270	—	1·8	3 700
7	2	2	15·3	10·4	1·0	6·6	4·9	310	—	1·6	3 200
8	3	3	25	12·4	1·5	9·0	6·7	410	—	1·7	4 200
9	6	2	21·6	9	3·0	8·0	6·0	330	253	—	—
10	6	1·5	25	12	4·0	5·5	4·8	425	330	—	—
11	5	7	36	13·5	—	8·0	5·6	442	297	—	—
12	5	3·6	29	13·5	—	5·8	4·2	407	343	—	—
13	4	5	30	15·0	2·5	7·0	5·6	464	—	—	—
14	4	0·7	30	15·0	2·5	7·4	7·0	446	—	—	—
15	4	4	34·4	16·0	2·5	7·5	7·4	395	—	—	—
16	5	27	29	13·5	—	6·6	2·0	590	340	—	—
17	—	—	28·3	14·7	4·9	15·0	10·0	—	—	—	—
18	—	—	28·3	14·7	4·9	12·6	8·1	—	—	—	—
19	—	—	—	12·2	3·1	9·1	6·7	—	—	—	—
20	—	—	—	12·2	3·1	9·5	7·0	1 060	—	—	2 580
21	—	—	—	14·7	4·9	11·0	8·1	—	785	—	9 200
22	—	—	—	14·7	4·9	13·0	12·4	361	—	—	9 000
23	—	—	25·9	12·2	3·1	4·1	3·0	—	172	—	4 150
24	—	—	29·6	12·2	3·1	—	3·4	—	1 030	—	—
25	—	—	25·4	12·2	3·1	6·0	3·9	—	965	—	—
26	—	—	40·5	13·1	4·3	10·0	8·8	—	—	—	—
27	4	—	40	16·2	2·5	6	4·4	—	—	4·8	—
28	4	—	31	16·2	2·5	5·5	4·1	—	—	5	—
29	4	—	35	16·2	2·5	6	4·4	—	—	4·3	—
30	4	—	33	16·2	2·5	10	7·4	—	—	4	—
31	6	—	25	10	4	3	2·2	—	—	17·2	—
32	6	—	33·5	10	4	13·8	10·2	—	—	2·1	—
33	7	—	30	10	4	6·3	4·7	—	—	4	—
34	7	—	27	10	4	3·2	2·4	—	—	15·1	—
35	7	—	25	10	4	5·2	3·9	—	—	5·7	—
36	2	4·0	17	10·4	1·0	10	9	292	—	4·0	—
37	10	—	29·0	17·0	4·5	11·0	8·1	—	430	1·16	2 700
38	11	9·6	27·3	15·6	5·0	17·0	10·0	550	435	2·1	1 070

of self-supporting antennae for use at 500 kHz

Effective height (m) (¹⁰)	Radiation resistance (ohms) (¹¹)	Antenna efficiency (%) (¹²)	Weather conditions and relative humidity	Shape factor (¹³)	Test frequency (kHz) (¹⁴)	Field strength mV/m (¹⁵)	Tonnage of ship (GRT)	Doc. of former S.G.XIII (period 1966-1969)	Country
(n)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)
9·7	0·45	9·0	—	0·37	520	13·4	3 000	58	Japan
7·9	0·31	10·3	—	0·30	530	16·8	1 900	58	Japan
11·2	0·60	20·0	—	0·37	520	25·1	1 900	58	Japan
2·7	0·39	11·8	—	0·14	530	4·0	500	58	Japan
10·1	0·47	18·8	—	0·33	520	15·0	4 700	58	Japan
4·0	0·78	4·3	—	0·25	520	6·7	370	58	Japan
4·0	0·06	3·8	—	0·26	470	6·3	390	58	Japan
7·5	0·27	15·9	—	0·30	520	18	10 000	58	Japan
7·7	—	–	Dry (42 %)	0·36	512	16·4	3 468	56	Norway
9·8	—	–	Dry (41 %)	0·39	512	16·1	8 781	56	Norway
9·8	—	—	Dry	0·27	512	19·2	11 734	56	Norway
11·3	—	—	Rain	0·39	512	17·3	8 055	56	Norway
6·0	—	—	Dry	0·20	512	11·8	8 189	56	Norway
6·85	—	—	Dry	0·23	512	16·7	5 854	56	Norway
8·0	—	—	Dry (41 %)	0·23	512	20·5	10 928	56	Norway
10·4	—	—	Dry (50 %)	0·36	512	7·2	7 638	56	Norway
11·7	0·61	—	—	0·41	—	40	7 210	132	U.S.A.
12·5	0·69	—	—	0·37	—	35	7 737	132	U.S.A.
7·0	0·22	—	Damp	—	—	16	9 927	132	U.S.A.
10·9	0·52	—	—	—	—	26	9 927	132	U.S.A.
10·5	0·48	—	—	—	—	29	11 420	132	U.S.A.
11·3	0·56	—	—	—	—	48	11 420	132	U.S.A.
9·8	0·42	—	Humid	0·38	—	10	10 325	132	U.S.A.
6·0	0·16	—	—	0·20	—	7	7 885	132	U.S.A.
4·1	0·07	—	—	0·16	—	5·5	10 654	132	U.S.A.
8·5	0·32	—	Clear	0·21	—	25	24 471	132	U.S.A.
5·2	1·26	2·6	—	0·13	512	8·0	20 000	138	F.R. of Germany
7·4	0·26	5·2	—	0·24	512	10·6	4 000	138	F.R. of Germany
9·8	0·45	10·4	—	0·28	512	15·0	30 500	138	F.R. of Germany
9·0	0·37	9·3	—	0·27	512	23·2	6 000	138	F.R. of Germany
8·7	0·35	2·0	—	0·35	512	6·7	9 300	138	F.R. of Germany
10·5	0·51	24·0	—	0·31	512	37·6	10 500	138	F.R. of Germany
12·1	0·68	17·0	—	0·40	512	19·9	294	138	F.R. of Germany
6·0	0·17	1·1	—	0·22	512	5·0	14 650	138	F.R. of Germany
7·0	0·23	4·0	—	0·28	512	9·45	6 900	138	F.R. of Germany
4·4	0·088	2·2	Dry	0·26	512	13·7	370	147	Japan
10·5	0·5	—	—	0·37	515	—	6 600	79(Rev.1) 153(Rev.1)	U.S.S.R.
8·93	0·32	15·2	—	0·32	468	19·2	3 500	153 (Rev.1)	U.S.S.R.

TABLE I (continued)

Electrical characteristics, as determined by measurement, of self-supporting antennae for use at 500 kHz

No.	Figure (antenna)	Length of feeder (m) (1)	Overall height (m) (2)	Length of mast (m) (1)	Diameter of top (m) (3)	Current (A) (4)	Current (A) (5)	Capacitance (pF) (6)	Capacitance (pF) (7)	Antenna resistance (ohms) (8)	Resonant frequency (kHz) (9)	Effective height (m) (10)	Radiation resistance (ohms) (11)	Antenna efficiency (%) (12)	Weather conditions and relative humidity	Shape factor (13)	Test frequency (kHz) (14)	Field strength mV/m (15)	Tonnage of ship (GRT)	Doc. of former S.G.XIII (period 1966-1969)	Country
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(l)	(m)	(n)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)
39	20	10	37.3	11.3	-	7.0*	5.18	325	-	-	-	16.0	1.18	-	Dry	0.43	512	27.6	6510		U.K.
40	4**	-	32.1	11.1	2.5	12.5	9.25	430	295	-	-	10.4	0.50	-	-	0.32	512	30.3	31035		U.K.
41	4	-	44.0	16.0	2.5	10.0	7.4	370	280	-	-	11.7	0.63	-	Windy Heavy rain	0.27	512	29.5	58889		U.K.
42	4	-	46.7	16.0	2.5	8.0	6.0	320	209	-	-	16.0	1.17	-	Windy Damp	0.34	512	32.9	58809		U.K.

* Using class of emission A2

** Fig. 4 with top whip removed.

TABLE II

Characteristics of self-supporting antennae for use at 500 kHz

No.	Tonnage of ship (GRT)	Figure (antenna)	Length of antenna above base insulator (m)	Resonant frequency as seen from transmitter (kHz)	Test frequency (kHz)	Current at base of antenna (A) at point C(16)	Field strength (mV/m) (15)	Effective height - h_e(m) (10)	Antenna height above actual load waterline - h_{LL} (m)	h_e/h_{LL}	Radiation resistance (ohms) (11)	Measured resistance at point A (ohms) (16)	Antenna efficiency (%) (12)	Current (A) at point A (16)	Current (A) at point B (16)	Length $\overline{AB}$ - S or U (m) (16)(17)	Capacitance of Section $\overline{AB}$ alone (pF) (16)	Length $\overline{BC}$ - S or U (m) (16)(17)	Vertical projection $\overline{BC}$ (m)(16)	Length of component parallel to ship's structure (m)	Mean distance to ship's structure (m)	Capacitance of Section $\overline{AC}$ alone (pF) (16)	Capacitance of antenna system seen from transmitter (pF)	Condition of insulators	Precipitation, temperature, (°C) relative humidity (%)	Overall antenna height (m)(2)	Figure (loading coil)	Location of loading coil (16)	Doc. of S.G. 8 (1970-1973)	Country
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1	11039	12	12.2	3203	480	7.25	14	5.9	28.0	0.21	0.14	3.5	4.3	7.9		2.5							395		9° 83%	26.8			45	U.S.A.
2	11601	12	12.2	5572	480	6.25	17.1	8.4	29.7	0.28	0.28	8.3	3.4	7.9		1.5							418		23° 54%	27.1			45	U.S.A.
3	11521	12	12.2	3160	480	7.0	25.2	11.1	26.9	0.41	0.50	6.4	7.7	8.2		1.5							420		Rain	26.8			45	U.S.A.
4	11420	14	13.7	2425	480	4.6	23.2	15.5	32.7	0.47	0.97	5.8	16.6	7.0		7.9							440		73%	30.8			45	U.S.A.
5	11420	14	13.7	2332	480	5.5	21.0	11.7	33.8	0.35	0.55	4.7	10.0	8.2		7.9							456		Warm 70%	30.8			45	U.S.A.
6	24471	13	12.5	1440	480	6.3	27.3	13.3	36.4	0.37	0.71	2.6	27.6	13.7		26.5*							583		50%	35.5			45	U.S.A.
7	11522	12	12.2	3000	480	5.6	17.4	9.54	26.9	0.36	0.37	4.9	7.5	6.7		3.7							408		24° 80%	26.8			45	U.S.A.
8	11758	12	12.2	1400	480	7.55	18	7.33	29.8	0.25	0.22	3.6	6.1	12.2		23.8							684		26° 60%	29.8			45	U.S.A.
9	12240	12	12.2	3500	480	7.8	24.7	9.7	31.4	0.31	0.38	4.2	4.9	9.7		3.8							413		20° 90%	29.9			45	U.S.A.
10	11349	12	12.2	2300	480	7.6	20.7	8.36	30.9	0.27	0.28	4.0	3.7	8.8		3.3							419		16° 87%	30.2			45	U.S.A.
11	11389	12	12.2	3133	480	7.4	28.2	11.7	27.2	0.43	0.55	5.0	7.45	8.9		3.6							418		19° 75%	26.8			45	U.S.A.
12	18877	15	13.7	3032	480	3.8	9.26	7.5	33.4	0.22	0.23	7.4	3.1	6.1		2.4							393		6° 70%	31.4			45	U.S.A.
13	9323	15	13.7	3040	480	4.5	18.5	12.6	40.2	0.31	0.64	2.9	22.0	6.3		4.2							777		20° 34%	36.7			45	U.S.A.
14	9313	15	13.7	3300	480	4.9	15.3	9.57	40.6	0.24	0.37	6.2	5.9	5.7		13.2							363		21° 64%	36.7			45	U.S.A.
15	17902	15	13.7	2370	480	5.25	14.7	8.6	28.2	0.30	0.30	5.4	5.5	7.8		6.5							518		27° 65%	25.6			45	U.S.A.
16	9323	15	13.7	2500	480	3.13	10.5	10.6	39.5	0.27	0.45	3.0	15.1	4.5		4.2							719		24° 70%	36.7			45	U.S.A.
17	11400	12	12.2	3215	480	7.3	20.8	8.75	31.9	0.27	0.30	5.2	4.1	9.4		2.8							430		24° 76%	31.0			45	U.S.A.
18	52000	5	13.5		512	7.0	32	13.2	38.3	0.34	0.8			8.0		3.6*							370		70%				69	Spain
19	"	5	"		512	2.4	12	13.8	"	0.36	0.9			3.6		7.2*									"				69	Spain
20	41000	4	16.2		512	8.7	42	13.8	47.2	0.29	0.9			12.5		7.2*									70%				69	Spain
21	"	4	"		512	2.1	11.4	15.6	"	0.33	1.1			4.6		8.2*									"				69	Spain
22	52000	5	13.5		512	6.7	31	13.3	40.5	0.33	0.82			9.2		2.9*									78%				69	Spain
23	"	5	"		512	1.7	7.15	12.1	"	0.30	0.68			3.1		9.1*									"				69	Spain
24	3000	4	16.2		480	3.2	20.4	10.8	30.0	0.36	0.48			6.0	5.8	2.8S		5.6U	5.6				450		80%				69	Spain
25	54000	4	16.2		512	9.5	29.4	8.9	43.4	0.21	0.37			12		3.2*									80%				69	Spain
26	"	4	"		512	3.3	10.5	9.1	"	0.21	0.38			4		3.3*									"				69	Spain
27	16000	4	16.2		512	5.2	15.4	8.5	36.5	0.23	0.33			6		3.8*									70%				69	Spain
28	"	4	"		512	3.4	9.8	8.3	"	0.23	0.32			5.8		4.9*									"				69	Spain
29	28000	18	13.2		512		26.7	12.3	40.6	0.30	0.70			9	6.2	3.7S		2.9U	0						7° 88%				69	Spain
30	"	18	"		512		11.9	12.6	"	0.31	0.73			4	2.7	3.7S		2.9U	0						"				69	Spain
31	31000	19	13.2		512	-	14.3	6.03	41.2	0.15	0.17			15	6.8	3.7S		8.3U	2.5						12° 70%				69	Spain
32	"	19	"		512		4.5	6.5	"	0.16	0.2			3.9	2.0	3.7S		8.3U	2.5						"				69	Spain
33																														
34																														
35																														
36																														
37																														
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* Length $\overline{AC}$

TABLE II (continued)

Characteristics of self-supporting antennae for use at 500 kHz

No.	Tonnage of ship (GRT)	Figure (antenna)	Length of antenna above base insulator (m)	Resonant frequency as seen from transmitter (kHz)	Test frequency (kHz)	Current at base of antenna (A) at point C (16)	Field strength (mV/m) (15)	Effective height - h_e (m) (10)	Antenna height above actual load waterline - h_{LL} (m)	h_e/h_{LL}	Radiation resistance (ohms) (11)	Measured resistance at point A (ohms) (16)	Antenna efficiency (%) (12)	Current (A) at point A (16)	Current (A) at point B (16)	Length $\overline{AB}$ - S or U (m) (16)(17)	Capacitance of Section $\overline{AB}$ alone (pF) (16)	Length $\overline{BC}$ - S or U (m) (16)(17)	Vertical projection $\overline{BC}$ (m) (16)	Length of component parallel to ship's structure (m)	Mean distance to ship's structure (m)	Capacitance of Section $\overline{AC}$ alone (pF) (16)	Capacitance of antenna system seen from transmitter (pF)	Condition of insulators	Precipitation, temperature, (°C) relative humidity (%)	Overall antenna height (m) (2	Figure (loading coil)	Location of loading coil (16)	Doc. of S.G. 8 (1966-1972)	Country
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
33	51623	7	14	-	500	7.4	26.7	10.6	45	0.24	0.5	2.5	20.0	10.0	-	14*							450		Light rain	42			193	Japan
34	40500	7	14	-	500	7.8	21.3	8.0	40	0.20	0.28	1.7	16.5	10.0	-	14*							385			35.3			193	Japan
35	65307	21	16	2500	512	6.4	16.6	8.0	39	0.21	0.26	2.0	12.9	8.0	-								360		fair	37			193	Japan
36	95933	21	16	2500	512	5.5	16.2	9.0	44	0.20	0.33	2.0	16.5	6.9	-								400			40.5			193	Japan
37	71735	2	13	2500	500	8.1	18.9	7.0	-		0.21	2.0	10.5	10.1	-							80	500			39			193	Japan
38	89370	2	13	-	500	8.0	21.6	8.0	-		0.27	2.0	13.5	10.0	-								450			36.5			193	Japan
39	95000	2	13	-	500	9.0	27.0	8.9	-		0.35	1.7	20.6	11.2	-	8*						90	450			35			193	Japan
40	5300	2	13	2460	512	8.2	21.1	7.9	29	0.27	0.26	1.9	13.6	9.2	-	5*							408			27			193	Japan
41	4361	2	13	2350	512	8.0	20.9	8.0	32	0.25	0.27	2.0	13.5	9.0	-								385			27			193	Japan
42	24278	4	16	-	500	3.2	6.3	5.8	36	0.16	0.15	1.5	10	3.8	-	2.5*						72	390		rain	36			193	Japan
43	4670	4	16	2400	500	3.3	8.6	7.8	36	0.22	0.26	2.0	13	4.5	-	9.0*						173	468		cloudy	33			193	Japan
44	37845	4	16	2500	500	6.2	16.2	7.7	45	0.17	0.26	1.8	14.5	8.7	-	5.0*									fair	40			193	Japan
45	499.9	2	10	-	500	4.0	5.9	4.8	19	0.25	0.08	2.0	4.0	5.0	-	2.4*							280			17.5			193	Japan

* Length $\overline{AC}$

TABLE II (continued)

No.	Tonnage of ship (GRT)	Figure (antenna)	Length of antenna above base insulator (m)	Resonant frequency as seen from transmitter (kHz)	Test frequency (kHz)	Current at base of antenna at point C (amp)	Field strength (mV/m)	Effective height - h_e (m)	Antenna height above actual load waterline - h_{LL} (m)	h_e/h_{LL}	Radiation resistance (ohms)	Measured resistance at point A (ohms)	Antenna effiency (%)	Current at point A (amp)	Current at point B (amp)	Length $\overline{AF}$ - S or U (m)	Capacitance of section $\overline{AB}$ alone (pF)	Length $\overline{BC}$ - S or U (m)	Vertical projection $\overline{BC}$ (m)	Length of component parallel to ships's structure (m)	Mean distance to ship's structure (m)	Capacitance of section $\overline{AC}$ alone (pF)	Capacitance of antenna system seen from transmitter (pF)	Condition of insulators	Precipitation, temperature (°C) relative humidity (%)	Overall antenna height (m)	Figure (loading coil)	Location of loading coil	Doc. of S.G. 8	Country
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
46	27,311	22	16.6	ab.600	512	8.6	44.2	14.8	40.0	0.37	1.01	4.0	25.2	10.5	9.7	2.5 S	43	6.0 U	2.7			115	604		-5°	40.0		See Fig. 22	260	Norway
					500	8.1	40.9	14.9	"	0.37	0.97	3.7	26.2	10.0	9.1	"	21	"	"			94	526		"	"				
					480	8.1	37.4	14.2	"	0.35	0.81	-	24.6	10.2	9.2	"	-	"	"			-	-		"	"				
					468	7.8	33.8	13.6	"	0.34	0.72	-	23.1	10.0	8.9	"	-	"	"			-	-		"	"				
					454	7.3	32.6	14.5	"	0.36	0.76	-	26.6	9.5	8.4	"	-	"	"			-	-		"	"				
					425	7.4	24.2	11.4	"	0.28	0.41	-	16.4	10.0	8.7	"	-	"	"			-	-		"	"				
					410	7.2	25.8	12.9	"	0.32	0.49	2.3	21.2	10.0	8.5	"	-	"	"			-	-		"	"				
47	7,715	22	13.7	ab.600	430	8.75	40.5	14.2	32.7	0.43	0.82			11.4	9.3	3.0 S		3.0 U	0.5						17°, Dry	32.7			260	Norway
					480	8.75	47.8	16.8	"	0.51	1.14			11.4	9.3	"		"	"						"	"				
					430	8.75	45.3	15.9	"	0.49	1.02			11.4	9.3	"		"	"						"	"				
					480	7.35	34.0	14.2	"	0.43	0.82			9.6	7.8	"		"	"						"	"				
					480	8.75	44.6	15.7	"	0.48	0.99			11.4	9.3	"		"	"						"	"				
					480	4.55	23.7	16.0	"	0.49	1.03			5.9	4.8	"		"	"						"	"				
					480	8.75	39.3	13.8	"	0.42	0.77			11.4	9.3	"		"	"						"	"				
					460	3.50	16.6	14.5	"	0.44	0.85			4.6	3.7	"		"	"						"	"				
					480	8.75	42.5	14.9	"	0.46	0.90			11.4	9.3	"		"	"						"	"				

NOTES TO TABLES I AND II

(1) For the first five values, the number indicated is the length of the radiating parallel wire feeder (C) in Fig. 1. In addition a feeder 3 m long connects the transmitter to the base of the parallel wire feeder.

(2) Overall height above deepest load waterline (m).

(3) Diameter of top-loading device (m).

(4) Current delivered by transmitter to antenna system (A).

(5) Current at base of antenna (A).
The currents in entries 1 to 8, 19 to 21, 23, 37, 39, 40, 41, and 42 were calculated by multiplying the currents in column (g) with a reduction factor of 0.74 (see also Conclusions, below). The values in the other lines were derived from measurements at base of the antenna.

(6) Capacitance as seen from transmitter (pF).

(7) Capacitance as seen from base of antenna (pF).

(8) Measured from transmitter (ohms).

(9) Resonant frequency of antenna system as seen from the transmitter (kHz).

(10) Calculated by the following formula: Effective height in metres $= \frac{\lambda DE}{120 \pi I}$

where λ : wavelength of test frequency (m),
D : distance from ship (m),
E : field strength measured at distance D (V/m),
I : current at base of antenna.

(11) Radiation resistance is calculated by the formula: Radiation resistance $= 160 \pi^2 \left(\frac{h_e}{\lambda}\right)^2$

where the radiation resistance is in ohms and
h_e : effective height (m).
λ : wavelength at test frequency (m).

(12) Antenna efficiency is calculated by the formula: efficiency in percent $= \left(\frac{\text{radiation resistance}}{\text{resistance of antenna system (measured from transmitter)}}\right) \times 100$

(13) Ratio of the effective height to the height above the deepest load water-line.

(14) The test frequencies in entries 17 to 26 lay between 410 and 510 kHz. When calculating the effective heights and shape factors, a test frequency of 500 kHz was assumed.

(15) Adjusted to 1 nautical mile in accordance with Recommendation 368-1.

(16) Refer to the figure in Annex to Study Programme 6A-2/8.

(17) S = screened U = unscreened

At the Interim Meeting of Study Group 8, Geneva 1972, it was decided that the shape factor should be replaced by the ratio h_e/h_{LL} as exemplified in Table II. Other modifications are indicated in the revised Study Programme 6A-2/8.

PART II

The International Convention for the Safety of Life at Sea, 1960, (SOLAS) provides, in Regulation 9 of Chapter IV, guidance in the form of a metre-ampere table. This table lists several values of metre-amperes and the expected range, in nautical miles, that may be associated with each of them. The rationale behind the use of such a table is the following :

SOLAS defines a "clearly perceptible signal" as 50 μV/m and requires, for installations aboard certain classes of vessel, that the signal emitted by the ship's transmitter be sufficiently powerful to assure such a clearly perceptible signal at an appropriate distance, e.g. a range of 150 nautical miles is specified for cargo ships of 1,600 tons gross tonnage and upwards engaged in international voyages. By using the theoretical propagation curves of C.C.I.R. Recommendation 368, it is readily determined that this is equivalent to saying that for this case the field strength, measured at one nautical mile from the vessel, must be not less than 12.5 mV/m.

Since measuring the actual field strength of all vessels in order to ascertain compliance with SOLAS Regulations is both expensive and time consuming, the question arises of whether it is possible to predict the values of field strength at one nautical mile by the simple expedient of making measurements on board the ship of certain selected parameters.

To begin with, for any vessel, by definition,

$$E = \frac{120 \pi h_e I}{\lambda D} \qquad (1)$$

where E = field strength measured at a distance D from the antenna in volts/metre

D = distance from the antenna in metres

λ = wavelength of the test frequency in metres

I = current at base of antenna in amperes

h_e = effective height of antenna, a fictitious height in metres defined by equation (1).

For a distance of one nautical mile (D = 1852 metres) and a frequency of 500 kHz (λ = 600 metres) equation (1) reduces to

$$E = \frac{120 \pi}{600 \cdot 1852} h_e I = 0.34 \cdot 10^{-3} h_e I$$

$$\text{or} \quad E \text{ (in mV/m)} = 0.34 \cdot h_e I \qquad (2)$$

Thus, for the class of vessels described above, E = 12.5 mV/m and $h_e I$ in metre amperes must equal at least :

$$\frac{12.5}{0.34} = 37 \text{ metre amperes}$$

Unfortunately, h_e is not directly measurable, and I can often be measured only at great inconvenience. Still it is obvious that the current at the base of the antenna is related to the output current of the transmitter which is usually continuously monitored by a meter in its output current. Similarly, h_e depends on the geometrical configuration of antenna and vessel, elements of which may be measured. Since however the exact relationships are in general unknown, recourse is normally made to approximations, the effects of which are ordinarily determined by statistical methods.

Doc. XIII/79(Rev.1)(U.S.S.R.)

On the basis of experiments carried out on three different types of self-supporting antennae, it is assumed that

$$h_e = 0.37 H$$

where H is the distance from the top of the antenna to the deepest load waterline of the vessel.

Thus $E = K_1 HI$

where from equation (2) above $K_1 = 0.34 \times 0.37 = 0.125$ and both H and I can be measured aboard the vessel.

The problem under these assumptions thus becomes immediately solvable.

The method of the document is to calculate the radiated power :

$$P_\Sigma = I^2 R_\Sigma$$

where R_Σ is the radiation resistance = $160\pi^2 \left(\frac{h_e}{\lambda}\right)^2$

Thus for a λ = 600 metres $R_\Sigma = K_2 (h_e)^2 = K_3 H^2$

or $P_\Sigma = \left(\frac{IH}{K_4}\right)^2$ where $K_4 = \frac{600}{\sqrt{160 \cdot \pi \cdot 0.37}} = 40.5$

Assuming an antenna efficiency of 5% the total antenna power P is related to the range as follows :

$$P_\Sigma = 0.05 P$$

Metre amperes = $\sqrt{0.05 P} \cdot 40.5$

Doc. 8/34 (Federal Republic of Germany)

The method given in this document sets up a constant F describing the overall antenna E_o characteristics and the field strength at one nautical mile on 500 kHz, to the product of H and I_A where I_A is the transmitter output current.

From equation (2) above it is immediately seen that :

$$h_e I = \frac{1}{0.34} E = 2.95 E_o ;$$

defining $F = \frac{h_e}{H} \cdot \frac{I}{I_A} = \frac{2.95 E_o}{H I_A}$

yields $E_o = F \cdot 0.34 \, HI_A$.

By making measurements of E, H and I_A, a mean F may be determined. It is found that by treating the different types of antennae as separate cases, the deviations of the F of an antenna installation from the mean F determined from many other installations of that type of antenna, are much reduced.

Doc. 8/181 (United Kingdom)

This document provides data for Table I. Its underlying assumptions are essentially those of Doc. 8/34. It assumes a linear dependence of h_e on H and of I on I_A. It recognizes the need for developing separate statistics for separate antenna types.

Doc. 8/233 (Spain)

Doc. 8/233 also bases itself on equation (2) above.

$$Ih_e = \frac{E}{0.34}$$

Multiplying both sides by $\frac{H}{h_e}$ yields

$$IH = \frac{E}{0.34 \frac{h_e}{H}}$$

It will be seen that this parallels the method of Doc. 8/34 except that the transmitter output current has been replaced by the antenna base current.

Doc. 8/265 (France)

This document is based on the fact that the field strength is proportional to the square root of the radiated power.

First, it assumes that the radiation resistance is linearly dependant on ${h_{LL}}^2$, h_{LL} being the distance from the top of the antenna to the actual load water line. This results in :

$$E = K_5 \; I \; h_{LL}$$

Second, the relationship between the transmitter current and the antenna base current is not absorbed into K_5. Third, the distinction of antenna types is preserved.

It is pointed out that K_5 can act as a sort of figure of merit of an installation. Obviously, for the same $I\ h_{LL}$, a higher K_5 yields a higher value of E, i.e. the installation is better. By measuring E, I and h_{LL} for a substantial number of vessels, we may derive a mean value of K_5 collectively for each separate type of antenna configuration. Then any arbitary vessel's installation may be evaluated by determining whether its K_5 is equal, superior, or inferior to that of the mean for its kind of antenna.

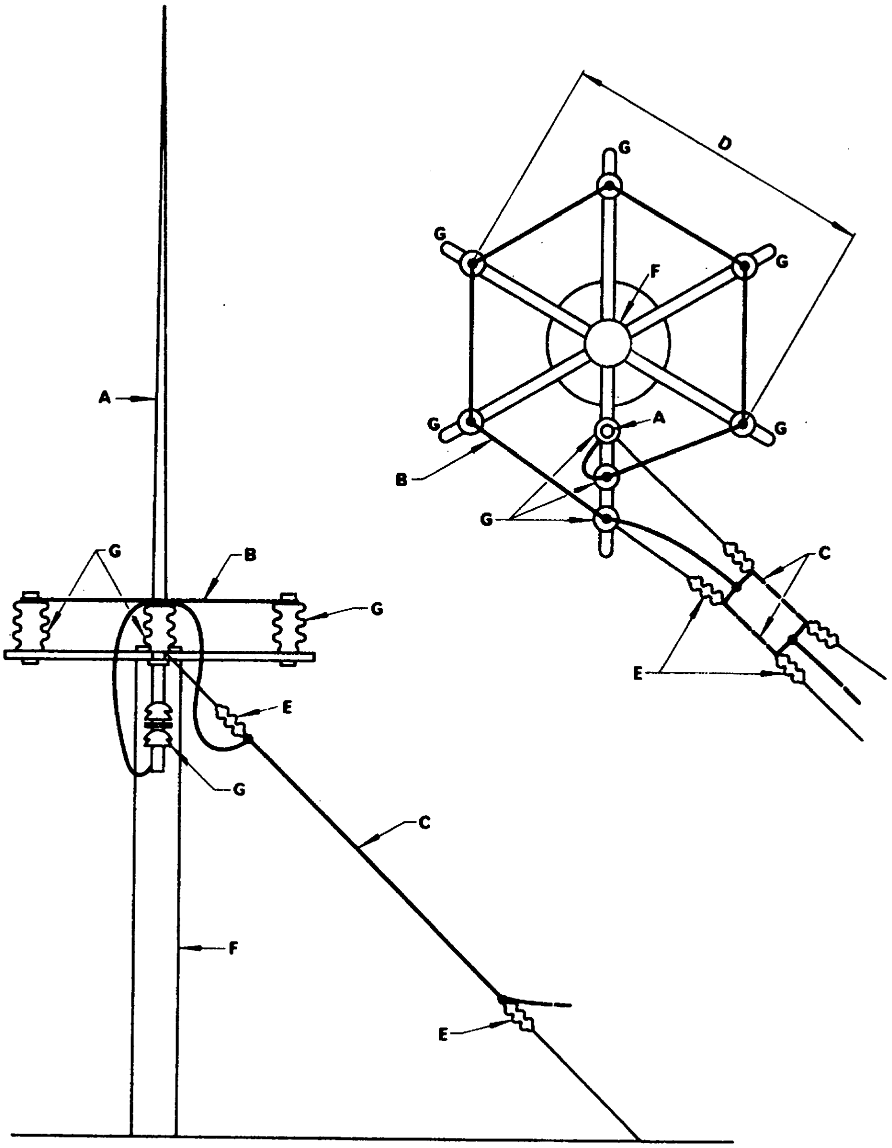


FIGURE 1

Top-loading antenna

A: vertical part of antenna (helical-coil conductor)
B: horizontal-loop part of antenna (helical-coil conductor)
C: parallel wire
D: diameter of the horizontal-loop part
E: antenna lead-in insulator
F: antenna post
G: insulator

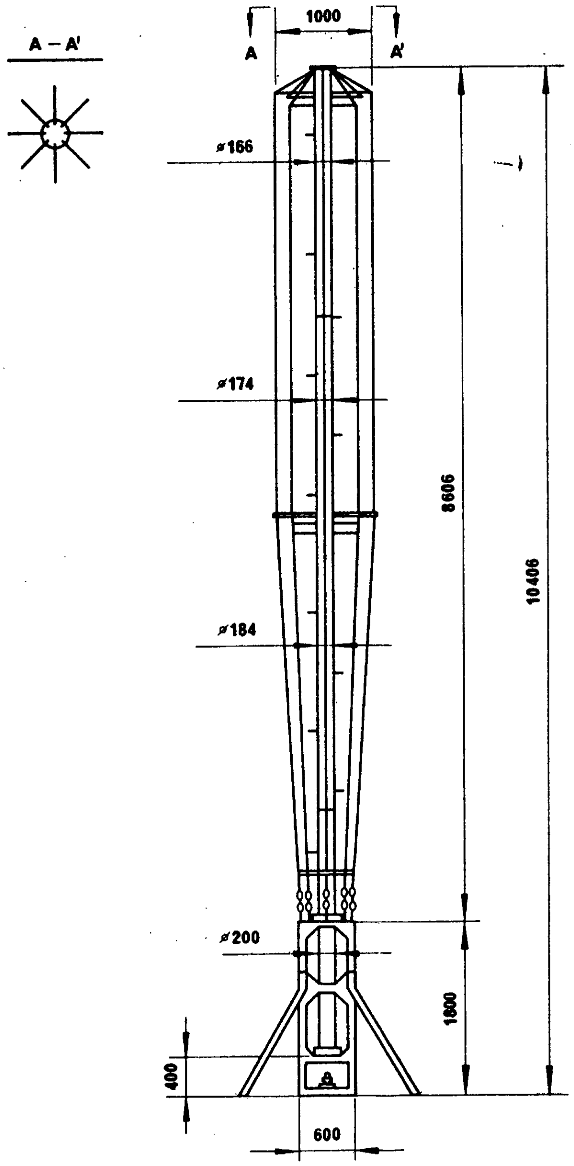


FIGURE 2

Cage antenna
(All dimensions in mm)

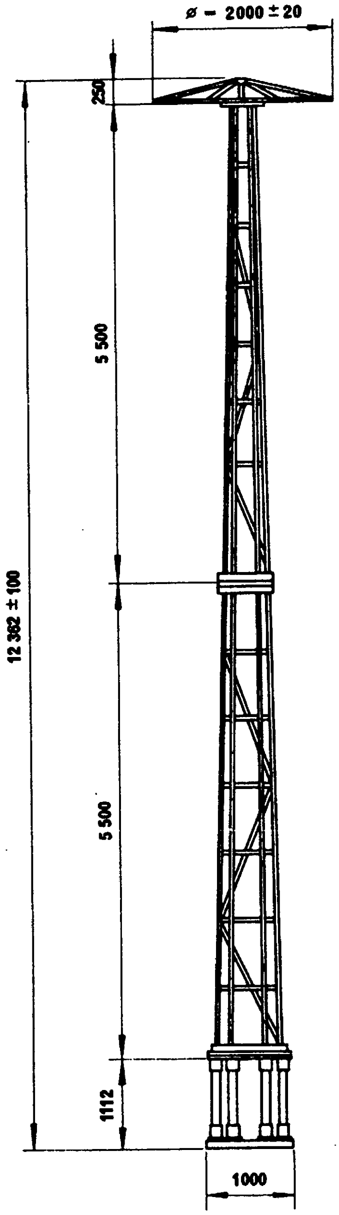


FIGURE 3

Top-ring cage antenna
(All dimensions in mm)

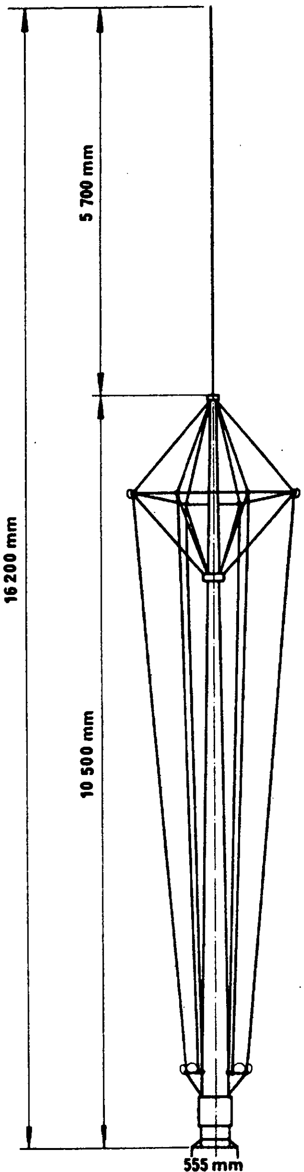


FIGURE 4

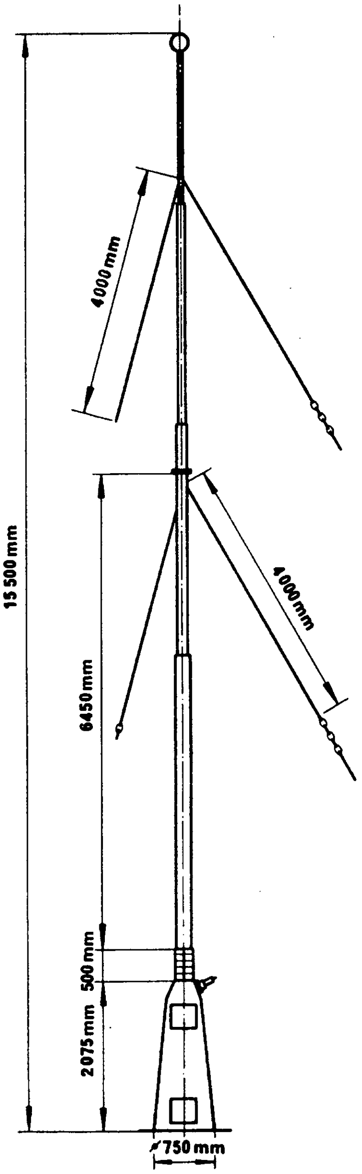


FIGURE 5

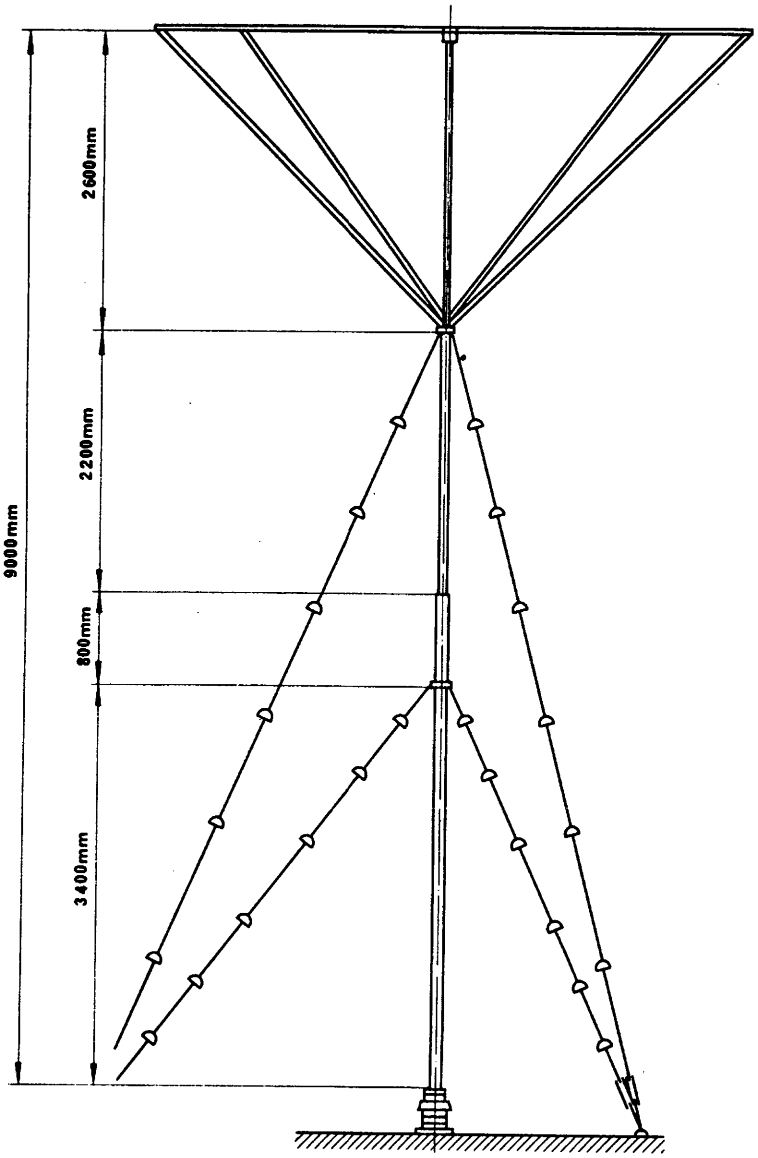


Figure 6

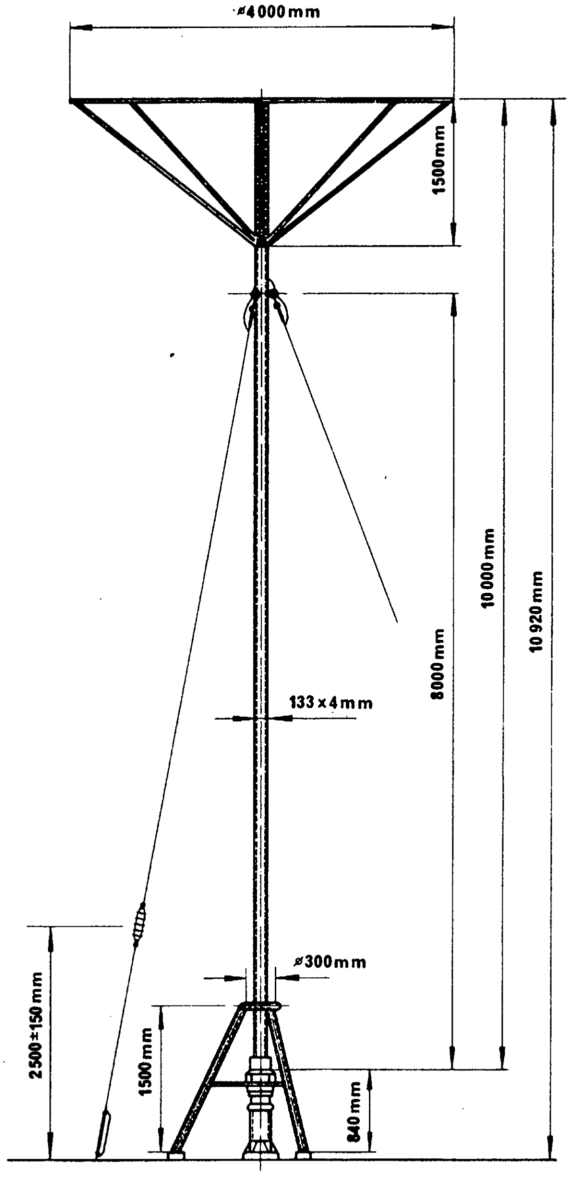

ø4000mm
1500mm
8000mm
10000mm
10920mm
133x4mm
ø300mm
2500±150mm
1500mm
840mm

FIGURE 7

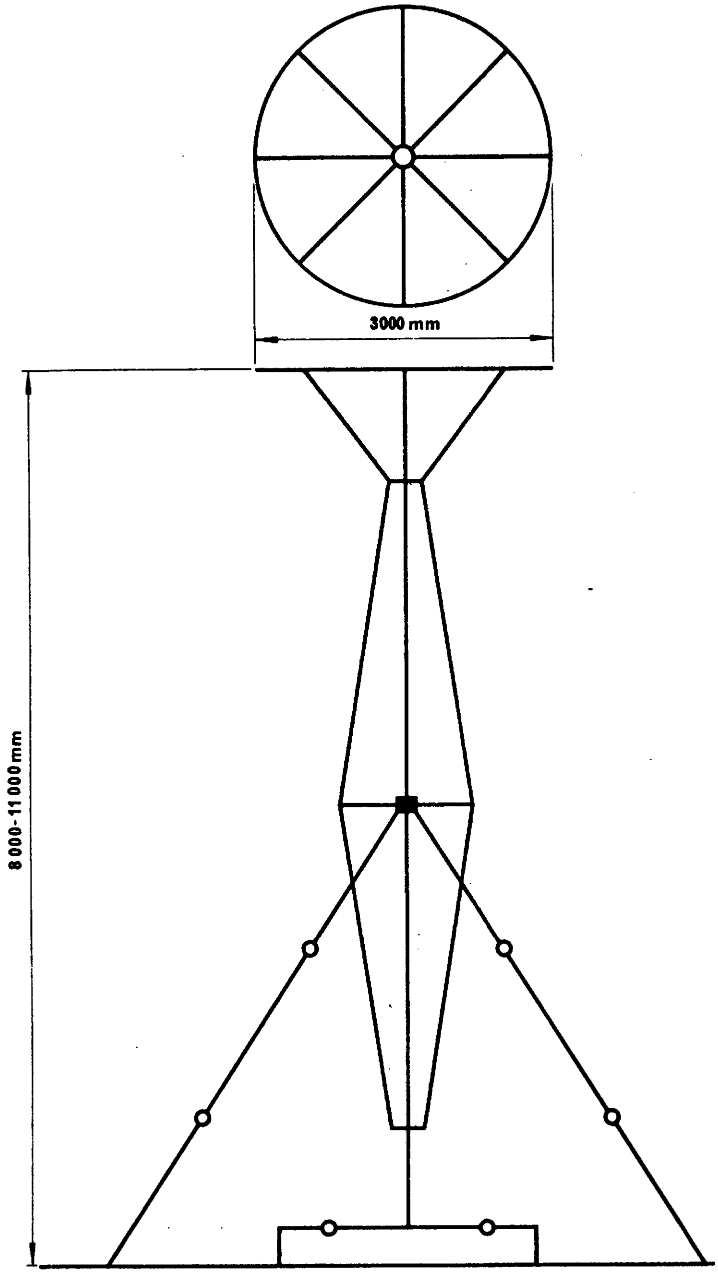


FIGURE 8

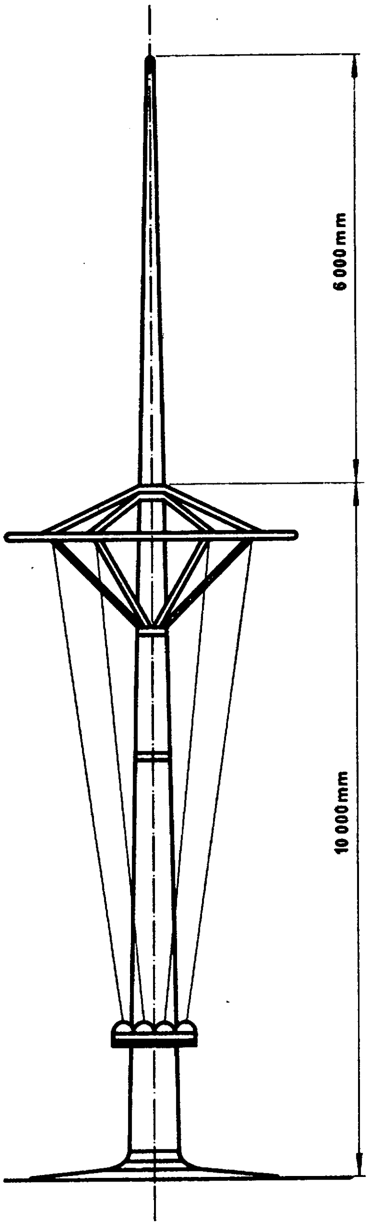


FIGURE 9

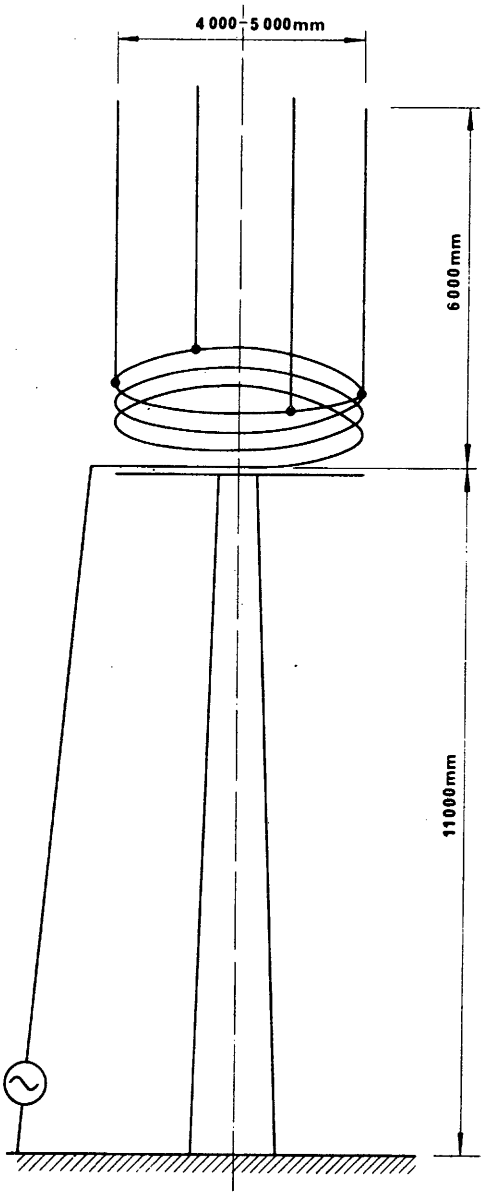
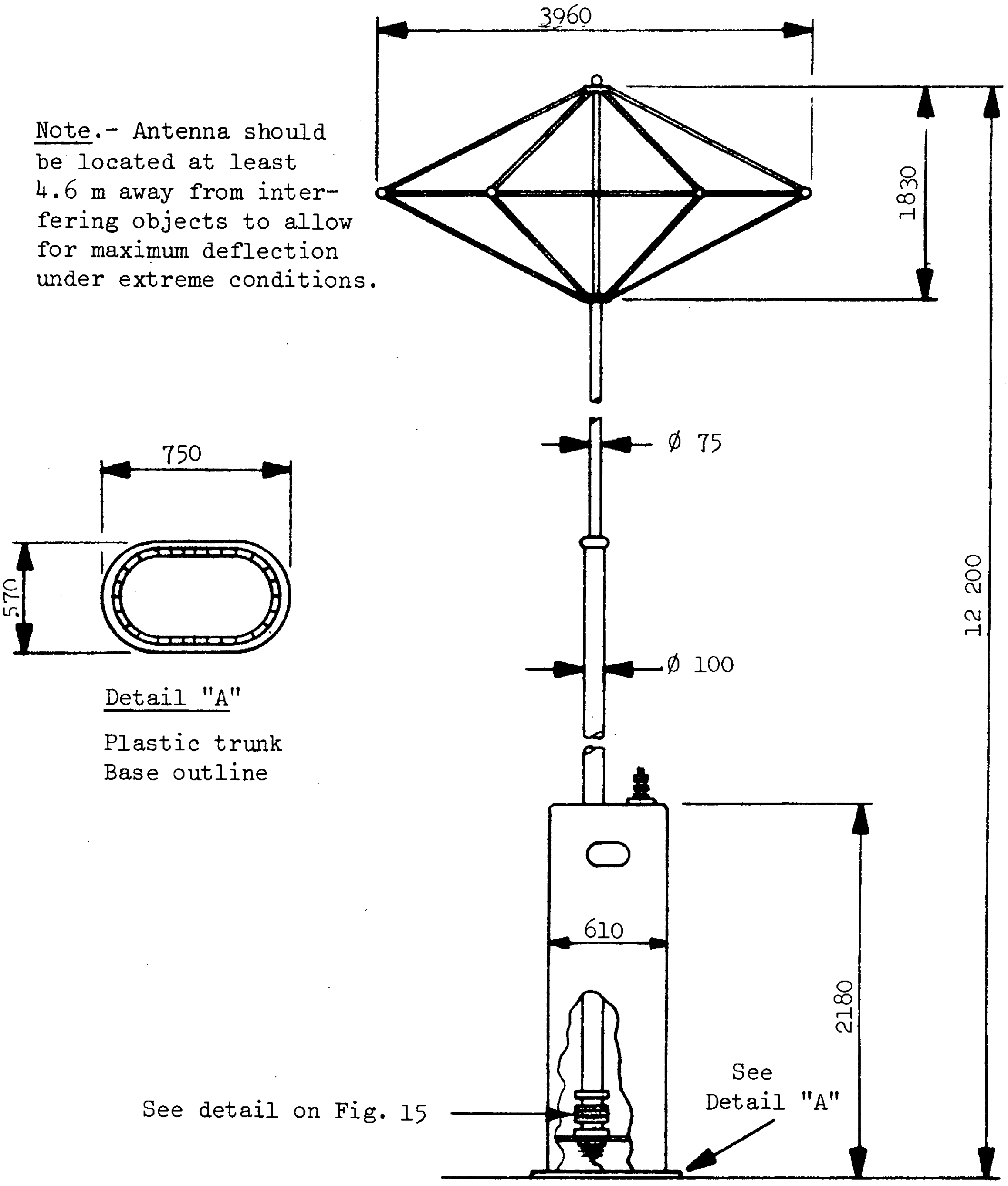


FIGURE 10



Note.- Antenna should be located at least 4.6 m away from interfering objects to allow for maximum deflection under extreme conditions.

Detail "A"

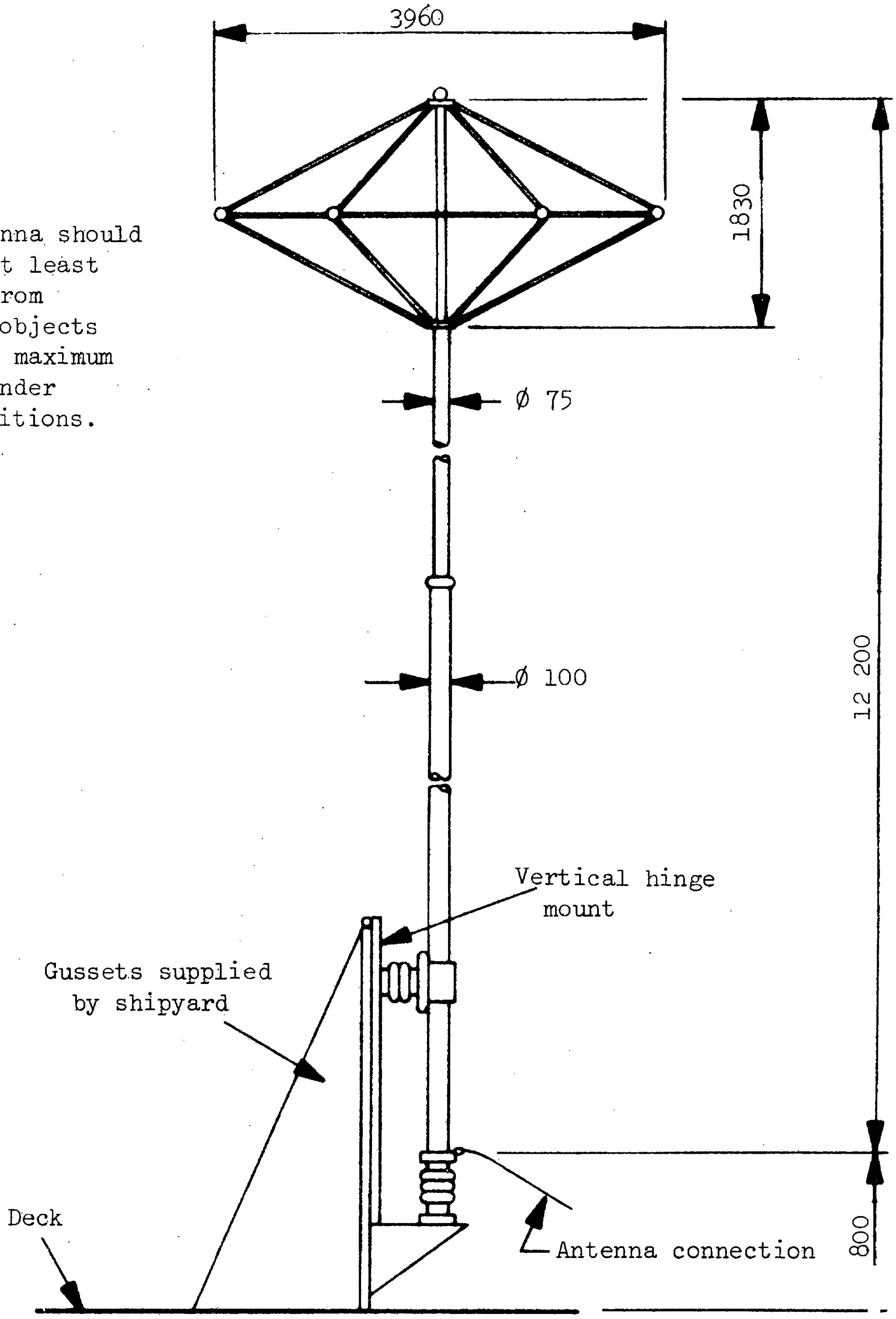
Plastic trunk
Base outline

Weight

Antenna	-	103 kg
Trunk	-	79 kg

FIGURE 11

(All dimensions in mm)



Note.- Antenna should be located at least 4.6 m away from interfering objects to allow for maximum deflection under extreme conditions.

Total weight (less gussets) approx. 480 kg

FIGURE 12

(all dimensions in mm)

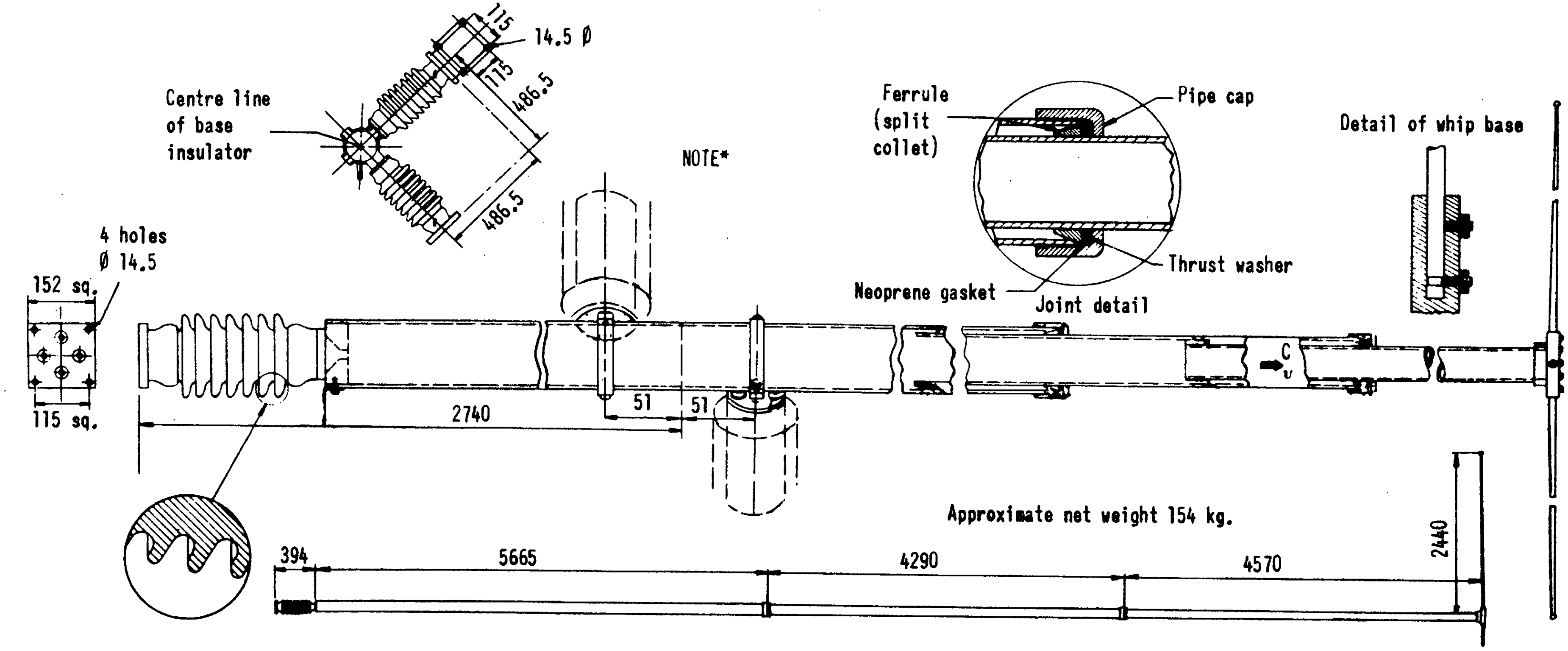


FIGURE 13

(All dimensions in mm)

(*) All aluminium threads are coated with anti-seize compound. Do not remove during assembly procedure

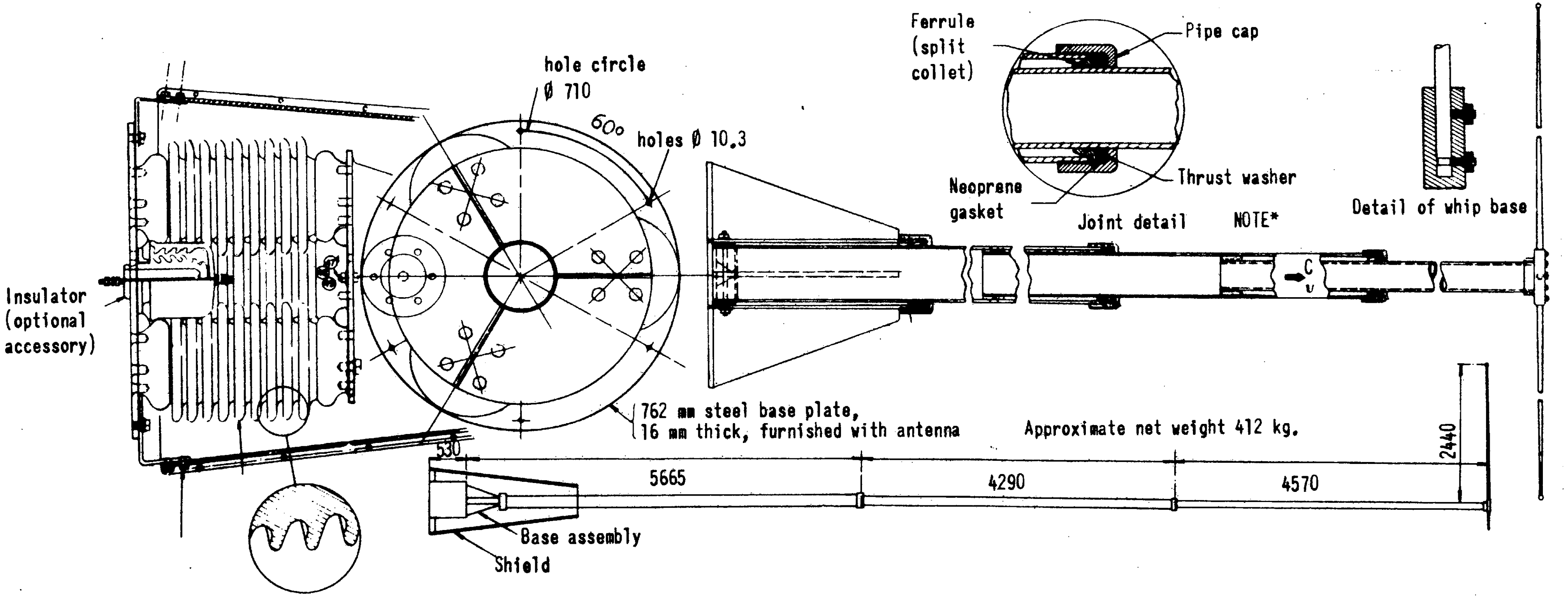
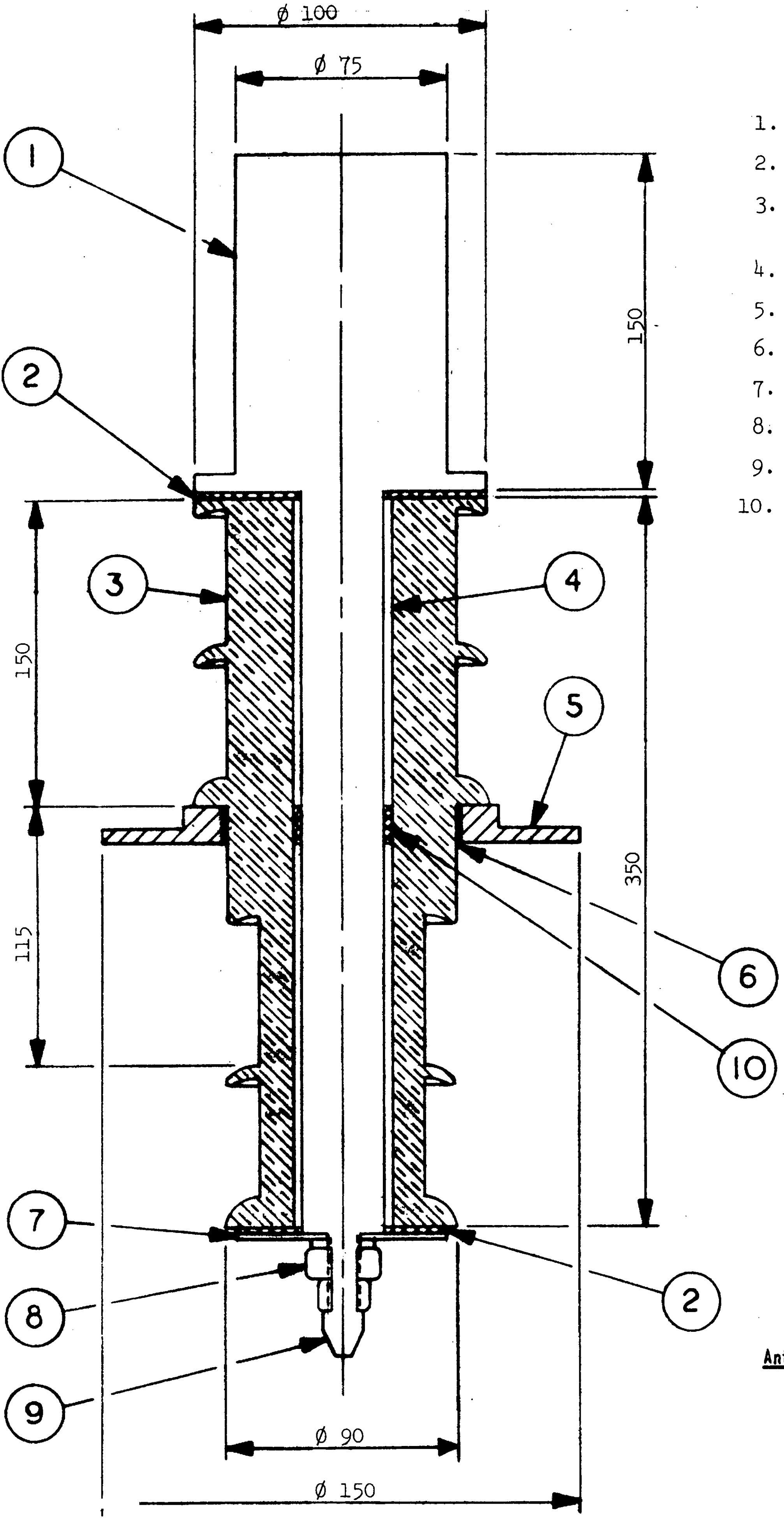


FIGURE 14

(All dimensions in mm)

(*) All aluminium threads are coated with anti-sieze compound. Do not remove during assembly procedure.



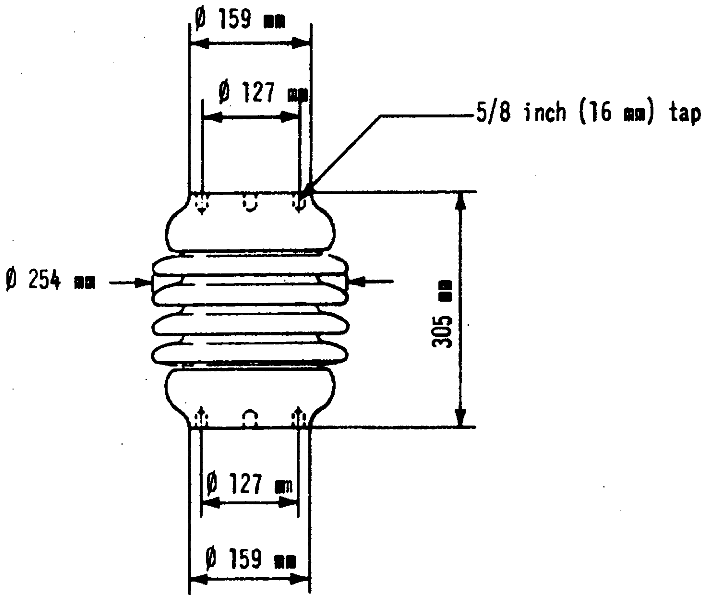
1. Aluminium case plug
2. Corprene washer
3. Steatite insulator (grade L5, white glaze)
4. Silicone rubber compound
5. Bronze mounting flange
6. Epoxy cement
7. Washer
8. Compression nut
9. Antenna lead fitting
10. Neoprene tape

FIGURE 15

(detail of Fig. 11)

Antenna base feed-through insulator

(all dimensions in mm)



DIMENSIONS

Weight	26.3 kg
Leakage distance	394 mm
Dry arcing distance	182 mm

MECHANICAL VALUES

Cantilever strength, upright	3600 kg
Cantilever strength, underhung	3600 kg
Tension strength	12 700 kg
Torsion strength	462 kg/m
Compression strength	18 200 kg

ELECTRICAL VALUES

Voltage rating	15 kV
Low frequency dry flashover	85 kV
Low frequency wet flashover	55 kV
Impulse flashover - positive	125 kV
Impulse flashover - negative	200 kV
Low frequency withstand - 1 min. dry	50 kV
Low frequency withstand - 10 sec. wet	45 kV
Impulse withstand	110 kV
Capacitance	~ 30 pF

RADIO INFLUENCE VOLTAGE DATA

Test voltage - rms to ground	10 kV
Maximum RIV at 1000 kHz	50 μV

FIGURE 16

Details of porcelain insulator
used with antenna of Fig.12.

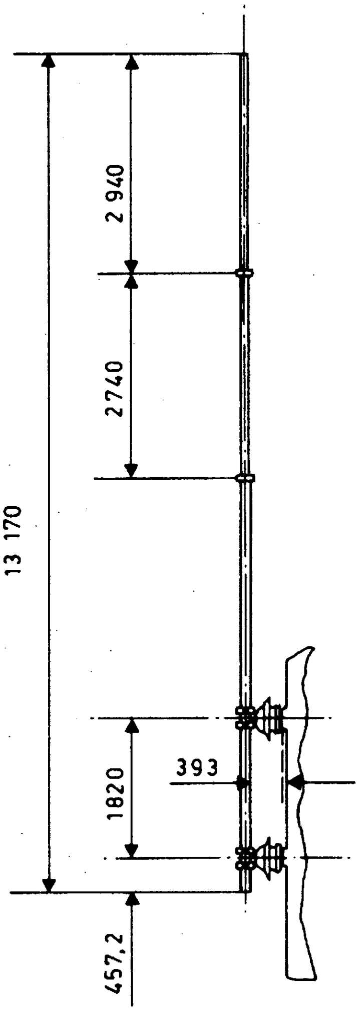
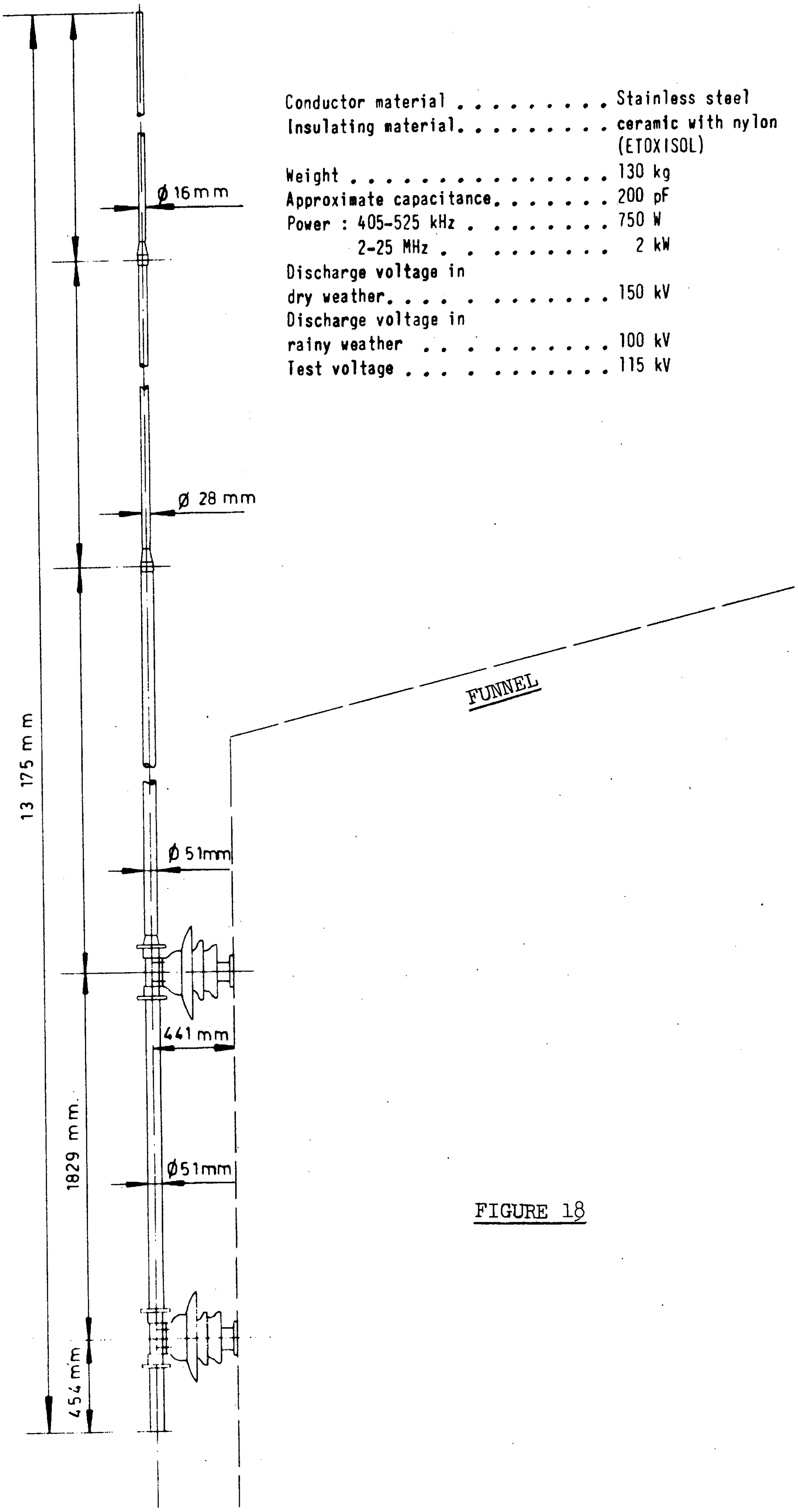


FIGURE 17

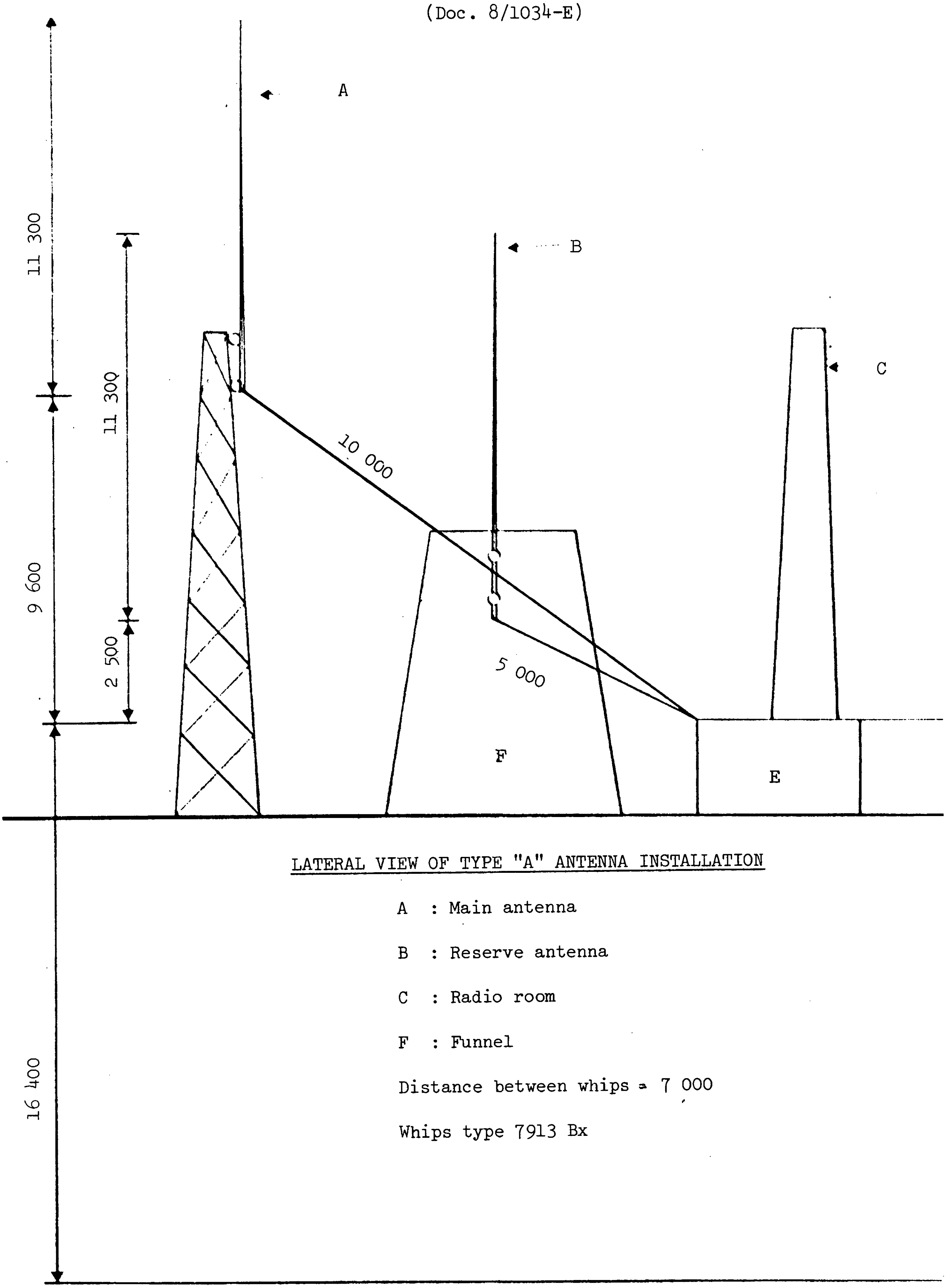
Material used : Stainless steel

Approximate capacitance : 220 pF



Conductor material	Stainless steel
Insulating material.	ceramic with nylon (ETOXISOL)
Weight	130 kg
Approximate capacitance.	200 pF
Power : 405-525 kHz	750 W
2-25 MHz	2 kW
Discharge voltage in dry weather.	150 kV
Discharge voltage in rainy weather	100 kV
Test voltage	115 kV

FIGURE 18



LATERAL VIEW OF TYPE "A" ANTENNA INSTALLATION

A : Main antenna

B : Reserve antenna

C : Radio room

F : Funnel

Distance between whips = 7 000

Whips type 7913 Bx

FIGURE 19

(All dimensions in mm)

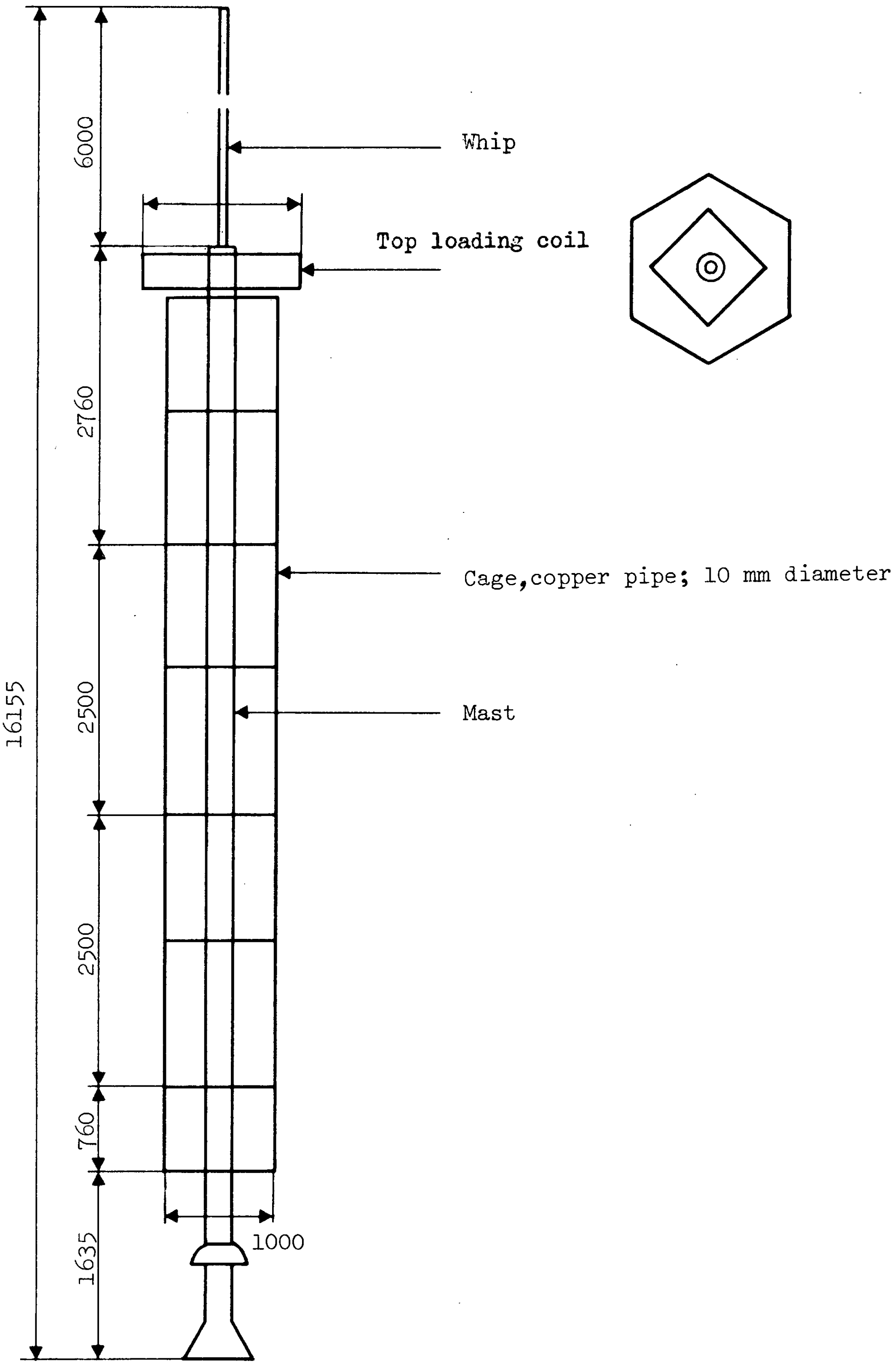


FIGURE 20

(All dimensions in mm)

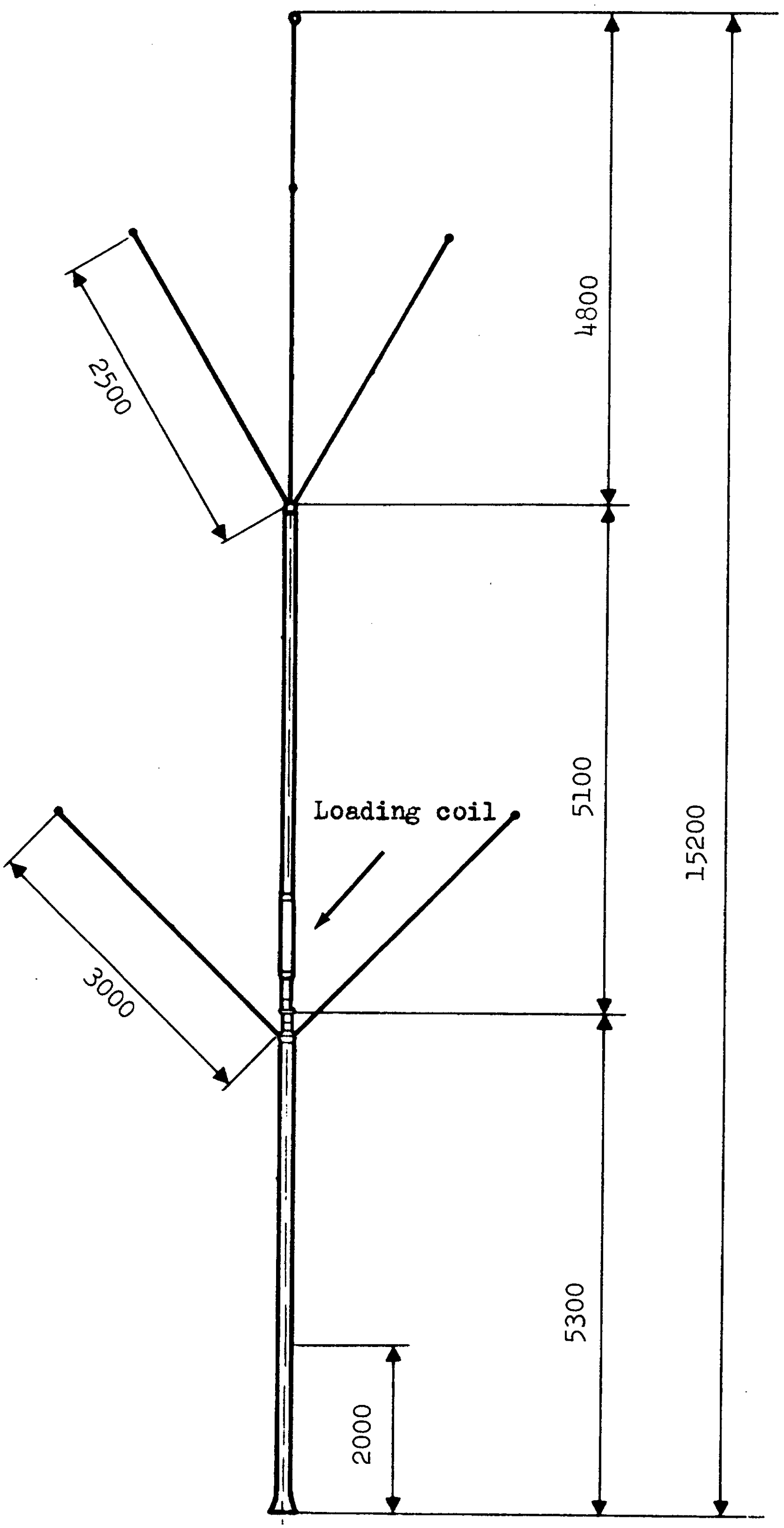


FIGURE 21

(All dimensions in mm)

PART III

Discussion

The papers summarized in Part II of this Report contain sets of results calculated by the method expressed in the particular paper. However, as the results are based on different numbers of ships and in some cases used different datums, no useful direct comparison between them can be made.

Some of the papers commented that the radiation from self-supporting antennae is affected both by the design of the antenna and its physical relationship with the superstructure of the vessel. The results of the tests by administrations given in Tables I and II of this Report, whilst indicating in some respects that such relationships do exist, provide insufficient data to enable the details of such relationships to be established at the present time.

When considering which method of determining values of metre-amperes should be used as a basis for giving advice to I.M.C.O., it was decided that for the best results use should be made of the measured field strength, the current at the base of the antenna and the height of the highest point of the antenna above actual water level.

It was also recognized that with different types of antenna and ship configurations in use, some form of distribution diagram would need to be produced and ultimately a decision made regarding the most suitable value to be used for calculations. In this connection, it was noted that the formulae for wire antennae contained in the International Convention for Safety of Life at Sea, 1960, uses an average ratio of 0.47 but comments that the ratio varies with local condition of the aerial and may be between about 0.3 and 0.7.

The method chosen is based upon the theory that for any ship the value $\frac{E}{Ih_{LL}}$ is constant, under the assumption that the radiation resistance is proportional to h_{LL}^2. The value of $\frac{E}{Ih_{LL}}$ is then a measure of the efficiency of the antenna system and once a suitable value of this quantity for a number of ships has been derived, and the usual deviations from this value are known, measurement of h_{LL} and I will give the field strength at 1 nautical mile, within a specified margin of error.

It should be noted that at constant frequency the ratio $\frac{E}{Ih_{LL}}$ is proportional to $\frac{h_e}{h_{LL}}$ of Column 11 in Table II.

Since $h_e = \frac{\lambda DE}{120\pi I}$ (Note 10 to the Tables refers) then

$$\frac{h_e}{h_{LL}} = \frac{\lambda D}{120\pi} \cdot \frac{E}{Ih_{LL}} = K_6 \frac{E}{Ih_{LL}}$$

where $K_6 = \frac{\lambda D}{120\pi}$

PART IV

Calculation of Metre-Ampere Table

The cumulative distribution of the value $\frac{E}{Ih_{LL}}$ for the trial results given in Table II is shown in Fig. 23. It will be seen that the abscissa is plotted under a logarithmic form in dB and that the value of E has been adjusted to 1 n.m. in accordance with C.C.I.R. Recommendation 368-1. The median value of this distribution is 39 dB.

As previously established in para. 2 of Part II of this Report, a field strength at 1 nautical mile of 12.5 mV/m, or 82 dB relative to 1μV/m, is indicated for compliance with SOLAS.

Letting the median value of $\frac{E}{Ih_{LL}} = m$, then

$$E = Ih_{LL}.m$$

or, in dB,

$$E(\text{dB above } 1\mu V/m) = 20 \log Ih_{LL} + 20 \log m$$

E has been calculated to be 82 dB and 20 log m, the median of the distribution is 39 dB, hence

$$82 = 20 \log Ih_{LL} + 39$$

and from this Ih_{LL}, the metre-amperes, may be calculated.

Similarly, other values of Ih_{LL} can be calculated for values of $\frac{E}{Ih_{LL}}$ other than the median by replacing the figure of 39 dB in the above equation by the appropriate number taken from the distribution curve for any desired percentage.

Table III below contains columns of metre-amperes at selected percentages, for various ranges of propagation in nautical miles. It should be noted that the cumulative distribution curve on which this table is based was produced from only 34 samples.

Table III

Normal range in nautical miles	Metre Amperes				
	50%	60%	70%	80%	90%
200	280	304	324	344	382
175	196	213	227	241	267
150	140	152	162	172	191
125	100	108	116	123	136
100	79	86	91	97	108
75	50	54	58	61	68

Note.- The metre-amperes columns indicate the percentage of vessels which would be expected to meet the "normal range" of transmission when the Ih_{LL} of the vessels just equalled the stated metre-ampere figure.

---

* The product of the distance (in metres) from the top of the antenna to the actual load water line and the current (in amperes) measured at the base of the radiating portion of the antenna.

PART V

Conclusions

1. The additions to be made to the table of metre-amperes given in the International Convention for the Safety of Life at Sea, 1960, Chapter IV, Regulation 9 (g) could be based upon Table III of this Report. However, in view of the small sample from which the Table was derived, the 60% figure should be used in preference to the average figures used for wire antennae or the median value as taken from Table III.

2. There is a need for the Study Programme to continue because improved design of self-supporting antennae may alter the shape of the distribution curve and more information is required on the effect of installation configuration on antenna radiation.

3. Attention should be paid to including the actual current at the base of the antenna and the height of the highest point of the antenna above the actual water level in the reports of all trial results.

4. There is an urgent need for more trial results to be reported to enable the cumulative distribution curve to be confirmed or amended in the light of such trials.

Note.- It is recognized that the method described in this Report may be used for the study of wire antennae efficiency.

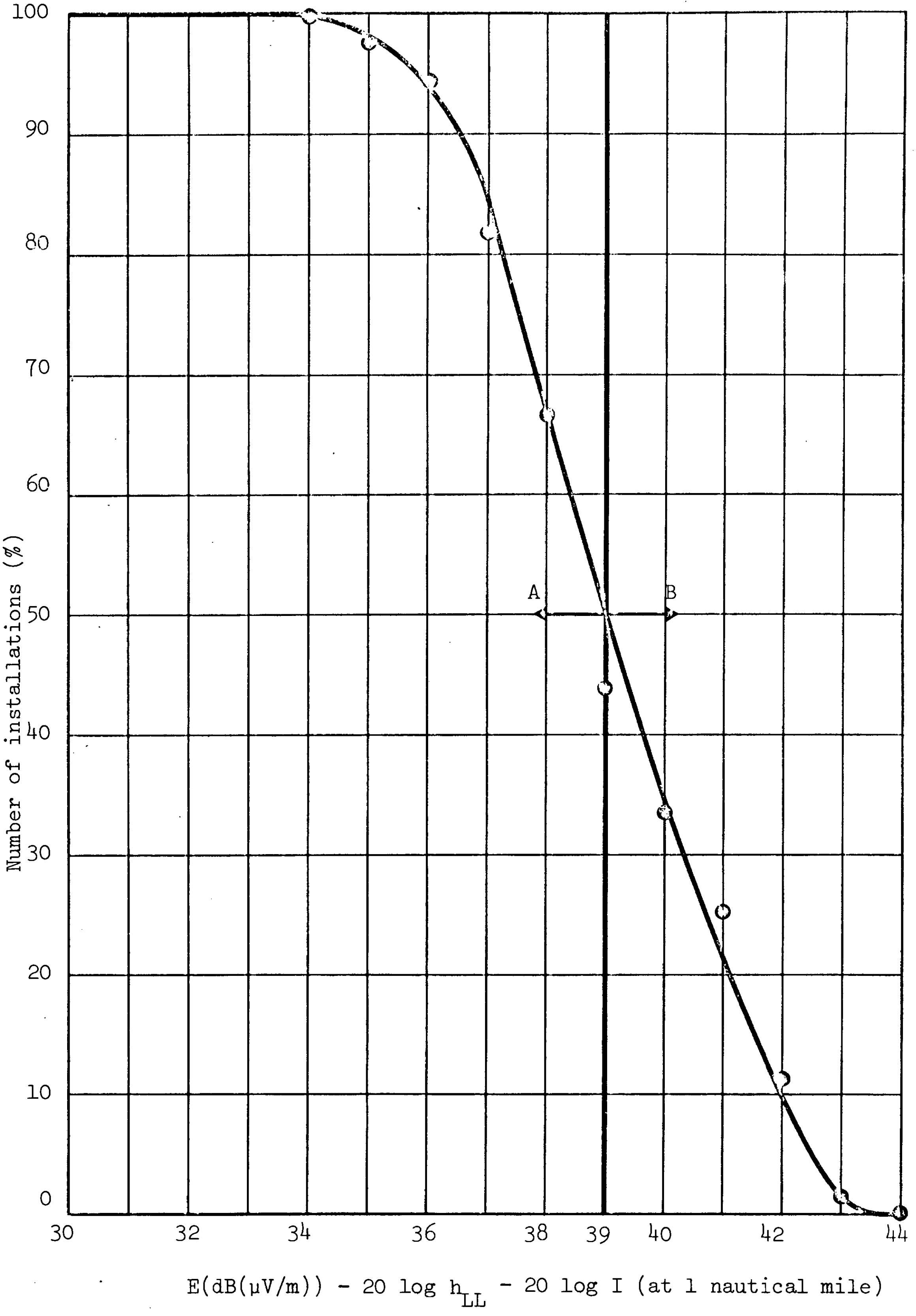


FIGURE 22

A: Below Average antenna system

B: Above average antenna system

C.C.I.R.
XIIIth Plenary Assembly
Geneva, 1974

Doc. 8/1035-E

STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2. of Resolution 24-2, presents the following Report to the Plenary Assembly, for consideration :

REPORT 504 (Rev. 74)

TECHNICAL CHARACTERISTICS OF SYSTEMS PROVIDING COMMUNICATION AND/OR RADIODETERMINATION USING SATELLITE TECHNIQUES FOR AIRCRAFT AND/OR SHIPS

Propagation, antennae and noise as factors affecting the choice of frequency for telecommunications between an aircraft/ship and a satellite

(Study Programme 17A/8)

(1970-1974)

1. Introduction

Conventional transmissions in the VHF and HF bands are currently used for two-way communications between an aircraft or a ship and a land station. The VHF band gives a service basically limited to line-of-sight distances and is unaffected by ionospheric disturbances. This line-of-sight limitation can be partially overcome by the use of high power transmission and forward scatter. Experience indicates that an extended range VHF system can provide communications out to about 900 km (500 nautical miles) for an aircraft operating at 12 000 m (40 000 feet) or above; this range diminishing by about 90 km (50 nautical miles) for each 3000 m (10 000 feet) reduction in altitude.

HF communications are not subject to this line-of-sight limitation, but are very susceptible to ionospheric disturbances. Protracted periods occur when communications are either not possible or are only possible at the lowest frequencies in the band. In addition, the HF bands are highly congested and subject to interference, so that the capacity for expansion of HF communications is small, at least in certain parts of the world.

These limitations on existing services have led to consideration of the technical feasibility of communications between an aircraft **or a ship and a remote ground terminal using a** satellite relay. Initial experiments between an aircraft and the ground were in fact conducted in the VHF band with the SYNCOM III satellite and subsequently repeated with the two **NASA satellites, ATS-1 and ATS-3, now in orbit. Telecommunications between ships and the shore** have also been conducted via the ATS satellites. It should be noted that these tests were not necessarily conducted under optimized conditions such as would be used in the future in a space telecommunications system especially established for aircraft **or ships. For** example, broadband rather than narrow-band techniques were used and the satellite antenna polarization was linear rather than circular. **Limited experiments have been performed in** the **UHF** band (1540-1660 MHz) **using the ATS-5 satellite.**

A number of important experiments using a stratospheric balloon at a height of 37 km to simulate a geostationary satellite were conducted in France. The experiments, between aircraft and balloon, were performed in the band 1540 - 1660 MHz.

This Report discusses the propagation, antenna and noise characteristics of the transmission path between satellite and aircraft in bands 8 and 9, taking account of the aeronautical or maritime environment. The aeronautical and maritime mobile services are late-starters in the field of satellite communications and thus benefit from fundamental studies already made, and particular reference is made to Report 205-2. It should be noted that the selection of frequency bands will depend upon other factors including:

- the current usage of the bands,
- the need for protection of existing users of the allocated bands,
- the type of equipment which can be installed, or is already installed, on board aircraft and ships,
- the needs of operators.

Further considerations would be entailed if **aircraft or ship** radionavigation and/or radiolocation facilities were required in addition to a communication service. For example, account might also have to be taken of the effects of the ionosphere and of the troposphere on the phase of the radiated signals.

This Report is not intended to specify or design an operational link, but rather to provide some of the technical data for aeronautical or maritime satellite systems.

The effects of propagation and noise on the choice of frequency for satellite relays between ground stations have already been summarized in Report 205-2. Much of this summary is relevant to aeronautical or maritime satellites, but a number of differences arise. In both cases, ground terminals can be large and highly developed, cooled receivers can be used; satellites can be autotracked with narrow beam antennae.

2. Allocated frequency bands

At the W.A.R.C.-S.T., Geneva 1971, exclusive allocations to the aeronautical mobile-satellite service and maritime mobile-satellite service were made in the band 1535-1660 MHz. In this band, two small sub-bands were also jointly allocated to the two services.

The provisions made at the E.A.R.C. (Space), Geneva 1963, of allowing aeronautical systems using space radiocommunication techniques to be used in the bands 118-136 MHz, 1558.5-1636.5 MHz, 4200-4400 MHz, 5000-5250 MHz and 15.4-15.7 GHz on a shared basis were confirmed.

The W.A.R.C.-S.T., Geneva 1971, made provision for possible future exclusive allocation to the maritime mobile-satellite service for safety and distress purposes in two small bands near 160 MHz (see also No. 287A, Spa 2 and Resolution Spa 2-5 of the Radio Regulations).

The band 406-406.1 MHz was also allocated to the mobile-satellite service for emergency position-indicating radio beacon systems.

The bands 43-48 GHz, 66-71 GHz, 95-101 GHz, 142-150 GHz, 190-200 GHz and 250-265 GHz were jointly allocated to the aeronautical and maritime satellite services.

3. Propagation

3.1 *Free-space attenuation*

Free-space conditions apply beyond the ionosphere and the power loss is then solely due to the divergence of the radiation. As shown in Report 205-2, the power loss of a link is a function of frequency, distance and the characteristics of the antennae at each end of the transmission link.

If an antenna can be provided on an aircraft or ship with a given effective area regardless of the frequency used, the received power available at the antenna will depend only on the e.i.r.p. of the satellite and the distance between the satellite and the aircraft or ship.

As the frequency increases, however, the beamwidth of the antenna decreases. Use of higher frequencies, therefore, raises greater problems in acquiring and tracking the satellite. Alternatively, if these problems cannot be solved, it may be necessary to increase the beamwidth of the antenna by reducing its effective area, thereby increasing the e.i.r.p. of the satellite needed at these higher frequencies.

3.2 *Tropospheric attenuation*

The upper end of the usable radio-frequency spectrum will be determined by the absorption caused by precipitation, clouds and gases in the atmosphere, although such absorption will not normally occur at the operational heights of aircraft. It will be necessary for systems to be viable for aircraft at all heights and so an upper frequency between 10 GHz and 20 GHz, as indicated in Report 205-2, is required to provide reliability under the worst conditions.

3.3 *Ionospheric attenuation*

The lower limit of the usable radio-frequency spectrum will be determined by ionospheric reflection and absorption which, in general, increase with decreasing frequency. For equatorial and temperate regions a lower frequency limit of about 70 MHz will assure penetration of the ionosphere without significant attenuation.

In addition to the diurnal and seasonal variations which occur in the ionosphere there are sporadic variations arising from variations in solar activity. These sporadic variations have the greatest effect in the auroral zones and must be allowed for in planning a service for a region which overlaps these zones.

In particular in these zones noticeable absorption can occur due to polar cap and auroral events; these two phenomena occur at random intervals, last for different periods of time and their effects are a function of the locations of the terminals and the elevation angle of the path. Therefore, for most effective system design these phenomena should be treated statistically, bearing in mind that the correlation times for auroral absorption are of the order of hours and for polar cap absorption are of the order of days.

Table I shows the southern limit of the northern auroral zone as a function of longitude. At some longitudes the auroral zone covers regions of the earth where an observer is within line-of-sight of a geostationary satellite.

TABLE I

Northern auroral zone

Longitude	Zone boundary (N-latitude) (degrees)	Northern limit of the principal North Atlantic flying zone (degrees)
45° E	80	
15° E	70	
15° W	65	58
30° W	62	62
45° W	60	62
60° W	58	58
90° W	57	
120° W	60	
150° W	70	

The values given in Table I are for broad guidance only. In most sectors there is a solar cycle change in position averaging about 3°, the zone being furthest south in solar maximum years. This boundary also changes with season and solar activity.

For aircraft or ship satellite links, with satellites in geostationary orbit, the shadow of the auroral absorbing zone will be displaced to the North by a maximum of 7° for angles of elevation of 5° and by a maximum of 3° for angles of elevation of 20°.

3.3.1 Auroral absorption

Auroral absorption is believed to be due to an enhancement of electron density in the lower ionosphere by the entry of energetic electrons following a solar disturbance and is one such sporadic source of attenuation. Auroral absorption tends to maximize in the morning hours [Hartz, 1968; Driatskiy, 1966]. Events are relatively short-lived, lasting up to a maximum of five or six hours, but with an average duration of about 30 minutes [Bellchambers *et al.*, 1955-1959, Hargreaves and Cowley, 1967]. Measurements have been made at 30 MHz [Hargreaves and Cowley, 1967] at 65 MHz [Little, 1954] and at 81.5 MHz [Little and Maxwell, 1952] but little information is available at higher frequencies. Assuming that the absorption is inversely proportional to the square of the frequency, calculations based on 7 400 hours of Kiruna riometer data [Piggott and Bellchambers] yielded the equivalent auroral zone maximum absorption at 127 MHz as shown in Table II. Thus, the effect appears to be of minor importance at VHF and will rapidly become negligible at higher frequencies. Moon-bounce experiments at 440 MHz yielded no measurable absorption [Ingalls *et al.*, 1961].

TABLE II

Auroral absorption at 127 MHz (Auroral zone maximum) (dB)

Percentage of the time	Angle of elevation		
	20°	10°	5°
0.1	1.0	1.6	2.1
1.0	0.6	0.9	1.2
2.0	0.5	0.7	0.9
5.0	0.3	0.5	0.7

3.3.2 Polar cap absorption

At high geomagnetic latitudes, greater than 64°, an infrequent source of attenuation is polar cap absorption (PCA) which is due mainly to the interaction of solar protons (energies greater than 10 MeV), with the lower ionosphere producing ionization at altitudes as low as 30 kilometres. A PCA event is long lasting and is invariably preceded by a major solar flare on or near the visible hemisphere of the sun; the delay time between flare and PCA onset varies between 20 minutes and several hours [Bailey and Harrington, 1962]. Unlike auroral absorption, which is largely confined to the auroral zones and shows a high correlation with the Earth's magnetic field, polar cap absorption covers the whole of the polar cap and is uncorrelated with magnetic activity [Davies, 1965; Ortner et al., 1962]. The absorption is constant within ±2 dB

throughout the sunlit portion of the polar cap but during night hours the absorption is significantly lower. The ratio depends mainly on solar zenith angle and is limited at night to about a fifth of a day value (in dB).

A list of confirmed principal PCA events over the period 1952 to 1963 (roughly one solar sunspot cycle) has been published [Bailey, 1964]. A principal event is defined as one which produces at least 2.5 dB absorption at 30 MHz vertical incidence. This is equivalent to 0.8 dB at 127 MHz for an elevation of 10° using an inverse frequency square law extrapolation.

The precise variation of absorption with frequency between 30 MHz and 127 MHz is difficult to establish as this will vary from one event to another due to variations in the energy spectrum of the incoming particles. It has been shown /Bennett and Rourke, 1967/ that deviations from an inverse frequency squared law can occur particularly at the edge of the polar cap. The distribution of riometer stations in the northern hemisphere is towards this edge and the PCA would be overestimated if inverse frequency square law data from these stations were used. Another consideration which should be noted is that riometer data do not include any correction for the effect due to a "pencil beam" so that riometer data would overestimate the absorption of a received satellite signal. A reasonable approximation for the extrapolation of 30 MHz riometer data for application to the absorption of a satellite signal at 127 MHz is to use the inverse frequency square law without "pencil beam" correction. This law has been used in the considerations which follow. However,due to the variations of electron density and collision frequency with height, further extrapolation of uncorrected absorption recorded on 30 MHz riometers to frequencies near 1600 MHz is not justified. Such theoretical considerations suggest that even for large PCA events the absorption would be very low at these frequencies.

Table III gives the number of hours per year of polar cap absorption at 30 MHz, during the last solar cycle, derived from Bailey's list. This covers the highest sunspot maximum so far recorded.

TABLE III

Year	1952- 1955	1956	1957	1958	1959	1960	1961	1962	1963
Hours of PCA Events : Amplitude $\geq$ 2.5 dB at 30 MHz	0	400	750	700	600	650	210	0	140
Smoothed Zurich sunspot number	6 to 38	142	190	188	160	114	55	38	28

Fig. 1 gives the number of PCA events, for two levels of absorption, which show the marked correlation of PCA events with years of high sunspot activity, particularly for the higher level events. The average number of events per year at high sunspot activity is approximately 8 for 0.8 dB events (127 MHz, 10° elevation) and approximately 3 for 3 dB events. An amplitude distribution of PCA events is given in Fig. 2 which shows the predominance of PCA events of small magnitude. The median duration of all events was 68 hours (standard deviation 31 hours) with a poor degree of correlation between absorption amplitude and event duration, although there is some evidence that the severest events last slightly longer.

In most events, recorded at stations where the day/night ratio is near unity, the absorption (measured in dB) normally decreases on the second day of the event to about half the maximum value of that on the first day and a further reduction by half is evident on the third day. Using this information and the event durations from the list established by Bailey and considering also a 12-hour day, Table IV has been constructed. The duration of the day within the polar cap can vary greatly depending on latitude and season.

TABLE IV

Number of hours of PCA for various levels (1952-1963)	
Absorption (dB) 127 MHz (10° elevation)	No. of hours
7 - 8	36
6 - 7	48
5 - 6	24
4 - 5	12
3 - 4	144
2 - 3	96
1 - 2	480

Thus, it is estimated that there was a total of 264 hours of absorption ≥ 3 dB (127 MHz 10° elevation) within the polar cap for the solar cycle 1952 - 1963.

Table IV and Fig. 2 suggest that PCA events have a bi-modal distribution.

It must be emphasized that polar cap absorption is an infrequent occurrence, particularly near sunspot minima, and that long-term percentages of absorption levels cannot be used to determine the effect on short-term system availability.

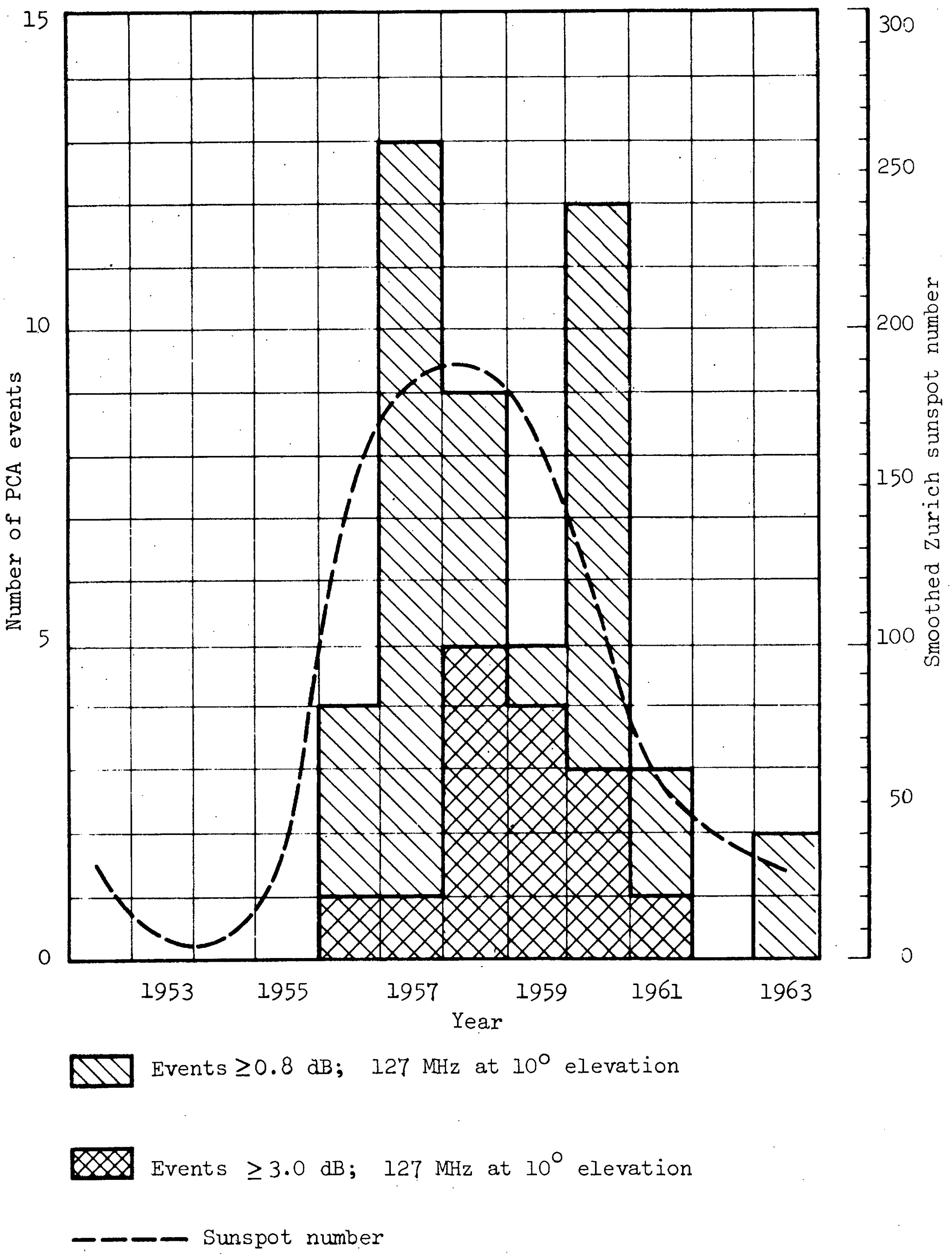


FIGURE 1

Distribution of number of PCA events 1952-1963 and sunspot number

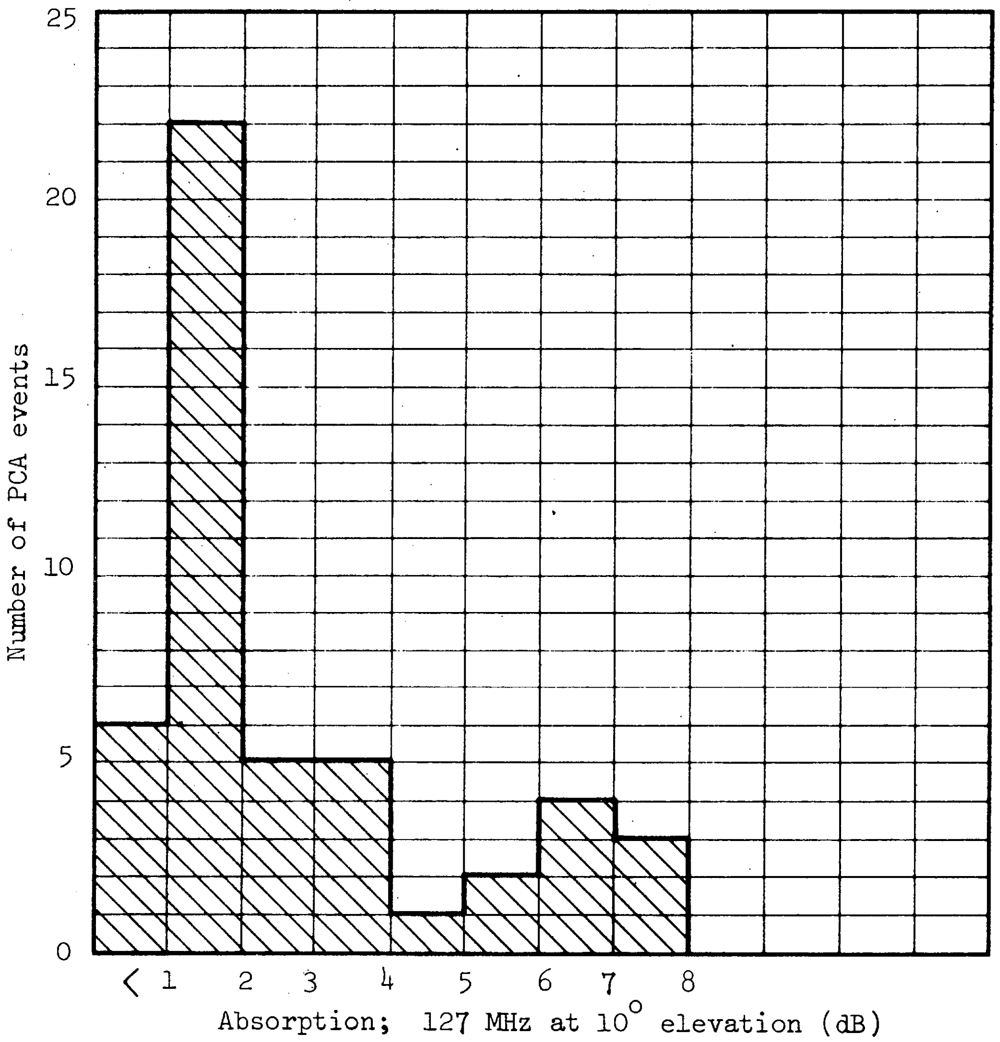


FIGURE 2

Distribution of amplitude of PCA events 1952-1963

3.4 Scintillation

Scintillations occur when radio waves pass through the ionosphere and significant irregularities of electron density are present. The consequent variations of refractive index give rise to variations of amplitude and phase. These fluctuations decrease as frequency is increased and depend upon path geometry, location, season, solar activity and local time. This dependence is discussed in a number of texts.

In equatorial and mid-latitude regions there is a marked diurnal variation, with increases in scintillation amplitude occurring around the local midnight hours, of several times the normal daylight values. Such diurnal variations are not evident in polar cap regions. However, the diurnal variation is evident at lower polar latitudes particularly during "quiet" periods.

A large amount of mid-latitude scintillation data has been extracted by the Communication Satellite Corporation /̅Schachne, 1970̲/̅ from INTELSAT II (F-3) 136 MHz telemetry recordings made by the U.S. Air Force Cambridge Research Laboratories at Hamilton, Massachusetts (latitude, 43° geographic, 53° geomagnetic). Fig. 3 shows the amplitude distribution extracted from 4103 hours of telemetry recording taken between May 1967 and February 1968. During this period the satellite elevation angle slowly changed from 13° to 10.5°. Fig. 3 also shows the amplitude distributions obtained when the twelve-hour periods centred on sub-satellite noon and midnight are analysed separately. At mid-latitudes, an inverse frequency squared relationship of fading depth, expressed in dB, is a useful approximation above 100 MHz. Table V is based on the INTELSAT II (F-3) measurements and assumes the inverse frequency squared relationship.

TABLE V

Distribution of mid-latitude fade depths due to ionospheric scintillation (dB)

Percentage of time (%)	Frequency (MHz)			
	100	200	500	1000
1.0	5.9	1.5	0.2	0.1
0.5	9.3	2.3	0.4	0.1
0.2	16.6	4.2	0.7	0.2
0.1	25.0	6.2	1.0	0.3

The data for fade duration obtained from the INTELSAT II (F-3) satellite are shown in Fig. 4.

In general, scintillation fade depths will be much greater in equatorial regions at night and at high latitudes, particularly at low elevation angles. Table VI shows the estimated maximum depths of fading at high latitudes.

TABLE VI

Estimated maximum depths of fading at high latitudes

Frequency (MHz)	100	200	500	1000	1500
Depth of fading (dB)	20	10	4	2	1.5

The extrapolation made in Table VI is based on an inverse frequency relationship. This frequency law was derived from simultaneous measurements at two different frequencies [I.C.A.O., 1971] and was then used to extrapolate VHF (136 MHz) data to other frequencies. Only a limited amount of data exists on depth of fading in high latitude regions. These were considered inadequate for determining the distribution of depths of fading and therefore maximum depths of fading only are given.

The maximum scintillation depth of fading in equatorial regions will be greater than in either mid-latitude or high-latitude regions. Only a limited amount of data exists for equatorial regions but simultaneous measurements at 136 and 1550 MHz [Golden] suggest that the law of frequency dependence lies between inverse frequency and inverse square root frequency. However, extrapolation of the limited equatorial VHF data which exists leads to depths of fading which are considerably less than those observed at 2.2 GHz [Christiansen, 1971] and at 4 and 6 GHz [Craft, 1971]. More data on depth of fading and its distribution are required for high latitude regions and particularly for equatorial regions before guidance similar to that in Table V can be given.

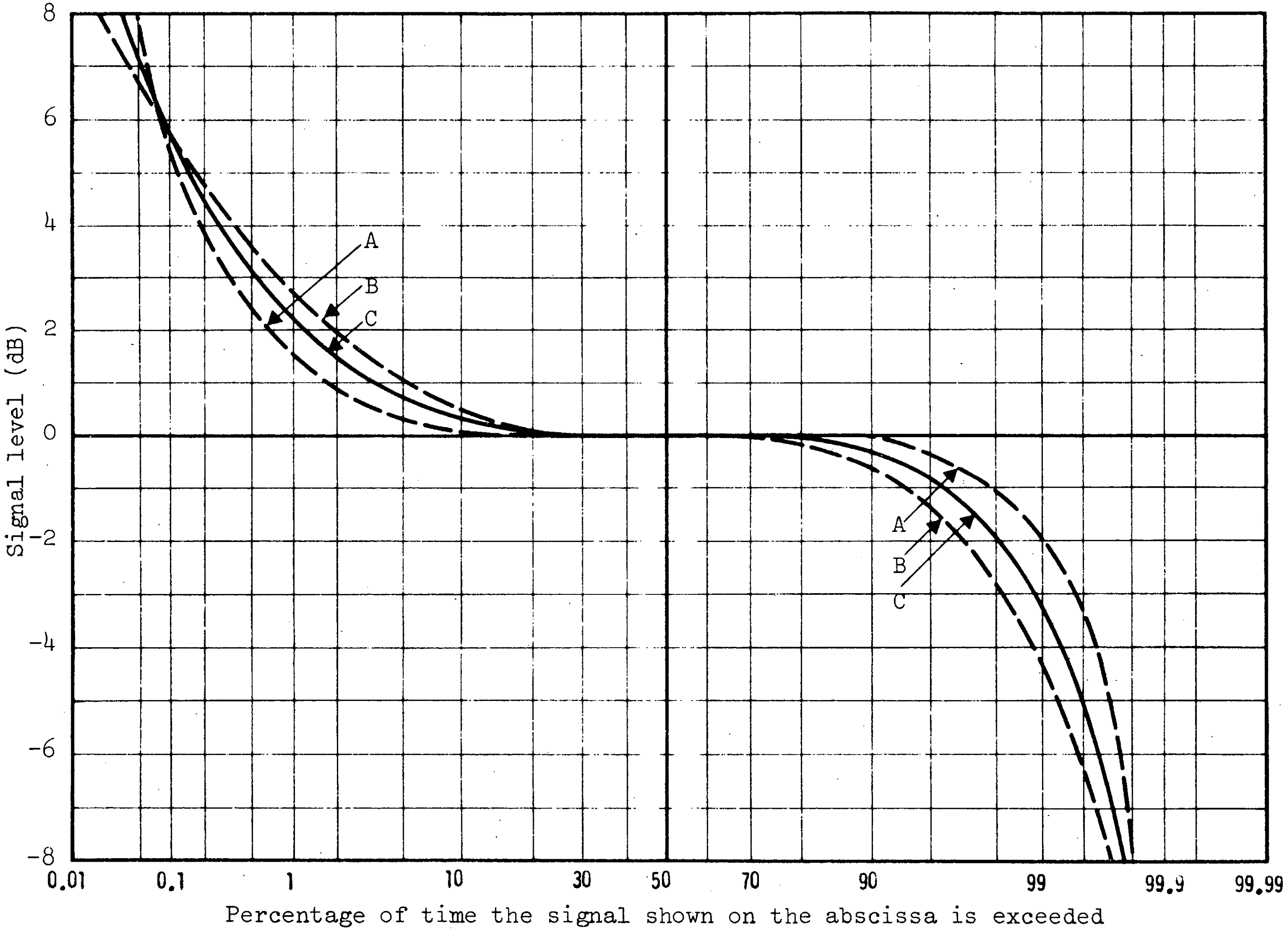


FIGURE 3

Ionospheric scintillation of Intelsat II VHF signal at mid-latitudes

A : Day

B : Night

C : Total 24 hour

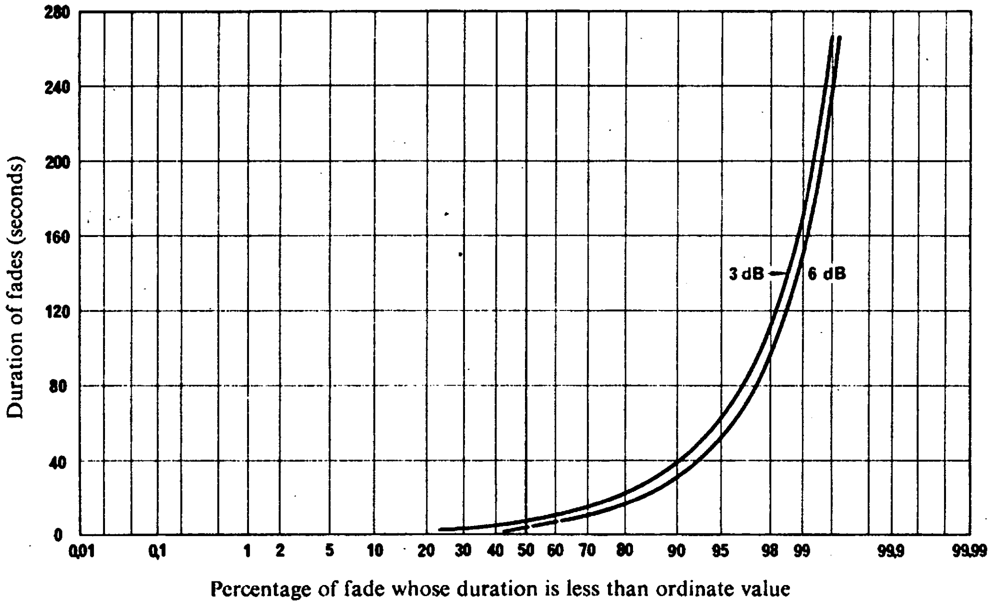


FIGURE 4

Distribution of duration of 3 dB and 6 dB fades due to ionospheric scintillation of INTELSAT II-F3

3.5 *Tropospheric ducting*

When meteorological conditions are such that a layer exists in the atmosphere in which the refraction index increases rapidly with height, radiation, originating in the layer at low angles of elevation, may be trapped and guided around the curved surface of the Earth. Under these conditions, abnormally good point-to-point ground communications are obtained at VHF, UHF and at microwave frequencies. This ducting also gives rise to severe interference from remotely sited co-channel stations.

A communication-satellite system may be severely affected under conditions of strong ducting, when transmissions from satellites at low angles of elevation may suffer complete refraction and never reach a receiver on the ground. However, in practice, it is believed that the angles of elevation of an operational aeronautical or maritime satellite system would be sufficiently large for this effect not to occur frequently.

3.6 *Multipath*

Signals travelling between aircraft/ships and satellites may travel by more than one path, the alternate paths being reflected. In such links the reflecting surface will usually be sea-water. The combination of both the direct and reflected signals may cause serious variation of the levels of received signal. Frequency dependence of this phenomenon is closely associated with the nature of the reflecting surface (ocean waves), as well as various other factors that are involved in the reflection, such as whether they are specular or diffuse. A theoretical discussion and experimental data on aircraft multipath effects are contained in Report 505.

3.7 *Other propagation factors*

3.7.1 *Faraday rotation*

Faraday rotation of the plane of polarization of a wave transmitted through the ionosphere is a consequence of the interaction of the Earth's magnetic field and the motion of the electrons in the ionosphere when excited by the transmitted wave. There are two distinct propagation velocities for the components of the polarized wave, one normal to and the other along the direction of the magnetic field component.

A linearly polarized wave, in passing through the ionosphere, undergoes a progressive rotation in the plane of polarization. The magnitude of the polarization rotation is dependent upon the total electron content over the propagation path; and changes as the electron content changes diurnally and with solar activity. Maximum rotation occurs during the day [Millman, 1958]. The total polarization rotation is proportional to the strength of the Earth's magnetic field, resolved along the direction of propagation. These propagation characteristics have the effect of causing fading between linearly polarized antennae. The total rotation experienced by the linearly polarized wave is inversely proportional to the square of the frequency [Lawrence _et al._, 1964] for quasi-longitudinal propagation.

The maximum change in polarization angle at 100 MHz can be of the order of 30 rotations but the effect of latitude and lower solar activity may reduce this by a factor of 2 or 3 [Garriott _et al._, 1970].

The avoidance of fading between linearly polarized antennae due to Faraday rotation, particularly at the lower frequencies, would require polarization tracking at the receive end of the link, a technique generally considered impractical for links between satellite and mobile stations. Therefore a circularly polarized antenna must be used on at least one end of the satellite-to-mobile link. A link between a linearly polarized and a circularly polarized antenna would produce a constant 3 dB loss compared to an ideal link with matched polarizations (e.g. circular-to-circular). Perfect circular polarization is usually not achievable in practical antenna designs so that on actual links some signal fluctuation will be observed due to Faraday rotation, the amplitude of which will be dependent upon the axial ratio (degree of polarization ellipticity) of the antennae.

Also to be taken into account when computing the effect of multipath from reflection at the Earth's surface is the fact that the axial ratio of an incident elliptically polarized wave may be increased or decreased upon reflection (particularly at small angles) since Faraday rotation varies the orientation of the principal polarization axis of the incident wave. This results from the difference in reflection coefficient to be expected between vertical and horizontal components in most multipath situations.

The effects of Faraday rotation on wideband signals can be of significance to system performance. When observed on a linearly polarized antenna the differential rotation effects cannot be corrected by reorientation of the antenna axis. On circularly polarized antennae, the effect is to introduce differential phase shifts of signal components across the band. Thus the effects of Faraday rotation for signal components separated in frequency may be expected to be subject to frequency and phase selective distortion. The total Faraday rotation observed with signals at 136 MHz indicates that this effect will not impose a serious limitation on the RF bandwidth of a narrow-band VHF satellite system.

3.7.2 *Dispersion*

Dispersion refers to the non-linear dependence of phase velocity with frequency in a transmission medium. The ionosphere is such a medium. The principal effects of dispersion are those produced on modulated signals. Transmission through the ionosphere results in signal distortion with a corresponding decrease in effective signal-to-noise ratio. In the lower VHF range it may be necessary to limit the design of systems to relatively narrow transmission bandwidths if this type of selective distortion is to be avoided /Staras, 1961/.

4. Noise

A major factor in the choice of an optimum frequency band is the distribution of background radio noise. This noise arises by radiation from :

— natural terrestrial and extra-terrestrial sources;
— the absorbing atmosphere of the Earth;
— electrical equipment.

The information presented in Report AJ/8(Doc. 8/114, 1970-1973) on Noise gives an indication of the possible noise contributions from these sources, both at VHF and UHF.

5. Antenna considerations

A number of constraints exist when designing and installing antennae on board both aircraft and ships. A principal constraint when choosing the frequency of a system is the physical size of the antenna. An antenna of a given physical area gives a beamwidth which is inversely proportional to frequency. If antenna stabilization and/or steering requirements are to be minimized, antennae with relatively broad beamwidth should be used, but this will mean a lower antenna gain. However, as shown in the preceding sections, other system factors which are frequency dependent will affect the required antenna effective area and there will be a frequency where the satellite power per channel is a minimum for a given effective area of the antenna of the mobile vehicle.

For the case of a fixed beamwidth of the satellite antenna and a fixed physical area of mobile vehicle antenna, the link loss, under free-space conditions, is independent of frequency (Report 205-2). The transmission frequency should then be chosen in the light of the considerations in §§ 3.2 to 4 inclusive, taking into account the design requirements and practicability of the satellite antenna and the practicability of stabilizing and/or steering the mobile vehicle antennae.

A theoretical discussion and experimental data on antennae are contained in Report AM/8 (Doc. 8/121, 1970-1973).

6. Summary and conclusions

Considerations of tropospheric and ionospheric attenuation indicate that an aeronautical or maritime satellite service which does not involve propagation across an auroral zone could operate in a frequency band lying between about 70 MHz at the lower end and between 10 and 20 GHz at the upper end. **The required system power margins will be dominated at the lower frequencies by ionospheric effects and at the higher frequencies by clouds, gases and precipitation in the lower atmosphere.**

The degrading effects of scintillation are statistical in nature and do not necessarily demand full excess power margins in order to produce a viable system.

Considerations of background noise generally indicate that, within the band determined above, minimum noise temperatures should be achievable in the UHF bands for the link satellite-to-aircraft or ship. The choice of frequency for the link aircraft/ship-to-satellite is not very dependent on noise considerations.

Assuming that aircraft and ships use antennae of constant effective areas (apertures) regardless of frequency, it would appear, on the basis of current knowledge of propagation and noise, that higher frequencies would be preferable to VHF frequencies for the satellite-to-aircraft/ship links of an aeronautical/maritime **mobile** satellite system. However, the use of higher frequencies could present practical antenna steering and installation difficulties but studies and developments are under way to solve such problems.

Finally, there are other considerations which must be taken into account, such as airborne and shipborne antenna design, satellite power per channel, geographical location of the area to be served, modulation techniques, and the satellite orbits used. Some of these considerations will in turn be affected by the type of traffic carried by the system, e.g. voice or data.

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C.C.I.R.
XIIIth Plenary Assembly
Geneva, 1974

Doc. 8/1037-E

STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration :

REPORT 507(Rev.74)

TECHNICAL CHARACTERISTICS OF SYSTEMS PROVIDING COMMUNICATION AND/OR RADIODETERMINATION USING SATELLITE TECHNIQUES FOR AIRCRAFT AND/OR SHIPS

Technical feasibility of systems employing space communication techniques jointly for communication and radiodetermination purposes

(Study Programme 17A/8)

(1970-1974)

1. Introduction

In partial response to Study Programme 17A/8, this Report describes several methods of employing a satellite jointly for radiodetermination and communication purposes in the form of speech or digital data transmission or of transmissions associated with access and system organization. The use of a single system, with frequency sharing or multiplexing of these various functions by time or frequency division may provide several economic **benefits.** The use of a single system with frequency sharing for both satellite communication and satellite radiodetermination applications provides several economic benefits. First, there are potential savings in the cost of the space segment, since fewer satellites are required if the system is shared. Second, a considerable reduction in user equipment costs may be achieved through the use of a common antenna and, in some cases, receiver, for both the communication and radiodetermination functions. In addition, there is an overall reduction in weight, both in the satellite and user equipment brought about through the shared use of equipment. The use of a single system could also result in more economical use of the frequency spectrum.

The technology required for the joint use of the same satellite for communication and radiodetermination has already been demonstrated in experiments with the United States ATS-1 and ATS-3 Applications Technology Satellites [Anderson, 1969]. The techniques employed in these experiments, and other techniques that have been proposed, are described in this document along with satellite design and system considerations.

2. General system characteristics

The use of communication and radiodetermination signals through the same satellite repeater or transponder implies that the signals are located in the same frequency band. In general, a radiodetermination signal can be designed to occupy a bandwidth comparable to a voice or data signal, and can require less satellite equivalent isotropic radiated power (e.i.r.p.) than a voice signal. The bandwidth of a radiodetermination signal is a function of the accuracy of position determination (the better the required accuracy, the larger the bandwidth). The accuracy of position determination and speed of acquisition of the radiodetermination signal by the receiver are both functions of the satellite e.i.r.p., since they both increase with increasing signal-to-noise ratio. Furthermore, a longer access time allowance increases the accuracy of position determination because of the longer integration times possible.

The satellite repeater or transponder for relaying the voice, data and radiodetermination signals can provide a single relatively wideband channel by combining these signals on a single carrier or on separate channels with individual gain control or level limiting. The latter method can create difficult filter design requirements in the repeater. On the other hand, this approach has the advantage that the share of the total available transmitter power allotted to each carrier can be individually controlled. Consequently, the correct balance of satellite e.i.r.p. for the voice, data, and radiodetermination carriers can be obtained.

Because of Doppler effects, plus transmit and receive carrier frequency instabilities that are inherent to any system, the required repeater bandwidth for a voice channel can range from about 15 to 50 kHz. For a data channel of 1200 to 2400 bits per second, a repeater bandwidth of 10 to 50 kHz can be expected. For high accuracy radiodetermination (0·01 to 0·1 km), repeater bandwidths ranging from 50 kHz to 2 MHz or more are required.

3. Narrow-band satellite techniques

Several narrow-band satellite techniques have been proposed for radiodetermination applications. One suggested method / Mitchell et al., 1968 / is based on the use of phase difference measurements made on several tones which modulate the carrier. The phase delay of each tone is measured either by the user or by a ground terminal.

Narrow-band satellite communication and radiodetermination techniques have been tested experimentally using the United States ATS-1 and ATS-3 Applications Technology Satellites. The VHF repeaters of the satellites used for these tests employed an up-link frequency of 149.22 MHz and a down-link frequency of 135.6 MHz. While the techniques may be used in other radio-frequency bands, one of the objectives of the experiments has been to determine the usefulness of a VHF communication repeater for radiodetermination purposes.

In the radiodetermination experiments, a tone-code ranging signal is used consisting of a 0.4 second transmission of a 2.4414 kHz tone followed immediately by a 30-bit digital address code transmission lasting approximately 12 milliseconds / Anderson, 1969 /. The address code is formed by transmitting an audio cycle for a digital "one" and suppressing a cycle for a "zero". Alternatively, phase shift keying could be used for the code. The bandwidth of the modulating signal is within the 2.5 kHz audio bandwidth commonly used for mobile communication, except during the 12-millisecond code transmission when components up to 4 kHz are present. The signal repetition rate can be established at the option of the system designer.

Standard deviations of independent range measurements through the ATS-3 satellite are typically 0.32 microsecond, 1 sigma, representing ± 50 m (60 feet) in two-way ranging.

The radio determination experiments were extended to the band 1500-1600 MHz using the ATS-5 satellite. The tone-code ranging signal consisted of a 0.027 second transmission of a 9.7656 kHz tone followed immediately by a 30-bit digital address code whose transmission required approximately 3 milliseconds. The radio frequency bandwidth was less than 60 kHz. An independent range measurement was made during each "window"* of the spinning ATS-5 satellite. The standard deviation of the range measurements as a function of signal-to-noise ratio in the 60 kHz bandwidth were:

Signal-to-noise	Standard deviation	Two-way range precision
14 dB	0.10 microsecond	± 16 m (50 feet)
11 dB	0.14 microsecond	± 23 m (70 feet)
6 dB	0.24 microsecond	± 40 m (120 feet)

The transmissions were synchronized to the "window" of the spinning ATS-5 satellite with one independent range measurements being made in each "window".

Averages of ten and one hundred independent range measurements were used to simulate longer signal averaging times. The standard deviation of the ten measurement averages was approximately 0.04 microsecond, and approximately 0.01 microsecond for the one hundred measurement averages. This data confirmed the expectation that ranging precision improves as the square root of signal duration.

The ATS-1 and ATS-3 experiments have employed both aircraft and ships for communication and radiodetermination test purposes. During these tests, the standard deviation of the range measurements from the two satellites to the mobile terminals has measured less than three microseconds for 95% of the time; however, the absolute range measurements may have been subject to bias errors due to ionospheric retardation (see Report 515).

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* Note.- "Window" : that part of the satellite rotational period during which the narrow satellite antenna beam illuminates the Earth.

Plans have been made to perform ranging experiments with quadraphase phase-shift keying in place of the frequency modulation of a carrier with a tone. The keying rate will be 9.7656 kHz. Four phase transmission will permit digital transmissions at rates of 19.3/N kbps where N is the number of transmission lists per information bit.

The shaping of the carrier's phase transitions by a raised cosine waveform will permit the transmission of signal within a 20 kHz RF bandwidth The phase of the basic keying frequency will be derived from the received signal and it is expected that the ranging precision observed in the tests that have been performed in the band 1500-1600 MHz with ATS-5 will be achieved.

4. Medium or wideband satellite emissions*

4.1 Spread spectrum techniques

Wideband techniques have been studied /Blasbalg et al., 1968; D'Antonio and Gaffney, 1968/ that employ spread spectrum multiple access modulation techniques, where pseudo-random sequences are used to spread the spectrum of the information. A satellite system which uses a simple limiting repeater, with all of the signals simultaneously occupying the full bandwidth of the repeater, might require bandwidths ranging from one to two per cent and operate in the 100 MHz to 5 GHz frequency range.

The radiodetermination signal might be generated in two ways. In the first way a ground terminal would transmit a repetitive pseudo-random sequence which would be relayed via a satellite hard-limiting repeater to the user being addressed, and detected with a matched filter. The user would then retransmit to the satellite the same pseudo-random sequence after a known time delay from the detection time. The ground station would detect the retransmitted signal in the same manner as the user equipment. The total two-way range may then be determined from the total time delay. Since the ranging error is inversely proportional to the bandwidth, the spread spectrum method, which utilizes the total bandwidth of the system, can provide an accuracy fully equivalent to a CW tone ranging system.

A second method of system operation is to employ several satellites which emit pseudo-random sequences in time synchronism. The users in the system must have the capability of detecting the pseudo-random sequence from each of the satellites and make time difference measurements to determine the difference in the ranges to the satellites.

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* For the satellite communication and satellite radiodetermination bands for use with aircraft and ships, it was thought useful to distinguish between narrow bands of emission which will be no greater than required for transmission of a telephone channel, medium bands which will occupy the equivalent of more than one voice transmission channel and widebands which will occupy the equivalent of many more telephone channels than are considered for the medium bands.

The communication in each method can also be performed by using a pseudo-random sequence to spread the spectrum of digitized voice or data. Each of the users has access to the satellite simultaneously with each signal occupying the total bandwidth of the repeater. Addressing is accomplished by the assignment of a unique pseudo-random sequence for each of the users. Information transmitted to a user via the satellite is detected with a matched filter technique.

Wideband spread spectrum techniques have the advantage of simultaneous access to the system by all the users, as well as narrow-band interference rejection. However, these techniques have the disadvantage that the user's signal-to-noise ratio generally decreases with the number of simultaneous users. Additionally, at VHF, spread spectrum techniques may present difficulties at high latitudes due to the effect of large-scale ionospheric irregularities which produce fading (see Report 504).

4.2 Multiplexing techniques

Techniques to combine voice, data and radiodetermination signals have been studied in France for aircraft /Manuali, 1969/ and also for aircraft and ships /Manuali, 1971/. If time-division multiplexing is employed, the combination can be achieved most readily if the voice signals are transmitted in binary digital form. This can result in a more economical use of the spectrum, increased efficiency in the satellite repeater and the possibility of using a single receiver in the vehicle to receive all the desired signals. Multiplexing also permits interrogation and data signals to be sent simultaneously to all the mobile terminals and this may lead to improved efficiency in an operational system. Moreover, if the signals are multiplexed and transmitted at rates of the order of several tens of kilobits per second, high precision radiodetermination may be achieved.

Frequency-division multiplexing can also be employed to combine the signals. In this case the data and radiodetermination signals can be transmitted as modulated sub-carriers simultaneously with analogue voice signals. Upon reception, the combined signals can be separated by appropriate bandpass filtering.

Code division multiplexing permits the simultaneous use of a channel by a number of users provided that the transmission channel has a linear characteristic and that each user transmits digital data at a rate which is an integral fraction, 1/N of the maximum bit rate of the channel. Each digital bit from a user is transmitted as an address code, N bits long. A digital one may be transmitted with the code in one phase and a digital zero with the code in the opposite phase. At the receiving station a correlator for each address separates the individual messages from the composite signal.

5. Conclusions

5.1 Radiodetermination by means of signals transmitted from earth satellites can be accomplished, whether or not multiplexed with telecommunications, through the use of narrow band, medium band or wideband techniques.

5.2 Experiments employing satellite communication repeaters in the VHF band have demonstrated that radiodetermination techniques can use a commun communication channel. Channel occupancy times of the order of 0.4 second have been demonstrated with ATS-1 and ATS-3 at VHF, and the order of 0.03 second with ATS-5 in the band 1500-1600 MHz.

Other ground-stratospheric balloon-aircraft experiments carried out in the band 1540 to 1660 MHz have shown that medium-band techniques using time division multiplex can be used for the simultaneous transmission of several functions on the same carrier frequency. For example, in the balloon-aircraft tests conducted in France in September 1970, a standard deviation of 50 m was obtained, on an angle of elevation of 10°, for the distance measurement made using a pseudo-random code.

5.3 Fundamentally, the precision of radiodetermination is a function of:

a) signal-to-noise ratio and hence the e.i.r.p. of the satellite and the mobile station;

b) the bandwidth, being higher for wider bandwidths at a given S/N ratio;

c) the integration time, being proportional to the square root of that time.

Precision is also affected by the efficiency of the measuring technique and also by bias errors, of which the following are the most important: -

i) satellite position errors;
ii) equipment time delay errors;
iii) signal multipath;
iv) variation in propagation velocities through the ionosphere.

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STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration:

REPORT 509 (Rev.74)

SIGNAL QUALITY AND MODULATION TECHNIQUES FOR RADIOCOMMUNICATION AND RADIODETERMINATION SATELLITE SERVICES FOR AIRCRAFT AND SHIPS

(Study Programme 17A/8)

(1970-1974)

1. Introduction

This Report contains, in §§ 2 and 3, a discussion of the signal quality specifications and the power efficiency characteristics of various voice and digital data modulation techniques for radiocommunication services by space techniques for aircraft and ships. It can be shown that if a system is designed to accommodate voice links, sufficient power would be available in that system to accomplish data transfer at rates of about 3 kilobits/second.

The parameter used for specifying link conditions will be the carrier-to-noise density ratio, denoted C/No. The statistical distribution of C/No will be part of the argument in selecting an optimum modulation technique. It should be noted that, unlike carrier-to-noise ratio, carrier-to-noise density ratio is independent of the RF bandwidth occupied.

In §§ 4 to 6 a review is given of several existing and proposed modulation techniques for radiodetermination based on distance, distance-rate and angle measurements performed from satellites. The techniques are discussed in terms of principles of operation, satellite power efficiency, multipath immunity, and complexity in implementation. The essential characteristics of these techniques are summarized in § 4.

The basic methods of using satellites for radiodetermination are described in Report 216-2.

The criteria for selection of a suitable modulation technique will, in general, include the energy efficiency, bandwidth utilization, fix rate potential, compatibility with communications requirement, accuracy potential, effects of propagation, and equipment complexity, cost and reliability.

2. Voice communications

2.1 Voice channel signal quality

The basic goal of a voice communications service for aeronautical and maritime traffic and operational control is to convey an adequate level of message intelligibility with very high reliability. A level of intelligibility, coupled with high reliability which eliminates the need for repeats and permits a higher word rate to be employed, would be advantageous. Furthermore, in an aeronautical satellite communications service, it is likely that the routine pilot/controller messages will be carried on data channels leaving voice communications for non-routine and emergency use only. Thus it is extremely important to determine accurately the minimum required signal quality for each type of service. In addition because communication is a statistical process, the channel quality should be specified for more than one design point.

Note : Reference should also be made to Report AP/8. Differences between the results of these two reports need resolution.

Intelligibility in a speech circuit has been measured by the percentage of correctly received monosyllabic nonsense words in an uncorrelated sequence by trained test crews. A modified rhyme test (MRT) has been designed to evaluate the intelligibility of a communications system using both untrained talkers and listeners. The use of standard procedures and vocabulary in Air Traffic Control (ATC) contribute substantially to obtaining adequate intelligibility particularly during routine communications. An ATC message text was used to estimate the worst case condition that experienced users could utilize for a communication transaction and the MRT was used for the inexperienced user. /̲ Obrien & Busch 1969_/.

The articulation index (AI) of a speech circuit indicates the effective proportion of an ideal voice channel (with respect to intelligibility) which that circuit will provide under the given signal and noise conditions. /̲ Beranek, 1947_/. The audio band is unequally divided into 20 segments, each of which contributes equally to the intelligibility of speech. This contribution is independent of what happens in other segments. To achieve an AI of 1.0, a signal-to-noise ratio of 30 dB must be provided in each of the segments i.e. each contributes 5 percent of the articulation index when the speech spectrum is not masked by noise and is sufficiently loud to be above the threshold of audibility. Noise density may or may not be constant over the audio base band so the effect in each segment will vary.

The relationship between AI and intelligibility obtained from subjective talker/listener intelligibility test scores for MRT and ATC message texts is shown in Fig. 1 / Obrien and Busch 1969 /. It is known that when messages depart from routine, requests for repeats from both aircraft and ground stations sometimes occur. It is believed that the MRT vocabulary is more representative for non-routine and emergency messages than ATC message texts. However, it could be argued that other test vocabularies are more appropriate. Taking the MRT vocabulary as an example, an Articulation Index of 0.6 would provide a word intelligibility of 90%.

In situations where there is high acoustical noise as in some aircraft due to the noise level on the flight deck, the microphone should be positioned close to the lips to maintain an adequate and reasonably constant noise level. The background noise limits the amount of speech processing which can be employed without introducing bursts of noise between words. The degree of speech clipping, baseband truncation and acoustical noise levels should be taken into account when calculating or measuring the intelligibility of a voice channel.

The above assumes that it is the intelligibility of speech rather than the flawless reproduction or fidelity of speech that is of prime importance in mobile communications. Sufficient realism in the speech sounds as received by the ear is an important factor in determining the acceptability of the signal quality of a communications service, particularly for public correspondence. Even if the message content is intelligible the degree of fidelity in speech reproduction may be unacceptable. Even for services intended for use between experienced operators, the fidelity of speech reproduction should be considered in addition to intelligibility because a harsh, distorted form of speech can rapidly cause listener fatigue. The effect of distortion in speech by the transmission medium in the presence of noise when using certain modulation techniques has not yet been investigated sufficiently to enable it to be included quantitatively in the factors affecting either high grade communications or threshold performance.

2.2 Analogue voice modulation techniques

Both frequency modulation (FM) and single sideband (SSB) have the potential for providing the aforementioned voice communications channel signal quality at reasonable expenditures of satellite power. Other factors, such as aircraft or ship equipment complexity, reliability and cost will probably bear heavily on the choice of modulation scheme.

The design parameters of an FM voice communications system which has been optimized to operate above receiver threshold and provide an articulation index of 0.6 with the minimum total signal power is as follows:

— direct carrier NBFM;

— audiofiltering 200-3000 Hz;

— no pre-emphasis;

— clipping such that the peak-to-r.m.s. ratio of the modulating wave form is 6 dB;

— radio-frequency bandwidth of 10 kHz;

— use of phase-locked demodulator with threshold extension.

A reduction of the baseband signal to 2 kHz bandwidth and use of a 5 kHz radio-frequency bandwidth improves the intelligibility slightly for the condition of very weak signal levels; however, the upper band of articulation index achievable will be less than that achievable by wider base bandwidth systems. Correspondingly, an increase of radio-frequency bandwidth to 18 kHz lowers performance under marginal signal conditions but yields a higher level of articulation index when exceeding receiver threshold. The phase-locked demodulator is slightly more complex than the conventional frequency-modulation discriminator; however, a significant advantage of 4 dB in threshold level is obtained. In the near future, the phase-locked demodulator will require a very small additional investment. For a frequency-modulation system, power levels in the satellite must be such that the system operates above the receiver threshold most (e.g. >95%) of the time.

At lower articulation indices (<0.5), the FRENA (Frequency and Amplitude) technique /de Jager and Greefkes, 1958/, which transmits an infinitely clipped SSB signal and a low frequency replica of the voice signal's amplitude variations, is more power efficient than NBFM; however, it cannot achieve the high AI's that are possible with NBFM or SSB. The transmitted spectrum occupies a radio-frequency bandwidth of 3 kHz.

An SSB system designed to provide the highest articulation index for any given signal power would have the following parameters:

— 6 dB per octave pre-emphasis above 800 Hz in baseband;

— 5 kHz baseband truncation;

— radio-frequency clipping with a peak-to-r.m.s. ratio of 6 dB.

Reducing the base bandwidth would require additional power in order to produce any given articulation index. For SSB operation, it is noted that clipping of the radio-frequency signal introduces significantly less distortion than clipping of the baseband signal.

2.3 *Comparison of analogue modulation technique performance*

The relation between articulation index and signal-to-noise density at the receiver is shown in Fig. 2 for various modulation techniques. For example, for the condition of a peak power limited satellite and a signal-to-noise density of 46 dB Hz, it is noted that SSB yields an articulation index of 0.43 and that FM using bandwidth of 8 kHz and 18 kHz yield articulation indices of 0.53 and 0.57, respectively. This C/N_0 is 1 dB above the threshold value for an 8 kHz system and is 3 dB below threshold point of an 18 kHz system. A signal-to-noise density of 49 dB Hz yields articulation indices of 0.52 for SSB, 0.60 for 8 kHz FM and 0.68 for 18 kHz FM, and is above threshold in both of these frequency-modulation systems.

The results shown are based upon a theoretical analysis of data generated by tests with the English language.

In addition to voice quality and satellite radiated power requirements other factors must be considered before selecting the modulation technique. Some of these factors are: current user equipment, spectrum requirements, effects of oscillator instabilities and Doppler shifts, system reliability and costs.

2.4 Comparison of digital voice transmissions by delta modulation and pulse code modulation techniques / Tomozawa and Kaneko, 1968; de Jager and Greefkes, 1968 /.

The transmission of voice by digital techniques could employ pulse code modulation (PCM) using an 8 kHz sampling rate and 16 quantization levels. This system would deliver a maximum sinusoidal signal to quantization noise ratio of approximately 26.5 dB in a 300-3 400 Hz audio bandwidth.

The system requires a data rate of 32 kbit/s which can be accommodated in an RF bandwidth of 32 kHz assuming 2-phase coherent phase shift keying (PSK). An error rate of better than 10^{-3} would probably be required, requiring a predetection carrier-to-noise ratio of 7 dB which corresponds to a 52 dB-Hz carrier-to-noise density ratio in the 32 kHz bandwidth.

A delta modulation system could also be employed. At bit rates less than 50 kbit/s, delta modulation provides a higher signal-to-quantization distortion ratio than an equivalent rate PCM system. For example, delta modulation operating at 18 kbit/s can deliver a sinusoidal signal-to-quantization noise of approximately 22 dB in a 300-3 400 Hz bandwidth. Such a system could employ PSK modulation, requiring only 18 kHz RF bandwidth.

4-phase coherent PSK modulation could also be used, requiring a pre-detection carrier-to-noise ratio of approximately 10 dB, but having an RF bandwidth half that of a 2-phase system.

It is to be noted that :

- At the data rate of 18 kbit/s and with an infinite pre-detection signal-to-noise ratio, delta modulation provides a SNR after decoding which is 5 dB better than PCM;
- delta modulation has the advantage of tolerating higher rates of transmission error than PCM, thus, for the same data rate, the carrier-to-noise density can be slightly reduced.

3. Digital modulation

The implementation of a digital data link provides an efficient means for the transfer of position reports, maintenance data, and other record messages [Cahn, 1959; Shaft, 1962; Becker and Lawton, 1958]. The use of this link would off-load a significant amount of communications time from the normal voice links.

3.1 *Compatibility with voice channel*

In order to minimize the overall aeronautical/maritime satellite service costs and to provide a maximum of operational flexibility, it is desirable that the basic system be capable of interchanging either digital data or voice modes in a typical voice channel and that common hardware be utilized.

3.2 *The human-machine interface problem*

Alphanumeric digital communication, such as via direct printing radio telegraph, can convey information to humans at nearly the same rate as voice, but through a much narrower bandwidth. Conversely a much higher rate of information may be contained in the same bandwidth.

Machines, such as digital data systems, cannot always interpret these human language alphanumeric messages. For this reason, it becomes necessary for the operator to translate his message into machine language or for this to be done after reception. Various coding (or " canned message ") systems have been proposed with the objective of originating the human's message in machine language as all or part of a relatively short binary number. These systems range from the use of a simple pushbutton for each possible message to sequentially coded techniques capable of providing a high degree of message flexibility with a corresponding degree of compression.

These sequential techniques generate binary numbers in which the meanings of digits depend on their location in the number, according to the format of the selected message. Any stored data such as the transmitting craft's identity and any pertinent instrument data can be entered automatically, so only the human information need be entered manually, in the code and sequence appropriate to the message format. The element of message information associated with any given key is changed in a manner depending on the sequential order in which the keys are actuated. Keyboards exist which facilitate this entry by providing for sequential change of key designations. These changes may be accomplished by projection by a key-tape transport mechanism or by any other suitable means.

3.3 *Link capacity and quality*

The relationship between data rate and data quality may be adjusted in order to take maximum advantage of the specific link signal strength for particular applications. A nominal bit error probability of one in 10^5 bits may be used as a design goal for a typical application [U.S. Techn.Comm.]. Error correction codes may be employed if higher data quality is desired for a particular data service.

It is anticipated that the total data load to be relayed from mobile craft to ground based terminals may be significantly larger than the reverse path. It is also important to note that the technical and economic constraints which limit the selection of equipment for the relatively few earth terminals are much less severe than those limiting the implementation in the great number of mobile craft.

3.4 *Digital data modulation techniques*

The most efficient of the angle modulation techniques is coherent detection of direct carrier phase shift keying (bi-phase PSK); however, this approach requires relatively complex AFC tracking because there is no strong radio-frequency carrier signal. In order to maintain coherent reception, either a " times-two loop " or an " in-phase quadrature loop " is required, and resynchronization must be accomplished if modulation is not continuous. Some carrier power can be transmitted continuously if the modulation index is reduced. This reduces the link efficiency by about 1·7 dB, but would alleviate the AFC tracking problem.

The use of differentially coherent PSK also alleviates the problems associated with coherent synchronization; however, it is about 0·6 dB less efficient than bi-phase PSK when compared at a bit error rate of 10^{-5}.

The subcarrier PSK (PSK/PM) technique provides a radio-frequency carrier signal component which can be continuously tracked by all users. However, this method requires twice the bandwidth of the previously described techniques and the link efficiency is about 1·7 dB below that of coherent PSK.

The use of direct carrier frequency shift keying (FSK) would permit data to be time division multiplexed with FM voice and would enable common modulator/demodulator equipment to be utilized. However, this technique is 2·6 dB less efficient than bi-phase PSK. Predetection IF bandwidths on the order of the bit rate can be employed because of the unique nature of the FSK spectrum /Link and Eatough, 1962/.

The use of subcarrier FSK (FSK/PM) would reduce the time required for initial acquisition and would provide continuous synchronization. This technique requires twice the spectrum of PSK and two demodulators in the receiver.

A comparison of the characteristics of candidate digital data modulation techniques is given in Table I. In addition to spectrum and power efficiency, other factors must also be considered before selecting the modulation technique. Some of these are: current user equipment, compatibility with voice equipment, propagation effects, and system costs.

TABLE I

Comparison of data modulation techniques

Characteristics	Digital data modulation techniques					
	Coherent detection PSK (bi-phase)	Differentially coherent PSK	PSK with carrier	Subcarrier PSK/PM	FSK (PCM/FM)	Subcarrier FSK/PM
Communications efficiency: Required C/N_0 for 600 bit./s with b.e.p. = 10^{-5} (dB-Hz)	38·0	38·6	39·7	39·7	40·6	42·3
Data capacity: Max. data rate for b.e.p. = 10^{-5} and C/N_0 = 45 dB-Hz (bit /s)	3000	2600	2100	2100	1700	1100
Relative amount of spectrum occupied by transmitted signal	2 Hz/bit/s	2 Hz/bit/s	2 Hz/bit/s	4 Hz/bit/s	2 Hz/bit/s	4 Hz/bit/s
Equipment complexity: Transmitter Receiver	 Minimum Significant	 Slight Significant	 Minimum Moderate	 Slight Moderate	 Minimum Minimum	 Slight Slight

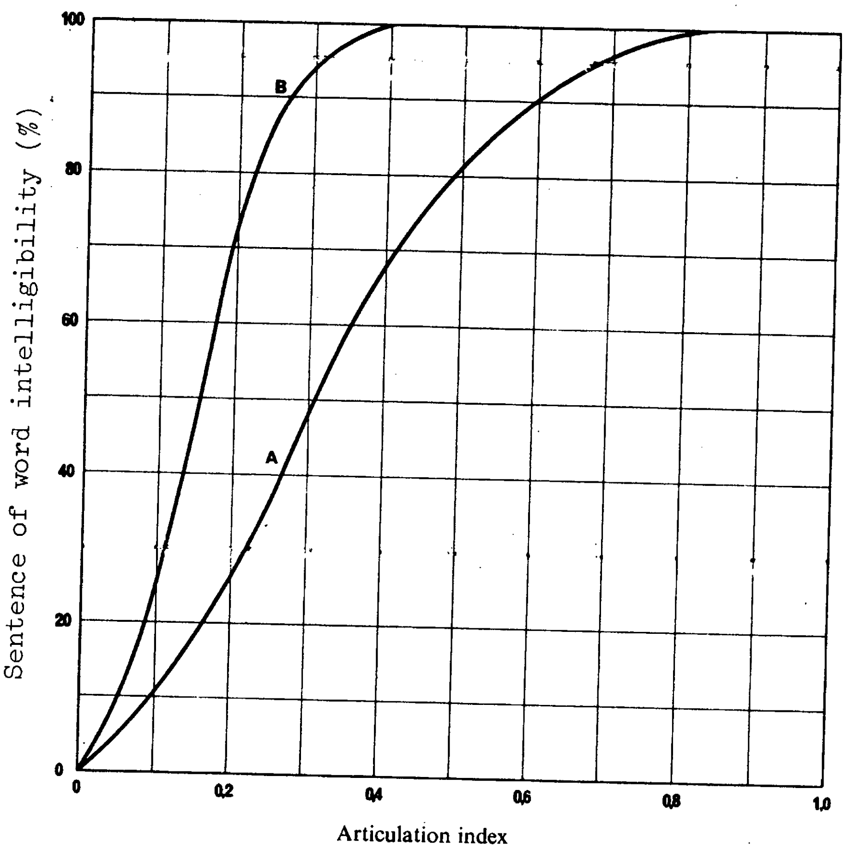

FIGURE 1

Percentage intelligibility as a function of articulation index

A: Modified rhyme tests

B: ATC message tests

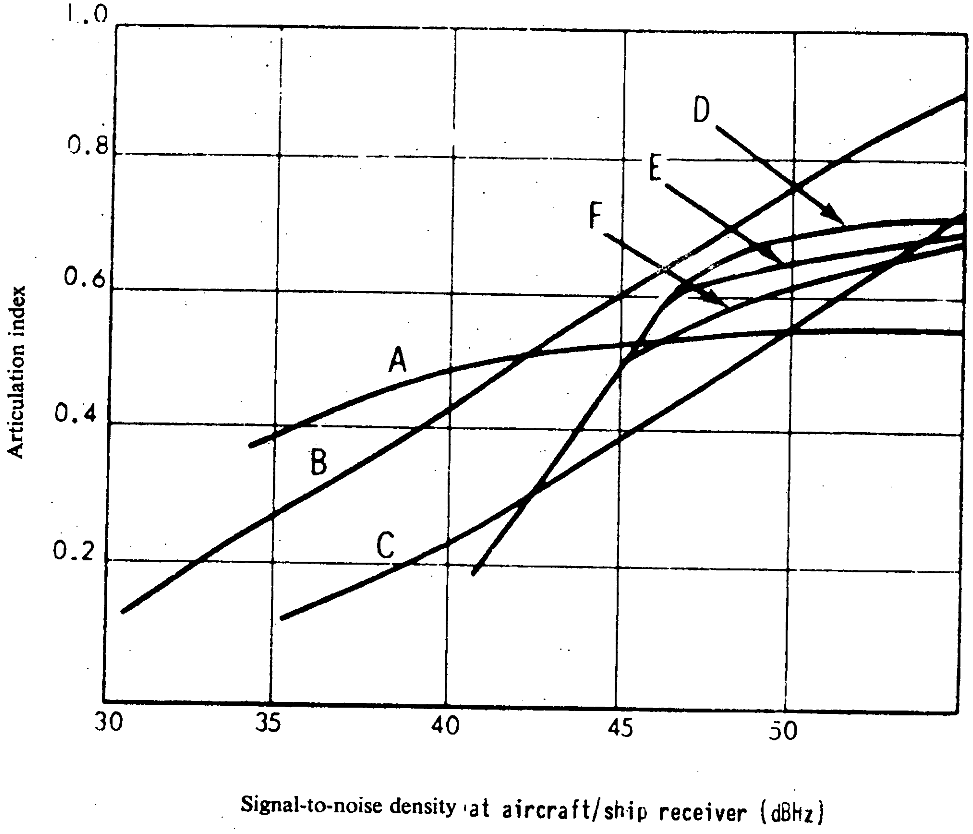

FIGURE 2

Comparison of analogue voice modulation techniques

A: FRENA
B: 5 kHz SSB-mean RF power
C: 5 kHz SSB-peak RF power
D: FM (18 kHz)
E: FM (10 kHz)
F: FM (8 kHz)

4. Modulation techniques for measurement of distance

4.1 Single pulse amplitude modulation

Single pulse amplitude modulation is the most basic concept for distance measurement. In this method, the distance from a satellite of known location to a user whose location is unknown is determined by measuring the elapsed round-trip propagation time of a pulse signal transmitted to the user via the satellite. The one-way distance (r) is determined from the relationship :

$$r = \frac{1}{2}c\ (\tau - T_o)$$

where c : speed of radio wave propagation;

τ : total measured time between transmitted and received pulses;

T_o : total time delay introduced by the satellite and user equipment circuits.

The satellite serves as a relay for the pulsed signals, and the satellite transmitter is required to produce peak powers that are the highest of all the modulation methods considered. This requirement for high peak satellite power poses an implementation problem.

The relationship between measurement error, bandwidth, and signal-to-noise ratio can be expressed by :

$$\sigma_\tau = 1/\left(\beta\ R^{\frac{1}{2}}\right)$$

where σ_τ : standard deviation of the time measurement;

β : effective bandwidth of the pulse;

R : ratio of received signal energy in the pulse to the noise density /Woodward, 1953/.

Single pulse distance measurement is susceptible to impulse noise interference. Noise or multipath reflected pulses can be mistaken for the true pulses and cause errors in system operation. In cases where the noise or multipath pulses differ in amplitude, duration, or expected time of reception, means can be provided to minimize the errors. Errors in the distance measurements may result, however, if the interfering pulses are similar to the desired signal and occur within expected reception periods.

Single pulse distance measurement is efficient compared to other methods, in terms of the energy required for a distance measurement if the noise in the channel is Gaussian and only one user is interrogated at a time. The slightly greater efficiency that may be achieved using single pulse distance measurement is of minor significance, however, and the high peak power may be an overriding disadvantage. In addition, the energy needed for addressing users and furnishing communications is much larger than that required for the actual distance measurement itself.

It is generally found that other methods of measuring distance trade between time and bandwidth to reduce peak power, but do not save energy over single pulse measurement. However, these methods may provide better protection against impulse noise for a given energy per interrogation.

The ultimate position fix rate is limited by the differential propagation time to the various users. Interrogations may be interleaved so that several can be made in the propagation time from the ground station, through the satellite, to the user, and back. Various procedures for address coding and use of a priori knowledge of user ranges may be used to programme interrogations.

Although single pulse distance measurement is well adapted to time division multiple access, it is not well adapted to frequency division. The bandwidth of a pulse signal is wide compared to other signal waveforms so that a relatively small number of channels may be accommodated within a given bandwidth. The user equipment required, however, is not complex, and envelope detection and threshold decision circuits can be employed /NASA, 1967/.

4.2 Multiple pulse train distance measurement

In the multiple pulse train distance measurement technique, the signal consists of a group of pulses rather than a single pulse. The basic limitation on distance measurement precision is given by the error in measurement of propagation time delay. Because the precision of a distance measurement depends primarily upon the signal waveform bandwidth and the energy it contains, pulse trains have several desirable features. One is that the energy can be increased by increasing the number of pulses without increasing the peak power, a consideration important because of practical satellite peak power limitations. The transmission of multiple pulses permits an averaging of measurements, and the averaging of N independent pulses decreases the standard deviation of the measurements by $\sqrt{N}$. Another advantage exists if it is necessary to address or interrogate one of many users. In this case, the pulse train can be coded, for example, by coding the pulse spacing so that the pulse train serves both as the distance measurement waveform and the address.

For pulse train distance measurement, it is possible to use the pulse envelope or alternatively pulse to pulse variation of spacing, or of carrier frequency or of carrier phase. The peak-power needed for a distance measurement transmission will be reduced if a longer pulse is used, but to retain the timing accuracy for accurate distance measurement a unique modulation pattern must be applied to this lengthened pulse. This is normally an angle modulation so that the amplitude of the pulse may be maintained throughout its duration. Modulation in the form of a code may be advantageous in the instrumentation of such a system thus the energy is maximized, while owing to the coding, the bandwidth required for measurement precision and the possibility of constructing various address codes is retained /NASA, 1967/.

4.3 FM Pulse compression

FM pulse compression is a means of achieving 'trade-offs' between energy bandwidth, time and precision in a distance measurement system. The technique can be used with either single pulse or pulse train distance measurement as described in the two preceding sections.

In this technique wide frequency-swept pulses are transmitted and, at the receiver, these pulses are compressed in time to produce narrow pulses of increased amplitude, thus the distance measurement accuracy of a narrow pulse system is obtained without the need for large peak powers. The transmitted frequency is usally made to vary linearly with time across the channel bandwidth during each pulse. Thus a pulse train is an FM transmission, the modulating waveform in the time/frequency domain being a succession of saw-teeth. Receivers which are matched to the predetermined time/frequency relationship are necessary to form the narrow pulses which are then processed in the distance measurement circuits.

Pulse dispersion can be achieved by using a narrow pulse to excite a bank of filters with adjacent pass bands, the filter outputs then being applied to a delay line which inserts progressively longer delays across the total band for each adjacent bandpass filter. The output of the delay line is a stretched pulse progressively increasing or decreasing in a step fashion in frequency. Alternatively, the dispersed pulses can be directly produced by using a saw-tooth waveform generator to frequency modulate a CW transmission.

Reconstitution of the narrow pulses at the receiver requires the use of either a complementary bank of filters and a tapped delay line or a dispersive delay line.

The output signal to noise ratio of an ideal pulse compression signal in the presence of white noise is given by :

$$\frac{S}{N} = \left(\frac{C}{N}\right)_p \cdot f_m t = \left(\frac{C}{N_o}\right) t$$

where $(C/N)_p$: carrier to noise ratio of the swept pulse before compression

(C/N_o) : carrier to noise density ratio of the swept pulse

f_m : width of the frequency sweep

t : duration of the swept pulse

The width of the compressed pulse is the reciprocal of the frequency sweep, thus the time measurement discrimination depends directly on the bandwidth available for the swept transmission. The peak power transmitted is smaller by the factor $f_m t$ than that required for an unswept pulse producing the same S/N ratio. For a given transmitter power and channel bandwidth, the duration of the swept pulse should be as long as possible for maximum S/N ratio but there are instrumental limitations to the value of the product $f_m t$.

For the user, FM pulse compression results in a rapid acquisition time and also provides good multipath rejection properties. Multipath interference can occur only when the time difference between direct and reflected pulses is of the order of the compressed pulse duration. The transmitted energy is uniformly distributed across the frequency channel and so the effects of interference are minimized.

In a multiple pulse distance measuring system, address coding (and data transmission) can be readily achieved in a binary manner, the binary states being increasing and decreasing frequency sweeps i.e. positive and negative slopes of the saw-tooth frequency modulation /NASA, 1967/.

4.4 Continuous audio-frequency modulation

4.4.1 Analogue techniques

Distance measurement can also be accomplished by means of phase comparison techniques in which a transmission consists of a signal modulated by one or more sinusoidal audio frequencies. The signal is retransmitted by repeaters located in the vehicle and at the satellite, and the total round-trip propagation time delay observed at the originating station is determined by measuring the phase of the received signal with respect to the transmitted one. If the one-way distance is r, then the difference in phase (Φ) between the transmitted and received signals is :

$$\Phi = 4\pi r f_m/c \text{ radians}$$

where f_m : modulating audio frequency;

c : speed of radio wave propagation.

For a given phase difference measurement error, the corresponding distance error is inversely proportional to the audio frequency. To minimize distance errors, therefore, it is desirable to use as high a ranging audio frequency as possible. The relationship between the distance measurement precision (σ_r) due to noise, and post-detection audio-frequency signal-to-noise ratio (S/N) is, disregarding integration improvement :

$$\sigma_r = \frac{c}{4\pi f_m \sqrt{2S/N}}$$

The choice of audio frequencies above the maximum frequency of speech may permit the audio frequencies to be transmitted simultaneously with voice or data without interference, since they can then be separated by filtering from the speech signals.

Another factor affecting the choice of audio frequencies is the ambiguity distance. Since a phase measurement can only be made over an interval of 360 degrees, there is an ambiguity in the number of full cycles of phase delay, and this phase measurement ambiguity corresponds to an ambiguity (r_{amb}) in the distance measurement of :

$$r_{amb} = \frac{c}{2 f_m}$$

The ambiguity can be resolved by employing additional audio frequencies, or by coding the signals, e.g., sending the audio frequencies in bursts.

Address coding (and data transmission) can be achieved by using a modulated sub-carrier, the same sub-carrier functioning as one of the distance measurement frequencies.

In general, continuous audio-frequency modulation does not provide the same type of immunity to the effects of multipath found with some of the other modulation techniques, because it becomes difficult to separate in time the direct and multipath-reflected signals. In some cases, however, it may be possible, using filters with narrow passbands, to filter the signal waveform to average out the multipath error. For ships these errors can be neglected. A further discussion of the effects of multipath is given in Report 505 /Klein, 1970/.

4.4.2 Digital techniques

A digital tone ranging technique has been developed in Japan to offer measured range data to a PCM-TDMA satellite communication system for its initial acquisition. In this digital tone ranging technique the rectangular waveform is used as a measurement signal. This is the difference from the analogue techniques described above, where the sinusoidal waveform is used. In this technique the measurement principle, estimated measurement error, the necessity of ambiguity check and multiple path effect are all similar to the analogue techniques. But, in addition, this technique has unique features as follows : Low frequency signals for ambiguity removal are inserted in a burst form into the precision measurement signal.

This measurement signal with a frequency high enough for obtaining the necessary measurement accuracy is shaped into a rectangular waveform. A small part of the rectangular waveform is replaced with a PN code signal, synchronized with the low frequency ambiguity removal signal. A carrier signal is phase-modulated by this digital waveform, and is transmitted and received through a satellite. The range is obtained by measuring the round trip propagation time delay of the PN code extracted from the digital waveform.

By utilizing such a digital waveform in a range measurement system, the number of low frequency signals necessary for ambiguity check can be made smaller than that of the analogue techniques. This is because the zero-crossing of the low frequency signal is determined by detecting the PN code inserted, with the same bit rate as the rectangular high frequency signal.

Many experiments have been conducted to verify this digital tone ranging technique by using a INTELSAT III satellite. Only two low frequency signals were required for ambiguity check, even in the case where S/N was only 3 dB in 200 kHz bandwidth. Compared with this, the analogue techniques would require 3 to 7 signals of low frequency for ambiguity check even in a higher S/N ratio than 3 dB.

This technique can simplify the operation and the configuration for ambiguity check, and accordingly, the measurement can be made very fast. Furthermore, this technique can be applicable to the narrow band system, and can easily be made compatible with digital data transmission systems (Kurihara and Takenaka, 1971).

4.5 Pseudo-random noise codes

In digital code ranging systems, a binary sequence is transmitted, and the phase of the sequence is determined at the receiver. A high-precision distance measurement is obtained from a phase measurement at the clock frequency of the sequence, and measurement ambiguity is resolved by measuring a time reference point in the sequence to within ½ bit interval. The distance measurement accuracy is a function of the bit rate of the binary sequence. To resolve measurement ambiguity to any practical value, the binary sequence is generally chosen to be thousands of bits long.

The phase of the binary sequence can be determined by correlating the received sequence with a replica, or reference sequence, in the receiver. Equipment limitations prevent the use of simultaneous correlation, and excessive acquisition time results from sequential correlation. Consequently, special binary sequences are employed to reduce the number of required correlations and the correlation time.

A usual form of pseudo-random noise code (PRN) is a sequence of binary digits having a random distribution within the length of the code. It may be generated in n stages of a shift register, with one or more feedback paths, driven by a regular pulse stream from a timing clock. With suitable feedback connections a repeating pattern (2^n-1) bits long may be produced; in this pattern any sequence of n bits is not repeated, and the sequence contains all the combinations of n bits except the all-zero code.

The acquisition of the code phase is accomplished in several steps. First, the clock phase is acquired by a phase-lock loop. Next, the component sequence phases are acquired in time sequence by correlating the received code with a reference code in the receiver. The total code phase can then be determined from the separate phases of the component sequences by an algorithm.

The reference code, consisting of each component sequence in turn, is advanced in phase in one-bit steps and correlated with the received code by the phase-lock loop. The correct component phase is assumed to be equal to the bit advance which results in maximum correlation level in the loop quadrature detector.

The distance measurement accuracy of a pseudo-random noise code is dependent on the phase noise in the clock phase-lock loop. If the loop is tracking square-waves, the r.m.s. phase measurement error due to thermal noise will be :

$$\sigma_{\phi} = \pi\sqrt{8(S/N)_c}$$

where $(S/N)_c$ is the code signal-to-noise ratio after complete correlation in the clock phase-lock loop.

In actual practive, a bandpass filter is placed in front of the loop to restrict the clock signal to the fundamental of the square-wave, or this filtering may occur due to the limited bandwidth of the transmitter or of the intermediate frequency amplifier of the receiver. In this case, the clock waveform will be a sine wave instead of a square-wave and the phase measurement error due to noise will be :

$$\sigma_{\phi} = \pi\sqrt{16(S/N)_c}$$

An alternative method of ranging systems using two pseudo-random noise codes can be accomplished. In this method, measurement ambiguity is removed by using a slow bit rate pseudo-random noise code in addition to the other pseudo-random noise code sequence which has a clock frequency high enough for obtaining the measurement accuracy. In this case, the pseudo-random noise code for ambiguity check is conventionally generated by the clock having the same period as the frame interval of the high bit rate pseudo-random noise code sequence. At the first stage of range measurement, two pseudo-random noise codes mixed together are transmitted and received. After removing ambiguity by using the slow bit rate pseudo-random noise code, only the high bit rate pseudo-random noise code is transmitted and received, and a high precision range measurements can be accomplished. This method would be suitable for a spread spectrum system and the range measurement can be conveniently made by using the pseudo-random code used for station identification.

A significant advantage of the pseudo-random noise code technique is protection from interference and the adverse effects of multipath. This protection results because undesired signals, including delayed replicas of the desired code delayed at least one bit, will produce very little correlation in the receiving equipment /Garabedian, 1969; Tsukamoto et al, 1972/.

4.6 Binary Optimum Ranging Code

The Binary Optimum Ranging (BINOR) Code is equivalent to a fixed audio-frequencies system where square-waves are used instead of sinusoidal signals. The code is a binary sequence generated from a series of "n" coherent square-waves which are harmonically related by multiples of two, a frequency ratio that tends to result in minimum signal power. The code is generated by subtracting the number of square-waves in binary state "zero" from the number of square-waves in binary state "one" during each half cycle of the highest-frequency square-wave. If the result is zero or positive, a binary "one" is generated. If the result is negative, a "zero" is generated. The code bit rate is equal to twice the highest-frequency square-wave (the code clock), and the code period is equal to the period of the lowest-frequency square-wave. The BINOR binary code is much more readily implemented for large values of n.

The acquisition procedure for the code consists of first acquiring the clock (highest-frequency square-wave) with a phase-lock loop as in the pseudo-random noise technique. The clock acquisition is followed by n-1 correlations of the code with n-1 square waves from a divide-down chain of flip-flops driven by the acquired clock. The correlations are made in sequence starting with the correlation using the one-half clock frequency square-wave and going down in frequency to the last correlation using the lowest-frequency square-wave. Each correlation will be positive or negative, depending on whether the square-wave is in or out of phase with the code. A total of n binary decisions are required to resolve the phase of a 2^n bit long code. The BINOR code lends itself to rapid acquisition, and since each acquisition step involves only a binary decision, the mechanization of the code acquisition is simplified considerably. The acquisition time is inversely proportional to the signal-to-noise ratio and the square of the sine of the modulation index.

The distance measurement is achieved by measuring the phase of the lowest-frequency square-wave. The period of this wave is identical to the period of the code and determines the distance ambiguity resolution. The accuracy of the distance measurement is determined by the phase noise in the clock loop, since this same noise appears on the lowest-frequency square-wave through the divide-down flip-flop chain. Therefore, the equations for the pseudo-random noise codes of § 4.5 also apply here for the distance measurement precision, providing there is complete correlation in the clock loop /Stiffler, 1966; T.R.W. Syst., 1967/.

5. Distance-rate and angle-measurement systems

Distance-rate and interferometer angle-measurement radiodetermination techniques generally require frequency or phase measurements on received carrier signals. Thus, the measurements are performed on unmodulated CW signals.

Distance-rate is determined by measurement of the Doppler shift of a CW signal radiated by a satellite /Guier and Weiffenbach, 1960/. Angle-measurement may be accomplished by measuring the difference in the phase of signals arriving at or transmitted from two or more satellite-borne interferometer antennae /Keats, 1965/.

The precision (σ_{ϕ}) with which phase difference measurements can be made is related to the post-detection signal-to-noise ratio (S/N) by the relationship $\sigma_{\phi} = 1/\sqrt{2S/N}$. In the case of a satellite-borne interferometer, the error (ε_{θ}) of each angle measurement is related to phase-measurement error (ε_{ϕ}) by :

$$\varepsilon_{\theta} = \frac{\lambda}{2\pi D \cos \theta} \varepsilon_{\phi}$$

where λ : wavelength of transmission;

θ : angle of arrival of the wave;

D : spacing between interferometer antennae.

The individual phases of the received signals are sensitive to multipath for measurements made on the carrier itself. However, the phases at the two antennae can be correlated (the amount of correlation depending upon D/λ, the elevation angle, and user altitude), thus reducing the effect of multipath upon angle measurement. A certain amount of multipath protection can be achieved through the use of wide bandwidths achieved by employing frequency modulation or pseudo-random noise codes, discussed in § 4.

6. Summary

6.1 The precision of a distance measurement system depends upon the bandwidth of the transmitted signal and the energy it contains. Single pulse amplitude modulation is the simplest and most straightforward concept for distance measurement, but requires high peak satellite transmitter power and bandwidth, particularly for high-precision systems. Protection against interference and multipath effects is possible if time-discrimination is used in processing the received signals.

6.2 Multiple pulse train distance measurement requires less peak transmitter power than the single pulse technique and offers the possibility of coding the pulse train to provide a discrete address. Protection against interference and multipath effects is achieved by pulse-averaging or by time-discrimination of the received signals.

6.3 FM pulse compression offers a trade-off between peak power, precision and bandwidth and requires less peak transmitter power than the single pulse technique. The FM pulse technique offers a significant degree of immunity to interference and multipath effects.

6.4 Continuous audio-frequency modulation can be employed as an alternative to pulse techniques and offers a trade-off between average transmitter power, bandwidth, measurement time and precision. This method of distance measurement generally has less discrimination against multipath errors than pulse techniques, but filtering using narrowband filters can be employed to reduce the effects of interference and multipath.

6.5 Pseudo-random noise codes can also be used to trade between power, precision and bandwidth and offers a very high degree of protection against the adverse effects of interference and multipath.

6.6 The BINOR code has characteristics similar to both continuous audio-frequency modulation and pseudo-random noise codes with the advantage that rapid signal acquisition is possible.

6.7 Distance-rate and angle-measurement satellite techniques generally require frequency or phase measurements on unmodulated carrier signals. Such unmodulated carrier signals are subject to multipath effects, but require the least amount of spectrum (bandwidth).

6.8 Multipath errors due to the delay time between the direct and reflected rays can be neglected for ships because of the very small difference in path length.

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STUDY GROUP 8

Study Group ..8.., in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration :

REPORT 510(Rev.74)

THE EFFECTS OF CARRIER TO INTERMODULATION RATIO UPON RADIO-FREQUENCY CHANNEL SELECTION AND SATELLITE TRANSPONDER DESIGN FOR AERONAUTICAL AND MARITIME SERVICES

(Study Programme 17A/8)

(1970-197

1. Introduction

This Report discusses the interrelation of channel spacing and carrier to intermodulation (*C/I*) requirements upon the design of channelized spacecraft transponders providing aeronautical and maritime communications services. If a non-linear transmitter follows the receiver, intermodulation products will be introduced which may affect system performance. Several alternative solutions are discussed.

2. Intermodulation products caused by transponder non-linearities

The direct current to radio-frequency power conversion efficiency of transponders, a significant factor in the overall spacecraft requirements, is highest when the final amplifier is operating in saturation. This limits the system to angle modulation schemes and inherently creates intermodulation products when a multiple number of signals are handled by the transponder. If the system is to perform within the constraint of a specified level of *C/I* such as 16 dB, then it is necessary that the channel spacing be controlled or the transponder be operated in the quasi-linear region.

2.1 *Controlled channel spacing*

If a hard-limiting transponder is used and the channels are equally spaced, the *C/I* for each signal will be 9 to 10 dB because odd order intermodulation products (i.e. the 3rd, 5th, 7th, etc.) will fall on the utilized signal channels. To alleviate this problem, controlled spacing frequency plans can be used. Babcock spacing [Babcock, 1953] will prevent third order products from falling in the used signal channels and will increase the *C/I* ratio to greater than 20 dB. Another controlled spacing frequency plan for a four-channel system could utilize a spacing ratio of 3/4/5. With this plan the signals are free of both 3rd and 5th order products and the *C/I* ratio is approximately 30 dB.

Both the Babcock and 3/4/5 techniques require that a relatively large bandwidth be divided into many channels. The specific channels to be used by the satellite system are then selected from this group. Table I gives examples of the required channel assignments for 4, 6 and 10-channel systems if this technique were employed. A systematic calculation based on Babcock's technique has given the highest spectrum utilization as shown in Fig. 1. Computer programmes have been developed which facilitate the determination of other channel spacings which are free of 3rd and 5th order intermodulation products /Edwards et al., 1969/. An extension of the Babcock method has been made using an elaborated algorithm applied systematically in a computer programme. An advantage is that, in the case of ten operating channels, fewer consecutive channels are required compared with the normal Babcock spacings, as shown in Table I and Fig. 1 (curve E).

There is another assignment which is easily calculated by the successive insertion of minimum possible spacing and gives a fairly high spectrum utilization not far inferior to the modified Babcock spacing (see Fig. 1 (curve F)). These assignments are obtained in the following way. Starting from an existing series of spacings, to add a new channel, a new spacing is interposed into the existing series. As an example, an existing allocation of channels 1, 2, 5, 11, 16 and 18 have spacings of 1, 3, 6, 5 and 2 channels respectively. Calculations show that spacing 8 can be interposed between 6 and 5, giving a new economical series of 1, 3, 6, 8, 5 and 2 channel spacings (channel allocations 1, 2, 5, 11, 19, 24 and 26).

It should be noted that intermodulation products will still fall on unused channels. In the case of a 6-channel Babcock spaced system the *C/I* ratio of channels 6, 7, 10, 12 and 14 is 13 dB. If close frequency separation between satellite up- and down-links is used, such as the 6 MHz suggested in ARINC characteristic No. 566, then it is difficult to filter out the intermodulation products falling within the satellite receiver's passband [Arinc, 1968]. Therefore selective spacing of even a four-channel system may not permit the use of a hard-limited transponder if the up- and down-links are closely spaced.

TABLE I

Channel assignments for Babcock and 3/4/5 frequency spacing plans

Channel plan	Number of adjacent channels	Channels used in the system	Spectrum efficiency	C/I
3/4/5 4 signals	13	1, 4, 8, 13	31%	30 dB
Babcock 4 signals	7	1, 2, 5, 7	57%	20 dB
" 6 "	18	1, 2, 5, 11, 13, 18	33%	20 dB
" 10 "	62	1, 2, 8, 12, 27, 40, 48, 57, 60, 62	16%	20 dB
Modified Babcock 10 signals	56	1, 2, 7, 11, 24, 27, 35, 42, 54, 56	18%	20 dB

Fig. 1 (curves B and D) shows the bandwidth required by Babcock type spacing and equal channel spacing, respectively. The increased bandwidth required by Babcock type spacing must be accommodated by the satellite transponder, thereby requiring broader bandwidth front end and power amplifier designs. At first glance, Babcock spacing may seem an inefficient use of spectrum. However, the unused channels could possibly be used by other satellites or for terrestrial communications.

It has been suggested that a VHF communication-satellite system could operate on channels of 50 kHz spacing, but interleaved between the present 50 kHz spaced channels of the terrestrial aeronautical mobile service. This would imply that the aeronautical service channels would be spaced at 25 kHz. A prohibition of the use of alternate channels essentially doubles the maximum bandwidth spread of channels as shown in Fig. 1 (curves A and C).

If a radio-frequency band is shared by a number of systems by assigning staggered radio-channel frequencies, assignment with algebraic sequence spacing can give a high overall spectrum utilization (see Fig. 1 (curve G). By this means, a high total amount of information can be carried by these systems operating within the definite bandwidth. For example, a 3/4/5 spacing gives three assignments of 4 channels, namely (1, 4, 8, 13), (2, 5, 9, 14) and (3, 6, 10, 15) with 15 consecutive channels. This method, however, can be used only in cases where the radiated intermodulation products falling in the unused channels of one system are prevented from interfering with the used channels of other systems.

2.2 *Quasi-linear transponder*

The generation of intermodulation products can be reduced in equally spaced channel systems by operating the transponder in a low efficiency non-saturation mode. A linear transistor amplifier will have a *C/I* ratio of greater than 30 dB, but will have an efficiency of only about 30% versus 89% for the limiting type amplifier. An optimized system would utilize a quasi-linear transponder which gives a *C/I* ratio of greater than 16 dB for equally spaced signals but which reduces the efficiency by approximately 0·4 dB for transistor transponders. If a travelling wave tube is necessary, the penalty for operation in the quasi-linear mode will depend on the transponder channel capacity and on the demodulator threshold. For a moderate transponder capacity and, say, a phase lock loop demodulator, the penalty is not excessive. Typical values are given in Table II below :

TABLE II

Assumptions	a	b
Demodulator C/N threshold dB	6.5	10
Up-path noise allowance dB	0.5	0.5
Intermodulation noise allowance dB	1.0	1.5
Required satellite carrier to intermodulation noise ratio dB	13.4	15.3

Results	a				b			
Active channels per transponder	4	8	16	∞	4	8	16	∞
Loss of transponder capacity dB	1.5	2.3	3.0	3.5	2.2	3.5	4.3	4.8

2.3 *Power conversion efficiency*

The ratio of effective radio-frequency output power per channel to the direct-current power required from the satellite power sub-system is a function of different variables, in particular: channels to be accommodated, the frequency band of operation, the type of frequency channel assignment, and the type of final stage power amplifier to be used. For the case of transistor operation, the efficiency takes into account the basic collector efficiency and losses associated with the driver, back-off to reduce intermodulation interference for multi-channel operation (quasi-linear operation), DC-DC conversion, intermodulation products and 1 dB for channel limiter variations, ageing and temperature variance.

The efficiency reached by the transistorized VHF equipment of the ATS-3 satellite (1967) was 67 % (single channel operation), a value which is very close to the theoretical limit. The efficiency of transistorized UHF equipment is presently still far from the theoretical limit. The efficiency reached by the travelling wave tube UHF equipment of the ATS-5 satellite (1969) was 25% (single channel operation). In a manner similar to VHF experience it may be expected that in the near future, as improved transistors become available, that transistorized UHF amplifier performance will also approach the theoretical limit.

It is seen from Fig. 2 that the use of Babcock channel separations significantly increases transponder efficiency for more than two-channel operation by eliminating interfering third-order harmonics.

3. Conclusions

The use of a hard-limiting transponder in a satellite gives the greatest DC to RF power conversion efficiency and hence gives the greatest number of channels for a given satellite DC power. Such a transponder creates intermodulation products when a multiple number of signals are handled by the transponder. These intermodulation products will coincide in frequency with operational channels which are uniformly spaced.

It has been shown that there are a number of techniques for selecting channels with non-uniform spacing to ensure freedom from 3rd and 5th order intermodulation products.

The consequence of non-uniform spacing is that total transponder bandwidth must be increased and hence non-optimum spectrum utilization. It has been shown however that spectrum utilization can be again improved by making a proper choice of the many alternative intermodulation-free channel spacings.

These techniques of improving system performance will only be applicable if there is sufficient frequency difference between the up and the down links, and, in practice, the bandwidth necessary to achieve the freedom from intermodulation products for more than a very limited number of channels is too large to be practicable. In addition, such theoretical channel spacings may pose technical problems in relation to frequency selection and the efficient use of the RF spectrum allocated for mobile services. These factors require careful consideration in relation to the advantages offered by controlled channel spacing.

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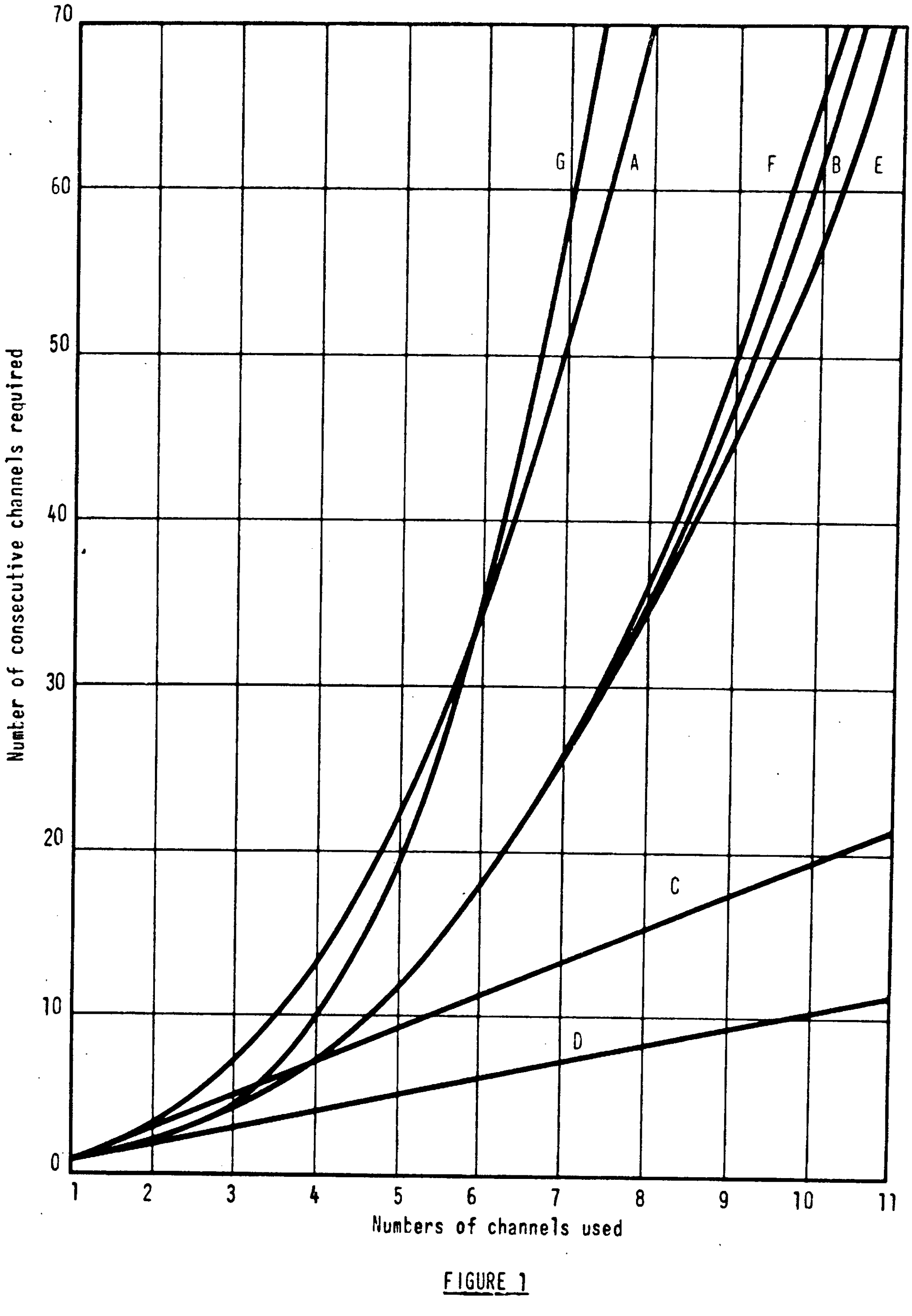

FIGURE 1

A : Babcock-alternate channel restriction
B : **Basic Babcock spacing**
C : Equal spacing; **alternate channel restriction**
D : Equal spacing
E : Modified babcock spacing
F : Successive insertion spacing
G : Algebraic series spacing

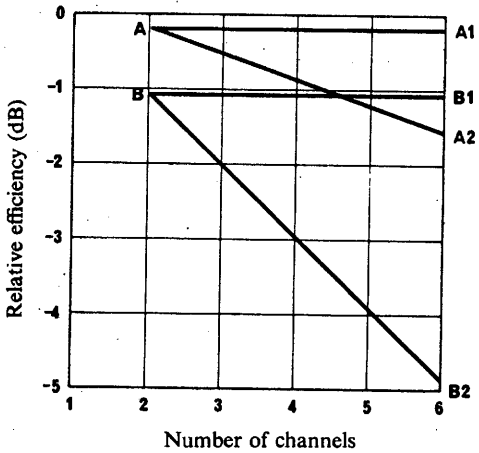

FIGURE 2

Relative power conversion efficiency for selected transponder types and channel spacing schemes *(C/I ≥16 dB)*

A: Transistor transponder
A1: Babcock spacing
A2: Equal spacing
B: Travelling wave tube amplifier
B1: Babcock spacing
B2: Equal spacing

C.C.I.R.
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STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2. of Resolution 24-2, presents the following Report to the Plenary Assembly, for consideration :

REPORT 513 (Rev. 74)

TECHNICAL CHARACTERISTICS OF SYSTEMS PROVIDING COMMUNICATION AND/OR RADIODETERMINATION USING SATELLITE TECHNIQUES FOR AIRCRAFT AND/OR SHIPS

Technical feasibility of systems employing space-communication techniques jointly for communication and radiodetermination purposes in the VHF mobile-communication bands

(Study Programme 17A/8)

(1970-1974)

1. Introduction

This Report discusses some of the technical considerations affecting the feasibility of using the VHF aeronautical and maritime-mobile communication bands jointly for communication and radiodetermination purposes using space techniques.

Recent experiments with the United States ATS-1 and ATS-3 Applications Technology Satellites have demonstrated the feasibility of using satellites to relay 135·6 MHz voice and data communications between aircraft and ground stations. These same satellites have been used to demonstrate the feasibility of radio position determination of ships and fixed stations at 135·6 MHz employing distance measuring techniques.

Several studies discussed in this Report have recommended the use of special narrow-band satellite ranging signals suitable for use within the bandwidth and power limitations of a communication-satellite voice channel. These methods are summarized in the next section to illustrate the application of distance measuring techniques to the VHF mobile-communication bands.

2. Radiodetermination techniques

The VHF mobile-communication bands are currently divided into 50 kHz channels. Civil aircraft use double-sideband amplitude-modulation, while in the maritime band frequency modulation is employed. Satellite communication experiments at 135.6 MHz have employed narrow-band frequency modulation in order to reduce the satellite power requirements. I.C.A.O. has established standards for 25 kHz channels in the aeronautical VHF band for international world-wide use. Maritime-mobile 25 kHz channels are being implemented in accordance with Resolution No. Mar 14 of the Radio Regulations. Therefore, it appears wise to design any planned radiodetermination signals to occupy less than 25 kHz bandwidth. There may be technical advantages in the use of a number of contiguous or non-contiguous 25 kHz channels as a single radiodetermination channel.

2.1 *CW sidetone ranging*

One method of providing a radiodetermination signal suitable for use with a voice signal is to transmit a sinusoidal tone which modulates the carrier with the same type and depth of modulation employed for voice transmission. In theory, tones up to 12·5 kHz can be used within a 25 kHz channel, assuming that in the case of angle modulation the modulation index is reduced until only the first-order sidebands are significant. In practice, considerations of frequency stability and other factors may reduce the maximum tone frequency as much as 50%. Measurement of the phase shift between a transmitted interrogation signal and received reply signal provides information on the distance from the satellite to the user vehicle. Ambiguity encountered in the measurement may be removed by transmitting lower frequency tones or by interrupting the tone in some known fashion. The radiodetermination signal may be either time-shared with the voice transmission, or else it may be frequency-multiplexed, using appropriate filtering techniques to separate the two signals.

2.2 *Shift keyed ranging*

Frequency-shift keyed or phase-shift keyed signals can also be used to provide a radiodetermination function suitable for use with a voice transmission. In this case, the time delay between a binary sequence transmitted to a vehicle and the same sequence received from the vehicle provides information on the distance from the satellite to the vehicle. If the shift rate is small compared with frequency shift, then shifts of less than 12.5 kHz ensure that the radiodetermination signal spectrum will not exceed the 25 kHz bandwidth of a single satellite voice channel. When phase shift keyed or narrow band frequency-shift keyed signals are used, the maximum shift rate that can be accommodated in a 25 kHz voice channel of bandwidth W Hz is approximately 16 kbit/s 0.67 W. For phase-shift keyed signals a channel of W Hz bandwidth can accommodate shift rates of approximately 0.83 W /Saltz, 1970/.

3. Radiodetermination accuracies

Two operational satellite systems already in existence have demonstrated the feasibility of using satellites transmitting in the VHF and lower-UHF regions of the spectrum to provide position information. These systems include the U.S.A. Doppler navigation satellite system [Guier, 1966; Guier, 1960; Kershner, 1966; Talwani et al., 1966] and the geodetic SECOR satellite system [Reid, 1965]. In addition, a series of ranging experiments conducted by the United States has provided further data on the accuracy of satellite ranging in the aeronautical mobile communication band [Anderson, 1968].

3.1 *Doppler navigation satellite system—operational results*

The United States has implemented an operational navigation satellite system in which Doppler shift measurements are made of stable carrier frequencies at 150 and 400 MHz to determine the location of the observer [Guier, 1966; Guier, 1960; Kershner, 1966; Talwani et al., 1966] The system uses two coherently related carrier frequencies to permit the elimination of ionospheric refraction effect. Based upon several years of operational experience, the navigation accuracy achieved by ships has generally been better than half a kilometre, limited primarily by the ability to measure the ship's velocity accurately. For stationary observers, accuracies of the order of 100 metres have generally been achieved for a single satellite pass.

3.2 *Geodetic SECOR satellite system—operational results*

Geodetic SECOR is an operational satellite system used for the geodetic surveying of stations on the Earth [Reid, 1965] The SECOR satellites are in medium altitude orbit, above the region of the ionosphere where most of the refraction effect occurs. Like the U.S. Doppler navigation satellite system, SECOR employs two coherent frequencies (224·5 and 449 MHz) to eliminate first-order ionospheric retardation error, while providing very high accuracy range information. In this system, four sidetones modulate each carrier signal. SECOR has consistently demonstrated position-fix accuracies of better than 15 metres for fixed stations.

3.3 *ATS-1* and *ATS-3 ranging experiments at 135·6 MHz*

The United States has been conducting ranging and position determination experiments with the ATS-1 and ATS-3 Applications Technology Satellites using frequencies of 149·22 MHz for the up-link and 135·6 MHz for the down-link [Anderson, 1968]. In these experiments, the ranging signal consists of a 2·4414 kHz tone which frequency-modulates the carrier. Measurement of the phase of the received tone with respect to the transmitted one provides information on the distance between the satellite and the user transponder. Phase measurement ambiguity is resolved by modulating the tone with a binary sequence which is correlated against the received signal. These experiments have deminstrated a measurement precision of better than a few microseconds under average ionospheric conditions, using a ranging signal that occupies the bandwidth of a single voice channel.

Aircraft and ships have been interrogated through a satellite and the responses from the craft have been relayed back to the ground terminal through two satellites, ATS-1 and ATS-3. Position fixes of the aircraft and ships were computed from the range measurements. Accuracy was compared with precision radar fixes of the aircraft and with docked or otherwise accurately determined positions of the ships. Standard deviation of position fixes at mid-latitudes was better than 1 nmi. The largest source of bias errors in the position fixes was the error in the predicted satellite positions. Other important error sources were equipment time delay calibration and in estimating the effects of the ionosphere on the VHF signals.

A position fixing experiment was conducted with a transponder that responded at VHF through ATS-3 with the 2.4414 kHz tone and through ATS-5 in the band 1500-1600 MHz with a 9.7656 kHz tone. Position fixes calculated from range measurements had a precision approaching 0.1 nautical miles. Bias errors due to the diurnally changing errors in satellite position prediction caused the computed fixes to trace an ellipse with a minor axis of 0.5 nautical miles and a major axis of 4.5 nautical miles. The centre of the ellipse is offset from the true position of the transponder by 0.7 nautical miles due to error in the initial calibration of equipment time delay and to error in estimating the effect of the ionosphere on the VHF signal path between the transponder and ATS-3.

An independent measurement of ionosphere electron content was made throughout the twenty-four hour period. The effect of the difference between the estimated ionosphere represented by the model and the actual ionosphere represented by the measurements accounted for a slant range error to ATS-3 of between 100 metres and 710 metres, depending upon the time of day. /‾Anderson, 1971; Anderson, 1973_7.

3.4 *Real-time ionospheric corrections*

The very high accuracy position determination capability achieved with the geodetic SECOR and Doppler navigation satellite systems is evidence that the coherent frequency technique is successful in eliminating most of the ionospheric retardation error. In a multi-channel communication-satellite system used also for radiodetermination, the two-frequency technique can be applied within the bandwidth limitations of the satellite repeater to correct the first-order ionospheric retardation. The technique can be applied by ranging either simultaneously or sequentially on two channels and observing the range difference for the ranging signals transmitted at the two carrier frequencies. Each of the two ranging signals can be designed to fit within a voice channel as discussed in § 2. Calculations indicate that the two-frequency technique applied on two channels 0·5 MHz apart will yield first-order ionospheric corrections with an accuracy of the order of a kilometre /‾Klein, 1969_7.

4. Conclusions

4.1 Radiodetermination techniques that can use a voice channel have already been demonstrated experimentally in the VHF aeronautical mobile communication band with the ATS-1 and ATS-3 Applications Technology Satellites.

4.2 Carrier frequencies as low as 224·5 and 150 MHz are in use on an operational basis and have proved successful in providing very high accuracy position determination of fixed stations with the SECOR satellite system, and of ships with the United States Doppler navigation satellite system.

4.3 The use of two-carrier frequencies for satellite radiodetermination at VHF and lower-UHF regions of the spectrum has proven successful in removing most of the position error caused by the ionosphere.

4.4 Two-carrier frequency ranging can be applied to achieve accurate radiodetermination. Extrapolation of experimental results together with theoretical studies leads to the conclusion that similar techniques may be applied in the VHF mobile communication bands in order to reduce ionospheric error. The ranging signals can be designed to be accommodated within two spaced voice channels.

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STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration :

REPORT 515 (Rev. 74)

TECHNICAL CHARACTERISTICS OF SYSTEMS PROVIDING COMMUNICATION AND/OR RADIODETERMINATION USING SATELLITE TECHNIQUES FOR AIRCRAFT AND/OR SHIPS

The use of geostationary satellites for radiodetermination by distance measuring techniques

(Study Programme 17A/8)

(1970-1974)

1. Introduction

The location of ships and aircraft may be determined by measuring the propagation time of a radio signal from the satellite to the user and return. The propagation time can then be converted to a range measurement by relating it to the known propagation velocity of the radio signals. The principles of various positioning techniques including distance measurements are discussed in Report 216-2. The distance measurement technique has gained attention because of its particular usefulness with geostationary satellites. There is considerable flexibility afforded in the design of an actual system and a number of different systems have been proposed using this technique. None have actually been implemented but the characteristics and results for some of these systems are summarized in the Annexes.

The selection of a preferred system is dictated by:

- the characteristics of the vehicle (aircraft or ships);
- accuracy with which location is needed:
- associated communications requirements;
- frequency with which location measurements must be repeated for each vehicle;
- speed with which fix must be made;
- state of technological development;
- the cost to the individual user;
- the cost of the terrestrial and space segments.

A number of these parameters affect the choice of the operating frequency; factors, other than range measurement accuracy, which must be considered when choosing an operational frequency, are discussed in draft Report 504(Rev.72). The accuracy of radio ranging will be affected by propagation delays due to the ionosphere and troposphere. Within the range of frequencies suitable for mobile satellite systems a lower frequency limit may be imposed by the propagation medium for a specific accuracy requirement.

2. Principles of system operation

Range measurement radiodetermination satellite systems can be characterized as single range, multiple range, or range difference systems. These systems generally require *a priori* knowledge of the user's altitude, although several of the concepts can be extended to provide altitude information.

2.1 *Single-range measurements*

A single satellite is sufficient to locate a user along a line of position if altitude is already known. In operation, a fixed earth station transmits a coded interrogation signal that is relayed to the user by the satellite. A transponder in the user vehicle is designed to recognize its own preassigned address upon receipt of the interrogation signal. The retransmitted signal is relayed by the satellite to the earth station, where the elapsed time between interrogation and reply signals is measured. If the position of the satellite is known the elapsed time gives the distance from the user to the satellite, the locus of which is a sphere. This sphere intersects the Earth's geoid, corresponding to the user's altitude, in a circular line of position. Annex I describes a radiolocation system for the North Atlantic region based on the single satellite ranging principle.

2.2 *Multiple-range measurements*

The single satellite ranging principle can be extended to additional satellites. Range measurements made from two geostationary satellites are sufficient to locate a user if altitude is known. In this case the two distances measured from the satellites to the user determine two spheres that intersect in a circle. The intersection of this circle with the Earth's geoid at the user's altitude determines two positions—one in the northern and one in the southern hemisphere. *A priori* information on the general location of the user will determine his position without ambiguity. Annexes II, III, IV and V describe four radiolocation satellite systems based on the two-satellite ranging principle.

A system of three satellites provides the additional range information needed to determine the user's altitude, and the user's position can then be located at the intersection of three spheres whose centres are the three satellites. Annex VI illustrates a method of employing satellites to determine a user's altitude.

2.3 *Range-difference measurement*

An alternative method of determining position is based on the principle of measuring the differences in distances between several satellites and a vehicle. Each range-difference measurement locates the user on a hyperbolic surface. Two independent range-difference measurements, obtained with three satellites, produce two hyperboloids which intersect the Earth at two points, one of which is the user's position.

In a typical operating system, a fixed earth station transmits signals to the satellites. The user measures the differences between the arrival times of the several satellite signals and transmits this information to the earth station. A configuration might also be used in which signals transmitted by the user are relayed through two satellites and the time difference measurement made at the fixed earth station.

3. Sources of measurement error

3.1 *Tropospheric and ionospheric ranging errors and their correction*

A major limitation to the accuracy of radiodetermination by satellite results from refractive effects in the troposphere and ionosphere. Radio wave retardation due to the troposphere is independent of frequency. Tropospheric retardation at sea level, 100% humidity and zero elevation is 116 m [Millman, 1965]. It decreases with increasing elevation angle from an observer to a satellite, altitude and decreasing humidity.

Ionospheric retardation at frequencies near 1500 MHz is comparable to the tropospheric retardation. At VHF it is much larger because it varies inversely as the square of the frequency. Ionospheric effects may be reduced by exploiting their strong frequency dependence, either by using sufficiently high frequencies or by using two lower frequencies simultaneously and thereby generating a first-order ionospheric refraction correction.

During undisturbed daytime, sunspot maximum conditions, the one-way range bias due to retardation is as shown in Fig. 1. It is 3600 m at 0° elevation, 3200 m at 10° and 2400 m at 20°. It is expected that corrections based on predictions of electron content may reduce the bias to the order of 30% of the total bias.

If calibration stations are used as part of a radiodetermination system, corrections to less than 10% of the total range bias (less than 240 m at 20° elevation) might be achieved in the region surrounding a station assuming that the distances from the satellite to the calibrating stations are accurately known. Appropriately located stations would be equipped with repeaters like those used in mobile craft. The known range from the satellite would be subtracted from a calibration range measurement to derive an accurate range correction.

Unpredictable solar disturbances cause changes in the ionosphere that can increase range bias as much as 50% over the values shown in Fig. 1.

If a two-satellite radiolocation system is used without an applied correction, the effect of the disturbance will be an apparent systematic displacement of all the craft in a limited area. The relative position determinations of these craft would not be significantly affected.

More data is needed on the size of the area in which the information from a calibration station can be used, and therefore the number required in the area served. However, an estimate can be made on the basis of an extreme case [Mendello et al., 1969], in that instance sunset occurred at the peak of the disturbance and the total electron content dropped by a factor of ten in one hour. It would have caused a change in total range bias from approximately 2700 to 270 m for an elevation angle of 20°. Assuming that the principal cause of the decay is related to sunset, the east-west gradient of electron density and hence range bias would have been over a distance approximating the distance the terminator moved over the Earth in one hour, or approximately 1000 km. Calibration stations at 1000 km intervals would probably have been sufficient to determine the range bias correction during that event.

3.2 *Multipath error*

Multipath error occurs when the ranging signal travels over two or more different paths, and is generally produced by reflections from the ocean or the Earth's surface (see also Report 505). For narrow bandwidth signals the desired direct signal and undesired multipath signals combine vectorially to produce a phase error or, equivalently, an error in measured propagation time delay. The greatest differences in propagation delay occur when the user is at high altitudes and the satellites are viewed at large elevation angles. The greatest multipath signal amplitudes occur when the user views the satellites at low elevation angles and the multipath signal appears specular. Several methods are available to reduce ranging errors caused by multipath. One technique takes advantage of the directional characteristics of high-gain user antennae by rejecting the multipath signals outside the main beam of the antenna since the antenna would normally be beamed away from the Earth. This technique is more readily implemented at the higher frequencies when, for a given gain, antenna apertures are smaller. At elevation angles above the Brewster's angle, circular polarization will also reduce multipath by discriminating against oppositely polarized multipath signals. As the aircraft moves through *the interference pattern*, the average of the errors due to multipath moves towards zero. It is therefore possible to reduce the multipath error by suitable averaging over several measurements or by filtering; it follows that satellite access time must be increased. This technique is most effective at high frequencies when used by high-speed aircraft. Other methods of multipath error reduction are based on the use of wideband radiodetermination signals or frequency diversity. In this case, an ensemble averaging effect is achieved due to the frequency dependence of the multipath signals.

The magnitude of the range error due to multipath is a function of :

1. The delay of the multipath signal behind the direct signal from the satellite;
2. the amplitude ratio of the direct and multipath signals; and
3. the radio frequency phase difference between the direct and multipath signals.

Although the average error is zero when taken over a path length difference change of one radio frequency wavelength, the largest error can be greater than the range represented by the difference in the direct and multipath ray paths. For aircraft, the delay of the multipath signal behind the direct signal can be large and cause individual range errors of several miles. For ships, the delay of the sea reflected multipath signal behind the direct signal is not large and may cause a maximum error of a few hundred metres. /̲ Anderson, 1971 /.

3.3 *Other sources of error*

3.3.1 *Accuracy of satellite location*

Uncertainty in satellite position will introduce errors in the range measurements of the radio location system. Range and angle tracking systems at microwave frequency (6 and 4 GHz) currently in use with operational geostationary satellites may have a single measurement accuracy (1 sigma) of the order of 0.015° in angle and a few metres in range. However, the short baselines afforded by current tracking systems compared with the distance from the earth to the geostationary satellites result in errors in the determination of satellite positions that may exceed 1,000 m in latitude and longitude.

Satellite location may be accomplished by making range measurements from widely separated points near the limits of the satellite coverage to provide baselines approaching the diameter of the earth and thus providing improved geometry for satellite location. Measurements taken from the widely separated locations over a sufficiently long period of time may reduce the satellite position uncertainties so that a geostationary satellite can be used to determine a line of position with an error less than 100 m except near the subsatellite point.

3.3.2 *Uncertainty in vehicle altitude*

Barometric type altimeters capable of providing instrument accuracies of approximately 40 m absolute (2σ) are due in the future to be standard on new aircraft. This includes the mechanical errors of the altimeter instrument. External pressure datum errors and non-standard atmospheric temperature errors can also be significant when absolute altitude is required. U.S.A. Weather Bureau data show that, for one per cent of the year, pressure altitude variation for subsonic aircraft due to barometric pressure change can exceed 150 m and could range as high as 250 m for short periods of time. The variation will be greater for supersonic aircraft at their cruise altitude.

As an alternative method of measuring aircraft altitude, radar altimetry is available, but is not in general use because it requires knowledge of the ground elevation in order to obtain the altitude above mean sea level. The effect of aircraft absolute altitude error is small at low user-to-satellite elevation angles in radiodetermination systems in which altitude is used as an input to the solution for the user's latitude and longitude. In the North Atlantic region, for example, the positioning error component due to this uncertainty may be calculated by multiplying the altitude error by a factor between 0·36 and 0·70 corresponding to elevation angles between 20 and 35 degrees, respectively.

3.3.3 *Equipment induced errors*

Propagation delays incurred as the signal passes through ground, satellite and aircraft or ship equipment will also contribute to the position-fix error. This type of error is primarily the result of non-linear phase shifts, oscillator instabilities, and thermal noise, each of which is under the system designer's control. Ground station and satellite contributions can be made negligible with a minimum effect upon total system cost.

Theoretically, at VHF the highest baseband frequency would be limited to approximately 10 kHz, assuming 25 kHz channelling. In this case, a one degree error in phase measurement will result in a 42 m one-way distance ranging error. This is more than an order of magnitude smaller than the error caused by ionospheric refraction. Thus, the phase accuracy requirements could be relaxed to 100 m (2·5° at 10 kHz) with little effect upon the net position fix accuracy achievable at VHF.

Frequency constraints at UHF (1540-1660 MHz) are not as severe and satellite power requirements can be reduced by increasing the highest baseband frequency. However, if the ranging signals must have characteristics which permit them to be transmitted via the same channels used for voice, the radio-frequency bandwidth of the ranging signals would be limited accordingly.

3.3.4 *Geometric dilution*

The geometry inherent in satellite ranging systems is such that position-fix accuracy is a function of the location of the user craft relative to the sub-satellite points. Very near the equator errors in the measurement of range, aircraft altitude or satellite position will cause latitudinal position-fix errors one or two orders of magnitude larger than the original range measurement error, while longitudinal errors will be about equal to the original error. At the higher latitudes the latitudinal error approaches the range measurement error and the longitudinal error increases slightly.

3.3.5 *Estimates of position accuracy*

Estimates of position accuracy for VHF and UHF are contained in the Annexes.

4. Status of technology

4.1 *Satellite technology*

Technology has been sufficiently developed to permit implementation of the satellite portion of a radiodetermination system using distance measurement. A satellite of the order of 150 kg mass could provide the necessary sensitivity and power levels at synchronous orbit altitude. In systems using common satellites for both communication and radiodetermination functions, with satellite mass of the order of 350 to 400 kg, the ranging signal can be accommodated in the same bandwidth as a voice grade communications channel, but will generally require less power for equal coverage.

4.1.1 *Satellite antennae*

The maximum gain of satellite antennae in the VHF bands is limited by the physical size of the antenna, while in the UHF bands the limitation is the maximum area on the Earth which requires coverage. VHF (135·6 MHz) antennae with a gain of about 9 dB are in use on the ATS-1 and ATS-3 satellites; designs exist for increasing this gain by 3 to 6 dB on satellites of about 150 kg in mass. The ATS-5 satellite launched in the summer of 1969, has an antenna gain of about 15 dB in the UHF band (1600 MHz). This gain could also be increased by 3 to 6 dB with less than Earth coverage. In the case of geostationary satellites in the range of 350 to 400 kg, present technology allows the use of a fixed antenna of 2 m diameter.

The planned ATS F and G satellites will have "deployable" antennae of about 9 m diameter.

4.1.2 *Satellite power*

The present technology used in geostationary satellites leads to, in the case of three axis stabilization, an end-of-life available power of about 2 W, DC, per kilogram. In typical designs, DC power levels of 800 W at the end of seven-year lifetime are achievable. In the case of spinning satellites, these figures should be reduced approximately by a factor of 2.

4.2 *Aircraft terminals*

4.2.1 *Aircraft antenna*

The important parameters in the antenna design are gain, attainable patterns and the polarization. The gain or effective area should be large in the direction of the satellite and low in the direction of the Earth, to minimize the effects of multipath. Additional isolation from multipath effects can be obtained above the Brewster angle if the aircraft and satellite antennae are circularly polarized. Such considerations imply the use of a directive steerable antenna on the aircraft.

Aerodynamic drag, size and weight, together with installation problems, however, preclude the use of conventional high gain antennae in current commercial aircraft. The economic value of all usable space in such aircraft favours as small an antenna as possible. These factors and the high cost of an airborne antenna control system plus the doubtful reliability of electro-mechanical switching to provide an automatic or semi-automatic tracking capability favours the use of low gain antennae or electronically steered arrays that do not protrude from the aircraft surface.

4.2.2 *Aircraft receivers*

Maximum advantage is to be gained from the use of low-noise receivers when external noise is negligible in comparison to internal receiver noise. Transistor preamplifiers could be used up to 3000 MHz and tunnel diode or parametric amplifiers above. With this choice, receiver noise figures will be between 2 and 4 dB for frequencies up to 5000 MHz. Transistor amplifiers have the advantages of simplicity, reliability and low cost.

4.2.3 *Aircraft transmitters*

Air-cooled VHF aircraft transmitters capable of 500 watts minimum power output, using NBFM with a 5 minute on/5 minute off duty cycle are current state-of-the-art. They have been tested in the ATS satellite experimental programme. A 1 500 MHz transistor amplifier of 45 watts output power level has been successfully used on board an aircraft during the last balloon-aircraft satellite simulation experiment sponsored by E.S.R.O. in 1971 /_ Brown, 1972_/. A 1 500 MHz transistor power amplifier, with 300 watts CW output power level and an efficiency of approximately 30% has been successfully tested in experiments with the ATS-5 satellite.

Air-cooled VHF aircraft transmitters capable of 500 watt minimum power output, using NBFM with a 5 minute on/5 minute off duty cycle are current state-of-the-art. They have been tested in the ATS satellite experimental programme. A 1·5 GHz transistor amplifier of 45 W output power level has been successfully used on board an aircraft during the last balloon-aircraft satellite simulation experiment sponsored by E.S.R.O. in 1971 [Brown, 1972].

4.3 *Ship terminal technology*

4.3.1 *Antenna*

The desirability of using antenna directivity to enhance signal strength, reduce multipath and provide protection in sharing, requires that the shipboard antenna have a reasonably high gain. However, economic factors suggest the undesirability of employing gains which require satellite tracking to overcome ship motion. Tests conducted on the U.S.A. Applications Technology Satellite programme have demonstrated that a gain of the order of 10 dB is feasible within these constraints. Provided the radiodetermination system does not require simultaneous use of two satellites, such antennae are well within economic constraints, current technology and can be designed to survive the maritime environment.

4.3.2 *Power amplifier*

VHF transmitters in the power range 30-300 watt are available for the shipboard terminal.

4.3.3 Experimental shipboard terminal equipment is being actively studied by several administrations. In general, much of the development work of both aeronautical and maritime systems may be applicable to either service.

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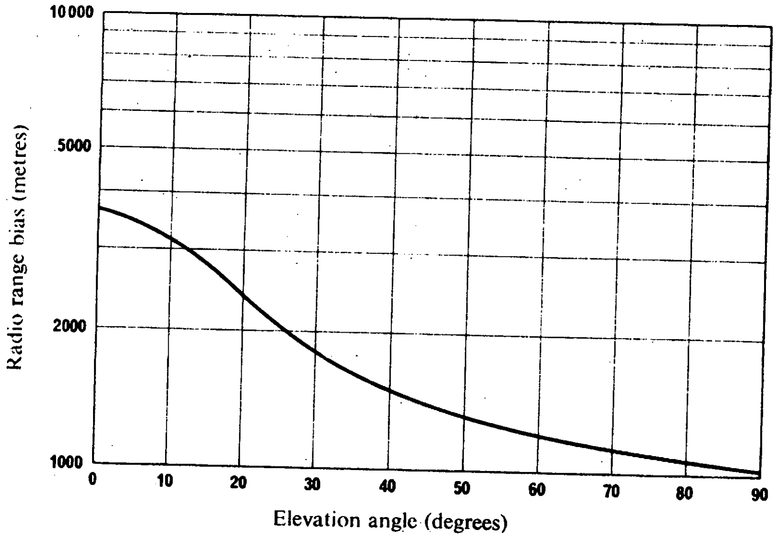

FIGURE 1

Uncorrected radio one-way range bias 130 MHz, daytime, sunspot maximum
($5{\cdot}4 \times 10^{17}$ electrons/m^2)

ANNEX I

A SINGLE SATELLITE LINE OF POSITION TECHNIQUE

Cross-track navigational accuracy of Doppler-equipped transatlantic aircraft can be greatly improved by augmenting the Doppler system with a satellite ranging system. A single range line of position from a synchronous satellite positioned over the mid-Atlantic provides the aircraft with an independent measure of its cross-track position. By periodically updating the Doppler system with ranging data, the normally increasing cross-track error can be reduced to a steady-state r.m.s. value, which depends on ranging accuracy and frequency of updating. The updating functions can be mechanized with a manual procedure or a fully automated system.

The principle depends on the use of a satellite-to-aircraft range measurement that defines a spherical surface of position. A second sphere is defined by the sum of the radius of the Earth and the aircraft altitude. The intersection of the two spherical surfaces results in a line of position, which, in the North Atlantic, is primarily in an east-west orientation. Considering the Doppler-measured along-track elapsed distance as a circular line of position centred at the previous waypoint, a position fix can be obtained by intersecting the two lines of position. The accuracy of this fix depends on the accuracy of the line of position measurements. The range line of position can be considered as an independent measure of the aircraft's cross-track position, and, if sufficiently accurate, the resulting Doppler/satellite fix can be used to update the Doppler system, thereby reducing the cumulative Doppler cross-track error.

The aircraft obtains the raw range signal with the satellite communications transceiver, as follows. At the beginning (or end) of a regularly scheduled position report, the aircraft transmits a few milliseconds of ranging signal to the satellite, which then returns the signal to the aircraft, where it is received and demodulated. Additional equipment then measures the round trip delay by comparing the phase of the received signal with that of the transmitted signal. The round trip delay is a function of satellite-to-aircraft range. The data are then adjusted for satellite/Earth relative motion, ionospheric delay, and equipment delay by using precomputed corrections and equipment calibrations. The resulting range delay determines the desired line of position which can be used to derive a Doppler/satellite fix.

Operations in the updating procedures can be grouped into three major functions: ranging, data processing, and control. The ranging function consists of the generation, transmission, reception, and delay determination of the ranging signal. The data processing function includes correction of the range data for satellite motion, ionospheric bias, and equipment delays, as well as Doppler/satellite range position determination and preparation of Doppler reset. There are two ways of mechanizing the update functions. The first approach is to perform the data processing and control manually, and the second is to fully automate these functions. In both mechanizations, the ranging function is automated in the interest of minimizing the satellite usage time.

The first step in designing the ranging system is selection of a suitable ranging concept. The concept must be compatible with planned aeronautical-satellite communications equipment and procedures. In addition, it must provide sufficient accuracy and have no significant ambiguities. Of the several concepts that have been proposed, a tone-burst technique operating in the VHF aeronautical band was selected.

The ranging system operates as follows. A VHF carrier is frequency modulated with a 1 kHz ranging tone, generated by an on-board reference, and transmitted to the satellite for a duration of 200 milliseconds. The returned signal is received about 50 to 70 milliseconds after the end of transmission, depending on the round trip range. After demodulation and cycle averaging, the phase of the received tone is measured relative to the phase of the reference tone.

This concept satisfies the necessary criteria. The frequency band of operation, mode of modulation, and bandwidth requirements (less than 15 kHz) are compatible with planned satellite-communications equipment. The 1 kHz tone supplies adequate ranging accuracy after compensation is made for ionospheric bias, and its inherent two-way range ambiguity of 81 nautical miles is automatically resolved by the Doppler-derived position fix. The technique is also compatible with operating procedures in that the tone burst can be added to the beginning or end of regularly scheduled position reports.

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ANNEX II

RADIODETERMINATION BY SATELLITES BY THE DISTANCE-MEASUREMENT TECHNIQUE

A. The Dioscures project

1. Introduction

The Dioscures system is a proposed world-wide integrated radiocommunication and radiodetermination system whose capacity can be progressively expanded to cope with the development of aeronautical and maritime transport. It is a permanently available system and its frequency bands have been selected in such a way that the performance characteristics of the system (transmission quality and accuracy of location) should prove satisfactory to users. The present document is limited to a discussion of the radiodetermination function of the system.

2. Principle of position-determination method

The system studied is based on the measurement of the distances between the moving craft (aircraft or ship) and two geostationary satellites (for example, a satellite S_1 situated at 10° W and another satellite S_2 situated at 60° W for coverage of the Atlantic). The position of a moving craft is generally determined on the initiative of a station on the ground, generally in accordance with a pre-set schedule. However, users are always able to ask for their positions at other times by using the radiocommunication system.

A measurement signal including the call sign of the moving craft is transmitted by the earth station in the band 5000-5250 MHz. Satellite S_1 amplifies this signal and retransmits it in the band 1540-1560 MHz in the common coverage zone of the two satellites. When the moving craft recognizes its call sign, it automatically retransmits the signal to the two satellites in the band 1640-1660 MHz. Satellites S_1 and S_2 each relay the signal to the ground in the band 5000-5250 MHz. By measuring the delay corresponding to the paths:

ground – satellite S_1 – moving craft – satellite S_1 – ground and

ground – satellite S_1 – moving craft – satellite S_2 – ground,

it is possible to deduce the distances between the satellite and the moving craft and thus locate the moving craft on two spheres centred on the satellites. By knowing the altitude of the moving craft, it is possible to pinpoint its position at the intersection of three spheres and the sense of the latitude is determined by the moving craft itself.

3. Application of the method

The distance measurement is based on the transmission of a 25 Hz digital signal:

— In the ground→moving craft direction, this signal sampled at a rate of 3·6 kilobauds is time-multiplexed with all the radiocommunication signals, i.e., three telephone channels coded and transmitted in digital form at a rate of 18 kilobauds each, one telex channel, two position-data transmission channels at 18 kilobauds and one synchronization channel at 18 kilobauds. This multiplex has a rate of 90 kilobauds.

— In the moving craft→ground direction, another 36 bauds multiplex is formed comprising the 25 Hz digital signal sampled at 9 kilobauds, a position-data transmission channel at 18 kilobauds and the synchronization at 9 kilobauds.

To obtain a distance measurement, the earth station transmits continuously a pseudo-random code with a period of 40 ms. All aircraft receive this code which synchronizes a clock in the moving craft which has a period of 40 ms. When it is interrogated, the aircraft retransmits a pseudo-random code with a period of 40 ms whose beginning and end are exactly in phase with the beginning and end of the code received.

The earth station measures the time difference between the beginning of a received code and the beginning of the transmitted code and evaluates the distance of the moving craft with respect to the two satellites. The accuracy of the distance determination depends on the short-term stability of the aircraft clock and the stability of the receiving clock on the ground.

The receiving clock of the aircraft is used again to synchronize the transmission clock to ensure strict synchronism of the transmitted and received signals. For a given signal-to-noise ratio, the phase jitter depends on the filtering function of the data clock.

The filtering necessitated by the primary synchronization corresponds to a noise band f of the order of 30 Hz ($f = 30$ Hz).

Thus the r.m.s. scintillation expressed as a fraction of the elementary duration of the digit for a signal-to-noise ratio (S/N) after demodulation is:

$$\sigma_\Phi = (0{\cdot}615/\sqrt{S/N}) \, . \, \sqrt{2\pi f T}$$

At a rate of 36 kilobauds one obtains for signal-to-noise ratios of 3 and 10 dB corresponding to extreme *S/N* values:

$$\sigma_{\Phi} = 3{\cdot}8 \times 10^{-2}$$

$$\sigma_{\Phi} = 1{\cdot}41 \times 10^{-2}$$

This corresponds to a variable error of between 300 m (degraded link) and 115 m.

Similarly at 90 kilobauds one obtains for signal-to-noise ratios of 5 and 10 dB:

$$\sigma_{\Phi} = 1{\cdot}5 \times 10^{-2}$$

$$\sigma_{\Phi} = 0{\cdot}7 \times 10^{-2}$$

This corresponds to an error of between 50 m and 25 m.

4. Measurement cycle

The duration of a position-determination cycle is 1160 ms and is broken down as follows:

- transmission of the call sign to the moving craft;
- reply to the moving craft on the position determination carrier frequency with a message which enables the earth station to achieve full synchronization;
- transmission of the distance measurement code by the earth station and repetition of this code by the moving craft and the satellites.

At the same time the earth station, using another data-transmission channel and operating at a rate of 75 bauds, sends the interrogated moving craft its calculated position 5 × 1160 ms beforehand.

In addition the earth station, the satellite and the moving craft all use coherent repeaters so that the passbands of the latter can be minimized and Doppler information is available for use if a satellite fails.

The capacity of the system is 256 interrogations every five minutes but can be increased without any difficulty.

5. System performance

The performance of the position as regards position determination has been predicted by means of a mathematical model assuming the following sources of error:

- measurement equipment and repeaters (electronic errors);
- altitude measurements (or in the case of ships, misevaluation of the geoid);
- multipath effects;
- ionospheric propagation;
- inaccuracies as regards the position of the satellite.

These errors can be broken down into a systematic error (any value between 0 and *M*) and a Gaussian error defined by a standard deviation σ. The values corresponding to these errors are given in Tables I and II, respectively, for an aircraft and a ship. Figs 2 and 3 show the maximum diameter of the zone of the error in the position of the moving craft as a function of its latitude and longitude for the two cases considered above.

For certain types of users (cable-laying and hydrographic vessels, for example) arrangements could be made to provide a high-precision position determination service. The whole sequence of the identification, synchronization and measurement signals lasts 1160 ms but as the actual measurement operation only lasts 200 ms, it is possible to perform at least four measurements. Averaging out such a small number of measurements would not yield any appreciable improvement in the method. In the case of ships, however, it would be possible to carry out position determinations over two cycles (i.e., 2320 ms) and perform measurements for 1320 ms—this would make it possible to carry out about 30 measurements. As the main errors are Gaussian, the position-determination accuracy could thus be improved by a factor of 5 and an accuracy of at least 100 m could be obtained in 95% of cases.

TABLE I

Errors for aircraft

Type of error	Systematic error	Standard deviation of the Gaussian error
electronic	$M = 0$	$\sigma = 150$ m
altitude	$M = \pm 100$ m	$\sigma = 200$ m
ionospheric	$M = \frac{+5 \text{ m}}{\sin \beta_i}$	$\sigma = 0$
multipath	$M = \frac{\pm 50 \text{ m}}{\sin \cdot \beta_i}$	$\sigma = 0$
satellite: altitude	$M = 0$	$\sigma = 50$ m
satellite: longitude and latitude	$M = 0$	$\sigma = 100$ m

β_i = angle of elevation of satellite with respect to the moving craft.

TABLE II

Error for ships

Type of error	Systematic error	Standard deviation of the Gaussian error
electronic	$M = 0$	$\sigma = 150$ m
geodesic	$M = \pm 20$ m	$\sigma = 0$
ionospheric	$M = \frac{+5 \text{ m}}{\sin \beta_i}$	$\sigma = 0$
multipath	$M = 0$	$\sigma = 0$
position of satellite: altitude	$M = 0$	$\sigma = 50$ m
position of satellite: longitude and latitude	$M = 0$	$\sigma = 100$ m

B. Correlation with experimental results

1. Single satellite simulation tests using Dioscures system (France)

During September and October 1970, ground/stratospheric balloon/aircraft experiments took place in the south-west of France with the object of evaluating the performance of a system of satellites for mobile vehicles operating in the 1540-1660 MHz frequency band. These experiments were complementary to the aircraft/aircraft experiments conducted off Brest in July 1970.

This system consisted in transmitting from the ground station a 5-channel digital multiplex signal (90 kb/s comprising three voice or data transmission channels and two additional data channels providing various service functions and ranging). The aircraft transmitted a digital multiplex signal at 36 kb/s comprising one voice channel and one channel composed of one 600 baud data transmission signal and one position determination signal.

The gain of the aircraft antenna was 10 dB /C.C.I.R., 1971/.

1.1 Measured accuracy

The measured accuracy in distance determinations (1σ) was better than 30 metres for an elevation of 15°, better than 60 metres at 10° and better than 150 metres at 6°. These distance measurements were compared with radar measurements with an accuracy of better than 10 metres.

The S/N ratios were also measured and were used to compute the theoretical thermal noise error, as well as the relation between the direct and reflected signal level. Thus, it was possible to determine the multipath effects on range errors.

2. Predicted error for the Dioscures satellite system

Extrapolations from the experiments were made for the satellite/aircraft link and these gave the following results :

- thermal noise error	σ = 20 metres
- error due to multipath effects (error not exceeded for 95% of time)	$\Delta \text{ (metres)} = \pm \frac{20\ 000}{i^2}$ where i is the angle of elevation in degrees ($i > 5^{\circ}$)

- antenna discrimination between the direct and the reflected signal :

6 dB for an elevation angle of 6°;
9 dB for an elevation angle of 10°;
12 dB for an elevation angle of 15°.

Introducing these new values into the mathematical model of position determination for two geostationary satellites spaced 50° in longitude, it is found that the accuracy of the horizontal position determination of an aircraft is better than 1 nautical mile for 95% of the time for latitudes between 10° and 65° with six consecutive measurements taking a total time of 240 milliseconds.

For a ship, it is predicted that the error due to multipath effects would become practically zero with the Dioscures system. The accuracy would then become 0.5 nautical miles for the same conditions. It could be improved to 0.1 nautical mile for 95% of the time if 25 consecutive measurements were taken for a total time of one second instead of 240 milliseconds.

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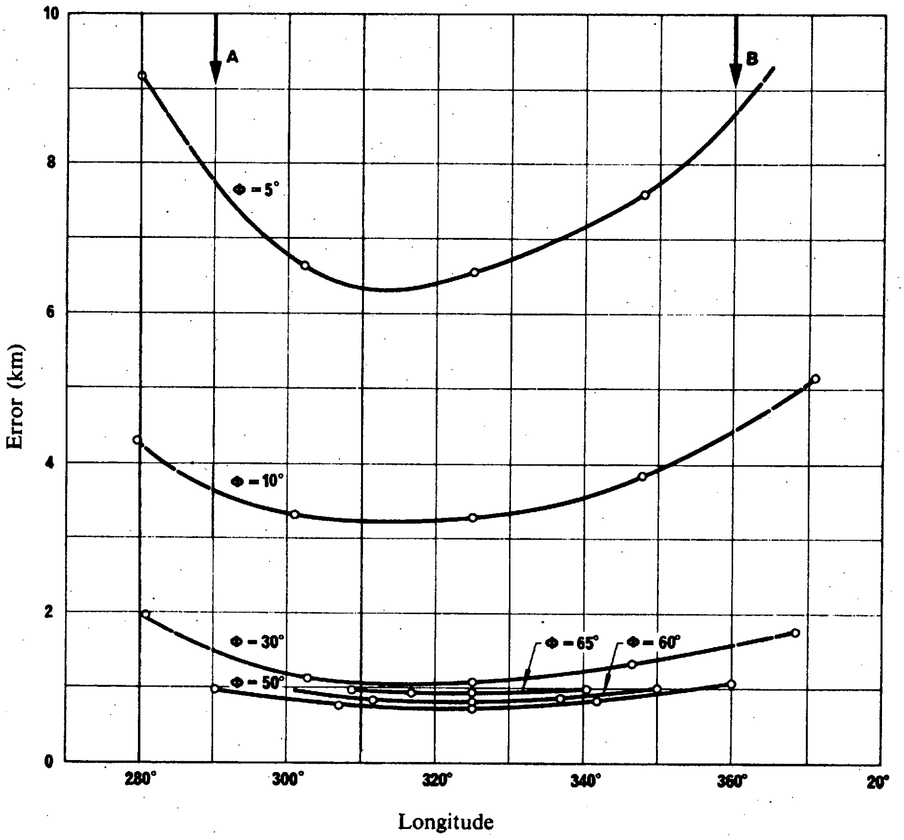

FIGURE 2

UHF (1540-1660 MHz, L band): errors in position of aircraft in 95% of cases

A, B: Dioscures limit

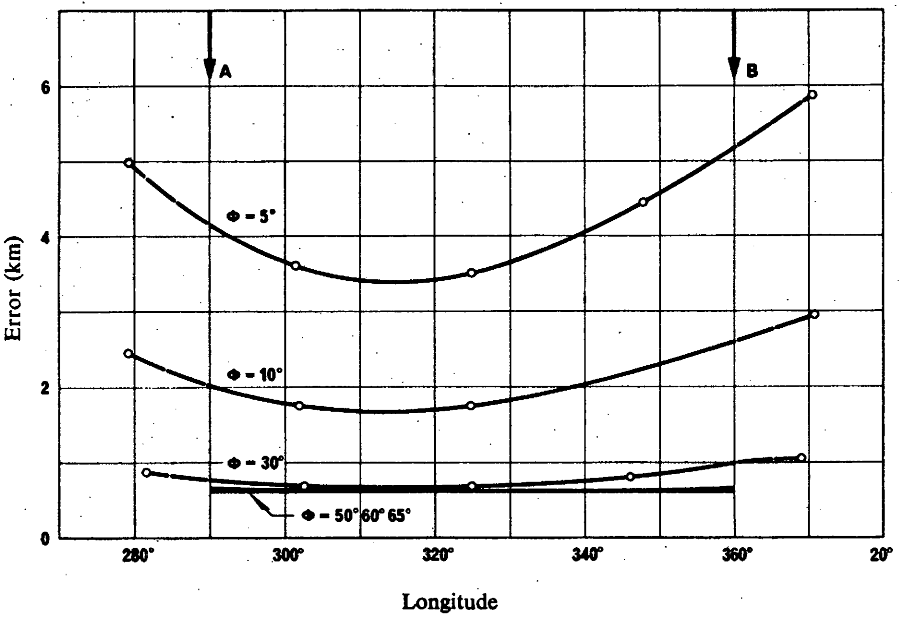

FIGURE 3

UHF (1540-1660 MHz, L band): errors in position of ship in 95% of cases

A, B: Dioscures limit

ANNEX III

THE RANGE PLUS RANGE SUM DISTANCE MEASURING TECHNIQUE

[Jorasch et al., 1968]

1. Introduction

Direct range measurements to aircraft via synchronous satellites coupled with a data relay of aircraft altitude can provide sufficient information to a ground based air traffic control centre for accurate and reliable independent traffic surveillance over whole ocean areas. This technique requires two satellites; however, this penalty is somewhat offset by the communications redundancy inherent in a multiple satellite system.

The particular aircraft location is defined by the intersection of three spheres, two of which are centred at the satellites with radii corresponding to the respective measured satellite-to-aircraft ranges and a third which is the geoid through the aircraft altitude. The minimum system implementation would utilize two antenna terminals, each directed to separate satellites, at a single ground site. Only one terminal is required to transmit at a given time; however, both are required to receive. The aircraft needs only a single receiver/transmitter and a single antenna provided that the beamwidth is large enough to encompass both satellites. The aircraft and satellite equipment are relatively simple because all of the processing functions are performed at the ground station.

2. Ranging signals

A comparison of ranging signal modulation techniques (including CW sidetone, pseudo-noise coded digital CW, pulse, and compressed pulse) in terms of power and bandwidth efficiency, position fix rate capacity and compatibility with satellite and aircraft equipment indicates that for a fix-time limited system (i.e., bandwidth constrained) the CW sidetone ranging is most appropriate for this application.

The power and bandwidth required is dependent upon the fix time per ranging measurement. Since the maximum speed of the supersonic transports is about 1800 knots, (3330 km/h), the goal of a maximum distance of 75 nautical miles (139 km) between fixes requires surveillance of each SST every 150 seconds. For the subsonic jets, the required fix rate would be once every 450 seconds. For example, in 1975, the maximum number of aircraft in flight over the Atlantic is expected to be about 150, including SST's. In this case, SST's would be serviced three times as often as the subsonic jets, resulting in a total allowable single position fix time of 2·2 seconds.

A practical baseband signal design incorporates modulation of the lower sidetones (as subcarriers) on the second highest tone. Ranging signal acquisition consists of sequentially acquiring the RF carrier, then the two highest sidetones simultaneously, and finally the lower tones simultaneously. This three-step process should consume no more than about one-half the total fix time. When system oscillator instabilities and Doppler rates are considered, it is acquisition time which dictates radio-frequency carrier and sidetone loop bandwidths. Accuracy, in terms of phase errors, then dictates required signal-to-noise ratios in the respective loops. When the distribution of radio-frequency power in the carrier and individual sidetones is optimized, the total received radio-frequency signal-to-noise density required can be determined as a function of accuracy, bandwidth and receiver acquisition time. For example, for a required accuracy of 0·1 nautical miles (thermal noise only) and a position fix time of 2·2 seconds, increasing the radio-frequency signal bandwidth from 20 kHz to 40 kHz saves less than 1·3 dB in total ranging signal power. Increasing bandwidth from 40 kHz to 100 kHz saves only 0·4 dB. Because the ranging powers are much less than that for a voice channel, it may be concluded that narrow-band ranging signals are quite appropriate for aircraft surveillance. The ground terminal can always be transmitting, with all aircraft frequency tracking the radio-frequency carrier component of the signal. Sub-carrier PSK may be used for a 32-bit address at 100 bits/s, time shared with sidetones. Upon recognition, a 32-bit signature is transmitted by the aircraft, followed by a 15-bit altitude message, and then the (relayed) ranging signals.

3. Performance

The satellite power required for the satellite-to-aircraft link is a factor influencing the overall system implementation. The accuracy versus signal-to-noise density is depicted in Fig. 4 for VHF (130 MHz). The ordinate is the latitudinal position-fix error which will result during a sunspot maximum day with an ionospheric disturbance which increases the total electron content in a vertical column to 8×10^{17}. This is an extremely unusual condition /Chamberlain and Kersley, 1969/. The utilization of calibration stations is expected to reduce the bias error to within 10% in the regions near the stations and could be expected to reduce the error to 25%, midway between the stations. The correction to 25% has been assumed for this figure.

4. Summary

The following aircraft surveillance requirements may be accommodated by a two-satellite ranging technique:

- surveillance independent of pilot/crew action of 150 to 200 jet aircraft (including 50-75 SST's) per communications data channel;
- position-fix accuracies of ±2 nautical miles or less and a maximum distance travelled between fixes of 75 nautical miles (139 km) of flight. Five nautical miles was determined to be adequate to support a 60 nautical miles (111 km) lateral separation standard at the mean-time-between-collisions of 1 per 10^8 flights;
- utilization of system/signal designs at VHF which are compatible with aircraft and satellite communications equipment and frequency assignment plans. In particular, it was assumed desirable to minimize the required radio-frequency bandwidth per surveillance channel to 25 kHz as a design goal because this is equivalent to the bandwidth required for an optimized voice communications channel.

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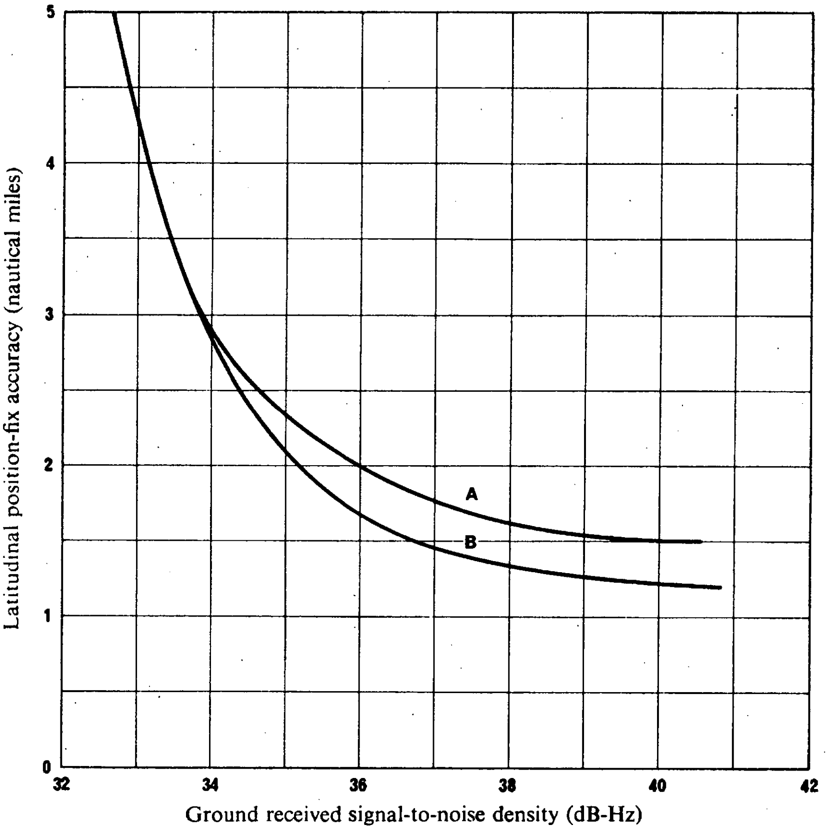

FIGURE 4

Performance of VHF ranging

Conditions: CW sidetone of 20 kHz bandwidth in a 25 kHz channel
Ionosphere: vertical electron content 8×10^{17} electrons/m^2
Multipath: 100 m + 100/sin β
Satellite position accuracy: 100 m
Aircraft altitude accuracy: 50 m
Equipment errors: 100 m
Ionospheric correction to 25% of bias error

A: 20° latitude
B: 65° latitude

ANNEX IV

THE TONE CODE RANGING TECHNIQUE

The tone-code ranging technique has been tested at VHF using the National Aeronautics and Space Administration's satellites ATS-1 and ATS-3, and in the band 1500-1600 MHz using the ATS-5 satellite. Hundreds of hours of tests and more than a million range measurements have verified that the technique has the following characteristics:

- useful accuracy can be achieved within the modulation and radio-frequency bandwidths of present-day mobile communications;
- the technique can be used with wide bandwidth for high accuracy;
- it requires only one channel for range measurement, receiving and transmitting in the simplex mode if desired without the need for an antenna diplexer;
- the time required for a range measurement is a fraction of a second so that it can time share a communication channel with little additional time usage of the channel;
- it can be implemented at a small incremental cost by the addition of an inexpensive solid-state responder unit attached to a communications receiver-transmitter;
- it can, but need not, employ digital or digitized voice transmissions to provide synchronizing of the user responder, thereby further increasing the efficiency of channel usage;
- there are no "lane" ambiguities in the range measurements;
- user identification is simple and is confirmed in the returned signal.

The tone-code interrogation signal is a short audio-frequency tone transmission followed by a digital address code in which audio cycles are inhibited for zeros, transmitted for ones. Alternatively, phase shift keying could be used, and is planned for future tests.

The tone-code technique was tested in the band 1500-1600 MHz using a tone-code frequency of 9.7656 kHz derived by binary devision from an accurate ten MHz oscillator. The RF bandwidth was 60 kHz. The tone duration was 256 cycles and the code 30 bits in duration so that the tone-code duration was 0.03 second. The precision of independent range measurements through ATS-5 was approximately 0.1 microsecond or ± 15 m 1 sigma, for two-way ranging. (See also Report 507).

At VHF the tone-code frequency was 2.4414 kHz derived by binary division from an accurate 10 MHz oscillator. The frequency is within the passband of aircraft voice communications. The radio frequency bandwidth was 15 KHz. The tone duration used in previous tests was 1024 cycles and in recent tests 256 cycles. The code is 30 bits in duration so that the presently used tone-code signal duration is 0.12 second. The improved phase matching technique used in the recent tests has achieved a provision of 0.32 microsecond, 1 sigma, which is equivalent to ± 50 meters, in two-way ranging. The automatic transponder aboard the user craft receives the tone cycles from the satellite on its communication receiver. All of the tone cycles received from the satellite, even though they may be interrogations from other aircraft, are applied to a phase matching circuit. A locally generated tone of the same frequency is also applied to the phase matcher, which adjusts the phase of the locally generated tone so that it corresponds to the phase of the received tone. The local tone is generated at the same frequency as the ground terminal tone within an accuracy of one part in 10^6 or better, an accuracy achievable from a moderately priced oscillator.

The phase matcher averages over the 256 received cycles in establishing the timing of the locally generated phase. The averaging process improves the timing precision by the square root of the number of cycles averaged. At threshold signal-to-noise ratio for a narrow-band FM receiver, the phase of the zero crossings of the locally generated tone is matched within approximately 1.0 microsecond to the phase of the received tone zero crossings.

The locally generated tone is used to generate clock pulses that clock the received interrogation signal into an address code recognizer that consists of a shift register with summing circuits pre-wired to correspond to the digital address code of the user. Digital pulses timed from the received tone zero crossings are clocked into the address code recognizer. When the sequence of pulses representing the user's address code is clocked into the recognizer, it produces a single output clock pulse that opens a gate to interrupt the locally generated pulses that are clocking the shift register. The duration of the interruption is precisely contro led by a pulse counter. During the interval in which the clock pulses are interrupted, the user's transmitter is activated and the antenna is switched from the receiver to the transmitter. When the switching is completed, the locally generated 9.7656 kHz tone is transmitted until the end of the precisely measured interval. Clock pulses are then reapplied to the shift register and the address code is clocked out to key the audio tone to the transmitter and return the address code, followed by the user's altitude, back through the satellite to the ground station. Introduction of the delay while the antenna is switched eliminates the need for a diplexer in the user equipment. It also enables reception and transmission to occur on the same frequency.

There are separate receivers at the ground terminal for the two satellites. If the transmissions from the satellites are on the same frequency, they may be distinguished at the ground terminal by directive antennae. Each receiver output is applied to an address code recognizer similar to that in the user equipment. Prior to the interrogation of an individual user, the taps of the summing circuit are switched to correspond to the code of the user to be addressed. When the address code is received from a satellite, a single output clock pulse occurs at the output of the summing circuit.

The first return from the interrogating satellite produces a time reference pulse that is followed by the user's return through the interrogating satellite as well as the user's return through the other satellite. The time interval between the reference pulse and the following returns are separately measured thereby enabling the ranges from the satellites to the user to be determined, and the user's location to be calculated.

A moderately sized computer can determine an explicit solution for the user's location within a fraction of a second.

The following is a description of experiments made to test this technique.

Tests of the technique were started in 1968 on VHF and early in 1972 in the band 1 500 - 1 600 MHz. Range measurements have been made to :

- a buoy moored in deep water near Bermuda;
- a DC-6B aircraft in flight over the continental United States and North Atlantic to Thule, Greenland; Shannon, Ireland; and the Azores;
- a KC-135 jet aircraft over the North Atlantic;
- ships in the Atlantic, Gulf of Mexico and Pacific;
- fixed transponders at Shannon, Ireland; Reykjavik, Iceland; Thule, Greenland; Gander, Newfoundland; Buenos Aires, Argentina; Kings Point, New York; Schenectady, New York; Seattle, Washington; and Melbourne, Australia.
- to a small panel truck in upstate New York.

Tone-code interrogations were usually made from a ground terminal at Schenectady, New York, and usually through ATS-3. In some of the tests the transponder responses were relayed back to the ground terminal by both ATS-1 and ATS-3; position fixes were computed for many of these dual responses. In the tests when the transponder was within the coverage area of only one satellite a line-of-position was computed.

Two-satellite position fixes were made to a Coast Guard ship in the Pacific. A few fixes were made while it was docked at Alameda, California on May 13, 1970. Fixes made while the ship was docked in San Francisco Bay are shown in Figure 1 . The ship then sailed to Ocean Station November, halfway between San Francisco and Hawaii where it remained on station for three weeks. The ship was tracked with two-satellite position fixes while underway and on station. The ship proceeded to Pearl Harbor, beyond the range of ATS-3. Lines of position from ATS-1 bracketed the ship at its docked position within 1 mile. The ship returned to the Alameda, California dock where two-satellite position fixes were determined on July 10. The ship was moved to a San Francisco dock where it was located on July 21. The precision of the two-satellite position fixes was better than ± 1 nautical mile 1 sigma, but with bias errors of approximately 1 nmi. The bias errors were shown to be errors in predicting positions of the satellites, estimating the propagation delay in the ionosphere, and in calibration of the equipment time delays.

A DC-6B aircraft and a KC-135 aircraft were flown for 5.5 hours within range of a precision radar off the coast of New Jersey and over the State of Pennsylvania. The positions of the aircraft as determined by two-satellite position fixes was compared with precision radar fixes. The poor signal-to-noise in the down link to the aircraft resulted from antenna characteristics and tended to cause position fix errors that were displaced along a hyperbolic line of position. A systematic progression of fix error bias over the 5.5 hour period was due to the diurnal changing error in satellite position prediction.

The results of a recently conducted twenty-four hour satellite test are shown in Figure 2 . A transponder was interrogated at VHF through ATS-3, and responded simultaneously and coherently in the band 1 500 - 1 600 MHz through ATS-5 and at VHF through ATS-3. Between 10 and 12 position fixes were made during a ten minute period each hour. Range measurements were made to other transponders during the same ten minute periods. The transponder was stationary at the location shown by ☒ in Figure 2 A time progression of fixes forms a closed ellipse, offset from the true position. The ellipse results from errors in predictions of satellite positions which are used as position references. The locus of intersections of computed lines of position from the satellites intersect to form the ellipse because each line of position has a sinusoidally varying error with a 24-hour period.

Displacement of the ellipse from the true position of the transponder resulted from error in estimating the time required for the signal to pass through the electronic circuits.

Peak-to-peak slant range error due to error in prediction positions of the satellites was 0.5 percent of the total slant range change for ATS-3, and 1 percent of the total slant range for ATS-5.

Test results obtained with ATS-1, ATS-3 and ATS-5 (U.S.A.) indicate that an accuracy of better than ± 1 nautical mile using VHF with a 2.4414 kHZ tone and 0.1 nautical miles using the band 1500-1600 MHz with a 9.7656 kHz tone for ships and aircraft can be achieved. This assumes an unobstructed view from the antenna to the satellite and the use of a circularly-polarized antenna which can discriminate against surface reflections. This accuracy may be achieved by employing calibration transponders functionally similar to the mobile equipments at fixed known strategic locations within the satellite coverage area and interrogating them at appropriate intervals to determine the satellite positions by trilateration. If a system were implemented at VHF, calibration transponders would be required to determine range measurement corrections for ionospheric propagation delay. The system would also require an occasional measurement of each transponder equipment's time delay when the transponder is at a known bench mark. The equipment time delay is stored and applied in a computation of the position of the user craft.

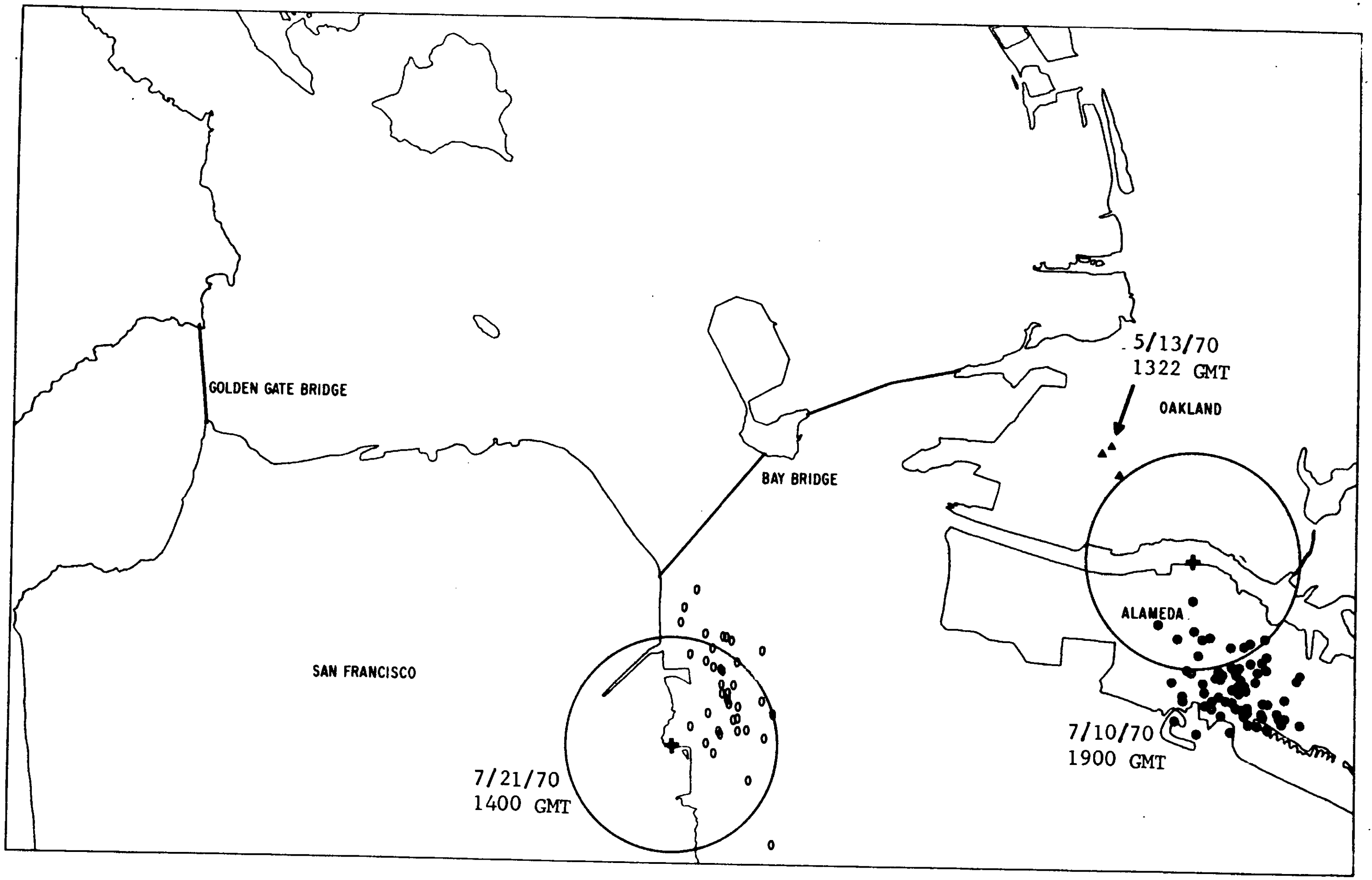

FIGURE 1

POSITION FIXES, USCG RUSH IN SAN FRANCISCO BAY

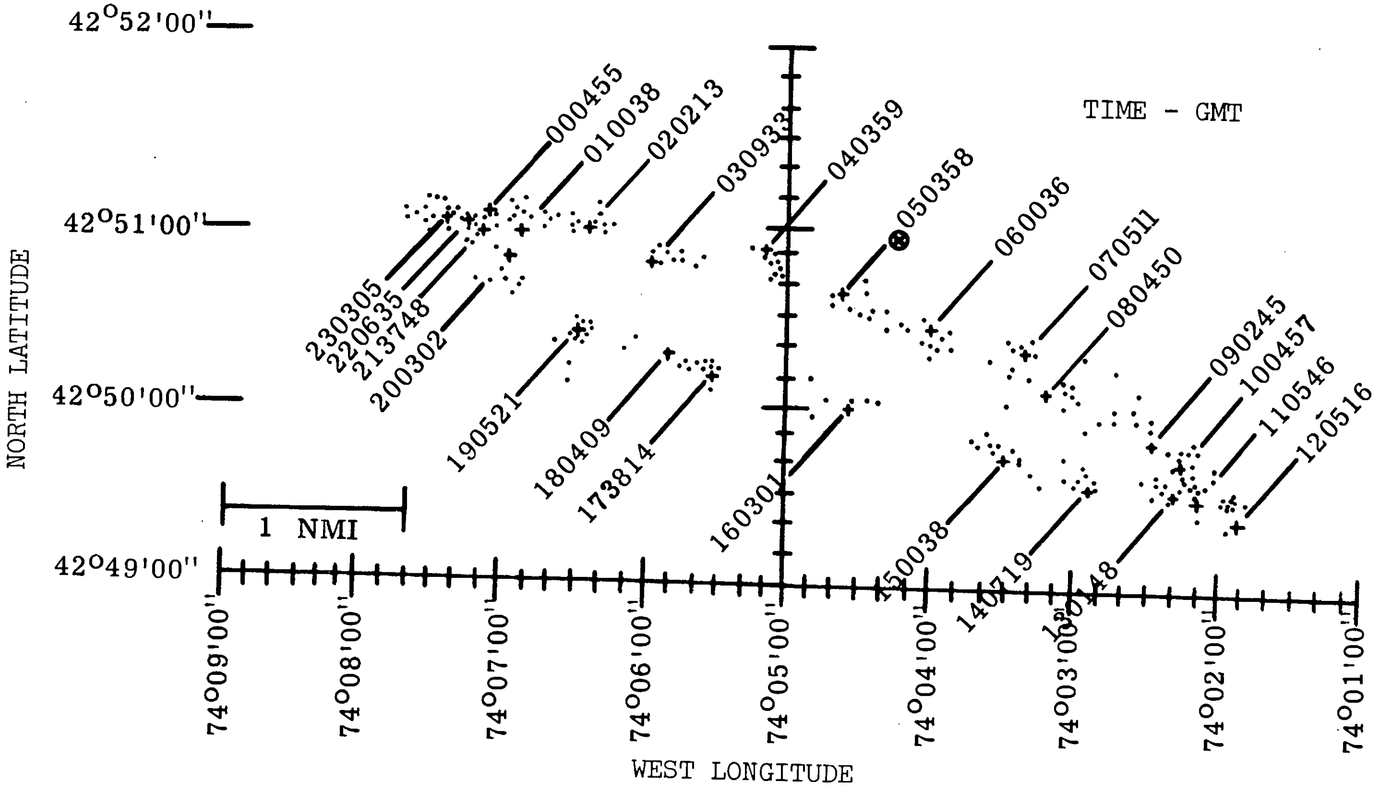

FIGURE 2

RESULTS OF TWENTY-FOUR HOUR TWO-SATTELITE TEST

⊗ Location of transponder
● Position fixes (Time - GMT)
\+ Position fixes chosen arbitrarily to show time progression of fix error

Twenty-four hour satellite test conducted from 1600 GMT on 30 November 1972 to 1510 GMT on 1 December 1972. Interrogations were made at VHF via ATS-3 and responses at VHF via ATS-3 and in the band 1 500 - 1 600 MHz via ATS-5.

ANNEX V

THE SPEED, POSITION AND TRACK (SPOT) TECHNIQUE

SPOT (speed, position and track) is a proposed synchronous satellite ranging system which utilizes phase difference measurements of angle modulated CW signals. It can provide precise position determinations of aircraft and marine vessels in both a traffic surveillance and self-navigation mode. Other applicable services, such as search and rescue and two-way data and voice communications, can readily be incorporated on the same satellites.

The SPOT system is comprised of ground control stations where CW signals at UHF (1540-1660 MHz), modulated with two or more tones and a data link, are generated and transmitted to satellites, and return signals are processed for traffic control and synchronization purposes; a network of satellites in 24-hour orbits which relays radio-frequency signals from the ground stations to a field of users and vice versa; and the " user " instrumentation where the navigation tones are processed for a position fix, and/or transponded and relayed to the ground stations for the traffic surveillance function.

Results of error analyses indicate the feasibility of achieving position-fix accuracies of 0·2 km over transoceanic distances and approximately an order of magnitude improvement over relative distances of a few hundred kilometres. Performance is related to the sophistication and cost of the user equipments.

Design configurations have been studied for a North Atlantic system employing satellites with low-noise, hard-limiting receivers and modest transmitter power requirements (20 watts average) for a traffic surveillance, passive navigation, or a combined system.

For traffic surveillance in the North Atlantic, the space segment can have two synchronous equatorial satellites located approximately at 20° and 70° West longitude. The ground control centre can be located on the east coast of the United States or the west coast of Europe convenient to international air traffic terminals. The operational sequence of the system is as follows:

— the ground control centre transmits a CW signal at UHF (1540-1660 MHz) to satellite A. This carrier is modulated with two tones, for example, a high tone of 8 kHz and a low tone of 500 Hz. In addition, binary phase shift-keying is employed on the low tone to serve as a digital data channel. The data channel also functions as a command link by instructing each user when to return the ranging signal. The ground control centre data processing and control equipment (in accordance with a predetermined role call schedule) selects a particular user for a surveillance check by transmitting his unique address code;

— satellite A, after frequency shifting, relays the radio-frequency signal to the field where it is continuously available to every user;

— when a particular user receives his address code via the data channel, his transmitter is turned on automatically for a brief period (1-2 seconds) and he transponds the received signal, adding his address code, altitude and other pertinent status data back to satellites A and B;

— both satellites then relay their respective return signals to the ground control centre after frequency shifting;

— the ground control centre compares the phases of the returned tones to the reference tones to obtain the range data which identifies the user's position. The satellite ephemerides are assumed to be known by the ground control centre.

The system configuration for the passive user mode closely resembles the forward link of the surveillance mode. The ground control centre transmits tone modulated carriers to the two satellites. At specific time intervals, the data channel conveys ephemeris data on the satellites and other general navigation advisories. The satellites, after frequency translation, relay their respective signals to the user field. The users continuously receive signals from both satellites. When making a position fix, the radio-frequency carriers are demodulated and the tones are extracted to be compared with a local reference oscillator in synchronism with the ground control centre tone generator. The data link provides updated information on the satellite ephemerides to complete the data inputs required by the user to compute his position. The typical method of operation is visualized as follows. Prior to departure from a terminal or a known geodetic reference, the user calibrates or sets his phase meters at zero. During his trip the zero crossings of phase are automatically recorded, thus providing lane identity at all times. For a precision position fix, the phase angles are read to the required accuracy. The user reference oscillator drift or instabilities will introduce errors. However, off-the-shelf, temperature-controlled crystal oscillators are reported to yield frequency stabilities of the order of 5×10^{-11} for periods up to 24 hours. For 1·85 km accuracy, an aircraft would not require recalibration of such an oscillator while en route. For marine users who may be on the high seas for periods of many days or weeks, however, a daily recalibration of the phase meter or local reference oscillator could be accomplished through the use of the surveillance mode, particularly during those daily periods when air traffic densities are low.

Ambiguities resulting from the repetition of phase-angle measurements at every tone cycle are resolved by adding tones of lower frequency until the equivalent range of the lowest tone is sufficiently long for non-ambiguous position fixes. If it is assumed that phase can be measured to 5°, a high tone of 8 kHz provides a range precision of 0·517 km, sufficient to meet a requirement of 1·85 km position-fix accuracy in the user's navigational (horizontal) plane. This tone has a lane width of 37·7 km thus requiring the lower tone to have a range precision within this limit to assure that the correct tone lane is identified during the position-determination process. Practical equipment considerations, however, limit the high-to-low tone ratio to approximately 16, indicating a low tone of 500 Hz. This tone provides a non-ambiguous lane width of 603 km and can be resolved well within the fine tone requirements. As a growth feature, additional tones can be added, such as a 64 kHz tone to provide 0·185 km position-fix accuracies, by the ground control centre without requiring any modifications to the satellite and user equipment, except for the special user who wants to take advantage of the higher precision.

Results with ATS-5 (United States of America)

Radio-frequency signals containing ranging modulation were transmitted (up-link 1650 MHz) from NASA's STADAN station at Mojave, relayed through the ATS-5 geostationary satellite and received (down-link 1550 MHz) by two stations, one aboard the United States tanker MANHATTAN and one on land in Moorestown, New Jersey. The results are presented in Report AQ/8 (Doc. 8/134, 1970-1973).

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ANNEX VI

AN INTEGRATED NAVIGATION AND TRAFFIC CONTROL SATELLITE SYSTEM

1. Introduction

This proposed system would use multiple satellites transmitting ranging signals accurately time-synchronized. If the user knows his own altitude and obtains signals from three properly located satellites, he has sufficient information to determine his position. If he also wishes to determine altitude, he needs to measure the range difference between four appropriately located satellites. Continuous coverage of the heavily travelled North Atlantic routes can be obtained using four satellites in 24-hour synchronous orbits. Should one of these four fail, altitude and rate of climb information is lost, but position and velocity information is still available. Failure of two of the four satellites causes a degradation of position accuracy to the order of several miles at the end of a transatlantic flight. Thus, the system provides considerable in-orbit redundancy. World-wide coverage (including altitude measurement) can be obtained with 12 to 18 satellites, the number of satellites depending on system design goals. Users obtain navigation data by measuring range differences between satellite pairs. In addition, data links to the satellites are provided for automatic relay of digital data between aircraft and a traffic control centre. The navigation data received at the traffic control centre from aircraft are processed by a ground-based computer with no airborne computations required. Traffic-control instructions in digital form can then be sent to the aircraft from the traffic-control centre via the satellite link. All transmissions are in the 1540-1660 MHz band.

2. System capabilities

The capabilities of this system include:

World-wide or area coverage

- all weather,
- near continuous.

Single-fix position and velocity accuracy of the world-wide system

- position CEP: 18 m absolute,
- velocity: 0·06 m/s,
- altitude accuracy: 39·2 m absolute,
- rate of climb accuracy: 0·12 m/s,
- world-wide time standard: better than 0·1 μs accuracy.

The system is in effect a satellite-based extension of previously known hyperbolic navigation concepts such as LORAN, OMEGA or DECCA. An alternate technique possible with this system is for a user to measure four one-way range measurements against his own (relatively inaccurate) crystal oscillator. He then has sufficient data to solve for his position, altitude and accurate time. Similarly, the user who wants to measure velocity and rate of climb measures either the range rate difference from the Doppler of each of these signals or the four inaccurate range rates.

The system makes use of a ground-station network to track the satellites. The number of ground stations needed ranges from 3 to 11, depending upon the satellite constellation and the design requirements. Only range difference information is measured by the tracking stations and, consequently, the antennae required are small and can be fixed. The simplicity of tracking antennae and measurements required leads to low overall ground station cost for the navigation network.

The tracking stations send their data to a master ground station via a transponder on the satellites. The transponder also relays traffic control data as described in another section.

The master ground station uses the tracking data to compute ephemeris and satellite oscillator time correction. These are transmitted to the satellites (approximately every hour) by the master station, which may be co-located with a tracking site. Periodically (every three or four months) attitude control and station-keeping commands are transmitted to the satellites. There will be one to three master stations required, depending on the constellation chosen. Ground station to satellite contact can be lost for up to eight hours. Moderate degradation will occur in system accuracy after several hours of outage.

BIBLIOGRAPHY

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STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly, for consideration :

REPORT AA/8 (Rev. 74)

USE OF RADIO-BEACON STATIONS FOR COMMUNICATIONS

(Question 15/8)

(1974)

1. Introduction

This report discusses the technical characteristics of supplementary emissions that can be superimposed on the carrier of a radio-beacon in the LF or lower MF band and is derived from the various submissions by administrations on this subject.

2. Protection of the primary function

It is important that any supplementary information superimposed upon the carrier of a navigational beacon should not degrade the prime function of the beacon in any way, although it is noted that in certain circumstances it is possible that information of a meteorological or safety nature might be even more important than the direction-finding function.

3. Reports of experience with supplementary A3 voice modulation

Japan reported modulating a non-directional A2 radio-beacon with meteorological information using A3, the duration of each meteorological transmission being one minute and thirty seconds. The carrier frequency was 313 kHz and the mean power 65W. Direction finding was possible at a distance of 150 km or more without prejudice to its accuracy, and the meteorological information was receivable at a distance of 100 km using a simple eight-transistor receiver. Studies continue.

Several administrations are making use of supplementary voice communications and weather broadcasts using amplitude modulation (A3).

In the United States, a Transcribed Weather Broadcast (TWEB) has been successfully superimposed on a number of aeronautical radio beacons using A3 emission. This is a recorded weather broadcast, which by updating the recording at frequent intervals, provides continuously current meteorological data.

After many years of operation, it can be concluded that these currently practised methods of voice modulation on radio-beacons do not degrade or interfere with the direction finding feature, and have provided worthwhile operational advantages.

4. Reports of experience with supplementary F1 emission

Tests in Canada using direct printing at various keying rates and with several carrier shift rates have shown that use of carrier-shift modulation on a non-directional radio-beacon has an adverse effect on the reliability of bearing information provided by some types of automatic direction-finding equipment in aircraft. The types affected appear to be those utilizing phase locked loop/synchronous detection techniques.

The intent of the tests was to show whether the performance of the beacon, as set down in the I.C.A.O. Standards and Recommended Practices contained in Annex 10 to the Chicago Convention on Civil Aviation, would be affected by carrier-shift modulation.

Tests were conducted with carrier frequency shift from ± 30 Hz to ± 85 Hz at keying rates from 30 to 200 bauds at signal levels of between 50 uV and 200 mV. Under no combination of these variables did the phase locked loop/synchronous detection automatic direction finding equipment (ADF) under test, lock onto or provide any bearing indication.

The effect that supplementary frequency shift keying (FSK) modulation (F1) has on ADF receivers appears to depend on the detection and demodulation techniques used by the different receivers. The frequency tolerance of .01% permitted by I.C.A.O. leads the engineer who designs a modern ADF to provide digital tuning to the nearest 0.5 kHz with a phase-lock fine tuning for final correction. If the response time of the phase-lock loop is short, the modern ADF with this feature remains in a continuous tuning mode when attempting to take a bearing on a beacon which has frequency-shift keying imposed upon it.

Some equipment using phase-locking happens to be designed with a longer response time, and is not adversely affected by the presence of frequency-shift keying. Equipment not having phase-lock loop/synchronous detection is not adversely affected even if the carrier is shifted ± 150 Hz and A3 modulation is transmitted simultaneously.

Annex 10, Volume I, Part I, para. 3.4.6, to the I.C.A.O. Convention permits supplementary modulation on radio-beacons, provided that these additional modulations do not materially affect the operational performance of these radio-beacons in conjunction with currently used airborne direction finders. A radio-beacon with frequency shifted carrier would not meet this criterion.

5. Aeronautical use

5.1 The I.T.U. Radio Regulations in its allocation table permits voice communications in the aeronautical radionavigation bands used for aeronautical radio-beacons.

5.2 The International Civil Aviation Organization (I.C.A.O.) has recommended at its various regional meetings that aeronautical radio-beacons operating in the LF and MF bands be replaced, where possible, by VHF navigational aids and that meteorological and safety information to aircraft in flight be sent by :

- either request/reply transmissions on the operational ATC air/ground channel in use;
- or HF/VHF broadcasts on dedicated aeronautical mobile meteorological service channels (VOLMET).

5.3 In addition, I.C.A.O., in its Standards and Recommended Practices (S.A.R.P.s) contained in Annex 10 to the Chicago Convention on Civil Aviation, has agreed international standards which recognize that in addition to A0, A1 or A2 emission, other types of modulation including voice may be utilized, although there is no voice communication function specified. In the European and Mediterranean Region of I.C.A.O. there are some 1,225 radio-beacons and locators serving civil aviation and operating, in the bands 255-285 and 315-405 kHz. It would be difficult in such an environment to ensure adequate protection between adjacent channels if the carriers were subject to other forms of modulation.

5.4 I.C.A.O. Annex 10 also cautions that any such voice modulation should not derogate the primary service of the radio-beacon, the direction - finding capability.

In particular reliable performance of airborne automatic direction finding (ADF) equipment may be seriously prejudiced if the beacon emission contains modulation by an audio frequency equal or close to the loop switching frequency or its second harmonic. The loop switching frequencies in currently used equipment lie between 30 Hz and 120 Hz.

In order to facilitate the planning of frequency assignments, Class A2 emissions are used in some areas to identify these radio-beacons with a modulation frequency of 400 Hz ± 25 Hz rather than 1 020 Hz ± 50 Hz to reduce occupied bandwidth. Airborne direction finding equipment employs automatically switched antenna techniques and equipment could be sensitive to other types of modulation when using certain switching rates.

5.6 If any administration wishes to add supplementary modulation on beacons specified for aeronautical use, these administrations are required to notify the I.F.R.B. If such beacons are specified in an I.C.A.O. Regional Plan then it would be desirable that I.C.A.O. should also be notified.

6. Conclusions

6.1 Any secondary modulation superimposed on a radio-beacon emission should not disturb the frequency relationship (separation) between the carrier and sidebands of the basic A2 emission.

6.2 The characteristics of the total emission should not result in greater interference with adjacent radio transmission than is caused by the basic A2 radio-beacon emission.

6.3 Although A3 emission is being used successfully by several Administrations, a radio-beacon emission should not be modulated by audio frequencies approximating to the ADF loop-switching frequency or its second harmonic. /̲ I.C.A.O., 1972/.

6.4 A radio-beacon should not be frequency-shift modulated unless a sufficiently long response time for phase-locking of the ADF receiver is adopted. An investigation of the practical implications is required.

6.5 The addition of point-to-point or non-safety information to a radio-beacon emission should not prejudice the later addition of navigational or safety information.

6.6 In Europe, the Paris Regional Arrangement (1951) restricts the range of maritime radio-beacons and groups them into threes and sixes, limiting the duration of emissions to two minutes or one minute respectively, which is just sufficient for a qualified operator to take a radio bearing.

6.6.1 The duration of emissions could not be increased without complete revision of the Paris Regional Arrangement (1951).

6.6.2 Emitting direction-finding signals and meteorological information alternately would diminish the efficacy of the radio-beacon network in its prime function.

6.7 More information on operational requirements, both for the mobile services and other services in remote areas is required before standards can be decided, particularly in respect of the means by which the information would be emitted (e.g. voice, fascimile, telegraphy).

REFERENCE

I.C.A.O. /‾1972_7 Convention, Annex 10, Part 1, § 3.4.6.5.

Note.- The Director, C.C.I.R. is requested to draw the attention of I.C.A.O. to this Report.

C.C.I.R.
XIIIth Plenary Assembly
Geneva, 1974

Doc. 8/1043-E

STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration:

REPORT AC/8(Rev.74)

REDUCTION OF FREQUENCY SEPARATION BETWEEN ADJACENT CHANNELS IN THE VHF (METRIC) MARITIME MOBILE BAND

(Question 10-1/8)

(1974)

1. Introduction

The following documents were submitted in reply to Question 10-1/8 at the Interim and Final Meetings of Study Group 8 at Geneva in 1972 and 1974 respectively :

Doc. 8/1 (U.S.A.), 1970-1973;
Doc. 8/33 (Federal Republic of Germany), 1970-1973;
Doc. 8/40 (Japan), 1970-1973;
Doc. 8/61 (Canada), 1970-1973;
Doc. 8/71 (U.S.A.), 1970-1973;
Doc. 8/168 (U.K.), 1970-1974;
Doc. 8/219 (U.S.A.), 1970-1974;
Doc. 8/235 (Canada), 1970-1974;
Doc. 8/282 (Switzerland), 1970-1974.

Doc. 8/33 deals only with the compatibility between transmitters with a peak deviation of ± 15 kHz and receivers designed for a 25 kHz channel spacing. It concludes that no essential reduction of the intelligibility will arise.

Doc. 8/71 recommends that Administrations proceed as rapidly as possible to adopt equipment conforming to 25 kHz channel spacing and to the standardization of essential technical specification.

Doc. 8/168 (U.K.) is a draft Recommendation in answer to the Question and contains proposed specification clauses for most of the required characteristics. It is generally in line with current U.K. practice.

Doc. 8/219 (U.S.A.) contains additional information on technical characteristics. In particular it specified the measurement and limits for spurious radiated emissions from receivers in accordance with U.S.A. practice.

Doc. 8/282 (Switzerland) is a reprint of Doc. 1/56 of Study Group 1 and has been issued to assist Study Group 8 in its deliberations. Of particular value is its comparison of the Sinad and 'Psophometer' methods of measuring sensitivity. This shows that for low values of signal the two methods give identical measurements of sensitivity provided the same audio measuring bandwidths are used and the paper recommends the use of an audio bandpass filter of defined characteristics such as the C.C.I.T.T. telephone filter. At high levels of signal input the two curves diverge because of the distortion term in the denominator of the $\frac{S + N + D}{N + D}$ term. (See Fig. 1)
This information should be very useful in helping to achieve a common set of specification values.

2. Position at Final Meeting 1974

From the material already available and that contained in the latest contributions Study Group 8 was able to prepare a draft Recommendation BJ/8 (Doc. 8/1023) covering the technical characteristics for equipment operating in the Maritime Mobile VHF bands. But this Recommendation is of limited extent only. It does not include receiver characteristics and certain transmitter characteristics, e.g. complete specifications of spurious radiation, have had to be omitted. From this point of view it is of a preliminary nature. Nevertheless the draft Recommendation covers those characteristics of greatest interest to participants in the WARC-M in April 1974.

The major disagreement which prevented the preparation of a fuller Recommendation centred mainly on agreed methods of measurement. In the case of receivers the use of the SINAD method by some administrations cannot be reconciled with the signal-to-noise (psophometric) method in use by others. There is also a basic difference of view in regard to the method of measuring spurious emissions. While many administrations accept a voltage measurement at the antenna feeder terminal others require a measurement of the spurious radiation level.

Considerable further study seems to be required before it will be possible to draw up a set of internationally agreed characteristics. As far as the methods of measurement are concerned this work would seem to be more appropriate to the International Electrotechnical Commission than to the C.C.I.R.

Note.- The Director, C.C.I.R. is requested to bring this Report to the attention of the I.E.C.

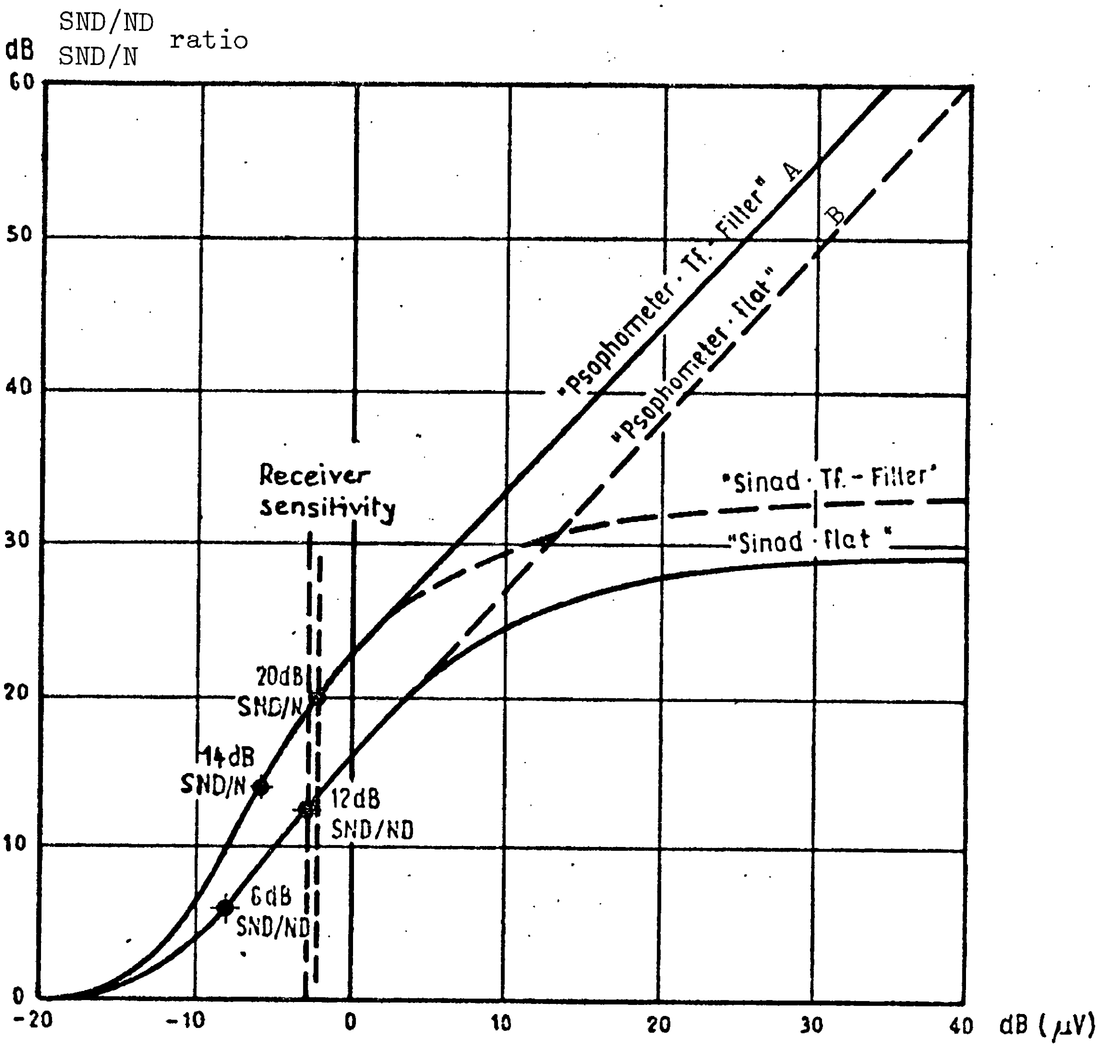

FIGURE 1

AF signal-to-noise ratio as function of the receiver input voltage in a typical 160 MHz radio telephone set for 25 kHz channel spacing (measured by the SINAD and the PSOPHOMETER methods with a modulation frequency of 1000 Hz and a frequency deviation of 3 kHz).

Curve A : with C.C.I.T.T. Telephone Filter in circuit.

Curve B : without C.C.I.T.T. Telephone Filter in circuit.

STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration:

REPORT AD/8 (Rev.74)

DIRECT-PRINTING AND OTHER DATA SIGNALS USING AUDIO-FREQUENCY TECHNIQUES IN THE VHF RADIOTELEPHONY CHANNELS IN THE MARITIME MOBILE SERVICE

(Question 14/8)

(1974)

1. Introduction

Five documents concerning the use of signals other than telephony in the VHF maritime mobile band were submitted to the Interim (1972) and Final (1974) meetings at Geneva :

Doc. 8/68	(Canada, 1972)
Doc. 8/75	(Netherlands, 1972)
Doc. 8/82	(Federal Republic of Germany, 1972)
Doc. 8/186	(United Kingdom, 1974)
Doc. 8/226	(Netherlands, 1974)

2. Position at Interim Meeting 1972

2.1 Doc. 8/68 suggested that audio frequencies chosen from C.C.I.T.T. Recommendation R.31 should be used for the direct-printing service and from C.C.I.T.T. Recommendation T.15 for phototelegraphy or facsimile. Doc. 8/75 concluded after tests in the Rotterdam Harbour area that error correction was necessary in such areas and also that it would be wasteful to employ a full radiotelephone channel to accommodate a single 170 Hz frequency-shift direct-printing channel.

2.2 On the other hand, Doc. 8/82 considered that the natural redundancy inherent in plain language would make error protection unnecessary in the VHF frequency band considered and by thus allowing simpler equipment to be used encourage earlier development of the service. Results of field tests with an unprotected code are given in the document.

2.3 It was generally agreed, however, that more study and tests were needed in order to determine what degree of reliability could be achieved with unprotected direct-printing systems, particularly in congested harbour areas where propagation was difficult and, for example, it has been shown that rapid fading to a depth of 5 dB to 20 dB, or more could often be experienced when receiving VHF signals on a moving vessel /_ Mossman, 1971_/.

2.4 It was further generally agreed that where connection into the public telex network was required the aim should be to meet the C.C.I.T.T. Recommendation R.54 standard of not more than 3 errors per 10^5 characters and that any error correction system employed should preferably be in accordance with Recommendation 476.

2.5 In the interests of economy, it was suggested that it would be desirable that vessels already equipped for VHF radiotelephony should be able to use existing radio equipment for direct-printing or data transmission and reception by adding normally available equipment (e.g. standard data modems).

2.6 There seems to be no advantage in locating a direct-printing signal in the upper part of the radiotelephony channel (2 500 - 3 000 Hz) as capture effect would make simultaneous use of a channel by separate ships impossible. If it were decided that for the immediate future it would be desirable to have one teleprinter emission per radiotelephony channel the direct-printing carrier should be in the middle of the audio-frequency band.

2.7 If a block of closely spaced direct-printing channels is allocated, a very high degree of frequency stability will be necessary in the radio equipment. It may be possible to use a common reference pilot frequency in a harbour or area; this would require rather special receivers.

3. Position at Final Meeting 1974

Further direct-printing tests were made by the United Kingdom and the Netherlands during the period between the Interim and Final Meetings.

3.1 Doc. 8/186 (1974) reported on tests carried out by the United Kingdom over an essentially open-sea path up to a distance of 100 km (Southampton to Cherbourg). Normal VHF radio-telephone equipment was used in conjuction with a standard low-speed data modem (C.C.I.T.T. Recommendation V.21) and teleprinter. The aerials of the coast station were approximately 280 m above sea level. No error protection was employed and no errors occurred in over 25 000 characters transmitted in the two-way test programme.

3.2 However, further tests were made by the Netherlands (Doc. 8/226 in the Rotterdam Harbour area, typical of many dock and harbour areas where there are numerous buildings, port installations and ships which obstruct direct propagation paths. These tests indicated that the use of forward error correction improved the error rate from 10^{-2} (unprotected) to about 10^{-4} (error protected).

4. System proposals (1974)

Doc. 8/226 also includes proposed operational requirements for a direct-printing service in the VHF maritime mobile band and describes the technical features of a system which could provide up to 146 direct-printing channels spaced 340 Hz by the sub-division of two 25 kHz VHF radiotelephony channels. Initially, the system would employ 73 pairs of adjacent 340 Hz channels; one channel of the pair carrying the traffic information frequency shift signals (± 85 Hz) and the other a pilot carrier for automatic frequency control purposes. The pilot-carrying channels could be converted into traffic information channels when frequency tolerances of future equipment were suitably tightened. The document emphasizes the need for early planning of channel arrangements and operational procedures and includes draft recommendations covering these aspects.

5. Future action

While the channelling arrangements and technical proposals contained in Doc. 8/226 appear to be attractive, it was generally agreed that more information on the practical performance of the system with a number of channels operating simultaneously would be needed before definitive recommendations could be adopted. Administrations are asked to give further consideration to this question.

REFERENCES

MOSSMAN, F.B. /¯1971_/ Rapid fading in the V.H.F. maritime mobile service R.T.C.M. Assembly, Montreal.

C.C.I.R.
XIIIth Plenary Assembly
Geneva, 1974

Doc. 8/1045-E

STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration:

REPORT AE/8(Rev.74)

INTRODUCTION OF DIRECT-PRINTING TELEGRAPH EQUIPMENT IN THE MARITIME MOBILE SERVICE

(Question 5-1/8)

(1974)

1. The following documents were submitted to the Interim and Final Meetings of Study Group 8, Geneva, 1972 and 1974.

Doc. 8/3 (United Kingdom), 1970-1973,
Doc. 8/9 (United States of America), 1970-1973,
Doc. 8/74 (Netherlands), 1970-1973,
Doc. 8/80 (Sweden), 1970-1973,
Doc. 8/93 (Japan), 1970-1973
Doc. 8/94 (U.S.S.R.), 1970-1973.
Doc. 8/192 (Japan) 1970-1974 and
Doc. 8/261 (C.C.I.R.) 1970-1974.

This Report discusses some operational and procedural considerations in the introduction of direct-printing equipment in the maritime mobile service. As a goal, it is considered that provision should be made for fully automatic and unattended operation. Provision should also be made for attended operation, particularly during the period of time leading up to the implementation of fully automated systems.

2. To make the maximum use of direct printing radiotelegraph service to ships, operational procedures should be agreed internationally and Administrations be invited to put them into effect as soon as possible. The automatic operation gives the possibility of messages being exchanged irrespective of the hours of duty of the radio operator on board ships. The ultimate objective would be for ships to be treated in the same way as any other subscriber using the international telex network.

Where non-automatic operation is employed it should still be possible for calls to be established by direct printing equipment. Normally, this should be accomplished by prior arrangement of the time schedule and the frequencies to be employed. Additionally, ships equipped only for direct printing reception, may acknowledge messages by radiotelephony or manual radiotelegraphy. Selective calling is an important element of the operation of both the attended and fully automatic systems.

3. Some administrations reported that they are installing direct printing equipment and a number of administrations have conducted tests, some of them with the purpose of achieving some form of automation.

The Netherlands reports that in the near future they will make arrangements to establish the circuit in the direction ship-shore, without prior contact by other means. For each frequency band, a pre-tuned receiver will be installed at the coast station. When a receiver is activated by a direct printing signal, a transmitter in the same band will be started automatically in the coast station, provided that this transmitter is not in use for other services. This system will gradually be implemented by the introduction of a number of daily schedules during which three HF-telegraphy transmitters and three pre-tuned receivers will be made available exclusively for direct printing traffic. The three frequencies per schedule may be chosen from a range of six frequencies depending on current propagation conditions. The frequencies used during a schedule will be published beforehand. The duration and the number of schedules will depend on the availability and the increase of direct printing-traffic, which will gradually build up to become a continuous service on all six frequencies.

The Swedish Administration has carried out tests with a system called MARITEX, which, technically, is based on relevant parts of Recommendation 476 and Appendix 20 B of the Radio Regulations. This system is designed for unattended operation in the coast station as well as on board ships, for message transmission in either direction. Operational features include automatic choice of the optimum frequency band based on propagation forecasts fed into the system. An experimental system is reported to have been operated on board for a continuous period of more than two years without evidence of any system failure and with very little maintenance necessary. The only operational limitation in these field tests has been that only one ship has been connected to the system. During the test period, the ship has traded between the Arabian Gulf and Japan. Most contacts have been established within a very short time, the maximum delay caused to any call being 24 hours. At the request of Swedish shipowners, this system started on a regular basis during 1972 with about 20 ships. The system will be operated at HF only, but nothing prevents its later extension to other frequency bands if the need should arise.

Doc. 8/93 (Japan), 1970-1973, describes a direct printing and selective calling system based on International Telegraph Alphabet No. 5 and the results of tests of this system.

Doc. 8/94 (U.S.S.R.), 1970-1973, contains proposals concerning the use of direct printing equipment in the maritime mobile service according to Recommendation 476.

Distinction is made between manual and automatic operation, while attention is paid to the following operational aspects :

- the determination of the duration of call signals, and the intervals between them, with a view to activating the called station transmitter, in order to reduce internal system interferences,
- clearing the ARQ-circuit, in the case of poor propagation conditions, by reverting to the stand-by position after reception of a predetermined number of RQ signals or identical control signals,
- using a fixed procedure for clearance of the circuit in the course of which the sequences "Fig+?" and "HHH" are exchanged between the stations concerned.

In a further contribution, Doc. 8/192 (Japan), information is given on the unattended operation of direct printing circuits. The need for close frequency tolerance is stressed and the results of laboratory tests to determine the effects of receiver off-tune on bit error rates are given in Figs. 1 and 2. (It should be noted that similar curves given in Doc. 8/192 are in terms of character error rates.) These results relate to tests upon a specific type of receiver demodulator. In the Document it is considered that automatic frequency control is one solution to the problem of detuning. During the discussion it was noted that other solutions to the problem could include the use of other demodulator techniques or closer frequency tolerances.

The document reports extensive field trials by Japan using unattended spot-frequency receivers fitted with automatic frequency control and quotes average character error rates of 6×10^{-5} and 5×10^{-3} for the A and B modes of operation respectively for a total sample of 4.2×10^7 characters.

The effect of receiver selectivity upon error rate is also considered in the document and curves are given, see Figs. 3 and 4, of the effect upon bit error rate of different values of selectivity without and in the presence of adjacent channel interference. (Similar curves in Doc. 8/192 are in terms of character error rate.) In discussion it was also noted that the selectivity problem was closely related to the phase delay characteristics of the receiver filters. The document considers that further study of these aspects is required.

Doc. 8/261 (C.C.I.R.) reproduces parts of an I.M.C.O. document prepared to assist I.M.C.O. members in their preparations for the World Maritime Administrative Conference in April 1974. It includes considerations of the use of direct printing telegraphy for safety purposes and for the reception of navigational warnings and safety messages in the 405 to 535 kHz, 1 605 to 4 000 kHz and the 156 to 174 MHz maritime frequency bands in addition to the HF bands.

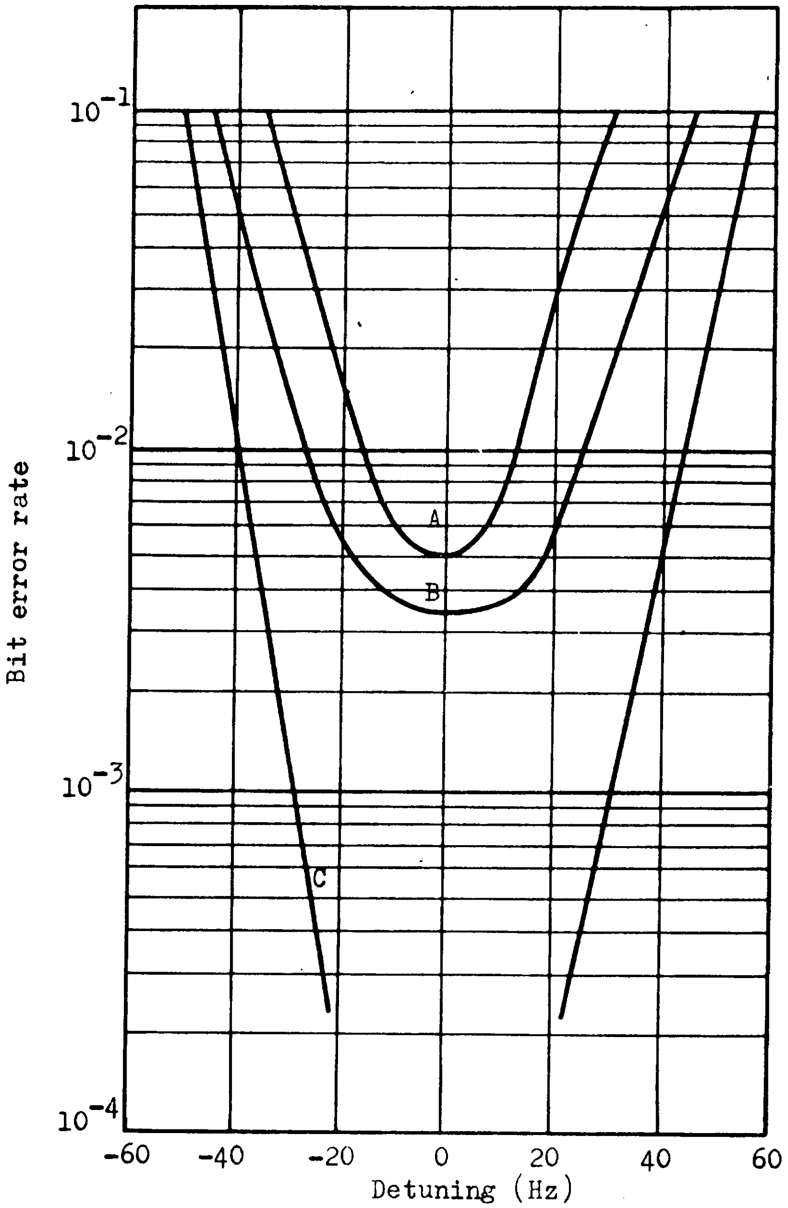

FIGURE 1

BIT ERROR RATE VS. DETUNING

(no fading)

Receiver input in dB rel 1µV

A: -22 dB, B: -20 dB, C: -18 dB

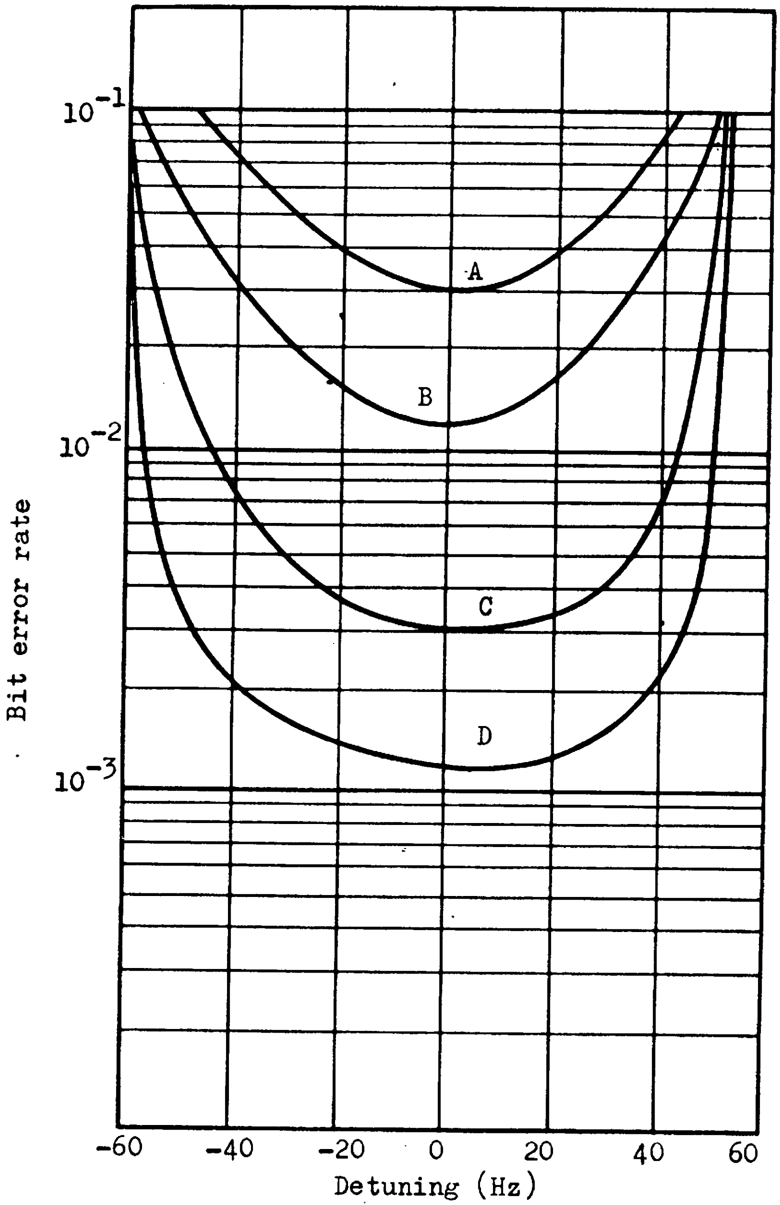

FIGURE 2

BIT ERROR RATE VS. DETUNING

(Under random fading close to Rayleigh distribution, with fading rate of 15 fades/min)

Receiver input median value
in dB rel 1μV

A: -8 dB, B: -3 dB, C: 2 dB:
D: 7 dB

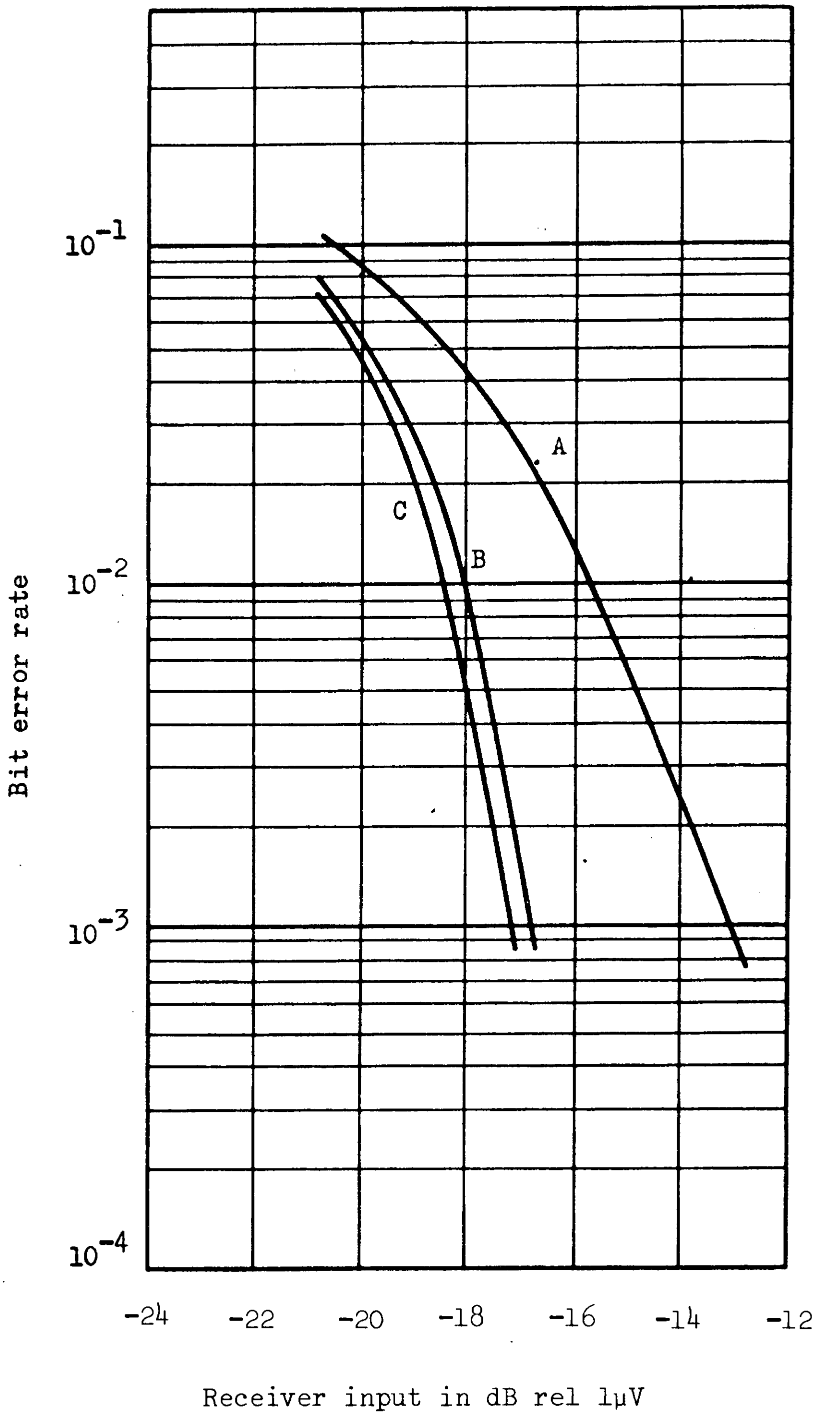

FIGURE 3

BIT ERROR RATE VS. RECEIVER INPUT FOR

VARIATION IN RECEIVER BANDWIDTHS UNDER NO INTERFERENCE CONDITIONS

	Receiver bandwidth	
	< 6 dB	>66 dB
A:	210 Hz	500 Hz
B:	240 Hz	560 Hz
C:	310 Hz	700 Hz

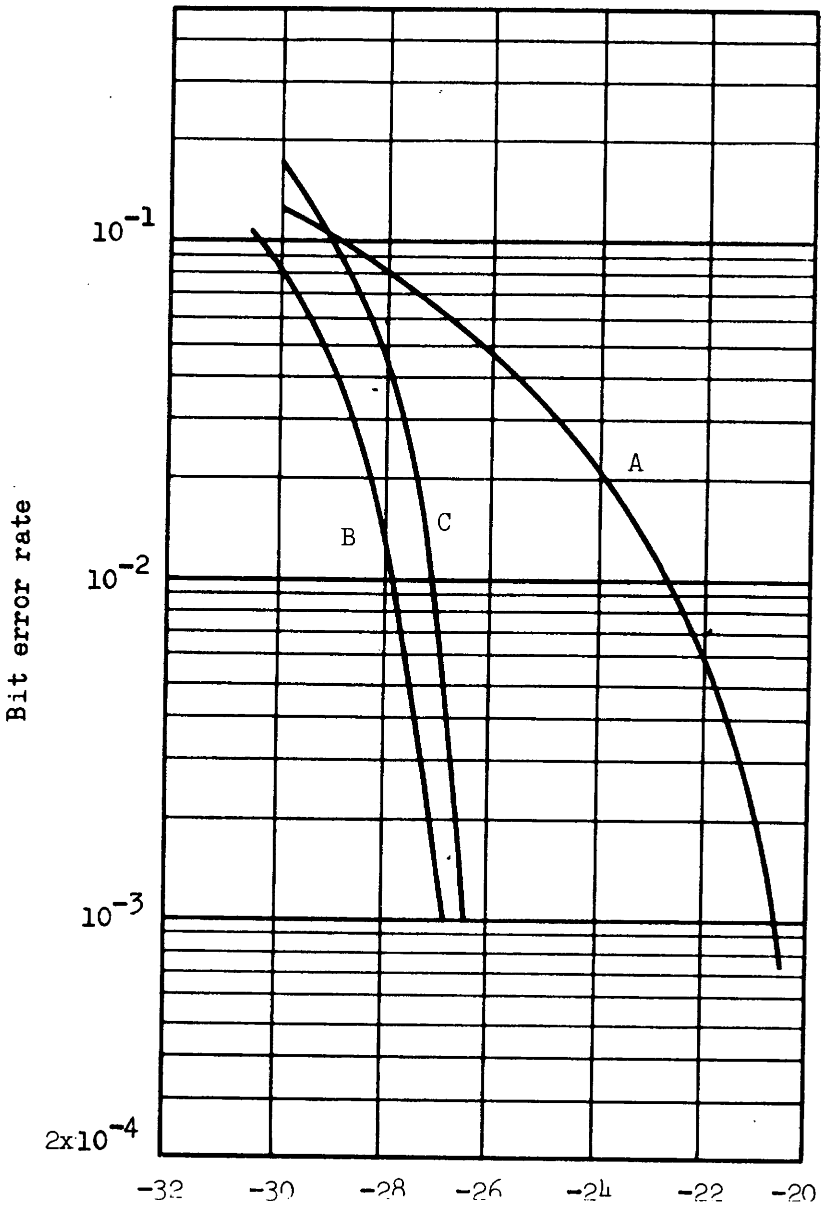

FIGURE 4

BIT ERROR RATE VS. W/U (RATIO OF WANTED TO UNWANTED SIGNAL) WITH DIFFERENT RECEIVER BANDWIDTHS IN THE PRESENCE OF ADJACENT CHANNEL INTERFERENCE

Wanted signal: 1 µV at receiver input
Unwanted signal: 100 bits/s dot signal, separated from desired signal by 500 Hz

Receiver bandwidth

	<6 dB	>66 dB
A:	210 Hz	500 Hz
B:	240 Hz	560 Hz
C:	310 Hz	700 Hz

C.C.I.R.
XIIIth Plenary Assembly
Geneva, 1974

Doc. 8/1047-E

STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration :

REPORT AJ/8 (Rev.74)

TECHNICAL CHARACTERISTICS OF SYSTEMS PROVIDING COMMUNICATION AND/OR RADIODETERMINATION USING SATELLITE TECHNIQUES FOR AIRCRAFT AND/OR SHIPS

Noise as a factor affecting the choice of frequency for telecommunications between an aircraft/ship and a satellite

(Study Programme 17A/8)

(1974)

1. Introduction

A major factor in the choice of an optimum frequency band is the distribution of background radio noise. This noise arises by radiation from :

- natural terrestrial and extra-terrestrial sources;
- the absorbing atmosphere around the Earth;
- electrical equipment.

For an aeronautical satellite system particular attention must be paid to the airborne terminal with its high density of electrical and electronic equipment.

For a maritime satellite system, attention will have to be given to the suppression of noise in shipborne electrical equipment.

Receiving system noise temperature, T_S, is an essential factor in the calculation of the power flux-densities required to produce a viable service. This is a function of the antenna noise temperature, losses in the antenna and transmission line, and the noise temperature of the receiver itself. The antenna noise temperature will be a function of the background radio noise, taking antenna beamwidth into account.

2. Extra-terrestrial noise

There are four extra-terrestrial sources contributing to noise observed at an earth station or at an aircraft or ship terminal. These are :

- background cosmic radiation amounting to 3 K;
- galactic radiation, which is a maximum from the centre of the galaxy. Report 205-2, Fig. 6, shows that the noise decreases rapidly with increase of frequency;
- point sources within the galaxy (radio stars). These are of very small angular width and would contribute insignificantly to the overall noise when using beamwidths which are practicable from airborne antennae;
- the Sun, which has an equivalent noise temperature varying from about 10^6 K in the VHF band to about 10^4 K at 10 GHz (quiet sun). There is a large variation over the sunspot cycle, e.g. from 2.3×10^4 K to 9.0×10^4 K at 4 GHz. Again, a small angle is subtended at the Earth (approximately 0.5°), even so there will be increases in apparent sky temperature if the Sun lies within the beam of the antenna (about 60 K for an antenna beam 20° wide at 1 GHz). (In the case of a disturbed Sun, the antenna temperature contribution from this source may be about one hundred times as much for a very small percentage of time.)

3. Natural terrestrial noise

For reception at an earth station or aircraft or ship terminal, atmospheric absorption may also add to the observed noise. Report 205-2, Fig. 6, shows how the total atmospheric sky temperature due to atmospheric absorption varies as a function of angle of elevation.

For reception at the satellite, and when the Earth lies wholly within its antenna beam, a background noise temperature of about 290 K will be observed at all the frequencies for which the ionosphere and the troposphere are completely transparent. However, radiation at all frequencies above a few hundred MHz, and particularly above a few GHz, is absorbed to a varying degree by water vapour, oxygen and precipitation. It follows that, for a given frequency, natural noise of terrestrial origin varies with time and from place to place. Considerable information on this subject is given in draft Reports 234-2 and AD/5 of Study Group 5.

Natural terrestrial noise is also produced by lightning discharges in thunderstorms. The level of this noise is very dependent on geographical location and season and is expected to be significantly greater than galactic noise at a frequency of about 100 MHz above a major storm area. This noise would therefore need to be taken into account in planning, if a VHF system were to be adopted.

If aircraft antennae can be designed with a wide beam to satisfy the required satellite viewing angles and with low side lobes and a high front-to-back ratio, the contribution of the Earth's radiation to the system noise temperature could be less than 10 K /Rawer, 1967/.

4. Man-made noise

Man-made noise arises in a variety of ways, motor-vehicle ignition, electric motors, switch gear, corona on high-tension lines, etc., and is obviously greatest in densely populated and industrial areas.

The equivalent temperature of this noise decreases rapidly with frequency / Hogg, 1960/. To the observer in space, the Earth has a small number of "hot" areas with noise temperatures above the background of up to 180 K at 100 MHz, these noise temperatures decreasing rapidly with increasing frequency to less than 1 K at 1 GHz. The angles subtended at a satellite by these "hot spots" are very small and so the extra noise produced will be negligible. The angles subtended at an aircraft may be quite large, but should only contribute to aircraft receiver noise through antenna side lobes or when satellites are being observed at low angles of elevation.

However, when considering satellite/aircraft and satellite/ship links, the noise environment becomes much more important especially as such noise may enter the receiving system via other paths than through the antenna. Little information is available on aircraft or shipboard noise over the region of the radio-frequency spectrum of interest, but such noise will certainly decrease with increasing frequency.

5. Receiving system noise temperature

Table I gives an estimate of a number of the noise contributions and of the resulting receiving system noise temperature for the stated antenna gains, satellite elevation, pre-amplifier noise figures and transmission line and diplexer losses. In the table, it has been assumed that receiver noise is dominated by pre-amplifier noise and that the noise contribution of subsequent receiver stages is negligible. Man-made noise, precipitation static, sferics and solar storm contributions have been ignored and so the table should be used with caution particularly at the lower frequencies.

TABLE I

Frequency (MHz)	100	200	500	1000	1500
Galactic noise (median value) 1)	1000 K	185 K	20 K	<10 K	<10 K
Natural terrestrial noise (9 dB antenna, 10° elevation) 2)	113 K	113 K	113 K	113 K	113 K
Natural terrestrial noise (6 dB antenna, 45° elevation) 2)	53 K	53 K	53 K	53 K	53 K
Galactic noise contribution (9 dB antenna, 10° elevation) 2)	609 K	113 K	12 K	6.0 K	6.0 K
Galactic noise contribution (6 dB antenna, 45° elevation) 2)	819 K	151 K	16 K	8.0 K	8.0 K
Noise temperature of transmission line & diplexer Line and diplexer loss,(dB) 3)5) L =	60 K (1.0) 1.259	65 K (1.1) 1.288	70 K (1.25) 1.333	85 K (1.5) 1.413	100 K (1.75) 1.496
Receiver noise 4) (preamplifier noise figure dB)	290 K (3.0)	295 K (3.0)	310 K (3.1)	330 K (3.3)	350 K (3.5)
Composite T_s, 9 dB antenna (dB relative to 1 K) 5)	875 K (29.4)	485 K (26.9)	420 K (26.2)	440 K (26.4)	460 K (26.6)
Composite T_s, 6 dB antenna (dB relative to 1 K) 5)	990 K (30.0)	470 K (26.7)	380 K (25.8)	400 K (26.0)	425 K (26.3)

Notes referring to Table I

Note 1. Median values based on data given in Report 205-2.

Note 2. The effective temperature of the antenna is calculated by the integration of noise contributions from the earth and from the atmosphere over the entire antenna radiation pattern, and can be expressed by the following :

$$T_A = T_E x + T_G (1 - x)$$

where

T_E = Earth temperature assumed to be 290 K

T_G = Galactic noise temperature

and

$$x = \frac{D \int P(\theta , \phi) \, d\Omega}{\oint P(\theta , \phi) \, d\Omega}$$

in which

Ω = Solid angle

$P(\theta, \phi)$ = Antenna radiation pattern

D = Portion of radiation intercepted by the Earth

$$x = \frac{\frac{1}{\pi} \int_{\theta_o}^{\pi/2} \left[P(\theta) - P(\pi - \theta) \right] \sin \theta \cos^{-1} \left(\frac{\tan \theta_o}{\tan \theta} \right) d\theta + \int_{\pi/2}^{\pi} P(\theta) \sin \theta \, d\theta}{\int_o^{\pi} P(\theta) \sin \theta \, d\theta}$$

for axially symmetric patterns

where θ_o = elevation angle of antenna beam axis.

Example 1 :

$$\text{Let } P(\theta) = \cos^2 \frac{\theta}{2} \left\{ \frac{\sin (2.525 \sin \theta)}{2.525 \sin \theta} \right\}^2$$

This pattern has a directivity of 9.02 dB. Sidelobe level : -13.5 dB.

The integration gives :

θ_o	x	xT_E
10°	0.39105	113 K
25°	0.25830	75 K

Example 2 :

Let $P(\theta) = \text{Cos}\,\frac{\theta}{2}\ \text{Cos}^2\,(0.75\,\theta)$

This pattern has a directivity of 6.02 dB. Sidelobe level : -13.5 dB.

The integration gives :

θ_o	x	xT_E
10°	0.42002	122 K
25°	0.30716	89 K
45°	0.18122	53 K

Example 3 :

Let $P(\theta) = \text{Cos}^2\,\frac{\theta}{2}$

This pattern has a directivity of 3.0 dB. No sidelobes.

The integration gives :

θ_o	x	xT_E
45°	0.32322	94 K

Note 3. Typical values referred to the input of the transmission line and diplexer.

Note 4. The pre-amplifier noise figures will vary considerably according to the type of active device and technology used. The values shown are representative figures.

Note 5. The effective system noise temperature, T_s, characterizes the noise performance of the entire receiving system and includes the effects of the antenna, transmission line and receiver noise. The point in the system to which T_s is referred is at the input terminals of the first active element in the receive system. For the case under consideration, the gain of the first stage is sufficiently high, so that the system noise temperature is approximately given by :

$$T_s = \frac{T_A}{L} + \frac{L - 1}{L} T_L + T_R$$

where

T_A = Effective antenna noise temperature (K)

T_L = Temperature of transmission line connecting antenna to the first active element

L = Transmission losses (expressed as a numerical ratio) between antenna and first active element

T_R = Effective noise temperature of first active element (K) = $(F - 1)T_O$

F = Noise factor of first active element

T_O = Ambient temperature of first active element.

6. Experimental results and further theoretical predictions

The information presented in previous paragraphs gives an indication of the possible noise contributions from various sources. There is much experimental information available at VHF and none at UHF. Thus, at UHF, predicted values must be used. The information presented in the following paragraphs can be used, with care, to give a more realistic composite noise temperature than that presented in Table I.

6.1 VHF antenna noise

Tests have been performed at VHF (135-150 MHz) which indicate the level of the antenna noise temperatures which can be anticipated on subsonic aircraft. This flight test programme was conducted during scheduled air carrier operations and included some 300 hours of instrumented flight tests and 8 hours of maritime area noise temperature recordings. Data taken from about 50 per cent of the maritime area noise temperature tests, and which are considered to be representative, had an average measured noise temperature of 575 K and showed that about 6 per cent of the 15-minute measured sequences had noise temperatures which are 3 dB greater than the average temperature. The normal range of maritime and land area noise temperature was 289 K to 2135 K and the average measured noise temperature was 1105 K /̲Collins, 1967/̲. Theoretical studies and laboratory tests indicate that precipitation static discharge(s) will decrease with increasing aircraft speed and altitude, so that supersonic aircraft should not be affected /̲Nanevicz et al., 1966/̲.

VHF satellite communications tests conducted aboard the "S.S. Santa Lucia" under a U.S.A. Maritime Administration test programme indicated that a shipboard antenna would have approximately the same range of antenna noise temperatures while the ship is in maritime areas as a VHF antenna on subsonic aircraft /̲Westinghouse/̲.

In populated areas, man-made noise can be expected to make a significant contribution to the antenna noise temperature. An evaluation and consolidation of man-made radio noise data obtained during the period 1951 to 1969 was made. The surveys covered, among others, a number of metropolitan areas with a fair amount of industrial development in Regions 1, 2 and 3. In the study, "suburban area" is defined as a region 15-35 miles (24-56 km) from the centre of the major city. For this area, it was shown that the level of available r.m.s. noise power spectral density delivered to the receiver by a half-wave dipole /̲Skomal, 1969/̲ can be described by :

$$P_{noise}\ (dBm/kHz) = 105.5 - 9.2 \log f_{MHz}$$

This is equivalent to 24 000 K and 19 000 K at 125 MHz and 160 MHz, respectively. Table II summarizes the VHF antenna noise temperatures.

TABLE II

VHF antenna typical noise temperatures

Area of operation	125 MHz	160 MHz
Suburban	24 000 K	19 000 K
Oceanic	575 K	575 K

6.2 Extra-terrestrial noise

The noise contribution of the quiet sun varies inversely with the square of the frequency over the UHF band /Pawsey and Smerd, 1953/ and to a first approximation, is directly proportional to the antenna gain. At 1500 MHz, its apparent temperature is approximately 1×10^5 K and the solid angle subtended is 1.35×10^{-4} steradians. This would produce a noise temperature of 11 K in an antenna with 10 dB gain. The antenna temperature caused by the Moon, Jupiter and Casseopeia A, the next strongest discrete sources of radio noise, are each more than 20 dB below that of the Sun. The galactic centre appears as a 1.9×10^{-3} steradian diameter source /Steinberg, 1963/ with a peak intensity about 0.65 times that of the Moon with a moderate temperature background. The maximum temperature it would produce in a 10 dB gain antenna is 7 K /Stanford Res. Inst., 1969/. Table III summarizes the effects of extra-terrestrial radio noise sources on 1500 MHz systems.

TABLE III

Extra-terrestrial radio source characteristics at 1500 MHz

Source		Sun	Moon	Jupiter	Casseopeia	Galactic centre
Source size (Steradians)		1.35×10^{-4}	1.07×10^{-4}	Point source	Point source	1.9×10^{-3} $(2.6 \times 1.4^{\circ})$
Power flux density ($W/m^2/Hz$)		9.3×10^{-21}	-	-	2.2×10^{-23}	
Apparent temperature (K)		10^5	250	2×10^3	-	162
Antenna temp. (K)	20 dB Ant. gain	107	0.21	<1	0.24	15
	10 dB Ant. gain	11	2.1×10^{-2}	$<10^{-1}$	2.4×10^{-2}	7
	3 dB Ant. gain	2	2.1×10^{-3}	$<2 \times 10^{-2}$	4.8×10^{-3}	2 (estimated)

6.3 Atmospheric noise (absorption, precipitation static, sferics)

An absorbent medium, such as oxygen and water vapour in the atmosphere, emits thermal noise that can be described in terms of apparent sky temperature. Calculations [Hogg, 1959], which agree closely with the few available experimental values, indicate that at 1 600 MHz, the temperature varies from 100 K to 2 K between elevation angles from 0° to 90°. At a 10° elevation angle the sky temperature is 11 K.

The primary sources of precipitation static are water droplets, ice crystals or dust particules striking a moving surface and resulting in a rapid accumulation of high charges on the aircraft which may create corona discharge(s). The power spectral flux density of corona discharge can be described as being proportional to :

$$\frac{\nu A^2}{(2\pi f)^2 + \alpha^2} .$$

where

ν = corona pulse rate

A = amplitude of the pulse voltage

α = average decay constant of the pulse [Tanner and Nanevicz, 1965]

Studies have indicated that νA^2 is independent of frequency and that α^2 varies directly with pressure. In the limiting case, the precipitation static power flux density is inversely proportional to the square of the frequency. Therefore, the precipitation static discharge(s) power in the receiver is inversely proportional to the fourth power of the frequency.

Theoretical studies and laboratory tests indicate that precipitation static discharge(s) will decrease with increasing aircraft speed and altitude, so that supersonic aircraft should not be affected.

A summary of measurements of the spectral density of sferics indicates that the peak field strength at 1500 MHz is 0 dB relative to 1 μV/m/kHz at 1.6 km (1 mile) [Oh, 1969]. This is equivalent to -145.8 dBW/m^2/kHz at 1.6 km (1 mile) or -195.8 dBW/m^2/Hz at a more representative distance of 16 km (10 miles). This would result in an antenna temperature of 52 K for a 10 dB gain antenna and 10.3 K for a 3 dB antenna. Table IV summarizes the effects of atmospherics :

TABLE IV

Apparent antenna temperature due to atmospherics at 1600 MHz

Source	Absorption (Maritime)	Sferics
3 dB gain antenna	11 K	10 K
10 dB gain antenna	11 K	52 K

6.4 Terrestrial noise

The Earth is generally assumed to have a noise temperature of about 290 K (see the note to Table V). The antenna temperature contribution of this source is a function of the frequency, polarization, elevation angle, surface characteristics and antenna pattern. Horizontally polarized noise from this source is approximately 10 dB less than that from vertically polarized noise at elevation angles less than 20°, below which the most significant contributions arise. Table V summarizes the apparent antenna noise temperatures due to earth radiation from low gain (3 dB) and high gain (assumed side lobes -20 dB) antennae operating at about 1600 MHz.

TABLE V

Apparent antenna noise temperature due to earth radiation at 1600 MHz

Antenna	Angle of elevation of the beam axis	Sea	Land
Low gain /Foley et al., 1968/ (3 dB) (vert.pol.)	90° 60°	45.1 K 102.8 K	45.8 K 137.1 K
High gain /Rawer, 1967/ (10 dB)	25°	10 K	10 K

Note referring to Table V :

The assumption of a 290 K earth temperature may be invalid for the sea surface case, particularly for relatively smooth sea conditions and high reflection coefficients. When the reflection coefficient of the surface is high, the apparent temperature of the surface is lower than its ambient temperature. Airborne radiometer measurements of the apparent sea surface temperature have shown this to be considerably less than 290 K in general. This consideration would be reflected in the numbers shown in Table V, and, in particular, the low gain antenna temperature over sea may be considerably lower than that listed in Table V.

6.5 Man-made noise

The effects of man-made noise, which is caused primarily by automobile ignition systems, may be significant when the mobile users are in populated areas. However, few studies of this problem have been conducted at frequencies above those of the VHF band. Preliminary results of the most recent tests have indicated that the noise level at 1200 m above cities with a population of about 700 000 is approximately 18 dB and 10 dB above KT_0B at 300 MHz and 1000 MHz, respectively /Anzic, 1970/. The noise level at the ground is approximately 6 dB lower. Extrapolating these results to

1600 MHz and converting the temperature would yield 1550 K and 390 K for airborne and surface systems, respectively. Table VI summarizes the man-made noise contribution for low and high gain antenna systems over a city with a diameter of 13.3 km. Table VI can only be considered an estimate. Extensive measurements are required to confirm UHF results.

TABLE VI

Man-made noise contribution in populated areas at 1600 MHz

Maritime	390 K
Aeronautical (60° elev. angle)	
3 dB antenna	735 K
10 dB antenna (-20 dB gain rel. isotropic at negative elev. angles)	16 K

6.6 Shipboard noise

The result of electromagnetic (EM) noise measurement performed in the band 1 500 MHz to 1 600 MHz on board various classes of ships indicate the following predominant sources of noise in this band:

- Broadband impulsive EM noise due to electric motor brush arcing. (This is evident only on older ships. The newer ships mostly employ AC induction motors and arcing is minimized.)

- Significant emissions from a 3 030 ±38 MHz radar system employed by a large number of merchant ships.

- Broadband impulsive noise from combustion engine ignition circuits used with ships' unloading apparatus at ports. (Apparatus both on ships and on docks.)

- Broadband impulsive noise from combustion engine ignition circuits associated with automobiles and trucks on highways and bridges adjacent to ports, harbors, and canals.

- Ambient EM noise levels from cities adjacent to ports. (These levels are considerably lower on Sundays and holidays when industrial plants are not in operation.)

An example of electromagnetic (EM) noise in the band 1 500-1 600 MHz recorded from a 3 030 ±38 MHz radar system on a cargo freighter (11,309 gross tons, 174 m (572 feet) in length) is illustrated in Figure 1. The portable horn antenna attached to the Radio Interference Analyzer/Receiver employed for these measurements was pointed toward the radar antenna. The radar antenna was rotating at a rate of approximately 12 revolutions per minute. Thus the peaks of the noise power (as seen in Figure 1) occurred at 5 second intervals. The maximum peak noise power amplitude shown in Figure 1 is -63 dBm (44 dB (1 (1μV/MHz) for a 50 ohm load). The radar antenna was located on a mast, above and forward of the bridge. The horn antenna receiving the noise power was positioned on the starboard side of the bridge. Since the frequency of the receiver was adjusted manually in the 1 500 to 1 600 MHz band, exact correlation between the individual peak amplitudes and frequency is not possible from the recording. However, the peak levels of the noise were sufficiently high to indicate that this noise would result in unacceptable degradation to a satellite-to-ship communications channel at the shipboard receiver. This noise can be easily suppressed by the insertion of a simple waveguide filter following the radar transmitter.

Figure 2 was recorded with the same conditions as Figure 1 except the radar transmitter was switched to stand-by operation with no radio frequency (RF) power being radiated from the antenna. The previously recorded EM noise power of Figure 1 is no longer evident except for some small intermittent peaks.

6.7 Transmission line and receiver noise

The temperature of the transmission line will be approximately 290 K under typical operating conditions, however, in supersonic aircraft this may reach 355 K. Ohmic and mismatch caused line losses will be approximately 1 dB. VHF mobile receivers with 2 to 3.5 dB noise figures were employed during the ATS-3 test programme /Collins, 1967; Westinghouse/. Advances in technology could be expected to enable the use of VHF operational mobile equipment with 2 dB noise figure transistor pre-amplifiers. The relatively high antenna temperatures of systems operating in this band would negate the advantages of parametric amplifiers. Thus, this type of pre-amplifier would not be utilized in VHF mobile equipment.

Two types of UHF receiver pre-amplifiers, transistor and uncooled parametric amplifiers, are being considered for use in aeronautical and maritime mobile equipment. While individual transistors have exhibited noise figures between 2.8 and 4.0 dB at 1500 MHz, a complete and packaged pre-amplifier will have a noise figure higher than these values. Current guaranteed units have noise figures of 4.5 to 6 dB. Assuming that these noise figures will be lowered to 2.5 dB during the coming years and that a 1 dB degradation can be expected in operational equipment, the noise figure for UHF transistorized pre-amplifiers is estimated to be 3.5 dB.

Noise temperatures of 50 K to 150 K at 1600 MHz are possible with uncooled parametric amplifiers. Factors which discourage the likelihood of realizing the lowest temperatures in operational mobile equipment are the needs for thermal control and high pump powers, both of which are essential for minimum temperatures. Mobile system users must have robustly constructed, reliable (solid state) devices with a minimum of complexity. Therefore, if mobile equipment which utilizes uncooled parametric amplifiers is employed, the noise figure for this component will probably be about 100 K.

Table VII summarizes the characteristics of the transmission line and receiver noise.

TABLE VII

Transmission line and receiver noise factors

Source	Loss	Noise temperature 1600 MHz	125 MHz
Transmission line	1.26 (1 dB)	60 K	60 K
Transistorized pre-amplifier	-	360 K (Noise factor = 3.5 dB)	170 K (Noise factor = 2 dB)
Uncooled parametric amplifier	-	100 K	-

6.8 Summary

Table VIII summarizes the data contained in § 6. At VHF, the system noise level in maritime areas is approximately 1100 K and will typically be 14 dB greater in suburban areas.

TABLE VIII

Effective system noise temperatures (K)

System	Maritime areas	Suburban areas
VHF (135 MHz)	1 100	17 000
UHF (1600 MHz)		
Uncooled parametric amplifiers		
Aeronautical		
3 dB gain antenna	250	850
10 dB gain antenna	250	250
Maritime		
3-10 dB gain antenna	250	550
UHF (1600 MHz)		
Transistorized pre-amplifier		
Aeronautical		
3 dB gain antenna	500	1 100
10 dB gain antenna	500	500
Maritime		
3-10 dB gain antenna	500	800

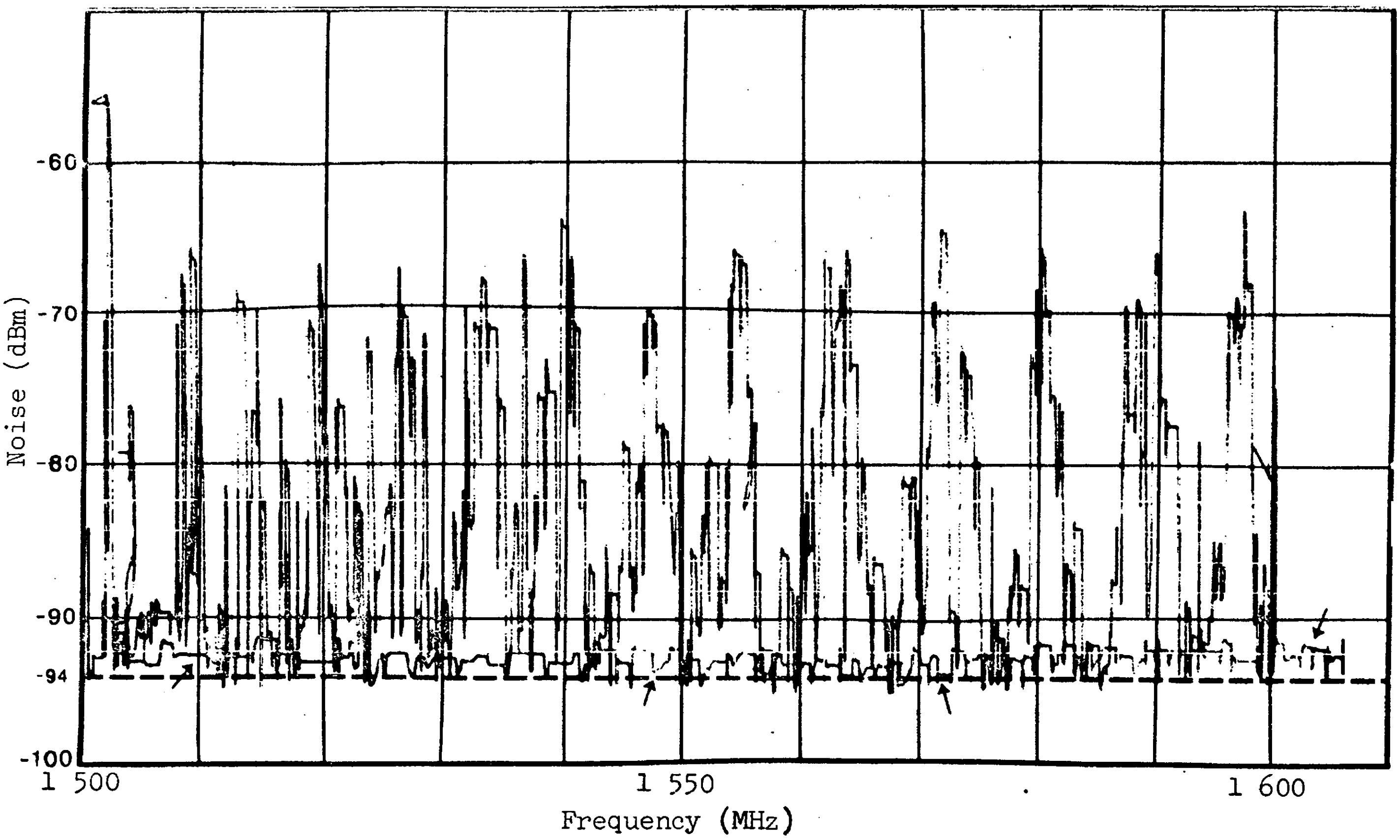

FIGURE 1

ELECTROMAGNETIC NOISE DUE TO SHIPBOARD RADAR ON 3 030 MHz

Radar on antenna rotating
Signals (peaks of upper curve) directly from radar on each rotation
Residual (instrument) noise shown by lower curve (indicated by arrows). Horn antenna replaced by 50 ohm load.

Notes:

a) Measurements made on board Farrell Lines SS African Comet - 174 m length (572 ft).

b) Ship underway March 18-19, 1973.

c) Horn antenna located on starboard side of bridge pointed at noise source (3 030 MHz radar).

d) Avantek preamplifier used.

e) Noise levels indicated are relative to a 0 dB gain antenna.

f) Instrument noise level -94 dBm.

g) Noise measurements made in a 5 MHz bandwidth. Instrument set to respond to peak values.

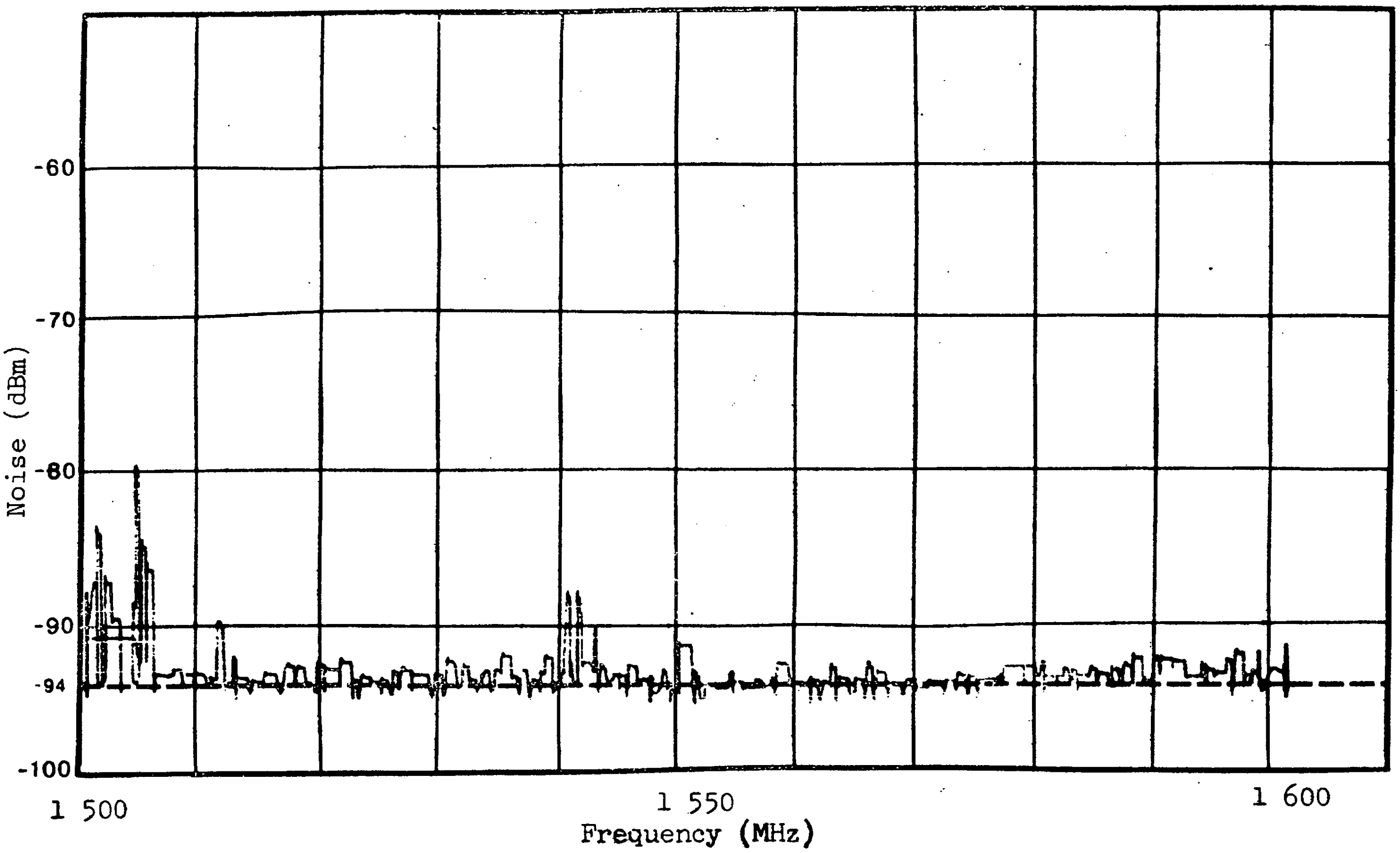

FIGURE 2

RESIDUAL ELECTROMAGNETIC NOISE

Radar in stand-by condition

Notes:

a) Measurements made on board Farrell Lines SS African Comet - 174 m length (572 ft).

b) Ship underway March 18-19, 1973.

c) Horn antenna located on starboard side of bridge pointed at noise source (3 030 MHz radar).

d) Avantek preamplifier used.

e) Noise levels indicated are relative to a 0 dB gain antenna.

f) Instrument noise level -94 dBm.

g) Noise measurements made in a 5 MHz bandwidth. Instrument set to respond to peak values.

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STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration:

REPORT AK/8 (Rev.74)

TECHNICAL CHARACTERISTICS OF SYSTEMS PROVIDING COMMUNICATION AND/OR RADIODETERMINATION USING SATELLITE TECHNIQUES FOR AIRCRAFT AND/OR SHIPS

Some factors affecting planning and designing a satellite system to be used in the maritime mobile service

(Question 17/8, Study Programme 17A/8)

(1974)

1. Introduction

The purpose of this document is to suggest certain technical characteristics of the systems which appear to be suitable for providing communication, including distress and safety, and radiodetermination.

2. Types of orbit and number of satellites

The service should operate reliably, unhindered by the prevailing weather or propagation conditions, for all maritime regions of the globe between approximately 70° latitude N and 70° latitude S. Polar regions between approximately 70° and 82° northern and southern latitudes should be served at least once a day for not less than three to four hours. At a later stage, the introduction of a satellite system to serve the polar regions should be considered. The first requirement can be taken care of by geostationary satellites. A combined system for communication and radiodetermination might use six geostationary satellites covering the whole of the Earth's surface below 70° for communication and most of the surface for radiodetermination. Two additional geostationary satellites would improve the coverage for radiodetermination purposes if this were justified operationally and economically.

3. Frequencies to be used

3.1 Frequencies for satellite/ship links

The frequencies most likely to be used for a maritime satellite system are:

Satellite-to-Ship

1 535-1 542.5 MHz; also 1 542.5-1 543.5 MHz*

Ship-to-Satellite

1 636.5-1 644 MHz; also 1 644-1 645 MHz*

3.2 Frequencies for satellite/ground links

Considerations of operational requirements, spectrum economy, power savings and related matters affect the choice of satellite-ground links. If it is considered desirable to permit direct ship to ship connections and allow all vessels to monitor communications traffic, the frequencies to be used would necessarily be in the same band as those used for the ship/satellite links. Conversely, if this requirement does not exist, use of higher frequencies such as those allocated to the fixed satellite services offers attractive advantages. In any case, the choice of frequency bands should be the subject of future studies.

4. Principal factors affecting the choice of technical characteristics for the system

In defining the technical characteristics of the links, certain technical and economic considerations must be taken account of which affect operations both for communication, including distress and safety, and for radiodetermination. Those primary considerations are :

4.1 Operational considerations

4.1.1 Communication

At present it seems desirable to restrict as far as possible the number of ground stations since the difficulty of multiple access increases with the number of earth terminals. For methods of access to communication-channels used for public correspondence, see Report AO/8 (Doc. 8/132, 1970-1973).

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* The use of this 1 MHz band is subject to prior operational co-ordination between the maritime mobile- and aeronautical mobile-satellite services, in conformity with the provisions of Nos. 352F and 352I of the Radio Regulations.

4.1.2 Distress and Safety

Alerting and the transmission of distress signals and messages as well as search and rescue communication should have immediate access to the system. Adequate priority should also be assigned to urgency and safety messages.

4.1.3 Radiodetermination

Radiodetermination may be used for the purpose of directing and regulating maritime traffic in a particular geographical area. In this case the controlling station concerned should have immediate access to the radiodetermination channel allocated to this area.

Radio determination may also be used for the purpose of locating ships at their own request or for services on land. For such an application all land stations should have access to appropriate radiodetermination channels.

4.2 Technical considerations

4.2.1 It should be possible to use all of the bandwidth allocated, which may entail a reduction in efficiency of the satellite transmitter.

4.2.2 It should be possible to use two types of ship stations:

- simple stations equipped with an antenna whose gain ranges from 0 to 3 dB, for ships concerned only with distress and safety and with radiodetermination and the communications relating thereto. It is envisaged that a single antenna could serve both functions;
- stations having a higher figure of merit (G/T) equipped with antennae whose gain ranges approximately from 9 to 25 dB for ships wishing to establish communication with land telephone and telegraph networks.

4.2.3 It should be possible to equip the satellites with high gain antennae covering a limited area where maritime traffic is particularly dense and where radiodetermination may prove necessary. This would permit a simpler installation on the ship if it operates only in this area.

4.2.4 Acceptable transmission quality should be provided for the channels corresponding to circuits which are to be extended over public networks. The final objective for the weighted signal to noise ratio to be met for at least 90% of the time should lie somewhere in the range 30 to 35 dB, or, assuming speech processing techniques are used, have a subjective quality which is equivalent to this (see Report 508). Other communications such as distress communications or those associated with radiodetermination could have lower standards.

4.2.5 For small ships and survival craft, the possibility of using portable low power, Emergency Position-Indicating Radio Beacons (E.P.I.R.B.) employing satellite relay at 1.6 GHz or at 406 MHz should be considered.

4.3 Economic consideration

4.3.1 The cost per telephone circuit should be relatively low, close to the cost of a circuit in the fixed service.

4.3.2 The cost of radiodetermination either to locate ships or to direct and regulate traffic, in the English Channel, for example, should be low.

4.3.3 The technical characteristics (e.i.r.p. of the satellite, G/T of ship stations, cost and number of land stations) should be the best possible commensurate with the economic viability of the system.

4.3.4 The cost of ship stations, especially for ships concerned only with distress, safety and radiodetermination and the communications relating thereto and particularly when their participation in the system is necessary for the direction and regulation of maritime traffic, should be low.

4.3.5 Satellite service should offer a substantial improvement in quality over the present communication modes and in speed of access and also offer a variety of new services, such as wideband data transmission.

4.3.6 Satellite service should offer the possibility of automating certain shipboard functions.

5. Example of a system serving the Atlantic area

5.1 Areas served

Fig. 1 shows the coverage of two geostationary satellites situated at longitudes 10°W and 40°W.

In the area common to the two satellites it is possible to provide radiodetermination and communication services and, in addition, to improve the radiodetermination service (see § 4.1.3) in a limited area where maritime traffic is heaviest.

In the areas covered by one satellite, only a communication service would be provided. The association of other satellites would permit the radiodetermination service to be extended.

5.2 Number of channels

5.2.1 Communication channels

Initially (in this example) a capacity of 10 channels per satellite could be envisaged, each channel being capable of routing either a telephone channel or a data transmission channel or several teleprinter channels.

5.2.2 Distress and safety channels

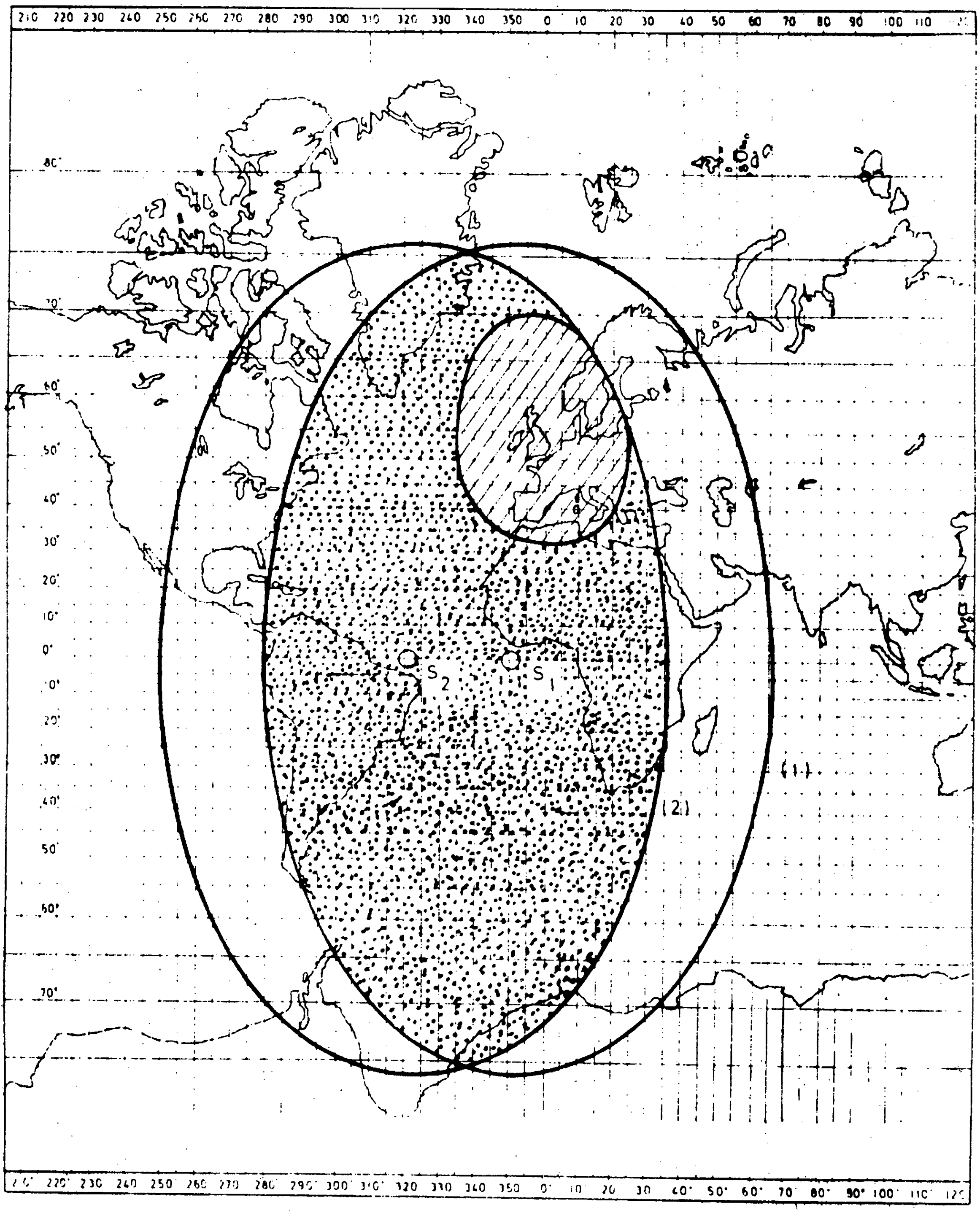
One or two channels could be allocated for this purpose in the direction from ship-to-shore. This would permit the operation of simple devices such as emergency position-indicating radio beacons (EPIRB's).

5.2.3 Radiodetermination channels

5.2.3.1 For the direction and regulation of maritime traffic, relatively small areas could be adopted, the service being provided jointly by a group of countries. There might thus be four radiodetermination channels in the limited area shown in Fig. 1 :

- one channel for the English Channel and the French Atlantic coast;
- one channel for the North Sea;
- one channel for the Norwegian Sea;
- one channel for the Western Mediterranean.

5.2.3.2 In the case of radiodetermination for navigation purposes or for keeping the table of ships' positions up to date, there might be one special channel which would be used on a time-sharing basis by all land stations.



▒ Common area

▨ Common area covered by a directional beam

FIGURE 1

EXAMPLE OF COVERAGE BY A SYSTEM WITH 2 GEOSTATIONARY SATELLITES

STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration:

REPORT AL/8(Rev.74)

FEASIBILITY OF SHARING BETWEEN THE MARITIME MOBILE SATELLITE SERVICE AND THE TERRESTRIAL MARITIME MOBILE SERVICE

(Study Programme 17A/8)

(1974)

1. Introduction

Frequency sharing between terrestrial maritime mobile systems in band 8 (VHF) and mobile systems using satellite techniques for maritime mobile radiotelephone communications would be advantageous for efficient use of the radio-frequency spectrum if mutual interference could be suppressed to a point where it would not disturb these two services.

The results of a preliminary theoretical study on the feasibility of frequency sharing between these two systems in the 150 MHz **band are described in this** Report. **The outstanding results are essentially as follows :**

Assuming that the most modern techniques which may be realized without unreasonable restrictions are used for both systems, an interleaved radio channel arrangement makes it possible to share the same frequency band, provided that minimum geographical separations are observed between any coast station in the terrestrial system and any ship station in the space system. Taking, for example, the ionospheric conditions found in tests in the North Sea region (see Recommendation 370-1), the minimum geographical separation required in 50% of locations would be about 100 to 200 km for 50% of the time and about 300 to 400 km for 99% of the time.

In this study, no consideration is given to the feasibility of satellite relay of the simplex circuits which are used for safety purposes.

2. Assumed main parameters of the terrestrial and the space maritime mobile system in band 8 (VHF)

The study of frequency sharing is based on the following assumptions :

- that a geostationary satellite is used;
- that the radio-frequency channel spacing of both systems is 25 kHz and that the spacing between the terrestrial system and the interleaved space system is 12.5 kHz;
- that the coast station transmitting (receiving) frequency band corresponds to the interleaved satellite transmitting (receiving) frequency band. In this case, the interference due to the coupling between transmitted signals and received signals in the satellite or ship can be suppressed to a negligibly small level;
- that a frequency plan will be adopted such that no interference occurs between ships;
- that the overall signal-to-noise ratio (S/N) objective of the space system is greater than 30 dB, which is prescribed as the worst condition for a circuit connected to the public telephone network;
- that the system margins of 2 dB due to multipath propagation and 9 dB due to fading (including scintillation) to prevent system degradation, are taken into account;
- that the minimum required received power of the satellite receiver is -140 dBW (6 dB relative to 1 µV in 75 Ω open circuit)*, which corresponds to a receiver which has noise factor of about 7 dB. With these figures, it is expected that signal deterioration due to cosmic noise is avoided;
- that the modulation of the space system is conventional phase modulation;
- that the system parameters of the terrestrial system are the same as those of a typical maritime mobile system now being used in Japan in band 8 (VHF). The assumed noise factor is 9 dB;
- that the main parameters of both the terrestrial and the space system are shown in Table I.

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* See Note 1 at the end of this Report.

TABLE I

Item \ System	Terrestrial maritime mobile system		Space maritime mobile system	
	Coast station	Ship station	Satellite	Ship station
Transmitter output power (W)	50	25	20	30
Transmitter feeder loss (dB)	2	2	1	2
Transmitter antenna gain (dB)*	9	2	16	12
e.i.r.p. (dBW)	24	14	28	25
Receiver antenna gain (dB)*	9	2	16	12
Receiver feeder loss (dB)	2	2	2	2

3. Estimation of interference

The estimation of interference in this Report is limited to the interference between the normal and interleaved (12.5 kHz spaced) channels. Other interference paths can be disregarded because of their large frequency separation.

Fig. 1 shows the interference paths treated in this Report.

3.1 Interference between a terrestrial coast station and a ship station of the space system

3.1.1 Interference from the terrestrial coast station to the ship station of the space system :

Power flux-density of the wanted signal at the ship station of the space system : -145 dBW/m^2**

Signal-to-interference protection ratio of the ship station of the space system : -15 dB***

Allowable maximum unwanted power flux-density : -130 dBW/m^2 (16 dB relative to 1 μV/m)

The minimum geographical separation required between the terrestrial coast station and the ship station of the space system is given in Table II.

---

* Isotropic gain

** See Note 3, at the end of this Report

*** See Note 2, at the end of this Report

TABLE II

Geographical separation required to prevent interference from the coast station in the terrestrial maritime mobile service to a ship station in the maritime mobile satellite service

Antenna height of the terrestrial coast station (m)		37.5	75	150	300	600	1200
Minimum geographical separation (km)	(1)	62	80	95	110	140	170
	(2)	95	110	130	150	180	220
	(3)	270	280	290	310	345	380

(1) North Sea region 50% of the time, 50% of the locations
(2) North Sea region 90% of the time, 50% of the locations
(3) North Sea region 99% of the time, 50% of the locations
(see Recommendation 370-1)

3.1.2 Interference from the ship station of the space system to the terrestrial coast station :

Power flux-density of the wanted signal at the terrestrial coast station : -140 dBW/m^2*

Signal-to-interference protection ratio of the terrestrial coast station : -15 dB**

Allowable maximum unwanted power flux-density :
-125 dBW/m^2 (21 dB relative to 1 µV/m)

The minimum geographical separation required between the terrestrial coast station and the ship station of the space system is given in Table III.

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* See Note 4, at the end of this Report.

** See Note 5, at the end of this Report.

TABLE III

Geographical separation required to prevent interference from a ship station in the maritime mobile satellite service to a coast station in the terrestrial maritime mobile service

Antenna height of the terrestrial coast station (m)		37.5	75	150	300	600	1200
Minimum geographical separation (km)	(1)	54	70	85	100	130	160
	(2)	75	90	110	140	160	200
	(3)	225	245	255	275	310	350

(1) North Sea region 50% of the time, 50% of the locations
(2) North Sea region 90% of the time, 50% of the locations
(3) North Sea region 99% of the time, 50% of the locations
(See Recommendation 370-1)

3.2 Interference between a ship station of a terrestrial system and the satellite

3.2.1 Interference from the satellite to the ship station of the terrestrial system :

Power flux-density of the wanted signal at the ship station of the terrestrial system : -133 dBW/m^2*.

Signal-to-interference protection ratio of the ship station of the terrestrial system : -15 dB**.

Allowable maximum unwanted power flux-density : -118 dBW/m^2

Unwanted power flux-density : -134 dBW/m^2***

Residual margin : 16 dB.

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* See Note 5 at the end of this Report
** See Note 2 at the end of this Report
*** See note 7 at the end of this Report

3.2.2 Interference from the ship station of the terrestrial system to the satellite :

Power flux-density of the wanted signal at the satellite : -148 dBW/m^2*

Signal-to-interference protection ratio of the satellite : -15 dB**

Allowable maximum unwanted power flux-density : -133 dBW/m^2

Unwanted power flux-density : -148 dBW/m^2***

Residual margin : 15 dB

4. Conclusions

- **The geographical separation between the coast station of the terrestrial system and the ship station of the space system is mainly determined by the interference produced by the terrestrial coast station to the ship station of the space system.**

- **The interference from the ship station of the space system to the terrestrial coast station is 4 dB smaller than that created in the opposite direction.**

- **Interference from the satellite to the ship station of the terrestrial system is negligible.**

- Interference from one ship station of the terrestrial system to the satellite is small but the cumulative effect of interference from many terrestrial stations, including land mobile stations may prove to be excessive. Further study on this effect would be required.

- **Frequency sharing of a terrestrial maritime mobile system and a space system is therefore feasible provided that a restriction is placed on the ship station of the space system to the effect that it should not transmit** within an **appropriate distance (which may be as much as several hundred kilometres) from the seashore.**

The above conclusions are dependent upon the parameters assumed and will be adversely modified if greater ship-borne transmitter powers are necessary.

However, the overall system economy could require different characteristics from those assumed for both ship and satellite equipment, depending upon the progress of technology.

Further study should be given to the limitation of power flux-density on the surface of the Earth, the e.i.r.p. and the spacing between transmitting and receiving frequencies, these studies should include other types of ship station and other sea areas.

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* See Note 6 at the end of this Report

** See Note 2 at the end of this Report

*** See Note 8 at the end of this Report

EXPLANATORY NOTES 1 TO 8

The numerical values used in this study are based on the following considerations :

Note 1.- Required minimum receiving power of the receiver used in the space system.

Required receiving power at the phase-modulation, single channel receiver input is given by the following formula :

$$Pr = S/N + 10 \log kTBF - 20 \log m_p - 10 \log (B/2b)$$
$$= -140 \text{ dBW}$$

Where Pr : receiving power (dBW)

S/N : required signal-to-noise ratio, 30 dB

k : Boltzman's constant, 1.38 x 10^{-23} (j/K)

T : temperature, 300 K

F : noise factor of the receiver, 7 dB

B : radio channel bandwidth, 15 kHz

m_p : modulation index, 3.5 rad. (peak)

b : baseband frequency bandwidth, 3.0 kHz.

Note 2.- Signal-to-interference protection ratio for a ship station of the terrestrial system, a coast station of the terrestrial system, a satellite and a ship station of the satellite system.

The signal-to-interference protection ratio (S/I) which is capable of securing a signal to noise ratio (S/N) of 30 dB is estimated to be -40 dB, provided that both signals are separated from each other by 12.5 kHz (interleaved frequencies).

The frequency drift of the system (including the transmitter and receiver oscillators) is, however, anticipated to be about 15 x 10^{-6} , therefore, the S/I of -40 dB estimated above has to be reduced to -15 dB.

Fig. 2 shows the actual interference characteristic of a receiver which is commonly used in a terrestrial system.

In accordance with Fig. 2, the S/N is expected not to deteriorate with the mutual interference between neighbouring channels.

Note 3.- Power flux-density of the wanted signal at the ship station of the space system (see Table I).

Satellite e.i.r.p. : 28 dBW

Power flux-density at the ship station of the space system corresponding to an e.i.r.p. of 1 W : -162 dBW/m^2 (Distance 36 000 km)

System margin : 11 dB

Power flux-density at the ship station of the space system : -145 dBW/m^2

Note 4.- Power flux-density of the wanted signal at the terrestrial coast station.

The required receiver input signal is assumed as 7 dB relative to 1µV/m which assures a S/N of 30 dB at the receiver output, referred to the characteristics shown in Fig. 3 which are obtainable for a typical receiver of current use.

According to the above assumption, the field strength or power flux-density is calculated by the following formula :

$$7 \text{ dB relative to } 1\ \mu V/m - (20 \log \frac{\lambda}{\pi} + GA - \Gamma f) = 6 \text{ dB}$$

$$\text{relative to } 1\ \mu V/m = -140\ dBW/m^2$$

where λ : wave length 2 m (150 MHz)

GA : receiving antenna gain relative to a dipole antenna : 7 dB

Γf : feeder loss : 2 dB

Note 5.- Power flux-density of the wanted signal at the ship station of the terrestrial system.

The required receiver input signal is assumed to be the same as that of the terrestrial coast station. The field strength or power flux-density is calculated as follows :

$$7 \text{ dB relative to } 1\ \mu V/m - (20 \log \frac{\lambda}{\pi} + GA - \Gamma f) = 13 \text{ dB}$$

$$\text{relative to } 1\ \mu V/m = -133\ dBW/m^2$$

Where λ : wave length 2 m (150 MHz)

GA : receiving antenna gain relative to a dipole antenna : 0 dB

Γf : feeder loss : 2 dB

Note 6.- Power flux-density of the wanted signal at the satellite (see Table I).

e.i.r.p. of the ship station of the space system : 25 dBW

Power flux-density at the satellite corresponding to an e.i.r.p. of 1 W : -162 dBW/m^2 (Distance 36 000 km)

System margin : 11 dB

Power flux-density at the satellite : -148 dBW/m^2

Note 7.- Power flux-density of the unwanted signal at the ship station of the terrestrial system (see Table I).

Satellite e.i.r.p. : 28 dBW

Power flux-density at the ship station of the terrestrial system corresponding to an e.i.r.p. of 1 W : -162 dBW/m^2 (Distance 36 000 km)

Power flux-density at the ship station of the terrestrial system : -134 dBW/m^2

In this case, no allowance is made for a system margin (11 dB) to take account of the worst condition.

Note 8.- Power flux-density of the unwanted signal at the satellite (see Table I).

E.i.r.p. of the ship station of the terrestrial system : 14 dBW

Power flux-density at the satellite corresponding to an e.i.r.p. of 1 W : -162 dBW/m^2 (Distance 36 000 km)

Power flux-density at the satellite : -148 dBW/m^2

In this case, no allowance is made of the system margin (11 dB) to take account of the worst condition.

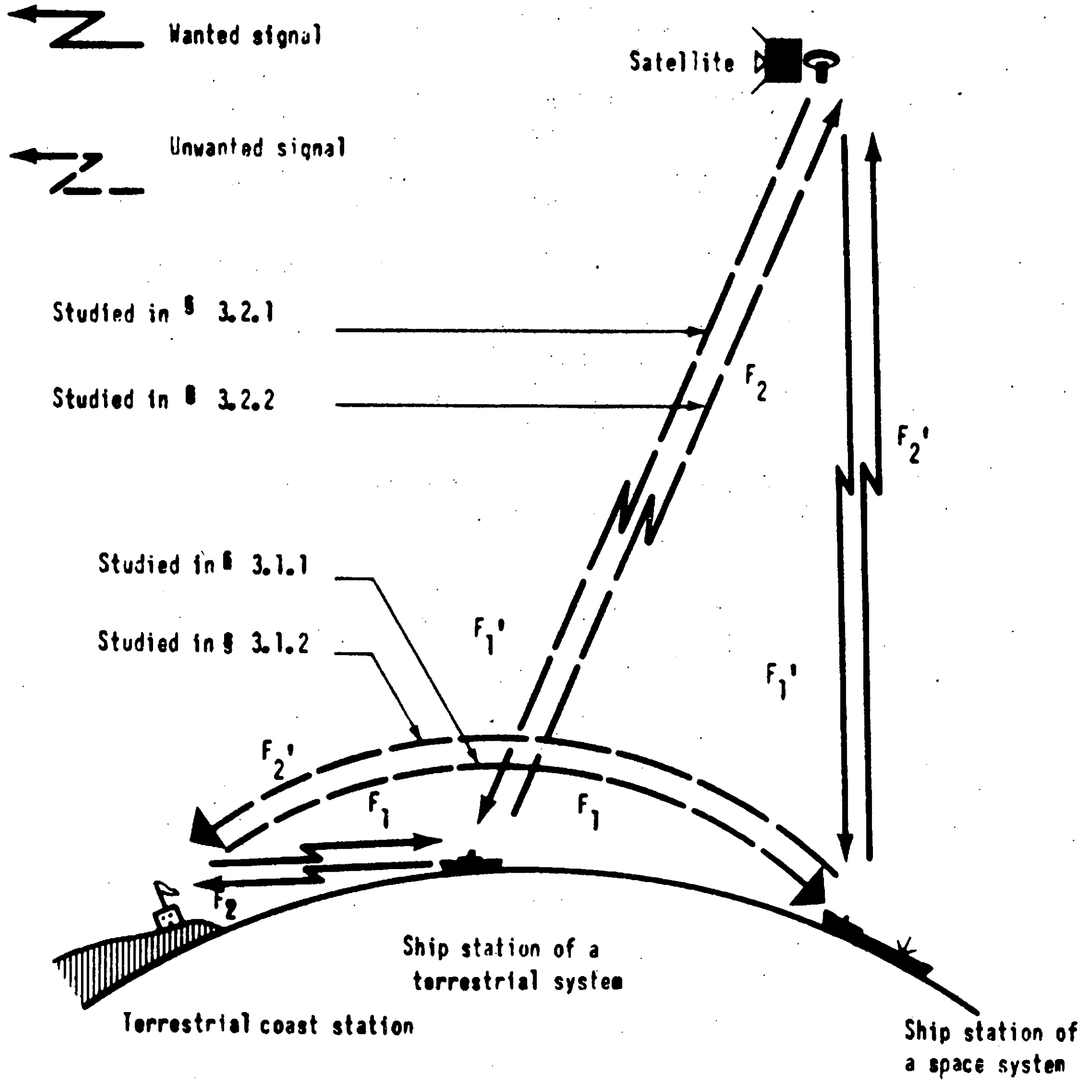
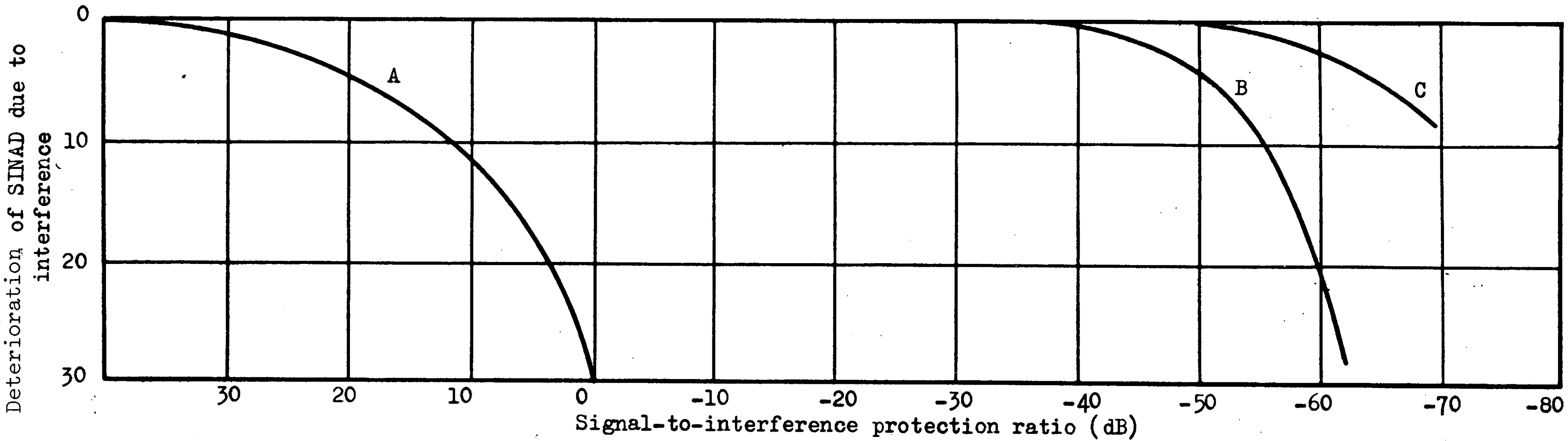


FIGURE 1.

INTERFERENCE PATHS

Note : $F_1 = F_1' + 12.5$ kHz

$F_2 = F_2' + 12.5$ kHz



A : Co-channel (F_o)

B : Interleaved channel (F_o + 12.5 kHz)

C : Adjacent channel (F_o + 25 kHz)

FIGURE 2

RECEIVER INTERFERENCE CHARACTERISTICS OF TERRESTRIAL MARITIME MOBILE SYSTEM

Wanted signal : 1 kHz, 3.5 rad., 30 dB rel. 1 μV/m

Unwanted signal : 400 Hz, 3.5 rad.

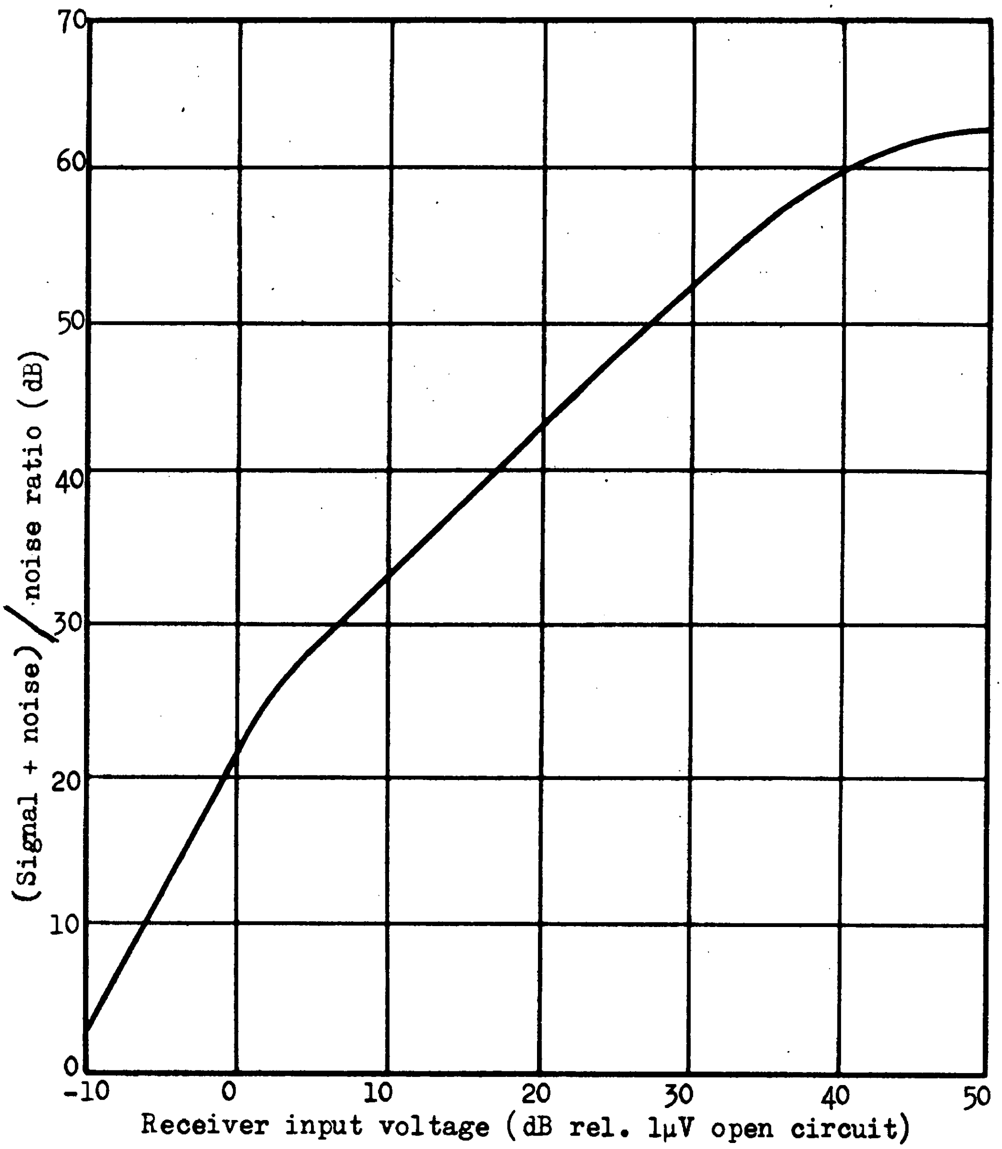


FIGURE 3

RECEIVER SIGNAL-TO-NOISE CHARACTERISTICS OF A TERRESTRIAL MARITIME MOBILE SYSTEM

Signal : 1kHz, 3.5 rad.

STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration :

REPORT AM/8(Rev.74)

TECHNICAL CHARACTERISTICS OF SYSTEMS PROVIDING COMMUNICATION AND/OR RADIODETERMINATION USING SATELLITE TECHNIQUES FOR AIRCRAFT AND/OR SHIPS

Antennae for aircraft and ships

(Question 17/8, Study Programme 17A/8)

(1974)

1. Introduction

In satellite communication or radiodetermination systems the critical link will usually be between the satellite and the mobile vehicle because :

- the total e.i.r.p. from the satellite is limited by the cost of providing large satellite transmitter powers and by the fixed satellite antenna gain resulting from the need to cover a specific geographical area;
- there are power limitations in aircraft.

System viability thus depends upon the practicability of attaining the antenna characteristics required on the mobile vehicle. Hence, the design of an antenna system for the mobile terminal of a mobile-satellite service represents a substantial task and must be considered in the context of total system requirements.

This report considers the major factors influencing the design of mobile vehicle antennae.

It is assumed that the satellites do not have rapid apparent motion with respect to a fixed observer and that the mobile antenna coverage extends over nearly a whole hemisphere.

2. The general antenna problem

2.1 Coverage in solid angle

For a satellite system designed to cover nearly a hemisphere of the Earth, and to be usable anywhere within that area, the satellite may be at any elevation angle. Moreover, the aircraft or ship may travel on any heading.

2.2 Antenna collecting area and gain

The system power budget determines the required collecting area of the vehicle antenna, i.e., determines the required gain. The gain is expressed in dB relative to the gain of some hypothetical agreed standard, usually isotropic, either linearly polarized or circularly polarized. The beam width associated with a given collecting area decreases inversely with frequency.

2.3 Antenna steering

If the combination of frequency and required collecting area results in a narrow beam width, then antenna steering/stabilization will be required of sufficient accuracy to maintain an adequate gain in the direction of the satellite during changes of attitude of the mobile vehicle.

2.4 Multipath

The ability to reject unwanted multipath signal power is a critical function in a mobile satellite communications antenna. Analysis, confirmed by experimental data, indicates that multipath signal power entering the system can become the limiting factor in the accuracy of a satellite-based surveillance system and can limit the minimum achievable bit error rate of a digital data system (FAA-RD-73-57, April 1973).

The quantitative determination of the ratio of direct path power to reflected power at the antenna terminals can be accomplished only through knowledge of the gain and polarization characteristics of the mobile vehicle antenna as mounted on the vehicle, and the relative amplitude and polarization characteristics of the direct and reflected signals (Report 505).

2.5 Polarization

Circular polarization on satellite links is desirable to :

- avoid the effects of Faraday rotation in the ionosphere (Report 504);
- avoid the need to stabilize the plane of polarization of the vehicle antenna as the vehicle heading and/or attitude is changed;
- minimize the effects of multipath propagation due to reflections from the surface of the earth and of the vehicle at elevations above the Brewster angle (Report 505);
- facilitate the production of the pair of beams required in some radiodetermination systems for transmission to two satellites simultaneously.

In practice, it is impossible to achieve truly circular polarization through an appreciable solid angle with a single antenna element. The off axis polarization degenerates to elliptical and it is important to define the maximum permitted ellipticity. For some applications it may be adequate to use a circular polarized satellite antenna and to use a linear polarized mobile antenna while recognizing that a 3 dB reduction in gain is incurred. This 3 dB reduction in gain will be eliminated if circular polarization is used at both terminals.

2.6 Multi-beam operation

In some proposed radiodetermination systems, links must be maintained with two satellites simultaneously. If directivity is a system requirement for the mobile antenna system, this necessitates two antennae or a single antenna giving two independently-steerable beams. The discrimination between the two beams may be by frequency difference alone, or by using different hands of circular polarization, or by both frequency and polarization diversity.

2.7 Power handling capacity

The power handling capacity of an antenna system can be limited by :

- corona discharge, particularly in the case of aircraft at high altitudes;
- mineral and ice deposition;
- overheating of feeder cables, particularly those passing through areas of high ambient temperature;
- overloading of devices associated with the antenna system.

2.8 Bandwidth

The frequency bandwidth limits may be determined by the radiation pattern, polarization axial ratio and feeder VSWR. The frequency bandwidth of the antenna on a ship or aircraft should accommodate the whole frequency band allocated to their respective services.

2.9 Impedance

Antennae must be designed to provide an impedance match to adjacent elements e.g., connectors, hybrids, transmission lines, diplexers transmitter outputs and receiver inputs. The specified impedance is based on what can be achieved realistically in the antenna design, and on a mismatch loss which is acceptable to the system designer. Typical values are an antenna VSWR of 2.0 : 1 implying a mismatch loss of approximately 0.5 dB.

2.10 General

In practice it will be necessary to produce an optimum antenna design by making trade offs between the above characteristics and factors e.g. between stabilization/steering and multipath losses.

3. Antenna measurements for aircraft

Characterization of the vehicle antenna system's gain and polarization throughout the defined coverage region is required to enable the system designer to determine the overall system performance as installed. This characterization can be done by scale modelling. Such model measurements have the advantage of economy and greater control of the variables (e.g., pitch, yaw, roll etc.) during experimental design testing. Practical scaling factors usually lie between 1/10th and 1/20th full size.

For example, given the task of determining the gain and polarization of typical UHF antenna system (e.g., the three element, switchable system described in para. 5.2.1) as installed on an aircraft, the following procedure has been used [T.S.C., October 1972].

- A full-scale element was constructed and its pattern characteristics measured. A standard flat ground plane is used. Patterns are measured for right-hand, left-hand, vertical, and horizontal polarization. Peak directivity and gain are measured to establish full-scale element efficiency.

- A scale model (1/20 of scale) element was developed which has pattern characteristics as nearly identical to the full-scale element as possible. Right-hand, left-hand, vertical, and horizontal polarized patterns are measured to ensure equivalency. The scale element is mounted on a flat ground plane sized to be equivalent to the ground plane used with the full-scale element.

- The scale element was mounted on a scale model aircraft Patterns are measured for right-hand, left-hand, vertical, and horizontal polarization. Peak directivity is determined by integration. Thus, the scale patterns provide directivity relative to the peak. The parameter of prime concern, gain, is determined by subtracting the efficiency factor (previously determined from the full-scale antenna) from the peak directivity.

The term pattern as used above refers to a spherical surface distribution plot of the power radiated by the antenna. Measurements are made in 2° intervals in azimuth and elevation, yielding a total of 16,200 data points per pattern.

4. Special problems of aircraft antennae

The antenna must meet the following particular requirements in the aircraft environment :

- it must not seriously affect the performance of the aircraft. Thus, it must have low aerodynamic drag, not introduce turning moments and be of low weight;

- it must withstand the aerodynamic stresses; vibration and buffeting, low pressures and extremes of temperature.

Having met these requirements, a site must be found where it can be mounted without unduly distorting its radiation pattern. This distortion depends upon the beam width. For a narrow beam, there is only a small probability of illuminating parts of the aircraft structure. For a wide beam, much of the aircraft structure will be illuminated and reflect the primary radiation. The direct radiation and the reflected radiation combine to give an interference pattern. Fig. 1 shows a measured radiation pattern of an antenna with an omni-azimuthal primary radiation pattern; at some azimuths, the radiation falls 13 dB below the maximum. Instances of variations of more than 20 dB have been observed and in practice, even for well chosen sites, a variation of between 10 and 15 dB must be expected. Reflections will, in general, also change the polarization of the resultant radiation. In particular, circular polarization can degenerate into elliptical in certain directions.

An aircraft antenna necessarily "breaks into" the structure of an aircraft. Thus, fuel tanks, hydraulic control lines, air ducts, etc. inside the aircraft may prohibit the use of certain areas. The satellite service antenna is only one of many which must be accommodated, without mutual radio interference, in the relatively small area available.

The possibility of intermodulation products being generated in parts of the aircraft structure or electronic installations must also be borne in mind.

When an antenna system is completely or partially installed in an unpressurized region of an aircraft, the successive temperature, humidity and pressure cycling is conducive to mould growth. The materials chosen, particularly insulating materials, should, therefore, resist mould growth.

5. Examples of Aircraft Communications Antennae

The antenna requirements imposed by the system power budget determine to a great extent the antenna configuration which can be considered for a given application. Optimum top-mounted single element antennae for use at UHF are capable of providing gains of -1 dB or greater throughout 95 percent of the specified coverage (generally defined as the hemispherical region above the aircraft in level flight with the exception of that region between the horizon and 10° above the horizon). If system requirements dictate gain for the specified coverage of greater than isotropic then switchable, multi-element systems or steerable antennae are required. Switchable systems for the specified coverage are limited in practice to about 4 to 5 dB gain. Steerable arrays can be designed to provide substantially higher gains than the fixed single element or switched multi-element systems but at the expense of initial cost, weight, complexity, reliability, and maintainability. Such antennae can take a number of forms, and examples of single antenna elements and arrays of elements are described in §§ 5.1 and 5.2 respectively.

5.1 Single elements

Simple antennae have low gain, poor directivity and are subject to deep nulls in some directions caused by reflection from the aircraft surfaces (Fig. 1).

5.1.1 Raked back whip or blade antenna

Raking back the antenna ensures that the radiation from the image of the antenna in the fuselage of the aircraft combines with that of the antenna to give a horizontally polarized radiation at high angles of elevation. In azimuth, such an antenna radiates a vertically polarized signal fore and aft but radiates an inclined polarization to each side.

5.1.2 The crossed dipole antenna

This antenna mounted on the top of an aircraft gives a circularly polarized beam in an upward direction. By inclining the elements it is possible to obtain a reasonable approximation to circular polarization over a large part of the upper hemisphere. A gain of about 2 to 4 dB might be expected.

5.1.3 Crossed slot antenna

Such an antenna for UHF applications is small (13.7 cm in diameter and 5.3 cm deep), light in weight, and has no active components or switches. When mounted on the top centreline of a four-engine commercial jet aircraft, it will provide a gain of -1 dB or greater throughout 95 percent of the specified coverage region. Typical roll and pitch plan patterns of this antenna are shown in Figs. 2 and 3 /TSC, 1972/.

5.1.4 Cavity-backed slot-dipole antenna

A dipole suitably mounted within a slot and backed by a shallow cavity provides a compact shallow profile UHF antenna which will radiate a close approximation to circular polarized radiation over a large solid angle / Sidford, 1973 /. A gain of about 6 to 8 dB might be expected.

5.2 Arrays of elements

Greater directivity can be achieved with more complex antennae by the use of a number of elements.

5.2.1 Switched antenna beams

Medium gain antennae (comprising several elements) dispersed around the aircraft, can give full coverage by switching. This arrangement can give a net gain of about 3 to 4 dB over the desired volume with good circular polarization with only moderate additional complexity /Blackband and Sidford, 1971/.

A switchable slot dipole antenna for UHF application consists of three slot dipole elements, one mounted on top centreline and the other two approximately 55 degrees off top centreline on each side of the fuselage. Typical fore-and-aft mounting location is aft of the cockpit but well forward of the wings. The elements are interconnected by coaxial cables and a switch assembly which permits that element which has the highest gain in the direction of the satellite to be selected. Preliminary North Atlantic route studies indicate that in-flight switching would rarely be required after the initial pre-flight selection is made. As with all multiple element antenna systems, whether switchable or steerable, there are limits over which two satellites can be viewed simultaneously, as is required for surveillance. The three-element, switchable slot dipole uses elements which are 16.8 cm. long, 5.8 cm. wide, and 4.8 cm. deep; are light in weight; and use an electromechanical coaxial switch for selection of the desired element. Three elements, optimally located on a B.707 aircraft, should provide a gain of 4 dB or greater for more than 90 percent of the specified coverage region (Fig. 4).

5.2.2 Electronically steered arrays

It is possible to use a number of planar and convex arrays, e.g. three or four arrays covering port, starboard, fore and aft, and each being switched and steered independently. The beam from each array can be steered by the adjustment of phase shifters in the feeds to the individual elements. Experimental arrays produced so far, using crossed dipoles as the basic elements, have had net gains over the desired coverage volume of 9 to 10 dB. With appropriate feeding adjustments, it is possible to steer two orthogonal circularly polarized beams simultaneously and independently, thus permitting simultaneous operation with two satellites /Fraser and Williams, 1971 : C.N.E.S., 1969/

5.2.3 Adaptive arrays

Adaptive, or self-steering, arrays have been tested for airborne use. The radiation patterns realized in practice from low-gain airborne antennae contain maxima of up to 3 dB greater and minima of up to 10 or 15 dB less than the theoretical value (Fig. 1). If two or more identical antenna elements are sufficiently spaced on the aircraft, the lobe structure of their radiation patterns are not correlated, and, in particular, their minima do not coincide. By combining the signals from several antennae in the correct phase relationships, a better effective radiation pattern is obtained. This type of array requires hybrid junctions and servo-driven phase shifters /Blackband and Nichols, 1967; Withers et al., 1967/. A net gain of 3 dB over the whole desired coverage volume can be achieved with the elimination of deep nulls.

6. Special problems of ship antennae

The special problems of ship antennae arise from :

- the difficulty of obtaining sites free from obstruction by parts of the superstructure;
- short-term variations in response due to rolling, pitching and yawing of the ship;
- restrictions on size and weight;
- the need to avoid interference arising from coupling with other antennae, intermodulation products generated in the ship's superstructure and in electronic equipments, etc;
- the salt water environment;
- the stresses set up by wind and ice loading and by vibration;
- the capability of operation in cases of distress, even if the performance is downgraded;
- maintenance requirements during long periods at sea.

Some of these problems will be aggravated by the lack of suitable sites in small ships, whilst in large ships with extensive radio installations, many antennae may compete for the limited number of suitable sites.

The lack of suitable sites, the limited size of the ship and the possible need to provide antenna stabilization restrict the antenna size and weight. If there is no ideal site, it might be possible to install two antennae to give all-round cover by switching from one to the other. This may be attractive for a simple, unstabilized, antenna system, particularly if the need to switch from one to the other is infrequent and can be done manually. The installation of two stabilized antennae, however, would be difficult and costly.

7. Examples of ship antennae

7.1 Introduction

Typical maximum movements of an unstabilized ship of 10 000 tons are ± 15° in roll and ± 7.5° in pitch with periods of about 7 to 10 seconds. Small ships, such as fishing vessels of 300 tons, will, typically, roll ± 25° and pitch ± 15° with periods of about 5 seconds. Maximum rolls of ± 40° are not uncommon for smaller ships. For roll-stabilized ships, the maximum roll angle may be reduced, at normal cruising speed, typically to ± 5° but other movements would be unaffected.

7.2 Ship antennae without stabilization

Without antenna platform stabilization or roll stabilization, an appropriate antenna beamwidth might be not smaller than 38° for the 10 000 ton ship and not smaller than 63° for the fishing vessel. These beamwidths include a margin of 5°, so that re-setting of the antenna mean pointing angle, as the ship changes its heading or geographical position, may be done periodically instead of continuously.

The full coverage requirements might be met by using a combination of low-gain antenna elements. The phasing and/or switching of the elements could be performed either manually or automatically [Goebel, 1971]. This could provide cheaper antennae for small vessels.

An antenna system possessing omnidirectional coverage in azimuth but having controlled directivity in elevation angle would not require re-setting for changes in the ship's heading.

7.3 Ship antennae with stabilization and steering

If high gains are required from ship antennae, the narrow beamwidth would make it necessary to provide some form of stabilization together with a steering capability. Yaw and course alterations may be compensated by coupling the antenna azimuthal steering system to the ship's gyro compass, if one is fitted.

A semi-stabilized antenna platform, i.e. one which reduces the antenna movement to a maximum of say, ± 5° would permit the use of an antenna beamwidth of 15°.

An antenna platform stabilized to within, say, ± 0.5° would permit a beamwidth of 6° to be used, if manual re-setting of the mean antenna angle were used.

Phased arrays offer the advantages of electronic beam steering, stabilization and automatic tracking. These would also permit fast scanning of the hemisphere for the purpose of searching for the satellite signal. A typical antenna system would comprise arrays of elements giving a minimum gain of 18 dB in the direction of the main lobe. The main lobe can be steered in directions with elevation angles equal to or greater than 10° independent of the motion of the ship, for roll and pitch angles of ± 13.5° and ± 6.5° respectively /̄ Ersdal and Kuhnle, 1971 /̲.

Some of the antennae suitable for the degrees of stabilization outlined above are given in Table I, in order of ascending values of antenna gain, for frequencies around 160 MHz, 400 MHz and 1600 MHz.

TABLE I

Possible ship's antennae

Beamwidth between -3 dB points	Gain at -3 dB points dB	Frequency in MHz		
		160	400	1 600
Omni-directional coverage	Low	Dipoles	Dipoles	Dipoles
63°	5.5	Helix, L = 1.3 m	Helix, L = 0.55 m	Helix, L = 0.13 m
38°	10.0	Helix, L = 3.75 m	Helix, L = 1.65 m	Helix, L = 0.38 m
15°	18.0	*	Quad-helix L = 2.5 m	Paraboloid, D = 1 m Quad-Helix L = 0.7 m
15°	18.0	*	*	Phased array
6°	26.0	*	*	Paraboloid, D = 2.5 m

Antenna dimensions : L = length, D = diameter

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* Too large to be practicable.

8. Summary and conclusions

Aircraft or ship antennae are critical components in aeronautical and maritime satellite systems because of the limitations of satellite power and the large coverage required.

In aircraft and ships, antennae with suitable characteristics have to be provided in unfavourable environments and sited to allow unobstructed and/or multipath-free visibility over the required arcs. The motions and manoeuvres of the vehicles cause apparent changes in the direction of the satellite(s) and so increase the antenna coverage required.

The required directivity of the vehicle antenna is a function of the transmission frequency and the maximum available power flux-density at the Earth's surface and will determine whether an antenna steering facility is required. Mechanical steering is probably not feasible for aircraft. In the case of ships, mechanical steering is feasible but a single antenna system will provide the necessary arc of view only if an ideal site is available.

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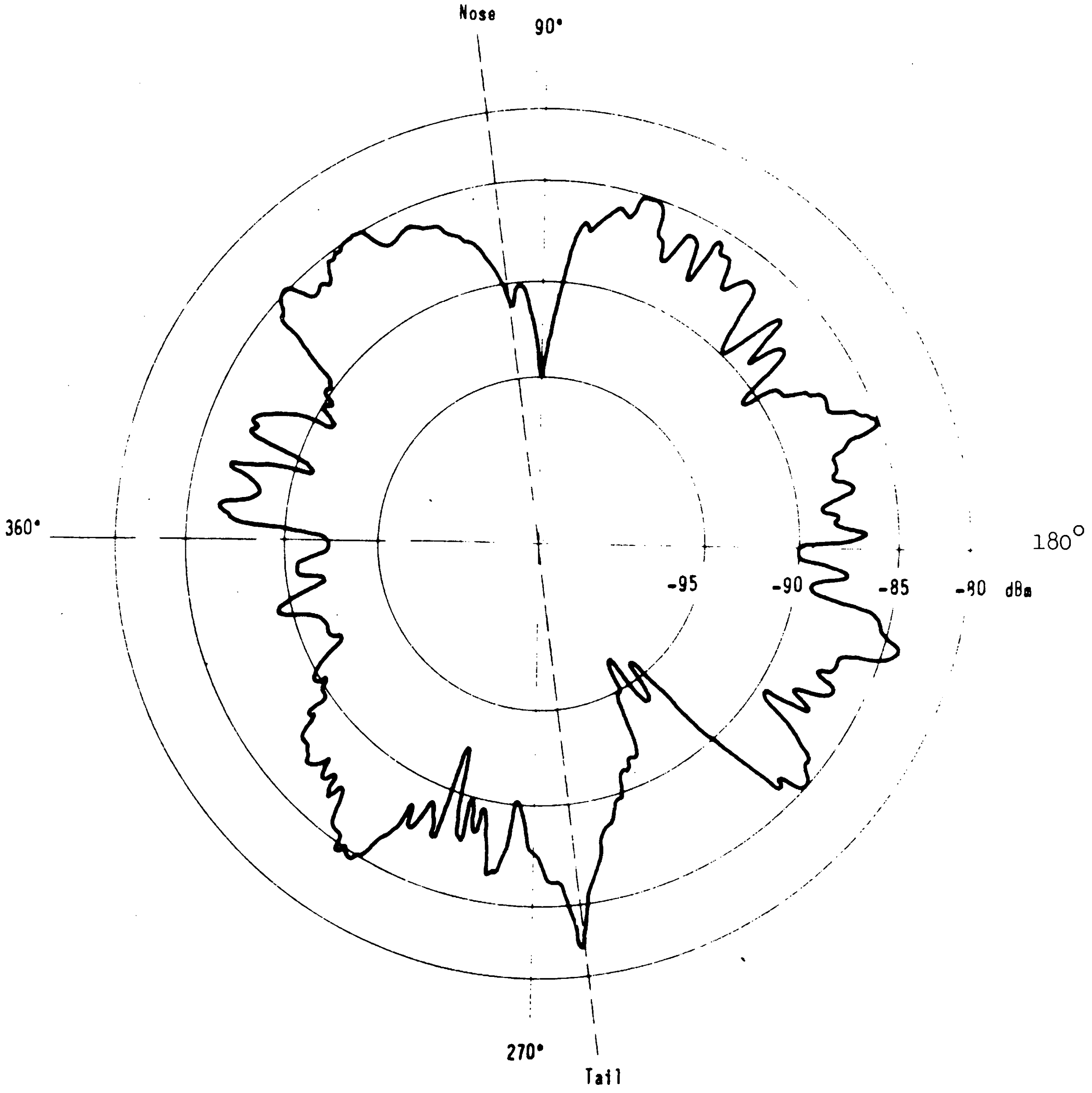

FIGURE 1

RADIATION PATTERN AT NOMINAL 0° ELEVATION OF BLADE ANTENNA MOUNTED ON A HASTINGS AIRCRAFT MEASURED AT 228 MHz, VERTICAL POLARISATION

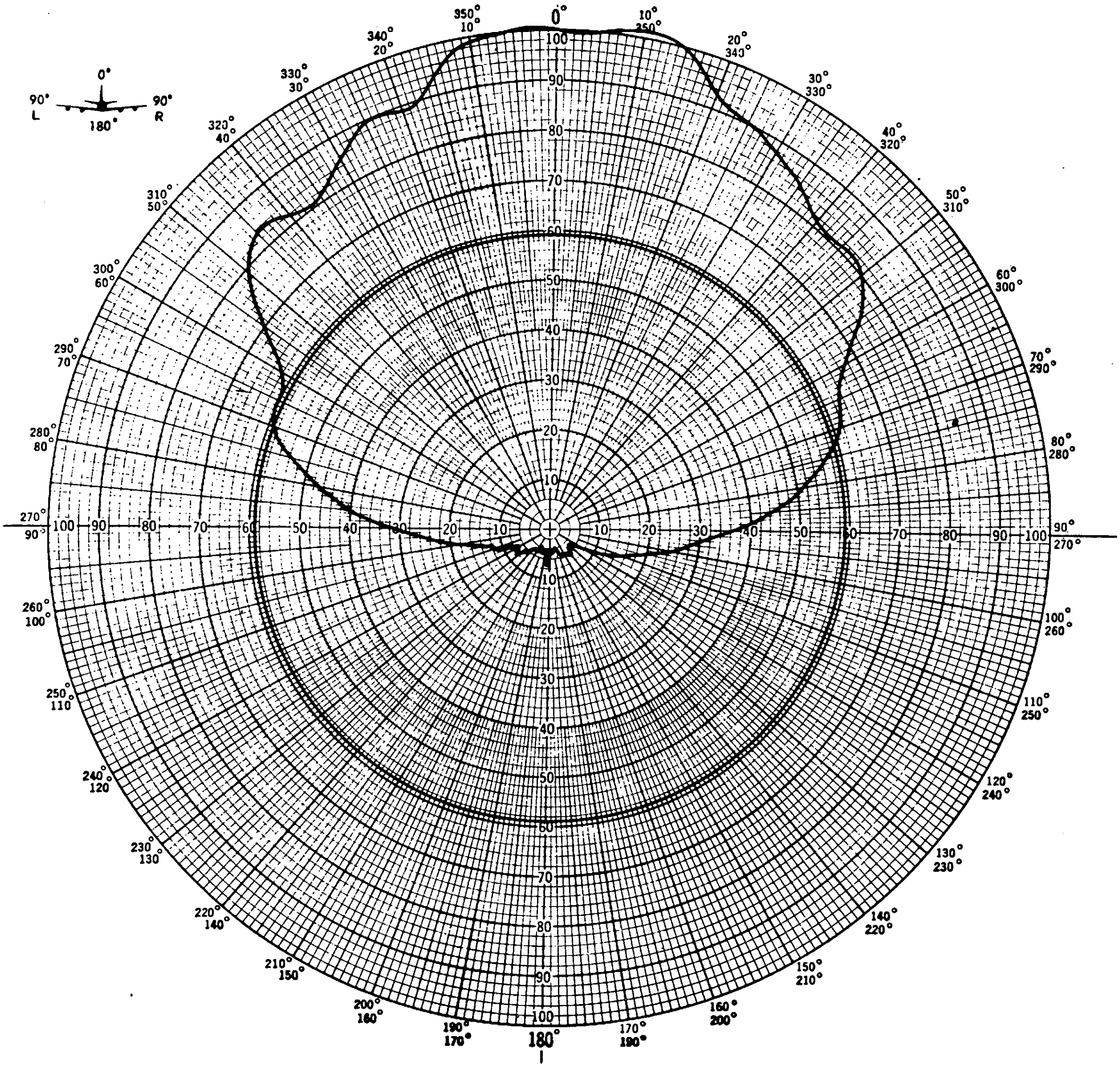

FIGURE 2

ORTHOGONAL MODE CROSSED SLOT ANTENNA - ROLL PLANE PATTERN

(full size antenna located on a 1.50 m^2 (4 foot square) curved ground plane)

Maximum gain: 4.5 dB relative to circularly polarized isotropic
Elevation angle variable
Azimuth angle fixed (90 degrees)
Curve plotted in voltage
Frequency : 1 540 MHz

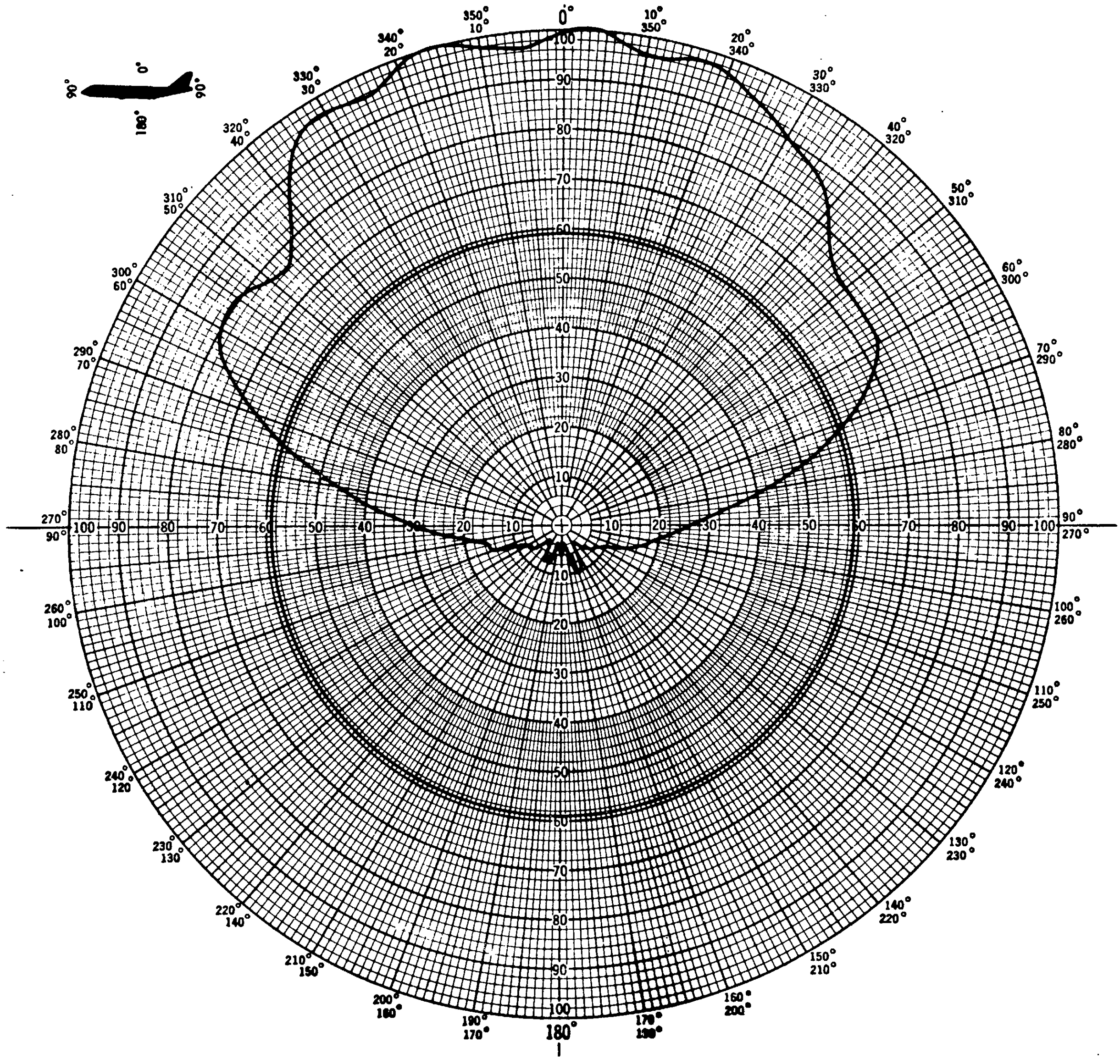

FIGURE 3

ORTHOGONAL MODE CROSSED SLOT ANTENNA - PITCH PLANE PATTERN

(full size antenna located on a 1.50 m^2 (4 foot square) curved ground plane)

Maximum gain: 4.5 dB relative to circularly polarized isotropic
Elevation angle variable
Azimuth angle fixed (0 degrees)
Curve plotted in voltage
Frequency : 1 540 MHz

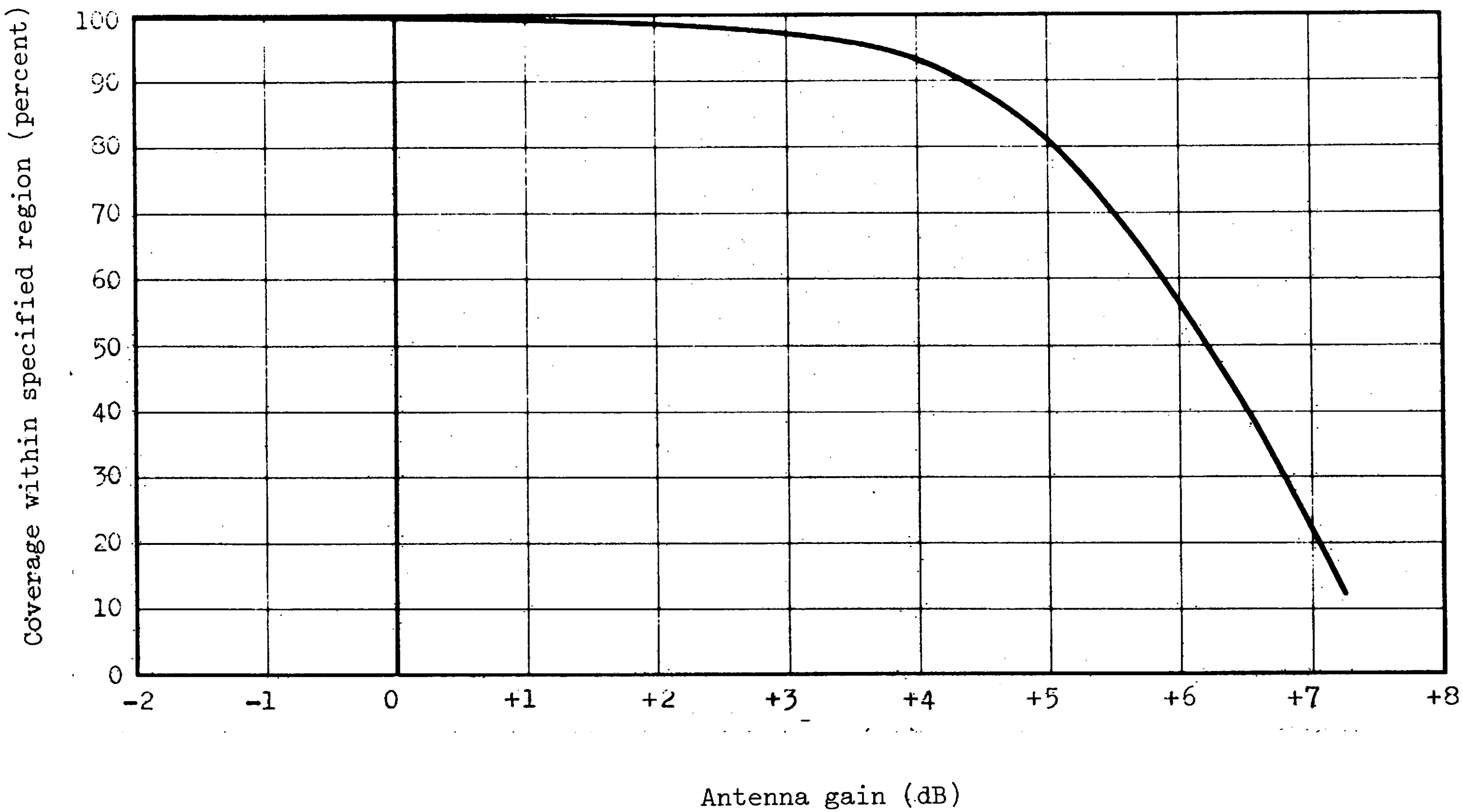

FIGURE 4

GAIN OF THREE-ELEMENT SWITCHABLE SLOT DIPOLE ANTENNA SYSTEM

Sector coverage - Elevation = 0^o to 80^o (zenith = 0^o)
Azimuth = 0^o to 358^o

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STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration:

REPORT AN/8(Rev.74)

SYSTEMS PROVIDING RADIOCOMMUNICATION AND/OR RADIODETERMINATION USING SATELLITE TECHNIQUES FOR AIRCRAFT AND/OR SHIPS

Operational aspects

(Question 16/8)

(1974)

1. Introduction

This report contains various operational aspects of the aeronautical and maritime mobile satellite services. As the operational needs of the aeronautical and maritime services are currently under consideration by I.C.A.O. and I.M.C.O., this report includes the results of their work to date.

2. Operational functions for the aeronautical service

2.1 Aeronautical telecommunications are distinguished by the fact that they are of prime importance for the safety, regularity and expeditious flow of air traffic. Moreover, at present, the speed of long-range aircraft reaches 1000 km/h and will attain 2500 km/h with the introduction of supersonic transport.

2.2 Within an oceanic area of high air traffic density, such as the North Atlantic, the number of aircraft between the meridians 15° W and 50° W during a peak hour was 110 in 1969. This peak figure corresponded to a total peak day traffic of 486 flights. Table I below shows peak day movements, peak hour statistics and total annual movements year by year.

TABLE I

Air traffic movements in the principal area of the North Atlantic (10° - 50°W between 45°N and 61°N)

Year	Peak day movements	Peak hour movements	Annual movements
1969	486	110	106,112
1970	487	106	111,947
1971	486	112	110,380
1972	485	112	108,882
1973	487	112	113,502

Although passenger and freight carriage has shown some increase in recent years, the change of aircraft type from second generation subsonic jet to third generation wide bodied jet has disturbed the rate of increase in air traffic movements. It is at present extremely difficult to estimate the peak day and peak hour traffic in the years ahead due to uncertain economic conditions and changing world situations.

2.3 In view of the volume of air traffic foreseen for the future, as evidenced by the above figures, it is obvious that the infrastructure of the aeronautical services must be improved in order to provide the necessary efficient flow of air traffic with the degree of safety now achieved. Some improvements can be achieved by the use of space telecommunication techniques. Considerable work in this regard has already been done by administrations both individually, and in mutual coordination within the framework of I.C.A.O.

2.4 A complete list of operational functions with priorities has not so far been completely agreed for an aeronautical satellite system, nor have the system specifications been established. However, it is already clear that the following principal functions can be identified :

2.4.1 Aeronautical mobile communications

- Air traffic control (ATC) voice communications (pilot-controller)
- Air traffic control communications (data)
- Company operational control (voice and data)
- Reporting of aircraft performance (data)
- Meteorological (MET) broadcasts to aircraft
- Aeronautical information service.

2.4.2 Aeronautical radiodetermination

ATC surveillance for strategic/tactical concepts of control accomplished by :

- Telemetering of in-flight determined position
- Multi-satellite ranging techniques.

The above radiodetermination functions would permit, in particular, the application of reduced separation minima between aircraft, required by the volume of air traffic which is constantly increasing. Thus a better utilization of the airspace would be achieved together with increased economy of air transport.

2.4.3 Search and rescue (SAR)

While no specific requirements have yet been established within I.C.A.O., the possibilities offered by space communication techniques have been reviewed with **the object of determining whether** these techniques could be used to improve communications required for SAR purposes. In this connection, the following aspects have been listed as meriting further consideration :

- long-range satellite relay of on-scene communications involving SAR centres, aircraft in distress, survival craft and SAR aircraft and/or surface vessels;
- determination, by satellite techniques, of the absolute and relative positions of mobile craft engaged in, or able to assist with, a particular SAR action and the relaying of this information to those concerned;
- the use of satellite relay for certain SAR fixed communications, since this would have advantages when the centres concerned are not, or cannot readily be, integrated with the Aeronautical Fixed Telecommunication Network (AFTN).

It is accepted that the above possible SAR applications are only tentative and that considerable further study would be required before definite conclusions could be reached with respect to the establishment of any specific requirements in this regard, and the manner in which such requirements should be satisfied (e.g., by inclusion of the SAR functions in an aeronautical space communication system or by providing a separate system for these functions, etc.);

2.4.4 other functions of possible benefit to aviation have been identified, amongst which is the possibility of satisfying any future need for linking of aircraft to the public telephone or telegraph networks.

Although aeronautical mobile communications can be implemented independently, where radio determination is to be employed, provision should be made for the simultaneous use of the two functions: aeronautical mobile communications and radiodetermination.

3. Operational requirements for the maritime mobile service

3.1 Areas to be covered

The maritime satellite system should ultimately operate reliably on a 24-hour basis for all maritime regions of the globe between, approximately, latitudes 70° North and 70° South. To the extent practicable, polar regions between approximately 70° and 82°, northern and southern latitudes, should also be served, not less than once daily, for a period of at least 3-4 hours.

Later, the introduction of satellites to cover polar regions should be envisaged. This would require additional satellites in inclined or polar orbits.

3.2 Categories of vessels likely to participate in the system

In the early stages the ships participating are likely to be those of specialized types (e.g. tankers, container ships, large passenger ships, etc.) and probably, initially, in small numbers.

The total number of vessels (gross tonnage of 100 and upwards) in the world is estimated at 60,000 by 1980 and 100,000 by the year 2000. Of this total population it is estimated that only a small percentage of vessels would actually be fitted with shipboard terminals by 1980. It is expected that vessels from the following categories would eventually participate :

(a) vessels covered by the International Convention for the Safety of Life at Sea, 1960;

(b) fishing vessels operating in distant waters;

(c) scientific, industrial and miscellaneous other units operating in marine environments.

It is expected that in the period 1980-2000, up to two-thirds of all vessels would be at sea at any given time.

3.3 General Communications

There is a requirement for connections using automated calling procedures and ultimately fully automated connections, between ships and public telephone and telegraph networks to establish information exchange by telephony and telegraphy, including voice, data transmissions, facimile, teleprinter and wide-band telegraphy, necessary for the administrative and operational handling of the ships and for the communications of the passengers and of the crews.

3.3.1 Special operational conditions

(a) The system should provide considerably more rapid access and higher reliability than the present terrestrial maritime radio systems. In order to achieve a high degree of utilization priority should be given to automated methods of establishing connections.

(b) The system should be capable of and suitable for interconnection with the general telecommunication networks.

(c) Provision for simplex and duplex operation should be made.

(d) The system should make provision for collective calling of predetermined groups of ships.

(e) Due to the large number of potential users and the need to achieve maximum possible uniformity, the shipborne equipment and antennae should be reliable, and as inexpensive as practicable consistent with the overall economics of the system.

(f) Maintenance and operation of the shipborne equipment should be as simple as possible, consistent with the overall demands of the service, including the effectiveness, reliability and economics of the satellite system.

3.3.2 Estimated volume of traffic

When estimating the volume of traffic consideration should be given to the following factors :

(a) The present volume of traffic and expected rate of growth for public correspondence.

(b) The improved quality and reliability of satellite communications.

(c) The possibility of providing high-speed data circuits.

(d) The additional provision of fascimile, teleprinter and wide-band systems.

(e) Inter-ship communications.

(f) Economic factors.

3.4 Distress, search and rescue

There is a maritime operational requirement to use satellite communication techniques for distress cases, including distress alerting and search and rescue control communications, complementing terrestrial communication systems. Distress traffic should always have immediate priority access. If practicable, provision should be made to enable low power emergency position-indicating radio beacons (EPIRBs) to alert rescue co-ordination centres of distress situations through the use of satellite techniques.

3.5 Safety

There is a requirement for :

(a) distribution of urgency and safety messages including medical assistance;

(b) broadcasts to mobile craft of meteorological, hydrographic and oceanographic information (e.g. reports, forecasts, warnings, etc.) including transmission by direct printing and/or fascimile;

(c) individual meteorological and oceanographic advice to mobile craft by land-based stations (e.g. weather routeing, navigation through ice, etc.);

(d) collection from mobile craft of meteorological, hydrographic and oceanographic observations.

3.6 Radiodetermination

Any possible radiodetermination capability should as far as practicable satisfy the following important operational requirements :

(a) position determination of ships in distress;

(b) (i) interrogation of a land-based station by a ship station in order to obtain positional information, possibly followed by environmental, meteorological and oceanographic information;

or

(ii) regular interrogation at appropriate time intervals of the ship station by the shore station and transmission to the ship station of the information of its position;

(c) automation of the position-reporting system based on position information as mentioned in the second item above. Thus, the present repeated individual reporting actions by mobile craft could be abolished;

(d) automatic warning of ships which are continuously tracked by the system, in cases of approaching shallow waters, underwater obstructions, drilling and production platforms, etc.;

(e) informing ships which are continuously tracked by the system on anti-collision actions and on avoidance of continuously tracked navigational hazards, e.g. icebergs;

(f) traffic control including collision warning especially in converging areas subject to the radiodetermination system providing sufficient relative accuracy.

3.6.1 Accuracy

The accuracy required in order to meet these needs depends on many factors, e.g. :

(a) the area of navigation (in open sea about 1-2 nautical miles seems adequate at present; confluence areas would require a higher order of accuracy);

(b) speed and direction;

(c) type of vessel (e.g. tankers have different needs from fishing vessels).

Furthermore, the absolute accuracy needed will generally be different from the relative accuracy.

3.7 Possible other requirements

There may be a requirement for :

(a) the emission of standard frequencies and time signals;

(b) the transmission of programmes to ships at sea for news and entertainment purposes.

3.8 Implications of harmonization of specifications of ships' equipment

There is a need for international agreement for uniform type approval and harmonization of specifications of shipboard communication equipment. Some reasons are as follows :

(a) to facilitate inter-system operability if multiple systems are established;

(b) to allow for standard interconnection to all international telecommunication networks;

(c) to facilitate interchange of equipment among ships of various flags, as well as to facilitate the transfer of vessels from flag to flag;

(d) to allow and encourage uniform inspection procedures and standards for ships under different flags;

(e) to allow internationally consistent type approval requirements to be established by each country;

(f) to facilitate uniform equipment operator training and operational procedures.

World-wide harmonization of specifications offers significant economic, operational, administrative and technical advantages. In all subsequent maritime satellite communication system and equipment designs there should be as much compatibility between the operational parameters of the subsequent design and the operational parameters of currently operating maritime satellite communication system(s) as is practical, without unduly restricting the optimum design of the subsequent system(s).

3.9 Capacity of the system

Sufficient channels should be provided to cater for the number of ships that can be expected to participate in the service (see § 3.2) and to take into account the expected traffic growth (see § 3.3.2).

The capacity of the system, first and subsequent stages, should be determined by one of two approaches, or perhaps a combination of them. These approaches are :

(a) Cumulative traffic forecasts

(b) A cost-efficiency approach to decide the optimum capacity available for economical launching and other considerations.

4. Sharing possibilities between the aeronautical and maritime services

4.1 Apart from possible requirements to share common frequencies for distress, urgency, SAR and radiodetermination purposes, it could also be advantageous to use common frequencies to meet specific needs common to both services.

Certain specific or functional communications have been investigated for which sharing might be advantageous from an operational or economic point of view.

The following possibilities of sharing exist :

4.1.1 the emission of standard frequencies and/or time signals, if required in addition to the existing standard frequency and time signal service;

4.1.2 specific meteorological broadcasts;

4.1.3 the transmission of meteorological observations;

4.1.4 public correspondence for ships and aircraft.

It is concluded that sharing is not appropriate for the cases mentioned in §§ 4.1.1, 4.1.2 and 4.1.3, owing to the divergent operational requirements of the two services. In relation to § 4.1.4, provision should be made for world-wide mobile public correspondence, by means of satellites. These provisions should be sufficient to meet the needs of the maritime mobile service with provision for expansion and, should it prove necessary and if channels are available, its extension to aviation.

4.2 It may be possible that advantages can be realized through a joint communication system for search and rescue purposes and for distress purposes, subject to the necessary agreements between the aeronautical and maritime mobile services. Further study of such a common system will need to be conducted by the two specialized agencies (I.C.A.O. and I.M.C.O.) which are concerned with the establishment of the operational requirements, acting in collaboration with the I.T.U., before any definite conclusions can be reached with regard to the need for the common system and, if a need is established, the specifications of the system.

C.C.I.R.
XIIIth Plenary Assembly
Geneva, 1974

Doc. 8/1052-E

STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration:

REPORT AO/8 (Rev.74)

SYSTEMS PROVIDING RADIOCOMMUNICATION AND/OR RADIODETERMINATION USING SATELLITE TECHNIQUES FOR AIRCRAFT AND/OR SHIPS

Methods of access to communication channels in the maritime mobile satellite service

(Question 16/8)

(1974)

The following Report has been prepared from Docs. 8/12 (United Kingdom), 8/38 (Japan) and 8/91 (France), 1970-1973, on this subject and submitted to the Interim Meeting of Study Group 8, Geneva, 1972.

1. Introduction

In this Report various multiple access and channel assignment techniques are examined which may be used for public correspondence using two-way telephony channels and telegraphy channels in the maritime mobile satellite service.

Estimates of the maritime communication traffic to be passed through satellite channels indicate that for the world-wide service more than 200 two-way telephone channels and a comparable number of narrower bandwidth telegraphy channels may ultimately be required. Some thousands of ships would use the service, with several calls per day from each ship. The duration of telephone calls could average 6 minutes, with rather less time for telegraph communications.

Considering that the number of mobile stations is very large, but the calls from each mobile station are relatively few, it is clear that demand assignment operation is needed for calls to different ships. It would also be very inefficient to pre-assign channels to each earth station since the number of available channels is limited and many earth stations have no need to use a channel for 24 hours a day. This examination covers various network models, multiple access techniques and channel assignment methods with the object of indicating what would be appropriate for the efficient operation of a maritime mobile satellite service for public correspondence.

Consideration is given to a particular access system and one which appears at the present time to satisfy many of the technical, operational and economic constraints of a maritime system, but other methods may well become advantageous as technical progress modifies these constraints.

Many of the general considerations on channel assignment for calls apply also to an aeronautical mobile satellite system, but because the number of mobile and earth stations, the frequency of calls, the duration of calls and the operating requirements are substantially different from the maritime case, the aeronautical access system should be considered separately.

2. Network models

The possible forms of a mobile communication network can be divided into three main types :

2.1 Restricted pre-assignment of channels

In this model, channels are pre-assigned to earth stations for calls between earth stations and mobile stations. The model is restricted in the sense that mobile stations cannot call other mobile stations. Circuit control is easy to apply, but the frequency utilisation is quite low because separate groups of channels are needed for each earth station.

2.2 Restricted demand assignment of channels

Circuits are established on demand between earth stations and mobile stations (but not between one mobile station and another) using any working channel in the system for any call. In this case, frequency utilisation would be much more effective, although circuit control would be more complicated than that of the pre-assignment model.

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* In this Report "earth station" refers to the stations on land in the maritime mobile satellite service.

2.3 Unrestricted demand assignment of channels

In this model, restrictions are removed on who may call who, and circuits may be established not only between earth stations and mobile stations, but also between mobile stations themselves using any channel for any communication. The circuit control would be at least as complex as that of § 2.2.

Comparing the three network models described above, the restricted demand assignment model of § 2.2 seems to be the most suitable for the effective utilization of the limited frequency band and meets the main requirements of the maritime system. The routing of ship-to-ship calls through an earth station using two tandem satellite relays needs additional consideration.

3. Multiple access techniques

Three categories of multiple access techniques for satellite communication, namely time division multiple access (TDMA), frequency division multiple access (FDMA) and common spectrum multiple access (CSMA) are discussed in Report 213-2, § 4.3. The multiple access method which is chosen for the maritime satellite communication system will depend mainly on the modulation method which can most economically provide the signal quality needed, on the number of ships and earth stations using each satellite and on the number of channels needed.

The control method by which channels are made available for calls on demand should not be significantly influenced by the way the channels are provided through the satellite, unless the chosen control system should need channel switching in the satellite.

However, the number of channels needed to support the peak traffic depends on the choice of both the multiple access method and the demand assignment method.

A multiple access method which could provide a unique channel through the satellite for every ship, with a limited number of ships using their channels at one time, would simplify the ship equipment at the cost of complexity at the earth stations, but would require for the ultimate number of ships a spectrum allocation far greater than can be provided for the maritime service.

A frequency division multiple access technique appears, at present, to be acceptable for the link from mobile stations to earth stations via satellite; the ship equipment would be less complex, and the satellite transponder and the frequency spectrum would still be used effectively. On the other hand, for the link from earth stations to mobile stations via satellite, a time division multiple access technique may be as attractive as a frequency division multiple access technique, because the complex equipment needed for T.D.M.A. transmission would then be concentrated at a few shore stations. In addition, if the multiple-spot beam technique on board satellite, which enables the effective use of limited satellite power, is adopted, T.D.M.A. may be more attractive than F.D.M.A., because of the lower complexity of beam switching function on board satellite. For example, the heavy filtering network, which is necessary for the beam switching in F.D.M.A., would not be required in the T.D.M.A. system.

The antenna beam configurations to cover the global service area is described in Annex I.

An additional advantage of using T.D.M.A. in the shore-satellite-ship direction is in the more efficient use of the satellite power amplifier and in the reduction of intermodulation effects, particularly if the power amplifier is very non-linear.

4. Methods of channel control

Report 213-2, § 1.2 describes three methods of demand assignment operation :

- Un-ordered access, in which a channel is seized whenever a call is required, irrespective of its availability. This could only be accepted if each ship had a pre-assigned channel for its use, which is not possible with present spectrum limitation.

- Self-ordered access, in which all users know which channels are free and are hence able to be seized for calls.

  The disadvantage of this method is that the control equipment at each station becomes complex. Also, the propagation time due to the length of the geostationary satellite path increases the possibility of simultaneous channel seizure by more than one station.

- Controlled access, in which requests are made for calls to a controlling station, which allocates channels according to availability. Earth stations could control their own calls, or there could be a single agreed master control station at any one time.

4.1 General considerations

Controlled access is acceptable for a maritime mobile satellite service because it simplifies the ship station equipment and can offer high utilization of channels at peak traffic hours. Two forms of organization can be identified :

- Control by each earth station. All earth stations assign channels for calls, according to their own requirements or on request from ships through one or more two-way control channels reserved for this purpose and used by all stations in the system.

  It may be concluded that all channels should be used by all ships and earth stations on a call-by-call basis, using the rapid calling channel system.

  If many earth stations can assign any channel which is free at the moment, there is a calculable chance that a channel will be allocated at the same time for more than one call. Such conflict can be avoided by providing a further separate signalling channel connecting the earth stations together through the satellite (cf. the SPADE /Werth, 1969/ proposal).

  This type of system is described in Annex II.

- Control by a single routing centre. Only one routing centre has the control function at any time, although for reliability several earth stations should be equipped to perform this function by agreement. Both earth stations and ships would communicate with the control station through one or more two-way control channels.

  This form of demand assignment organization appears to give a satisfactory utilization of channels, with costly equipment at onlv a few earth stations.

  This type of system is described in Annex III.

5. Conclusions

From the various network models considered, the "restricted demand assignment of channels" seems to meet the potential requirements of a maritime mobile satellite service. If a calling system similar to that now used for HF services were to be used in the satellite system, with callers waiting until the channel is released, a substantial fraction of the channel time would have to be used for calling and there would be many simultaneous attempts to use calling channels at the moment of release.

Under the present technical, operational and economic constraints a Frequency Division Multiple Access (FDMA) system would be acceptable for a maritime mobile service. However, some particular advantages of using Time Division Multiple Access (T.D.M.A.) in the shore-satellite-ship direction makes such a use of T.D.M.A. worth further study. Two potential channel assignment methods are examined in some detail in Annexes II and III.

A system with control by each earth station is examined in Annex II. Despite the complexity of the earth station control equipment, such a system is worth consideration from the viewpoints of spectrum efficiency, flexibility and reliability.

Annex III examines a system with control by a single routing centre. This system merits consideration for reasons of economy and efficiency, although it may not be as reliable as the method considered in Annex II.

As long as the satellite channel attains the predicted reliable service, the calling systems considered in this Report are capable of further integration into the public telephone and telex networks. Interface translations and storage would be required at earth stations to match the different calling systems in the inland and satellite systems.

ANNEX I

SATELLITE ANTENNA BEAM

In order to provide a global service area by a stationary satellite, there are basically two methods of satellite antenna beam format; the one using a single global beam and the other using multiple spot beams. /̲ Redish et al, 1972 ; Hirata et al, 1972 /̲

Global beam technique

This technique not only makes the antenna size and weight on board satellite small, but also simplifies the configuration of satellite repeater. However, it is impossible to achieve high antenna gain. For example, in case of the global beam with a beamwidth of 17°, the minimum antenna gain in the coverage area is about 16 dB at the most.

Multiple spot beam techniques

The adoption of multiple spot beam techniques would complicate the configuration of the satellite repeater together with the satellite antenna sub-system, making the size and weight of the satellite larger than for the single global beam case for the same satellite r.f. power. However, multiple spot beams would significantly increase the effective radiated power of the satellite, and consequently could lead to a decrease in the size and weight of the antennae of mobile stations. It should be noted that the number of beams to cover the global service area increases as the gain of the spot beam increases. For example, the antenna with a beamwidth of 7° exhibits a gain of about 24 dB. Seven beams are needed, though, to achieve the global service area with the antennae of this type. In the case of the beamwidth of 5°, the antenna gain is 27 dB and the necessary number of beams is sixteen. A slight advantage could be gained if coverage is restricted to ocean areas but this has the disadvantage that satellites could not be interchanged between ocean areas to maintain full service in the event of satellite failure. A general disadvantage of multiple spot beams is the added operational complication of determining in the case of shore-to-ship calls in which beam a ship is located.

ANNEX II

SYSTEM WITH CONTROL AT EVERY EARTH STATION

1. In such a system, a special signalling channel through the satellite would interconnect all the earth stations; each earth station would therefore be aware of which channels are occupied at all times.

2. One or more high capacity calling channels linking all ships and earth stations would permit :

   - a calling ship to communicate with an earth station through a satellite which is visible from both earth station and ship. The called station would indicate the free-working channel to be used for the call, both the earth and ship equipments being switched automatically to that channel; the call would then be set up on that channel.

     If no channel were free at the time of the call, the earth station would record the request and call the ship back as soon as a traffic channel became free.

   - a calling earth station to enter into communication with a ship to which it would indicate the free channel to be used. The call would be set up as described above; however, should no channel be free when the call is requested, the ship could only be called back later if the earth station were operated manually; if it were operated fully automatically, the caller would have to repeat the call.

Note.- It is advisable to determine a time limit for the calling channel to be occupied for setting up the call. This time must be very short to ensure a small probability of coincidence of two or more calls (see Annex II).

If necessary, several calling channels could be used; earth stations could receive the calls of ships on any of these channels; a ship would have only one channel on which it could be called or could make calls, and the call-sign issued to the ship would indicate this channel.

ANNEX III

CONTROL SIGNALLING CHANNEL FOR A SINGLE ROUTING CENTRE SYSTEM

1. Requirement

The common control signalling channel linking all ships and earth stations to the routing centre should meet the following conditions :

- the ship equipment must be simple but should include some automated functions such as calling bells, channel selection and switching to terminal devices (telephones, teleprinters, etc.);
- delay in making calls should be small and the need to repeat requests for calls should be infrequent;
- users should not occupy a working channel whilst a called person is being found;
- for efficient channel utilisation, any station should have access to any working channel.

2. Access to the control channel

The initial call from a ship or earth station could use either ordered or un-ordered access to the control channel. An ordered access method would provide either frequency channels, time slots or unique codes pre-assigned for every ship and earth station. Because there are many ships, each making infrequent calls, such a system would be wasteful in bandwidth for the control channel and some systems would need costly ship equipment. Un-ordered access to the calling channel should therefore be considered.

With un-ordered access to a common channel, transmission from two or more stations can overlap, and the lost information must be re-transmitted. Transmissions should therefore be short and the calling channel loading should be light to reduce these conflicts. A digital modulation with short messages meets these requirements.

3. Message length

The initial call from ship or earth station to request a working channel assignment could be about 70 bits long, comprising a synchronising signal (20 bits), ship identity (20 bits), earth station identity (10 bits), type of message (3 bits), error check (16 bits). The return message to both ship and earth station to assign a channel for a call would be shorter; however, since the control station only uses the channel, there is no problem of lost messages.

4. Assignment procedure

To establish a call on a working channel from a ship to an earth station, four digital messages on the calling channel would be required :

- ship to control : request for telephony, telegraphy, facsimile, data or emergency call to a nominated earth station;
- control to ship and earth station : assignment of a free working channel, so that the ship may notify to the earth station details of the call required. This would be a short service call, after which the working channel would be released;
- earth station to control : when the called party is found, a further working channel for the call is requested;
- control to ship and earth station : allocation of working channel.

For earth station to ship calls the format of the control messages would be similar, with an indication that the call was from the earth station. Provision must be made for the delay which may be expected in alerting some of the ships which do not have continuous attendance at the communication terminal. The ship may be alerted by a digital selective call, and when the ship is ready to reply it should use the procedure already described, with a "who is calling me?" code.

5. Control channel loading

Assuming that channel assignment requires two control channel messages of 70 bits in each direction, that there are at peak traffic 4000 calls per hour in the system, and that a single digital control channel working at 2400 bits per second is used, the probability of call coincidence is 0.12. If this rate is considered excessive, either the digital rate should be increased, or more than one control channel should be used (see Annex II).

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STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration:

REPORT AP/8 (Rev.74)

TECHNICAL CHARACTERISTICS OF SYSTEMS PROVIDING COMMUNICATION AND/OR RADIODETERMINATION USING SATELLITE TECHNIQUES FOR AIRCRAFT AND/OR SHIPS

A theoretical comparison of voice communication techniques for aeronautical and maritime applications

(Study Programme 17A-8)

(1974)

1. Introduction

A number of modulation techniques for voice communications are being considered for the aeronautical and maritime mobile satellite services. The importance of determining the relative performance of these techniques has led to comparative theoretical analysis /‾Campanella and Sciulli, 1972_/. The techniques considered are FM discriminator (FM-D), FM-phase locked loop demodulation (FM-PLL), pulse code modulation (PCM)/PSK, delta modulation (DM)/PSK, and pulse duration modulation (PDM)/PSK.

Note.- Reference should also be made to Report 509. Differences between the results of these two Reports need resolution.

For each modulation system, the characteristic for test-tone-to-noise ratio (T/N) against carrier-to-noise density ratio (C/N_o) was first determined and then converted to a characteristic for articulation index (A.I.) against C/N_o, using an analytic method based on noise masking of frequency bands of equal articulation index weight in the speech spectrum. This permits a determination of the relative performance of each system under the power and bandwidth constraints expected for aeronautical and maritime applications. Results are given for the various modulation techniques for RF bandwidths of 10 kHz, 20 kHz and 40 kHz. It is assumed that the audio frequency band is limited from 200 Hz to 2 500 Hz. This yields a maximum possible articulation index of 0.7 for all systems considered although not all are capable of achieving this value. It has also been assumed that a degree of speech clipping is used which results in the clipped speech having a peak-to-rms ratio of 8 dB. It should be noted that the results presented in this Report are sensitive to the choice of system parameters, particularly base-band truncation, degree of speech clipping, noise and speech spectra. In the latter regard the speech spectrum used for these calculations has a frequency response characteristic that descends at 6 dB per octave from 500 Hz to 1 500 Hz and at 12 dB per octave beyond 1 500 Hz. The choice of a different speech spectrum (e.g. that used by Beranek /¯1947_7) could alter significantly the results obtained when transferring calculated values of test-tone-to-noise ratio to articulation index. Although this would not alter the validity of comparisons between systems, it would produce different values of articulation index resulting from given carrier-to-noise densities. The noise spectrum used depends on the ability or otherwise to make use of pre- and de-emphasis in the various modulation systems.

The designer should therefore not interpret these results as guidelines for system designs whose requirements and parameters may differ considerably from those assumed here. The theoretical analysis referred to above provides the generalized analytical techniques from which a theoretical comparison of various voice communication techniques may be computed for any set of system parameters.

2. Discussion of results

The principal results are shown in Figs. 1, 2 and 3. These plots show the performance of DM, PCM, FM and PDM in channel bandwidths of 10 kHz, 20 kHz and 40 kHz, respectively in terms of articulation index against C/N_o. Note that consideration is given to the use of encoding for error correction in PCM and DM. The use of rate ½ coding (one parity check bit per information bit) and 4 phase PSK modulation is considered in the 20 and 40 kHz bandwidths. For the parameters considered, it has been found that only a small improvement is attained through coding. This improvement is realized in the vicinity of threshold for both PCM and DM. This follows from the fact that the coding improvement for those coding methods decreases rapidly for channel error rates higher than 1 in 10^3. For channel error rates higher than 1 in 10^2, the coded system results in a performance degradation compared to an uncoded system.

In the 10 kHz bandwidth case shown in Fig. 1, the difference in performance between DM and the other systems increases. The results indicate that FM may provide acceptable performance in this case. DM at 18 kb/s with four-phase PSK delivers the highest values of articulation index for all values of $C/N_o < 51$ dBHz. The reason that DM with two phase PSK is not considered in this case is that a rate of only 9 kb/s could be accommodated in a 10 kHz bandwidth. This would result in a DM performance characteristic with a severe limitation in signal to quantization noise ratio and is therefore considered impractical.

PDM in this bandwidth has no practical advantage over the other methods. The performance offered by PCM is poor compared to that achieved by the other methods because the bandwidth constraint limits the number of available quantization levels and is therefore not shown in Fig. 1.

In the 20 kHz bandwidth case shown in Fig. 2, it is clear that the performance of FM-PLL and DM is good for $C/N_o > 49$ dBHz. The performance of all except PDM degrades rapidly for $C/N_o < 49$ dBHz. It should be noted that the projected high relative performance of PDM at low values of C/N_o is probably optimistic since the curve is an extension of the performance above threshold and takes into account only the perturbation of the information-bearing axis crossings caused by noise. Other effects occurring at low values of C/N_o are ignored.

The FM systems considered in the 20 and 40 kHz cases assume the use of Carson's Rule to determine RF bandwidth. The FM system studied in the 10 kHz case is a departure from this approach. The spectral characteristic of speech which, unlike white noise, diminishes rapidly in amplitude with increasing frequency implies that the RF bandwidth necessary to contain the essential FM carrier components is less than that indicated by Carson's Rule or, alternatively, that a higher deviation and hence a higher modulation index can be achieved within the given bandwidth. The second alternative has been adopted in the 10 kHz case only.

The 40 kHz results shown in Fig. 3 indicate that the digital techniques, particularly PCM, provide substantial performance improvements near and above threshold as a consequence of the bandwidth expansion. The general result in this case is that DM, DM coded 4-phase, PCM coded 4-phase and FM-PLL are capable of producing excellent performances at C/N_o values above 52 dBHz. FM and PCM uncoded 2-phase are less efficient. PDM, having no pronounced threshold, has a better performance below a C/N_o of about 52 dBHz, but as previously mentioned the curve given is probably optimistic in this region.

3. Conclusions

A number of single-channel-per-carrier modulation methods which are suitable for use in an aeronautical or maritime service have been compared to determine their relative merits for a satellite system. These results have been expressed in terms of articulation index (AI) against carrier-to-noise density ratio (C/N_o). Although these results have been derived from firmly based theoretical arguments the need to conduct practical experiments designed to test the validity of the analytical techniques is emphasized.

In the absence of international agreement on the acceptance of the articulation index as a measure of speech characteristics, it is not possible to assume a suitable index for each of the two services. Other undecided factors such as bandwidth allocation, speech processing technique including clipping, appropriate noise and speech spectra preclude a choice at this stage. However, the analytical techniques will be applicable for comparative analysis of voice communication systems since methods for comparative evaluation in terms of test-tone-to-noise ratio are also contained in the theoretical analysis.

Despite the limitations noted above the results may be regarded as giving an indication of the relative merits of various systems. Although the choice of articulation index required for the aeronautical and maritime services has not yet been made, a preference may be given to the modulation system having the flattest slope, i.e. that giving the least change in the articulation index for variations of C/N_o below the chosen operating point. It should be noted, however, that the results shown are purely theoretical and the final choice would depend on the performance of these systems in the aeronautical or maritime environments. In addition, such factors as cost, complexity, weight and size may be important.

It should also be noted that a modulation system that is optimum for one application (e.g. voice communication) may not be compatible with the requirements of another application (e.g. data transmission or radiodetermination). Therefore a compromise may be necessary in order to provide economically a satellite service embodying all requirements.

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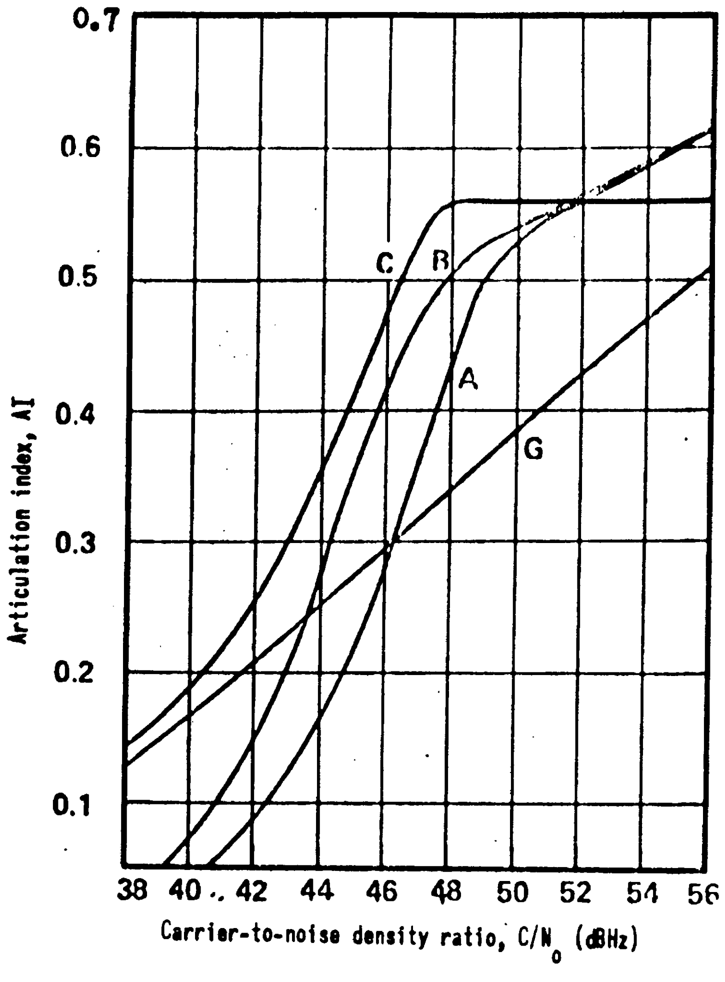

FIGURE 1

VARIATION OF THE ARTICULATION INDEX WITH

$C/N_0.(dB\ Hz)B_{IF} = 10\ kHz$

A : FM discriminator

B : FM phase-locked loop

C : Delta modulation; 18 kb/s uncoded 4-phase PSK

G : Pulse-duration modulation

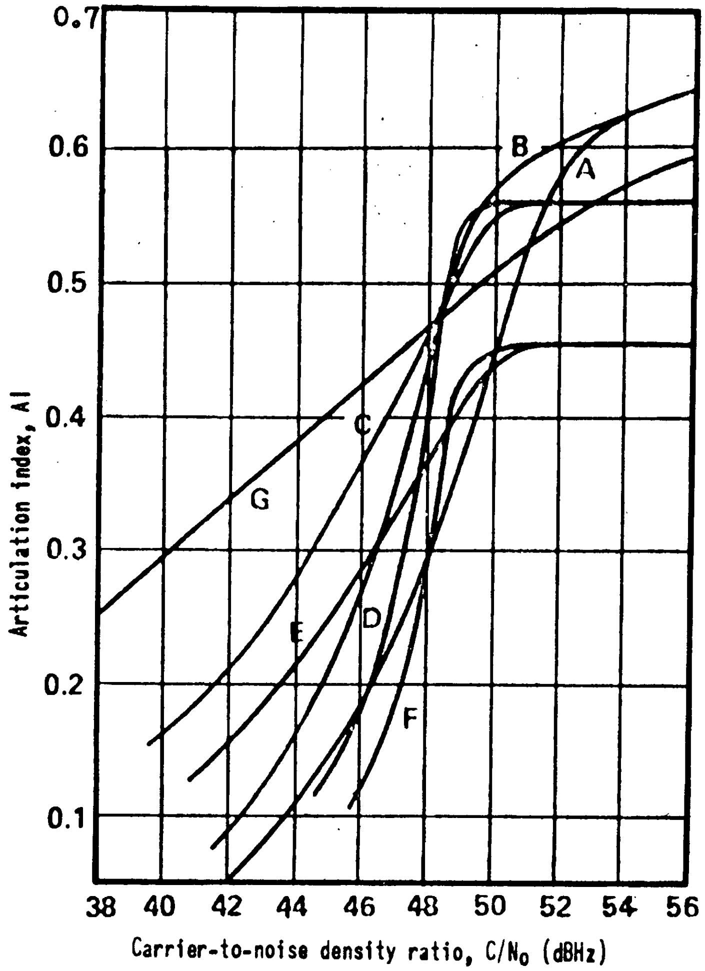

FIGURE 2

VARIATION OF THE ARTICULATION INDEX WITH

C/N_0 (dBHz), B_{IF} = 20 kHz

A : FM discriminator

B : FM phase-locked loop

C : Delta modulation; 18 kb/s;
Uncoded 2-phase PSK

D : Delta modulation; 18 kb/s; rate ½ coded; 4-phase PSK

E : Pulse-code modulation; 18 kb/s; uncoded 2-phase PSK

F : Pulse-code modulation; 18 kb/s; rate ½ coded; 4-phase PSK

G : Pulse-duration modulation

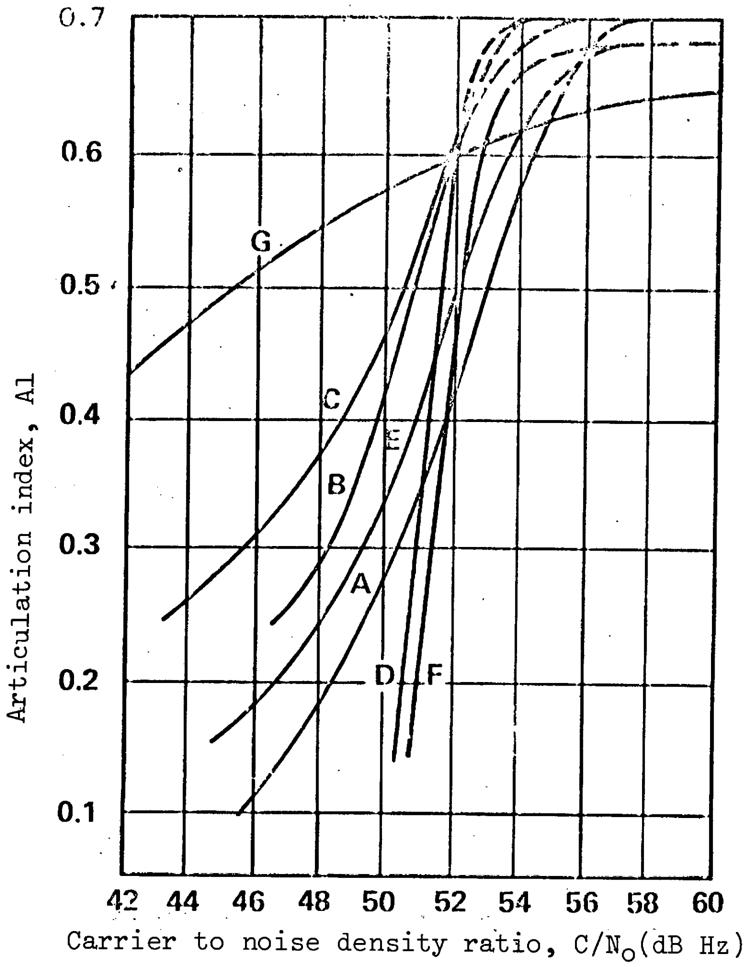

FIGURE 3

VARIATION OF THE ARTICULATION INDEX WITH

CN_0(dB Hz) B_{IF} = 40 kHz

A : FM discriminator

B : FM phase-locked loop

C : Delta modulation; 36 kb/s; uncoded 2-phase PSK

D : Delta modulation; 36 kb/s; rate ½ coded; 4-phase PSK

E : Pulse-code modulation; 36 kb/s; uncoded 2-phase PSK

F : Pulse-code modulation; 36 kb/s; rate ½ coded; 4-phase PSK

G : Pulse-duration modulation

Note : Dotted extensions of curves are approximations and require confirmation.

C.C.I.R.
XIIIth Plenary Assembly
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Doc. 8/1054-E

STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration:

REPORT AQ/8

TECHNICAL CHARACTERISTICS OF SYSTEMS PROVIDING COMMUNICATION AND/OR RADIODETERMINATION USING SATELLITE TECHNIQUES FOR AIRCRAFT AND/OR SHIPS

Maritime tests in Band 9 (UHF)

(Study Programme 17A/8)

(1974)

1. Introduction

The test programme described in this Report was executed by the Electronics Research Centre of the U.S.A. National Aeronautics and Space Administration (NASA). The objective of the programme was to conduct a series of navigation and communications experiments on ocean craft through the ATS-5 satellite with wide variations in latitude, longitude, elevation angle and weather conditions so as to provide a basis to demonstrate the feasibility of navigation and communication services via geostationary satellite and correlate the measured quantitative data with the theoretical expectations.

2. Test programme

Radio-frequency signals containing "ranging" modulation using a pseudo random noise code were transmitted (up-link 1650 MHz) from NASA's STADAN station at Mojave, relayed through the spinning ATS-5 geostationary satellite and received (down-link 1550 MHz) by two stations. One was fixed, located at Moorestown, N.J. and the other was a maritime mobile station, installed on the icebreaking tanker, MANHATTAN. This experiment demonstrated the feasibility of line-of-position (LOP) fixing by making one-way range measurements between a fixed ground station, a satellite in a known position and a moving platform on the surface of the Earth. This experiment also demonstrated the simultaneous transmission and reception of data communications on the ranging signal.

At the beginning of each day's experiment, the antenna azimuth and elevation angles were optimized to produce highest carrier-to-noise ratio. A 0.9 m (3-foot) diameter parabolic dish was used, except for two days when a 0.6 m (2-foot) diameter antenna was used.

3. Results

It is possible to achieve reliable lock-up and demodulation of signals from the ATS-5 spinning satellite within 100 milliseconds of accumulated signal time. This is equivalent to two or three bursts of signal produced as the ATS-5 antenna beam sweeps through the receiver antenna.

The line-of-position as determined from the satellite navigational signals can be reconciled to position fixes obtained from other navigational systems on board to within values ranging from zero to 1.3 nautical miles from day to day.

Limited experiments at low satellite elevation angles seem to indicate that the effects due to multipath at those low elevation angles are small.

The potential of a passive user navigation system was demonstrated.

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C.C.I.R.
XIIIth Plenary Assembly
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Doc. 8/1055-E

STUDY GROUP 8

Study Group ..8.., in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration :

REPORT AR/8 (Rev.74)

TECHNICAL CHARACTERISTICS OF SYSTEMS PROVIDING COMMUNICATION AND/OR RADIODETERMINATION USING SATELLITE TECHNIQUES FOR AIRCRAFT AND/OR SHIPS

Aeronautical and maritime satellite tests in Band 8 (VHF)

(Study Programme 17A/8)

(1974)

1. Introduction

This Report is based on several series of ATS-1 and ATS-3 satellite tests which have been conducted by the United States of America, the Federal Republic of Germany, the United Kingdom and the Netherlands to obtain experimental data on the use of satellites for the aeronautical and maritime mobile service. Data has been collected throughout the Atlantic and Pacific regions and across the Western Hemisphere from the Arctic to the Antarctic. The VHF experiment programmes incorporated in the Applications Technology Satellites ATS-1 and ATS-3 (provided by the United States of America) were used in each case on the following frequencies : up-link 149.22 MHz; down-link 135.6 MHz.

2. Test programmes

The factors listed in Table I were considered in the test programme; however, all items were not necessarily included in each test.

TABLE I

Tests carried out by specific countries

Tests carried out	United States of America	Federal Republic of Germany	United Kingdom	Netherlands
(a) Signal level behaviour	S,A	S,S*	S	S
(b) Noise measurements	S,A	S,S*	S	
(c) FM voice transmission	S,A	S,A,S*	S	S
(d) SSB voice transmission				S
(e) DSB-suppressed carrier voice transmission			S	
(f) Speech processing			S	
(g) Teleprinting and/or data transmission	S,A	S	S,A	S
(h) Multipath propagation	A	S*	A	S*
(j) Time synchronization	S			
(k) Radio-determination	S,A	S, S*		
(l) Selective calling			S	S
(m) Facsimile			S	S

S = tests via the satellite to and from ships

A = tests via the satellite to and from aircraft

S* = simulated ship tests conducted on shore.

3. Discussion

3.1 Signal level behaviour

In tests with ATS-3, an aeronautical ground test station located in Annapolis, Maryland observed a long-term signal level of -113.8 dBm with a standard deviation of 2.4 dB. The theoretical free space received signal level from ATS-3 was -111.2 dBm. In similar tests with ATS-1, an average long-term signal level of -117.26 dBm with a standard deviation of 3.1 dB was obtained. The theoretical free space received signal level from ATS-1 was-113.7 dBm. Some short-term fading was observed however, without degradation of communications. In one particular test, long-term fading and an abnormally high noise level was observed. This occurred on 31 October, 1968 on the occasion of aircraft-satellite-ground tests on a North Atlantic flight during an obviously worst case of solar activity. During some 2500 hours of testing over a period of about two years, this five hour period was the only occasion when fading of such magnitude was observed during the U.S.A. conducted trials. However, U.K. monitoring of U.S.A. trials detected similar long-term fading during a North Atlantic flight on 21 November 1967, but this was not accompanied by an abnormal noise level. There was a complete loss of received signal at PANAM and BOAC receiving stations at London Airport and also at R.A.E., Farnborough, although the signals from the aircraft via ATS-3 were reported to be well received at Frankfurt throughout the flight. This selective area black-out persisted throughout the final two hours of the West-East transatlantic flight and was accompanied by exceptionally abnormal signal enhancements on terrestrial fixed links in Southern England.

In aircraft-satellite-ground tests with a Boeing 747 and ATS-3, the mean signal level at Annapolis was -117 dBm with a standard deviation of 2.4 dB. Similar results were obtained through ATS-1. During other aircraft-satellite-ground tests, the average signal level at Annapolis was -117 dBm ± 2 dB.

A series of maritime tests were carried out between eight ships and several NASA earth stations via ATS-1 and ATS-3. The received signal level at the ships averaged around -117 dBm. Variation from all causes, with extremes between -101 dBm and -127 dBm were experienced among the wide geographical distribution of ships during tests. The U.S.A. Maritime Administration test with the ship Santa Lucia, reported a long-term level of -114.8 dBm with a standard deviation of 2.28 dB. In general, the antenna beamwidth was sufficiently broad so that the effect of the movement of the ship was small. However, the ship's heading was noted to have an effect on signal level, due to parasitic radiation and super-structure masking. In later tests by the U.K. and the Netherlands with low gain antennae the same effect was experienced. It was noted however that when the signal level started to decrease a new signal maximum could often be found by pointing the ship's antenna in another direction. During the U.K. tests, antennae having higher gain were also used resulting in improved signal levels and reduced ship effects. The ships were roll-stabilized and the antenna beamwidths used (± 20°) were adequate to allow for ship movement.

3.2 Noise measurements

Aeronautical VHF satellite testing was conducted using a quasi-circularly polarized airborne antenna. During these tests, the ground-satellite-ground signal-plus-noise to noise ratio was within the range of 24 to 28 dB. The aircraft-satellite-ground signal-plus-noise to noise ratio was within the range of 18 to 24 dB.

Noise measurements were conducted on the ship METEOR (Federal Republic of Germany) using two installations and several antennae. Communications, ship-satellite-ship, ship-satellite-earth station and vice versa, were completed either with a crossed YAGI shipboard antenna or with dipole antennae (vertical or horizontal, crossed). The gain of the YAGI was 12 dB, with the main lobe ± 20°. It was used in horizontal or vertical polarization depending on Faraday rotation angle. The test tone-to-noise ratio measured in loop operation ship-satellite-ship was 30 dB and in the path ground station-satellite-ship and vice versa, about 38 dB.

The use of low gain antennae (dipoles) in ship-satellite-ship operation gave test-tone-to-noise ratios of 4 dB or less. With an earth station-ship link 18 dB was measured. An important improvement may be obtained if no duplex communications are needed, since losses in diplexer and antenna switching systems are avoided. In this case, the carrier-to-noise ratio can be improved by 6.5 dB.

Tests were also conducted on six U.S.A. Coast Guard ships using quasi-circularly polarized crossed dipole antennae. The ship-satellite-ship signal-to-noise ratio was nominally 38 dB. During another series of tests conducted by the U.S.A. Maritime Administration using a crossed YAGI antenna with an effective gain of 9 dB, a long-term mean signal-to-noise ratio of 43 dB for shore-to-ships and 45 dB for ships-to-shore was predicted upon measured carrier levels.

3.3 Frequency modulation voice transmission

Voice communication (FM; 5 kHz deviation) during two round trip transatlantic flights was recorded at several geographic locations. Subjective readability grades during the tests ranged from 4 to 5 on a scale of 1 to 5. In tests involving other aircraft, figures were slightly lower. A readability index of 3 means usable voice communications in the presence of some noise.

During radiotelephone tests aboard the ship METEOR (Federal Republic of Germany) between ships, planes or fixed terrestrial stations, good speech intelligibility was the general result. During voice transmission (FM; up to 7 kHz deviation) tests aboard U.S.A. ships, communications were in most cases reported subjectively "loud and clear". In one series of tests, voice channel performance was successfully accomplished during 82 of 88 test periods. In those tests not successful, failures were attributed to antenna patterns at high elevation angles. The U.K. tests also produced good results for a high proportion of the time when a deviation of 5 kHz was used. Reduction to 1.75 kHz deviation, as expected, produced a noisier signal.

During 157 test periods by the Netherlands, voice channel performance on the link from the United States ground station Mojave to the ship varied between "acceptable" and "very good".

3.4 Single sideband voice transmission

SSB voice transmissions were tested by the Netherlands although it was recognized that the satellite transponder was not very well suited for amplitude modulated systems. A carrier of half amplitude was added as a pilot for automatic frequency control. In 78% of the transmissions the subjective evaluation was "good" and 16% were rated "moderately good".

3.5 Double sideband, suppressed carrier voice transmission

The U.K. test included a brief assessment of the value of double sideband-suppressed carrier working. The transmission occupied a bandwidth of 10 kHz and a peak speech-to-noise ratio of 15 dB was estimated. The system was considered to be efficient for transmitting medium grade duplex channels but would not be capable of providing high quality transmission (e.g. $S/N > 25$ dB).

3.6 Speech processing

Recognising the need to combine the requirements, in a maritime-satellite service, of good quality voice communications with maximum economy of satellite power, tests of speech processing were conducted by the United Kingdom. The purpose of the tests was to determine whether or not the use of syllabic compandors or the Lincompex system, in a frequency modulated telephony channel, could significantly improve a moderate speech-to-noise ratio so that it became subjectively acceptable for connection to the telephone networks for public correspondence.

When using compandors on FM transmissions using 5 kHz deviation, the results obtained showed considerable improvement and some improvement in readability. There was less improvement when 1.75 kHz deviation was used. Using Lincompex, considerable improvement in speech-to-noise ratio was obtained when using deviations of both 1.75 kHz and 5 kHz. Owing to non-linearity in the radio equipment, however, intermodulation occurred between the control tone and the speech and some degradation in readability was observed. The results of both systems were sufficiently encouraging to warrant further development.

3.7 Teleprinting and data transmission reliability

The tests conducted in the aeronautical service during transatlantic flights verified that data transmission and direct printing radio-telegraph provided good communications. For the most part, reception was error free with a transmission rate of 100 b/s under normal propagation conditions. In aircraft-satellite-ground data transmission tests during the unusually active solar period (31 October, 1968), a low error rate was observed at Annapolis. This signal behaviour can be considered "worst case" as a result of the drastically disturbed conditions.

During the shipboard tests conducted by the Federal Republic of Germany, the bit error rate on the transmission link to a ground station of the Federal Republic of Germany was 10^{-3} for 96% of the time for the YAGI configuration and for a transfer rate of 1000 b/s. During the many tests conducted by the U.S.A. Coast Guard and the U.S.A. Maritime Administration, an error rate of 10^{-3} was recorded with a transmission rate of 600 b/s. The direct printing radio-telegraph (15F2, PCM/FM, 75 baud) error rate was 2×10^{-3}. The teleprinter tests conducted by the United Kingdom were broadly comparable with these results. During 24 test transmissions conducted by the Netherlands, a Q9S-test signal was transmitted at a speed of 100 b/s, using narrow-band FSK (85 Hz shift). A bit error rate of 4×10^{-4} was achieved.

3.8 Multipath propagation

In the aeronautical service, quantitative studies of multipath effects were made during a series of typical flights offering high to low elevation angles toward the satellite. Data was selected to exclude the overall aircraft radiation pattern effects and fluctuations due to aircraft attitude and orientation. Signal variations included those from all sources together with the significant effects of adverse polarization decoupling due to Faraday rotation which greatly affects low-angle signals. These observations clearly indicate the relationship between multipath fading and elevation angle. Also, while not clearly identified in these tests, the effects of sea surface conditions on the amplitude and spectral characteristics of multipath reflections are routinely observed. The worst case arises from the focusing effect of smooth seas which, fortunately, is of rare occurrence. Short-term cyclic peak-to-peak variations in the 1 to 99% range, 5.9 dB, 6.9 dB and 13.2 dB were measured in the respective 50-70°, 30-50° and 0-30° elevation angle sectors. In the latter case, the characteristic high-ellipticity of the aircraft test antenna at the lower look-angles is believed to have contributed appreciably to the wide variation. Numerous observations of low elevation angle signals on many other flights using several antenna configurations have shown fading patterns characteristic of multipath with peak-to-peak amplitudes rarely exceeding 5 or 6 dB and having no significant effect on voice communications. In truly marginal conditions, severe multipath fading may adversely affect high speed data transmissions.

United Kingdom tests have been carried out with chirp modulated data transmissions, with a frequency sweep of 14 kHz and at a data rate of 1200 b/s, on VHF from a ground station to an aircraft via ATS-3. Comparisons with CW showed reduced signal level variations when chirp modulation was used, thus indicating that it provides a protection against the consequences of multipath reception /Barnes, 1969/.

Tests on the ship METEOR (Federal Republic of Germany) demonstrated that the repetition rate of signal variation by multipath fading is identical with the pitch period of the ship and thus fadings, as predictable by calculation, were caused by the up and down movement of the antenna. Peak-to-peak variations of maximum 20 dB were observed.

The only multipath propagation observed in U.S.A. maritime tests was in the polar region over smooth sea or ice. This was at low satellite angles of less than 10°. In the open ocean, multipath propagation was insignificant. Slow fades at the earth station used for the United Kingdom tests was shown to be caused by multipath effects. This was confirmed by the use of antennae used in space diversity. No multipath effects were observed on the ship.

At the Netherlands earth station, slow fades of about 10 dB were experienced due to the joint occurrence of Faraday rotation and ground reflection, at an elevation angle of 13°. This could be verified by varying the antenna height during a test transmission. The effect disappeared after a second antenna was installed, and the signals of both antennae were combined in a summing network. The height of the second antenna was chosen in such a way that when one antenna was in a signal minimum the other antenna was in a signal maximum. More elaborate tests on this basis were conducted by the Federal Republic of Germany (see also Report AT/8 (Doc. 8/153, 1970-1973)).

3.9 Time synchronization

As part of the U.S.A. National Geodetic Satellite Programme, it became necessary to acquire geodetic satellite data from Tristan da Cunha Island, South Atlantic. Owing to the remoteness of this island, the fact that it is accessible only by ship and the need for precise timing at satellite triangulation stations, it became necessary to employ VHF satellite transponder time synchronization to obtain the best possible guarantee of high quality data from that location. The ship which provided the transportation of the satellite triangulation station to Tristan da Cunha was the U.S.A. Coast and Geodetic Survey Ship DISCOVERER. With a caesium clock and satellite timing equipment aboard, successful precise time transfers between Mojave ATS, near Barstow, California, and the ship, while underway, were effected with an accuracy of better than ± 10 μs on 22-23 January, 1968. On the day of the last transfer, ATS-3 was less than 1/2 degree above the horizon as viewed from the DISCOVERER.

Due to a mishap during off-loading operations from the ship to the island, precise timing on the caesium clock was lost. Auxiliary quartz crystal clocks were available for the resetting of the caesium clock. However, the uncertainty of this reset was ± 30 μs. Fortunately, an eastward movement of ATS-3 was planned from 95° to 86° west longitude. On the 7 February 1968 test, ATS-3 was in an asynchronous orbit moving eastward at approximately 2° per day. Five transfers were completed on this day with a precision of ± 2 μs. By 10 February, the satellite was again geostationary. Tests on 11 and 12 February showed a slight improvement in precision to ± 1.8 μs.

3.10 Radiodetermination

A series of tests have been conducted aboard aircraft, ships and buoys to determine the position fixing feasibility of VHF from geostationary satellites. Two primary categories of radiodetermination were emphasized : ranging and relay of terrestrial navigation signals.

Position fixing is feasible by range measurements from the ground terminal through two geostationary satellites operating on essentially the same frequency. The user mobile station is interrogated via the satellites with a discrete audio frequency and code which is transmitted back to the ground terminal. Ranging is accomplished by measuring the time delay between a phase match of the locally generated audio frequency code with the transponded replica. The mobile position can be computed in terms of the time delay with applicable allowances for mobile altitude and propagation corrections. The mobile equipment is calibrated by interrogating the mobile station when it is at a known location(s).

Test results in the U.S.A. indicate that an accuracy of approximately ± 1 nautical mile ($1\ \sigma$) for ships and aircraft can be achieved using VHF. This assumes an unobstructed view from the antenna to the spacecraft and the use of circularly-polarized antennae which can discriminate against surface reflections. This accuracy can be achieved by employing calibration transponders functionally similar to the mobile equipments, at fixed known strategic locations along the routes and interrogating them at appropriate intervals to determine range measurement corrections. These are stored and applied in the computation of the position of the user mobile station.

During 1968 tests by the Federal Republic of Germany were conducted on the ship METEOR with an audio frequency ranging technique using 24 Hz, 1562 Hz and 3125 Hz. The phase was measured with an accuracy of $\pm 2^\circ$ giving a resolution of 260 metres. To correct for time delay in the equipment, a closed loop test at zero distance was conducted before every ranging measurement.

Further tests were conducted by the Federal Republic of Germany in 1969 when, for accurate range measurement, a land mobile station was used, the absolute geographical position of which was known to within ± 50 metres /Goebel/. Simple equipment was used in these experiments to simulate that which would be used on ships. In this second series of tests, the techniques used were modified in the following ways :

- use of only two audio frequencies separated by 24 Hz, i.e. 3125 and 3101 Hz, without introducing ambiguity. This was achieved by obtaining the difference between the phase changes of the two frequencies over the transmission path.

Over the practical range of distances, the difference in the number of wave trains between the two frequencies is 1.0 or, expressed as phase difference, 360°. Hence by subtracting the phase differences of both frequencies measured at any location on the surface of the Earth (disregarding multiples of 2π) one obtains an angle between 0° and 360° which represents the coarse fix;

- use of simple omnidirectional antennae combined in a diversity system (see Report AT/8 (Doc. 8/153, 1970-1973)), to demonstrate the feasibility of non-directive antennae for signal reception;
- use of a simple radiotelephone receiver to demonstrate the feasibility of inexpensive equipment for use in ranging techniques. This was modified, however, by introducing a steep-slope filter having a phase-angle stability of 0.1°;
- provision of a digital read-out to improve reading accuracy to ± 0.5° corresponding to a range error of ± 65 m.

The results obtained showed a variation of distance with time and these were plotted and compared with the calculated ranging curves, the values of which were derived from the accurately known location at Oberpfaffenhofen (Federal Republic of Germany) and from the satellite position.

Owing to the long time intervals between orbit surveyings (about two weeks), the satellite position was not always known with sufficient accuracy so as to allow a comparison of absolute values. However, to assess the soundness and the reliability of the method all measurement values obtained during the 30-minute test periods were plotted. An r.m.s. error of ± 100 m could be derived from the statistical spread of the measuring points around the monotone curve and this represents the ranging accuracy of the equipment, errors caused by the atmosphere not being taken into account.

Other ranging tests were made observing the phase difference between a transmitted and received 1 kHz audio frequency. Although these tests were relatively crude, the accuracies of estimation of a ship's line of position were found to be of the order of 9 km.

A number of tests were conducted using a relay of terrestrial navigation system information for processing in a central location. OMEGA signal phase information in the OPLE experiment was one such technique. Similarly, LORAN time information was also relayed through a satellite repeater.

A shipboard installation of the OPLE system was tested in the Caribbean. Here, the ship carried also an OMEGA receiver so that direct comparison could be made between the systems. An average error of 700 m was observed. This may be attributable to the ship's motion during the OPLE three minute integration period. A direct comparison of radar fixes with OPLE positions showed a variation of up to 3.6 km, with an average difference of 2.25 km.

3.11 Selective calling

The selective calling tests using the system of Recommendation 257-1 were conducted by both the United Kingdom and the Netherlands. Those of the United Kingdom resulted in a high success rate when the ship's own and unique code was used; the "all ships" code, although initially less successful owing to a technical fault, later gave equally good results.

The Netherlands tests produced very good results when using both FM (99%) and SSB (96.5%). The Netherlands programme included also tests with a digital selective calling system, based on 7-unit error-correcting code as recommended in Recommendation 476; 8320 calls were transmitted, using FSK (200 Hz shift), and received in correct 3 to 4 ratio of the elements. Thus, the call error rate was less than 6×10^{-5} /C.C.I.R., 1970-1973/.

3.12 Facsimile

A high percentage of good results was obtained in facsimile transmission by both the Netherlands and the United Kingdom. Results of FM transmissions from the U.S.A. earth station at Mojave to the Netherlands ship NIEUW AMSTERDAM were generally excellent. The majority of transmissions using SSB to the ship from the Netherlands earth station were assessed as "good, noise just noticeable".

In the United Kingdom tests, the transmissions were from the ship to the shore only and the majority of the results were rated either very good or good with some streaking. The streaking was caused by satellite spin modulation when the transponder was not fully saturated.

4. Conclusions

The results of tests conducted on the Applications Technology Satellites (ATS) over the last five years have demonstrated that a VHF satellite service would be technically feasible. Further, it was demonstrated that satellites employing VHF will provide satisfactory communications over maritime areas where present-day communications techniques are limited by the curvature of the earth and/or varying propagation conditions.

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STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration :

REPORT AS/8 (Rev.74)

TECHNICAL CHARACTERISTICS OF SYSTEMS PROVIDING COMMUNICATION AND/OR RADIODETERMINATION USING SATELLITE TECHNIQUES FOR AIRCRAFT AND/OR SHIPS

Consideration of possible technical characteristics for a maritime satellite system for public correspondence

(Study Programme 17A/8)

(1974)

1. Introduction

To establish a global maritime satellite system for public correspondence, it would be desirable for agreement to be reached internationally on the characteristics of an operational system. These characteristics will be influenced by the quality of service required and by the frequency bands allocated for the service. In this Report, broad assumptions are made regarding possible system parameters and these are subject to further study.

2. Initial service requirements

The service requirements initially foreseen are as follows :

- telephony

- telegraphy (data transmission and direct-printing telegraphy)
- facsimile

Requirements for handling distress cases should also be borne in mind, but these are not considered in this Report.

Of these services, the needs of telephony constitute an important factor in determining the minimum power and bandwidth required per communication channel. The bandwidth of a telephone channel may be utilized for one or more channels carrying other services, with due allowance for equipment and Doppler frequency tolerances.

3. Multiple access

Two multiple access methods are considered here, Time division multiple access (TDMA) and Frequency division multiple access (FDMA). TDMA has an advantage over multi-carried FDMA in that it makes more efficient use of the available satellite power, particularly when a saturable device is used in the satellite transponder.

Considering the terminal equipment required on board ship and on shore in a TDMA system, the major expense is in the common items such as the equipment needed for sychronization. A particular TDMA study was undertaken in France [Manuali, 1971]. In an FDMA system, the expense lies more with the equipment associated with each individual channel. For these reasons, it is generally recognized that, for low-capacity links, FDMA has a lower cost per channel. A maritime-satellite service will consist mostly of a large number of single-channel terminals (i.e., terminals for operating on any one selected channel at a time); hence, the FDMA system has advantages for the ship terminals. Since the cost of ship-station equipment will have a significant influence on the growth of the service, (and in consequence, on the efficient use of the satellite), an FDMA system is assumed. It is recognized, however, that other methods may well become advantageous as technical progress modifies the assumptions made.

The service will require sufficient flexibility for any ship to communicate with any shore station and vice versa, although most ships will only require a circuit for a very small fraction of the total time. Therefore, more efficient use will be made of the satellite and of the available frequency spectrum if circuits are only allocated on demand. This second multiple access problem, i.e. how the ship or shore station will obtain access to the satellite to demand a free channel, is discussed in Report AO/8.

4. Telephony performance objective

Report 508 indicates that a final objective for the minimum signal-to-weighted noise ratio, to be met for at least 90% of the time, should lie somewhere in the range 30 to 35 dB or the signal, assuming speech processing techniques are used, should have a subjective quality equivalent to this. This refers to a long-term mean speech-to-noise ratio while active which is equivalent to a test-tone-to-weighted noise ratio of 41 to 46 dB /Richards, 1964/.

This objective sets a high standard which may be difficult to achieve, particularly in the initial phases of maritime satellite communications. Therefore, as an example, a test-tone to weighted noise ratio of 38 dB has been assumed in order to examine the possibilities of achieving this objective.

To define the required quality for a public correspondence telephone service more fully, two other parameters should also be stipulated; these parameters and proposed requirements are as follows :

- speech peak-to-mean power ratios	10 dB
- audio-frequency bandwidth	300-3000 Hz

5. Telephone channel bandwidth in the case of FDMA

Assumptions are made as to telephone channel bandwidths at two possible operational frequencies. These are given in Table I.

TABLE I

Possible bandwidth allocations

Frequency (MHz)	1600	400
	(kHz)	(kHz)
Assumed satellite channel spacing	50	25
Satellite channel guardband, say	8	4
Frequency instability, say, 4 parts in 10^6	± 6.4	± 1.6
Remaining information bandwidth	29	18

6. Possible modulation systems

To make economic use of a satellite system it is essential to use modulation methods which make use of minimum satellite power for a given quality of service. Also, the efficient utilization of the frequency spectrum should be taken into account. The final choice of modulation method and baseband processing techniques will in general be a compromise between minimum consumption of satellite power and maximum utilization of the frequency spectrum. In addition these considerations should be associated with the desirability of providing ship's equipment having minimum complexity and cost and having maximum reliability.

In Fig. 1 a theoretical comparison of possible modulation methods for single-channel per carrier telephony is made for the case of 1600 MHz (I.F. bandwidth limited to 29 kHz, test-tone-to-weighted noise ratio objective of 38 dB).

Table II calculated on the same basis as Fig. 1, displays comparisons between modulation methods for a test-tone-to-weighted noise ratio of 38 dB or one estimated to achieve this subjectively with speech processing. Bandwidth limitations are as given in Table I.

The columns of Table II show, respectively :

- Column 1 : the required information bandwidth within the limits derived in § 5, it being assumed that the effects of frequency instability will be eliminated by automatic frequency control;
- Column 2 : the required carrier-to-noise ratio (C/N) at the demodulator input;
- Column 3 : the required carrier-to-noise density ratio (C/N_0), at the demodulator input.

TABLE II

Theoretical comparison of modulation methods
/Campanella and Sciulli, 1972; Schilling and Billig, 1964; Carlson, 1968/

Frequency (MHz)	1600			400		
	(1) Band-width (kHz)	(2) C/N (dB)	(3) C/N_o (dBHz)	(1) Band-width (kHz)	(2) C/N (dB)	(3) C/N_o (dBHz)
(a) FM conventional discriminator (unprocessed)	29	12.0	56.3	18	19.0	61.5
(b) FM conventional discriminator (companded)	14	9.0	50.4	14	9.0	50.4
(c) FM phase lock loop (unprocessed)	29	12.0	56.3	18	19.5	62.0
(d) FM phase lock loop (companded)	17	5.0	47.3	17	5.0	47.3
(e) PCM - quadriphase PSK *	29	12.0	56.6	-	-	-
(f) Delta-quadriphase PSK *	29	11.0	55.6	-	-	-
(g) Pulse duration - quadriphase PSK	29	22.4	67.0	18	28.5	71.0
(h) Single sideband	5	35.0	72.0	5	35.0	72.0

* Companding has not been assumed for these modulation methods.

Notes referring to Table II

1) These basic results do not take into account multi-channel use of the power stages of a transponder. To avoid unacceptable intermodulation distortion, quasi-linear operation of power amplifiers might be used, which will result in different carrier power relationships from those shown in the Table, in that the permissible intermodulation will depend upon the method of modulation.

2) In cases (b) and (d), the use of compandors /C.C.I.T.T., 1968/ is proposed to reduce the speech peak-to-mean ratio before modulation and to restore it after demodulation and also to reduce inter-syllabic noise. The overall result will give a subjective improvement in signal-to-noise ratio, permitting a lower nominal signal-to-unweighted noise ratio to be used. This improvement has been calculated, for the purpose of comparison in Fig. 1, from an empirical formula which is applicable to the English language. The curves are therefore intended to be representative of the improvement that can theoretically be achieved. These results should be confirmed experimentally in conditions representative of those likely to be met in the maritime environment.

3) Pre-emphasis has not been taken into account in the FM systems listed.

4) The pulse code modulation (PCM) alternative is assumed to use 6 bit encoding and 8 kHz sampling with quadriphase phase-shift-keying and does not assume the use of instantaneous companding.

5) The Delta modulation technique is assumed to use a sampling rate of 48 kHz, an audio frequency bandwidth with its lower limit at 300 Hz and a test-tone frequency of 1 kHz.

6) In cases (e) and (f), companding has not been taken into account. In general, companding is now being used for digitally encoded voice channels, resulting in a subjective improvement in signal-to-noise ratio.

7) Pulse duration modulation is assumed to use an 8 kHz sampling rate.

8) At 400 MHz, the 18 kHz bandwidth available would not permit the assumed performance objective to be achieved in cases (e) and (f).

9) The possible use of voice-operated carrier-switching has not been considered, although an advantage would undoubtedly be gained when using this technique in conjunction with modulation methods (a) to (g) in Table II.

7. Link objectives

Owing to satellite power limitation and the relatively low gains available from practical forms of ship's antennae, the satellite-ship paths are the more critical and the system should be designed:

(a) to use the most effective modulation method requiring the least amount of power per telephone channel;

(b) to minimize the satellite-to-shore power requirements, by means of a high value of receive station figure of merit (G/T) at the shore station, so as to permit the major part of the satellite power to be used in the satellite-to-ship path;

(c) to use sufficient power in the shore-to-satellite path to ensure minimum contribution by this path to the overall degradation of the shore-to-ship link;

(d) to use sufficient power in the satellite-to-shore path to ensure minimum degradation of the ship-to-shore link, thus permitting the use of minimum transmitter power on the ship.

In order to meet the required overall performance, taking account of (b), (c) and (d) above, carrier-to-noise density ratios in excess of those given in Table I are required for each of the links. Possible values of link margins to meet these requirements are given in Table III below :

TABLE III

Possible link margins

Radio link	Possible link margin (dB)
Shore/satellite	10.0
Satellite/ship	0.5
Ship/satellite	0.5
Satellite/shore	10.0

Note.- The link margins given above do not include fading margins; these are given in Table V.

These objectives will generally be most easily achieved by the use of super high frequencies (SHF) in the shore-to-satellite and satellite-to-shore paths. Frequencies in the region of 4 GHz and 6 GHz or 11 GHz and 14 GHz would be suitable since the use of these frequencies would permit the use of high-gain parabolic antennae of moderate size.

8. Required transmit and receive characteristics

The combination of effective transmitter power (e.i.r.p.) and receive station figure of merit (G/T) required per telephone channel for each of the four satellite/earth paths can be obtained from :

$$\text{e.i.r.p.} + (G/T) = (C/N_o) + L_p + M + L_m - 228.6 \qquad (1)$$

where

e.i.r.p. : equivalent isotropic radiated power (dBW)

G/T : figure of merit of a receiving system, comprising the ratio between antenna gain relative to an isotropic antenna and the absolute noise temperature of the receiver (dB/K)

C/N_o : required carrier-to-noise density ratio at the demodulator input (dB.Hz).

L_p : path loss between isotropic antennae (dB)

M : fading margin (dB)

L_m : miscellaneous losses (dB)

Table IV shows the e.i.r.p. + G/T required for a range of frequencies, assuming a required carrier-to-noise density ratio (C/N_o) of 47.3 dB Hz (Table II(d)). The appropriate adjustment in e.i.r.p. + G/T for other modulation methods can be obtained by comparison of C/N_o requirements.

TABLE IV

Frequency	Satellite/ship link		Satellite/shore links			
	400 MHz	1600 MHz	4 GHz	6 GHz	11 GHz	14 GHz
e.i.r.p. + G/T (dBW)	2.2	12.2	30.7	33.7	42.7	43.8

Table IV shows that in the case of the satellite-ship link for a given satellite e.i.r.p., the G/T required at the ship is lowest at 400 MHz.

The parameters and possible practical values used in Equation (1) and Table IV are discussed below :

Equivalent isotropic radiated power (e.i.r.p.) (dBW)

This is the sum of the effective transmitter power and the effective gain of the antenna used, expressed in dB.

- The gain of the satellite antenna will depend on the service area to be covered. This will usually be full visible earth coverage (about 18° beamwidth) although there may be some advantage in the satellite-to-ship direction at 1600 MHz to use narrower beams to cover little more than the ocean areas.

  The required satellite e.i.r.p. to ships will depend on the antenna requirements of individual ships because the antenna beamwidth should be wide enough to encompass all ship movements in pitch, roll etc, for a high percentage of the time and there is a wide range of possible ship movements and rate of movement depending on the size and type of ship. For multiple access by all ships to all channels in a satellite, the satellite e.i.r.p. must be standardized and the level must therefore be set to a suitable value to permit operation to ships having a wide range of size and type. The satellite e.i.r.p. to the shore station can be arranged to be a small fraction (say, 5%) of that from satellite-to-ship by using high gain atennae at the shore stations.

- The ship's antenna beamwidth should be as narrow as practicable. The minimum beamwidth will be determined by the movement of the ship's antenna relative to the satellite when the ship is moving in pitch, roll,etc. This restriction may be reduced by using some degree of antenna stabilization. If high stabilization is provided, the narrowness of the beam will be limited by the maximum physical size of ship's antenna that can be accommodated in an unobstructed position.

In practice, for a given satellite coverage area and a given carrier-to-noise objective at the satellite, the e.i.r.p. required from the ship will be determined by the noise temperature of the satellite receiver. In this link, it may be advantageous to design for a low noise temperature in the satellite receiver which will enable relatively low powered ship's transmitters to be used.

- The shore station antenna gain can be made very high by use of a large diameter paraboloid operating in band 10 (SHF). The e.i.r.p. required to the satellite can be easily achieved using a few watts of RF power per telephone channel.

Antenna/receiver figure of merit (G/T) (dB/K)

This comprises the ratio between effective gain of receive antenna relative to an isotropic antenna and the system noise temperature at the receiver.

The e.i.r.p. + G/T will be determined by the requirements of small ships which will need to employ wide-beam antennae and hence low noise receivers. Large ships, on which narrow-beam antennae can be used, will have greater flexibility in the choice of antenna gain and receiver noise temperature to achieve the required G/T.

Carrier to noise density ratio (C/N_o) (dB-Hz)

See Tables II and III.

Path loss between isotropic antennae (L_p) (dB)

Path losses appropriate to the slant range at the edge of the service area of an earth coverage beam are given in Table V.

Fading margin (M) (dB)

Further work needs to be done to establish practical margins for the maritime environment. In this example, the fade margins shown in Table V are used.

TABLE V

Frequency	Satellite/ship links		Satellite/shore links			
	400 MHz	1600 MHz	4 GHz	6 GHz	11 GHz	14 GHz
Path loss (L_p) dB	177	189	197	200	205	207
Fading margin (M) dB	4	2	3	3	6	6

Miscellaneous losses (L_m) (dB)

Feeder, diplexer and other losses. A figure of 2 dB is assumed.

9. Conclusions

The technical characteristics of a possible maritime satellite system have been considered and a broad outline of the required parameters for that system is given. Some of these parameters are influenced to a large extent by the modulation method assumed.

Although the FM phase lock loop (companded) system appears to give the best performance, it will be necessary to conduct comprehensive practical tests to confirm these theoretical results before a final choice is made. This is particularly important in view of the probable requirement for random access to the satellite to give the facility for any ship or earth station to use any available channel in the satellite. To achieve this, some measure of standardization, requiring international agreement of system parameters, would be necessary.

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LEGEND TO FIGURE 1

a : FM conventional discriminator (unprocessed)

b : FM conventional discriminator (companded)

c : FM phase lock loop (unprocessed)

d : FM phase lock loop (companded)

e : PCM - quadriphase PSK (uncompanded)

f : Delta - quadriphase PSK (uncompanded)

g : pulse duration (delta sigma) - quadriphase PSK

h : single sideband

Note.- Curves (b) and (d) represent the equivalent test-tone-to-weighted noise ratio, taking into account the subjective improvement obtained by the use of companders.

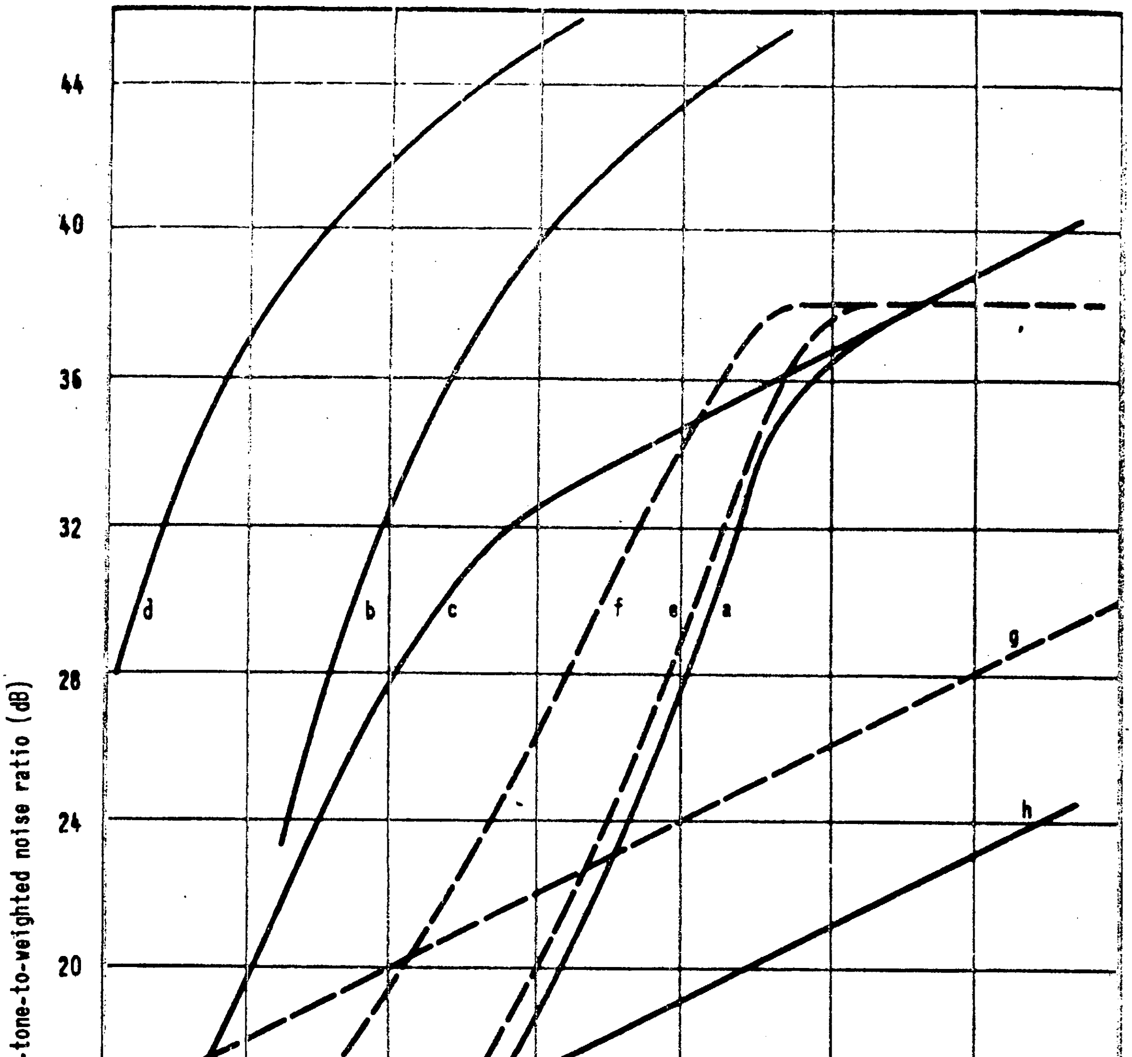

FIGURE 1

Theoretical comparison of modulation methods for single-channel-per-carrier systems (IF bandwidth limited to 29 kHz, and test-tone-to-weighted noise ratio objective of 38 dB).

STUDY GROUP 8

Study Group ..8., in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration :

REPORT AT/8

TECHNICAL CHARACTERISTICS OF SYSTEMS PROVIDING COMMUNICATION AND/OR RADIODETERMINATION USING SATELLITE TECHNIQUES FOR AIRCRAFT AND/OR SHIPS

A method of eliminating multipath fading using an omnidirectional antenna diversity system for reception of satellite signals in the maritime mobile satellite service

(Question 17/8)

(1974)

1. Introduction

As far as navigation is concerned, the participation in a maritime mobile satellite system requires the installation of a special satellite radio station on board ships. Irrespective of the technical specifications, such ship stations should meet the following general requirements. They must be :

- of robust construction, because the environmental conditions are extremely severe;
- inexpensive, because even smaller craft (e.g. fishing vessels above 100 grt) are to be fitted with such a station;

- reliable, because satellite communications are particularly important in the case of distress at sea.

For many years, simple omnidirectional dipoles have been used in the maritime mobile service. By reason of their simple design, they satisfy all three requirements set out above in an excellent manner. Above all, they do not require tracking equipment (mechanical or electrical) with all concomitant elaborate arrangements necessary for antenna orientation, such as calculation from the ephemeris, of satellite azimuth and elevation, as well as position and course of the ship. Moreover, for antennae with a higher directivity, the rolling and pitching angles of the ship have to be considered; this is also indispensable for cases of distress at sea when a ship may develop a considerable list.

The disadvantage of non-directional antennae is, however, their lack of gain. On the ship-satellite transmission link, this can be compensated for by a higher transmitter power, which, for ships, does not present any problems. This applies to frequencies up to about 500 MHz.

The critical link is the downward path between satellite and ship, owing to the limited power available in the satellite. To overcome the ensuing lack of signal level, use can be made of the power margin provided for cases of fading due to multipath effects, if means can be found to prevent these fadings. This multipath margin should be of the order of 10 dB in the upper VHF band, provided the polarization of the satellite antenna is circular and that of the ship antenna is linear. Multipath effects, and consequently, the level margins, could be substantially decreased if the ship antennae were also circularly polarized, but such antennae are, as a rule, directional antennae. For the reasons outlined above, it is, however, desirable to avoid the application of directional antennae.

The purpose of this Report is to show that in the frequency band up to 500 MHz satisfactory satellite communications are also possible with simple omnidirectional ship antennae, provided that use is made of an antenna diversity system which excludes multipath fading. The feasibility of such a system has been proved in the form of a land-based station in tests with the satellites ATS-3 (geostationary) and AZUR (polar orbit) on 136 MHz.

2. Interference pattern of the received waves in the vicinity of the antenna

Considering specular reflection only, which gives rise to the most pronounced signal fadings and thus represents the worst case of all possible reflection conditions (e.g. diffuse), and, furthermore, assuming a simplified reflection coefficient of unity, as well as neglecting, for the time being, the Brewster angle, the geometric correlation of field strength of the resulting signal is

$$E_V = 2 \cos \left(\frac{2\pi h}{\lambda} \sin \varepsilon\right) \text{ for vertical polarization}$$

and

$$E_H = 2 \sin \left(\frac{2\pi h}{\lambda} \sin \varepsilon\right) \text{ for horizontal polarization,}$$

where

h : the antenna height above the reflecting medium,
λ : the wavelength of the electromagnetic field,
ε : the grazing angle of the incoming wave.

The difference in the formulae is due to the fact that horizontally polarized waves undergo a phase shift of π at the point of reflection, whereas this does not apply to the vertically polarized wave.

As an illustration of the formulae, Fig.1 shows the variation of the field strength as a function of the antenna height h or of the grazing angle ε, with the absolute values of the angular function being plotted, as only these are of interest in this connection.

Fig. 2 indicates the position of the maxima and minima of the formulae as a function of the relative antenna height h/λ and of the grazing angle ε. The solid lines represent the maxima and the dashed lines the minima for horizontal polarization and vice versa, for vertical polarization. If, in practice, antenna height and grazing angle are known, these data can be entered into the graph in the form of a point. This point moves in vertical direction, when the antenna height is changed (ship moving in high sea), and in horizontal direction, when the grazing angle is changed (low orbiting satellite). The intersections with the families of curves represent the maxima and minima, respectively.

For the avoidance of deep level fades due to multipath interference, this graphical representation allows methods to be determined which enable the receiving station always to have at least one out of a number of antennae near the phase adding interference maximum; such an antenna is called in the following the "maximum antenna". These methods are :

2.1 Use of the fact that vertically separated antennae can be made complementary by using pertinent spacings. For a concrete case, this spacing can be taken from Fig. 2. In the plotted example, the heights of two antennae above the reflecting medium are $h/\lambda = 5$ and $h/\lambda = 6.5$, respectively. Each of the antennae operates within the plotted ranges around the maximum without loss of level due to multipath fading (between $E_{rel} = 1 \ldots 2$ in Fig. 1). Both antennae complement one another in an elevation range between 0° and 18° and between 19° and 39°. Consequently, in this example, an angular range of about 20° can be covered (Fig. 3a). The elevation range with complementary characteristics obtained by a given antenna spacing is not affected by a change of the antenna height above the reflection medium;

2.2 Use of the complementary characteristics of the polarization planes, if both are radiated by the satellite (e.g. circular polarization). Since it is characteristic of the absolute values of sine and cosine functions that one function has a maximum while the other has a minimum, and vice versa, this complementary behaviour can be utilized if both a horizontally and a vertically polarized dipole are located at the same place. However, this method can no longer be applied near or below the Brewster angle because the vertically polarized wave in this angular range also undergoes a phase shift between 0 and π which has not been allowed for in the formulae. Up to 500 MHz,the Brewster angle for sea water is below 4°, thus a useful range of application from approximately 10° to 50° (Fig. 3b) is practical.

2.3 Shading against the reflected wave by means of a reflector is an obvious method and is only mentioned for the sake of completeness (Fig. 3c). Owing to the limited size of the reflector surface this method is applicable from about 40° to 90°.

The above shows that, in the entire range of angles of incidence from 0° to 90°, reception without multipath fading is possible by using omnidirectional antennae (Fig. 3d).

3. Combination of diversity antennae

Unfortunately, it is not possible simply to connect the respective antennae together because they all are at different phase positions. Of the various ways of combining the antennae, the use of a separate receiver for each antenna is considered as the most economical solution, since it offers the added advantage of increasing the reliability of the service by equipment redundancy. Suitable measures are known which allow the interconnection of the receiver outputs without running the risk of signal suppression by phase cancellation; however, the addition of the output signals must be controlled by the AGC voltage or the AGC must be switched off.

A different method was used for the experiments described below. Owing to the linear polarization of the antennae of the satellite ATS-3 use had to be made of a diversity system with five antennae. As only two receivers were used a fairly complex switching arrangement was required (Fig. 4).

The signal levels supplied by the five antennae were amplified in pre-amplifiers. Capacitive couplers were used to take samples which were applied to an auxiliary receiver by means of an electronic commutator. The respective automatic gain control voltages of the signal samples were evaluated by a logic circuit device which had also to determine the respective maximum antenna. The maximum antenna was then connected to the main receiver by means of an electronic channel selector. The time response of this device depends on the time constant of the automatic gain control of the auxiliary receiver; the lowest value obtained was 10 ms.

4. Test results

The heights above the ground of the slot dipoles for horizontal polarization were 15 and 17.5 m and the vertical dipoles 16 and 18.5 m. During the experiment, the antenna signal levels supplied to the auxiliary receiver were recorded in time multiplex mode.

The satellite AZUR (Federal Republic of Germany) offered the opportunity of experimenting with variable grazing angles and it radiated circularly polarized waves. The frequency was 136.57 MHz. With this satellite, the theoretical predictions were checked, however, only according to the method of § 2.1 with the vertical antenna spacing λ. The method of § 2.2 could not be applied because the Brewster angle over land is very high, and thus it is no longer typical of the conditions proper to the maritime mobile service. The land was covered with snow, thus increasing the Brewster angle.

Fig. 5 shows the variation of the signal levels of two slot dipoles which are complementary to one another. The measurements apply to AZUR pass No. 250. The pertinent grazing angles are also indicated. The level varies between the noise levels (abscissa) and about 15 dB above.

Fig. 6 shows the levels during a 10-minute period with grazing angles between 0° and 60°. The first minimum appears at 1.7° to 2.3° according to the respective antenna heights. In the range from 5° to about 22°, the slot dipoles are complementary. With the vertical antenna, the influence of the Brewster angle can be observed over a range of from about 10° to 25°, with the reflection coefficient having a minimum at the Brewster angle. Therefore, the reflected ray suffers attenuation and the resulting fadings are less severe.

Fig. 7 shows an AZUR pass with culmination point at an elevation of 2.8° only. A useful signal was received above an elevation angle of 1°. The decrease in level at the culmination point indicates that the first maximum (2°) has already been passed, and that with further ascent of the satellite the level decreases towards the first phase-cancellation minimum. This minimum (about 4°), however, is not reached because the culmination angle is limited to 2.8°. This example shows that low elevation angles can be profitable if the multipath effects are used for signal level improvement instead of putting up with the fading due to phase cancellation. The feasibility of using grazing angles down to 1° would open up vast areas of the polar regions to satellite communications. The approximate correct phase addition of the two waves, present on the respective "maximum antenna", yields twice the field strength corresponding to quadruple power (6 dB gain).

Fig. 8 shows an experiment with the geostationary satellite ATS-3 which radiated with linear polarization. The polarization plane is, however, rotated by the Faraday effect. The receiving installation was used as polarization diversity system in which the logic circuit has the choice between vertically and horizontally polarized antennae. In this application the complementary condition is obvious.

The main receiver was a commercial radiotelephone set (of the Federal Republic of Germany) of the kind that is frequently used in taxi radio control centres. This was in line with the basic objective of the experiments, viz. to use robust, inexpensive and reliable equipment on board ships.

The signal-to-noise ratio was measured at the output of this receiver. The results of 34 consecutive tests are plotted in Fig. 9. A 1000 Hz test-frequency was emitted on 149.22 MHz by the test station (see left-hand portion of Fig. 4), received by the satellite ATS-3, converted and retransmitted to earth at an RF power of 50 W and with an antenna gain of 8.8 dB. The test site (scientific institutes) contributed considerably to the outer noise level. Disregarding the cases of extreme interference (measuring points below dashed line), the average signal-to-noise ratio is 22 dB. Speech transmissions performed concurrently resulted in a good transmission quality in line with the signal-to-noise ratios obtained.

Moreover, the described antenna diversity system and the simple main receiver were also used for distance measurements according to the audio frequency modulation method [Goebel]. The measuring accuracy due to equipment limitations was ± 100 m.

5. Conclusions

The advantage of using omnidirectional antennae on board ships exists mainly for frequencies below 500 MHz. A transmitter power of 30 W per channel and an antenna gain of 19 dB (earth coverage) was assumed for the satellite. Above this frequency, the use of directional antennae may be unavoidable, resulting in considerably increased cost and complexity.

With the aid of the antenna diversity system described above it is possible to prevent level fade-outs due to specular reflection. The latter is of particular importance in the case of omnidirectional antennae owing to their lack of discrimination between the direct and the reflected rays. There was good agreement between the theoretical predictions and measurements over land but the experiments should be supplemented by measurements over sea (where the Brewster angle is small).

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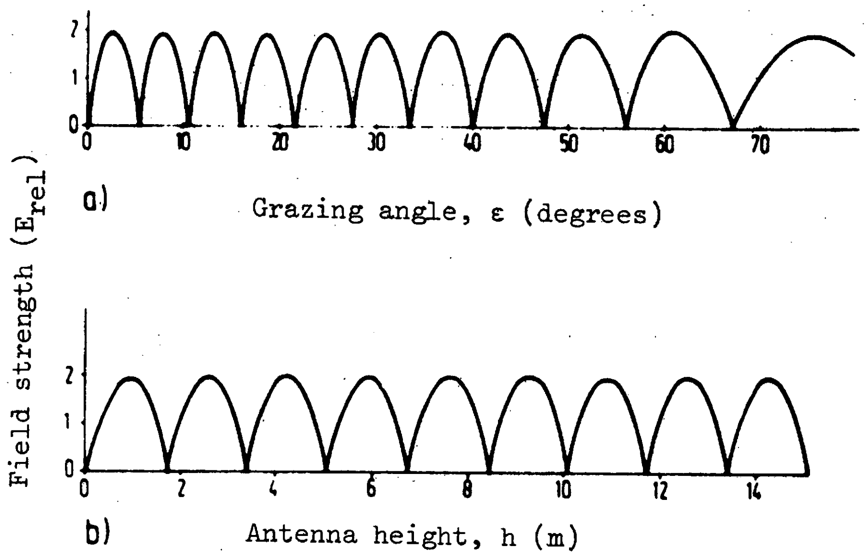

FIGURE 1

Field strength variation caused by two-ray multipath effect (specular reflection), horizontally polarized antenna

(a) as a function of the grazing angle, ε, antenna height h = 11.8 m, λ = 2.18 m.

(b) as a function of the antenna height h above water, grazing angle ε = 40°, λ = 2.18 m.

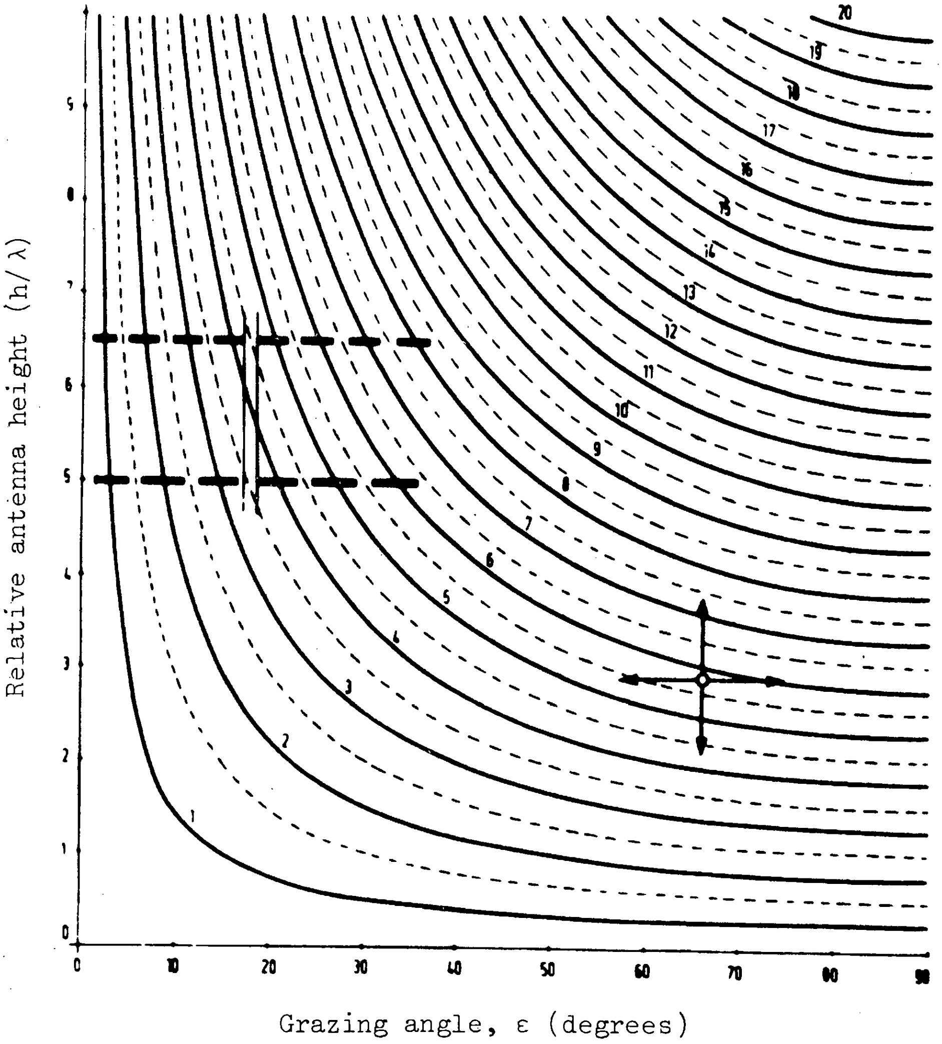

FIGURE 2

Diagram for the determination of the maxima and minima of the antenna characteristic on the basis of multipath reception as a function of the grazing angle ε and the relative antenna height h/λ above the reflecting surface; in the case of horizontal polarization, the solid lines are the maxima and the dashed lines the minima and in the case of vertical polarization, vice versa

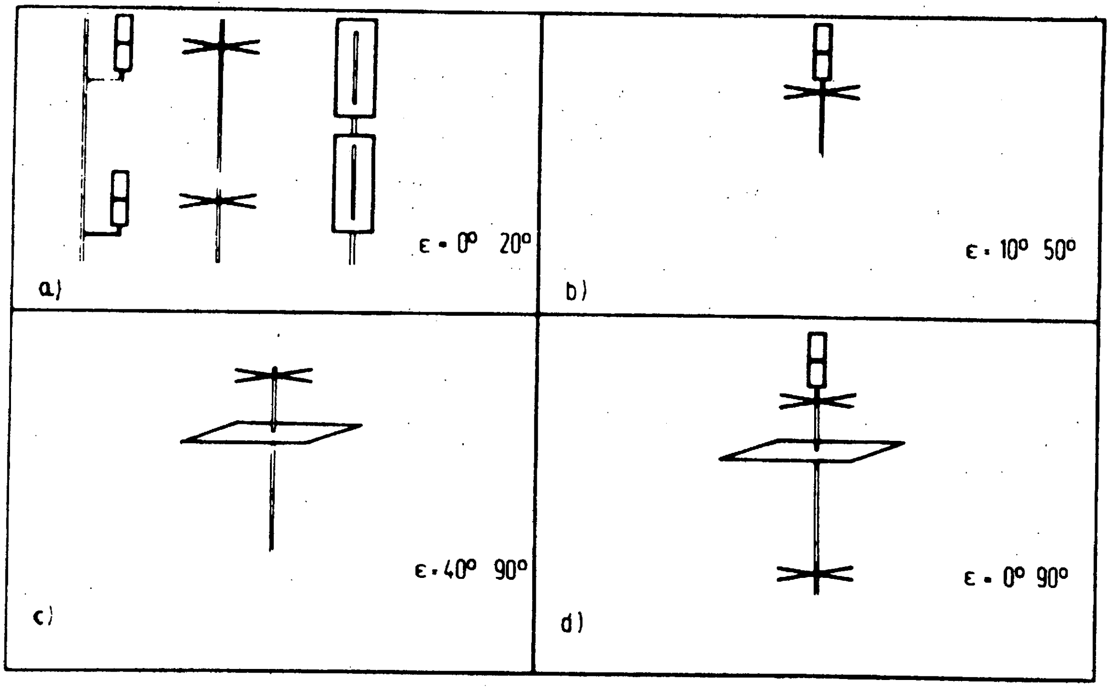

FIGURE 3

Antenna configuration for the reception of satellite communications without multipath fading

(a) complemented by vertical separation,

(b) complemented by direction of polarization,

(c) shading by a reflector,

(d) combination of (a) to (c) by diversity arrangement.

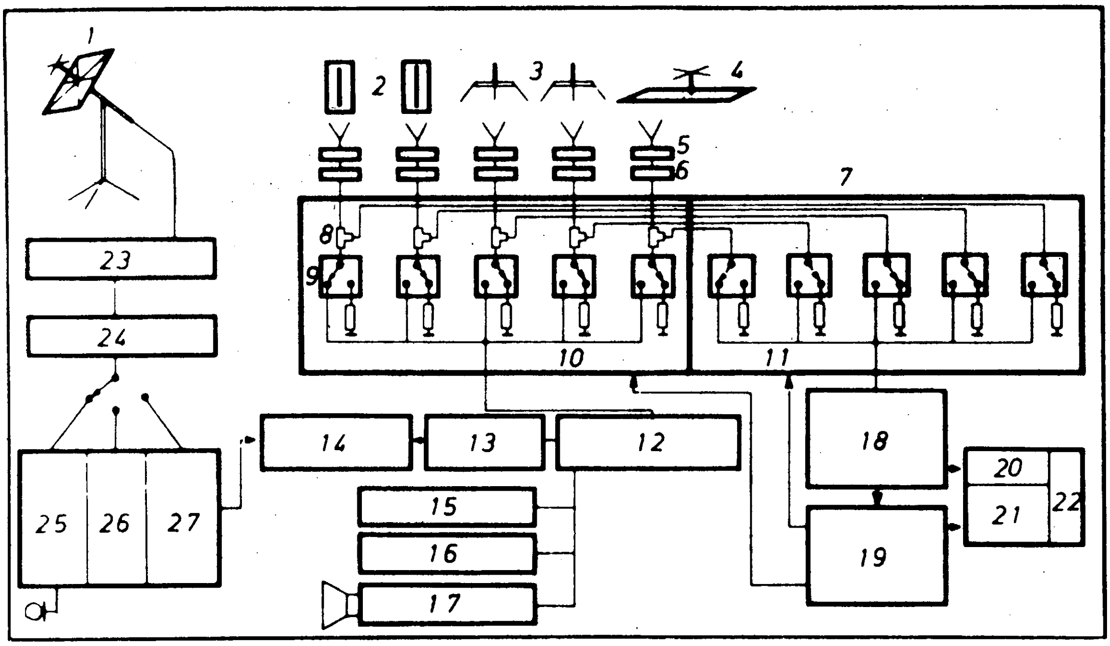

FIGURE 4

Block diagram of antenna diversity system for experiments with the satellites ATS-3 and AZUR

1. transmitting antenna (crossed dipole)
2. receiving antenna (slot antenna)
3. receiving antenna (vertical dipole)
4. receiving antenna (crossed dipole)
5. filter
6. pre-amplifier
7. switching device
8. capacitive coupler
9. diode switch
10. channel selector
11. antenna commutator
12. main receiver
13. filter 3100-3125 Hz
14. phase meter
15. noise meter
16. tape recorder
17. AF amplifier
18. auxiliary receiver
19. logic device and control unit
20. AGC
21. channel marker
22. recorder

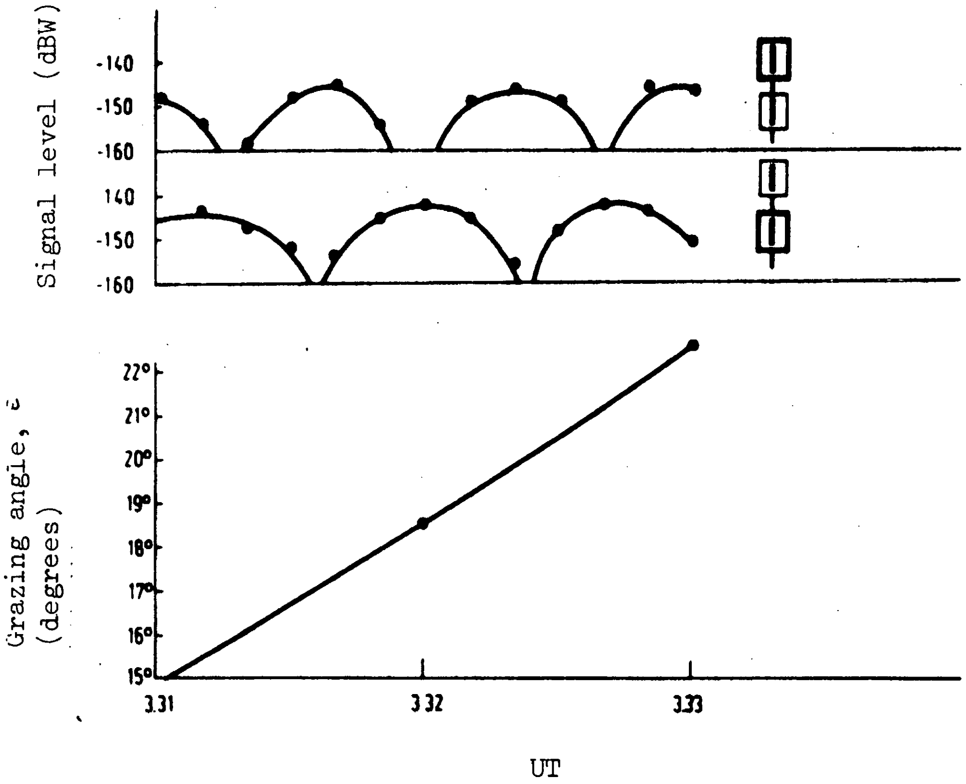

FIGURE 5

Signal level diagram of AZUR, pass No. 250, received by complementary antennae; -160 dBW corresponds to the noise level

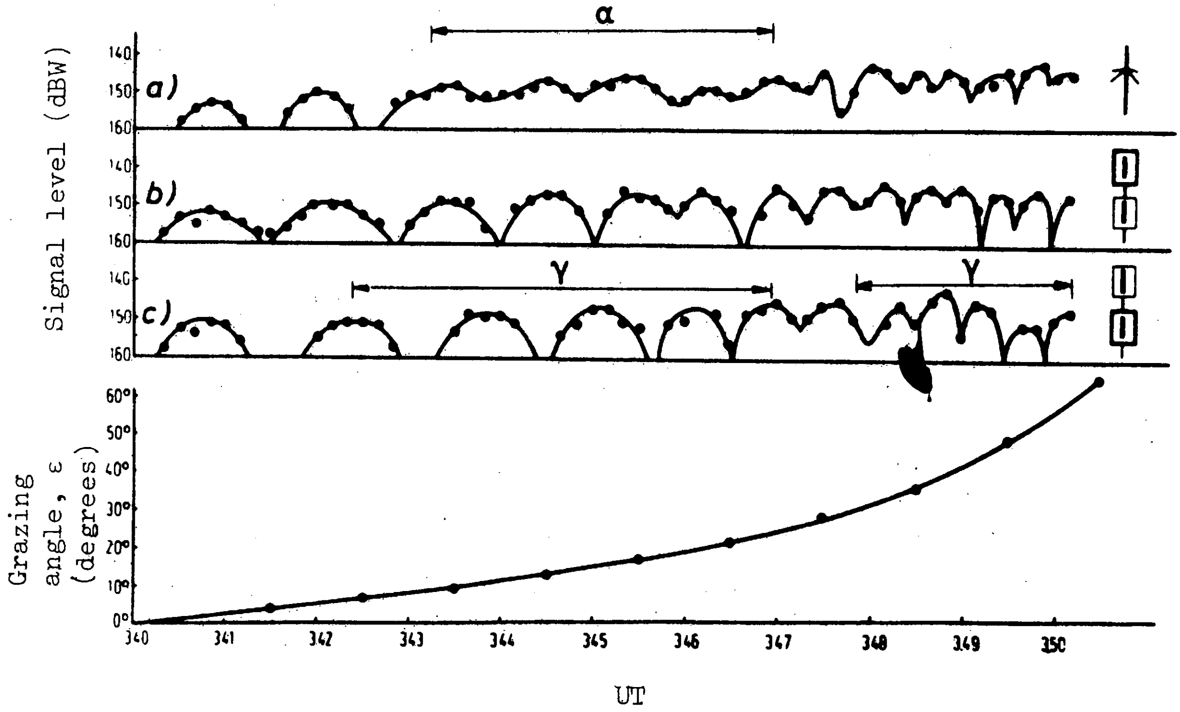

FIGURE 6

Signal level diagram of AZUR, pass No. 379, received on one vertical and two slot dipoles; -160 dBW corresponds to the noise level

(a) vertical polarization

α : Brewster angle with reflection coefficient < 1 (depths of fadings decrease)

(b) horizontal polarization

(c) horizontal polarization

γ : slot antennae operate complementarily

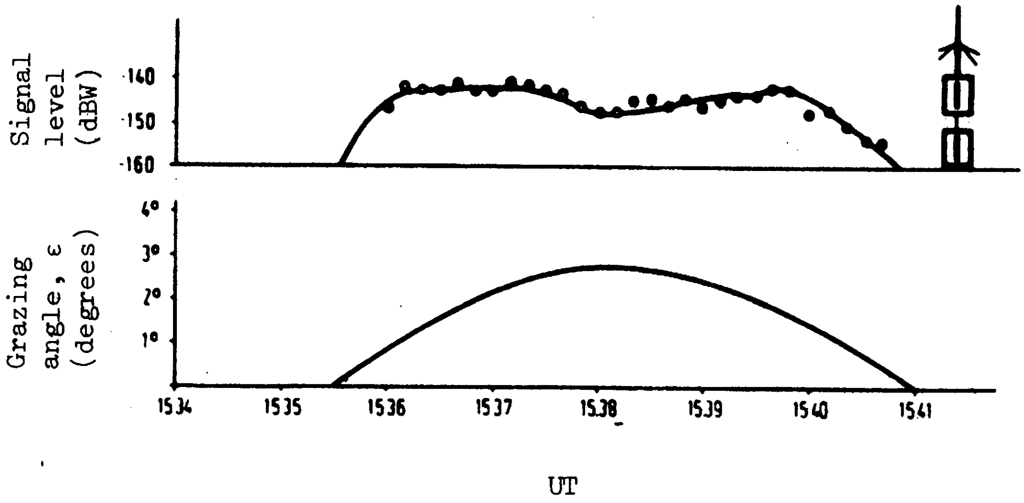

FIGURE 7

Signal level diagram of AZUR, pass No. 361, received on complementary antennae (diversity arrangement) culmination point at 2.8°

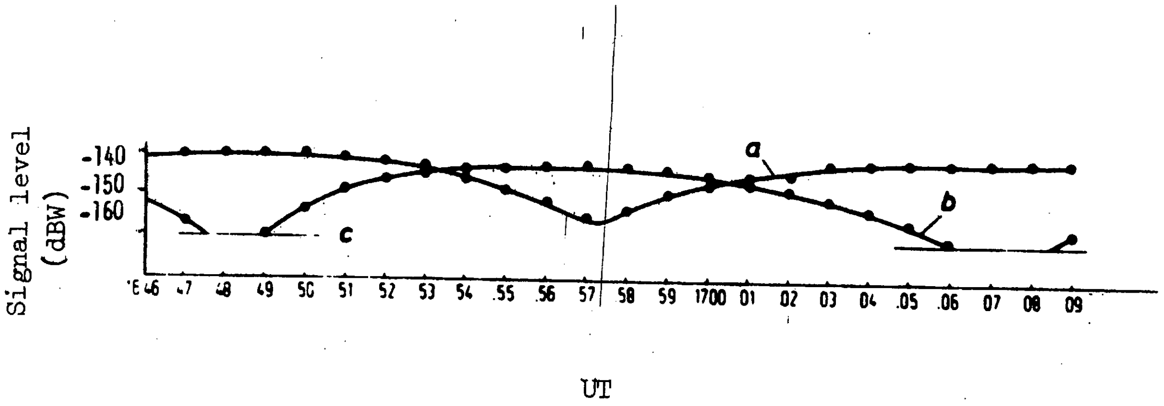

FIGURE 8

Signal level diagram of satellite ATS-3 (linear polarization, grazing angle 13°), polarization plane rotated by Faraday effect

(a) horizontally polarized slot antenna

(b) vertically polarized dipole

(c) noise level

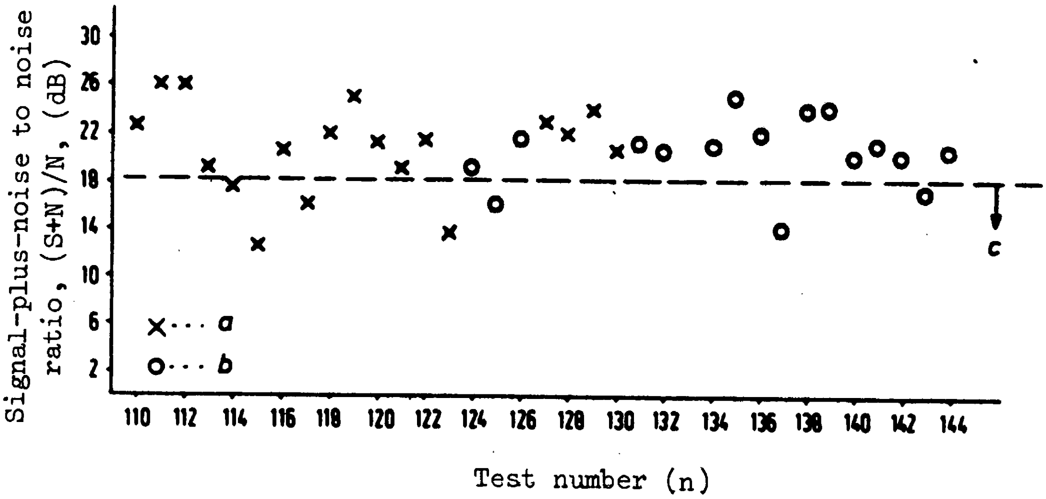

FIGURE 9

Noise measurements in the speech channel with a frequency of 1000 Hz via ATS-3

(a) up-link 400 W to Yagi antenna (x)

(b) up-link 400 W to crossed dipole (o)

(c) strong interfering stations

n = test number

C.C.I.R.
XIIIth Plenary Assembly
Geneva, 1974

Doc. 8/1058-E

STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration:

REPORT AX/8

BLACK AND WHITE FACSIMILE TRANSMISSIONS OVER COMBINED METALLIC AND RADIO CIRCUITS IN THE MARITIME MOBILE SERVICE

(Question 20/8)

(1974)

1. Introduction

Two documents concerning black and white facsimile transmission were submitted for consideration at the final meeting of Study Group 8 Geneva 1974. These documents are :

Doc. 8/184 (United Kingdom)

Doc. 8/264 (Norway)

1.1 Doc. 8/184 (U.K.) states that there are no established standards in the maritime service for the transmission of documents by facsimile. It suggests suitable parameters that take into account the Recommendations of C.C.I.T.T. for document transmission by facsimile over metallic circuits. It also notes that the C.C.I.T.T. Recommendations are not compatible with current World Meteorological Organization (W.M.O.) standards, based on C.C.I.R. Recommendation 343-1 and Opinion 24 for the transmission of weather charts.

1.2 Doc. 8/264 (Norway) considers the requirements of a maritime facsimile service and refers to tests to determine the most suitable scanning speed. It suggests system characteristics that would achieve a rapid transmission of messages and at the same time would allow the equipment on ships used for the reception of W.M.O. weather chart transmissions to be also used for the reception of news and messages.

It refers to the extended trial by facsimile transmissions of news by Norway.

In regard to document transmissions, it stresses the operational advantages that would result if a facsimile call could, if necessary, be considered as part of a telephone call.

2. Uses of facsimile and operational aspects

During the discussions at the Final Meeting of Study Group 8 in 1974, it was considered that facsimile transmissions could have special advantages for the safe and efficient operation of ships. In addition to the already existing W.M.O. meteorological transmissions facsimile could be used for broadcasting navigational warnings. For example, the U.S.A. is already transmitting by facsimile information on the state of ice to ships operating on the Great Lakes. The transmission of documents in both the shore-ship and ship-shore directions makes possible the rapid and accurate interchange of technical information and diagrams.

Several Administrations stressed the operational advantages of being able to carry on telephone conversations between ship and shore, changing over as required for the interchange of documents by facsimile without the need for intervention by the coaststation operator. Ideally there was a need to permit the transmission of both emissions on the same radio channel. However, several Administrations had strong reservations about this and indeed, reservations about the general development of maritime public correspondence facsimile services, bearing in mind the further overloading of the already congested maritime frequency bands that would ensue.

3. System characteristics

3.1 General

There was general agreement that as far as possible all maritime facsimile transmissions should adopt a single set of standards. Both Doc. 8/184 (U.K.) and Doc. 8/264 (Norway) suggested that, system characteristics generally should follow those listed in C.C.I.T.T. Recommendation T2 (revised) and T10bis covering facsimile message transmissions over metallic circuits as follows :

Modulation of sub-carrier	F.M.
Centre frequency (fo)	1 700 Hz
"Black" frequency	fo - 400 Hz
"White" frequency	fo + 400 Hz
Frequency stability	± 32 Hz over a 15-minute period
Index of cooperation*	264

However, there was disagreement on the choice of scanning line frequency.

3.2 Centre frequency and "black" and "white" frequencies

It was noted that the centre frequency in general use for the transmission of meteorological charts was 1 900 Hz in accordance with C.C.I.R. Recommendation 343-1. However, this Recommendation is generally concerned with transmissions over radiocircuits and would not normally include extension into the public telephone networks. It was considered therefore that it was not strictly appropriate to a maritime facsimile service. It was also noted that, in accordance with Opinion 24, weather chart transmissions to ships use, in principle, direct frequency modulation of the assigned radio frequency. This Recommendation also would be inappropriate to a public facsimile service. It was agreed that whilst the adoption of a single centre frequency was operationally desirable, the use of two different values for the weather chart and public correspondence facsimile services respectively, would not pose insuperable problems and could be allowed for by slight adjustment to the tuning of radio receivers.

There is no discrepancy between the proposed "black" and "white" frequencies and those recommended in Recommendation 343-1 and Opinion 24 for transmission in the 3-30 MHz frequency range.

3.3 Scanning line frequency

No conclusion has been reached on the choice of scanning line frequency.

Doc. 8/184 (U.K.) recommends a scanning line frequency of 180 lines/minute since this is the C.C.I.T.T. recommended speed for document transmission over metallic circuits and would simplify the connection of ship and land stations. In a maritime facsimile service, ships would normally wish to be connected to their offices or other land-based subscribers. The U.K. document also considers that this speed offers

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* The index of cooperation is defined as 1/π times the ratio between the line length and the line spacing.

a reasonable compromise between the rapid transmission of messages and the need for an acceptable performance under conditions of multipath propagation over long distance circuits. It is appreciated that the proposed speed would not be compatible with existing weather chart practice. On the other hand, present ships' weather chart equipment is normally suitable for reception only and could not be used in a full 2-way service.

Doc. 8/264 (Norway) recommends a scanning line frequency of 240 lines/minute, which is also an allowed scanning speed in C.C.I.T.T. Recommendation T2. This would permit reception on existing ships' weather chart equipments operating at 120 lines/minute. It would speed up the transmission of messages and would provide a satisfactory performance under multipath propagation conditions. This speed would also operate satisfactorily within the frequency bandwidth limits permitted for a radiotelephone channel in the maritime mobile service.

4. W.M.O.'s views

It was pointed out by the W.M.O. observer that his organization had not adopted the recommendation of its Commission of Marine Meteorology that the scanning line frequency for W.M.O. weather charts should be standardized at 120 lines/minute and that the matter was still under consideration. Opinion 24 from C.C.I.R. to W.M.O., whilst stressing the desirability of one standard scanning speed and one standard index of cooperation had not made any specific proposals for these characteristics. The existing W.M.O. standards are 60, 90 and 120 lines per minute with indexes of cooperation of 576 and 288. A scanning line frequency of 240 lines/minute would also be adopted in April 1974 but it was intended primarily for use over metallic circuits.

In discussion it is considered that whilst a single standard scanning speed for all maritime facsimile transmissions was desirable, there is insufficient information at the present time to decide on what it should be. In particular, more information is required about the W.M.O.'s future intentions.

5. Need for further study

It is noted that Recommendation 343-1 is not compatible with the C.C.I.T.T. Recommendations for facsimile transmissions over metallic circuits. Whilst it is considered that Recommendation 343-1 is not strictly appropriate to the maritime mobile service, it is considered that this Report should be brought to the attention of Study Group 3.

Although there is some agreement between the two contributions to the question on the standards to adopt, there is insufficient information at the present time to permit a choice of scanning line frequency and other characteristics. Further study of Question 20/8 is required.

Note : The Director, C.C.I.R., is requested to draw the attention of W.M.O. to this Report.

STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration:

REPORT AZ/8

TECHNICAL CHARACTERISTICS OF SYSTEMS PROVIDING COMMUNICATION AND/OR RADIODETERMINATION USING SATELLITE TECHNIQUES FOR AIRCRAFT AND/OR SHIPS

Possible maritime distress systems using satellites

(1974)

1. Introduction

The basic requirements for the provision of a distress service are communications for making distress calls and if possible, receiving acknowledgement, and a means by which a station on land may determine the position of the distressed craft. The incidence of distress in a given ocean area is such that it is not uncommon for a number of distress calls to be made simultaneously. These incidents occur mainly in coastal waters or in busy shipping lanes where local assistance would be obtainable more rapidly than could be organized via a satellite system. Thus, to avoid congestion, a satellite distress service should desirably be used only when local assistance is not available. Although this reduces the possibility of coincidence of distress calls causing mutual interference, it would still be highly desirable to keep distress alerting, position fixing and acknowledgement procedures to the shortest possible time interval to avoid such interference. Methods are therefore examined which are capable of meeting these requirements in a worldwide maritime system.

Although some of the systems included could, with certain reservations, apply to aircraft or to land mobiles, no consideration of these applications has been given here.

2. Possible systems and procedures

Three position-fixing systems which could be adapted for use in a satellite distress system, have been successful in practice; these are :

(a) Ranging - using two geostationary satellites per service area;

(b) Transit - using the Doppler-shift generated by multiple low orbit satellites; and

(c) Omega - using a terrestrial VLF system.

System (a) would be capable of providing both position-fixing and communications requirements but would not be capable of providing coverage much above latitudes of 70° North and South.

Systems (b) and (c) would provide position-fixing worldwide but would require satellites to provide the communications requirement. These would probably be in geostationary orbit and would therefore have the same coverage as alternative (a).

It should be noted that none of the following systems has been tested at 1 600 MHz. Although there is no reason to expect that they would not be suitable at 1 600 MHz, difficulties may arise in providing sufficient power in mobile distress equipment to establish a reliable link.

The systems considered are not exhaustive; other systems are under active consideration and test.

2.1 Ranging

A proposed system [1] uses established satellite communication techniques but requires two geostationary satellites spaced by about 40 degrees in longitude per service area. In operation, the station on land is either quiescent until it is triggered by a distress signal, or it sends a constant succession of interrogation pulses which may be used as a check on the operation of the system. In either case, when activated, the station on land transmits to one of the satellites a short burst of carrier. phase modulated by an audio frequency tone (digital methods can also be used [2]).

The distress equipment, which may be in a lifeboat or ship, receives the burst and locks a local generator onto this tone. After completion of the burst, the distress equipment switches from receive to transmit and then transmits a short burst comprising a carrier, frequency modulated by a tone, in phase coherence with the received tone, followed by a burst of digital information consisting of an identification code and possibly some basic supplementary information on the state of the distressed craft and its occupants. This signal is transmitted to both satellites by means of an antenna with a near-hemispherical response and each satellite relays the signal back to the station on land.

At the station on land, the delay times between transmission and reception of the signals is measured and the position of the distressed craft determined from the distances associated with these delays. The position can be fixed to an accuracy of less than 1 mile at high latitudes; within latitudes of about 10°, however, the accuracy reduces because of geometric dilution /̄ 3_7. In the worst case, i.e., on the equator, the ranging system produces little more than a North/South line-of-position passing within 1 mile of the distressed craft's position but having a positional uncertainty on that line of perhaps 100 or 200 miles.

For worldwide coverage of the ocean areas between latitudes 70° North and South, 7 geostationary satellites would be required. However, at least some of the satellite and associated earth station facilities could be provided by communication satellites and earth stations in the maritime service. Coverage further North and South would call for additional satellites in inclined orbits.

The Omega and Transit system could be extended to provide full global coverage by the use of fewer additional satellites than can be achieved using the Ranging system.

2.2 Transit relay system

A system using Doppler effect is in use as a navigational aid and may be adaptable for use in a distress system. In this system, several satellites in low altitude polar orbits are used. These satellites broadcast frequency stable radio signals on 150 and 400 MHz to allow independent Doppler measurements to be made to compensate for errors due to ionospheric refraction. Sufficiently accurate results would be achieved (about 1 mile by day and 0.5 mile at night) using only one of these frequencies, and a transition time of about 6 minutes. A distressed craft could receive these signals and relay them to a station on land via a geostationary satellite. At the station on land, a digital computer would calculate the distressed craft's position after the relevant Doppler measurements had been made. The speed of calculation depends on the complexity and, therefore, cost of the station-on-land computer employed. A very simple processor would take about 5 minutes to give a position fix.

Additional errors that will be introduced by re-transmitting the Doppler signal to a station on land in real time are :

(a) differential time delay, i.e. the difference in slant range and hence in transmission time between a signal originating at the subsatellite point of the communication (relay) satellite and that originating from a different point in the coverage area; and

(b) those introduced by the Doppler shift caused by the slow movement away from the perfect geostationary position of the communication satellite used to relay the Transit signal to the station on land.

These errors will be small, however, and can be eliminated in the computation, at the station on land, of the distressed craft's position.

Several orbiting satellites would be needed to provide the required availability because any one satellite would be visible, for example, for only about 18 minutes, out of a nominal 108 minute orbit, to a ship situated on the satellite's earth-track; rotation of the earth would normally result in intervals between sightings of around 12 hours at a fixed point on the equator.

Assuming prior knowledge of the ship's approximate position, a set of four satellites would make position fixes available at about 2 hour intervals at the equator, and about 1 hour intervals at 30 degrees latitude /_4_/. Without the ship's approximate position, two satellite passes would be required to resolve longitudinal ambiguity. Orbit heights of 500 - 2 000 km are suitable /_5_/.

To provide facilities for acknowledging distress calls, it would be necessary to provide two-way transmission between the distressed craft and the station on land, however, this essentially adds only a receiver to the required transmitter.

2.3 Omega relay system

Experiments have been carried out at 149 MHz with the ATS-3 satellite using distressed craft transmit powers of about 7 watts feeding into omni-directional, low gain, antennae. Accuracies of about 2 miles by day and 5 miles at night have been achieved /̅ 6_7. Three geostationary satellites would give coverage over most of the earth within latitudes of about 70°.

A proposed system involves re-transmission of Omega navigation signals received at the distressed craft from a chain of VLF transmitting stations, back to the station on land via a single geostationary satellite. The VLF stations transmit various combinations of signals between 10 and 14 kHz. Four Omega stations are now in operation and four more are planned to give world coverage.

In one proposal, the distressed craft receives VLF signals from several of these stations and compresses them into a 2 kHz band. These signals, together with other information including identification codes, etc., are up-converted to suitable frequencies in the VHF, UHF or SHF bands and re-transmitted to the station on land.

The station on land processes the received signal using integration techniques to improve signal-to-noise ratio and accuracy, resolve the Omega lane ambiguity and finally determine the position of the distressed craft from phase measurements of the integrated received VLF signals. The whole interrogation and position-fixing process is completed in about one to three minutes.

As for Transit, two-way transmission between the distressed craft and the station on land would be necessary to provide for both distress calls and acknowledgement.

3. Satellite requirements

For coverage within latitudes 70° North and South the satellite requirements will be as follows :

(a) Ranging system

In the Atlantic and Indian Ocean, two geostationary satellites separated in longitude by 40° would provide adequate coverage over the great majority of the required coverage area. To give full coverage over the Pacific Ocean, three satellites would be required. These satellites would also provide for communications and consideration would need to be given to positioning the satellites to provide suitable coverage for both services.

(b) Transit system

To provide for the Transit position fixing facility, a number of low-orbit satellites will be needed, the number being dependent on the proportion of the time that coverage is required. A two-way communication facility for distress calls, acknowledgment and the transmission of the Transit system signals will also be required in a geostationary satellite in each ocean area. Thus a total of 4 or more low orbit satellites (the existing system uses 6) and a duplex channel in each of 3 geostationary satellites would be required.

(c) Omega system

No satellites would be required for Omega position fixing. The use of a duplex channel in each of 3 geostationary satellites for relay and acknowledgement purposes would be needed as in the Transit system.

4. System comparisons

A comparison of the basic parameters of the alternative systems are given in Table I.

5. Conclusions

The established Transit satellite system has the disadvantage of providing service for only about 20% of the time at 30° latitude; it would be possible to provide continuous coverage with more satellites but the cost would be great. In addition, the Transit relay system is not likely to cost less to install and maintain than the other proposed system and is therefore not favoured.

The Ranging and Omega systems, both provide sufficiently accurate fixes or lines of position, i.e., within 10 miles, to enable rescue services searching within this range to home on to a beacon on the distressed craft. The relative accuracy, i.e. that between the distressed craft and the searching vessel or aircraft, would be much better than this.

Land station equipment is of similar cost and complexity for both these systems, but the Omega system requires the basic elements of a VLF receiver in the distressed craft equipment in addition to the satellite communications equipment. The Ranging system requires the use of duplex channels in two satellites for each coverage area but can provide a position fix in a time of about 5 seconds. The Omega system uses a duplex channel in only one satellite per coverage area but takes 1 to 3 minutes to fix the position, and with this method, more than one duplex channel may be needed to avoid simultaneous use of the system by two or more craft in distress. Both systems would appear also to have similar power and frequency requirements for both satellite and lifecraft equipments.

References

1. "Possible Earth Station Techniques for a Survival-Distress Service by Satellite" : D.G. Pope; IEE Conference Publication No. 72.

2. C.C.I.R. Draft Report 509(Rev.72) - Signal Quality and Modulation Techniques for Radiocommunication and Radiodetermination Satellite Services for aircraft and ships.

3. C.C.I.R. Report 515(Rev.72) - The use of geostationary satellites for radiodetermination by distance-measuring techniques.

4. "Shipboard Equipment for Navigation and Position Fixing" : Electrical Communication; Volume 44, No. 2, 1969.

5. C.C.I.R. Report 216-2 : "Use of Satellites for Terrestrial Radiodetermination".

6. "The Role of Time-Frequency in satellite position determination systems", Eugene Ehrlich, Proc. IEEE, Vol. 60, No. 5, May, 1972.

TABLE I

System comparisons

	RANGING SYSTEM	TRANSIT SYSTEM	OMEGA SYSTEM
Position-fixing accuracy	1-6 miles in latitudes greater than 5° reducing to line of position at the equator	Day : 1.0 mile Night : 0.5 mile Using one frequency only	Day : 2 miles Night : 5 miles
System availability	Continuous	Typically 1 hour intervals at 30° latitude	Continuous
Frequencies	Distressed craft to and from satellite : 160 or 1 600 MHz + 400 MHz distressed craft to satellite only	As for Ranging System + 150 or 400 MHz receiver in the distress craft	As for Ranging System + VLF receiver (10-14 kHz) in distressed craft
Distressed craft equipment approximate d.c. power requirements	30 watts (160 MHz) or 159 watts (1 600 MHz)	No information available but likely to be similar to Ranging System	Broadly similar to Ranging requirements
Period of transmission	About 2 seconds	6 minutes	1 to 3 minutes
Antenna requirements	Low gain e.g., 60° to 80° beamwidth at 1 600 MHz or omni-directional at 160 MHz or 400 MHz	Omni-directional for reception of Transit signals, also moderate gain (40° to 50° beamwidth) at 1 600 MHz or omni-directional at 160 MHz or 400 MHz	Whip antenna for VLF also moderate gain (40° to 50° beamwidth) at 1 600 MHz or omni-directional at 160 MHz or 400 MHz

Note. - The examples of frequencies chosen are broadly in accordance with those allocated for use in the maritime satellite service.

C.C.I.R.
XIIIth Plenary Assembly
Geneva, 1974

Doc. 8/1062-E

STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration:

REPORT BB/8

Internal communications on board ships by means of portable radiotelephone equipment

(Question 18-1/8)

(1974)

1. Introduction

The following Documents have been submitted for the period 1970-1974: 8/15 (C.I.G.R.E.), 8/81 (O.M.C.I.), 8/95 (U.R.S.S.), 8/176 (Norway), 8/187 (United Kingdom), 8/217 (United States of America), 8/238 (Canada).

Administrations have made tests, some of a comprehensive nature, in attempts to determine what frequency bands, number of channels and effective radiated powers are required for effective communication between on-board portable equipments.

Comparison of reports on the results of the tests, together with practical experience, shows that there are many factors involved, and a common solution applicable to all ships and conditions may not be practicable.

It is noted that some Administrations have made proposals to the WARC-M 1974 for a definition of On-board Communications. The sharing possibilities with other Services will depend on the precise definition agreed.

2. Frequency bands

Present systems use VHF (around 160 MHz) or UHF (around 460 MHz) and both bands are considered technically suitable depending on particular circumstances. Frequencies may be shared with other users, with limitations placed on radiated power when working in or near to port, and the ultimate choice of band may not depend solely upon technical considerations. Within Appendix 18 only a limited number of channels are available for on-board communications.

3. Number of channels required

Channels are required to permit vessels to operate with acceptable co-channel, adjacent channel, and/or intermodulation interference in harbours, congested areas and contiguous areas.

The requirement for on-board communication is expanding rapidly and it is impracticable at this time to determine the precise number of channels necessary to satisfy the requirement. Further studies will be required when On-board communication has been defined by the WMARC 1974.

A number of Administrations felt that at least 8 frequencies are necessary and that this may be totally inadequate in congested waters, particularly in port approaches. The channel requirement in the next decade is likely to be significantly greater.

4. VHF operation

The 160 MHz band is technically suitable, but there are operational problems caused by the fact that all the frequencies in Appendix 18 of the Radio Regulations are urgently required for other maritime needs. At present on-board communications on channels 15 and 17 are permitted providing the effective radiated power is limited to 0.1 W.

Some laboratory measurements have been carried out in the Federal Republic of Germany on four different VHF sets intended for fixed installation on board ships in order to assess the admissible minimum distances of interfering stations to the fixed installation without causing undue degradation of the reception on channel 16. Only adjacent-channel and intermodulation interference have been taken into account, because these have been considered to be the most serious cases of interference occurring in practice (i.e. portable radiotelephone equipment for on-board communications transmitting on channels 15 or 17 with 0.1 W e.r.p. alone or together with the fixed VHF installation on board another ship transmitting on channels 14 or 18 with 25 W e.r.p.).

The distance calculations have been based on the following assumptions :

- adjacent-channel selectivity 75 dB relative to the maximum usable sensitivity as an average value of the four sets tested;
- intermodulation response 71 dB relative 1μV (average value);
- conversion from e.m.f. to field strength by means of a half-wave dipole;
- antenna heights of the fixed VHF installations 20 m above the sea level;
- conversion from field strength to distance according to the propagation curves of C.C.I.R. Recommendation 370-1, Annex I, Fig. 1; extrapolation for small distances.

With no allowance for any additional attenuation due to the environmental conditions on board the ship the following minimum distances to the antenna of the main VHF station have been obtained :

(a) approximately 200 m in the case of adjacent-channel interference;

(b) 100 m for the portable equipment and 8 km for the second interfering station on board another ship in the case of intermodulation interference; other pairs of distances have also been calculated. (See Fig. 1 attached).

Taking into consideration the environmental conditions on board ships it has been deemed justifiable to decrease the distances with respect to the portable equipment to one tenth of the distances calculated allowing for shielding effects and the unfavourable orientation of the portable set in the immediate vicinity of the antenna of the fixed VHF installation.

The F.R. of Germany document concluded that an increase in the power of the portable equipment, say to 1 W e.r.p. was not considered advisable. At the final meeting, however, this Administration agreed that the above mentioned allowance was too restrictive.

A theoretical study of the interference caused to shipborne receivers on channel 16 by transmitters operating on channels 15 and 17 has been made in the U.S.S.R. /̲ 1̲ /.

A description is also given of intermodulation noise of the third order components, 2A-B, that occur during simultaneous operation of the transmitter on channels 15 and 14, 17 and 18.

A calculation for two values of effective radiation power, 0.1 W and 1.0 W with different distances between stations is given for receiver sensitivity 1 µV(-145 dBW), intermodulation characteristic 60 dB, and received antenna height of 20 m above the water.

The calculations showed that when the power of the portable radio station was raised from 0.1 W to 1.0 W the distance from the receiver to the interfering transmitter must be multiplied by ≈ 2.5 in order to obtain exactly the same value of intermodulation noise at the receiver input.

It has been shown that when the power is increased from 0.1 W to 1.0 W the receiver sensitivity deteriorates approximately by 10 dB.

Experiments carried out in both laboratory conditions and on board ships showed that the modulation products from a portable radio station with a power of 1.0 W operating on an adjacent channel would cause no detectable interference to a shipborne receiver.

Discussion of the documents from the U.S.S.R. and the F.R. of Germany at the Final Meeting (February 1974) resulted in a general agreement that, from considerations of environmental conditions on board ships, the effective radiated power on channels 15 and 17 could be increased to 1 W.

5. UHF operation

The use of UHF frequencies (about 460 MHz) is technically feasible and has been studied in depth in the United States of America [2]. Generally, it was possible to obtain satisfactory communication between two hand-carried transceivers located at different locations aboard small to medium size vessels. Under these conditions, and using an e.r.p. of 2 W, the single frequency mode of operation could satisfy the requirements of this category of user.

On the larger vessels, it was not possible to obtain satisfactory communication at all desired locations between two hand-carried transceivers using the single frequency mode of operation. Satisfactory coverage was obtained by use of the two-frequency simplex mode of operation via a relay.

The use of a relay, using two-frequency simplex, was considered a satisfactory means of providing coverage to all parts of a ship without resorting to the use of high power transmitters. Spacing of the order of 10 MHz would permit the use of relatively inexpensive equipment.

6. Radiating cable systems

It has been suggested by the International Conference on High Tension Electric Systems (C.I.G.R.E.) that on-board communication systems employing radiating cables could provide a satisfactory service. Such systems for maritime applications have not been studied in C.C.I.R.

7. Summary

The VHF band (around 160 MHz) and the UHF band (around 460 MHz) are the most suitable bands but the VHF band in Appendix 18 is limited to two channels which will be insufficient to meet the requirements. The UHF band offers advantages since no special precautions are necessary to prevent interference to the fixed VHF radio installation in the vessel by the operation of UHF on-board communication equipment.

In the VHF band a maximum e.r.p. of 1 W could be used on channels 15 and 17 and in the UHF band a maximum e.r.p. of 2 W would be satisfactory. For the purposes of type approval of equipment, the transmitter carrier power output terminated in its characteristic output impedance should not exceed 2 W and 4 W respectively. At UHF, when using relays, frequencies with a spacing of the order of 10 MHz are to be recommended.

It is difficult to assess the number of channels required with such a rapidly expanding requirement, but a number of Administrations felt that at least 8 frequencies will be necessary and that this should be treated as a conservative figure. The number of channels will need to be assessed at the WMARC 1974.

Further studies are required on the use of relays, the degree of sharing with other mobile users and the implications of any agreed definition for on-board communication at WARC-M 1974. A study of the use of radiating cables in C.C.I.R. might also prove advantageous.

In the long term, on-board communications should operate solely in the UHF band.

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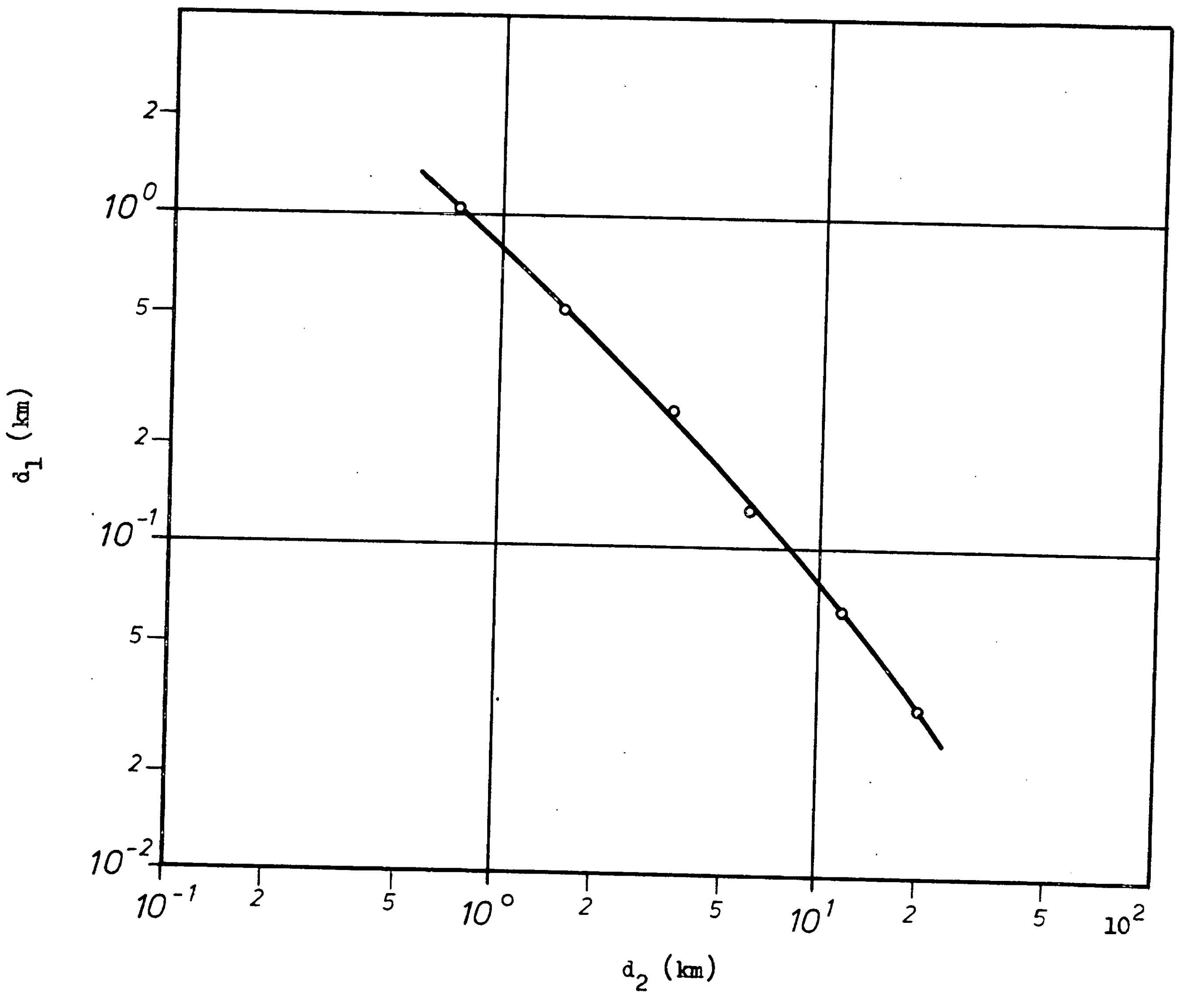

FIGURE 1

$d_1 = f(d_2)$ with an e.m.f. of the wanted signal 2 µV

d_1 = distance between the portable radiotelephone apparatus (channel 15 or 17) and the antenna of the fixed maritime mobile VHF installation (channel 16) on board the same ship

d_2 = distance between the second interfering station (channel 14 or 18) and the maritime mobile VHF installation operating on channel 16

C.C.I.R.
XIIIth Plenary Assembly
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Doc. 8/1063-E

STUDY GROUP 8

Study Group 8, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration:

REPORT BC/8

EQUIVALENT POWERS OF DOUBLE-SIDEBAND AND SINGLE-SIDEBAND RADIOTELEPHONE EMISSIONS

(in the Maritime Mobile Service)

(Question 19/8)

(1974)

1. General

In response to Question 19/8 the following documents have been submitted to the Final Meeting of Study Group 8, Geneva 1974 :

Doc. 8/177 (Germany, Federal Republic of)
Doc. 8/183 (United Kingdom)
Doc. 8/199 (United States of America)
Doc. 8/201 (United States of America)
Doc. 8/202 (United States of America)

Since Doc. 8/199 proposes a new Study Programme related to Question 19/8 and since this was felt unnecessary, because enough material was already available for a Recommendation on this matter, which is based on this Report, only Docs. 8/177, 183, 201 and 202 together with the discussions on the Final Meeting of Study Group 8 have been taken into account in drafting paragraphs 2 to 8 of this Report.

2. Nature of the problem

For a double-sideband system, Regulation 15(c) of Chapter IV of the International Convention for the Safety of Life at Sea, 1960, (SOLAS) currently provides for a conventional solution to the problem of effective communication range by restricting itself to a unique set of conditions. Thus it postulates that, for a certain class of vessels, the transmitter shall have a minimum normal range of 150 nautical miles, i.e. it shall be capable of transmitting clearly perceptible signals from ship to ship by day and under normal conditions and circumstances over this range. Clearly perceptible signals will normally be received if the r.m.s. value of the field-strength produced at the receiver by the unmodulated carrier is at least 25 µV/m. Further it assumes that this range will be obtained by a power in the aerial of 15 Watts (unmodulated carrier) with an aerial efficiency of 27%.* In addition, Regulation 15(c) requires that in normal operation the transmitter shall have a depth of modulation of at least 70% at peak intensity.

Since in the interest of more efficient spectrum utilization, the W.A.R.C. for the Maritime Mobile Service, Geneva 1967, decided upon the conversion by 1 January 1982, in accordance with Resolution Mar 5, of all emissions in the 2 MHz maritime band to classes of emission A3A or A3J except those on the international calling and distress frequency 2 182 kHz, which may be A3 or A3H, it has become necessary to specify the field-strength and peak envelope power equivalences for A3H emissions in order to meet the SOLAS requirements for the A3 case.

There has been some discussion on which depth of modulation the equivalences should be based. SOLAS requires a minimum depth of modulation of 70% at peak intensity, whereas a depth of modulation of 100% was felt, for practical reasons, to be more appropriate for peak envelope power rating of SSB transmitters. Therefore it was generally agreed to give values for both depths of modulation.

It was also agreed to incorporate all reasonable combinations of classes of emission and methods of reception including A3A and A3J emissions.

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* These results are given in SOLAS, but some administrations have felt that further study is necessary; that is, on the relationship between the power in the antenna and the field-strength, and on the radiating pattern of the ship's antenna in the 2 MHz band taking into account the ship's superstructure.

3. Basic assumptions for equivalences

In order to arrive at equivalent values of field-strengths and peak envelope powers the following basic assumptions are made :

(a) The signal-to-noise ratio at the output of the demodulator is the same for all cases considered.

(b) Envelope demodulation of an A3H emission results in a certain amount of distortion products. For determining the signal-to-noise ratio, the fundamental component for the case of single-tone modulation only has been considered.

(c) Only fading-free propagation conditions have been taken into account, since the SOLAS requirement is related to communication by day over a minimum range of 150 nautical miles, which - as was generally felt - excludes a deviation from the theoretical equivalences in favour of a relaxation with regard to SSB emissions in the frequency band considered.

4. General SSB/DSB system equivalences

Based on Item (a) of § 3 it is evident that under idealized propagation conditions DSB and SSB communication links provide identical performance, if the total sideband mean power outputs of the two transmitters are the same, provided that bandwidths and demodulation methods are adapted to the classes of emission employed. This fundamental law of SSB communications results from the fact that the 3 dB loss in the output power after demodulation in the SSB case with respect to the DSB case is compensated for by a 3 dB decrease of the noise power due to the halved bandwidth, thus resulting in equal signal-to-noise ratios in either case.

For cross-system operation, two cases have to be considered, namely DSB emissions received by an SSB receiver and SSB emissions (for compatibility reasons only class of emission A3H) received by a DSB receiver. The first case is rather simple to deal with, since the demodulation of one of the two sidebands only of the A3 emission requires an increase by 3 dB for both carrier and sideband mean powers. The latter case is a little more complex, if the distortion products due to envelope demodulation are to be taken into account. With no allowance for demodulator distortion the mean power in the A3H sideband has to be increased by 3 dB relative to the total mean power of the two sidebands of the A3 emission in order to achieve equal performance, because the A3 emission has a 3 dB advantage due to the coherent addition of the two sidebands. Allowing for the distortion effects requires an additional increase of the A3H power by 0.6 dB and 1.4 dB at 70% and 100% modulation respectively. These values have been calculated for single-tone modulation, however, measurements carried out with weighted noise modulation have revealed that these values apply in good approximation also to a more complex modulating signal (Doc. 8/177).

5. Test signals for field-strength measurements

The choice by SOLAS of an unmodulated carrier as a reference in the A3 condition suggests that the same kind of signal may also be used for an A3H signal. In the case of A3A and A3J emissions, however, it is not practicable to measure the reduced and suppressed carrier, and in these cases measurement of the field set up by a single-tone modulated emission has been agreed upon.

6. Field-strength equivalences

In addition to the basic assumptions given in § 3, the following assumptions are valid for the calculation of the field-strengths of the test signals, as defined in § 5, of A3, A3H, A3A and A3J emissions received by different types of receivers equivalent to an A3 emission received by a DSB receiver of which the unmodulated carrier produces a field-strength of 25 µV/m at the receiver :

(a) For class of emission A3 the carrier is modulated by a single modulating tone to depths of 70% and 100% respectively.

Note.- It has to be borne in mind, however, that the A3 test signal is an unmodulated carrier; nevertheless, this assumed modulation is indispensable in order to arrive at the equivalent field-strengths for the other classes of emission.

(b) For class of emission A3H the sideband amplitude for a single modulating tone is 70% and 100% respectively of the carrier amplitude for equivalent 70% and 100% depths of modulation (the Note under Item (a) above applies similarly).

(c) For class of emission A3A the amplitudes of the sideband signals corresponding to 70% and 100% modulation are the same as those for A3H in Item (b) above but the carrier level is reduced to 16 dB below peak power corresponding to 100% modulation.

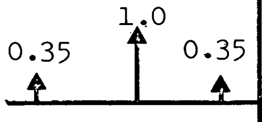
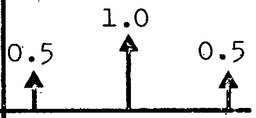
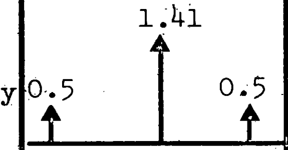
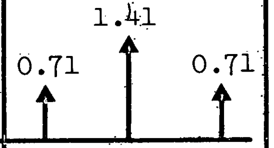
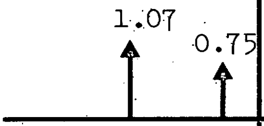
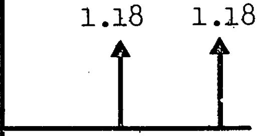
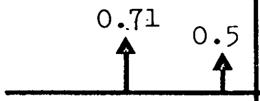
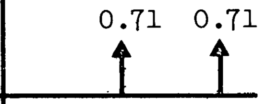
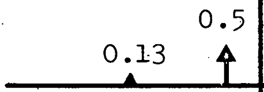
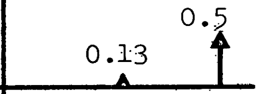
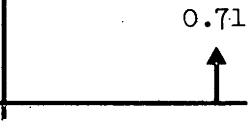
(d) For class of emission A3J the amplitudes of the sideband signals corresponding to 70% and 100% modulation are the same as those for A3H in Item (b) above but the carrier level is reduced by at least 40 dB below peak power corresponding to 100% modulation.

(e) Both the calculations for 70% and 100% modulation respectively are based upon the reference carrier (unmodulated) field-strength of 25 µV/m.

The table indicates the r.m.s. values of field-strength equivalences calculated on the above-mentioned assumptions for all combinations of classes of emission and methods of reception which are in use at present or might be conceivable in the future. This does, however, not imply that A3A and A3J emissions on 2 182 kHz will in any case replace A3 and A3H emissions prescribed in the Radio Regulations for this frequency. They have merely been included for the sake of completeness, since DECIDES 1 of Question 19/8 calls for their inclusion.

The spectra of the different modulated signals have been added in order to ease the calculations. They represent voltage or field-strength levels relative to the reference case of the A3 carrier signal to be received by a DSB receiver, which is taken to be 1.

In order to avoid a second table with mostly identical entries, this Table also includes the values of the corresponding transmitter peak envelope powers. These figures, however, can be disregarded in the context of this paragraph.

Class of emission	Method of reception	Type of test signal for field strength measurements	Spectrum for a depth of modulation of		r.m.s. field-strength(μV/m) of test signal for a depth of modulation of		Peak envelope power (watts) for a depth of modulation	
			70% LSB Carrier USB	100% LSB Carrier USB	70%	100%	70%	100%
A3 (SOLAS reference)	DSB	Carrier only			25.0	25.0	43.4	60.0
A3	SSB	Carrier only			35.4	35.4	86.7	120.0
A3H	DSB	Carrier only			26.8	29.4	49.7	83.2
A3H	SSB	Carrier only			17.7	17.7	21.7	30.0
A3A	SSB	Carrier and sideband			12.8	18.0	5.9	10.6
A3J	SSB	Sideband only			12.4	17.7	3.7	7.5

7. Peak envelope power equivalences

The calculated equivalent peak envelope powers into the aerial in order to achieve the field strengths given in para. 6 are contained in the Table of para. 6. These powers are in all cases based upon a modulated signal. They are valid irrespective of what type of modulating signal (i.e. single-tone, two-tone etc.) is employed, provided the same modulating signal is used. This follows directly from the general SSB/DSB system equivalences discussed in para. 4.

8. Interference potential

Although the problem of analysing interference capability is in general quite complex, under the specific circumstances and the emissions here being considered, the mean power of a signal has been found to quite accurately reflect its interference potential. From a qualitative assessment it follows that, irrespective of the kind of modulating signal used, the interference potential is appreciably reduced for A3A and A3J emissions. However, it was felt that even this does not necessarily call for a conversion of A3 and A3H emissions to A3A and A3J emissions on 2 182 kHz, because there are other important considerations not included in this Report.

Note.- The Director C.C.I.R. is requested to bring this Report to the attention of IMCO.

C.C.I.R.
XIIIth Plenary Assembly
GENEVA, 1974

Doc. 8/1064-E

STUDY GROUP 8

Study Group ..8.., in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration :

REPORT BD/8.

AUTOMATED VHF MARITIME MOBILE TELEPHONE SYSTEMS

(Question 23/8)

(1974)

1. In response to Question 23/8, one document, Doc. 8/280 (Sweden), was submitted to the final meetings of the C.C.I.R. Study Groups in February 1974. This document discusses the operational requirements of Automated VHF Maritime Mobile Telephone Systems.

2. Discussion of this document resulted in the following list of operational requirements :

2.1 The system shall use VHF channels according to Appendix 18 to the Radio Regulations.

2.2 The system shall be suitable for international use.

2.3 The automated VHF service shall as far as possible be compatible with other automated maritime services, e.g. a future maritime satellite communication service.

2.4 The system shall not restrict the use of channel 16 in the international maritime VHF safety service.

2.5 The operations of the system shall not degrade the quality of the existing manual services.

2.6 The system shall not necessitate modification of existing manual shipborne equipment.

2.7 The system shall not necessitate modification of existing manual shore equipment in those areas where an automatic service is not established.

2.8 The ship's automatic equipment **should be capable of operation** in areas where no automatic service is established.

2.9 The system **should not require any significant changes in the** existing telephone networks.

2.10 The system **should not preclude the possibility of utilizing** the same traffic channels for both the manual and automatic services in a given coverage area.

2.11 The system should be designed to provide ultimately for automatic operation in both directions but it shall be possible to implement the system in the ship-to-shore direction only.

2.12 The system **should permit transmission of charging information to** the ship for ship-to-shore calls.

2.13 The operation of the equipment on board **should be as simple as** possible and the operational procedures shall be as similar as possible to those used in the normal land telephone network.

2.14 The setting up of calls in the shore-to-ship direction **should as** far as possible be similar to the setting up of normal telephone calls. The system shall not require the party initiating the call to know the exact position of the ship to be called.

2.15 When designing the system special consideration should be given to the overall cost.

2.16 The reliability of signalling over the radio path should be of the same order as the reliability of the signalling in the land telephone network.

2.17 The signalling system chosen for the radio path shall, besides the basic signalling necessary in an automated telephone system, be flexible enough to provide for existing and future optional signalling requirements. *

3. The main objective of the C.C.I.R. studies should be to specify the signalling methods to be used on the radio path as well as the characteristics of the radio equipment itself.

4. The study of the characteristics of the interface with the land telephone networks should be coordinated with the C.C.I.T.T. It was noted that the C.C.I.T.T. Study Group XIII had started to study the possible inclusion of mobile stations in the World Numbering Plan. Other C.C.I.T.T. Study Groups may be involved as well.

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* Possible requirements may be :

- shipboard terminal mode and type switching (e.g., selection of telephone, facsimile or data transmission),
- onboard routing (PABX),
- automatic polling.

Note.- The Director, C.C.I.R., is requested to bring this Report to the attention of the C.C.I.T.T.

C.C.I.R.
XIIIth Plenary Assembly
Geneva, 1974

Doc. 1/1011-E

STUDY GROUP 1

Study Group 1, in accordance with § 2.7.2 of Resolution 24-2, presents the following Report to the Plenary Assembly for consideration :

REPORT 181-1* (Rev.74)

FREQUENCY TOLERANCE OF TRANSMITTERS

(Study Programme 40A/1)

(1963-1966-1974)

1. Introduction

Study Programme 40A/1 invites the C.C.I.R. to study further frequency tolerances with a view to achieving a more economical use of the radio-frequency spectrum; to predict what the ultimate values of these tolerances might be under currently known conditions of operation; to report upon the possibilities of achieving these ultimate values consistent with technical and economic considerations; and to indicate which of the currently specified tolerances have already achieved these ultimate values.

The greatest difficulty in adopting improved tolerances is the economic problem created by the large number of transmitters in operation and which were manufactured in accordance with existing tolerances. For this reason, and in accordance with Study Programme 40A/1, Table I has been prepared for certain categories of stations where it can be foreseen that improved tolerances are desirable and feasible for new equipment manufactured in the near future. The intention is to provide guidance for the manufacturer of new equipment so that, at some future date, improved tolerances may be adopted without serious economic injury, because of large amounts of equipment not able to meet the new tolerances.

2. Factors affecting frequency tolerances

The first consideration, with respect to the efficient use of the radio-frequency spectrum, is that the frequency space lost because of instability should be a small part of the necessary bandwidth used for communication. For purposes of illustration, the figure of ±1% of the representative bandwidth has been used to provide a guide to the value of frequency tolerances which may be acceptable from the standpoint of spectrum economy in each case.

Reduction in the frequency bandwidth, lost by instability, is not the only criterion with respect to conservation of radio spectrum. For example, in A3 broadcasting and in other forms of A3 emission, the tolerance should be small enough to reduce common channel interference caused by the beat note between off-frequency carriers. In radiotelephone single-sideband classes of emission, by a number of stations on a single frequency, the tolerance should be small enough to permit the suppression of the carrier and to provide good voice intelligibility without the readjustment of receivers.

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* This Report is submitted to the Maritime Conference at the request of Study Group 1.

There are certain categories of stations which should not be required to meet a strict tolerance for operational and administrative reasons. An example is mobile radar systems, where the administrative problem of rigid frequency assignments is now unnecessary and, from an operational standpoint, interference is reduced by permitting normal manufacturing tolerances to cause a distribution within the assigned bands.

The advantages of tighter frequency tolerances for transmitters cannot, in all cases, be fully realized unless corresponding improvements are made in receivers.

3. Form of the Table

Table I includes categories of stations with respect to which it is believed possible to make recommendations at the current state of development of technique. As studies continue under Study Programme 40A/1, it is hoped that additional categories of stations in additional frequency ranges may be added.

The purpose of the columns is discussed below :

(1) The frequency bands, category of station and class of emission.

(2) A value of necessary bandwidth regarded as representative.

(3) Tolerances which can be attained now or in the near future, taking into account economic and environmental factors. Such tolerances should not be adopted by an Administrative Radio Conference until new equipment, meeting these tolerances, has replaced a major portion of existing equipment.

(4) Ultimate tolerances which will be equal to, or less than ±1%, of the representative necessary bandwidth except in unusual circumstances. The choice of these values should take into account system advantages which would be available because of strict tolerances, for example, in A3 broadcasting and the A3J telephony service (see § 2 above). It is not necessary that the tolerances shown be obtainable in the foreseeable future.

TABLE I

Frequency bands and categories of stations	Representative value of necessary bandwidth of emission (kHz)	Tolerance achievable now, or in the near future (Hz)	Ultimate tolerance (Hz)
(1)	(2)	(3)	(4)
Band 535–1605 kHz			
Broadcasting stations	10	10	10
Band 1605–4000 kHz			
1. Fixed stations :			
A3	6	60	60
A3H-A3J	3	10	10
A3A-A3B	3–6	10	10
2. Land stations :			
A3	6	20	10
A3H-A3A-A3J	3	20	10
3. Mobile stations :			
(a) Ship stations : A3H-A3A-A3J	3	50	20
(b) Land mobile stations : A3H-A3J	3	50	20
(c) Aircraft stations : A3H-A3J	3	20	20
4. Broadcasting stations	10	10	10
Band 4–29·7 MHz			
1. Fixed stations :			
(a) Telephone network with several stations on a single frequency : A3A-A3J	3	10	10
(b) Other fixed stations	1·7 to 12	10	3

Frequency bands and categories of stations	Representative value of necessary bandwidth of emission (kHz)	Tolerance achievable now, or in the near future (Hz)	Ultimate tolerance (Hz)
(1)	(2)	(3)	(4)
2. Land stations :			
(a) Coast stations :			
A3H- A3A-A3J	3	10	10
A7A	3	3	3 (¹)
A1	0·1	100	100
Other than A1	1·7	17	17
(b) Aeronautical stations : A3H-A3J .	3	10	10
(c) Base stations : A3H-A3J	3	20	10
3. Mobile stations :			
(a) Ship stations : A3H- A3A-A3J . .	3	50	20
F1	0·2	10	10 (¹)
(b) Aircraft stations : A3H-A3J . . .	3	20	20
(c) Land mobile stations : A3H-A3J	3	50	20
4. Broadcasting stations	10	10	10
Band 29·7–108 MHz		(kHz)	(kHz)
1. Land stations (50 MHz)	16	1	
2. Mobile stations (50 MHz)	16	1	
3. Broadcasting FM stations	200	2	2
4. Television stations	6000	2·5 Hz (²)	2·5 Hz (²)
Band 108–470 MHz		(kHz)	(kHz)
1. Land stations :			
(a) Coast stations (156 MHz) . . .	16	1	
(b) Base stations (470 MHz)	16	1.5	0·36
2. Mobile stations :			
(a) Ship stations (156 MHz)	16	1.6	
(b) Land mobile stations (470 MHz)	16	2·5	
3. Television stations	6000	2·5 Hz (²)	2·5 Hz (²)

(¹) This tolerance is required for reception without automatic frequency control, for narrow-band frequency-modulation telegraph channels.

(²) The tolerance of the sound-channel carrier with respect to the visual carrier frequency is 1 kHz.

INTERNATIONAL TELECOMMUNICATION UNION
MARITIME CONFERENCE
GENEVA, 1974

Document No. 127-E
25 March 1974
Original : French

PLENARY MEETING

Algeria

PROPOSALS FOR THE WORK OF THE CONFERENCE

Item 1 of the Agenda

1. Basic principles for revision of the plan

1.1 The Allotment Plan contained in Appendix 25 MOD to the Radio Regulations originated in the Plan prepared by the Extraordinary Radio Conference held in Geneva, 1951.

Appendix 25 MOD in force at present owes its present form to two successive revisions (1959 and 1967) but the amendments made were of a minor nature and do not take due account of the changes which have taken place during the past two decades, such as the increase both in the number of Members of the Union and in their maritime telecommunication requirements, the evolution of world economic relationships, etc.

1.2 The Plan adopted by the 1974 Conference should reflect the changeover from double sideband to single sideband technique. The use of this latter technique will make it possible to double the capacity of the frequency bands allocated to the maritime radiotelephone service. Furthermore, the channels in Section III of Appendix 25 MOD represent an appreciable contribution, especially as they are not yet allotted.

Algeria considers that it is time to reconcile the new requirements caused by the changes mentioned above and the interests of existing services.

The Algerian proposal is based on two main principles :

a) equal rights to allotment for all present or future Members of the Union;

b) non-disturbances of existing services, as a function of the possibilities offered by the frequency spectrum allocated to the maritime radiotelephone service.

2. Outline of the Plan

2.1 Appendix 25 MOD comprises allotments (Sections I and II) and provisions concerning the new channels for maritime radiotelephony. According to "Considering" b) and "Resolves" 9 of Resolution Mar 15, these new channels are to be included in the plan to be adopted by the Conference. The Algerian proposal is to divide the Plan into two sections.

2.1.1 Section I of the Plan should confirm the principle of equal rights of present and future Members of the Union, and thus contain an equitable system for allotting all the channels.

In line with this principle, all channels in Section B of Appendix 17 should be allotted to all Members of the Union (two channels in each band per Member). The allotment should be made in such a way that all Members are afforded the same possibilities for using the channels, i.e. the same useful range. For this, a maximum permitted power in each band should be defined.

This maximum permitted power could be used by every Member of the Union. It would be defined as a function of the geographical distribution of the allotments so that a judicious compromise is obtained between useful range and probability of interference.

The allotments in this section and the assignments conforming to them should have the same date (designated below by the letter D) in column 2a of the Master Register regardless of the date when they are notified to the I.F.R.B.

In principle two channels should be reserved in each band for future Members of the Union so that they can be allotted according to a procedure defined in point 11 of our draft Resolution.

Section I would thus extend rights to the equitable use of the maritime radiotelephone service channels to all present and future Members of the Union.

2.1.2 The present stage of development of the maritime radiotelephone service in different countries is such that channel allotments in Section I of the Plan will not necessarily give rise to immediate assignments.

Pending notification of these assignments, the unoccupied allotments could be used provisionally by other Members of the Union, in the form of allotments under Section II of the Plan and according to criteria adopted by the Conference.

The I.F.R.B. should record these allotments and the assignments conforming to Section II with the date D + 1 day in column 2b of the Master Register.

2.1.3 An assignment made after the Conference and conforming to Section I would be recorded in the Master Register with date D in column 2a. Such an assignment would be entitled to protection from interference from any assignment not conforming to Section I.

2.1.4 Notifications of assignments not conforming to either section of the Plan would be treated in accordance with the procedure laid down in the Radio Regulations.

2.2 Section II would permit existing services to continue to function without problems but Section I would ensure that all Members of the Union have equal rights to organize their services in line with the development of their requirements.

3. Programme for elaborating Appendix 25 MOD 2 during the Conference

Algeria proposed the following programme of work to enable the Conference to elaborate and possibly adopt the text of Appendix 25 MOD 2 :

3.1 The Conference should designate in each of the bands (8, 12, 16 and 22 MHz) the two channels to be kept in reserve for future Members of the Union. These two channels would be selected, for practical reasons, from those in Section III of Appendix 25 MOD. In the 4 MHz band the one traffic channel in Section III should be reserved for the same purpose until other possibilities are made available by a competent Conference.

3.2 Members of the Union with assignments conforming to Section I of Appendix 25 MOD should make known to the Conference on its th day a preference in each band for two channels defined in Appendix 17, Section B with a view to a corresponding allotment being made in Section I of the future plan.

3.3 Members of the Union with no assignment and those with no assignments corresponding to all the allotments provided for in Section I should inform the conference on its th day whether they intend to notify all or some of the assignments in question by 1 January 1975 at the latest. In the absence of such communications, these Members would subsequently follow the procedure defined by the Radio Regulations.

3.4 The I.F.R.B. would prepare, together with the Members of the Union, on the th day of the Conference, a draft Section I of Appendix 25 MOD 2 based on the principles and criteria mentioned above.

3.5 Section II of Appendix 25 MOD 2 would contain :

a) the unassigned allotments of Section I for which no intention of notification has been expressed (see 3.3 above);

b) the channels reserved for future Members of the Union.

The I.F.R.B. would present .... days before the date planned for signature of the Final Acts a draft Section II prepared in accordance with the criteria adopted by the Conference.

ALG/127/1 4. Draft Resolution Mar ..... relating to the application of Appendix 25 MOD 2 of the Radio Regulations and the recording of the resulting allotments and assignments in the Master Register

The World Administrative Radio Conference for Maritime Mobile Telecommunications, Geneva (1974) :

Considering

a) that the Frequency Allotment Plan for coast radiotelephone stations operating in the exclusive maritime mobile bands between 4 000 and 23 000 kHz adopted by this Conference and appearing in Appendix 25 MOD 2 replaces the Plan in Appendix 25 MOD;

b) that Appendix 25 MOD 2 contains amendments to Appendix 25 MOD due particularly to the changeover of double sideband allotments to single sideband allotments and to the distribution of the channels allotted to Members of the Union;

c) that the Master Register will have to be brought up to date;

d) that the entries of allotments and assignments already in the Master Register will have to be made to conform to Appendix 25 MOD 2;

e) that frequency assignments not conforming to Appendix 25 MOD 2 should be modified without delay so as to benefit as soon as possible from the advantages of the changes introduced;

f) that assignments notified in accordance with Section I of the Plan and corresponding to the intentions expressed by Members during the Conference should be entered in the Master Register;

Resolves

1. that on 1 January 1975 at the latest Members with assignments in the Master Register shall notify to the I.F.R.B. the amendments to these assignments which will make them conform to Sections I and II of the Allotment Plan;

2. that Members who have announced to the Conference their intention to notify new assignments conforming to Section I of the Plan should do so by 1 January 1975 at the latest. Members shall also notify, by the same date, assignments concerning channels allotted to them by the Conference in Section II of the Plan;

3. that thirty days after this date the Board shall send to Members who have not notified the assignments mentioned in paragraphs 1 and 2 above an extract from the Master Register showing the pertinent entries and the allotments under their name in Sections I and II of Appendix 25 MOD 2 and remind them of the provisions of this Resolution;

4. that the Board shall apply, as from the date of signature of the Final Acts of the Conference, the provisions of Appendix 25 MOD 2 when examining any notice covered by No. 542 of the Radio Regulations. When recording any amendment or new assignment in the Master Register, the Board shall enter a symbol in the Remarks column opposite that frequency indicating that the entry was made before the date of entry into force of the provisions adopted by this Conference. However, it shall take account of paragraph 9 of this Resolution when recording the date in column 2;

5. that the Board shall publish, three months before the date of entry into force of the new provisions adopted by the Conference, a supplement to the List of Coast Stations containing the modifications and new assignments notified by Member countries before 1 March 1975;

6. that a 0001 GMT on 1 July 1975, the date of entry into force of the revised provisions of the Radio Regulations, Members shall apply the amendments notified in accordance with paragraph 1 with a view to the application of Appendix 25 MOD 2;

7. that on 1 July 1975, the Board shall make the entries in the Master Register made in accordance with 2.1c) of Resolution No. 1 conform to Appendix 25 MOD 2;

8. that on 1 July 1975 the Board shall change the pertinent date in column 2 of the Master Register for assignments already entered which conform to Appendix 25 MOD 2 and shall delete the symbol in the Remarks column opposite assignments notified in accordance with paragraph (4);

9. that the I.F.R.B. shall enter the date D + 2 in column 2b opposite any assignment entered in the Master Register on the date of signature of the Final Acts of the Conference which still does not conform to Appendix 25 MOD 2 on 1 March 1975;

10. that if a new Member accedes to the Union, the Board shall record as an allotment in its name in the Master Register the reserve channels of Appendix 25 MOD 2;

11. that from 1 July 1975 Resolutions Mar 11 and Mar 15 shall be annulled.

5. Proposed modifications to the Radio Regulations

ALG/127/2 MOD 491 Spa2

§ 3. (1) Whenever practicable, each notice should reach the Board before the date on which the assignment is brought into use. It must reach the Board not earlier than ninety days before the date on which it is to be brought into use, but in any case not later than thirty days after the date it is actually brought into use. However, for a frequency assignment to one of the terrestrial stations mentioned in Sub-Section IIB of this article or in No. 639AQ, the notice must reach the Board not earlier than three years and not later than ninety days before the date on which the assignment is to be brought into use. In addition, a frequency notice in conformity with an allotment in Section I of Appendix 25 MOD 2 should reach the Board not earlier than one year and not later than sixty days before the date on which the frequency assignment in question is brought into use.

ALG/127/3 ADD 492H

A frequency assignment relating to an allotment in Section I of Appendix 25 MOD 2 which is notified to the Board after the deadline specified in No. 491 before the date of entry into use can claim the protection provided for in the Radio Regulations only sixty days after its receipt by the Board.

Reasons : The above two amendments are designed at allowing the Administrations concerned and the I.F.R.B. at least sixty days before the assignment is brought into use to proceed with the coordination described in the proposal concerning Nos. 543A and 543B.

ALG/127/4 ADD 543A

In cases to which No. 543 applies the Board shall automatically examine the notice to see whether it is likely to be affected by harmful interference caused by :

a) an assignment with a date in column 2b of the Master Register if the notice in question corresponds to Section I of Appendix 25 MOD 2;

b) an assignment not in conformity with the Allotment Plan if the notice in question corresponds to Section II of Appendix 25 MOD 2.

ALG/127/5 ADD 543B If the finding is unfavourable with respect to No. 543A the Board shall communicate it without delay to Administrations whose assignments are likely to cause interference as well as to the notifying Administration. At the same time it shall propose measures to be taken by the Administrations concerned to ensure protection of the notified assignment in accordance with Nos. 607 and 608 of the Radio Regulations.

If the proposed amendments are made or if an agreement is reached between all the Administrations concerned not later than ninety days after the new assignment is brought into service Administrations shall so inform the Board by appropriate notices. The assignments thus notified shall keep their initial dates in column 2 of the Master Register.

If the necessary amendments are not made to an assignment likely to cause interference within the period indicated, the initial assignment is retained and a remark stating that the amendment has been requested but not carried out is entered in column 13c.

ALG/127/6 MOD 544 (4) If a notice relates to an amendment to an assignment in conformity with an allotment in Section I or Section II of the Allotment Plan, which is only a change in the characteristics (including the frequency) of the emission of a radiotelephone coast station, without extending the necessary bandwidth beyond the upper or lower limits of the band provided ~~for double-sideband emissions~~ in accordance with the Table in Appendix 17 (Sections B and C) and provided that no harmful interference results, the original assignment shall be amended according to the notice. The date to be entered in Column 2a or 2b shall be that determined according to the relevant provisions of Section III of this Article.

ALG/127/7 MOD 545 (5) In the case of a notice which is not in conformity with the provisions of Nos. 542 or 544, the Board shall examine this notice with respect to the probability of harmful interference to the service rendered by a radiotelephone coast station for which a frequency assignment :

a) is in conformity with one of the allotments in Section I or II of the Plan and is already recorded in the Master Register or may be so recorded in the future; or

b) was recorded in the Master Register on a frequency specified in Appendix 17 (Section B) as a result of a favourable finding with respect to Nos. 544 or 545; or

c) was recorded in the Master Register on a frequency specified in Appendix 17 (Section B) after an unfavourable finding with respect to Nos. 544 or 545, but has not, in fact, caused harmful interference to any frequency assignment to a radiotelephone coast station previously recorded in the Master Register.

ALG/127/8 MOD 548 (2) The Board shall examine each notice covered by No. 547 to determine whether the notified assignment corresponds to a frequency associated, according to Appendix 17 (Section B), with a frequency allotted to the notifying administration under Section I or Section II of the Allotment Plan contained in Appendix 25 to these Regulations.

ALG/127/9 MOD 550 (4) Where a notice relates to an amendment to an assignment of a frequency which is associated, according to Appendix 17 (Section B), with a frequency allotted to the notifying administration under Section I or Section II of the Plan, and this amendment is only a change in the characteristics (including the frequency) of the emission of radiotelephone ship stations, without extending the necessary bandwidth beyond the upper or lower limits of the band provided ~~for double sideband emissions~~ in accordance with the Table in Appendix 17 (Section B), and provided that the probability of harmful interference is not inversed the original assignment shall be amended according to the notice. The date to be entered in Column 2a or 2b shall be that determined according to the relevant provisions of Section III of this Article.

ALG/127/10 MOD 580 (4) For all other cases referred to in No. 541, the relevant date (see Nos. 510, 514, 515, 518, 533 and 534) shall be entered in Column 2b ~~(see Nos. 510, 514, 515, 518, 533 and 534~~).

ALG/127/11 MOD 581 (5) For assignments to station other than radiotelephone coast stations, the relevant date (see Nos. 510, 514, 515, 518, 533 and 534) shall be entered in Column 2b ~~(see Nos. 525, 526, 530 and 531)~~.

ALG/127/12 MOD 586 (5) For assignments other than assignments of frequencies for reception by radiotelephone coast stations, the relevant date (see Nos. 510, 514, 515, 518, 533 and 534) shall be entered in Column 2b ~~(see Nos. 525, 526, 530 and 531)~~.

ALG/127/13 MOD 608 (2) Any frequency assignment which bears a date in Column 2b is recorded in the Master Register in order that administrations may take into account the fact that the frequency assignment concerned is in use. This recording shall not give the right to international protection to the frequency assignment concerned, except as provided for in No. 502, sub-paragraph 2). However, such an assignment cannot claim protection from any assignment, even made subsequently, which bears a date in column 2a or 2b and which conforms to Appendix 25 MOD 2.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Corrigendum No. 1 to
Document No. 128-E
3 May 1974
Original : English

PLENARY MEETING

German Democratic Republic

PROPOSALS FOR THE WORK OF THE CONFERENCE

Proposal in connection with Agenda Item 3.9

Replace the proposal under this heading by the following :

ARTICLE 36

Section VIIIA

Emergency position-indicating radiobeacon signals

DDR/128/5 MOD 1476B (a) for medium frequencies, i.e. 2 182 kc/s[1]

[1] a keyed emission modulated by a tone of 1 300 cycles per second, and having a ratio of the period of the emission to the period of silence equal to or greater than one, and an emission duration between one and five seconds; this signal is only permitted until 1 January 1980.

Reasons : 1) It is felt that radiobeacon signals should be able to activate radiotelephone auto alarms. Consequently only the signal specified in No. 1476C should be used.

2) There is an urgent need for unification of the characteristics of radiobeacon signals.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 128-E
2 April 1974
Original : English

PLENARY MEETING

German Democratic Republic

PROPOSALS FOR THE WORK OF THE CONFERENCE

Proposal in connection with Agenda, Item 3

The provisions concerning distress and safety in the Maritime Mobile Service

DDR/128/1	MOD	201 Mar	The frequency 2 182 ~~kc/s~~ kHz is the international distress ~~and calling~~ frequency for radiotelephony. The conditions for the use of the band 2 170-2 194 ~~kc/s~~ kHz are prescribed in Article 35.
DDR/128/2	ADD	201A Mar	The frequency 2 191 kHz is the international calling frequency for radiotelephony.
DDR/128/3	MOD	1226 Mar	a) the carrier frequency ~~2 182 kc/s~~ 2 191 kHz;
DDR/128/4	SUP	1227A Mar	

The Associated Nos. of the Radio Regulations should be changed accordingly.

Reasons : The efficiency of the frequency 2 182 kHz as the international distress frequency will be increased by providing for the call, after a certain period of time, the international calling frequency 2 191 kHz, on a world-wide basis.

Proposal in connection with Agenda, Item 3.9

The use of portable devices on lifeboats and other survival craft

DDR/128/5 SUP 1476B a) 1)

and introduce changes, resulting therefrom, in the Radio Regulations.

Reasons : By means of the one-tone signal of 1 300 Hz produced by the emergency position-indicating radiobeacons it is not possible to start operation of the radiotelegraph auto alarm, as defined in the revised version of the International Convention for the Safety of Life at Sea.

Proposal in connection with Agenda, Item 10

Problems relating to the maritime services operating in the bands between 1 605 kHz and 3 800 kHz including the future assignment of the single sideband channels derived from the present double sideband coast and ship station assignments

DDR/128/6

In Article 7, No. 442 Mar, and Article 32, No. 1138 Mar, of the Radio Regulations unambiguous provision should be included with a view to indicate the classes of emission admitted for use on specified frequencies (channels) for the mobile maritime service in the bands between 1 605 and 3 800 kHz.

The German Democratic Republic proposes that necessary investigations be carried out by competent organs of the I.T.U.

Reasons : A precise and uniform distribution of channels in all Regions is a prerequisite for ensuring an effective and free of interference operation of radio services in the frequency range between 1 605 and 3 800 kHz.

In this connection, the classes of operation should be determined.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 129-E
2 April 1974
Original : English

PLENARY MEETING

German Democratic Republic

PROPOSALS FOR THE WORK OF THE CONFERENCE

Request in connection with
Agenda, Item No. 1 : The revision on the basis of single sideband operation of the Frequency Allotment Plan for HF radiotelephone coast stations covering the channels in the present Appendix 25 and the additional channels made available by the 1967 Maritime Conference

Comments

To ensure smooth operation of HF-radiotelephone services, at present and in future, it is considered necessary that in the course of revision of the Frequency Allotment Plan for Coast Radiotelephone Stations operating in the Exclusive Maritime Mobile Bands between 4 000 and 23 000 kHz (Appendix 25 MOD) the following carrier frequencies should be allotted to the Administration of the German Democratic Republic.

Series No.	Carrier frequency/kHz	Series No.	Carrier frequency/kHz
19	4 419.0	9	4 387.0
20	4 422.2	10	4 390.2
19	8 786.4	5	8 741.6
20	8 789.6	6	8 744.8
19	13 172.0	9	13 137.0
20	13 175.5	10	13 140.5
19	17 318.0	9	17 283.0
20	17 321.5	10	17 286.5
19	22 688.5	9	22 653.5
20	22 692.0	10	22 657.0

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 130-E(Rev.1)
30 May 1974
Original : French

COMMITTEE 5

Czechoslovak Socialist Republic

FREQUENCY REQUIREMENTS TO BE MET WHEN REVISING APPENDIX 25 MOD TO THE RADIO REGULATIONS

The frequency requirements of the Czechoslovak Administration contained in Document 130 and Addendum No. 1 thereto, were very modest.

In view of the overloading of frequency bands and the serious diminution of effective sharing possibilities resulting from the excessive number of requests submitted to the Conference, we feel obliged to revise our frequency requirements as follows :

SSB radiotelephone channel requirements

Band (MHz)	4	6	8	12	16	22
Number of channels	2	1	2	2	2	2

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Addendum 1 to
Document No. 130-E
24 April 1974
Original : French

PLENARY MEETING

Czechoslovak Socialist Republic

PROPOSALS FOR THE WORK OF THE CONFERENCE

The frequency requirements indicated in Document No. 130 represent the new requirements for the Prague station which will be put into service in the very near future.

Apart from this station, now under construction, the Bratislava coast station, belonging to another Czechoslovak shipping undertaking whose vessels navigate on the Danube, the Black Sea and the Mediterranean, has existed for a long time past. This station has three frequencies for SSB radiotelephony in the 4, 8 and 13 MHz bands. These assignments appear in the International Frequency List.

They are :

assigned frequency : 4 398 kHz 8 762.2 kHz 13 127.9 kHz
carrier frequency : 4 396.6 kHz 8 760.8 kHz 13 126.5 kHz

The above-mentioned existing assignments should continue to be assigned to the Bratislava coast station.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 130-E
2 April 1974
Original : French

PLENARY MEETING

Czechoslovak Socialist Republic

FREQUENCY REQUIREMENTS TO BE TAKEN INTO ACCOUNT WHEN REVISING APPENDIX 25 MOD TO THE RADIO REGULATIONS

The Praha coast station, which will be set up and brought to service in the very near future to provide direct links between the Czechoslovak shipping enterprise and Czechoslovak seagoing vessels, will require the following single sideband radiotelephone channels :

Band (MHz) :	4	6	8	13	17	22
Number of channels :	1	1	1	1	1	1

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 131-E
2 April 1974
Original : Spanish

PLENARY MEETING

Bolivia

HF RADIOTELEPHONY FREQUENCY REQUIREMENTS TO BE TAKEN INTO ACCOUNT WHEN REVISING APPENDIX 25 MOD TO THE RADIO REGULATIONS

Bands in MHz	4	6	8	13	17	22
Number of single sideband channels	2	2	2	1	1	1

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 132-E(Rev.1)
17 May 1974
Original : French

COMMITTEE 5

Bulgaria (People's Republic of)

REVISION OF APPENDIX 25 MOD

Frequency requirements :

Band (MHz)	4	6	8	13	17	22
Number of channels	3	3	3	3	3	3

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 132-E
2 April 1974
Original : French

PLENARY MEETING

Bulgaria (People's Republic of)

REVISION OF APPENDIX 25 MOD

Frequency requirements :

Coast stations		Country	Power kw. A3A Class of emission A3J	Remarks
Carrier frequencies kHz	Assigned frequency kHz			
4 418.6	4 430.0	BUL	5	
6 521.8	6 523.2	BUL	5	
8 770.4	8 771.8	BUL	5	
13 133.5	13 134.9	BUL	5	
17 272.5	17 273.9	BUL	5	
22 664.0	22 665.4	BUL	5	

Document No. 133-E
2 April 1974
Original : French
English
Spanish

PLENARY MEETING

Note by the Secretary-General

IMPLEMENTATION OF THE FREQUENCY ALLOTMENT PLAN CONTAINED IN SECTIONS I AND II OF APPENDIX 25 MOD TO THE RADIO REGULATIONS, GENEVA (1968 EDITION). (FREQUENCY BANDS BETWEEN 4 000 AND 23 000 kHz ALLOCATED EXCLUSIVELY TO THE RADIOTELEPHONE MARITIME MOBILE SERVICE)

Annexed hereto is a copy of a memorandum prepared by the International Frequency Registration Board for submission to the Maritime Conference.

M. MILI
Secretary-General

Annex : 1

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ANNEX

MEMORANDUM BY THE INTERNATIONAL FREQUENCY REGISTRATION BOARD

Implementation of the Frequency Allotment Plan contained in Sections I and II of Appendix 25 MOD to the Radio Regulations, Geneva (1968 edition). (Frequency bands between 4000 and 23,000 kHz allocated exclusively to the Radiotelephone Maritime Mobile Service)

1. Introduction

The Frequency Allotment Plan for HF coast radiotelephone stations which is contained in Sections I and II of Appendix 25 MOD was originally adopted by the Extraordinary Administrative Radio Conference held in Geneva in 1951. This Plan, based on the use of double sideband technique, was revised by the Administrative Radio Conference held in Geneva in 1959 when the spacing between channels was reduced from 7 kHz to about 6.3 kHz and an additional channel was created to satisfy new requirements which had arisen. As a result of this rearrangement, the frequencies allotted in the revised Plan adopted by the Administrative Radio Conference, Geneva, 1959, were slightly different from those in the 1951 Plan and they were changed again by the World Administrative Maritime Radio Conference, Geneva, 1967, in Resolution No. Mar 11 (see Document No. 102). It is these new frequencies which are shown in Sections I and II of Appendix 25 MOD to the Radio Regulations to which a Section III, established in accordance with Resolution No. Mar 15, was added. The contents of Section III are dealt with in a separate report (see Document No. 107). The present memorandum therefore deals mainly with matters relating to Sections I and II of Appendix 25 MOD.

2. Implementation of the Frequency Allotment Plan for HF coast radiotelephone stations, Sections I and II of Appendix 25 MOD

2.1 At 31 December 1973, the progress achieved in implementing the Allotment Plan may be summarized essentially by the data entered in the following Table (Table A) and relating both to Sections I and II of the Plan. Generally speaking, it may be deduced from these data that about 87% of the allotments in the Plan have been brought into use, that is, a very large proportion.

2.2 Table B gives in a summarized form the situation, as of 31 December 1973, of frequency assignments not in conformity with the Plan, which were entered in the Master Register.

Entries in accordance with Sections I or II of the Plan

Table A

Band (MHz)	Number of allotments in the Plan	Number of countries (No. of symbols)	Number of allotments brought into service	Number of countries (No. of symbols)	Number of assignments in conformity with the Plan	Number of allotments not brought into service	Number of countries (No. of symbols)	Total
4	137	93	120	79	472	17	15	
8	145	102	125	85	442	20	17	
12	108	77	91	61	307	17	16	
16	75	53	68	48	178	7	5	
22	46	30	41	26	134	5	4	
Total	511	104	445	91	1533	66	26	

Note: This table does not include the few assignments which correspond to Plan allotments but certain characteristics of which do not conform with those specified in the Plan.

Entries not in conformity with Sections I or II of the Plan

Table B

Band (MHz)	Number of assignments on behalf of countries with allotments		Number of countries (No. of symbols)	Number of assignments on behalf of countries without allotments		Number of countries (No. of symbols)	Total
	Favourable finding *	Unfavourable finding		Favourable finding *	Unfavourable finding		
4	127	157	36	73	61	29	
8	88	150	36	21	57	24	
12	55	130	22	16	50	20	
16	42	130	16	5	58	16	
22	48	67	14	15	73	19	
Total	360	634	43	130	299	45	

* Including frequency assignments notified after implementation of the provisions of Note 2 of Appendix 25 MOD.

3. Processing of frequency assignment notices for HF coast radiotelephone stations

3.1 Under Article 9 of the Radio Regulations, frequency assignments in conformity with the allotments in Section I of the Plan in Appendix 25 MOD carry the date of 3 December 1951 in Column 2a of the Master International Frequency Register (Nos. 578 and 579 of the Radio Regulations) and are entitled to international protection from harmful interference by virtue of No. 607 of the Radio Regulations.

3.2 Assignments in conformity with the allotments in Section II of the Plan carry the date of 4 December 1951 in Column 2b (Nos. 578 and 579 of the Radio Regulations). Frequency assignments not in conformity with allotments in the Plan carry the date of receipt by the Board of the assignment notice in Column 2b (No. 580 of the Radio Regulations). The extent of their right to international protection in case of harmful interference is specified in No. 608 of the Radio Regulations and, when they operate outside the channels listed in Appendix 17 to the Radio Regulations, they are under obligation not to cause harmful interference to assignments which are in conformity with that Appendix.

3.3 The Board examines each assignment notice of this kind with respect to the probability of harmful interference under the terms of No. 545 of the Radio Regulations, using the I.F.R.B. Technical Standards and according to the methods laid down in Chapter G of the I.F.R.B. Rules of Procedure. In brief, the result of the technical examination, on which the finding is based, depends on the extent of the reduction of the service area of coast stations already recorded in the Master Register, or likely to be recorded in future in accordance with an allotment in the Plan, because of the frequency use newly notified.

3.4 It should be pointed out here that the congestion in the channels listed in Appendix 17 is such that in most recent cases the Board has reached an unfavourable finding on new frequency assignments except in certain instances where stations using very low power are situated in regions of the world remote from the busy shipping routes.

3.5 So far as notices of frequency assignments which are not in conformity with allotments in the Plan are concerned, before applying the pertinent provisions of Article 9 of the Radio Regulations (Nos. 541 to 546 and 577 to 580), the Board attempted, where appropriate, to induce administrations to notify frequencies that were in conformity with Appendix 17 to the Radio Regulations. It stressed that such action was in these administrations' own interest, pointing out that by virtue of paragraph 9 of Appendix 17 and No. 545 of the Radio Regulations assignments which are not in conformity with Appendix 17 were not taken into consideration when the Board examined notices with respect to the probability of harmful interference. A number of assignments involving frequencies not in accordance with Appendix 17 to the Radio Regulations, however, were recorded in the Master Register as a consequence of entries made prior to 1 May 1961: such entries had been transferred on that date to the Master International Frequency Register under Resolution No. 1 of the Administrative Radio Conference held in Geneva in 1959 (see Annexes 3 and 4 to that Resolution). The Board asked the administrations concerned, when making the frequency changes required by Resolution No. Mar 11, to take the opportunity to bring these assignments into line with Appendix 17. In most cases the Board's suggestions were followed.

4. Processing of notices relating to single sideband emissions

4.1 As from 1 January 1972, double sideband emissions shall have ceased at all HF coast radiotelephone stations and have been replaced by single sideband emissions in pursuance of Resolution No. Mar 6 of the Maritime Conference, Geneva, 1967. As mentioned in another report on the matter (see Document No. 108), since that date the Board has considered entries for such stations showing A3 class of emission in Column 7 of the Master Register as no longer in conformity with the Radio Regulations. It therefore drew the attention of administrations to the need to change the entries appearing on their behalf in the Master Register to indicate that the single sideband technique had been introduced. The notices of these changes received by the Board were dealt with in accordance with No. 534 or 544 of the Radio Regulations; that is, provided the notices showed no change in the basic characteristics of the assignment other than a change of frequency, the new entry or entries entailed retained the dates inserted opposite the previous entry relating to double sideband emissions. In many cases, the action taken by administrations consisted in splitting the channel formerly occupied by double sideband emissions into two single sideband channels.

4.2 In the case of single sideband radiotelephone transmissions with reduced or suppressed carrier (A3A or A3J) the Board considers that, from the point of view of harmful interference which may be caused by such emissions, an assignment is in conformity with an allotment under Sections I or II of Appendix 25 MOD if the value of the notified peak power does not exceed four times that of the mean power entered for class of emission A3 in Column 3 of the said Appendix, in respect of the allotment concerned.

5. I.F.R.B. assistance sought by administrations, in accordance with Note 2 of Appendix 25 MOD, in choosing additional frequencies

5.1 In Note 2 of Appendix 25 MOD to the Radio Regulations, the Administrative Radio Conference held in Geneva in 1959 recommended that when countries brought additional frequencies into use, the assistance of the I.F.R.B. should be requested "so as to avoid harmful interference to assignments which are in conformity with the Allotment Plan". In fact, those provisions were already included in the Radio Regulations preceding those adopted in 1959.

5.2 Since 1 May 1961 (date of entry into force of the revised Plan) 17 countries have sought the assistance of the I.F.R.B., which suggested the use of 55 additional frequencies corresponding to 69 assignments. These 69 frequency assignments can be broken down as follows:

a) 60 frequency assignments (on behalf of 13 countries) were suggested by the I.F.R.B. to countries with allotments in the Plan;

b) 9 frequency assignments (on behalf of 4 countries) were suggested by the I.F.R.B. to countries without allotments in the Plan.

5.3 Whenever an administration asked for its assistance, the Board examined all of the information available on frequency use. It did not hesitate in several instances to discuss with the requesting administration the extent of their proposed frequency assignments bearing in mind the narrowness of each of the frequency bands available; in such cases it usually secured some reduction of the original requirement, 5.4 With regard to the implementation of the provisions of Note 2 it is to be noted that, when the Board receives a frequency assignment notice which is not in conformity with Section I or II of Appendix 25, it examines the notice in accordance with Article 9 of the Radio Regulations to ascertain the probability of harmful interference to the assignments and allotments already entered in the Master Register. On the other hand, when it receives a request pursuant to Note 2 to Appendix 25, the Board examines the frequencies it is considering suggesting to the administration concerned, not only from the point of view of the harmful interference their use might cause, but also to ascertain whether they themselves might suffer harmful interference from the allotments or assignments already recorded in the Master Register. It considers that it is its duty to ensure that the administration concerned will be able to use the frequencies suggested in a reasonably satisfactory manner. In submitting its suggestions, moreover, the Board has always recommended that the administration concerned should take the necessary precautions when it found that some probability of mutual harmful interference was evident. It urged the administration to do everything possible, before notifying the frequency assignments suggested, to make sure by monitoring or even trial usage that there was little risk of mutual harmful interference to coast stations already recorded in the Master Register.

5.5 It should be pointed out, however, that the requests for assistance submitted to the Board in the last five or six years have been much more difficult to satisfy because they came mainly from countries in the Europe-Mediterranean area where, because of the large number of coast stations and the density of radiotelephone traffic, the congestion problems that arise in the part of the frequency spectrum concerned are particularly hard to solve. In all these cases, the Board found that it was not a question of satisfying new requirements but of coping with an increase in the radiotelephone traffic of the country's Maritime Mobile

Service. It therefore tried to determine which of the channels in Appendix 17 were used by countries with a volume of maritime traffic which may be relatively low and hence were most likely to offer time-sharing possibilities so that the pressure on the main frequencies of the requesting country during the peak traffic periods of its coast stations could be relieved. The Board's recommendations were thus always accompanied by the proviso that the use of the frequencies it suggested should first be coordinated on a time-sharing basis with the other administrations on whose behalf entries had already been made in the Master International Frequency Register. Given the small number of channels available in each frequency band, the density of radiotelephone maritime traffic and the large number of coast stations belonging to different administrations, the Board is convinced that prior coordination among user countries is the essential prerequisite of any attempt to ensure the most rational and efficient use of the radiotelephone channels allocated in this part of the spectrum to the Maritime Mobile Service.

5.6 The Board has also found that, since the cessation of double sideband emissions, sharing possibilities are more favourable, on the whole, for assignments in the lower half of the former double sideband channels. In studies of this nature, therefore, it has concentrated its research mainly on these portions of the frequency spectrum.

5.7 It appears that, generally speaking, the frequency assignments suggested by the Board have satisfied requirements to a reasonable extent.

6. Complaints of harmful interference

6.1 Complaints submitted to the Board of harmful interference between coast radiotelephone stations were comparatively few. Recently, however, action by the Board has been requested on several occasions by administrations under No. 717 of the Radio Regulations on the ground that one or more of their HF coast radiotelephone stations sharing frequencies with other coast stations were unable to route their traffic over a particular frequency because it was never available.

6.2 The Board therefore examined each of these cases within the framework of Nos. 623 and 627 of the Radio Regulations. After assembling all available information, it found that the frequency in question was indeed continuously occupied by one coast station which, when it was not in communication with a ship station, transmitted signals, particularly its call sign, without interruption. This method of working prevents the other coast stations to which the same frequency is assigned on a time-sharing basis from routing their traffic over that frequency.

6.3 The Board concluded that notwithstanding the provisions of No. 1214 of the Radio Regulations this method of operation abusively used, was not in conformity with the Radio Regulations, particularly No. 693, taking into account in particular the fact that the Plan was essentially based on the time-sharing of frequencies. It therefore contacted the administrations concerned in accordance with No. 628 of the Radio Regulations, requesting them to see to it that the coast station refrained from making unnecessary transmissions so that the other coast stations using the same frequency might handle their traffic in normal conditions.

6.4 Other cases of interference brought to the Board's attention were due to stations of services other than the Maritime Mobile Service. The Board intervened on each occasion, basing itself particularly on Resolution No. Mar 9 of the World Administrative Maritime Radio Conference, Geneva, 1967.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 134-E
2 April 1974
Original : English

PLENARY MEETING

Papua - New Guinea

FREQUENCY REQUIREMENTS

Telegram dated 22 March 1974 from the Director, Posts and Telegraphs, Port Moresby :

"Have assumed control of frequency management in Papua - New Guinea from 1 December 1973. Prior to this date this was done by Australia.

At forthcoming WARC Papua - New Guinea wishes to be allocated for maritime services all existing used frequencies as listed in I.T.U. List of Coast Stations and additionally two new frequencies for the coast stations one in the 8 MHz and one in the 12 MHz band for radio telegraphy.

Formal application for these new frequencies to I.F.R.B. will be made in due course. Regards

Carter, Director POSTGEN ne 22119
Port Moresby"

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 135-E
3 April 1974
Original : French

Memorandum by the Secretary-General

CONVENING OF THE CONFERENCE

1. The World Administrative Radio Conference to deal with Matters Relating to the Maritime Mobile Service (Geneva, 1967) recommended in its Recommendation No. Mar 6 :

1. that a World Administrative Radio Conference be convened :

   1.1 to establish on the basis of single sideband operation a new Frequency Allotment Plan for high-frequency radiotelephone coast stations, covering the channels in the present Appendix 25 as well as the new channels referred to in f) above;

   1.2 to amend the associated provisions of the Radio Regulations;

2. that such a conference be convened in 1973;

3. that the Administrative Council determine the exact date and place of such a conference, in accordance with No. 64 of the International Telecommunication Convention, Montreux, 1965;

4. that this conference be preceded by a preparatory meeting, in accordance with No. 73 of that Convention.

2. At its 25th Session (1970), the Administrative Council considered the question of coordinating the dates of conferences and meetings of the Union; it decided after consulting the Members of the Union, that the Maritime Conference should be held at the beginning of 1974 and that the work of the preparatory meeting referred to in Recommendation No. Mar 6 should be replaced by studies carried out by the I.F.R.B. and the competent C.C.I.R. Study Groups (Resolution No. 678).

3. At its 26th Session (1971), the Administrative Council instructed the Secretary-General to request administrations to send him their views on the contents of the agenda of this Conference and any other suggestions for the inclusion of particular items in that agenda.

4. At its 27th Session (1972), the Administrative Council examined the replies of administrations to the Secretary-General's inquiry. It also took note of a draft recommendation prepared by the Radiocommunications Sub-Committee of I.M.C.O. containing a list of items which it thought the Maritime Conference should consider.

The Council then drew up a provisional agenda for the Conference, to which it annexed a non-exhaustive list of items to be considered.

After that agenda had been approved by the Members of the Union, it was included in Administrative Council Resolution No. 704. It is further stated in that Resolution (which is reproduced in Document No. 1 of the Conference) that the Conference shall meet on 22 April 1974 for a period not in excess of seven weeks.

M. MILI

Secretary-General

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Corrigendum to
Document No. 136-E
18 April 1974

Memorandum by the Secretary-General

INVITATIONS TO THE MARITIME RADIO CONFERENCE

With reference to paragraph 3 (Recognized Private Operating Agencies), the French Administration has informed us that the Compagnie Radio Maritime also wishes to take part in the Maritime Conference.

M. MILI
Secretary-General

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 136-E
10 April 1974
Original : French

Memorandum by the Secretary-General

INVITATIONS TO THE WORLD ADMINISTRATIVE RADIO CONFERENCE FOR MARITIME MOBILE TELECOMMUNICATIONS

1. Members of the Union

On 24 April 1973, invitations were sent to all the Members of the Union (except Rhodesia).

After the People's Republic of Bangladesh had acceded to the Convention, an invitation was also sent to this new Member.

Annex 1 shows the replies received to these invitations by the date of the present document.

In this connection, it should be borne in mind that under Resolutions Nos. 30 and 31 adopted by the Malaga-Torremolinos Plenipotentiary Conference (1973), Portugal and the Republic of South Africa cannot participate in this Conference.

2. Associate Member

An invitation sent to the Associate Member, Papua New Guinea, was accepted.

3. Recognized private operating agencies

The letters of invitation specified that any country or Associate Member might transmit the invitation to private operating agencies recognized by it.

In pursuance of this, the United Kingdom Administration has informed us that the Marconi International Marine Co., Ltd. wishes to take part in the Maritime Conference.

4. United Nations and specialized agencies

On 25 April 1973 invitations were sent to the Secretary-General of the United Nations, to the specialized agencies and to the International Atomic Energy Agency.

Acceptances of these invitations are listed in Annex 2.

M. MILI

Secretary-General

Annexes : 2

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ANNEX 1

PARTICIPATION IN THE MARITIME CONFERENCE

NAME OF COUNTRIES	YES	NO
MEMBERS AFGHANISTAN (Republic of)		
ALBANIA (People's Republic of)	X	
ALGERIA (Algerian Democratic and Popular Republic)	X	
GERMANY (Federal Republic of)	X	
SAUDI ARABIA (Kingdom of)	X	
ARGENTINE REPUBLIC	X	
AUSTRALIA	X	
AUSTRIA	X	
BANGLADESH (People's Republic of)	X	
BARBADOS		
BELGIUM	X	
BYELORUSSIAN SOVIET SOCIALIST REPUBLIC		
BURMA (Socialist Republic of the Union of)		X
BOLIVIA (Republic of)	X	
BOTSWANA (Republic of)		X
BRAZIL (Federative Republic of)	X	
BULGARIA (People's Republic of)	X	
BURUNDI (Republic of)		

NAME OF COUNTRIES	YES	NO
CAMEROON (United Republic of)	X	
CANADA	X	
CENTRAL AFRICAN REPUBLIC		
CHILE	X	
CHINA (People's Republic of)	X	
CYPRUS (Republic of)	X	
VATICAN CITY STATE		X
COLOMBIA (Republic of)	X	
CONGO (People's Republic of the)	X	
KOREA (Republic of)	X	
COSTA RICA		
IVORY COAST (Republic of the)	X	
CUBA	X	
DAHOMEY (Republic of)	X	
DENMARK	X	
DOMINICAN REPUBLIC		X
EGYPT (Arab Republic of)	X	
EL SALVADOR (Republic of)		
UNITED ARAB EMIRATES		
Group of Territories represented by the French Overseas Post and Telecommunication Agency	X	
ECUADOR	X	
SPAIN	X	
UNITED STATES OF AMERICA	X	
ETHIOPIA		
FIJI		X

NAME OF COUNTRIES	YES	NO
FINLAND	X	
FRANCE	X	
GABON REPUBLIC		
GHANA	X	
GREECE	X	
GUATEMALA		
GUINEA (Republic of)		
EQUATORIAL GUINEA (Republic of)		
GUYANA		
HAITI (Republic of)		
UPPER VOLTA (Republic of)		
HONDURAS (Republic of)		
HUNGARIAN PEOPLE'S REPUBLIC	X	
INDIA (Republic of)	X	
INDONESIA (Republic of)	X	
IRAN	X	
IRAQ (Republic of)		
IRELAND	X	
ICELAND	X	
ISRAEL (State of)	X	
ITALY	X	
JAMAICA	X	
JAPAN	X	
JORDAN (Hashemite Kingdom of)		X
KENYA (Republic of)		
KHMER REPUBLIC	X	

NAME OF COUNTRIES	YES	NO
KUWAIT (State of)	X	
LAOS (Kingdom of)		
LESOTHO (Kingdom of)		
LEBANON		
LIBERIA (Republic of)	X	
LIBYAN ARAB REPUBLIC	X	
LIECHTENSTEIN (Principality of)		
LUXEMBOURG		
MALAYSIA	X	
MALAWI		
MALDIVES (Republic of)		X
MALAGASY REPUBLIC		
MALI (Republic of)		
MALTA	X	
MOROCCO (Kingdom of)	X	
MAURITIUS	X	
MAURITANIA (Islamic Republic of)		
MEXICO	X	
MONACO	X	
MONGOLIAN PEOPLE'S REPUBLIC		
NAURU (Republic of)		
NEPAL		
NICARAGUA		
NIGER (Republic of the)		
NIGERIA (Federal Republic of)	X	
NORWAY	X	

NAME OF COUNTRIES	YES	NO
NEW ZEALAND	X	
OMAN (Sultanate of)		
UGANDA (Republic of)		
PAKISTAN	X	
PANAMA (Republic of)	X	
PARAGUAY (Republic of)	X	
NETHERLANDS (Kingdom of the)	X	
PERU	X	
PHILIPPINES (Republic of the)	X	
POLAND (People's Republic of)	X	
PORTUGAL	X*)	
PORTUGUESE OVERSEA PROVINCES	*)	
QATAR (State of)		
SYRIAN ARAB REPUBLIC		
GERMAN DEMOCRATIC REPUBLIC	X	
UKRAINIAN SOVIET SOCIALIST REPUBLIC		
ROUMANIA (Socialist Republic of)	X	
UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND	X	
RWANDA (Republic of)		X
SENEGAL (Republic of the)	X	
SIERRA LEONE	X	
SINGAPORE (Republic of)	X	
SOMALI DEMOCRATIC REPUBLIC	X	
SUDAN (Democratic Republic of the)		

*) See Resolution No. 30 of the Plenipotentiary Conference (Malaga-Torremolinos, 1973).

NAME OF COUNTRIES	YES	NO
SRI LANKA (CEYLON) (Republic of)		
SOUTH AFRICA (Republic of)	X**)	
SWEDEN	X	
SWITZERLAND (Confederation of)	X	
SWAZILAND (Kingdom of)		X
TANZANIA (United Republic of)		
CHAD (Republic of the)		
CZECHOSLOVAK SOCIALIST REPUBLIC	X	
SPANISH SAHARIAN TERRITORY		
TERRITORIES OF THE UNITED STATES OF AMERICA	X	
Overseas Territories for the international relations of which the Government of the United Kingdom of Great Britain and Northern Ireland are responsible		
THAILAND	X	
TOGOLESE REPUBLIC		
TONGA (Kingdom of)		
TRINIDAD AND TOBAGO		
TUNISIA	X	
TURKEY	X	
UNION OF SOVIET SOCIALIST REPUBLICS	X	
URUGUAY (Oriental Republic of)	X	
VENEZUELA (Republic of)	X	
VIET-NAM (Republic of)	X	
YEMEN ARAB REPUBLIC	X	
YEMEN (People's Democratic Republic of)		

**) See Resolution No. 31 of the Plenipotentiary Conference (Malaga-Torremolinos, 1973)

NAME OF COUNTRIES	YES	NO
YUGOSLAVIA (Socialist Federal Republic of)	X	
ZAIRE (Republic of)	X	
ZAMBIA (Republic of)		X
ASSOCIATE MEMBER		
PAPUA NEW GUINEA	X	

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ANNEX 2

SPECIALIZED AGENCIES WHICH HAVE ACCEPTED INVITATIONS

United Nations Educational, Scientific and Cultural Organization (UNESCO),
Intergovernmental Oceanographic Commission

International Civil Aviation Organization (I.C.A.O.)

World Meteorological Organization (W.M.O.)

Intergovernmental Maritime Consultative Organization (I.M.C.O.)

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Corrigendum to
Document No. 137-E
18 April 1974

Memorandum by the Secretary-General

NOTIFICATIONS TO INTERNATIONAL ORGANIZATIONS

In the Annex, under 1, add :

"African and Malagasy Postal and Telecommunication Union (UAMPT)"

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 137-E
18 April 1974

PLENARY MEETING

Memorandum by the Secretary-General

NOTIFICATIONS TO INTERNATIONAL ORGANIZATIONS

In accordance with No. 614 of the General Regulations annexed to the International Telecommunication Convention (Montreux, 1965), notifications of the convening of the Maritime Conference were sent to those international organizations which seemed likely to be interested in its work.

Formal requests for admission to the Conference were received from the organizations listed in the Annex.

In pursuance of No. 616 of the General Regulations, the Conference is invited to decide whether these organizations are to be admitted.

M. MILI

Secretary-General

Annex : 1

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ANNEX

INTERNATIONAL ORGANIZATIONS

1. Organizations exempt from all contributions towards defraying expenses (Administrative Council Resolution No. 574)

   International Air Transport Association (I.A.T.A.)
   International Marine Radio Association (C.I.R.M.)
   Inter-Union Commission on Allocation of Frequencies (I.U.C.A.F.)
   Committee on Space Research (C.O.S.P.A.R.)
   International Amateur Radio Union (I.A.R.U.)

2. Other organizations

   International Association of Lighthouse Authorities (I.A.L.A.)
   International Chamber of Shipping (I.C.S.)
   European Space Research Organization (E.S.R.O.)
   International Transport Workers' Federation (I.T.F.)

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INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 138-E
23 April 1974
Original : French

Memorandum by the Secretary-General

COMMITTEE STRUCTURE

(adopted in the first Plenary Meeting)

The following suggestions have been drafted on the basis of the committee structure adopted by the Maritime Conference of 1967.

Committee 1 - Steering

Terms of reference : To coordinate the work of the Committees, fix meeting times, etc.

Committee 2 - Credentials

Terms of reference : Verification of the credentials of delegations (No. 639 of the General Regulations annexed to the International Telecommunications Convention (Montreux, 1965))

Committee 3 - Budget Control

Terms of reference : To determine the organization and the facilities available to the delegates and to examine and approve the accounts for expenditure incurred throughout the duration of the Conference (General Regulations, No. 674)

Committee 4 - Radiotelegraphy

Terms of reference : To examine the provisions of the Radio Regulations concerning radiotelegraphy (see Annexes 1 and 2)

Committee 5 - Radiotelephony

Terms of reference : To examine the provisions of the Radio Regulations concerning radiotelephony and particularly the revision of Appendix 25 (see Annexes 1 and 2).

Committee 6 - Operation

Terms of reference : To examine the provisions of the Radio Regulations and the Additional Radio Regulations concerning operation (see Annexes 1 and 2).

Committee 7 - Editorial

Terms of reference : To perfect the form of the texts prepared by the Committees without altering their sense and to combine them with those parts of previous texts which have not been altered (General Regulations, No. 759)

M. MILI

Secretary-General

Annexes : 2

ANNEXE 1 - ANNEX 1 - ANEXO 1

REPARTITION DES PROPOSITIONS

(Documents 1 à 146, voir DT/1)

DISTRIBUTION OF PROPOSALS

(Documents 1 - 146, see DT/1)

DISTRIBUCIÓN DE LAS PROPOSICIONES

(Documentos 1 a 146, véase el DT/1)

	C.4 Tg.	C.5 Tf.	C.6 Op. Expl.	
	4	5	6	Titre de ADD Title of ADD Título del ADD
RR. Art. 1 *	x	x	x	
5 *	x	x		
6			x	
7 (IV) *	x	x		
9 (I)	x	x		
9 (IIA)		x		
9 (III, IV, VIII) *	x	x		
18			x	
19			x	
20			x	
21			x	
22			x	
23			x	
24			x	

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* Voir aussi l'Annexe 2.
See also Annex 2.
Véase también el Anexo 2.

	C.4 Tg.	C.5 Tf.	C.6 Op. Expl	
	4	5	6	Titre de ADD Title of ADD Título del ADD
RR. Art.25			x	
27			x	
28 (I, II) *			x	
28 (III)	x			
28 (IV)		x		
28 (V - VI) *	x	x		
28A			x	
ADD 28B	x	x	x	Appel sélectif numérique Digital selective calling Llamada selectiva numérica
ADD 28C	x			Télégraphie à impression directe, à bande étroite Narrow band direct-printing telegraphy Telegrafía de impresión directa y banda estrecha
29 (II, III, IV)			x	
ADD 29A			x	Télégraphie à impression directe, à bande étroite Narrow band direct-printing telegraphy Telegrafía de impresión directa y banda estrecha
30			x	
31			x	
32 (II)	x			
32 (V - A, B, C)	x			
32 (V - D.1)	x			
32 (V - D.2)	x			
33 (I)			x	

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* Voir aussi l'Annexe 2.
See also Annex 2.
Véase también el Anexo 2.

	C.4 Tg.	C.5 Tf.	C.6 Op. Expl.	
	4	5	6	Titre de ADD Title of ADD Título del ADD
RR. Art.33 (III)			x	
33 (IV, V, VI)			x	
34			x	
35 (I)		x		
35 (II)		x		
35 (III)		x		
35 (IV)		x		
ADD 35 (V)		x		Utilisation de fréquences pour la radiotéléphonie (450-470 MHz) Use of frequencies for radiotelephony (450-470 MHz) Utilización de frecuencias para radiotelefonía (450-470 MHz)
ADD 35A 1) 2)	x	x		1) Conditions devant être respectées par les stations terriennes mobiles. 2) Utilisation de fréquences pour la télécommande. 1) Conditions to be observed by mobile earth stations. 2) Use of frequencies for telecommand. 1) Condiciones que deben respetar las estaciones móviles terrenas. 2) Utilización de frecuencias para telemando.
36			x	
37			x	
40 (I)			x	
40 (II)			x	
40 (III)			x	

	C.4 Tg.	C.5 Tf.	C.6 Op. Expl.	
	4	5	6	Titre de ADD Title of ADD Título del ADD
ADD 40 (IIIA)			x	Etablissement des comptes, appels radio télex, etc. Establishment of account, radio telex calls, etc. Establecimiento de cuentas, llamadas en radiocomunicaciones, télex, etc.
40 (IV)			x	
40 (V)			x	
43 (I)			x	
AP 3	x	x		
AP 9			x	
AP 10			x	
AP 11			x	
AP 12			x	
AP 13			x	
AP 13A			x	
AP 15	x			
ADD AP 15A	x			Fréquences pouvant être assignées aux stations côtières radiotélégraphiques. Certain frequencies assignable to coast radiotelegraph stations. Frecuencias que pueden asignarse a las estaciones costeras radiotelegráficas.
AP 17		x		
AP 17A		x		
AP 18		x		
ADD AP 18A	x			Télégraphie à impression directe (voies 80 et 81). Direct-printing telegraphy (channels 80 - 81). Telegrafía de impresión directa (canales 80 y 81).

	C.4 Tg.	C.5 Tf.	C.6 Op. Expl	
	4	5	6	Titre de ADD Title of ADD Título del ADD
AP 19		x		
ADD AP 19A		x		Communications à bord des navires, caractéristiques techniques. On-board communications, technical characteristics. Comunicaciones a bordo de los barcos, características técnicas.
ADD AP 20AA			x	Radiobalises de localisation des sinistres, caractéristiques techniques. Emergency position indicating radio-beacons, technical characteristics. Radiobalizas de localización de siniestros, características técnicas.
AP 20B *	x		x	
AP 20C *	x		x	
ADD AP 20D	x		x	Système d'appel sélectif numérique. Digital selective calling system. Sistema numérico de llamada selectiva.
ADD AP 20DA		x	x	Systèmes à compresseur et extenseur couplés. Linked compressor and expander systems. Sistemas con compresores-expansores acoplados.
AP 21				
AP 22			x	
AP 25 MOD		x		
AR 1			x	
4			x	
5			x	

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* Voir aussi l'Annexe 2.
See also Annex 2.
Véase también el Anexo 2.

	C.4 Tg.	C.5 Tf.	C.6 Op. Expl.	
	4	5	6	Titre de ADD Title of ADD Título del ADD
ADD 5A			x	
6			x	
7			x	
8			x	
10			x	
13			x	

Note : On se reportera également à la première partie du Document DT/1 pour les observations générales et les propositions de caractère général.

Note : Reference is also made to the first part of DT/1 containing general remarks and proposals of a general character.

Nota : Para las observaciones generales y las proposiciones de carácter general véase también la primera parte del Documento DT/1.

ANNEXE 2

RÉPARTITION DES ARTICLES ET APPENDICES ATTRIBUES A DEUX OU TROIS COMMISSIONS

(Documents 1 à 111, voir DT/1)

ANNEX 2

BREAKDOWN OF ARTICLES AND APPENDICES ASSIGNED TO MORE THAN ONE COMMITTEE

(Documents 1-111, see DT/1)

ANEXO 2

REPARTICIÓN DE LOS ARTÍCULOS Y APÉNDICES ASIGNADOS A DOS O TRES COMISIONES

(Documentos 1-111, véase el DT/1)

RR Art. 1

C.4 92A, 92B, 92C

C.5 41A, 92A, 92B, 92C

C.6 3, 14, 18, 18A, 21BA, 35, 36, 37, 37A, 38A, 39A, 84AG, 84AGA

RR Art. 5

C.4 201, 201A, 222, 367A, 367B, 385A, 387A, 387B, 399A, 399B

C.5 201, 201A, 205A, 209A, 210A, 222, 273, 273B, 284B, 287, 287A, 287B, 318B, 319C, 324C

Note: Les dispositions soulignées doivent faire l'objet d'une coordination entre les Commissions intéressées.

Note: Underlined provisions to be coordinated between committees concerned.

Nota: Las disposiciones subrayadas deben coordinarse entre las Comisiones interesadas.

RR Art. 7

C.4 442, 446, 451, 451A, 451A.1, 451B, 451C, 452, 452A, 452B, 453, 453A, 453B, 453C, 453G, 453H, 453I, 457A, 457D

C.5 442, 445, 446, 447, 448, 449, 449A, 453A, 453C, 453D, 453E, 453F, 453I, 456, 457

RR Art. 9 (I, III, IV, VIII)

C.4 491, 492H, 573, 607, 608

C.5 491, 492A, 573, 577, 578, 578A, 578B, 579, 579A, 580, 580A, 581, 582, 583, 584, 585, 586, 607, 608, 635

RR Art. 28 (I, II)

C.5 964B, 964C, 964D, 969

C.6 969

RR Art. 28 (V, VI)

C.4 992, 997, 997.1

C.5 992, 996, 998, 998A, 999

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 139(Rev)-E
25 April 1974
Original : French

Memorandum by the Secretary-General

CONFERENCE SECRETARIAT

(adopted at the 1st Plenary Meeting)

Secretary to the Conference	Mr. M. Mili, Secretary-General
Secretary for technical and operating questions	Mr. K. Čomić
Executive Secretary	Mr. A. Winter-Jensen
Meeting secretaries	
Plenary meetings	Mr. R. Smith
Committee 1 - Steering	Mr. R. Smith
Committee 2 - Credentials	Mr. P.A. Traub
Committee 3 - Budget Control	Mr. R. Prélaz
Committee 4 - Radiotelegraphy	Mr. M. Sant
Committee 5 - Radiotelephony	Mr. J. Balfroid
Committee 6 - Operation	Mr. A. Maclennan
Committee 7 - Editorial	Mr. R. Macheret

The secretariat will also comprise staff members detached from Union Headquarters and the requisite supernumerary personnel.

M. MILI

Secretary-General

(The revision concerns the French text only)

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 139-E
23 April 1974
Original : French

Memorandum by the Secretary-General

CONFERENCE SECRETARIAT

(adopted at the 1st Plenary Meeting)

Secretary to the Conference	Mr. M. Mili, Secretary-General
Secretary for technical and operating questions	Mr. K. Čomić
Executive Secretary	Mr. A. Winter-Jensen
Meeting secretaries	
Plenary meetings	Mr. R. Smith
Committee 1 - Steering	Mr. R. Smith
Committee 2 - Credentials	Mr. P.A. Traub
Committee 3 - Budget Control	Mr. R. Prélaz
Committee 4 - Radiotelegraphy	Mr. M. Sant
Committee 5 - Radiotelephony	Mr. J. Balfroid
Committee 6 - Operation	Mr. A. Maclennan
Committee 7 - Editorial	Mr. R. Macheret

The secretariat will also comprise staff members detached from Union Headquarters and the requisite supernumerary personnel.

M. MILI
Secretary-General

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 140-E
16 April 1974
Original : French

BUDGET CONTROL
COMMITTEE

Note by the Secretary-General

BUDGET OF THE CONFERENCE

The provisional budget of the Maritime Conference, as approved by the Administrative Council of the Union at its 28th session in 1973, is annexed to this document for the information of the Budget Control Committee.

This Annex also refers to the draft final budget which the Secretary-General will submit for the consideration and approval of the Administrative Council at its next session.

The main changes included in the draft final budget are as follows :

a) The Malaga-Torremolinos Plenipotentiary Conference provided for a credit within the new ceiling for recurring expenditure in 1974 with a view to transforming certain fixed-term posts under the Conferences and Meetings budget into permanent posts. These posts were incorporated in the permanent staff of the Union as from 1 January 1974, so that the credits for supernumerary staff for the Maritime Conference have been reduced by 240,000 Swiss francs.

b) On the other hand, the salaries of supernumerary staff have been changed to take into account the rise in the cost of living in Geneva, and the credits for this staff have had to be readjusted accordingly.

c) The provisional budget provides for a credit of 450,000 Swiss francs for the Final Acts, on the basis of Final Acts produced entirely by outside printers. Since the Union's internal reproduction services have been supplied with adequate equipment, they can now undertake to print the Final Acts which will be signed. The revised credit is 260,000 Swiss francs.

M. MILI
Secretary-General

Annex : 1

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ANNEX

Section 7 - World Administrative Maritime Radio Conference

No.		Provisional budget 1974	Final budget 1974
		- Swiss francs -	
	1. Staff		
106	Salaries and related expenditure	1,815,000	1,792,000
107	Travel	40,000	28,000
108	Insurance	35,000	35,000
		1,890,000	1,855,000
	2. Premises and equipment		
110	Premises, furniture, machines	460,000	460,000
111	Document production	150,000	200,000
112	Office supplies and overheads	45,000	45,000
113	Postage, telephone, telegrams	54,000	54,000
114	Technical installations	1,000	1,000
115	Sundry and unforeseen	30,000	30,000
		740,000	790,000
	3. Other expenses		
117	I.F.R.B. preparatory work	20,000	20,000
118	Final Acts of the conference	450,000	260,000
		470,000	280,000
	Total, Section 7	3,100,000	2,925,000

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 141-E
16 April 1974
Original : English

PLENARY MEETING

Memorandum by the Secretary-General

SITUATION OF CERTAIN COUNTRIES WITH RESPECT TO THE INTERNATIONAL TELECOMMUNICATION CONVENTION, MONTREUX, 1965

Attention is drawn to the fact that the following two countries which signed the Montreux Convention, have not yet ratified that Convention and therefore do not at present have the right to vote :

Colombia (Republic of)

Haiti (Republic of).

M. MILI
Secretary-General

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 142(Rev.1)-E
3 May 1974
Original : English

COMMITTEE 5

Kingdom of the Netherlands

PROPOSALS FOR THE WORK OF THE CONFERENCE

The frequency requirements of the Kingdom of the Netherlands in the revised Frequency Allotment Plan for Coast Radiotelephone Stations (Appendix 25 MOD) are as follows :

Frequency bands MHz	4	6	8	12	16	22
Number of single sideband channels	5	2	5	5	4	4

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 142-E
10 April 1974
Original : English

PLENARY MEETING

Kingdom of the Netherlands

PROPOSALS FOR THE WORK OF THE CONFERENCE

The frequency requirements of the Kingdom of the Netherlands in the revised Frequency Allotment Plan for Coast Radiotelephone Stations (Appendix 25 to the Radio Regulations) will be as follows :

Frequency bands in MHz	4	6	8	12	16	22
Number of SSB channels	4	1	2	3	3	2

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 143-E
10 April 1974
Original : English

PLENARY MEETING

Federal Republic of Nigeria

PROPOSALS FOR THE WORK OF THE CONFERENCE

The frequency requirements of the Federal Republic of Nigeria in the revised Frequency Allotment Plan for Coast Radiotelephone Stations (Appendix 25 to the Radio Regulations) will be as follows :

4 MHz band - 3 with a PEP of 5 kW

6 " " - 2 "

8 " " - 3 "

12 " " - 3 "

16 " " - 3 "

22 " " - 3 "

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 144-E
21 April 1974
Original : French

Memorandum from the Secretary-General

ELECTION OF THE MEMBERS OF THE I.F.R.B.

1. Introduction

1.1 The Plenipotentiary Conference (Malaga-Torremolinos, 1973) decided that the next election of the members of the I.F.R.B. would be placed on the agenda of the Maritime Conference (see Annex 1 to Document No. 72 of the present Conference).

1.2 The Members of the Union were invited by Circular-letter No. 442 of 5 November 1973 to notify the Secretary-General of the name of any candidate whom they wished to nominate (the text of this Circular-letter was also published as an annex to Document No. 72).

1.3 The replies received to this Circular-letter were reproduced in Document No. 72 or the addenda thereto.

2. Action to be taken

2.1 The Conference is invited to take a decision on the date of the election and the final date for submitting nominations.

2.2 The Secretary-General will then have to notify the Members of the Union of this date by circular telegram (draft text attached as Annex 1).

2.3 Under No. 175 of the International Telecommunication Convention (Montreux, 1965), it is for the present Conference to determine the date on which the newly-elected members shall take up their duties.

2.4 According to the same number, the Conference shall also fix the date until which the members of the Board who are not re-elected shall remain in office.

3. Election procedure

3.1 Under No. 173 of the Convention, the election procedure shall be established by the Conference itself in such a way as to ensure equitable representation of the various parts of the world.

3.2 Annex 2 shows the procedure followed by the Montreux Plenipotentiary Conference in 1965.

3.3 A draft ballot paper is attached as Annex 3.

M. MILI
Secretary-General

Annexes : 3

ANNEX 1

DRAFT

CIRCULAR TELEGRAM TO BE SENT TO THE MEMBERS OF THE UNION

Maritime Conference now meeting Geneva has decided first date election members of I.F.R.B. fixed at 1974 second final date for submission candidates is 1974

= M. MILI Secretary-General +

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ANNEX 2

PROCEDURE FOR THE ELECTION OF THE MEMBERS OF THE I.F.R.B.

(Procedure followed by the Plenipotentiary Conference (Montreux, 1965) for the election of the members of the I.F.R.B. - see Document No. 293 as adapted from the procedures for elections held in 1947 and 1965)

1. One member of the I.F.R.B. shall be elected from each of the Regions A, B, C, D and E.

2. The election shall take place by secret ballot.

3. Each delegation shall receive a voting slip bearing the names in French alphabetical order of the countries, Members of the Union, which have presented candidates for membership of the Board, grouped into the Regions A, B, C, D and E. Against the name of each country shall be indicated the name of the candidate submitted by the country concerned.

4. Before proceeding to the vote, five tellers, one for each Region, shall be designated by the Chairman.

5. Each delegation should indicate on its voting slip the names of the candidates it supports by means of crosses against a maximum of one candidate per Region.

6. Voting slips bearing more than one cross for any Region shall be considered invalid for the Region or Regions concerned.

7. The candidates receiving the largest number of votes for each Region shall be elected members of the I.F.R.B.

8. After the ballot, a list shall be drawn up by the Secretariat of the candidates in each Region in decreasing order of the number of votes obtained. This list, after verification by the tellers, shall be handed to the Chairman of the Conference.

9. Special ballots shall be held to classify, if necessary, candidates for the same Region receiving an equal number of votes.

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ANNEXE 3 - ANNEX 3 - ANEXO 3

Projet - Draft - Proyecto

BULLETIN DE VOTE - BALLOT PAPER - PAPELETA DE VOTACIÓN

Election des membres de l'I.F.R.B.
Election of members of the I.F.R.B.
Elección de miembros de la I.F.R.B.

Régions - Regions - Regiones				
A	B	C	D	E
PAYS-COUNTRY-PAÍS (AAA) M. .... ☐	PAYS-COUNTRY-PAÍS (EEE) M. .... ☐	etc.	etc.	etc.
PAYS-COUNTRY-PAÍS (BBB) M. .... ☐	PAYS-COUNTRY-PAÍS (FFF) M. .... ☐			
PAYS-COUNTRY-PAÍS (CCC) M. .... ☐	etc.			
PAYS-COUNTRY-PAÍS (DDD) M. .... ☐	etc.			

Chaque délégation doit indiquer sur son bulletin de vote les noms des candidats qu'elle désigne au moyen de croix portées dans les cases correspondantes ☒ , à raison d'un maximum d'un candidat par région.

Tout bulletin de vote portant plus d'une croix pour une des régions sera considéré comme nul pour la ou les régions considérées.

Each delegation should mark a cross in the boxes on its ballot paper corresponding to the names of the candidates of its choice; not more than one candidate can be voted for per region.

Any ballot paper with more than one cross per region will be considered as null and void for the region or regions concerned.

Cada delegación deberá indicar en su papeleta de votación el nombre de los candidatos que apoya por medio de una cruz colocada en la casilla correspondiente ☒ , a razón de un candidato por Región, como máximo.

Se considerarán nulas para la Región o Regiones de que se trate las papeletas de votación que contengan más de una cruz por Región.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 145-E
16 April 1974
Original : French

BUDGET CONTROL
COMMITTEE

Note by the Secretary-General

CONTRIBUTIONS OF NON-EXEMPTED RECOGNIZED PRIVATE OPERATING AGENCIES AND INTERNATIONAL ORGANIZATIONS

Under No. 231 of Article 16 of the International Telecommunication Convention, Montreux, 1965,

> "The amount of the contribution per unit payable towards the expenses of administrative conferences by recognized private operating agencies which participate in accordance with No. 621 of the General Regulations and by participating international organizations shall be fixed by dividing the total amount of the budget of the Conference in question by the total number of units contributed by Members and Associate Members as their share of Union expenses. The contributions shall be considered as Union income. They shall bear interest from the sixtieth day following the day on which accounts are sent out, at the rates fixed in No. 222."

Since the total amount of the draft final budget of the Maritime Conference is 2,925,000 Swiss francs and the total number of Members' contributory units is 474, the amount of the contribution per unit payable by recognized private operating agencies and international organizations not exempted under Administrative Council Resolution No. 574 is 6,170 Swiss francs.

A list of non-exempted recognized private operating agencies and international organizations participating in the Conference, stating the number of contributory units chosen, will be published later.

M. MILI
Secretary-General

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 146-E
16 April 1974
Original : French

BUDGET CONTROL COMMITTEE

Report by the Secretary-General

COST OF PRINTING THE FINAL ACTS

Administrative Council Resolution No. 83 (amended) entitled :

ORGANIZATION, FINANCING AND LIQUIDATION OF THE ACCOUNTS OF CONFERENCES AND MEETINGS

stipulates the following concerning the publication of the Final Acts of conferences or meetings :

> "20.1 if a conference ... prints, for its own use, documents of which typographical composition can subsequently be used, in whole or in part, for the printing of the Final Acts, it must bear a percentage of the composition costs and the whole of the printing costs of the said document;
>
> 20.2 ....
>
> 20.3 the percentage of the composition cost mentioned in a) above ... shall be decided by the Plenary Assembly of the conference ...".

Arrangements have been made for the blue first proofs, the pink second proofs and the white third proofs (documents for signature) to be produced by the Union's internal reproduction services. Arrangements have also been made for the definitive edition of the Final Acts (sales documents) to be produced by other facilities of the I.T.U. reproduction services. The question of sharing costs between the Conference budget and the Publications budget therefore does not arise.

M. MILI

Secretary-General

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 147-E
17 April 1974
Original : French

PLENARY MEETING

France*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 4

4. VHF Provisions

4.6 The use of frequencies for movements and safety communications

MARITIME TRAFFIC

F/147/76 ADD 37 A Maritime traffic service : Maritime mobile service, distinct from the port operations service, between coast stations and ship stations, or between ship stations, for the purposes of maritime traffic schemes in the areas in which movements of shipping are subject to special rules.

The purpose of this service is to transmit messages dealing with :

- maritime traffic, including nautical and meteorological information required for the safety of ships and navigation;
- in emergencies, for the safety of human life.

Messages in the nature of public correspondence are excluded.

F/147/77 ADD 419 A The frequencies allocated to the maritime traffic service may be used by land mobile stations and by aircraft stations taking part in maritime traffic schemes.

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*) See also Documents 64-71, 77-81 and 113

F/147/78 MOD ADD 953 B (a) only on the frequencies .... (1) and on the frequencies of the maritime traffic service.

F/147/79 MOD Appendix 18 Insert in the Table of Transmitting Frequencies in the band 156-174 MHz for Radiotelephony in the International Maritime Mobile Service, on the right of the column "Port operations" a new double column headed "Shipping traffic" as shown below.

Channel designators	Transmitting frequencies (MHz)			Maritime traffic	
	Ship stations	Coast stations		Single frequency	Two frequency
60 g)	156.025	160.625			10
01	156.050 f)	160.650			15
61	156.075	160.675			4
02	156.100	160.700			17
62	156.125	160.725			7
03	156.150 f)	160.750			16
63	156.175 f)	160.775			9
04	156.200	160.800			14
64	156.225	160.825			5
05	156.250	160.850			19
65	156.275	160.875			6
06	156.300 e)				
66	156.325	160.925			8
07	156.350	160.950			18
67	156.375	156.375		7	
08	156.400				
68	156.425	156.425		①	
09	156.450	156.450		10	
69	156.475	156.475		3	

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(1) Three port operations or intership single frequency channels should be selected. To facilitate the introduction of this service, it might be useful to select a channel in the series 01 to 28, and the two others in the series 60 to 88 of Appendix 18.

Channel designators	Transmitting frequencies (MHz)			Maritime traffic	
	Ship stations	Coast stations		Single frequency	Two frequency
10	156.500	156.500		8	
70	156.525				
11	156.550	156.550			
71	156.575	156.575		11	
12	156.600	156.600			
72	156.625				
13	156.650	156.650		②	
73	156.675	156.675		6	
14	156.700	156.700			
74	156.725	156.725		9	
15 d) i)	156.750	156.750		4	
75		Guard band 156.7625-156.7875 MHz j)			
16	156.800	156.800	CALLING AND SAFETY		
76		Guard band 156.8125-156.8375 MHz j)			
17 d) i)	156.850	156.850		5	
77	156.875				
18	156.900	161.500			
78	156.925	161.525			①
19	156.950	161.550			21
79	156.975	161.575			②
20	157.000	161.600			
80	157.025	161.625			11
21	157.050	156.050 f) or 161.650			20
81	157.075	161.675			12
22	157.100	161.700			
82	157.125	161.725			13

Channel designators	Transmitting frequencies (MHz)			Maritime traffic	
	Ship stations	Coast stations		Single frequency	Two frequency
23	157.150	156.150 f) or 161.750			
83	157.175	156.175 f) or 161.775			
24	157.200	161.800			
84	157.225	161.825			3
25	157.250	161.850			
85	157.275	161.875			
26	157.300	161.900			
86	157.325	161.925			
27	157.350	161.950			
87	157.375	161.975			
28	157.400	162.000			
88 g)	157.425	162.025			

Reasons : To define a new service required to establish maritime traffic schemes of the type envisaged in the International Regulations for Preventing Collisions at Sea (London, 1972), which may be expected to come into force on 1 January 1976, and for the schemes which are already in operation (Dover Strait).

To prevent any harmful interference this service must be quite separate from the port operations service.

With regard to the content of messages, it is clear that they may include all the information required for the guidance or control of ships operating in the area : nautical or meteorological data (local meteorology).

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 148-E
20 April 1974
Original : English

PLENARY MEETING

India*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

ARTICLE 23

Operators' certificates for ship and aircraft stations

Section I

General provisions

NOC 848-850

IND/148/130 (MOD) 851 (4) Nevertheless, in the service of mobile radiotelephone stations operating solely on frequencies above 30 ~~Mc/s~~ MHz, each government shall decide for itself whether a certificate is necessary and, if so, shall define the conditions for obtaining it.

Reasons : Drafting amendment to clarify the scope of the provision.

NOC 852-855

IND/148/131 MOD 856 (1) Each administration shall take the necessary steps to prevent, to the maximum extent possible, the fraudulent use of certificates. For this purpose, such certificates shall bear the holders photograph and signatures, and shall be authenticated by the issuing administration. Administrations may also employ, if they wish,

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*) See also Document 111.

other means of identification such as ~~photographs~~, ~~fingerprints~~, height, complexion, marks of identification, etc.

Reasons : To lay down minimum requirements for identification of holders of operators' certificates. Fingerprints as means of identification of such holder is considered inappropriate and hence its reference in the text is deleted.

IND/148/132 MOD 857 (2) To facilitate verification of certificates, these ~~may~~ shall carry, ~~if necessary~~, in addition to the text in the national language, a translation of this text in one of ~~a~~ the working languages of the Union if the national language is not the same as the latter.

Reasons : The text is modified to clarify the objective.

NOC 858

ARTICLE 23

Radio operators' certificates

1. Article 23 of the Radio Regulations, Geneva, 1959 (Edition of 1968), provides for two categories of radiotelephone operators' certificates, general and restricted.

2. SCOPE of radiotelephone certificates

2.1 The holder of a radiotelephone operators' general certificate is entitled to carry out the radiotelephone service of any ship or aircraft station.

2.2 The holder of a radiotelephone operators' restricted certificate is entitled to perform the radiotelephone service of ship or aircraft stations subject to certain conditions.

2.2.1 In accordance with the existing provisions radiotelephone service of aircraft stations deploying transmitters with simple external switching devices and maintaining frequency tolerance within specified limits on frequencies allocated exclusively to the aeronautical mobile service, may be performed by the holder of restricted certificate. Consequently holder of general certificate is required only in case the transmitter needs manual adjustment for determining frequency or the stability of frequencies is not maintained within the limits of tolerance specified by Appendix 3 of Radio Regulation.

2.2.2 The radiotelephone service of ship stations while working on the frequencies of the maritime mobile service and employing transmitter using simple external switching devices (excluding all manual adjustment of frequency determining elements) and maintaining frequency tolerance within specified limits may be performed by the holder of restricted certificate providing the peak envelope power of the transmitter does not exceed 1 Kilowatt. As a result the holder of general certificate is required to perform the service of any ship where either the peak envelope power of the transmitter exceeds 1 Kilowatt or it needs manual adjustment for determining frequency or when it does not maintain the stability of frequency within the limits of tolerance specified by Appendix 3 of Radio Regulations.

2.2.3 The holder of restricted certificate is also authorised to carry out the radiotelephone service on any aircraft station, when working on frequencies of the maritime mobile service, provided that the P.E.P. of the transmitter does not exceed 200 W. He is however permitted to operate a transmitter with P.E.P. not exceeding 1 Kilowatt provided the transmitter requires only the use of simple external switching devices (excluding all manual adjustment of frequency determining elements) and maintain frequency stability within specified limits. In this case also the holder of general certificate is required to perform the service where either the P.E.P. of transmitter exceeds 1 Kilowatt or it needs manual adjustment for determining frequency or where it does not maintain frequency tolerance within specified limits.

2.3 In nut shell for performing the radiotelephone service of ship station (on frequencies of the maritime mobile service) and aircraft stations (on frequencies of the maritime mobile service), the holder of general certificate is required only when :

(i) P.E.P. of the transmitter exceeds 1 Kilowatt, or

(ii) transmitter needs manual adjustment for determining frequency, or

(iii) transmitter does not maintain frequency tolerance within specified limits.

In case of aircraft stations (on frequencies allocated exclusively to the aeronautical mobile service) services of the holder of general certificate are required only in the case of (ii) and (iii) above.

3. There has been substantial advancement in the field of electronics and consequently more sophisticated radiocommunication equipment is being employed by maritime and aeronautical mobile services. Such equipment, in general, uses simple external controls for the operation of transmitter and maintains specified frequency stability which is often better than one specified in Appendix 3 of Radio Regulations. The Indian Administration is of the view that aircraft stations have now come to use equipment only with above characteristics and requirement of general certificate has outlived. Similar position, more or less, prevails in case of radiotelephone ship stations. In ships of 300 tons gross tonnage and upwards but less than 1600 tons gross tonnage radiotelephone installation only is mandatory. These ships having a limited operation within the harbour or along the coast-line generally deploy a transmitter with a P.E.P. not exceeding 1 Kilowatt. Radiotelephone service of such stations is generally performed by the master or any other member of the crew holding a restricted certificate for radiotelephony.

In accordance with international agreements passenger ships and cargo ships of 1600 tons gross tonnage and above are fitted with radiotelegraph station. On those ships radiotelephone installation is provided to meet additional service requirements. The service of such ship stations is performed by the holder of a first or second class radiotelegraph operators' certificate in accordance with No. 861 Mar of Radio Regulations and no radiotelephone operator is carried. In view of virtually no requirement of holders of radiotelephone general certificate in maritime mobile services, a sharp decline is observed in the number of candidates seeking this qualification.

4. In view of the above, the Indian Administration is of the opinion that two categories of radiotelephone operators' certificates are no longer necessary and it is desirable to have only one category of radiotelephone operators' certificate which would meet the present as well as future needs. A proposal to this effect is as follows :

ARTICLE 23

Section II

Classes and categories of certificates

NOC 859-859.1

IND/148/133 MOD 860 (2) There ~~are~~ is one class of radiotelephone operators' ~~certificates~~ certificate[1] ~~general-and-restricted[1]~~

NOC 860A-861

IND/148/134 MOD 862 (2) The holder of a radiotelephone operators' ~~general~~ certificate may carry out the radiotelephone service of any ship or aircraft station.

IND/148/135 SUP 863-Mar

IND/148/136 SUP 863A Mar

IND/148/137 SUP 864

IND/148/138 MOD 865 ~~(5)~~ (3) The radiotelegraph service of ships for which a radiotelegraph installation is not made compulsory by international agreements, as well as radiotelephone service of ship stations and aircraft stations ~~for which only a restricted radiotelephone operators' certificate is required~~, may be carried out by an operator holding a radiotelegraph operators' special certificate.

NOC 866

Section III

Conditions for the issue of operators' certificates

NOC 867-869

IND/148/139 MOD 870 (2) Administrations should take whatever steps they consider necessary to ensure the continued proficiency of operators both while they are in service on board a ship or aircraft and after prolonged absences from operational duties.

Reasons : It is imperative that Administrations also exercise control over certified operators while they are performing operational duties to ensure that they continue to possess professional knowledge. Several administrations have laid down the condition of certain minimum experience as radio operator on coast, land, ship or aircraft stations before revalidating the authority to carry out the service on board a ship or aircraft. The proposed modification shall lend an international backing to the existing practices.

NOC 871-893

D. Radiotelephone operators' certificate

IND/148/140	SUP	894	
IND/148/141	SUP	895	
IND/148/142	SUP	896	
IND/148/143	SUP	897	
IND/148/144	SUP	898	
IND/148/145	MOD	899	14. (1) The ~~restricted~~ radiotelephone operators' certificate is issued to candidates who have given proof of the knowledge and professional qualifications enumerated below :
IND/148/146	ADD	900A	a) Practical knowledge of operation, and adjustment of radiotelephone apparatus. Reasons : To clarify the qualifications in regard to knowledge required for handling radiotelephone apparatus.
	NOC	900-902	
IND/148/147	MOD	903 Mar	(2) For ship radiotelephone stations where the peak envelope power of the transmitter does not exceed 400 watts and for aircraft radiotelephone stations operating on frequencies allocated exclusively to the aeronautical mobile service, each administration may itself fix the conditions for obtaining a ~~restricted~~ radiotelephone operators' certificate, provided that the operation of the transmitter requires only the use of simple external switching devices, excluding all manual adjustment of frequency determining elements, and that the stability of the frequencies is maintained by the transmitter itself within the limits of tolerance specified in Appendix 3. However, in fixing the conditions, administrations shall ensure that the operator has an adequate knowledge of radiotelephone operation and procedure particularly as far as distress, urgency and safety are concerned. This in no way contravenes the provisions of No. 906.
	NOC	904	

IND/148/148 MOD 905

15. A radiotelephone operators' certificate ~~shall-show-whether-it-is-a-general-certificate-or-a restricted-certificate-and,-in-the-latter-case,-if it-has-been~~ when issued in conformity with the provisions of No. 903 shall bear an endorsement to this effect.

NOC 906

ARTICLE 20 AND ARTICLE 40

Agenda item No. 16 : Article 40 and the associated provisions of the Additional Radio Regulations.

1. Settlement of Accounts

1.1 In accordance with the provisions of Radio Regulations and Additional Radio Regulation (Edition of 1968), the administration or the recognized private operating agency to which the land station is subject, forwards the account to the concerned administration or the private companies which settle the accounts or the ship-owners themselves as the case may be, for exchange and verification of accounts, and payment of balances.

1.2 In the settlement of accounts, Indian Administrations have been experiencing that certain bills for radiotelegrams exchanged with ships of foreign registry through the Indian coast stations either remain outstanding for a long time or are not settled at all. The establishing of the accounts entailed avoidable correspondence with the I.T.U. and the other administrations. This problem has assumed great proportions, in the recent years, so much so that, during the year 1970-71 the outstanding bills amounted to Rs. 8,41,471.92, involving as many as 147 accounting parties.

1.3 The main reasons for this difficulty are as follows :

a) In many cases the bills cannot be forwarded to the correct accounting authority since the particulars in respect of many ships are not circulated in published documents (List of Ship Stations) or are not received by I.T.U. in time for publication in the supplement to the List of Ship Stations.

b) Sometimes the particulars, especially in regard to the address of the private company settling the account undergoes a change about which I.T.U. is not kept informed. In such cases the provisions of No. 1082 are also not observed, and many ship stations do not furnish as a matter of procedure, to the land stations to which it transmits traffic, the necessary particulars of the accounting authority. It leads to enquiries with the I.T.U. and concerned administrations in regard to particulars of private operating agency controlling the mobile station.

c) There is a considerable lapse of time between the communication of the additions, modifications or deletions to be made in List V (List of Ship Stations) to the Secretary-General (See No. 815 Mar) for publication by him (See No. 825 Mar) and their receipt by Administrations and the recognized private operating enterprises.

d) Bills sent to the ship owners or the private company settling the accounts, have been sometimes rejected months after forwarding the bills, on the ground that the ships had been sold and relevant correspondence regarding the ship had been destroyed.

e) In the absence of particulars regarding the operating enterprises controlling the mobile stations, the accounts sent to the Administration to which the mobile station was subject, were at times not accepted by the Administration on the ground that no ships station with call-sign and name as that of the ship station to which the accounts relate was registered in the country.

f) Sometimes even the enquiries made by I.T.U. from their latest records and sources outside the Union, were of no avail to identify the concerned Administration or private enterprise settling the accounts of the ship in question.

g) The enquiries often are time consuming and it is not possible to adhere to forward the accounts for payment within the period specified in Nos. 1534-1537.

h) With the gradual increase in the number of ships, the number of accounting authorities has also gone up with the result that the task of presentation of accounts and persuing the outstanding cases has assumed formidable magnitude.

2. Possible remedial measures

Indian Administration is of the view that a great deal of difficulties in the matter would be eliminated if the Administrations notify to the I.T.U. necessary additions, modifications or deletions to be made in the List of Ship Stations in time and the List is kept up-to-date more frequently. Accordingly it is proposed to modify some of the provisions of Radio Regulations in order to ensure speedy settlement of accounts by administrations or recognized private operating agencies.

ARTICLE 20

Service documents

IND/148/149 MOD 825 7. The List of Ship Stations (List V) shall be republished each year. It shall be kept up-to-date by means of a ~~half-yearly~~ supplement issued every month.

ARTICLE 40

Accounting for radiotelegrams and radiotelephone calls

Section I

General

IND/148/150 MOD 1509 (2) When the provisions of No. 1082 are not followed, and the operating enterprise controlling the mobile station is not known, accounts should be sent to the Administration to which the mobile station is subject ~~for forwarding to the appropriate~~ This Administration shall then be regarded as accounting authority for settlement.

IND/148/151

Table of frequencies to be used by ship radiotelegraph stations in the bands between 4 and 27.5 MHz allocated exclusively to the Maritime Mobile Service

In the Table (Appendix 15), among others, the lowest and highest assignable frequencies, spacing between two allocable frequencies in different bands, etc. are indicated for allocation to ship radiotelegraph stations. Each administration undertakes the task of working out discrete frequencies in each of the bands reserved for ship radiotelegraph stations for the purposes of calling and working for wideband telegraphy, facsimile and special transmission systems, oceanographic data transmissions, narrow-band direct printing telegraph and data transmission systems, and manual or automatic A1 morse telegraphy.

1.1 The assignable frequencies for different purposes are arranged in groups having one or more frequencies from each of the bands between 4 and 27.5 MHz by administrations. Such groups of frequencies are normally assigned by the Administration in such a manner as to ensure, to the maximum possible extent, uniform distribution of assignments on all the frequencies in the 4, 6, 8, 12, 16, 22 and 25 MHz bands, in so far as their usages are concerned.

1.2 In the absence of internationally agreed standard groups of frequencies, the discrete frequencies assigned to a ship station are specifically indicated in the ship station licence to facilitate inspection of such stations.

2. The plan in regard to frequencies assignable to ship radiotelegraph stations as now indicated in Appendix 15 presents considerable work in drawing up of details of the plan by each administration. Grant of ship station licences again ential, among others, preparation of manuscripts and typing of a large number of assigned frequencies in each licence. This adds to the volume of the licence which does not facilitate its exhibition on board a ship.

3. Therefore, it is suggested that another table may be added in Appendix 15, including all assignable frequencies in the ship radiotelegraph bands, arranged in groups. Each group may have frequency or frequencies from 4, 6, 8, 12, 16, 22 and 25 MHz bands, with suitable nomenclature for each group. The group of frequencies could then be indicated in the ship station licence by reference to the appropriate group designator, with suitable remarks where entire group of frequencies are not assigned. Such an arrangement would be advantageous in as much as the task of working out discrete assignable frequencies and arranging them in different groups by each administration would be eliminated. Further the preparation of licences will be facilitated substantially and as the arrangement would have international recognition the task of inspection would also be much easier.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 149-E
20 April 1974
Original : English

India

PROPOSALS FOR THE WORK OF THE CONFERENCE

APPENDIX 25

The revision on the basis of single sideband operation of the Frequency Allotment Plan for coast HF radiotelephone stations covering the channels in the present Appendix 25 and the additional channels made available by the 1967 Maritime Conference

Principle

The World Administrative Radio Conference for Maritime Mobile Telecommunications, Geneva, 1974, is required to revise the Frequency Allotment Plan (Appendix 25 MOD) to take into account the use of single sideband technique in the maritime mobile radiotelephone service in the bands between 4 000 and 23 000 kHz. The revised plan shall take into account all the channels contained in Section B of Appendix 17 (see also Resolution No. Mar.11) and other additional channels which may be available in consequence of the decisions of the Conference.

While revising the plan it would be imperative for the Conference to take into consideration the present requirement of the countries and at the same time plan should have flexibility to accommodate future needs of countries listed in Appendix 25 MOD at present and those who may be developing HF radiotelephone communication system at their coast stations. The latter provision is of great significance to new and developing countries where HF maritime radiotelephone services have either not developed or they are still in developing stage.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 150-E(Rev.1)
25 May 1974
Original : English

COMMITTEE 5

India

ADDITIONAL REQUIREMENTS OF FREQUENCIES FOR INDIAN COAST HF RADIOTELEPHONE STATIONS

India has plans for the development of its coast HF radiotelephone facilities during its fifth Five-year Plan (1974-1979) to cater for the large number of ships which India has and plans to build or procure during this period and also to meet the increasing international shipping traffic requirements. For this purpose, the following additional frequencies would be required. These are in addition to those already in operation and notified to I.F.R.B.

Frequency band	4 MHz	6 MHz	8 MHz	12 MHz	16 MHz	22 MHz
Number of channels required for						
i) India (West), and	2	-	1	2	1	1
ii) India (East)	1	-	2	1	2	2

Reasons for revision

India hoped that an allotment plan would be evolved at this Conference taking into consideration all the technical sharing criteria for sharing of frequency channels. Such a plan was expected to provide interference-free and reliable operation on the channels allotted to each country. In view of this, India earlier projected the existing operations only and did not request for any additional assignments. However, it now appears that the situation, as far as interference is concerned, is likely to be different and interference-free operation cannot be expected on the existing operations. As a matter of fact, the interference is sure to increase on these channels. In view of this, it would be very essential to have a few additional channels allotted to India so as to enable reduction in the loading of the existing channels which are already extensively shared by a large number of coast stations within India. Further, the expected increase in traffic during the next two years cannot be met with the existing few channels which are being heavily loaded in the draft Plan being prepared by Working Group 5C-3-F. The requirements projected now are the minimum additional number of frequencies needed for the next two or three years.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 150-E
20 April 1974
Original : English

India

REVISION OF ARTICLE 25 MOD

Specific requirement of frequencies for Indian Coast HF Radiotelephone stations

India has ambitious plans for the development of its coast HF radiotelephone facilities during its fifth Five Year Plan (1974-1979) to cater for the large number of ships which India has and plans to build or procure during this period and also to meet the increasing international shipping traffic requirements.

Considering its present and prospective requirements, India requests the Conference to allocate the following frequencies for its coast radiotelephone stations.

Frequency (kHz)			Country or area	Power in KW
Carrier		Assigned		
1.*	4 377.4	4 378.8	India (West)	5
2.	4 380.6	4 382.0	India (West)	5
3.*	4 415.8	4 417.2	India (East)	5
4.	4 425.4	4 426.8	India (East)	5
5.	6 515.4	6 516.8	India (West)	5
6.	6 521.8	6 523.2	India (East)	5
7.	8 741.6	8 743	India (West)	5
8.*	8 751.2	8 752.6	India (West)	5
9.*	8 770.4	8 771.8	India (East)	5
10.	8 786.4	8 787.8	India (East)	5
11.	13 116.0	13 117.4	India (West)	5
12.	13 130.0	13 131.4	India (West)	5

Frequency (kHz)			Country or area	Power in KW
Carrier		Assigned		
13.*	13 154.5	13 155.9	India (East)	5
14.*	13 161.5	13 162.9	India (East)	5
15.*	17 272.5	17 273.9	India (West)	5
16.	17 276.0	17 277.4	India (West)	5
17.	17 290.0	17 291.4	India (East)	5
18.*	17 300.5	17 301.9	India (East)	5
19.	22 639.5	22 640.9	India (West)	10
20.	22 660.5	22 661.9	India (West)	10
21.*	22 678.0	22 679.4	India (East)	5
22.*	22 692.0	22 693.4	India (East)	10

*) Frequencies already allotted to India vide Appendix 25 MOD

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 151-E
20 April 1974
Original : French

Albania

PROPOSALS FOR THE WORK OF THE CONFERENCE

LIST OF FREQUENCIES FOR RADIOTELEPHONY IN THE MARITIME MOBILE SERVICE

4 068 kHz
4 082 kHz
4 391.85 kHz
4 417.85 kHz
6 208 kHz
6 520 kHz
8 210 kHz
8 280 kHz
8 750 kHz
8 807 kHz
12 335 kHz
12 410 kHz
13 110 kHz
13 165 kHz
16 485 kHz
17 305,5 kHz
22 015 kHz
22 633.9 kHz

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 152-E
23 April 1974
Original : English

PLENARY MEETING

United Kingdom of Great Britain and Northern Ireland*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

ARTICLE 5, Insert

G/152/277 MOD 167 MAR Only classes A1 or F1, A4 or F4 emissions are authorized in the band 90-160 ~~kc/s~~ kHz for stations of the fixed ~~and maritime mobile services~~ service and in the band 110-160 kHz for stations of the maritime mobile service. Exceptionally, class A7J emissions is also authorized in the band ~~90 --- 160 kc/s~~ 110-160 kHz for stations of the maritime mobile service.

Reason: No 167, as it currently stands, could be interpreted as a contradiction of No 158. With 167 modified as proposed, the ambiguity is removed.

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*) See also Document 57

ARTICLE 7, Insert

Vessel Movement Service

G/152/278 ADD 457B The Vessel Movement Service should as far as possible be restricted to the International Maritime Mobile Band between 156-174 MHz.

Reason: To avoid increasing the load on the other already overloaded maritime mobile bands, particularly those between 1605 and 4000 kHz. The service is basically short range and communications should be handled on VHF.

ARTICLE 7

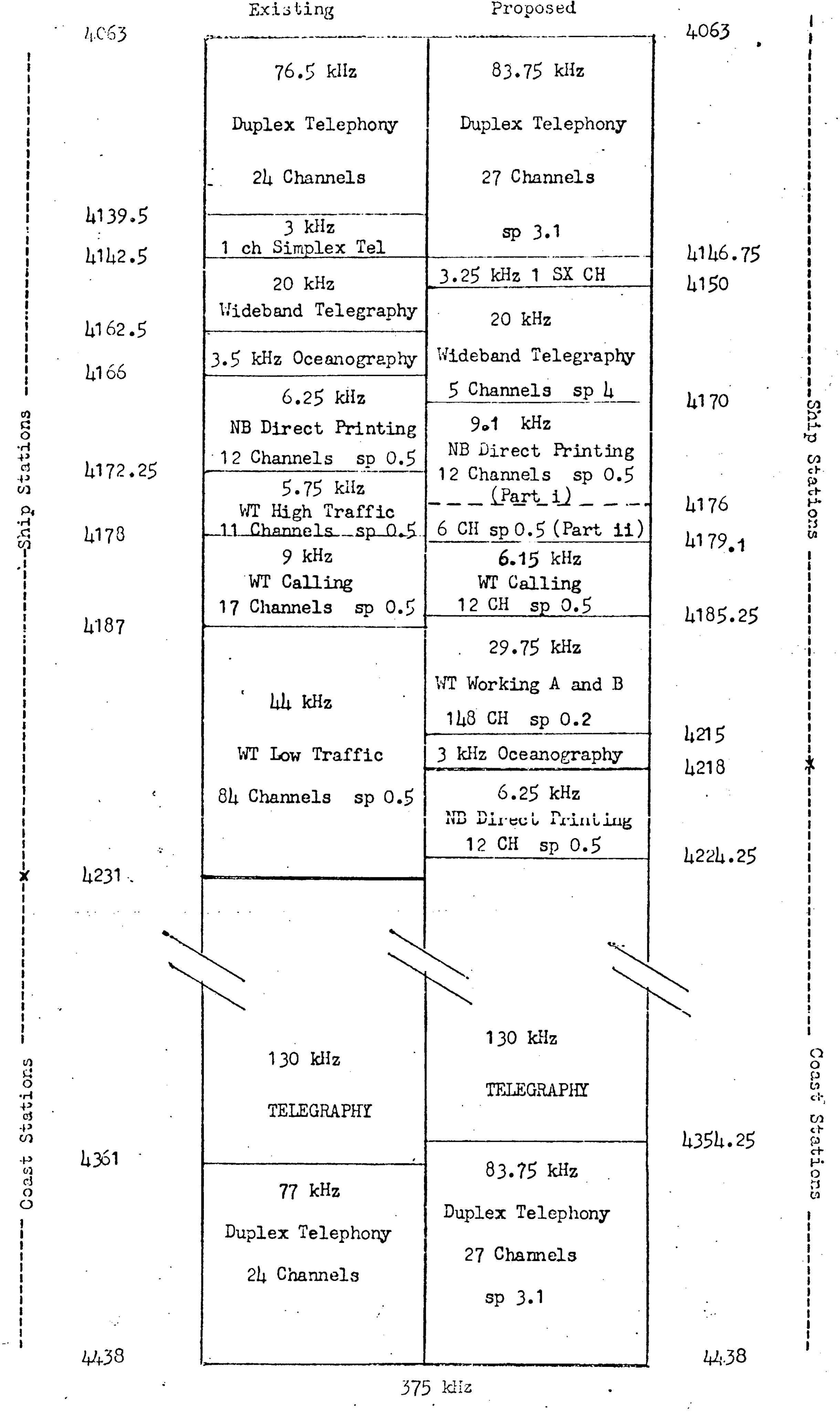
REVISION OF THE MARITIME MOBILE FREQUENCY BANDS

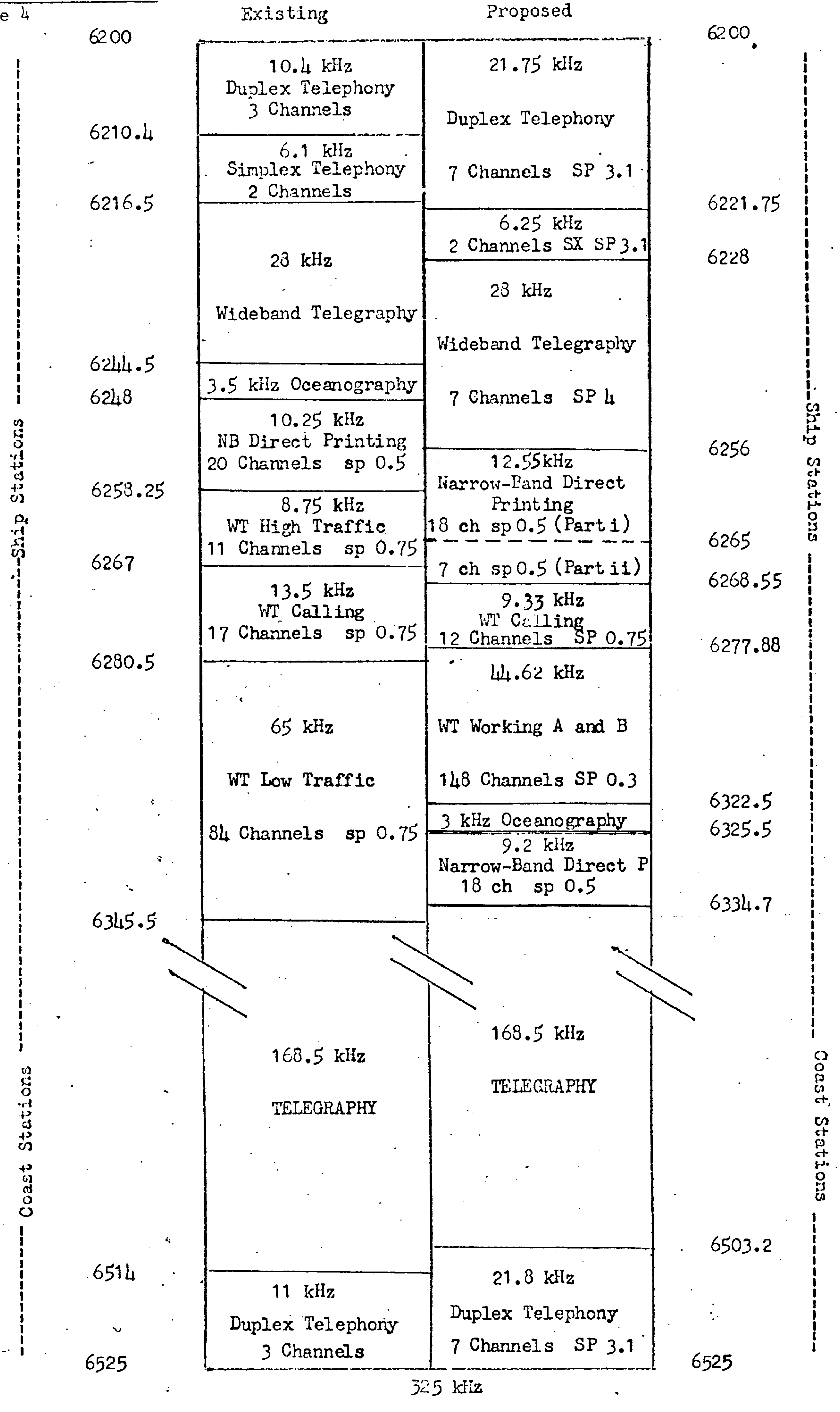
The UK proposals for the re-arrangement of the maritime mobile frequency bands have been re-examined in an attempt to meet objections and difficulties which have arisen both within the UK and with other administrations.

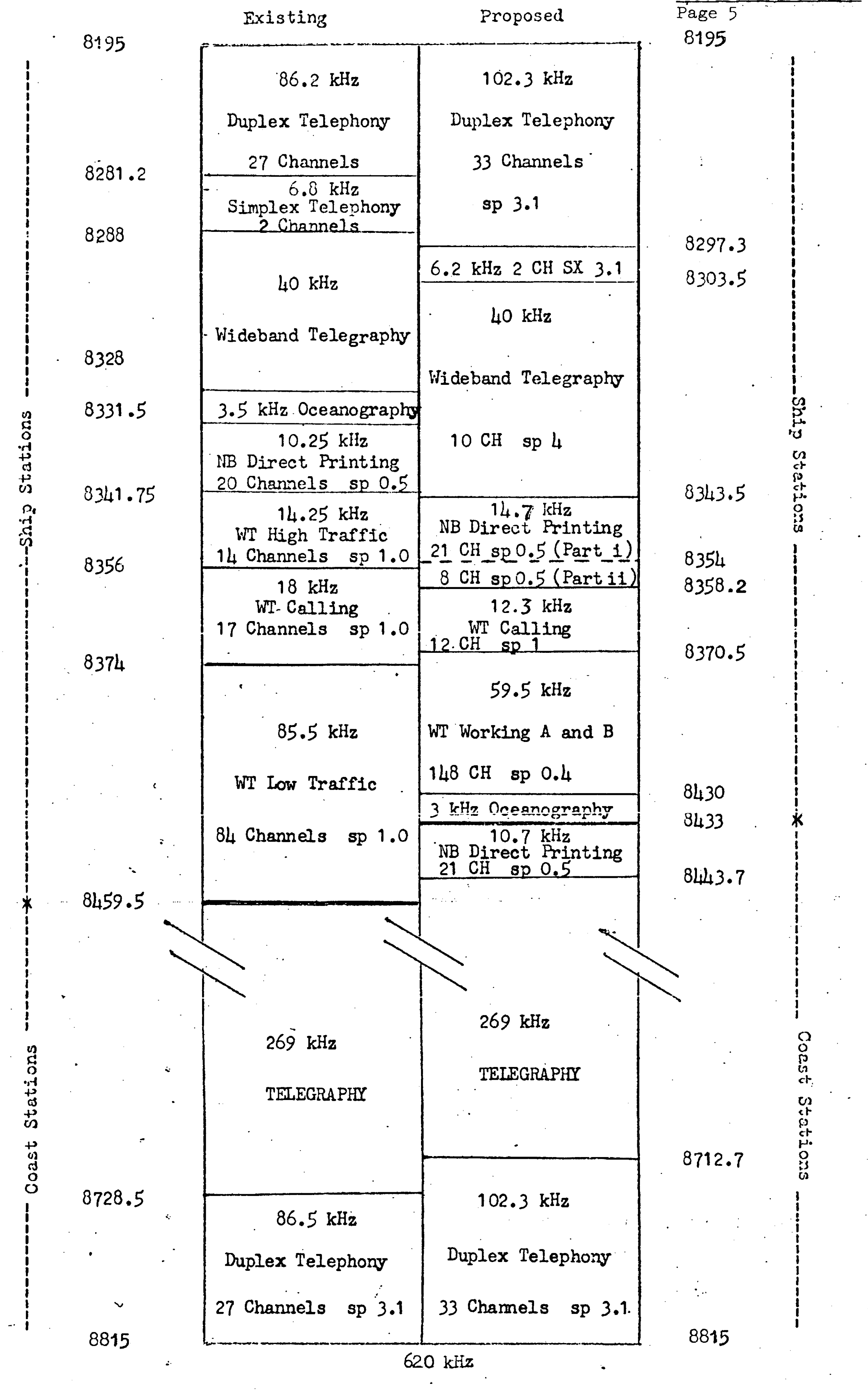
The Revision attached shows the effect of reducing the new exclusive coast station narrow-band direct-printing allocations by an amount sufficient to restore the existing coast station telegraphy allocations. The ship narrow-band direct-printing allocations have been retained but have been divided into two parts. Part i equals the reduced coast station narrow-band direct-printing allocation and allows for pairing with a standard separation. Frequencies in Part ii can be paired with existing coast station telegraphy assignments without a standard separation.

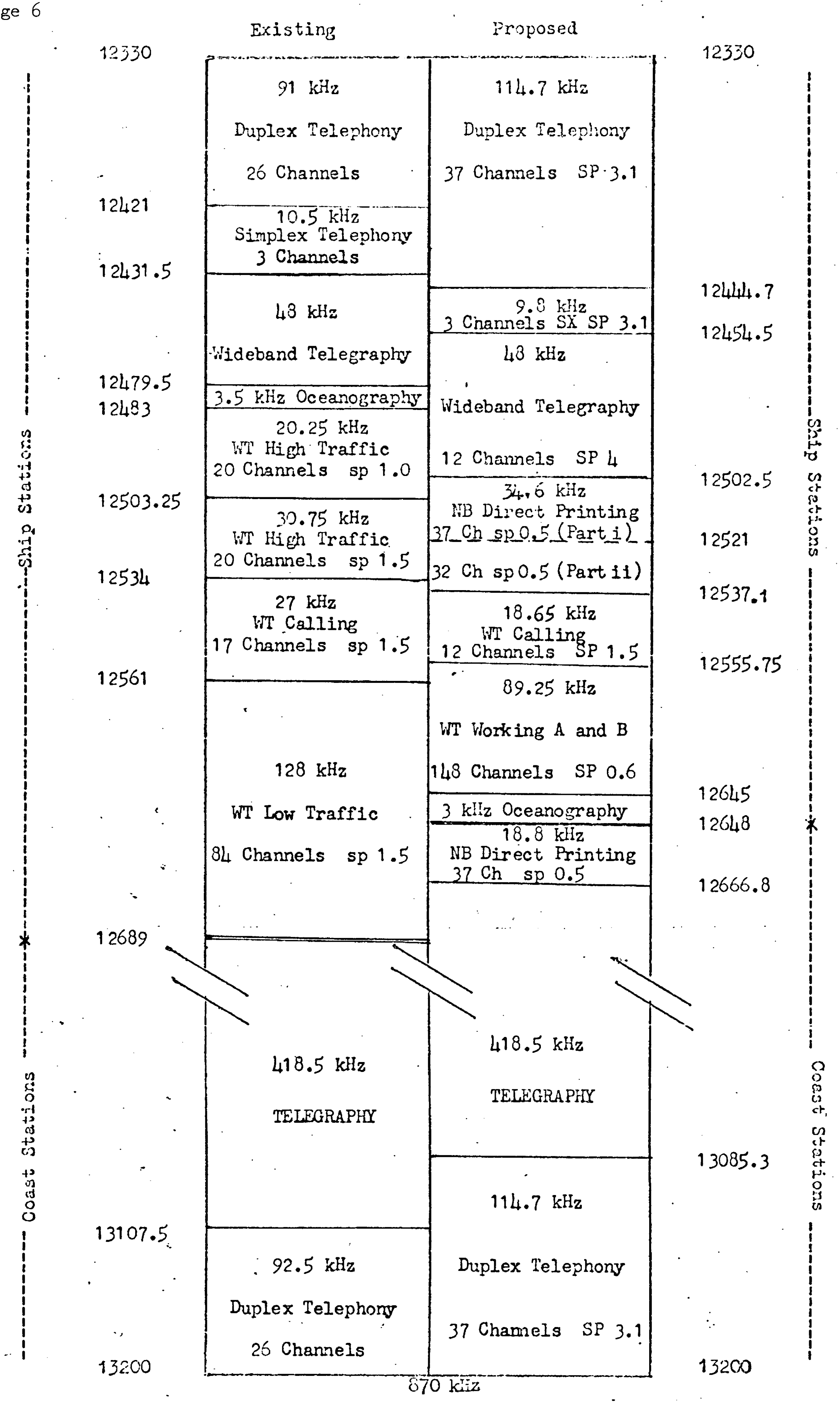
In this revision the advantages of the UK proposals are preserved. Additional narrow-band direct-printing frequencies have been made available in the 16 and 22 MHz bands by reducing the frequency spacing to 0.5 kHz in these bands.

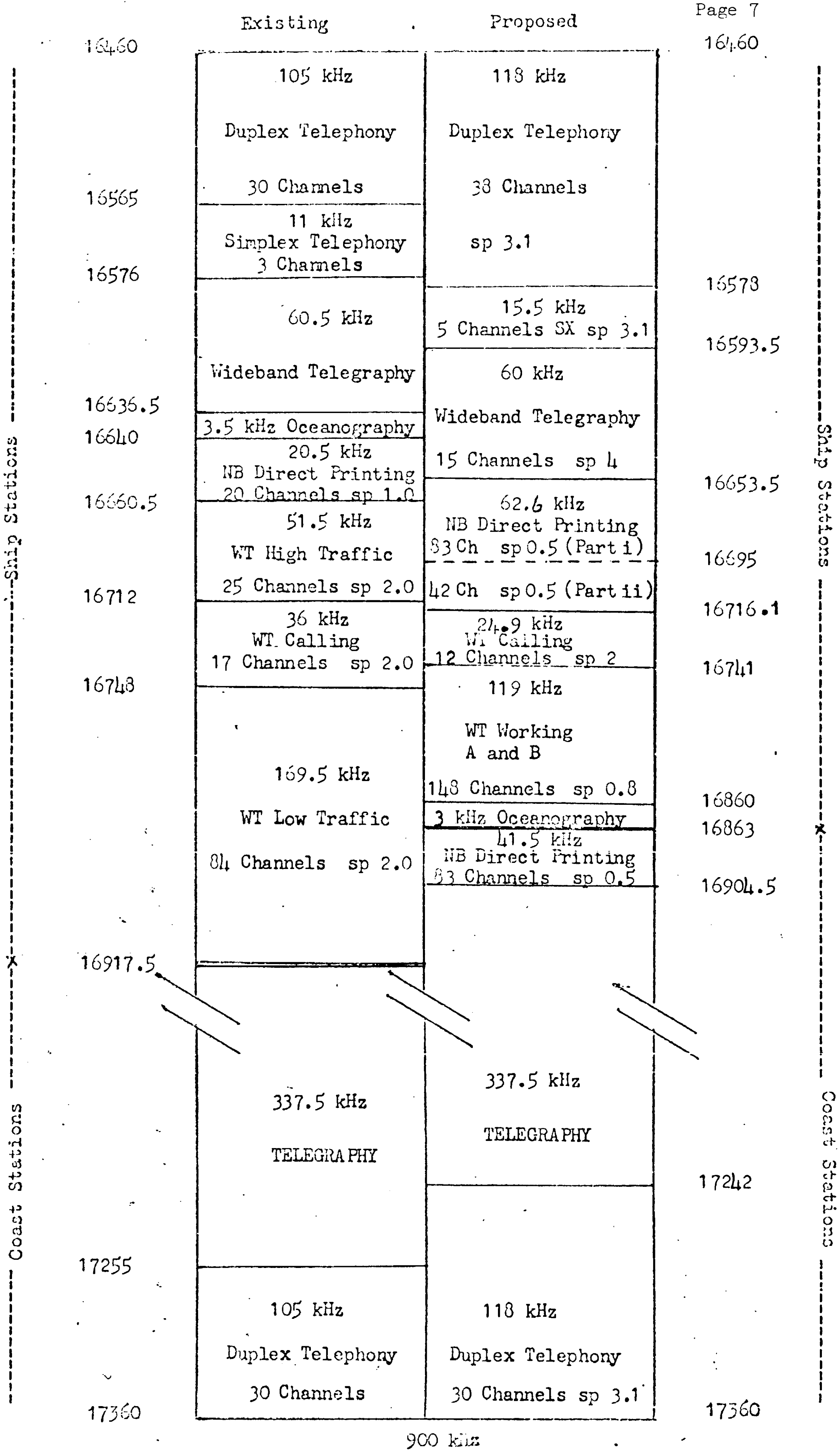
The attached proposed Resolutions WW and YY concern implementation of the above proposals.

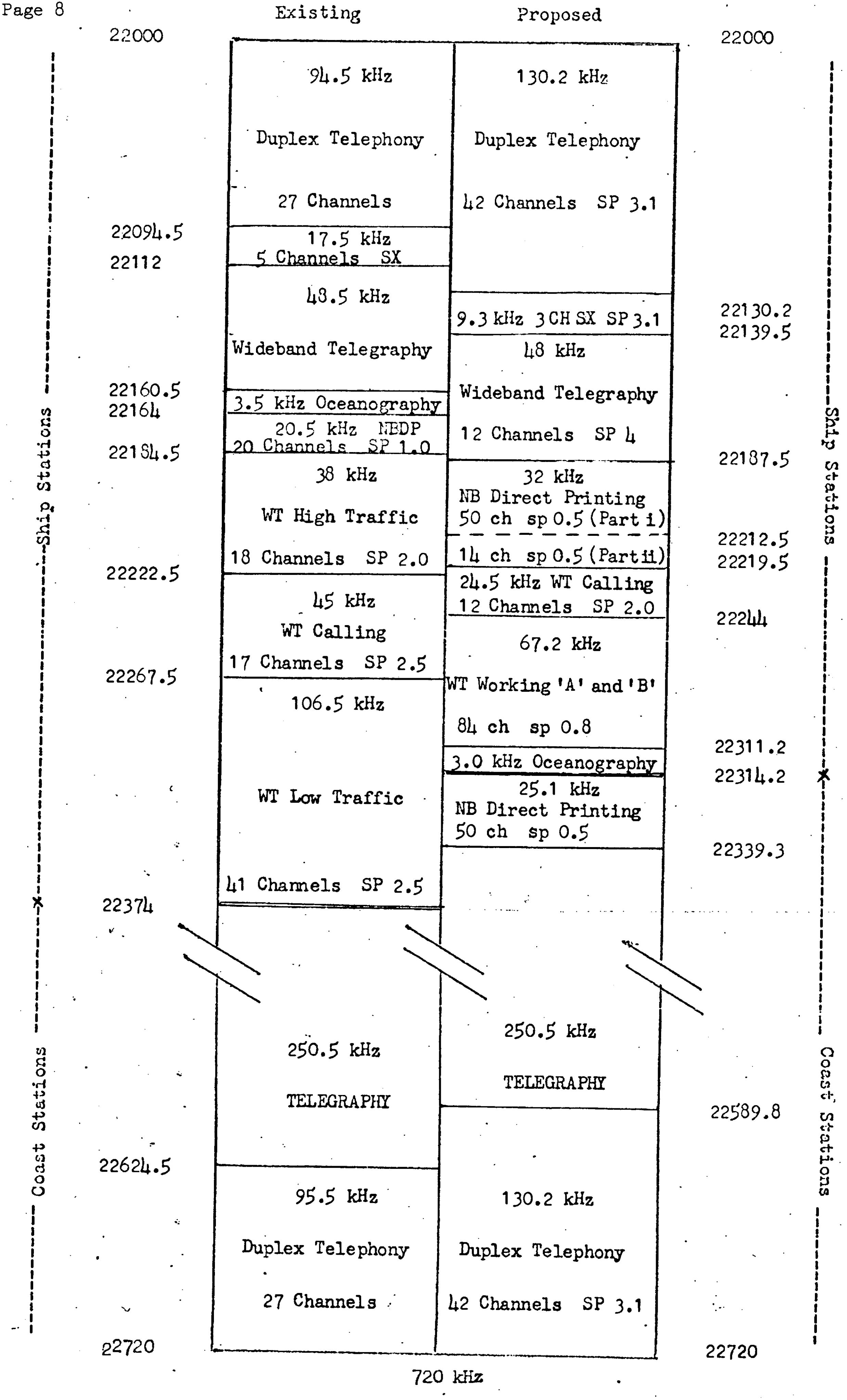

Existing
Proposed
4063
76.5 kHz
Duplex Telephony
24 Channels
4139.5
3 kHz
1 ch Simplex Tel
4142.5
20 kHz
Wideband Telegraphy
4162.5
3.5 kHz Oceanography
4166
6.25 kHz
NB Direct Printing
12 Channels sp 0.5
4172.25
5.75 kHz
WT High Traffic
11 Channels sp 0.5
4178
9 kHz
WT Calling
17 Channels sp 0.5
4187
44 kHz
WT Low Traffic
84 Channels sp 0.5
4231
130 kHz
TELEGRAPHY
4361
77 kHz
Duplex Telephony
24 Channels
4438
4063
83.75 kHz
Duplex Telephony
27 Channels
sp 3.1
4146.75
3.25 kHz 1 SX CH
4150
20 kHz
Wideband Telegraphy
5 Channels sp 4
4170
9.1 kHz
NB Direct Printing
12 Channels sp 0.5
(Part i)
4176
6 CH sp 0.5 (Part ii)
4179.1
6.15 kHz
WT Calling
12 CH sp 0.5
4185.25
29.75 kHz
WT Working A and B
148 CH sp 0.2
4215
3 kHz Oceanography
4218
6.25 kHz
NB Direct Printing
12 CH sp 0.5
4224.25
130 kHz
TELEGRAPHY
4354.25
83.75 kHz
Duplex Telephony
27 Channels
sp 3.1
4438
375 kHz
Ship Stations
Coast Stations
Ship Stations
Coast Stations


Existing
Proposed
6200
6200
10.4 kHz
Duplex Telephony
3 Channels
21.75 kHz
Duplex Telephony
7 Channels SP 3.1
6210.4
6.1 kHz
Simplex Telephony
2 Channels
6216.5
6221.75
6.25 kHz
2 Channels SX SP 3.1
6228
28 kHz
Wideband Telegraphy
28 kHz
Wideband Telegraphy
7 Channels SP 4
6244.5
3.5 kHz Oceanography
6248
10.25 kHz
NB Direct Printing
20 Channels sp 0.5
6256
12.55kHz
Narrow-Band Direct Printing
18 ch sp 0.5 (Part i)
6258.25
8.75 kHz
WT High Traffic
11 Channels sp 0.75
6265
7 ch sp 0.5 (Part ii)
6267
6268.55
13.5 kHz
WT Calling
17 Channels sp 0.75
9.33 kHz
WT Calling
12 Channels SP 0.75
6277.88
6280.5
44.62 kHz
WT Working A and B
148 Channels SP 0.3
65 kHz
WT Low Traffic
84 Channels sp 0.75
6322.5
3 kHz Oceanography
6325.5
9.2 kHz
Narrow-Band Direct P
18 ch sp 0.5
6334.7
6345.5
168.5 kHz
TELEGRAPHY
168.5 kHz
TELEGRAPHY
6503.2
6514
11 kHz
Duplex Telephony
3 Channels
21.8 kHz
Duplex Telephony
7 Channels SP 3.1
6525
6525
325 kHz
Ship Stations
Coast Stations
Ship Stations
Coast Stations


Existing
Proposed
8195
86.2 kHz
Duplex Telephony
27 Channels
8281.2
6.8 kHz
Simplex Telephony
2 Channels
8288
40 kHz
Wideband Telegraphy
8328
8331.5
3.5 kHz Oceanography
10.25 kHz
NB Direct Printing
20 Channels sp 0.5
8341.75
14.25 kHz
WT High Traffic
14 Channels sp 1.0
8356
18 kHz
WT Calling
17 Channels sp 1.0
8374
85.5 kHz
WT Low Traffic
84 Channels sp 1.0
8459.5
269 kHz
TELEGRAPHY
8728.5
86.5 kHz
Duplex Telephony
27 Channels sp 3.1
8815
8195
102.3 kHz
Duplex Telephony
33 Channels
sp 3.1
8297.3
6.2 kHz 2 CH SX 3.1
8303.5
40 kHz
Wideband Telegraphy
10 CH sp 4
8343.5
14.7 kHz
NB Direct Printing
21 CH sp 0.5 (Part i)
8354
8 CH sp 0.5 (Part ii)
8358.2
12.3 kHz
WT Calling
12 CH sp 1
8370.5
59.5 kHz
WT Working A and B
148 CH sp 0.4
8430
3 kHz Oceanography
8433
10.7 kHz
NB Direct Printing
21 CH sp 0.5
8443.7
269 kHz
TELEGRAPHY
8712.7
102.3 kHz
Duplex Telephony
33 Channels sp 3.1
8815
620 kHz
Ship Stations
Coast Stations
Ship Stations
Coast Stations


Existing
Proposed
12330
12330
91 kHz
Duplex Telephony
26 Channels
114.7 kHz
Duplex Telephony
37 Channels SP 3.1
12421
10.5 kHz
Simplex Telephony
3 Channels
12431.5
48 kHz
Wideband Telegraphy
12444.7
9.8 kHz
3 Channels SX SP 3.1
12454.5
48 kHz
Wideband Telegraphy
12 Channels SP 4
12479.5
3.5 kHz Oceanography
12483
20.25 kHz
WT High Traffic
20 Channels sp 1.0
12502.5
34.6 kHz
NB Direct Printing
37 Ch sp 0.5 (Part i)
32 Ch sp 0.5 (Part ii)
12503.25
30.75 kHz
WT High Traffic
20 Channels sp 1.5
12521
12534
12537.1
27 kHz
WT Calling
17 Channels sp 1.5
18.65 kHz
WT Calling
12 Channels SP 1.5
12555.75
12561
89.25 kHz
WT Working A and B
148 Channels SP 0.6
128 kHz
WT Low Traffic
84 Channels sp 1.5
12645
3 kHz Oceanography
12648
18.8 kHz
NB Direct Printing
37 Ch sp 0.5
12666.8
12689
418.5 kHz
TELEGRAPHY
418.5 kHz
TELEGRAPHY
13085.3
13107.5
114.7 kHz
Duplex Telephony
37 Channels SP 3.1
92.5 kHz
Duplex Telephony
26 Channels
13200
13200
870 kHz
Ship Stations
Coast Stations
Ship Stations
Coast Stations


Existing
Proposed
16460
16460
105 kHz
Duplex Telephony
30 Channels
118 kHz
Duplex Telephony
38 Channels
sp 3.1
16565
11 kHz
Simplex Telephony
3 Channels
16576
16578
60.5 kHz
Wideband Telegraphy
15.5 kHz
5 Channels SX sp 3.1
16593.5
60 kHz
Wideband Telegraphy
15 Channels sp 4
16636.5
3.5 kHz Oceanography
16640
20.5 kHz
NB Direct Printing
20 Channels sp 1.0
16660.5
16653.5
62.6 kHz
NB Direct Printing
83 Ch sp 0.5 (Part i)
16695
42 Ch sp 0.5 (Part ii)
51.5 kHz
WT High Traffic
25 Channels sp 2.0
16712
16716.1
36 kHz
WT Calling
17 Channels sp 2.0
24.9 kHz
WT Calling
12 Channels sp 2
16741
16748
119 kHz
WT Working
A and B
148 Channels sp 0.8
169.5 kHz
WT Low Traffic
84 Channels sp 2.0
3 kHz Oceanography
16860
16863
41.5 kHz
NB Direct Printing
83 Channels sp 0.5
16904.5
16917.5
Ship Stations
Ship Stations
337.5 kHz
TELEGRAPHY
337.5 kHz
TELEGRAPHY
17242
Coast Stations
Coast Stations
17255
105 kHz
Duplex Telephony
30 Channels
118 kHz
Duplex Telephony
30 Channels sp 3.1
17360
17360
900 kHz


Existing
Proposed
22000
94.5 kHz
Duplex Telephony
27 Channels
22094.5
17.5 kHz
5 Channels SX
22112
48.5 kHz
Wideband Telegraphy
22160.5
3.5 kHz Oceanography
22164
20.5 kHz NBDP
20 Channels SP 1.0
22184.5
38 kHz
WT High Traffic
18 Channels SP 2.0
22222.5
45 kHz
WT Calling
17 Channels SP 2.5
22267.5
106.5 kHz
WT Low Traffic
41 Channels SP 2.5
22374
250.5 kHz
TELEGRAPHY
22624.5
95.5 kHz
Duplex Telephony
27 Channels
22720
22000
130.2 kHz
Duplex Telephony
42 Channels SP 3.1
22130.2
9.3 kHz 3 CH SX SP 3.1
22139.5
48 kHz
Wideband Telegraphy
12 Channels SP 4
22187.5
32 kHz
NB Direct Printing
50 ch sp 0.5 (Part i)
22212.5
14 ch sp 0.5 (Part ii)
22219.5
24.5 kHz WT Calling
12 Channels SP 2.0
22244
67.2 kHz
WT Working 'A' and 'B'
84 ch sp 0.8
22311.2
3.0 kHz Oceanography
22314.2
25.1 kHz
NB Direct Printing
50 ch sp 0.5
22339.3
250.5 kHz
TELEGRAPHY
22589.8
130.2 kHz
Duplex Telephony
42 Channels SP 3.1
22720
Ship Stations
Coast Stations
Ship Stations
Coast Stations
720 kHz

G/152/279

Frequencies Assignable to Ship Radiotelegraph Stations using the Maritime Mobile Service Bands between 4 and 27.5MHz

MOD APPENDIX 15

Bands MHz	Limits	Assignable frequencies for wide-band telegraphy facsimile and special transmission systems	Limits	Assignable paired frequencies for narrow-band direct printing telegraph and data transmission systems (i)	Assignable non-paired frequencies for narrow-band direct printing telegraph and data transmission systems (ii)	Limits	Calling frequencies c)	Limits	Assignable working frequencies		Limits
									GROUP A	GROUP B	
4	4150	4152 - 4168 5 frequencies spaced 4	4170	4170.3-4175.8 12 frequencies spaced 0.5	4176.3-4178.8 6 frequencies spaced 0.5	4179.1	4179.5-4185 12 frequencies spaced 0.5	4185.25	4185.4-4200 74 frequencies spaced 0.2	4200.2-4214.8 74 frequencies spaced 0.2	4215
6	6228	6230 - 6254 7 frequencies spaced 4	6256	6256.3-6264.8 18 frequencies spaced 0.5	6265.3-6268.3 7 frequencies spaced 0.5	6268.55	6269.25-6277.5 12 frequencies spaced 0.75	6277.88	6278.1-6300 74 frequencies spaced 0.3	6300.3-6322.2 74 frequencies spaced 0.3	6322.5
8	8303.5	8305.5-8341.5 10 frequencies spaced 4	8343.5	8343.8-8353.8 21 frequencies spaced 0.5	8354.3-8357.8 8 frequencies spaced 0.5	8358.2	8359 - 8370 (b) 12 frequencies spaced 1	8370.5	8370.8- 8400 74 frequencies spaced 0.4	8400.4-8429.6 74 frequencies spaced 0.4	8430
12	12454.5	12456.5-12500.5 12 frequencies spaced 4	12502.5	12502.8-12520.8 37 frequencies spaced 0.5	12521.3-12536.8 32 frequencies spaced 0.5	12537.1	12538.5-12555 12 frequencies spaced 1.5	12555.75	12556.2-12600 74 frequencies spaced 0.6	12600.6-12644.4 74 frequencies spaced 0.6	12645
16	16593.5	16595.5-16651.5 15 frequencies spaced 4	16653.5	16653.8-16694.8 83 frequencies spaced 0.5	16695.3-16715.8 42 frequencies spaced 0.5	16716.1	16718-16740 12 frequencies spaced 2	16741	16741.6-16800 74 frequencies spaced 0.8	16800.8 16859.2 74 frequencies spaced 0.8	16860
22	22139.5	22141.5-22185.5 12 frequencies spaced 4	22187.5	22187.8-22212.3 50 frequencies spaced 0.5	22212.8-22219.3 14 frequencies spaced 0.5	22219.5	22221-22243 12 frequencies spaced 2	22244	22244.4-22277.2 42 frequencies spaced 0.8	22278-22310.8 42 frequencies spaced 0.8	22311.2

Limits	Oceanographic data transmission a	Limits
42 15	4215.15-4217.85 10 frequencies spaced 0.3	4218
6322.5	6322.65-6325.35 10 frequencies spaced 0.3	6325.5
8430	8430.15-8432.85 10 frequencies spaced 0.3	8433
12645	12645.15-12647.85 10 frequencies spaced 0.3	12648
16860	16860.15-16862.85 10 frequencies spaced 0.3	16863
22311.2	22311.35-22314.05 10 frequencies spaced 0.3	22314.2

	Limits	Calling frequencies	Limit	Working frequencies	Limit
25	25 070	25 073.5-25 881 6 frequencies spaced 1.5	25 082.5	25 084-25 106.5 16 frequencies spaced 1.5	25 110

a. The frequency bands may also be used by buoy stations for oceanographic data transmission and by stations interrogating these buoys, in accordance with the conditions set forth in Resolution No Mar 20.

b. For the conditions of use of 8364kHz see No 1179.

c. The frequencies 4185, 6277.5, 8370, 12555, 16740 and 22263 kHz may also be assigned as special calling frequencies. Administrations should not assign these frequencies as normal calling frequencies (see Nos 1013E and 1013E.1).

d. When making assignments in the various sub-bands the frequency assigned to a station shall be separated from the limits of the sub-band allocated to its service in such a way that, taking account of the frequency assigned to a station, no harmful interference is caused to services to which the frequency sub-bands immediately adjoining are allocated.

Reason: Consequential upon proposals for the revision of the allocation of sub-bands within the exclusive Maritime Mobile bands between 4 and 27.5MHz given in the proposals for Articles 7, 32 and 35.

G/152/280

RESOLUTION MAR WW

Relating to the rearrangement of certain Frequency Assignments for Coast Radiotelegraph Stations in the Frequency Bands Allocated Exclusively to the Maritime Mobile Service between 4000 and 23000 kHz.

The World Administrative Radio Conference, Geneva 1974

considering

a. that the frequency band limits for coast radiotelegraph stations have been modified as a result of the revision of Appendices 15 and 17 to the Radio Regulations

b. that the new limits of the frequency bands for coast radiotelegraph stations are

4224.25 - 4354.25 kHz
6334.7 - 6503.2 kHz
8443.7 - 8712.7 kHz
12666.8 - 13085.3 kHz
16904.5 - 17242 kHz
22339.3 - 22589.8 kHz

recognising

that the rearrangement of the frequency usage within the frequency bands allocated to the maritime mobile service should be carried out in several stages and that the transfer of certain coast radiotelegraph station frequency assignments governs any subsequent arrangements and should therefore be one of the phases of the rearrangement;

resolves

1 that the frequency assignments to coast radiotelegraph stations which, on the 1 April 1974, are recorded in the Master International Frequency Register, shall be transferred as follows:

- any frequency assignment f in the 4354.25 to 4361 kHz band shall be transferred to the frequency f - 130 kHz;

- any frequency assignment f in the 6503.2 to 6514 kHz band shall be transferred to the frequency f - 168.5 kHz;

- any frequency assignment f in the 8712.7 to 8728.5 kHz band shall be transferred to the frequency f - 269 kHz;

- any frequency assignment f in the 13085.3 to 13107.5 kHz band shall be transferred to the frequency f - 418.5 kHz;

- any frequency assignment f in the 17242 to 17255 kHz band shall be transferred to the frequency f - 337.5 kHz;

- any frequency assignment f in the 22589.8 to 22624.5 kHz band shall be transferred to the frequency f - 250.5 kHz.

2 that between 1 July 1976 and 1 August 1976 administrations shall transfer the transmitting frequencies of their coast radiotelegraph stations as indicated in paragraph 1 above. Administrations shall notify the IFRB of these transfers, in accordance with the provision of Section 1 of Article 9 of the Radio Regulations;

3 that provided the notices receiced by the IFRB in accordance with paragraph 2 above do not contain any change in the basic characteristics of the originally recorded assignment, other than the assigned frequency, the IFRB shall record the change in the Master Register. The dates to be entered in the appropriate parts of Column 2 shall be those of the original assignment. Should any other change in the basic characteristics of the original assignment be notified, this change shall be dealt with in accordance with the provisions of Article 9 of the Radio Regulations;

4 that on 2 August 1976, the IFRB shall also include in the Master Register, in respect of each original assignment the transfer of which has not at that time been notified to the Board, a provisional entry determined in accordance with paragraph 1 above. For such provisional entries, the dates in Column 2 recorded for the original

assignment shall be ratained. The original entries shall be retained in the Master Register but with a special remark in the Remarks Column and any dates in Column 2a shall be transferred to Column 2b;

5 that thirty days after 2 August 1976 the IFRB shall send to those administrations which have not yet notified the transfer of frequency assignments to their coast radiotelegraph stations in accordance with paragraphs 1 and 2 above, an extract from the Master Register showing the relevant entries contained therein on their behalf, and shall remind them of the provisions of this Resolution;

6 that if, sixty days after the despatch of these extracts, an administration has still not notified to the IFRB the transfer of an existing assignment in accordance with paragraphs 1 and 2 above, the corresponding provisional new entry shall be deleted from the Master Register and the original entry shall be retained with its date in Column 2b and a special remark in the Remarks Column; if however, the administration concerned notifies the transfer during the sixty days period, the provisions of paragraph 3 above shall apply;

7 that in those cases where the foregoing transfer procedure will result in an increase in the probability of a specific frequency assignment causing or experiencing harmful interference, the IFRB shall render such assistance as will be necessary to the administrations concerned in order to solve the problem. In doing so, the IFRB shall apply the provisions of No. 534 or Nos. 629 to 633 of the Radio Regulations, as the case may be.

G/152/281

RESOLUTION NO. MAR YY

RELATING TO THE IMPLEMENTATION OF THE NEW ARRANGEMENT OF RADIOTELEGRAPHY AND RADIOTELEPHONY BANDS ALLOCATED TO THE MARITIME MOBILE SERVICE BETWEEN 4000 AND 27500 KHZ

The World Administrative Radio Conference, Geneva 1974

considering

a. that each of the high frequency radiotelegraphy and radiotelephony bands allocated to the maritime mobile service by the Administrative Radio Conference, Geneva 1959, (and modified in Geneva 1967) has been further modified.

b. that a considerable number of both ship and coast stations will be transferred from existing frequencies to the new frequencies and channels designated by this Conference ;

c. that changes in frequency assignments should be made as soon as possible so that the advantages of the re-arrangement of bands may be realised at the earliest opportunity ;

d. that the transfer of assignments should be made with the least possible disruption of the service rendered by each station ;

e. that the transfer of assignments should be made in such a manner that harmful interference between stations involved is avoided during the implementation period ;

resolves

1. that the implementation of the decisions made by this Conference relating to the re-arrangement of the high-frequency bands allocated to the maritime mobile service should follow an orderly procedure for the transfer of the existing services from the old to the new assignments ;

2. that administrations should make every effort to implement the re-arrangement in accordance with the time schedule shown below.

DATE OF IMPLEMENTATION			STARTING DATE	COMPLETION DATE
STEP 1	a.	Transfer ship stations radiotelegraphy calling frequencies to their new frequencies	1.1.75	30.11.75
	b.	Vacate High Traffic ship radiotelegraphy frequencies by transferring High Traffic ships to assignments in the new radiotelegraphy working bands, avoiding those parts of the previous manual telegraphy calling band.	1.1.75	30.11.75
	c.	Transfer low traffic radiotelegraphy assignments to frequencies in the new radiotelegraphy working bands.	1.1.76	30.6.76
	d.	Transfer ship station narrow-band direct-printing assignments to frequencies in the new narrow-band direct-printing bands.	1.1.76	30.11.76
STEP 2		Transfer oceanography assignments to frequencies in the new oceanography bands.	1.7.76	30.6.77
STEP 3	a.	Transfer coast station radiotelegraph assignments to the new frequencies in accordance with RES. Mar WW .	1.7.76	1.8.76
	b.	Coast stations may commence use of the new coast station narrow-band direct-printing allotments.	1.7.76	
STEP 4		Transfer existing ship wide-band assignments to corresponding channels in the new wide-band allocations	1.7.77	30.11.77
STEP 5		Ship and coast radiotelegraph stations may commence use of the new radiotelephone channels.	[........]	

ARTICLE 28, Amend

G/152/282 MOD 980 to read:

(a) in each of the bands necessary to carry on the station's service, it shall have at least two working frequencies in addition to ~~one-in-the-calling-band~~ two calling frequencies. (See Nos ~~1193~~ 1177A, 1177B, 1177C, 1177D and 1198)

Reason: Consequential upon the UK Proposals in Articles 29 and 32.

ARTICLE 35, Insert

G/152/283 MOD 1295 MAR (2) Any signals sent for testing shall be kept to a minimum, particularly:

- on the carrier frequency 2182 ~~kc/s~~ kHz;
- on the frequency 156.80 ~~Mc/s~~ MHz;
- in the zone lying between the parallels 33° North and 57° South, on the carrier frequency ~~4136.3 kc/s~~ 4143.7 kHz;
- in the zone of Regions 1 and 3 lying between the parallels 33° North and 57° South, on the carrier frequency ~~6204 kc/s~~ 6215.6 kHz.

Reason: Consequential upon the conversion of spacing between frequencies to a standard 3.1 kHz.

- see Nos 1352B and 1353.

G/152/284 ARTICLE 40, Insert

SUP 1545-1549

Reason: as given.

APPENDIX 18, Insert

TABLE OF TRANSMITTING FREQUENCIES FOR THE BAND 156 - 174 MHZ

G/152/285 APPENDIX 18, Channel Designator column,

Add '1)' against channels 09, 10, 13, 18, 19, 21, 67, 73, 77.

Add 'n)' against channels 09, 10, 11, 12, 13, 14, 18, 19, 20, 21, 67, 68, 69, 71, 73, 74, 78, 79.

APPENDIX 18, amend Note 1) to read:

G/152/286 ADD 1) This channel may also be used for maritime support communications between ships and helicopters or light aircraft in accordance with Nos 951, 952, 952A, 952B, 952C and 952D.

Add a Note n) to read:

G/152/287 ADD n) This channel may also be used for maritime support communications between coast stations and helicopters or light aircraft in accordance with Nos 951, 952, 952A, 952B, 952C and 952D.

Reason: To provide channels for communications by helicopters and light aircraft in maritime support operations.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 153-E
22 April 1974
Original : English/
French

PLENARY MEETING

Switzerland*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item No. 1 : Revision of Appendix 25 etc.

The frequency requirements of Switzerland in the revised Frequency Allotment Plan for Coast Radiotelephone Stations (Appendix 25 to the Radio Regulations) will be as follows :

Frequency bands in MHz	4, 6	8	12	16	22
Number of SSB channels	2	3	3	3	2

Annex : 1

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*) See also Document 7.

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ANNEX

HF RADIOTELEPHONE TRAFFIC PASSED THROUGH THE COAST STATION OF HEB (SWITZERLAND)

Time GMT	Telegraphy Erlang	Telephony Erlang
	All Oceans	All Oceans
00-01	0.29	0.37
01-02	0	0
02-03	0	0
03-04	0	0
04-05	0.12	0.27
05-06	0	0
06-07	0	0
07-08	0.13	0.4
08-09	0.29	1
09-10	0.35	1.8
10-11	0	0
11-12	0	0
12-13	0.33	0.73
13-14	0.41	0.6
14-15	0.18	1.38
15-16	0.12	0.75
16-17	0.15	0.72
17-18	0.3	1.3
18-19	0	0
19-20	0.15	1.78
20-21	0.33	0.92
21-22	0.25	0.9
22-23	0	0
23-00	0	0

PERCENTAGE ANNUAL INCREASE IN TRAFFIC

	69	70	71	72	73
Telegraphy	+ 22 %	+ 40 %	+ 23 %	+ 30 %	+ 40 %
Telephony (minutes)	-	-	-	+159 %	+158 %

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 154-E
22 April 1974
Original : English

PLENARY MEETING

New Zealand

PROPOSALS FOR THE WORK OF THE CONFERENCE

New Zealand undertakes frequency notifications for the Cook Islands, Niue Island and Western Samoa. These administrations have advised their frequency requirements for the HF maritime radiotelephone service as follows :

	Frequency band in MHz					
	4	6	8	12	16	22
Cook Islands	1		1	1	1	1
Niue Island	1		1	1	1	1
Western Samoa	1	1	1	1	1	1

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 155-E
22 April 1974
Original : Spanish

PLENARY MEETING

Republic of Cuba

FREQUENCY REQUIREMENTS TO BE ADDED TO CUBA'S ASSIGNMENTS
IN APPENDIX 25 (MOD) OF THE RADIO REGULATIONS

SERIES	ASSIG. FREQ.	COUNTRY	SITE OF COAST STATION	LOCALITY(IES) OR AREA(S) WITH WHICH COMMUNICATION IS ESTABLISHED	MAX. LENGTH OF CIRCUIT (KM)	NATURE OF SERVICE	CLASS OF EMISSION NECESSARY BAND-WIDTH DESCRIPTION OF TRANSMISSION	POWER (in kW) PEP	MAXIMUM HOURS OF OPERATION FOR EACH LOCALITY (GMT)
7	4382.0	CUBA	STGO CUBA	LOCAL & CARIBBEAN SEA	2000	FC CP-CO	2.8A3A/J	5	H/24
21	4426.8	CUBA	HABANA	LOCAL & GULF OF MEXICO	1500	FC CP-CO	2.8A3A/J	5	H/24
7	8749.4	CUBA	STGO CUBA	CENTRAL & SOUTH ATLANTIC	6000	FC CP-CO	2.8A3A/J	5	H/24
21	8794.2	CUBA	HABANA	NORTH & CENTRAL ATLANTIC	6000	FC CP-CO	2.8A3A/J	5	H/24
7	13131.4	CUBA	STGO CUBA	CENTRAL & SOUTH ATLANTIC	5000	FC CP-CO	2.8A3A/J	5	H/24
23	13187.4	CUBA	HABANA	NORTH & CENTRAL ATLANTIC CENTRAL & SOUTH PACIFIC	6000	FC CP-OC	2.8A3A/J	5	H/24
7	17277.4	CUBA	STGO CUBA	CENTRAL & SOUTH ATLANTIC INDIAN OCEAN	16000	FC CP-OC	2.8A3A/J	5	2400-1200
21	17326.4	CUBA	HABANA	NORTH & CENTRAL ATLANTIC CENTRAL & SOUTH PACIFIC	6000	FC CP-OC	2.8A3A/J	5	2400-1200
7	22647.9	CUBA	STGO CUBA	CENTRAL & SOUTH ATLANTIC INDIAN OCEAN	16000	FC CP-OC	2.8A3A/J	5	1200-2400
23	22703.9	CUBA	HABANA	NORTH & CENTRAL ATLANTIC CENTRAL & SOUTH PACIFIC	16000	FC CP-OC	2.8A3A/J	5	1200-2400

NOTE : This document corresponds to Cuba's request to the I.F.R.B. dated 30 August 1972 which was confirmed on 2 February 1973. It has been reconsidered by our Administration and adjusted to current requirements.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 156-E
22 April 1974
Original : English

PLENARY MEETING

Norway

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item No. 1 : Norwegian HF Telephone Traffic Statistics

Reference is made to Document No. 47, which contains Norwegian proposals concerning the revision of the Frequency Allotment Plan for HF radiotelephone coast stations.

The Annex to the present document contains traffic statistics for the Norwegian HF coast station. The statistics are established in accordance with Annex 1 of Draft Resolution D in Document No. 47.

1. Traffic has been measured on typical days in the weeks 50-52 of 1973 and 1-11 of 1974. Table 1 shows the average traffic intensity recorded.

It should be noted that the traffic intensity in the evenings was somewhat lower than usual in part of the period, due to poor propagation conditions.

It should also be noted that the relevant frequency channel in the 6 MHz band was blocked most of the time by the pirate broadcasting station "Radio North Sea International" which still operates in the maritime mobile band (on 6 210 kHz).

Annex : 1

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ANNEX

HF RADIOTELEPHONE TRAFFIC PASSED THROUGH THE COAST STATION OF NORWAY

Time GMT	Number of connections completed	Time in paid minutes	Traffic intensity (ERLANGS)
00-01	0.5	3.3	0.09
01-02	0.2	0.8	0.03
02-03	0.1	0.4	0.01
03-04	-	-	-
04-05	0.1	0.8	0.03
05-06	0.1	0.2	0.01
06-07	1.1	5.9	0.17
07-08	11.9	91.5	2.32
08-09	33.4	250.6	6.40
09-10	37.0	291.1	7.32
10-11	36.7	286.6	7.22
11-12	34.9	260.7	6.67
12-13	34.2	262.5	6.66
13-14	31.3	243.4	6.14
14-15	33.1	238.8	6.19
15-16	35.3	241.4	6.38
16-17	33.4	215.4	5.82
17-18	28.4	188.8	5.04
18-19	26.7	182.4	4.82
19-20	24.1	159.7	4.27
20-21	13.5	89.4	2.39
21-22	7.3	47.5	1.28
22-23	3.2	25.4	0.64
23-24	0.6	6.8	0.15

2. Number of completed HF radiotelephone connections effected in 1973 : 133.508.

3. The total number of paid minutes corresponding to the calls of above paragraph : 967.933 minutes.

4. The average value of paid minutes per HF radiotelephone call : 7.25 minutes.

5. The percentage of HF radiotelephone traffic per Ocean :*)

Atlantic (30°E - 90°W) : 74.7%

Pacific (90°W - 150°E): 0.9%

Indian (30°E - 150°E): 24.4%

6. The percentage of radiotelephone traffic per HF band :*)

4	:	4.3%
6	:	0.9%
8	:	21.6%
12	:	36.8%
16	:	33.4%
22	:	3.0%

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*) Based on number of connections

INTERNATIONAL TELECOMMUNICATION UNION
MARITIME CONFERENCE
GENEVA, 1974

Document No. 157-E
22 April 1974
Original: English

PLENARY MEETING

Federative Republic of Brazil

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item No. 1 : Revision on the basis of single sideband operation of the Frequency Allotment Plan for coast HF radiotelephone stations covering the channels in the present Appendix 25 and the additional channels made available by the 1967 Maritime Conference

Comments

The Brazilian Administration considers that the present Frequency Allotment Plan for radiotelephone coast stations in the HF bands (Appendix 25 MOD to the Radio Regulations), should be revised with a view to ensuring that the operational needs of countries will be met in the best possible way, providing for the expansion of existing services and establishing new services. This revision should involve the assignments recorded in the Master International Frequency Register and an endeavour should be made to correct the lack of balance characterizing the present allotment of frequencies.

Since Resolution Mar 13 permitted the utilization of both sidebands, many countries recorded with the I.F.R.B. lower sideband channels corresponding to the allocations in Section I of the Appendix 25 MOD, with a view to meeting present requirements as well as those likely to arise in the very near future. These assignments should be kept in the new Section II of the revised Plan.

The Brazilian Administration considers that since the powers of existing allotments in the present Plan vary from 0.3 to 20 kW, countries employing the higher powers quite legally hamper the operations of the coast stations of those countries with which they share the frequency and which have lower allotted powers. In view of this, the revised Plan should fix a new maximum transmitter power to be used by coast stations all over the world.

With a view to the solution of interference problems, it would be useful to limit the number of coast stations with high power transmissions.

As it will be impossible for this Conference to analyze traffic data and other pertinent data specifying the frequency needs of countries, since the format for the presentation of these data is not defined, the Brazilian Administration is of the opinion that this Conference should regulate the information to be requested by the I.F.R.B. as well as issue the necessary instructions to the I.F.R.B.

The requests for new frequencies from countries listed in the Appendix 25 MOD, as well as from countries that have no frequencies registered in the Master Register should be considered later in accordance with instructions to be given to the I.F.R.B. by this Conference.

PROPOSALS

B/157/1 MOD 457 Mar (2) Appendix 25 contains the frequency allotment plan for coast radiotelephone stations in the high frequency bands (see, however, Resolution A).

B/157/2

RESOLUTION A

Relating to the adoption of the revised Frequency Allotment Plan for high frequency coast radiotelephone stations

The World Administrative Maritime Radio Conference, Geneva, 1974,

considering

a) that Recommendation Mar 6 requests the Conference to establish, on the basis of single sideband operation, a new Frequency Allotment Plan for high frequency radiotelephone coast stations covering the channels in the existing Appendix 25 as well as the new channels made available by the 1967 Maritime Radio Conference;

b) that this Conference may decide to make available additional channels for the maritime HF radiotelephone service;

c) that many countries have registered the lower sideband corresponding to their channels listed in Appendix 25 MOD, Sections I and II;

resolves

1. that on 1 January 1976 Sections I, II and III of Appendix 25 MOD shall be cancelled and replaced by two new sections containing all the channels listed in Section B of Appendix 17 MOD, that is:

- Section I, containing all allotments to be recorded in column 2a of the Master Frequency Register
- Section II, containing all allotments to be recorded in column 2b of the Master Frequency Register;

2. that the new Plan shall be based on the use of single sideband emissions only;

3. that each existing allotment, in Section I of the Appendix 25 MOD shall be transferred to the new Plan so as to provide one upper sideband allotment if the allotment is in use and if assignments have been recorded in the Master Frequency Register prior to 22 April 1974. This new allotment shall be recorded in column 2a of the Master Frequency Register with the date of the old entry;

4. that each existing allotment, in Section II of the Appendix 25 MOD shall be transferred to the new Plan so as to provide one lower sideband allotment if the allotment is in use and if assignments have been recorded in the Master Frequency Register prior to 22 April 1974. This new allotment shall be recorded in column 2a of the Master Frequency Register and these channels shall be shared in accordance with the planning procedures to be defined by this Conference for the use of the I.F.R.B.

5. that each existing allotment in Section III of the Appendix 25 MOD, shall be transferred to the new Plan if the allotment is in use and if assignments have been recorded in the Master Frequency Register prior to 22 April 1974. This new allotment shall be recorded in column 2a of the Master Frequency Register with the date of the old entry.

6. that each existing notification to the I.F.R.B. corresponding to the lower sideband of the allotments listed in Section I of the Appendix 25 MOD shall be transferred to the new Plan and recorded in column 2b of the Master Frequency Register if the lower sideband channel is in use and if assignments have been recorded in the Master Frequency Register.

7. that each existing notification to the I.F.R.B. corresponding to the lower sideband of the allotments listed in Section II of the Appendix 25 MOD shall be transferred to the new Plan but corresponding to the upper sideband of the respective allotments if the lower sideband is in use and if assignments have been recorded in the Master Register. This new allotment shall be recorded in column 2b of the Master Frequency Register.

8. that frequency assignments notified to the I.F.R.B. by countries not listed in the Appendix 25 MOD shall be transferred to the new Plan, provided that the frequencies are in use, in accordance with planning procedures to be defined by this Conference for use by the I.F.R.B.

9. that if any additional channels which the Conference may decide to make available for the maritime HF radiotelephone service do not become known in time for them to be taken into account in the preparation of the revised Plan, the Conference shall determine the date on which such additional channels shall be added to the Plan. Frequency allotments on these channels shall be made by the I.F.R.B. in accordance with the planning procedures to be defined by this Conference for use by the I.F.R.B.

10. that the revised Plan shall be published in loose-leaf form and the I.F.R.B. shall periodically publish additions and amendments thereto.

B/157/3

RESOLUTION B

Relating to the sharing arrangements for frequencies in the revised Appendix 25 MOD

The World Administrative Maritime Radio Conference, Geneva, 1974,

considering

a) that the sharing arrangements set forth in Appendix 25 MOD do not meet the needs of the countries listed;

b) that the large number of coast stations using high power emissions is one of the basic problems of interference in the present sharing arrangements;

c) that the high density traffic of coast stations using high power emissions is causing difficulties to the coast stations of countries that are only now using their shared frequencies;

resolves

1. that the radiotelephone coast stations of a country shall be classified as main and secondary stations;

2. that each country shall make every effort to have not more than two main stations;

3. that the criterion for a main station shall be a maximum transmitter power of 5 kW pep;

4. that the other coast stations shall be called secondary stations;

5. that the criterion for secondary stations shall be a maximum transmitter power of 1.5 kW pep;

6. that main stations shall preferably use the frequencies listed in Section I of the revised Plan;

7. that when using the frequencies listed in Section II of the revised Plan, main stations shall have a maximum transmitter power of 1.5 kW pep;

8. that secondary stations shall only use the frequencies listed in Section II of the revised Plan;

9. that the I.F.R.B. shall make periodical studies in order to obtain better sharing arrangements and shall inform administrations of the results.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 158-E
22 April 1974
Original: English

PLENARY MEETING

Greece*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item No. 4.1

GRC/158/14 SUP 287A
Spa2

Reasons : Greece considers that the frequencies of Appendix 18 should not be used by any satellite system because :

a) of the extensive requirements of these frequencies by the terrestrial communications of the Maritime Mobile Service ;

b) the implementation of the Resolution Spa 2-5 will lead to the creation of two satellite systems for safety and distress in the Maritime Mobile Service (one in the 150 MHz and one in the 1 500 MHz band), which is unpracticable and uneconomic.

GRC/158/15 SUP Resolution Spa 2-5

Reasons : As a consequence of the proposal GRC/158/14

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*) See also Documents 9, 10, 97 and 159-163.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Corrigendum to
Document No. 159-E
26 April 1974
Original : English

PLENARY MEETING

Greece

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item No. 4.5 :

On page 5 of Document No. 159 in connection with the proposal GRC/159/19 for a modification of Resolution No. Mar 4, please replace paragraph 8.5 as follows :

~~8.5~~ 8.1 date by which all equipments shall conform to 25 ~~kc/s~~ kHz standards ~~and all interleaved channels may be generally introduced~~ .... 1 January 1983.

ADD 8.2 date by which all interleaved channels may be generally introduced .... 1 January 1976.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 159-E
22 April 1974
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PLENARY MEETING

Greece*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 4.5 : The requirement for more telephone channels in the band 156-174 MHz from the Maritime Mobile Service increases rapidly. In addition the coexistence of the old requirements with 50 kHz spacing and the new ones with 25 kHz, renders the exploitation of the channels of Appendix 18 difficult and unpracticable. The date of 1 January 1983 of the full implementation of 25 kHz channels is considered as too far ahead. A convenient acceleration of the date of this implementation is deemed therefore as necessary.

GRC/159/16 MOD 1363.1 1. After 1 January ~~1983~~ 1976 this band is reduced to 156.7625-156.8375 MHz (see Resolution No. Mar 14).

Reasons : As a consequence of the proposal (GRC/159/19)

APPENDIX 18

Mar

Table of Transmitting Frequencies for the Band 156-174 MHz for Radiotelephony in the International Maritime Mobile Service

. . . .

. . . .

Notes referring to the table

GRC/159/17 MOD d) On channels 15 and 17 the maximum frequency deviation shall be limited to ± 5 ~~Kc/s~~ kHz. Until 1 January ~~1983~~ 1976 the ~~the effective radiated~~ carrier power of ship stations must not exceed 1 Watt.

---

*) See also Documents 9, 10, 97, 158 and 160 - 163.

MOD g) Before 1 January 1976 channels 60 and 88 can be used subject to special agreements between interested and affected administrations.

MOD j) This guard-band will apply after 1 January ~~1983~~ 1976 (see No. 1363.1).

Reasons : As a consequence of the proposal GRC/ /19.

APPENDIX 19

Mar

Technical Characteristics for Transmitters and Receivers Used in the Maritime Mobile Service in the 156-174 MHz band

(See Articles 28 and 35 Appendix 18 and Resolution No. Mar 14)

GRC/159/18 SUP Section A

MOD ~~Section B~~ Transmitters and receivers using 25 ~~Kc/s~~ kHz - spacing between adjacent channels.

NOC 1 - 5

MOD 6 It shall be possible to reduce readily, the ~~effective radiated~~ carrier power of a ship station to 1 Watt or less.

Reasons : In accordance with the proposal GRC/159/19.

GRC/159/19 MOD

RESOLUTION No. Mar 14

Relating to the Channel Spacing of Transmitting Frequencies Allotted to the International Maritime Mobile Service for Radiotelephony in the band 156-174 ~~Mc/s~~ MHz

(See Appendix 18 and Article 35)

The World Administrative Radio Conference, Geneva, ~~1967~~ 1974, considering

a) the expanding use of the maritime mobile radiotelephone frequencies in the VHF bands between 156 ~~Mc/s~~ MHz and 174 ~~Mc/s;~~ MHz;

b) the increasing demand for additional channels for port operations (including pilotage, tug and other services);

c) that the need for additional VHF channels for short-distance communications in the maritime mobile service to relieve the congestion and saturation on the maritime mobile frequencies in the band 1 605 ~~kc/s~~ kHz to 3 800 ~~kc/s~~ kHz increases rapidly ;

d) that this expanding use of VHF cannot be fully met by the existing available channels given in the Table of Transmitting Frequencies in Appendix 18 to the Radio Regulations, Geneva, 1959;

and further considering that by the World Administrative Radio Conference Geneva 1967

e) ~~that~~ additional channels ~~could be~~ were made available by reducing the present channel spacing of 50 ~~kc/s~~ kHz to 25 ~~kc/s~~ kHz;

f) a schedule of dates for modification of equipments from channel spacing of 50 kHz to 25 kHz spacing were adopted and this modification has been completed by 1 January 1973;

g) was decided that any new equipment must conform to 25 kHz standards by 1 January 1973.

resolves

1. that the ~~channel spacing for international maritime mobile VHF radiotelephone services shall be reduced from 50 kc/s to 25 kc/s~~ transition from channel spacing of 50 kHz to that of 25 kHz shall be completed for the international maritime mobile service by 1 January 1976.

2. that additional channels shall be obtained by interleaving the 25 ~~kc/s~~ kHz channels midway between the existing 50 ~~kc/s~~ kHz channels given in Appendix 18 to the Radio Regulations, Geneva, 1959, ~~and that they~~ shall be numbered from 60 to 88;

3. that the 25 ~~kc/s~~ kHz channels should be allocated on an international basis;

4. that, until 1 January ~~1983~~ 1976, administrations shall arrange that ship stations fittes with any of the channels from 01 to 28 of Appendix 18 to the Radio Regulations, Geneva, 1959, can obtain an adequate use of available services;

5. that, in bringing into use channels 15, 17 and 60 to 88 (see Appendix 18) before 1 January ~~1983~~ 1976, no harmful interference shall be caused to those services on channels 01 to 28 referred to in paragraph 4 above, especially with respect to ships equipped with receivers built for 50 ~~kc/s~~ kHz spacing between channels;

6. that the technical characteristics of equipment for 25 ~~kc/s~~ kHz channel spacing in the international maritime mobile VHF radiotelephone service shall be in accordance with Appendix 19; ~~Section B;~~

7. that, after 1 January ~~1983~~ 1976, guard-bands on either side of 156.80 ~~Mc/s~~ MHz shall be 156.7625 to 156.7875 ~~Mc/s~~ MHz and 156.8125 to 156.8375 ~~Mc/s~~ MHz;

8. ~~that the transition from a channel spacing of 50 kc/s to that of 25 kc/s shall be in accordance with the following :~~

8.1 ~~date by which modification of transmitters to a maximum deviation of ± 5 kc/s and of receivers to increase the audio gain, where necessary, may commence~~ . . . . ~~1 January 1972~~

8.2 ~~date by which the modifications specified in paragraph 8.1 shall be completed for all existing equipments~~ . . . . ~~1 January 1973~~

8.3 ~~date-up-to-which-coast-stations-should-maintain capability-to-receive-transmissions-with-a-maximum deviation-of-±-15-kc/s-and-after-which-the-modification of-coast-station-receivers-should-take-place-as-early as-practicable-to-meet-the-selectivity-requirements-for a-channel-spacing-of-25-kc/s~~ . . . . ~~1-January-1973~~

8.4 ~~date-by-which-all-new-equipments-shall-conform to-25-kc/s-standards~~ . . . . ~~1-January-1973~~

8.5 ~~date-by-which~~ that after 1 January 1976 all equipments shall conform to 25 ~~kc/s~~ kHz standards and all interleaved channels may be generally introduced . . . . . ~~1-January-1983~~

Reasons : In order to allow a rational use of the 25 kHz channels and the serving of the new requirements.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 160-E
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PLENARY MEETING

Greece*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item No. 12 :

ARTICLE 5

GRC/160/20 MOD

Allocation to Services		
Region 1	Region 2	Region 3
450-460	FIXED MOBILE 318 318B 319A	

GRC/160/21 ADD 318B The frequencies 457.525, 457.550 and 457.575 MHz may be used on board ships for internal operational communications and also for mooring, berthing and towing purposes. Equipment for this use shall satisfy the technical characteristics of Appendix 19A.

Reasons : To provide a better serving to the respective needs.

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*) See also Documents 9, 10, 97, 158, 159 and 161-163.

APPENDIX 18

GRC/160/22 SUP Note i)

Reasons : As a consequence of the proposal GRC/160/20

GRC/160/23 ADD

APPENDIX 19A

Technical characteristics for transmitters and receivers used in the maritime mobile service for on-board communications (See No. 318E)

1. Only frequency modulation with a pre-emphasis of 6 dB/octave (phase modulation) shall be used.

2. The frequency deviation corresponding to 100% modulation shall approach 5 kHz as nearly as practicable. In no event shall the frequency deviation exceed ± 5 kHz.

3. The frequency tolerance shall not exceed 10 parts in 10^6.

4. The audio-frequency band shall be limited to 3000 c/s.

5. The effective radiated power should be as low as possible and in no event should exceed 2.5 Watts.

6. The centre of the radiating system shall be less than 5 metres above the upper working deck.

Reasons : To specify the technical characteristics for on-board communication stations, to allow uniformity of the respective equipments and to minimize the probability of harmful interference.

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Greece*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item No. 3 : The provisions concerning distress and safety in the maritime mobile service.

Greece deems that measures should be further taken for improving the maritime distress system and, in particular, in radiotelephony. Accordingly, Greece taking also into consideration Resolution No. 217 of the 7th Assembly of I.M.C.O., proposes in the following the necessary changes of the Radio Regulations which will permit :

a) an alleviation of the use of 2 182 kHz in order that this frequency will be used and left more for distress purposes:

b) the use of the frequency 156.8 MHz as a distress frequency.

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*) See also Documents 9, 10, 97, 158-160, 162, 163

PROPOSALS CONCERNING THE REGULATIONS RELATING TO THE USE OF 2 182 kHz AS THE DISTRESS FREQUENCY

ARTICLE 33

General radiotelephone procedure in the maritime mobile service

Frequency to be used for calling and preparatory signals

A. Bands between 1 605 and 4 000 kHz

GRC/161/24	MOD	1225	§ 8 (1) A radiotelephone ship station calling a coast station ~~of its own nationality~~ should use for the call, in order of preference :
GRC/161/25	MOD	1226	(a) ~~the carrier frequency 2 182 kc/s~~ the working frequency on which the coast station is keeping watch according to the list of coast stations;
GRC/161/26	MOD	1227	(b) ~~a working frequency, whenever and wherever traffic density is high~~ the carrier frequency 2 182 kHz, only when other means of establishing contact are not available or unsuccessful.
GRC/161/27	SUP	1228 Mar	
GRC/161/28	MOD	1229	(3) A radiotelephone ship station calling another ship station should use for the call, in order of preference :
GRC/161/29	MOD	1230	(a) ~~the carrier frequency 2 182 kc/s~~ the appropriate inter-ship frequency established for that purpose by the competent authority;
GRC/161/30	MOD	1231	(b) ~~an inter-ship frequency whenever and wherever traffic density is high and prior arrangements can be made~~ the carrier frequency 2 182 kHz, only when other means of establishing contact are not available or unsuccessful.

Reasons : To allow the implementation of the Resolution A.217 of the 7th Assembly of I.M.C.O. and to improve the maritime distress system.

B. Distress

GRC/161/31 MOD 1323
Mar

§ 3 (1) The frequency 2 182 ~~kc/s~~ kHz is the international distress frequency for radiotelephony; it shall be used for this purpose by ship, aircraft and survival craft stations and by emergency position indicating radio beacons using frequencies in the authorized bands between 1 605 and 4 000 ~~kc/s~~ kHz when requesting assistance from the maritime services.

It is used for the distress call and distress traffic, for signals of emergency position-indicating radio beacons, for the urgency signal and urgency messages and for the safety signal. Safety messages shall be transmitted, ~~where practicable~~, on a working frequency after a preliminary announcement on 2 182 ~~kc/s~~ kHz. The class of emission to be used for radiotelephony on the frequency 2 182 ~~kc/s~~ kHz shall be A3 or A3H (see No. 984). The class of emission to be used by emergency position-indicating radio beacons shall be as specified in Appendix 20A (see also 1476G).

Reasons : To allow the implementation of Resolution A.217 of the 7th Assembly of I.M.C.O. and to improve the maritime distress system.

ARTICLE 36

Distress, alarm, urgency and safety

Section X

Safety signal

GRC/161/32 MOD 1492 Mar (3) ~~Wherever possible~~, the safety message which follows the call shall be sent on a working frequency, ~~particularly in areas of heavy traffic~~. A suitable announcement to this effect shall be made at the end of the call.

Reasons : To allow the implementation of Resolution A.217 of the 7th Assembly of I.M.C.O. and to improve the maritime distress system.

In addition to an improvement of the maritime mobile distress system on the frequencies 500 kHz and 2 182 kHz, Greece deems also that a distress frequency shall be established in the band 156 - 174 MHz to facilitate the distress procedure for the ships using this band and as such, the frequency of 156.8 MHz is proposed accordingly.

ARTICLE 5

Frequency allocations 10 kHz to 275 GHz

Section IV

Table of Frequency Allocations 10 kHz to 275 GHz

GRC/161/33 MOD 287 Mar The frequency 156.8 ~~Mc/s~~ MHz is the international distress safety and calling frequency for the maritime mobile VHF radiotelephone service. Administrations shall ensure that a guard-band on each of the frequency 156.8 ~~Mc/s~~ MHz is provided. The conditions for the use of this frequency are contained in Article 35.

In the bands 156.025 - 157.425 ~~Mc/s~~ MHz, 160.625 - 160.975 ~~Mc/s~~ MHz and 161.475 - 162.025 ~~Mc/s~~ MHz, each administration shall give priority to the maritime mobile service ~~on only such frequencies as are assigned to stations of the maritime mobile service by that administration~~ (see Article 35). (The rest remains unchanged).

Reasons : To establish 156.8 MHz as the distress frequency for ships using only and/or the maritime bands between 156 and 174 MHz and to express a regulation similar to No. 187 for the 500 kHz and to No. 201 Mar for the 2 182 kHz.

ARTICLE 6

GRC/161/34 MOD 421 § 7 Any emission capable of causing harmful interference to distress, alarm, urgency or safety signals on the international distress frequencies of 500 ~~Kc/s~~ kHz, 2 182 ~~Kc/s~~ kHz or 156.8 MHz is prohibited (see Nos. 187, 201, 287, 1112 and 1325).

Reasons : As a consequence of the proposal GRC/161/33.

GRC/161/35 Bands between 156 and 174 ~~Mc/s~~ MHz

NOC 988 §21 All ship stations equipped with radiotelephony to work in the authorized bands between 156 and 174 ~~Mc/s~~ MHz (see No. 287 and Appendix 18) shall be able to send and receive class F3 emissions (see Resolution No. Mar 14) on :

MOD 989 a) the distress, urgency, ~~calling~~ safety and calling frequency 156.80 ~~Mc/s~~ MHz. (The rest remains unchanged)

Reasons : As a consequence of the proposal GRC/161/33.

GRC/161/36 MOD 992 §22 (1) Any aircraft following a maritime course and required by national or international regulations to communicate for distress, safety or urgency purposes with stations of the maritime mobile service shall be capable of transmitting preferably class A2 or A2H and receiving preferably class A2 and A2H emissions on the carrier frequency of 500 ~~Kc/s~~ kHz or, on the carrier frequency of 2 182 ~~Kc/s~~ kHz, transmitting class A3 or A3H and receiving class A3 and A3H emissions, or on the frequency of 156.8 MHz transmitting and receiving class F3 emissions.

Reasons : As a consequence of the proposal GRC/161/33.

GRC/161/37 ADD 998A in the bands between 156 and 174 MHz be able to transmit on 156.8 MHz, using class F3 emission. If a receiver is provided for any of these bands, it shall be able to receive class F3 emissions on 156.8 MHz.

GRC/161/38 MOD 1252 §14 (1) When a station is called on 156.80 ~~Mc/s~~ MHz it should reply on the same frequency unless another frequency is indicated by the calling station.

Reasons : As a consequence of the proposal GRC/161/33.

GRC/161/39 MOD 1359 §18 (1) The frequency 156.80 ~~Mc/s~~ MHz is designated for world-wide use by the international maritime mobile radiotelephone service in the band 156 to 174 ~~Mc/s~~ MHz for distress, call, reply and safety purposes in accordance with the provisions of Article 33. ~~It may also be used for messages preceded by the urgency and safety signals and, if necessary, for distress messages.~~ It shall be used for this purpose by ship, aircraft and survival craft stations using frequencies in the authorized bands between 156 and 174 MHz when requesting assistance from the maritime services. It is used for the distress call and distress traffic, for signals of emergency position-indicating radio beacons, for the urgency signal, urgency traffic, and the safety signal and for call and reply. Safety messages shall, however, be transmitted whenever practicable on a working frequency after a preliminary announcement on 156.8 MHz. The class of emission to be used for radiotelephony on the frequency 156.8 MHz shall be F3 (see Appendix 19).

Reasons : As a consequence of the proposal GRC/161/33.

GRC/161/40 ADD 1363A (SA) Before transmitting on the frequency 156.8 MHz, a station in the mobile service should listen on this frequency for a reasonable period to make sure that no distress traffic is being sent (see No. 1217).

Reasons : As a consequence of the proposal GRC/161/33 and similar to 1326A Mar.

GRC/161/41 MOD 1364 §19 (1) A coast station providing an international maritime mobile service of radiotelephony in the band 156 to 174 ~~Mc/s~~ MHz ~~should~~ shall, during its working hours in that band, maintain, ~~as far as possible~~, an efficient aural watch on 156.80 ~~Mc/s~~ MHz.

Reasons : As a consequence of the proposal GRC/161/33.

GRC/161/42 MOD 1367 (4) Ship stations should, ~~where practicable~~, as far as possible, maintain watch on 156.80 ~~Mc/s~~ MHz ~~when within the service area of a coast station providing international maritime mobile service in the band 156-174 MHz~~ for receiving any probable distress, or urgency or safety signal in the band 156 - 174 MHz.

Reasons : As a consequence of the proposal GRC/161/33.

GRC/161/43 MOD 1456 §36 (1) The transmission of a distress message under the conditions prescribed in Nos. 1453 to 1455 shall be made on ~~either or both~~ one or more of the international distress frequencies (500 ~~Kc/s~~ kHz, 2 182 ~~Kc/s~~ kHz, 1 568 MHz) or on any other frequency that may be used in case of distress (see Nos. 1107, 1108, 1121, 1323 and 1324 and 1359).

Reasons : As a consequence of the proposal GRC/161/33.

GRC/161/44 MOD 1482 Mar (2) The urgency signal and the message following it shall be sent on one or more of the international distress frequencies (500 ~~Kc/s~~ kHz, 2 182 ~~Kc/s~~ kHz, 156.8 MHz) or on ~~one of the~~ any other frequency that may be used in case of distress.

Reasons : As a consequence of the proposal GRC/161/33.

GRC/161/45 MOD 1491 Mar (2) The safety signal and call shall be sent on one or more of the international distress frequency (500 kHz, 2 182 kHz, 156.8 kHz) or on ~~one of the frequencies which~~ any other frequency that may be used in case of distress.

Reasons : As a consequence of the proposal GRC/161/33.

GRC/161/46 MOD

APPENDIX 18

16	156.800	156.800	DISTRESS, SAFETY AND CALLING

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

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Greece*)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item No. 2 : The provision for high-frequency radiotelephony.

ARTICLE 33

General radiotelephone procedure in the Maritime Mobile Service

Section I

General provisions

GRC/162/47 ADD 1214A (1A) However in the bands between 4 000 and 23 000 kHz the duration of such signals shall be less than two minutes and then only to ensure the establishment or the supervision of a communication.

Reasons : To reduce mutual interference between the services of different coast stations using the same frequency.

ARTICLE 35

Use of frequencies for radiotelephony in the Maritime Mobile Service

Section III

Bands between 4 000 and 23 000 kHz

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*) See also Documents 9, 10, 97, 158-161, 163

E. Traffic

GRC/162/48 MOD 1355 §17. (1) For the conduct of duplex telephony, the transmitting frequencies of the coast stations and of the corresponding ship stations shall be associated in pairs, ~~as far as possible,~~ as indicated in Appendix 17, Sections A and B.

APPENDIX 17

Mar

Channeling of the Maritime Mobile Radiotelephone bands between 4 000 and 23 000 kHz

GRC/162/49 MOD 3. One or more series of frequencies from Sections A or B (with the exception of those frequencies of Section B mentioned in paragraph 5 below) are assigned to each coast station, which uses these frequencies associated, ~~as far as possible,~~ in pairs; each pair comprises a transmitting and a receiving frequency. The series shall be selected with due regard to the areas served and so as to avoid, as far as possible, harmful interference between the services of different coast stations.

Reasons : To limit the cross-band and cross-channeling working and their corresponding interferences.

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PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 7

1. As it is concluded from traffic observations and statistics, the long-distance communications needs of the ships have been enormously increased during the last years, especially in radiotelephony. In Greece e.g., the annual rate of growth of traffic, during the past five years, was at an average 24% for the radiotelephony and 15% for the radiotelegraphy. Proportional figures have been noticed in other countries too. The number of corresponding channels of the existing Appendices 15 and 17 is no more adequate to serve neither the present nor the future needs. As it is well known, congestions and serious interferences are frequent and they prevent the normal exchange of traffic. Moreover the small number of the existing Radiotelephone and Radiotelegraph channels does not allow the satisfaction of new requirements.

2. For the current decade, it is estimated that the increase of traffic will continue with a high rate. This increase, however, cannot be served unless radical measures are taken for a proportional increase of the telephone and telegraph channels on one side, and for an improvement of the communication quality on the other side. Most of the measures which have to be taken are to-day readily feasible, without economic drawbacks, due to the progress made in the technology. Their implementation needs only the approriate modifications of the Radio-Regulations.

3. The maritime satellite system to be put into operation in the course of the next few years, it is estimated that it will not, at the beginning of its life, serve the majority of ships due to practical and economical reasons. The long-distance communications of these ships will therefore continue for many years to rely entirely on the H.F. bands and therefore the necessary measures have to be taken.

4. To improve M.M.S. communications the Greek Administration believes that the followings have to be done.

a) A rearrangement of the frequency bands exclusively allocated to the M.M.S. between 4 and 23 MHz amongst the service categories.

---

*) See also Documents 9, 10, 97 and 158-162

b) A provision for duplex telephone channels and direct printing channels to MMS in the 25 MHz band and

c) Progressive limitation of emissions not belonging to the MMS in the exclusive allocated bands between 4 and 23 MHz.

5. Attachment No. 1 shows the plan for the aforementioned rearrangement of the exclusive to the MMS H.F. bands, between 4 and 23 MHz. This plan aims at providing the followings :

a. More duplex SSB telephone channels.

b. More A1 channels for manual morse keying.

c. Allocation for direct-printing channels in the direction shore to ship, to allow duplex working with ships and increase of the total number of these channels.

The increase of the beforementioned channels will render possible an alleviation of the congestion experienced to-day and a more rational and efficient spectrum utilisation. The benefits from such a rearrangement are indicated in the following table.

SUBDIVISION OF MMS BANDS BETWEEN 4 and 23 MHz

USE OF THE SUBBAND	NO. OF CHANNELS			
	RR 1967	GREEK PROPOSAL		
		No.	DIFFERENCE	% CHANGE
SHIP STATIONS				
DUPLEX TELEPHONY	137	206	69	50
SIMPLEX "	16	11	-5	- 31
WIDEBAND TELEGRAPHY	61	61	0	0
OCEAN DATA	60	60	0	0
DIRECT PRINTING	112	220	108	96
HIGH TRAFFIC	99	0	-99	-100
CALLING	102	120	18	17
LOW TRAFFIC	461	664	203	44
COAST STATIONS				
DIRECT PRINTING	-	220	220	-
TELEGRAPHY		NC	NC	NC
DUPLEX TELEPHONY	137	206	69	50

NC = No change

6. Attachment No. 2 shows the proposal for a better utilisation of the 25 MHz band for the MMS, in accordance with the view expressed in para. 4b above.

7. Finally it is considered that the Conference should examine the possibility of limitation of emissions affecting the communications between ship and shore on the exclusive to the MMS H.F. bands.

8. In the attached Annex the necessary changes at the Radio-Regulations are included. These changes are consequential to the above-mentioned modifications of the Appendices 15 and 17 and constitute the Greek proposals for the Agenda item No.7.

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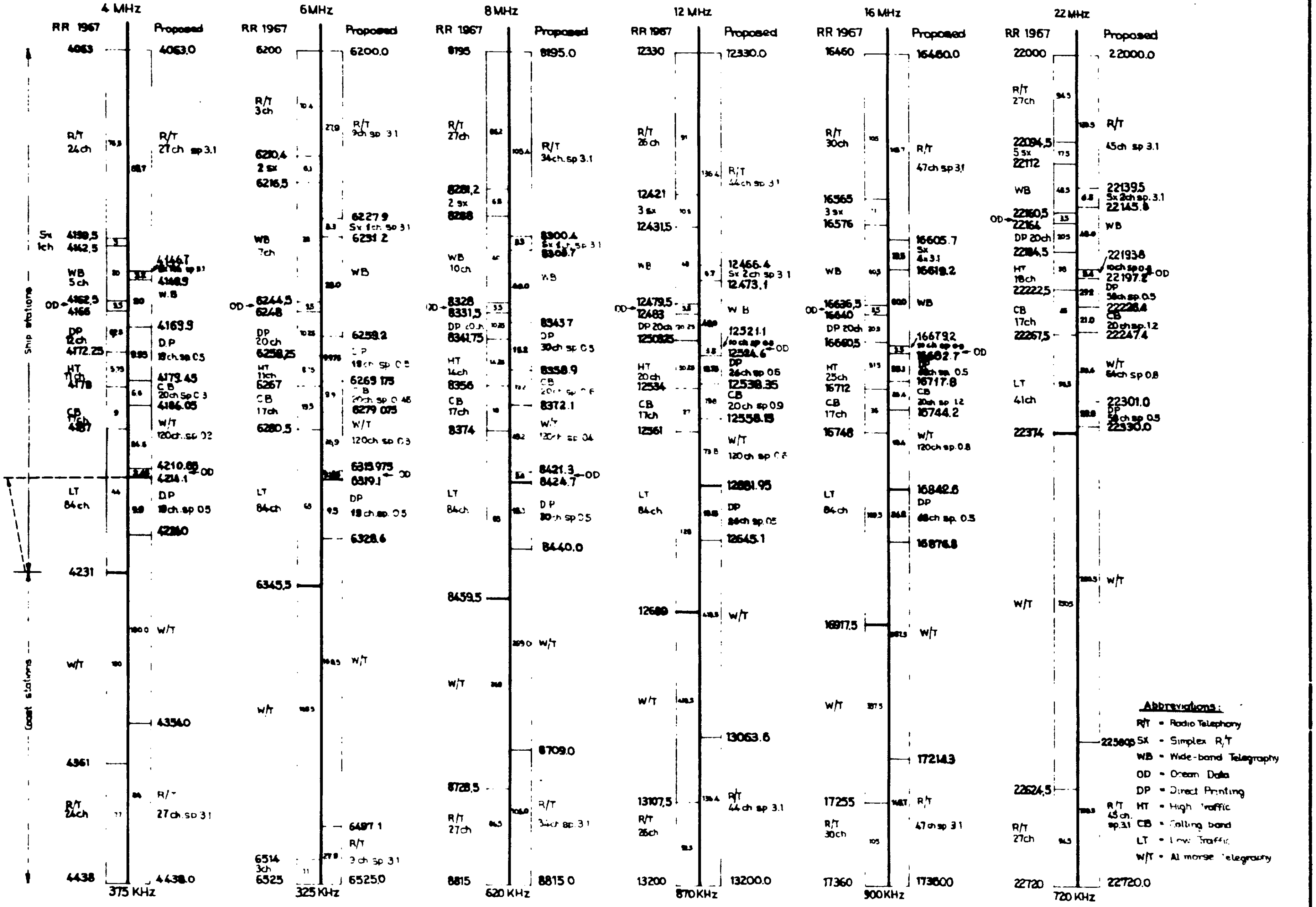
GREEK PROPOSAL FOR THE SUBDIVISION OF THE EXCLUSIVE MARITIME MOBILE HF BANDS BETWEEN 4 AND 23 MHz TO THE SEVERAL SERVICE CATEGORIES



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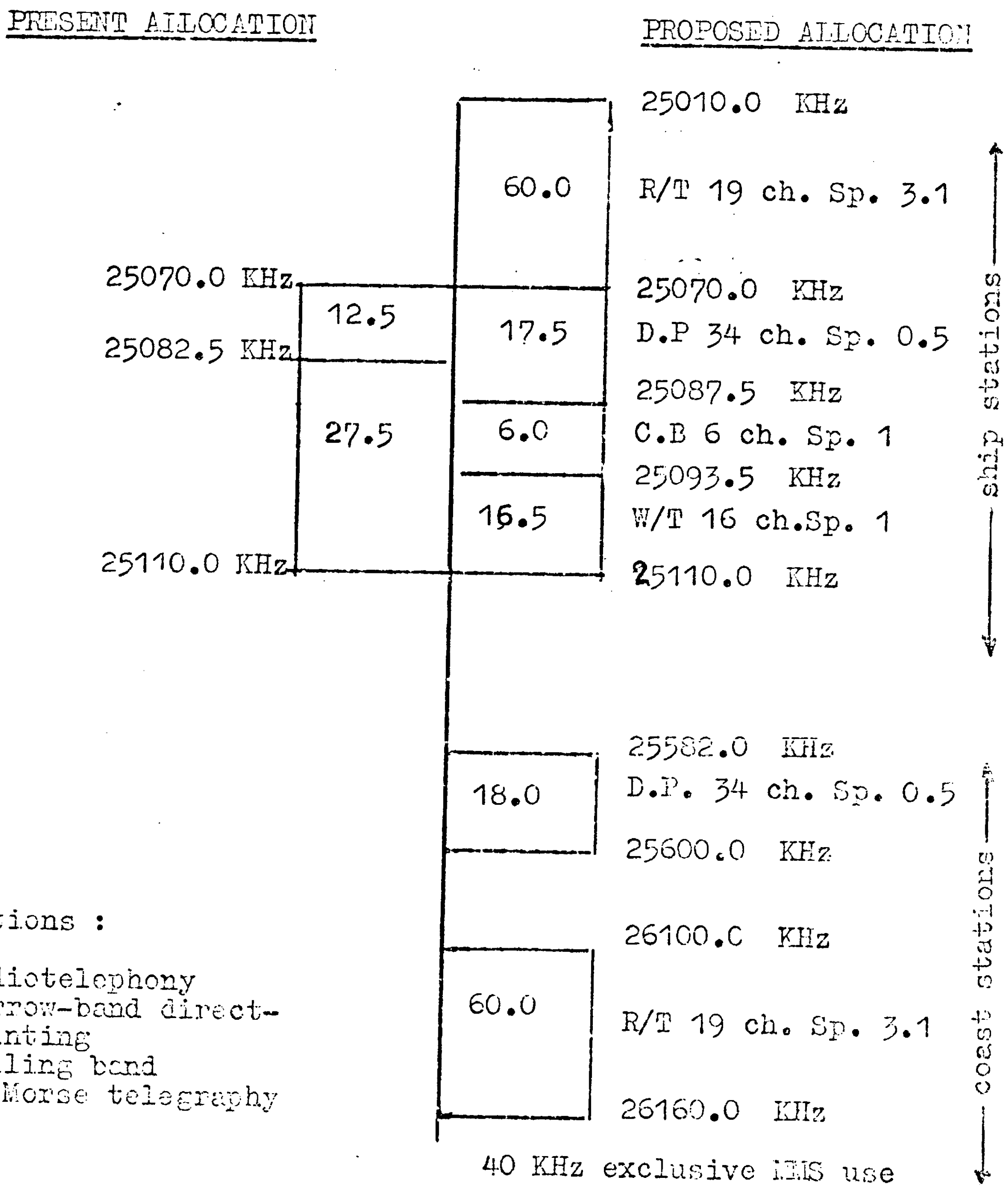
ATTACHMENT No. 2

PROPOSALS FOR A REARRANGEMENT OF MMS IN THE BAND OF 25 MHz



40 KHz exclusive MMS use
138 KHz shared use with FX

Abbreviations :

R/T = Radiotelephony
D.P.= Narrow-band direct-printing
C.B.= Calling band
W/T = A1 Morse telegraphy

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ANNEX

Agenda item 7

PROPOSED CHANGES TO ARTICLE 5 OF THE RADIO REGULATIONS

GRC/163/50 On the exclusive maritime mobile high frequency bands, communications not belonging to this service and done on the base of footnotes e.g. Nos.209, 211 affect seriously the communications between ships and coast stations. It is therefore proposed that Administrations concerned consider a possible deletion of such footnotes, in an effort to improve the maritime mobile communications and that the Conference should consider the necessary steps.

Article 5

Spa 2 Section IV. Table of Frequency Allocations -10 KHz to 275 GHz.

GRC/163/51 MOD 222 Inter-ship radiotelegraphy and/or radiotelephony simplex operation (one frequency channels) may be used in the maritime mobile service between the frequencies 23350 and 24000 ~~Kc/s~~ KHz.

Reasons : To provide for simplex radiotelephony operation between ships.

	Allocation to Services
GRC/163/52 MOD	25010 - 25070 FIXED MOBILE except aeronautical mobile 223A
NC	25070 - 25110 MARITIME MOBILE 224
MOD	25110 - 25600 FIXED MOBILE except aeronautical mobile 224A

GRC/163/53 ADD 223A

This band, when used by the Maritime Mobile Service, will be used only from ship stations, telephony, duplex operation (two frequency channels, see 226A and 453D).

Reasons : To provide for radiotelephony duplex channeling for the MMS in the 25 MHz band.

GRC/163/54 ADD 224A

The band 25582-25600, when used by the Maritime Mobile Service, will be used only from coast stations, telegraph narrow-band direct-printing telegraph and data transmissions (see 453 G).

Reasons : To provide for narrow-band direct-printing channels for the coast stations in the 25 MHz band, (see 453G).

GRC/163/55 MOD	26100 - 27500 FIXED MOBILE except aeronautical mobile 225 226 226A

GRC/163/56 ADD

The band 26100-26160 KHz, when used by the Maritime Mobile Service, will be used only from coast stations, telephony, duplex operation (two frequency channels, see 223A and 453E).

Reasons : To provide for radiotelephony duplex channeling for the MMS in the 25 MHz.

GRC/163/57 MOD 446

12.(1) The bands exclusively allocated to the maritime mobile service between 4 000 and ~~27 500 kc/s~~ 23.000 KHz (see Articles 5, 32 and 35) are subdivided into the following categories :

GRC/163/58 MOD 447 Mar

a) Ship stations, telephony, duplex operation (two-frequency channels)

4 063 - ~~4 439.5 kc/s~~ 4146.7 KHz
6 200 - ~~6 240.4 kc/s~~ 6227.9 KHz
8 195 - ~~8 284.2 kc/s~~ 8300.4 KHz
12 330 ~~- 12 424 kc/s~~ 12466.4 KHz
16 460 ~~- 16 565 kc/s~~ 16605.7 KHz
22 000 ~~- 22 094.5 kc/s~~ 22139.5 KHz

GRC/163/59 MOD 448 Mar

b) Coast stations, telephony, duplex operation (two-frequency channels)

4354.0 ~~4 364~~ - 4 438 ~~kc/s~~ KHz
6497.1 ~~6 511~~ - 6 525 ~~kc/s~~ KHz
8709.0 8 728.5- 8 815 ~~kc/s~~ KHz
13063.6 ~~13 107.5~~- 13 200 ~~kc/s~~ KHz
17214.3 ~~17 255~~ - 17 360 ~~kc/s~~ KHz
22580.5 ~~22 624.5~~- 22 720 ~~kc/s~~ KHz

GRC/163/60 MOD 449 Mar

c) Ship stations and coast stations, telephony, simplex operation (single-frequency channels)

4146.7 ~~4 439.5~~ - ~~4 442.5 kc/s~~ 4149.9 KHz
6227.9 ~~6 240.4~~ - ~~6 246.5 kc/s~~ 6231.2 KHz
8300.4 ~~8 284.2~~ - ~~8 288 kc/s~~ 8303.7 KHz
12466.4 ~~12 424~~ - ~~12 434.5 kc/s~~ 12473.1 KHz
16605.7 ~~16 565~~ - ~~16 576~~ ~~kc/s~~ 16619.2 KHz
22139.5 ~~22 094.5~~ - ~~22 442 kc/s~~ 22145.8 KHz

GRC/163/61 MOD 451 Mar

e) Ship stations, wide-band telegraphy, facsimile, and special transmission systems

4149.9 ~~4 442.5~~ - ~~4 462.5 kc/s~~ 4169.9 KHz
6231.2 ~~6 246.5~~ - ~~6 244.5 kc/s~~ 6259.[illegible] KHz
8303.7 ~~8 288~~ - ~~8 328~~ ~~kc/s~~ 8343.7 KHz
12473.1 ~~12 434.5~~ - ~~12 479.5 kc/s~~ 12521.1 KHz
16619.2 ~~16 576~~ - ~~16 636.5 kc/s~~ 16679.2 KHz
22145.8 ~~22 442~~ - ~~22 460.5 kc/s~~ 22193.8 KHz

GRC/163/62 MOD 451A
Mar

f) Ship stations, oceanographic data transmission (see note a in Appendix 15)

4210.65 - 4214.1 KHz ~~4 462.5~~ - ~~4 466 kc/s~~
6315.975- 6319.1 KHz ~~6 244.5~~ - ~~6 248 kc/s~~
8421.3 - 8424.7 KHz ~~8 328~~ - ~~8 334.5 kc/s~~
12621.1 -12524.6 KHz ~~12 479.5~~ - ~~12 483 kc/s~~
16679.2 -16682.7 KHz ~~16 636.5~~ - ~~16 640 kc/s~~
22193.8 -22197.2 KHz ~~22 460.5~~ - ~~22 464 kc/s~~

GRC/163/63 MOD 451B
Mar

g) Ship stations, narrow-band direct-printing telegraph and data transmission systems

4169.9 ~~4 466~~ - ~~4 472.25 kc/s~~ 4179.45 KHz
6259.2 ~~6 248~~ - ~~6 258.25 kc/s~~ 6269.175 KHz
8343.7 ~~8 334.5~~ - ~~8 344.75 kc/s~~ 8358.9 KHz
12524.6 ~~12 483~~ - ~~12 503.25 kc/s~~ 12538.35 KHz
16682.7 ~~16 640~~ - ~~16 660.5~~ kc/s 16717.8 KHz
22197.2 ~~22 464~~ - ~~22 484.5 kc/s~~ 22226.4 KHz
25070.0 25087.5 KHz

GRC/163/64 MOD 452
Mar

h) Ship stations, telegraphy

4179.45 ~~4 472.25~~ - ~~4234 kc/s~~ 4210.65 KHz
6269.175 ~~6 258.25~~ - ~~6345.5kc/s~~ 6315.975 KHz
8358.9 ~~8 344.75~~ - ~~8459.5 kc/s~~ 8421.3 KHz
12538.35 ~~12 503.25~~ - ~~12689~~ kc/s 12631.95 KHz
16717.8 ~~16 660.5~~ - ~~16945.5kc/s~~ 16842.4 KHz
22226.4 ~~22 484.5~~ - ~~22 374 kc/s~~ 22301.0 KHz
25087.5 - 25110.0 KHz

GRC/163/65 ADD 452A

i) Coast station, narrow-band direct-printing telegraph and data transmission systems

4214.1 - 4224.0 KHz
6319.1 - 6328.6 KHz
8424.7 - 8440.0 KHz
12631.95-12645.1 KHz
16842.4 -16876.8 KHz
22301.0 -22330.0 KHz

GRC/163/66 MOD 453 Mar

j) Coast stations, wide-band and manual telegraphy, facsimile, special and data transmission systems ~~and direct-printing telegraph systems~~

4224.0	~~4-234~~	-	~~4-364~~	~~kc/s~~	4 254.0 KHz
6328.6	~~6-345.5~~	-	~~6-544~~	~~kc/s~~	6 497.1 KHz
8440.0	~~8-459.5~~	-	~~8-728.5~~	~~kc/s~~	8 709.0 KHz
12645.1	~~12-689~~	-	~~13-407.5~~	~~kc/s~~	13 063.6 KHz
16876.8	~~16-947.5~~	-	~~17-255~~	~~kc/s~~	17 214.3 KHz
22330.0	~~22-374~~	-	~~22-624.5~~	~~kc/s~~	22 580.5 KHz

GRC/163/67 MOD 453A Mar

(1A) Frequencies in the bands ~~25-040-25-070 kc/s~~ 25 110-25600 ~~kc/s~~ KHz and 26100 - 27 500 ~~kc/s~~ KHz may be assigned to coast stations.

GRC/163/68 ADD 453B

(2) The bands between 23 000 and 27 500 KHz, when used on exclusive or conditional basis (see Articles 5, 32 and 35) by stations of the maritime mobile service, are subdivided into the following categories:

GRC/163/69 ADD 453C

a) Inter-ship radiotelegraphy or radiotelephony (see No.222)

23 350 to 24 000 KHz

GRC/163/70 ADD 453D

b) Ship stations, telephony, duplex operation (two-frequency channels, see No. ADD 223A and Appendix 17 MOD) :

25 010 to 25 070 KHz

GRC/163/71 ADD 453E

c) Coast stations, telephony, duplex operation (two-frequency channels, see No.ADD 224A and Appendix 17 MOD) :

26 100 to 26 160 KHz

GRC/163/72 ADD 453F

d) Ship stations, telegraph , narrow-band direct-printing telegraph and data transmission systems (see No.MOD 224 and Appendix 15 MOD):

25 070 to 25 087.5 KHz

GRC/163/73 ADD 453G

e) Coast stations telegraph , narrow-band direct-printing telegraph and data transmission systems :

25 582.0 to 25 600 KHz

GRC/163/74 MOD 456

13 (1) Appendix 17 shows the radiotelephone channels of the maritime mobile service in the frequency bands listed in Nos. 447, 448, 449, 453D, 453E .

Reasons : For the MOD 446, 447, 448, 449, 451, 451A, 451B, 452, 453, 453A and ADD 453B-C-D-E-F-G.

Consequential changes due to the proposed modifications of Appendices 15 and 17, see proposal GR/ /125 and 126

ARTICLE 28

Section III, Ship Stations using Radiotelegraphy Bands between 400 a and 27500 KHz

GRC/163/75 MOD 980 a) in each of the bands necessary to carry on the stations service, it ~~shall~~ may have ~~at least two~~ one or more working frequencies in addition to at least one in the calling band (see No. 1193 and 1198).

Reasons : To assign frequencies in proportion to traffic requirements.

Section VI. Survival Craft Stations

GRC/163/76 MOD 997 In the bands between 4000 and 27500 ~~kc/s~~ KHz, be able to transmit with a carrier frequency of 8364 ~~kc/s~~ KHz using class A2 or A2H emissions. If a receiver is provided for any of these bands, it shall be able to receive class A1, A2 and A2H emissions throughout the band 8341.75 to 8728.5 kc/s : 8358.9 to 8709.0 KHz.

Reasons : Consequential to the proposed changes in Appendix 15.

ARTICLE 28A

GRC/163/77 MOD 999E 4 Selective calls should be sent on one or more of the following calling frequencies :

500 ~~kc/s~~ KHz
2182 ~~kc/s~~ KHz
2170.5 ~~Kc/s~~ KHz 1
~~-4434.9~~ ~~kc/s~~ 4425.6 KHz
~~-6578.6~~ ~~kc/s~~ 6500.2 KHz
-8802.4 kc/s 8780.9 KHz
~~-13482.5~~ ~~kc/s~~ 13134.9 KHz
~~-17328.5~~ ~~kc/s~~ 17235.6 KHz
~~-22699.0~~ ~~kc/s~~ 22651.8 KHz

156.9 ~~Mc/s~~ MHz

Reasons : Consequential to the proposed changes in Appendix 17

GRC/163/78 MOD 999E1 This frequency will replace 2182 ~~kc/s~~ KHz for selective calling not later than 1 April 1977.

ARTICLE 32

Section V. Bands between 4000 and 27000 KHz

Reasons : The following changes of Article 32 are consequential to the proposed changes of Appendix 15.

C/163/79 MOD 1149 Mar

18.(1) Each of the bands reserved for ship radiotelegraph stations, except for the band 25 070 to 25 110 ~~kc/s~~ KHz, shall be divided ~~into six parts, beginning at the low frequency end~~ as follows :

C/163/80 SUP 1151 Mar

C/163/81 MOD 1153 Mar

f) a band of working frequencies for the use of ~~low-traffic~~ ship stations using A1 Morse telegraphy.

C/163/82 MOD 1154 Mar

(2) The bands ~~25 070 to 25 082.5 kc/s and 25 082 to 25 110 kc/s~~ 25087.5 to 25093.5 KHz and 25093.5 to 25110.0 KHz are allocated respectively for calling and working by ship radiotelegraph stations on ships of all categories which employ A1 ~~or F1 emissions (see No. 224)~~ Morse telegraphy.

C/163/83 ADD 1154A

(3) The band 25070 to 25087.5 KHz is allocated for ship stations using narrow-band direct-printing telegraph and data transmission systems.

C/163/84 SUP 1156 Mar

C/163/85 MOD 1173

(3) Working frequencies assignable to coast stations for A1 Morse telegraphy, wide-band, facsimile, special and data transmission systems and direct printing telegraph systems, using the bands between 4000 and 27500 ~~kc/s~~ KHz are included within the following band limits:

4224.0 ~~4234~~ to ~~4364~~ ~~kc/s~~ 4354.0 KHz
6328.6 ~~6345.5~~ to ~~6 544~~ ~~kc/s~~ 6497.1 KHz
8440.0 ~~8459.5~~ to ~~8728.5~~ ~~kc/s~~ 8709.0 KHz
12645.1 ~~12689~~ to ~~13107.5~~ ~~kc/s~~ 130[illegible].6 KHz
16826.8 ~~16944.4~~ to ~~17255~~ ~~kc/s~~ 172[illegible].2 KHz
22330.0 ~~22574~~ to ~~22624.5~~ ~~kc/s~~ 22580.5 KHz

(See also No. 453A.)

Reasons : To specify the use of these bands and to distinguish them from the use of narrow-band direct-printing channels.

GRC/163/86 ADD 1173A

(4) Working frequencies assignable to coast stations for narrow-band direct-printing telegraph and data transmission systems:

4214.1	to	4224.0	KHz
6319.1	to	6328.6	KHz
8424.7	to	8440.0	KHz
12631.95	to	12645.1	KHz
16842.6	to	16876.8	KHz
22301.0	to	22350.0	KHz

Reasons : Consequential to proposal MOD 1173.

GRC/163/87 ADD 1173B

(5) The assignable frequencies for coast stations working on narrow-band direct-printing telegraph and data transmission systems are spaced 0.5 KHz apart. The extreme assignable frequencies in the bands concerned are :

4214.5	and	4223.5	KHz
6319.25	and	6328.25	KHz
8425.0	and	8439.5	KHz
12632.2	and	12644.7	KHz
16843.0	and	16876.5	KHz
22301.25	and	22329.75	KHz

Reasons : Consequential to proposal ADD 1173A.

1. Calling Frequencies of Ship Stations

GRC/163/88 MOD 1174 Mar

29. (1) The calling frequencies assignable to ship stations are included within the following band limits :

4179.45	~~4178~~	to	~~4187~~	~~kc/s~~	4186.05 KHz
6269.175	~~6267~~	to	~~6280.5~~	~~kc/s~~	6279.075 KHz
8358.9	~~8356~~	to	~~8374~~	~~kc/s~~	8372.1 KHz
12528.35	~~12534~~	to	~~12564~~	~~kc/s~~	12558.15 KHz
16717.8	~~16712~~	to	~~16748~~	~~kc/s~~	16744.2 KHz
22226.4	~~22222.5~~	to	~~22267.5~~	~~kc/s~~	22247.4 KHz
25087.5	~~25070~~	to	~~25082.5~~	~~kc/s~~	25093.5 KHz

GRC/163/89 MOD 1175

(2) In the band ~~4178 to 4187 kc/s~~ 4179.45 to 4186.05 KHz, the calling frequencies are spaced ~~0.5 kc/s~~ 0.3 KHz apart. The extreme frequencies assignable are ~~4 478.5~~ 4179.9 and ~~4483.5 kc/s~~ 4185.6 KHz as indicated in Appendix 15.

GRC/163/90 MOD 1176
Mar

(3) In each of the other maritime mobile service bands between 4000 and 18000 ~~kc/s~~ KHz, the calling frequencies shall be in harmonic relationship with those in the band ~~4178 to 4187 kc/s~~ 4179.45 to 4186.05 KHz . In the bands ~~22222.5 to 22267.5 kc/s~~ 22226.4 to 22247.4 KHz and ~~25070.0 to 25082.5 kc/s~~ 25087.5 to 25093.5 KHz the spacing of calling frequencies is ~~2.5 kc/s and 1.5 kc/s~~ 1 KHz ~~respectively~~. The extreme frequencies assignable are ~~22225 and 22265 kc/s~~ 22227.0 and 22246.0 KHz and ~~25073.5 and 25084 kc/s~~ 25088.0 and 25093.0 KHz respectively.

GRC/163/91 MOD 1177
Mar

30. The administration to which a ship station is subject shall assign to it a series of calling frequencies including one frequency in each of the bands in which the station is equipped to transmit. Administrations, may, however, assign a supplementary series of calling frequencies for use in the event of interference. In the bands between 4000 and 18000 kc/s, the frequencies assigned to each ship station shall be in harmonic relationship. Each administration shall take the necessary steps to assign such harmonic series of calling frequencies to ships in accordance with an orderly system of rotation so as to distribute these frequencies uniformly throughout the calling bands. The same system of uniform distribution shall be applied in the assignment of calling frequencies in the bands ~~22222.5 to 22267.5 kc/s and 25070 to 25082.5 kc/s~~ 22226.4 to 22247.4 and 25087.5 to 25093.5 KHz. Administrations may also assign to their ship stations the special calling frequencies appearing in the footnote indicated by d) in Appendix 15.

2. Working Frequencies of Mobile Stations.

a. Channel Spacing and Assignment of Frequencie:

GRC/163/92 MOD 1180B Mar

32B. The working frequencies for ship stations using narrow-band direct-printing telegraph and data transmission systems are spaced 0.5 kc/s apart ~~in the 4,6 and 8 Mc/s bands and 4,0 kc/s apart in the 12, 16 and 22 Mc/s bands.~~ The frequencies assignable are shown in Appendix 15.

GRC/163/93 SUP 1181 Mar

GRC/163/94 MOD 1182 Mar

(2) In the band ~~4487 to 4234 kc/s~~ 4186.05 to 4210.65 KHz, the working frequencies ~~for low traffic ships~~ A1 Morse telegraphy ship stations are spaced 0.2 KHz apart, the extreme frequencies assignable being ~~4487,5 and 4229 kc/s~~ 4186.2 and 4210.4 KHz as shown in Appendix 15.

GRC/163/95 MOD 1183 Mar

34. The working frequencies assigned to each ship station in the 6,8,12 and 16 ~~Mc/s~~ MHz bands for A1 Morse telegraphy shall be harmonically related to those assigned in the 4 ~~Mc/s~~ MHz band, ~~in all cases where such a relationship is provided in~~ see Appendix 15.

NOC 1184 Mar

GRC/163/96 MOD 1185 Mar

a) in the ~~high traffic~~ calling band, the ~~working~~ frequencies are spaced ~~2 kc/s~~ 1 KHz apart, the extreme frequencies assignable being ~~22487 and 22221 kc/s~~ 22227 and 22246 KHz.

GRC/163/97 MOD 1186 Mar

b) in the ~~low traffic~~ A1 Morse telegraphy band, the working frequencies are spaced ~~2,5 kc/s~~ 0.8 KHz part, the extreme frequencies assignable being ~~22270 and 22370 kc/s~~ 22248.6 and 22299.8 KHz.

GRC/163/98 MOD 1187 Mar

36. In the 25 ~~Mc/s~~ MHz band the working frequencies for the A1 Morse telegraphy are spaced ~~4,5 kc/s~~ 0.8 KHz apart. The extreme frequencies assignable are ~~25084 and 25106,5 kc/s~~ 25093.9 and 25109.6 KHz, as shown in Appendix 15.

b) Working Frequencies for Ship Stations using Wide-Band Telegraphy, Facsimile and Special Transmission Systems

GRC/163/99 MOD 1188
Mar

37. The working frequencies assignable for ship stations using wide-band telegraphy, facsimile and special transmission systems are included within the following band limits:

4149.9	~~4142.5~~	to	~~4162.5 kc/s~~	4169.9 KHz
6231.2	~~6216.5~~	to	~~6244.5 kc/s~~	6259.2 KHz
8303.7	~~8288~~	to	~~8328~~ ~~kc/s~~	8343.7 KHz
12473.1	~~12431.5~~	to	~~12479.5 kc/s~~	12521.1 KHz
16619.2	~~16576~~	to	~~16636.5 kc/s~~	16679.2 KHz
22145.8	~~22112~~	to	~~22160.5 kc/s~~	22193.8 KHz

c) Working Frequencies for Oceanographic Data Stations

GRC/163/100 MOD 1191A
Mar

38A. The working frequencies assignable to ship stations for oceanographic data transmissions are included within the following band limits :

4210.65	~~4162.5~~	to	~~4166~~	~~kc/s~~	4214.1 KHz
6315.975	~~6244.5~~	to	~~6248~~	~~kc/s~~	6319.1 KHz
8421.3	~~8328~~	to	~~8331.5~~	~~kc/s~~	8424.7 KHz
12521.1	~~12479.5~~	to	~~12483~~	~~kc/s~~	12524.6 KHz
16679.2	~~16636.5~~	to	~~16640~~-	~~kc/s~~	16682.7 KHz
22193.8	~~22160.5~~	to	~~22164~~	~~kc/s~~	22197.2 KHz

d) Working Frequencies for Ship Stations using Narrow-Band Direct-Printing Telegraph and Data Transmission Systems

GRC/163/101 MOD 1191D
Mar

38D. Working frequencies assignable to ship stations using narrow-band direct-printing telegraph and data transmission systems are included within the following band limits :

4169.9	~~4166~~	to	~~4172.25 kc/s~~	4179.45 KHz
6259.2	~~6248~~	to	~~6258.25 kc/s~~	6269.172 KHz
8343.7	~~8331.5~~	to	~~8344.75 kc/s~~	8358.9 KHz
12524.6	~~12483~~	to	~~12503.25 kc/s~~	12538.35 KHz
16682.7	~~16640~~	to	~~16660.5 kc/s~~	16717.8 KHz
22197.2	~~22164~~	to	~~22184.5 kc/s~~	22226.4 KHz
25070.0	to	25087.5 KHz		

e) Working Frequencies for ~~High-Traffic~~ Ship Stations using A1 Morse telegraphy

GRC/163/102 MOD 1192 Mar

39. The working frequencies assignable to ~~high-traffic~~ ship stations using A1 Morse telegraphy are included within the following band limits :

4186.05 ~~4472.25~~ to ~~4478~~ ~~kc/s~~ 4210.65 KHz
6279.075 ~~6258.25~~ to ~~6267~~ ~~kc/s~~ 6315.975KHz
8372.1 ~~8344.75~~ to ~~8356~~ ~~kc/s~~ 8421.3 KHz
12558.15 ~~12503.25~~ to ~~12534~~ ~~kc/s~~ 12631.95 KHz
16744.2 ~~16660.5~~ to ~~16742~~ ~~kc/s~~ 16842.6 KHz
22247.4 ~~22484.5~~ to ~~22222.5~~ ~~kc/s~~ 22301.0 KHz
25093.5 to 25110.0 KHz

GRC/163/103 MOD 1193 Mar

40. (1) Each administration shall assign to each ~~high-traffic~~ ship station under its jurisdiction ~~two~~ one or more of the series of working frequencies shown in Appendix 15 ~~for vessels of this class~~. The total number of series of frequencies assigned to each ship station should be determined by the traffic requirements

GRC/163/104 MOD 1194

(2) When ~~high-traffic~~ ships stations are assigned less than the total number of working frequencies in a band, the administration concerned shall assign working frequencies to such ships in accordance with an orderly system of rotation which will ensure approximately the same number of assignments of any one frequency.

GRC/163/105 MOD 1195

41. For the exclusive purpose of communication with stations of the maritime mobile service an aircraft station may be assigned one or more series of working frequencies ~~in the high traffic bands.~~ These frequencies shall be assigned in accordance with the same system of uniform distribution ~~provided for high-traffic~~ ships mentioned in No. MOD 1194.

GRC/163/106 SUP 1196 Mar

GRC/163/107 SUP 1197 Mar

GRC/163/108 SUP 1198 Mar

GRC/163/109 SUP 1199 Mar

GRC/163/110 SUP 1200 Mar

g) Working Frequencies Available for Use by Ships of all Categories

GRC/163/111 SUP 1202 Mar

GRC/163/112 MOD

h f) Abbreviations for the Indication of Working Frequencies

ARTICLE 35

Use of Frequencies for Radiotelephony in the Maritime Mobile Service

Section I. General Provisions.

GRC/163/113 ADD 1322AA

2B. The peak envelope power of the transmitters of the coast radiotelephone stations operating between 1605 and 4000 KHz, or in the maritime mobile exclusive bands between 4000 and 27500 KHz, shall at no time be in excess of 5 KW per speech channel.

Reasons : This power, established according to Resolution No. Mar 15 for the new SSB channel created during the WARC Maritime, Geneva 1967, proved to be satisfactory for the SSB working. It should therefore be generalized for all SSB channels for uniformity purposes, for improving the exploitation and for reducing the interferences.

GRC/163/114 ADD 1322AB

2C. The peak envelope power of the transmitters of the ship radiotelephone stations operating between 1605 and 4000 KHz, or in the maritime mobile exclusive bands between 4000 and 27500 KHz, shall at no time be in excess of 1.5 KW per speech channel. In case of transmitters with an output peak envelope power between 400 and 1500 Watts and when such a power is not necessary, means shall exist on the transmitters to reduce this power to a value between 150 and 400 watts, to avoid provoking interferences to other stations of the maritime mobile stations.

Reasons : To be in conformity to the Resolution No. Mar 15.

GRC/163/115 SUP 1341

Reasons : Consequential to ADD 1322 AB.

GRC/163/116 SUP 1342
Mar

Reasons : This power established during the WARC Maritime, Geneva 1967, was based on a theoretical criterion of equivalence between DSB and SSB power. With the experienced gain since then, the PEP powers of 8 and 14 KW seem excessive. A reduction to the general limit of 5 KW is considered a satisfactory and rational solution.

Section III. Bands between 4000 and 23000 ~~kc/s~~ KHz.

A. Mode of Operation of Stations

GRC/163/117 MOD 1351A
Mar

13A.(1) The classes of emission to be used for radiotelephony in the maritime mobile service bands between 4000 and ~~23000 kc/s~~ 27500 KHz are :

~~a) class A3~~[1]~~, at~~ a maximum until 1 January 1978, for ship stations equipped with DSB transmitters prior to 1 January 1972, or

~~b) class A3H~~[2]~~, A3A and A3J~~[3].

However, unless otherwise specified in these Regulations (see No. 1353A):

- ~~after 1 January 1972, class A3 emissions shall no longer be authorized for coast stations, and~~
- after 1 January 1978, class A3H emissions for coast stations and class A3 and A3H emissions for ship stations shall no longer be authorized.

Reasons : The bring up-to-date the Regulations.

GRC/163/118 SUP 1351A.1

[1] For the use of class A3B emissions, see Resolution No. Mar.13.

Reasons : With the implementation of SSB technique, A3B emissions are no more feasible.

B. Call, Reply and Safety

GRC/163/119 MOD 1352
Mar

14.(1) Ship stations may use the following carrier frequencies for calling in radiotelephony :

~~4 136.3~~	~~kc/s~~[1]	4134.3 KHz
~~6 204.0~~	~~kc/s~~	6203.1 KHz
~~8 268.4~~	~~kc/s~~	8266.3 KHz
~~12 403.5~~	~~kc/s~~	12401.3 KHz
~~16 535.5~~	~~kc/s~~	16531.3 KHz
~~22 073.5~~	~~kc/s~~	22071.2 KHz
		25052.1

GRC/163/120 MOD 1352A Mar

(2) Coast stations may use the following carrier frequencies for calling in radiotelephony :

~~4434.9 kc/s~~[3]	4425.6 KHz
~~6518.6 kc/s~~[3]	6500.2 KHz
~~8802.4 kc/s~~	8780.9 KHz
~~13182.5 kc/s~~	13134.9 KHz
~~17228.5 kc/s~~	17185.6 KHz
~~22599.0 kc/s~~	22651.8 KHz
	26147.1 KHz

GRC/163/121 MOD 1352.1 Mar

[1] In Region 2, the frequency 4136.3 kc/s is also authorized for common use by coast and ship stations for single sideband radiotelephony on a simplex basis, provided the peak envelope power of such stations does not exceed 1 kW (see also No. 1352A.2).

GRC/163/122 MOD 1352.2 Mar

[2] In Region 2, the frequencies 4434.9 and 6518.6 kc/s are also authorized for common use by coast and ship stations for single sideband radiotelephony on a simplex basis, provided the peak envelope power of such stations does not exceed 1 kW. The use of 6518.6 kc/s for this purpose should be limited to daytime use (see also No. 1352.1).

Reasons : Consequential to proposed changes of Appendix 17.

GRC/163/123 MOD 1352B Mar

15.(1) In the zone lying between the parallels 33° North and 57° South, the carrier frequency ~~4436.3 kc/s~~ 4134.3 KHz is designated for call, reply and safety purposes. It may also be used for messages preceded by the urgency or safety signals and, if necessary, for distress messages.

GRC/163/124 MOD 1353 Mar

(2) In the zone of Regions 1 and 3 lying between the parallels 33° North and 57° South, the carrier frequency ~~6204 kc/s~~ 6203.1 KHz is designated for call, reply and safety purposes. It may also be used for messages preceded by the urgency or safety signals and, if necessary, for distress messages.

GRC/163/125 MOD 1353A Mar

(3) Stations using the frequencies ~~4436.3 kc/s and 6204 kc/s~~ 4134.3 KHz and 6203.1 KHz in the conditions specified in Nos. 1352B and 1353 may continue to use class A3H emissions beyond 1 January 1978.

E. Traffic

GRC/163/126 MOD 1355 Mar

17.(1) For the conduct of duplex telephony, the transmitting frequencies of the coast stations and of the corresponding ship stations shall be associated in pairs, as far as possible, as indicated in Appendix 17, Sections A ~~and B~~.

GRC/163/127 MOD 1356 Mar

(2) The frequencies to be used for the conduct of simplex radiotelephony are shown in Appendix 17, Section ~~C~~ B. In these cases, the peak envelope power of the coast station transmitter shall not exceed 1 kW.

Radiotelephony

GRC/163/128 MOD 1357 Mar

(3) The frequencies indicated in Appendix 17, Sections A and B ~~and C~~, for ship station transmissions may be used by ships of any category according to traffic requirements.

GRC/163/129 MOD 1358 Mar

(4) The technical characteristics of transmitters used for radiotelephony in the maritime mobile service in the bands between 4000 and ~~23000 kc/s~~ 27500 KHz are specified in Appendix 17A.

Reasons Consequential to the proposed changes of Appendix 17.

GRC/163/130 **MOD**

APPENDIX 15

Mar

Table of Frequencies to be used by ~~Ship Radiotelegraph~~ Stations in the Bands Between 4 and 27.5 ~~Mc/s~~ MHz Allocated Exclusively to the Maritime Mobile Service

(See Article 32)

In the Table :

a) the assignable frequencies in a given band for each usage are :

   - indicated by the lowest and highest frequency, in heavy type, assigned in that band;
   - regularly spaced, the number of assignable frequencies and the spacing in ~~kc/s~~-KHz being indicated in italics;

b) the vertical arrows indicate the harmonic relationship between the frequencies assigned in the different bands.

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FREQUENCIES ASSIGNABLE TO STATIONS USING THE MARITIME MOBILE SERVICE ON THE EXCLUSIVE BANDS BETWEEN 4 AND 27.5 MHz

	Bands MHz	Limits	Frequencies for ship radiotelephone stations (duplex channel working on A3H, A3A and A3J)	Limits	Frequencies for ship and coast radiotelephone stations (simplex channel working on A3H, A3A, and A3J)	Limits KHZ	Frequencies for ship stations working on wide – band telegraphy facsimile and special transmission systems	Limits KHZ	Frequencies for oceanographic data transmission (a)	Limits KHZ	Frequencies for ship stations working on narrow-band direct-printing telegraph and data transmission systems(F1)	Limits KHZ	Ship stations calling frequencies (working on A1) d)	Limits	Frequencies for ship stations working on A1 Morse telegraphy b)		Limits KHz	Frequencies for oceanographic data transmission (a)		Frequencies for coast stations working on narrow-band direct printing telegraph and data transmission systems(F1)	Limits	Frequencies for coast radiotelegraph stations working as specified in No 453 Mar.	Limits	Frequencies for coast radiotelephone stations (duplex channel working on) A3H, A3A and A3J	Limits
															GROUP A	GROUP B									
1	4	4063.0	4063.0 .... 4143.6 27 channels spaced 3.1 KHz	4146.7	4146.7 1 channel spaced 3.1 KHz	4149.9	4151.9 ..... 4167.9 5 frequencies spaced 4	4169.9	→	4169.9	4170.2 ..... 4179.2 19 frequencies spaced 0.5	4179.45	4179.9 .... 4185.6 20 frequencies spaced 0.3	4186.05	4186.2 .... 4198.0 60 frequencies spaced 0.2	4198.4 .... 4210.2 60 frequencies spaced 0.2	4210.65	4211.0 ..... 4213.7 10 frequencies spaced 0.3 KHz	4214.1	4214.5 .... 4223.5 19 frequencies spaced 0.5 KHz	4224.0	Total bandwidth 130 KHz	4354.0	4354.3 .... 4434.9 27 channels spaced 3.1 KHz	4438.0
2	6	6200.0	6200.0 .... 6224.8 9 channels spaced 3.1 KHz	6227.9	6227.9 1 channel spaced 3.1 KHz	6231.2	6233.2 ..... 6257.2 7 frequencies spaced 4	6259.2	→	6259.2	6259.7 .... 6268.7 19 frequencies spaced 0.5	6269.175	6269.85 .... 6278.45 20 frequencies spaced 0.45	6279.075	6279.3 ..... 6297.0 60 frequencies spaced 0.3	6297.6 .... 6315.3 60 frequencies spaced 0.30	6315.975	6316.2 6318.9 10 frequencies spaced 0.3 KHz	6319.1	6319.25 .... 6328.25 19 frequencies spaced 0.5 KHz	6328.6	Total bandwidth 168.5 KHz	6497.1	6497.1 .... 6521.9 9 channels spaced 3.1 KHz	6525.0
3	8	8195.0	8195.0 ..... 8297.3 34 channels spaced 3.1 KHz	8300.4	8300.4 1 channel spaced 3.1 KHz	8303.7	8305.7 ..... 8341.7 10 frequencies spaced 4	8343.7	→	8343.7	8344.0 .... 8358.5 30 frequencies spaced 0.5	8358.9	8359.8 .. c) .. 8371.2 20 frequencies spaced 0.6	8372.1	8372.4 ..... 8396.0 60 frequencies spaced 0.4	8396.8 .... 8420.8 60 frequencies spaced 0.4	8421.3	8421.6 8424.3 10 frequencies spaced 0.3 KHz	8424.7	8425.0 .... 8439.5 30 frequencies spaced 0.5 KHz	8440.0	Total bandwidth 269 KHz	8709.0	8709.6 .... 8811.9 34 channels spaced 3.1 KHz	8815.0
4	12	12330.0	12330.0 ... 12463.3 44 channels spaced 3.1 KHz	12466.4	12466.4 & 12469.5 2 channels spaced 3.1 KHz	12473.1	12475.1 .... 12519.1 12 frequencies spaced 4	12521.1	12521.5 .... 12524.2 10 frequencies spaced 0.3	12524.6	12525.0 .... 12537.5 26 frequencies spaced 0.5	12538.35	12539.7 .... 12556.8 20 frequencies spaced 0.9	12558.15	12558.6 .... 12594.0 60 frequencies spaced 0.6	12595.2 .... 12631.2 60 frequencies spaced 0.6	12631.95	→	12631.95	12632.2 .... 12644.7 26 frequencies spaced 0.5 KHz	12645.1	Total bandwidth 418.5 KHz	13063.6	13063.6 .... 13196.9 44 channels spaced 3.1 KHz	13200.0
5	16	16460.0	16460.0 .... 16602.6 47 channels spaced 3.1 KHz	16605.7	16605.7 ..... 16615.0 4 channels spaced 3.1 KHz	16619.2	16621.2 .... 16677.2 15 frequencies spaced 4	16679.2	16679.6 .... 16682.3 10 frequencies spaced 0.3	16682.7	16683.5 .... 16717.0 68 frequencies spaced 0.5	16717.8	16719.6 .... 16742.4 20 frequencies spaced 1.2	16744.2	16744.8 .... 16792.0 60 frequencies spaced 0.8	16793.6 .... 16840.6 60 frequencies spaced 0.8	16842.4	→	16842.6	16843.0 ... 16876.5 68 frequencies spaced 0.5 KHz	16876.8	Total bandwidth 337.5 KHz	17214.3	17214.3 .... 17356.9 47 channels spaced 3.1 KHz	17360.0
6	22	22000.0	22000.0 22136.4 45 channels spaced 3.1 KHz	22139.5	22139.5 & 22142.6 2 channels spaced 3.1 KHz	22145.8	22147.8 ..... 22191.8 12 frequencies spaced 4	22193.8	22194.2 .... 22196.9 10 frequencies spaced 0.3	22197.2	22197.5 .... 22226.0 58 frequencies spaced 0.5	22226.4	22227.0 .... 22246.0 20 frequencies spaced 1	22247.4	22248.6 ..... 22274.2 32 frequencies spaced 0.8	22275.8 .... 22299.8 32 frequencies spaced 0.8	22301.0	→	22301.0	22301.25 .... 22329.75 58 frequencies spaced 0.5 KHz	22330.0	Total bandwidth 250.5 KHz	22580.5	22580.5 .... 22716.9 45 channels spaced 3.1 KHz	22720.0
7	25									25070	25070.5 .... 25087.0 34 frequencies spaced 0.5 KHz	25087.5	25088.0 .... 25093.0 6 frequencies spaced 1 KHz	25093.5	25093.9 ..... 25101.1 20 frequencies	25102.4 .... 25109.6	25110.0								

a) The frequency bands may also be used by buoy stations for oceanographic data transmission and by stations interrogating these buoys, in accordance with the conditions set forth in Resolution N° Mar 20

b) Manual or automatic A1 Morse telegraphy at speeds not exceeding 40 bauds

c) For the conditions of use of 8364.KHz, see N° 1179

d) The frequencies 4185.6, 6278.45, 8371.2, 12556.8, 16742.4, 22246.0 may also be assigned as spesial calling frequencies. Administrations should, if possible, abstain from assigning these frequencies as normal calling frequencies (see N° 1013E and 1013 E.1)

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APPENDIX 17

MAR

Channelling of the Maritime Mobile Radiotelephone Bands between 4 000 and 23 000 ~~kc/s~~ KHz

(See Article 35)

MOD 1. Channelling arrangements for the frequencies to be used by coast and ship stations in the bands allocated to the maritime mobile radiotelephone service are indicated in three sections as follows :

~~Section-A --Table-of-double-sideband-transmitting frequencies-for-duplex-(two-frequency) operation-(in-kc/s)~~

Section ~~B~~A- Table of single sideband transmitting frequencies for duplex (two-frequency) operation (in kc/s KHz)

Section ~~C~~B Table of single sideband transmitting frequencies for simplex (single-frequency) operation (in ~~kc/s~~ KHz).

Reasons : Section A may be deleted as it is no longer required.

2. The technical characteristics for single sideband transmitters are specified in Appendix 17A.

MOD 3. One or more series of frequencies from Sections A ~~or-B~~ (with the exception of those frequencies of Section B mentioned in paragraph 5 below) are assigned to each coast station, which uses these frequencies associated, ~~as-far as-possible~~, in pairs ; each pair comprises a transmitting and a receiving frequency. The series shall be selected with due regard to the areas served and so as to avoid, as far as possible, harmful interference between the services of different coast stations.

Reasons : To eliminate cross-band and cross-channelling working.

MOD 4. The frequencies in Section ~~C~~B are provided for world-wide common use by ships of all categories, according to traffic requirements, for ship transmissions to coast stations and for intership communication. They are also authorized for world-wide common use for transmissions for coast stations (simplex operation) provided the peak envelope power does not exceed 1 kW.

MOD 5. ~~a.~~ The following series of frequencies in Section B are allocated for calling purposes:

- Series No.24 in the 4 ~~Mc/s and 8 Mc/s~~ 8, 12, 16 and 22 MHz bands ;
- Series No. 2 in the 6 Mc/s band;
- ~~Series No. 22 in the 12, 16 and 22 Mc/s bands~~
- Series No. 16 in the 25 MHz band.

The remaining frequencies in Sections A and B ~~and C~~ are working frequencies.

SUP ~~b~~

SUP ~~6. Stations utilising double sideband emissions shall operate only on the frequencies in Section A subject to No. 4354A and on the frequencies mentioned in paragraph 5 b) above.~~

Reasons : When the MOD.App. 17 will become effective, DSB will have stopped and its provisions will not be necessary.

MOD 7. a. Stations using single sideband emissions shall operate only on the carrier frequencies shown in Section ~~B~~ A and ~~C~~ B in conformity with the technical characteristics specified in Appendix 17A. The upper sideband mode shall always be employed.

b. Stations employing the single sideband mode shall use only class A3A and A3J emissions. However, administrations should endeavour, as far as possible, to restrict to class A3J emissions, the use of the Series No. 1 frequencies from Section ~~B~~ A.
~~Until 1 January 1978 class A3H emissions (in accordance with No.4354A) are permitted only on those carrier frequencies shown in Section B A which are coincident with, or within 400 c/s of, the frequencies shown in Section A.~~ However, on the calling frequencies for coast stations class A3H emissions may be used until 1 January 1978.

SUP 8.

SUP 9.

Reasons : The case is covered under No.115.

SUP Section A.

MOD Section ~~B~~ A

MOD Section ~~C~~ B

Reasons : Consequential to the proposed suppression of Section A.

SECTION A

Table of Single Sideband Transmitting Frequencies for Duplex (two-frequency) Operation (in KHz)

Series No	4 MHz Band				6 MHz Band			
	Coast stations		Ship stations		Coast stations		Ship stations	
	Carrier frequency	Assigned frequency	Carrier frequency	Assigned frequency	Carrier frequency	Assigned frequency	Carrier frequency	Assigned frequency
1.	4354.3	4355.7	4063.0	4064.4	6497.1	6498.5	6200.0	6201.4
2.	4357.4	4358.8	4066.1	4067.5	6500.2 *	6501.6 *	6203.1 *	6204.5 *
3.	4360.5	4361.9	4069.2	4070.6	6503.3	6504.7	6206.2	6207.6
4.	4363.6	4365.0	4072.3	4073.7	6506.4	6507.8	6209.3	6210.7
5.	4366.7	4368.1	4075.4	4076.8	6509.5	6510.9	6212.4	6213.8
6.	4369.8	4371.2	4078.5	4079.9	6512.6	6514.0	6215.5	6216.9
7.	4372.9	4374.3	4081.6	4083.0	6515.7	6517.1	6218.6	6220.0
8.	4376.0	4377.4	4084.7	4086.1	6518.8	6520.2	6221.7	6223.1
9.	4379.1	4380.5	4087.8	4089.2	6521.9	6523.3	6224.8	6226.2
10.	4382.2	4383.6	4090.9	4092.3				
11.	4385.3	4386.7	4094.0	4095.4				
12.	4388.4	4389.8	4097.1	4098.5				
13.	4391.5	4392.9	4100.2	4101.6				
14.	4394.6	4396.0	4103.3	4104.7				
15.	4397.7	4399.1	4106.4	4107.8				
16.	4400.8	4402.2	4109.5	4110.9				
17.	4403.9	4405.3	4112.6	4114.0				
18.	4407.0	4408.4	4115.7	4117.1				
19.	4410.1	4411.5	4118.8	4120.2				
20.	4413.2	4414.6	4121.9	4123.3				
21.	4416.3	4417.7	4125.0	4126.4				
22.	4419.4	4420.8	4128.1	4129.5				
23.	4422.5	4423.9	4131.2	4132.6				
24.	4425.6 *	4427.0 *	4134.3 * 1)	4135.7 * 1)				
25.	4428.7	4430.1	4137.4	4138.8				
26.	4431.8	4433.2	4140.5	4141.9				
27.	4434.9	4436.3	4143.6	4145.0				

* The frequencies marked with an asterisk are calling frequencies (see Nos 1352 and 1352 A)

1) For the conditions of use of the frequency 4134.3 and 6203.1 KHz see Nos 1352 B and 1353

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SECTION A continued

Table of Single Sideband Transmitting Frequencies for Duplex (two-frequency) Operation (in KHz)

Series No	8 MHz Band				12 MHz Band			
	Coast stations		Ship stations		Coast stations		Ship stations	
	Carrier frequency	Assigned frequency	Carrier frequency	Assigned frequency	Carrier frequency	Assigned frequency	Carrier frequency	Assigned frequency
1.	8709.6	8711.0	8195.0	8196.4	13063.6	13065.0	12330.0	12331.4
2.	8712.7	8714.1	8198.1	8199.5	13066.7	13068.1	12333.1	12334.5
3.	8715.8	8717.2	8201.2	8202.6	13069.8	13071.2	12336.2	12337.6
4.	8718.9	8720.3	8204.3	8205.7	13072.9	13074.3	12339.3	12340.7
5.	8722.0	8723.4	8207.4	8208.8	13076.0	13077.4	12342.4	12343.8
6.	8725.1	8726.5	8210.5	8211.9	13079.1	13080.5	12345.5	12346.9
7.	8728.2	8729.6	8213.6	8215.0	13082.2	13083.6	12348.6	12350.0
8.	8731.3	8732.7	8216.7	8218.1	13085.3	13086.7	12351.7	12353.1
9.	8734.4	8735.8	8219.8	8221.2	13088.4	13089.8	12354.8	12356.2
10.	8737.5	8738.9	8222.9	8224.3	13091.5	13092.9	12357.9	12359.3
11.	8740.6	8742.0	8226.0	8227.4	13094.6	13096.0	12361.0	12362.4
12.	8743.7	8745.1	8229.1	8230.5	13097.7	13099.1	12364.1	12365.5
13.	8746.8	8748.2	8232.2	8233.6	13100.8	13102.2	12367.2	12368.6
14.	8749.9	8751.3	8235.3	8236.7	13103.9	13105.3	12370.3	12371.7
15.	8753.0	8754.4	8238.4	8239.8	13107.0	13108.4	12373.4	12374.8
16.	8756.1	8757.5	8241.5	8242.9	13110.1	13111.5	12376.5	12377.9
17.	8759.2	8760.6	8244.6	8246.0	13113.2	13114.6	12379.6	12381.0
18.	8762.3	8763.7	8247.7	8249.1	13116.3	13117.7	12382.7	12384.1
19.	8765.4	8766.8	8250.8	8252.2	13119.4	13120.8	12385.8	12387.2
20.	8768.5	8769.9	8253.9	8255.3	13122.5	13123.9	12388.9	12390.3
21.	8771.6	8773.0	8257.0	8258.4	13125.6	13127.0	12392.0	12393.4
22.	8774.7	8776.1	8260.1	8261.5	13128.7	13130.	12395.1	12396.5
23.	8777.8	8779.2	8263.2	8264.6	13131.8	13133.2	12398.2	12399.6
24.	8780.9*	8782.3*	8266.3*	8267.7*	13134.9*	13136. *	12401. *	12402.7*
25.	8784.0	8785.4	8269.4	8270.8	13138.0	13139.4	12404.4	12405.8
26.	8787.1	8788.5	8272.5	8273.9	13141.1	13142.5	12407.5	12408.9
27.	8790.2	8791.6	8275.6	8277.0	13144.2	13145.6	12410.6	12412.0
28.	8793.3	8794.7	8278.7	8280.1	13147.3	13148.7	12413.7	12415.1
29.	8796.4	8797.8	8281.8	8283.2	13150.4	13151.8	12416.8	12418.2
30.	8899.5	8800.9	8284.9	8286.3	13153.5	13154.9	12419.9	12421.3
31.	8802.6	8804.0	8288.0	8289.4	13156.6	13158.0	12423.0	12424.4
32.	8805.7	8807.1	8291.1	8292.5	13159.7	13161.1	12426.1	12427.5
33.	8808.8	8810.2	8294.2	8295.6	13162.8	13164.2	12429.2	12430.6
34.	8811.9	8813.3	8297.3	8298.7	13165.9	13167.3	12432.3	12433.7
35.					13169.0	13170.4	12435.4	12436.8
36.					13172.1	13173.5	12438.5	12439.9
37.					13175.2	13176.6	12441.6	12443.0
38.					13178.3	13179.7	12444.7	12446.1
39.					13181.4	13182.8	12447.8	12449.2
40.					13184.5	13185.9	12450.9	12452.3
41.					13187.6	13189.0	12454.0	12455.4
42.					13190.7	13192.1	12457.1	12458.5
43.					13193.8	13195.2	12460.2	12461.6
44.					13196.9	13198.3	12463.3	12464.7

* The frequencies marked with an asterisk are calling frequencies (see Nos1352 and 1352 A)

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SECTION A (continued)

Table of Single Sideband Transmitting Frequencies for Duplex (two-frequency) Operation (in KHz)

Series No	16 MHz Band				22 MHz Band			
	Coast stations		Ship stations		Coast stations		Ship stations	
	Carrier frequency	Assigned frequency	Carrier frequency	Assigned frequency	Carrier frequency	Assigned frequency	Carrier frequency	Assigned frequency
1.	17214.3	17215.7	16460.0	16461.4	22580.5	22581.9	22000.0	22001.4
2.	17217.4	17218.8	16463.1	16464.5	22583.6	22585.0	22003.1	22004.5
3.	17220.5	17221.9	16466.2	16467.6	22586.7	22588.1	22006.2	22007.6
4.	17223.6	17225.0	16469.3	16470.7	22589.8	22591.2	22009.3	22010.7
5.	17226.7	17228.1	16472.4	16473.8	22592.9	22594.3	22012.4	22013.8
6.	17229.8	17231.2	16475.5	16476.9	22596.0	22597.4	22015.5	22016.9
7.	17232.9	17234.3	16478.6	16480.0	22599.1	22600.5	22018.6	22020.0
8.	17236.0	17237.4	16481.7	16483.1	22602.2	22603.6	22021.7	22023.1
9.	17239.1	17240.5	16484.8	16486.2	22605.3	22606.7	22024.8	22026.2
10.	17242.2	17243.6	16487.9	16489.3	22608.4	22609.8	22027.9	22029.3
11.	17245.3	17246.7	16491.0	16492.4	22611.5	22612.9	22031.0	22032.4
12.	17248.4	17249.8	16494.1	16495.5	22614.6	22616.0	22034.1	22035.5
13.	17251.5	17252.9	16497.2	16498.6	22617.7	22619.1	22037.2	22038.6
14.	17254.6	17256.0	16500.3	16501.7	22620.8	22622.2	22040.3	22041.7
15.	17257.7	17259.1	16503.4	16504.8	22623.9	22625.3	22043.4	22044.8
16.	17260.8	17262.2	16506.5	16507.9	22627.0	22628.4	22046.5	22047.9
17.	17263.9	17265.3	16509.6	16511.0	22630.1	22631.5	22049.6	22051.0
18.	17267.0	17268.4	16512.7	16514.1	22633.2	22634.6	22052.7	22054.1
19.	17270.1	17271.5	16515.8	16517.2	22636.3	22637.7	22055.8	22057.2
20.	17273.2	17274.6	16518.9	16520.3	22639.4	22640.8	22058.9	22060.3
21.	17276.3	17277.7	16522.0	16523.4	22642.5	22643.9	22062.0	22063.4
22.	17279.4	17280.8	16525.1	16526.5	22645.6	22647.0	22065.1	22066.5
23.	17282.5	17283.9	16528.2	16529.6	22648.7	22650.1	22068.2	22069.6
24.	17285.6*	17287.0*	16531.3*	16532.7*	22651.8*	22653.2*	22071.3*	22072.7*
25.	17288.7	17290.1	16534.4	16535.8	22654.9	22656.3	22074.4	22075.8
26.	17291.8	17293.2	16537.5	16538.9	22658.0	22659.4	22077.5	22078.9
27.	17294.9	17296.3	16540.6	16542.0	22661.1	22662.5	22080.6	22082.0
28.	17298.0	17299.4	16543.7	16545.1	22664.2	22665.6	22083.7	22085.1
29.	17301.1	17302.5	16546.8	16548.2	22667.3	22668.7	22086.8	22088.2
30.	17304.2	17305.6	16549.9	16551.3	22670.4	22671.8	22089.9	22091.3
31.	17307.3	17308.7	16553.0	16554.4	22673.5	22674.9	22093.0	22094.4
32.	17310.4	17311.8	16556.1	16557.5	22676.6	22678.0	22096.1	22097.5
33.	17313.5	17314.9	16559.2	16560.6	22679.7	22681.1	22099.2	22100.6
34.	17316.6	17318.0	16562.3	16563.7	22682.8	22684.2	22102.3	22103.7
35.	17319.7	17321.1	16565.4	16566.8	22685.9	22687.3	22105.4	22106.8
36.	17322.8	17324.2	16568.5	16569.9	22689.0	22690.4	22108.5	22109.9
37.	17325.9	17327.3	16571.6	16573.0	22692.1	22693.5	22111.6	22113.0
38.	17329.0	17330.4	16574.7	16576.1	22695.2	22696.6	22114.7	22116.1
39.	17332.1	17333.5	16577.8	16579.2	22698.3	22699.7	22117.8	22119.2
40.	17335.2	17336.6	16580.9	16582.3	22701.4	22702.8	22120.9	22122.3
41.	17338.3	17339.7	16584.0	16585.4	22704.5	22705.9	22124.0	22125.4
42.	17341.4	17342.8	16587.1	16588.5	22707.6	22709.0	22127.1	22128.5
43.	17344.5	17345.9	16590.2	16591.6	22710.7	22712.1	22130.2	22131.6
44.	17347.6	17349.0	16593.3	16594.7	22713.8	22715.2	22133.3	22134.7
45.	17350.7	17352.1	16596.4	16597.8	22716.9	22718.3	22136.4	22137.8
46.	17353.8	17355.2	16599.5	16600.9				
47.	17356.9	17358.3	16602.6	16604.0				

* The frequencies marked with an asterisk are calling frequencies (see Nos 1352 and 1352 A)

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SECTION A (continued)

Table of Single Sideband Transmitting Frequencies for Duplex (two frequency) Operation in KHz

Series No	25 MHz Band							
	Coast stations		Ship stations					
	Carrier frequency	Assigned frequency	Carrier frequency	Assigned frequency				
1.	26100.6	26102.0	25010.6	25012.0				
2.	26103.7	26105.1	25013.7	25015.1				
3.	26106.8	26108.2	25016.8	25018.2				
4.	26109.9	26111.3	25019.9	25021.3				
5.	26113.0	26114.4	25023.0	25024.4				
6.	26116.1	26117.5	25026.1	25027.5				
7.	26119.2	26120.6	25029.2	25030.6				
8.	26122.3	26123.7	25032.3	25033.7				
9.	26125.4	26126.8	25035.4	25036.8				
10.	26128.5	26129.9	25038.5	25039.9				
11.	26131.6	26133.0	25041.6	25043.0				
12.	26134.7	26136.1	25044.7	25046.1				
13.	26137.8	26139.2	25047.8	25049.2				
14.	26140.9	26142.3	25050.9	25052.3				
15.	26144.0	26145.4	25054.0	25055.4				
16.	26147.1*	26148.5*	25057.1*	25058.5*				
17.	26150.2	26151.6	25060.2	25061.6				
18.	26153.3	26154.7	25063.3	25064.7				
19.	26156.4	26157.8	25066.4	25067.8				

* The frequencies marked with an asterisk are calling frequencies.

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GRC/163/132

RECOMMENDATION No. Mar.......

Relating to the allocation of exclusive bands to the Maritime Mobile Services between 23000 and 27500 KHz.

The World Administrative Radio Conference, Geneva 1974,

considering

a) that the present Frequency assignments for ship and coast radiotelephone stations contained in Appendices 15 and 17 to the Radio Regulations, Geneva 1959, as was prepared by the Provisional Frequency Board in the years from 1948 to 1950 and amended by the Extraordinary Administrative Radio Conference, Geneva, 1951, the Administrative Radio Conference, Geneva, 1959 and by the Administrative Radio Conference Geneva, 1967, does not contain allocation for the Maritime Mobile Service radiotelephone and narrow-band direct printing stations in the band between 23000 and 27500 KHz;

b) that such an allocation is considered as necessary for the normal exchange of long distance traffic of the Maritime Mobile Services;

c) that the Maritime Mobile Services may use the bands between 25010 and 25070 KHz, 25110 and 25600 KHz and 26100 and 27500 KHz on equal right with other Mobile Services (except aeronautical mobile) and with Fixes Services;

d) that by such a shared use harmful interferences are created and the corresponding spectrum is not utilized in a rational way;

in view of

the provisions of No.60 and 61 of the International Telecommunication Convention, Montreux, 1965;

recommends

that the next competent World Administrative Radio Conference should consider allocating on an exclusive basis to the Maritime Mobile Services part from each of the 3 bands between :

25010 and 25070 KHz
25110 and 25600 KHz and
26100 and 27500 KHz

Reasons : To allow a better utilisation of the above-mentioned band by the authorized services.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 164-E
23 April 1974
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PLENARY MEETING

Portugal

PROPOSAL FOR THE WORK OF THE CONFERENCE

Agenda item No. 1

Portugal's frequency requirements to be included in the new Appendix 25 of the Radio Regulations

1. Portugal needs to keep the duplex telephone channels allotted it by the 1967 Conference (Appendix 25 of the Radio Regulations) with the two sidebands in the event of the former double sideband channels being used for single sideband operation.

Portugal's minimum frequency requirements are the following :

Series No.	Carrier frequency kHz	POR	MDR	AZR	CPV	GNP	STP	AGL	MOZ	TMP
15	4406,2	X	X	X	X	X	X	X	X	X
16	4409,4	X	X	X	X	X	X	X	X	X
15	8773,6	X	X	X	X	X	X	X	X	X
16	8776,8	X	X	X	X	X	X	X	X	X
18	8783,2								X	X
8	13133,5								X	X
13	13151,0	X	X	X	X	X	X	X	X	X
14	13154,5	X	X	X	X	X	X	X	X	X
13	17297,0	X	X	X	X	X	X	X	X	X
14	17300,5	X	X	X	X	X	X	X	X	X
	17342,5	X	X	X						
13	22667,5	X	X	X	X			X	X	X
14	22671,0	X	X	X	X			X	X	X
	22709,5	X	X	X						

Note : The requirements for each frequency and area are indicated by a (X) in the corresponding box.

2. Portugal also requests an allotment in the 6 MHz band.

3. The powers to be taken into consideration in planning are as follows :

Portugal : 10 kW P_p

Other areas : 3 kW P_p.

4. The requirements indicated above correspond to existing needs. It will be necessary, however, to consider the adoption of a procedure for meeting the foreseeable long-term increase in the volume of traffic.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

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PLENARY MEETING

Federative Republic of Brazil

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item No. 3.2 : The possibility of an alternative to 2 182 kHz as the radiotelephone, distress and calling frequency.

I. Comments

The Brazilian Administration proposes 4 136.3 kHz, as international radiotelephone, distress and calling frequency, alternative to 2 182 kHz.

It is a real fact that the frequency 2 182 kHz has been not so efficient during the transmission of distress signals, due to its short range and to the congestion caused by the great number of calling.

The frequency 4 136.3 kHz has a good efficiency in distances up to 400 km, at any time, which do not happen with 2 182 kHz. In this way, a coast stations national system, with stations separated by 600 km from each other has better conditions to attend to the safety, utilizing 4 136.3 kHz.

Propagations tests and ionospheric prediction computations was made in the bands 2, 4 and 6 MHz. The final considerations are that the MHz band has the most favourable conditions to distress and calling signals.

The Brazilian Administration has in mind that the use of 4 136.3 kHz, as international radiotelephone, distress and calling frequency, will not affect the use of 2 182 kHz. On the contrary, 2 182 kHz will have better conditions of use, attending to the I.M.C.O. recommendations.

The Brazilian Administration has in mind too, that the use of 4 136.3 kHz, as international radiotelephone, distress and calling frequency, will make possible the use of one single equipment with 2 182 kHz and 4 136.3 kHz.

II. PROPOSED CHANGES TO ARTICLE 5

B/165/4

Section IV

Table of Frequency allocation - 10 ~~kc/s~~ kHz to 275 ~~Gc/s~~ GHz

MOD

Region 1	Region 2	Region 3
4 063-4 438 MARITIME MOBILE 208 209 209A		

B/165/5 ADD 209A The frequency 4 136.3 kHz is the international distress and calling frequency in HF, for radiotelephony of the Maritime Mobile Service.

III. PROPOSED CHANGES TO ARTICLE 6

Special Rules for the Assignment and Use of Frequencies

B/165/6 MOD 421 §7. Any emission capable of causing harmful interference to distress, alarm, urgency or safety signals on the international distress frequencies of 500 ~~kc/s~~ kHz, 2 182 ~~kc/s~~ kHz or 4 136 kHz is prohibited (see Nos. 187, 201, 209A, 1112, 1325 and 1354F).

IV. PROPOSED CHANGES TO ARTICLE 28

Conditions to be observed by Mobile Stations

NOC 955-987
After 987 :

B/165/7 ADD Bands between 4 000 and 23 000 kHz

B/165/8 ADD 987A §20A All ship stations equipped with radiotelephony apparatus to work in the authorized bands between 4 000 and 23 000 kHz shall be able to :

B/165/9 ADD 987B (a) send class A3H and, optionally, A3A or A3J with the carrier frequency of 4 136.3 kHz and receive class A3H emission, and, optionally, class A3A or A3J with the carrier frequency of 4 136.3 kHz, however, after 1 January 1978, it is no longer authorized to send class A3H emissions.

B/165/10 ADD 987C (b) send, in addition,

(1) class A3 or

(2) class A3H, A3A and A3J,

emissions and at least one working frequency in the band of 4 000 kHz. However, after 1 January 1978, it is no longer authorized to send class A3 and A3H emissions.

B/165/11 ADD 987D (c) receiver, in addition :

(1) class A3 and A3H or

(2) class A3, A3H, A3A and A3J

emissions on all other frequencies necessary for their service. However, after 1 January 1978, the ability to receive class A3 and A3H emissions is no longer required.

ADD 987E The provision of Nos. 987C and 987D do not apply to apparatus provided solely for distress, urgency and safety purposes.

NOC 988-991

B/165/12 MOD 992 §22. (1) Any aircraft following a maritime course and required by national or international regulations to communicate for safety purposes with stations of the maritime mobile service, shall be capable of transmitting preferably class A2 or A2H and receiving preferably class A2 and A2H emissions on the carrier frequency of 500 ~~kc/s~~ kHz or, on ~~the carrier-frequency~~ the carrier frequencies of 2 182 ~~kc/s~~ kHz and 4 136.3 kHz, transmitting class ~~A3 or~~ A3H emissions and, optionally, class A3A or A3J emissions and receiving class ~~A3 and~~ A3H emission and, optionally, class A3A or A3J emissions. However, after 1 January 1978, it is no longer authorized class A3H emissions.

B/165/13 ADD 996A In the bands between 4 000 and 23 000 kHz, be able to transmit with the carrier frequency of 4 136.4 kHz, using class A3H emissions and, optionally, class A3A or A3J emissions. If a receiver is provided for any of these bands, it shall be able to receive class A3H emissions and, optionally, class A3A or A3J emissions.

V. PROPOSED CHANGES TO ARTICLE 33

General Radiotelephone Procedure in the Maritime Mobile Service

B/165/14 MOD 1290 §25. (1) Calling, and signals preparatory to traffic, shall not exceed two minutes when made on the carrier frequency 2 182 ~~kc/s~~ kHz, 4 136.3 kHz or 156,80 ~~Mc/s~~ MHz, except in cases of distress, urgency or safety to which the provision of Article 36 apply.

B/165/15 MOD 1295 (2) Any signals sent for testing shall be kept to a minimum, particularly :

- on the carrier frequency 2 182 ~~kc/s~~ kHz,
- on the carrier frequency 4 136.3 kHz;
- on the carrier frequency 156.80 ~~Mc/s~~ MHz;
- ~~in the zone lying between the parallels 33° North and 57° South, and the carrier frequency 4 136.3 kc/s~~;
- in the zone of Regions 1 and 3 lying between the parallels 33° North and 57° South, on the carrier frequency 6 204 ~~kc/s~~ kHz.

VI. PROPOSED CHANGES TO ARTICLE 34

Calls and Radiotelephony

B/165/16 MOD 1303 (4) The provisions of No. 1302 are obligatory when 2 182 ~~kc/s~~ kHz, 4 136.3 kHz or 156.80 ~~Mc/s~~ MHz is used.

VII. PROPOSED CHANGES TO ARTICLE 35

Use of Frequencies for Radiotelephony in the Maritime Mobile Service

Section I

General Provisions

B/165/17 MOD 1321 (3) Any aircraft in distress shall transmit the distress call on the frequency on which watch is kept by the land or mobile stations capable of helping it. When the call is intended for stations in the maritime mobile service, the provision of Nos. 1323, 1324, 1351C and 1351D shall be complied with.

Section III

Bands between 4 000 and 23 000 ~~kc/s~~ kHz

A. Mode of Operation of Stations

B/165/18 MOD 1351A §13A (1) Except in the cases specified in Nos. 987B, 992 and 1351C, the classes of emissions to be used for radiotelephony in the maritime mobile service bands between 4 000 and 23 000 ~~kc/s~~ kHz, are :

(a) class A3[1], or

(b) class A3H[2], A3A and A3J[3].

However, unless otherwise specified in these Regulations (see No. 1353A):

- ~~after 1 January 1972~~, class A3 emissions ~~shall no longer be~~ are not authorized for coast stations, and

- after 1 January 1978, class A3H emissions for coast stations and class A3 and A3H emissions for ship stations shall no longer be authorized.

SUP 1351A.1

NOC 1351B

After 1351B

B/165/19 ADD AA. Distress

B/165/20 ADD 1351C §13A (1) The frequency 4 136.3 kHz[1] is the international distress for radiotelephony in HF for the maritime mobile service; it shall be used for this purpose by ship aircraft and survival craft stations using frequencies in the authorized bands between 4 000 and 23 000 kHz when requesting assistance from the maritime services.

It is used for distress call and distress traffic, for urgent signal and urgency messages and for the safety messages shall be transmitted where practicable, on a working frequency after a preliminary announcement on 4 136.3 kHz.

The class of emission to be used for radiotelephony on the frequency 4 136.3 kHz shall be A3H and, optionally, A3A or A3J (see No. 987B).

B/165/21 ADD 1351C.1 [1] Whatever the class of emission used the frequency 4 136.3 kHz always designates the carrier frequency of the emission.

B/165/22 ADD 1351D (2) However, ship and aircraft stations which cannot transmit on 4 136.3 kHz should use any other frequency on which attention might be attracted.

B/165/23 ADD 1351E (3) Any coast station using the carrier frequency 4 136.3 kHz for distress purposes shall be able to transmit the radiotelephone alarm signal described in No. 1465 (see also Nos. 1471, 1472 and 1473).

B/165/24 ADD 1351F (4) Before transmitting on the carrier frequency 4 136.3 kHz, a station in the mobile service should listen on this frequency for a reasonable period to make sure that no distress traffic is being sent (see No. 1217)

B/165/25 ADD 1351G (5) The provisions of No. 1351F do not apply to stations in distress.

B. Call, Reply and Safety

B/165/26 MOD 1352 §14. (1) Ship stations may use the following carrier frequencies for calling in radiotelephony :

4 136.3 ~~kc/s~~[1] kHz
6 204.0 ~~kc/s~~ kHz
8 268.4 ~~kc/s~~ kHz
12 403.5 ~~kc/s~~ kHz
16 533.5 ~~kc/s~~ kHz
22 073.5 ~~kc/s~~ kHz

B/165/27 SUP 1352.1

B/165/28 MOD 1352A (2) Coast stations may use the following carrier frequencies for calling radiotelephony[2] :

4 136.3 kHz
~~4-434.9-kc/s~~[3]
6 518.6 ~~kc/s~~[3] kHz[3]
8 802.4 ~~kc/s~~ kHz
13 182.5 ~~kc/s~~ kHz
17 328.5 ~~kc/s~~ kHz
22 699.0 ~~kc/s~~ kHz

B/165/29 MOD 1352A.2 In Region 2, the ~~frequencies-4-434.9-and~~ frequency 6 518.6 ~~kc/s~~ kHz ~~are~~ is also authorized for common use by coast and ship stations for single sideband radiotelephony on a simplex basis, provided the peak envelope power of such stations does not exceed 1 kW. The use of 6 518.6 ~~kc/s~~ kHz for this purpose should be limited to daytime use (~~see-also No.-1352.1~~).

B/165/30 MOD 1352B §15. (1) ~~In the zone lying between the parallels 33° North and 57° South~~, the carrier frequency 4 136.3 ~~kc/s~~ kHz is designated for distress call, reply and safety message (see No. 1351C). It may also be used for messages preceded by the urgency or safety signals, ~~and, if necessary for distress messages~~.

B/165/31 ADD 1352C (1A) To facilitate the reception of distress calls, all transmissions on 4 136.3 kHz shall be kept to a minimum.

NOC 1353

B/165/32 MOD 1353A (3) Stations using the ~~frequencies 4 136.3 kc/s and~~ frequency 6 204 ~~kc/s~~ kHz in the conditions specified in ~~Nos., 1352B and~~ No. 1353 may continue to use class A3H emissions beyond 1 January 1978.

C. Search and Rescue

NOC 1353B

D. Watch

NOC 1354

B/165/33 ADD 1354A §16A. (1) All coast stations which are open to public correspondence and which form an essential part of the coverage of the area for distress purposes shall, during their hours of service, maintain a watch on 4 136.3 kHz.

B/165/34 ADD 1354B (2) These stations shall maintain this watch by means of an operator using some aural method, such as headphones, split headphones or loudspeaker.

B/165/35 ADD 1354C (3) In addition, ship stations should keep the maximum watch practicable on 4 136.3 kHz for receiving by any appropriate means the radiotelephone alarm signal described in No. 1465, as well as distress, urgency and safety signals.

B/165/36 MOD 1354D §16B. Ship stations open to public correspondence should, as far as possible during their hours of service, keep watch on 4 136.3 kHz.

B/165/37 ADD 1354E §16C. (1) In order to increase the safety of life at sea and over the sea, all stations of the maritime mobile service normally keeping watch on frequencies in the authorized band between 4 000 and 23 000 kHz shall, during their hours of service, and as far as possible, take steps to keep watch on the international distress frequency 4 136.3 kHz for three minutes twice each hour beginning at xh. 15 and x.h.45 Greenwich Mean Time (G.M.T.).

B/165/38 ADD 1354F (2) During the periods mentioned above, except for the transmissions provided for in Article 36, transmission shall cease within the band 4 136.3 and 4 139.3 kHz.

E. Traffic

B/165/39 ADD 1358A §17A. (1) Coast stations which use 4 136.3 kHz for calling shall be able to use at least one other frequency in the authorized bands between 4 000 kHz.

B/165/40 ADD 1358B (2) Coast stations authorized to use radiotelephony on one or more frequencies other than 4 136.3 kHz in the authorized bands between 4 000 and 23 000 kHz shall be capable of transmitting on those frequencies class A3H, A3A and A3J emissions[1]. However, after 1 January 1978 class A3H emissions shall no longer be authorized.

B/165/41 ADD 1358B.1 [1] See also Resolution No. Mar 6

B/165/42 ADD 1358C (3) Coast stations open to the public correspondence service on one or more frequencies between 4 000 and 23 000 kHz shall also be capable of transmitting and receiving class A3H, A3A and A3J with a carrier frequency of 4 136.3 kHz. However, after 1 January 1978 class A3H emission shall no longer be authorized.

B/165/43 ADD 1358D (4) One of the frequencies which coast stations are required to be able to use (see No. 1336) is printed in heavy type in the List of Coast Stations to indicate that it is the normal working frequency of the stations. Supplementary frequencies, if assigned, are shown in ordinary type.

VIII. PROPOSED CHANGES TO ARTICLE 36

Distress Signal and Traffic Alarm, Urgency and Safety Signals.

Section IV

Distress Call and Message Transmission Procedure

B. Radiotelephony

NOC 1415-1419

B/165/44 MOD 1420 §18. (1) The distress message, preceded by the distress call, shall be repeated at intervals, especially during the periods of silence prescribed in ~~No~~. Nos. 1349 and 1354E for radiotelephony, until an answer is received.

Section VII

Transmission of a Distress Message by a Station not itself in Distress

NOC 1452-1455

B/165/45 MOD 1456 §36. (1) The transmission of a distress message under the conditions prescribed in Nos. 1453 to 1455 shall be made on ~~either or both~~ one or all of the three international distress frequencies (500 ~~kc/s~~ kHz, 2 182 ~~kc/s~~ kHz and 4 136.3 kHz) or any other frequency that may be used in case of distress (see Nos. 1 107, 1 108, 1 208, 1 321, 1 323, 1 324, 1 351C and 1 351D

Section IX

Urgency Signal

NOC 1477-
1481

B/165/46 MOD 1482 (2) The urgency signal and the message following it shall be sent on one of the international distress frequencies (500 ~~kc/s~~ kHz, 2 182 ~~kc/s~~ kHz, or 4 136.3 kHz) or on one of the frequencies which may be used in case of distress.

Section X

Safety Signal

NOC 1488-
1492A

B/165/47 MOD 1493 §53 (1) With the exception of message transmitted at fixed times, the safety signal, when used in the maritime mobile service shall be transmitted towards the end of the first available period of silence (see No. 1130 for radiotelegraphy and ~~No.~~ Nos. 1349 and 1354E for radiotelephony); the message shall be transmitted immediately after the period of silence.

B/165/48 MOD

Section B

Table of Single Sideband Transmitting Frequencies for Duplex (two frequency) Operation ~~(in kc/s)~~(in kHz)

Series nos.	4 ~~Mc/s~~ MHz Band			
	Coast Stations		Ship Stations	
	Carrier Frequency	Assigned Frequency	Carrier Frequency	Assigned Frequency
1	4361.6	4363.0	4063.0	4064.4
2	4364.7	4366.1	4066.1	4067.5
3	4367.8	4369.2	4069.2	4070.6
4	4371.0	4372.4	4072.4	4073.8
5	4374.2	4375.6	4075.6	4077.0
6	4377.4	4378.8	4078.8	4080.2
7	4380.6	4382.0	4082.0	4083.4
8	4383.8	4385.2	4085.2	4086.6
9	4387.0	4388.4	4088.4	4089.8
10	4390.2	4391.6	4091.6	4093.0
11	4393.4	4394.8	4094.8	4096.2
12	4396.6	4398.0	4098.0	4099.4
13	4399.8	4401.2	4101.2	4102.6
14	4403.0	4404.4	4104.4	4105.8
15	4406.2	4407.6	4107.6	4109.0
16	4409.4	4410.8	4110.8	4112.2
17	4212.6	4414.0	4114.0	4115.4
18	4415.8	4417.2	4117.2	4118.6
19	4419.0	4420.4	4120.4	4121.8
20	4422.2	4423.6	4123.6	4125.0
21	4425.4	4426.8	4126.8	4128.2
22	4428.6	4430.0	4130.0	4131.4
23	4431.8	4433.2	4133.2	4134.6
~~24~~	~~4434.0~~	~~4436.3~~	~~4136.3~~ 1	~~4137.7~~

B/165/49 MOD

For the conditions of use of ~~frequencies 4 136.3 kc/s kHz and~~ frequency 6 204 ~~kc/s~~ kHz, see ~~Nos. 1352B and~~ No. 1353 ~~respectively~~.

Section C

Table of Single Sideband Transmitting Frequencies for Simplex (single-frequency) Operation (in ~~kc/s~~ kHz)

4 ~~Mc/s~~ MHz band		6 ~~Mc/s~~ MHz band		8 ~~Mc/s~~ MHz band		12 ~~Mc/s~~ MHz band		16 ~~Mc/s~~ MHz band		22 ~~Mc/s~~ MHz band	
Carrier Freq.	Assigned Freq.	Carrier Freq.	Assigned Freq.	Carrier Freq.	Assigned Freq.	Carrier Freq.	Assigned Freq.	Carrier Freq.	Assigned Freq.	Carrier Freq.	Assigned Freq.
4 139.5	4 140.9	6 210.4	6 211.8	8 281.2	8 282.6	12 421.0	12 422.4	16 565.0	16 566.4	22 094.5	22 095.9
4 434.9	4 436.3	6 213.5	6 214.9	8 284.4	8 285.8	12 424.5	12 425.9	16 568.5	16 569.9	22 098.0	22 099.4
						12 428.0	12 429.4	16 572.0	16 573.4	22 101.5	22 102.9
										22 105.0	22 106.4
										22 108.5	22 109.9

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

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PLENARY MEETING

Kingdom of Saudi Arabia

PROPOSALS FOR THE WORK OF THE CONFERENCE

The Administration of the Kingdom of Saudi Arabia, which is having six coast stations under expansion or in construction in Jedda, Gizan and Yambo on the Red Sea coast, and in Damman, Dhahran and Jubail on the Gulf coast, requires two frequencies in each high frequency band in the revised plan for SSB radio telephony on sharing basis among the six stations, with the PEP of 5.0 kW. These stations will be put into operation in 1975.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

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PLENARY MEETING

Kingdom of Saudi Arabia

PROPOSALS FOR THE WORK OF THE CONFERENCE

The Administration of the Kingdom of Saudi Arabia, which is having four coast stations under expansion or construction in Jeddah, Damman, Yambo and Gizan, requires one frequency in each high frequency band for radiotelephony on sharing basis among the four stations. These stations are expected to be in operation in 1975.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

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PLENARY MEETING

Mauritius

PROPOSALS FOR THE WORK OF THE CONFERENCE

The frequency requirements of Mauritius radiotelephone coast stations in the light of the revised Frequency Allotment Plan (Appendix 25 of the Radio Regulations) are as follows :

MHz order	4	6	8	13	17	22
Number of SSB channels	1	-	1	1	1	1

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

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Corrigendum No. 1 to
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COMMITTEE 5

Ireland

PROPOSALS FOR THE WORK OF THE CONFERENCE

Reduction of Additional Requirements

Details of our statement at Sub-Working Group 5C-3-F on Wednesday, 22 May 1974, as requested by the Chairman, are given hereunder :

1. Ireland does not at present operate a maritime HF service.
2. Our requirements as set out in Document 168 are for one channel in each band, which we consider the minimum necessary to commence an HF service, should this prove necessary.
3. The commencement of an HF service within the next three years is not foreseen at the present time.
4. We would therefore be prepared to withdraw our requirement for HF Radiotelephone channels subject to a satisfactory procedure being developed by the Conference, which would permit us to obtain channels at a later date, if then required.
5. However, if a satisfactory Article 9 procedure is not agreed to, we would be prepared to reduce our requirements to one channel, in each of the bands 4, 6 and 8 MHz, in order to facilitate the work of the Conference.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

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PLENARY MEETING

Ireland

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item No. 1 :

The frequency requirements of Ireland in the revised Frequency Allotment Plan for Coast Radiotelephone Stations (Appendix 25 of the Radio Regulations) will be as follows :

Frequency bands in MHz	4, 6	8	12	16	22
No. of SSB working channels	1	1	1	1	1

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

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COMMITTEE 5

Socialist Republic of Roumania

PROPOSALS FOR THE WORK OF THE CONFERENCE

The frequency requirements shown in Document No. 169(Rev.1) represent present requirements.

The requirements listed below represent estimated requirements for development.

Frequency bands (MHz)	4	6	8	12	16	22
Number of SSB channels	1	-	1	1	2	1

In view of the foregoing, the total frequency requirements of the Socialist Republic of Roumania to be taken into consideration in revising the Frequency Allotment Plan for Coast Radiotelephone Stations (Appendix 25 to the Radio Regulations) are as follows :

Frequency bands (MHz)	4	6	8	12	16	22
Number of SSB channels	4	2	4	4	5	3

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

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COMMITTEE 5

Socialist Republic of Roumania

PROPOSALS FOR THE WORK OF THE CONFERENCE

The frequency requirements of the Socialist Republic of Roumania to be taken into consideration in the revision of the Frequency Allotment Plan for Coast Radiotelephone Stations (Appendix 25 to the Radio Regulations) are as follows :

Frequency bands (in MHz)	4	6	8	12	16	22
Number of SSB channels	3	2	3	3	3	2

INTERNATIONAL TELECOMMUNICATION UNION
MARITIME CONFERENCE
GENEVA, 1974

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COMMITTEE 5

Socialist Republic of Roumania

PROPOSALS FOR THE WORK OF THE CONFERENCE

The frequency requirements of the Socialist Republic of Roumania to be taken into consideration in the revision of the Frequency Allotment Plan for Coast Radiotelephone Stations (Appendix 25 to the Radio Regulations) are as follows :

Frequency bands (in MHz)	4	6	8	12	16	22
Number of single sideband channels	2	2	2	2	2	1

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

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COMMITTEE 5

Indonesia (Republic of)

PROPOSALS FOR THE WORK OF THE CONFERENCE

1. The table below shows the frequency requirement of the Republic of Indonesia in connection with the revision of the Allotment Plan contained in Appendix 25 to the Radio Regulations.

Band	Frequencies in kHz	Country or area	Power in kW A3H/A3A,A3J	Remarks
4 MHz band	4 366.1 (4 364.7)	Indonesia	1/1	ex Netherlands New Guinea
	4 391.6 (4 390.2)	Indonesia	1/2	
	4 410.8 (4 409.4)	Indonesia	1	
	4 363.0 (4 361.6)	Indonesia	1	
	4 372.4 (4 371.0)	Indonesia	1	
	4 436.3 (4 434.9)	Indonesia	1	Calling
	4 140.9 (4 139.5)	Indonesia	1	Simplex
	4 426.8 (4 425.4)	Indonesia	1	
6 MHz band	6 205.4 (6 204.0)	Indonesia	0.5	Distress, urgency safety, call and reply

Band	Frequencies in kHz	Country or area	Power in kW A3H/A3A,A3J	Remarks
6 MHz band	6 516.8 (6 515.4)	Indonesia	0.5	
	6 520.0 (6 518.6)	Indonesia	0.5	Calling
	6 523.2 (6 521.8)	Indonesia	0.5	
	6 214.9 (6 213.5)	Indonesia	0.5	Simplex
	6 211.8 (6 210.4)	Indonesia	0.5	Simplex
8 MHz band	8 739.8 (8 738.4)	Indonesia	1	
	8 784.6 (8 783.2)	Indonesia	0/5	
	8 282.6 (8 281.2)	Indonesia	1	Simplex
	8 285.8 (8 284.4)	Indonesia	1	Simplex
	8 768.6 (8 767.2)	Indonesia	0.5	
	8 755.8 (8 754.4)	Indonesia	1	
	8 771.8 (8 770.4)	Indonesia	0.5	
	8 803.8 (8 802.4)	Indonesia	0.5	Calling

Band	Frequencies in kHz	Country or area	Power in kW A3H/A3A,A3J	Remarks
12 MHz band	13 113.9 (13 112.5)	Indonesia	1/5	ex Netherlands New Guinea
	13 176.9 (13 175.5)	Indonesia	2/5	
	13 141.9 (13 140.5)	Indonesia	2/5	
	13 159.4 (13 158.)	Indonesia	2/5	
16 MHz band	17 322.9 (17 321.5)	Indonesia	2/5	
22 MHz band	22 675.9 (22 674.5)	Indonesia	2/5	

The frequency requirements of the Republic of Indonesia in the revised frequency Allotment Plan for Coast Radiotelephone Stations (Appendix 25 to the Radio Regulations) will be as follows :

MHz order	4	6	8	12	16	22
Number of SSB channels	8	6	8	4	1	1

Reasons : Shortage of frequencies, because Indonesia (Republic of) consists of many islands.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

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23 April 1974
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PLENARY MEETING

Note by the Secretary-General

PROXY

(Egypt - Morocco)

The Board of Directors, Telecommunications Organization, Cairo, has given the Delegation of Morocco the right to represent the Arab Republic of Egypt at the Maritime Conference.

M. MILI
Secretary-General

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

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PLENARY MEETING

Note by the Secretary-General

PROXY

(Luxembourg - Belgium)

The Administration des postes et télécommunications of the Grand Duchy of Luxembourg has given the delegation of Belgium powers to vote and sign on behalf of Luxembourg in accordance with No. 640 of the General Regulations.

M. MILI
Secretary-General

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

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COMMITTEE 5

Indonesia

PROPOSALS FOR THE WORK OF THE CONFERENCE

ARTICLE 19

Identification of the stations

INS/173/7 MOD 747 Table of Allocations of international call sign series

Call sign series	Allocation to :
JZA - JZZ	~~Netherlands New Guinea~~ Indonesia (Republic of)

Reasons : Since May 1963 Netherlands New Guinea became one of the provinces of Indonesia (Republic of).

ARTICLE 33

General Radio Telephone Procedure in the maritime mobile service

INS/173/2 MOD 1251 (3) In the Tropical zone of Region 3, the carrier frequency 6 204 ~~Kc/s~~ kHz is designated for call and reply purposes.

ARTICLE 35

Use of frequencies for Radiotelephone in the maritime mobile service

INS/173/3 MOD 1353 (2) In the zone of Region 1 and 3 lying between the parallels 33° North and 57° South, the carrier frequency 6 204 kHz is designated for call, reply and safety purposes. It should also be used for distress messages, call and reply and other safety purposes.

Reasons : As an addition to the existing frequency 2 182 kHz.
To avoid atmospherics in the tropics on the frequency 2 182 kHz.

APPENDIX 17

Mar

INS/173/4

Relating to the frequencies in section C for world-wide common use by ships of all categories

The World Administrative Radio Conference for Maritime Mobile Telecommunications, (Geneva, 1974),

Considering

a) that the frequencies nominated in the table of single sideband transmitting frequencies for simplex (single frequency) operation not yet in use as world-wide frequencies;

b) the need of world-wide communication for ocean going vessels with coast station of any administration;

Recommends

that administrations as far as possible provide their main coastal station with frequencies in the 6 - 8 - 12 MHz.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

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PLENARY MEETING

Hungarian People's Republic

PROPOSALS FOR THE WORK OF THE CONFERENCE

The table below shows the frequency requirements of the Hungarian People's Republic in connection with the allotment plan contained in Appendix 25 of the Radio Regulations.

The Hungarian Administration has chosen the complete range of the new series for the 4, 6, 8, 12, 16 and 22 MHz bands.

These tables do not contain any calling frequencies. Number of telephony channels for the ...

Baud (MHz)	Coast stations*)		
	present situ-ation	present require-ments	require-ments in future
4	3	4	4
6	-	2	3
8	3	4	4
12	3	4	4
16	3	4	4
22	3	4	4

*) These data are given only for SSB transmissions for duplex operation.

The Hungarian Administration should like to remark that these requirements are independent of the frequency requirements of the inland waterways.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

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Note by International Chamber of Shipping (ICS)

TELEX WITH FOREIGN COAST STATIONS

1. Modern business methods depend more and more on rapid, reliable and economic communication systems. For the shipping industry too, the efficiency of the mangement of vessels is greatly dependent on radio communications.

2. Since the introduction of the public telex service in the nineteen thirties, a worldwide network has developed through which hundreds of thousands of messages are despatched daily by telex subscribers which were previously handled as telegrams by telegraph offices. These telegraph transmissions had then to be effected by means of the labour-intensive Morse key, as a consequence of which charging per word was self-evident and logical.

3. Apart from many operational advantages, telex subscriber-to-subscriber transmission offers a more economic and efficient method of charging per unit of transmission time instead of the cumbersome procedure of charging and collecting per word, and has lead to a substantial increase in business traffic.

4. For handling radio traffic with ships, too, more and more use is made of modern means of communication, and transmission is effected by telex wherever possible. However, the long-established charging and accounting procedures governed by the provisions of the relevant ITU Regulations and Recommendations still apply for traffic to and from foreign coast stations and have not yet been adapted to suit these modern transmission methods.

5. (a) Under the existing provisions, a shipowner must file a radio-telegram with the appropriate telegraph office in his country. If he is a telex subscriber, which is generally the case, he will do this by telex. If the message is to be handled by a foreign coast station, it will be forwarded - generally also by telex but paid for on a word basis - for delivery to the ship station of destination.

(b) ICS therefore feels that a simplified system is urgently required to improve efficiency in the management of vessels.

(c) The existing charge per word of a radiotelegram consists of three components, viz. the land station charge, the ship charge and the charge for transmission over the general network of telecommunication channels, all three of which are charged per word.

(d) ICS is of the opinion that the present tariff structure should be adapted to the modern transmission methods. It no longer seems realistic that, for two activities, namely the handing in of a radio telegram by the shipowner to the telegraph office in his country by telex and its onward transmission by teleprinter to the foreign coast station, charging per word is still applied.

(e) If the shipowner had been able to telex the radiotelegram direct to the foreign coast station, it is clear that for P.T.T. Administrations a number of time-consuming operations could have been eliminated and that both time and money could have been saved by the shipowner.

(f) It has been said that such a procedure would create accounting difficulties and a risk of non-payment for the Administrations controlling the coast stations. However, it would seem that these problems might be solved by a change in accounting methods, e.g. by billing traffic accounting companies, acceptable to the Administrations concerned, which themselves have accepted responsibility for guaranty of payment.

It is recognised that the institution of such an accounting procedure will require further detailed study.

6. (a) In addition to the despatch of radiotelegrams by telex direct from the shipowner to the selected foreign coast station as discussed above, it should equally be made possible for coast stations to deliver radiotelegrams received from vessels direct by telex to addresses in foreign countries at a rate based on transmission time.

(b) It is realised that the latter procedure may create accounting problems for ships' radio officers, but these would be taken into account in detailed study referred to above.

7. (a) ICS is convinced that the simplified procedures as proposed would greatly speed up the transmission of radio communications and assist shipowners in the conduct of their business. It may also be expected that a more realistic tariff structure might well result in an increase in radio communications. As already indicated it would relieve coast stations and/or Administrations from a considerable part of the work currently involved in the handling of radiotelegrams.

(b) In addition to the above advantages the H.F. service will improve and frequency bands will become less congested as abortive calling of long range coast stations by ship stations will diminish. Consequently access to, and operating with coast stations will be easier and more efficient. Moreover, some IMCO members have recognised that there are safety advantages to be gained from such a procedure.

(c) ICS requests ITU to invite the appropriate group to study the possibility of recommending a system which would permit the proposed type of service to foreign coast stations.

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PLENARY MEETING

France

FREQUENCIES FOR HF RADIOTELEPHONY

The table below lists the number of channels for HF coast radiotelephone stations, in use or planned :

Bands MHz	4	8	12	16	22
F	5	5	5	7	6
GUF	1	1	1		
MRT and GDL	2	2	2	2	1
REU	2	2	1	1	
AFI	1	1	1		
COM	1				
KER	1	1			
NCL	1	1	1		
OCE		1		1	
SPM	1	1			

INTERNATIONAL TELECOMMUNICATION UNION

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Secretariats of
the Intergovernmental Oceanographic Commission (IOC) and
the World Meteorological Organization (WMO)

HIGH FREQUENCIES ALLOCATED BY WARC, 1967, FOR OCEAN DATA TRANSMISSIONS

Agenda item 20

1. In recent years requirements of Meteorological and Oceanographic Services for marine environmental data have considerably increased as needed for meteorological and oceanographic prediction services to a variety of marine users. Acquisition of ocean data had, therefore, been receiving increased attention within the Integrated Global Ocean Station System (IGOSS) of the Intergovernmental Oceanographic Commission (IOC) and the World Weather Watch (WWW) programme of the World Meteorological Organization (WMO). A number of Member States had pursued plans to deploy buoy stations to improve meteorological and oceanographic data coverage. Thus, the need for the allocation of radio frequencies for such buoy stations had long been recognized. The World Administrative Radio Conference (WARC) to deal with matters relating to the Maritime Mobile Service, held in 1967, endorsed this need and decided to allocate six high frequency bands each with 3.5 kHz band width for the transmission of ocean data.

2. The Conference adopted at the same time Resolution No. Mar 20 "concerning the establishment of a co-ordinated world-wide system for the collection of data relative to oceanography". This resolution invited the IOC and WMO, amongst others, "to develop jointly, in consultation with the I.F.R.B., and in consultation with administrations of the Members and Associate Members of the Union, as appropriate, a co-ordinated plan designed to meet existing and future requirements of all interested Members and Associate Members, for use by stations in the collection of data relating to oceanography in a world-wide system, ...".

3. Following this resolution, the IOC and WMO developed "Interim Procedures for Co-ordination of the Use of Frequencies allocated by WARC, 1967, for Ocean Data Transmissions" and have undertaken co-ordination of requirements and requests for frequency allocations submitted by their Member States. The outcome of this co-ordination has been recorded in a plan entitled "Agreed Interim Frequency Utilization Plan", first published in September 1970 and revised in August 1973. It should be mentioned in this relation that in carrying out this task, the WMO and IOC Secretariats enjoyed full collaboration of the I.F.R.B. and received valuable technical and legal advices.

4. The time period between 1970 and 1973 referred to above was marked not only by the considerable increase in the utilization of allocated frequencies, but also by rapid technological progress in the development of various types of buoy systems, interrogation, transmission and receiving systems using HF bands allocated by WARC. Some countries deployed during that period experimental and operational buoys, while others plan to do so in the near future. In brief, the development of networks of ocean data stations has now started and is expected to gather momentum in the next few years. It was for this very reason that the second session of the Joint IOC/WMO Planning Group for IGOSS considered that any changes at this juncture in frequencies presently allocated for ocean data transmissions or reduction in their number would result in serious technical and operational difficulties. This view was subsequently supported by the twenty-fifth session of the WMO Executive Committee and the eighth session of the IOC Assembly.

Action suggested

5. The Conference is invited:

(i) to note the information contained in the present document, particularly regarding the implementation of Resolution No. Mar 20;

(ii) to maintain the present frequency bands allocation for ocean data transmissions unchanged.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

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French
Spanish

PLENARY MEETING

Inter-Governmental Maritime Consultative Organization

RECOMMENDATION ON WORLD ADMINISTRATIVE RADIO CONFERENCE FOR MARITIME MOBILE TELECOMMUNICATIONS

THE MARITIME SAFETY COMMITTEE,

NOTING that the International Telecommnication Union has convened a World Administrative Radio Conference for Maritime Mobile Telecommunications in April 1974, hereinafter referred to as the WARC Conference,

NOTING FURTHER that many Agenda items of the WARC Conference have a bearing on safety of life at sea,

TAKING INTO ACCOUNT previous relevant decisions by the IMCO Assembly, i.e. Resolution A.127(V) pertaining to the unification of emergency position-indicating radio beacon signals, and Resolution A.217(VII) concerning measures for strengthening and improving the maritime distress system,

RECOMMENDS that Member Governments when preparing their national positions for the WARC Conference, take into account:

(a) the views expressed in the Appendix to this Recommendation;

(b) the contents of Annex XVI concerning the Maritime Distress System;

*) (c) the contents of Resolution A.217(VII),

REQUESTS the Secretary-General to bring this Recommendation to the attention of IMCO Member Governments, Parties to the 1960 Safety Convention and Governments which participated in the 1960 Safety Conference,

REQUESTS ALSO the Secretary-General to give similar circulation to supplementary Recommendations which may be prepared by the Sub-Committee on Radiocommunications for early consideration by Member Governments, on the understanding that the Committee will further consider these at its next session.

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*) Note by the I.T.U. General Secretariat

The text of Resolution A.217(VII) ("Measures for strengthening and improving the maritime distress system") was transmitted to all Members of the I.T.U. by letter RM/CONF/2 of 19 January 1972.

APPENDIX

Agenda item 3 - The provisions concerning distress and safety in the Maritime Mobile Service.

General

Use of 156.8 MHz for distress

IT IS RECOGNIZED THAT:

(i) the role of the frequency of 156.8 MHz as part of the maritime distress system has not yet been determined. It will, however, some time in the future form the basis for a short range distress system;

(ii) it is therefore appropriate to take action beyond the existing provisions of the Radio Regulations;

(iii) the action taken should not prejudge future decisions by IMCO concerning the carriage of VHF equipment.

IT IS NOTED THAT THE ACTION TAKEN:

(i) will improve the status of the frequency in the Radio Regulations;

(ii) will provide guidance for and encourage Member Governments to proceed with national planning for a VHF distress system, where required.

Consequently the following changes to the Radio Regulations are recommended:

- Footnote 287 to Article 5 should be amended to read:

The frequency 156.80 ~~Mc/s~~ MHz is the international distress, safety and calling frequency for the maritime mobile VHF radiotelephone service. Administrations shall ensure that a guard-band on each side of the frequency 156.80 ~~Mc/s~~ MHz is provided. The conditions for the use of this frequency are contained in Article 35. In the bands 156.025-157.425 ~~Mc/s~~ MHz, 160.625-160.975 ~~Mc/s~~ MHz and 161.475-162.025 ~~Mc/s~~ MHz, each Administration shall give priority to the maritime mobile service ~~on only such frequencies as are assigned to stations of the maritime mobile service by that administration (see Article 35)~~. Any use of frequencies etc. ...

- Radio Regulations 1364 - no change.
- Radio Regulations 1367 should be amended to read:

(4) Ship stations should, where practicable, maintain watch on 156.80 ~~Mc/s~~ MHz ~~when within the service area of a coast station providing international maritime mobile radiotelephone service in the band 156,174 Mc/s~~ for receiving by any appropriate means distress, safety and calling signals, where this can be achieved without prejudice to ships' needs.

Agenda item 12 - The international assignment of frequencies for operational internal communication on board ships.

IT IS RECOGNIZED THAT:

(i) the Maritime Safety Committee at its twenty-second session, recognizing the benefits to the safety of life at sea from the use of equipment for internal communications, agreed that the existing provisions of the Radio Regulations are too restrictive in emergency cases when reliable internal communications on board ships are essential;

(ii) at its ninth session (17-21 January 1972), the Sub-Committee on Radiocommunications prepared a statement on "Provisional Requirements for the Use of Internal Communications on Board Ships", which recommends the allocation of a minimum of two frequencies in the VHF band and a minimum of three frequencies in the 450 MHz band for world-wide use without limitation to geographical position;

(iii) the CCIR is studying under Question 18 - 1/8 technical and operational characteristics of internal communications on board ships in order to develop a recommendation;

(iv) nevertheless it is considered necessary for IMCO to make a recommendation based on the existing situation to ensure allocation of sufficient frequencies for on board communications.

IT IS NOTED THAT:

(i) general consent has been reached on the allocation of three UHF frequencies (457.525, 457.550 and 457.575 MHz) for this purpose for international use;

(ii) several Administrations have indicated a requirement to have both VHF and UHF frequencies available for on board communications;

(iii) IMCO is of the opinion that in the future additional channels will be required and invites Member Governments to bring this problem to the attention of the International Telecommunication Union;

(iv) some Administrations believe that duplex or repeater operation is required for on board communications on larger vessels;

(v) the present Radio Regulations permit a power of 0.1 watts for VHF on board communications on channels 15 and 17, but that IMCO want higher powers authorized. This problem is included in the study by CCIR mentioned above;

(vi) in the UHF region, a maximum effective radiated power of 2 watts appears satisfactory.

IT IS RECOMMENDED THAT:

Administrations, when formulating their proposals to the WARC Conference, consider the following points:

(a) the need for a definition of "on board communications";

(b) a minimum of two frequencies in the VHF band and a minimum of three frequencies in the 450 MHz band (457.525 MHz, 457.550 MHz and 457.575 MHz) should be allocated for world-wide use and be permitted for use without limitation of geographical position;

(c) the provision for additional channels and/or duplex operations should be considered;

(d) for UHF frequencies a maximum effective radiated power of 2 watts should be permitted;

(e) an operator's licence is not required for the normal operation of on board communications equipment.

Agenda item 3.5 - The 1971 Space Conference's provisions with respect to frequencies for EPIRBs (Emergency Position-Indicating Radio Beacons).

Agenda item 4.1 - Resolution No. Spa 2-5 of the 1971 Space Conference with regard to the use of satellite systems for safety and distress on certain channels in the bands 157.3125-157.4125 MHz and 161.9125-162.0125 MHz.

Agenda item 13 - Operational, technical and frequency regulations for the Maritime Mobile Satellite and Radio-determination Satellite Services.

IT IS RECOGNIZED THAT:

(i) emergency position-indicating radio beacons (EPIRBs) can be of significant value in locating and rescuing survivors at sea;

(ii) IMCO has urged Administrations to require the carriage, where appropriate, of such beacons operating on the frequencies 2182 kHz and/or 121.5 MHz and/or 243 MHz;

(iii) satellite relay of EPIRB signals offers the potential of enhanced maritime safety on a world-wide basis. Useful frequency bands for this purpose were allocated at the 1971 Space Conference;

(iv) maritime satellite planning is still largely in a conceptual stage as indicated by the work of IMCO to date. The Panel of Experts is planning more meetings to develop operational requirements and desired characteristics for a maritime satellite capability;

(v) in the area of safety and distress, there are still decisions to be made as to the manner in which satellite technology would be applied to provide for this important service. Furthermore, it is noted that maritime terrestrial usage of the VHF-FM bands is heavy and increasing (See ITU Recommendation MAR 3);

(vi) in its study of the Distant Future Maritime Distress System, IMCO has indicated a need for automatic distress alerting and locating signals as a requirements.

IT IS NOTED THAT:

(i) the 1971 Space Conference allocated one small band of 100 kHz (406-406.1 MHz) to the mobile satellite service (earth-to-space) solely for the use and development of low power (not to exceed 5 W) emergency position-indicating radio beacon (EPIRB) systems using space techniques (See No's 317A and 317B of the Radio Regulations)

(ii) the 1971 Space Conference adopted Resolution No. SPA 2-5 with regard to the future use of satellite systems for safety and distress on certain channels in the bands 157.3125-157.4126 MHz and 161.9125-162.0125 MHz;

(iii) in-depth development and testing of satellite EPIRBs has not yet been undertaken, and thus uncertainty exists as to the eventual choice of frequency bands for the most suitable satellite system.

IT IS RECOMMENDED THAT:

1. Administrations, in their proposals to the WARC Conference, consider the following:

   (a) Although use of VHF for satellite communications is not anticipated by IMCO, No. 287A of the Radio Regulations and Resolution No. SPA 2-5 should be basically retained for the present as suitably amended (to keep options open to the maritime service until means for applying satellite technology for emergency and distress purposes are adopted);

   (b) The present allocation of 100 kHz (406-406.1 MHz) for low power EPIRBs (i.e. No's 317A and 317B of the Radio Regulations) should be preserved.

2. Administrations be guided in their preparatory work for the WARC Conference by the basic principle that the desired objective should be to provide in the Radio Regulations for flexibility that will enhance, and give initial direction to maritime satellite communications. In other words, the broad objective should be the provision of those minimal technical, operational and procedural regulations needed to introduce in an orderly manner the maritime satellite services made possible by actions of the 1971 Space Conference.

3. With regard to paragraph 2 immediately above, and while it is believed that radio-determination can be provided in a first phase maritime satellite system, Administrations should nevertheless avoid proposals that would delay the implementation of a communications capability while awaiting development and implementation of a navigation capability.

ANNEX XVI

MARITIME DISTRESS SYSTEM

I. GENERAL INTRODUCTION

1. DEFINITION

1.1 A maritime distress system is the co-ordinated use of various radio elements for the purpose of safety of life at sea.

1.2 The system is designed to serve the distress radiocommunications requirements of Convention ships[1].
The system will also serve any other craft properly equipped.

1.3 It provides for radiocommunications at various distances between those which may become involved in a distress incident.

1.4 The principal elements of the maritime distress system include:

(i) stations participating in the maritime mobile service;

(ii) frequencies/modes;

(iii) equipment;

(iv) procedures and regulations in force;

(v) personnel; and

(vi) organizations.

---

[1] In this context "Convention ships" are those fitted with radio equipment in accordance with the provisions of the International Convention for the Safety of Life at Sea, in force.

Radiocommunications in the maritime distress system include:

(i) alerting;
(ii) identifying;
(iii) locating;
(iv) co-ordinating and expediting assistance; and
(v) on-scene communications.

2. REQUIREMENTS

2.1 The system should comprise facilities for radiocommunications over all distances, of which one - a medium distance facility - should be common to all Convention ships in all areas.

2.2 The equipment needed in the system should be as reliable as possible, require minimum amount of maintenance and be easy to operate.

2.3 The procedures used should be internationally standardized and it is imperative that shore rescue facilities, coast stations, vessel reporting systems, search and rescue organizations and other terminal facilities be established and co-ordinated into a network.

2.4 Ultimately the system should include reliable means for automatic alerting and position indicating.

2.5 However, any new system must be proven to be more reliable than the system it is intended to replace.

2.6 A future distress system should be evolved as a natural development of the present system.

II. NEAR FUTURE DISTRESS SYSTEM

3. PROPOSED IMPROVEMENTS FOR THE NEAR FUTURE

3.1 During the transition to a future distress system it is necessary to maintain existing provisions of the International Convention for the Safety of Life at Sea to ensure a reliable distress system for ships fitted with both existing and new equipment. The present provisions for 500 kHz, 2182 kHz, HF and VHF are the foundation upon which consideration is based. In addition to improving these, recommendations for new provisions are listed below.

3.2 The following evolutionary, technically feasible and practical steps should be taken to augment the present system. It is recommended as a matter of urgency that:

(a) Administrations require that all ships under their jurisdiction compulsorily equipped with radiotelegraph installations be fitted with 2 MHz radiotelephone transmitting and receiving equipment, including watch receivers, as specified in Resolutions A.205(VII) and A.217(VII), for the purpose of providing early and effective linkage between the 500 kHz and 2182 kHz distress systems;

(b) The frequency 156.8 MHz be designated the international distress, safety and calling frequency for the maritime mobile VHF radiotelephone service.[2]

It is further recommended that Administrations consider the early implementation of 156.8 MHz for distress and safety purposes, where short-range facilities are required and that ship stations should where practicable, maintain watch on 156.8 MHz for receiving by any appropriate means distress, safety and calling signals, where this can be achieved without prejudice to ships' needs;

(c) The carriage of emergency position-indicating radio beacons (EPIRBs) operating on 2182 kHz and/or 121.5 MHz and/or 243 MHz be required in accordance with Resolution A.217(VII). Note also Resolution A.91(IV) EPIRBs on very high frequencies should preferably operate on both 121.5 and 243 MHz;

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[2] Note concerning WARC 1974: It is recommended to Member Governments that specific changes be made in the Radio Regulations noting that the WARC 1974 will be the only opportunity for several years for the maritime mobile service to improve its international status in the Radio Regulations with respect to other radio services.

(d) the selective calling system which meets the requirements of the Radio Regulations be implemented;

(e) the use of the high frequency spectrum for safety purposes be encouraged. In addition to the normal means of distress, alerting and communications, vessels maintaining HF communications with coast stations are urged to utilize this alternative means of alerting and communicating with respect to distress incidents, particularly when outside the normal communications range of 500 kHz, 2182 kHz, or 156.8 MHz. In this connexion the attention of Administrations is drawn to Radio Regulation No. 1381;

(f) equipment performance and reliability be improved. Telecommunication equipment used for safety should be designed, instruction manuals prepared, and test equipment provided, so as to improve reliability and to facilitate maintenance at sea;

(g) the training of radio officers and radio operators be expanded. Radio officers and radio operators should be given appropriate training, according to their differing technical backgrounds, in maintenance and repairs at sea of the telecommunications and other electronic navigation equipment involved in the safety of life at sea. In addition, all crew members should be trained in the use of lifeboat and survival craft radio equipment;

(h) wider participation of vessels and coast stations in vessel position-reporting systems should be further encouraged;

(i) all Convention ships be fitted with maritime VHF facilities;

(j) the radiotelephone coast station distress coverage in those regions where it is at present inadequate be improved;

(k) the measures for improving the effectiveness of 2182 kHz set forth in Resolution A.217(VII) be implemented as far as possible;

(1) adequate frequencies must be made available in all maritime bands for calling purposes and the transmission of urgency and safety messages. In particular in congested areas the transmission of urgency and safety messages by coast stations should be co-ordinated by Administrations concerned and preferably be done by selected coast stations, by means of "safety broadcasts".

3.3 The proposals constitute an integrated programme to improve the maritime distress system on the basis of the existing and presently anticipated technology and regulatory situation.

3.4 Administrations are also urged to put into effect those items that can be accomplished by administrative action.

III. DISTANT FUTURE DISTRESS SYSTEM

4. GENERAL

4.1 A distress system in a distant future should evolve as a natural development of the near future distress system and should include improved telecommunications facilities as they become available.

4.2 Elements of the near future distress system should be augmented and, if necessary, be replaced or simplified when more effective measures, methods or techniques become available. These should however be subjected to adequate practical testing to ensure that they meet all the requirements.

4.3 A maritime satellite system will be an important resource of the distant future distress system. While the primary role of satellite communications will be public correspondence, the fact that such communications exist will improve safety.

5. REQUIREMENTS

5.1 (a) Even with the advent of satellite and automatic communications, the need will remain for some terrestrial and conventional methods of communications between ships, from ship-to-shore, and between ships and aircraft.

Conventional terrestrial communications would then still provide, on a mandatory or voluntary basis, the following functions for the maritime service:

(i) For non-satellite equipped ships - all communications services;

(ii) Complementary or supplementary services, such as short-range communications and distress in the maritime 500 kHz, 2 MHz and VHF bands, and as necessary, long-range communications via HF bands, during the transition period and for an undetermined period thereafter;

(iii) Linkage between satellite - equipped ships and non-satellite - equipped vessels.

These factors underscore the need for close integration between satellite and terrestrial communications facilities and systems, aboard ship.

(b) The system should provide for a ship-to-shore and shore-to-ship relaying capability by means of satellites as such facilities become available, especially for regions outside the MF coverage from land.

5.2 The system should also provide for the possible future fitting of automatic distress alerting, followed by the automatic transmission of essential additional information, such as identity of the vessel in distress, its position and the nature of the distress case, preferably transmitted in a standard format.

5.3 The system should further provide for supplementary ship-to-shore, shore-to-ship and ship-to-ship channels for the purpose of locating, co-ordinating and expediting assistance, including communications for search and rescue and "on-scene" operations.

5.4 Adequate frequencies must be available in all maritime bands for calling purposes and the transmission of urgency and safety messages with a continuing need for co-ordination in congested areas and in satellite systems.

5.5 Vessel position-reporting systems, where established, should provide for vessels to report their positions by automatic means to a centralized computer facility by either satellite or terrestrial means.

5.6 A co-ordinated distress and search and rescue communications network for maritime and aeronautical distress should be provided, with the necessary interconnections among appropriate SAR organizations, such as rescue co-ordination centres, vessel reporting centres, terrestrial coast stations and satellite ground stations.

5.7 The training of radio officers and radio operators should be further expanded, as appropriate, to ensure continued and adequate maintenance and repairs at sea of the telecommunications and other electronic navigation equipment involved in the safety of life at sea.

6. PROPOSED TRANSITIONAL MEASURES

6.1 During the transition to a distress system in the distant future it will be necessary to review and, if necessary, to modify the existing provisions of the Safety Convention.

6.2 The implementation of satellite communications could meet certain requirements for a future distress system, in particular for ship-to-shore alerting, locating, co-ordination and long-distance search and rescue communications. These satellite communication facilities should remain supplementary to ship-to-ship alerting and "on scene" communications, on terrestrial channels. Further studies regarding the additional uses of satellite communication in a future distress system will be necessary and should be included in the proposals for a maritime satellite system.

6.3 The need for a single medium range distress frequency exclusively reserved for distress purposes should be studied in the light of continuing technological developments and the associated requirements for safety and calling.

6.4 In addition to the improvements proposed in the near future distress system the following steps should be taken in preparing a distress system in the distant future:

(a) Provisions for maritime terrestrial and/or satellite communication should be made for supplementary ship-to-shore and shore-to-ship communications; this would achieve the purpose of locating, co-ordinating and expediting assistance, including communications for search and rescue.

(b) Provisions should be made for ship-to-ship and ship-to-aircraft communications for "on-scene" operations, taking due regard of the provisions in the Radio Regulations which permit this type of terrestrial communication in the 1535-1660 MHz band, in addition to the MF, HF and VHF bands.

(c) The introduction of a general purpose selective calling system, capable of facilitating the transmission and reception of all communications, should be expedited.

IV. IMPLEMENTATION

7. (a) It is intended that, where practicable, steps in the near future distress system will be introduced into the existing system as soon as possible, through whatever procedure is appropriate.

(b) It is intended that, where practicable, steps in the distant future distress system will be introduced in the near future distress system, whenever the introduction of new measures, methods or techniques will make this technically feasible and possible.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

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PLENARY MEETING

Inter-governmental Maritime Consultative Organisation

DRAFT SUPPLEMENTARY RECOMMENDATION

WORLD ADMINISTRATIVE RADIO CONFERENCE FOR MARITIME MOBILE TELECOMMUNICATIONS

THE MARITIME SAFETY COMMITTEE,

NOTING that the International Telecommunication Union has convened a World Administrative Radio Conference for Maritime Mobile Telecommunications in April 1974, herewith referred to as the WARC Conference,

NOTING FURTHER that many Agenda items of the WARC Conference have a bearing on safety of life at sea,

TAKING INTO ACCOUNT previous relevant decisions by the IMCO Assembly, i.e. Resolution A.127(V) pertaining to the unification of emergency position-indicating radio beacon signals, and Resolution A.217(VII) concerning measures for strengthening and improving the maritime distress system,

RECALLING that the Maritime Safety Committee, at its twenty-seventh session (26-30 March 1973) adopted a Recommendation on matters to be considered by the WARC Conference and that since then Administrations have submitted Proposals to the ITU Secretary-General for the work of that Conference,

BEARING IN MIND the need to give similar circulation to Supplementary Recommendations,

RECOMMENDS that Member Governments when preparing their national positions for the WARC Conference and in the course of negotiations at that Conference take into account the foregoing and the views expressed in the Appendix to this Supplementary Recommendation,

REQUESTS the Secretary-General to bring this Supplementary Recommendation to the attention of IMCO Member Governments, Parties to the 1960 Safety Convention and Governments which participated in the 1960 Safety Conference.

APPENDIX

Agenda item 3 - The provisions concerning distress and safety in the Maritime Mobile Service

GENERAL

As regards measures for improving the maritime distress system, the IMCO Assembly has adopted (by Resolution A.217(VII)) the following Recommendations for strengthening and improving the maritime distress system, with particular regard to radiotelephony:

(a) Improving listening watch on 2182 kHz;

(b) avoidance of unnecessary radiotelephone alarm signal transmissions on 2182 kHz;

(c) extension of the maritime distress system on the radiotelephone distress frequency;

(d) restricting calling on 2182 kHz;

(e) utilization of 2182 kHz for safety purposes;

(f) carriage of emergency position-indicating radio beacons;

(g) use of shore-based direction-finding stations.

The use of the high frequency spectrum for safety purposes is encouraged by IMCO. In addition to the normal means of distress alerting and communications, vessels maintaining HF communications with coast stations are urged to utilize this alternative means of alerting and communicating with respect to distress incidents, particularly when outside the normal communications range of 500 kHz, 2182 kHz, or 156.8 MHz. Radio Regulation No.1381 is pertinent. As regards coverage of radiotelephone coast stations, IMCO has urgently recommended improvement of coverage of radiotelephone coast stations for distress in those regions where it is at present inadequate. (IMCO Assembly Resolution A.283(VIII)).

The Ad Hoc Joint IMCO/IHO Committee on Radio Navigational Warnings has agreed that the present excessive use of the safety signal is caused by too wide an interpretation of the existing provisions of the Radio Regulations, which permits that signal being used for all messages concerning the safety of navigation. The Ad Hoc Committee went on to suggest that No.1490 of the Radio Regulations should be made more restrictive in order to limit the use of safety signals to important navigational or important meteorological warnings.

THEREFORE:

(a) Account should be taken of the actions already approved in IMCO as cited above, as well as the suggestion by the Ad Hoc Joint IMCO/IHO Committee regarding the application of No.1490 of the Radio Regulations, (N.B.: Definition of what is "important" as regards navigational and meteorological warnings is considered a matter for decision by Administrations originating warning messages); and

(b) the need for a single medium range distress frequency exclusively reserved for distress purposes should be studied in the light of continuing technological developments and the associated requirements for safety and calling.

Agenda item 3.1 - The maintenance by certain ships of a distress watch on both 500 kHz and 2182 kHz

IMCO, by its Resolution A.217(VII), agreed that ships compulsorily fitted with either a radiotelegraph or radiotelephone installation shall have, in addition, facilities for listening continuously, while at sea, on the radiotelephone distress frequency by means and in conditions which will have to be determined and approved by the Administration e.g. by means of a watch receiver whose output should be as near as possible to the place from which the ship is usually navigated.

Regulation 7 of Chapter IV of the 1960 Safety Convention was amended to the effect that each ship which, in accordance with Regulation 3 or Regulation 4, is fitted with a radiotelegraph station shall, while at sea, maintain continuous watch on the radiotelephone distress frequency in a place to be determined by the Administration, by use of a radiotelephone distress frequency watch receiver, using a loudspeaker, a filtered loudspeaker or a radiotelephone auto alarm. (See Resolution A.205(VII)).

IMCO Resolutions A.205(VII) and A.217(VII), which are responsive to this Agenda item, should be taken into account by Member Governments.

Agenda item 3.3 - The use of radioteleprinter and selective calling systems in relation to the safety service:

SELECTIVE CALLING SYSTEMS

(a) As regards selective calling systems, IMCO has already taken several decisions specifically:

(i) Administrations are recommended to organize, as a matter of urgency, a world-wide selective calling system based on the technical provisions and operating on the frequencies provided by the Radio Regulations 1967, and to take measures to equip all coast stations at the earliest date with encoders producing signals complying with the provisions of Appendix 20C to the Radio Regulations, including the "all ships" call signal. (Resolution A.220(VII)).

(ii) The early implementation by the Administrations of selective calling is strongly recommended so that ships are able to use these facilities. (Resolution A.217(VII)).

(iii) The "all ships" call signal should not be used in the MF and HF bands for calls of a lower priority than urgency and in the VHF band for calls of a lower priority than safety.

(iv) Further means of restricting the use of the "all ships" call signal should be considered, such as a procedure intended to prevent the transmission of such calls by more than one coast station for the same message.

(v) The introduction of a general purpose selective calling system, capable of facilitating the transmission and reception of all communications, should be expedited. (Resolution A.283(VIII)).

(b) It is also considered that:

(i) Any introduction of a binary digital system, whilst this is recognized as being the probable future development, should await the outcome of CCIR studies into the subject;

(ii) a selective calling system should, in particular, have an important function in distress alerting and should also be used for safety purposes;

(iii) operational requirements on which a selective calling system should be based, have a direct relationship to an improvement of the safety of life at sea.

(c) Member Governments should take into account:

(i) That the following operational requirements should be included in the system:

- two-way operation in the direction shore-to-ship, ship-to-shore, and ship-to-ship
- individual selective calls
- distress alerting and following additional information
- urgency calls
- safety calls
- all ships calls
- selective geographic area calls
- selective group calls
- priority calls
- routine calls
- calling station identification
- reply frequency identification
- special coded messages
- answer-back and self-identification
- polling or interrogation
- command functions (unlimited);

(ii) that the system should be able to serve as an automatic alerting device in distress cases capable of transmitting, receiving and recording an initial alerting signal, followed by additional information such as the identity and position of the ship in distress and the nature of the distress case;

t the system should also be employed for urgency and safety affic, without restrictions on the use of the "all stations" call;

hat the system should be sufficiently moderate in price to encourage widespread fitting on ships fitted with radio equipment in accordance with the provisions of Chapter IV of the 1960 Safety Convention.

IRECT-PRINTING

With regard to the use of direct-printing for safety purposes, the owing general considerations are applicable and, accordingly, have n considered:

(i) the use of narrow-band direct-printing telegraphy on HF frequencies;

(ii) the feasibility of using narrow-band direct-printing telegraphy on MF and VHF frequencies;

(iii) the capability of error detecting and correcting facilities, related to the operating conditions on MF, HF and VHF frequencies;

(iv) the capacity for unattended operation;

(v) the advantages of the use of direct-printing for the dissemination of safety traffic.

Further, it is noted that the Ad Hoc Joint IMCO/IHO Committee agreed that facilities should be provided for receiving printed navigational warnings by automatic means and recommended that appropriate provisions for such facilities should be included in the Radio Regulations.

(b) Member Governments when considering their national positions for the WARC Conference on direct-printing for safety purposes, might well take into account:

(i) the use of narrow-band direct-printing telegraphy on MF and VHF, in addition to the authorized use on HF frequencies;

(ii) that narrow-band direct-printing telegraphy in particular for broadcasts of safety messages, should be authorized, where necessary, in the bands between 405 and 535 kHz, 1605 and 4000 kHz and between 156 and 174 MHz, allocated to the maritime mobile service.

Agenda item 3.4 - The designation of common scene-of-action frequencies other than 500 kHz and 2182 kHz.

Agreement has been reached with ICAO that the frequency 123.1 MHz may be used for search and rescue, and scene-of-action purposes for intercommunication between aircraft and surface craft in addition to the frequencies 3023.5 kHz, 5680 kHz and 121.5 MHz already provided for such use in the Radio Regulations.

As a consequence, a new footnote to cover this should be included in the Table of Frequency Allocations in Article 5 of the Radio Regulations.

The use of distress frequencies for scene-of-action communications can jeopardize the former. This has been recognized at MF and HF and at VHF in the case of 121.5 MHz and the concept should now be carried forward to the maritime mobile VHF band.

These common, international, scene-of-action frequencies should be made available for use by surface craft, aircraft and participating land stations. The specific frequency for this purpose should be chosen at the WARC Conference.

Member Governments should be prepared to make or act on proposals at the WARC Conference in the selection of the frequency.

Agenda item 3.7 - The use of auto-alarm signals:

(a) IMCO Resolution A.217(VII) recommends measures to reduce unnecessary alarm signal emissions.

(b) Regulation 9 of Chapter IV of the 1960 Safety Convention has been amended to the effect that arrangements shall be made to check periodically the proper functioning of the radiotelephone alarm signal generator on frequencies other than 2182 kHz, using a suitable artificial aerial. (Resolution A.205(VII)).

(c) As a result of an IMCO study on the reliability of radiotelegraph auto-alarms, the Maritime Safety Committee at its twenty-second session, recognizing the need for improvements, recommended the following measures:

(i) to invite Member Governments to take all necessary steps to include in the training of radio officers, practical knowledge necessary for the location and remedying, with the means available on board, of faults which may occur during a voyage in this equipment;

(ii) to invite special attention to the daily checking of the equipment, as prescribed in Regulation 10(c), Chapter IV of the 1960 Safety Convention;

(iii) to recommend that Member Governments make practical tests to ensure that existing types of radiotelegraph auto-alarms still comply with the provisions of Regulation 10, Chapter IV of the 1960 Safety Convention and with CCIR Recommendation 224.

(d) Attention is called to the comments and discussions under Agenda item 3.3 on selective calling, relating to its use as an automatic alerting device.

(e) Recognition should be made of the suggestion made by the Ad Hoc Joint IMCO/IHO Committee that a special signal for alerting should be introduced to indicate that a vital navigational warning concerning imminent danger to human life will be transmitted.

Attention of Member Governments is called to the need to propose a type of signal, the modulation and how the signal should be used. There is an immediate need for this special alerting signal.

Agenda item 3.8 - Silence periods

IMCO Resolution A.217(VII) recommends that Administrations in ITU Region 2 consider implementing the silence periods on 2182 kHz now existing in ITU Regions 1 and 3. The Recommendation was brought to the attention of the ITU, with the request that action be taken, as necessary, with a view to its wide implementation.

Member Governments are invited to note the foregoing action.

Agenda item 3.9 - The use of portable devices on lifeboats and other survival craft;

(a) IMCO is of the opinion that a facility for long-range communications should be retained in the existing maritime distress system. In the absence of a suitable alternative, no change should be recommended for the time being with respect to the use of 8364 kHz.

(b) By Resolution A.283(VIII), IMCO agreed that all crew members should be trained in the use of lifeboat and survival craft equipment.

(c) Emergency position-indicating radio beacons

(i) Resolution A.279(VIII), recommends that, as a matter of urgency, emergency position-indicating radio beacons operating on 2182 kHz and/or 121.5 MHz and/or 243 MHz be required in accordance with **Resolution** A.217(VII). Emergency position-indicating radio beacons on VHF should preferably operate on both 121.5 and 243 MHz.

(ii) Relevant provisions and recommendations adopted by ITU and IMCO are incorporated in a Recommendation intended to assist Member Governments in their preparation of national regulations. (Resolution A.279(VIII)).

Member Governments are invited to take the foregoing into account.

Agenda item 3.10 - The use of radio direction-finding:

(a) Regulation 12 of Chapter V of the International Convention for the Safety of Life at Sea has been amended to the effect that all ships of 1,600 tons gross tonnage and upwards, the keel of which is laid on or after the date of coming into force of this provision, when engaged on international voyages, shall be fitted with radio equipment for homing on 2182 kHz complying with the relevant provisions of Regulation 11, paragraph (b) of Chapter IV. (Resolution A.174(VI)).

(b) The fitting of ships of less than 1,600 tons gross tonnage with radio equipment for homing on 2182 kHz has been recommended. (Resolution A.221(VII)).

(c) Where practicable and necessary, Administrations should establish shore-based direction-finding stations to take bearings of distress signals, calls and messages, particularly those transmitted on the radiotelephone distress frequency along coasts, especially in areas of high traffic density; close collaboration between direction-finding stations of all nations whose coastlines are in the area, should be an essential feature of such a system. (Resolution A.217(VII)).

Member Governments are invited to take the foregoing into account.

Agenda item 4 - The VHF Provisions generally

Increasing use of VHF for maritime communications is such that, in order to meet operational requirements, there is a need for use of the new interleaved channels, i.e. 25 kHz channelling, as soon as possible. The 50 kHz protection date should be deleted to permit early implementation of the interleaved 25 kHz channels in the areas where this is required. (ITU Res. MAR.14)

In this regard, IMCO Resolution A.122(V) should be noted, as it points out that Chapters IV and V of the International Convention for the Safety of Life at Sea have been amended to the effect that a Contracting Government may require ships navigating in an area under its sovereignty to be provided with a VHF radiotelephone station to be used in conjunction with a system which it has established in order to permit safety of navigation. The amendments also prescribe requirements for VHF installations and listening watches.

Since the operational situation is such that conversion to 25 kHz channelling should be advanced, Member Governments should be prepared to deal with this matter at the WARC Conference.

Agenda item 4.2 - The use of VHF facsimile and similar transmissions, other than radiotelephony

While it is noted that the Radio Regulations do not prohibit the use of facsimile and direct-printing in the maritime VHF band, Member Governments should note the desirability to make specific provisions in these Regulations for such operations in that band, particularly for safety messages (see also reference to the Ad Hoc Joint IMCO/IHO Committee related to provisions for printed navigational warnings under Agenda item 3.3 - Section Direct Printing).

Agenda item 4.3 - The use of selective calling on VHF

IMCO has agreed that the "all ships" call signal should not be used in the VHF band to precede messages of a lower priority than safety.

Member Governments are invited to note the foregoing.

Agenda item 4.6 - The use of frequencies for movements and safety communications

Operational requirements have been stated by several Member Governments for a system of vessel movements and safety communications in the maritime mobile VHF band.

There is significant agreement, in principle, among Member Governments as to the need for this type of communication. However, there are variations in the proposal for the name and the method of satisfaction of this requirement.

Some Member Governments have proposed exclusive channels while others state that, although channels should be available for this use on a priority basis, greater flexibility should be provided to permit port operations communications on these channels where not required for vessel movement systems.

Member Governments are invited to take into account the foregoing and the need for:

(a) the adoption of a definition appropriately describing the service to be performed;

(b) the designation of channels for the service and their sequence of employment;

(c) the establishment of the relative priority to be observed as between the port operations service and the vessel movements and safety communications.

Agenda item 5.2 - The classes of emission to be used

Member Governments should take into account that the following classes of emissions should be permitted for selective calling when employing the system in accordance with the Radio Regulations, Appendix 20C:

- A2H on 2170.5, 2182 kHz, and on HF radiotelephone calling frequencies for coast stations,
- A2 or A2H on 500 kHz,
- F2 on VHF.

Agenda item 6 - The introduction of facsimile in the MF bands

While it is noted that the Radio Regulations do not prohibit the use of facsimile in the MF bands, Member Governments should note the desirability to make specific provisions in these Regulations for such operations in these bands.

Agenda item 10 - Problems relating to the maritime services operating in the bands between 1605 kHz and 3800 kHz including the future assignment of the single sideband channels derived from the present double sideband coast and ship station assignments.

An Administration should be allowed, at its discretion, to permit ships to call coast stations on 2182 kHz using A3A or A3J emissions for the exchange of distress or safety communications when those ships are beyond the range of 2182 kHz A3 or A3H emissions. This would not alter the normal 2182 kHz watch required by ships or coast stations and would be an additional watch, on a permissive basis, at the applicable coast stations. It was felt that an appropriate modification or footnote to 1323 of the Radio Regulations will be necessary.

Agenda item 10.3 - International common frequencies for working:

(i) from coast radiotelephone stations to ships of other nationalities, and

(ii) from ships to coast stations of other nationalities.

Recommendation MAR 5 appended to the ITU Radio Regulations, recommends that Administrations study the matter of international common working frequencies in the medium frequency band with a view to formulating proposals for consideration by the next competent WARC and that, in the meantime, countries should explore the possibility of concluding regional, bilateral, or multilateral arrangements to provide for communication for coast stations working with ship stations of other nationalities. Regional agreements have been developed under which ships are authorized to work on specific national frequencies assigned to coast stations of another nationality, when they are on regular routes or are in need to work with these coast stations on a routine basis.

One approach to establishing international common working frequencies would be to make four frequencies available by taking advantage of the conversion of present DSB channels to SSB channels. However, it is recognized that a complex co-ordination problem is involved, both within an Administration and between Administrations, with the further complication that the 1605-2850 kHz band is shared with other services. Further, in order to make this possible, SSB equipment will have to be installed.

Member Governments should take into account the desirability of identifying four international common working frequencies for coast radiotelephone stations to ships and four international common working frequencies for ships to coast stations. At least one of the coast radiotelephone frequencies would be reserved for safety traffic. In providing for these additional frequencies, Member Governments should note the need for extensive co-ordination, both within and among administrations, and that conversion to SSB would be necessary.

Agenda item 14 - Questions relating to the use of frequencies for radiodetermination:

(a) The advance of solid state technology during the past few years has led to the development of small, low power drain, highly reliable radar beacons. Indications are that fixed frequency radar beacons are superior to the swept frequency radar beacons. Yet to be established are technical characteristics such as bandwidths required for the radar beacons and the technical parameters to be met by such devices, including the electromagnetic compatibility with other uses in the frequency bands concerned. Possible applications for fixed frequency radar beacons have been identified by IMCO as follows:

(i) to improve ranging on and identification of positions on inconspicuous coastlines;

(ii) to provide identification of positions on coastlines which permit good ranging but are featureless;

(iii) to aid identification of selected navigational marks both seaborne and landbased;

(iv) to improve landfall identification;

(v) to provide approach information to a specific point or into a channel or harbour;

(vi) to identify ships;

(vii) to pass additional information about a vessel; (Data transfer)

(viii) to provide berthing information; (Data transfer)

(ix) to provide identification of Ocean Data Acquisition Sytems (ODAS) and other scientific flotation platforms.

Member Governments are invited to note the foregoing and take the following into account:

(1) that a frequency sub-band for fixed frequency radar beacons be allocated in each of the radionavigation bands currently used for marine radar, i.e. 2900-3100 MHz, 5460-5650 MHz and 9300-9500 MHz;

(2) that the effective radiated power of fixed frequency radar beacons should be limited to a level which in operational service would not cause harmful interference to marine radar operating in the adjacent parts of the spectrum;

(3) the desirability for IMCO and other appropriate organizations to continue to evaluate the operational benefits that could be derived from widespread use of fixed frequency radar beacons;

(4) that the CCIR should be invited to recommend the most suitable order of frequencies and bandwidths required to meet operational needs and the technical parameters to be met, including electromagnetic compatibility with other allocated uses.

(b) There are requirements for hydrographic surveying and for off-shore exploration that can be satisfied from a practical standpoint by the use of MF systems.

Member Governments should note that a few sub-bands should be judiciously chosen between 1605 and 3000 kHz for allocation on a regional basis for maritime radiolocation.

Agenda item 15 - Transmission of port radar images to ships

IMCO has agreed that, at present, there is no firm operational need for such a system; but that in view of future developments in ports and their approaches a requirement might be established at a later date. In this event CCIR could be invited to determine the most suitable order of frequencies required for this purpose and the relevant technical parameters.

Agenda item 17 - The hours of watchkeeping on board ships and the watchkeeping zones:

(a) By Resolution A.263(VIII) IMCO adopted amendments to Regulations 6 and 16, Chapter IV of the 1960 Safety Convention related to the circumstances under which the Radio Officer may interrupt the listening watch on 500 kHz by order of the Master to carry out urgent repairs or maintenance required to prevent imminent malfunction of radiocommunications used for safety, radionavigational equipment or other electronic navigational equipment. These circumstances include provisions that the Radio Officer, at the discretion of the Administration concerned, is appropriately qualified, that the ship is fitted with a receiving selector which meets the requirements of the Radio Regulations, and that radio log entries be made as to the times and reasons for such watch interruption.

(b) The Ad Hoc IMCO/IHO Joint Committee agreed that a limited uniform watchkeeping period for ship radio stations of the fourth category in each ITU zone could contribute to the timely reception of radio navigational warnings.

Member Governments are invited to note the foregoing actions and take them into account.

Agenda item 18 - Radio operators' certificates:

(a) By IMCO Resolution A.283(VIII) it was agreed as a matter of urgency that the training of radio officers and radio operators should be expanded. Radio officers and radio operators should be given appropriate training, according to their differing technical backgrounds in maintenance and repairs at sea of the telecommunications and other electronic navigation equipment involved in the safety of life at sea.

(b) Note should be taken that major changes in maritime radio and electronic technology have occurred and are reflected in shipboard radiocommunication and radionavigation installations of increasingly greater complexity. As technology has advanced an increase in both theoretical and practical knowledge is required of holders of operators' certificates in order to produce a higher standard of practical performance than has hitherto been required.

Member Governments should take into account the need for expanded training of radio officers and radio operators as indicated in the foregoing.

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COMMITTEE 5

Iran

PROPOSALS FOR THE WORK OF THE CONFERENCE

In response to the appeal in Committee 5C on Tuesday, 21 May, Iran has revised its requirements to the following totals :

Frequency bands MHz	4	6	8	12	16	22
Number of required frequencies	10	5	11	11	9	9

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

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COMMITTEE 5

Iran

PROPOSALS FOR THE WORK OF THE CONFERENCE

The frequency requirements of Iran in the revised Frequency Allotment Plan (Appendix 25 MOD to the Radio Regulations) are as follows :

Frequency bands MHz	4	6	8	12	16	22
Number of required frequencies	10	9	11	11	10	11

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

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PLENARY MEETING

Iran

PROPOSALS FOR THE WORK OF THE CONFERENCE

Add the following table :

Bands kHz	COAST STATIONS	
	Carrier frequencies kHz	Assigned frequencies kHz
22*	22 098	22 099.4
	22 629	22 630.4
	22 639.5	22 640.9
	22 657	22 658.4
	22 667.5	22 668.9
	22 685	22 686.4
	22 692	22 693.4

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

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PLENARY MEETING

Iran

PROPOSALS FOR THE WORK OF THE CONFERENCE

The frequency requirements of Iran in connection with the revision of the allotment plan contained in Appendix 25 to the Radio Regulations are as follows :

Frequency bands-MHz	4	6	8	12	16	22
Number of required frequencies	6	5	7	7	6	7

The frequencies which we are proposing for above requirements are listed in the following chart. The already registered frequencies are included in the said chart and are designated by an asterisk.

BANDS MHZ	COAST STATIONS	
	Carrier frequencies KHZ	Assigned frequencies KHZ
4	4139.5	4140.9
	4361.6	4363
	4390.2	4391.6
	4409.4	4410.8
	4422.2	4423.6
*	4418.6	4430
6	6210.4	6211.8
	6213.5	6214.9
	6515.4	6516.8
	6518.6	6520
	6521.8	6523.2
8	8281.2	8282.6
	8741.6	8743
	8754.4	8755.8
	8757.6	8159
	8760.8	8762.2
	8773.6	8775
*	8789.6	8791
12 *	12424.5	12425.9
	13116	13117.4
	13140.5	13141.9
	13151	13152.4
	13161.5	13162.9
	13175.5	13176.9
	13193.3	13194.4
16 *	16568.5	16569.9
	17262	17263.4
	17286.5	17287.9
	17293.5	17294.9
	17311	17312.4
	17321.5	17322.9

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

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PLENARY MEETING

Iran

PROPOSALS FOR THE WORK OF THE CONFERENCE

IRN/181/1 MOD 209 On condition that harmful interference is not caused to maritime mobile service, the frequencies between 4 063 and 4 438 ~~kc/s~~ kHz may be used exceptionally by fixed stations communicating only within the boundary of the country in which they are located, with a ~~mean-power~~ Peak Envelope Power not exceeding ~~50-watts~~ 100 watts; however, in Regions 2 and 3, between 4 238 and 4 368 ~~kc/s~~ kHz, a ~~mean-power~~ Peak Envelope Power not exceeding ~~500-watts~~ 150 watts may be used by such fixed stations.

IRN/181/2 ADD 1352.2 In Iran frequencies 4 136.3 and 6 204 kHz are also authorized for common use by coast and ship stations for radiotelephony on a simplex basis, provided the Peak Envelope Power of such coast stations does not exceed 1 kW.

IRN/181/3 ADD 1148B Ship radiotelegraph stations employing multichannel telegraph emissions and operating bands between 4 000 and 27 500 kHz shall at no time use a mean power in excess of 2.5 kW per 500 c/s bandwidth.

IRN/181/4 MOD 1065 2. (1) As a general rule, it rests with the mobile station to establish communication with the land station. For this purpose, the mobile station may call the land station ~~only-when-it-comes-within the-service-area-of-the-latter,-that-is-to-say, that-area-within-which,~~ by using an appropriate frequency. ~~The-mobile-station-can-be-heard-by-the land-station~~.

IRN/181/5	MOD	1066	(2) However, a land station having traffic for a mobile station may call this station if it has reason to believe that the mobile station is keeping watch ~~and is within the service area of~~ for the land station.
IRN/181/6	MOD	1298	As No. 1065 (see proposal IRN/181/4).
IRN/181/7	MOD	1299	As No. 1066 (see proposal IRN/181/5).
IRN/181/8	MOD	1341	(2) The peak envelope power of mobile radiotelephone stations operating in the authorized bands between 1 605 and ~~2 850 kc/s~~ 3 800 kHz shall not exceed 400 Watts.

INTERNATIONAL TELECOMMUNICATION UNION
MARITIME CONFERENCE
GENEVA, 1974

Corrigendum No. 1 to
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23 May 1974
Original : English

COMMITTEE 5

Finland

PROPOSALS FOR THE WORK OF THE CONFERENCE

In response to the appeal in Working Group 5C on Tuesday, 21 May 1974 and believing that Sub-Working Group 5C-3 shall make every effort to reach an efficient sharing pattern Finland has revised its frequency requirements in the revised Frequency Allotment Plan for Coast Radiotelephone Stations operating in the Exclusive Maritime Mobile Bands between 4 000 and 23 000 kHz (AP 25 to the Radio Regulations) to be as follows :

Frequency bands in MHz	4	6	8	12	16	22
Number of SSB channels	5	-	5	7	7	5

INTERNATIONAL TELECOMMUNICATION UNION
MARITIME CONFERENCE
GENEVA, 1974

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15 May 1974
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COMMITTEE 5

Finland

PROPOSALS FOR THE WORK OF THE CONFERENCE

The frequency requirements of Finland in the revised Frequency Allotment Plan for Coast Radiotelephone Stations operating in the Exclusive Maritime Mobile Bands between 4 000 and 23 000 kHz (AP 25 to the Radio Regulations) are as follows :

Frequency bands in MHz	4	6	8	12	16	22
Number of SSB channels	6	-	6	8	8	6

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 182-E
24 April 1974
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COMMITTEE 5

Finland

PROPOSALS FOR THE WORK OF THE CONFERENCE

The frequency requirements of Finland in the revised Frequency Allotment Plan for Coast Radiotelephone Stations operating in the Exclusive Maritime Mobile Bands between 4 000 and 23 000 kHz (AP 25 to the Radio Regulations) are as follows :

Frequency bands in MHz	4	6	8	12	16	22
Number of SSB channels	2	-	2	3	3	2

These requirements are based on the assumption that in the new sharing pattern decided upon by the Conference the traffic handling capacity will be greater than in the present plan.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 183-E
24 April 1974
Original: English

COMMITTEE 5

United States of America

INFORMATION PAPER - 2182 kHz CONVERSION TO A3A/A3J EMISSION

The United States has proposed (Nos. 984, 992, 996, 1323 and Appendix 3) amendment of the Radio Regulations to introduce the use of classes of emission A3A and A3J on 2182 kHz and to discontinue, effective January 1, 1982, the use of emissions A3 and A3H. This proposal is based on the experience of the United States over the past three years with an intermixture of emissions A3 and A3H on 2182 kHz.

In brief summary, in mid-1970 our national regulations for the band 1.6 - 4 MHz were amended to prohibit the fitting of double sideband in new installations aboard ship after January 1, 1972, and to prohibit the use of double sideband aboard any vessel after January 1, 1977. Numerous vessels, therefore, were fitted for the use of single sideband during 1970 and the number which have fitted single sideband has increased each year since 1970.

In recommending that the maritime services convert from DSB to SSB the Panel of Experts*) had as its objective the use of suppressed carrier SSB, since this is the more efficient mode of SSB and the one which provides the maximum benefits. At the same time, the Panel recognized:

a) That conversion could not be effected by all ship stations simultaneously on a specified date and time.

b) That during the transition from DSB to SSB a means was required to permit intercommunication between vessels employing DSB and those employing SSB.

The Panel of Experts intended that emission A3H would serve only as an interim device to bridge the transition from DSB to SSB. As set forth in the CCIR Report "Equivalent Powers of Double-Sideband and Single-Sideband radiotelephone Emissions"**), as well as later in this paper, it is

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*) Rec. 37, 1959 Panel of Experts.

**) CCIR Report, Final Meeting Study Group 8, Page 6, February 2-26, 1974 responsive to CCIR Question 19/8.

clearly apparent that emission A3H is the most inefficient of the three SSB modes. It is also clear that once emission A3H has served the interim purpose of assisting the transition from DSB to SSB it should be discarded.

No agency or administration has claimed that emission A3H is an efficient mode of SSB. Similarly, no agency or administration has devised an alternative to the use of emission A3H as a means of providing intercommunication between systems employing an intermixture of double sideband and single sideband emissions. If the signal strength is adequate, a DSB receiver will demodulate a transmission employing A3H emission. An SSB receiver will, also, demodulate a transmission employing A3 emission, provided the DSB carrier is reasonably close to the frequency. The difficulties commonly experienced by two stations endeavoring to intercommunicate using emissions A3 and A3H are of two general types:

First type: Single sideband (A3H) transmission into a double sideband (A3) receiver.

Complaint: Decreased communication range.

Second type: Double sideband transmission into a single sideband receiver.

Complaint: Distorted or unintelligible speech.

In examining the first type, we note that:

a) In the routinely encountered installation aboard United States vessels, the peak envelope power of a double sideband installation exceeds that of a single sideband installation, being approximately 360 watts versus 90 watts. Our regulations permit 240 watts for DSB and 150 watts for SSB.

b) The SSB signal suffers in excess of a 3 dB noise power degradation in the DSB receiver. (The DSB receiver bandwidth is more than twice that required to pass the SSB signal.)

c) The SSB (A3H) signal is demodulated by the envelope detector in the DSB receiver, resulting in a 3 dB power loss over that of the DSB signal.

Summary: Reception of SSB (A3H) on a DSB receiver suffers at least a 6 dB degradation, as compared to reception of DSB on the same receiver.

In examining the second type, we note that:

a) With voice communications, when the DSB carrier is off-frequency (different from the reinserted carrier), there is an equal and corresponding shift in the voice register.

b) Appendix 3 to the Radio Regulations provides frequency tolerances:

Category of station	Frequency tolerance (Parts in 10^6)	Permitted tolerance at 2182 kHz (in Hz)
Ship	200	436.4
Survival craft . .	300	654.6
E.P.I.R.B.	300	654.6

c) Speech will be unintelligible with a voice register shift of substantially less than 436 Hz.

d) A departure on 2182 kHz of this magnitude may be beyond the range of the receiver "clarifier" control, or if provided circuitry in receivers for automatic frequency control.

e) Distortion and unintelligibility occur, also, under a number of other conditions, dependent upon the selectivity, detection, and audio systems employed in the particular receiver under consideration, for example:
   i) when the DSB sideband is only partially within the pass band of the SSB receiver; or
   ii) when the DSB carrier falls within the SSB receiver pass band; etc.

Summary: In order to be intelligible on a SSB receiver, the carrier of the DSB transmission on 2182 kHz must be within reasonable proximity to the frequency 2182 kHz.

With regard to the use of DSB on 2182 kHz, the frequency tolerance applicable thereto should be small enough to assure satisfactory reception on a SSB receiver. In many sets, and noting solid state technology, it would be technically and could be economically feasible to install a crystal oscillator with buffer which will maintain the DSB carrier within substantially less than 50 Hz of 2182 kHz. In fact, in a significant number of cases, no change to the frequency control circuitry would be required. It is fully appropriate for the Conference to require that any new DSB sets brought into use after (for example two to three years) be required to conform to a frequency tolerance of less that 50 Hz. Further, the Conference should provide a period during which administrations will develop a program for the improvement of stability of existing DSB sets. For example, a period of three to four years would permit administrations to develop low-cost frequency-stable hardware and to fit that hardware into existing sets. Such an arrangement would pave the way to the discontinuance of use of double sideband (A3 emission) on and after January 1, 1982.

The foregoing paragraphs are directed to the matter of intercommunication between equipments employing DSB and those employing SSB. In the following paragraphs we comment further on the matter of emissions, but direct those comments to the matter of increase in battery life which can be obtained by prudent selection of emission. That is, by selection of emission, we can increase the battery life several times without increasing the reserve or battery power supply beyond that provided for emissions A3 or A3H.

To that end, we have estimated, for each class of emission, the power which would be consumed by the final amplifier. We have disregarded power consumed in the stages ahead of the final amplifier. Using a recent CCIR Report*) as a convenient reference, we have added three columns showing, for the value of PEP 100% modulated set forth in the right hand column of the CCIR table (page 6, thereof), corresponding values of average output power, estimated efficiency of the radio, and average watts consumed, as follows:

CCIR			USA		
Class of emission	Method of reception	PEP (watts) for 100% modulation	Average output power(W)	Estimated Efficiency(%)	Average watts consumed
A3(Solas)	DSB	60.0	15	50	30
A3	SSB	120.0	30	50	60
A3H	DSB	83.2	20	30	66
A3H	SSB	30.0	6	30	20
A3A	SSB	10.6	0.5 **)	30	1.6
A3J	SSB	7.5	0.35 **)	30	1.2

The figures included in these last three columns are based on two assumptions: the use of voice and that equal transmission time is employed for each class of emission.

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*) CCIR Report, Final Meeting Study Group 8, Page 6, February 2-26, 1974 responsive to CCIR Question 19/8.

**) Assumed: Peak to average power in the envelope is 13 dB.

The figures in the right hand column clearly show that emissions A3A and A3J will impose a substantially lower drain upon the power supply and, where batteries are employed for emergency use, will permit the set to be used for a substantially longer period of time.

Administrations members of the Union should at this Conference prepare final plans for completion of the transition from DSB to SSB, in accordance with the recommendation of the Panel of Experts. Accordingly, with regard to 2182 kHz the following steps must all be accomplished.

1. The duration of the period provided for the transition from DSB to SSB be rearranged to reduce to a minimum the period during which A3 and A3H will be permitted;
2. The use of emissions A3A and A3J be brought into use at the earliest practicable date;
3. The use of emissions A3 and A3H be discontinued on or before January 1, 1982;
4. The frequency tolerance applicable to DSB (emission A3) transmitters operating on 2182 kHz be the same as that for SSB transmitters, to permit reception on SSB A3A/A3J receivers;
5. Coast and ship stations guarding or required to guard 2182 kHz be fitted on or before January 1, 1982, with a SSB receiver capable of receiving SSB emissions A3A and A3J.

NOTE: Stabilization of the frequency 2182 kHz in existing DSB transmitters is not technically complex and need not be expensive. The current state of the art in solid state technology is fully capable of providing within a small package a crystal oscillator, buffer amplifier and voltage regulator which can be plugged into an existing crystal socket. Quantity production in medium scale integration should reduce the unit cost to $15 or less.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

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24 April 1974
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COMMITTEE 5

Monaco

PROPOSALS FOR THE WORK OF THE CONFERENCE

FREQUENCIES FOR HF RADIOTELEPHONY

The table below gives the number of channels for the HF radiotelephone coast station, in service or planned.

Bands (MHz)	4	6	8	12	16	22
MCO	2	1	2	1	1	1

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 185-E
24 April 1974
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COMMITTEE 4

Norway

PROPOSALS FOR THE WORK OF THE CONFERENCE

Item 7 of the Agenda : HF ship/shore A1 calling frequencies

The present method of assigning HF A1 calling frequencies to ship stations, the calling procedure described in Article 29 of the Radio Regulations, and the manner in which watch is being kept by HF coast stations (scanning the whole calling bands either manually or automatically) have deficiencies of which all administrations are well aware.

Even with several operators guarding each calling band at a specific coast station, many ships calling that coast station may have to repeat their calls time and again before being intercepted, resulting in delay, excessive loading of the bands and in unnecessary expenditure both at the coast station and on board ships.

It is felt that the technical advances during recent years in transmitter and receiver design should now lead to a revision of the relevant provisions with the aim of improving the HF A1 ship/shore calling procedure radically. A recent test at the Norwegian coast station Rogaland Radio with the calling procedure described in R.R. 1013E confirms that "spot listening" reduces the loading of the calling bands drastically, as the calls generally are being intercepted after one call, although some calls had to be repeated. The Radio Officers have reported that the time spent on calling has been reduced to approximately 1/10 of the time spent when employing the ordinary calling procedure.

A proposal for the revision of Article 29 is presented as a separate document.

Attached to this document is an Annex which contains a proposed table of HF A1 calling frequencies.

The table is based on 17 series of calling channels for the bands 4-16 MHz, 10 channels in the 22 MHz band and 5 channels in the 25 MHz band. The bands 4-16 MHz are harmonically related and have a bandwidth of 400 Hz in the 4 MHz band, increasing to 1 600 Hz in the 16 MHz band.

Series 5/6 in which the frequency 8 364 kHz is included, constitutes what is called a general calling channel, designated for use by ships calling coast stations of other nationality than that of the ship. The other 15 series, called national channels should be assigned as coast station receiving frequencies, in a manner which would secure an even distribution on all channels, e.g. along the lines proposed by the Netherlands in Annex 5 to Document No. 27 (New Appendix 15B).

For the bands 22 and 25 MHz, however, the available channels will have to be shared by a greater number of countries compared with the number of countries sharing the channels in the lower bands. A table of distribution will have to be prepared by the Conference.

It will be noted that each channel is sub-divided into specific calling frequencies, starting 100 Hz from the lower end of each channel and ending 100 Hz from the upper end, e.g. 4/1/a = 4 180.1 kHz, 4/1/b = 4 180.2 kHz, 4/1/c = 4 180.3 kHz.

The idea is that the mid-frequency within each channel be assigned to ships with transmitters still being dependent on crystal controlled oscillators and harmonic relationship for the A1 calling frequencies, whereas the adjacent frequencies within each channel should be assigned to ships with synthesized transmitters.

The number of discrete frequencies within each channel will thus be :

In 4 MHz band - 3
In 6 MHz band - 5
In 8 MHz band - 7

In 12 MHz band - 11
In 16 MHz band - 15
In 22 MHz band - 19
In 25 MHz band - 19

Frequency assignments to ship stations with synthesized transmitters should be spread evenly on the available discrete frequencies.

For the general calling channels in the bands 4-16 MHz, comprising two series, 5 and 6, the mid frequency in each series should be assigned to all ship stations with crystal controlled transmitters and wishing to communicate with foreign coast stations.

For crystal controlled transmitters a frequency tolerance of 40 ppm is foreseen in all the calling bands. For synthesized transmitters a frequency tolerance of 100 Hz in all the calling bands is sufficient. Appropriate proposal to up-date Appendix 3 to the Radio Regulations will be submitted separately.

Annex : 1

ANNEX

SERIES OF HF CALLING FREQUENCIES

Note : For the bands 4-16 MHz the mid-frequency in each series is harmonically related, see example below.

Series	4 MHz band	6 MHz band	8 MHz band	12 MHz band	16 MHz band	22 MHz band	25 MHz band
1	4180.0 - 4180.4	6270.0 - 6270.6	8360.0 - 8360.8	12540.0-12541.2	16720.0-16721.6	22230.0-22232.0	25071.0-25073.0
2	4180.4 - 4180.8	6270.6- 6271.2	8360.8 - 8361.6	12541.2-12542.4	16721.6-16723.2	22232.0-22234.0	25073.0-25075.0
3	4180.8 - 4181.2	6271.2 - 6271.8	8361.6 - 8362.4	12542.4-12543.6	16723.2-16724.8	22234.0-22236.0	25075.0-25077.0
4	4181.2 - 4181.6	6271.8 - 6272.4	8362.4 - 8363.2	12543.6-12544.8	16724.8-16726.4	22236.0-22238.0	25077.0-25079.0
* 5	4181.6 - 4182.0	6272.4 - 6273.0	8363.2 - 8364.0	12544.8-12546.0	16726.4-16728.0	22238.0-22240.0	25079.0-25081.0
6	4182.0 - 4182.4	6273.0 - 6273.6	8364.0 - 8364.8	12546.0-12547.2	16728.0-16729.6	22240.0-22242.0	
7	4182.4 - 4182.8	6273.6 - 6274.2	8364.8 - 8365.6	12547.2-12548.4	16729.6-16731.2	22242.0-22244.0	
8	4182.8 - 4183.2	6274.2 - 6274.8	8365.6 - 8366.4	12548.4-12549.6	16731.2-16732.8	22244.0-22246.0	
9	4183.2 - 4183.6	6274.8 - 6275.4	8366.4 - 8367.2	12549.6-12550.8	16732.8-16734.4	22246.0-22248.0	
10	4183.6 - 4184.0	6275.4 - 6276.0	8367.2 - 8368.0	12550.8-12552.0	16734.4-16736.0	22248.0-22250.0	
11	4184.0 - 4184.4	6276.0 - 6276.6	8368.0 - 8368.8	12552.0-12553.2	16736.0-16737.6		
12	4184.4 - 4184.8	6276.6 - 6277.2	8368.8 - 8369.6	12553.2-12554.4	16737.6-16739.2		
13	4184.8 - 4185.2	6277.2 - 6277.8	8369.6 - 8370.4	12554.4-12555.6	16739.2-16740.8		
14	4185.2 - 4185.6	6277.8 - 6278.4	8370.4 - 8371.2	12555.6-12556.8	16740.8-16742.4		
15	4185.6 - 4186.0	6278.4 - 6279.0	8371.2 - 8372.0	12556.8-12558.0	16742.4-16744.0		
16	4186.0 - 4186.4	6279.0 - 6279.6	8372.0 - 8372.8	12558.0-12559.2	16744.0-16745.6		
17	4186.4 - 4186.8	6279.6 - 6280.2	8372.8 - 8373.6	12559.2-12560.4	16745.6-16747.2		

* Series 5 and 6 in the bands 4-16 MHz, series 8 in the 22 MHz band and series 3 in the 25 MHz band are general calling channels.

Examples of subdivision of channels:

4/1/a	4180,1	6/1/a	6270.1	8/1/a	8360.1	12/1/a	12540.1	16/1/a	16720.1	22/1/a	22230.1	25/1/a	25071.1
4/1/b	4180.2	6/1/b	6270.2	8/1/b	8360.2	12/1/b	12540.2	16/1/b	16720.2	22/1/b	22230.2	25/1/b	25071.2
4/1/c	4180.3	6/1/c	6270.3	8/1/c	8360.3	12/1/c	12540.3	16/1/c	16720.3	22/1/c	22230.3	25/1/c	25071.3
		6/1/d	6270.4	8/1/d	8360.4	12/1/d	12540.4	16/1/d	16720.4	22/1/d	22230.4	25/1/d	25071.4
		6/1/e	6270.5	8/1/e	8360.5	12/1/e	12540.5	16/1/e	16720.5	22/1/e	22230.5	25/1/e	25071.5
				8/1/f	8360.6	12/1/f	12540.6	16/1/f	16720.6	22/1/f	22230.6	25/1/f	25071.6
				8/1/g	8360.7	12/1/g	12540.7	16/1/g	16720.7	22/1/g	22230.7	25/1/g	25071.7
						12/1/h	12540.8	16/1/h	16720.8	22/1/h	22230.8	25/1/h	25071.8
						12/1/i	12540.9	16/1/i	16720.9	22/1/i	22230.9	25/1/i	25071.9
						12/1/j	12541.0	16/1/j	16721.0	22/1/j	22231.0	25/1/j	25072.0
						12/1/k	12541.1	16/1/k	16721.1	22/1/k	22231.1	25/1/k	25072.1
								16/1/l	16721.2	22/1/l	22231.2	25/1/l	25072.2
								16/1/m	16721.3	22/1/m	22231.3	25/1/m	25072.3
								16/1/n	16721.4	22/1/n	22231.4	25/1/n	25072.4
								16/1/o	16721.5	22/1/o	22231.5	25/1/o	25072.5
										22/1/p	22231.6	25/1/p	25072.6
										22/1/q	22231.7	25/1/q	25072.7
										22/1/r	22231.8	25/1/r	25072.8
										22/1/s	22231.9	25/1/s	25072.9

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Corrigendum No. 1 to
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COMMITTEE 5

Republic of the Philippines

PROPOSAL FOR THE WORK OF THE CONFERENCE

In proposal PHIL/186/2, the VHF channels are deleted.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 186-E
24 April 1974
Original : English

PLENARY MEETING

Republic of the Philippines

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item No. : Revision of Article 5 (Frequency allocations 10 kHz to 275 GHz)

PHL/186/1 ADD 285D The frequencies 156.375, 156.475 and 156.875 MHz in the band 150.05 to 174.0 MHz are allocated to the maritime mobile service for the use of on-board communication stations.

Reasons : To establish VHF channels in this band for the use of on-board communication stations.

PHL/186/2 ADD 318B The frequencies 457.525, 457.550, 457.575, 457.600, 467.750, 467.775, 467.800, 457.825, 156.375, 154.475 and 156.875 MHz shall be used by on-board communication stations. Equipment for this purpose shall satisfy the technical characteristics set forth in Appendix 19.

Reasons : To provide sufficient channels and flexibility in the choice of working channels for on-board communication stations.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 187-E
24 April 1974
Original : English

COMMITTEE 5

Republic of the Philippines

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item No. 4 : Revision of Appendix 18 Mar

PHL/187/1 ADD k) To notes referring to the table

The frequencies 156.375, 156.475 and 156.875 MHz in channels 67, 69 and 77, respectively, may also be used by on-board communication stations provided the provisions of Appendix 19 are complied with.

Reasons : Consequential to designating channels 67, 69 and 77 for the use of on-board communication stations.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 188-E
24 April 1974
Original: Spanish

COMMITTEE 5

Republic of Peru

PROPOSALS FOR THE WORK OF THE CONFERENCE

REQUIREMENTS FOR HF RADIOTELEPHONY CHANNELS

(APPENDIX 25 MOD OF THE RADIO REGULATIONS)

The Administration of Peru has selected the complete range of the new series for the 4, 6, 8, 12, 16 and 22 MHz bands.

These tables contain no calling frequencies. The numbers of channels indicated in the following table would cover minimum requirements:

Band (MHz)	Coast stations*)	
	Present position	Requirements
4	-	5
6	-	5
8	-	5
12	-	5
16	-	5
22	-	5

*) These data relate to SSB transmissions with duplex operation.

The Peruvian Administration wishes to point out that these requirements are independent of those relating to inland waterway stations.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 189-E
24 April 1974
Original : English

COMMITTEE 5

Republic of the Philippines

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item No. 1 : Revision of Appendix 25

The total frequency requirements of the Republic of the Philippines in the revised frequency allotment plan for coast radiotelephone stations (Appendix 25 to the Radio Regulations will be as follows :

Frequency Bands (MHz)	4	6	8	12	16	22
Number of SSB Channels (OLD)	1		1	1	1	1
(NEW)	1	2	2			
Total	2	2	3	1	1	1

Reasons ; The additional new channels are required to cope with the present and prospective increase in ship movements in the Philippine Archipelago.

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 190-E
25 April 1974
Original : French

PLENARY MEETING

Note by the Secretary-General

APPOINTMENT OF PROXY

(Central African Republic - Cameroon)

The Ministry of Posts and Telegraphs of the Central African Republic announces that it will be represented by Cameroon at the election of the members of the I.F.R.B.

M. MILI
Secretary-General

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 191-E
24 April 1974
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COMMITTEE 6

ORGANIZATION OF THE WORK

COMMITTEE 6 - OPERATION

Terms of Reference

To examine the provisions of the Radio Regulations and the Additional Radio Regulations concerning operation.

Working Group Structure

The following working groups will examine all proposals within the competence of Committee 6.

Working Group A

Subject	Reference
Terms and Definitions	ART 1 (RR)
Licences and Certificates	ART 18 (RR) ART 23 (RR) ART 24 (RR) RES MAR 16
Selective Calling Systems	ART 19 (RR) ART 28A (RR) APP 20C REC MAR 8
Service Documents	ART 20 (RR) APP 9, 10, 11
Inspection of Mobile Stations	ART 21 (RR)
Working conditions and working hours of stations in the Maritime Mobile Service	ART 22 (RR) ART 25 (RR) ART 27 (RR) APP 12
Conditions to be observed by Mobile Stations	ART 28 (RR)
Radiotelegraph operational procedures	ART 28 (RR) ART 29 (RR) ART 30 (RR) ART 31 (RR) ART 37 (RR) APP 13 APP 13A APP 20B ART 32 (RR) RES MAR 18

Radiotelephone operational procedures	ART 33 (RR) ART 34 (RR) ART 37 (RR) ART 35 (RR)

Working Group B

Subject	Reference
Distress and Safety	ART 6 (RR) ART 28 (RR) ART 36 (RR) APP 20A
Radiodetermination Service	ART 43 (RR)

Working Group C

Subject	Reference
Accounting for radiotelegrams and radio-telephone calls	ART 40 (RR) APP 21 APP 22
Additional Radio Regulations	
Resolution No. 37 of the Plenipotentiary Conference (Montreux, 1965)	
Miscellaneous	REC Mar 1

The references given are not necessarily exclusive.

W.W. SCOTT
Chairman
Committe 6

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 192-E
25 April 1974
Original : English

COMMITTEE 5

Malaysia

PROPOSALS FOR THE WORK OF THE CONFERENCE

The frequency requirements of Malaysia in the revised Frequency Allotment Plan for Coast Radiotelephone Stations operating in the Exclusive Maritime Mobile Bands (Appendix 25 to the Radio Regulations) are as follows :

Frequency Bands in MHz	4	6	8	12	16	22
No. of SSB channels	4	1	3	1	1	1

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Corrigendum to
Document No. 193-E
2 May 1974
Original : French

COMMITTEE 5

Belgium

PROPOSALS FOR THE WORK OF THE CONFERENCE

Belgium requests that the requirements shown below be taken into consideration in the revision of the Frequency Allotment Plan (Appendix 25 to the Radio Regulations) :

Frequency bands (MHz)	4	6	8	12	16	22
Number of SSB channels	5	1	5	5	5	5

INTERNATIONAL TELECOMMUNICATION UNION
MARITIME CONFERENCE
GENEVA, 1974

Document No. 193-E
26 April 1974
Original: French

COMMITTEE 5

Belgium

PROPOSALS FOR THE WORK OF THE CONFERENCE

Belgium requests that the requirements shown below be taken into consideration in the revision of the Frequency Allotment Plan (Appendix 25 to the Radio Regulations) :

Frequency bands (MHz)	4	6	8	12	16	22
Number of SSB channels	3	1	3	3	3	3

INTERNATIONAL TELECOMMUNICATION UNION
MARITIME CONFERENCE
GENEVA, 1974

Document No. 194-E
25 April 1974
Original : French

PLENARY MEETING

Memorandum by the Secretary-General

CANDIDATURES FOR SEATS ON THE I.F.R.B.

The list of candidatures submitted by 2400 hours GMT on 24 April 1974, the deadline laid down by the Plenary Meeting, is given below :

See Document No. 72

Region A - America	
Mr. Fioravanti Dellamula (Argentina)	Annex 7
Mr. Francis Gerard Perrin (Canada)	" 4
Region B - Western Europe	
Mr. José Maria Pardo Horno (Spain)	Add. 5
Mr. Charles William Sowton (United Kingdom)	" 4
Mr. Carlo Terzani (Italy)	" 3
Region C - Eastern Europe and Northern Asia	
Mr. Alexandre N. Gromov (U.S.S.R.)	Add. 1
Region D - Africa	
Mr. Abderrazak Berrada (Morocco)	Annex 2
Mr. Taofiqui Bouraïma (Dahomey)	Add. 2
Mr. Tchouta Moussa (Cameroon)	Annex 3
Region E - Asia and Australasia	
Mr. K. Basu (India)	Annex 5 (and corr.)
Mr. Sakae Fujiki (Japan)	Annex 6

M. MILI
Secretary-General

INTERNATIONAL TELECOMMUNICATION UNION
MARITIME CONFERENCE
GENEVA, 1974

Document No. 195-E
24 April 1974
Original : English

COMMITTEE 5

Jamaica

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item No. 1

The frequency requirements of Jamaica in the revised Frequency Allotment Plan for coast radiotelephone stations (Appendix 25 of the Radio Regulations) are as follows :

Frequency Bands in MHz	4	6	8	13	17	22
Number of SSB Channels	1	1	1	1	1	1

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 196-E
24 April 1974
Original: English

COMMITTEE 5

Republic of Cyprus

PROPOSAL FOR THE WORK OF THE CONFERENCE

Agenda item No. 1

The frequency requirements of the Republic of Cyprus in the revised Frequency Allotment Plan (Appendix 25 of the Radio Regulations) for its Maritime Radiotelephone Services are as follows:

Frequency band in MHz	4	6	8	13	17	22
No. of SSB channels	2	1	2	1	1	1

INTERNATIONAL TELECOMMUNICATION UNION
MARITIME CONFERENCE
GENEVA, 1974

Document No. 197-E
26 April 1974
Original : English

COMMITTEE 5

SUMMARY RECORD
OF THE
FIRST MEETING OF COMMITTEE 5
(RADIOTELEPHONY)

Tuesday, 23 April 1974, at 1000 hrs

Chairman : Mr. O.J. HAGA (Norway)

Subject discussed	Document No.
1. General discussion and organization of the work of Committee 5	–

1. General discussion and organization of the work of Committee 5

The Chairman, after welcoming all those participating in the work of Committee 5, proposed, with the support of the delegates of the United Kingdom and Greece, that in order to facilitate and expedite the work of the Committee a number of working parties should be set up for initial discussion of the various proposals before it.

The delegate of Spain, supported by the delegate of Argentina, felt that before taking a decision on whether or not to set up working groups it would be preferable to discuss what subjects would be on the agenda of each group.

The Chairman said that it was proposed to follow the same principle of subdividing the work according to frequency band as had proved so successful at the 1967 Maritime Conference. Four working groups were envisaged : Working Group 5A to deal with matters relating to the MF bands, Working Group 5B to deal with matters relating to the HF bands except for the HF frequency allotment plan, Working Group 5C to deal with matters relating to the HF frequency allotment plan (Appendix 25) and Working Group 5D to deal with matters relating to the VHF and UHF bands. In addition it was proposed to set up a Joint Working Group to deal with questions affecting both Committees 4 and 5 in the frequency bands allocated to the maritime mobile service between 4 and 25 MHz.

The delegate of the Federal Republic of Germany, supported by the delegate of the United States of America, said that in view of the fact that decisions made in Group 5B might affect the discussions in Group 5C he proposed that those two groups be combined into a single one.

The delegates of Dahomey, Israel, Turkey and Saudi Arabia supported that proposal in view of the difficulty experienced by small delegations, especially those from developing countries, in covering a large number of working groups.

The delegates of the U.S.S.R., the Netherlands, India, Switzerland, the United Kingdom, Mexico, Canada, Spain and Argentina, considering the importance of the revision of Appendix 25, the need to start that work as soon as possible and the overwhelming load that would be placed on the Chairman of a single working group dealing with all HF matters, felt it essential to retain two separate working groups.

The Chairman, supported by the delegates of Mexico, Spain, Argentina and Roumania, considered that the opposing views expressed could be reconciled by making sure as far as possible that the two working groups concerned never met simultaneously.

On that understanding, it was agreed to retain Working Groups 5B and 5C as two separate groups.

On a proposal from the delegate of the Netherlands, supported by the delegates of India, the United States of America, Switzerland and Canada, it was agreed to add the word "possible" when referring, in the terms of reference for Working Group 5C, to additional channels made available for the frequency allotment plan.

After some discussion as to whether, as proposed by the delegate of Italy, the questions of principle involved in the revisions of Appendix 25 should first be discussed in full Committee or whether, as maintained by the delegates of the United Kingdom and Canada, it would be more useful to get the broad areas for discussion worked out first in Working Group 5C, it was agreed that Working Group 5C should start its work at once without a prior discussion of principles in full Committee.

With regard to satellite questions, the delegate of the U.S.S.R., supported by the delegates of the United Kingdom and Switzerland, felt that such matters should be dealt with by Working Group 5D.

The delegate of the United States of America, however, considered that the satellite question on the Conference agenda (item 13, see Document No. 1) was more properly the province of Committee 6 (Operations).

It was agreed to allocate satellite questions to Group 5D for the time being and to refer the question of the committee to handle space matters to the Steering Committee for consideration.

With regard to questions relating to radiodetermination (items 13 and 14 of the Conference agenda, see Document No. 1) the delegate of France drew attention to the difficulties of assigning them to a committee as they could be considered the province of both telegraphy and telephony.

It was therefore agreed to refer the question of the Committee to handle radiodetermination to the Steering Committee and the Chairman of Committees 4 and 5 for consideration.

With regard to the terms of reference of Joint Working Group C4/C5, the delegate of Norway proposed that the upper frequency limit be raised from 25 MHz to 27.5 MHz to include the frequency bands in that range open on an exclusive or shared basis to the maritime mobile service. The reference to exclusive use of the bands in question would in that case be dropped from the terms of reference.

It was so agreed.

Following a suggestion by the Vice-Chairman of the I.F.R.B., supported by the delegate of Algeria, it was agreed to clarify the terms of reference of Group 5C by mentioning Article 9 in addition to Appendix 25.

In reply to a query by the Director of the C.C.I.R., it was confirmed by the Chairman that although the division between the MF and HF bands was given as 3 MHz in the Radio Regulations, it was, for the purposes of organizing the work of Committee 5, being taken as 4 MHz.

In conclusion, it was agreed to set up the working groups proposed by the Chairman, with the terms of reference amended as agreed in the course of the discussion.

The Chairman indicated that a document would be distributed later giving the working groups and their terms of reference as agreed in the discussion, together with the details of the articles to be dealt with by each group.

It was agreed that the various working groups should begin provisional examination of the work before them without waiting for the appearance of that document.

The Chairman proposed that the following delegations be requested to provide Chairmen for the following working groups :

Working Group 5A - France (Mr. J. Piponnier)

Working Group 5B - Federal Republic of Germany (Mr. E. George)

Working Group 5C - Australia

Working Group 5D - United States of America

Joint Working Group C4/C5 (nomination subject to approval by Committee 4) - United Kingdom (Mr. W.M. Dunell)

These nominations were approved.

After the Chairman of the I.F.R.B. had indicated that the I.F.R.B. had, in accordance with No. 482 of the Radio Regulations, prepared documentation for the guidance of the Chairmen of Committees and working groups, the Chairman requested that that documentation be issued as a conference document.

The meeting rose at 1150 hours.

The Secretary :	The Chairman :
J. BALFROID	O.J. HAGA

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 198-E
25 April 1974
Original : English

COMMITTEE 5

Federal Republic of Nigeria

PROPOSALS FOR THE WORK OF THE CONFERENCE

The frequency requirements of the Federal Republic of Nigeria in the revised Frequency Allotment Plan for Coast Radiotelephone Stations (Appendix 25 to the Radio Regulations) will be as follows :

Frequency bands MHz	No. reqd.	Power in kW
4	4	20
6	4	20
8	4	20
12	4	20
16	4	20
22	4	20

INTERNATIONAL TELECOMMUNICATION UNION

MARITIME CONFERENCE

GENEVA, 1974

Document No. 199-E
25 April 1974
Original : English

COMMITTEE 4

United Kingdom of Great Britain
and Northern Ireland *)

PROPOSALS FOR THE WORK OF THE CONFERENCE

NARROW-BAND DIRECT-PRINTING ASSIGNMENTS

Consequential on the revised proposals for ARTICLE 7 and APPENDIX 15 it is necessary to revise the U.K. proposals for narrow-band direct-printing.

It is therefore proposed that Resolution No. Mar 8 be suppressed and replaced by Resolution No. E (Annex I) which is concerned with narrow-band direct-printing on existing Coast Station ship-to-shore telegraphy channels.

Resolution No. Mar 'C' included in the U.K. proposals is concerned with paired high frequency channels specifically allocated to narrow-band direct-printing and data transmission in the proposed Appendix 15. That proposed Resolution has been revised and should be replaced by Resolution Mar C (Revised) at Annex II.

Annexes : 2

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*) See also Documents 57 and 152.

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ANNEX I

G/199/288

RESOLUTION No. E

Relating to the use of narrow-band direct-printing within the bands allocated to coast radiotelegraph stations

The World Administrative Radio Conference, Geneva, 1974.

considering

a) that the use of narrow-band direct-printing telegraphy, as well as other modes of transmission, is permitted in the bands allocated to coast radiotelegraph stations within the bands allocated to the maritime mobile service between 4 000 and 27 500 kHz.

b) that Administrations operating a narrow-band direct-printing service in these bands have notified to I.F.R.B. the frequencies on which ship stations participating in the service will be required to transmit.

c) that there would be difficulty in transferring the whole narrow-band direct-printing service to a two-frequency arrangement in the first instance.

resolves

1. that Administrations may continue to make use of existing coast station telegraphy allocations for narrow-band direct-printing services associated with receive frequencies, without standard separation, from the "B" section of the ship narrow-band direct-printing band.

2. a) that on and after 1.1.76 any Administration operating or bringing into operation narrow-band direct-printing telegraphy or data transmission for ships using a coast station telegraphy frequency as described in 1. above, shall notify to the I.F.R.B., for recording in the Master International Frequency Register, and to the Secretary General for inclusion in the List of Coast Stations, the frequencies on which ship stations participating in the service will be required to transmit;

b) the ship frequencies shall be chosen from amongst those shown in Appendix 15 C.

c) that these notices concerning frequencies used for reception by coast stations shall not be subject to technical examination by the Board, and that the assignments notified shall be recorded in the Master Register for information only, bearing no date in Column 2, but with a suitable remark in the Remarks Column merely referring to this Resolution.

A N N E X II

G/199/289

RESOLUTION No. Mar C (REVISED)

Relating to the use of the paired high frequency channels made available for maritime narrow-band direct-printing and data transmission

The World Administrative Radio Conference, Geneva, 1974

considering

a) that the Conference has provided as from /̅ ...._/ two frequency channels for narrow-band direct-printing in the HF bands as shown in Appendix 15B to the Radio Regulations without alloting them to countries;

b) that a World Administrative Radio Conference, competent to revise Article 5 of the Radio Regulations is likely to be held before 1980 and that this may involve a re-arrangement of the exclusive maritime mobile bands;

c) that, however, /̅ interim_/ measures have to be taken by administration and by the I.F.R.B. to provide for the orderly introduction of these new two-frequency channels.

resolves

1. that I.F.R.B. shall obtain from administrations their immediate requirements for use of these channels;

2. that these immediate requirements shall be those which are required for implementation within six months of the new two-frequency narrow-band direct-printing channels becoming available;

3. that, after compilation of the requirements obtained from administrations, the I.F.R.B. in consultation, where appropriate, with the administrations concerned, shall endeavour to distribute such requirements amongst the new channels, dealing with them in the following order, band by band :

3.1 requirements of those countries already operating a narrow-band direct-printing service who are prepared to relinguish an existing assignment in the coast station telegraphy allocation in the same frequency band.

3.2 requirements of other countries.

4. that the distribution of requirements amongst the channels in accordance with paragraph 3 above shall be circulated to all administrations at least 6 months before the new channels become available for maritime narrow-band direct-printing and data transmission;

5. that the channels distributed in accordance with paragraph 4 above shall be regarded as allotments to the countries concerned from the point of view of the frequency notification and registration procedure to be applied as from the date the channels become available;

6. that nevertheless the allotments mentioned in 5. above shall be regarded as cancelled if not taken up within 12 months after the date when the channels become available;

7. that every assignment notified in accordance with 3.1, 3.2 and 5 above shall carry the Column 2a date of /̲ 1 March 1976_/;

8. that the above procedure shall be discontinued after /̲ date of implementation plus one year_/ and that thereafter the relevant provisions of Nos. 486 to 540 shall apply to the frequency bands covered by the new channels.

INTERNATIONAL TELECOMMUNICATION UNION
MARITIME CONFERENCE
GENEVA, 1974

Document No. 200-E
29 April 1974

LIST OF DOCUMENTS

(101 to 200)

No.	Origin	Title	Destination
101	S.G.	Implementation of the Provisions of Resolution No. Mar 8 of the World Administrative Maritime Radio Conference, Geneva, 1967, relating to the notification of ship station frequencies used for narrow-band direct-printing telegraph and data transmission systems.	PL
102	S.G.	Implementation of Resolutions Nos. Mar 10, Mar 11 and Mar 12 to the World Administrative Maritime Radio Conference, Geneva, 1967, relating to the implementation of the new arrangement of radiotelegraph and radiotelephone bands between 4 000 and 27 500 kHz allocated to the Maritime Mobile Service.	PL
103	S.G.	Implementation of the Provisions of Resolution No. Mar 14 of the World Administrative Maritime Radio Conference, Geneva, 1967, relating to the channel spacing of transmitting frequencies for the band 156-174 MHz for radiotelephony in the International Maritime Mobile Service.	PL
104	S.G.	Implementation of the Provisions of Resolutions Nos. Mar 19 and Mar 20 of the World Administrative Maritime Radio Conference, Geneva, 1967, concerning the use of frequency bands designated for oceanographic data transmission.	PL
105	Singapore	Frequency requirements to be included in the revised App. 25 to the RR.	PL
106	Belgium	(Withdrawal of Document No. 22)	PL
107	S.G.	Implementation of the Provisions of Resolution No. Mar 15 of the World Administrative Maritime Radio Conference, Geneva, 1967, concerning the use of the new HF channels made available to the maritime radiotelephony from 1 March 1970	PL

No.	Origin	Title	Destination
108	S.G.	Implementation of Resolution No. Mar 6 of the World Administrative Maritime Radio Conference, Geneva, 1967, on the introduction of single sideband technique in the HF radiotelephone Maritime Mobile Service.	PL
109	S.G.	Implementation of Resolutions Nos. Mar 4 and Mar 5 of the World Administrative Radio Maritime Conference, Geneva, 1967, concerning the introduction of the single sideband technique in the radiotelephone Maritime Mobile Service operating in the bands between 1 605 and 4 000 kHz.	PL
110 (Rev.)	Argentine	Proposals	PL
111	India	Proposals	PL
112 + corrig	Israel	Proposals	PL
113	France	Proposals (Agenda Item 14)	PL
114	Sweden	Proposals (Agenda Item 2)	PL
115	Sweden	Proposals (Agenda Item 2)	PL
116 + rev	Sweden	Proposals (Agenda Item 3)	PL
117	Sweden	Proposals (Agenda Item 3.7)	PL
118	Sweden	Proposals (Agenda Item 4)	PL
119	Sweden	Proposals (Agenda Item 4.3)	PL
120	Sweden	Proposals (Agenda Item 4.4)	PL
121	Sweden	Proposals (Agenda Item 8)	PL
122	Sweden	Proposals (Agenda Items 8 and 13)	PL
123	Sweden	Proposals (Agenda Item 10)	PL
124	Sweden	Proposals (Agenda Item 16)	PL
125 + Add	Sweden	Proposals (Agenda Item 1)	PL
126 + Corrig	S.G.	Texts of C.C.I.R. Study Group 8	PL
127	Algeria	Proposals (Item 1 of the Agenda)	PL
128 + corrig	German Dem. Rep.	Proposals (Agenda Items 3, 3.9 and 10)	PL
129	German Dem. Rep.	Proposals (Agenda Item 1)	PL

No.	Origin	Title	Destination
130 + Add.1 ✓	Czechoslovak Soc. Rep.	Frequency requirements to be taken into account when revising App. 25 MOD to the RR.	PL
Rev 131	Bolivia	HF radiotelephony frequency requirements to be taken into account when revising App. 25 MOD to the RR.	PL
132 ✓	Bulgaria	Revision of App. 25 MOD	PL
Rev 133	S.G.	Implementation of the Frequency Allotment Plan contained in Sections I and II of App. 25 MOD to the RR, Geneva (1968 edition). (Frequency bands between 4 000 and 23 000 kHz allocated exclusively to the Radiotelephone Maritime Mobile Service).	PL
134	Papua New Guinea	Frequency requirements	PL
135	S.G.	Convening of the Conference	-
136 + Corr.	S.G.	Invitations to the World Administrative Radio Conference for Maritime Mobile Telecommunications.	-
137 + Corr.	S.G.	Notificatications to International Organizations.	-
138	S.G.	Committee Structure	-
139 (Rev.)	S.G.	Conference Secretariat	PL
140	S.G.	Budget of the Conference	C.3
141	S.G.	Situation of certain countries with respect to the International Telecommunication Convention, Montreux, 1965.	PL
142 ✓	Netherlands	Proposals	PL
rev 143	Nigeria	Proposals	PL
144	S.G.	Election of the members of the I.F.R.B.	-
145	S.G.	Contributions of non-exempted recognized private operating agencies and International Organizations.	C.3
146	S.G.	Cost of printing the Final Acts	C.3
147	France	Proposals (Agenda Item 4)	PL
148	India	Proposals	PL

No.	Origin	Title	Destination
149	India	Proposals (App. 25)	C.5
150 + Rev	India	Revision of App. 25 MOD	C.5
151	Albania	Proposals (List of frequencies for radiotelephony in the Maritime Mobile Service)	C.5
152	United Kingdom	Proposals	PL
153	Switzerland	Proposals (Agenda Item 1)	PL
154	New Zealand	Proposals	PL
155	Cuba	Frequency requirements to be added to Cuba's assignments in App. 25 (MOD) of the RR	PL
156	Norway	Proposals (Agenda Item 1)	PL
157	Brazil	Proposals (Agenda Item 1)	PL
158	Greece	Proposals (Agenda Item 4.1)	PL
159 + Corr.	Greece	Proposals (Agenda Item 4.5)	PL
160	Greece	Proposals (Agenda Item 12)	PL
161	Greece	Proposals (Agenda Item 3)	PL
162	Greece	Proposals (Agenda Item 2)	PL
163	Greece	Proposals (Agenda Item 7)	PL
164	Portugal	Proposals (Agenda Item 1)	PL
165	Brazil	Proposals (Agenda Item 3.2)	PL
166 + rev	Saudi Arabia	Proposal	PL
167	Mauritius	Proposal	PL
168 + Corrig	Ireland	Proposals (Agenda Item 1)	PL
169 + rev + Add	Roumania	Proposals	C.5
170	Indonesia	Proposals	C.5
171	S.G.	Proxy (Egypt-Morocco)	PL
172	S.G.	Proxy (Luxembourg-Belgium)	PL
173	Indonesia	Proposals	C.5
174	Hungarian People's Rep.	Proposals	PL
175	I.C.S.	Telex with foreign coast stations	-
176	France	Frequencies for HF radiotelephony	PL

No.	Origin	Title	Destination
177	IOC/WMO	High frequencies allocated by W.A.R.C., 1967, for Ocean data Transmissions.	-
178	I.M.C.O.	Recommendation	PL
179	I.M.C.O.	Draft supplementary recommendation	PL
180 + Add. + rev + Corrig	Iran	Proposals	PL
181	Iran	Proposals	PL
182 + rev + Corrig	Finland	Proposals	C.5
183	U.S.A.	Information paper-2182 kHz Conversion to A3A/A3J emission.	C.5
184	Monaco	Frequencies for HF radiotelephony	C.5
185	Norway	Proposals (Agenda Item 7)	C.4
186 + Corrig	Philippines	Proposals (Agenda Item 10)	PL
187	Philippines	Proposals (Agenda Item 4)	C.5
188	Peru	Requirements for HF radiotelephony channels (App. 25 MOD of the RR)	C.5
189	Philippines	Proposals (Agenda Item 1)	C.5
190	S.G.	Appointment of proxy (Central African Republic-Cameroon)	PL
191	C.6	Organization of the work Committee 6 - Operation	C.6
192	Malaysia	Proposals (Frequency requirements)	C.5
193 + Corrig	Belgium	Proposals (Frequency bands requirements)	C.5
194	S.G.	Candidatures for seats on the I.F.R.B.	PL
195	Jamaica	Proposals (Agenda Item 1)	C.5
196	Cyprus	Proposals (Agenda Item 1)	C.5
197	C.5	Summary Record, first session of Committee 5	C.5
198	Nigeria	Proposals (Frequency requirements)	C.5
199	United Kingdom	Narrow-band direct-printing assignments	C.4
200	S.G.	List of documents	PL