Documents of the World Administrative Radio Conference for mobile services (1st session)
(WARC MOB-83 (1)) (Geneva, 1983)

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR MOBILE SERVICES

GENEVA, MARCH, 1982

Corrigendum No. 1 to
Document No. DL/1-E
21 April 1981

PROVISIONAL REPORT

TO THE

WORLD ADMINISTRATIVE RADIO CONFERENCE

FOR MOBILE SERVICES

1982

from CCIR Study Group 8

1. Page 82, paragraph 8.3.2.2 should read:

"8.3.2.2 VHF/UHF Channels

If the HM digit ..."

2. Page 109, replace the entire page by the attached new page 109.

3. Page 123, delete in section 1 the 7th paragraph:

~~Further-more, it was~~ ...

4. Page 151, paragraph 4.17, line 1 replace No. ~~2980~~ by 2990.

5. Page 201, paragraph 4.4, line 5 should read:

"yacht race from ..."

6. Page 205, paragraph 4.7.2 modify the 7th and 8th characteristics as follows:

Antenna gain at 30° elevation angle	$\geq$ 2 dB
C/N_0	$\geq$ 34 dB

7. Page 228, footnote (2) should read:

"(2) The depth of modulation modes 2.2 and 2.3 is at least ..."

Annex: Page 109

6.2 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 § 6.1 above applies similarly).

6.3 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 § 6.2 but the carrier level is reduced to 16 dB below peak power corresponding to 100% modulation.

6.4 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 § 6.2 but the carrier level is reduced by at least 40 dB below peak power corresponding to 100% modulation.

6.5 Both the calculations for 70% and 100% modulation respectively are based upon the reference carrier (unmodulated) field strength of 25μV/m.

Table I 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 not, however, imply that A3A and A3J emissions on 2182 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 called 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.

To avoid a second table with mostly identical entries, Table I also includes the values of the corresponding transmitter peak envelope powers. These figures, however, can be disregarded in the context of this paragraph.

TABLE I

Class of emission	Method of reception	Type of test signal for field strength measurements	Spectrum for a depth of modulation of 70%			Spectrum for a depth of modulation of 100%			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 of	
			LSB	Carrier	USB	LSB	Carrier	USB	70%	100%	70%	100%
A3 (SOLAS reference)	DSB	Carrier only	0,35	1,0	0,35	0,5	1,0	0,5	25·0	25·0	43·4	60·0
A3	SSB	Carrier only	0,5	1,41	0,5	0,71	1,41	0,71	35·4	35·4	86·7	120·0
A3H	DSB	Carrier only		1,07	0,75		1,18	1,18	26·8	29·4	49·7	83·2
A3H	SSB	Carrier only		0,71	0,5		0,71	0,71	17·7	17·7	21·7	30·0
A3A	SSB	Carrier and sideband		0,13	0,5		0,13	0,71	12·8	18·0	5·9	10·6
A3J	SSB	Sideband only			0,5			0,71	12·4	17·7	3·7	7·5

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR MOBILE SERVICES

GENEVA, MARCH, 1982

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Note by the Secretary-General

INTERIM MEETING OF CCIR STUDY GROUP 8

I have the honour to transmit to the Administrations the provisional report of the Interim Meeting of CCIR Study Group 8 elaborated in response to Resolution No. 853 of the Administrative Council.

This report has been forwarded to me by the Director of the CCIR who informs me that it is expected that the content of this provisional report will be reviewed by the Special Study Group 8 meeting in September 1981 in preparation for the Conference and that a final version will be prepared by this meeting.

M. MILI

Secretary-General

Annex : 1

CCIR

PROVISIONAL REPORT
TO THE
WORLD ADMINISTRATIVE RADIO CONFERENCE
FOR MOBILE SERVICES
1982

from CCIR Study Group 8

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NOTE BY THE DIRECTOR, CCIR

The World Administrative Radio Conference, Geneva 1979, in Resolution No. 202(DH), relating to the convening of a World Administrative Radio Conference for the Mobile Services, invited

> "the CCIR to prepare the technical and operational bases for the Conference; "

The ITU Administrative Council in Resolution No. 853 adopted the Conference Agenda and endorsed the invitation to the CCIR for the Conference preparation.

This provisional report is a preliminary response to the two Resolutions mentioned above.

Richard C. Kirby
Director

Note.- Numbers of references to Radio Regulations and new designations of classes of emissions have only partially been modified in this provisional report.

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FOREWORD BY THE CHAIRMAN OF STUDY GROUP 8

The purpose of this booklet is to give some provisional guidance to Administrations in preparing for the World Administrative Radio Conference for Mobile Services, Geneva 1982.

The texts included in the booklet result from the continuing programme of work of the Study Group and represent the current position on the studies. Further work will be undertaken at the Final Meeting and these texts may be modified. The selected texts relate directly to items of the conference agenda prepared by the Administrative Council in May 1980. In addition, a list of Questions and Study Programmes, to which the Reports and Recommendations relate, are given and background material from other Study Groups has also been included.

The Special Meeting of Study Group 8 (7-18 September 1981) to prepare the technical and operating bases for WARC - M-82 will consider additional documentation and prepare a comprehensive report for transmission via the Director of the CCIR to the Conference.

W.H. BELLCHAMBERS
Chairman, Study Group 8

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PROVISIONAL REPORT TO THE WORLD ADMINISTRATIVE RADIO CONFERENCE

FOR MOBILE SERVICES, 1982, FROM CCIR

STUDY GROUP 8 - MOBILE SERVICES

1. Introduction

The following report was prepared at the Interim Meeting of Study Group 8 in response to Resolution No. 853 of the Administrative Council of the ITU which invited the CCIR to prepare the technical and operational bases for the World Administrative Radio Conference for Mobile Telecommunications (WARC-M) to be convened in Geneva on 2 March 1982 for a period of three weeks and three days.

It is expected that this report will be reviewed by the Final Study Group 8 Meeting, August 1981, and then considered by the Special Study Group 8 Meeting in September in preparation for the WARC-M-82.

The texts of the CCIR, listed below, are considered to form the basis for a provisional report to the WARC-M-82.

They are divided into three Parts:

Part I Full copies of all relevant CCIR Recommendations and Reports prepared by Study Group 8

Part II A list of the titles and numbers of the relevant CCIR Questions and Study Programmes assigned to Study Group 8

Part III A list of the titles and numbers of CCIR texts from Study Groups 1, 3, 5 and 6 considered to be of interest to Administrations preparing for WARC-M-82.

The texts have been identified against the agenda items for the Conference:

Agenda item

1. To review and revise as necessary, the provisions of the Radio Regulations for the mobile and mobile-satellite-services within the limits specified in the items below;

1.1 adding to Article 1(N1/1) only new definitions relating to these services which are not already provided for and without in any way altering the existing definitions.

1.1.1 Texts

No texts proposing definitions which may be added to the Radio Regulations have been approved by Study Group 8 at the Interim Meeting. The definition of a "satellite EPIRB" is, however, proposed to IMCO for use in their studies of the Future Global Maritime Distress and Safety System;

1.2 adding to Article 8(N7/5) only new footnotes or to revise existing footnotes relating to these services and which are consequential to decisions taken by this Conference in pursuance of the decisions reflected in the pertinent Resolutions or Recommendations of the World Administrative Radio Conference, 1979, provided they do not change any existing provision in such a way to affect adversely the provisions relating to any other non-mobile service.

Agenda item

1.2.1 Texts

Proposals for this item of the agenda are expected to be made by Administrations. Texts of the CCIR and in particular those of Study Group 8 concerning sharing with other services and the use of specific frequencies or frequency bands may be used as a technical basis for such proposals.

1.3 The notification and registration procedures contained in sub-section IIB and IIC of Article 12(N12/9).

1.3.1 Text

Report 748	Improved use of the HF radiotelephone channels for coast stations in the bands allocated exclusively to the maritime mobile service.

Note.- The notification and registration procedures in sub-section IIB and IIC of Article 12(N12/9) contain provisions for technical examination by the IFRB of the frequency assignment notices in frequency bands allocated exclusively to the maritime mobile and aeronautical mobile services. The IFRB technical standards used for this purpose need improvement and further refinements to reflect the currect technical and operational characteristics of radio equipment used in the services concerned. Particular attention is drawn to Recommendations Nos. 60(Q), 64(R) and 70(S) of the WARC-79.

1.4 The parts of Appendix 16(17(Rev.)) relating to the channelling of the existing maritime mobile radiotelephone service in the bands between 4 000 - 23 000 kHz and to add new channelling plans for the maritime mobile radiotelephone service in the new shared bands at 4 000 - 4 063 and 8 100 - 8 195 kHz.

1.4.1 Texts relating to the channelling of the maritime mobile radiotelephone bands between 4 000 and 23 000 kHz.

1.4.1.1 Texts

Rec. 475-1	Improvements in the performance of radiotelephone circuits in the MF and HF maritime mobile bands
Draft Rep.500-2 (MOD I)	Improvements in the performance of radiotelephone circuits in the MF and HF bands. Linked compressor and expandor systems
Report 748	Improved use of the HF radiotelephone channels for coast stations in the bands allocated exclusively to the maritime mobile service
Rec. 77-3	Conditions necessary for interconnection of mobile radiotelephone stations and international telephone lines
Rec. 488	Equivalent powers of double-sideband and single-sideband radiotelephone emissions in the maritime mobile service
Report 586	Equivalent powers of double-sideband and single-sideband radiotelephone emissions in the maritime mobile service
Draft Rec. 545 (MOD I)	The choice of frequencies in the maritime mobile bands above 1 605 kHz to be reserved for distress and safety purposes
Draft Rep. 746 (MOD I)	The choice of frequencies in the maritime mobile bands above 1 605 kHz to be reserved for distress and safety purposes

Agenda item

	1.4.1.2	Texts of Study Group 3
Draft Rep. 354-3 (MOD I)		Improved transmission systems for use over HF radiotelephone circuits (Lincompex).
Report 701		Improvements in the performance of HF radiotelephone circuits by means of receiver design (A.G.C. time constant)
Rec. 455-1		Improved transmission system for HF radiotelephone circuits
Report 176-4		Compression of the radiotelephone signal spectrum in the HF bands
	1.4.1.3	Texts of Study Group 1
Report 660		An electromagnetic compatibility figure of merit for single channel voice communication systems
Report 661		Measurement procedures for an electromagnetic compatibility figure of merit for single-channel-voice-communication systems
Report 325-2		Results of spectrum measurements of amplitude modulated radiotelephone emissions and multichannel voice-frequency radiotelephone emissions

1.4.2 Use of the new bands shared between the maritime mobile service and the fixed service.

	1.4.2.1	Text of Study Group 3
Rec. 240-3		Signal-to-interference protection ratios
	1.4.2.2	Texts of Study Group 1
Report 656		Efficient spectrum utilization using probabilistic methods
Draft Rep. 658 (MOD I)		Assessment of the feasibility of sharing between mobile users and a fixed service circuit in the frequency band 4 - 28 MHz
	1.4.2.3	Texts of Study Group 5
Draft Rec. 368-3 (MOD I)		Ground-wave propagation curves for frequencies between 10 kHz and 30 MHz
	1.4.2.4	Texts of Study Group 6
Report 322-1		World distribution and characteristics of atmospheric radio noise
Draft Rep. 252-2 (MOD I)		Second CCIR computer-based interim method for estimating sky-wave field strength and transmission loss at frequencies between 2 and 30 MHz.

Agenda item

1.5 Chapter IX (NIX), Distress and safety communications

1.5.1 Texts

Draft Rep. 744 (MOD I)	Use of class J3E emissions for distress and safety purposes
Rec. 543	The use of R3E and J3E emissions for distress and safety purposes
Rec. 544	The use of class J3E emissions for distress and safety purposes on the carrier frequencies 4125 kHz and 6215.5 kHz
Report 745	The choice of a frequency in the maritime mobile bands between 1605 kHz and 3800 kHz to be reserved for safety requirements
Draft Rep. 749 (MOD I)	Future use and characteristics of emergency position-indicating radio beacons in the mobile service and in the mobile satellite service
Draft Rec. 439-2 (MOD I)	Emergency position-indicating radio beacons operating at the frequency 2182 kHz
Draft Rep. 746 (MOD I)	The choice of frequencies in the maritime mobile bands above 1605 kHz to be reserved for distress and safety purposes
Draft Rec. 545(MOD I)	The choice of frequencies in the maritime mobile bands above 1605 kHz to be reserved for distress and safety purposes
Draft Rep. 747 (MOD I)	Technical and operating considerations for a Future Global Distress and Safety System at sea
Draft Rep. 761(MOD I)	Technical and operating characteristics of distress systems in the maritime mobile satellite service
Draft Report BB/8	Operational and technical factors relevant to global distress systems in the aeronautical mobile service
Draft Rep. 585-1 (MOD I)	Introduction of direct printing telegraph equipment in the maritime mobile service
Draft Rec. 476-2 (MOD I)	Direct printing telegraph equipment in the maritime mobile service
Rec. 491	Direct printing telegraph equipment in the maritime mobile service
Rec. 492-1	Operational procedures for the use of direct printing telegraph equipment in the maritime mobile service
Draft Rec. 540(MOD I)	Automated direct printing telegraph system for transmission of navigational and meteorological information to ships

Agenda item

Draft Report AL/8	**Operational aspects of the use of automatic direct printing telegraph system for transmission of navigational and meteorological information to ships (NAVTEX)**

1.6 Article 62 (N59), Selective calling procedure in the maritime mobile service

1.6.1 Texts

Draft Rep. 501-2 (MOD I)	Digital selective-calling system for future operational requirements of the maritime mobile service
Draft Rec. 493-1 (MOD I)	Digital selective-calling system for use in the maritime mobile service
Rec. 541	Operational procedures for the use of digital selective calling equipment in the maritime mobile service

2. To review and take appropriate action as necessary on the following Resolutions and Recommendations of the World Administrative Radio Conference, 1979, solely from the viewpoint of the mobile and mobile satellite services involved without adverse impact on other radiocommunication services:

2.1 Recommendation No. 204(C) Relating to the application of Chapters NX, NXI and NXII of the re-arranged Radio Regulations (insofar as it relates to safety and distress services)

Recommendation No. 202(F) Relating to the improvement of protection of distress and safety frequencies, and those related to distress and safety, against harmful interference

Recommendation No. 200(ZZ) Relating to the date of entry into force of the 10 kHz guardband for the frequency 500 kHz in the mobile service (distress and calling)

2.1.1 Texts

For technical and operational texts relating to safety and distress, see Agenda § 1.5.

2.2 Recommendation No. 203(YA) Relating to the future use of the band 2 170 - 2 194 kHz

2.2.1 Texts

Draft Rep. 744 (MOD I)	Use of class J3E emissions for distress and safety purposes
Draft Rec. 439-2 (MOD I)	Emergency position-indicating radio beacons operating at the frequency 2 182 kHz

Agenda item

Draft Rep. 746(MOD I)	The choice of frequencies in the maritime mobile bands above 1 605 kHz to be reserved for distress and safety purposes

2.3 Recommendation No. 309(YB) Relating to the designation of a frequency in the bands 435-495 or 505 - 526.5 kHz (525 kHz in Region 2) on a worldwide basis for the transmission by coast stations of navigational and meteorological warnings to ships, using narrow-band, direct-printing telegraphy

2.3.1 Texts

Draft Report AL/8	Operational aspects of the use of the automatic direct-printing telegraph system for transmission of navigational warnings and meteorological information to ships (NAVTEX)
Draft Rec. 540(MOD I)	Automated direct-printing telegraph system for transmission of navigational and meteorological information to ships
Draft Rep. 746(MOD I)	The choice of frequencies in the maritime mobile bands above 1 605 kHz to be reserved for distress and safety purposes
Draft Rep. 747(MOD I)	Technical and operating considerations for a Future Global Distress and Safety System at Sea

2.4 Recommendation No. 300(YD) Relating to planning the use of frequencies by the maritime mobile service in the band 435 - 526.5 in Region 1

2.4.1 Text

Draft Rep. 747(MOD I)	Technical and operating considerations for a Future Global Distress and Safety System at Sea

2.5 Recommendation No. 301(YE) Relating to planning for the use of frequencies in the bands between 1 606.5 and 3 400 kHz allocated to the maritime mobile service in Region 1

2.5.1 Texts

Draft Rec. 545(MOD I)	The choice of frequencies in the maritime mobile bands above 1 605 kHz to be reserved for safety and distress purposes
Draft Rep. 747(MOD I)	Technical and operating considerations for a Future Global Distress and Safety System at Sea
Draft Rep. 746(MOD I)	The choice of frequencies in the maritime mobile bands above 1 605 kHz to be reserved for distress and safety purposes

2.6 Recommendation No. 307(YL) On the choice of a frequency in the mobile maritime bands between 1 605 and 3 800 kHz to be reserved for safety requirements

2.6.1 Texts

As listed under § 2.5.1

Agenda item

2.7 Recommendation No. 308(YO) Relating to the designation of common frequencies in the medium frequency bands for use by coast radiotelephone stations for communicating with ships of other nationalities

2.7.1 Texts

No specific texts proposed.

2.8 Recommendation No. 313(YR) Relating to temporary provisions covering the technical and operational aspects of the maritime mobile satellite service

2.8.1 No texts proposed.

2.9 Recommendation No. 201(YS) Relating to distress, urgency and safety traffic

2.9.1 Texts

See texts listed under § 1.5.

2.10 Recommendation No. 605(XA) Relating to technical characteristics and frequencies for shipborne transponders

2.10.1 Text

Draft Rep. 775(MOD I)	Frequency requirements for shipborne transponders

2.11 Recommendation No. 602(XD) Relating to maritime radiobeacons

2.11.1 Text

Draft Report AO/8	Technical characteristics of maritime radiobeacons

2.12 Recommendation No. 604(XI) Relating to the future use and characteristics of emergency position-indicating radiobeacons

2.12.1 Texts

Draft Rep. 749(MOD I)	Future use and characteristics of emergency position-indicating radiobeacons in the mobile service and in the mobile satellite service
Draft Rec. 439-2 (MOD I)	Emergency position-indicating radiobeacons operating at the frequency 2 182 kHz

2.13 Resolution No. 200(AN) Relating to the use of class R3E and J3E emissions for distress and safety purposes on the carrier frequency 2 182 kHz

2.13.1 Texts

Draft Rep. 744(MOD I)	Use of class J3E emissions for distress and safety purposes

Agenda item

Rec. 543 The use of R3E and J3E emissions for distress and safety purposes

2.14 Resolution No. 305(AO) Relating to the use of class R3E and J3E emissions on the carrier frequencies 4 125 kHz and 6 215.5 kHz used to supplement the carrier frequency 2 182 kHz for distress and safety purposes

2.14.1 Text

Rec. 544 The use of class J3E emissions for distress and safety purposes on the carrier frequencies 4 125 kHz and 6 215.5 kHz

2.15 Resolution No. 38(BR) Relating to the reassignment of frequencies of stations in the fixed and mobile services in the bands allocated to radiolocation and amateur services in Region 1

2.15.1 Texts

No texts proposed. The implementation of this Resolution will depend upon administrative provisions to be developed by the Conference.

2.16 Resolution No. 310(CN) Relating to frequency provisions for development and future implementation of ship movement telemetry, telecommand and data exchange systems

2.16.1 No texts proposed.

2.17 Resolution No. 11(CY) Relating to the use of radiocommunications for ensuring the safety of ships and aircraft of states not parties to an armed conflict

2.17.1 Texts

No texts proposed.

2.18 Resolution No. 313(DD) Relating to the introduction of a new system for identifying stations in the maritime mobile and maritime mobile satellite services (maritime mobile service identities)

2.18.1 Text

Draft
Rec. AA/8 Assignment and use of maritime mobile service identities

3. To make such minimum consequential changes to the associated Articles and Appendices related to the foregoing Resolutions and Recommendations.

RECOMMENDATION 77-3

CONDITIONS NECESSARY FOR INTERCONNECTION OF MOBILE RADIOTELEPHONE STATIONS AND INTERNATIONAL TELEPHONE LINES

(1951 - 1966 - 1970 - 1978)

The CCIR,

CONSIDERING

(a) that the conditions concerning which international agreement is necessary appear to be few in number;

(b) that these conditions, if met, would permit suitable interconnection between mobile radiotelephone stations and international telephone lines,

UNANIMOUSLY RECOMMENDS

1. that mobile radiotelephone circuits, intended for connection to international telephone systems, should terminate (on a two-wire basis, for the present at least) in such a way that they may be connected to international lines in the same manner as other landline connections;

2. that the mobile radiotelephone circuits should accept from and deliver to the landline system speech levels conforming, as far as possible, to the CCIR and CCITT standards for connections to international circuits;

3. that the attenuation-frequency characteristics of the radio system (including the landlines to the radio receiver and radio transmitter) should be such that the grade of transmission is not unduly affected; and, in particular, the effectively transmitted band should be not less than 300 to 2600 Hz (for single-sideband maritime radiotelephone equipment, see Appendix 17A to the Radio Regulations);

4. that the noise from a radio circuit, connected to an international circuit, should not be unduly great and should be insufficient to operate echo suppressors or other devices on domestic or international circuits frequently;

5. that, for mobile radiotelephone stations, which may have to communicate with land stations in more than one country, consideration be given to the necessity for agreement as to a method of signalling for use between the land mobile stations.

RECOMMENDATION 475-1

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

(Question 11-1/8)

(1970 - 1974)

The CCIR,

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 used by several 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,

UNANIMOUSLY 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 2700 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 contained in Annex III.

Annex I : Characteristics for ship stations.

Annex II : Characteristics for coast stations.

Annex III: Characteristics of SSB radio equipment.

ANNEX I

CHARACTERISTICS OF EQUIPMENT FOR SHIP STATIONS

1. Transmit side (Fig. 1a)

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. 3a) (Note 1)	5 to 10 ms
Recovery time (Fig. 3b) (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

2. Receive side (Fig. 1b)

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

2.1.2 *Expander* (controlled by the discriminator output)

Effective dynamic range	60 dB

* 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.

	Frequencies	Attenuation relative to response at 800 Hz
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. 3c)	15 to 30 ms
	Recovery time (Fig. 3d)	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	⩽ 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 CCITT 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.

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.

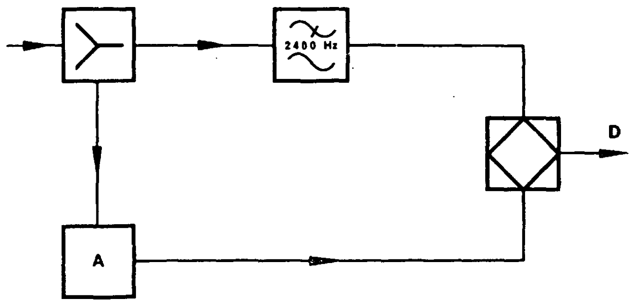


FIGURE 1*a*

Transmit side

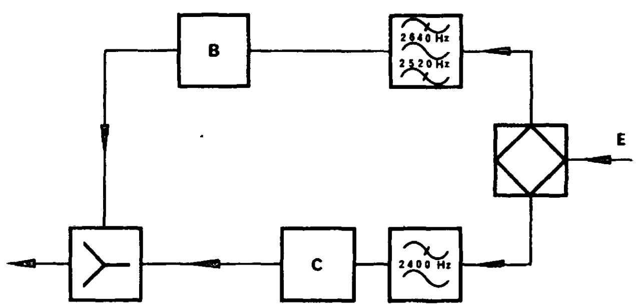
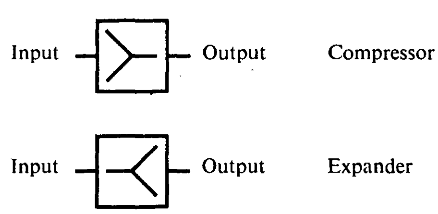


FIGURE 1*b*

Receive side

A: frequency-modulated oscillator
B: frequency discriminator
C: fading regulator (constant volume amplifier)
D: to radio transmitter
E: from radio receiver



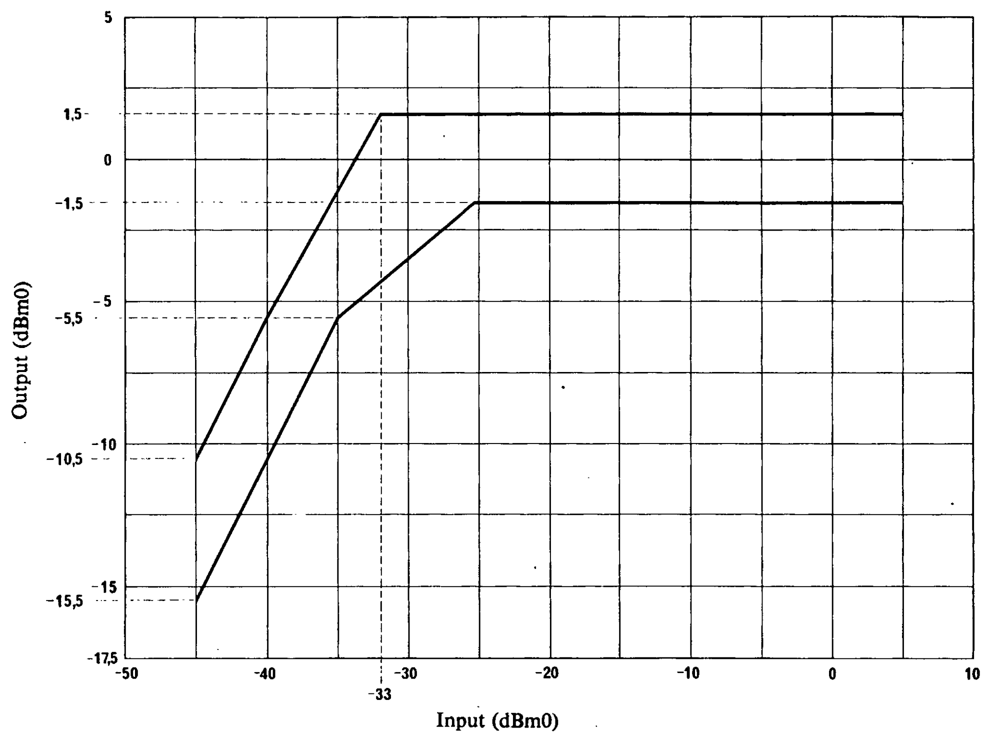


FIGURE 2

Input/output characteristic of transmit side

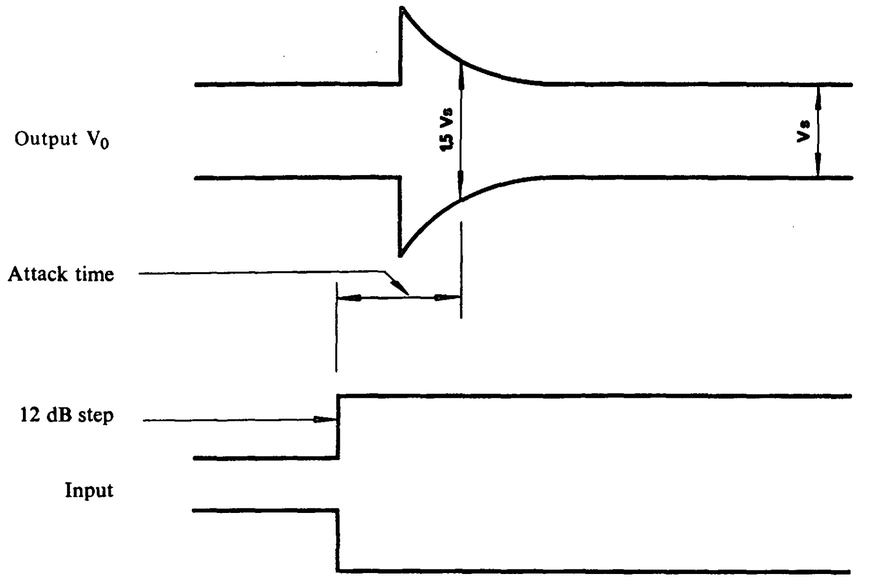


FIGURE 3*a*

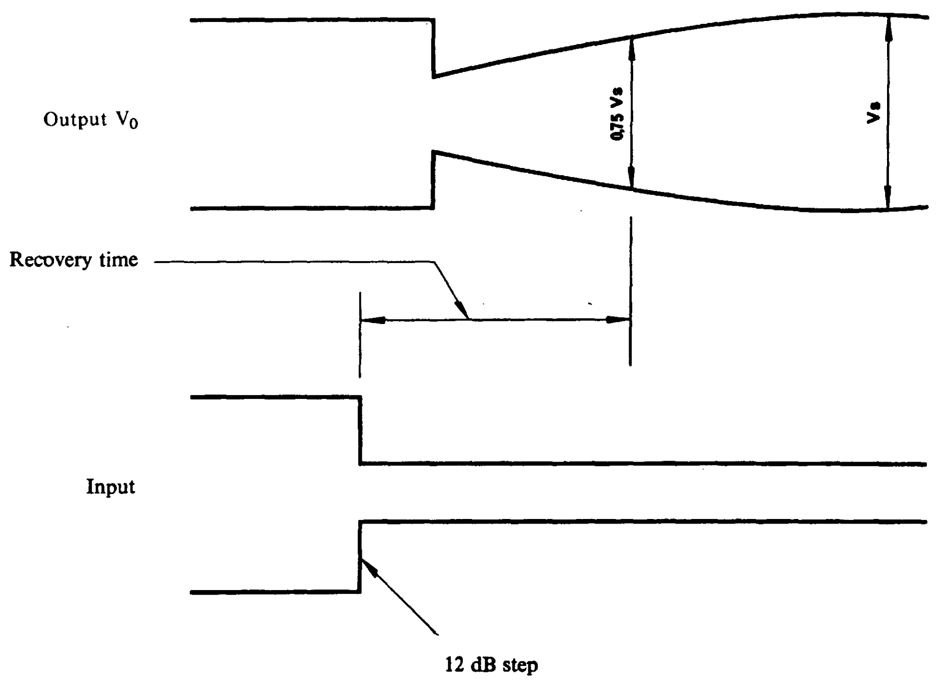


FIGURE 3*b*

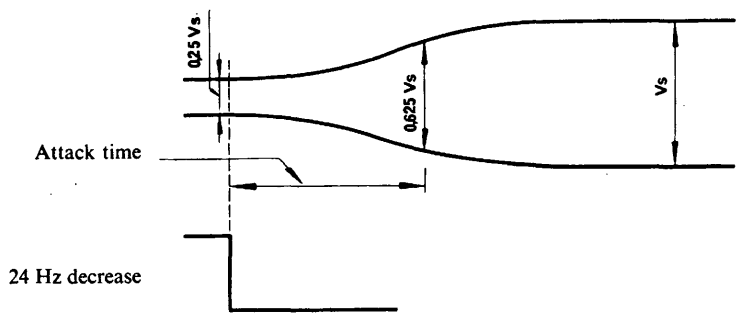


FIGURE 3*c*

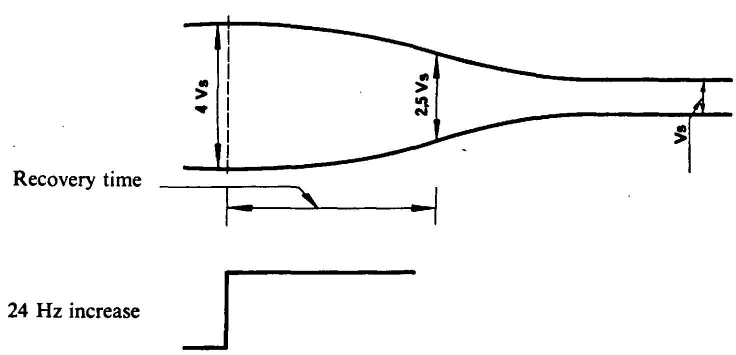


FIGURE 3*d*

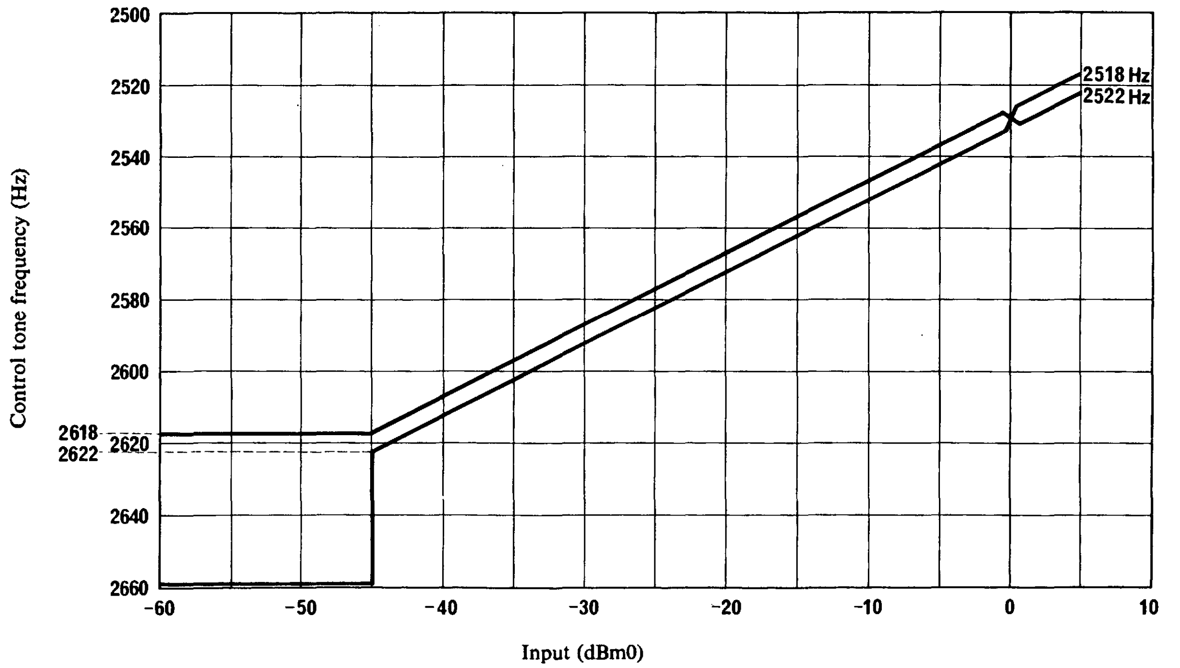


FIGURE 4

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

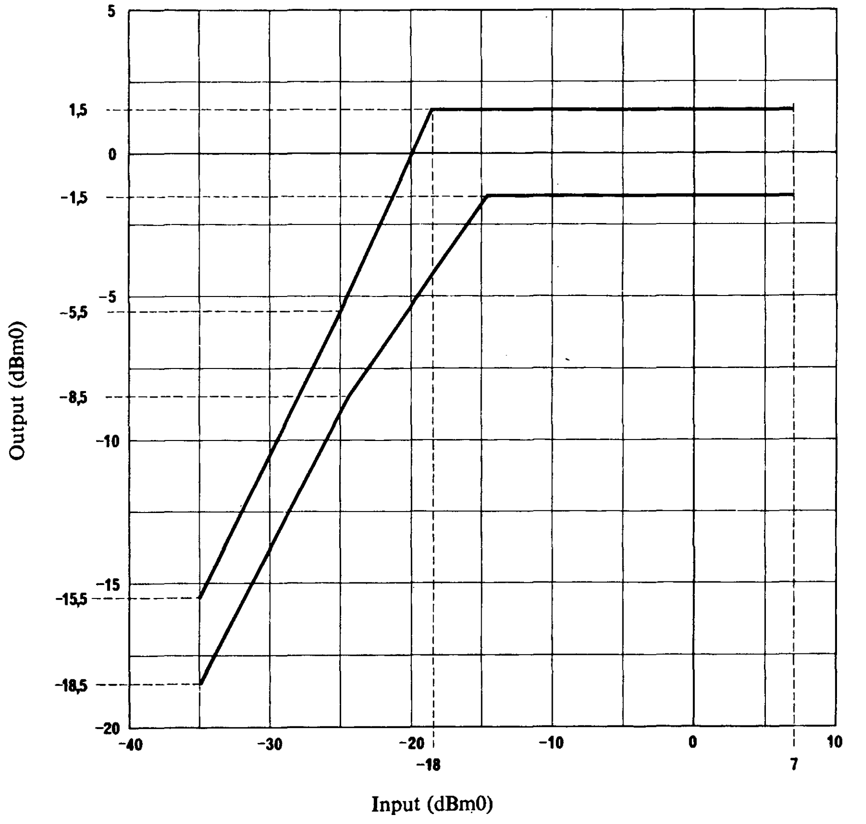


FIGURE 5

Input/output characteristic of fading regulator

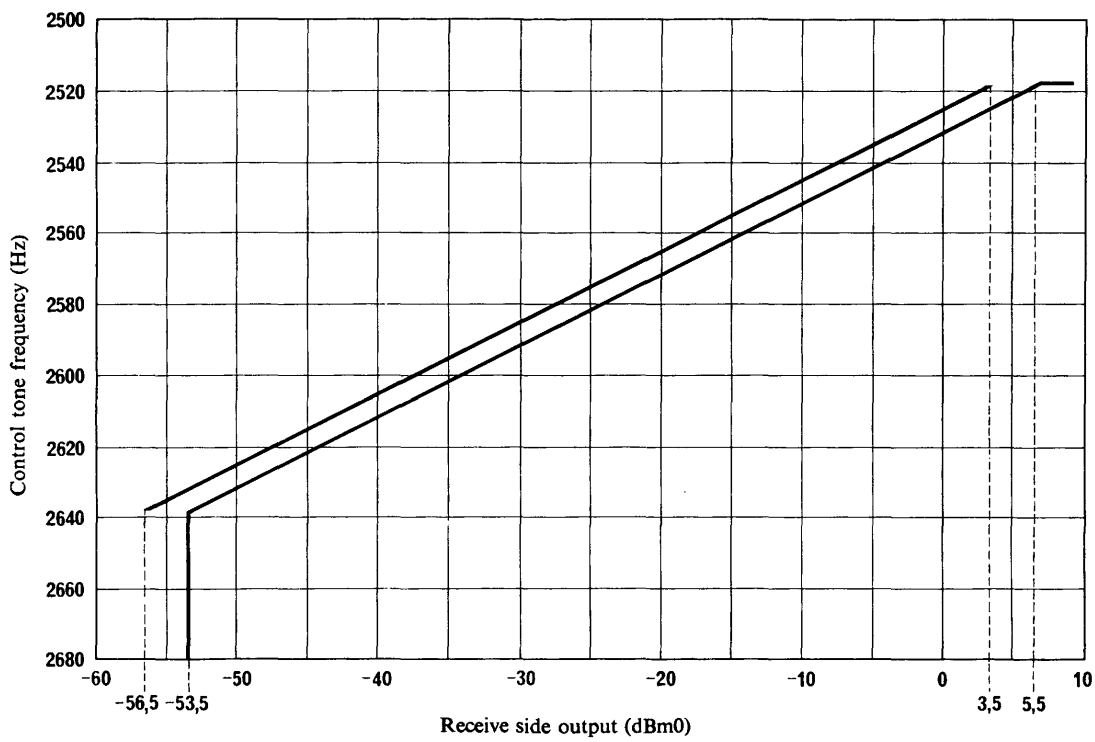


FIGURE 6

Variation of receive side output with changes of control tone frequency

ANNEX II

CHARACTERISTICS OF EQUIPMENT FOR COAST STATIONS

1. Transmit side (Fig. 7a)

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. 9a) (Note 1)	5 to 10 ms
Recovery time (Fig. 9b) (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

2. Receive side (Fig. 7b)

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.

* 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.

Frequencies	Attenuation relative to response at 800 Hz
2.1.1.2 *Transmit response*	
Attack time (Fig. 9a) (Note 1)	7 to 13 ms
Recovery time (Fig. 9b) (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. 9c)	15 to 30 ms
Recovery time (Fig. 9d)	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. – The definitions of attack and recovery time which are similar to those defined by the CCITT 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.

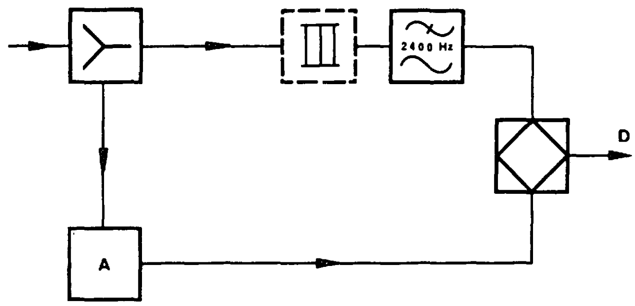


FIGURE 7*a*

Transmit side

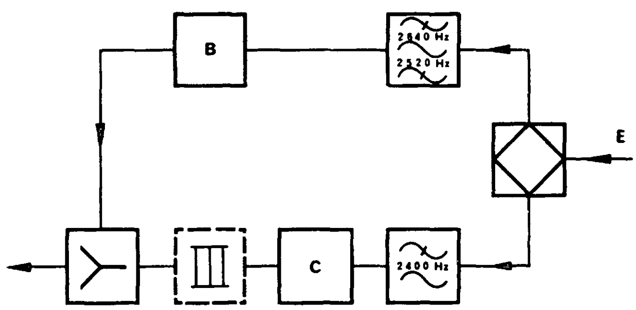
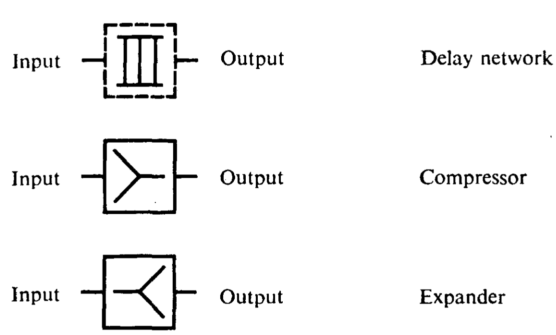


FIGURE 7*b*

Receive side

A: frequency-modulated oscillator
B: frequency discriminator
C: fading regulator (constant volume amplifier)
D: to radio transmitter
E: from radio receiver



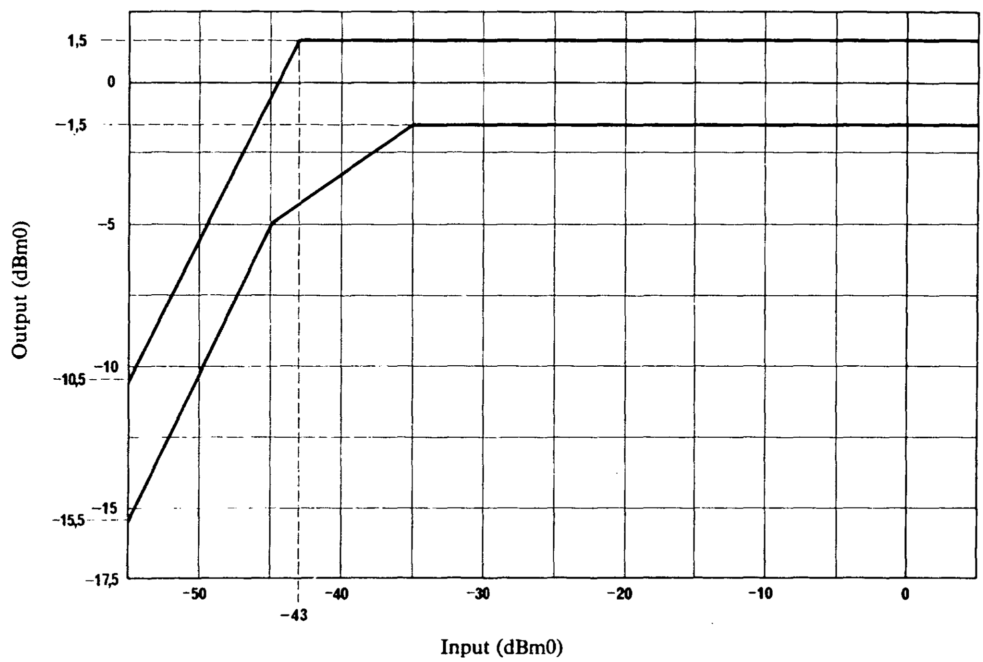


FIGURE 8

Input/output characteristic of transmit side

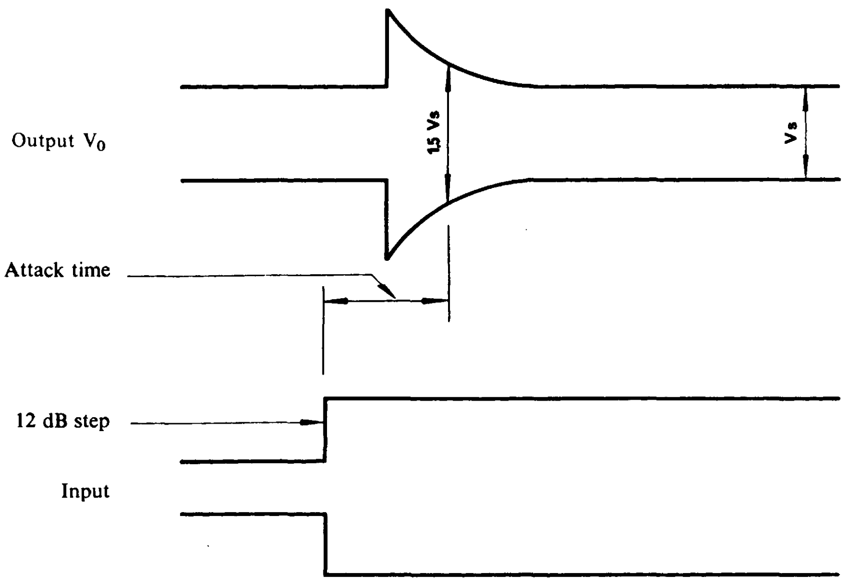


FIGURE 9*a*

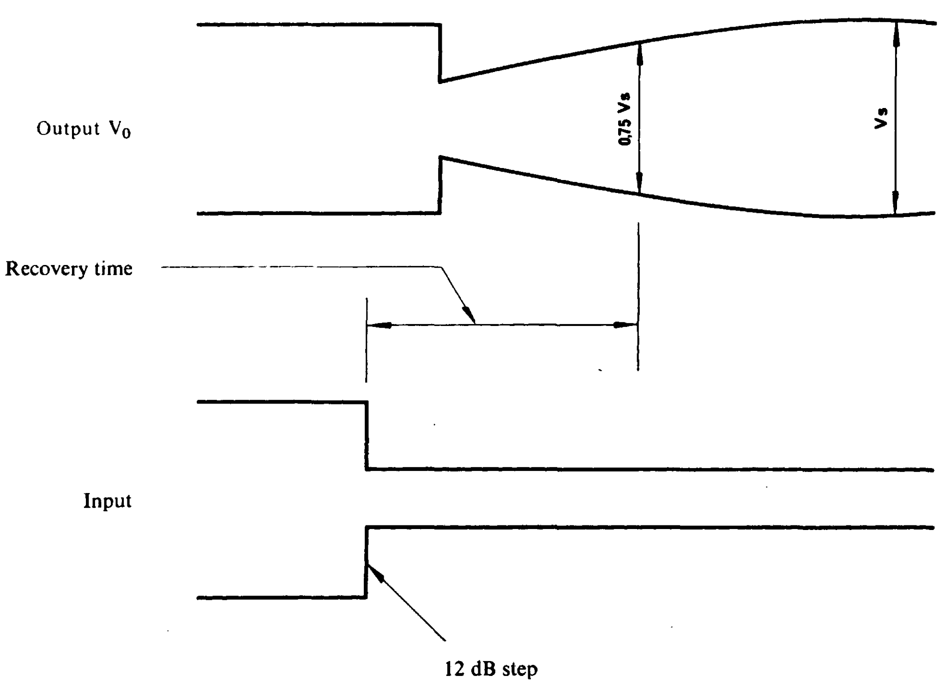


FIGURE 9*b*

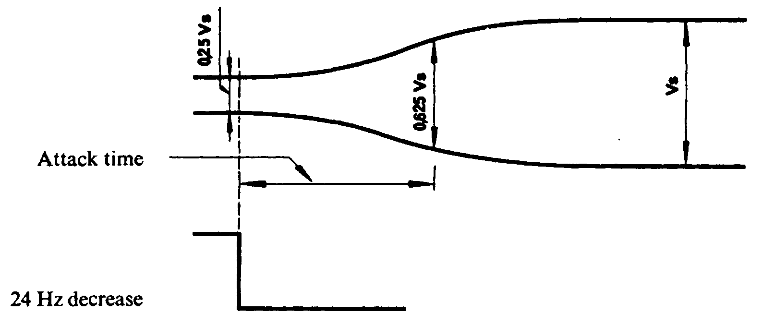


FIGURE 9*c*

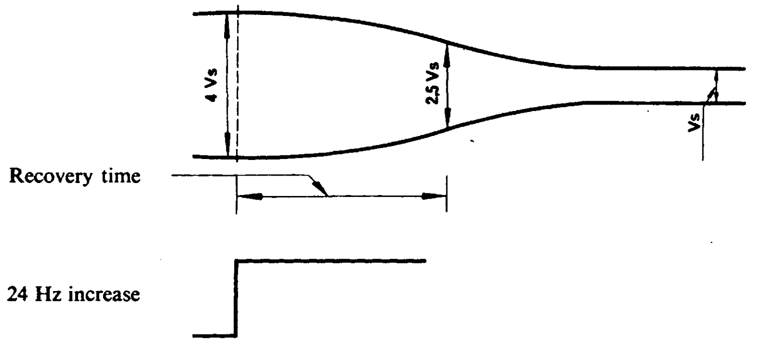


FIGURE 9*d*

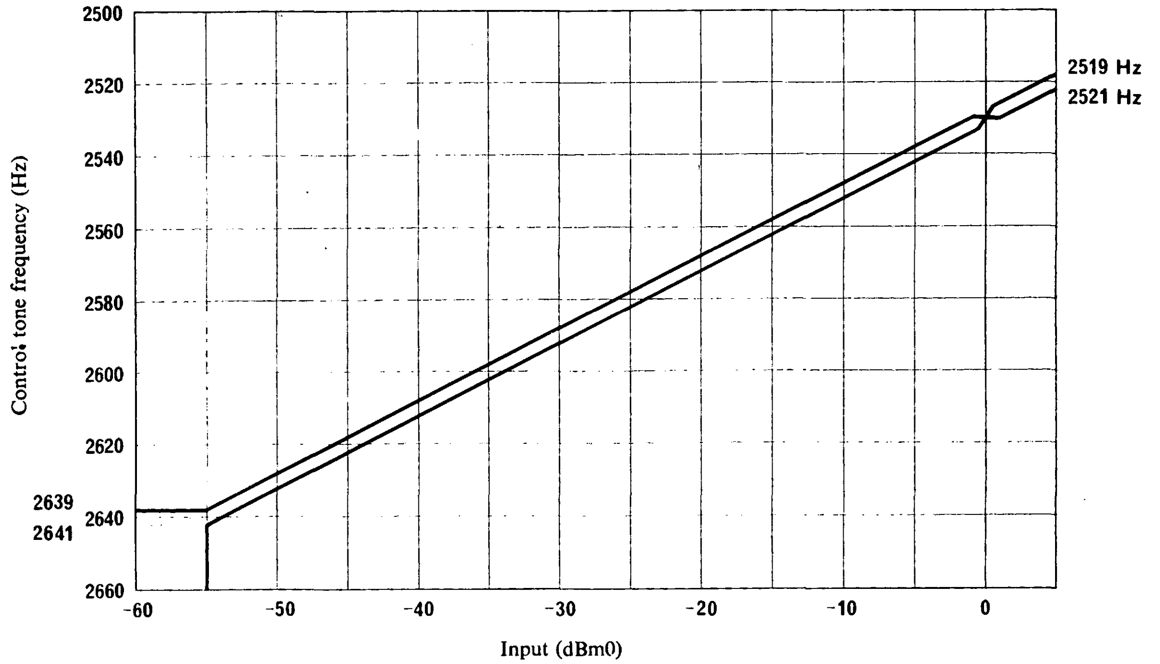


FIGURE 10

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

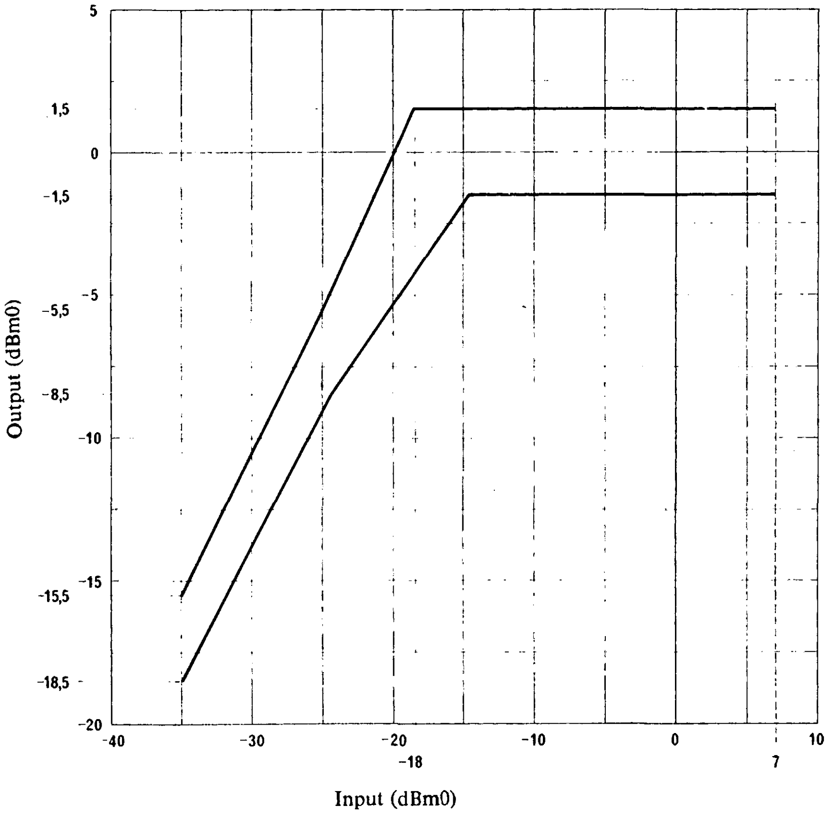


FIGURE 11

Input/output characteristic of fading regulator

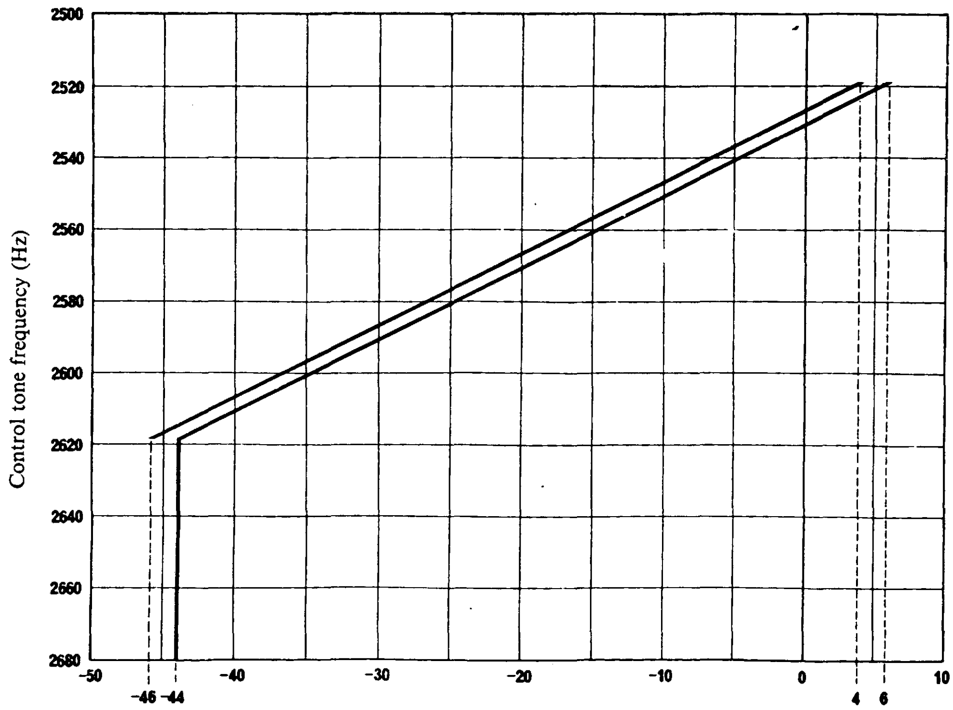


FIGURE 12

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 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 to 2700 Hz audiofrequency 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. 1000 Hz ± 1 Hz) 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, in Annex I of this Recommendation, the upper audio frequency of the speech channel is 2380 Hz.

RECOMMENDATION 488 *

EQUIVALENT POWERS OF DOUBLE-SIDEBAND AND SINGLE-SIDEBAND RADIOTELEPHONE EMISSIONS IN THE MARITIME MOBILE SERVICE

(1974)

The CCIR,

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 W (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 shall have a depth of modulation of at least 70% at peak intensity;

(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 2182 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 the Inter-Governmental Maritime Consultative Organization (IMCO) 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;

UNANIMOUSLY 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 amplitude of the sideband signal corresponding to 70% and 100% modulations is the same as that 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 amplitude of the sideband signal corresponding to 70% and 100% modulations is the same as that 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:

* This Recommendation terminates the study of Question 19/8.

TABLE I

Class of emission	Type of receiver	Test signal	r.m.s. field strength (μV/m) equivalent to the reference signal (see § 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 § 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 (W) equivalent to the reference signal (see § 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

Note.—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, CCIR, is requested to bring this Recommendation to the attention of IMCO.

RECOMMENDATION 491

DIRECT-PRINTING TELEGRAPH EQUIPMENT IN THE MARITIME MOBILE SERVICE

(Question 5-2/8)

(1974)

The CCIR,

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 or signal, or coast station selective call number or signal;

(b) that the two-block call signal described in Recommendation 476-2 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 476-2, §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)*) 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 Annex I is already in use in existing direct-printing equipment,

UNANIMOUSLY RECOMMENDS

1. that, in direct-printing systems, the two-block call signal used in the phasing procedure described in Recommendation 476-2 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 476-2 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 476-2 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 Tables in Annex I.

ANNEX I

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 in accordance with 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

RECOMMENDATION 492-1 *

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

(Question 5-2/8)

(1974 - 1978)

The CCIR,

CONSIDERING

(a) that narrow-band direct-printing telegraph services are in operation using equipment as described in Recommendation 476-2;

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

(c) that, as far as possible, these procedures should be similar for all services and for all frequency bands **,

UNANIMOUSLY 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 476-2 in the maritime mobile service should be observed:

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;

Note. – Before an international automatic service can be introduced, agreement has to be reached on a numbering plan, traffic routing and charging. This should be considered by both the CCITT and the CCIR.

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 476-2. The ship station concerned could have available traffic stored ready for automatic transmission on 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;

1.8 where paired frequencies are used, as for the bands 4 MHz to 22 MHz, arrangements should be made, if required, for the coast station to indicate when the circuit is open for traffic. The format of the signal, transmitted by the coast station, i.e. the "free channel" signal should be composed of signals in the 7-unit error detecting code as listed in § 2 of Annex I to Recommendation 476-2. Three of these signals are grouped into a block, the middle signal being the "Signal Repetition" (RQ), the first and third signals of the block being any of the signals VXQKMPCYFS TBUEOIRZDA (see Recommendation 491). The signals in the block are transmitted at a modulation rate of 100 bauds and the blocks are separated by pauses of 240 ms. This "free channel" signal may be interrupted by a signal or signals, that would enable an operator to recognize the "free channel" condition by ear. The aurally recognizable signal, e.g. a Morse signal, may be used alone as the "free channel" signal in manual systems.

* The Director, CCIR, is invited to bring this Recommendation to the attention of Director, CCITT.

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

1.9 *Procedure for setting up a call in the ship-to-coast station direction*

Coast station	*Step*	*Ship station*
	1	Ship initiates the call (may include "Who are you?")
"This is"	2	
"Who are you?"	3	
	4	"This is"
< ≡ ↓ GA ↑ +?	5	
	6	< ≡ ↓ TLX ↑ yz + or < ≡ ↓ DIRTLX ↑ yz + or < ≡ ↓ SVC ↑ +* or < ≡ ↓ TGM ↑ +**
< ≡ ↓ MSG ↑ +?	7	
	8	MESSAGE
	9	< ≡ ↓ NNNN***
"Who are you?"	10	
	11	"This is"
"This is"	12	
< ≡ ↓ GA ↑ +?	13	
	14	Go to step 6**** or end of communication

* The characters SVC+ are transmitted in sequence and preceded by at least one carriage return and a line feed; SVC denotes that the message that follows is a service message and "+" indicates end of sequence.

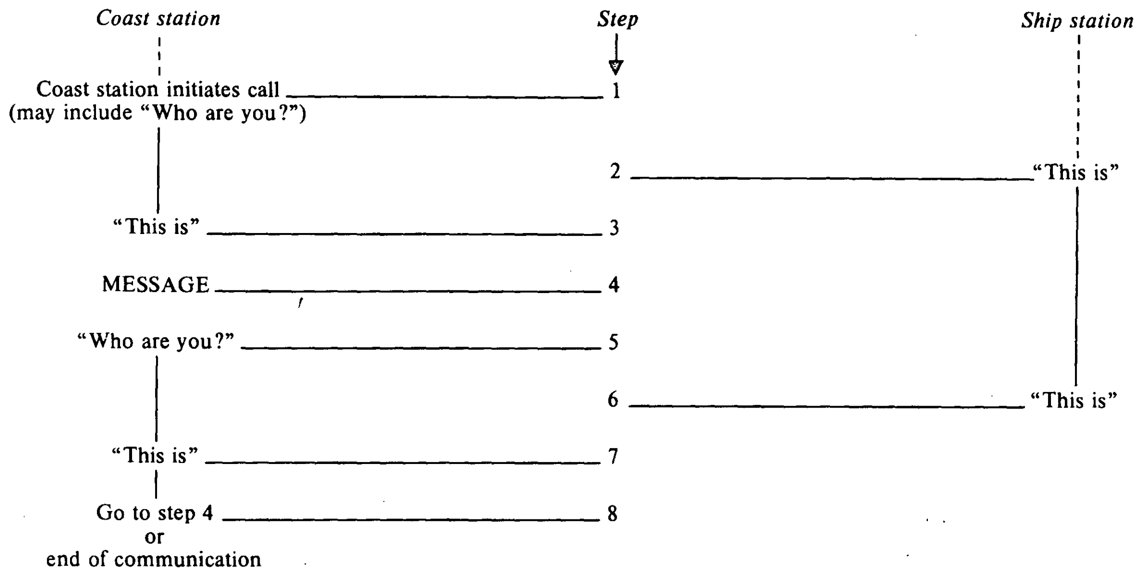
** The characters TGM+ are transmitted in sequence and preceded by at least one carriage return and a line feed; TGM denotes that the message that follows is a radiotelegram and "+" indicates end of sequence.

*** This sequence of combinations may need to be considered further by the CCITT.

**** Each separate radiotelegram shall be both preceded and followed by an exchange of answerback signals, the latter indicating the acknowledgement of receipt of that particular radiotelegram.

1.10 *Procedure for setting up a call in the coast-to-ship station direction*

Operation in the direction coast station to ship may need to be in the store-and-forward mode owing to the fact that radio propagation conditions may not allow the setting up of a call at the intended time.



2. Mode B (FEC)

2.1 Messages could, by prior arrangement, be sent in the B mode from a coast station or ship to a number of ships or to a single ship, preceded if desired by the selective call code of the ship(s) concerned where:

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

2.1.2 communications are intended for more than one ship, or

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 messages should start with "carriage return" and "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.

RECOMMENDATION 541

OPERATIONAL PROCEDURES FOR THE USE OF DIGITAL SELECTIVE CALLING EQUIPMENT IN THE MARITIME MOBILE SERVICE

(Question 9-3/8)

(1978)

The CCIR,

CONSIDERING

(a) that provisions for digital selective calling have been set out in Articles 7 and 28A of the Radio Regulations;

(b) that digital selective calling will be used as described in Recommendation 493-1;

(c) that the operational procedures necessary for such services should be agreed upon particularly for ships subject to the Convention for the Safety of Life at Sea of the Inter-Governmental Maritime Consultative Organization (IMCO);

(d) that, as far as is practicable, operational procedures in all frequency bands and for all types of communications should be similar;

(e) that digital selective calling may provide a useful supplementary means of transmitting a distress call in addition to the provisions of transmitting the distress call by existing methods and procedures in the Radio Regulations;

(f) that conditions when alarms have to be actuated should be specified,

UNANIMOUSLY RECOMMENDS

that digital selective calling system having technical and operational characteristics in accordance with Recommendation 493-1 be used in the Maritime Mobile Service and that the following operational procedures in the MF, and HF and VHF bands should be observed particularly on ships fitted pursuant to the Safety Convention:

1. Procedures for Distress Calls

1.1 *Transmission*

1.1.1 Following transmission of the distress call (using the required procedures on the international distress and calling frequencies by appropriate means as provided in the Radio Regulations) a distress call may be made using the digital selective calling system. The digital selective calling equipment shall be set to transmit the distress call on the appropriate distress frequencies.

1.1.2 The distress call shall be transmitted in accordance with Recommendation 493-1, where the nature of distress and the position information shall be entered as appropriate. If the position of the ship cannot be entered, then the position information shall be automatically transmitted as the digit 9 repeated 10 times.

1.1.3 Where possible, additional information, which may be useful in establishing distress communications, may be included.

1.1.4 Several distress calls may be transmitted consecutively, followed by intervals sufficiently long to allow time for reply to be received. *

1.2 *Reception*

1.2.1 The digital selective calling equipment should maintain an efficient watch on a 24 hour basis on the distress frequencies appropriate to the ship's operation as well as on any other frequencies on which the station will receive selective calls.

1.2.2 Upon receipt of a distress call the station should comply with the procedures set out in Article 36 of the Radio Regulations.

1.2.3 The digital selective calling equipment shall provide a distinctive aural alarm upon receipt of a distress call.

* Provisionally three distress calls may be transmitted consecutively and the interval before repetition should be at least 5 minutes.

2. Procedures for calls with category "distress", "urgency", "vital safety" and "important safety"

2.1 *Distress relay*

2.1.1 The distress relay call should be a call with the category "distress".

3. Procedures for other calls

3.1 *Transmission*

3.1.1 A selective call should be sent on an appropriate calling frequency or on a working frequency where prior arrangements have been made for the area of operation of the station or stations being called or on an international exclusive digital selective calling frequency in accordance with the Radio Regulations.

3.1.2 Repetitive calls on the same frequency should be kept to a minimum.

3.2 *Reception*

3.2.1 To provide access at any time, stations of the Maritime Mobile Service should maintain, as far as possible, a continuous watch on appropriate frequencies allocated for digital selective calling.

3.2.2 To monitor several calling frequencies by means of the digital selective calling system, multi-channel receivers or scanning single-channel receivers may be used.

4. Information entry

4.1 Provisions should be made for manual entering of address, type of call, category and various messages.

4.2 In case of manual entry, verification and, if necessary, correction of the formed calling sequence should be carried out.

5. Aural alarms and indicators

5.1 A specific aural alarm and visual indicator should be provided to indicate receipt of a distress call or a call with category distress. It should not be possible to disable this alarm. Provisions should be made for the alarm to be reset manually.

5.2 An aural alarm and visual indicator should be provided to indicate the receipt of an "urgency" or "vital safety" call. The aural alarm may be capable of being disabled.

5.3 Aural alarms and visual indicators should be provided for calls other than distress, urgency and vital safety. The aural alarm may be capable of being disabled.

6. Information display and storage

6.1 At a called station the digital selective calling equipment should provide a visual indication of the following data:

6.1.1 type of a received call address (to all stations, to a group of stations, geographical, individual).

6.1.2 category.

6.1.3 identity of calling station.

6.1.4 numerical or alphanumerical type of information.

6.1.5 detected errors, if any.

6.2 Selective calling equipment should have as a minimum the capability to store at least 5 calls each equal in length to a complete distress message. The equipment should have the capability to store a distress message even if the storage capacity is fully utilized.

Note – The Director, CCIR, is requested to bring this Recommendation to the attention of IMCO.

RECOMMENDATION 543 *

THE USE OF A3A AND A3J EMISSIONS FOR DISTRESS AND SAFETY PURPOSES

(Question 26-1/8)

(1978)

The CCIR,

CONSIDERING

(a) that the use of classes of emissions A3A and A3J for distress and safety purposes provides substantial operational advantages, particularly in terms of power saving;

(b) that of these two classes of emissions, A3J provides greater spectrum utilization efficiency;

(c) that system frequency stability requirements for class A3A and A3J services are similar;

(d) that the development and operational use of class A3J has proved satisfactory;

(e) that maritime public correspondence radiotelephone services have adopted class A3J;

(f) that no substantial operational, technical or economic advantage accrues from the use of the class A3A;

(g) that it would be an unnecessary and unjustified complication to introduce two new classes of emission for distress and safety purposes;

(h) that the use of class A3J on 2182 kHz is under study,

UNANIMOUSLY RECOMMENDS

that class A3A emissions should not be used for distress and safety purposes.

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* This Recommendation should be brought to the attention of the International Civil Aviation Organization (ICAO) and the Inter-Governmental Maritime Consultative Organization (IMCO).

RECOMMENDATION 544 *

THE USE OF CLASS A3J EMISSIONS FOR DISTRESS AND SAFETY PURPOSES ON THE CARRIER FREQUENCIES 4125 kHz AND 6215.5 kHz

(Question 26-1/8)

(1978)

The CCIR,

CONSIDERING

(a) that the World Maritime Administrative Radio Conference, Geneva, 1974, recognized the need to supplement the radiotelephone distress frequency, 2182 kHz, in certain regions by the use of the carrier frequencies 4125 kHz and 6215.5 kHz;

(b) that in conditions of low shipping density, widely spaced coast stations and high medium frequency noise levels, a service has been successfully established using 4125 kHz and 6215.5 kHz for call, reply, distress and safety purposes;

(c) that these frequencies are not used for the two tone alarm signal, survival craft radio equipment and emergency position-indicating radio beacons (EPIRB);

(d) that communications on 4125 kHz and 6215.5 kHz are between coast stations and ship stations;

(e) that the frequency tolerance permitted in ship SSB transmitters is ± 50 Hz but ± 100 Hz for transmitters installed before 1 January 1978;

(f) that the maximum anticipated frequency translation error in a system between coast stations and ships is ± 300 Hz;

(g) that such a frequency translation error is within the range over which it has been proved that class A3J emission gives intelligibility equal to or better than that obtained with class A3H emission of equal peak envelope power;

(h) that the use of class A3J emissions for distress and safety purposes provide substantial operational advantages,

UNANIMOUSLY RECOMMENDS

that coast station A3J services should be introduced on the carrier frequencies 4125 kHz and 6215.5 kHz.

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* The Director, CCIR, is requested to bring this Recommendation to the attention of the International Civil Aviation Organization (ICAO) and the Inter-Governmental Maritime Consultative Organization (IMCO).

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DRAFT

RECOMMENDATION 439-2 (MOD I)*

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

(Question 31-1/8)

(1966 - 1974 - 1978)

The CCIR,

CONSIDERING

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

b) that Radio Regulations, Article 41(N38), Section I lays down the purpose and use of emergency position-indicating radio beacons (EPIRB) signals;

c) that inherent in the EPIRB is the capability to alert stations in the mobile service to the occurrence of a distress, especially in confined waters;

d) 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, 1974);

e) that all passenger ships and cargo ships of 300 gross tonnage and upwards are required to keep continuous watch at the frequency 2182 kHz by the International Convention for the Safety of Life at Sea (1974);

f) that the signal emitted by an EPIRB should be suitable for reception by a watch-keeping receiver with a loudspeaker;

g) that in accordance with Regulation 10, Chapter IV, of the International Convention for the Safety of Life at Sea (1974), a radiotelephone distress frequency watch receiver pre-set to this frequency shall be provided. The receiver shall be provided with a filtering unit or a device to silence the loudspeaker, if the latter is located on the bridge, in the absence of a radiotelephone alarm signal. The device shall be capable of being easily switched in and out and may be used when in the opinion of the captain, conditions are such that maintenance of the listening watch would interfere with the safe navigation of the ship;

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* The Director CCIR, is requested to transmit this Recommendation to the Inter-Governmental Maritime Consultative Organization (IMCO), the International Civil Aviation Organization (ICAO) and to the General Secretariat of the ITU.

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 search and rescue (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 IMCO Resolution No. A.383(X) provides that the distress watch receiver fitted with a muting device should respond to the radiotelephone alarm and the navigational warning signal and may, in addition, also respond to the type "L" EPIRB signal (Radio Regulations No. 3257 (6922/1476B)) and therefore the mute may not be lifted on all distress watch receivers by the type "L" EPIRB signal;

n) that the definition of the duty cycle of the 1300 Hz tone modulated emission (Radio Regulations No. 3257) (6922/1476B)) is not suitable for reliable operation of muted watch receivers only if there are specific national provisions;

o) that it is desirable that both types of beacons perform an alerting function;

p) that certain technical characteristics are defined in Appendix 37 to the Radio Regulations,

UNANIMOUSLY RECOMMENDS

1. that the keying signal for "L" type beacons should consist of a keyed emission modulated by a tone of 1300 Hz (± 20 Hz) having a period of emission of 1.0 to 1.2 s and a period of silence (carrier suppressed) of 1.0 to 1.2 s.; *

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

- when stowed, at least −20 °C to +55 °C;
- 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);

* Administrations are invited to study:

- the utilisation of the radiotelephone alarm signal for "L" type beacons and
- the possible need for, and consequences upon the dimensions of the device of an extension of the homing range of 2182 kHz EPIRBs.

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.

3. 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;

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

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

6. that the mechanical design of the beacons should be such that they are small, light-weight, floatable, water-tight and shock-resistant;

7. that Administrations are invited to propose amendments to provision No. 3257(6922/1476B) of the Radio Regulations at the next competent World Administrative Radio Conference.

DRAFT

RECOMMENDATION 476-2 (MOD I)

DIRECT-PRINTING TELEGRAPH EQUIPMENT IN THE MARITIME MOBILE SERVICE

(Question 5-2/8) (MOD I)

(1970 - 1974 - 1978)

The CCIR,

CONSIDERING

a) that there is a requirement to interconnect mobile stations, or mobile stations 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 different degrees 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 a lower transmission quality than that required for 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 the use of ARQ, another mode, i.e. the forward error-correcting (FEC) mode should 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,

UNANIMOUSLY 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 § 1 should meet the characteristics laid down in Annex I.

ANNEX I

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 CCITT International Telegraph Alphabet No. 2 at a modulation rate of 50 bauds.

1.4 The frequency shift on the radio link is 170 Hz. When frequency shift is effected by applying audio signals to the input of a transmitter, the centre frequency of the audio spectrum offered to the transmitter should be 1700 Hz. *

* A number of equipments are presently in service, using a centre frequency of 1500 Hz. These may require special measures to achieve compatibility.

2. Table of conversion

2.1 Traffic information signals

No.	Letter	Figures	International Telegraph Alphabet No. 2 Code	Emitted 7-unit signal (1)
1	A	—	ZZAAA	BBBYYYB
2	B	?	ZAAZZ	YBYYBBB
3	C	:	AZZZA	BYBBBYY
4	D	⊠ (3)	ZAAZA	BBYYBYB
5	E	3	ZAAAA	YBBYBYB
6	F	(2)	ZAZZA	BBYBBYY
7	G	(2)	AZAZZ	BYBYBBY
8	H	(2)	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) At present unassigned (see CCITT Rec. F.1 C8). Reception of these signals, however, should not initiate a request for repetition.

(3) The pictorial representation shown is a schematic of ✤ which may also be used when equipment allows (CCITT Rec. F1).

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 repetition	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 Master and slave arrangements

3.1.1.1 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, regardless of which station, at any given time, is the Information Sending Station (ISS) or Information Receiving Station (IRS);

3.1.1.2 the clock in the master station controls the entire circuit (see circuit timing diagram, Fig. 1);

3.1.1.3 the basic timing cycle is 450 ms, and for each station consists of a transmission period followed by a transmission pause during which reception is effected;

3.1.1.4 the master station transmitting time distributor is controlled by the clock in the master station;

3.1.1.5 the slave station receiving time distributor is controlled by the received signal;

3.1.1.6 the slave station transmitting time distributor is phase-locked to the slave station receiving time distributor; i.e. the time interval between the end of the received signal and the start of the transmitted signal (t_E in Fig. 1) is constant;

3 1.1.7 the master station receiving time distributor is controlled by the received signal.

3.1.2 The Information Sending Station (ISS)

3.1.2.1 Groups the information to be transmitted into blocks of three characters (3 x 7 signal elements);

3.1.2.2 emits a "block" in 210 ms after which a transmission pause of 240 ms becomes effective, retaining the emitted block in memory until the appropriate control signal confirming correct reception by the Information Receiving Station (IRS) has been received;

---

* See § 2.2.

3.1.2.3 numbers successive blocks alternately "Block 1" and "Block 2" by a local numbering device, the numbering being interrupted at the reception of:

- a request for repetition;
- a mutilated signal;
- a control signal 3; *

3.1.2.4 emits the information of Block 1 on receipt of control signal 1; *

3.1.2.5 emits the information of Block 2 on receipt of control signal 2; *

3.1.2.6 emits a block of three "signal repetitions" on receipt of a mutilated signal.

3.1.3 <u>The Information Receiving Station (IRS)</u>

3.1.3.1 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 and 3.1.2.5)

3.1.3.2 after the reception of each block, emits one of the control signals of 70 ms duration after which a transmission pause of 380 ms becomes effective;

3.1.3.3 emits the control signal 1 at the reception of:

- an unmutilated "Block 2",
- a mutilated "Block 1",
- Block 1" containing at least one "signal repetition";

3.1.3.4 emits the control signal 2 at reception of:

- an unmutilated "Block 1",
- a mutilated "Block 2",
- a "Block 2" containing at least one "signal repetition".

---

* See § 2.2.

3.1.4 Phasing

3.1.4.1 When no circuit is established, both stations are in the "stand-by" position. In this stand-by 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,

- 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 stand-by 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 §§ 3.1.2.4 and 3.1.2.5.

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 "stand-by" 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 initiates rephasing along the same lines as laid down in § 3.1.4;

3.1.5.2 if, at the time of interruption, the slave station was in the IRS position, the control signal to be returned after phasing should be the same as that last sent before the interruption to avoid the loss of an information block upon resumption of the communication;****

---

* 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 Recommendation 491).

*** A preferable predetermined time would be the duration of 32 cycles of 450 ms.

**** Some existing equipments may not conform to this requirement.

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;

3.1.5.4 if rephasing has not been accomplished within the time-out interval of § 3.1.8.1, the system reverts to the stand-by position and no further rephasing attempts are made.

3.1.6 Change over

3.1.6.1 The Information Sending Station (ISS)

- Emits, to initiate a change in the direction of the traffic flow, the information signal sequence "Figure shift" – "Plus" ("Z") – "Question Mark" ("B") followed, if necessary, by one or more "Idle Signals β" to complete a "Block";

- emits, on receipt of a control signal 3, a block containing the signals "Idle Signal β" – "Idle Signal α" – "Idle Signal β";

- changes subsequently to IRS after the reception of a "signal repetition".

3.1.6.2 The Information Receiving Station (IRS)

- Emits the control signal 3:

  a) when the station wishes to change over to ISS,

  b) 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;

- changes subsequently to ISS after reception of a block containing the signal sequence "βαβ";

- emits one "signal repetition" as a master station, or a block of three "signal repetitions" as a slave station, after being changed into ISS;

3.1.7 Output to line

3.1.7.1 the signal offered to the line output terminal is a 5-unit start-stop signal at a modulation rate of 50 bauds.

3.1.8 Answerback

3.1.8.1 The signal information character ⊠(upper case "D") is used to request terminal identification.

3.1.8.2 The Information Receiver Station (IRS), on receipt of a block containing the signal information character ⊠(upper case "D") which will actuate the teleprinter answerback code generator:

— changes the direction of traffic flow in accordance with § 3.1.6.2;

— transmits the signal information characters derived from the teleprinter answer-back code generator;

— changes the direction of traffic flow in accordance with § 3.1.6.1.

3.1.9 End of communication

3.1.9.1 When reception of information blocks or of control signals is continuously mutilated, the system reverts to the "stand-by" position after a predetermined time of continuous repetition, * which causes the termination of the established circuit;

3.1.9.2 the station that wishes to terminate the established circuit transmits an "end of communication signal";

3.1.9.3 the "end of communication signal" consists of a block containing three "Idle Signal α" signals;

3.1.9.4 the "end of communication signal" is transmitted by the ISS;

3.1.9.5 if an IRS wishes to terminate the established circuit it has to change over to ISS in accordance with § 3.1.6.2;

3.1.9.6 the IRS that receives an "end of communication signal" emits the appropriate control signal and reverts to the "stand-by" position;

3.1.9.7 on receipt of a control signal that confirms the unmutilated reception of the "end of communication signal", the ISS reverts to the "stand-by" position;

3.1.9.8 when after a predetermined number of transmissions ** of the "end of communications" signal no control signal has been received confirming the unmutilated reception of the "end of communication signal", the ISS reverts to the stand-by position and the IRS times out in accordance with § 3.1.9.1.

---

* A preferable predetermined time would be the duration of 64 cycles of 450 ms.

** A preferable predetermined number would be four transmissions of the "end of communications" signal.

3.2 Mode B, forward error correction (FEC) (see Figs. 3 and 4)

A synchronous system, transmitting an uninterrupted stream of characters from a station sending in the collective B-mode (CBSS) to a number of stations receiving in the collective B-mode (CBRS), or from a station sending in the selective B-mode (SBSS) to one selected station receiving in the selective B-mode (SBRS).

3.2.1 The station sending in the collective or in the selective B-mode (CBSS or SBSS)

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 ms time space;

3.2.1.2 emits as a preamble to messages or to the call sign, alternately 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. At least four of these signal pairs (phasing signal 1 and phasing signal 2) should be transmitted.

3.2.2 The station sending in the collective B-mode (CBSS)

3.2.2.1 Emits during the breaks between two messages in the same transmission the phasing signals 1 and the phasing signals 2 in the RX and the DX position, respectively.

3.2.3 The station sending in the selective B-mode (SBSS)

3.2.3.1 Emits after the transmission of the required number of phasing signals (see § 3.2.1.2) the call sign of the station to be selected. This call sign is a sequence of four characters that represents the number code of the called station. This transmission takes place in the time diversity mode according to § 3.2.1.1;

3.2.3.2 emits the call sign and all further signals in a 3B/4Y ratio, i.e. inverted with respect to the signals in the Tables, of § 2 in the column "emitted 7-unit signal". Consequently, all signals, i.e. both traffic information signals and service information signals, following the phasing signals are transmitted in the 3B/4Y ratio;

3.2.3.3 emits the service information signal "Idle signal β" during the idle time between the messages consisting of traffic information signals.

3.2.4 The station(s) receiving in the collective or in the selective B-mode (CBRS or SBRS)

3.2.4.1 Checks both characters (DX and RX), printing an unmutilated DX or RX character, or printing an error symbol or space, if both are mutilated.

---

* See § 2.2.

3.2.5 Phasing

3.2.5.1 When no reception takes place, the system is in the "stand-by" position as laid down in § 3.1.4.1;

3.2.5.2 on receipt of the sequence "phasing signal 1" – "phasing signal 2", or of the sequence "phasing signal 2" – "phasing signal 1", in which phasing signal 2 determines the DX and phasing signal 1 determines the RX position, and at least one further phasing signal in the appropriate position, the system changes from "stand-by" to the CBRS position;

3.2.5.3 when started as CBRS the system changes to the SBRS (selectively called receiving station) position on receipt of the inverted characters representing its selective call number;

3.2.5.4 having been changed into the CBRS or into the SBRS position the system offers continuous stop-polarity to the line output terminal until either the signal "carriage return" or "line feed" is received;

3.2.5.5 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;

3.2.5.6 both the CBRS and the SBRS revert to the stand-by position if, during a predetermined time, the percentage of mutilated signals received has reached a predetermined value.

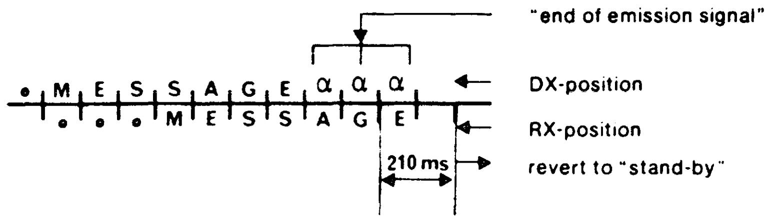
3.2.6 Output to line

3.2.6.1 The signal offered to the line output terminal is a 5-unit start-stop CCITT International Telegraph Alphabet No. 2 signal at a modulation rate of 50 bauds.

3.2.7 End of emission

3.2.7.1 The station sending in the B-mode (CBSS or SBSS) that wishes to terminate the emission transmits the "end of emission signal";

3.2.7.2 the "end of emission signal" consists of three consecutive "idle signals α" * transmitted in the DX position only, immediately after the last transmitted traffic information signal in the DX position, after which the station terminates its emission and reverts to the "stand-by" position;



3.2.7.3 the CBRS or the SBRS reverts to the "stand-by" position not less than 210 ms after receipt of at least two consecutive "idle signals α" in the DX position.

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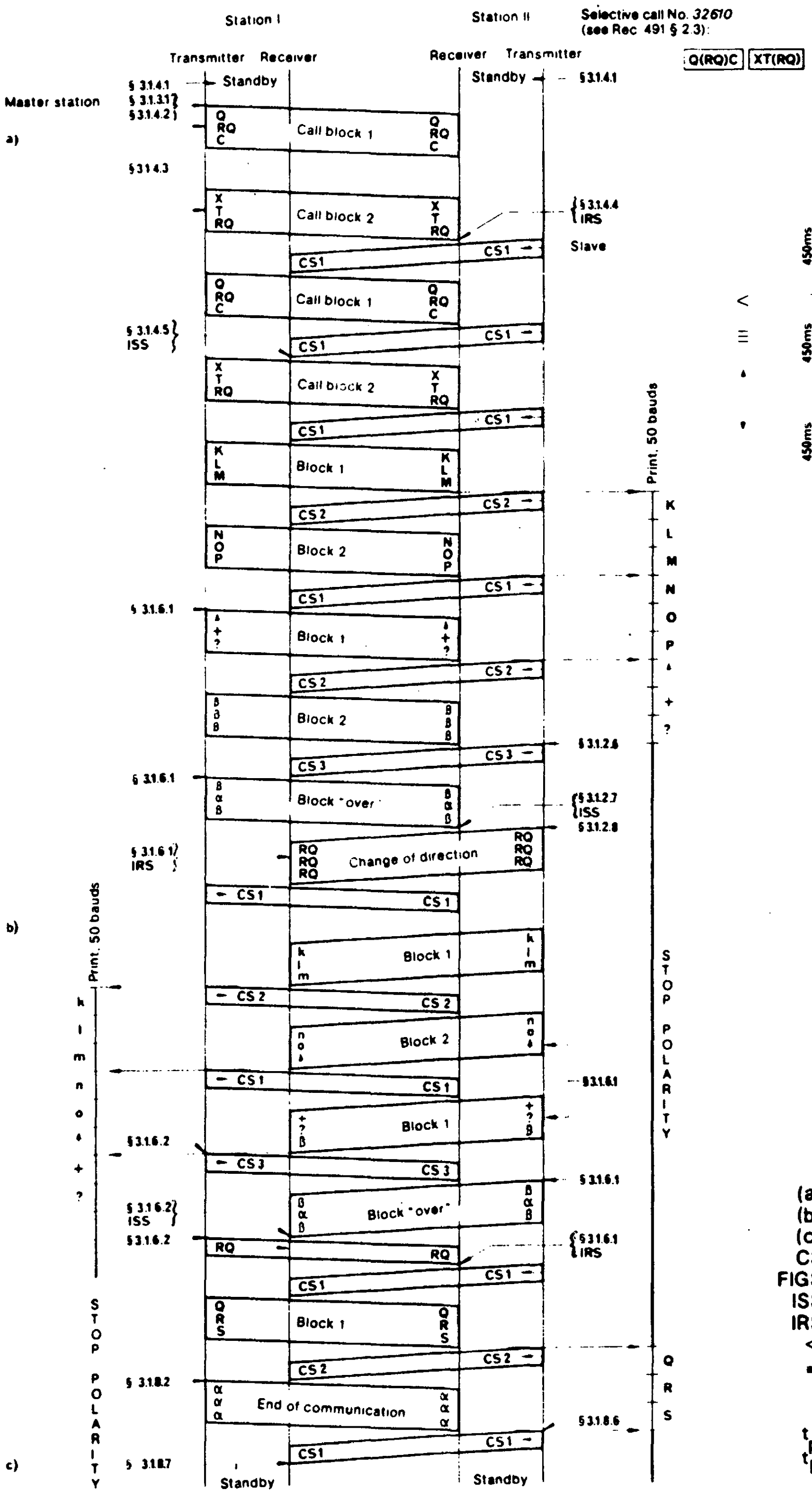
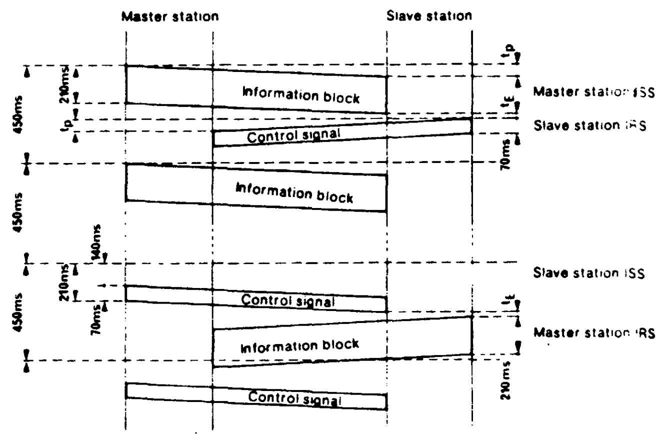
* See § 2.2.





Basic timing cycle

FIGURE 1 – *A-Mode operation*

(a): Start of communication
(b): Change of the direction of the traffic flow
(c): End of communication
CS: Control signal
FIGS: Figure shift
ISS: Information sending station
IRS: Information receiving station
<: Carriage return
≡: Line feed
↑: Figure shift
↓: Letter shift
t_p: (One way) progation time
t_E: (Fixed) equipment delay

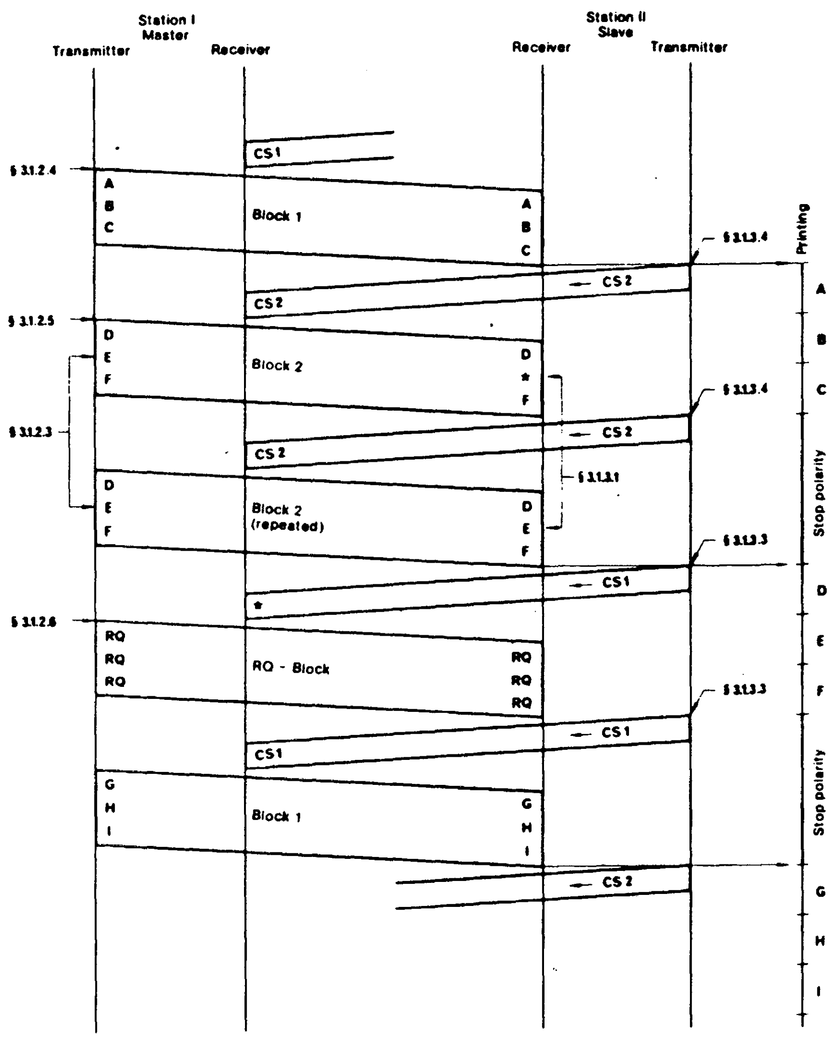


FIGURE 2 - *Mode A under error receiving conditions*

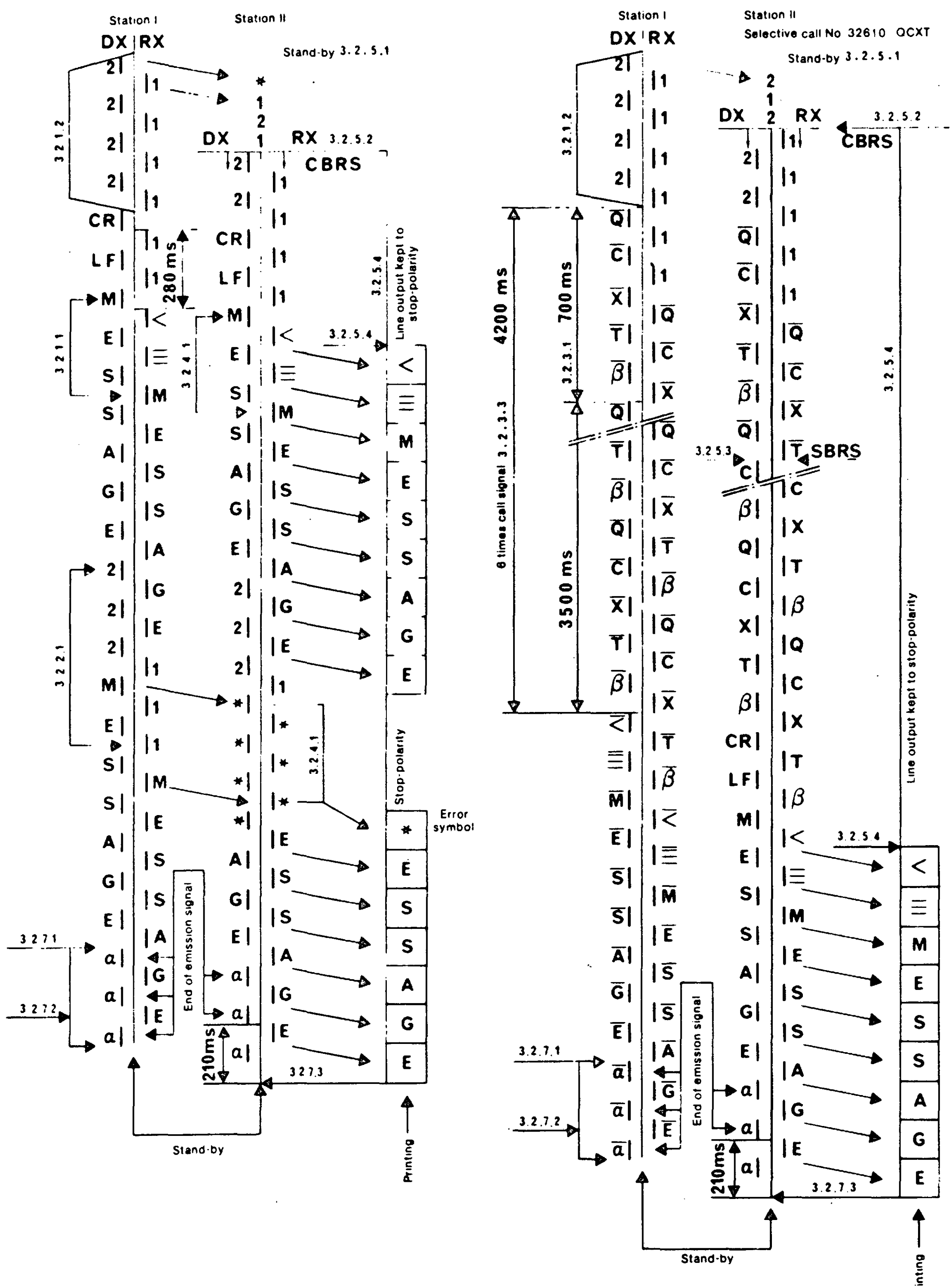


FIGURE 3 – *B-mode operation*

Collectively
1: Phasing signal 1
2: Phasing signal 2
<: Carriage return (CR)
▬: Line feed (LF)
•: Detected error symbol

Selectively
CBSS: B-mode – Sending collectively
CBRS: B-mode – Receiving collectively
SBSS: B-mode – Sending selectively
SBRS: B-mode – Receiving selectively

Overlined symbols (e.g. $\overline{M}$) are transmitted in the 3B/4Y ratio

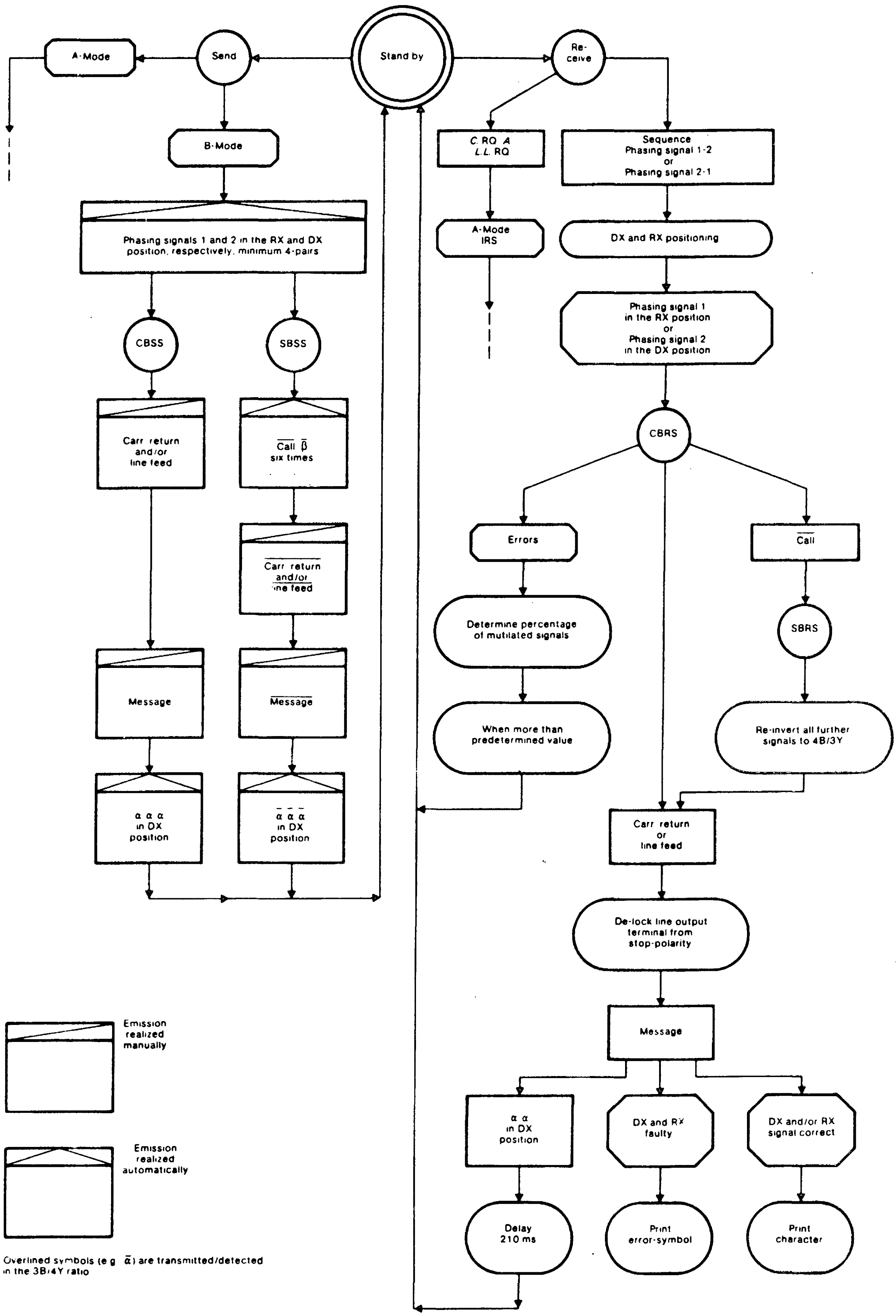


FIGURE 4 – *Flow chart showing processes in B-Mode operation*

DRAFT

RECOMMENDATION 493-1 * (MOD I)

DIGITAL SELECTIVE-CALLING SYSTEM FOR USE IN THE MARITIME MOBILE SERVICE

(Question 9-3/8 (MOD I))

(1974 - 1978)

The CCIR,

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 maritime mobile service;

b) that the Inter-Governmental Maritime Consultative Organization (IMCO) has listed a number of operational requirements that should be taken into account when designing a general purpose selective-calling system;

c) that IMCO has recommended for the maritime mobile service that digital selective-calling be the only method of distress alerting and safety calling in the Future Global Maritime Distress and Safety System;

d) that neither the selective-calling system described in Recommendation 257-2, nor that forming part of the system described in Recommendation 476-2, can fully meet the IMCO 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 the system should be applicable to the maritime mobile service, both for international and national needs;

h) that it is desirable that the selective-calling system fulfil the requirements of all types of vessels desiring to use it,

UNANIMOUSLY RECOMMENDS

1. that, where there is a need for a general purpose digital selective-calling system, the system should have operational characteristics according to Annex I;

2. that equipment designed in accordance with § 1 above should meet the technical characteristics given in Annex II.

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* The Director, CCIR, is requested to bring this Recommendation to the attention of IMCO.

ANNEX I

OPERATIONAL CHARACTERISTICS

1. General

1.1 The format of a call sequence is:

format specifier	address	category	self-identification

message 1	message 2	...	end of sequence

1.2 The call sequence may be of variable length.

1.3 Provision should be made for call sequences of the following types:

1.3.1 distress calls;

1.3.2 calls other than distress calls;

1.3.3 "reply to received call" sequences.

1.4 The flow-charts illustrating the operation of the digital selective-calling system are shown in Fig. 1a and Fig. 1b.

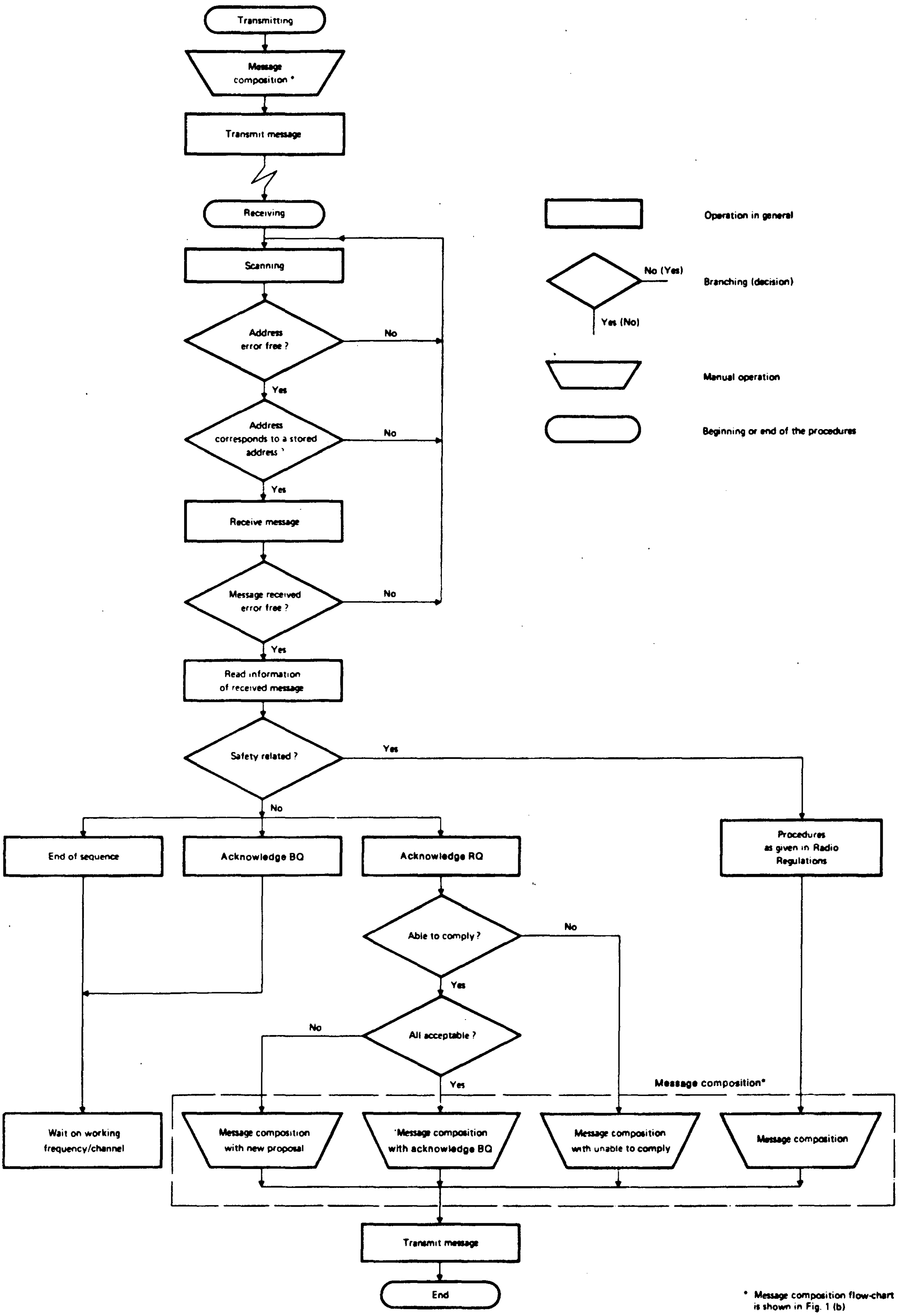


FIGURE 1-a – *Operational flow-chart*

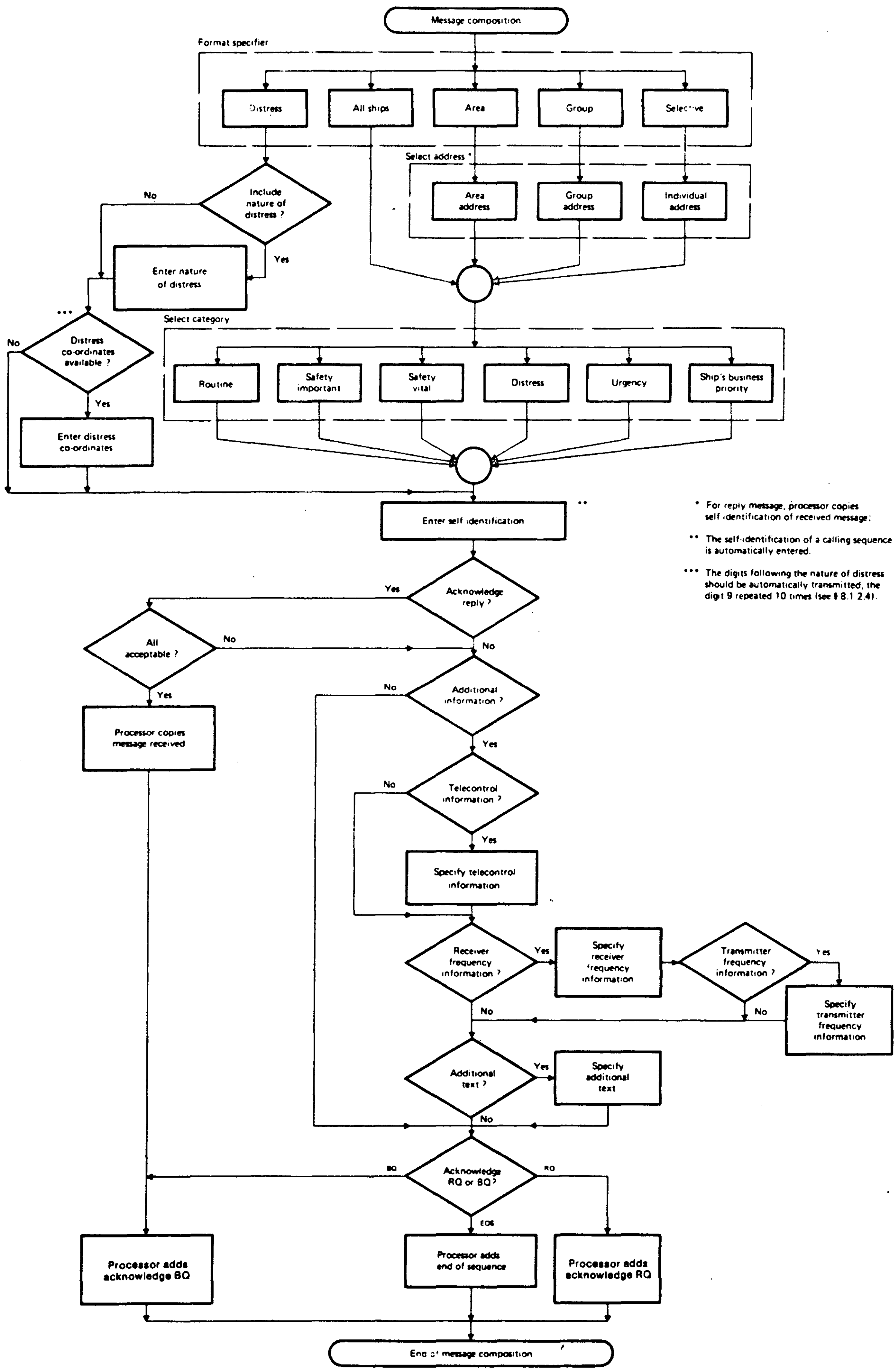


FIGURE 1-b – *Message composition flow-chart*

2. Format specifier

2.1 The format specifier indicates:

2.1.1 a "distress call" with an alphanumerical self-identification address; or

2.1.2 a "distress call" with a numerical self-identification address; or

2.1.3 an "all ships call"; or

2.1.4 a selective call with an alphanumerical address assigned:

2.1.4.1 either to an individual station; or

2.1.4.2 to a group of stations having a common interest; or

2.1.5 a selective call with a numerical address, assigned:

2.1.5.1 either to an individual station; or

2.1.5.2 to a group of stations having a common interest; or

2.1.6 a selective call directed to a group of ships in a particular geographical area; or

2.1.7 special sequences for automated VHF/UHF services (e.g. marking sequences, signalling sequences).

3. Address

3.1 For "distress calls" and "all ships calls" the address information is contained in the format specifier.

3.2 For other calls the address is:

3.2.1 the numerical, or alphanumerical identification or call sign of the called ship or coast station; or

3.2.2 the numerical, or alphanumerical identification assigned to a group of ships having a common interest; or

3.2.3 a numerical identification of a particular geographical area.

3.3 The "format specifier" indicates whether the address of the called station is numerical or alphanumerical (§ 2.1).

4. Category

4.1 For a "distress call" (Radio Regulations No. 3086(6767)) the category information is contained in the format specifier.

4.2 For other calls, the "category" information specifies:

4.2.1 the degree of priority of the call sequence:

4.2.1.1 distress (Radio Regulations 3134(6815));

4.2.1.2 urgency;

4.2.1.3 vital safety;

4.2.1.4 important safety;

4.2.1.5 ship business priority *;

4.2.1.6 routine;

4.2.1.7 ... (the possibility of adding up to five more categories later);

4.2.2 whether the self-identification of the calling station is numerical or alphanumerical.

5. Self-identification

5.1 The self-identification is the selective call (identification) of the calling station.

5.2 The self-identification is either numerical or alphanumerical as indicated by the "category" signal (§ 4.2.2).

---

* Proposed definition:

"Designating a call authorized by the ship owner or his agent requiring immediate handling on the ship."

This definition should be established by the ITU.

6. Messages

The messages that may be included in a call sequence may contain the following message elements, which are listed in the order in which they would appear in each message:

6.1 Distress information is part of a "distress call" and includes, in the following sequence:

6.1.1 an indication of the nature of the distress as follows:

6.1.1.1 fire, explosion;

6.1.1.2 flooding;

6.1.1.3 collision;

6.1.1.4 grounding;

6.1.1.5 listing, in danger of capsizing;

6.1.1.6 sinking;

6.1.1.7 disabled and adrift;

6.1.1.8 undesignated distress;

6.1.1.9 EPIRB emission;

6.1.1.10 (the possibility of adding up to 14 more indications of the nature of the distress).

6.1.2 an indication of one of the four quadrants: north-west, south-west, south-east, north-east;

6.1.3 the longitude in degrees and minutes;

6.1.4 the latitude in degrees and minutes;

6.1.5 the time in hours and minutes UTC;

6.1.6 ..., the possibility of additional information, to be decided later (e.g., frequency or channel information and indication of type of assistance requested).

6.2 Telecommand information which may include:

6.2.1 terminal control functions;

6.2.2 transmitter and receiver control functions;

6.2.3 special response functions;

6.2.4 ..., the possibility for expansion at a future time.

6.3 Frequency or channel information consisting of:

6.3.1 an actual frequency value, given in multiples of 100 Hz, or

6.3.2 a channel number.

Note. — If only one channel or frequency message element is used, this indicates the called station receive channel or frequency or a two-frequency (paired) channel. A second channel or frequency message element may be used to designate the called station transmit channel or frequency.

6.4 ..., (the possibility of additional information to be decided at a future time).

6.5 Acknowledgement

6.5.1 Acknowledge RQ

This message element is used if a confirmation of the call is required.

6.5.2 Acknowledge BQ

This message element designates the call as being the confirmation of a received call containing the "Acknowledge RQ" request.

7. End of sequence

The "end of sequence" signal terminates a particular call sequence and may be followed by a character that serves to check the entire sequence for the absence of undetected errors.

Note. — All coast stations which handle international traffic should include the error check character in the transmitted call sequences. It is recommended that ships engaged in international traffic also have this capability.

8. Protection against errors

8.1 For call sequences containing telecommand information intended to automatically control the communications equipment at the called station, the following requirements should apply:

8.1.1 the total transmission time of the call, including repetitions of the call sequence, should not exceed 30 s;

8.1.2 the probability of undetected errors in the call sequence should be less than 1 in 10^6, for any value of bit error probability at the receiving station;

8.1.3 in watch-keeping operation, including simultaneous multichannel monitoring in several frequency bands, the probability of receiving a false call resulting in the unintentional activation of radio transmitting equipment should be less than one such occurrence per year;

8.1.4 the probability of correct reception of the entire call sequence should be not less than 0.99 under receiving conditions characterized by a bit error probability of 1 in 10^2 or better.

ANNEX II

TECHNICAL CHARACTERISTICS

1. General

1.1 The system is a synchronous system using a ten-unit error-detecting code as listed in Table I of this Annex.

1.1.1 The first seven bits of the ten-unit code of Table I of this Annex are information bits. Bits 8, 9 and 10 indicate, in the form of a binary number, the number of B elements that occur in the seven information bits, a Y element being binary number 1 and a B element a binary number zero. For example, a BYY sequence for bits 8, 9 and 10 indicates 3 $(0 \times 4 + 1 \times 2 + 1 \times 1)$ B elements in the associated seven information bit sequence; and a YYB sequence indicates 6 $(1 \times 4 + 1 \times 2 + 0 \times 1)$ B elements in the associated seven information bit sequence.

1.2 Time diversity is provided in the call sequence as follows:

1.2.1 Apart from the phasing signals, each signal is transmitted twice in a time-spread mode; the first transmission (DX) of a specific signal is followed by the transmission of four other signals before the re-transmission (RX) of that specific signal takes place, allowing for a time-diversity reception interval of:

1.2.1.1 400 ms for HF and MF channels, and

1.2.1.2 33 1/3 ms for VHF radio-telephone channels.

1.2.2 For a call which includes repetition(s) of the call sequence (see § 8.1.1 of Annex I), Fig. 3c shows the transition between end of one call sequence and the start of the following call sequence.

1.3 The classes of emission, frequency shifts and modulation rates are as follows:

1.3.1 F1B, 170 Hz and 100 bauds for use on HF and MF channels. When frequency-shift keying is effected by applying audio signals to the input of single-sideband transmitters, the centre of the audio-frequency spectrum offered to the transmitter is 1700 Hz.

1.3.2 Frequency-modulation with frequency-shift keying of the modulating sub-carrier: shift of 800 Hz and 1200 bauds on the VHF telephony channels; the sub-carrier is at 1700 Hz.

1.3.3 The radio-frequency tolerances of both transmitters and receivers in the MF and HF bands should be:

Coast station ± 10 Hz

Ship station ± 10 Hz

Receiver bandwidth 200 to 270 Hz.

Initially the following tolerances could apply:

Coast station ± 15 Hz

Ship station ± 40 Hz

Receiver bandwidth 270 to 340 Hz.

1.4 The higher frequency corresponds to the B-state and the lower frequency corresponds to the Y-state of the signal elements.

1.5 The information in the call is presented as a sequence of seven-unit binary combinations constituting a primary code.

1.5.1 The seven information bits of the primary code express a symbol number from 0 to 127, as shown in Table I, and where:

1.5.1.1 the symbols from 0 to 99 are used to code two decimal figures according to Table IVa;

1.5.1.2 for alphanumerical address and self-identification information, the symbols according to Table IVb are used;

1.5.1.3 the symbols from 100 to 127 are used to code service commands.

1.6 Where the reliability requirements described in § 8.1 of Annex I apply, the following conditions are considered necessary:

1.6.1 the transmitter encoder must include the error check character (§ 11 of this Annex) and provide repetitive transmission of the call sequence, but within the limitation of § 8.1.1 of Annex I; and

1.6.2 the receiver decoder must provide maximal utilization of the received signal, e.g. by proper utilization of the error check character and by using an iterative decoding process with adequate memory provision.

2. Technical format of a call sequence

2.1 The technical format of the call sequence is:

dot pattern	phasing sequence	format specifier	address	category	self-identification

message 1	separator*	message 2	separator*	...	end of sequence	error check character

2.2 Examples of typical call sequences and the construction of the transmission format are given in Figs. 3, 4, 5 and 6 and in Tables IX, X and XI.

3. Dot pattern and phasing

3.1 The phasing sequence provides information to the receiver to permit correct bit phasing and unambiguous determination of the positions of the signals within a call sequence.

3.2 The phasing sequence consists of specific signals in the DX and RX positions transmitted alternatively. A minimum of four and a maximum of six DX signals are transmitted.

3.2.1 The phasing signal in the DX position is symbol 125 of Table I.

3.2.2 The phasing signals in the RX position specify the start of the information sequence (i.e. the format specifier) and consist of the signals for the symbols 111 *, 110 * 109, 108, 107, 106, 105 and 104 of the Table I, consecutively.

3.3 To allow for scanning methods to monitor several frequencies, the phasing sequence of § 3.2 should be preceded by a dot pattern (i.e., alternating B-Y sequence) with a duration of:

3.3.1 2 s for HF and MF channels

3.3.2 1 s for VHF channels.

---

* If required.

4. Format specifier

4.1 The format specifier signals are:

4.1.1 symbol No. 112 for a "distress call" followed by numerical self-identification, or

4.1.2 symbol No. 113 for a "distress call" followed by alphanumerical self-identification, or

4.1.3 symbol No. 116 for an "all ships call", or

4.1.4 symbol No. 114 for a selective call to a group of stations having a common interest (e.g. belonging to one particular country, or to a single shipowner, etc.) which has been assigned a numerical address, or

4.1.5 symbol No. 115 for a selective call to a group of stations having a common interest (see § 4.1.4) which has been assigned an alphanumerical address, or

4.1.6 symbol No. 120 for a selective call to a particular individual station which has been assigned a numerical address, or

4.1.7 symbol No. 121 for a selective call to a particular individual station which has been assigned an alphanumerical address, or

4.1.8 symbol No. 102 for a selective call to a group of ships in a particular geographic area,

4.1.9 symbol No. 110 for a special marking sequence (e.g. in the automated VHF/UHF service),

4.1.10 symbol No. 124, for special signalling sequences.

4.2 It is considered that receiver decoders must detect the format specifier signal in both the DX and RX positions for "distress calls" and "all ships calls" to effectively eliminate false alerting. For other calls, the address signals provide additional protection against false alerting and, therefore, single detection of the format specifier signal is considered satisfactory.

5. Address

5.1 "Distress calls" and "all ships calls" do not have addresses, since the address information is contained in the format specifier.

5.2 For a selective call directed to an individual ship or to a coast station, the address consists of the signals corresponding to the identification assigned to that station, as follows:

5.2.1 for a numerical identification, a sequence consisting of signals coded in accordance with Table IVa * or

5.2.2 for an alphanumerical identification, a sequence consisting of signals with symbol numbers corresponding to those indicated in Table IVb.

5.3 For a selective call directed to a group of ships the address should be constructed as follows:

5.3.1 for calls to ships in a particular geographic area a numerical geographic coordinates address consisting of either 6 or 8 digits (i.e., 3 or 4 characters), and is constructed as follows (see Fig. 2):

5.3.1.1 the designated geographic area will be a rectangle in Mercator projection;

5.3.1.2 the upper left-hand (i.e., north-west) corner of the rectangle is the reference point for the area;

---

* According to Appendix 43(CA) to the Radio Regulations, maritime mobile service identities are formed of a series of nine digits, consisting of 3 digits of the Nationality Identification Digits (NID) and six more digits.

These identifications are included in the address and self-identification parts of the call sequence and are transmitted as five signals $S_1S_2S_3S_4S_5$, comprising the ten digits of

(X_1, X_2) (X_3, X_4) (X_5, X_6) (X_7, X_8) and
(X_9, X_{10})

respectively, whereas digit X_{10} is always the figure 0 and reserved for future use.

Example:

NID X_4 X_5 X_6 X_7 X_8 X_9 being the ship station identity is transmitted by the digital selective calling equipment as:
(N, I) (D, X_4) (X_5, X_6) (X_7, X_8) $(X_9, 0)$.

5.3.1.3 the horizontal (i.e., west-to-east) and vertical (i.e., north-to-south) sides of the rectangle, $\Delta\lambda$ and $\Delta\varphi$, are specified in degrees if the coordinates of the reference point are given in degrees, and in tens of degrees if the coordinates of the reference are given in tens of degrees;

5.3.1.4 the first and second digits indicate $\Delta\varphi$ and $\Delta\lambda$, respectively;

5.3.1.5 the third digit indicates the azimuth sector in which the reference point is located, as follows:

5.3.1.5.1 quadrant NE is indicated by the digit "0",

5.3.1.5.2 quadrant NW is indicated by the digit "1",

5.3.1.5.3 quadrant SE is indicated by the digit "2",

5.3.1.5.4 quadrant SW is indicated by the digit "3",

5.3.1.6 the fourth, sixth and eighth digits indicate the longitude of the reference point in hundreds, tens, and units of degrees;

5.3.1.7 the fifth and seventh digits indicate the latitude of the reference point in tens and units of degrees;

5.3.1.8 the seventh and eighth digits, i.e., the fourth character, are not transmitted if the coordinates of the reference point (and consequently $\Delta\varphi$ and $\Delta\lambda$) are only specified in tens of degrees.

5.3.2 for calls to ships having a common interest, the signals with symbol numbers corresponding to the identification assigned to that group and in accordance with § 5.2.1 or § 5.2.2 above.

5.4 The "category" information following the address determines the end of the address part.

6. Category

6.1 The "category" information is coded as shown in Table III and defines:

6.1.1 the degree of priority of the call sequence and

6.1.2 whether the following self-identification address is in numerical or alphanumerical form.

7. Self-identification

7.1 Self-identification may be:

7.1.1 a numerical identification assigned to the calling station, coded as indicated in § 5.2.1, or

7.1.2 an alphanumerical identification of the calling station, coded as indicated in § 5.2.2.

7.2 The indication of the end of the "self-identification" information is constituted by:

7.2.1 the beginning of the "nature of distress" message in the case of a "distress call";

7.2.2 the beginning of the "telecommand" message in the case of other types of calls.

8. Messages

8.1 For a "distress call", the distress information is contained in two or three messages in the following order:

8.1.1 a "nature of distress" message, coded as shown in Table VII.

8.1.2 a "distress coordinates" message, consisting of ten digits coded on the principle described in § 1.5.1.1, in pairs, starting from the first and the second digits.

8.1.2.1 the first digit indicates the quadrant in which the incident has occurred, as follows:

8.1.2.1.1 quadrant NE is indicated by the digit "0",

8.1.2.1.2 quadrant NW is indicated by the digit "1",

8.1.2.1.3 quadrant SE is indicated by the digit "2",

8.1.2.1.4 quadrant SW is indicated by the digit "3".

8.1.2.2 The next five figures indicate the longitude in degrees and minutes.

8.1.2.3 The next four figures indicate the latitude in degrees and minutes.

8.1.2.4 If "distress coordinates" cannot be included, the 10 digits following the "nature of distress" should be automatically transmitted as the digit 9 repeated 10 times.

8.1.3 The time indication consisting of four digits coded on the principles described in § 1.5.1.1 and Table IVa starting from the first and second digits in pairs.

8.1.3.1 The first two digits indicate the time in hours.

8.1.3.2 The third and fourth digits indicate the part of the hour in minutes.

8.1.3.3 If the time cannot be included the four time indicating digits should be transmitted automatically as ′8 8 8 8′.

8.1.4 An optional signal to indicate the type of communication which is preferred by the station in distress for subsequent exchange. This one-character signal is coded as shown in Table Va.

8.2 For other types of calls, message 1 is the "telecommand" information (if used) and consists of one or two signals * coded as follows:

8.2.1 a one-symbol signal to indicate one of the types of communication as shown in Table Va;

8.2.2 if a station is unable to comply it sends back the telecommand signal "104" which may be followed by a second telecommand signal in accordance with Table Vb;

8.2.3 should it be necessary to transmit information in addition to the type of communication or to transmit other telecommand information, a two-symbol signal as shown in Table VI may be used.

8.3 The "frequency or channel information" always consists of three signals, "signal 1", "signal 2" and "signal 3", coded in accordance with Table IVa, indicating the actual frequency (in multiples of 100 Hz) or the channel number (see Table VIII).

8.3.1 Frequency information

The actual frequency in multiples of 100 Hz may only be indicated as such when the frequency is below 30 MHz. The three signals provide for the required six decimal digits. Signal 1 represents the units (U) and tens (T) of 100 Hz, signal 2 the hundreds (H) and thousands (M) and signal 3 the tens of thousands (TM) and hundreds of thousands (HM) of 100 Hz.

---

* This may be expanded, if necessary, to a maximum of three signals.

8.3.2 Channel information

8.3.2.1 HF and MF channels

If the HM digit is 3, this indicates that the number represented by the digits TM, M, H, T and U is the HF/MF channel number (either single frequency or two frequency channels).

8.3.2.2 If the HM digit is 8 this indicates that the number represented by the values of the digits M, H, T and U is the channel number on which the transmission takes place (own channel number).

If the HM digit is 9, this indicates that the number represented by the values of the digits M, H, T and U is the assigned or proposed VHF/UHF working channel number.

If the HM digit is 8 or 9, the values of the TM digit may be used to indicate up to ten types of VHF/UHF operations in accordance with Table VIII of Annex II to this Recommendation.

Note. — When the frequency message consists of both "receive" and "transmit" frequency or channel information no separator signal shall be used between these two elements.

9. Separator

The "separator" is the unique signal corresponding to symbol number 126 of Table I and is used to separate adjacent messages which are otherwise not distinguishable, i.e., when both adjoining messages are symbols 0 to 99 or both messages are symbols 100 to 124.

10. End of sequence

The "end of sequence" signal is one of the three unique signals corresponding to symbols 117, 122 and 127 as follows:

10.1 Symbol 117 if the call requires acknowledgement (Acknowledge RQ);

10.2 Symbol 122 if the sequence is an answer to a call that requires acknowledgement (Acknowledge BQ);

10.3 Symbol 127 for all other calls.

11. Error check character

The seven information bits of the error-check signal shall be equal to the least significant bit of the modulo-2 sums of the corresponding bits of all information characters (i.e., even vertical parity). The Format Specifier, the Separator and the End of Sequence characters are considered to be information characters. The phasing signals shall not be considered to be information characters. The error check character shall also be sent in the DX and RX positions.

TABLE I – *Ten-unit error-detecting code*

Symbol No.	Emitted signal
0	BBBBBBBYYY
1	YBBBBBBYYB
2	BYBBBBBYYB
3	YYBBBBBYBY
4	BBYBBBBYYB
5	YBYBBBBYBY
6	BYYBBBBYBY
7	YYYBBBBYBB
8	BBBYBBBYYB
9	YBBYBBBYBY
10	BYBYBBBYBY
11	YYBYBBBYBB
12	BBYYBBBYBY
13	YBYYBBBYBB
14	BYYYBBBYBB
15	YYYYBBBBYY
16	BBBBYBBYYB
17	YBBBYBBYBY
18	BYBBYBBYBY
19	YYBBYBBYBB
20	BBYBYBBYBY
21	YBYBYBBYBB
22	BYYBYBBYBB
23	YYYBYBBBYY
24	BBBYYBBYBY
25	YBBYYBBYBB
26	BYBYYBBYBB
27	YYBYYBBBYY
28	BBYYYBBYBB
29	YBYYYBBBYY
30	BYYYYBBBYY
31	YYYYYBBBYB
32	BBBBBYBYYB
33	YBBBBYBYBY
34	BYBBBYBYBY
35	YYBBBYBYBB
36	BBYBBYBYBY
37	YBYBBYBYBB
38	BYYBBYBYBB
39	YYYBBYBBYY
40	BBBYBYBYBY
41	YBBYBYBYBB
42	BYBYBYBYBB

B = 0
Y = 1

Symbol No.	Emitted signal
43	YYBYBYBBYY
44	BBYYBYBYBB
45	YBYYBYBBYY
46	BYYYBYBBYY
47	YYYYBYBBYB
48	BBBBYYBYBY
49	YBBBYYBYBB
50	BYBBYYBYBB
51	YYBBYYBBYY
52	BBYBYYBYBB
53	YBYBYYBBYY
54	BYYBYYBBYY
55	YYYBYYBBYB
56	BBBYYYBYBB
57	YBBYYYBBYY
58	BYBYYYBBYY
59	YYBYYYBBYB
60	BBYYYYBBYY
61	YBYYYYBBYB
62	BYYYYYBBYB
63	YYYYYYBBBY
64	BBBBBBYYYB
65	YBBBBBYYBY
66	BYBBBBYYBY
67	YYBBBBYYBB
68	BBYBBBYYBY
69	YBYBBBYYBB
70	BYYBBBYYBB
71	YYYBBBYBYY
72	BBBYBBYYBY
73	YBBYBBYYBB
74	BYBYBBYYBB
75	YYBYBBYBYY
76	BBYYBBYYBB
77	YBYYBBYBYY
78	BYYYBBYBYY
79	YYYYBBYBYB
80	BBBBYBYYBY
81	YBBBYBYYBB
82	BYBBYBYYBB
83	YYBBYBYBYY
84	BBYBYBYYBB
85	YBYBYBYBYY

Symbol No.	Emitted signal
86	BYYBYBYBYY
87	YYYBYBYBYB
88	BBBYYBYYBB
89	YBBYYBYBYY
90	BYBYYBYBYY
91	YYBYYBYBYB
92	BBYYYBYBYY
93	YBYYYBYBYB
94	BYYYYBYBYB
95	YYYYYBYBBY
96	BBBBBYYYBY
97	YBBBBYYYBB
98	BYBBBYYYBB
99	YYBBBYYBYY
100	BBYBBYYYBB
101	YBYBBYYBYY
102	BYYBBYYBYY
103	YYYBBYYBYB
104	BBBYBYYYBB
105	YBBYBYYBYY
106	BYBYBYYBYY
107	YYBYBYYBYB
108	BBYYBYYBYY
109	YBYYBYYBYB
110	BYYYBYYBYB
111	YYYYBYYBBY
112	BBBBYYYYBB
113	YBBBYYYBYY
114	BYBBYYYBYY
115	YYBBYYYBYB
116	BBYBYYYBYY
117	YBYBYYYBYB
118	BYYBYYYBYB
119	YYYBYYYBBY
120	BBBYYYYBYY
121	YBBYYYYBYB
122	BYBYYYYBYB
123	YYBYYYYBBY
124	BBYYYYYBYB
125	YBYYYYYBBY
126	BYYYYYYBBY
127	YYYYYYYBBB

TABLE II – *Format specifier*

Format	Symbol No.	Bit number 1	2	3	4	5	6	7	8	9	10
Distress call	112	0	0	0	0	1	1	1	1	0	0
	113	1	0	0	0	1	1	1	0	1	1
All ships call	116	0	0	1	0	1	1	1	0	1	1
Marking sequence	110	0	1	1	1	0	1	1	0	1	
Selective calls to:											
Individual ships	120	0	0	0	1	1	1	1	0	1	1
	121	1	0	0	1	1	1	1	0	1	0
Ships in a particular geographic area	102	0	1	1	0	0	1	1	0	1	1
Ships having a common interest	114	0	1	0	0	1	1	1	0	1	1
	115	1	1	0	0	1	1	1	0	1	0
Signalling in automated VHF/UHF service	124	0	0	1	1	1	1	1	0	1	0

Numerical format = 0 }
Alphanumerical format = 1 } → bit 1

Call sequence specifier → bits 3–8

TABLE III – *Category*

Category	Symbol No.	Bit number 1	2	3	4	5	6	7	8	9	10
Safety related:											
Distress	112	0	0	0	0	1	1	1	1	0	0
	113	1	0	0	0	1	1	1	0	1	1
Urgency	110	0	1	1	1	0	1	1	0	1	0
	111	1	1	1	1	0	1	1	0	0	1
Vital safety	108	0	0	1	1	0	1	1	0	1	1
	109	1	0	1	1	0	1	1	0	1	0
Important safety	102	0	1	1	0	0	1	1	0	1	1
	103	1	1	1	0	0	1	1	0	1	0
Others:											
Ships business priority	106	0	1	0	1	0	1	1	0	1	1
	107	1	1	0	1	0	1	1	0	1	0
Routine	100	0	0	1	0	0	1	1	1	0	0
	101	1	0	1	0	0	1	1	0	1	1

Numerical format = 0 }
Alphanumerical format = 1 } → bit 1

TABLE IVa – *Packing table for decimal numbers into ten-unit signals*

	The digits for the							
	Tens of millions D2	Millions D1	Hundreds of thousands D2	Tens of thousands D1	Thousands D2	Hundreds D1	Tens D2	Units D1
	Signal 4		Signal 3		Signal 2		Signal 1	

The digit sequence D2-D1 varies from 00 to 99 inclusive in each signal (signal 1 to 4 inclusive). The signal that represents a particular two-decimal figure is transmitted as the symbol number (see Table I) that is identical to that particular two-decimal figure. Signal 1 is the last signal transmitted.

When the number consists of an odd number of decimal digits, a zero shall be added in front of the most significant position to provide an integral number of ten-unit signals.

TABLE IVb – *Table of conversion for figures and letters in alphanumerical address and self-identification information*

Figures	Symbol No. (¹)	Letters	Symbol No. (¹)	Letters	Symbol No. (¹)
0	– 48	A	– 65	N	– 78
1	– 49	B	– 66	O	– 79
2	– 50	C	– 67	P	– 80
3	– 51	D	– 68	Q	– 81
4	– 52	E	– 69	R	– 82
5	– 53	F	– 70	S	– 83
6	– 54	G	– 71	T	– 84
7	– 55	H	– 72	U	– 85
8	– 56	I	– 73	V	– 86
9	– 57	J	– 74	W	– 87
		K	– 75	X	– 88
		L	– 76	Y	– 89
		M	– 77	Z	– 90

(¹) See Table I.

TABLE Va – *One-symbol telecommand signal*

Symbol No. (1)	Mode of operation	Class of emission	Additional equipment	Terminal equipment
100	Simplex	G3E		Telephone
101	Duplex	G3E		Telephone
105	Transceive	J3E	Lincompex	Telephone
106	Duplex			Data
107	Transceive	R3E	Lincompex	Telephone
109	Transceive	J3E		Telephone
111	Transceive	R3E		Telephone
113	Receive	F1B	(2)	Teleprinter ARQ
114	Transmit	F1B	(2)	Teleprinter ARQ
115	Transceive	F1B	(2)	Teleprinter ARQ
116	Receive	F1B		Teleprinter
118	Transmit	F1B		Teleprinter
119	Transceive	F1B		Teleprinter
120	Receive	A1A		Morse, tape recorder
123	Transceive	A1A		Morse
124	Receive	F1C, F2C, F3C		Phototelegraphy

(1) Symbols 102, 106, 108 and 110 are reserve combinations. Symbols 117, 122, 125, 126 and 127 should not be used.

(2) Equipment to increase transmission reliability, such as defined in draft Recommendation 476-2.

Symbol No.	Telecommand
103	Polling
104	Unable to comply
112	Distress relay
121	Ship's position or location register updating

TABLE Vb

Second telecommand signal when the first telecommand signal is "Unable to comply"

100	No reason given
101	Congestion at the Maritime Switching Centre
102	Busy
103	Queue indication, the queue number Q_1, Q_2 may follow (In TDMA configurations for VHF/UHF telephony only)
104	Station barred
105	No operator available
106	Operator temporarily unavailable
107	Equipment disabled
108	Unable to use proposed channel (a 4-digit alternative channel number may follow)
109	Reserve

TABLE VI – *Two-symbol telecommand signal*

Symbol No. of first telecommand character \ Symbol No. of second telecommand character	100	101	102	103	.	.	.	.	120	121	123	124
100												
101												
102												
103												
.												
.												
120												
121												
123												
124												

Note 1. – The assignment of specific functions is to be determined at a later date.

Note 2. – Symbols 117, 122, 125, 126 and 127 should not be used.

TABLE VII – *Nature of distress*

Nature of distress	Symbol No.
Fire, explosion	100
Flooding	101
Collision	102
Grounding	103
Listing, in danger of capsizing	104
Sinking	105
Disabled and adrift	106
Undesignated distress	107
EPIRB emission	112

Note. – Symbols 117, 122, 125, 126 and 127 should not be used for future expansion of this table.

TABLE VIII – *Frequency or channel information*

Frequency	0 1 2	X X X	X X X	X X X	X X X	X X X	The frequency in multiples of 100 Hz as indicated by the figures for the digits HM, TM, M, T, U.
Channels	3	X	X	X	X	X	The HF/MF channel number indicated by the values of the digits TM, M, H, T and U.
	8	X[1]	X	X	X	X	The ~~VHF~~ VHF/UHF own channel number ~~is~~ indicated by the values of the digits M, H, T and U.
	9	X[2]	X	X	X	X	The VHF/UHF assigned channel number indicated by the values of the digits M, H, T and U.
	HM	TM	M	H	T	U	
	signal 3		signal 2		signal 1		

Note. – **Signal 1 is the last signal transmitted.**

(1) May be used for power level control.

(2) Used in automated VHF/UHF services.

TABLE IX – *Use of symbol 100 to 127*

Symbol No.	Phasing and unique functions	Format specifier	Category	Nature of distress	Telecommand	Remarks
100			N / AN Routine	Fire, explosion	Simplex G3E (TP)	
101				Flooding	Duplex G3E (TP)	Request (from coast station): combination of 103 and Ack. RQ (117) Reply (from ship station): combination of 103 and Ack. BQ (122)
102		Geographical area	N / AN Important safety	Collision	*	
103				Grounding	Polling	
104	Phasing RX-0 position			Listing, in danger of capsizing	Unable to comply	
105	Phasing RX-1 position			Sinking	Transceive J3E (LCPX, TP)	
106	Phasing RX-2 position		N / AN Ship business priority	Disabled and adrift	Data transmission services	
107	Phasing RX-3 position			Undesignated distress	Transceive R3E (LCPX, TP)	
108	Phasing RX-4 position		N / AN Vital safety		*	
109	Phasing RX-5 position				Transceive J3E (TP)	
110	Phasing ** RX-6 position	Marking sequence	N / AN Urgency		*	
111	Phasing ** RX-7 position				Transceive R3E (TP)	
112		N / AN Distress	N / AN Distress	EPIRB emission	Distress relay	
113					Receive F1B (TTY-ARQ)	
114		N / AN Ships having common interest			Transmit F1B (TTY-ARQ)	
115					Transceive F1B (TTY-ARQ)	
116		All ships			Receive F1B (TTY)	
117	Ack. RQ (EOS)					
118					Transmit F1B (TTY)	Request (from coast station): combination of 121 and Ack. RQ (117) Reply (from ship station): combination of 121 and Ack. BQ (122) Registration (from ship station): combination of 121 and EOS (127)
119					Transceive F1B (TTY)	
120		N / AN Individual ships			Receive A1A (Morse TR)	
121					Ship's position or Location Register updating	
122	Ack. BQ (EOS)					
123					Transceive A1A (Morse TR)	
124		Signalling sequence in VHF/UHF service			Receive F1C, F2C, F3C (Photo)	
125	Phasing DX position					
126	Separator					
127	EOS					

AN: Alphanumerical format
N: Numerical format
*: Reserve
**: If required
LCPX: Lincompex
TP: Telephone
TR: Tape recorder
TTY: Direct printing
ARQ: Rec. 476-2 equipment
EPIRB: Emergency position-indicating radiobeacons
Photo: Phototelegraphy
EOS: End of sequence

TABLE X – *Call sequences of "distress call" and "all ships call"*

(1) Format specifier	(*n*) Address	(1) Category	(*n*) Self-identification	Message			(1) EOS	(1) ECC
				1	2	3--------*n**		
Distress call 112/113	————	————	N/AN 00--------99	(1) Nature of distress 100--------124	(5) Distress coordinates 00--------99	See § 6.1.5 of Annex I	127	ECC**
All ships call 116	————	Distress 112/113 Urgency 110/111 Vital Safety 108/109 Important Safety 102/103	N/AN 00--------99	(1-2) Telecommand 100--------124 except 117 and 122	(3-6) Frequency or channel 00--------99	See § 6.4 of Annex I	Ack. RQ 117 or Ack. BQ 122 or EOS 127	ECC

* See § 9 ("Separator") of Annex II.
** When the "Nature of distress" is "EPIRB emission", the call sequence does not have ECC.
(): Number of characters.
ECC: Error check character.
EOS: End of sequence.

TABLE XI – *Call sequences of selective calls*

<table>
<tr><th rowspan="2">(1)
Format specifier</th><th rowspan="2">(n)
Address</th><th rowspan="2">(1)
Category</th><th rowspan="2">(n)
Self-identification</th><th colspan="3">Message</th><th rowspan="2">(1)
EOS</th><th rowspan="2">(1)
ECC</th></tr>
<tr><th>1</th><th>2</th><th>3--------n**</th></tr>
<tr><td>Geographical area call
102</td><td rowspan="3">N*/AN
00--------99

see § 5.3
of Annex II</td><td rowspan="3">Distress
112/113
Urgency
110/111
Vital safety
108/109
Important safety
102/103
Ship business priority
106/107
Routine
100/101</td><td rowspan="3">N/AN
00--------99</td><td rowspan="3">(1-2)

Telecommand
100--------124
except
117 and 122</td><td rowspan="3">(3-6)

Frequency
or channel
00--------99</td><td rowspan="3">see § 6.4
of Annex I</td><td rowspan="3">Ack. RQ
117
or
Ack. BQ
122
or
EOS
127</td><td rowspan="3">ECC</td></tr>
<tr><td>Ships having common interest call
114/115</td></tr>
<tr><td>Individual call
120/121</td></tr>
</table>

* When the format specifier is "Geographical area" (102), the address is numerical format only.
** See § 9 ("Separator") of Annex II.
( ): Number of characters.
ECC: Error check character.
EOS: End of sequence.

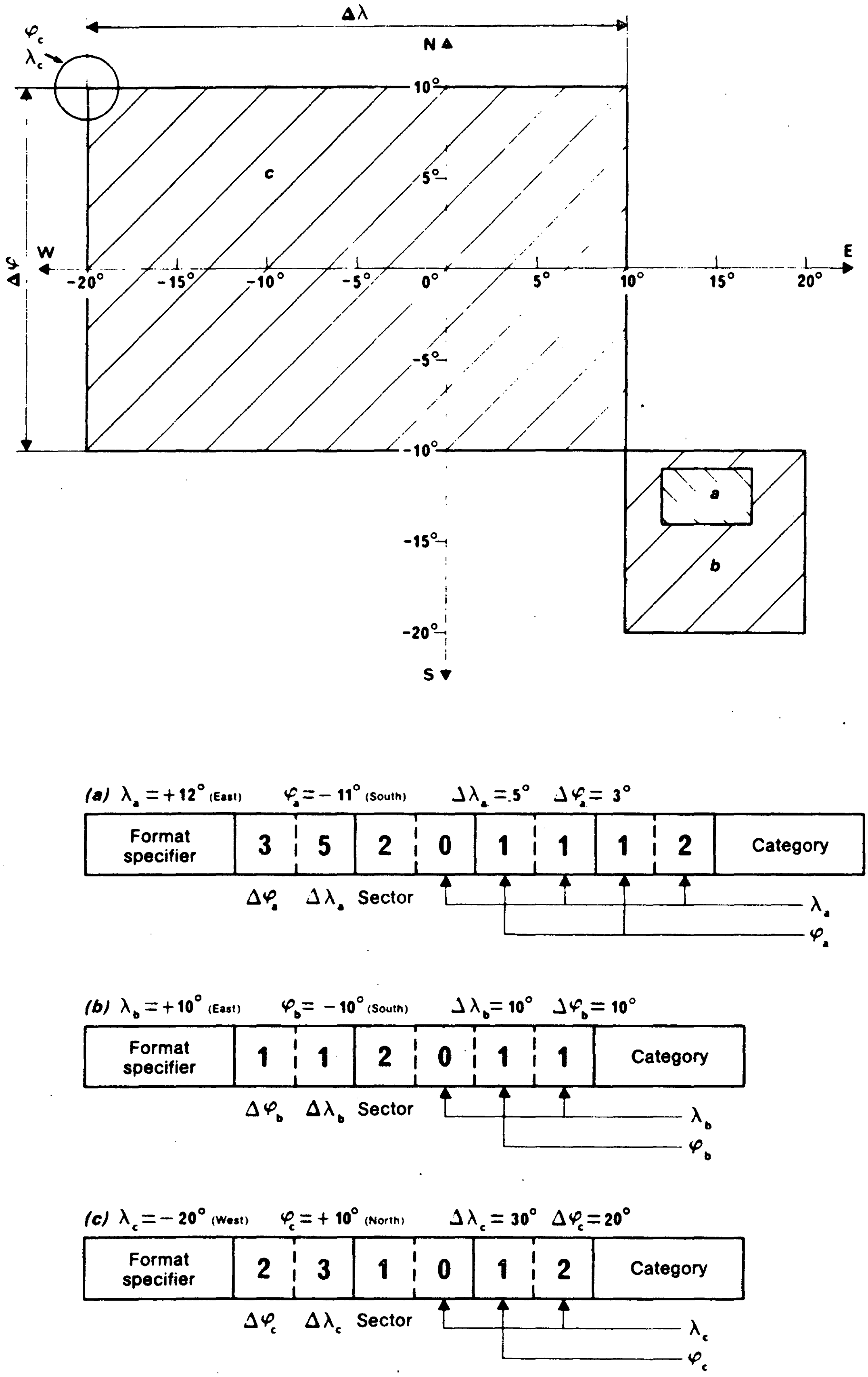
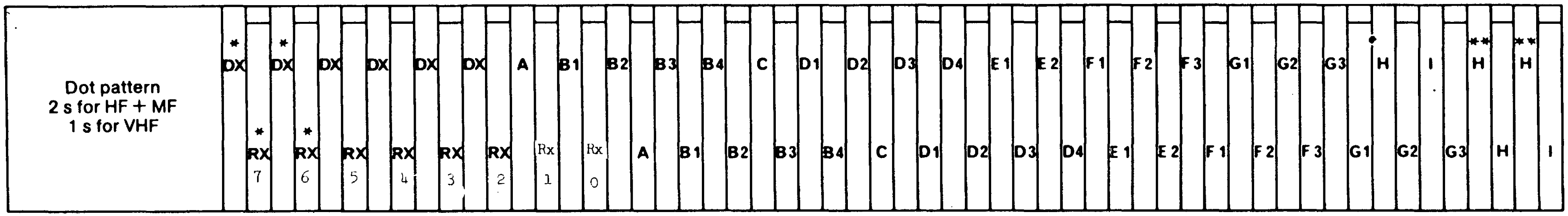


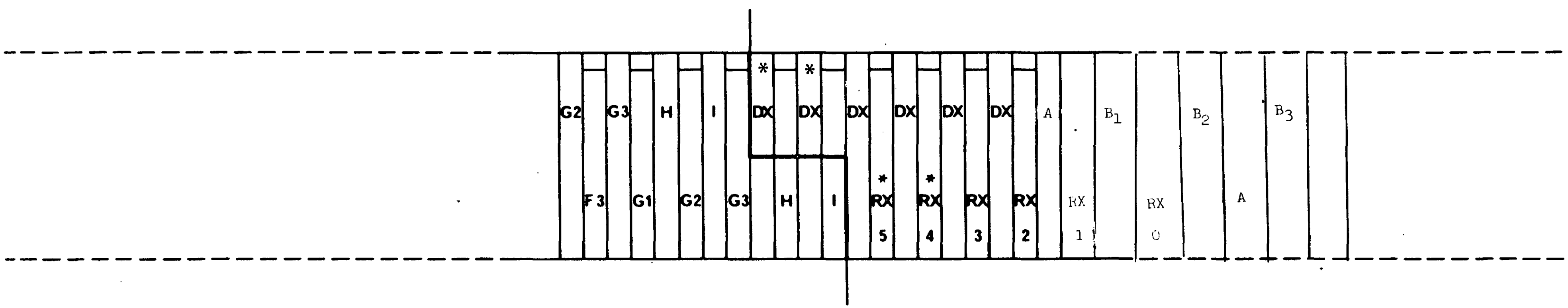
FIGURE 2 – *Geographic coordinates*

	DX/RX	A	B	C	D	E	F	G	H	I
Dot pattern	Phasing sequence	Format specifier 1 symbol	Called party address 4 symbols	Category 1 symbol	Self identification 4 symbols	Telecontrol message 2 symbols	Frequency message Element 1	Frequency message Element 2	End of sequence 1 symbol	Error check character 1 symbol

a) Technical format of a typical routine message



b) Transmission sequence corresponding to Fig. 3-a)



c) Transmission sequence for repetition of a call to the same address according to § 8.1.1 of Annex I

* The first two DX/RX pairs are deleted if a four-pair phasing-sequence is used.
** In these DX positions, any signals excluding symbol 125 may be transmitted.

FIGURE 3 – *Construction of call sequence*

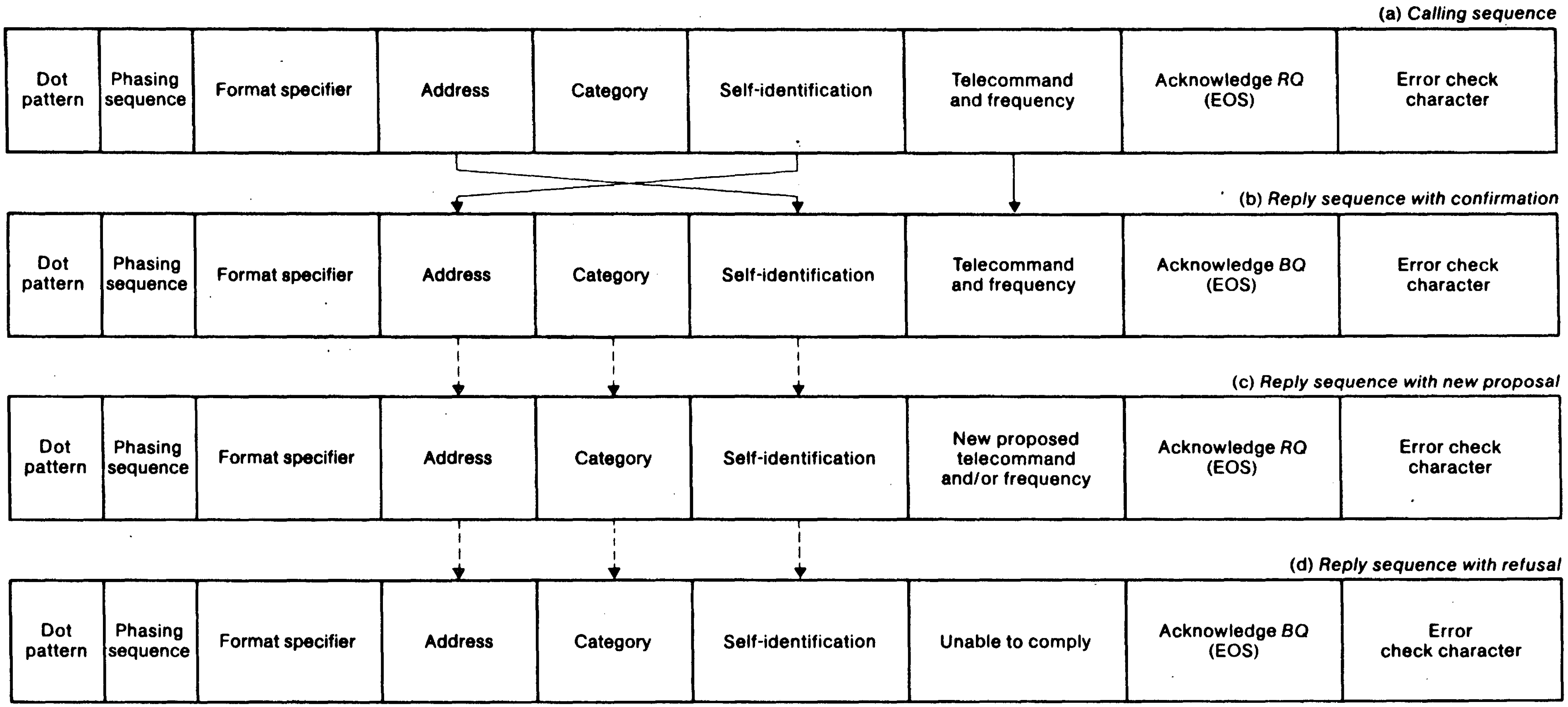


FIGURE 4 – *Examples of a calling sequence and reply sequences for typical individual calls*

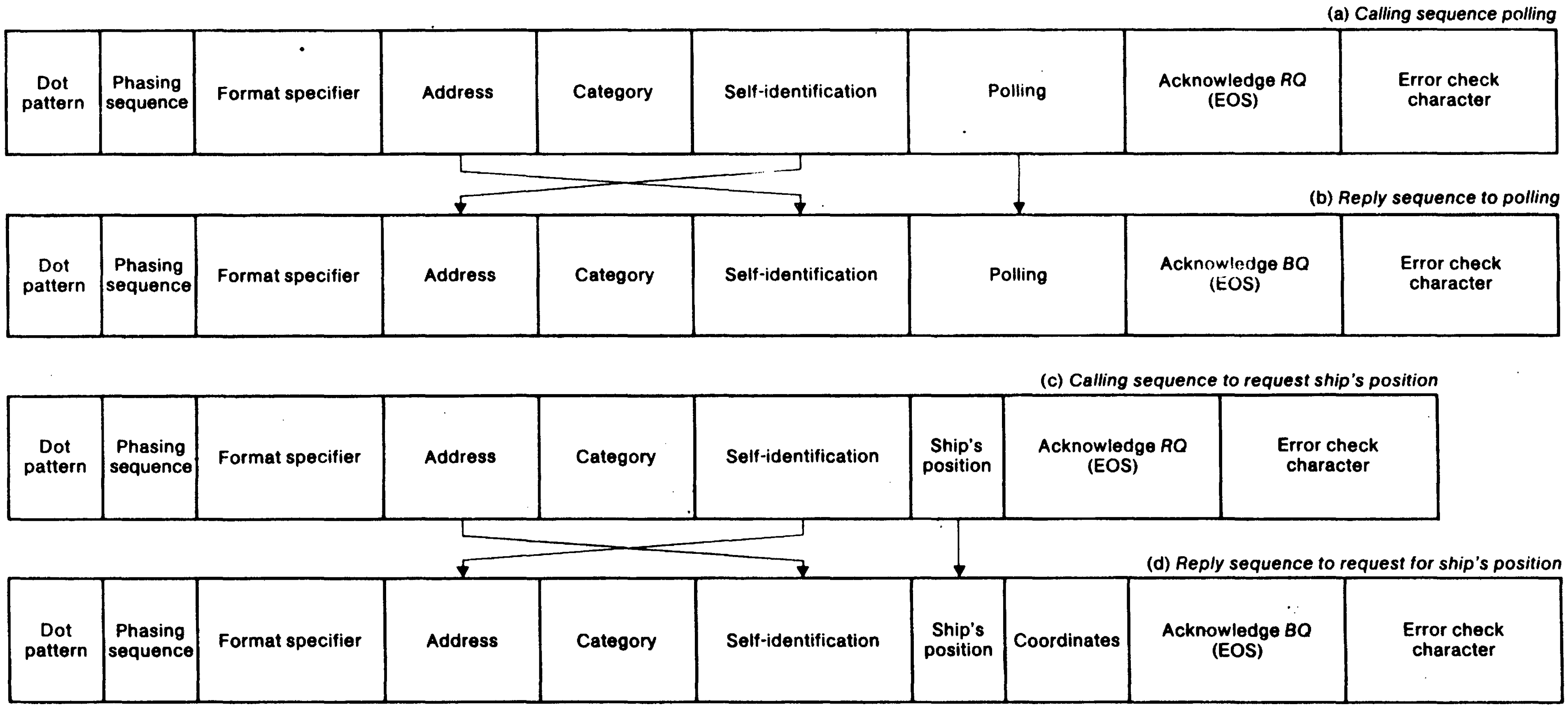


FIGURE 5 – *Calling sequences and reply sequences for polling and ship's position*

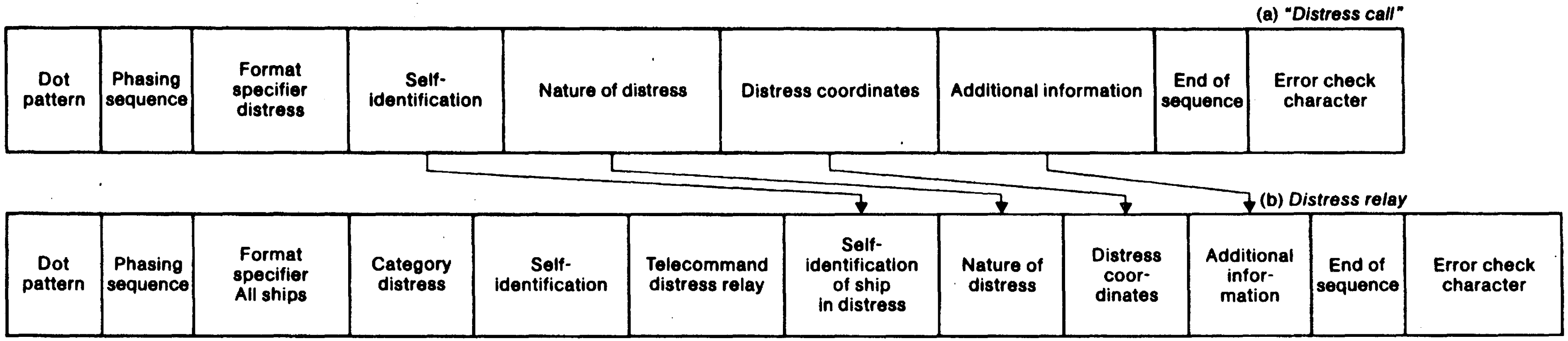


FIGURE 6 – *Sequences of "distress call" and distress relay call*

DRAFT

RECOMMENDATION 540 (MOD I) *

AUTOMATED DIRECT PRINTING TELEGRAPH SYSTEM FOR TRANSMISSION OF NAVIGATIONAL AND METEOROLOGICAL INFORMATION TO SHIPS

(Question 5-2/8)

(1978)

The CCIR,

CONSIDERING

a) that the availability of navigational and meteorological information on board ships is of great importance for safety;

b) that the existing radiocommunication system for transmission of navigational and meteorological information to ships can be improved by use of modern techniques;

c) that some Administrations have been developing a system to operate a service on the basis of narrowband direct printing;

d) that the system should be applicable to the maritime mobile service (both international and national);

e) that it is desirable that the service fulfils the requirements of all types of ships desiring to use it;

f) that operational procedures necessary for such a service should be agreed upon;

g) that the use of a standard technical format would facilitate the operation of the service,

UNANIMOUSLY RECOMMENDS

1. that narrowband direct-printing techniques be used for an automated telegraph system for transmissions of navigational and meteorological information to ships. Common frequencies for such transmissions should be internationally agreed upon **;

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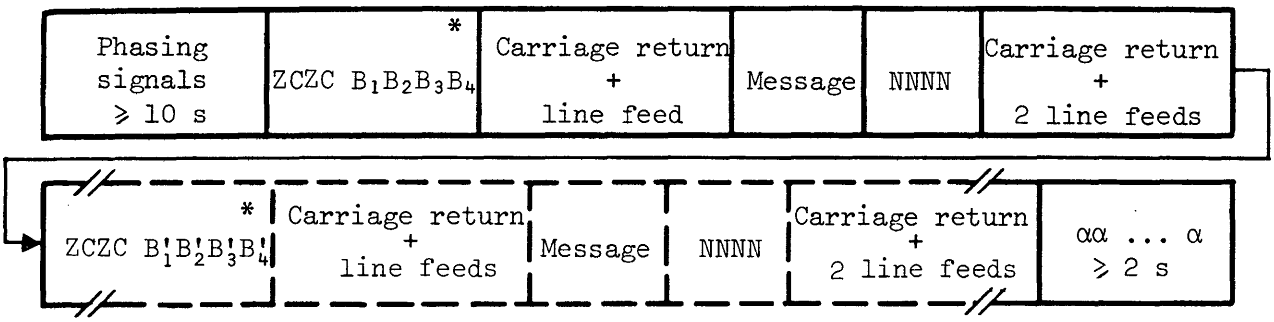
* The Director, CCIR, is requested to bring this Recommendation to the attention of the Inter-Governmental Maritime Consultative Organization (IMCO) and of the International Hydrographical Office (IHO).

** In Europe the frequency 518 kHz has been designated for this purpose.

2. that the signals transmitted should be in conformity with the collective B-mode of the direct printing system specified in CCIR Recommendation 476-2;

3. that the technical format of the transmission be as follows:



in which

ZCZC defines the end of the phasing period

B_1 is a character identifying the transmitter coverage area

B_2 is a unique character for each type of message as follows:

A: navigational warning,
B: gale warning,
C: ice report,
D: search and rescue information,
E: weather forecast,
F: pilot message,
G: Decca message,
Z: No message on hand,
H to Y: reserve indications to be defined later,
B_3B_4 is a two-character serial number for each B_2 starting with 01;

* This block need not be printed.

4. that the printer should only be activated if the preamble B_1–B_4 is received without errors;

5. that facilities should be provided to avoid printing of the same message several times on the same ship, when such a message has already been satisfactorily received;

6. that the necessary information for the measures under § 5 above be deduced from the sequence $B_1B_2B_3B_4$ and from the message;

7. that a message should always be printed if B_3B_4 = 00;

8. that extra (redundant) letter and figure shifts should be used in the message to reduce garbling;

9. that, in case a message is repeated by another transmitting station (e.g. for better coverage) the original preamble B_1–B_4 should be used;

10. that the equipment on board ships should be neither unduly complex nor expensive.

DRAFT

RECOMMENDATION 545 * (MOD I)

THE CHOICE OF FREQUENCIES IN THE MARITIME MOBILE BANDS ABOVE 1605 kHz TO BE RESERVED FOR DISTRESS AND SAFETY PURPOSES

(Question 44/8)

(1978)

The CCIR,

CONSIDERING

a) that the WMARC, Geneva 1974, recognized the need to supplement the radio-telephone distress frequency, 2182 kHz, in certain regions by the use of the carrier frequencies 4125 kHz and 6215.5 kHz;

b) that in conditions of low shipping density, widely spaced coast stations and high noise levels on the medium frequency bands, a service has been successfully established using 4125 kHz and 6215.5 kHz for call, reply, distress and safety purposes;

c) that studies by IMCO and CCIR for a Future Global Maritime Distress and Safety System at sea indicate that this will require additional frequencies;

d) that studies undertaken have concluded that a frequency allocation in each of the 2, 4, 6, 8, 12 and 16 MHz bands, using J3E class of emission, would be required to provide an adequate communication capacity for a global distress and safety system,

UNANIMOUSLY RECOMMENDS

that to implement the Future Global Maritime Distress and Safety System:

1. the frequency of 2182 kHz and one frequency band in each of the 4, 6, 8, 12 and 16 MHz maritime mobile bands be allocated for distress and safety purposes;

2. the bandwidth for each allocation be sufficient to permit adjacent channels for narrow-band direct printing, radiotelephone using class J3E emission and digital selective calling, with guardbands in the order of one radiotelephone channel width at 2182 kHz and in the order of 1 kHz at each of the 4, 6, 8, 12 and 16 MHz allocations.

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* The Director, CCIR, is requested to bring this Recommendation to the attention of the Inter-Governmental Maritime Consultative Organization (IMCO) and the International Civil Aviation Organization (ICAO).

DRAFT

RECOMMENDATION AA/8

ASSIGNMENT AND USE OF MARITIME MOBILE SERVICE IDENTITIES

The CCIR,

CONSIDERING

a) the need for a unique ship identity for safety and telecommunication purposes;

b) the need for this identity to be usable in automatic systems;

c) that, in the interest of having a common address format for automatic systems, identities assigned to ship stations, coast stations and used for establishing group calls should be of a similar nature when transmitted over the radio path;

d) Article 25(N23) and Appendix 43(CA) of the Radio Regulations;

e) that it is highly desirable that the code which forms the ship identity or part thereof can be used by subscribers to the public switched networks for calling ships automatically;

f) that the public switched networks in some countries have restrictions, with respect to the maximum number of digits that may be dialled or keyed to indicate ship station identity;

g) that CCITT Recommendation E.210/F.120 describes a ship station identification method which provides for this contingency;

h) that whatever restrictions may be required should, in the interests of the development of automatic shore-to-ship operations, be as few as possible,

UNANIMOUSLY RECOMMENDS

1. that assignment of ship station identities should be in accordance with Annex I to this Recommendation;

2. that ship and coast stations using Morse telegraphy may continue to use existing alphanumeric call signs;

3. that ship and coast stations using digital selective-calling equipment in accordance with Recommendation 493-1 should use their 9-digit numerical identities transmitted as a 10-digit address/self-identity with a digit 0 added at the end of the identity;

4. that Administrations issuing 5-digit numbers according to Radio Regulation 2134(5390/738A) should, if possible, assign 9-digit numerical identities and 5-digit numbers in such a way that there is a clear relation between them;

5. that the present octal numbering system in use in an existing maritime mobile-satellite system should be converted as early as feasible to a decimal system with 9-digit ship station identities;

6. that any future international automatic maritime telecommunication system should be designed to use the 9-digit ship station identities on the radio path.

ANNEX I

ASSIGNMENT OF SHIP STATION IDENTIFICATION

1. Introduction

1.1 Every ship participating in the various maritime radio services shall be assigned a nine digit unique ship station identity in the format $N_1I_2D_3X_4X_5X_6X_7X_8X_9$ wherein the first three digits represent the Nationality Identification Digits.

1.2 Restrictions may apply with respect to the maximum number of digits which can be transmitted on some national telex and/or telephone networks for the purpose of ship station identification.

1.3 At present, the maximum number of digits that are able to be transmitted over the national networks of many countries for the purpose of determining ship station identity is six. The digits carried on the network to represent the ship station identity is referred to as the "ship station number" in this text and in the relevant CCITT Recommendation. The use of the techniques described below should make it possible for the coast stations of such countries to engage in the automatic connection of calls to ship stations.

1.4 To obtain the required nine digit ship station identity a series of trailing zeros is added to the ship station number by the coast station for shore-originated automatic services, e.g.:

SHIP STATION NUMBER	SHIP STATION IDENTITY
$N_1I_2D_3X_4X_5X_6$	$N_1I_2D_3X_4X_5X_60_70_80_9$

2. As long as the restrictions in § 1 apply in one's own network limiting ship station numbers to 6 digits, ships that intend to receive automatic network traffic from national coast stations only, should be assigned identities wherein X_9, but not X_8, = 0. This assumes that "9" is used to abbreviate the national NID for such ships for network purposes.

SHIP STATION NUMBER	SHIP STATION IDENTITY
$9\ X_4X_5X_6X_7X_8$	$N_NI_ND_NX_4X_5X_6X_7X_80_9$

$N_NI_ND_N$ are the Nationality Identification Digits of one's own country.*

If a country has more than one NID, only one may be used for this purpose.

* See also § 3.2 of CCITT Recommendation E.210/F.120.

3. As long as the restrictions in § 1 apply it may be useful for some Administrations to expand the capacity for numerical ship station identification by using as many as ten "8 Y" abbreviations for NIDs.

Such a technique may allow the assignment of ship station identities wherein trailing zeros are applied only to X_8 and X_9.

SHIP STATION NUMBER	SHIP STATION IDENTITY
8 Y $X_4X_5X_6X_7$	$N_1I_2D_3X_4X_5X_6X_7 0_8 0_9$

The usefulness of this technique to a given Administration may depend on whether its abbreviation (e.g. 83) of its own NID is duplicated in other Administrations in which some of its ships have a community of interest. When such is the case the ship in question can be called using the same ship station number in all the automatic networks of interest to that ship. As an example, a group of up to ten countries, with community of interest, might agree to assign the same abbreviation for their respective NIDs. The abbreviation should always relate to the numerically lowest NID, when more than one is assigned to a given country.

Country	"8 Y" Assignment
A	80
B	81
C	82
D	83
E	84
F	85
G	86
H	87
I	88
J	89

(All countries recognize a particular 8 Y abbreviation as associated with a particular country)

For example a coast station in any of the countries A to J receiving "83" as the first two digits of a ship station number would transmit the NID of country D.

4. As long as the restrictions in § 1 apply, ships that require regular automatic communications from foreign coast stations additional to those that may conform to the abbreviation arrangement noted in § 3 shall only be assigned ship station identities with $X_7X_8X_9$ = 000 to support 6 digit ship station numbers.

5. When it becomes necessary to progress to stage 2*, in the ship station identity scheme the format of ship station identities in § 4 would change from $N_1I_2D_3X_4X_5X_60_70_80_9$ to $N_1I_2D_3X_4X_5X_6X_70_80_9$. If "8 Y" abbreviations are used in stage 1** some ship station identity assignments will already have taken the $N_1I_2D_3X_4X_5X_6X_70_80_9$ format. It would therefore be useful to reserve at least one value in the X_7 digit position if ship station identity assignments are made on the basis of "8 Y" network abbreviations:

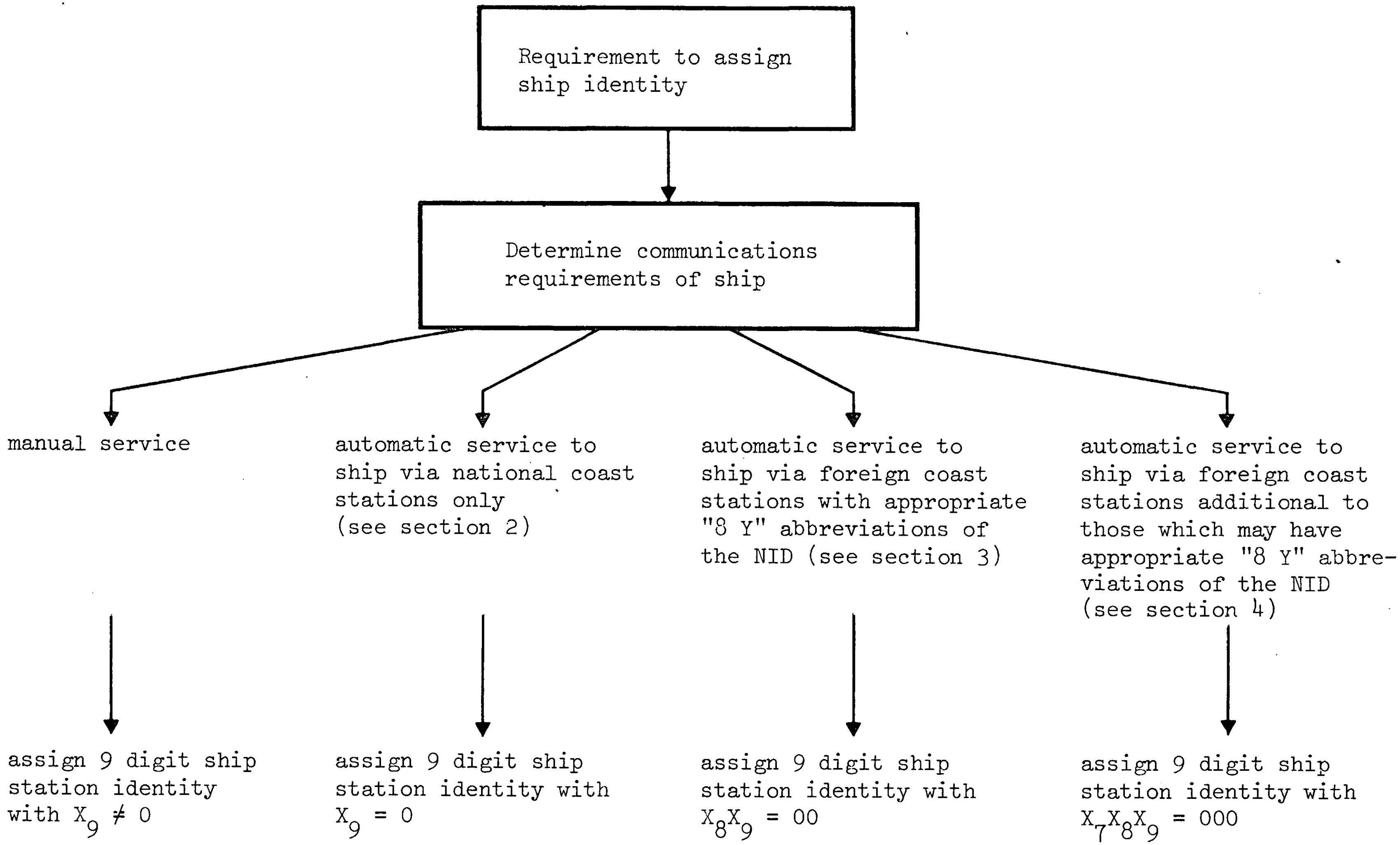
SHIP STATION NUMBER	SHIP STATION IDENTITY
8 Y $X_4X_5X_6X_7$	$N_1I_2D_3X_4X_5X_6X_70_80_9$

* Seven digit ship station numbers for automatic shore-originated traffic.

** Six digit ship station numbers for automatic shore-originated traffic.

FIGURE 1

Procedure for selecting numerical ship station identities as long as network restrictions apply



REPORT 586

EQUIVALENT POWERS OF DOUBLE-SIDEBAND AND SINGLE-SIDEBAND RADIOTELEPHONE EMISSIONS IN THE MARITIME MOBILE SERVICE

(1974)

1. General

In response to Question 19/8 the following documents of the period 1970-1974 were submitted to the Final Meeting of Study Group 8, Geneva, 1974: [CCIR, 1970-74a, b, c, d, e].

Since [CCIR, 1970-74c] 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 [CCIR, 1970-74a, b, d, e] together with the discussions on the Final Meeting of Study Group 8 have been taken into account in drafting §§ 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 25μV/m. Further, it assumes that this range will be obtained by a power in the antenna of 15 W (unmodulated carrier) with an antenna 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 World Administrative Radio Conference to deal with matters relating to 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 2182 kHz, which may be A3 or A3H, it has become necessary to specify the field strengths 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.

* 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:

3.1 The signal-to-noise ratio at the output of the demodulator is the same for all cases considered.

3.2 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.

3.3 Only fade-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.

4. General SSB/DSB system equivalences

Based on § 3.1 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 [CCIR, 1970-74a].

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 25μV/m at the receiver:

6.1 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 to arrive at the equivalent field strengths for the other classes of emission.

UNANIMOUSLY 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 amplitude of the sideband signal corresponding to 70% and 100% modulations is the same as that 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 amplitude of the sideband signal corresponding to 70% and 100% modulations is the same as that 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	r.m.s. field strength (μV/m) equivalent to the reference signal (see § 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.

7. Peak envelope power equivalences

The calculated equivalent peak envelope powers into the antenna necessary to achieve the field strengths given in § 6 are contained in Table I. 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 § 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 2182 kHz, because there are other important considerations not included in this Report.

Note. – The Director, CCIR, is requested to bring this Report to the attention of IMCO.

REFERENCES

CCIR Documents

[1970-74]: **a.** 8/177 (Germany (Federal Republic of)); **b.** 8/183 (United Kingdom); **c.** 8/199 (USA); **d.** 8/201 (USA); **e.** 8/202 (USA).

REPORT 745 *

THE CHOICE OF A FREQUENCY IN THE MARITIME MOBILE BANDS BETWEEN 1605 kHz AND 3800 kHz TO BE RESERVED FOR SAFETY REQUIREMENTS

(Question 29/8)

(1978)

1. Introduction

There are various technical, operational and economic aspects likely to affect the choice of a frequency in the bands between 1605 kHz and 3800 kHz to be reserved exclusively for distress, urgency and safety purposes. Some of the more important are:

- range and power budget requirements and propagation;
- survival craft antennae;
- homing facilities;
- operational considerations;
- medium range distress frequencies;
- existing equipment.

2. Range and power budget requirements and propagation

A frequency used for distress, urgency and safety purposes should be capable of providing reliable communication, throughout the 24 hours, over a certain distance. The International Convention for Safety of Life at Sea, 1960, specifies a daylight range of 150 nautical miles for ship's installations and for the purpose of this Report this distance is used. However, in distress situations, very low power transmitters are often used and the frequency should, if possible, be one which would provide the maximum possible range under such circumstances.

To achieve consistent communication throughout the 24 hours the optimum frequency should have adequate ground-wave coverage and be least affected, within the required range, by sky-wave propagation during the hours of darkness.

Fig. 1 shows the attenuation, relative to that at 500 kHz, for a range of frequencies, of the ground wave over a sea path.

3. Survival craft antennae

An antenna used in survival craft or with portable equipment will, over the frequency bands in question, be small in height compared with a wavelength. Such an antenna may be regarded as a short monopole above a conducting plane.

Under these circumstances, for a given radiated power, the lower the frequency used the greater becomes the voltage developed across the antenna insulator. Assuming that a typical dimension for a survival craft antenna is 3 metres and its capacitance is 27.5 pF, Fig. 2 shows the variation of base voltage with frequency for a number of radiated powers. With such small antenna systems it is difficult to achieve high antenna efficiency (radiated power relative to input power). For a given antenna, the problem worsens with a reduction in frequency.

* The Director, CCIR, is requested to draw the attention of IMCO to this Report and invite their comments on this matter.

4. Homing facilities

In order to provide rapid assistance to vessels in distress the frequency in use should be suitable for "homing" purposes by ships and aircraft.

Recommendation 428-2 indicates that the accuracy of homing can be degraded by sky-wave components and by re-radiation from various parts of a ship's superstructures. In the frequency bands between 1605 kHz and 3800 kHz generally, the higher the frequency the greater the effects of both sky-wave propagation and ship's superstructures on the accuracy of the results obtained.

5. Operational considerations

In some areas the use of MF radiotelephony for maritime safety purposes is increasing and in many areas the watch on the present MF radiotelephone distress frequency is very difficult because of the large number of routine traffic calls sent on that frequency.

On the other hand some Administrations believe that voice-calling should continue to be permitted on the distress frequency to increase the interest in listening and reduce the number of receivers required.

In the long term separate frequencies for safety purposes and for routine traffic calls would ensure that the use of each frequency was developed in the way most suited to the needs of the particular service.

There are, however, some other factors which should be taken into consideration. The VHF radiotelephone service is also expanding, probably at a faster rate than the MF service. It is therefore possible that much of the coast-to-shore traffic now handled on MF, both distress and calling, will in the future transfer to VHF. This is already the situation along the coast line in certain areas.

Watch is normally kept on a safety and distress frequency in the bands between 1605 kHz and 3800 kHz on the bridge of a ship. In order to minimize the effect of the noise level on a bridge it may be necessary to use either a "filtered" loudspeaker or a muted receiver *. In this case it may be necessary to arrange for urgency and safety signals either to lift the mute or pass through the filter. However, if a dedicated distress urgency and safety frequency, which had little background noise, was introduced it might be possible to use an open loudspeaker for watch-keeping purposes.

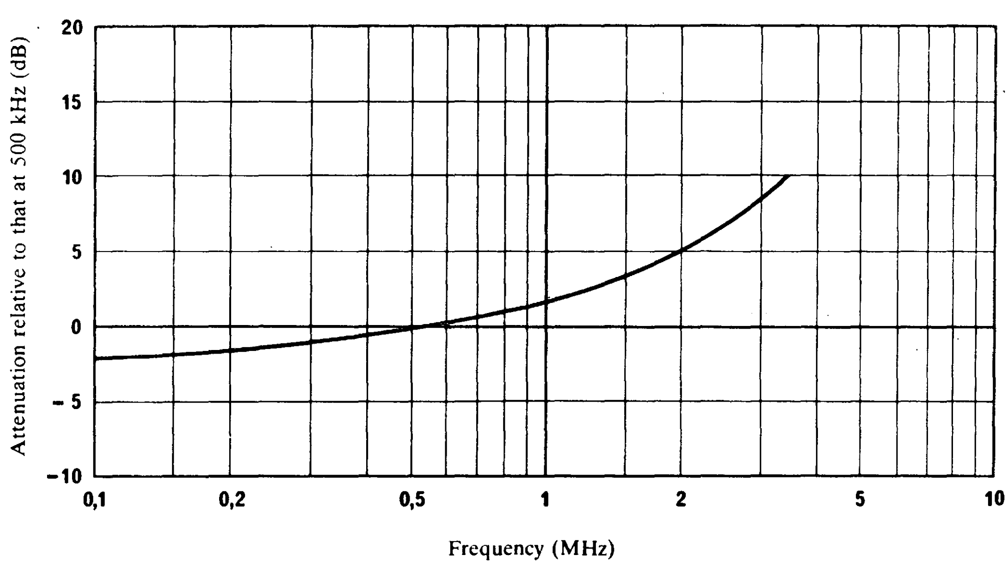


FIGURE 1 – *Relative attenuation/frequency of ground-wave over a sea path of 150 nautical miles*

* At least one Administration does not allow the use of filtered loudspeakers or muted receivers.

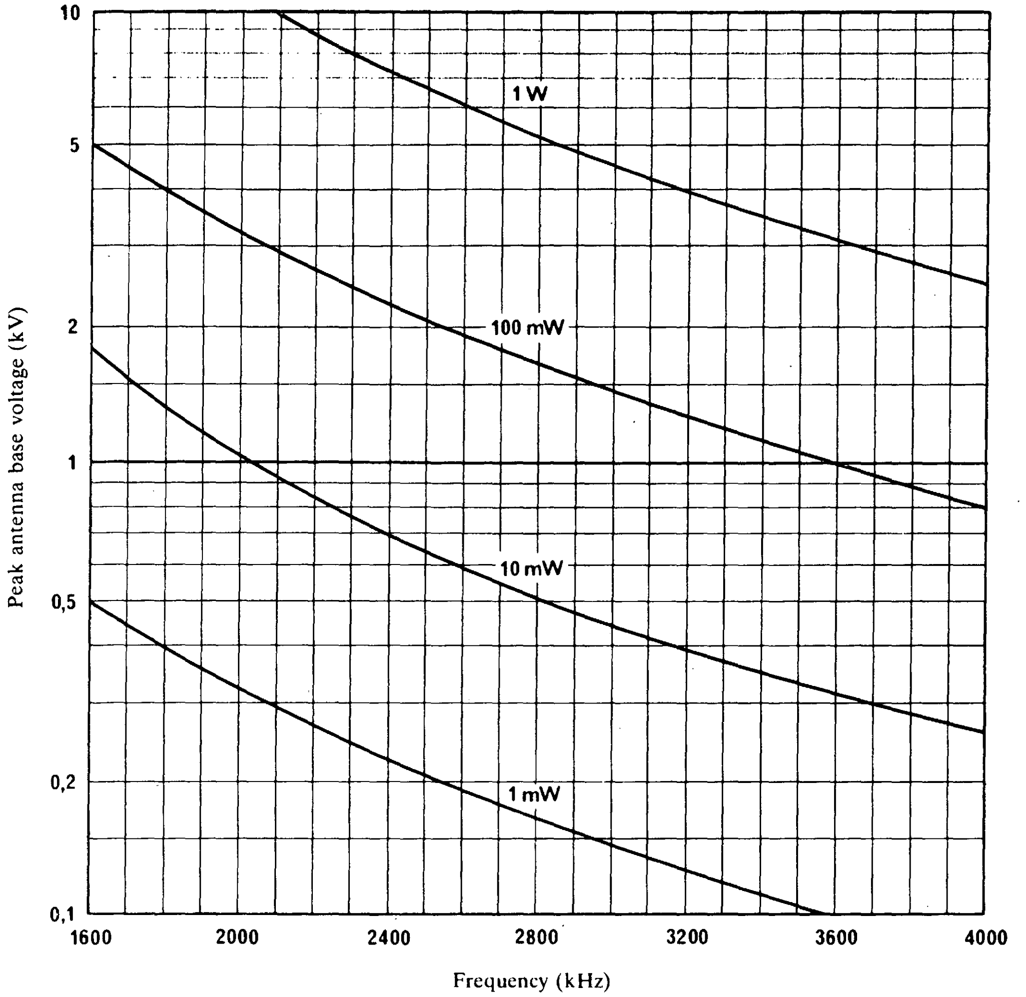


FIGURE 2 – *Variation of antenna base voltage with frequency for a number of radiated powers*

(Antenna assumed to be 3 metres in length and 27.5 pF capacitance)

The operational use of 2182 kHz has been the subject of previous liaison between IMCO and ICAO.

If a frequency lower than 2182 kHz is selected there will be serious technical problems arising from the limited frequency range of aircraft radio equipment in providing satisfactory operational watch-keeping coverage of the frequency by civil aircraft and helicopters. * If, on the other hand, a higher frequency is selected the ability of aircraft installations to operate on the frequency will be increased and the installations simplified.

* Future avionic HF equipment design (ARINC (Aeronautical Radio Inc. Annapolis Maryland USA) Characteristic 559A, 1975) is now being limited to a frequency selection range of 2.8 MHz to 24 MHz largely due to the lack of operational use of frequencies below 2.8 MHz and due to technical factors associated with the matching of equipment to modern aircraft antenna systems and in particular, to helicopter antenna systems.

6. Medium range distress frequencies

The need for all vessels to be able to communicate on one frequency for distress purposes has been recognized by IMCO Resolution A.335(IX) which recommends the inclusion in ships' radiotelegraph installations of facilities for radiotelephony transmission and reception on 2182 kHz. If this is done, 2182 kHz – besides being common to all Convention ships – will also provide linkage between radiotelegraphy and radiotelephony equipped ships, thereby increasing the safety of all.

With the exception of survival craft equipment, the distress service operated on 500 kHz is normally reliable over a greater range than would be possible with any frequency in the bands between 1605 kHz and 3800 kHz. It is also operated by professional communicators and, as telegraphy is used, minimizes language problems.

Although not in the category of MF, it is recognized that because of different propagation conditions, particularly in the southern hemisphere, designated 4 MHz and 6 MHz frequencies are supplementing 2182 kHz and their use is very important to the safety of vessels operating in those regions.

7. Existing equipment

For many years 2182 kHz has been the distress, urgency, safety and calling frequency for ships equipped in the 2 MHz band. It is very likely that there are more existing equipments operating on this frequency than on any other maritime mobile frequency. Therefore the selection of a different frequency for this purpose would have a very large economic impact and its implementation would require interim operational procedures until the changeover was completed.

8. Conclusions

8.1 Taking into consideration all the factors, technically there is little difference between the various frequencies in the bands between 1605 kHz and 3800 kHz. However, operational factors show that 2182 kHz is the most appropriate frequency for distress calls and messages and, possibly, urgency signals and messages, safety signals and certain safety messages in the Maritime Mobile Service.

8.2 For calling purposes, a frequency in the vicinity of 2000 kHz to 2300 kHz would be most appropriate. However, there will be significant problems involved in removing calling from the frequency of 2182 kHz.

8.3 It would be advantageous for the future distress service, if the MF and HF radiotelephone frequencies were studied with the view of providing maximum world-wide distress coverage.

REPORT 748

IMPROVED USE OF THE HF RADIOTELEPHONE CHANNELS FOR COAST STATIONS IN THE BANDS ALLOCATED EXCLUSIVELY TO THE MARITIME MOBILE SERVICE

(Question 30-1/8)

(1978)

1. Introduction

Under Question 30-1/8 it was decided that the CCIR should consider the technical and operational criteria to be adopted to enable the best utilization to be made of the HF radiotelephone channels.

In the Conclusions of the Interim Meeting of Study Group 8, [CCIR, 1974-78a], the results of Interim Working Party 8/2 (Geneva, 1974) are set out. Interim Working Party 8/2 was initially set up to give provisional advice to the IFRB concerning the allocation of HF radiotelephone channels and later to study Question 30-1/8.

Norway gave special attention to the operational aspects of Question 30-1/8 [CCIR, 1974-78b].

2. Results of Interim Working Party 8/2

The Interim Working Party agreed to base its work on existing CCIR Recommendations and Reports, in particular Recommendation 339-4 and Reports 252-3, 322-1, 340-3 and 525-1. In addition, use was made of Report 358-3.

Values of signal-to-interference protection ratios were derived in §§ 7.4 and 7.5 of the Report of the second meeting of the Interim Working Party to provide the IFRB with a basis for its work in relation to the allocation of radiotelephone channels in the Maritime Mobile Service. The figures recommended were:

12 dB for just usable circuit quality and

21 dB for marginally commercial circuit quality.

In § 7.7 of the Report of the second meeting it was suggested that means of providing propagation forecasts for ships were desirable to enable them to select the optimum frequency band. Administrations were encouraged to provide such information to their ship and coast stations.

In § 7.8 figures for the amount of channel time per hour to be considered in connection with determining sharing possibilities were proposed.

3. Operational method for improving channel utilization used by Norway, Sweden and Denmark

Norway described a particular method used by Norway, Sweden and Denmark (as from 1 January 1978) to assist in improving the utilization of radiotelephone channels assigned to all three countries [CCIR, 1974-78b].

The method is based on sub-dividing the channels into exclusive and common channels, allocation of the exclusive channels being on a traffic load basis.

A combined conference and signalling system was described which indicates the state of the channels (free or occupied) thus enabling the operators to coordinate the use of the channels.

It was noted that the sub-division of the channels may need revision in the light of further experience.

REFERENCES

CCIR Documents

[1974-78]: **a.** 8/205 (Conclusions of Interim Meeting of Study Group 8); **b.** 8/363 (Norway).

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DRAFT

REPORT 500-2 (MOD I)

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

Linked compressor and expandor systems

(Question 11-1/8)

(1970 - 1974 - 1978)

1. Introduction

1.1 Techniques for improving the maritime radiotelephone service were discussed at the interim meeting of Study Group 8 in Geneva in 1968.

1.2 Compandor techniques had recently been applied to the point-to-point services in a system called "Lincompex" with considerable success and this resulted in the acceptance of Question 11-1/8.

1.3 The United Kingdom indicated that tests had shown that the use of Lincompex in the maritime service would give similar advantages to those obtained on the point-to-point services. Moreover, the ability of the system to suppress interference would be of great advantage in the maritime services where interference is more frequently the limitation than it is in the point-to-point services [CCIR, 1966-69].

1.4 It was pointed out 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 United Kingdom made proposals for a modified version of Lincompex specially designed to fit into the maritime channel allocations. The approved specifications were then incorporated into Recommendation 475-1.

1.5 At the final meeting of Study Group 8, Geneva 1978, Canada reported on the development and evaluation of equipment utilizing digital techniques and designed for use with equipment meeting existing maritime frequency stability requirements [CCIR, 1974-78; Chow, 1978]. The system is called "Syncompex" and differs basically from "Lincompex" in that digital rather than analogue techniques are used to modulate the control channel. A system description is contained in Annex I.

2. Tests in the HF (4 to 27.5 MHz) and MF (1.6 to 3.8 MHz) bands

2.1 Comparisons were made on ship-to-shore links in the HF and MF bands between Lincompex and the conventional system. The tests indicated that, during daylight, with Lincompex a good commercial SSB telephony circuit was obtained on the MF band over a distance of about 650 miles. This compared with less than 400 miles using conventional SSB. During darkness the advantages were even greater. Interference made the conventional system uncommercial when extended over the inland network, while the new system was generally satisfactory. Tests were also made on the HF bands and the results fully confirmed the improvements expected.

2.2 In relation to the Syncompex system, an experimental evaluation on an HF radio system was reported to be in progress in 1978.

3. General circuit parameters for linked compressor expandor systems

3.1 Standard syllabic compandors designed to the 13-segment A law [Bell Telephone Labs., 1970] cannot be used in links in which the signal levels can fluctuate as in a fading ionospheric channel because the companding action tends to accentuate the effects of the fluctuation by an amount equal to the compression ratio. Linked compressor expandors have special features which enable them to overcome this difficulty.

3.2 The use of linked compressor expandor systems on HF and MF circuits employing A3J emissions is extremely difficult unless care is taken to ensure that the information in the associated control channel is correctly received.

3.3 For the system described in Recommendation 475-1, the end-to-end frequency accuracy has to be better than ± 5 Hz, which may require the use of automatic frequency control.

For the system described in Annex I the control information is in digital form which gives it much greater tolerance to end-to-end frequency error.

3.4 Linked compressors and expandors provide satisfactory circuits when a signal-to-noise ratio of about 10 dB exists between the wanted and the interfering signal in the overall channel [CCIR, 1970-74a], although the control channel is more susceptible to discrete frequency interference than the voice channel [CCIR, 1970-74b].

3.5 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 system [CCIR, 1970-74a and b].

3.6 The effect of noise caused by stays could be increased by the presence of the control signal [CCIR, 1970-74b]. However, interference resulting from audio rectification of the voice modulation is greatly reduced when the speech is efficiently compressed.

3.7 Emphasis is placed on the need to improve ship and shore installations and adjustment, with particular regard to transmission levels, so that operator attention can be reduced and circuit availability improved [CCIR, 1970-74a and c].

4. Modifications to the Lincompex system

4.1 The United Kingdom proposed a number of amendments to Annex III of Recommendation 475-1 aimed at enabling the technical requirements for the associated radio equipment to be simplified [CCIR, 1970-74d].

4.2 It also outlined the technical parameters for privacy equipment with 3000 Hz inversion frequency when used with Recommendation 475-1 equipment. However, it is noted that Recommendation 336-2 recommends that such equipment should not be used on SSB systems.

5. Echo suppression

5.1 Japan described an economical method of providing echo suppression by making use of the Recommendation 475-1 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 expandor. The new system was designed to meet the requirements of CCITT Recommendation G.161. Tests showed that it was fully compatible with conventional echo suppressors and speech quality was satisfactory [CCIR, 1970-74e].

5.2 For distances greater than about 5000 km it was found desirable to use echo suppressors with the equipment described in Recommendation 475-1, [CCIR, 1970-74f].

6. Band compression

Japan described 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 to 1.8 kHz signal. It is considered that the study of band compression systems applicable to the maritime mobile service is 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 systems (Recommendation 475-1). 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 [CCIR, 1970-74g].

Report AB/3 (Volume III), based on Japanese tests, describes the possibility of reducing interference by band compression techniques. Report 176-4 (MOD I) contains some test results of these band compression techniques.

7. Compatibility

A considerable improvement in performance is derived from the use of efficient voice processing techniques at the transmitters of both coast and ship stations (voice operated gain adjusting devices for example).

It is possible that the compressor section of a linked compressor and expandor system could be used in conjunction with a distant station employing a conventional receiver. This would require the removal of the control tone and the setting of the receive-side expandor to a suitable constant gain and perhaps some modification of the compressor time-constants. Use of automatic gain control circuitry with rapid attack and long hangover times in the conventional receiver aids in the reduction of noise during speech pauses [CCIR, 1970-74h].

REFERENCES

Bell Telephone Laboratories [February, 1970] Transmission system for communications. 4th Edition, 501-583.

CHOW, S. [1978] Synchronized compressor-expandor (Syncompex). CRC Report No. 1716, Department of Communications, Ottawa K2H 8S2.

CCIR Documents

[1966-69]: XIII/80 (United Kingdom).

[1970-74]: **a.** 8/36 (USA); **b.** 8/35 (Germany (Federal Republic of)); **c.** 8/37 (USA); **d.** 8/185 (United Kingdom); **e.** 8/194 (Japan); **f.** 8/195 (Japan); **g.** 8/196 (Japan); **h.** 8/64 (Canada).

[1974-78]: 8/309 (Canada).

ANNEX I

SYSTEM DESCRIPTION OF SYNCOMPEX

The Syncompex system [Chow, 1978] is being developed to bring the advantages of linked compressor and expander systems to all classes of HF telephony service.

In its simplest application, Syncompex may be connected to a radio system at the audio input and output points. In equipment developed specially, the FSK control channel may be additionally used for automatic gain control and automatic frequency control by suitable connections to the radio-frequency circuits.

Block diagrams of the system are shown in Figs. 1a and 1b.

1. Transmission

The output of the audio bandpass filter is sampled by an analogue-to-digital (A—D) converter at 9600 samples per second under the control of a microprocessor. The microprocessor stores 128 successive samples defined as a "syllable" with duration 13.33 ms. The microprocessor determines the instantaneous gain to be applied to each syllable. The compressor gain is limited to 6 dB steps from 0 dB to 48 dB with gain change limited to a single 6 dB step every 13.33 ms syllabic period. The direction of the gain change is determined by the instantaneous amplitude of the voice, an increasing amplitude causing a decrease in the gain of the compressor by 6 dB. The microprocessor, after applying the appropriate gain to the samples, drives a digital-to-analogue (D—A) converter which converts the samples to analogue form which after filtering constitutes the audio input to the transmitter.

The gain change applied in the compression process is available at a digital output port of the microprocessor which is used as input to a pair of FSK modulators. The FSK signals called the control channel are centred at 765 and 2125 Hz and have ±42.5 Hz shift. The compressed voice is eliminated from two bands centred about 765 and 2125 Hz to allow the FSK signal to be transmitted. Identical information is transmitted in the two FSK channels to minimize the effects of selective fading and narrowband interference often encountered in HF circuits.

2. Reception

The receiver output is separated by filters into the two FSK signals and the compressed voice signal. Each FSK channel is separately demodulated. They are then diversity combined so that fading of one FSK channel does not cause errors to occur in the combiner output. The compressed voice, after appropriate filtering, is sampled by an A—D converter operating at 9600 samples per second under the control of the microprocessor. The microprocessor adjusts the gain of the syllable according to the information received in the control channel. A gain change of +6 dB in the compressor is matched with a -6 dB change in the expander. The analogue output is formed by filtering the D—A converter output.

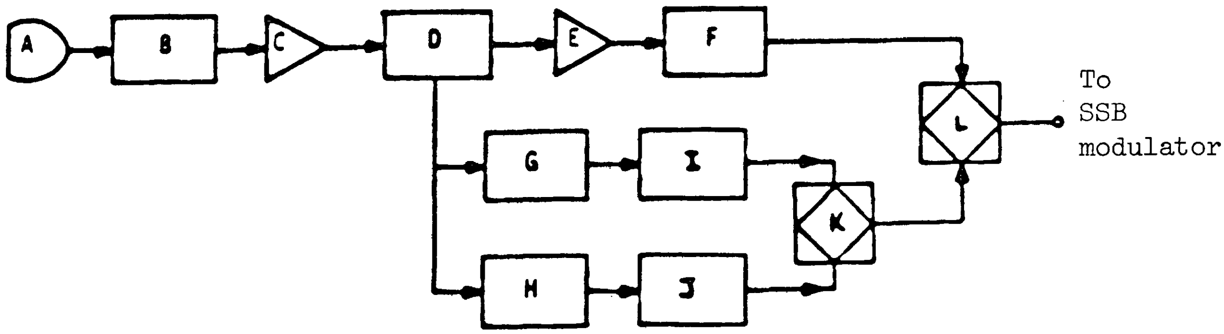

FIGURE 1a - Block diagram of Syncompex compressor

A : Microphone
B : Bandpass filter 300 - 2800 Hz
C : Analogue to digital converter
D : Microprocessor
E : Digital to analogue converter
F : Band elimination filter
- Stop bands at 765 and 2125 Hz

G : FSK modulator 765 ± 42.5 Hz
H : FSK modulator 2125 ± 42.5 Hz
I : Bandpass filter 765 ± 125 Hz
J : Bandpass filter 2125 ± 125 Hz
K : Combiner
L : Combiner

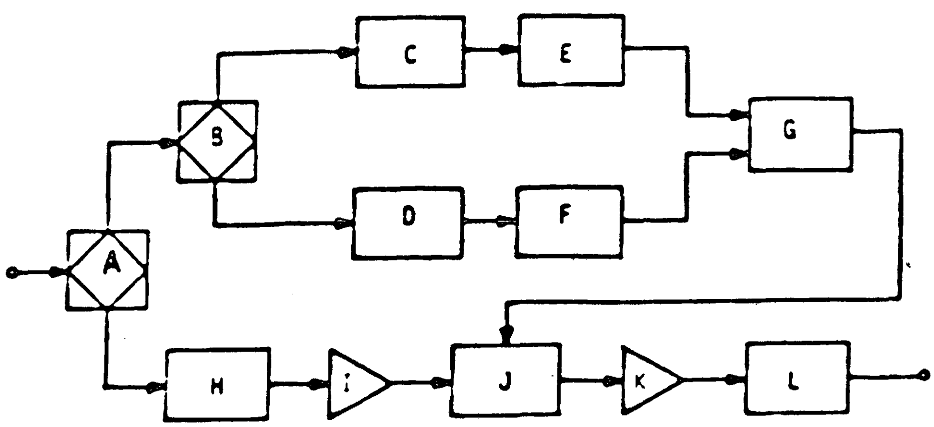

FIGURE 1b - Block diagram of Syncompex expander

A : Audio splitter
B : Audio splitter
C : Bandpass filter 765 ± 125 Hz
D : Bandpass filter 2125 ± 125 Hz
E : FSK demodulator 765 ± 42.5 Hz
F : FSK demodulator 2125 ± 42.5 Hz

G : Diversity combiner
H : Band elimination filter
- Stop bands at 765 and 2125 Hz
I : Analogue to digital converter
J : Microprocessor
K : Digital to analogue converter
L : Bandpass filter 300 - 2800 Hz

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REPORT 501-2 * (MOD I)

DIGITAL SELECTIVE-CALLING SYSTEM FOR FUTURE OPERATIONAL REQUIREMENTS OF THE MARITIME MOBILE SERVICE

(Question 9-3/8 (MOD I))

(1970 - 1974 - 1978)

1. Summary of work

Studies on the subject of a digital selective-calling system to meet the future operational requirements of the maritime mobile service have been carried out since the 1966-69 study period.

The choice of the system is based on theoretical studies and on field tests carried out by the Administrations of the USA, U.S.S.R., Japan and the Netherlands [CCIR, 1974-78].

In order to expedite the study of the digital selective-calling system, Interim Working Party 8/3 was set up in 1975.

Recommendation 493-1 (MOD I) resulted mainly from the work carried out by Interim Working Party 8/3 during the study period 1974-78. It covers both the operational and technical characteristics in detail.

At the Final Meeting of Study Group 8, January 1978, Geneva, Recommendation 493-1 (MOD I) which was modified at the second meeting of Interim Working Party 8/3, held in Stockholm 1977, was considered in detail and adopted with minor amendments.

Initial guidance on operational procedures is contained in Recommendation 541 (Operational procedures) which was prepared at the second meeting of Interim Working Party 8/3 and considered at the Final Meeting of Study Group 8. It is recognized that these procedures are in general terms only and that the formulation of detailed procedures cannot be carried out until practical experience has been gained in the actual operation of the digital selective-calling system.

Furthermore, it was agreed that the frequency tolerance for MF and HF transmitters of the digital selective-calling system should be specified as ± 20 Hz.

In accordance with CCIR Resolution 24-4 Interim Working Party 8/8 was set up in 1979 to hasten the development of operational procedures especially in relation to the requirements of a Future Global Distress and Safety System which is scheduled for consideration at the World Mobile Adminstrative Radio Conference for Mobile Services in 1982.

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* The Director, CCIR, is invited to bring this Report to the attention of the Inter-Governmental Maritime Consultative Organization (IMCO).

2. Future work

2.1 Radio Regulations

It was noted that following the introduction of the digital selective-calling system, a number of provisions of the Radio Regulations will have to be reviewed and possibly modified by a competent World Administrative Radio Conference. These include Articles 1, 9, 25, 33, 35, 54 to 64, Appendices 7, 31, 36, and 41.

2.2 Operational procedures

Interim Working Party 8/8 is preparing a revised draft of Recommendation 541 containing procedures for both the distress and safety and "other" services which it is hoped to present to the Final Meeting of Study Group 8 in 1981. Nevertheless the procedures will need to be reviewed in the light of operational experience gained with the digital selective-calling system.

2.3 Calling channels

Studies of the loading capability of random access calling channels will be required for the future allocation of exclusive digital selective-calling frequencies. Interim Working Party 8/8 has commenced studies into the loading capabilities of calling channels including random access channels and has achieved some preliminary results. However, considerable further work is required especially in regard to the estimation of demand in the "other" services.

2.4 EPIRB signal

Further study is required to assure compatibility between EPIRB emissions and the digital selective-calling system.

This study should include the consideration of frequency tolerances.

Annex I to this Report shows a possible format of an EPIRB emission containing digital selective-calling signals.

REFERENCE

CCIR Document

[1974-78]: 8/205 (Conclusions of the Interim Meeting of Study Group 8, 1976).

ANNEX I

A POSSIBLE EPIRB EMISSION INCORPORATING DIGITAL SELECTIVE-CALLING SIGNALS

There should be a facility for the automatic detection of an EPIRB emission, incorporated in the receiving/detecting equipment of the proposed digital selective-calling system for use in the international maritime mobile service.

The detection of an EPIRB emission should activate a device giving an audible signal on board ships (or at coast stations) to attract attention. An indication should thereby be given that the received call has been sent by an EPIRB.

1. The EPIRB emission

As a "distress call" is a call that is transmitted by a ship in distress, it seems justified to consider an EPIRB transmission, later on referred to as an "ES" (EPIRB Sequence), as a distress call from a ship in distress, not being able to transmit itself.

Consequently an ES should be classified as a special form of a distress call, with an indication that this special distress call is in fact an ES.

Fig. 1 shows an example of an ES for an EPIRB belonging to a ship with the identification number e.g. 123456789. If the ship had an alphanumerical call sign (e.g. PA 739), the indication: "distress call" in sequence Part I would be 113 instead of 112. The self-identification, as in sequence Part 2, would then be:

80	65	55	51	57	
P.	A.	7	3	9	(International Alphabet No. 5)

instead of 123456789

2. The emission cycle

If the above-mentioned ES is to be incorporated in the digital selective-calling system, the signal from the EPIRB as presently prescribed in Article 41, Section I of the Radio Regulations could, certainly for the period of introduction, be retained.

However, to be compatible with the proposed digital selective calling-system, the ES should follow the signal of No. 3258 of the Radio Regulations and produce tones of 1615 Hz and 1785 Hz by frequency shift-keying of a sub-carrier.

Note. — The duration of the cycle in Fig. 1, and the separate parts in it, are to be decided by IMCO.

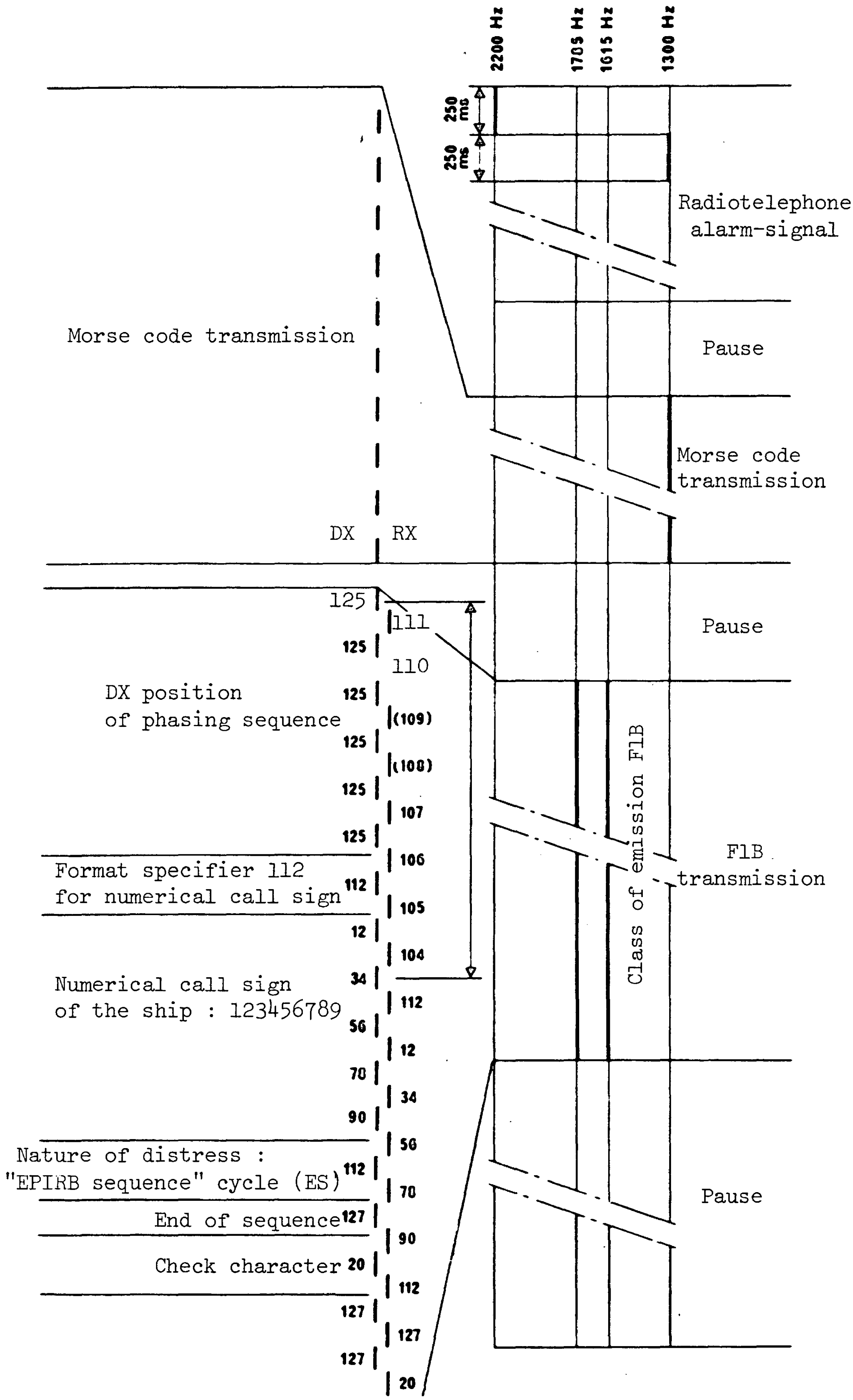
2200 Hz
1705 Hz
1615 Hz
1300 Hz
250 ms
250 ms
Radiotelephone alarm-signal
Pause
Morse code transmission
Morse code transmission
DX
RX
Pause
125
111
125
110
DX position of phasing sequence
125
(109)
125
(108)
125
107
125
106
Format specifier 112 for numerical call sign
112
105
12
104
Numerical call sign of the ship : 123456789
34
112
56
12
70
34
90
56
Nature of distress : "EPIRB sequence" cycle (ES)
112
70
End of sequence
127
90
Check character
20
112
127
127
127
20
Class of emission F1B
F1B transmission
Pause

FIGURE 1

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REPORT 585-1(MOD I)*

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

(Question 5-2/8(MOD I))

(1974 - 1978)

1. 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 [CCIR, 1970-74a, b, c, d, e, f, g and h].

2. To make the maximum use of a 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. Automatic operation gives the possibility of messages being exchanged irrespective of the hours of duty of the radio operator on board ship. The ultimate objective would be for ships to be treated in the same way as a 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.

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* This Report should be brought to the attention of the CCITT.

The Swedish Administration has carried out tests with a system called MARITEX, which, technically, is based on relevant parts of Recommendation 476-2 and Appendix 20B 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 traded between the Persian 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 twenty ships. The system will be operated at HF only, but nothing prevents its later extension to other frequency bands if the need should arise. After an introductory period of semi-automatic service, a fully automated service was introduced. This fully automated service has been in operation for a number of years with good results. At the end of 1977 the number of ship station installations was of the order of 100.

[CCIR, 1970-74e] describes a direct-printing and selective-calling system based on International Telegraph Alphabet No. 5 and the results of tests of this system.

[CCIR, 1970-74f] contains proposals concerning the use of direct-printing equipment in the maritime mobile service according to Recommendation 476-2.

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 interference,

- 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, [CCIR, 1970-74g] 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 the contribution mentioned above 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.

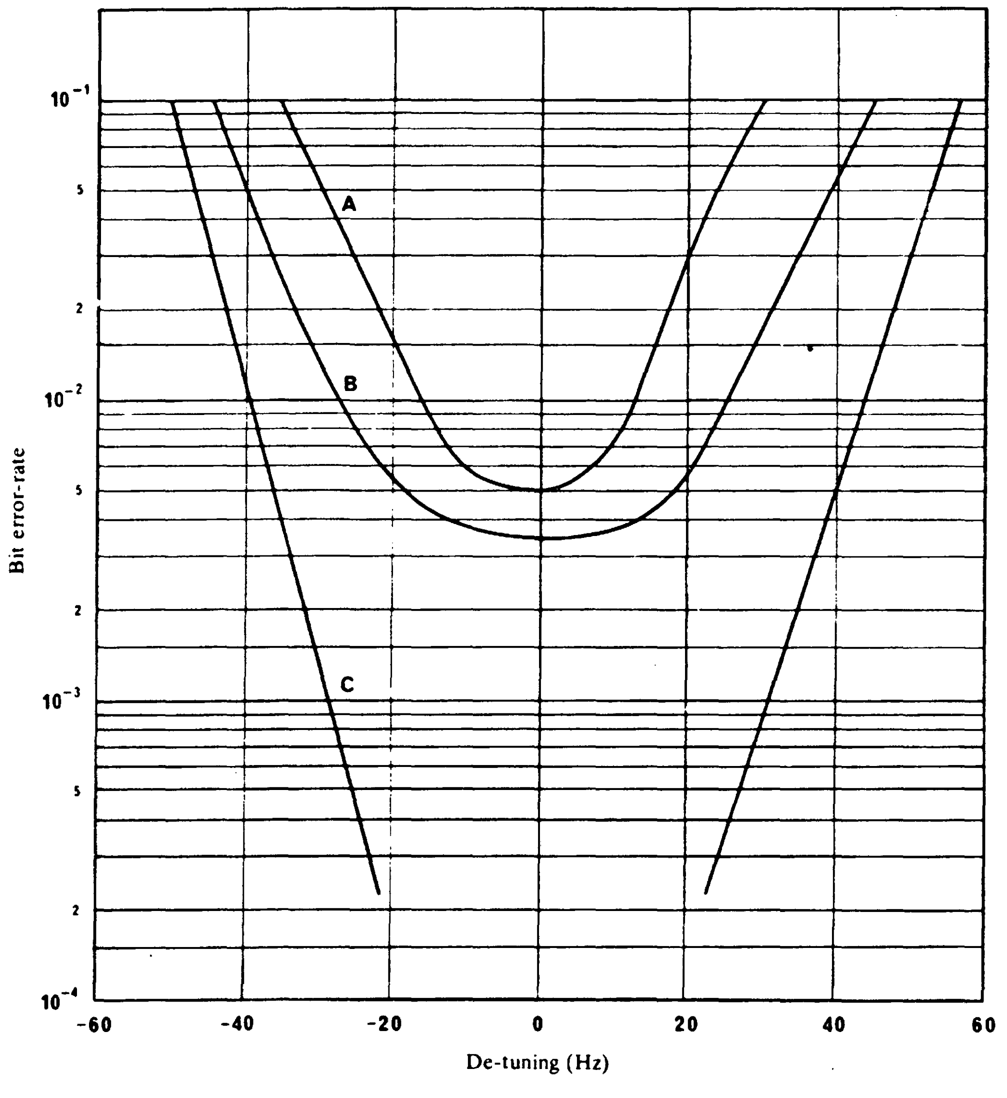

FIGURE 1 – *Bit error-rate as a function of de-tuning*
(No fading)

Receiver input voltage:
Curves A: −22 dB(1μV)
B: −20 dB(1μV)
C: −18 dB(1μV)

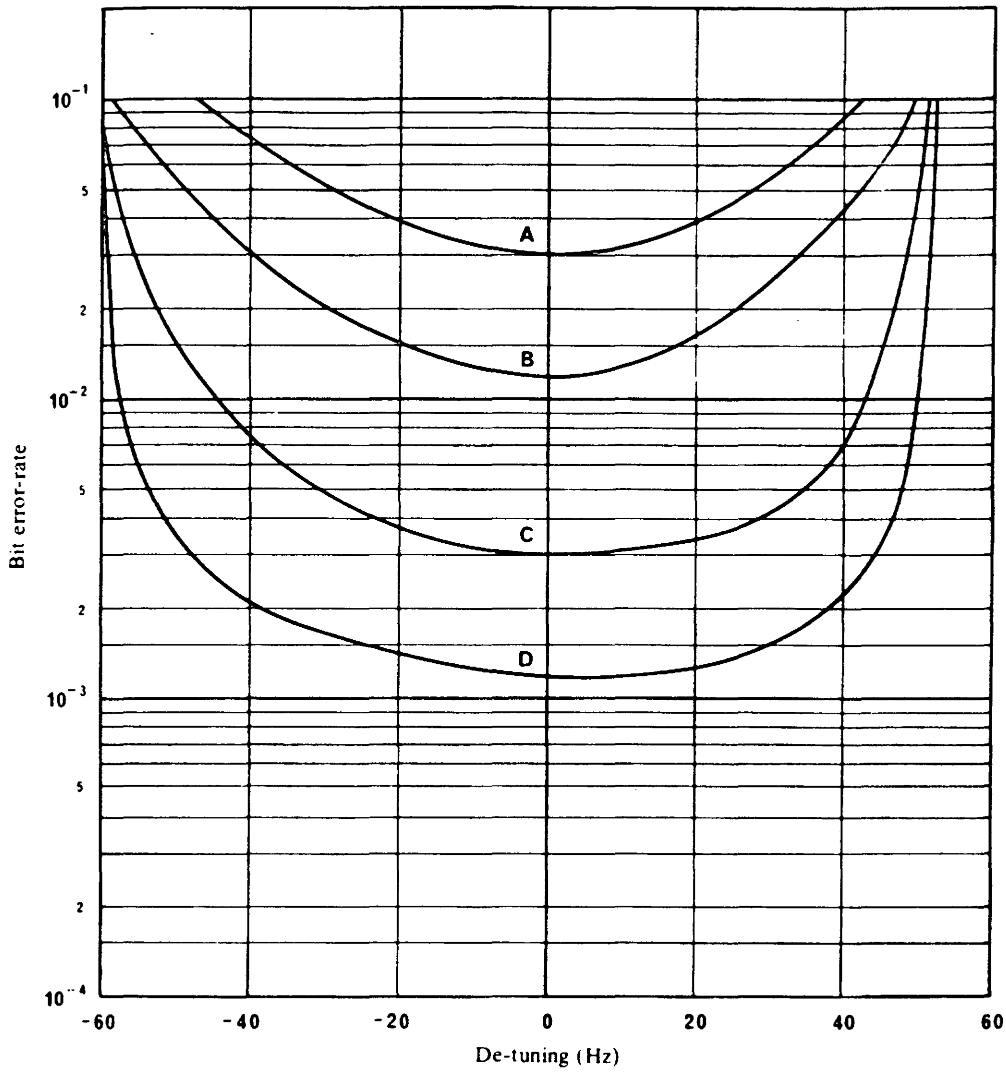

FIGURE 2 – *Bit error-rate as a function of de-tuning*
(Under random fading close to Rayleigh distribution, with fading rate of 15 fades/min)

Receiver input voltage (median value):
Curves A: −8 dB(1μV)
B: −3 dB(1μV)
C: 2 dB(1μV)
D: 7 dB(1μV)

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 mode and the B mode 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 the contribution mentioned above 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.

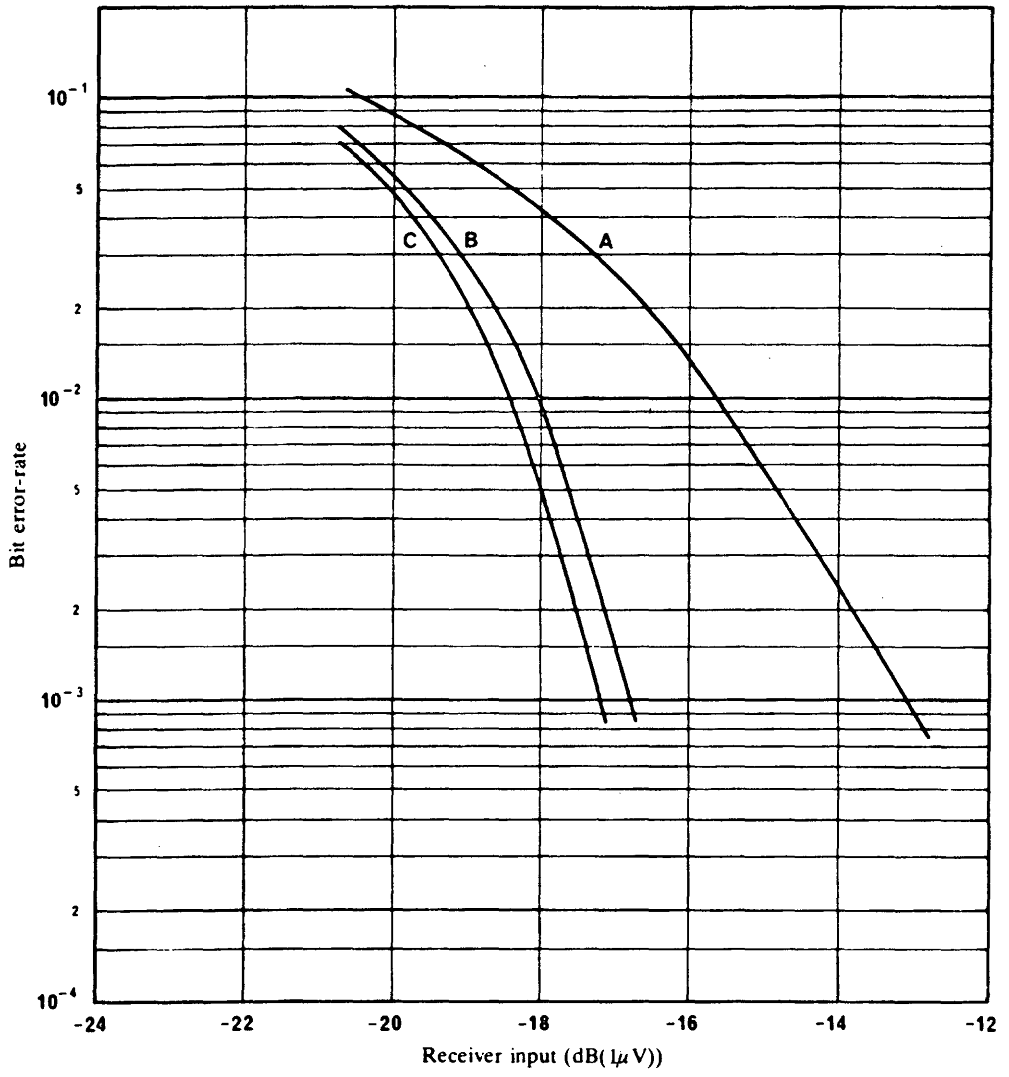

FIGURE 3 – *Bit error-rate as a function of receiver input for variation in receiver bandwidths under no interference conditions*

Receiver bandwidth:

	<6 dB	>66 dB
Curves A:	210 Hz	500 Hz
B:	240 Hz	560 Hz
C:	310 Hz	700 Hz

[CCIR, 1970-74h] reproduces parts of an IMCO document prepared to assist IMCO members in their preparations for the World Maritime Administrative Radio 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, 1605 to 4000 kHz and the 156 to 174 MHz maritime frequency bands in addition to the HF bands.

[CCIR, 1974-78a and b] propose some additions to the operational procedures for the narrowband direct printing service outlined in Article 29A of the Radio Regulations. These have been incorporated in Recommendation 492-1. Further study is required on the precise format of the answer-back signals to be used by coast-station and ship.

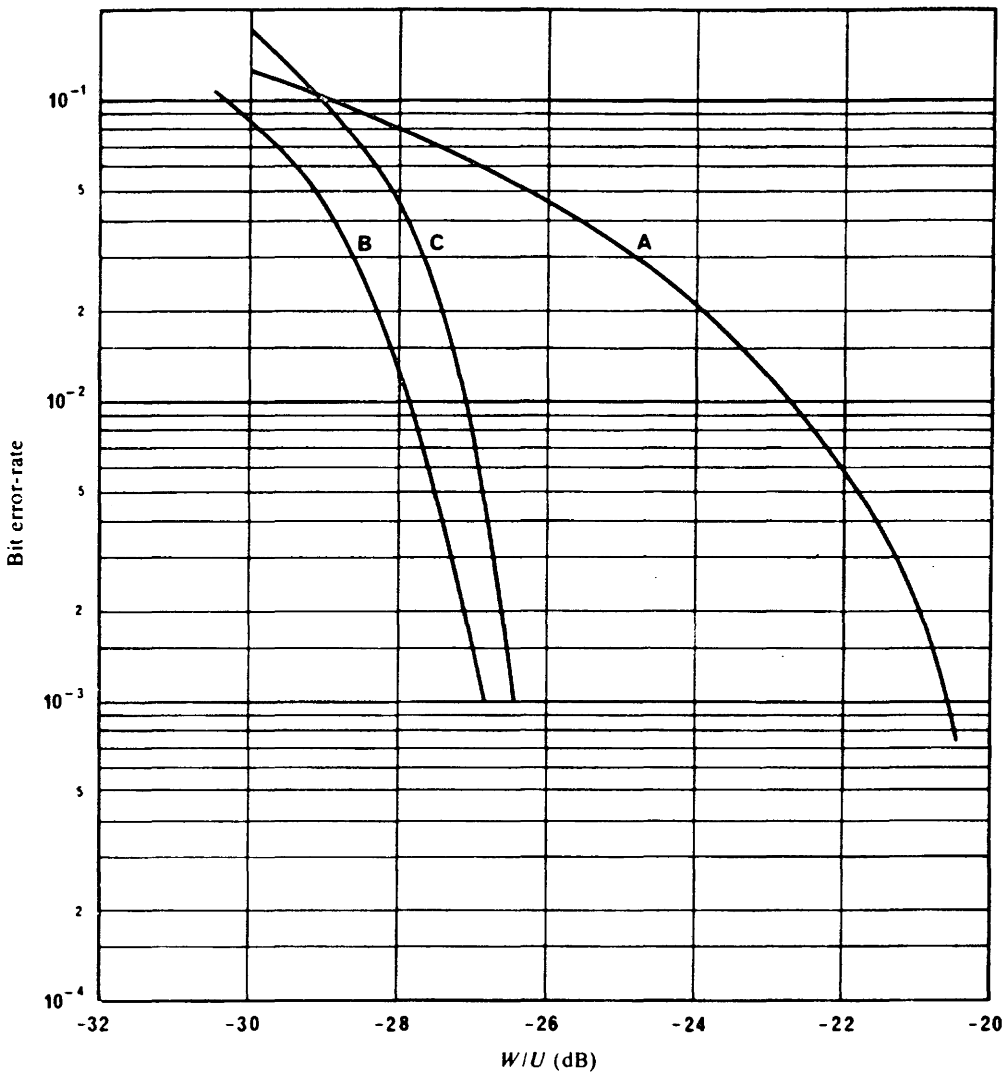

FIGURE 4 – *Bit error-rate as a function of W/U (ratio of wanted to unwanted signal) with different receiver bandwidths in the presence of adjacent channel interference*

Wanted signal: 1 μV at receiver input
Unwanted signal: 100 bit/s dot signal, separated from desired signal by 500 Hz

Receiver bandwidth:

	< 6 dB	> 66 dB
Curves A:	210 Hz	500 Hz
B:	240 Hz	560 Hz
C:	310 Hz	700 Hz

4. During the Interim Meeting of Study Group 8 (1980), Recommendation 492-1 was discussed. It was the opinion of the Meeting that this Recommendation should be extended. Administrations are therefore invited to study the operational procedures considering:

- the relevant CCITT Recommendations;
- the requirements of manual, semi-manual and fully-automatic operations;
- the type of service offered, and
- the following proposal made by the U.S.S.R. [CCIR, 1978-82] concerning §§ 1.9 and 1.10 of Recommendation 492-1:

Proposed § 1.9 of Recommendation 492-1:

1.9 <u>Procedure for setting up a call in the ship-to-coast station direction</u>

Coast Station	Step	Ship Station
	1	Call
	2	"Who are you?"
Answer-back	3	
	4	Answer-back
	5	< ≡ ↓ TLX ↑ yz + ? or < ≡ ↓ DIRTLX ↑ yz +? or < ≡ ↓ SVC ↑ + ? (1) or < ≡ ↓ TGM ↑ +? (2)
< ≡ ↓ GA ↑ +?	6	
	7	Answer-back
	8	Message
	9	< ≡ ↓ NNNN (3)
	10	"Who are you?"
Answer-back	11	
	12	Go to step 5 or steps 7-10 or "end of communication" (ααα) (4)

(1) The sequence SVC indicates that the message which follows is a service message.

(2) The sequence TGM indicates that the message which follows is a radiotelegramme.

(3) This sequence may need to be considered further by the CCITT.

(4) Each radiotelegramme shall be preceded and followed by an exchange of answer-back signals, the latter acknowledging receipt of the radiotelegramme.

Proposed § 1.10 of Recommendation 492-1:

1.10 Procedure for setting up a call in the coast-to-ship station direction

Coast Station	Step	Ship Station
Call	1	
"Who are you?" (↑D)	2	
	3	Answer-back (5)
Answer-back	4	
Message	5	
<≡↓NNNN	6	
"Who are you?" (↑D)	7	
	8	Answer-back
Go to steps 4-7 or <≡↓GA↑+?	9	
	10	Answer-back
	11	Message
	12	<≡↓NNNN
	13	"Who are you?' (6)
Answer-back	14	
	15	Go to steps 10-13 or <≡↓GA↑+?
"End of communication" (ααα)	16	

(5) As defined by the CCITT in Recommendation F.130.

(6) For attended ship station.

REFERENCES

CCIR Documents

[1970-74]: **a.** 8/3 (United Kingdom); **b.** 8/9 (USA); **c.** 8/74 (Netherlands); **d.** 8/80 (Sweden); **e.** 8/93 (Japan); **f.** 8/94 (U.S.S.R.); **g.** 8/192 (Japan); **h.** 8/261 (CCIR).

[1974-78]: **a.** 8/313 (Australia); **b.** 8/365 (Sweden).

[1978–82]: 8/143 (U.S.S.R.).

DRAFT

REPORT 744 * (MOD I)

USE OF CLASS J3E EMISSIONS FOR DISTRESS AND SAFETY PURPOSES

(Question 26-1/8 (MOD I))

(1978)

1. Introduction

This Report discusses the use of class J3E emissions for distress and safety purposes on the carrier frequency 2182 kHz. The use of J3E emissions for distress and safety purposes on the carrier frequencies 4125 kHz and 6215.5 kHz is the subject of Recommendation 544. Recommendation 543 recommends that class R3E emission should not be used for distress and safety purposes.

IMCO recognized the significant advantages in using the class of emission J3E and the desirability of using it for distress and safety communications [IMCO a and b].

One of the major problems in the past was the compatibility of A3E, H3E and J3E alerting emissions on 2182 kHz. In the new distress and safety system mentioned below it is envisaged to discontinue the use of the alerting function of 2182 kHz.

Nevertheless, this Report contains also the compatibility considerations for alerting on 2182 kHz, for the case where these considerations might still be useful for IMCO when deliberating on the transitional plan.

However, the general introduction of J3E should not be realized before the Future Global Maritime Distress and Safety System becomes operational.

IMCO has prepared the operational requirements for the Future Global Maritime Distress and Safety System and was of the opinion that for this system, based on the use of automatic digital selective-calling alerting techniques, new equipment will need to be designed and manufactured for ships and survival craft. This new equipment will need to work with closer frequency tolerances and to higher technical standards than existing equipment.

2. Operational considerations

2.1 The main operating advantage in using class J3E emission for distress is a power budget saving or alternatively an improved range of communications. Reliability and economy of ships's equipment would be enhanced because distress and commercial communication channels would use the same class of emission. There would also be an improvement in the utilization of frequency spectrum. However, there are large numbers of existing survival craft equipment, portable distress equipment and EPIRBs which use A3E or H3E emissions.

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* The Director, CCIR, is requested to draw the attention of ICAO and IMCO to this Report and invite their comments on this matter.

2.2 Recommendation 488 implies that for a given primary input power, the use of J3E would improve the range of operation of the equipment. This has been confirmed by practical experience. In a distress situation the greatest possible communication range is desirable.

2.3 Conversely, Recommendation 488 indicates that, for the same signal/noise ratio, a peak envelope power saving of approximately 10 dB could be achieved by the use of J3E compared with A3E or H3E. Such a saving would be particularly attractive where limitations of space and weight could impose serious problems. These circumstances apply to radio equipment intended for use in survival craft and for other mobile and portable equipment which is battery operated.

2.4 The provision of a carrier signal or unvarying sideband improves direction-finding techniques. If J3E emissions are used, technical and operational procedures are required to ensure optimum performance for direction finding in an SSB environment. Investigations are required to define optimum solutions for either SSB tone transmission or DF design changes. The operational requirements for "homing" must be recognized.

2.5 The atmospheric noise levels in temperate zones and the packaging constraints for 2182 kHz survival craft equipment and EPIRBs reduce their effectiveness in those zones.

3. Considerations with respect to the existing distress and safety system

3.1 Compatibility of A3E, H3E and J3E classes of emission

3.1.1 The problem to be solved before J3E class of emission could be introduced for distress and safety purposes is the difficulty of ensuring a satisfactory system, compatible with existing arrangements and capable of operation with A3E, H3E and J3E classes of emission.

3.1.2 Tests have shown that where operator-attended watchkeeping is provided by coast stations, the identification and reception of type A3E and H3E signals in a J3E system is practicable. Communication for distress and safety between ships and coast stations is, in these circumstances, therefore achievable. The United States [CCIR, 1978-82] has reported implementation of single sideband (J3E) distress frequency watchkeeping by national ships in US waters and by US Coast Guard stations, effective 1 September 1978. The implementation of J3E has significantly improved the transmitting range as compared to H3E or A3E emissions. J3E receivers precisely tuned on the carrier frequency 2182 kHz reproduce intelligible audio signals when receiving A3E or H3E emissions with carrier frequencies deviating not more than 100 Hz from 2182 kHz.

Distress alarm signals can still be detected by an operator when their carrier frequencies deviate up to 300 Hz from the nominal frequency 2182 kHz.

In this regard it is significant to note that the Radio Regulations at present permit survival craft radio equipment to deviate 660 Hz from 2182 kHz.

When an operator at a US Coast Guard station recognizes that he is receiving other than J3E signals he will use the double sideband mode for further reception or transmission of signals.

3.1.3 However, existing distress and safety requirements call for the reception of distress signals from ships, survival craft stations and EPIRBs by ship stations as well as by coast stations.

To achieve this it may be necessary to design a watchkeeping receiver which automatically inserts into its demodulator a locally-generated carrier when a J3E signal is received and which would ensure that this local carrier was not present when A3E or H3E was being received.

3.1.4 The presence of an A3E or H3E signal in a J3E receiver would produce an inter-carrier beat frequency which could have a maximum frequency depending on the frequency tolerance of survival craft transmitters (300 ppm, or 655 Hz at 2182 kHz). Allowing a tolerance of ± 10 Hz on the carrier re-insertion frequency, the maximum anticipated inter-carrier beat frequency would be 665 Hz.

3.1.5 Beats would also occur between the re-inserted carrier and the sideband frequencies which, when demodulated, would produce tones within the audio passband of the receiver. These tones would obviously detract from the aural effectiveness of the two-tone alarm by an amount depending on the relative frequencies of the wanted and the unwanted tones. If the receiver was used in conjunction with a filtering device, the audio tone filters might reduce the likelihood that unwanted tones would be heard.

3.1.6 The problem cannot be completely solved except by arranging for the re-inserted carrier to be injected only in the presence of a J3E signal, or, to be absent during reception of an A3E or H3E signal. This arrangement would in any case be necessary for the satisfactory reception of voice transmissions.

3.1.7 Watchkeeping receivers designed to be compatible with both A3E or H3E and J3E transmissions are technically feasible. However, the need for such receivers should be overtaken by implementation of the Future Global Maritime Distress and Safety System.

3.2 Frequency accuracies and stabilities

3.2.1 Before J3E can be introduced universally, some adjustments will be needed to the various frequency tolerances permitted by the Radio Regulations in distress equipment, particularly for satisfactory J3E operation with watchkeeping receivers using filters or a muting device.

3.2.2 The permitted long-term frequency tolerance on shipborne transmitters is 50 Hz for transmitters installed after 1 January, 1982. The permitted tolerance on the frequency of each of the tones of the two-tone alarm is ± 1.5% which, on the lower frequency tone of 1300 Hz, is ± 19.5 Hz (say ± 20 Hz). Typical requirements for the audio tone filter characteristic for watchkeeping receivers state that the response should be not more than 3 dB below the maximum response within 3% of the frequency of maximum response. This should occur within ± 1.5% of the tone frequency, and at least 20 dB below the maximum response at 15% of the frequency of maximum response.

3.2.3 If the frequency tolerance of ± 50 Hz for shipborne equipment was also applied to EPIRBs and survival craft equipment, the total system tolerance could be in the order of ± 120 Hz, or ± 9%, of the 1300 Hz tone. The effect of this in a J3E system would be that the tone frequencies at the receiver could vary between 1180 Hz and 1420 Hz, and between 2080 Hz and 2320 Hz respectively. However, the tone difference between the two notes should be reasonably constant at about 900 Hz and in most practical cases the variation of the tone frequencies would probably not exceed ± 50 Hz.

3.2.4 If watch for the two tones was kept aurally, it is unlikely that the variation in the tone frequencies would have any effect on the detection of the alarm signal because the distinctive "warble" would still be present. Similarly, if a muted watchkeeping receiver was used, the effect would probably be negligible because detection can be carried out by a combination of tone frequencies and the timing sequence. Provided the two tones are present and in the correct time relationship, such equipment should function correctly.

3.2.5 However, if a filtering device was used, the widening of the filters would increase the background noise possibly to the extent of defeating the purpose of the filters as a means of reducing the noise on a ship's bridge.

3.2.6 For satisfactory operation of a filtering device, or for the aural tones to be similar in note to the present system, considerably tighter tolerances will need to be applied to J3E equipment. In the present A3 and H3E modes the allowable tone frequency tolerance is applicable only to the tone generator in the transmitter. In the J3E mode the ± 20 Hz tolerance must be shared between the tone generator frequency, the transmitter carrier frequency and the receiver oscillator frequency, because in this mode the received tone frequency and amplitude depend also on the accuracy of the carrier re-inserted at the receiver.

3.2.7 Due to the frequencies involved, nearly all of the tolerance would have to be shared between the transmitter carrier frequency and the receiver oscillator, leaving a small tolerance of about ± 0.1 Hz on the frequency of the tone generator at 1300 Hz.

3.2.8 The division of the ± 20 Hz between different types of equipment will, in practice, probably be dictated by operational considerations and the current state-of-the-art of high stability oscillators. At present for equipment operating on the frequency 2182 kHz, the following tolerances could be achieved at moderate cost:

Type of equipment	Temperature range	Frequency variation	
		with oven	without oven
Shipborne	0 to 40°C	±0.3 Hz	±10 Hz
Survival craft	−25 to +70°C	±0.3 Hz	±22 Hz

However, further study is required, in particular as regards the cost aspects.

3.2.9 Although it would be technically possible to provide survival craft equipment with temperature controlled ovens, this would introduce several problems, in particular the extra power which would be needed and the "warm up" arrangements. Under these circumstances, the necessary system tolerance of ± 20 Hz could not be met. However, if the shipborne equipment was temperature controlled, a worst system tolerance of ± 22.4 Hz could be achieved. This would be made up of ± 22 Hz for the survival craft equipment, ± 0.3 Hz for the shipborne equipment and ± 0.1 Hz on the frequency of the 1300 Hz tone generator. In view of crystal ageing etc., such requirements would require regular frequency verification of shipborne equipment. Other techniques providing stringent frequency tolerance in a hostile environment may be found to be applicable and study on this subject is necessary.

3.3 Summary

The advantages of J3E emissions are so significant that this class of emission should be adopted for distress and safety purposes. However, if a transitional period is considered in which both A3E, H3E and J3E emissions are employed, it will be necessary to:

3.3.1 Introduce effective watch at coast radio stations for A3E, H3E and J3E distress signals thus ensuring that the existing distress service is in no way degraded.

3.3.2 Introduce the capability for maintaining watch for A3E, H3E and J3E distress signals on all ships.

3.3.3 Improve the frequency accuracy and stability of equipment required to be used in distress situations. In this connection, the ability of survival craft radio equipment and EPIRBs to achieve and maintain a frequency tolerance of around ± 20 Hz and for ship equipment a tolerance of ± 0.3 Hz should be studied. Investigation into new techniques for SSB compatible auto-alarm signals would be helpful.

3.3.4 Assess in the present global philosophy of a 2182 kHz distress service the value of survival craft equipment and EPIRBs in relation to their dominant influence on the introduction of J3E emissions for distress and safety purposes.

3.3.5 Develop emergency equipment for J3E operation which is simple to operate and capable of reliable operation in widely variable environments after long periods of storage.

3.3.6 Take into account IMCO Recommendation on operational standards for radiotelephone watch receivers (Resolution No. A.383(X)) which requires equipment provided with a filtering unit to select the frequencies 1300 Hz and 2200 Hz. These frequencies are subject to a tolerance of ±1.5%. In such cases the following tolerances are required:

- shipborne equipment ±0.3 Hz
- survival craft equipment ±22 Hz
- tone generators ±0.1 Hz

4. Considerations with respect to the Future Global Maritime Distress and Safety System

4.1 The use of the frequency 2182 kHz

The frequency 2182 kHz will be required to be a dedicated international frequency for distress and safety traffic. It will be used for this purpose by ship, aircraft and survival craft stations.

As there will be no requirement for retaining the alerting function of the frequency 2182 kHz and thus the radiotelephone alarm and vital navigational warning signals will lose their present essential function, the introduction of J3E could be made considerably easier.

However, the use of the frequency 2182 kHz for homing purposes should be taken into account.

4.2 Frequency accuracies and stabilities

When the Future Global Maritime Distress and Safety System is fully implemented there will be no requirements for the distress frequency watchkeeping receiver as mentioned in § 3.3.6. Without this constraint, a frequency tolerance of 50 Hz would therefore seem to be suitable for a J3E operation on 2182 kHz.

5. Conclusions

5.1 The schedule for the introduction of the use of J3E emissions for distress and safety purposes will depend on the requirements for transition to the Future Global Maritime Distress and Safety System as developed by IMCO.

5.2 Full consideration should be given to all necessary measures to be taken during a transitional period for the reception of A3E and H3E emissions on the frequency 2182 kHz.

5.3 Consideration will have to be given to the most effective homing techniques on equipment using J3E emissions on 2182 kHz.

REFERENCES

IMCO: **a.** Doc. COM XXI/12; **b.** Doc. COM XXII/12.

CCIR Document

[1978-1982]: 8/154 (USA).

DRAFT

REPORT 746 (MOD I)*

THE CHOICE OF FREQUENCIES IN THE MARITIME MOBILE BANDS ABOVE 1605 kHz TO BE RESERVED FOR DISTRESS AND SAFETY PURPOSES

(Question 44/8 (MOD I))

(1978)

1. Introduction

1.1 For the exchange of public correspondence, the maritime mobile service has, in the HF range, frequencies in the 4, 6, 8, 12, 16, 22 and 25 MHz bands. However, except for 8364 kHz (for use by survival craft) and the supplementary radiotelephone distress frequencies of 4125 kHz and 6215.5 kHz, the only designated distress frequencies are VHF channel 16, and 500 kHz and 2182 kHz in the MF bands.

1.2 Whilst use of the latter frequencies has provided a valuable alert capability, based on the need for a ship in distress to communicate with the nearest ship, there are many areas of the world of low shipping density, widely-spaced coast stations and different propagation conditions where the designated MF frequencies do not provide adequate communication coverage for distress and safety purposes. To improve the latter capability, many Administrations are now using the radiotelephone frequencies of 4125 kHz and 6215.5 kHz. Experience has proved that frequencies in the 4 MHz and 6 MHz bands, although not designated exclusively for distress and safety purposes, provide a comprehensive coverage over a wide range of conditions. However, to fully utilize the available HF spectrum for distress and safety purposes, frequencies higher than 6 MHz are required.

2. Frequency bands

2.1 Some Administrations have conducted tests of a comprehensive nature to determine the choice of a frequency, or frequencies, in the maritime mobile bands above 4000 kHz to be reserved for distress and safety purposes. Comparison of reports by the USA, Argentina, Canada and Australia, together with extensive theoretical analysis and operational experience, shows that a single HF frequency would be inadequate to provide coverage in most areas, particularly taking into account the recommended use of HF frequencies in a future global distress system (Report 747 (MOD I) [IMCOa and b; CCIR, 1974-78 a and b]).

2.2 In analyzing sky-wave propagation over night and day, summer and winter and levels of solar activity over conditions prevailing in the North Atlantic, South Atlantic and South Pacific Ocean regions, it is concluded that an allocation of a frequency in each of the 4, 6, 8, 12 and 16 MHz bands, using class of emission J3E, will be required to provide an adequate communication capability for a global distress and safety system. In relation to this system, an allocation of a frequency in each of the 4, 6, 8, 12 and 16 MHz bands would result in rationalization of the number of coast stations, particularly in providing surveillance for a global scheme.

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* The Director, CCIR, is requested to bring this Report to the attention of IMCO and ICAO.

2.3 Shipping, including small craft, sailing around countries with a large coastline might be adequately covered for distress and safety by a combination of 2182 kHz for ship-to-ship alerting, and a 4 MHz or 6 MHz frequency for ship-to-shore alerting. On long voyages away from the land, this combination might be augmented by one frequency in each of the bands from 8 MHz upwards, i.e. 12 and 16 MHz. The number of bands required and the number of shore stations selected in a coordinated plan to provide safety coverage would depend on the distances involved. The shore station coverage could well constitute a cohesive global network, interconnected to the various authorities, such as SAR, over existing terrestrial networks.

2.4 Further studies on the need to include a frequency in the 22 MHz band, for a global system, will need to be undertaken recognizing that the number of coast stations required to guard J3E voice frequencies on a world-wide basis will depend on the higher frequency bands selected for use by ship stations. Additionally, the studies would include formulating a participating coast station coordination plan.

2.5 Studies (Report 745, Kyoto, 1978) have shown that in the frequency bands between 1605 kHz and 3800 kHz, the frequency 2182 kHz is the most appropriate for distress and safety purposes.

3. Frequencies for maritime distress and safety purposes

The Inter-Governmental Maritime Consultative Organization (IMCO) has set out its requirements for frequencies, and their proposed functions, for a Future Global Maritime Distress and Safety System (Report 747(MOD I)). An extract from the IMCO Recommendation concerning frequencies as given in Annex I although not all the frequencies included in the Annex come within the scope of this Report.

4. Protection of maritime distress and safety frequencies

4.1 With the development by IMCO of a global maritime distress and safety system, based on the integration of satellite and terrestrial communication techniques, a need has been identified to study the bandwidth needed to permit adjacent mutually compatible channels for digital selective-calling, radiotelephone and narrowband direct printing in the maritime mobile bands.

4.2 Protection may be discussed in terms of:

- bandwidth needed for the functional channels;
- bandwidth needed for guardbands;
- the most suitable arrangements for the functional channels within the guardbands.

4.3 The bandwidth required for a radiotelephone signal is given in the Radio Regulations Appendix 17(17A) as 350 — 2700 Hz. Current specifications allow for an additional 300 Hz for the filter response to provide a 40 dB attenuation, enabling the signal with its frequency tolerance to fit a 3.1 kHz channel spacing.

4.4 Digital selective calling and narrowband direct printing are specified in the Radio Regulations Appendix 38(20B) as frequency shift keying systems each with a 500 Hz channel spacing and requiring about 240 Hz bandwidth.

4.5 A composite bandwidth for the distress functions, as illustrated (between the guardbands) in § 4.13 and comprising radiotelephone (RT), narrowband direct printing NBDP and digital selective-calling (DSC), would be the total channel spacing of each individual function.

4.6 Consideration may be given to the possibility of reducing this bandwidth by various techniques, including:

- special filters for the radiotelephony signal;

- reduction of radiotelephone bandwidth;

- reduction of the digital signal bandwidth.

By using special filters and by introducing a 2400 Hz speech cut-off it might be possible to fit speech and one digital signal into a 3.1 kHz channel. With more special techniques, such as vocoders, it might be possible to fit in two digital signals. However, unless the radiotelephone bandwidth is reduced generally in the maritime mobile service, such measures would have the disadvantage that the distress channel would become non-standard with possible implications concerning connection to the public switched network, and would be different from other marine channels and would probably be incompatible with other equipment such as that in SAR aircraft.

4.7 Consideration was also given to the possible need for additional separation between the different functions to provide protection against mutual interference. It was considered, provisionally, that as the nature of the transmissions in adjacent channels differed substantially, no additional separation is needed.

4.8 It may therefore be concluded, provisionally, that the composite bandwidth requirement is the sum of the channel spacings of each individual function. With current arrangements in the maritime mobile service, this totals to 4.1 kHz.

4.9 Guardbands serve to allow a distress signal to be received under the following conditions:

- when the distress transmitter has drifted from its nominal frequency (frequency stability);

- when there is a stronger signal on an adjacent frequency.

4.10 Frequency stability of transmitters will improve in 1990 e.g. (from Appendix 7(3) of the Radio Regulations):

		1990	Until 1990
Ship station	MF	40 Hz	400 Hz
	HF	50 Hz	50×10^{-6} (200 - 850 Hz)
Survival craft station	MF	200 Hz	600 Hz
	HF	50×10^{-6} (200 - 850 Hz)	200×10^{-6} (800 - 3400 Hz)

It can be seen that only survival craft stations will have a significant tolerance. However, digital selective-calling is seen as an essential part of the distress system after 1990 and the required frequency stability for this is ±40 Hz (Appendix 38(20B)). If a high stability oscillator is provided in a survival craft for digital selective-calling it is reasonable to assume that this oscillator will also control the frequency of other associated transmitters such as radiotelephony. It may then be assumed that with the implementation of the future maritime distress and safety system, the stability of all transmitters (MF, HF, ship and survival craft) will be within ±40 Hz.

4.11 A signal on an adjacent frequency can be received as a stronger signal than the distress signal for two reasons:

- the propogation loss is different for the two signals;

- the two signals are transmitted with different powers.

Annex II to the Report contains some calculations on the protection of distress frequencies at 2 MHz and at 8 MHz from which it can be deduced that protection by guardbands is not practicable in the case of survival craft transmitters and that the guardbands required to protect ships' transmitters need to be wider at 2 MHz than at 8 MHz.

TABLE I — **Protection calculations for the frequency of 2182 kHz**

$\frac{\text{Ptr. 400 W}}{\text{Ptr. 1500 W}}$	= −6 dB	at 10 NM(1), L = −25 dB at 25 NM, L = −33 dB
$\frac{\text{Ptr. 60 W}}{\text{Ptr. 1500 W}}$	= −14 dB	at 100 NM, L = −50 dB where L = the received field strength calculated from Recommendation 368-3

400 Watts

	10 NM :	Rec. level DSC = −50 −6 dB		= −56 dB
		Rec. level telephony		= −25 dB
				−31 dB
Appendix 17(17A)		1.5 < Δ < 4.5	31 dB	0 dB
		4.5 < Δ < 7.5	38 dB	+7 dB
		7.5 < Δ <	43 dB	+12 dB
	25 NM :	Rec. level DSC = −50 −6 dB		= −56 dB
		Rec. level telephony		= −33 dB
				−23 dB
Appendix 17(17A)		1.5 < Δ < 4.5	31 dB	+8 dB
		4.5 < Δ < 7.5	38 dB	+15 dB
		7.5 < Δ	43 dB	+20 dB

60 Watts

	10 NM :	Rec. level DSC = −50 −14 dB		= −64 dB
		Rec. level telephony		= −25 dB
				−39 dB
Appendix 17(17A)		1.5 < Δ < 4.5	31 dB	−8 dB
		4.5 < Δ < 7.5	38 dB	−1 dB
		7.5 < Δ	43 dB	+4 dB
	25 NM :	Rec. level DSC = −50 −14 dB		= −64 dB
		Rec. level telephony		= −33 dB
				−31 dB
Appendix 17(17A)		1.5 < Δ < 4.5	31 dB	0 dB
		4.5 < Δ < 7.5	38 dB	+7 dB
		7.5 < Δ	43 dB	+12 dB

(1) NM: nautical miles

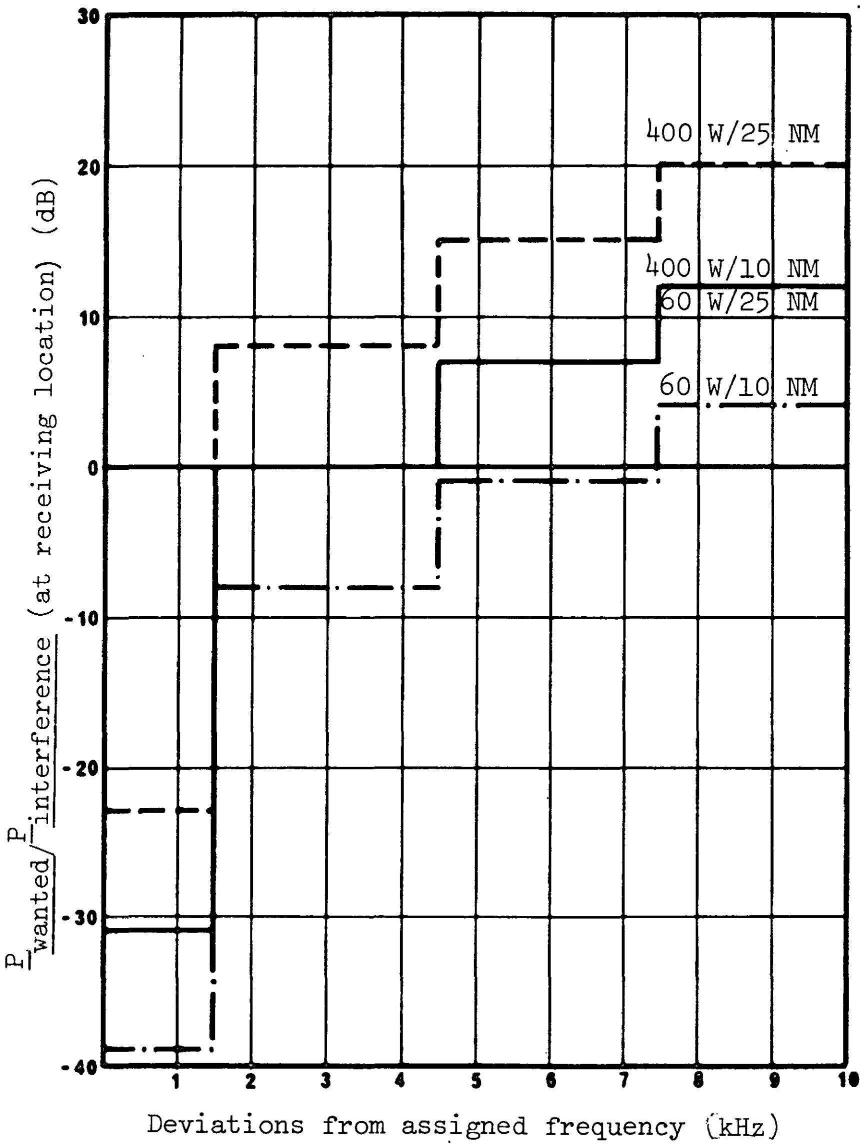
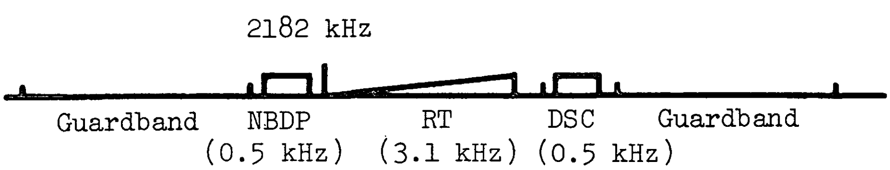


FIGURE 1 - Protection calculations for the frequency of 2182 kHz

4.12 The results of more detailed calculations at 2 MHz, based on the wanted signal (DSC) being transmitted with a power of 60 watts and 400 watts, and the interfering signal (RT) being transmitted with a power of 1500 watts at ranges from the receiving station of 10 and 25 nautical miles, are given in Table I and Fig. 1.

4.13 It may therefore be concluded, provisionally, than an adequate guardband for 2182 kHz would be in the order of one radiotelephone channel on each side of the distress functions as follows, based on current radiotelephone channel spacings:



4.14 In the case of HF frequencies of 4 MHz and above used for distress and safety purposes, narrower guardbands could be provided. A guardband convenient to channel spacing would probably be suitable and, with current arrangements, would be in the order of 1 kHz on each side of the distress functions.

4.15 Assuming comparable channel loading of all three distress functions within the guardbands, the best protection against mutual interference will probably occur when the two narrowband channels are separated by the radiotelephone channel, although an alternative arrangement might have advantages if the narrowband direct printing channel is seldom used.

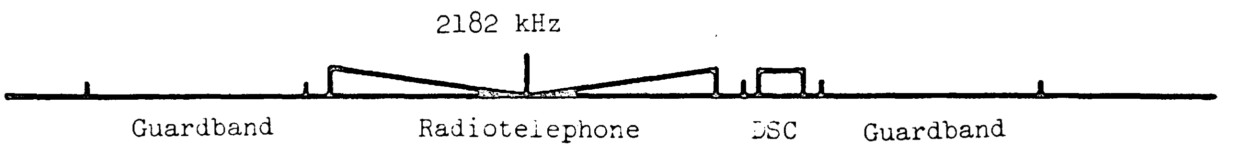
4.16 A characteristic of radiotelephony is that more energy is contained in the lower frequencies of the speech spectrum than in the higher frequencies. It is therefore considered that the probability of interference to an adjacent channel above a radiotelephony channel would be less than that for a channel below it.

4.17 It may therefore be concluded that the most suitable arrangement for the functional channels within the guardbands would be for the digital selective-calling channel to be located above the radiotelephony channel and for the narrowband direct printing channel to be below it.*

5. Summary

5.1 Facilities should be provided for distress and safety communications to permit the implementation by IMCO of the Future Global Maritime Distress and Safety System.

5.2 The frequency of 2182 kHz should be retained for distress and safety purposes and when class J3E emission has been fully implemented on that frequency, the guardbands and arrangement of functions should be as illustrated in § 4.13. Pending full implementation of J3E an adequate arrangement would be:



* Studies should be carried out into the technical means by which such a channel configuration could be achieved.

5.3 In the HF maritime mobile bands above 4 MHz, the arrangement of distress and safety functions within the guardbands should be the same as that illustrated in § 4.13. However, the guardbands may be reduced to the order of 1 kHz.

REFERENCES

IMCO [a] Doc. COM XVI/INF.2 (USA).

IMCO [b] Doc. COM XVIII/3(a)/2 Canada.

CCIR Documents

[1974-78]: **a.** 8/386 (Argentina); **b.** 8/406 (Australia).

ANNEX I

FREQUENCIES FOR DISTRESS AND SAFETY

(Extract from Doc. 8/157 (1978-82) – IMCO)

1. The future system is based on the concept that a ship in distress will transmit a distress call to a rescue coordination centre* and to shipping in the vicinity of the ship in distress. The rescue coordination centre will be responsible for alerting other units able to assist and, if necessary, to coordinate the rescue operations.

2. The system must provide an overall telecommunications network capable of sustaining this concept.

3. To enable a suitable telecommunications network to be set up, a number of dedicated frequencies and a number of designated frequencies** in the bands used by the maritime mobile service and the maritime mobile-satellite service will be necessary. Frequencies need to be made available for distress and safety calls using digital selective-calling techniques in the maritime mobile service and also frequencies for subsequent distress and safety traffic. Frequencies are also required for the transmission of navigational and meteorological information.

4. Frequency requirements needed to implement the future system and their proposed functions are the following:

4.1 5xx kHz

A dedicated frequency in the band 435-525 kHz will be required as an international distress frequency for alerting in the shore-to-ship direction. The frequency is to be used only for distress and safety calls using digital selective-calling techniques.

4.2 5yy kHz

A dedicated frequency in the band 435-525 kHz will be required as an international frequency for the transmission of coastal navigational and meteorological information only, using narrowband direct printing.

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* For the purposes of this (IMCO) Recommendation a rescue coordination centre includes associated coast stations and coast earth stations and is defined as a unit responsible for promoting efficient organization of search and rescue services and for coordinating the conduct of search and rescue.

** For the purposes of this (IMCO) Recommendation a dedicated frequency is a frequency on which only distress and safety communications are permitted. A designated frequency is a frequency assigned for distress and safety communications on which other authorized communications are permitted.

4.3 2xxx kHz

A dedicated frequency in the band 2170-2194 kHz will be required as an international distress frequency for alerting in the shore-to-ship, ship-to-shore and ship-to-ship directions. The frequency is to be used only for distress and safety calls using digital selective-calling techniques.

4.4 2182 kHz

The frequency 2182 kHz is required to be a dedicated international frequency for distress and safety traffic. It shall be used for this purpose by ship, aircraft and survival craft stations. It may also be used for homing purposes.

4.5 3023 kHz

No change, see Radio Regulations No. 2980(6640/1326C).

4.6 4xxx kHz

A dedicated frequency in the band 4063-4438 kHz will be required as an international distress frequency for alerting in the shore-to-ship and ship-to-shore directions. The frequency is to be used only for distress and safety calls using digital selective-calling techniques.

4.7 4yyy kHz

A frequency in the band 4063-4438 kHz is required to be a designated international frequency for distress and safety traffic.

4.8 5680 kHz

No change, see Radio Regulations No. 2984(6646/1353B).

4.9 6xxx kHz

A dedicated frequency in the band 6200-6525 kHz will be required as an international distress frequency for alerting in the shore-to-ship and ship-to-shore directions. The frequency is to be used only for distress and safety calls using digital selective-calling techniques.

4.10 6yyy kHz

A frequency in the band 6200-6525 kHz is required to be a designated international frequency for distress and safety traffic.

4.11 8xxx kHz

A dedicated frequency in the band 8195-8815 kHz will be required as an international distress frequency for alerting in the shore-to-ship and ship-to-shore directions. The frequency is to be used only for distress and safety calls using digital selective-calling techniques.

4.12 8yyy kHz

A frequency in the band 8195-8815 kHz is required to be a dedicated international frequency for distress and safety traffic.

4.13 12xxx kHz

A dedicated frequency in the band 12 230-13 200 kHz will be required as an international distress frequency for alerting in the shore-to-ship and ship-to-shore directions. The frequency is to be used only for distress and safety calls using digital selective-calling techniques.

4.14 12yyy kHz

A frequency in the band 12 230-13 200 kHz is required to be a designated international frequency for distress and safety traffic.

4.15 16xxx kHz

A dedicated frequency in the band 16 360-17 410 kHz will be required as an international distress frequency for alerting in the shore-to-ship and ship-to-shore directions. The frequency is to be used only for distress and safety calls using digital selective-calling techniques.

4.16 16yyy kHz

A frequency in the band 16 360-17 410 kHz is required to be a designated international frequency for distress and safety traffic.

4.17 121.5 and 123.1 MHz

No change, see Radio Regulations No. 2980(6651A/968) and 2991 (6652/969).

4.18 156.3 and 156.8 MHz

No change, see Radio Regulations No. 2993(6654/953).

4.19 15x.x MHz

A dedicated frequency in the band 156-174 MHz will be required as an international distress frequency for alerting in the shore-to-ship, ship-to-shore and ship-to-ship directions. The frequency is to be used only for distress and safety calls using digital selective-calling techniques.

4.20 15y.y MHz

A frequency in the band 156-174 MHz is required to be a dedicated international frequency for distress and safety traffic. It may also be used for homing purposes.

4.21 243 MHz

No change, see Radio Regulations No. 2996(6658).

4.22 406-406.1 MHz

The frequency band 406-406.1 MHz is an international distress frequency band to alert rescue coordination centres. It will be used for distress calls using frequencies and techniques recommended by the CCIR.

4.23 1544-1545 MHz

No change, see Radio Regulations No. 728(3695A).

4.24 1645.5-1646.54 MHz

The frequency band 1645.5-1646.5 MHz is an international distress frequency band to alert rescue coordination centres. It will be used for distress calls using frequencies and techniques recommended by the CCIR.

ANNEX II

PROTECTION OF DISTRESS FREQUENCIES IN THE 2 MHz AND 8 MHz BANDS

1. Introduction

The assumptions in § 2 and the calculations in § 3 are related to the 2182 kHz band.

The cases considered are of an alert from a survival craft-transmitter with a low antenna efficiency (§§ 3.1 and 3.2) and of an alert from another ship with a normal antenna efficiency (§§ 3.3 and 3.4) being received by a coast station while a ship is transmitting using a power of 1500 watts on an adjacent frequency.

2. Assumptions

2.1 $$\frac{P_{survival\ craft}}{P_{ship}} = 10 \log \frac{5}{1.5 \times 10^3} = -25 \text{ dB}$$

2.2 Antenna efficiency, $$\frac{\text{survival craft}}{\text{ship}} = -10 \text{ dB}$$

2.3 Distance of unwanted transmission (a) 10 NM = 18.5 km
(b) 25 NM = 46 km

2.4 Distance of wanted transmission 100 NM = 185 km

2.5 $$\frac{P_{ship\ in\ distress}}{P_{ship}} = -8 \text{ dB}$$

3. Calculations

3.1 <u>10 NM case (ship – survival craft)</u>

at 100 NM, $\underline{L}$ = –50 dB where $\underline{L}$ = the received field strength
at 10 NM, $\underline{L}$ = –25 dB calculated from Recommendation 368–3

Receiving level DSC = –50 dB –25 dB –10 dB	= –85 dB
Receiving level telephony	= –25 dB
Receiving level DSC rel. to telephony	= –60 dB

Appendix 17(17A) :	1.5 < Δ < 4.5	31 dB	–29 dB
	4.5 < Δ < 7.5	38 dB	–22 dB
	7.5 < Δ	43 dB	–17 dB

3.2 <u>25 NM case (ship – survival craft)</u>

at 100 NM, L = −50 dB
at 25 NM, L = −33 dB

Receiving level DSC = −50 dB −25 dB −10 dB	= −85 dB
Receiving level telephony	= −33 dB
Receiving level DSC rel. to telephony	= −52 dB

Appendix 17(17A) :	1.5 < Δ < 4.5	31 dB	−21 dB
	4.5 < Δ < 7.5	38 dB	−14 dB
	7.5 < Δ	43 dB	− 9 dB

3.3 <u>10 NM case (ship – ship)</u>

at 100 NM, L = −50 dB
at 10 NM, L = −25 dB

Receiving level DSC = −50 dB −8 dB	= −58 dB
Receiving level telephony	= −25 dB
Receiving level DSC rel. to telephony	= −33 dB

Appendix 17(17A) :	1.5 < Δ < 4.5	31 dB	−2 dB
	4.5 < Δ < 7.5	38 dB	+5 dB
	7.5 < Δ	43 dB	+10 dB

3.4 <u>25 NM case (ship – ship)</u>
at 100 NM, L = −50 dB
at 25 NM, L = −33 dB

Receiving level DSC = −50 dB −8 dB	= −58 dB
Receiving level telephony	= −33 dB
Receiving level DSC rel. to telephony	= −25 dB

Appendix 17(17A) :	1.5 < Δ < 4.5	31 dB	+6 dB
	4.5 < Δ < 7.5	38 dB	+13 dB
	7.5 < Δ	43 dB	+18 dB

4. 8 MHz

At 8 MHz the propagation of the distress signal will be by sky wave. Sky-wave attenuation is very variable so the worst case is considered. This occurs when the distress signal is received at the minimum usable field strength of the coast-station receiver. Interference could be caused by a ship transmitting from the vicinity of the coast station to a distant coast station situated a similar distance away as the distress transmitter. The interference would then be propagated by ground-wave.

5. Assumptions

- Received field strength of distress call 2.5 μV/m (derived from the IMCO requirement of 25 μV/m at 2182 kHz)

- Transmitted e.i.r.p. of interference 1000 watts.

6. Calculations

From Fig. 1 of Recommendation 368-3 the relative amplitudes of the signals at the coast station are:

	Distance	
	10 NM	25 NM
Unwanted interference signal / Wanted distress signal	+78 dB	+68 dB

where the distance is that between the coast station receiving the distress signal and the interfering ship.

Spurious emissions from the interfering transmitter which are co-channel with the distress emission are then required to be say 88 to 78 dB below the interference e.i.r.p. Appendix 17(17A) requires only 43 dB. This level of spurious emission would be 10 dB below the wanted signal if the distance was 160 NM. Alternatively the required loss would be obtained if the coast station was 40 NM inland due to the high attenuation of the ground-wave over the land.

7. Conclusion

The calculations show that at 2 MHz the interference is always greater than the wanted signal from a survival craft and therefore it may be concluded that it is not practicable to protect a survival craft emission at 2 MHz.

At 8 MHz it is not practicable to protect any distress emission unless the coast-station receiver is assumed to be 70 km (40 NM) inland to take advantage of the extra attenuation of the interfering ground-wave. Any interference will then be by sky wave and the difference in levels is likely to be the difference in the power transmitted, i.e. 8 dB in the case of a ship transmitter and 35 dB in the case of a survival craft transmitter.

DRAFT

REPORT 747 (MOD I)*

TECHNICAL AND OPERATING CONSIDERATIONS FOR A FUTURE GLOBAL DISTRESS AND SAFETY SYSTEM AT SEA

(Question 45/8 (MOD I))

(1978)

1. Introduction

A future distress system should ensure the rapid receipt of all distress messages and provide the communication capabilities necessary to coordinate the rescue of survivors in order to promote safety at sea.

2. Present system

The present maritime distress system is based upon the requirement that certain classes of ships keep radio watch on one of the international distress frequencies when at sea, carry equipment capable of transmitting over a minimum specific surface distance and, where practicable, are required to assist another vessel in distress. To supplement the efforts of ships at sea, most maritime countries maintain a life-saving service for the rescue of people in distress around their coasts, although the particular search and rescue (SAR) organization varies from country to country.

In practice these arrangements have limitations, and various methods have been, or are being, implemented to try to reduce these. For example, the following developments have occurred during the last decade:

2.1 international agreement has been reached on the need for ships to be able to communicate on a common distress frequency;

2.2 there are advocates for the mandatory carriage of HF equipment for distress purposes and serious reservations have been expressed about the use of 500 kHz in survival craft;

2.3 aircraft of airlines are being pressed, through the International Civil Aviation Organization (ICAO), to improve the watch on 121.5 MHz when flying over ocean areas;

2.4 countries in some areas have implemented the use of frequencies in the 4 MHz and 6 MHz bands to supplement 2182 kHz;

2.5 some Administrations have implemented the use of class J3E emission on 2182 kHz for safety purposes;

2.6 a number of countries have introduced legislation concerning the carriage of emergency position-indicating radio beacons (EPIRB) and

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* The Director, CCIR, is requested to bring this Report to the attention of ICAO, IMCO and the INMARSAT Organization.

2.7 the introduction of selective calling.

Each development is beneficial under certain circumstances. However, one adverse result has been that for ships operating world-wide to obtain assistance rapidly, and at any time, equipment would need to be carried permitting use of each of the frequencies 500 kHz, 2182 kHz, 4125 kHz, 6215.5 kHz, 8364 kHz, 121.5 MHz, 243 MHz and 156.8 MHz. These developments have come about generally because of shortcommings of the present system, for example the difficulties in obtaining assistance when a distress situation occurs beyond the range imposed by the propagation limitations of existing distress frequencies and the problem of an alert not being transmitted in the event of a ship being suddenly overwhelmed.

The introduction of satellite techniques in the maritime mobile service introduces further considerations. A ship in distress fitted with a satellite terminal will be able to transmit an alert rapidly to an appropriate shore authority and SAR organization. However, until all ships can be contacted by satellite or by a selective calling system, there might be difficulty in contacting any which may be in a position to assist, particularly if the incident occurred beyond the range of coast radio stations.

To summarize, it can be seen that the present distress system, whilst adequate in particular circumstances, has resulted in general growth of small sub-systems and an increase in the number of frequencies needed by ships in order to improve the probability of a distress call being received. In addition, the use of satellites, whilst improving the distress communication of suitably equipped ships, will introduce greater shore authority involvement and, indirectly, promote the need for better long-range terrestrial distress communications as well as for the widespread use of selective calling.

3. Future system

The Inter-Governmental Maritime Consultative Organization (IMCO) has set out its requirements of the Future Global Maritime Distress and Safety System which are given without any modification in Annex I to this Report.

IMCO is continuing its work on planning the future system with the objective of it being implemented in 1990. However IMCO recognizes that a number of administrative, technical and operating problems may arise and that these might affect the date of implementation.

4. Technical and operating factors affecting implementation

Special measures which should be undertaken by the CCIR to assist the implementation of such a system include the need to:

4.1 complete Recommendation 541 on the digital selective calling system and for operational trials to be carried out;

4.2 make recommendations on the frequencies and techniques to be used for alerting by satellite EPIRBs (Report 761 refers), and to coordinate trials of such systems;

4.3 study the possibilities for utilizing simple shipborne equipment for receiving shore-to-ship alerting via satellites;

4.4 complete Report 746, particularly in respect of the maritime mobile VHF frequency band;

4.5 study the most suitable homing techniques to be used.

ANNEX I

REQUIREMENTS OF THE FUTURE GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM

1. Introduction

1.1 The objective of the system is to provide for adequate communications in order to promote safety of life at sea. The system shall be in support of the International Convention on Maritime Search and Rescue, 1979.

1.2 The system shall ensure the rapid transfer of distress messages from those in distress to the units best suited for giving or coordinating assistance. It shall also ensure rapid receipt of all relevant distress and safety communications.

1.3 The Future Global Maritime Distress and Safety System shall provide for the integrated use of appropriate frequency bands to ensure the transmission and receipt of distress and safety calls and messages at short, medium and long ranges. By definition:

- short ranges do not exceed 25 miles;
- medium ranges do not exceed the order of 100 miles;
- long ranges exceed the order of 100 miles.

1.4 The Future Global Maritime Distress and Safety System shall use the numerical ship station identification system * prescribed in the Radio Regulations. This numbering system permits the assignment of unique numbers to each station.

1.5 Standard operational procedures and equipment standards shall be used in the Future Global Maritime Distress and Safety System.

2. System requirements

2.1 The future system should be global and designed with the objectives of ensuring that:

- the alerting, identification and positioning are quickly and reliably performed in all types of distress incidents;
- communications means exist to facilitate the rescue of survivors including their location and the coordination of rescue units;
- it is reliable, and equipment to be used by persons in distress is simple to operate. The equipment is to be capable of maintenance when necessary;
- it is able to accommodate coincident distress calls.

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* Referred to in the Radio Regulations (Appendix 43 (CA)) as Maritime Mobile Service Identities.

2.2 The system requirements are considered under the following general headings:

Distress Alerting	PART 1
Identifying	PART 2
Positioning	PART 3
SAR Coordinating Communications	PART 4
On-Scene Communications	PART 5
Locating	PART 6
Preventive Actions	PART 7

2.3 In these PARTS each frequency requirement is identified by a three-character code. The first character is the letter "f" for frequency; the second character is a number indicating the frequency band in megahertz; and the third is a letter indicating as follows:

A — Digital selective calling, Simplex channel

B — Radiotelephony Simplex channel

C — Narrow band direct printing (NBDP) channel

PART 1 TO ANNEX I

DISTRESS ALERTING

1. Definition

Distress alerting means the successful reporting of a distress situation to a unit which can provide or coordinate assistance.

2. Operational requirement

The basic operational requirement for alerting is that in every distress situation it should be possible to rapidly alert the unit(s) able to give, as fast and efficiently as possible, the assistance required.

3. Alerting methods and ranges

3.1 Referring to Fig. 1, alerting may be achieved using the following methods:

- ship *-to-shore alerting (link A-1 and A-2)
- shore-to-ship alerting (link B)
- ship *-to-ship alerting (link C)

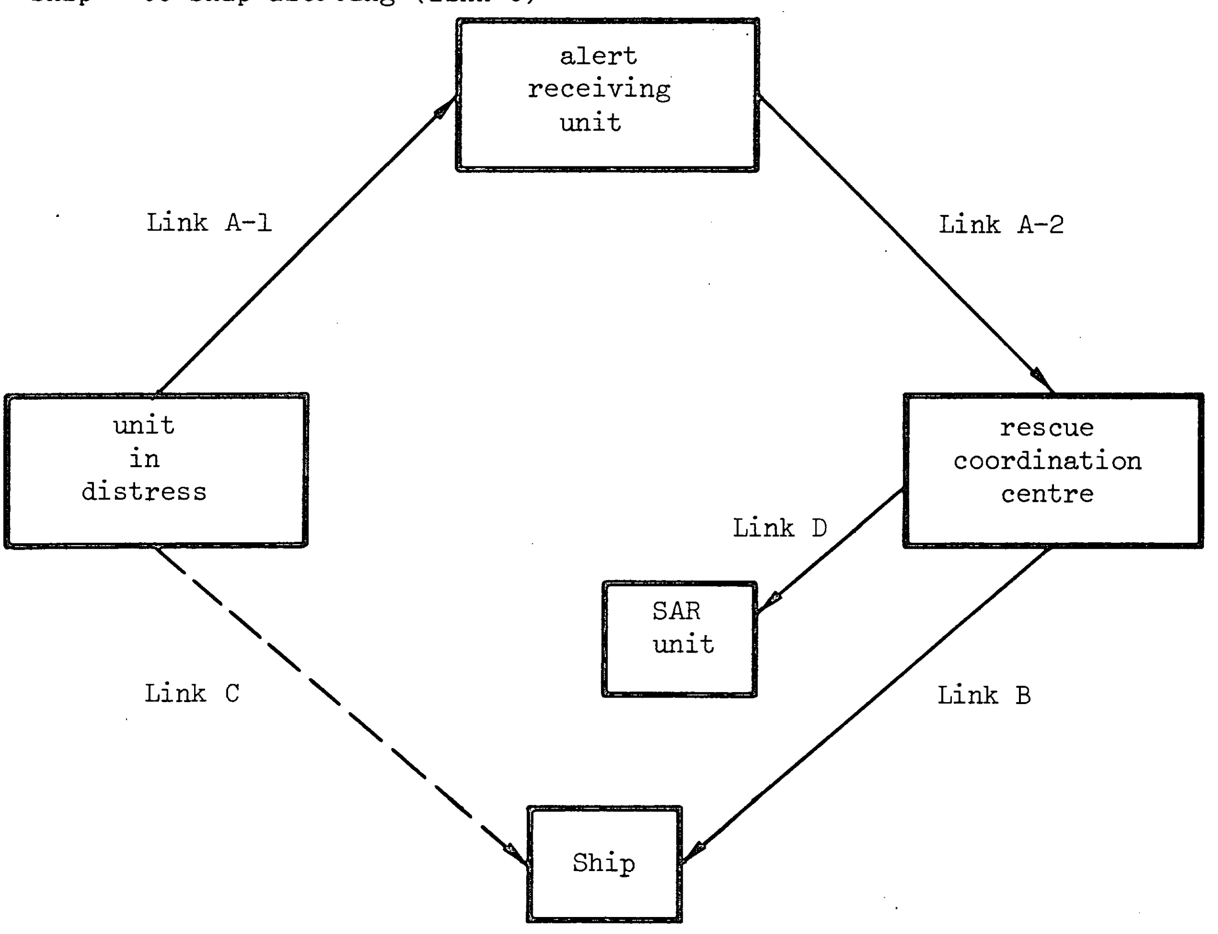

FIGURE 1

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* Although the term "ship" is used, it also represents any unit in distress at sea.

3.2 It has been agreed that in order to fulfil the operational requirement stated in § 2, the following range requirements should apply to the different alerting methods:

- ship-to-shore alerting: short, medium and long range
- shore-to-ship alerting: short, medium and long range
- ship-to-ship alerting: short and medium range.

3.3 Shore-to-ship alerting is closely related to SAR Coordinating Communications, and the methods are described in Part 4, § 3.

4. Operational characteristics

4.1 The future global maritime distress alerting system shall serve all ships and units suitably equipped.

4.2 The system shall provide for the receipt of distress alerts from units situated in all maritime areas.

4.3 The probability of alerting the unit(s) able to give, as rapidly and effectively as possible the assistance required, should be high, and the time required to alert should be short compared to the total rescue time.

4.4 The system should allow for automatic and manual alerting, be simple to operate and maintain at full effectiveness, accommodate the probable number of coincident distress alerts, and be free of false alerts or be capable of discriminating between false and true alerts, as far as practicable.

4.5 To perform ship-to-ship alerting using terrestrial frequencies, the ships which are supposed to receive the alert must have a radio receiver operating on the frequency used by the unit in distress for transmitting the alert. If different frequencies for ship-to-ship alerting were to be utilized in different areas, this would imply that ships in world-wide trade must be equipped to transmit and receive on every frequency adopted. Thus it is desirable to adopt the minimum number of frequencies necessary for ship-to-ship alerting.

4.6 Dependent on the following conditions, there is no requirement for ships to be fitted with a common system to achieve ship-to-shore alerting:

- the unit in distress must be able to alert shore stations using one of the radio system elements included in the distress system;
- any ship must be able to be contacted in the shore-to-ship direction by use of one of the radio system elements included in the distress system;
- the shore stations of all radio system elements must be able to communicate with the appropriate Rescue Coordination Centres;
- facilities are provided to ensure that an alert received by any radio system element is forwarded to the Rescue Coordination Centre for the appropriate area, and to enable an area call or an individual call to be sent to ships.

4.7 Alerting can be achieved by:

- terrestrial communications within the limitations imposed by propagation characteristics as they relate to frequency, effective radiated power and distance between transmitter and receiver in the system;

- communications by satellite relay within the area of coverage of the satellite.

4.8 Selective calling shall be used for alerting purposes.

5. Terrestrial communications

5.1 Long range alerting

5.1.1 Two alternatives for long range alerting are available and may be summarized as follows:

- transmission on a comprehensive range of frequencies to include those which can be calculated to give the required field strength at a given receiving station;

- transmission on a limited number of frequencies calculated to allow for the geographic coverage area of the signal to be intercepted by a number of receiving stations at various distances from the transmitter.

5.1.2 The probability of receiving a distress alert is significantly enhanced by a comprehensive system of mutually coordinated receiving stations. A similar network of transmitting stations will also improve the probability of alerting ships.

5.1.3 With terrestrial techniques, shipborne equipment would need to be capable of transmitting on a frequency in each of a number of dedicated maritime HF bands.

5.1.4 It is complicated to provide an HF multi-frequency facility of transmission from survival craft and low powered distress transmitters.

5.2 Medium and short range alerting

5.2.1 Medium and short range alerting may be considered entirely as a function of ground wave propagation. All existing maritime distress systems are based on this method of propagation. It is considered that alerting using these methods of propagation will form an important part of the future distress system, as in many parts of the world, because of the local density of ship population, it will provide a rapid and reliable means of alerting. Where shore stations are situated within the range of the unit in distress, then alerting to the Rescue Coordination Centre is provided. This form of alerting will also help to reduce the load on the long range system.

5.2.2 Short range alerting is most commonly identified with line-of-sight paths such as applicable to the VHF or higher bands. These will continue to serve an essential role in close coastal waters where a majority of ship population occurs.

6. Satellite relay in alerting

6.1 The high technical performance of maritime communication by satellite relay is well established and documented. The reliability of the space segment in providing relay from geostationary orbit and polar orbit is similarly established and quantified. Distress alerting through satellites will therefore be included in the global system design and may be used for long, medium and short range alerting.

6.2 The provision of special facilities for alerting by geostationary satellite between installed ship earth stations, coast earth stations and Rescue Coordination Centres is already the subject of study for a future INMARSAT service; is a feature of the first commercial maritime satellite communication service, and will form an alerting capability for those ships fitted with such equipment.

6.3 Radiocommunication systems for ship-to-shore alerting via satellite from survival craft and other low powered distress transmitters are under development and may require special provision at the space segment. One design of transmitter might be used for these functions and from a ship itself, the only difference being in the "packaging" or protection provided.

6.4 Although the technique and system design for low powered distress transmitters has yet to be defined, such transmissions will form an essential component of a future global system.

6.5 The limitations of satellites in geostationary orbit and those in polar orbit need to be taken into consideration when assessing their effectiveness in meeting the requirement for receipt of distress alerts from units located anywhere at sea.

6.6 In order to achieve reliable shore-to-ship alerting, CCIR and the INMARSAT Organization are requested to study the possibilities for utilizing simple shipborne equipment for receiving shore-to-ship alerting via satellites.

7. Assessment of terrestrial and satellite techniques

7.1 From a consideration of the previous sections it has been agreed that the long range alerting function of the future global distress system will be based primarily on the use of satellite techniques and will include the use of low powered distress transmitters.

7.2 Low power distress transmitters should operate through geostationary satellites, but the use of polar orbiting satellites is also desirable.

7.3 It is desirable that a common frequency for low power distress transmissions should be provided for both geostationary and polar orbiting satellites. It is noted that 1.6 GHz is likely to be used in the initial plan of INMARSAT, and experiments are conducted with the use of 406 MHz by polar orbiting satellites.

8. Alerting based on the non-receipt of a scheduled reporting signal

8.1 Passive alerting is based on the non-receipt of radio signals:

- provided a highly reliable communication system is available, passive alerting may be used;

- passive alerting based on radio signals implies that central units guard each ship by receiving OK-signals transmitted at regular intervals by the ship. When a distress situation occurs, this transmission is stopped (manually or automatically) and this will be interpreted as an alert;

- an advantage of this type of alerting is that alerting will be obtained even if the radio equipment is damaged as a consequence of the distress incident. A disadvantage is that there may be a delay from when the distress situation occurs until an alert is registered (maximum delay equals the interval between each repetition of OK-signal). Another disadvantage is that false alerting may occur if the radio equipment malfunctions.

8.2 Equipment which monitors the OK-transmission must therefore be available in the ship. Furthermore, the ship must have some type of radio equipment in addition to the equipment used for the OK-signal, so that information regarding transmission problems may be given to the central unit, either directly or via another ship in the same area.

9. Combined active and passive alerting

Passive alerting only cannot be recommended, but a combination of active and passive alerting may have some advantages:

9.1 in most distress incidents it will be possible to achieve rapid alerting by active alerting;

9.2 in most, or possibly all situations where active alerting is precluded, passive alerting could take place;

9.3 when both active and passive alerts are registered, the probability of a false alert should be low.

10. Frequencies designated for distress alerting

10.1 Short range distress alerting

The frequency band 156 MHz should accommodate a simplex channel dedicated for ship-to-shore distress alerting, shore-to-ship distress alerting and ship-to-ship distress alerting using digital selective calling (DSC) (hereafter referred to as f 156A). The same channel should also be used for safety calling.

10.2 Medium range distress alerting:

- a simplex channel in the 2 MHz band should be dedicated for ship-to-shore distress alerting shore-to-ship distress alerting and ship-to-ship distress alerting using DSC. This channel is hereafter referred to as f 2A. This channel should also be used for safety calling;

- a frequency/ies in the 500 kHz band should be designated for shore-to-ship distress alerting (f 0.5A and/or f 0.5C). This/these frequency/ies could also be used for long range shore-to-ship alerting.

10.3 Long range distress alerting:

- a frequency should be dedicated in the 406 MHz and/or 1.6 GHz bands for ship-to-shore distress alerting using Low Power Distress Transmitters (LPDT's) operating through satellites (see § 7.3);

- a frequency should be dedicated for shore-to-ship alerting in the 1544-1545 MHz band (see § 6.6);

- a provision will be included in the future INMARSAT system for ship-to-shore and shore-to-ship distress alerting through geostationary satellites using a ship earth station in the frequency band 1530-1645.5 MHz;

- each of the frequency bands 4, 6, 8, 12 and 16 MHz should accommodate the following channel:

  A simplex channel dedicated to ship-to-shore distress alerting and shore-to-ship distress alerting using DSC. (These channels are hereafter referred to as f 4A, f 6A, f 8A, f 12A and f 16A.) The same channels should also be used for safety calling.

PART 2 TO ANNEX I

IDENTIFYING

1. Definition

1.1 Identifying means the receipt of sufficient information in order to determine without ambiguity the unit in distress.

2. Operational requirement

2.1 The code to be used for identification shall be in accordance with the provisions described in Article No. 25(N23), Appendix 43(CA) and Resolution No. 313(DD) of the Radio Regulations, taking into account relevant CCIR and CCITT Recommendations.

2.2 The distress alerting message must contain such identification of the unit in distress to enable the most effective assistance and SAR support.

PART 3 TO ANNEX I

POSITIONING

1. Definition

1.1 Positioning means establishing the geographical place of the unit in distress. It is normally expressed in degrees and minutes of latitude and longitude.

2. Operational requirement

2.1 The distress alert, when received, should enable the position of the unit in distress to be established for:

- selection of the most suitable rescue unit(s);
- the rescue unit(s) to choose a course not causing significant additional delays;
- the rescue unit to head for a position which is inside the range of the locating method, taking into account the possible drift of the survivors.

2.2 It is essential that the SAR units should have the best available information on the position of the ship in distress in order to carry out SAR operations rapidly and efficiently.

3. Possible methods

3.1 Positioning may be performed, using any of the following methods:

3.1.1 The unit in distress determines its position and transmits this information.

3.1.2 Radio signals transmitted by the unit in distress are used by other units participating in the system to determine the position. The following principles may be applied:

3.1.2.1 The position is determined by radio direction-finding from at least two different positions.

3.1.2.2 The radio signals transmitted by the unit in distress contain information derived from radionavigation signals received at the distress site. The position is determined by processing at the receiving site.

3.1.2.3 The radio signals transmitted by the unit in distress are received via satellite(s) in such a way that the position may be calculated by, for example:

- Doppler shift measurements via a low orbiting satellite;
- transmitting signals via two or more geostationary satellites.

3.1.3 The ships participate in a ship reporting system. Time of alerting plus the ship identification will define the approximate position.

3.1.4 In coastal areas the position of each ship is monitored continuously, e.g. by radars or optical instruments.

3.2 Where coastal positioning systems exist, e.g. direction-finding, radar, optical, effective communications between these stations and the SAR centre should be established for immediate reporting.

3.3 The positioning accuracy should be sufficiently high to avoid excessive search time.

3.4 Relevant combinations of methods for alerting and positioning are summarized in Table I.

TABLE 1

Alerting			Positioning					
Principle	Radio system		Own positional data	Retrans. of navigational signals	Direction finding	Doppler principle	Ranging	Position, route/ speed reporting (Note 1)
Active alerting	Terres- trial	HF (long range)				Not applicable	Not applicable	Applicable
		MF (medium, short range)		Probably not applicable	Applicable	Not applicable	Not applicable	Applicable
		VHF/UHF (short range)	Applicable			Not applicable	Not applicable	Applicable
	Geostationary satellite system			Requires further study	Not applicable	Not applicable	Probably not applicable in 1st generation system	Applicable
	Low-orbiting satellite system		Applicable but unnecessary	Probably not applicable, and unnecessary	Not applicable	Applicable	Not applicable	Applicable
Passive alerting	Geostationary or low-orbiting system, or, highly reliable terrestrial systems				(Note 2)			Applicable and necessary

Note 1.- Position/route/speed reporting implies that central unit(s) keeps track of the ship's planned route. In principle, time of alert plus identification of the ship will be sufficient to determine the approximate position where the distress incident has occurred.

Note 2.- Positioning in connection with OK-signals may be obtained by using the same methods that are applicable for positioning in connection with active alerting in the relevant radio systems.

PART 4 TO ANNEX I

SAR COORDINATING COMMUNICATIONS

1. Definition

1.1 SAR coordinating communications mean the SAR communications other than on-scene communications necessary for the coordination and control of units participating in a distress incident. It includes control communications between the SAR shore authority and the on-scene commander or coordinator surface search.

2. Operational requirements

2.1 The system should provide communications with those units which are in the vicinity of the unit in distress, to enable the most effective employment of suitable assisting mobile unit(s).

2.2 These communications should provide the SAR coordinator with information regarding the distress situation and potential rescue units.

2.3 To fulfil the objective of the system, the SAR coordinator must be able to contact rapidly the specific potential rescue unit that is able to give the assistance as fast and efficiently as possible.

3. Coordinating methods

3.1 The SAR coordinator must have, or be able to obtain, information on the position of potential assisting units. Alternative methods for obtaining this information are:

3.1.1 for ships participating in a ship reporting system the SAR coordinator may obtain the information from the system;

3.1.2 ships equipped for receiving area calls by the use of a selective calling system could be notified automatically and then report their positions to the SAR coordinator;

3.1.3 ships not equipped as specified in § 3.1.2 above, but equipped for receiving an all-ships call, could be notified by this method. The all-ships call must be followed by a specification of what area is of interest. Ships within this area must report back. This method may be suitable in a short-range system, but has operational drawbacks if used in a long-range system.

3.2 The SAR coordinator must be able to contact selected units and give instructions and information. The method for contacting a specific unit will be related to the method available for obtaining the survey of potential units:

- for the conditions stated in §§ 3.1.1 and 3.1.2 the ship selected will be contacted by transmitting a selective call;
- for the conditions stated in § 3.1.3, an all-ships call must be subsequently transmitted associated with an identification of the ship selected.

3.3 Possible relay communications through another mobile unit in the event of communication difficulties.

4. Frequencies for SAR coordinating communications

4.1 In order to contact ships required to participate in SAR operations, the Rescue Coordination Centre should use the DSC channels for shore-to-ship alerting (see Part 1, § 10).

4.2 Frequencies for SAR coordinating communications:

4.2.1 Simplex channels should be dedicated for SAR coordinating communication by J3E voice communications and by narrowband direct printing (NBDP) in the bands 2 MHz, 8 MHz and 156 MHz. At this stage the channels will be referred as follows:

Voice: f 2B, f 8B, f 156B

NBDP: f 2C, f 8C, f 156C

These channels should also be used for safety traffic (see PART 7, § 2.1);

4.2.2 Simplex channels should be designated for SAR coordinating communication by J3E voice communications and by narrowband direct printing (NBDP) in the bands 4 MHz, 6 MHz, 12 MHz and 16 MHz. At this stage the channels will be referred as follows:

Voice: f 4B, f 6B, f 12B, f 16B

NBDP: f 4C, f 6C, f 12C, f 16C

These channels should also be used for safety traffic (see PART 7, § 2.1);

4.2.3 Provisions will be included in the future INMARSAT system for SAR coordinating communications through geostationary satellites in the frequency band 1530-1645.5 MHz.

5. Inter-SAR region coordination

Recognizing the Recommendations of the SAR Convention, effective communication links and procedures are essential between the rescue coordination centres (RCC) in each area. These communications will include the use of the international switched telephone and telex networks, ship earth stations located at the RCC and effective general maritime communications. Simplex techniques should be used between coast radio stations.

PART 5 to ANNEX I

ON-SCENE COMMUNICATIONS

1. Definition

1.1 On-scene communications are those between the unit in distress and assisting units and between searching units and the on-scene commander or the coordinator surface search.

2. Operational requirements

2.1 The system should provide for communications between the unit in distress and assisting units.

2.2 The system should also provide for communications between the on-scene commander or coordinator surface search and other searching units.

2.3 It is essential that all on-scene units are able to share relevant information concerning the distress incident and consequently simplex communications should be used.

3. Frequencies designated for on-scene communications

3.1 Frequencies for ship-ship communications:

3.1.1 the preferred frequencies to be used for on-scene communications are the following:

Voice: f 2B and f 156B
NBDP: f 2C and f 156C.

3.1.2 If the frequencies listed above are inadequate, any of the frequencies designated for SAR coordinating communications (see Part 4, § 4.2) may be used for on-scene communications. Due regard should be given to avoiding unnecessary long range.

3.2 Frequencies for ship-aircraft communications:

- the preferred frequencies to be used for ship-aircraft on-scene communications are the same as for ship-ship communications (§ 3.1.1);
- other frequencies may be utilized such as 3023 kHz, 5680 kHz, 121.5 MHz, 123.1 MHz and 243 MHz.

PART 6 to ANNEX I

LOCATING

1. Definition

1.1 Locating is the finding of the unit in distress or its survivors by an assisting unit.

2. Operational requirements

2.1 The system shall provide means of facilitating the rendezvous between the unit in distress or survivors and the assisting unit. Effective locating methods could reduce or eliminate the search phase of many search and rescue incidents.

3. Locating methods

3.1 Provided equipment is available for indicating positioning continuously until rescue is completed, and if the positioning accuracy is sufficiently high, a separate method for locating may not be required.

3.2 If it is not possible to update positioning until rescue is completed, the range of the locating method must be sufficient to allow for possible drift in the position of those in distress in the interval between positioning and rescue.

3.3 The following methods are available for locating:

- homing on radio signals (including by means of radio direction-finding);
- search by active microwave instruments (radar);
- search by passive infra-red or microwave instruments that are able to detect radiation from those in distress;
- locating by updated and accurate positioning data (e.g. retransmission of electronic navigational aids);
- visual search;
- homing on light or sound signals from those in distress.

4. Frequencies for homing

4.1 Homing may be performed on any transmitting frequency used by a unit in distress.

4.2 Frequencies for homing should be provided in those frequency bands used for distress alerting which are most suitable for homing, i.e. 2 MHz, 156 MHz and possibly 406 MHz/1.6 GHz. In the 2 MHz and 156 MHz bands, the following channels should be considered for homing: f 2B, f 2C, f 156B, and f 156C.

4.3 In addition to the frequencies listed above, the frequencies 410 kHz, 121.5 MHz and 243 MHz are available for homing purposes, if voluntarily fitted with the necessary equipment.

PART 7 to ANNEX I

PREVENTIVE ACTIONS

1. Definitions

Preventive actions means collecting, sorting and disseminating information or taking other actions which will either help reduce the number of distress incidents or, when they occur, will facilitate rescue or expedite the SAR process.

2. Methods and measures

2.1 Urgency and safety messages:

- provisions for urgency and safety calling and messages must be included in the future system. The frequencies proposed for distress alerting using DSC (see Part I, § 10) should be available for urgency and safety calling. The frequencies proposed for SAR coordinating communications (see Part 4, § 4.2) should be available for urgency messages, vital navigational messages and urgent cyclone warnings;

- provisions for the transmission of navigational and meteorological warnings using NBDP techniques on a common frequency in the 500 kHz band should also be included in the system.

2.2 Ship position reporting:

- the use of ship reporting systems will provide the RCC with an information base of surface units which may be suited to give assistance. Ship position reporting systems will contribute to avoiding delays and unnecessary diversions of assisting units;

- the systems employed should be designed to provide the best possible immediate information with the minimum effort by the participating ship;

- the following channels designated for SAR coordinating communications should be available on a non-interference basis for ship position reporting using NBDP techniques: f 4C, f 6C, f 12C and f 16C;

- channels should be designated in the HF band for ship position reporting using radiotelephony.

2.3 Ship polling:

- "ship polling" means the interrogation of ships by manual or automatic techniques and the response by the ships to the interrogating station. Ship polling may be performed using satellite ship-shore circuits or highly reliable terrestrial circuits;

- there may be operational advantages in combining ship polling with ship position reporting. Such a system may also be utilized for passive alerting (see Part 1, § 8).

2.4 Ship movement services:

- "ship movement services" is defined in the Radio Regulations and implies voluntary or mandatory participation in routing and traffic controls intended to reduce the risks of collisions while maintaining a maximum safe movement;

- ship movement services should be established in areas with high traffic density.

2.5 Communication availability:

- "communication availability" expresses the proper functioning of communication networks as a function of time;

- the communication availability should be high for maritime communication equipment, and in particular for equipment intended to be used in distress situations, so that each ship can maintain a continuous communication capability to shore and to other ships;

- the following factors affect communication availability: equipment reliability, preventive and corrective maintenance capability, training, spares, tools, test instruments, documentation, duplication of equipment, skilled maintenance personnel, operational training equipment design.

2.6 Public correspondence systems:

- effective global public correspondence systems and supporting communication systems are essential to the Future Global Maritime Distress and Safety System, and to support maritime safety in general.

2.7 International cooperation:

- preventive actions include the cooperative efforts among Administrations to organize and commit resources to the support of SAR facilities in accordance with the SAR Convention, 1979, interconnections between rescue coordination centres, and to improve maritime safety in general. This includes continuing effort to improve systems, interconnections, techniques and procedures.

DRAFT

REPORT 749 (MOD I))*

FUTURE USE AND CHARACTERISTICS OF EMERGENCY POSITION-INDICATING RADIO BEACONS IN THE MOBILE SERVICE AND THE MOBILE SATELLITE SERVICE

(Question 31-1/8 (MOD I))

(1978)

1. Introduction

To avoid confusion in using terms for low-power distress alerting and locating devices in the future there should be a distinction between:

- EPIRBs (Homing on terrestrial frequencies) and
- Satellites EPIRBs (Alerting using satellite techniques).

Report 749 (MOD I) reflects this distinction.

2. EPIRBs in the Future Global Maritime Distress and Safety System

The Inter-Governmental Maritime Consultative Organization (IMCO) has prepared requirements for the Future Global Maritime Distress and Safety System. These requirements relate to Recommendation No. 201(YS) of the World Administrative Radio Conference (Geneva, 1979).

The basic operational requirement for alerting is that in every distress survival craft it should be possible to rapidly alert the unit(s) able to give, as fast and as efficiently as possible, the assistance required.

Radiocommunication systems for ship-to-shore alerting via satellite from survival craft and other low-power distress transmitters (Satellite EPIRBs) are under development and may require special provision at the space segment.

Although the technique and system design for EPIRBs and Satellite EPIRBs has yet to be defined, such transmissions will form an essential component of the distress alerting and locating functions of the Future Global Maritime Distress and Safety System. In this context IMCO has prepared general requirements for EPIRBs and Satellite EPIRBs covering these functions. These requirements are described in [CCIR, 1978-82].

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* The Director, CCIR, is requested to bring this Report to the attention of ICAO, IMCO and the INMARSAT Organization.

3. EPIRBs using maritime VHF frequencies

One Administration reported the use of EPIRBs operating on frequencies in the maritime mobile VHF band on a regional basis in coastal areas.

The description and the technical specifications of this type of EPIRB are given in Annex I. With the implementation of the Future Global Maritime Distress and Safety System, the specifications of these EPIRBs may be modified to those described in § 2.

4. EPIRBs using the aeronautical distress frequencies 121.5 MHz and 243 MHz

EPIRBs also form an essential part of the existing maritime as well as of the existing aeronautical distress and safety system. The main function of these EPIRBs is to locate those in distress.

The preferred technical and operating characteristics of emergency position-indicating radio beacons known as emergency location beacons aircraft (ELBA) in the aeronautical service and operating on 121.5/243 MHz have already been established by ICAO and no changes are contemplated. Any maritime use of 121.5/243 MHz for homing purposes should therefore be in conformity with the relevant Standards of ICAO, Annex 10 to the Chicago Convention on International Civil Aviation, Vol. I. With regard to the frequencies 2182 kHz and 500 kHz, it should be noted that:

- 2182 kHz is normally not carried by aircraft, but the possibility that ICAO may eventually introduce a requirement for SAR aircraft to be able to home on 2182 kHz may be considered;
- aircraft are normally unable to communicate on 500 kHz but when fitted with ADF are normally able to home on this frequency.

Should, however, the study on this question consider the use of frequencies other than those MF, HF and VHF/UHF frequencies in common use, ICAO has stated that it would be prepared to make known its requirements to the CCIR.

Measurements and studies by one Administration [Gillard, 1975] have shown that an alternating tone alert signal (similar to the radiotelephone alarm signal) is capable of providing an improved audio detection range and direction-finding performance compatible with existing search and locating equipment operating at frequencies of 121.5 MHz and 243 MHz, compared with the performance obtainable for existing EPIRBs which use swept tone modulation. Use of the alternating tone modulation also makes possible the incorporation of a very comprehensive identification coding system now that cheap and robust microprocessors are available.

Should continuing study on this question lead to the development of EPIRBs to operate on frequencies other than the exclusive aeronautical emergency frequency 121.5 MHz, a modulation, coding and identification system as described in Annex II and its Appendix may offer possible advantages.

REFERENCES

GILLARD, P. O. [December, 1975] Preliminary investigation into the performance of search and rescue locating systems using VHF beacons (EPIRBs) to meet Australian conditions. WRE-TM-1530(A), Dept. of Defence, Australia.

<u>CCIR Document</u>

[1978-82]: 8/157 (IMCO (§ 11.5)).

ANNEX I

DESCRIPTION AND TECHNICAL SPECIFICATIONS OF
EPIRBs USING MARITIME VHF FREQUENCIES

1. Introduction

The use of emergency position indicating radio beacons (EPIRBs) operating on the frequency 121.5 and 243.0 MHz is limited in the United States to vessels which are engaged on voyages which require operation at distances beyond 32 km from shore. Carriage of this type of EPIRB is mandatory on US vessels which are subject to the Convention for the Safety of Life at Sea (SOLAS) (1974) and are generally not used by vessels in coastal traffic or by recreational vessels.

In the United States the need for an EPIRB for vessels operating in coastal waters is evidenced by statistics which indicate that 95% of the boating accidents, many involving loss of life, occur within 40 km of shore. In a great many cases the capability to transmit a signal for alerting and locating purposes could have improved the efficiency of search and rescue operations and in some cases prevented the loss of life. For these reasons, it is considered important that provisions should be made for the voluntary use of an EPIRB operating in the VHF maritime mobile band in US coastal waters.

2. Frequency of operation and modulation

The effectiveness of any distress system is directly related to the degree of monitoring which exists in the system. Channel 16 (156.8 MHz) is the international VHF maritime distress, safety and calling frequency. This channel is continuously monitored along the entire US coastline by the US Coast Guard. The radio watch which the Coast Guard provides on this frequency is further supplemented by ship and coast stations which operate in this frequency band. Accordingly, because of the monitoring provided in Channel 16, this frequency was chosen to be used for the alerting function. Channel 15 (156.75 MHz) was chosen to be used for location purposes.

The EPIRB transmits the international radiotelephone alarm signal (1300 and 2200 Hz tones repeated alternately) on Channels 15 and 16. The transmission on Channel 15 provides a signal suitable for homing purposes; the transmission on Channel 16 provides a signal suitable for alerting nearby vessels and coast stations to an emergency situation. The EPIRB will operate for a 24-hour period once activated after which time it will automatically turn off.

During the 24-hour period there will be four different cycles. The details of the EPIRB operation are specified in Table I and shown in Fig. 1 of the Appendix to this Annex. Each cycle is made up of a number of sequences and a sequence is made up of six periods. The number of sequences increases for each subsequent cycle. The sequences differ only in that periods 4 and 6 become progressively longer (40 to 320 s) for each subsequent cycle. If a 30-minute period is considered, it is noted that the transmission time on Channel 16 is approximately 47, 28, 16 and 8 seconds for cycle 1 through 4, respectively. Tests have shown that this sequential method of transmission on Channels 15 and 16 will not cause an unacceptable level of interference to normal traffic on Channel 16.

The technical specifications for this type of EPIRB are shown in the Appendix attached.

APPENDIX TO ANNEX I

VHF — EPIRB FOR USE IN COASTAL AREAS

Frequency:	156.75 MHz and 156.8 MHz
Frequency tolerance:	0.001%
Peak radiated power:	1 W
Transmission life:	24 hours (automatic turn off)
Polarization:	vertical
Temperature for operation:	(1) 0 °C to 50 °C for 24 hours continuous operation
	(2) −20 °C to 50 °C for 12 hours continuous operation
Maximum frequency deviation:	± 5 kHz
Modulating frequency:	1300 Hz and 2200 Hz ± 5%
Tone duration:	250 ms ± 5%
Modulation format:	see Fig. 1 and Table I
Capable of floating:	yes

TABLE 1

Signal format for EPIRBs using maritime VHF frequencies

Characteristic (1)	Cycle			
	1	2	3	4
Period 1 (Channel 16)	1.5	1.5	1.5	1.5
Period 2 (Channel 15)	14.5	14.5	14.5	14.5
Period 3 (Channel 16)	1.5	1.5	1.5	1.5
Period 4 (No transmission)	40.0	80.0	160.0	320.0
Period 5 (Channel 15)	14.5	14.5	14.5	14.5
Period 6 (No transmission)	40.0	80.0	160.0	320.0
Total time for 1 sequence	112.0	192.0	352.0	672.0
Duration of cycle	0.49 h	1.7 h	6.25 h	15.53 h
Number of sequences/cycle	15.75	31.87	63.92	83.19

(1) Time is in seconds unless otherwise specified.

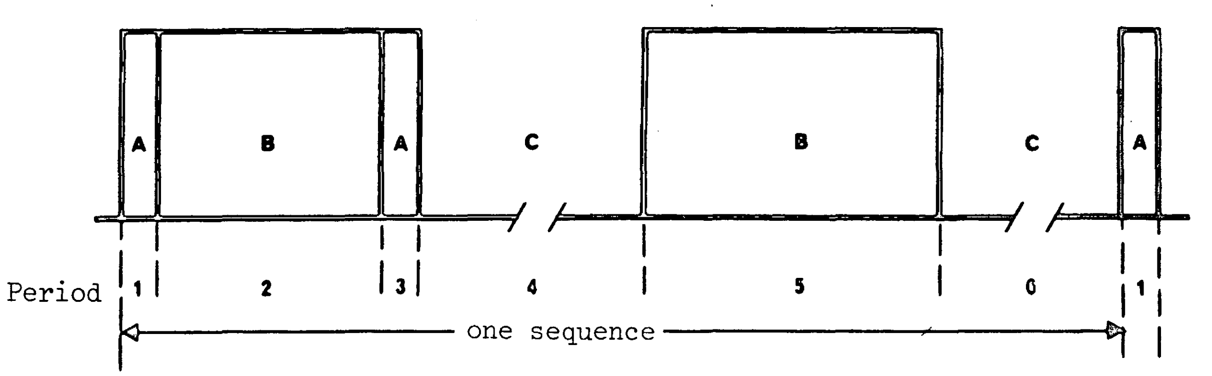

FIGURE 1 - EPIRB signal transmission

A : Channel 16 transmission for 1.5 s
B : Channel 15 transmission for 14.5 s
C : No transmission for 40, 80, 160 and 320 s during cycles 1, 2, 3 and 4 respectively.

ANNEX II

PROPOSAL FOR AN IDENTIFICATION CODING AND MODULATION SYSTEM FOR EPIRBs COMPATIBLE WITH EXISTING SEARCH AND LOCATION EQUIPMENT

1. Identification coding

1.1 The proposal is to use a pair of alternating audio tones for alert and identification coding. The alert tone sequence is interrupted periodically with a burst of code to provide identification of the country of origin of the beacon, the class of craft or vehicle with which it is intended for use, and the serial identification of the beacon. Morse is recommended in preference to other more efficient codes to facilitate early interpretation of distress signals by a wide range of observers. The code is designed to permit rapid verification of the authenticity of an alert in a given zone and hence to provide a means of estimating the scale of SAR resources likely to be required in rescue.

Although the code is primarily intended for maritime purposes, it possesses sufficient capacity to permit its use in emergency locater transmitters (ELTs) and EPIRBs to be used in aircraft and other classes of vehicle.

1.2 The preferred format (see Fig. 2) consists of three morse alphanumeric characters to provide an internationally recognized call sign prefix for the country of registration of the beacon, one character to allow identification of up to 34 (omitting letters I and O) classes of vehicle, and four characters to allow individual serial identification of up to 1 336 336 beacons within each class per country. Typically, a code would have a duration of approximately 15 seconds and would be repeated at two minute intervals. It is proposed that the morse be transmitted on the lower audio tone and that the spaces be transmitted on the upper audio tone in order to maintain constant carrier power.

1.3 It is envisaged that the characters designated for various classes of vehicle would be internationally agreed, but that member nations would allocate serial identifications as required to meet national needs.

1.4 It is envisaged that beacons would be coded at the point of manufacture, that ownership would be controlled by permit, and that the registered owner would be responsible for notifying to the National SAR Authorities specified details of the intended use of each beacon at any time. The secondary purpose of identification coding is to provide a means of exercising some control of misuse of beacons.

2. Carrier modulation

2.1 The carrier modulation for distress alert consists of two audio tones having frequencies of 2184.53 Hz and 1310.72 Hz, the tolerance being 0.005%, and the tones alternating, each occurring for a period of 274.6 ms with phase continuity at the transitions.

2.2 The above audio tones are also used to generate the identification code characters to minimize beacon cost.

2.3 The coherent generation of common stable tone frequencies for both alert and identification coding and the use of an accurate modulation waveform and a stable carrier frequency allow use of optimum signal processing techniques to extract the alert signal and code in the presence of noise, and to extract Doppler information for location of a distress beacon by low polar orbiting satellites. It provides an overall system performance that is considerably better than that obtainable with the currently used non-coherent swept tone modulation and also provides improved probability of separating simultaneous distress signals.

2.4 The choice of tone frequencies of 2184.53 Hz and 1310.72 Hz is based on the use of already approved distress modulation tone frequencies of 2200 and 1300 Hz, the exact frequencies in this proposal being derived from a quartz watch crystal having a frequency of 32 768 Hz.

APPENDIX TO ANNEX II

PROPOSED EPIRB CHARACTERISTICS

Frequency (Typical) :	243.0 MHz ± 0.005%
Effective radiated power : (10° take-off angle — calm sea conditions)	100 mW (243.0 MHz)
Transmission life :	100 hours minimum at 0 °C
Polarization : (rough sea conditions)	Vertical ± 45°
Temperature for operation :	0 °C to 55 °C (Australian conditions)
Carrier frequency stability: (at 243 MHz)	Better than ± 10 Hz over any 10 second period under constant conditions Better than ± 10 Hz for antenna mismatch of 10/1 SWR (simulating rough sea conditions) Less than 60 Hz/minute from full sunlight to shade conditions
Modulation depth :	100%
Modulation duty factor :	50% ± 5%
Modulating frequencies :	1310.72 Hz, 2184.53 Hz } ± 0.005%
Modulation format :	See Fig. 2.

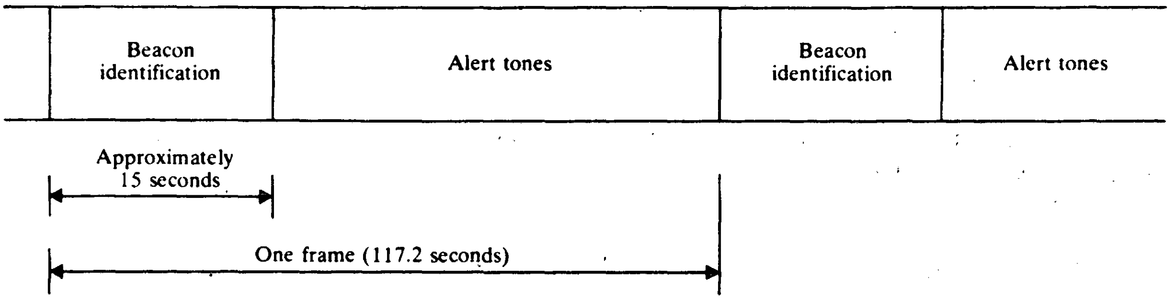

FIGURE 2a – *Modulation format*

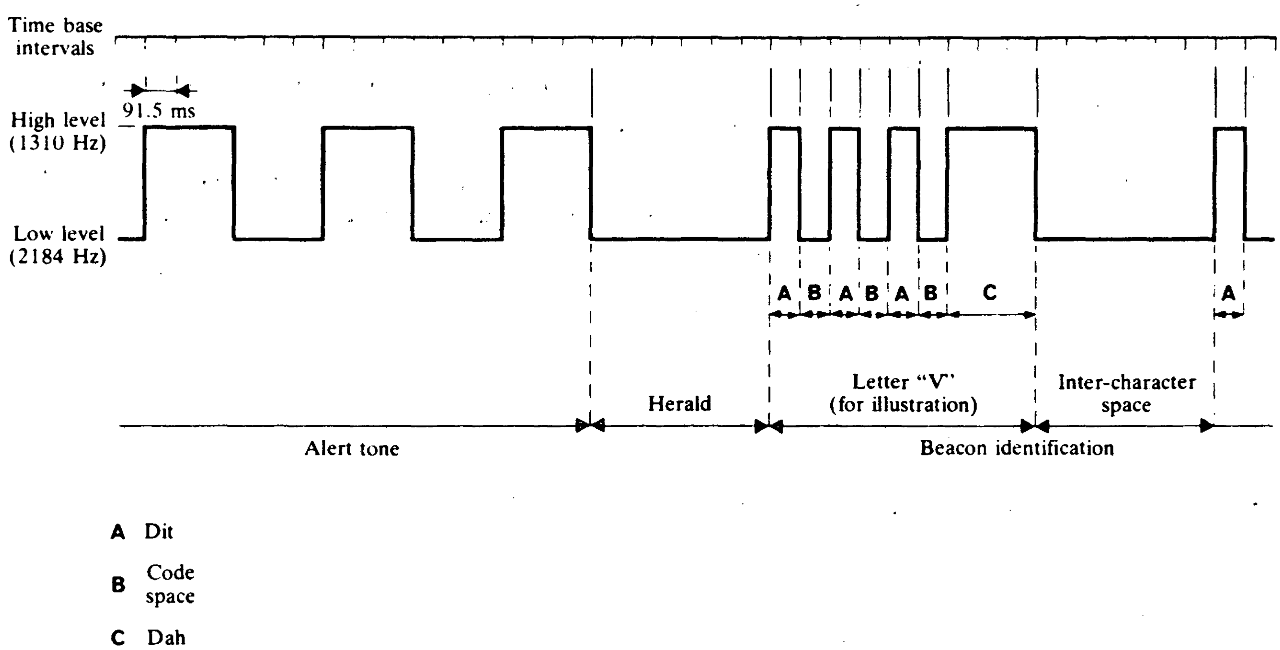

FIGURE 2b – *Segment of modulation illustrating commencement of coded identification*

DRAFT

REPORT 761 * (MOD I)

TECHNICAL AND OPERATING CHARACTERISTICS OF DISTRESS SYSTEMS IN THE MARITIME MOBILE SATELLITE SERVICE

(Study Programme 17B-2/8)

(1978)

1. Introduction

The use of maritime mobile satellites for the handling of safety and distress communications is a matter of increasing importance. The Inter-Governmental Maritime Consultative Organization (IMCO) is placing a major reliance on the use of satellites for the relay of distress signals in the development and design of their future maritime distress and safety system, which is scheduled to become operational in the early 1990's. IMCO has requested that the International Maritime Satellite Organization INMARSAT) include an emergency position indicating radio beacon (EPIRB) service in the initial INMARSAT satellite system.

This Report considers the major factors influencing the design of maritime distress systems using satellites and the associated technical and operating characteristics. § 1 reviews the present terrestial sytem, the development of the low power distress transmitter concepts and the developing operational requirements for a future system. § 2 discusses some of the considerations to be taken into account when deciding on the development of such operational requirements. The technical requirements will depend on the various techniques used in individual systems; however, some of the considerations that will need to be taken into account, when deciding on technical tradeoffs are reviewed in § 3. Current and planned experimental programmes are reviewed in § 4. The conclusions in § 5 recommend subjects for further study. A comparison of the proposed technical and operating characteristics of the various systems is given in Annex I.

1.1 Present terrestrial system

Statistics published by Lloyds of London show that there is an average annual loss of 260 vessels of over 100 gross tons. The growth of worldwide shipping and the introduction of larger, faster, more capital intensive vessels will result in an increasing threat to loss of life and property at sea.

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* The Director, CCIR, is requested to bring this Report to the attention of IMCO.

The probability of human survival decreases rapidly with time following a distress occurrence, in particular, in cold weather conditions or where the survivors are in the sea. It is, therefore, fundamental to any distress system that the existence of the distress occurrence is made known to those capable of rendering assistance in the minimum practical time. The present maritime distress system is based on a complicated interlinking of several elements, and uses telephony, morse code telegraphy or EPIRBs on existing allocated terrestrial frequencies. In most cases the transmission of the message requires manual activation and manual operation. The successful receipt of a distress message depends on the propagation characteristics of the various available frequencies which in turn depend on the geographical location, the time of day and season. Delays of several hours may result. Past failure to successfully execute rescue in some cases has raised considerable concern internationally about the adequacy and effectiveness of the distress and safety communications.

In order to overcome some of these problems EPIRBs using terrestrial frequencies were developed for alerting ships in the vicinity, overflying aircraft and the shore, of the occurrence of a distress. These EPIRBs have two separate designs:

- float/free, which is automatically activated in the event of a ship sinking,

- manually activated, to be carried in each survival craft.

The advent of maritime communication satellites presents the possibility of overcoming all these problems referred to above.

Chapter III of the Convention for the Safety of Life at Sea, 1974, which refers to life saving systems is being revised.

The draft revised Regulations state that every ship to which the Convention applies shall carry a float/free EPIRB and every survival craft carried on ships to which the Convention applies will be fitted with a manually activated EPIRB. An EPIRB shall operate on 2182 kHz and/or 121.5 MHz and/or 243 MHz.

1.2 Space systems

Satellite links are largely unaffected by propagation variations. A vessel in distress fitted with a satellite communication terminal would have a priority channel available for the transmission of the distress message. Such a service capability is currently provided by the present MARISAT system, and is under development for the future INMARSAT system.

In view of the high cost not all vessels can be expected to be fitted with satellite terminals. There also remains a need for automatic distress alerting in the event of a sudden foundering. Furthermore, if the crew of a vessel in distress take to survival craft, the use of the satellite system to maintain two-way communication with the shore or rescue vessels raises technical problems because survival craft cannot carry antennae of sufficiently high gain.

In order to meet these needs, the concept of a low power distress transmitter dedicated to providing distress alerting via satellite has evolved. Such equipment should be capable of fulfilling an alerting role in the following three applications:

- manual activation from on board ship;
- float free and automatic activation in the case of a sudden foundering;
- manuals activation from on-board a survival craft.

The same signalling techniques could be used in the three applications.

1.3 Operational requirements

The IMCO Sub-Committee on Radiocommunications is developing operational requirements for satellite EPIRBs * [IMCO a and b] and has stated:

- The future EPIRB system should be part of a global maritime distress and safety system and so configured as to promote safety of life at sea in the highest possible manner. To achieve this aim the system should cover all navigable waters including those north of 70^{o}N and south of 70^{o}S.
- The future EPIRB system should take into consideration requirements of the aeronautical mobile service where a shared system might yield mutual benefits to both services and to search and rescue organizations.
- Provision should be made in the system for EPIRB signals to be treated as distress messages and correctly routed to the appropriate search and rescue authority.
- The system should provide a 0.99 probability of distress message reception and interpretation. It is desirable to achieve this probability as quickly as possible; however, the exact specification of this time will be dependent on system characteristics and implementation.
- In regard to the number of simultaneous transmissions of EPIRB alerting signals in any one ocean area, IMCO is of the opinion that a future operational satellite-aided EPIRB system should support at least 20 in a 10 minute interval. In obtaining this estimate, both IMCO convention and non-convention vessels were considered in an entire ocean area. The system should support this with a probability of 0,95.

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* In this Report satellite EPIRBs are referred to as low power distress transmitters (LPDT). However, further study of the definition of this term is necessary.

- As a minimum, the EPIRB system should provide the following information:

  - Alerting or alarm notification

  - Identification of the unit in distress

  - Data which enables the SAR authority to determine the position of the unit in distress

- Optionally, the EPIRB system could provide information concerning the nature of distress.

- A capability for homing is required. However, this is a terrestrial function and must operate and be compatible with the future global maritime distress and safety system under consideration by IMCO.

2. Operational considerations

The operational requirements identified by IMCO for EPIRBs listed in § 1.3 call for worldwide coverage with negligible delay in the receipt of the distress message, together with a capability for the simultaneous reception of multiple transmissions. It can be assumed that these criteria will apply equally to ship and survival craft low power distress transmitters. The preparation of operational requirements for a maritime distress system is the responsibility of IMCO. However, the following considerations are considered relevant to the development of these requirements:

- time taken to achieve a certain probability of error free message transfer;

- system performance during simultaneous distress transmission;

- effect of varying sea states on performance;

- coverage;

- contents of distress message;

- methods of positioning;

- the complexity and cost of the distress equipment, satellite and ground terminal equipment.

2.1 Time taken to achieve a certain probability of error-free message transfer

The time taken to achieve 0.99 probability of error-free message transfer will depend on various geographical, atmospheric, oceanographic and radio propagation conditions. Interference from other sources, including interference from other distress messages which may be transmitted simultaneously will also affect this probability. This subject requires further study.

2.2 Coverage

Systems designed to use geostationary satellites will have their coverage limited to latitudes approximately between the 70° parallels but would still serve the majority of world shipping. However, to provide coverage of the polar regions polar orbiting satellites would be necessary. With polar orbiting satellites distress alerting delays due to the intermittent passing of satellites result. This delay is greatest at the equator and depends on the number of satellites and ground receiving stations. One advantage of polar orbiting satellites is that real-time positional information is obtainable by Doppler measurement of the receiver low power distress transmitter signal. There is also a saving in low power distress transmitter power due to lower path losses compared to geostationary systems (see § 3.1).

There would appear to be a case, therefore, for combining the advantages of geostationary and polar orbiting systems.

2.3 Contents of distress message

The distress message should contain, as far as possible, an essential amount of information about the incident. However, in the interests of decreasing the probability of error and also message acquisition time, the contents of the distress message should be limited. The possible contents of the message and the number of bits are shown in Table I in order of priority.

TABLE I

Possible contents of distress message

Item	Contents	Approximate No. of bits
1.	Ship station identity	30
2.	Position co-ordinates : latitude (minutes) hemisphere symbol longitude (minutes) hemisphere symbol	 13 1 14 1
3.	Time of position update (minutes)	11
4.	Time of activation (minutes)	11
5.	Course (360 degree notation)	9
6.	Speed (up to max. 63 knots)	6
7.	Nature of distress	4

Note.- Position, time of position, input, course and speed would not be necessary if position is determined by Doppler measurement techniques.

Items 3, 4, 5, and 6 may not be required if position updating is continuous, or at short intervals.

Item 4 may not be required if acquisition time is short.

2.4 Methods of positioning

Upon determination that an emergency or distress exists, the problem becomes one of determining the geographical position of the distress to sufficient accuracy so that assistance can be effectively rendered.

Geostationary satellites can be used for position location by ground stations using ranging techniques, re-transmission of signals of existing radio navigation systems, and transmission of position data obtained on board ship. Low orbiting satellites can use any of these methods or can determine low power distress transmitter position by Doppler ship measurements.

2.4.1 Techniques for geostationary satellite systems

Range measurement techniques use multiple satellites for simultaneous ranging on the low power distress transmitter. Although the system allows position determination quickly, it requires at least 3 satellites within visibility and high accuracy in determining positions of the ranging satellites. Errors in the latter factor may produce large errors in the lower power distress transmitter position.

Transmission of position information by the low power distress transmitter appears to be practicable in the foreseeable future and may be in one of two forms. The low power distress transmitter may re-transmit navigation signals it receives or may re-transmit position information it has processed from received navigational signals. Although the system allows quick position determination, low power distress transmitter complexity (and cost) are increased and errors and ambiguities inherent in the navigational system are carried over (and possibly increased).

Difficulties may occur in reception during specific time slots for some of the radionavigation systems in the case of re-transmission of navigation signals.

Hybrid techniques are also possible using a combination of ranging and information from navigation systems.

Alternatively, the low power distress transmitter could transmit position information loaded into it prior to the distress. This could be accomplished either manually or by electrical attachment to existing shipboard navigational equipment. [Kimura et al, 1978.] This reduces the complexity from the technique above (no integral navigation receiver required), however, in the case of manual entry the position transmitted by the lower power distress transmitter may not represent the position of the distress. In this case, the SAR authority must be provided with the information given in items 3, 4, 5, and 6 of Table I to determine in the distress position.

2.4.2 Techniques for low orbiting systems

In addition to the techniques noted for geostationary systems which also may be used with low orbiting satellites, Doppler shift measurements are possible. This technique allows use of a very simple low power distress transmitter. A disadvantage of the system is that there is a wait time between satellite passes. This time is a function of latitude, orbit, and the number of satellites employed.

2.5 The complexity and cost of distress equipment, satellite and ground terminal equipment

In the interests of widespread acceptance the cost of the system should be minimized. In particular the cost to the user, that is, the cost of the shipboard equipment, should be as low as possible.

3 Technical considerations

3.1 Satellite orbits

Two alternative satellite orbits are being considered : geostationary (at an approximate altitude of 35 800 km) and low altitude near-polar (at an approximate altitude of 850 km). The low power distress transmitter should provide sufficient energy for maximum operational slant ranges. At 5° elevation and angle these respective ranges are approximately 41 130 km and 2890 km.

Another parameter to be considered in the orbit evaluation is the resultant satellite earth coverage antenna beamwidth at the half power points. In the case of the geostationary satellite this beamwidth is around 17.3°, and for the low altitude satellite it is about 123°.

Thus, in the analyses of the power requirement advantages of each orbit, considering both the slant range and the satellite antenna half power beamwidths, it can be shown that the low orbit system has an overall 6 dB power advantage. Also, its antenna size (assuming that in both cases a dish antenna is used) is reduced by a factor of 7.

3.2 Frequency considerations for distress systems

Significant changes in frequency allocations for satellite distress system operations were effected by WARC-79. The band 406-406.1 MHz is now exclusively allocated to the mobile-satellite service (Earth-to-space) for satellite EPIRB use and development. The band 1645.5-1646.5 MHz is also allocated exclusively to the mobile-satellite service (Earth-to-space) and limited in use to distress and safety operations. The bands 121.45-121.55 MHz and 242.95-243.05 MHz are allocated by Footnote to the mobile-satellite service for reception on board satellites of EPIRBs transmitting at 121.5 MHz and 243 MHz.

As a practical matter the uplink frequency choice is limited to the 406 MHz and 1646 MHz bands. Either of these could be used with geostationary or near-polar orbiting satellites. However, experiments with near-polar orbiting satellites are planned at 406 MHz while preference for geostationary satellites is at 1646 MHz since normal communications occur at 1.6 GHz.

The WARC-79 also allocated the band 1544-1545 exclusively to the mobile-satellite service (space-to-Earth) for distress and safety operations which would include low power distress transmitter downlinks. Downlinks could also operate in fixed-satellite service bands used for normal satellite-to-Earth communications (e.g. 4 GHz band). Either downlink could accommodate geostationary satellites operations. However, feeder links for near-polar orbiting satellites would be limited to 1545 MHz, where experiments are planned since geostationary satellites have priority in fixed-satellite bands (RR No. 2613(6106/470VA)) and power flux-density limits in the 4 GHz band make large earth station antennae necessary.

The other frequencies allocated in the maritime mobile satellite service may be used for distress and safety purposes.

3.2.1 Earth to satellite frequencies

The major factor influencing the selection of a suitable frequency from the available bands is the increased free space loss of approximately 12 dB for the 1.6 GHz band as compared to the 406 MHz band, assuming that the satellite antenna aperture is configured to allow for earth coverage in both cases. The magnitude of this degradation for the 1.6 GHz band, which holds for both the geosynchoronous and the low altitude satellites, may be decreased by the ionospheric and the multipath effects. Additional work is necessary to refine the estimate of degradation due to these latter effects.

Thus, approximately an order of magnitude reduction in low power distress transmitter power is possible if the 406 MHz band is used. This reduction is important since the low power distress transmitter antenna gain will be low in order to be consistent with hemispherical coverage and minimum pointing requirements.

This reduction in low power distress transmitter power can reduce cost, size, and weight of the low power distress transmitter. These factors are very important to user acceptance of the system. However, the disadvantage of the 406 MHz band is that the satellite antenna size must be increased by a factor of 4 as compared to the 1.6 GHz case (assuming a dish antenna is used) to provide the same coverage of the earth from the satellite.

The COSPAS/SARSAT system using low altitude near-polar orbiting spacecraft has adopted the 406 MHz band for the reasons outlined above.

The initial INMARSAT geostationary satellite system will not have a 406 MHz capability.

Thus, practical considerations preclude operation at 406 MHz in the initial INMARSAT satellite system and dictate the use of a 1.6 GHz low power distress transmitter regardless of the link penalty.

3.2.2 Satellite-to-Earth frequencies

Geostationary satellites to be used for maritime communications will operate in fixed satellite bands (e.g. 4 GHz band) for communications from satellite to the coast earth station. Operation of the low power distress transmitter feeder link in these bands would require co-ordination with other users such as the fixed satellite service.

The band 1544 MHz to 1545 MHz can be used for feeder links between satellites and low power distress transmitter and between satellites and coast earth stations as well as for distress and safety communications between satellites and ship earth stations.

The size of a coast earth station antenna operating at 4 GHz is controlled by the power flux-density specified for the fixed satellite band.

3.3 Special satellite payload configurations for distress

A special high gain channel could be used in order to increase the satellite transmitted power level of the distress signal. This solution has been adopted for the MARECS satellites, by incorporating an additional 15 dB gain IF amplifier before the TWT amplifier.

This increases the C/N_0 at the earth station by about 8 dB.

3.4 Required bandwidth

The required bandwidth for transmission of distress messages depends largely on the system employed, and particularly on such factors as the modulation method and the required number of simultaneous transmissions.

3.5 Burst duration of distress message

The burst duration of the distress message will depend on the system used.

3.6 Interference considerations

The bands for the space-to-Earth feeder link (e.g. 4 GHz band) are heavily used for fixed satellite systems. These bands are also allocated to other services such as fixed and mobile services. At this time, a channel is not allocated exclusively for low power distress transmitter use. The two bands 1544 to 1545 MHz and 1645.5 to 1646.5 MHz are allocated on an exclusive basis to the mobile satellite service and are limited by a Footnote to distress and safety operations.

The frequency band 1626.5 to 1645.5 MHz is also allocated on a primary basis by a Footnote, to the fixed service in seventeen countries. Low power distress transmitters used in this band should be designed to operate reliably in the presence of anticipated interference since safety of life at sea is involved. Further study is therefore needed into the magnitude of the potential interference and the low power distress transmitter design implications.

3.6.1 Interference from radio relay equipment

A particular site selection for radio relay equipment could cause interference to a low power distress transmitter under certain rare circumstances. This small probability of intereference could be eliminated by avoiding use of those specific channels used by low power distress transmitters.

The use of suitable frequency co-ordination techniques such as avoiding pointing at the geostationary orbit could eliminate even this small probability.

The elimination of any possible interference could also be effected by the use of design techniques for the low power distress transmitter which could make the system more immune to interference.

3.7 Link budgets

Link budgets for low power distress transmitters operating in the 406 MHz and 1.6 GHz frequency bands have been considered.

An example of a low power distress transmitter-to-satellite link budget is given in Table II. A point which may be questioned is the propagation margin; the required margin depends on the type of modulation and signal processing schemes adopted, as systems are based on message repetition.

To derive the overall link budget, the NOAA-E (406 MHz) and the MARECS (1.6 GHz) satellite data have been used. Care should be taken when applying the results to other satellites.

The results corresponding to various system configurations at 1.6 GHz are given in Table III. No allowance has been made for interference from other systems, or for simultaneous transmissions.

TABLE II

Low power distress transmitter to satellite uplink

Parameter	Units	Geo-stationary satellite (MARECS)	Low-altitude satellite (NOAA-E)
Up-link frequency	MHz	1645	406
Transmitter power	dBW	7	7
Net antenna gain (including pointing and cable losses)	dB	- 0.5	- 3
EIRP	dBW	6.5	4
Link margin	dB	- 6.5	- 3
Free space path loss (1)	dB	- 189	- 152.4
Polarization losses (2)	dB	- 0.4	-
Satellite G/T	dBK	- 12.1	- 32.5
Up-link C/N_0	dBHz	27.1	44.7

(1) 5° elevation angle at 1645 MHz and 10° elevation angle at 406 MHz.

(2) This loss computed on the bases of the following assumptions:

- at 1645 MHz the axial ellipticity ratios of the EPIRB and the satellite antennae are 2 dB and 3 dB; the antennae are of the same polarization and the angle between the major axes of the two ellipses is 90°;
- at 406 MHz the polarization loss is included in the antenna gain.

TABLE III

Overall C/N_0 with alternative MARECS system configurations

Spacecraft EIRP (dBW)	Shore station G/T (dBK)	Overall C/N_0 (dBHz)
- 29.2 (1)	32	26.0
- 42.2	32	19.2
- 42.2	40.7	23

(1) Dedicated SAR channel

4 Experimental systems

Experiments have been carried out with geostationary satellites using the Federal Republic of Germany's Distress Radio Call System, (DRCS), and the USA Satellite-aided Maritime Search and Rescue System (SAMSARS). Experiments will be carried out with low altitude near-polar orbiting satellites through a joint effort between Canada, France, USA and USSR called COSPAS—SARSAT. Experiments with the ARGOS system and future activity were also reviewed.

4.1 DRCS (Distress Radio Call System)

DRCS is a low power distress transmitter system. It contains a float free device and a portable distress keyboard sender and meets the requirements of § 1.2 and § 2.3.

After automatically floating free, the float free device transmits the ship station identity of the unit in distress and a position information derived and updated from the ship.

The portable distress keyboard sender is able to transmit not only the ship station identity but also an individual message of alphanumeric characters which may be fed into a memory by means of a keyboard.

The keyboard sender can be installed on the ship, using the vessel's power supply and connected to a fixed antenna. Under these circumstances it can be used as a reserve transmitter in case of distress. The same distress keyboard sender may also be easily disconnected in order to be used in a survival craft. The power is then supplied by an internal battery and the signal is transmitted via an antenna which is integral with the equipment. Additionally, the float free device includes a transmitter for homing purposes on the maritime radiotelephone distress frequency 2182 kHz.

In order to overcome the high attenuation of the transmission path between the DRCS and the geostationary satellite, a specific technique of modulation, reception and processing was developed and successfully tested in several trials with the ATS-6 satellite in 1975/1976. [ESTEC 1975; ESTEC 1977].

The narrow band DRCS signal is FSK modulated and transmitted at a frequency of 1.6 GHz. In the satellite it is coherently up-converted to the appropriate frequency of the down-link feeder link and then down-converted to 70 MHz in the earth station. This signal is input to a standard receiver using a special tuner and down-converted to the first IP of 50 MHz. The second IF of 10 MHz is fed to a special down-converter without any demodulator to obtain the FSK signal at audio frequencies in a filter-bank. Each of the filters has a bandwidth approximately equal to the bit rate. The modulation index is chosen such that the frequency spacing comprises 4 channels for the float free device and 8 channels for keyboard senders.

All filter outputs enter the signal detection unit. There they are rectified and each connected with an integration circuit with a time constant of several seconds. The output levels are permanently monitored by a multiplexer and an amplitude comparator to detect channels of higher amplitude than the noise level. In a correlation circuit these channels are examined for correct channel spacing. If this procedure results in the identification of two probable channels, they are combined to a single line signal, sampled at ten times the information bit rate, switched to an analogue/digital converter, and stored in a memory not synchronized to the data frame.

The continuously transmitted data frames of constant time duration are superimposed. The signal-to-noise ratio increases up to 15 dB for 64 superpositions. After bit synchronization, bit decision and "syncword" detection the frame beginning is identified and the message can be decoded and printed out on an alphanumeric printer.

Theoretical calculations on the possible number of simultaneous alerts were made for the DRCS under the assumption that the frequency assignments to both the EPIRBs and the keyboard senders will be in steps of 1 kHz, that the transmission duration will be 8.5 minutes with a 2-hour interval, and that the long-term frequency stability of the oscillator will be 1×10^{-6}.

Assuming 0.95 probability of no occurrence of mutual interference and 53 kHz bandwidth a total of 200 simultaneous distress calls is derived. For a total of 20 simultaneous alerts a bandwidth of only 5 kHz is required.

Future sea trials are to be conducted starting in September 1981 using a MARECS spacecraft with the aim to optimize overall system performance. These trials will be conducted together in UK and Norway in a Coordinated Trials Programme (CTP).

In order to supplement these experiments with respect to multipath and wave shadowing effects it is planned to carry out laboratory simulator tests by applying the stored channel principle. The simulator is controlled by the recorded variation of the distorted radio link under a broad range of realistic conditions.

4.2 SAMSARS Spread Spectrum System

The concept of the Satellite-aided Maritime Search and Resue System (SAMSARS) is based upon the utilization of the ground and space elements of the INMARSAT system for the near instantaneous transmission to the cognizant rescue forces of the distress alert, vessel identification, position location, and other emergency related information [Fee, et al., 1980].

The distress data is relayed by a 10 W transmitter using a 256 kHz wide portion of the 1.6 GHz band distress channel. The multiple access capability for numerous near-simultaneous distress transmissions and the immunity to terrestrial and satellite originated interference is inherently provided through the employment of the direct sequence, bi-phase PSK modulated, spread spectrum technique. The required rapid detection is achieved by the use of a charge transfer device (CTD) filter which is matched to a maximum length, pseudorandom noise (PN) code [Peterson and Weldon, 1972]. In order to reduce the receiver complexity and to lower the production costs of the transmitter, a single 127 chip code is employed in the system. Further transmitter cost reduction, as well as an increase in the system capacity is achieved through the employment of a low stability (10^{-5}) oscillator. This approach, however, requires more sophistication in the receiver which employs a digital mini-computer to perform most of the receiver functions.

The SAMSARS message content is derived from operational requirements (§ 1.3) and a format which has been proposed (§ 2.3). It contains a syncword that is followed by the information data. The syncword is a unique 20 bit Neuman-Hofman code [Neuman and Hofman, 1971] utilizing one code cycle per bit. The information data bits in the remainder of the message are encoded using a 5 code cycle Barker code [Barker, 1953]. Because of the very low resultant signal-to-noise ratio at the receiver, the system requires that several hundred message repetitions, made up of thousands of code cycles, be transmitted during each 75 second burst period so that the receiver can integrate numerous messages to obtain an effective $\underline{E_b}/\underline{N_0}$ sufficiently high to reduce the bit error rate to less than 10^{-5}.

Though the method of positioning has not yet been finalized for SAMSARS, the various alternatives discussed in § 2.4.1 could be incorporated into the system.

The SAMSARS receiver consists of 64 pre-processor sections which are connected to a common multiport mini-computer central processor. Each pre-processor detects signals within an adjacent 500 Hz band, thus assuring that the entire transmitter frequency uncertainty band of ±16 kHz is covered. Each pre-processor consists of a micro-processor connected to two PN code matched filters in phase quadrature. The pre-processors noncoherently acquire and track the PN code and determine the sample timing. When code tracking is achieved, the matched filter output is sampled at each code cycle and stored in the central processor. Computer software is then employed to acquire the frequency and detect the data in a coherent fashion.

The multiple access capacity of SAMSARS has been computed to be 58 under the signal detection probability conditions stated in § 1.3 and a duty cycle of 0.125. This value has also been confirmed by a Monte Carlo simulation of the multiple low power distress transmitter signal emissions.

The ground-satellite-ground tests of the SAMSARS equipment conducted in November 1979 via the Pacific MARISAT satellite provided the following results:

- In the absence of an external terrestrial interference 0.99 probability of error free distress alert was achieved with a single transmission burst at a $\underline{C}/\underline{N_0}$ of 26 dBHz. This signal quality was attained at a low power distress transmitter e.i.r.p. of 2.5 W.

In the presence of a 1600 W 1.6 GHz band FM terrestrial interferer, with an approximate bandwidth of 215 kHz, the same result was achieved at a 10 W e.i.r.p. level.

- In the presence of a 500 W 1.6 GHz band FM terrestrial interferer, with an approximate bandwidth of 20 kHz, the above performance was achieved using a 10 W e.i.r.p. level. In the presence of the same interferer, but of a 1600 W level, five transmission bursts were required to attain the same performance.

Further tentative developmental efforts include construction of a prototype low power distress transmitter with a 100 bit message handling capacity, installation of sufficient computer capacity to handle the longer message length and to expedite the message processing. A series of laboratory and satellite tests are also being considered for the purpose of verifying the equipment performance in multipath and wave shadowing environments and for the establishment of a new data base.

4.3 Systems using the frequency band between 406.0 MHz and 406.1 MHz with low orbiting satellites (COSPAS/SARSAT)

Several Administrations have agreed to conduct an experimental project to demonstrate and evaluate the use of low altitude, near polar orbiting satellites to receive and process distress alerting, reporting and position location transmissions from low power distress transmitters operating in the 406.0-406.1 MHz band. The project combines the United States of America, Canada, and France SARSAT project and the USSR COSPAS project into a joint COSPAS-SARSAT project. [Redisch and Trudell, 1978; Zurabov, et al, 1979].

For the SARSAT project, a special instrument package will be placed on board at least three satellites operated by the United States National Oceanographic and Atmospheric Administration (NOAA). The first instrument package is scheduled for launch aboard NOAA-E (fifth in the series of TIROS-N satellites) in the second quarter of 1982. The nominal orbital altitude is 850 km, inclined 98.6^{o} with respect to the equator.

This satellite system will significantly augment existing terrestrial distress alerting, reporting and position location facilities by providing global coverage, increasing the probability of detecting a distress event and by decreasing the time elapsed between the occurrence of a distress event and its detection.

A description of the major elements of the SARSAT system and the technical characteristics of the low power distress transmitter have been published [GSFC, 1979; Redisch and Trudell, 1978].

The instrument package contains receivers operating at 121.5, 243.0 and 406.025 MHz, frequency translators, a signal processor, and a phase modulated transmitter operating in the 1544-1545 MHz band.

Signals received by the satellite in the 121.5, 243.0 and 406.025 MHz bands are linearly down-converted and frequency division multiplexed before phase modulating (FDM/PM) the 1544.5 MHz transmitter. The signals received in the 406.025 MHz band receive additional processing. A two channel signal processor similar to the ARGOS processor (Report 538-1 (Vol. I)) has been included in the instrument package. The processor demodulates the digital message from the received low power distress transmitter carrier and measures the carrier frequency to an accuracy of ±0.5 Hz. Two channels of received digital messages and carrier frequency measurements are time tagged, formatted, bi-phase-L encoded and transmitted in real time at a 2.4 kbit/s rate by direct phase modulation of the 1544.5 MHz carrier.

The real time information is also stored in the spacecraft mass memory for later readout on command. It is this feature that provided global coverage independent of earth station location.

The 1544.5 MHz transmissions are received by Local User Terminals (LUTs). These earth stations use a three meter diameter tracking parabolic antenna to achieve an antenna gain-to-noise temperature ratio (G/T) of 3 dB. The 2.4 kbit/s bit stream is obtained by coherent demodulation of the carrier and is demultiplexed to obtain the lower power distress transmitter message, frequency measurements, and time tags. The low power distress transmitter position is computed using the spacecraft ephemeris and the time tagged Doppler shift embedded in the EPIRB carrier frequency measurements. Position location accuracy on the order of 2 to 5 km is expected.

The linearly translated 406.025 MHz spectrum is also recovered by the coherent demodulation of the carrier and will be used primarily for the purpose of characterizing the 406.025 MHz earth-to-space channel. Additional processing to recover individual low power distress transmitter transmissions is not planned at this time in the 406 MHz band.

The data stored in the spacecraft mass memory will not be directly available to the LUT in SARSAT. This mass memory is associated with the meteorological mission of the NOAA satellite and will be read out only on command by the NOAA command and acquisition earth station. A 15 month demonstration and evaluation phase will be conducted when the first COSPAS/SARSAT spacecraft will be launched and is successful in operation (1982-1983).

4.4 ARGOS Experiment – France

In May-July 1979, an ARGOS maritime experiment was conducted using the TIROS-N satellite operating at 401.6 MHz in a low polar orbit. ARGOS is a location and meteorological data collection satellite system implemented in co-operation between USA and France. Forty boats participating in a 6000 mile yatch rate from France to Bermuda and back, were each fitted with an ARGOS transmitter, operating at 3 watts, and a deck mounted 30 cm, disc-shaped antenna. The transmitter was additionally fitted with a special distress switch.

More than 10 000 postional and meteorological messages were received over a 70 day period. The positional accuracy given by the system was, on average, better than one nautical mile (2 km). During the race four distress incidents occurred. The ARGOS system provided the initial alarm in two cases and position data for rescue purposes in all cases.

A further experiment was performed in June 1980 during a trans Atlantic sailing race involving 110 boats.

4.5 Norway

The system will be designed for use in a maritime communication satellite system operating at 1.6 GHz. Two spacecraft configurations are considered:

- A MARECS satellite with a narrow-band (200 kHz) high gain (15 ± 2 dB) transponder in the ship-to-shore direction.

- A maritime transponder (MCS) on an INTELSAT V spacecraft (no additional amplification in ship-shore direction).

The required distress transmitter output power will depend on the required uplink margin, the spacecraft transponder characteristics and the receiving earth station performance. With the enhanced gain transponder the output power could be substantially reduced.

Selection of transmission technique for the low power distress transmitter system has been made in view of the low signal levels encountered and other system constraints, such as:

- phase noise on the low power distress transmitter signal introduced by the low power distress transmitter and the satellite transponder;
- uncertainties and instabilities of the low power distress transmitter signal frequency;
- interference from other signals in the satellite:
- deep signal fadings, inter alia due to multipath transmission and screening by waves;
- mutual interference between several low power distress transmitter signals.

The technique makes use of a 240 Hz sub-carrier phase-modulating the 1.6 GHz carrier at a low modulation index (m = 1.2). This provides a stable reference free from phase noise. In the first part of the transmission sequence (the alarm phase), the sub-carrier is unmodulated, enabling high detection probability and low false alarm probability. The alarm signal is used to determine and track the received carrier frequency and to preset the phase of the receiver's sub-carrier reference, for use in the data demodulation. The alarm phase is followed by the information transfer phase, in which the sub-carrier is PSK-modulated in synchronism with the sub-carrier (60 baud). In order to minimize the transmission error probability, each 6 bit information character is transmitted in the form of a 31 chip code word, all words forming a bi-orthogonal code. The transmission sequence is repeated a number of times to overcome link interruptions and to improve the signal quality by message integration.

The selected technique is based on a theoretical study and simulations made by the European Space Agency (ESA) and the parameters are shown in Annex I, Table V. Trials and operational demonstration with the system are planned for 1981-1982.

4.6 United Kingdom

Initial study suggests that an LPDT system using direct sequence spread spectrum modulation with bi-phase shift keying should be practicable, provided that the dedicated SAR channel in MARECS is used. This results from the improved overall link quality obtainable. To ensure compatibility with the dedicated SAR channel in MARECS, it is proposed to use a spread bandwidth of 200 kHz with a PN code clock rate of 100 kHz. Subject to suitable matched filters being available, the PN code length will be 1023 chips. The use of charge coupled devices (CCD) is being considered for this application. It is proposed to adopt a single PN code common to all users and provide a message capability of at least 100 data bits.

The transmitter design uses conventional techniques and will provide a power output of 5 watts. Surface acoustic wave (SAW) and crystal oscillators are being considered for RF and PN code generation.

The receiver will interface with the earth tracking station at an intermediate frequency of 70 MHz. Digital matched filters will be used for PN code acquisition and, in combination with a delay lock loop, tracking. Carrier acquisition and tracking will be achieved using a matched filter and Costas loop. A matched filter and integrate and dump technique will be used for message detection and recovery. The receiver will operate under software control. This will enable short-term carrier frequency instability to be resolved. A number of parallel receivers will be required to allow for long-term carrier frequency instability. Trials and operational demonstration with the system are planned for 1981-1982.

4.7 Japan

In Japan, activities have been directed towards the development of satellite low power distress transmitter systems at 406 MHz. Several possibilities of satellite field trials are considered so as to examine the performance of the low power distress transmitter systems.

4.7.1 Narrowband FSK system using geostationary satellites

Narrowband FSK low power distress transmitter system using 406 MHz band in a geostationary satellite system has been proposed [Kimura, et al., 1978]. The system concept is basically similar to the DRCS narrowband system described in § 4.1

By 1978, laboratory tests of the system via a simulated geostationary satellite have been conducted to evaluate the performance at low carrier-to-noise density power ratio (C/N_0). The demodulator used in the receiver applies a digital superposition technique to improve bit-error rate resulting from the low C/N_0. FSK demodulation is accomplished through the filter-bank system which is composed of a number of narrowband band-pass filters spaced every 60 Hz across the baseband. This method is useful in detecting frequency deviated signals without using any AFC device.

In 1979, simulated sea trials of the system were carried out. A buoy type low power distress transmitter was floated at sea within one nautical mile off the shore. A receiving station was installed on a cliff at the shore with the antenna height being 57.5 m above the sea level.

The station consisted of an antenna system that combined horizontally and vertically polarized three elements Yagi arrays, simulated geostationary satellite and receiver with demodulator made up of narrowband filter bank. In order to attain the same low C/N_0 as in the satellite link, an RF attenuator and a noise signal generator were connected to the receiving system.

Elevation angles to the receiving antenna at the low power distress transmitter were varied from 3 degrees to 1.5 degrees and the heights of the sea waves were about 3 m. The height of the top of the transmitter from the sea level was about 1.3 m. Therefore, the strength of the received signals from the transmitter and the values of the C/N_0 fluctuated several decibels as the result of the shielding effect of the waves.

The results of the trials show that BERs of non-superposition detection can be improved approximately by a factor of ten times or more by using 2 times superposition detection within the value of C/N_0 from 23 dBHz to 33 dBHz.

4.7.2 Spread spectrum PSK system using low orbiting satellites

It is planned to test in the near future a low power distress transmitter system at 406 MHz using direct sequence spread spectrum bi-phase PSK technique.

In general, spread spectrum techniques are found effective for spectrum spreading of 100 or more times the information bit rate.

Therefore, considering the 100 kHz bandwidth limitation and the frequency stability of the transmitter, the information bit rate and the PN code chip rate of the system are specified as 2.5 bit/s and 40 kbit/s, respectively.

Referring to § 3.1 and § 3.2, the low power consumption due to the use of 406 MHz and low orbiting satellites will make it easy to realize the low power distress transmitter in light weight and small size.

A continuous transmission will not only make possible the continuous determination of the position of the lower power distress transmitter by Doppler shift relayed from low-orbiting satellites but will also improve locating the transmitter by the direction-finders during the final positioning (homing) stage.

The major characteristics of the system are as follows:

PN code rate	19.54 codes/s
PN code duration	0.051175 s corresponding to 15 352.5 km*
PN code length	2047 chips
Transmitter power	0.01 W or 1 W
Duty factor	100 % or 5 %
Transmission life	48 h or 12 h
Antenna gain at 30° elevation angle	≤ 2 dB
C/N_0	≤ 34 dBHz
Message code demodulation error rate	≤ 10-5

The satellite sea trials of the low power distress transmitter system are expected to use the Japanese Marine Observation Satellite (MOS-1) which is scheduled to be launched in 1984. The other possibility under consideration is to use the NOAA-E satellites.

A preliminary simulated experiment using Japanese geostationary communication satellite (CS) is scheduled for 1981.

4.8 U.S.S.R.

The USSR is considering development of a low power distress transmitter system, utilizing the 1.6 GHz band, which will use the INMARSAT geostationary satellite. A preliminary decision has been made to use a narrow-band modulation technique.

4.9 Summary of system requirements and proposed systems

A comparison of the advantages and disadvantages of system options is given in Annex I, Table IV. The proposed technical and operational characteristics of the various systems are shown in the Annex, Table V. It should be noted, however, that not all of the required information is available at this time, and many parameters shown are estimates based on interpretation of available specific data. In particular, the assessment of the 0.95 probability of the number of simultaneous alerts that may be received is based upon certain assumptions.

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* PN code duration multiplied by the speed of light (c = 2 997 925 x 10^5 km/s)

5 Conclusions

The opportunity to achieve a means of long range distress alerting by the use of satellite techniques has been identified.

The possible considerations to be taken into account when deciding on the operational requirements have been suggested.

Technical requirements will develop from these and the results of future trials.

Extensive experimental work has already been carried out with favourable results. Further experiments with improved systems and new techniques are being planned with demonstration trials scheduled during 1981 and 1982.

Operational requirements have been identified by IMCO for satellite EPIRBs. It has been assumed that these will apply equally to ship and survival craft low power distress transmitters. For ships with satellite communication terminals, the operational procedures for distress situation reporting should make use of standard communication channels with priority access.

Further investigation is needed into the following:

- the effects of potential interference from other sources;
- the radiating efficiency of low power distress transmitter antennae when mounted on the decks of ships, carried in survival craft or floating in the sea under various sea states;
- the response of various modulation techniques to propagation effects and, in particular, multipath, wave shadowing effects and ionospheric ventilation effects;
- the effects of simultaneous transmission of low power distress transmitters;
- a method of providing position data;
- a means of providing input data.

Investigation of the technical possibility of a return link to low power distress transmitters may also be required.

IMCO's attention should be drawn to the need to study release mechanisms and activation.

The frequency allocations at 1.5/1.6 GHz provide for both communications and distress and safety operations, whereas the allocation at 406 MHz provides an exclusive band for low power distress transmitters (EPIRBs) in the earth-to-space direction. Frequency allocations appear to be adequate and experiments are planned in these frequency bands.

A future global maritime distress and safety system may include the use of geostationary and low altitude near-polar orbiting satellites. The technical, operational and economic impacts of low power distress transmitters operating at one or more frequencies via one or more satellite systems on both the satellites and coast earth stations need to be assessed.

It is highly desirable operationally that the systems conform to a single international standard.

ANNEX I

TABLE IV

Summary of the IMCO operational requirements

IMCO operational requirements	Geostationary satellite	Low altitude polar orbiting satellite	Combined geostationary and low altitude polar orbiting satellite
immediate alerting	immediate alerting within coverage area	average of 1 hour for a 4 satellite system	immediate alerting except average of 1/2 hour in polar regions with a 4 satellite low altitude polar orbiting system /¯ORI, May 1979_7
identification	in message content	in message content	in message content
positioning	re-transmission of NAVAIDs or ships position	Doppler measurement and possibly re-transmission of NAVAIDs or ship's position	Doppler measurement and possibly re-transmission of NAVAIDs or ship's position
global coverage	limited to approximately between 70°N and 70°S	global	global
Nature of distress (optional)	in message content	in message content	in message content
simultaneous transmissions (20 in 10 minutes)	awaits evaluation	awaits evaluation	awaits evaluation

TABLE V

Summary of expected system parameters

SYSTEM PARAMETER	COSPAS/ SARSAT	DRCS FRG	FSK JAPAN (1)	SAMSARS USA	U.K.	PN-PSK NORWAY/E-SA	U.S.S.R. EPIRB	PN-PSK JAPAN (2)
Satellite orbit	Polar about 850 km	Geostationary	Geosta-tionary	Geosta-tionary	Geosta-tionary	Geosta-tionary	Geosta-tionary	Polar
Minimum No. of satellites	3 NOAA and 2 COSPAS (3)	3	3	3	3	3	3	-
Type of distress equipment	121.5/243 MHz ELT/EPIRB. 406 MHz : -float free -on board ship -survival craft	-float free -on board ship -survival craft	-float free -on board ship -survival craft	-float free -on board ship -survival craft	-float free -on board ship -survival craft	-float free -on board ship -survival craft	-float free -on board ship -survival craft	-float free -on board ship -survival craft
Message type	IMCO requirements	IMCO requirements and individual telegraph message	IMCO require-ments	IMCO requirements	IMCO require-ments	IMCO require-ments	IMCO require-ments	IMCO require-ments
Position information	Doppler measurement, ship derived position	By up-dating of ship's derived position information	By up-dating of ship's derived position information	Position information or NAVAID re-transmission or Doppler measurement	By up-dating of ship's derived position information	By up-dating of ship's derived position information	By up-dating of ship's derived position information	Doppler measurement

TABLE V (Continued)

System Parameter	COSPAS/ SARSAT	DRCS FRG	FSK JAPAN (1)	SAMSARS USA	U.K.	PN-PSK NORWAY/ESA	U.S.S.R.	PN-PSK JAPAN (2)
Time : for transfer (mean) (4)	Midlatitude mean : 1. 5.5 h 2. 2.5 h 3. 1.5 h 4. 1.3 h	1-8 min	2 min	2.5 min	10 min	< 5 min	5 min	see COSPAS/ SARSAT
Frequency Up-link, MHz	121.5, 243, 406	1645.5 - 1646.5	406	1645.5 - 1646.5	1645.5 - 1646.5	1645.5 - 1646.5	1645.5 - 1646.5	406
Transmitter power EIRP (5)	121.5, 243 MHz : -11.3 dBW 406 MHz : 7 dBW	Float free 10 dBW Keyboard 13 dBW	7 dBW	10 dBW	7 dBW	7 dBW	7 dBW	-20 dBW
Information bit rate/ modulation	400 bit/s - PM	32 bit/s - non-coherent FSK	63 bits/s, FSK	1.3 bit/s - bi-phase PSK	10 bit/s - bi-phase PSK	11.61 bit/s - PSK on a sub-carrier	24 bit/s - DPSK	2.5 bit/s - bi-phase PSK
Required bandwidth	< 100 kHZ	5 kHz for 20 (6)	100 kHz	200-256 kHz	200 kHz	awaits evaluation	100 kHz	100 kHz
Theoretical simultaneous alerts, 0.95 probability	121.5/243 MHz for 10; 406 MHz for 100	53 kHz for 200 (6)	136	58 with 32 dBW interference	awaits evaluation		awaits evaluation	above 200
Experiments carried out	1975 (OSCAR), land trials; 1979 ALGOS sea trials	1975/1976 (ATS-6) sea trial	1979 sea trial, but simulated satellite	1979 MARISAT land trials	None	None	None	None
Date of operational trials	1982	1981	-	1981	1981	1981	-	1981

(1) (to be completed)
(2) (to be completed)
(3) Initial system
(4) Time between initiation of transmission and read out of error free message at ground station.
(5) This value does not consider the affects of external terrestrial interference.
(6) Depends on the number of simultaneous alerts.

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DRAFT

REPORT 775 * (MOD I)

FREQUENCY REQUIREMENTS FOR SHIPBORNE TRANSPONDERS

(Question 28/8)(MOD I)

(1978)

1. Introduction

Shipborne applications of transponders have been under study by IMCO and elsewhere for some years. In [IMCO, Resolution No. A423(XI)] a shipborne transponder is defined as follows:

Transponder a receiver-transmitter device in the maritime radionavigation service which transmits automatically when it receives the proper interrogation, or when a transmission is initiated by a local command. The transmission may include a coded identification signal and/or data. The response may be displayed on a radar PPI or on a display separate from any radar or both, depending upon the application and content of the signal.

In the course of the IMCO study the following observations were made concerning the future use and development of transponders.

Transponders offer a capability for the exchange of information between ships, and between a ship and shore. The use of transponders could therefore offer a potential for reducing collisions and other accidents which may be caused by inadequate knowledge of the identity, manoeuvring characteristics, position, intended or actual movement of ships.

The proliferation and uncontrolled use of transponder devices generally could lead to an unacceptable increase in responses presented on a ship's radar display, degrading the usefulness of the navigational radar display, and causing confusion among multiple transponder responses.

Larger numbers of transponders might be supported by the use of selective interrogation, as well as by the international specification of technical parameters to be met by these devices.

Realization of most of the future benefits of some types of transponders requires modification or replacement of shipboard radars to provide radar equipment with the necessary transponder modes. The uncontrolled proliferation of transponders could produce incompatibilities among devices developed for different uses, or could necessitate a succession of modifications to shipboard radars to accommodate progressive developments of transponders.

The greatest value will be gained from these devices when navigational information derived from their responses is presented in a simple and straightforward form.

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* The Director, CCIR, is requested to bring this Report to the attention of IALA, ICAO and IMCO.

2. Operational characteristics

IMCO Resolution No. A423(XI) states that a transponder is a device which, when properly interrogated, can provide for:

2.1 ship radar target identification and echo enhancement with the proviso that such enhancement should not significantly exceed that which could be achieved by passive means on the radar PPI of an interrogating ship or shore station;

2.2 radar target correlation with voice or other radio transmission for identification on the radar PPI of an interrogating ship or shore station;

2.3 operator selectable presentation of transponder responses, either superimposed on the normal PPI display or free of clutter and other targets;

2.4 transfer of information pertinent to avoidance of collision or other hazards, manoeuvre, and manoeuvring characteristics, etc.

Transponders should be used to meet the following purposes:

- identification of certain classes of ships (ship-to-ship);
- identification of ships for the purposes of shore surveillance;
- search and rescue operations;
- identification of individual ships and data transfer;
- establishing positions for hydrographic purposes.

3. Basic concepts

It follows from the IMCO work that the broad heading of shipborne transponders covers simple systems involving a short transmission indicating only that an interrogation has been received, through target enhancement and identification, up to complex systems involving high data-rate exchange.

Therefore, a wide range of potential systems needs to be considered, taking account of the various technical parameters of the interrogating transmitters, the transponders and the receivers of transponder emissions to determine the optimum frequency requirements.

4. Present state of system development

4.1 USA – Maritime Radar Interrogator Transponder (MRIT)

In the United States, development intended to assist in safe navigation of ships is being investigated.

4.1.1 Technical description

The technical development in 1976 had reached a stage whereby feasibility had been demonstrated. Fig. 1 shows a block diagram of the basic configuration of the MRIT as tested. The principal elements are:

- transceiver,
- microwave diplexer,
- omni antenna,
- antenna switch,
- control and display sub-system.

Preliminary tests have been made (at power levels of less than 100 watts output) in the band 9300 to 9500 MHz, which is shared with other services.

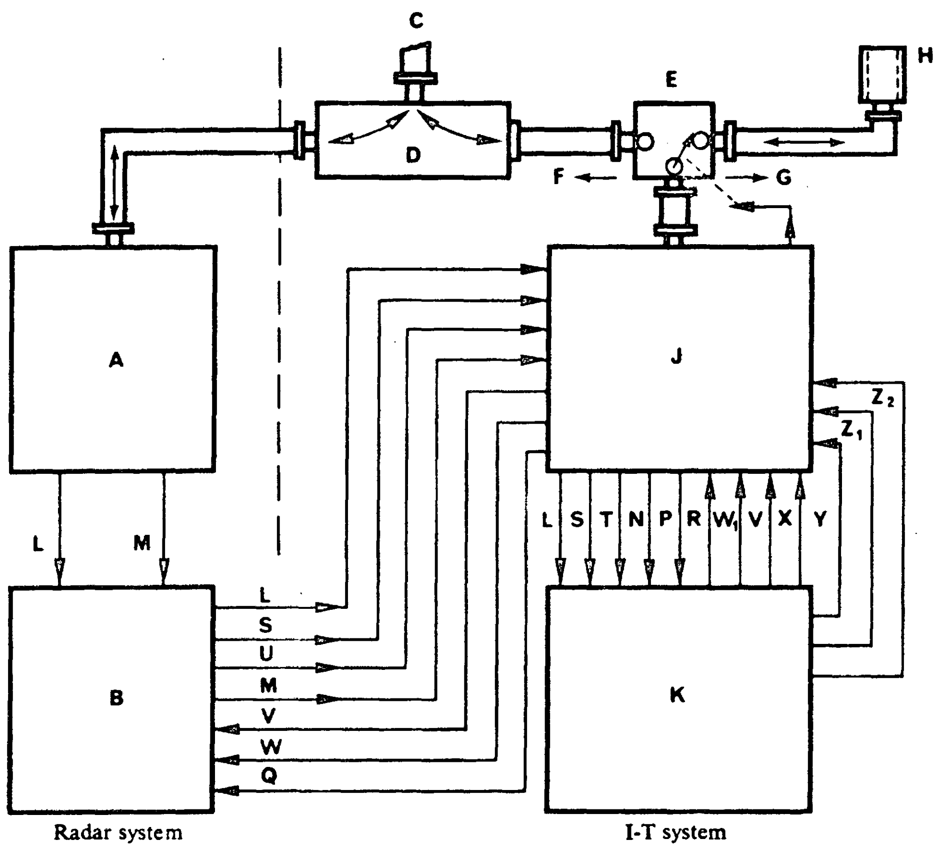

FIGURE 1 — *Block diagram of a Maritime Radar Interrogator Transponder (MRIT) (USA)*

A: radar transceiver unit
B: radar indicator
C: radar antenna
D: diplexer
E: antenna switch
F: interrogate
G: transpond
H: omnidirectional antenna
J: I-T transponder/transceiver unit
K: I-T control display (digital circuits)
L: trigger
M: video

N: R video
P: B video
Q: composite video
R: composite video to radar
S: variable range marker
T: range gate
U: end of range gate
V: delayed trigger
W: sweep start
W_1: delayed sweep start
X: antenna switch
Y: receiver inhibit
Z_1: data to modulator
Z_2: data detector

4.1.2 Operation

The MRIT is integrated into a standard shipboard radar and operates in two principal modes:

- interrogation — the operator interrogates all equipped vessels through an omnidirectional antenna or a particular vessel through the directional scanning antenna;

- response — the transponder responds through an omnidirectional antenna.

Specific interrogation and response messages are transmitted by coding of the pulse trains. The following information interchange transactions are examples:

Interrogation	*Abbreviation*	*Addressed to*	*Response of own identification and selected data*
Echo enhancement	**EE**	**All**	**Automatic**
Identification	**ID**	**All**	**Automatic**
Selective supplementary information	**SSI**	**Selected vessel**	**Automatic**
Direct communication	**DC**	**Selected vessel**	**By operator**

4.1.3 Initial evaluation

Tests on very simple MRIT configurations have demonstrated the technical feasibility of accomplishing the objectives of the system. Several problem areas were encountered which will require additional development or study. These include the most suitable order of frequencies and bandwidth required for this purpose. Technical parameters to be established for MRIT devices also must take into account electromagnetic compatibility with other services having allocations in the same band.

4.2 U.S.S.R — Interrogator Transponder (IT)

4.2.1 Operational experience

Studies and successful operational trials of shipborne Interrogator-Transponders (IT) conducted in fishing vessels have demonstrated their utility as navigational and ship movement control aids.

The studies and tests carried out for many years past point to the convenience of secondary radar for fishing and merchant vessels.

Cumulative experience of shipborne IT operation has demonstrated the usefulness of this equipment for:

- intership exchange of operational navigational data;
- individual vessel identification;
- discrimination of identification responses against a background of interference;
- extending the detection range for small vessels through active response.

4.2.2 Operating principles

The system presupposes that vessels are equipped with interworking IT sets. Each IT operates in conjunction with the ship's navigational radar. The pulses triggering the interrogation signal coder are sent from the radar to the IT, and the pulses on the indicator screen derived from the identification pips of the vessel equipped with an IT are sent from the IT to the radar.

Interrogation takes place on two frequencies, by the sounding pulse of the ship's radar (in the 9 GHz band) and by the coded interrogation pulse of the IT (in the 3 GHz band).

The interrogation code pulses are emitted ahead of the radar main pulse. This 12 μs lead is essential for decoding by the interrogated vessel's responder.

A block diagram of an IT operating in conjunction with a ship's radar is given in Fig. 2.

The IT operates in both interrogation and response mode. It is normally in the response mode ("Interrogate" switch off). To receive information from a ship whose echo pulses are reproduced on the radar display screen, the navigator switches the IT to interrogation mode.

4.2.3 Advantages of two-frequency interrogation

The design principle proposed differs from the radar frequency interrogation system described in §§ 4.1.1 and 4.1.2.

The advantages of the two-frequency interrogation method over systems using shipborne radar frequency interrogation are:

- improved noise-immunity of the interrogation channel;
- electromagnetic compatibility between shipborne radar and IT;
- simple interworking of IT with existing and future shipborne radar.

The radar produces the triggering-lead pulse, the variable-range pulse and the course-blip pulse, while the identification video signal is sent from the IT to the radar.

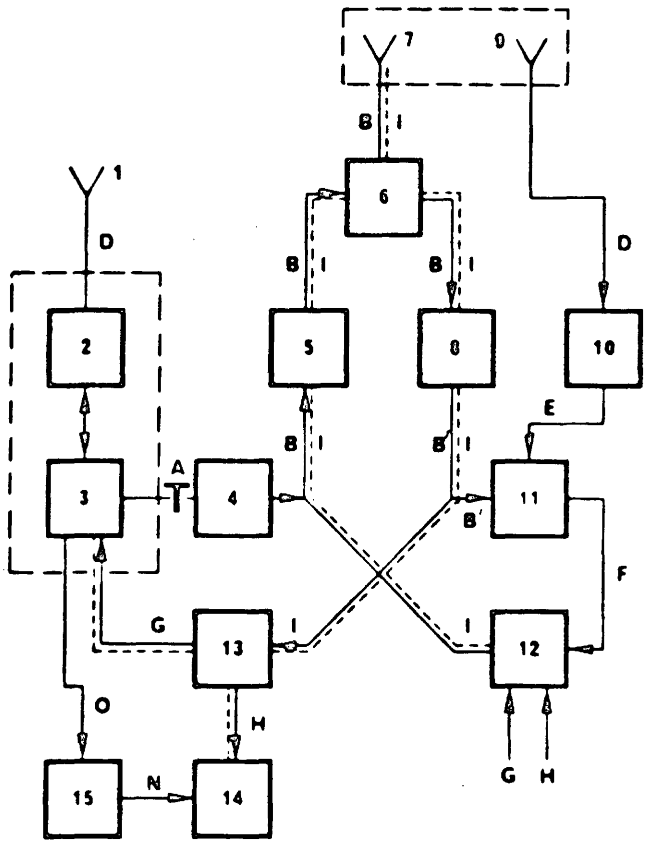

Figure 2 - Interrogator transponder (IT) (U.S.S.R.)

——— { B interrogation signal
B′ interrogation video signal

------ I response signal

The interrogation pulses (A) of the radar indicator (3) are sent to the coder (4) which forms the interrogation signal (B) to be emitted by the transmitter (5).

The coded interrogation signal (B) passes from the output of the transmitter (5) through the (Y)-circulator (6) for emission by the omnidirectional antenna (7). After the interrogation signal (B) has been emitted, the radar transceiver (2) emits the main pulse (D) by the narrow-beam radar antenna (1). The IT of the interrogated vessel, which is in response mode, receives the interrogation signal via the antenna (7) and the main pulse (D) via the antenna (9). The interrogation signal (B) then passes through the (Y)-circulator to the receiver (8), is converted into the video signal (B′) and is directed to one of the inputs of the decoder (11). Another input of the decoder (11) receives the pulse (E) from the output of the receiver (10); this pulse (E) is formed by detection of the main pulse (D) received by the antenna (9). When both signals from the pulse (F) match up, they trigger the coder of the response signal (12). The coded response (I) contains either the identification signal (G) or course and speed data (H), depending on the helmsman's requirements. The response code (I) is sent to the transmitter (5) and is then connected through (Y)-circulator (6) to the omnidirectional antenna (7) for emission.

The IT antenna (7) on board the interrogating vessel receives the response signal (I), which reaches the receiver (8) via (Y)-circulator (6), and then passes to the response signal decoder (13). The identification pulse (G) transmitted for reproduction on the radar indicator (3) is extracted from one output of the decoder (13), while data on course and position (H), for example, reach the IT digital display (14) from the other output. The digital display (14) also receives the strobe-pulse (N) generated by the IT circuit (15) at a given instant corresponding to the angular position of the blip relative to the radar course blip pulse (0).

When these signals coincide on the digital display (14), the digital information is reproduced. The helmsman selects the blip on the radar screen on which it may be useful to obtain information.

An omnidirectional antenna and a standard transceiver are used for interrogation and response.

The system capacity of 100 000 code combinations means that up to 100 000 ships can be individually identified.

4.3 Japan-liferaft-borne transponders for search and rescue operations

A swept-frequency in-band for operation at a frequency of 9320-9500 MHz has been developed for use on the inflatable liferafts generally used in Japan. The use of liferaft-borne transponders is an effective means for indicating the position of survival craft on a radar PPI and thus improving the consistency of urgent recognition of survival craft on the sea.

4.3.1 Technical description and operation

The transponder is composed of:

- an electronics package with an antenna, which is mounted on the canopy of the liferaft
- a monitor speaker unit
- a sea-water battery, which is thrown overboard.

The dimensions of the electronics package are 200 mm height and 60 mm diameter, and the weight is 120 grams. Fig. 3 shows a block diagram of the transponder. The transponder receives any signals in the 9 GHz band, and responds with a signal that paints a 20-blip display of an equivalent length of 8 NM * (100 μs) or 16 NM (200 μs) on a radar PPI to indicate the position of the transponder. On the liferaft, the beeping of a monitor speaker informs those in distress that a rescue vessel is approaching. The 20-blip signal used as the distress code is provisionally selected for the following reasons:

- The coded signal should be different from the swept-frequency radar beacon response codes for navigational aids recommended by IMCO.

- The oscillator circuit has to be simply constructed to assure high reliability.

- Harmful degradation of images on radar PPIs should be avoided. In the future, an international standard code for use with survival craft transponders should be discussed.

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* nautical miles

4.3.2 Results of sea trials and computer simulations

An interrogating radar with an antenna height of 14.8 m was able to recognize the transponder with 100% consistency at distances of 10 NM or more. In comparison with this, the maximum visual-search distances using binoculars were found to be 1 NM at night and 2-3 NM under day-time clear skies. By computer simulations, it was found that at Beaufort 8 sea conditions, obstruction of the propagation path by large waves and off-beam of the radar and/or transponder antenna caused the consistency of recognition to fall below 50%.

It was found that at a distance between 0.05 NM and 0.5 NM, as a result of multipath reflections and side-lobe response of the radar antenna, the chain of blips on the rescue vessel's radar scope broadens to form a series of concentric circles to indicate close proximity to the survival craft.

Signals emitted by several radars and the presence of several transponders did not cause harmful mutual interference or any deterioration of the usefulness of the normal radar PPIs. Therefore, it is possible to use this in-band transponder for enhancing the indication of the position of survival craft.

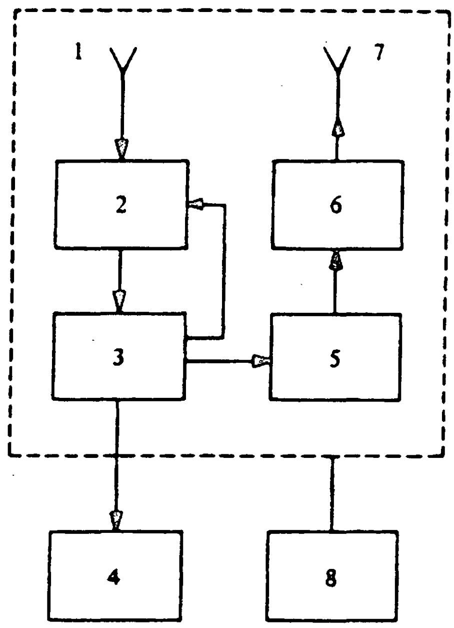

FIGURE 3

Block diagram of a swept-frequency in-hand transponder for search and rescue operation (Japan)

The interrogating radar signal is received using the horizontal omnidirectional antenna (1) and the wide band receiver (2). The gate generating circuit (3) generates a gate pulse of width 100μs or 200μs synchronized to the interrogating pulse train and used to drive the receive inhibit circuit and the monitor speaker (4) as well as being fed to the sawtooth deviation frequency modulator (5). The modulator generates 20 repetition of sawtooth signal for every gate pulse and this sawtooth signal is used to frequency modulate the solid state microwave oscillator (6) within a given frequency range (e.g. 9320-9500MHz) the signal of which is radiated by a horizontal omnidirectional antenna (7). The output power of the transmitter is approximately 40mW. Power Supply (8) is a seawater battery developed for the transponder.

5. Other transponder types

In support of local and particular applications, transponders which use techniques and frequency bands different from those conventionally used by radars can be very effective.

In this respect, France has commenced experiments using low power transponders in the UHF band.

These experiments are associated with civil applications in providing navigational assistance to very large vessels entering and leaving harbours.

In the United Kingdom a system has been developed, and is now operational, to provide range and velocity information to vessels entering the narrow confines of the deep dredged channel of a particular harbour. The system interrogates and responds in that part of the 9 GHz band available for harbour surveillance radar systems.

6. Choice of frequency

Most marine radars currently operate in the bands 2900 MHz to 3100 MHz and 9300 MHz to 9500 MHz.

The band 9300 MHz to 9500 MHz is allocated to services in addition to the maritime service. There is widespread implementation of airborne weather/mapping radar in this band and any proposals for change to maritime use of the band will need to take into account the aeronautical use.

In some shipborne systems, there may be advantages in choosing a frequency that would permit the use of conventional radar antenna. This is because a narrow-beam rotatable antenna may be needed both to make possible the measurement of the bearing of a transponder with the necessary precision and reduce the intensity of interference between systems. However, for many systems other frequency bands may be more suitable.

Although it may also be necessary for interrogation purposes to use bands allocated for radionavigation, it would be more appropriate to use other maritime mobile bands for data responses.

A swept frequency in-band transponder designed to reduce the harmful deterioration of radar PPI displays can be used for search and rescue operations.

7. Interference

7.1 Assessment of interference

The basic information to be taken into consideration when evaluating interference includes:

- the physical environment, e.g. ship structure reflections and blind arcs, propagation over the sea and clutter;
- unavoidable engineering limitations, e.g. antenna sidelobes and limited available bandwidth;

- the level of interference as a function of possible systems parameters and the number of transponders in operation, including interactions between transponders and effects of different methods of display;

- the maximum density of the distribution of shipping likely to make use of transponding systems;

- the extent of the use by other services of the frequency bands allocated to radionavigation.

7.2 Factors which may be taken into account to minimize interference

Signals from a transponder are unintelligible unless received separately from other signals. Many transponders may share the same frequency band. Some of the techniques available for reducing the probability of interference are:

- selection of bearing by means of a directional antenna. This technique is limited by the response of the antenna to signals received from directions away from the main lobe. The sidelobe response may be no more than 20 dB below the main lobe response;

- selection by coded interrogation. This technique would not normally be used when interrogation by the primary radar is required, because of the difficulties involved in coding the pulse. It is most effective and minimizes interference to the transponder system when using a transmitter other than the radar (posssibly on another frequency) to interrogate the transponder. In the event the transponder receiver is operating on the frequency of a primary radar, a separate transmitter other than the radar might transmit in the interpulse period between primary radar transmissions and make use of the primary radar antenna.

8. Coding

Coding systems will need to be determined to satisfy applications such as ship identification, location of survival craft, and data transfer.

9. Summary

The development of transponder systems for shipborne information transfer has been reported from the USA and U.S.S.R., for search and rescue operations from Japan,and for ship-to-shore applications from France and the United Kingdom.

IMCO Resolution A423(XI) recommends for transponders that:

- the design of transponder systems should ensure that there is no significant degradation of fixed-frequency radar beacons, and the response of a transponder should not be capable of being interpreted as being from a radar beacon of any type;

- where a transponder is to be used with a marine navigational radar, any modifications necessary to the radar should not degrade its performance, be kept to a minimum, be simple and, where possible, be compatible with a fixed-frequency radar beacon facility;

- in-band transponders should not be used to enhance the detection of marine craft, except when specially authorized by Administrations for use in survival craft;

IMCO [1977] also considers that:

- the long-term aim should be to develop transponder systems which are compatible with each other. Work has only recently started in this field and the preparation of international operational standards should be deferred pending the results of further study into the operational requirements.

10. Conclusions

The most important requirement is to determine the interference between radar and transponder systems and the interference between transponder systems. Studies are required to achieve an acceptable interference model which should include those factors identified in §§ 7.1 and 7.2.

To achieve optimum results in these studies, it will be necessary to assume certain nominal values for the power spectra of current radar transmitters and the output of radar receivers as a function of frequency.

There is also a need to study the capacity and integrity of the coding systems that might be necessary, since they are likely to be significantly different and have a range of options of increasing complexity to satisfy the various operational requirements.

It will also be necessary to assess the likely degradation of data transfer in adverse environmental and propagation conditions and to determine the limits of acceptable error in the information received.

Assessment of future systems should include both radar and non-radar techniques.

A thorough investigation and evaluation into the techniques suitable for the various possible operational uses of transponders is necessary before the most suitable order of frequencies and bandwidths could be recommended.

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DRAFT

REPORT AL/8*

OPERATIONAL ASPECTS ON THE USE OF THE AUTOMATIC DIRECT-PRINTING TELEGRAPH SYSTEM FOR TRANSMISSION OF NAVIGATIONAL AND METEOROLOGICAL INFORMATION TO SHIPS (NAVTEX)

(Question 5-2/8(MOD I))

1. The above service called NAVTEX was introduced in 1976 using the frequency of 518 kHz. Since then several Administrations bordering the North Sea and the Baltic have participated in the trials and agreed upon transmitting time-schedules and other operational aspects. By 1980 the service covered the entire North Sea and Baltic areas.

Technical performance and user views have been investigated. Ships equipped with dedicated, as well as ships fitted with traditional, radio-telex equipment have participated in these investigations.

2. In the document [CCIR, 1978-82a] some of the findings during these trials have been briefly described and summarized. Some of the results were considered to be of a technical nature and have been included in Recommendation 540(MOD I).

3. In the document [CCIR, 1978-82b] which is an extract from meetings of the IMCO Sub-Committee on Radiocommunications, CCIR Recommendation 540(MOD I) is endorsed and some of the problems that need further study on a global and on a regional basis are listed.

The opinion expressed by IMCO is that the service should continue and would be best served by the use of a single world-wide frequency which should be designated on an international basis by action of the WARC-M-1982.

4. The provisional operational considerations summarized from the above documents and outlined in Annex I are provided for guidance during future expansion of the service until sufficient operational experience permits the preparation of a Recommendation covering detailed operational aspects.

ANNEX I

1. The radiated power from the coast station transmitter should be adjusted to cover the intended service area of that coast station. The range extension occurring during night hours should also be considered.

2. The information transmitted should primarily be of the type used for coastal waters preferably using a single frequency (see also Recommendation No. 309(YB), WARC-79).

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* The Director, CCIR, is requested to bring this Report to the attention of IMCO and IHO.

3. The transmitting stations should be allocated transmission time with 4 to 6 hours' interval. Transmission durations of 5 to 10 minutes should generally be adequate.

4. Periods should be scheduled between the regular transmission periods permitting immediate/early transmission of particularly important messages.

In certain cases message types A*, B*, D* and G* should be sent immediately upon issue subject to avoiding interference to ongoing or scheduled transmissions.

According to IMCO, initial distress messages should also be broadcast on the agreed frequency by coast stations in whose SAR area distress cases are handled.

5. Participating transmitting stations should be provided with monitoring facilities to enable them to:

- monitor their own transmissions;

- confirm that the channel is not occupied.

6. The service is international and only the English language should be used.

7. Dedicated on-board equipment is recommended.

8. Ships should be allowed to disable printout of messages from selected coast stations.

9. Ships should be allowed to disable printout of selected categories of messages with the exception of message types A*, B* and D*.

10. If any facility is disabled as described in §§ 8 and 9 above, the extent of any such limitation must be clearly indicated to the user.

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[1978-82]: **a.** 8/58(Norway, Sweden); **b.** 8/162(IMCO).

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* A: Navigational warning
B: Gale warning
D: Search and rescue information
G: Decca message

DRAFT

REPORT AO/8*

TECHNICAL CHARACTERISTICS OF MARITIME RADIOBEACONS

(Draft Question BK/8)

1. Introduction

Radio direction-finding has been used in navigation and search and rescue at sea for many years.

The International Convention for the Safety of Life at Sea (SOLAS), 1974 requires ships over 1,600 tons gross tonnage to be equipped with a direction finding (DF) receiver.

A regional agreement known as the Regional Arrangement concerning maritime radiobeacons in the European Zone of Region 1 (Paris Plan) was concluded in Paris in 1951.

The use of radiobeacon stations for communications is covered by Report 581-1, and Recommendation 487.

The World Administrative Radio Conference, Geneva, 1979 made provisions (RR No. 466 (3472B)) for the use of radiobeacon stations in the maritime
radionavigation service for transmitting additional navigation information using narrowband techniques, e.g. differential Omega corrections.

Also in 1979, IMCO recommended performance standards for Differential Omega Correction Transmitting stations (IMCO Resolution No. A425(XI)).

Recommendation No. 602(XD) adopted by the WARC-79 considers the need for revision of the 1951 Paris Plan and to review the technical characteristics of maritime radiobeacons in the European Area concerned.

This Report relates to Recommendation No. 602(xD) and contains those operational requirements which should be considered in preparing new characteristics for maritime radiobeacons in the European Zone. Similar provisions could be considered by countries outside the European Zone.

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* The Director, CCIR, is requested to bring this Report to the attention of the International Association of Lighthouse Authorities (IALA) and of the Inter-Governmental Maritime Consultative Organization (IMCO).

2. Transmission modes currently in use for maritime radiobeacons

2.1 A1A : the carrier is not modulated; it is keyed with the identification signal. (1)

2.2 A2A : the carrier is amplitude modulated by an audio tone; both carrier and modulation tone are keyed with the identification signal. (2)

2.3 A2A"*" : the carrier is amplitude modulated by an audio tone, but only the modulation tone is keyed with the identification signal. (2) (A "*" is sometimes added after the emission symbol to distinguish mode 2.3 from mode 2.2.

2.4 H2A : "Dual carrier" transmission : two radio frequencies are transmitted with a frequency spacing equivalent to the wanted audio tone frequency (heterodyning instead of amplitude modulating); one frequency only is keyed with the identification signal.

In some geographical areas maritime radiobeacons operating on the same frequency are combined into groups of up to six which operate in a time-sharing mode, assigning slots of one minute to each of the beacons. The main disadvantages are that the time availability of each radiobeacon is low, and that the time to obtain a position fix may be long.

3. Radiodirection finding methods

Methods currently in use are as follows:

a) Minimum-signal (aural) direction-finding, with or without a beat-frequency oscillator (BFO).

b) Automatic direction-finding (ADF).

c) Dual-channel visual (cathode-ray-tube direction-finding).

The Paris Plan was designed primarily to accommodate a) above and any new system should also take the more recent methods of b) and c) into consideration.

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(1) According to Article 25 (N23) of the Radio Regulations, any radio station must transmit an identification signal. In the case of maritime radiobeacon stations, this consists of two or more Morse characters.

(2) The depth of modulation modes (b) and (c) is at least 70% (RR No. 2866 (6488/464)).

4. Operational requirements

4.1 In developing technical characteristics for maritime radiobeacons, present and future operational requirements need to be taken into consideration. These include:

4.1.1 Radiobeacon emissions should take into account the need for shipborne direction-finding equipment to be compatible with navigational functions and search-and-rescue (SAR) operations;

4.1.2 The use of geographic separarion must take into account the numbers and location of radiobeacons needed to satisfy the navigational requirements of the area.

4.2 International coordination needs to be achieved concerning frequency, location, and service range for optimum protection against interferences.

4.3 The time required for position fixing should be related to the accuracy requirements for safe navigation in the area.

4.4 The system should be compatible with modern techniques, such as frequency synthesizers, automatic bearing measurements and decoding, alpha-numeric display and automatic calibration error corrections.

4.5 The system should use appropriate techniques to increase protection against interferences.

4.6 The system should be compatible with the use of maritime radiobeacons for transmitting additional navigation information in compliance with Recommendation 487 and according to IMCO Resolution No. A425(XI) and to RR No. 466 (3472B).

4.7 The maritime radiobeacon service should be suitable for use by all properly equipped ships and small craft. Performance standards should accommodate the requirements of all classes of ships and small craft.

4.8 Any new radiobeacon systems should be compatible with the existing system at least for a transitional period.

5. Technical studies

To define the technical characteristics of marine radiobeacons, and taking into account the operational requirements given in § 4, the following studies are required:

5.1 Determination of the necessary field strength values at service range, and methods and procedures by which the field strength could be periodically monitored.

5.2 Examination of the validity of propagation curves for night-time operation in the 300 kHz frequency band, as they appear in Document 3 of [Paris, 1951].

5.3 Examination of the possibility of reducing frequency separation between radiobeacons, in particular consideration of:

5.3.1 the reduction in number and frequency of the modulation audio tones;

5.3.2 the type(s) of modulation to be adopted.

5.4 Investigation of the risks of interference occurring when diminishing frequency and/or distance separation between maritime radiobeacons [Bukovsky, 1965]. This involves study of protection ratios according to carrier frequency separation and modulation frequency, taking into account the possible adoption of modern techniques in the design of receivers, examination of filtering techniques in receivers, and of the practical ways of using them.

5.5 The preferred method of identifying a radiobeacon transmission.

5.6 The optimum and maximum number of maritime radiobeacons associated in groups on a single frequency in a time-sharing mode.

5.7 Examination of the possibility of diminishing the duration of a complete transmission cycle of grouped radiobeacons, including the possibilities of a periodical rapid transmission cycle for use by automated receivers.

The above items should not be considered as exhaustive, and other aspects may appear in the course of the study.

REFERENCES

PARIS [1951] Documentation of the Conference for the preparation of the Regional Arrangement concerning maritime radiobeacons in the European Area of Region 1.

BUKOVSKY [1965] On the problem of permissible interference level for maritime radiobeacons. International Conference on Lighthouses and Other Aids to Navigation, Rome, 7.1.11.

DRAFT

REPORT BB/8

OPERATIONAL AND TECHNICAL FACTORS RELEVANT TO GLOBAL DISTRESS SYSTEMS IN THE AERONAUTICAL MOBILE SERVICE

(Questions 17-1/8 and 31-1/8)

1. Introduction

This Report seeks to identify relevant factors from the civil aviation distress environment which are expected to be significant in any detailed investigation of an operational requirement for an aviation distress location/alerting service using satellites.

In this Report an aviation distress system is not intended to include the involvement of aircraft in maritime distress incidents.

2. Basic factors

Published statistics about aircraft accidents (some of which are included in Annex I) show two dominant features relevant to a possible future aviation distress system provided via satellites:

- The vast majority of accidents to large aircraft take place on or relatively near an aerodrome. Location of the accident is rarely a problem in these cases.
- There are very many more accidents involving general aviation (i.e. light aircraft predominantly) than air transport operations (i.e. large aircraft predominantly).

In 1978 there were approximately 325 000 civil aircraft in the world of which some 290 000 were classed as general aviation.

These facts strongly suggest that if a future operational requirement was to emerge for a satellite system for aircraft in distress then it would need to ensure that light aircraft operations and the en-route phase of flight are catered for, to realise the most significant benefits — although the needs of en-route large aircraft clearly must also be met.

This view is strengthened by consideration of the relative "survivability" of those involved in a light aircraft en-route accident compared with those in a large aircraft en-route accident. Examination of the relative airspeeds, manoeuverability, operating heights, etc. all point to a general conclusion that the occupants of light aircraft are likely to have a better chance of surviving such a crash than occupants of a large aircraft. Further study of aircraft accident statistics would be needed to quantify this "survivability" in absolute terms.

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* The Director, CCIR, is requested to draw the attention of ICAO, IMCO and the INMARSAT Organization to this Report.

It is considered that a system meeting general aviation needs would also be very likely to meet the needs of air transport operations.

3. Discussion

If the above line of approach is accepted then it is possible to proceed further to identify some consequential operational and technical factors which would need to be taken into account in any future consideration of an aeronautical distress system using satellites:

3.1 To gain wide acceptance by the light aircraft owners and operators any on-board device would need to be lightweight, cheap and simple. If acceptable for light aircraft it could reasonably be assumed to be acceptable for large aircraft also.

3.2 The normal navigational and other equipment on light aircraft is likely to be limited. It would therefore seem inadvisable for system designers to assume that on-board-derived position information would or could be made available for transmission in the event of a distress incident.

3.3 Even if position information was available the speed of aircraft is such that an on-board device designed to store the latest aircraft position would require very frequent updating (every 5-10 minutes, say) to prevent an excessive area of search uncertainty. Point 3.2 above indicates that automatic updating should not be relied upon in light aircraft and flight deck workload would certainly rule out manual updating at the interval required.

3.4 Points 3.2 and 3.3 together strongly indicate that any position fixing for a global aeronautical system should be carried out without reliance on aircraft-derived navigational data transmitted by an on-board device, although it would seem desirable to permit the latter if this could be effectively included as an optional additional feature.

3.5 To be effective an on-board device would need to have facilities to permit both manual and automatic actuation of a distress alerting signal in the event of emergencies on either land or sea. The equipment will clearly need to be designed to withstand an aircraft crash.

3.6 A large number of general aviation and other aircraft are already required to carry emergency beacons on 121.5 MHz and 423 MHz and internationally-recognised transmission characteristics exist for these (in essence they are required to use amplitude modulation with a rapidly sweeping audio signal. Simultaneous transmission on 121.5 MHz and 243 MHz is required.) It would clearly be highly desirable for any proposed global distress system to utilize these existing types of equipment if the problem of the high incidence of false alarms can be resolved.

3.7 Notwithstanding § 3.6 above there could be operational advantages in using a totally new frequency band dedicated for global alerting and distress location (e.g. 406.1 MHz). However these possible advantages require further study and may, at least in part, be offset by the large-scale existing aeronautical investment and procedures associated with 121.5 MHz and 243 MHz. It would appear necessary to ensure that any future system takes into account both aircraft and survival craft equipments.

The results of studies being carried out under the various tests described in Report 761 (MOD I) will be of considerable interest in future considerations of the points under this section and section 3.6 above.

3.8 True global coverage would appear to be required. Coverage of the high Arctic latitudes would be essential as well as most of the world's land and sea areas. Closer examination of aircraft operations might reveal a few areas where lack of coverage might not be too serious.

3.9 Points 3.4 and 3.6 would bring a need for any position location system to have an accuracy significantly better than the "Worst" expected line of sight range from the aircraft in distress and the search vehicles (e.g. surface to surface VHF/UHF line of sight range, say 5-10 miles).

3.10 On the question of capacity of a satellite-based distress system the 1978 statistics given in Annex I permit a first assessment of the needs to be made (1978 was neither a particularly good year nor a particularly bad year for aviation accidents). The pure arithmetic average over all aircraft under all phases of flight gives a value of approximately 1 fatal accident every 6 hours of the day throughout the year (0.17 accidents per hour). Poisson probability theory indicates that, for this average frequency of occurrence, no more than 3 fatal accidents are likely in any 1 hour period (99.9% probability level). Even if the 0.17 per hour overall average was considered to be unrealistic due to various reasons including daily and seasonal traffic variations, the 99.9% figure would only rise to no more than 4 or 5 per hour if the overall average was trebled. If accidents that occur in the same hour are regarded as "simultaneous" then it can be seen that a fairly modest maximum simultaneous capacity is required. However, consideration also needs to be given to the fact that a distress alerting service may well continue to transmit for several hours after the distress has been received by the search and rescue services — even after the aircraft has perhaps been located.

3.11 When a detailed assessment of the benefits of a global civil aviation distress system is made, there are three main areas for investigation:

(a) rescuing survivors,

(b) recovery of the aircraft for accident investigation purposes,

(c) commercial salvaging.

In respect of (a) the previous comments on "survivability" (see § 2) are also relevant. It is evident that any system must have a very high probability of alerting the search and rescue services within a few minutes of the activation of an on-board device.

4. Summary and conclusions

4.1 Although considerable aviation interest exists in the possibilities offered by satellite-based systems a firm preference for a global solution has not yet emerged.

4.2 There is strong evidence based on past aircraft accident statistics to suggest that if an operational requirement does eventually emerge then it will be of greatest benefit if it can cater for the needs of light aircraft as well as those of large aircraft. This stems mainly from the much larger numbers of general aviation aircraft and their significantly worse accident record. Also relevant to this is the fact that a very high proportion of accidents to large aircraft occur in circumstances where a distress location system would not appear to offer much assistance.

4.3 If a future system was matched to general aviation characteristics it could reasonably be expected to be compatible with large aircraft operations also.

4.4 In view of the current type of emergency beacons carried by many light aircraft there would appear to be strong advantages if any future proposed system could utilize such existing equipment. Internationally accepted standards exist for this equipment.

4.5 There appears to be some doubt that a global system could offer significant benefits unless it included both distress alerting and distress location.

4.6 There appears to remain some significant operational differences between the aeronautical and maritime cases. (See Report 595-1 also.) Therefore continuation of close cooperation between aeronautical and maritime interest is essential.

ANNEX I

1978 CIVIL AVIATION STATISTICS – WORLD

		General aviation	Air transport (large aircraft)	Total
1	No. of aircraft(1)	290 000	35 000	325 000
2	No. of accidents with fatalities(1)	1 426	27	1 453
3	Total hours flown(1)	46.1 million	24.9 million	71 million
4	Fatal accidents per 100,000 h flown	3.1	0.11	2.05

(1) from ICAO Annual Statistics 1978

from these figures:

Average no. of fatal accidents per hour during the year $= \frac{1453}{365 \times 24} = \underline{0.17}$

Hence, likely maximum no. of fatal accidents in any hour (Poisson 99.9%) = 3 approx.

ICAO world-wide accident statistics are divided into those with fatalities and those without. They include incidents outside the scope of this Report (e.g. ground movement incidents) as well as cases where fatalities are caused solely to people not in the aircraft which has crashed. It is not possible to provide precise statistics relevant to this Report but it is considered that the figures for "accidents with fatalities" are the closest to what is required.

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PART II

LIST OF THE NUMBERS AND TITLES OF THE RELEVANT CCIR QUESTIONS, STUDY PROGRAMMES AND DECISION ASSIGNED TO STUDY GROUP 8

Q. 1/8*	Signal-to-interference protection ratios and minimum field strengths required in the mobile services . . .
Q. 5-2/8 (MOD I)	The introduction of direct-printing telegraph equipment in the Maritime Mobile Service . . . .
Q. 9-3/8 (MOD I)	Digital selective-calling system for future operational requirements of the Maritime Mobile Service . . . . .
Q. 11-1/8*	Improvements in the performance of radiotelephone circuits in the MF and HF maritime bands. . . . . . .
Q. 17-1/8(MOD I)	Technical and operating characteristics of systems providing communication and/or radiodetermination using satellite techniques for aircraft and/or ships. . . .
S.P.17B-2/8	Technical and operating characteristics of systems providing radiocommunication and/or radiodetermination using satellite techniques for distress and safety operations. . . . .
S.P.21A-1/8*	Definition of interference and units and methods of measurement . . . .
Q. 26-1/8(MOD I)	Use of class J3E emissions for distress and safety purposes. . . . .
Q. 28/8 (MOD I)	Frequency requirements for shipborne transponders . .
Q. 30-1/8(MOD I)	Improved use of the HF radiotelephone channels for coast stations in the bands allocated exclusively to the Maritime Mobile Service . . . .
Q. 31-1/8 (MOD I)	Future use and characteristics of emergency position-indicating radio beacons in the Mobile Service and the Mobile Satellite Service. . . . .
Q. 32-1/8 (MOD I)	Preferred technical and operating characteristics for a Mobile-Satellite System . . . .
Q. 35-1/8*	Efficient use of the radio spectrum by radar stations in the radio determination service. . . . .
Q. 38/8 (MOD I)	Use of frequencies in the bands between about 1606 and 4000 kHz allocated to the Maritime Mobile Service
Q. 44/8 (MOD I)	The choice of frequencies in the maritime mobile bands above 1605 kHz to be reserved for distress and safety purposes . . . .
Q. 45/8 (MOD I)	Technical and global considerations for a Future Global Distress and Safety System at sea . . . .
Q. 47/8 (MOD I)	Preferred technical and operational characteristics for the Land Mobile-Satellite Service . . . .
Q. BE/8	Use of frequencies by the Maritime Mobile Service in the band 435 - 526.5 kHz. . . . .
Q. BG/8	Development and future implementation of ship movement telemetry, telecommand and data exchange systems. . .
Q. BH/8	Frequency sharing between services in the band 4 to 30 MHz. . . . .

* These texts are contained in Volume VIII of the XIVth Plenary Assembly, all others in the Conclusions of the Interim Meeting (1980) of Study Group 8.

Q. BK/8	Technical characteristics of maritime radio-beacons . . . .
S.P. 32A/8	A global low-orbit satellite system for detection and positioning of low-power transmitters . . . .

Decision

D. 32-1	Technical and operating characteristics of systems in the Maritime Mobile Satellite Service . . . .

PART III

LIST OF THE NUMBERS AND TITLES OF CCIR TEXTS FROM STUDY GROUPS 1, 3, 5 AND 6 CONSIDERED TO BE OF INTEREST TO ADMINISTRATIONS PREPARING FOR THE WARC-M 82

STUDY GROUP 1

Report 660*	An electromagnetic compatibility figure of merit for single channel voice communication system. .
Report 661*	Measurement procedures for an electromagnetic compatibility figure of merit for single channel voice communication system . . . .
Report 325-2*	Results of spectrum measurements of amplitude modulated radiotelephone emissions and multi-channel voice-frequency radiotelephone emissions
Report 656*	Efficient spectrum utilization using probabilistic methods. . . . .
Report 658(MOD I)**	Assessment od the feasibility of sharing between mobile users and a fixed service circuit in the frequency band 4 - 28 MHz. . . . .
Question 47-1*	Definition of efficiency and utility of spectrum use. . . . .
Question 58/1*	Frequency sharing between various services . . .
Question 18-2/1 (MOD I)**	System design for maximizing the efficiency and utility of spectrum use. . . . .
Question 45/1 (MOD I)**	Technical criteria for frequency sharing . . . .

STUDY GROUP 3

Rec. 455-1***	Improved transmission system for HF radiotelephone circuits . . . .
Rec. 240-3***	Signal to interference protection ratios . . . .
Report 701***	Improvements in the performance of HF radiotelephone by means of receiver design (A.G.C. time constant). . . . .

* Volume I of the XIVth Plenary Assembly, Kyoto, 1978.

** Conclusions of the Interim Meeting of Study Group 1.

*** Volume III of the XIVth Plenary Assembly, Kyoto, 1978.

Report 354-3(MOD I)*	Improved transmission systems for use over HF radiotelephone circuits (LINCOMPEX) . . . .
Report 176-4**	Compression of the radiotelephone signal spectrum in the HF bands. . . . .
Question 1/3**	Factors affecting the quality of performance of complete systems of the Fixed Service. . . . . .
Question 13-1/3**	Improvements in the performance and efficiency of HF radiotelephone circuits . . . .
Question 27/3**	Compression of the radiotelephone signal spectrum in the HF bands. . . . .
Opinion AI/3*	Frequency sharing between services below 30 MHz.

STUDY GROUP 5

Rec. 368-3(MOD I)***	Ground-wave propagation curves for frequencies between 10 kHz and 30 MHz. . . . .

STUDY GROUP 6

Report 322-1****	World distribution and characteristics of atmospheric radio noise. . . . .
Report 252-2(MOD I)*****	Second CCIR computer-based interim method for estimating sky-wave field strength and transmission loss at frequencies between 2 and 30 30 MHz . . . .

* Conclusions of the Interim Meeting of Study Group 3.

** Volume III of the XIVth Plenary Assembly, Kyoto, 1978.

*** Conclusions of the Interim Meeting of Study Group 5.

**** Separate edition.

***** Conclusions of the Interim Meeting of Study Group 6 and separate edition.

Document No. DL/2-E
28 February 1983
Original : French

HEADS OF DELEGATIONS

AGENDA

OF THE

MEETING OF HEADS OF DELEGATIONS

Monday, 28 February 1983, at 1030 hrs

(Room 2)

		Document No.
1.	Opening by the Secretary-General and designation of the Chairman of the meeting	-
2.	Approval of the agenda of the meeting	-
3.	Proposals for the election of the Chairman of the World Administrative Radio Conference for Mobile Services, Geneva, 1983	-
4.	Proposals for the election of the Vice-Chairmen of the Conference	-
5.	Conference structure (Committees and main Working Groups)	DT/3
6.	Proposals for the election of the Chairmen and Vice-Chairmen of the Committees and of the main Working Groups of the Plenary Meeting	-
7.	Draft agenda of the first Plenary Meeting	DT/2
8.	Allocation of documents to Committees (draft)	DT/4
9.	Other business	-

R.E. BUTLER
Secretary-General

Document No. DL/3-F/E/S
28 février 1983
Original: français
anglais
espagnol

COMMISSION DE DIRECTION
STEERING COMMITTEE
COMISION DE DIRECCION

Calendrier des travaux de la Conférence
Schedule of the Work of the Conference
Horario de los trabajos de la Conferencia

1ère semaine / 1st week / 1.a semana : 28.02.1983 - 06.03.1983

GTT/TWG/GTT (PL-A) : termine ses travaux vendredi le 4 mars /
completes its work on Friday, 4 March /
termina sus trabajos el viernes 4 de marzo

2ème semaine / 2nd week / 2.a semana : 07.03.1983 - 13.03.1983

GTS/SWG/GTS (PL-B) : termine ses travaux mercredi le 9 mars /
completes its work on Wednesday, 9 March /
termina sus trabajos el miércoles 9 de marzo

C4 : termine ses travaux vendredi le 11 mars /
completes its work on Friday, 11 March /
termina sus trabajos el viernes 11 de marzo

C5 : termine ses travaux vendredi le 11 mars /
completes its work on Friday, 11 March /
termina sus trabajos el viernes 11 de marzo

3ème semaine / 3rd week / 3.a semana : 14.03.1983 - 20.03.1983

C2 : Rapport final - mardi le 15 mars/
Final Report - Tuesday, 15 March/
Informe final - el martes 15 de marzo

C3 : Rapport final - mercredi le 16 mars /
Final Report - Wednesday, 16 March /
Informe final - el miércoles 16 de marzo

V.R.Y. WINKELMAN

Président / Chairman / Presidente

Document No. DL/4-E
28 February 1983
Original : English

COMMITTEE 4

Working Group 4A (Frequency matters)

Terms of reference :

To consider proposals concerning frequency matters for the following Articles and Appendix of the Radio Regulations :

- Article 8, as defined in agenda item 1.2;
- Articles 38 and 60 (as far as the configuration of the distress and safety channels are concerned);
- Appendix 16 and channelling plans in the new shared bands (4 MHz, 8 MHz) as defined in agenda item 1.4.

To review and take appropriate action, as necessary, on the following Resolution and Recommendations of the WARC-79, as defined in agenda items 2 and 3 :

Resolution No. 310, Recommendations Nos. 203, 307, 308, 309 and 605.

Working Group 4B (Regulatory matters)

Terms of reference :

To consider proposals concerning regulatory matters for the following Articles of the Radio Regulations :

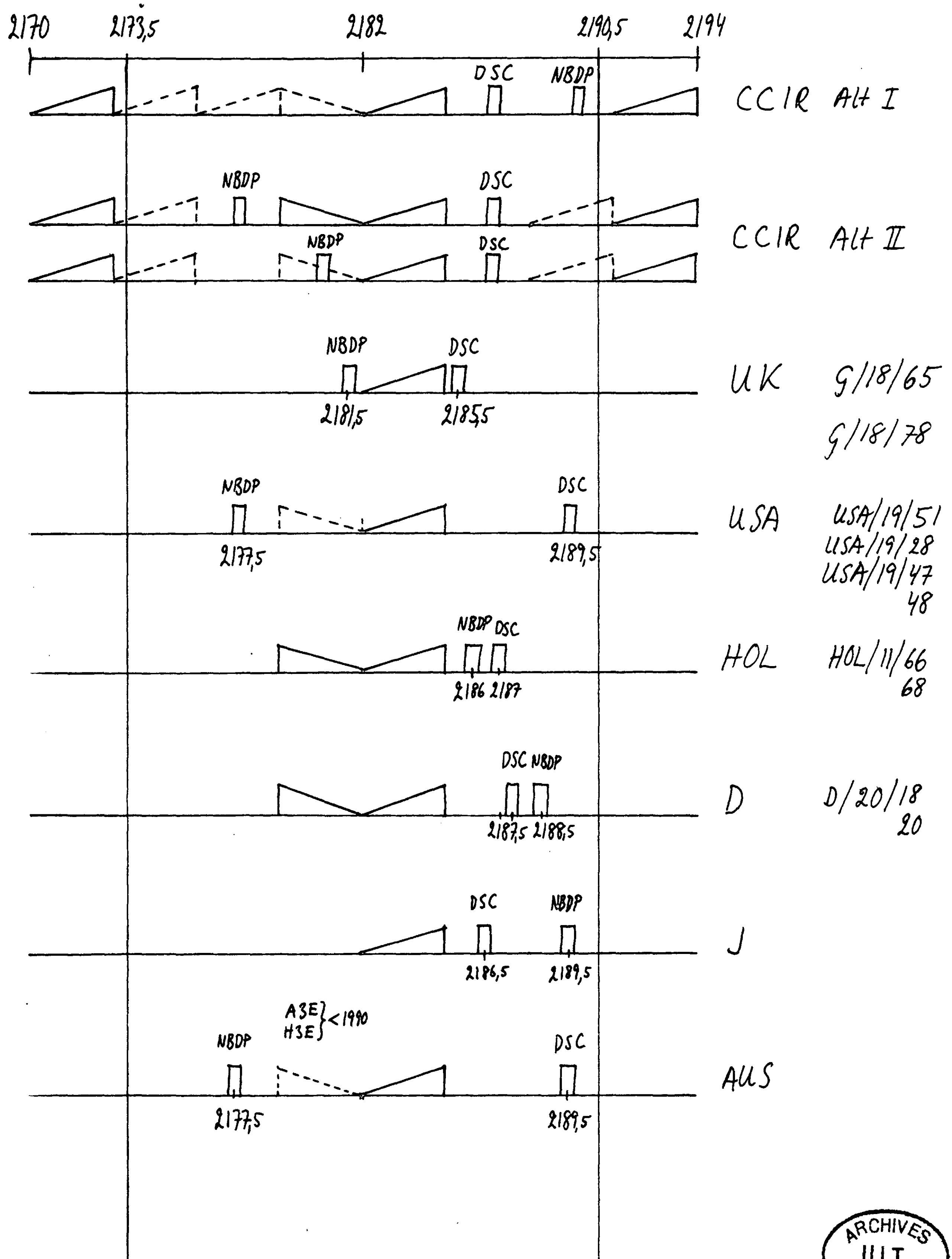
- Article 1, as defined in agenda item 1.1;
- Article 12, as defined in agenda item 1.3.

M. MENON K.P.R.
Chairman of Committee 4

Document No. DL/5-E
2 March 1983
Original: English

COMMITTEE 4

CONFIGURATIONS OF THE DISTRESS AND SAFETY CHANNELS IN THE 2 MHz BAND PROPOSED IN VARIOUS DOCUMENTS



Document No. DL/6-E
2 March 1983
Original : English

TECHNICAL WORKING GROUP

Report of the Chairman of the ad hoc Group 1
of the Technical Working Group

The draft Recommendation relating to Distress, Urgency and Safety Traffic is contained in the Annex to this Report.

B.J. STRINGFELLOW
Chairman of the ad hoc Group 1

RECOMMENDATION No. [201]

Relating to Distress, Urgency and Safety Traffic[2]

The World Administrative Radio Conference, Geneva, 1983,

having noted

that the International Maritime Organization (IMO) :

a) has adopted a Resolution[1] on the development of the maritime distress system;

b) has under development a future global maritime distress and safety system;

c) is considering transitional measures to this future system;

further noting

that the requirements of the future global maritime distress and safety system are being studied by the CCIR;

considering

a) that the IMO requirement for the possible future fitting of automatic distress alerting, followed by the automatic transmission of additional information concerning the distress case, is of particular importance;

b) that automatic distress alerting, followed by the automatic transmission of additional information concerning the distress case, should take place on one or more frequencies reserved for this purpose;

c) that this Conference has made available frequencies for automatic distress alerting using digital selective calling techniques;

d) that within the framework of the future global maritime distress and safety system the transmission and the recorded reception of distress, urgency and safety messages should be able to take place without interruption and irrespective of human attendance;

e) that there will be a continuing requirement for non-automatic alerting for ships not required by international conventions to participate in the future global maritime distress and safety system;

recommends

1. that IMO be invited to continue its studies with a view to early implementation of the future distress system and that in doing so to recognize the need for the future distress system to provide for the continued use of non-automatic alerting by ships not subject to international conventions and for existing equipment in such ships to be able to continue in use for distress and safety purposes;

2. that CCIR continue its studies to determine the role of maritime-satellite radiocommunications in a coordinated distress system as well as in safety applications;

3. that a prerequisite to the introduction of the future distress system be proof by field trials that it will provide an improved service in all respects;

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1 IMO Resolution A.420 (Xl)

4. that administrations consider, in the light of advancing techniques, the introduction of more automated telecommunication systems for the dissemination of distress, urgency and safety messages on a continuous basis, to replace Morse telegraphy and possibly radiotelephony;

5. that the introduction and operation of the future global maritime distress and safety system should be complementary to and not adversely affect the existing distress and safety services.

Document No. DL/7-E
2 March 1983
Original : Russian

TECHNICAL WORKING GROUP (PL/A)

PROPOSAL BY THE U.S.S.R.

Point 1.6 - Procedures for digital selective calling in the maritime mobile service

In view of the planned introduction of the Future Global Maritime Distress and Safety System (FGMDSS), requirements for stations using the digital selective calling system should be included in the Radio Regulations.

The Technical Working Group requests Committee 5 to examine this question.

Document No. DL/8-E
2 March 1983
Original: English

WORKING GROUP 5C

Note by the Chairman of Working Group 5C

Alternative text to existing /adopted/proposed Section II, Subsection D, provisions of Article 62

4679A Selective Calling may be carried out on:

a) working frequencies in the band 1 606.5 - 4 000 kHz (Regions 1 and 3) and in the band 1 605 - 4 000 kHz (Region 2);

b) working frequencies in the band 4 000 - 27 500 kHz;

c) working frequencies in the band 156 - 174 MHz;

d) additionally on the following calling frequencies :

5xx kHz
2xxx kHz
4xxx kHz
6xxx kHz
8xxx kHz
13xxx kHz
17xxx kHz
22xxx kHz
156.xxx MHz

O. ANDERSEN
Chairman of Working Group 5C

Document No. DL/9-E
2 March 1983
Original : English

TECHNICAL WORKING GROUP (PL/A)

RESOLUTION No. [PL/A-1]

Relating to Frequency Provisions for Development and Future Implementation of Ship Movement Telemetry, Telecommand and Data Exchange Systems

The World Administrative Radio Conference for Mobile Telecommunications, Geneva, ~~1979~~, 1983

considering

a) the need to specify radio frequencies which may be used by the maritime mobile service on a worldwide basis for ship movement requirements using digital automated data exchange, telemetry and telecommand techniques;

b) the developments now in progress in different portions of the frequency spectrum which will require common frequency bands in the future for efficient frequency utilization;

c) the importance of these short-range systems in the safe and efficient operations of ships;

d) the advantages to port authorities for safe and efficient port management and operations;

noting

a) ~~the findings of the Special Preparatory Meeting of the CCIR that frequencies in the region of 10 GHz appeared satisfactory for short-range automated systems of this nature;~~ the conclusions of the Special Meeting of Study Group 8 of the CCIR in preparation for the 1983 Mobile WARC, that CCIR studies are underway (particularly, Question 55/8);

b) that further operational and technical information is needed in deciding the most effective frequency utilization and sharing criteria;

resolves

1. that the next competent world administrative radio conference shall review possible frequency provisions in the light of additional studies;

2. that the CCIR shall examine and advise on bandwidths and data formats in coordination with administrations developing and testing these digital transmission systems;

requests the Secretary-General

to refer this Resolution to the International Maritime Organization (IMO), inviting it to define the operational requirement for data exchange with ships using digital transmission techniques and to make appropriate recommendations to assist administrations in preparing for a future conference.

H. GOTZE
Chairman of the Technical Working Group

*) Replaces Resolution No. 310 of the World Administrative Radio Conference, Geneva, 1979.

Document No. DL/10-E
4 March 1983
Original: English

WORKING GROUP 5C

Note by the Chairman of Working Group 5C

1. Adopted text for Section II provisions of Article 62:

ADD 4679A Selective calling may be carried out on:

a) [appropriate radiotelephone] working frequencies in the band 1 606.5 - 4 000 kHz (Regions 1 and 3) and in the band 1 605 - 4 000 kHz (Region 2);

b) [appropriate radiotelephone] working frequencies in the band 4 000 - 27 500 kHz;

c) [appropriate radiotelephone] working frequencies in the band 156 - 174 MHz;

d) additionally on the following calling frequencies :

5xx kHz
2xxx kHz
4xxx kHz
6xxx kHz
8xxx kHz
13xxx kHz
17xxx kHz
22xxx kHz
156.xxx MHz [2]

SUP 4680

2. Alternative text for Section III provisions of Article 62:

MOD 4683 a) Ship stations

5xx kHz
2xxx kHz
4xxx kHz
6xxx kHz
8xxx kHz
12xxx kHz
16xxx kHz
22xxx kHz
156.xxx MHz

MOD 4684 b) Coast stations

5xx kHz
2xxx kHz
4xxx kHz
6xxx kHz
8xxx kHz
13xxx kHz
17xxx kHz
22xxx kHz
156.xxx MHz

ADD 4685 In addition to the frequencies listed in Nos. 4683 and 4684, appropriate working frequencies in the following bands may be used for selective calling:

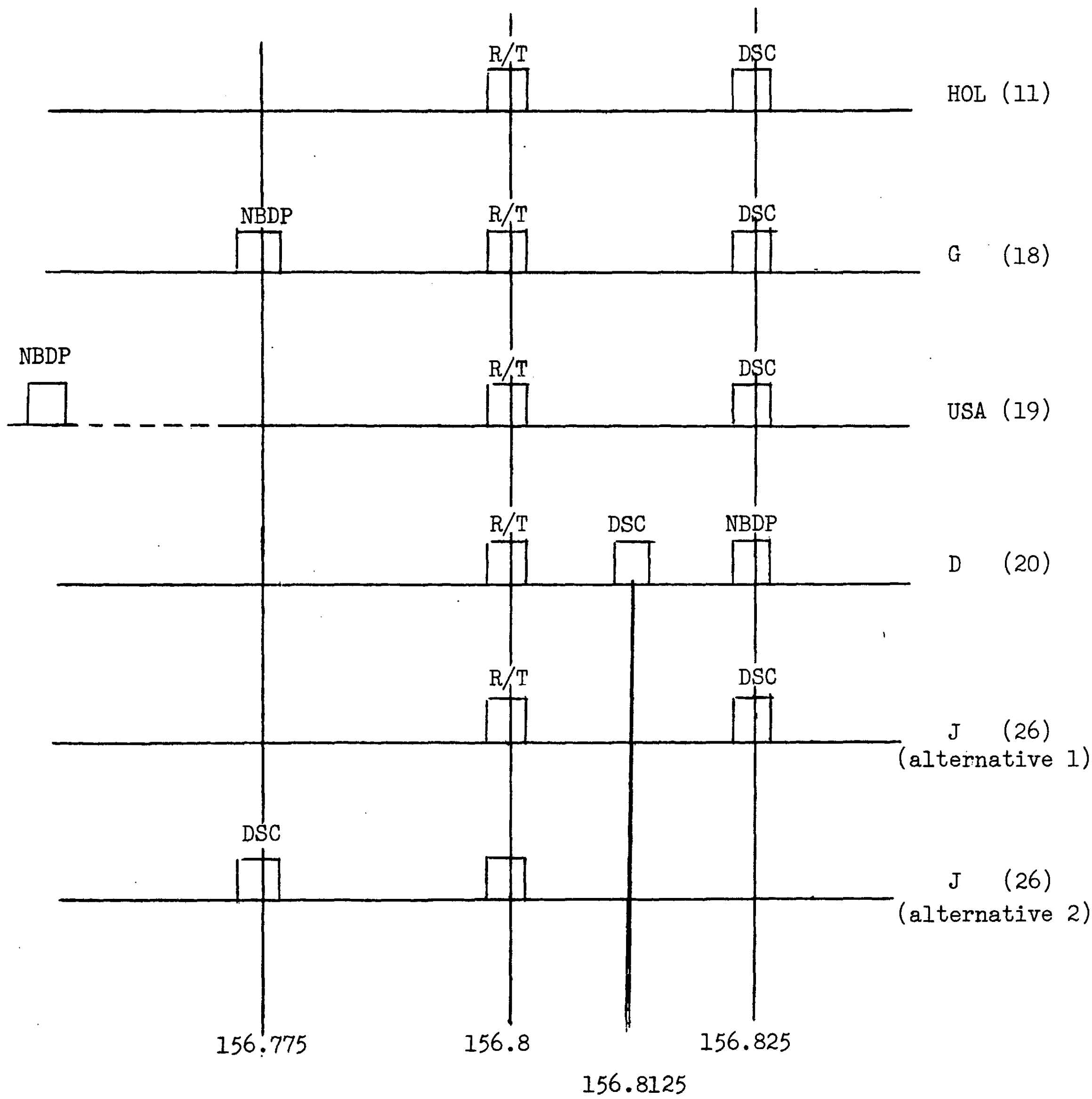
415 - 526.5 kHz (Regions 1 and 3)
415 - 525 kHz (Region 2)
1 606.5 - 4 000 kHz (Regions 1 and 3)
1 605 - 4 000 kHz (Region 2)
4 000 - 27 500 kHz
156 - 174 MHz

O. ANDERSEN
Chairman of Working Group 5C

Document No. DL/11-E
4 March 1983
Original : English

COMMITTEE 4
AD HOC GROUP 3

PROPOSALS FROM VARIOUS COUNTRIES FOR FREQUENCIES IN THE
MARITIME VHF BAND FOR USE IN THE FGMDSS



156.525
(intership channel; see also Notes c) and o)
to the table of Appendix 18)

E. GEORGE
Chairman of ad hoc Group 3
of Committee 4

Document No. DL/12-E
5 March 1983
Original : English

WORKING GROUP 5C

Note by the Chairman of Working Group 5C

Attached is a draft of a new Resolution No. /‾313_7 and its Annex, prepared in accordance with the decisions taken at our third meeting.

O. ANDERSEN
Chairman of Working Group 5C

Annex : 1

ANNEX

/‾DRAFT_7

RESOLUTION No. /‾313_7

Relating to the Formation and Allocation of Nationality Identification Digits (NIDs), and the Assignment of Identities in the Maritime Mobile and Maritime Mobile-Satellite Services (Maritime Mobile Services Identities)

The World Administrative Radio Conference for the Mobile Services, Geneva, 1983,

considering

a) the provisions of Resolution No. 313 of the World Administrative Radio Conference, Geneva, 1979, relating to the introduction of a new system for identifying stations in the maritime mobile and maritime mobile-satellite services;

b) the need for an internationally recognized method for assigning identities to ship and coast stations in order that such stations may have a unique identity, also justified by the increased number of Members of the Union and by the increased telecommunication requirements of ships of countries which are already Members;

c) the information supplied by the Secretary-General regarding the formation and allocation of such ship station identities, as well as the constraints which apply for the preparation of a table of nationality identification digits (NIDs);

believing

a) that nationality identification digits should be allocated in a uniform and careful manner;

b) that a ship station should have an identity formed from the NID allocated to its country* of registration (flag) regardless of the part of the world in which the vessel operates;

c) that additional NIDs should be allocated only where essential and that the initially allocated NID is envisaged to serve each country for an extended period if ship station identities are assigned in accordance with certain guidelines;

d) that no country, in any case, can justify more NIDs than the total number of its ship stations shown in the ITU List of Ship Stations (List V) divided by 1000;

noting

a) that the format of maritime mobile service identities is defined in Appendix 43 to the Radio Regulations;

b) that the ship station number defines the ship station within the public switched network;

c) that a CCITT Recommendation** defines the relationship between the ship station number and the ship station identity;

---

* Throughout this Resolution, the word "country" is used with the meaning attributed to it in No. 2246 of the Radio Regulations.

** CCITT Recommendation E.210/F.120

d) that the 10-digit address/self-identity of the digital selective calling system described in the relevant CCIR Recommendations* may be used to convey the ship station identity;

e) that a table of Nationality Identification Digits (NIDs) has been adopted for inclusion in Appendix 43 to the Radio Regulations;

f) that initially one NID has been allocated to each country;

g) that the first digit of the NIDs allocated to countries by this Conference indicates the geographical zone in which a country is located, in accordance with the relevant CCITT Recommendation**;

h) that the initial allocation of NIDs has been distributed within the numerical range given to each geographical zone to allow for the possibility of consecutive NIDs;

i) that such a consecutive capability is considered to be only an incidental feature which should not be viewed as a basic requirement in the allocation of required NIDs;

j) that No. 2087 of the Radio Regulations authorizes the Secretary-General to allocate NIDs to countries not included in this table;

k) that No. 2087A of the Radio Regulations authorizes the Secretary-General to allocate additional NIDs to countries included in the table;

resolves to urge administrations

1. to follow the guidelines for the assignment of ship station identities annexed to this Resolution;

2. to make optimum use of the possibilities of forming identities from the single NID initially allocated to them;

3. to take particular care in assigning ship station identities with six significant digits (three-trailing-zero identities) which should only be assigned to ship stations which can be reasonably expected to require such an identity for automatic access on a worldwide basis from public switched networks;

4. to seriously examine the possibility of assigning one-trailing-zero or two-trailing-zero identities to such vessels when they require automatic access only on a national or regional level, as defined in the relevant CCITT Recommendation**;

5. to assign ship station identities without trailing zeros to all other vessels requiring a numerical identification;

resolves to instruct the Secretary-General

1. to allocate additional NIDs, within the limits specified in believing d) above, provided he is satisfied that, in spite of judicious ship station identity assignment as outlined in resolves to urge administrations above and in conformity with the guidelines annexed to this Resolution, the possibilities offered by the NIDs allocated to an administration will soon be exhausted;

2. to submit a report on the utilization of Maritime Mobile Service Identities and on the status of the Table of Nationality Identification Digits to the next competent administrative radio conference.

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* CCIR Recommendations 493 and 585

** CCITT Recommendation E.210/F.120

ANNEX

(to Resolution No. /‾313_7)

GUIDELINES FOR ASSIGNMENT OF SHIP STATION IDENTITIES

Introduction

The maritime mobile identification plan is based on a set of compromises intended to satisfy most of the major requirements. Its first stage requires that administrations conserve numerical capacity to limit the demand for NIDs and extend the life of the plan as long as needed. The following guidelines are indicated to assist administrations and conserve capacity. (See also the relevant CCIR and CCITT Recommendations.*)

Identity format

1. A ship station identity with one or more trailing zeros should be assigned only when a vessel may reasonably be expected to require it for automatic shore network-to-ship communication. Such communication may be via maritime satellite or HF, VHF, MF or UHF radio but it should involve the need to receive communications from a land based network without coast station operator assistance.

2. Other vessels that require numerical identification may be assigned 9-digit ship identities without any trailing zeros.

National schemes

3. When it is intended that a vessel receive automatically communications in the shore-to-ship direction, only from coast stations belonging to the country in which it is registered, a ship station identity with only one trailing zero should be used. It is assumed that these identities will be used in the context described in CCITT Recommendation E.210/F.120 which provides that in such cases the NID may be replaced in the ship station number by the prefix "9", thereby enabling the use of five digits within a given country.

4. When ship station identities with only one trailing zero are assigned by an administration it should in the X_8 position avoid assigning at least two digits, e.g. 2 or 3, so that ship station identities containing these digits in position X_8 are available for potential use in stage 2 of the plan.

Regional schemes

5. Ship station identities with two trailing zeros should be assigned to ships whose need for automatic shore-to-ship communications is confined to those through coast stations in a limited number of countries each of which agrees to convert a given "8Y" dialling prefix to the same primary (first assigned) NID when calling in the shore-to-ship direction. If several administrations whose terrestrial networks can handle "8Y" ship station number prefixes agree, for example, to convert the "8Y" prefix "83" to the NID "214", then the country whose NID is "214" can assign ship station identities with two trailing zeros (starting with 214) to ship stations which need to be called automatically only through the coast stations of the countries having decided to effect the above-mentioned "8Y" to "NID" conversion.

6. It is important to note that network subscribers in all these countries will use the same 83 $X_4X_5X_6X_7$ ship station number to address a given vessel. Combinations of countries may be developed to embrace communities of interest as automatic network calling from shore to ship develops.

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* CCIR Recommendation 585
CCITT Recommendation E.210/F.120

7. When ship station identities with two trailing zeros are assigned by an administration it should in the X_7 position avoid assigning at least two digits, e.g. 2 or 3, so that ship station identities containing these digits in the position X_7 are available for potential use in stage 2 of the plan.

World-wide scheme

8. If national or regional coding cannot be applied the vessel must be assigned an identity with three trailing zeros assuming the need to receive automatic shore network-to-ship communications is present.

9. Any vessel fitted with a ship earth station or anticipated to be so equipped in the foreseeable future should be provided with an identity using three trailing zeros. A vessel equipped for communications in the HF bands and having a need in the foreseeable future for receiving automatic communications from land networks (unable to carry more than 6 digits) may also be considered a candidate for a ship identity with three trailing zeros. Administrations must, however, use discretion in this matter in order to preserve the capacity of the ship identity plan since HF capability does not, of itself, require such an identity.

General

10. A single NID has been allocated to each country. A second NID should not be requested unless the first allocated NID is more than 80% exhausted in the basic category of three trailing zeros and the rate of assignments is such that 90% exhaustion is foreseen. The same criteria should be applied to succeeding requests for NIDs.

11. This set of guidelines does not require an administration to assign numerical identities until it determines that the need exists for such identities. These guidelines do not address the assignment of ship station identities without trailing zeros as it is assumed that there is enough capacity inherent in the system to provide for the assignment of such identities to all ship stations which an administration may wish to identify in this manner.

Document No. DL/13-E
5 March 1983
Original : English

WORKING GROUP 5C

Note by the Chairman of Working Group 5C

The amendments to Article 25 and Appendix 43 which are consequential to the amended Resolution No. 313 are set out in Annex.

O. ANDERSEN
Chairman of Working Group 5C

Annex : 1

ANNEX

ARTICLE 25

Identification of Stations

Section II. Allocation of International Series and Assignment of Call Signs

MOD 2083 (2) As the need arises, ~~All~~ ship stations and ship earth stations with respect to which the provisions of Chapter XI apply and all coast stations or coast earth stations capable of communicating with such ships shall have assigned to them maritime mobile service identities in accordance with Appendix 43[1].

MOD 2087 § 15. The Secretary-General shall, for the maritime mobile service identification system, be responsible for allocating nationality identification digits ~~series~~ to countries not included in the Table of Nationality Identification Digits (see Appendix 43[1]).

ADD 2087A § 15. The Secretary-General shall, for the maritime mobile service identification system, be responsible for allocating additional nationality identification digits to countries in accordance with Resolution /‾313_7.

Section VI. Maritime Mobile Service Identities in the Maritime Mobile Service and the Maritime Mobile-Satellite Service

(MOD) 2149 § 37. When a station in the maritime mobile service or the maritime mobile-satellite service is required to use maritime mobile service identities, the responsible administration shall assign the identity to the station in accordance with the provisions described in Appendix 43 and Resolution ~~313~~ /‾313_7 and taking into consideration relevant CCIR and CCITT Recommendations.

(MOD) 2069.1 [1]For the application of Appendix 43, see Resolution ~~313~~ /‾313_7.

(MOD) 2083.1 / 2087.1 [1]For the application of Appendix 43, see Resolution ~~313~~ /‾313_7.

APPENDIX 43

Maritime Mobile Service Identities

1. *General*

1.1 Maritime mobile service identities are formed of a series of nine digits which are transmitted over the radio path in order to uniquely identify ship stations, ship earth stations, coast stations, coast earth stations and group calls.

1.2 Ship station identities shall be in accordance with relevant CCIR and CCITT Recommendations.

1.3 These identities are formed in such a way that the identity or part thereof can be used by telephone and telex subscribers connected to the general telecommunications network to call ships automatically in the shore-to-ship direction.

1.4 There are three kinds of maritime mobile service identities:

- i) ship station identities,
- ii) group call identities,
- iii) coast station identities.

1.5 The nationality or flag of a station is given by a three-digit group, the Nationality Identification Digits (NID).

2. *Nationality Identification Digits (NID)*

MOD Table I gives the Nationality Identification Digits (NID) allocated to each country. In accordance with Radio Regulation No. **2087** the Secretary-General is authorized to allocate Nationality Identification Digits to countries not included in this table[1]. Radio Regulation No. 2087A authorizes the Secretary-General to allocate additional NIDs to countries in accordance with Resolution /‾313_/.

SUP [1] Details of Nationality Identification Digits (NID) allocations have to be worked out by the Secretary-General in close cooperation with the CCIR and CCITT in accordance with Resolution 313 and the provisions of this Appendix. Until such time as this information becomes available for final decision by the next competent conference, provisional allocations of NIDs may be issued by the Secretary-General. These allocations will therefore be subject to review and/or revision by the above-mentioned conference.

3. *Ship Station Identities*

The 9-digit code constituting a ship station identity is formed as follows:

N I D X X X X X X
1 2 3 4 5 6 7 8 9

wherein

N I D
1 2 3

represent the Nationality Identification Digits and X is any figure from 0 to 9.

4. *Group Call Identities*

Group call identities for calling simultaneously more than one ship are formed as follows:

0 N I D X X X X X
1 2 3 4 5 6 7 8 9

where the first figure is zero and X is any figure from 0 to 9.

The particular NID reflects only the country allocating the group call identity and so does not prevent group calls to fleets containing more than one ship nationality.

5. *Coast Station Identities*

Coast station identities are formed as follows:

0 0 N I D X X X X
1 2 3 4 5 6 7 8 9

where the first two figures are zeros and X is any figure from 0 to 9.

The NID reflects the country in which the coast station or coast earth station is located.

MOD

TABLE I

NATIONALITY IDENTIFICATION DIGITS L

Country	Digits

SUP

[1] Details of Nationality Identification Digits (NID) allocations have to be worked out by the Secretary-General in close cooperation with the CCIR and CCITT in accordance with Resolution 313 and the provisions of this Appendix. Until such time as this information becomes available for final decision by the next competent conference, provisional allocations of NIDs may be issued by the Secretary-General. These allocations will therefore be subject to review and/or revision by the above-mentioned conference.

Document No. DL/14-E
10 March 1983
Original : English

COMMITTEE 4
AD HOC GROUP 3

Note by the Chairman of ad hoc Group 3
of Committee 4

1. To facilitate the discussion on the future use of the new shared bands at 4 and 8 MHz for radiotelephony the following possible types of operation are listed :

4 MHz band (ship stations only)

1. intership simplex;
2. ship stations supplementary to ship-to-shore channels in Section A of Appendix 16 for duplex operation;
3. crossband operation with coast stations working in the 8 MHz shared band;
4. intership crossband operation;
5. ship-to-shore simplex.

8 MHz band (ship and coast stations)

1. see 1 above;
2. see 2 above;
3. coast stations working crossband with ship stations in the 4 MHz shared band;
4. see 4 above;
5. see 5 above;
6. coast stations supplementary to shore-to-ship channels in Section A of Appendix 16 for duplex operation.

2. Possible wording for a note regarding the use of the band 4 000 to 4 005 kHz :

In the band 4 000 to 4 005 kHz, administrations are requested to urge ships under their jurisdiction and which are navigating in Region 3 to refrain from using this band (see also RR 516).

E. GEORGE
Chairman of Committee 4 ad hoc Group 3

Document No. DL/15-E
10 March 1983
Original : English

STEERING COMMITTEE

Note by the Secretary-General

LAST DAYS OF THE CONFERENCE

1. Reservations (Convention No. 513)

When the last text to be included in the Final Acts of the Conference has been approved in second reading by the Plenary Meeting, a time-limit for the deposit of reservations will be set.

These reservations are to be handed in to the Executive Secretary of the Conference (Office J 166) for publication in a consolidated document.

The Plenary Meeting will take note of these reservations and fix a second deadline for the deposit of further reservations in the light of the first set of reservations.

The Plenary Meeting will take note of the additional reservations.

The signing ceremony (see paragraph 3 below) will take place at the time decided by the preceding Plenary.

2. Final Acts

Prior to the opening of the signing ceremony, delegates will receive one copy of the Final Acts which will be distributed in the document distribution boxes. Delegations which leave the Conference before the signing ceremony are requested to fill in a form available at the distribution service to enable the secretariat to dispatch their copies after the Conference.

Members of delegations who remain are of course free to collect copies for members who have left.

3. Signing ceremony

Some twelve hours will be necessary for the printing of the Final Acts and the time of the opening of the signing ceremony will therefore depend on when the last text is cleared in Plenary.

Before the opening of the ceremony, delegations will be invited to collect, in Meeting Room I, a folder containing four sheets :

- a pink sheet for listing, in order of the signatories and in PRINTED CAPITAL LETTERS, the names of the delegates whose signatures appear on the following sheets;

- a white sheet marked ACTES FINALS for the signatures of the Agreement;
- a white sheet marked PROT FINAL for the signatures of the Final Protocol;
- a spare unmarked sheet.

At the opening of the ceremony, the Secretary-General will ask delegations to sign the sheets contained in the folder. After about ten minutes, the roll call of delegations eligible to sign the Final Acts will start.

As the roll call proceeds, the representatives of delegations will come forward individually to the table below the rostrum to deposit their folders of signatures. As each delegation deposits its folder, an announcement will be made to the effect that "the delegation of ...... has signed the Final Acts".

When the roll call is finished, the Secretary-General will announce the number of delegations which have signed the Final Acts.

It should be noted that delegations (or members thereof) which want to sign before the signing ceremony can do so by addressing themselves to office J 167 (Mr. Macheret).

R.E. BUTLER

Secretary-General

Document No. DL/16-E
10 March 1983
Original : French

PLENARY MEETING

DRAFT

PREAMBLE TO THE FINAL ACTS OF WARC MOB 83

In accordance with the task entrusted to it by Committee 1 at its meeting on 10 March 1983, Committee 6 hereby submits for the attention of the Plenary Meeting the draft Preamble to the above-mentioned Final Acts.

P. ABOUDARHAM
Chairman of Committee 6

Annex : 1

A N N E X

PREAMBLE

PARTIAL REVISION OF THE RADIO REGULATIONS [1]

The World Administrative Radio Conference (Geneva, 1979), by Resolution No. 202, invited the Administrative Council to take the necessary steps to arrange a World Administrative Radio Conference for the Mobile Services to revise the provisions of the Radio Regulations which relate specifically to these services; it also invited the CCIR to prepare the technical and operational bases for the Conference and the IFRB to give its technical assistance for the preparation and the organization of the Conference.

At its 35th session (1980), the Administrative Council decided, in consultation with the Members, that the Conference would be convened in Geneva on 2 March 1982 for a period of three weeks and three days; it also laid down the terms of reference of the Conference, on the understanding that final decisions concerning the formal arrangements (agenda, date, duration, etc.) would be taken at its 1981 session.

At its 36th session (1981), the Council decided, in consultation with the Members, to change the dates of the Conference so that it would start on 23 February and end on 18 March 1983. No amendments were made to the agenda.

At its 37th session (1982), the Council drew up the budget of the Conference and, for budgetary reasons, proposed that it be shortened from three weeks and three days to three weeks. This proposal having been accepted by a majority of the Members (see Notification No. 1175 of 10 June 1982), the opening date was fixed at 28 February 1983.

By Resolution No. PLA/5, the Plenipotentiary Conference (Nairobi, 1982) decided that the World Administrative Conference for the Mobile Services was to be held in Geneva from 28 February to 18 March 1983. It further decided that the agenda of the Conference, as established by the Administrative Council, would remain unchanged.

The World Administrative Radio Conference for the Mobile Services, accordingly convened on the appointed date, considered and revised the relevant parts of the Radio Regulations in conformity with its agenda. Particulars of this revision are given in the Annex hereto.

The revised provisions of the Radio Regulations shall form an integral part of the Radio Regulations which are annexed to the International Telecommunication Convention. These revised provisions shall come into force on /̄ 1 July 1984, at 0001 hours UTC_7. The provisions of the Radio Regulations which are cancelled, superseded or modified by these revised provisions shall be abrogated on the date of the entry into force of the revised provisions.

---

[1] Namely the Radio Regulations, as revised by the World Administrative Radio Conference, Geneva, 1979.

The delegates signing this revision of the Radio Regulations hereby declare that, should an administration make reservations concerning the application of one or more of the revised provisions of the Radio Regulations, no other administration shall be obliged to observe that provision or those provisions in its relations with that particular administration.

*

* *

Members of the Union shall inform the Secretary-General of their approval of the revision of the Radio Regulations by the World Administrative Radio Conference for the mobile services (Geneva, 1983). The Secretary-General shall inform Members promptly regarding receipt of such notifications of approval.

In witness whereof the delegates of the Members of the International Telecommunication Union represented at the World Administrative Radio Conference for the Mobile Services (Geneva, 1983) have signed in the names of their respective countries this revision of the Radio Regluations in a single copy which will remain in the archives of the International Telecommunication Union and of which a certified copy will be delivered to each Member of the Union.

Done at Geneva, March 1983

Document No. DL/17-E
12 March 1983
Original : English

AD HOC GROUP 5
COMMITTEE 4

DRAFT REPORT OF DRAFTING GROUP 4

AD HOC GROUP 5 TO THE PLENARY MEETING

Subject : Documents Nos. 59(Rev.1), 60 and 119

1. Drafting Group 4 ad hoc Group 5 was formed by Committee 4 on Saturday, 12 March, to consider the above listed three documents. Because there was no time to finish the work and report back to Committee 4, Mr. Menon, Chairman of the Committee requested that Group 4 ad hoc Group 5 report directly to the Plenary.

2. Conclusions of the Drafting Group are reproduced in Documents Nos. /‾DL/18, 19, 20_7.

William A. LUTHER
Chairman of ad hoc Group 5
of Committee 4

Document No. DL/18(Rev.2)-E
14 March 1983
Original : English

AD HOC GROUP 5
COMMITTEE 4

DRAFT RESOLUTION No. /¯COM4/7_7

Relating to the Improved Use of the International Monitoring System in Applying Decisions of Administrative Radio Conferences as well as to Action with Respect to Unauthorized Emissions in the Mobile Services Bands

The World Administrative Radio Conference for the Mobile Services, Geneva, 1983,

considering

a) Article 20 of the Radio Regulations concerning the international monitoring system;

b) No. 1218 of the same Regulations concerning the assistance which may be provided by the IFRB in the selection of frequency assignments;

c) Resolution No. 103 of WARC-79, relating to improvements in assistance to developing countries in securing access to the HF bands for their fixed services and ensuring protection of their frequency assignments from harmful interference;

/¯d) Resolution No. 309 of WARC-79, relating to the unauthorized use of frequencies in the bands allocated to the maritime mobile service; _7

/¯e) Resolution No. 407 of WARC-79, relating to the unauthorized use of frequencies in the bands allocated to the aeronautical mobile service; _7

f) Recommendation No. 202 of WARC-79, relating to the improvement of protection of distress and safety frequencies, and those relating to distress and safety, against harmful interference;

g) Recommendation No. 203 of WARC-79, relating to the future use of the band 2 170 - 2 194 kHz;

h) Resolution No. 9 (PLEN./7) of the Plenipotentiary Conference relating to the unauthorized use of frequencies in the bands allocated to the broadcasting service;

i) that it is of the utmost importance to ensure that distress and safety channels, particularly those used for alerting, are kept free of harmful interference;

j) that monitoring observations of the use of frequencies in the bands allocated exclusively to the maritime mobile service and the aeronautical mobile (R) service show that a number of frequencies in these bands are still being used by stations of other services, notably by high-powered broadcasting stations, some of which are operating in contravention of No. 2665 of the Radio Regulations;

k) it is necessary to draw the attention of the WARC for HF Broadcasting, 1984-1986, to the effects of high-powered broadcasting transmitters operating in bands allocated to mobile services;

convinced

that an increase in the number of stations participating in the international monitoring system, and that a more rational use of the information obtained from such stations, would be of considerable assistance to all administrations and to the IFRB :

a) in acquiring a real knowledge of the degree of occupancy of the radio-frequency spectrum;

b) in the performance of certain tasks assigned to the IFRB by administrative radio conferences, particularly as regards the application of the provisions of the Radio Regulations relating to assistance to administrations and to the identification and elimination of harmful interference (see RR 1963 to RR 1965);

aware

that the nature and the form of the monitoring information received by the IFRB is so diverse as to make it difficult to analyze and publish;

noting

- the new Article 79A of the Final Acts of the Plenipotentiary Conference, Nairobi, 1982, requesting that financial implications be taken into account when decisions are made by administrative conferences, and

- Resolution No. 48 (COM4/8) of the Plenipotentiary Conference, Nairobi, 1982, concerning the impact on the Budget of the Union of the decisions of world administrative conferences;

resolves

1. that there is an urgent need to improve protection of frequency bands allocated to the maritime mobile and aeronautical mobile services and to the distress and safety system and that this protection may be facilitated through an improvement in the international monitoring system;

2. that to this end, ad hoc meetings shall be organized between monitoring experts from administrations, the IFRB and the CCI Secretariat;

3. that for practical reasons such ad hoc meetings should be organized to coincide in time and place with the competent CCIR Study Group meeting, without increasing their duration. A similar meeting may be organized, if necessary, concurrently with the World Administrative Radio Conference for Mobile Services foreseen in 1987;

4. that the purpose of such meetings is :

- to examine the international monitoring system procedures (see Article 20) with a view to making the system more effective by improving the quality of information collected, as well as the form in which it is analyzed, used and published by the IFRB;

- to draw up for administrations a report indicating recommended actions with respect to this review;

requests the Chairman of the IFRB and the Director of the CCIR

1. to take appropriate measures in order to convene such ad hoc meetings during the interim and final meetings of the CCIR competent Study Group;

2. to jointly report results of these meetings to the Administrative Council for consideration, as appropriate, when the Council is formulating the agenda of a future competent administrative radio conference;

invites administrations

- to develop monitoring systems and contribute to improved spectrum management by participating in the international monitoring system, and

- to take the joint report of the IFRB and CCIR into account when preparing proposals for the competent administrative radio conference.

requests the IFRB, as an interim measure

- to carry out a monitoring programme in the HF bands allocated to the mobile services in accordance with Article 20, and to prepare a report indicating the broadcasting stations operating in these bands for consideration by the World Administrative Radio HFBC Conference, 1984-1986.

Se. Rev. 2

Document No. DL/18(Rev.1)-E
14 March 1983
Original : English

AD HOC GROUP 5 OF
COMMITTEE 4

DRAFT RESOLUTION No. /‾COM4/7_7

Relating to the Improved Use of the
International Monitoring System
in Applying Decisions of
Administrative Radio Conferences

The World Administrative Radio Conference for the Mobile Services, Geneva, 1983,

considering

a) Article 20 of the Radio Regulations concerning the international monitoring system;

b) No. 1218 of the same Regulations concerning the assistance which may be provided by the IFRB in the selection of frequency assignments;

c) Resolution No. 103 of WARC-79, relating to improvements in assistance to developing countries in securing access to the HF bands for their fixed services and ensuring protection of their frequency assignments from harmful interference:

/‾d) Resolution No. 309 of WARC-79, relating to the unauthorized use of frequencies in the bands allocated to the maritime mobile service; _7

/‾d) Resolution No. /‾DL/20_7 relating to the unauthorized use of frequencies in the bands allocated to aeronautical and maritime mobile services; _7

/‾e) Resolution No. 407 of WARC-79, relating to the unauthorized use of frequencies in the bands allocated to the aeronautical mobile service; _7

f) Recommendation No. 202 of WARC-79, relating to the improvement of protection of distress and safety frequencies, and those relating to distress and safety, against harmful interference;

g) Recommendation No. 203 of WARC-79, relating to the future use of the band 2 170 - 2 194 kHz;

h) Resolution No. 9 (PLEN./7) of the Plenipotentiary Conference relating to the unauthorized use of frequencies in the bands allocated to the broadcasting service;

i) that it is of the utmost importance to ensure that distress and safety channels, particularly those used for alerting, are kept free of harmful interference;

convinced

that an increase in the number of stations participating in the international monitoring system, and that a more rational use of the information obtained from such stations, would be of considerable assistance to all administrations and to the IFRB :

a) in acquiring a real knowledge of the degree of occupancy of the radio-frequency spectrum;

b) in the performance of certain tasks assigned to the IFRB by administrative radio conferences, particularly as regards the application of the provisions of :

- Resolution No. 8 of WARC-79, relating to implementation of the changes in allocations in the bands between 4 000 kHz and 27 000 kHz, and

- Nos. 1963, 1964 and 1965 of the Radio Regulations concerning the procedure to be adopted to combat harmful interferences;

aware

that the nature and the form of the monitoring information received by the IFRB is so diverse as to make it difficult to analyze and publish;

noting

- the new Article 79A of the Final Acts of the Plenipotentiary Conference, Nairobi, 1982, requesting that financial implications be taken into account when decisions are made by administrative conferences, and

- Resolution No. 48 (COM4/8) of the Plenipotentiary Conference, Nairobi, 1982, concerning the impact on the Budget of the Union of the decisions of world administrative conferences;

resolves

1. that there is an urgent need to improve protection of frequency bands allocated to the maritime mobile and aeronautical mobile services and to the distress and safety system;

2. that to this end, within the 1982-1986 CCIR cycle, during scheduled meetings of the competent Study Group, ad hoc meetings shall be organized between monitoring experts from administrations, the IFRB, and the CCIR; a similar meeting may be organized, if necessary, during the World Administrative Radio Conference for Mobile Services foreseen in 1987;

3. that the purpose of such meetings is :

- to review the international monitoring system procedures (see Article 20) with a view to making the system more effective by improving the quality of information collected, as well as the form in which it is analyzed, used and published by the IFRB;

- to draw up a report for administrations;

requests

1. the Director of the CCIR, in cooperation with the IFRB, to take appropriate measures in order to convene such ad hoc meetings during the interim and final meetings of its competent Study Group;

2. the IFRB and the CCIR to jointly report results of these meetings to the Administrative Council for consideration, as appropriate, when formulating the agenda of a future competent administrative radio conference;

invites administrations

- to develop monitoring systems and contribute to improved spectrum management by participating in the international monitoring system, and

- to take the joint report of the IFRB and CCIR into account when preparing proposals for the competent administrative radio conference.

See Rev 1, 2

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AD HOC GROUP 5
COMMITTEE 4

DRAFT RESOLUTION No. /‾COM4/7_7

Relating to the Increased Use of the
International Monitoring System
in Applying Decisions of
Administrative Radio Conferences

The World Administrative Radio Conference for the Mobile Services, Geneva, 1983,

considering

a) Article 20 of the Radio Regulations concerning international monitoring;

b) No. 1218 of the same Regulations concerning the assistance which may be provided by the IFRB in the selection of an assignment;

c) Resolution No. 103 of WARC-79, relating to improvements in assistance to developing countries in securing access to the HF bands for their fixed services and ensuring protection of their assignments from harmful interference;

/‾d) Resolution No. 309 of WARC-79, relating to the unauthorized use of frequencies in the bands allocated to the maritime mobile service; _7

/‾e) Resolution No. 407 of WARC-79, relating to the unauthorized use of frequencies in the bands allocated to the aeronautical mobile service; _7

f) Recommendation No. 202 of WARC-79, relating to the improvement of protection of distress and safety frequencies, and those relating to distress and safety, against harmful interference;

g) Recommendation No. 203 of WARC-79, relating to the future use of the band 2 170 - 2 194 kHz;

h) Resolution No. 9 (PLEN./7) of the Plenipotentiary Conference relating to the unauthorized use of frequencies in the bands allocated to the broadcasting service;

convinced

that an increase in the number of stations participating in international monitoring, and that a more rational use of the information obtained from such stations, would be of considerable assistance to all administrations and to the IFRB :

a) in acquiring a real knowledge of the degree of occupancy of the radio-frequency spectrum;

b) in the performance of certain tasks assigned to the IFRB by administrative radio conferences, particularly as regards the application of the provisions of :

- Resolution No. 8 of WARC-79, relating to implementation of the changes in allocations in the bands between 4 000 kHz and 27 000 kHz, and

- Nos. 1963, 1964 and 1965 of the Radio Regulations concerning the procedure to be adopted to combat harmful interferences;

aware

that the nature and the form of the monitoring information received by the IFRB is so diverse as to make it difficult to analyze and publish;

noting

- the new Article 79A of the Final Acts of the Plenipotentiary Conference, Nairobi, 1982, requesting that financial implications be taken into account when decisions are made by administrative conferences, and

- Resolution No. 48 (COM4/8) of the Plenipotentiary Conference, Nairobi, 1982, concerning the impact on the Budget of the Union of the decisions of world administrative conferences;

resolves

1. that there is an urgent need to improve protection of frequency bands allocated to the maritime mobile and aeronautical mobile services and to the distress and safety system;

2. that to this end, during the 1982-1986 CCIR cycle, during scheduled meetings, and as well during the World Administrative Radio Conference for Mobile Services foreseen in 1987, ad hoc meetings shall be organized between experts in monitoring representing the administrations, the IFRB, and the CCIR, without any additional costs to the ITU;

3. that the purpose of such meetings is :

- to review the international monitoring system procedures (see Article 20) with a view to making the system more effective by improving the quality of information collected, as well as the form in which it is analyzed, used and published by the IFRB;

- to draw up a report for administrations;

requests

the IFRB and the CCIR to jointly report results of these meetings to the Administrative Council for consideration, as appropriate, when formulating the agenda of the next administrative radio conference;

invites administrations

- to develop monitoring systems and contribute to improved spectrum management by participating in the international monitoring system, and

- to take the joint report of the IFRB and CCIR into account when preparing proposals for the competent administrative radio conference.

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AD HOC GROUP 5
COMMITTEE 4

DRAFT RESOLUTION No. /‾COM4/8_7

On Protection of the Band 406 - 406.1 MHz Allocated to the Mobile-Satellite Service

The World Administrative Radio Conference for Mobile Services, Geneva, 1983,

considering

a) that the World Administrative Radio Conference, Geneva, 1979 allocated the band 406 - 406.1 MHz to the mobile-satellite service in the Earth-to-space direction;

b) that /‾MOD 649_7 of the Radio Regulations limits the use of the band 406 - 406.1 MHz to low power satellite emergency position-indicating radiobeacons;

c) that this Conference has made provision in the Radio Regulations for the introduction and development of a global distress and safety system;

d) that the use of satellite emergency position-indicating radiobeacons is an essential element of the global distress and safety system;

e) that, like any frequency band reserved for a distress and safety system, the band 406 - 406.1 MHz is entitled to full protection against all harmful interference;

f) that this Conference has adopted /‾Modified Recommendation No. 604_7 which recommends that the CCIR continue its studies in the technical and operational questions for EPIRBs, including those using the frequencies in the band 406 - 406.1 MHz;

considering further

g) that some administrations are participating in the development of a /‾polar orbiting_7 satellite system operating in the band 406 - 406.1 MHz to provide alerting and to aid in the locating of distress incidents;

h) that observations of the use of frequencies in the band 406 - 406.1 MHz show that they are being used by stations other than those authorized by provision No. 649 of the Radio Regulations, and that these stations could cause harmful interference to the mobile-satellite service and particularly to the satellite system being developed to aid those in distress;

i) that in the future, new satellite systems may be introduced in this band and which may be either geostationary or non-geostationary;

recognizing

that it is essential for the protection of human life and property that bands allocated exclusively to a service for distress and safety purposes be kept free from harmful interference;

resolves
to urge administrations

1. to take part in monitoring programmes requested by the IFRB in accordance with RR 1874, in the band 406 - 406.1 MHz, with a view to identifying and locating stations of services other than those authorized in this band;

2. to ensure that stations other than those operated under provision No. 649 abstain from using frequencies in the band 406 - 406.1 MHz;

3. to take the appropriate measures to eliminate harmful interference caused to the distress and safety system;

invites the CCIR

to urgently study conditions of compatibility between EPIRBs and services using bands adjacent to 406 - 406.1 MHz.

See Rev 1

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AD HOC GROUP 5
COMMITTEE 4

DRAFT RESOLUTION No. /¯COM4/8_7

On Protection of the Band 406 - 406.1 MHz Allocated to the Mobile-Satellite Service

The World Administrative Radio Conference for Mobile Services, Geneva, 1983,

considering

a) that the World Administrative Radio Conference, Geneva, 1979 allocated the band 406 - 406.1 MHz to the mobile-satellite service in the Earth-to-space direction;

b) that /¯MOD 649_7 of the Radio Regulations limits the use of the band 406 - 406.1 MHz to low power satellite emergency position-indicating radiobeacons;

c) that this Conference has made provision in the Radio Regulations for the introduction and development of a global distress and safety system;

d) that the use of satellite emergency position-indicating radiobeacons is an essential element of the global distress and safety system;

e) that, like any frequency band reserved for a distress and safety system, the band 406 - 406.1 MHz is entitled to full protection against all harmful interference;

f) that this Conference has adopted /¯Modified Recommendation No. 604_7 which recommends that the CCIR continue its studies in the technical and operational questions for EPIRBs, including those using the frequencies in the band 406 - 406.1 MHz;

considering further

g) that some administrations are participating in the development of a /¯polar orbiting_7 satellite system operating in the band 406 - 406.1 MHz to provide alerting and to aid in the locating of distress incidents;

h) that observations of the use of frequencies in the band 406 - 406.1 MHz show that they are being used by stations other than those of the mobile-satellite service, and that these stations could cause harmful interference to the mobile-satellite service and particularly to the satellite system being developed to aid those in distress;

recognizing

that it is essential for the protection of human life and property that bands allocated exclusively to a service for distress and safety purposes be kept free from harmful interference;

resolves
to urge administrations

1. to organize monitoring programmes in the band 406 - 406.1 MHz with a view to identifying the stations of services other than the mobile-satellite operating in this band;

2. to make every effort to identify and locate the source of any unauthorized emission in the band 406 - 406.1 MHz which could cause harmful interference to the authorized service [thereby endangering human life and property];

3. to ensure that stations of other than the mobile-satellite service abstain from using frequencies in the band 406 - 406.1 MHz;

invites the CCIR

to study conditions of compatibility of services using bands adjacent to 406 - 406.1 MHz as well as measures, such as, receiver selectivity and space station antenna pointing to improve protection of distress signals against interference from other EPIRBs.

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AD HOC GROUP 5
COMMITTEE 4

DRAFT RESOLUTION No. [COM4/9]

Relating to Unauthorized Emissions Being Encountered in the HF Bands Allocated to the Mobile Services

The World Administrative Radio Conference for Mobile Services, Geneva, 1983,

considering

a) that monitoring observations of the use of frequencies in bands allocated to the mobile services show that a number of frequencies in these bands are currently being used by stations of services to which the bands are not allocated;

b) that these stations are causing harmful interference to stations of the mobile services;

c) that radio is the sole means of communication of the mobile services;

considering further

d) that there is an urgent need to reduce the congestion in Band 7 of the radio frequency spectrum;

e) that the mobile services have been availing themselves of improved technology in order to make more efficient use of the portions of Band 7 allocated to them;

f) that the other services, in particular the broadcasting service, should make more efficient use of those portions of Band 7 allocated to them;

g) that monitoring observations of the use of frequencies in the bands allocated exclusively to the maritime mobile service and the aeronautical mobile (R) service show that a number of frequencies in these bands are still being used by stations of other services, notably by high-powered broadcasting stations, some of which are operating in contravention of No. 2665 of the Radio Regulations;

recognizing

h) that it is important to ensure that the mobile services of all countries are guaranteed equitable access to the use of the bands allocated to those services;

i) that this Conference has taken steps to improve spectrum utilization for distress and safety purposes;

j) that it is necessary that frequencies used by the mobile services, especially for distress and safety, should be kept free from harmful interference in order not to degrade the safety of life and property which is dependent on use of these frequencies;

resolves
to urge administrations

1. to ensure that, in Band 7, stations of services other than the mobile services or the services sharing an allocation with the mobile services, abstain from using frequencies in the bands allocated to the mobile services;

2. to continue to make every effort to identify and locate the source of any unauthorized emission in bands allocated to the mobile services in Band 7, and to communicate their findings to the IFRB;

3. to participate in the monitoring programmes that the IFRB may organize pursuant to this Resolution;

4. to encourage organizations operating in Band 7 to make greater use of existing techniques which will reduce the congestion in this Band;

5. to recommend to their governments that they support IMO and ICAO actions in support of measures prescribed by the ITU for the elimination of unauthorized emissions in bands allocated to the mobile services in Band 7;

6. to request their governments to enact such legislation as is necessary to prevent stations located off their coasts operating in contravention of No. 2665 of the Radio Regulations;

to request the IFRB

1. to coordinate among administrations participating in the international monitoring system in accordance with the provisions of Article 20 of the Radio Regulations and of Recommendation No. 30, specific monitoring in the bands allocated to the mobile service and particularly, in Band 7;

2. to advise administrations responsible for the stations making out-of-band emissions with a view to securing the immediate cessation of such emissions or, failing that, their transfer to an appropriate band as soon as possible;

3. to informally publish, on a quarterly basis, within existing resources and on a temporary basis, a list of all stations operating in bands allocated to the mobile services in Band 7 which operate in derogation of the frequency allocations set out in Article 8 of the Radio Regulations;

4. to continue to publish on a temporary basis until further decision is taken by the next competent administrative conference;

5. to draw the attention of the 1984 HF Broadcasting Conference to this Resolution;

to request the Secretary-General

to send this Resolution to the Secretary-General of IMO and the Secretary-General of ICAO.

Note : Upon adoption of this Resolution [this Conference or the next competent conference] should consider suppression of Resolution No. 309 and Resolution No. 407.