Documents of the World Administrative Radio Conference for the planning of the HF bands allocated to the broadcasting service (1st session) (WARC HFBC-84 (1))
(Geneva, 1984)

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INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 101-E
19 January 1984
Original : English

COMMITTEE 4

THIRD REPORT OF WORKING GROUP 4B

TO COMMITTEE 4

The texts reproduced in the Annex to this Report were considered in Working Group 4B and are submitted to Committee 4 for approval.

Y. TADOKORO
Chairman of Working Group 4B

Annex : 1

ANNEX

/ 2. / Definitions

/ 2.1 / The First Session of the Conference noted the following definitions contained in the Radio Regulations, Geneva, 1982 :

- Terms relating to emission

  Emission (RR 132)

  Class of emission (RR 133)

  Single-sideband emission (RR 134)

  Full-carrier single-sideband emission (RR 135)

  Reduced-carrier single-sideband emission (RR 136)

  Suppressed-carrier single-sideband emission (RR 137)

  Out-of-band emission (RR 138)

- Terms relating to frequency

  Frequency tolerance (RR 145)

- Terms relating to bandwidth

  Necessary bandwidth (RR 146)

- Terms relating to power

  Power (RR 150)

  Peak envelope power (RR 151)

  Mean power (RR 152)

  Carrier power (RR 153)

  Gain of an antenna (RR 154)

  Equivalent isotropically radiated power (e.i.r.p.) (RR 155)

  Effective radiated power (e.r.p.) (RR 156)

- Terms relating to zones of reception

  Geographic zones for broadcasting* (Appendix 1 of RR)

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* Commonly known as CIRAF zones.

/‾2.2_7 The following definitions were also adopted :

Terms relating to the emission

- Reduced carrier

Carrier emitted at a power level reduced by at least 6 dB below the peak envelope power.

Terms related to field-strength

- Minimum usable field-strength (E_{min})

Minimum value of the field-strength necessary to permit a desired reception quality, under specified receiving conditions, in the presence of natural and man-made noise, but in the absence of interference from other transmitters.

- Usable field-strength (E_u)

Minimum value of the field-strength necessary to permit a desired reception quality, under specified receiving conditions, in the presence of noise and interference, either in an existing situation or as determined by agreements or frequency plans.

- Reference usable field-strength (E_{ref})

The agreed value of the usable field-strength that can serve as a reference or basis for frequency planning.

Terms related to the ratio of wanted and unwanted signals

- Audio-frequency (AF) signal-to-interference ratio

The ratio (expressed in dB) between the values of the voltage of the wanted signal and the voltage of the interference, measured under specified conditions*, at the audio-frequency output of the receiver.

- Audio-frequency (AF) protection ratio

The agreed minimum value of the audio-frequency signal-to-interference ratio considered necessary to achieve a subjectively-defined reception quality.

- Radio-frequency (RF) wanted-to-interfering signal ratio

The ratio, expressed in dB, between the values of the radio-frequency voltage of the wanted signal and the interfering signal, measured at the input of the receiver under specified conditions*.

* The specified conditions include such diverse parameters as : spacing ΔF of the wanted and interfering carrier, emission characteristics (type of modulation, modulation depth, carrier-frequency tolerance, etc.), receiver input level, as well as the receiver characteristics (selectivity and susceptibility to cross-modulation, etc.).

- Radio-frequency (RF) protection ratio

  The value of the radio-frequency wanted-to-interfering signal ratio that enables, under specified conditions*, the audio-frequency protection ratio to be obtained at the output of a receiver.

- Relative radio-frequency protection ratio

  This ratio is the difference, expressed in decibels, between the protection ratio when the carriers of the wanted and unwanted transmitters have a frequency difference of Δf (Hz or kHz) and the protection ratio when the carriers of these transmitters have the same frequency.

- Selectivity of a receiver

  A measure of its ability to discriminate between a wanted signal to which the receiver is tuned and unwanted signals.

- Sensitivity of a receiver

  A measure of its ability to receive weak signals and to produce an output having usable strength and acceptable quality.

- Noise-limited sensitivity of a receiver

  The noise-limited sensitivity expresses the ability of the receiver's radio-frequency part to receive weak signals. It is equal to the minimum level of the radio-frequency input signal, expressed in dB(μV/m) modulated 30% at the standard reference frequency, and which produces in the output power a chosen value of AF signal-to-noise ratio.

Terms related to coverage and service area

- Coverage area (of a broadcasting transmitter in a given broadcasting band) :

  The area within which the field-strength of a wanted transmission is equal to or greater than the usable field-strength. In the case of fluctuating interference or noise, the percentage of time during which this condition is satisfied should be stated.

- Service area

  The area associated with a station for a given service and a specified frequency under specified technical conditions where radiocommunications may be established with existing or projected stations and within which the protection afforded by a frequency assignment or allotment plan or by any other agreement must be respected.

* The specified conditions include such diverse parameters as : spacing ΔF of the wanted and interfering carrier, emission characteristics (type of modulation, modulation depth, carrier-frequency tolerance, etc.), receiver input level, as well as the receiver characteristics (selectivity and susceptibility to cross-modulation, etc.).

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 102-E
19 January 1984
Original : English

COMMITTEE 4

THIRD REPORT OF WORKING GROUP 4A
TO COMMITTEE 4

3.3.5.2 Solar index values

3.3.5.2.1 The Conference adopts the 12-month running mean sunspot number R_{12} as the index to be used for planning.

3.3.5.2.2 [The reference values of R_{12} to be used for planning shall be the five values given in Table 3.3.5-II. This Table also states the range of applicability of each of the reference values.

When a seasonal plan is to be selected from the set of plans prepared in accordance with the reference values of R_{12}, the applicable plan shall be selected based on the lowest value of R_{12} predicted for any of the months in that season.]*

[The seasonal plan shall be prepared in accordance with the values of R_{12} predicted for the period. The lowest value of R_{12} predicted for any of the months in that season shall be used.]*

* Note 1 - The first alternative relates to a planning method which produces plans for a period of more than one year ahead; the second relates to a planning method which produces plans for periods within one year ahead.

Note 2 - Predicted values of the 12-month running mean sunspot number R_{12} are prepared for periods up to six and twelve months ahead of the current month. The predicted values are obtainable from the CCIR Secretariat.

TABLE 3.3.5-II

Selection of R_{12} index values for planning

Index values	Range of applicability of predicted R_{12}
5	0-14
30	15-44
60	45-74
90	75-104
120	105 and above

]

L.W. BARCLAY
Chairman of Working Group 4A

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 103-E
24 January 1984
Original : French

COMMITTEE 4

SUMMARY RECORD

OF THE

THIRD MEETING OF COMMITTEE 4

(TECHNICAL CRITERIA)

Friday, 20 January 1984, at 0900 hrs

Chairman : Mr. J. RUTKOWSKI (People's Republic of Poland)

Subjects discussed :		Document
1.	Third report of Working Group 4A	102
2.	Second, third and fourth reports of Working Group 4B	99, 101, 104

1. Third report of Working Group 4A (Document 102)

1.1 The Chairman of Working Group 4A introduced Document 102, which was the result of the meetings held by Working Group 4A during the week. The final numbering of paragraphs could be entrusted to the Editorial Committee.

Two alternatives were proposed in paragraph 3.3.5.2.2, as Committee 4 did not know which planning method would be used. Table 3.3.5-II applied to the first alternative only.

1.2 The delegate of France suggested that a sentence should be added at the end of the document to indicate that one of the two alternatives would be deleted, once Committee 5 had decided which method to apply.

1.3 The Chairman of Working Group 4A proposed that the sentence be added to Note 1.

It was so decided.

1.4 In reply to a question by the delegate of the Federal Republic of Germany, the Chairman of Working Group 4A said that a square bracket should be inserted before Table 3.3.5-II.

Document 102 was approved for transmission to Committee 6.

2. Second, third and fourth reports of Working Group 4B (Documents 99, 101 and 104)

2.1 The Chairman of Working Group 4B said that his Group had held two meetings, on Wednesday and Thursday. No compromise solution had been found in respect of the values for either the AF signal-to-noise ratio or noise limited sensitivity of the receiver, as explained in Documents 99 and 104. The Committee was asked to take a decision on the subject.

With regard to the definitions (Document 101), all questions had been settled, except those relating to a note concerning minimum usable field-strength and usable field-strength, which could be added later.

2.2 The Chairman said that the Steering Committee had expressed the view that it would be preferable not to take a hasty decision on the two matters referred to in Documents 99 and 104. The decision could be deferred until the next meeting of Committee 4, on Tuesday morning, to allow delegations time to hold consultations. A consensus would be preferable to a vote.

It was so agreed.

2.3 The Chairman of Working Group 4A said that, in view of the definitions already contained in the Radio Regulations, it might be necessary at the end of the Conference to delete some of the terms and add others in Document 101. Perhaps a Note 2 should be inserted to that effect, to draw the Editorial Committee's attention to the fact, particularly with respect to the definitions of e.i.r.p. and e.r.p. Otherwise some confusion could arise regarding which should serve as a reference for broadcasting.

It was so decided.

Document 101 was approved.

The meeting rose at 0920 hours.

The Secretaries :

G. KOVACS

G. ROSSI

The Chairman :

J. RUTKOWSKI

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 104-E
19 January 1984
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COMMITTEE 4

FOURTH REPORT OF WORKING GROUP 4B
TO COMMITTEE 4

Working Group 4B considered the proposals concerning the AF signal-to-noise ratio values to be recommended for planning purposes. The Group would not take a unanimous decision on this subject.

More than half of the delegations which expressed their opinion were in favour of 21 dB. Several others wanted to fix that value at 30 dB as reported by the CCIR, but they would accept a compromise solution of 26 dB. Some administrations maintained their position for 30 dB because a compromised solution was not accepted.

The Working Group decided to ask Committee 4 to take the decision on the above subject.

Y. TADOKORO
Chairman of Working Group 4B

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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19 January 1984
Original : English

COMMITTEE 5

Note by the Secretary-General

At the request of the International Frequency Registration Board, I transmit the attached document for the consideration of the Conference.

R.E. BUTLER
Secretary-General

Comments by the IFRB on Intersessional Working Groups

1. In reply to the questions raised in the first meeting of WG 5B on 18 January 1984 and in the third meeting of Committee 5 on 19 January 1984, and the request to the Board to provide some additional information relating to the comments made by the Chairman of the IFRB, the Board is pleased to provide the following information to the Conference.

2. In considering such an Intersessional Working Group (IWG), the Board has assumed that the first session will adopt a clear, unambiguous planning method and all the required technical criteria so that the intersessional work should normally be limited to the development, preparation and testing of computer programmes prior to the start of the second session and any related studies that the first session may require.

3. Considerable computer development work may result from these tasks during the intersessional period, and as in previous similar cases the assistance from Administrations will greatly help in carrying out these tasks. The question is how this cooperative effort is to be best organized in order to permit the effective usage of the resources of the Board and the Administrations in order to successfully complete the tasks assigned by this first session, within the limited available time.

4. The Board would like to confirm that the overall results of the two Panels of Experts (POEs) for Region 2 Conferences were successful in completing the tasks assigned to them and to reiterate its thanks to those Administrations who participated in the work of these two POEs and provided software. It was necessary, however, to draw the attention of this first session to a number of difficulties encountered, mainly with respect to the status of the POEs and the methods of work. The statement by the Chairman of the Board made at the first meeting of WG 5B was in no way intended to be negative; it was intended to request the first session to take appropriate measures in order to avoid similar difficulties.

5. Depending on the planning method to be adopted, there could be a considerable amount of complex computer programmes to be developed to implement it. In view of the limited time available between the two sessions to design, programme and test the software, as well as to undertake any other tasks that this session may assign to the Board it is very likely that even with a significant increase in resources, the Board may find it very difficult to develop or adapt all programmes, and therefore assistance from Administrations would be helpful and greatly appreciated.

6. There are two possible approaches to the organization of the international activities:

a) a working group composed of Administrations;

b) a group of experts.

Each of these two approaches would result in a different structure and relationship between the Board and members of the group.

6.1 If the Conference decides to create an Intersessional Working Group composed of Administrations, the Board will consider it as a continuation of the First Session of the Conference and will continue to give all assistance available to it.

6.2 If the Conference decides to create a group of experts (see No. 2007 of the Convention), i.e. individuals acting on their own behalf and not as representatives of their respective Administrations, there is no provision in the Convention or in the Radio Regulations that describes the type of assistance that the Board may give to such a group.

7. For the above reasons and considering the past POEs, the Board is of the view that the assistance from Administrations is necessary and welcome. Should the Conference decide to establish a Panel of Experts (individuals) from Administrations, the main task of such a group would be to assist the Board in developing and adapting the software in accordance with the decisions of this session. The tasks of experts must be clearly defined by this session in order to ensure that they are not required to consider questions of substance during the intersessional period. The division of work between the experts and the Board, based on the decisions of this first session, could be as follows if the Conference decides to establish a group of experts:

Board

a) develop the overall computer programme system architecture indicating the individual modules required (with the assistance of the experts);

b) develop the data base structure;

c) develop the necessary programmes to integrate the modules provided by administrations into a single working system within the overall system architecture;

d) develop any required modules that are not available from administrations;

e) process requirements in accordance with the decisions of this session;

f) test the integrated system with the assistance of the experts;

g) prepare a report for the second session.

Experts

a) assist the Board in the design of the architecture of the system;

b) provide any computer modules which can satisfy the specific requirements;

c) convert the above modules to the ITU computer;

d) provide expert advice to the Board on the many aspects of the intersessional work;

e) assist the Board in the testing of the integrated system;

f) assist the Board in the preparation of the report to the second session.

8. Once the planning method is adopted by this session the above tasks will have to be reviewed and revised as necessary.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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20 January 1984
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COMMITTEE 4

Note from the Chairman of Committee 5 to the Chairman of Committee 4

Having taken into account the comments which have been made on the subject of planning principles and methods, Committee 5 has concluded that there is a possibility that the requirements to be submitted to the second session of WARC-HFBC may exceed the quantity that can be accommodated on the basis of the desirable technical criteria to be established at the first session. One of the possible solutions that may be applied in that case is the accommodation of some proportion of the submitted requirements with the desired quality objectives and the remaining with reduced quality objectives. In order to do this, it may be necessary for the second session to have guidance regarding the minimum acceptable values of the various planning parameters.

Committee 5 has therefore decided to request Committee 4 to establish, in addition to the desired values, the minimum values of the technical parameters below which the service can be deemed unusable. The following is a non-exhaustive list of the key parameters for which these minimum values may be established :

- co-channel protection ratio)
) Under stable as well as fluctuating conditions
- signal-to-noise ratio)
- man-made noise
- reception reliability
- broadcast reliability

This request is hereby transmitted to Committee 4 for appropriate action.

Mr. IRFANULLAH
Chairman of Committee 5

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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COMMITTEE 6

SECOND SERIES OF TEXTS FROM

COMMITTEE 4 TO THE EDITORIAL COMMITTEE

The texts reproduced in Annexes 1 and 2 to this document were adopted in Committee 4 and are hereby submitted to the Editorial Committee.

J. RUTKOWSKI
Chairman of Committee 4

Annexes : 2

ANNEX 1

/ 2. / Definitions

/ 2.1 / The First Session of the Conference noted the following definitions contained in the Radio Regulations, Geneva, 1979 : / ** /

- Terms relating to emission

  Emission (RR 132)
  Class of emission (RR 133)
  Single-sideband emission (RR 134)
  Full-carrier single-sideband emission (RR 135)
  Reduced-carrier single-sideband emission (RR 136)
  Suppressed-carrier single-sideband emission (RR 137)
  Out-of-band emission (RR 138)

- Terms relating to frequency

  Frequency tolerance (RR 145)

- Terms relating to bandwidth

  Necessary bandwidth (RR 146)

- Terms relating to power

  Power (RR 150)
  Peak envelope power (RR 151)
  Mean power (RR 152)
  Carrier power (RR 153)
  Gain of an antenna (RR 154)
  Equivalent isotropically radiated power (e.i.r.p.) (RR 155)
  Effective radiated power (e.r.p.) (RR 156)

- Terms relating to zones of reception

  Geographic zones for broadcasting* (Appendix 1 of RR)

* Commonly known as CIRAF zones.

/ ** Note to the Editorial Committee : some of the definitions listed below may not be required in the final version of the Report of the First Session. /

/‾2.2_/ The following definitions were also adopted :

Terms relating to the emission

- Reduced carrier

Carrier emitted at a power level reduced by at least 6 dB below the peak envelope power.

Terms related to field-strength

- Minimum usable field-strength (E_{min})*

Minimum value of the field-strength necessary to permit a desired reception quality, under specified receiving conditions, in the presence of natural and man-made noise, but in the absence of interference from other transmitters.

- Usable field-strength (E_u)*

Minimum value of the field-strength necessary to permit a desired reception quality, under specified receiving conditions, in the presence of noise and interference, either in an existing situation or as determined by agreements or frequency plans.

- Reference usable field-strength (E_{ref})

The agreed value of the usable field-strength that can serve as a reference or basis for frequency planning.

Terms related to the ratio of wanted and unwanted signals

- Audio-frequency (AF) signal-to-interference ratio

The ratio (expressed in dB) between the values of the voltage of the wanted signal and the voltage of the interference, measured under specified conditions*, at the audio-frequency output of the receiver.

- Audio-frequency (AF) protection ratio

The agreed minimum value of the audio-frequency signal-to-interference ratio considered necessary to achieve a subjectively-defined reception quality.

- Radio-frequency (RF) wanted-to-interfering signal ratio

The ratio, expressed in dB, between the values of the radio-frequency voltage of the wanted signal and the interfering signal, measured at the input of the receiver under specified conditions**.

---

* Note 1 - /‾Will follow._7

** Note 2 - The specified conditions include such diverse parameters as : spacing ΔF of the wanted and interfering carrier, emission characteristics (type of modulation, modulation depth, carrier-frequency tolerance, etc.), receiver input level, as well as the receiver characteristics (selectivity and susceptibility to cross-modulation, etc.).

- Radio-frequency (RF) protection ratio

  The value of the radio-frequency wanted-to-interfering signal ratio that enables, under specified conditions*, the audio-frequency protection ratio to be obtained at the output of a receiver.

- Relative radio-frequency protection ratio

  This ratio is the difference, expressed in decibels, between the protection ratio when the carriers of the wanted and unwanted transmitters have a frequency difference of Δf (Hz or kHz) and the protection ratio when the carriers of these transmitters have the same frequency.

- Selectivity of a receiver

  A measure of its ability to discriminate between a wanted signal to which the receiver is tuned and unwanted signals.

- Sensitivity of a receiver

  A measure of its ability to receive weak signals and to produce an output having usable strength and acceptable quality.

- Noise-limited sensitivity of a receiver

  The noise-limited sensitivity expresses the ability of the receiver's radio-frequency part to receive weak signals. It is equal to the minimum level of the radio-frequency input signal, expressed in dB(μV/m) modulated 30% at the standard reference frequency, and which produces in the output power a chosen value of AF signal-to-noise ratio.

Terms related to coverage and service area

- Coverage area (of a broadcasting transmitter in a given broadcasting band) :

  The area within which the field-strength of a wanted transmission is equal to or greater than the usable field-strength. In the case of fluctuating interference or noise, the percentage of time during which this condition is satisfied should be stated.

- Service area

  The area associated with a station for a given service and a specified frequency under specified technical conditions where radiocommunications may be established with existing or projected stations and within which the protection afforded by a frequency assignment or allotment plan or by any other agreement must be respected.

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* The specified conditions include such diverse parameters as : spacing ΔF of the wanted and interfering carrier, emission characteristics (type of modulation, modulation depth, carrier-frequency tolerance, etc.), receiver input level, as well as the receiver characteristics (selectivity and susceptibility to cross-modulation, etc.).

ANNEX 2

3.2.4 Values of the appropriate solar index and the seasonal periods based on which planning should be carried out

. . . .

3.2.4.2 Solar index values

3.2.4.2.1 The 12-month running mean sunspot number R_{12} shall be the solar index to be used for planning.

3.2.4.2.2 ⁄ The reference values of R_{12} to be used for planning shall be the five values given in Table 3.2.4-II. This Table also states the range of applicability of each of the reference values.

When a seasonal plan is to be selected from the set of plans prepared in accordance with the reference values of R_{12}, the applicable plan shall be selected based on the lowest value of R_{12} predicted for any of the months in that season. *

TABLE 3.2.4-II

Selection of R_{12} index values for planning

Index values	Range of applicability of predicted R_{12}
5	0-14
30	15-44
60	45-74
90	75-104
120	105 and above

⁄7

⁄ The seasonal plan shall be prepared in accordance with the values of R_{12} predicted for the period. The lowest value of R_{12} predicted for any of the months in that season shall be used. ⁄7*

* Note 1 - The first alternative relates to a planning method which produces plans for a period of more than one year ahead; the second relates to a planning method which produces plans for periods within one year ahead. Only one of these options will be retained according to the method chosen by Committee 5.

Note 2 - Predicted values of the 12-month running mean sunspot number R_{12} are prepared for periods up to six and twelve months ahead of the current month. The predicted values are obtainable from the CCIR Secretariat.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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20 January 1984
Original : English

COMMITTEE 5

United Kingdom and Netherlands

PROPOSAL FOR A FURTHER PLANNING PRINCIPLE

The choice and implementation of any planning method must recognize that the prevalence of harmful interference in the High Frequency Broadcasting Bands may prevent any given frequency assignment from satisfying the requirements of administrations. As a consequence the planning method adopted by the Conference should incorporate procedures to ensure overall broadcast reliability for administrations.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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COMMITTEE 4

FIFTH REPORT OF WORKING GROUP 4B
TO COMMITTEE 4

The texts reproduced in the Annex to this Report were considered in Working Group 4B and are submitted to Committee 4 for approval.

Y. TADOKORO
Chairman of Working Group 4B

Annex : 1

ANNEX

/‾3.3_/ Radio-frequency protection ratios

After a careful review of Administrations proposals and the extensive study of this matter by the CCIR, the Conference adopted recommendations which consider the subjective tests comparing quality of listener satisfaction with various levels of protection ratios. The decisions were also made with a recognition that the number of requirements and the limited amount of allocated spectrum space would require a reduction of the desired protection ratio comensurate with the number of requirements to be satisfied. With these considerations in mind the following decisions were made.

/‾3.3.1_/ Co-channel protection ratios and frequency tolerances

For stable conditions where the frequency difference between wanted and unwanted carriers does not exceed 100 Hz the value of 27 dB is adopted as a value to be achieved if feasible. If this value of protection ratio is unobtainable the values in figure /‾B_/ provide planners with advice on the resultant quality of service when protection ratios are reduced from the level of 27 dB.

Transmitter frequency tolerances are contained in Appendix 7 of the Radio Regulations. In order to preserve the need for no more than 100 Hz difference between wanted and unwanted carriers referred to above, administrations are urged to use a frequency tolerance of no more than ± 50 Hz.

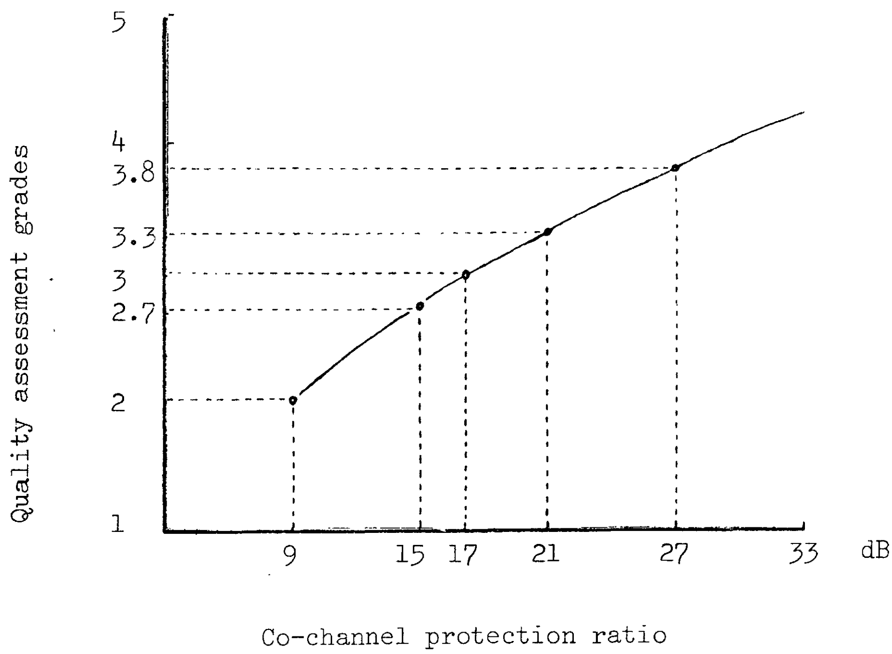

FIGURE /‾B_7

Relationship between reception quality and co-channel RF protection ratio

TABLE /‾C_7

Table /‾C_7 provides a description of the five levels of quality assessment grades.

Quality	Impairment
5 Excellent 4 Good 3 Fair 2 Poor 1 Bad	5 Imperceptible 4 Perceptible, but not annoying 3 Slightly annoying 2 Annoying 1 Very annoying

/¯3.3.2_7 Relative values of protection ratio as a function of carrier frequency separation

Once a value for the co-channel radio-frequency protection ratio has been determined, then the radio-frequency protection ratio, expressed as a function of the carrier frequency spacing, shall be determined by adding the value given in the curve in Figure /¯C_7 to the value of the co-channel RF protection ratio.

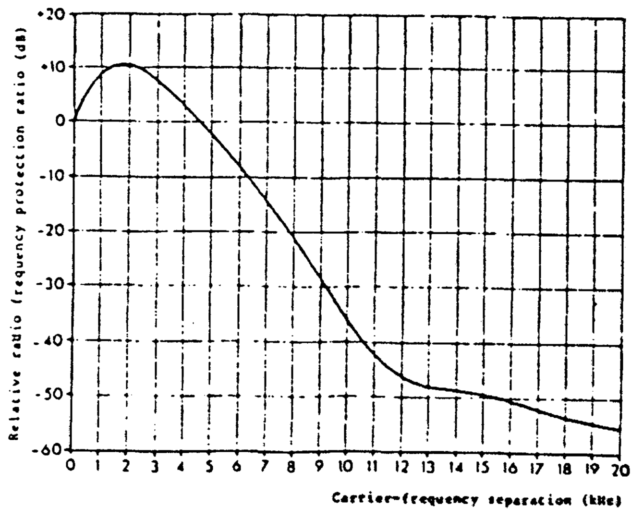

FIGURE /¯C_7

Relative value of the radio-frequency protection ratio as a function of the carrier-frequency separation

/¯3.6_7 Use of synchronized transmitters

/¯3.6.1_7 The use of synchronized transmitters, where appropriate, is an efficient means of economizing frequency spectrum. When synchronized transmitters are utilized the carrier frequency difference shall be 0.1 Hz or less for broadcasting the same programme to partially overlapping or non-overlapping service areas.

/¯3.6.2_7 Protection ratios in the range of 3 to 11 dB give satisfactory reception with a carrier frequency difference of 0.1 Hz or less. For planning purposes a value of 8 dB shall be used.

When the synchronized transmitters are driven by a common oscillator and use antennas which have similar vertical radiation characteristics a lower protection ratio of 3 dB shall be adopted for planning.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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COMMITTEE 4

FOURTH REPORT OF WORKING GROUP 4A TO COMMITTEE 4

REPORT TOPICS 3.2.2 AND 3.2.3

3.2.2 Atmospheric and man-made radio noise data

3.2.2.1 Atmospheric radio noise data

The hourly median values of atmospheric noise intensity as contained in CCIR Report 322-2 are adopted.

The method of implementation of the data may be :

- a direct calculation as required based upon a numerical representation of the maps;
- a grid representation similar to that currently in use by the IFRB, except that the grid should have a size of 10° latitude by 15° longitude in all parts of the world;
- the precalculation of values appropriate for each test point.

The choice from these options should be such as to minimize the calculation time required during the operation of the planning method.

3.2.2.2 Man-made radio noise data

The median value of man-made noise power F_{am} expressed in dB above thermal noise at T_o = 288K, to be adopted is given by :

[$F_{am} = 67.2 - 27.7 \log f$]

[$F_{am} = 60.4 - 28.15 \log f$]

where f is the frequency in MHz.

3.2.2.3 The combination of atmospheric and man-made noise

In each case the values of atmospheric noise and man-made noise intensities shall be compared and the greater one shall be used.

3.2.3 Signal fading

3.2.3.1 Short-term (within the hour) fading

The upper-decile amplitude deviation from the median of a single signal is to be taken as 5 dB and the lower-decile deviation is to be taken as 8 dB.

3.2.3.2 Long-term (day-to-day) fading

The magnitude of the long-term fading, as determined by the ratio of operating frequency to basic MUF is given in Table 3.3.3-I.

TABLE 3.3.3-I

Decile deviations from the predicted monthly median value of signal field strength, in dB, arising from day-to-day variability

Corrected geomagnetic latitude[1]	< 60°		≥ 60°	
Transmitting frequency/ predicted basic MUF	Lower decile	Upper decile	Lower decile	Upper decile
≤ 0.8	-8	6	-11	9
1.0	-12	8	-16	11
1.2	-13	12	-17	12
1.4	-10	13	-13	13
1.6	-8	12	-11	12
1.8	-8	9	-11	9
2.0	-8	9	-11	9
3.0	-7	8	-9	8
4.0	-6	7	-8	7
≥ 5.0	-5	7	-7	7

1 If the pole-ward extreme of the great circle between transmitter and receiver reaches a corrected geomagnetic latitude of 60° or greater, the values for ≥ 60° have to be used. The relationship of corrected geomagnetic latitude to geographical coordinates is shown in Figures 1 and 2.

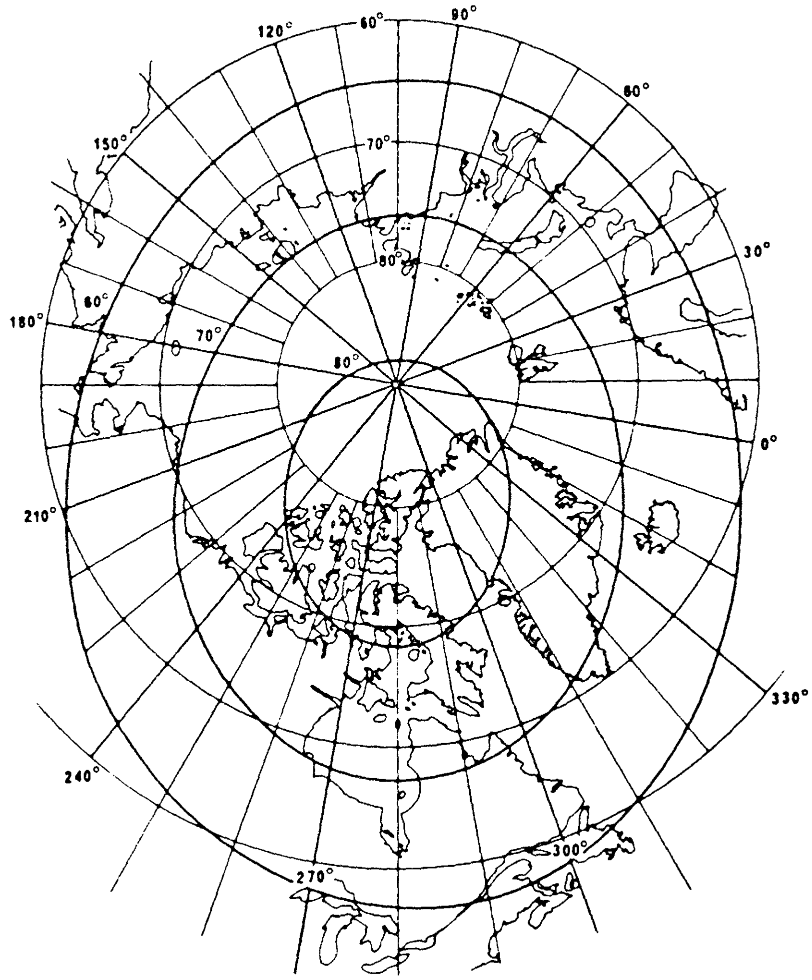

FIGURE 1 - *Corrected geomagnetic latitude in the northern hemisphere*

(Geographic latitude and longitude are also displayed for reference)

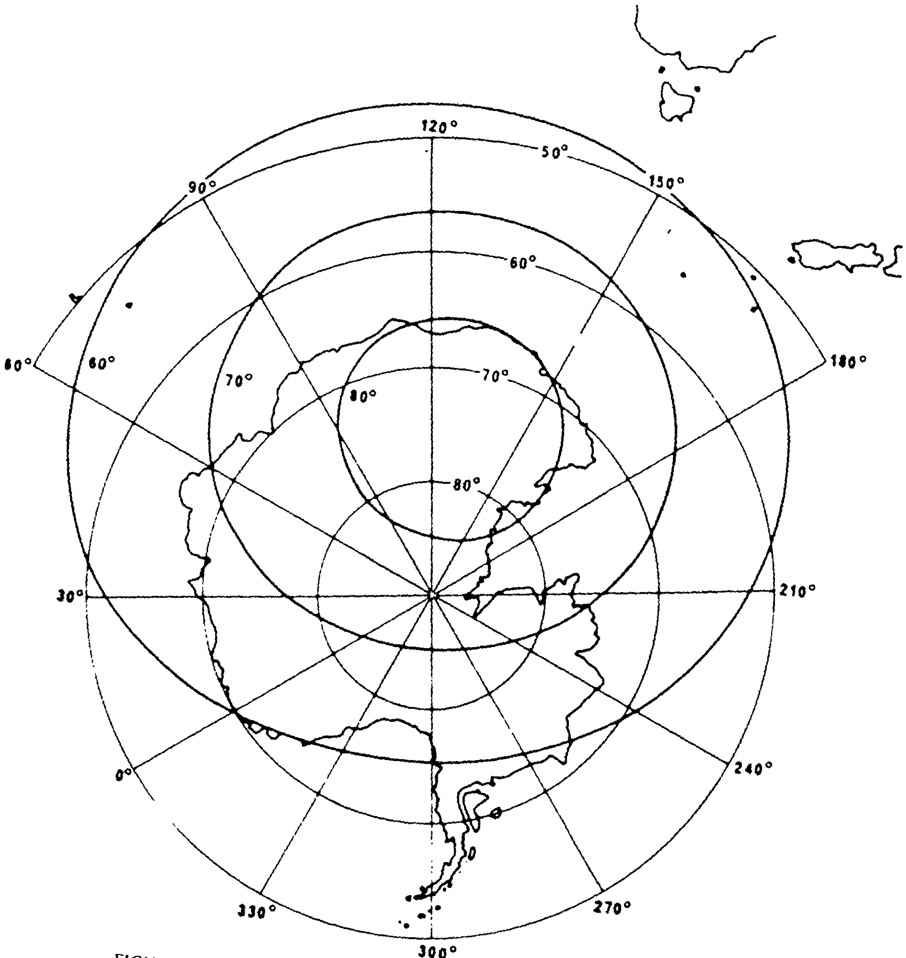

FIGURE 2 - *Corrected geomagnetic latitude in the southern hemisphere*

L.W. BARCLAY
Chairman of Working Group 4A

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 111-E
21 January 1984
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COMMITTEE 4

Sweden

PROPOSALS FOR THE WORK OF THE CONFERENCE

MAXIMUM NUMBER OF FREQUENCIES

(Agenda item 4.1.9)

In the Report from CCIR to the Conference (Document 22), Chapter 9, it is suggested that an overall service reliability of the order of 90% is desirable for a broadcasting service over the time of transmission throughout the service area.

It is further suggested that, if the calculated overall circuit reliability (single frequency) does not reach the desired value of the overall service reliability (90%), it is necessary to consider if a combination of frequencies could improve the overall service reliability and if the amount of improvement would justify the use of further frequencies. If the use of any additional frequencies does not increase the service reliability for the specified value, for a specific percentage of test points in the required service area the original number of frequencies should not be increased.

The Swedish Administration supports these general principles. However, for planning purposes it will be necessary to establish accurate limits for the overall service reliability in order to assess if additional frequencies shall be assigned.

We propose that in those cases where the overall service reliability obtained with one frequency is less than 80% a second frequency shall be tested. The overall service reliability using the two frequencies shall be calculated and if the result exceeds the relevant limit stated below the second frequency shall be assigned.

In those cases where the overall service reliability using two frequencies still will be below 80% the procedure shall be repeated for an additional (third) frequency.

The justification for the proposed limits is that there should be a considerable improvement of the overall service reliability in order to be permitted to use additional frequencies.

Overall service reliability* (%)	Overall service reliability with an additional frequency (%)	Additional frequency to be assigned?
< 40	> 50	Yes
	⩽ 50	No
40 - 50	> 60	Yes
	⩽ 60	No
50 - 60	> 70	Yes
	⩽ 70	No
60 - 70	> 80	Yes
	⩽ 80	No
70 - 80	> 90	Yes
	⩽ 90	No

* Calculated for one frequency in the first round and for two frequencies in the second round.

In the Annex there is a Table showing the calculated overall service reliabilities.

Annex : 1

ANNEX

TABLE

Overall service reliabilities of multiple frequency use

Overall circuit reliability for an additional frequency

		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	0.9	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99
	0.8	0.82	0.84	0.86	0.88	0.90	0.92	0.94	0.96	
Overall circuit reliability (or overall service reliability)	0.7	0.73	0.76	0.79	0.82	0.85	0.88	0.91		
	0.6	0.64	0.68	0.72	0.76	0.80	0.84			
	0.5	0.55	0.60	0.65	0.70	0.75				
	0.4	0.46	0.52	0.58	0.64					
	0.3	0.37	0.44	0.51						
	0.2	0.28	0.36							
	0.1	0.19								

Resulting overall service reliability

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

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COMMITTEE 4

SIXTH REPORT OF WORKING GROUP 4B

TO COMMITTEE 4

The texts reproduced in Annex to this Report were considered in Working Group 4B and are submitted to Committee 4 for approval.

Y. TADOKORO
Chairman of Working Group 4B

Annex : 1

ANNEX

3.1 Double sideband (DSB) system specifications

After a review of administrations' proposals and the study of this matter by the CCIR, the Conference adopted the following Double Sideband (DSB) System specifications.

3.1.1 Transmission characteristics

3.1.1.1 Audio-frequency bandwidth

The upper limit of the audio bandwidth of the transmitter shall not exceed 4.5 kHz and the lower limit shall be 150 Hz with lower frequencies attenuated at a slope of 6 dB per octave.

3.1.1.2 Necessary bandwidth

The necessary bandwidth is twice the audio-frequency bandwidth.

3.1.1.3 Characteristics of modulation processing

The audio signal shall be processed such that the modulating signal retains a dynamic range of not less than 20 dB. Excessive amplitude compression, together with improper peak limitation, will lead to excessive out-of-band radiation and thus to adjacent channel interference, and shall therefore be avoided.

3.1.2 Channel spacing

(For the text already adopted see Document 93, Annex 4.)

3.1.3 Nominal carrier frequencies

(For the text already adopted see Document 93, Annex 4.)

3.1.4 Receiver characteristics

3.1.4.1 Overall selectivity of the receiver

The overall selectivity of the receiver as shown in Figure [1] below, shall be used for planning purposes.

3.1.4.2 Noise limited sensitivity of the receiver

(To be concluded.)

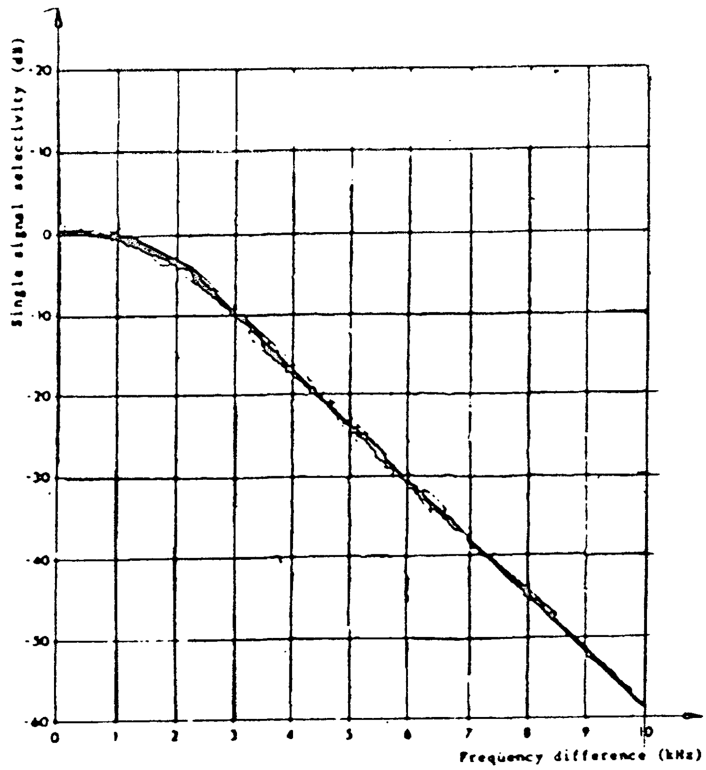

FIGURE [1]

Overall frequency response of the reference receiver

3.5 Antennas and power

The combined effects of transmitter power and antenna characteristics which determine the equivalent isotropic radiated power (e.i.r.p.) are the overall consideration which is significant in computations for HF broadcasting planning purposes. The selection of power and associated antennas should be based on the use of the most directional antenna possible appropriate to the broadcasting requirement. The power required must be as low as possible to achieve broadcasting objectives.

3.5.1 Characteristics of antennas to be used for planning

(Text will follow.)

3.5.2 Transmitter power and equivalent isotropic radiated power appropriate for satisfactory service

The propagation prediction method described in section 3.3.1 shall be used to determine the appropriate transmitter power to achieve satisfactory service. The appropriate transmitter power varies with the propagation conditions which in turn are functions of diurnal, seasonal, and solar cycle period and geographic location.

(Additional texts will follow pending Committee 4 actions.)

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 113-E
23 January 1984
Original : English

COMMITTEE 4

SEVENTH REPORT OF WORKING GROUP 4B
TO COMMITTEE 4

The text reproduced in the Annex to this Report was considered in Working Group 4B and is submitted to Committee 4 for approval.

Y. TADOKORO
Chairman of Working Group 4B

Annex : 1

ANNEX

Text of Note 1 on page three of Document 107, concerning the definitions "minimum usable field strength" and "usable field strength" :

Note 1 - The terms "minimum usable field strength" and "usable field strength" refer to specified field strength values to be achieved by a wanted signal in order to obtain the required reception quality.

In determining whether these requirements are met, the 50% (median) level of a fading signal is taken as appropriate characteristics.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 114-E
23 January 1984
Original : French

BUDGET CONTROL COMMITTEE

Note by the Secretary-General

POSITION OF THE CONFERENCE ACCOUNTS AT 20 JANUARY 1984

In accordance with No. 477 of the International Telecommunication Convention (Nairobi, 1982), a statement of the accounts of the Conference at 20 January 1984 is submitted to the Budget Control Committee for consideration.

The statement shows that expenditure is within the budget limits approved by the Administrative Council.

This document also comprises a statement of expenditure relating to the preparatory work carried out in 1983 for the Conference and a statement of the limits set on expenditure by the Nairobi Plenipotentiary Conference.

R.E. BUTLER

Secretary-General

Annexes : 3

Item No.	Headings	Budget approved by AC	Budget adjusted	Expenditure at 20 January 1984			
				Actual	Committed	Estimated	Total
	<u>Sub-head I - IFRB preparatory work</u>						
11.401	Salaries and related expenses	325,000	340,500	-	334,900	14,500	349,400
11.403	Insurance	52,000	58,500	-	-	58,500	58,500
11.404	Office space, furniture	20,000	20,000	-	-	20,000	20,000
11.405	Electronic equipment	100,000	100,000	-	-	80,000	80,000
		497,000	519,000	-	334,900	173,000	507,900
	<u>Sub-head II - Staff expenditure</u>						
11.421	Salaries and related expenses	1.281,000	1.386,000	-	1.156,200	180,000	1,336,200
11.422	Travel (recruitment)	190,000	192,000	1,403	77,504	113,093	192,000
11.423	Insurance	34,000	34,000	-	-	32,000	32,000
		1.505,000	1.612,000	1,403	1,233,704	325,093	1,560,200
	<u>Sub-head III - Premises and equipment</u>						
11.431	Premises, furniture, machines	90,000	90,000	-	26,300	60,000	86,300
11.432	Document production	100,000	100,000	4,273	5,000	79,027	88,300
11.433	Office supplies and overheads	40,000	40,000	9,762	9,700	20,538	40,000
11.434	PTT	150,000	150,000	9,572	-	70,028	79,600
11.435	Technical installations	20,000	20,000	-	-	10,000	10,000
11.436	Sundry and unforeseen	10,000	10,000	-	-	10,000	10,000
		410,000	410,000	23,607	41,000	249,593	314,200
	<u>Sub-head IV - Other expenses</u>						
11.441	Report to the 2nd session	15,000	15,000	-	-	15,000	15,000
	Total, Section 11.4	2.427,000 *	2.556,000	25,010	1,609,604	762,686	2.397,300

Excluding common expenditure for conferences and meetings (section 17), which is estimated at 712,000.- Swiss francs for this Conference (value 1.9.82 : limit 721,000.- Swiss francs)

*) Value 1.9.82 (limit) : 2,454,000.- Swiss francs

ANNEX 2

PREPARATORY WORK CARRIED OUT IN 1983 FOR THE WORLD ADMINISTRATIVE CONFERENCE FOR HF BROADCASTING

Items	Section 11 - Conference	1983 budget*)	1983 accounts
		- Swiss francs -	
	Sub-head I - Staff expenditure		
11.401	Salaries and related expenses	205,700	198,773.40
11.402	Insurance	31,400	35,609.70
	Total, sub-head I	237,100	234,383.10
	Sub-head II - Other expenses		
11.405	Document production	-	8,265.95
11.410	CCIR preparatory work	270,000	86,385.70
	Total, sub-head II	270,000	94,651.65
	Total expenditure, Section 11.4	507,100 **)	329,034.75
	Section 17 - Common services	237,000***)	85,000.00****)
	Total, value 1.9.1982 (limit on expenditure)	734,000	

*) 1983 budget, including additional credits
**) i.e. 500,000.- Swiss francs, value 1.1.1983
***) i.e. 230,000.- Swiss francs, value 1.1.1983
****) Provisional amount

ANNEX 3

LIMIT SET BY THE NAIROBI CONFERENCE, 1982, ON EXPENDITURE FOR THE WORLD ADMINISTRATIVE RADIO CONFERENCE FOR THE PLANNING OF THE HF BANDS ALLOCATED TO THE BROADCASTING SERVICE, 1984/86, AND COMPARISON WITH THE CREDITS AUTHORIZED BY THE ADMINISTRATIVE COUNCIL

WARC - HFBC	Sections 11 and 17		
	Limit on expenditure Add.Prot.I	Expenditure entered in the budget	Difference
1983 : Preparatory work	900,000	734,000	166,000
1984 : Preparatory work, cost of the first session and intersessional work	4,100,000	3,175,000	925,000
1985 : Intersessional work	500,000		
1986 : Intersessional work, cost of the second session, immediate post-Conference work	4,500,000		
Totals	10,000,000		

The amounts given in this table correspond to values at 1.9.1982.

INTERNATIONAL TELECOMMUNICATION UNION

BLUE PAGES

WARC FOR HF BROADCASTING

Document 115(Rev.1)-E
25 January 1984

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

PLENARY MEETING

B.1(Rev.1)

FIRST SERIES OF TEXTS SUBMITTED BY THE
EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for first reading :

Source	Document	Title
COM.4	93	Chapter 2 - Definitions
COM.4	107	Chapter 3 - Technical criteria
COM.4	119	

Marie HUET
Chairman of Committee 6

Annex : 15 pages

CHAPTER 2

DEFINITIONS

The First Session of the Conference adopted the following definitions. It also noted certain definitions contained in the Radio Regulations, Geneva, 1979 (identified by their RR number). /** /

2.1 Terms relating to emission

- Emission (RR 132)
- Class of emission (RR 133)
- Single-sideband emission (RR 134)
- Full-carrier single-sideband emission (RR 135)
- Reduced-carrier single-sideband emission (RR 136)
- Reduced carrier

  Carrier emitted at a power level reduced by at least 6 dB below the peak envelope power.

- Suppressed-carrier single-sideband emission (RR 137)
- Out-of-band emission (RR 138)

2.2 Term relating to frequency

- Frequency tolerance (RR 145)

2.3 Term relating to bandwidth

- Necessary bandwidth (RR 146)

2.4 Terms relating to power

- Power (RR 150)
- Peak envelope power (RR 151)
- Mean power (RR 152)
- Carrier power (RR 153)
- Gain of an antenna (RR 154)
- Equivalent isotropically radiated power (e.i.r.p.) (RR 155)
- Effective radiated power (e.r.p.) (RR 156)

2.5 Term relating to zones of reception

- Geographic zones for broadcasting* (Appendix 1 of RR)

* Commonly known as CIRAF zones.

/** Note from Committee 4 to the Editorial Committee - Some of the definitions from the RR may not be required in the final version of the Report of the First Session. /

2.6 Terms relating to propagation

- Operational MUF*

The highest frequency that would permit acceptable operation of a radio service between given terminals at a given time under specified working conditions (such as antenna types, transmitter power, class of emission and required signal-to-noise ratio).

- Optimum working frequency (OWF)*

The lower decile of the daily values of operational MUF at a given time over a specified period, usually a month. That is, the frequency that is exceeded by the operational MUF during 90% of the specified period.

- Basic MUF*

The highest frequency by which a radio wave can propagate between given terminals, on a specified occasion, by ionospheric refraction alone.

* Note - This definition is applicable only to the HF broadcasting service.

2.7 Terms relating to reliability

- Circuit reliability*

  Probability for a circuit that a specified performance is achieved at a single frequency.

- Reception reliability*

  Probability for a receiver that a specified performance is achieved by taking into account all transmitted frequencies.

- Broadcast reliability*

  Probability for a service area that a specified performance is achieved by taking into account all transmitted frequencies.

Note 1 - In the above terms circuit means a one-way transmission from one transmitter to one receiving location.

Note 2 - The above terms are preceded by the word "basic" when the background is noise alone and by "overall" when the background is noise and interference.

Note 3 - When the background is noise and interference, the above terms may relate either to the effects of a single interferer or to multiple interference from co-channel and adjacent-channel transmissions.

Note 4 - A given value of signal-to-noise ratio or signal-to-(noise and interference) ratio is the specified performance.

Note 5 - The above terms relate to one or more periods of time which shall be stated.

* Note - This definition is applicable only to the HF broadcasting service.

2.8 Terms relating to field-strength

- Minimum usable field-strength (E_{min})*

Minimum value of the field-strength necessary to permit a desired reception quality, under specified receiving conditions, in the presence of natural and man-made noise, but in the absence of interference from other transmitters.

- Usable field-strength (E_u)*

Minimum value of the field-strength necessary to permit a desired reception quality, under specified receiving conditions, in the presence of noise and interference, either in an existing situation or as determined by agreements or frequency plans.

- Reference usable field-strength (E_{ref})

The agreed value of the usable field-strength that can serve as a reference or basis for frequency planning.

2.9 Terms relating to the ratio of wanted and unwanted signals

- Audio-frequency (AF) signal-to-interference ratio

The ratio (expressed in dB) between the values of the voltage of the wanted signal and the voltage of the interference, measured under specified conditions*, at the audio-frequency output of the receiver.

- Audio-frequency (AF) protection ratio

The agreed minimum value of the audio-frequency signal-to-interference ratio considered necessary to achieve a subjectively-defined reception quality.

- Radio-frequency (RF) wanted-to-interfering signal ratio

The ratio, expressed in dB, between the values of the radio-frequency voltage of the wanted signal and the interfering signal, measured at the input of the receiver under specified conditions**.

---

* The terms "minimum usable field strength" and "usable field strength" refer to the specified field strength values which a wanted signal must have in order to provide the required reception quality.

In determining whether these requirements are met, the median value (50%) of a fading signal should be used.

** The specified conditions include such diverse parameters as : spacing ΔF of the wanted and interfering carrier, emission characteristics (type of modulation, modulation depth, carrier-frequency tolerance, etc.), receiver input level, as well as the receiver characteristics (selectivity, susceptibility to cross-modulation, etc.).

- Radio-frequency (RF) protection ratio

  The value of the radio-frequency wanted-to-interfering signal ratio that enables the audio-frequency protection ratio to be obtained at the output of the receiver under specified conditions*.

- Relative radio-frequency protection ratio

  The difference, expressed in decibels, between the protection ratio when the carriers of the wanted and unwanted transmitters have a frequency difference of ΔF (Hz or kHz) and the protection ratio when the carriers of these transmitters have the same frequency.

- Selectivity of a receiver

  A measure of its ability to discriminate between a wanted signal to which the receiver is tuned and unwanted signals on other frequencies.

- Sensitivity of a receiver

  A measure of its ability to receive weak signals and to produce an output having usable strength and acceptable quality.

- Noise-limited sensitivity of a receiver

  The ability of the receiver's radio-frequency part to receive weak signals. It is equal to the minimum level of the radio-frequency input signal, expressed in dB(μV/m) modulated 30% at the standard reference frequency, which produces in the output power a chosen values of AF signal-to-noise ratio.

2.10 Terms relating to coverage and service area

- Coverage area (of a broadcasting transmitter in a given broadcasting band) :

  The area within which the field-strength of a wanted transmission is equal to or greater than the usable field-strength. In the case of fluctuating interference or noise, the percentage of time during which this condition is satisfied should be stated.

- Service area

  The area associated with a station for a given service and a specified frequency under specified technical conditions where radiocommunications may be established with existing or projected stations and within which the protection afforded by a frequency assignment or allotment plan or by any other agreement must be respected.

---

* The specified conditions include such diverse parameters as : spacing ΔF of the wanted and interfering carrier, emission characteristics (type of modulation, modulation depth, carrier-frequency tolerance, etc.), receiver input level, as well as the receiver characteristics (selectivity, susceptibility to cross-modulation, etc.).

CHAPTER 3

TECHNICAL CRITERIA

3.1 Double sideband (DSB) system specifications

After a review of administrations' proposals and the study of this matter by the CCIR, the Conference adopted the following double sideband (DSB) system specifications.

3.1.1 Transmission characteristics

3.1.1.1 Audio-frequency bandwidth

The upper limit of the audio-frequency bandwidth of the transmitter shall not exceed 4.5 kHz and the lower limit shall be 150 Hz, with an attenuation of 6 dB per octave for frequencies lower than 150 Hz.

3.1.1.2 Necessary bandwidth

The necessary bandwidth is twice the audio-frequency bandwidth.

3.1.1.3 Characteristics of modulation processing

The audio-frequency signal shall be processed so that the modulating signal retains a dynamic range of not less than 20 dB. Excessive amplitude compression, together with improper peak limitation, leads to excessive out-of-band radiation and thus to adjacent channel interference, and is therefore to be avoided.

3.1.2 Channel spacing

Channel spacing for double sideband (DSB) shall be 10 kHz.

In the interest of spectrum conservation, it is also permissible to interleave double sideband transmissions midway between two adjacent channels, i.e. with 5 kHz separation between carrier frequencies, provided that the interleaved transmission is not to the same geographical area as either of the transmissions between which it is interleaved.

When single sideband (SSB) transmissions are introduced the channel spacing shall become 5 kHz.

3.1.3 Nominal carrier frequencies

Carrier frequencies shall be integral multiples of 5 kHz, for both DSB and SSB transmissions.

3.1.4 Receiver characteristics

3.1.4.1 Overall selectivity of the receiver

The overall selectivity of the receiver as shown in Figure [1] below, shall be used for planning purposes.

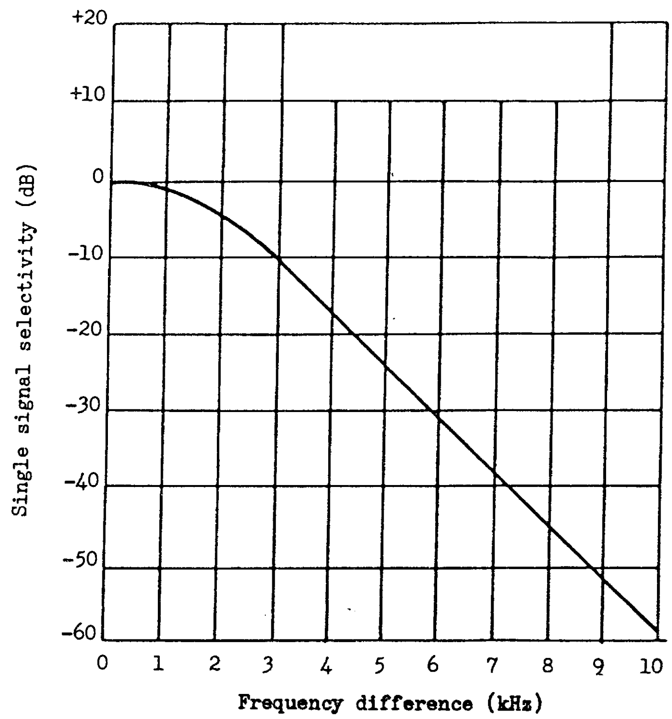

FIGURE [1/3.1.4]

Overall frequency response of the reference receiver

3.1.4.2 Noise limited sensitivity of the receiver

[Text will follow.]

3.2 Propagation, radio noise and solar index

3.2.1 [Text will follow.]

3.2.2 Atmospheric and man-made radio noise data

3.2.2.1 Atmospheric radio noise data

The hourly median values of atmospheric noise intensity as contained in CCIR Report 322-2 are adopted.

The method of implementation of the data may be :

- a direct calculation as required based upon a numerical representation of the maps;

- a grid representation similar to that currently in use by the IFRB, except that the grid should have a size of 10^{o} latitude by 15^{o} longitude in all parts of the world;

- the precalculation of values appropriate for each test point.

The option selected should be such as to minimize the calculation time required during the operation of the planning method.

3.2.2.2 Man-made radio noise data

The median value of the man-made noise power (F_{am}) to be adopted, expressed in dB above thermal noise at T_o = 288K, is given by :

$$F_{am} = 60.4 - 28.15 \log f$$

where f is the frequency in MHz.

3.2.2.3 The combination of atmospheric and man-made noise

In each case the values of atmospheric noise and man-made noise intensities shall be compared and the greater one shall be used.

3.2.3 Signal fading

3.2.3.1 Short-term (within the hour) fading

The upper-decile amplitude deviation from the median of a single signal is to be taken as 5 dB and the lower-decile deviation is to be taken as 8 dB.

3.2.3.2 Long-term (day-to-day) fading

The magnitude of the long-term fading, as determined by the ratio of the operating frequency to the basic MUF, is given in Table /̲ I.3.2.3_/.

TABLE /̲ I/3.2.3_/

Decile deviations from the predicted monthly median value of signal field strength, in dB, arising from day-to-day variability

Corrected geomagnetic latitude[1]	< 60°		≥ 60°	
Transmitting frequency/ predicted basic MUF	Lower decile	Upper decile	Lower decile	Upper decile
≤ 0.8	-8	6	-11	9
1.0	-12	8	-16	11
1.2	-13	12	-17	12
1.4	-10	13	-13	13
1.6	-8	12	-11	12
1.8	-8	9	-11	9
2.0	-8	9	-11	9
3.0	-7	8	-9	8
4.0	-6	7	-8	7
≥ 5.0	-5	7	-7	7

Note 1 - If any point on that part of the great circle which passes through the transmitter and the receiver and which lies between control points located 1,000 km from each end of the path reaches a corrected geomagnetic latitude of 60° or more, the values for ≥ 60° have to be used. The relationship of corrected geomagnetic latitude to the geographical coordinates is shown in Figures /̲ 1 and 2_/.

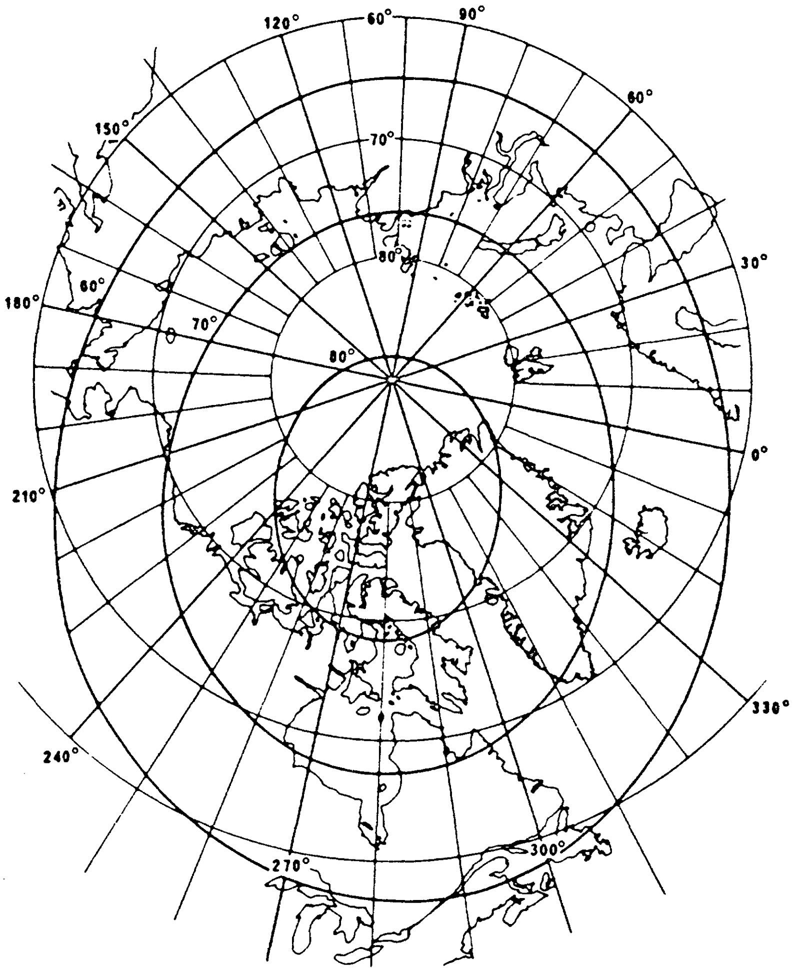

FIGURE [1/3.2.3]

Corrected geomagnetic latitude in the northern hemisphere

(Geographic latitude and longitude are also displayed for reference)

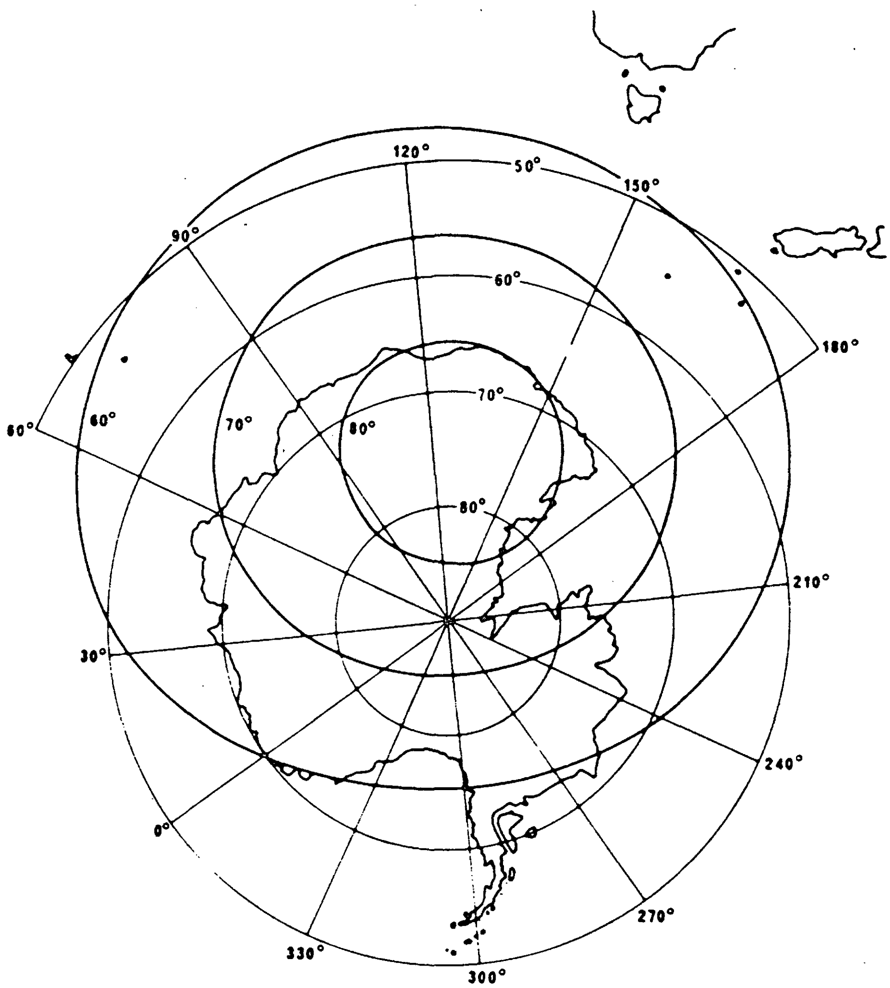

FIGURE [2/3.2.3]

Corrected geomagnetic latitude in the southern hemisphere

3.2.5 Values of the appropriate solar index and the seasonal periods on the basis of which planning shall be carried out.

3.2.5.1 Seasonal divisions of the year and representative months

The year shall be sub-divided into four seasons for propagation prediction purposes. These seasons are listed in the Table [I/3.2.5]. When predictions are made for a single month to represent a season, the month selected shall be as indicated in the second column of the Table.

TABLE [I/3.2.5]

Season	Representative month
November-February	January
March-April	April
May-August	July
September-October	October

3.2.5.2 Solar index values

[Text will follow.]

3.3 Radio-frequency protection ratios

After a careful review of administrations' proposals and the extensive study of this matter by the CCIR, the Conference adopted Recommendations which take account of subjective tests comparing the quality of listener satisfaction for various protection ratio levels. The decisions taken also took account of the fact that the number of requirements and the limited amount of allocated spectrum space would require a reduction of the desired protection ratio commensurate with the number of requirements to be satisfied. With these considerations in mind, the following decisions were made.

3.3.1 Co-channel protection ratios and frequency tolerances

For stable conditions where the frequency difference between wanted and unwanted carriers does not exceed 100 Hz, the value of 27 dB is adopted as a value to be achieved if feasible. If this protection ratio value is unobtainable, the values in figure [B] provide planners with advice on the resultant quality of service when protection ratios are less than 27 dB.

Transmitter frequency tolerances are contained in Appendix 7 of the Radio Regulations. To make sure that the frequency difference between wanted and unwanted carriers referred to above does not exceed 100 Hz, administrations are urged to use a frequency tolerance of no more than ± 50 Hz.

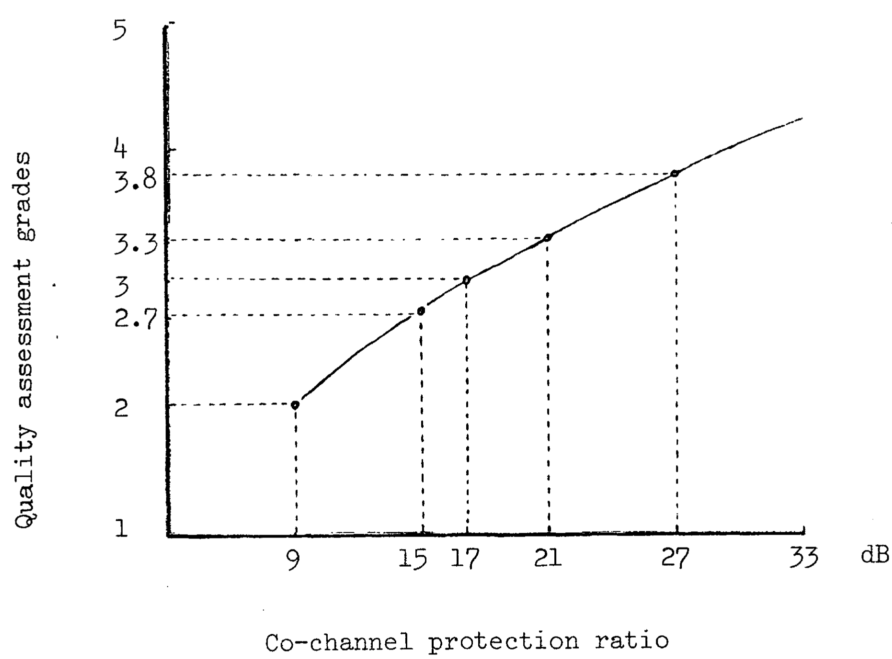

FIGURE [B/3.3.1]

Relationship between reception quality and co-channel RF protection ratio

Table /‾C_7 indicates the five quality and impairment assessment grades.

TABLE /‾C/3.3.1_7

Quality	Impairment
5 Excellent 4 Good 3 Fair 2 Poor 1 Bad	5 Imperceptible 4 Perceptible, but not annoying 3 Slightly annoying 2 Annoying 1 Very annoying

3.3.2 Relative values of protection ratio as a function of carrier frequency separation

Once a value for the co-channel radio-frequency protection ratio has been determined, the radio-frequency protection ratio, expressed as a function of the carrier frequency spacing, shall be determined by adding the value given in the curve in Figure /‾C_7 to the value of the co-channel RF protection ratio.

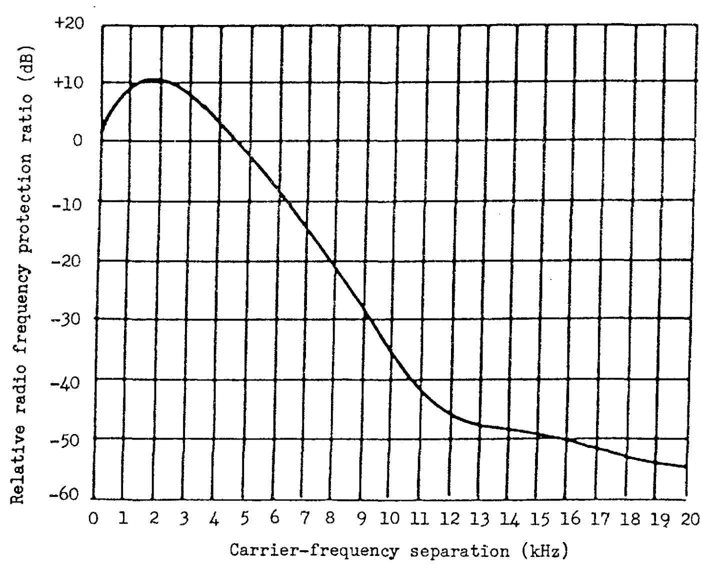

FIGURE /‾C/3.3.2_7

Relative value of the radio-frequency protection ratio as a function of the carrier-frequency separation

3.4 /‾Text will follow._7

3.5 Antennas and power

The combined effect of transmitter power and antenna characteristics which determines the equivalent isotropically radiated power (e.i.r.p.), is the main factor in computations for HF broadcasting planning. The most directional antenna possible which is appropriate to the broadcasting requirement should be chosen when selecting power and associated antennas. The power required must be as low as possible to achieve broadcasting objectives.

3.5.1 Characteristics of antennas to be used for planning

[Text will follow.]

3.5.2 Transmitter power and equivalent isotropically radiated power appropriate for satisfactory service

The propagation prediction method described in section 3.3.1 shall be used to determine the appropriate transmitter power to achieve satisfactory service. The appropriate transmitter power varies with propagation conditions which in turn are functions of the time of day, the season and the solar cycle period as well as the geographical location.

[Additional texts will follow pending Committee 4 actions.]

3.6 Use of synchronized transmitters

3.6.1 The use of synchronized transmitters, where appropriate, is an efficient means of economizing frequency spectrum. When synchronized transmitters are used, the carrier frequency difference shall be 0.1 Hz or less when the same programme is broadcast to partially overlapping or non-overlapping service areas.

3.6.2 Protection ratios in the range of 3 to 11 dB give satisfactory reception when the carrier frequency difference is 0.1 Hz or less. For planning purposes a value of 8 dB shall be used.

When the synchronized transmitters are driven by a common oscillator and use antennas with similar vertical radiation characteristics, a lower protection ratio of 3 dB shall be adopted for planning.

INTERNATIONAL TELECOMMUNICATION UNION

BLUE PAGES

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 115-E
24 January 1984

B.1

PLENARY MEETING

FIRST SERIES OF TEXTS SUBMITTED BY THE
EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for first reading :

Source	Document	Title
COM.4	93	Chapter 2 - Definitions
COM.4	107	Chapter 3 - Technical criteria
		Paragraph - Paragraph 3.1.5
		3.1.6
		3.2.4, 3.2.4.1

Marie HUET
Chairman of Committee 6

Annex : 7 pages

CHAPTER 2

DEFINITIONS

The First Session of the Conference adopted the following definitions. It also noted certain definitions contained in the Radio Regulations, Geneva, 1979 (identified by their RR number). /** /

2.1 Terms relating to emission

- Emission (RR 132)
- Class of emission (RR 133)
- Single-sideband emission (RR 134)
- Full-carrier single-sideband emission (RR 135)
- Reduced-carrier single-sideband emission (RR 136)
- Reduced carrier

  Carrier emitted at a power level reduced by at least 6 dB below the peak envelope power.
- Suppressed-carrier single-sideband emission (RR 137)
- Out-of-band emission (RR 138)

2.2 Term relating to frequency

- Frequency tolerance (RR 145)

2.3 Term relating to bandwidth

- Necessary bandwidth (RR 146)

2.4 Terms relating to power

- Power (RR 150)
- Peak envelope power (RR 151)
- Mean power (RR 152)
- Carrier power (RR 153)
- Gain of an antenna (RR 154)
- Equivalent isotropically radiated power (e.i.r.p.) (RR 155)
- Effective radiated power (e.r.p.) (RR 156)

2.5 Term relating to zones of reception

- Geographic zones for broadcasting* (Appendix 1 of RR)

* Commonly known as CIRAF zones.

/** Note from Committee 4 to the Editorial Committee - Some of the definitions from the RR may not be required in the final version of the Report of the First Session. /

2.6 Terms relating to propagation

- Operational MUF*

  The highest frequency that would permit acceptable operation of a radio service between given terminals at a given time under specified working conditions (such as antenna types, transmitter power, class of emission and required signal-to-noise ratio).

- Optimum working frequency (OWF)*

  The lower decile of the daily values of operational MUF at a given time over a specified period, usually a month. That is, the frequency that is exceeded by the operational MUF during 90% of the specified period.

- Basic MUF*

  The highest frequency by which a radio wave can propagate between given terminals, on a specified occasion, by ionospheric refraction alone.

---

* Note - This definition is applicable only to the HF broadcasting service.

2.7 Terms relating to reliability

- Circuit reliability*

  Probability for a circuit that a specified performance is achieved at a single frequency.

- Reception reliability*

  Probability for a receiver that a specified performance is achieved by taking into account all transmitted frequencies.

- Broadcast reliability*

  Probability for a service area that a specified performance is achieved by taking into account all transmitted frequencies.

Note 1 - In the above terms circuit means a one-way transmission from one transmitter to one receiving location.

Note 2 - The above terms are preceded by the word "basic" when the background is noise alone and by "overall" when the background is noise and interference.

Note 3 - When the background is noise and interference, the above terms may relate either to the effects of a single interferer or to multiple interference from co-channel and adjacent-channel transmissions.

Note 4 - A given value of signal-to-noise ratio or signal-to-(noise and interference) ratio is the specified performance.

Note 5 - The above terms relate to one or more periods of time which shall be stated.

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* Note - This definition is applicable only to the HF broadcasting service.

2.8 Terms relating to field-strength

- Minimum usable field-strength (E_{min})*

  Minimum value of the field-strength necessary to permit a desired reception quality, under specified receiving conditions, in the presence of natural and man-made noise, but in the absence of interference from other transmitters.

- Usable field-strength (E_u)*

  Minimum value of the field-strength necessary to permit a desired reception quality, under specified receiving conditions, in the presence of noise and interference, either in an existing situation or as determined by agreements or frequency plans.

- Reference usable field-strength (E_{ref})

  The agreed value of the usable field-strength that can serve as a reference or basis for frequency planning.

2.9 Terms relating to the ratio of wanted and unwanted signals

- Audio-frequency (AF) signal-to-interference ratio

  The ratio (expressed in dB) between the values of the voltage of the wanted signal and the voltage of the interference, measured under specified conditions*, at the audio-frequency output of the receiver.

- Audio-frequency (AF) protection ratio

  The agreed minimum value of the audio-frequency signal-to-interference ratio considered necessary to achieve a subjectively-defined reception quality.

- Radio-frequency (RF) wanted-to-interfering signal ratio

  The ratio, expressed in dB, between the values of the radio-frequency voltage of the wanted signal and the interfering signal, measured at the input of the receiver under specified conditions**.

---

* [Note will follow.]

** The specified conditions include such diverse parameters as : spacing ΔF of the wanted and interfering carrier, emission characteristics (type of modulation, modulation depth, carrier-frequency tolerance, etc.), receiver input level, as well as the receiver characteristics (selectivity, susceptibility to cross-modulation, etc.).

- Radio-frequency (RF) protection ratio

  The value of the radio-frequency wanted-to-interfering signal ratio that enables the audio-frequency protection ratio to be obtained at the output of the receiver under specified conditions*.

- Relative radio-frequency protection ratio

  The difference, expressed in decibels, between the protection ratio when the carriers of the wanted and unwanted transmitters have a frequency difference of ΔF (Hz or kHz) and the protection ratio when the carriers of these transmitters have the same frequency.

- Selectivity of a receiver

  A measure of its ability to discriminate between a wanted signal to which the receiver is tuned and unwanted signals on other frequencies.

- Sensitivity of a receiver

  A measure of its ability to receive weak signals and to produce an output having usable strength and acceptable quality.

- Noise-limited sensitivity of a receiver

  The ability of the receiver's radio-frequency part to receive weak signals. It is equal to the minimum level of the radio-frequency input signal, expressed in dB(μV/m) modulated 30% at the standard reference frequency, which produces in the output power a chosen values of AF signal-to-noise ratio.

2.10 Terms relating to coverage and service area

- Coverage area (of a broadcasting transmitter in a given broadcasting band) :

  The area within which the field-strength of a wanted transmission is equal to or greater than the usable field-strength. In the case of fluctuating interference or noise, the percentage of time during which this condition is satisfied should be stated.

- Service area

  The area associated with a station for a given service and a specified frequency under specified technical conditions where radiocommunications may be established with existing or projected stations and within which the the protection afforded by a frequency assignment or allotment plan or by any other agreement must be respected.

---

* The specified conditions include such diverse parameters as : spacing ΔF of the wanted and interfering carrier, emission characteristics (type of modulation, modulation depth, carrier-frequency tolerance, etc.), receiver input level, as well as the receiver characteristics (selectivity, susceptibility to cross-modulation, etc.).

2.11 Terms relating to planification

[Will follow]

[CHAPTER 3 - TECHNICAL CRITERIA]

3.1.5 Channel spacing

Channel spacing for double sideband (DSB) shall be 10 kHz.

In the interest of spectrum conservation, it is also permissible to interleave double sideband transmissions midway between two adjacent channels, i.e. with 5 kHz separation between carrier frequencies, provided that the interleaved transmission is not to the same geographical area as either of the transmissions between which it is interleaved. When single sideband (SSB) transmissions are introduced the channel spacing shall become 5 kHz.

3.1.6 Nominal carrier frequencies

Carrier frequencies shall be integral multiples of 5 kHz, for both DSB and SSB transmissions.

3.2.4 Values of the appropriate solar index and the seasonal periods on the basis of which planning shall be carried out.

3.2.4.1 Seasonal divisions of the year and representative months

The year shall be sub-divided into four seasons for propagation prediction purposes. These seasons are listed in the Table 3.2.4-I. When predictions are made for a single month to represent a season, the month selected shall be as indicated in the second column of the Table.

TABLE 3.2.4-1

Season	Representative month
November-February	January
March-April	April
May-August	July
September-October	October

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Corrigendum 1 to
Document 116-E
14 March 1984

COMMITTEE 4

SUMMARY RECORD

OF THE

FOURTH MEETING OF COMMITTEE 4

1. Replace paragraph 1.1.5 by the following :

"1.1.5 The delegate of India said that he shared the view of the United States delegate and recalled that his country had proposed that in the evaluation of the minimum available field strength the man-made noise should not be taken into account. By way of compromise, he was prepared to agree to a curve lying between curves C and D."

2. In paragraph 1.1.12, replace the last sentence by :

"He suggested that the second formula between square brackets in section 3.2.2.2 should be submitted to the Plenary Meeting."

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 116-E
27 January 1984
Original : French

COMMITTEE 4

SUMMARY RECORD

OF THE

FOURTH MEETING OF COMMITTEE 4

Tuesday, 24 January 1984, at 0905 hrs

Chairman : Mr. J. RUTKOWSKI (People's Republic of Poland)

Subjects discussed :		Document
1.	Report of Working Group 4A	110
2.	Reports of Working Group 4B	109, 112, 113
3.	Note from the Chairman of Committee 5 to the Chairman of Committee 4	106
4.	Second and fourth reports of Working Group 4B	99, 104

1. Report of Working Group 4A (Document 110)

1.1 The Chairman of Working Group 4A introduced the first part of Document 110, i.e. section 3.2.2 : Atmospheric and man-made radio noise data. With regard to section 3.2.2.1 - Atmospheric radio noise data - the choice between the three options proposed would depend on subsequent decisions of the Conference. All three methods were equally acceptable and would not appreciably affect the results obtained.

As to section 3.2.2.2 - Man-made radio noise data - it was a matter of choosing, from the two expressions in square brackets, the one which gave the median value of man-made noise power (F_{am}). Both expressions had been taken from CCIR Report 258-4, the first corresponding to curve C and the second to a compromise between curves C and D. During the meetings of Working Group 4A, a majority had favoured the second expression although certain administrations preferred the first, which gave a higher value.

1.1.1 The Chairman opened the discussion on sections 3.2.2.1 and 3.2.2.2.

Since section 3.2.2.1 elicited no comments, it was approved.

1.1.2 The delegate of the United States said that after a thorough review of the question raised in section 3.2.2.2, his delegation was prepared to accept a compromise between curves C and D.

1.1.3 The delegate of the USSR said that his delegation could not accept such a compromise and recalled that the curves in the CCIR Report were based on measurements taken about ten years previously. Since then the man-made noise level had considerably increased and that factor had to be taken into account. The value corresponding to curve C was the minimum acceptable to his delegation.

1.1.4 The delegate of Poland proposed that both the curves indicated should be adopted and that each country should choose whichever suited it.

1.1.5 The delegate of India said that he shared the view of the United States delegate and recalled that his country had proposed that only the minimum field strength, not man-made noise, should be taken into account. By way of compromise, he favoured a curve lying between curves C and D.

1.1.6 The delegate of Iran agreed; his Administration could not accept two values as the delegate of Poland had suggested.

1.1.7 The Chairman of the Conference stressed the need for an immediate decision in order to advance the work of the Conference.

1.1.8 He was supported by the delegates of Iran, Italy, Korea, Canada, the Netherlands and Cameroon.

1.1.9 The Chairman, supported by the delegate of the German Democratic Republic, proposed that the suggestion by the Chairman of the Conference should be adopted.

It was so decided.

1.1.10 The delegate of China said that he could accept a compromise between curves C and D. The question of man-made noise was dealt with in the Radio Regulations and administrations were required to take appropriate measures to avoid all harmful interference.

1.1.11 The delegates of Algeria, Yugoslavia, Brazil, Indonesia, France, Japan, Korea, Oman, the Federal Republic of Germany, the Netherlands, Cameroon, Kenya, Saudi Arabia, Pakistan and Malawi favoured the compromise solution proposed by the United States delegate.

1.1.12 The Chairman said that most of the delegates present seemed to favour the compromise solution between curves C and D while others preferred to keep curve C. That suggested that Committee 4 was in favour of the compromise solution which took practically no account of man-made noise. He suggested that the two formulae between square brackets in section 3.2.2.2 should be submitted to the Plenary Meeting.

It was so decided.

1.1.13 The delegate of the USSR reserved the right of his delegation to revert to the matter at the Plenary Meeting.

1.2 The Chairman of Working Group 4A introduced the second part of Document 110, i.e. section 3.2.3 : Signal fading. The Working Group had decided to use the data supplied by the CCIR and to indicate two values, one for short-term and the other for long-term fading. The latter was supplemented by a table taken from the CCIR report to the Conference. The footnote to the table had been amended and two figures taken from CCIR Reports had been added.

1.2.1 The delegate of Brazil proposed, in view of the work of Interim Working Party 6/12 and of the Conference itself, that the footnote should be slightly amended to read :

"**Note 1 - If the pole-ward extreme of the great circle between transmitter and receiver, considered between the control points located 1,000 km from each end of the path, reaches a corrected geomagnetic latitude of 60° or greater, the values for ≥ 60° have to be used. The relationship of corrected geomagnetic latitude to geographical coordinates is shown in Figures [1 and 2].**"

His proposal was welcomed by the Chairman of Working Group 4A who suggested that it be adopted.

It was so decided.

1.2.2 The delegate of Iran recalled that his delegation had proposed that Working Group 4A should insert in the document Table 4-II in the CCIR Report. The Chairman of Working Group 4A replied that the Table would be included in the document, a complete version of which would be submitted to Committee 4 at its next meeting.

1.3 The Chairman of Working Group 4A invited Committee 4 to discuss the characteristic to be taken into consideration for noise variability : while intrinsic noise in the receiver hardly varied, the same was not true of man-made and atmospheric noise. The characteristic was needed to calculate basic circuit reliability. The value adopted for the upper and lower deciles had to be known for stage 13 of the calculations. Provisionally, that value was given as [X] dB in Document DT/23. Two values had been proposed, namely, 0 dB (supported by most participants) and 3 dB (advocated by a small group of delegations).

1.3.1 After an exchange of views between the Chairman, who feared that delegations had not had time to take cognizance of Document DT/23, and the Chairman of Working Group 4A, the Chairman of the Conference urged the Committee to take an immediate decision on the matter in order to advance the work of the Conference.

1.3.2 The delegate of Iran supported the Chairman of the Conference and proposed that a value of 0 dB be adopted for stage 13 of the basic circuit reliability calculation.

1.3.3 He was supported by the delegates of Japan, India, the United Kingdom, Indonesia, Brazil, Algeria, China, the United States of America, Yugoslavia and Chile.

1.3.4 While recognizing that the adoption of either value would not lead to major numerical differences, the delegate of the USSR said that a question of principle arose because, if the value 0 dB was adopted, a noise variability would no longer be taken into consideration at all. By way of compromise, he proposed that the value 3 dB be adopted whenever atmospheric noise predominated; the value 0 dB was acceptable in other cases. The proposal reflected the physical reality yet introduced no major difference in the final result of the calculations.

1.3.5 He was supported by the delegate of Bulgaria and by the delegate of Paraguay who said that he would nonetheless be prepared to accept the value 0 dB.

1.3.6 The Chairman noted that a majority of delegations favoured a value of 0 dB and suggested that it should be inserted in Document DT/23.

It was so decided.

2. Reports of Working Group 4B (Documents 109, 112, 113)

2.1 The Chairman of Working Group 4B said that his Group had held two further meetings and recalled that Sub-Groups 4B-3, 4B-4, 4B-5 and 4B-6 had been set up to permit an exchange of views between administrations. Sub-Group 4B-1 had met throughout the preceding week and had transmitted its conclusions to Working Group 4B.

The following documents were submitted for approval :

2.2 Document 109 : As there were no comments, the document was approved and is to be transmitted to the Editorial Committee.

2.3 Document 112 : Sections 3.1.2 and 3.1.3 had already been approved by Committee 4. Both points 3.1.4.1 (with Figure 1) and 3.1.4.2 in section 3.1.4 (Receiver characteristics) were submitted for approval. Sub-Group 4B-2 was still considering the question raised in section 3.5.1 and would be reporting later; the result of certain discussions on the power required was set out in section 3.5.2.

2.4 The Chairman said that point 3.1.4.2 would be considered under agenda item 5 and that sections 3.5.1 and 3.5.2 had been inserted to give an overall idea of the text.

2.5 The delegate of Paraguay said that the Spanish title of point 3.1.4.2 should be aligned with the English. He was assured by the Chairman that Committee 6 would be asked to make the amendment.

Document 112 was approved.

2.6 The Chairman of Working Group 4B introduced Document 113. He recalled that the definitions of minimum usable field strength and usable field strength had already been approved but that a footnote remained to be inserted on page 3 of Document 107. The second paragraph of the footnote should read "... is considered to have the appropriate characteristic".

Document 113 was approved.

3. Note from the Chairman of Committee 5 to the Chairman of Committee 4 (Document 106)

The Chairman opened a general discussion on the note from the Chairman of Committee 5.

3.1 The delegate of the United States noted that, with regard to the first of the six parameters, Committee 4 had already adopted a document setting out several values for the co-channel protection ratio with a table showing what they signified in terms of quality assessment. As to the other five parameters, he doubted whether, in view of their interdependence, it would be possible to establish values different from those in the existing documentation.

3.2 The delegate of Brazil said that there were two aspects to the question. First, the technical parameters adopted could be considered with a view to identifying those likely to introduce variables in the planning process, e.g. the co-channel protection ratio, which would certainly have to be modified at the second session. Broadcast reliability might be among the other variable parameters. Second, acceptable minimum values should be decided upon for those parameters which might be modified. The United States delegate had mentioned the table relating to protection ratios, but Committee 5 still needed other values which Committee 4 regarded as minimal for good quality service. For instance, a minimum of 17 dB might be accepted for the protection ratio. The list submitted by Committee 5 was not exhaustive; the second parameter considered should be broadcast reliability.

3.3 The delegate of India agreed with some of the remarks made by the delegate of Brazil. It was possible to identify other parameters for which minimum values could be specified, e.g. the adjacent channel protection ratio and the man-made noise level.

3.4 The delegate of the Netherlands pointed out that the values already adopted by Committee 4 lay just at the minimum acceptable level; it was hardly possible to go further.

3.5 The delegate of Sweden agreed with the previous speaker. The protection ratio (Figure B and Table C, page 3 of Document 109) recommended by Committee 4 corresponded to good guality and "perceptible but not annoying" impairment, or even less. He proposed that values should be found corresponding to the grade immediately below, i.e. "fair" quality and "slightly annoying" impairment. The co-channel protection ratio corresponding to that grade was 17 dB.

3.6 The delegate of the United Kingdom agreed with the Netherlands delegate and, to some extent, the delegate of Sweden. However, if the values already agreed were to be reconsidered, there would be insufficient time to discuss all the questions before the end of the Conference.

3.7 The Chairman suggested that an ad hoc Working Group should be set up at a later stage to select the technical parameters to be taken into consideration. Those parameters should be submitted in a separate document formulating the conclusions of Committee 4.

It was so decided.

4. Second and fourth reports of Working Group 4B (Documents 99 and 104)

4.1 The Chairman suggested that both documents should be considered jointly since the parameters in question (noise-limited sensitivity of the receiver and AF signal-to-noise ratio) were closely linked.

4.2 The delegate of the United States supported by the delegate of Canada, considered that all the values formed a whole and logically should be considered as such. In view of the discussions in Working Group 4B, he would be prepared to accept as a compromise a value of 100 µv/m for noise-limited sensitivity of the receiver, provided that the AF signal-to-noise ratio was equal to 30 dB.

4.3 The delegate of India, supported by the delegates of Algeria and Yugoslavia, said that in fact all the values were interdependent. It would be better to discuss the two parameters separately.

4.4 The delegate of the USSR disagreed. Both parameters could and should be considered jointly since they determined the signal-to-noise ratios obtained by adding all sources of noise. The United States proposal was reasonable and acceptable as a compromise.

4.5 The delegate of Brazil said he hoped that a consensus would be reached not only on the two parameters but on all the other parameters. The United States proposal did not cover all the parameters to be considered in calculating both the minimum field strength and the field strength to be used for planning purposes. Some proposals favoured the adoption of 3 dB above the minimum field strength as a reference value. In order to achieve a consensus, those proposals would have to be withdrawn; otherwise the problem could not be solved.

4.6 The Chairman said that receiver sensitivity was measured under specific signal-to-noise ratio conditions.

4.7 The delegate of Thailand supported the view expressed by the Chairman and by the delegations of the United States and the USSR. According to CCIR Document 22, the sensitivity measurements had given a value of 26 dB for the signal-to-noise ratio and he was prepared to accept that as a compromise.

4.8 The delegate of Sweden supported by the delegates of the Federal Republic of Germany and Syria, suggested that the Committee should first establish an AF signal-to-noise ratio and then a sensitivity value. Since the CCIR report informally recommended a value of 30 dB and the tests conducted in India had given a value of 21 dB, he proposed that a compromise value of 26 dB should be adopted.

4.9 The delegate of Brazil, supported by the delegates of Pakistan and Mexico, said that the high powers required for broadcasting in tropical regions made it impossible to adopt certain values for those parameters. The value of 21 dB proposed by India was acceptable.

4.10 Raising a point of order, the delegate of the USSR recalled that no decision had been taken as to whether the two parameters should be considered jointly or separately.

4.11 The Chairman considered that no decision could be reached even if the meeting were extended. Delegations held differing views on the correlation between the two parameters in question, some wishing them to be considered jointly, others separately. It had also been proposed that the AF signal-to-noise ratio should be considered first and noise-limited sensitivity of the receiver afterwards.

In the circumstances, he suggested that further discussion should be deferred until the Committee's next meeting on Monday, 30 January, in order to allow the delegations concerned time to consult one another on the matter.

It was so decided.

The meeting rose at 1200 hours.

The Secretaries :

G. KOVACS

G. ROSSI

The Chairman :

J. RUTKOWSKI

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Corrigendum 1 to
Document 117-E
2 April 1984
Original : English

COMMITTEE 5

SUMMARY RECORD

OF THE

FOURTH MEETING OF COMMITTEE 5

Replace paragraph 2.3 by the following :

"2.3 The delegate of the Islamic Republic of Iran fully endorsed the view that all administrations should seek a common understanding and degree of compromise. He also considered that no further work should be assigned to ad hoc Group 5A-2, which was already overloaded. Lastly, he proposed that the planning principles set out in Document DT/10(Rev.2) be taken as provisionally adopted in ad hoc Group 5A-2 since there were other elements of principle which had not yet been discussed or adopted, and be dealt with fully in Working Group 5A. Only after those remaining principles had been approved by that Working Group should it be submitted to Committee 5."

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 117-E
27 January 1984
Original : English

COMMITTEE 5

SUMMARY RECORD

OF THE

FOURTH MEETING OF COMMITTEE 5

(PLANNING)

Tuesday, 24 January 1984, at 1600 hrs

Chairman : Mr. IRFANULLAH (Islamic Republic of Pakistan)

Subjects discussed	Document
1. Organization of work	-
2. Oral report by the Chairman of Working Group 5A	-

1. Organization of work

1.1 The delegate of the United Kingdom, supported by the delegate of the Federal Republic of Germany, proposed that the meeting consider Document 108 ("Proposal for a further planning principle"). If necessary, the Committee might decide during its discussions on the subject to pass the document on to one of its Working Groups.

1.2 The delegate of Algeria, supported by the delegates of the USSR, Bulgaria, German Democratic Republic and Canada, considered that Document 108 should initially be dealt with in Working Group 5A rather than in Committee 5.

After some discussion, it was decided that Document 108 was to be transmitted directly to Working Group 5A for consideration at the following meeting of that Working Group.

2. Oral report by the Chairman of Working Group 5A

2.1 The Chairman of Working Group 5A informed the Committee that an ad hoc Group 5A-2, comprising 13 administrations and chaired by Mr. Railton from Papua New Guinea, had been set up to study a planning method and to examine and draft a number of planning principles for submission to Working Group 5A. No report had yet been received from the ad hoc Group, but he had been advised that progress was slow in view of the extremely difficult nature of the task entrusted to the Group and the widely diverging positions of delegations.

Working Group 5A itself was endeavouring to develop and approve a programme for the progressive introduction of SSB transmissions (agenda item 4.2.4). With regard to agenda item 4.2.6, it had been decided that the theoretical capacity of high frequency broadcasting bands came more within the terms of reference of Committee 4. However, he had been instructed to stress the importance of that Question for ensuring the efficient use of the spectrum. Consensus had been reached on a number of planning principles, which were set out in Document DT/10(Rev.2). In order to expedite work, that document might be submitted to Committee 5 as a white document. Working Group 5A had also considered some definitions, in particular those in Document 88. Examination of the terms "broadcasting requirements", "national HF broadcasting" and "international HF broadcasting" had been deferred. It had been decided that there was no need to define "national broadcasting station" and "international broadcasting station". A partial definition for the expression "required service area" had been developed and approved by the majority of delegations, although one administration had reservations which would be put before Committee 5 at the appropriate time.

2.2 The Chairman of Committee 5 expressed concern that no consensus seemed to be emerging on planning methods, which were the key to the success of the whole Conference. He thus appealed to all delegations to show a willingness to compromise and to endeavour to find areas of agreement. Similarly, some of the definitions still pending were holding up the approval of a number of important documents. He therefore urged that work on those definitions, as well as the work of ad hoc Group 5A-2, be expedited as far as possible.

2.3 The delegate of the Islamic Republic of Iran fully endorsed the view that all administrations should seek a common understanding and degree of compromise. He also considered that no further work should be assigned to ad hoc Group 5A-2, which was already overloaded. Lastly, he proposed that the planning principles set out in

Document DT/10(Rev.2) be taken as a package deal and that the document be dealt with fully in Working Group 5A. Only after being approved by that Working Group should it be submitted to Committee 5.

2.4 The Chairman of the Conference drew attention to the general schedule of the work of the Conference contained in Document 74, which showed that the Working Groups of Committee 5 were expected to complete their work by Thursday, 2 February. It was most important therefore that administrations should work on compromise solutions and cease to press their own initial proposals.

2.5 The delegate of Jamaica said that, as his delegation did not participate in ad hoc Group 5A-2, it would be helpful to know what progress that Group was making and how soon it could be expected to complete its work. His delegation supported the proposal to convert Document DT/10(Rev.2) into a white document immediately, since several of the principles contained therein had been determined on the basis of consensus, the outstanding problems being definitions.

2.6 The delegates of Botswana and the USSR also supported that view.

2.7 The Chairman said that when ad hoc Group 5A-2 had made some significant progress, it would report orally to Working Group 5A, which would in turn report to Committee 5. Replying to points raised by the delegates of India and the United Kingdom, he agreed that a short meeting of Working Group 5A would have to be held the following day to consider Document 108. That Group might also consider which of the two proposed courses of action should be taken in respect of Document DT/10(Rev.2). The remainder of the meeting time that day could be devoted to ad hoc Group 5A-2. Committee 5 meetings for the following week would be programmed in the light of the progress of work and the schedule contained in Document 74.

The meeting rose at 1715 hours.

The Secretary : J. DA SILVA

The Chairman : Mr. IRFANULLAH

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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24 January 1984
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COMMITTEE 2

SECOND REPORT OF THE WORKING GROUP OF COMMITTEE 2

(CREDENTIALS)

The Working Group of Committee 2 held a second meeting on 24 January 1984 to examine the Credentials of the following delegations :

BYELORUSSIAN SOVIET SOCIALIST REPUBLIC

BOLIVIA (Republic of) *

BOTSWANA (Republic of)

CHILE

IVORY COAST (Republic of the)

GABONESE REPUBLIC

MALAWI

MALI (Republic of)

DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA

RWANDESE REPUBLIC

TANZANIA (United Republic of)

UNION OF SOVIET SOCIALIST REPUBLICS

YEMEN (People's Democratic Republic of)

The Credentials of these delegations were all found to be in order.

N. TCHIMINA
Chairman of the Working Group C2-A

* Provisional Credentials

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

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COMMITTEE 6

THIRD SERIES OF TEXTS FROM

COMMITTEE 4 TO THE EDITORIAL COMMITTEE

The texts reproduced in Annexes 1 to 4 to this document were adopted in Committee 4 and are hereby submitted to the Editorial Committee.

J. RUTKOWSKI
Chairman of Committee 4

Annexes : 4

ANNEX 1

3.2 Propagation, radio noise and solar index

. . . .

3.2.2 Atmospheric and man-made radio noise data

3.2.2.1 Atmospheric radio noise data

The hourly median values of atmospheric noise intensity as contained in CCIR Report 322-2 are adopted.

The method of implementation of the data may be :

- a direct calculation as required based upon a numerical representation of the maps;

- a grid representation similar to that currently in use by the IFRB, except that the grid should have a size of 10° latitude by 15° longitude in all parts of the world;

- the precalculation of values appropriate for each test point.

The choice from these options should be such as to minimize the calculation time required during the operation of the planning method.

3.2.2.2 Man-made radio noise data

The median value of man-made noise power F_{am} expressed in dB above thermal noise at T_o = 288K, to be adopted is given by :

$$F_{am} = 60.4 - 28.15 \log f$$

where f is the frequency in MHz.

3.2.2.3 The combination of atmospheric and man-made noise

In each case the values of atmospheric noise and man-made noise intensities shall be compared and the greater one shall be used.

3.2.3 Signal fading

3.2.3.1 Short-term (within the hour) fading

The upper-decile amplitude deviation from the median of a single signal is to be taken as 5 dB and the lower-decile deviation is to be taken as 8 dB.

3.2.3.2 Long-term (day-to-day) fading

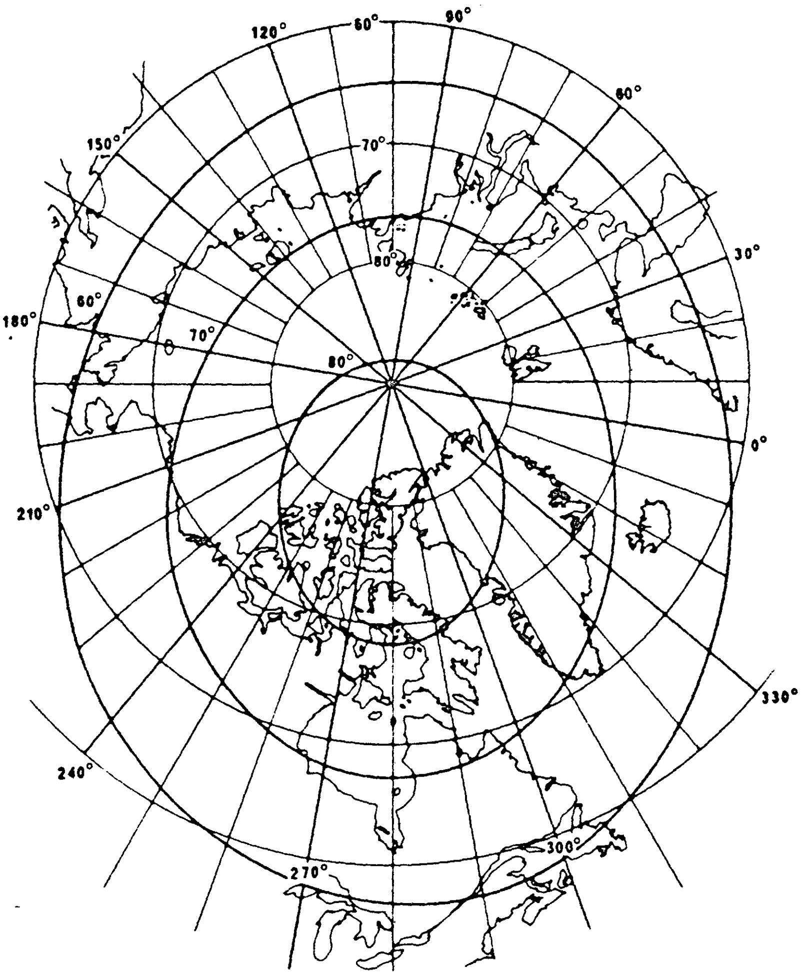
The magnitude of the long-term fading, as determined by the ratio of operating frequency to basic MUF is given in Table 3.3.3-I.

TABLE 3.3.3-I

Decile deviations from the predicted monthly median value of signal field strength, in dB, arising from day-to-day variability

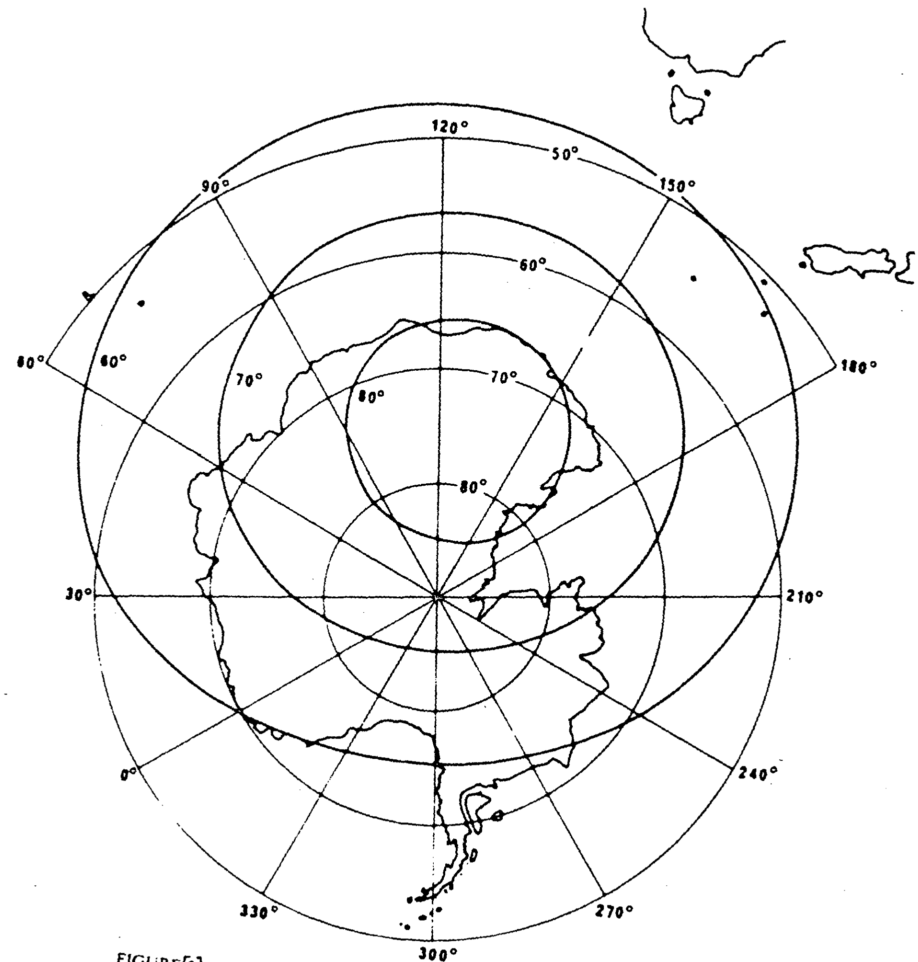
Corrected geomagnetic latitude[1]	< 60°		≥ 60°	
Transmitting frequency/ predicted basic MUF	Lower decile	Upper decile	Lower decile	Upper decile
≤ 0.8	-8	6	-11	9
1.0	-12	8	-16	11
1.2	-13	12	-17	12
1.4	-10	13	-13	13
1.6	-8	12	-11	12
1.8	-8	9	-11	9
2.0	-8	9	-11	9
3.0	-7	8	-9	8
4.0	-6	7	-8	7
≥ 5.0	-5	7	-7	7

Note 1 - If the pole-ward extreme of the great circle between transmitter and receiver considered between the control points located 1,000 km from each end of the path, reaches a corrected geomagnetic latitude of 60° or greater, the values for ≥ 60° have to be used. The relationship of corrected geomagnetic latitude to geographical coordinates is shown in Figures [1 and 2].



FIGURE[1] - *Corrected geomagnetic latitude in the northern hemisphere*

(Geographic latitude and longitude are also displayed for reference)



FIGURE[2]- *Corrected geomagnetic latitude in the southern hemisphere*

ANNEX 2

3.3 Radio-frequency protection ratios

After a careful review of Administrations proposals and the extensive study of this matter by the CCIR, the Conference adopted recommendations which consider the subjective tests comparing quality of listener satisfaction with various levels of protection ratios. The decisions were also made with a recognition that the number of requirements and the limited amount of allocated spectrum space would require a reduction of the desired protection ratio comensurate with the number of requirements to be satisfied. With these considerations in mind the following decisions were made.

3.3.1 Co-channel protection ratios and frequency tolerances

For stable conditions where the frequency difference between wanted and unwanted carriers does not exceed 100 Hz the value of 27 dB is adopted as a value to be achieved if feasible. If this value of protection ratio is unobtainable the values in figure /‾B_7 provide planners with advice on the resultant quality of service when protection ratios are reduced from the level of 27 dB.

Transmitter frequency tolerances are contained in Appendix 7 of the Radio Regulations. In order to preserve the need for no more than 100 Hz difference between wanted and unwanted carriers referred to above, administrations are urged to use a frequency tolerance of no more than ± 50 Hz.

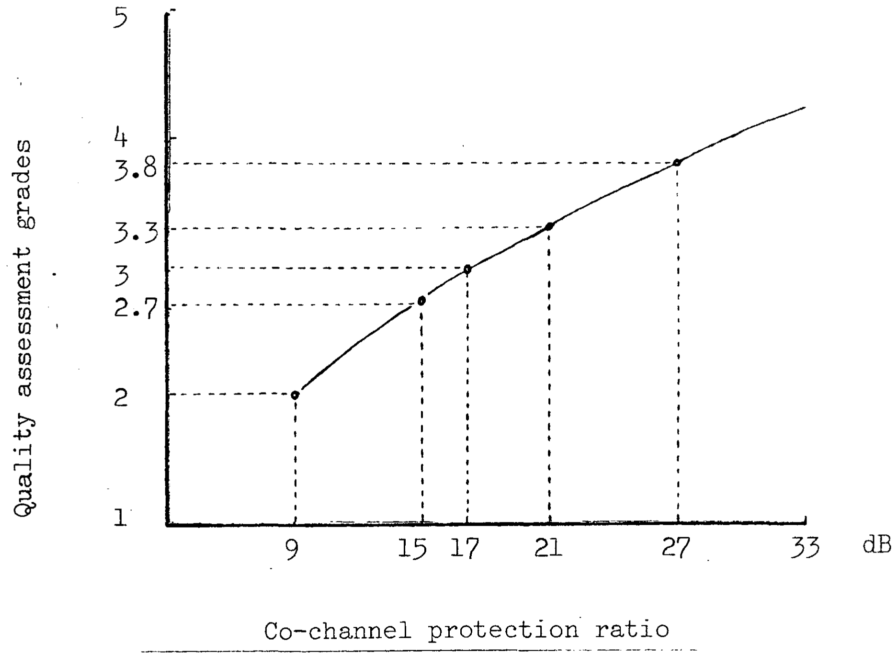


FIGURE /‾B_7

Relationship between reception quality and co-channel RF protection ratio

TABLE /‾C_7

Table /‾C_7 provides a description of the five levels of quality assessment grades.

Quality	Impairment
5 Excellent 4 Good 3 Fair 2 Poor 1 Bad	5 Imperceptible 4 Perceptible, but not annoying 3 Slightly annoying 2 Annoying 1 Very annoying

3.3.2 Relative values of protection ratio as a function of carrier frequency separation

Once a value for the co-channel radio-frequency protection ratio has been determined, then the radio-frequency protection ratio, expressed as a function of the carrier frequency spacing, shall be determined by adding the value given in the curve in Figure /‾C_7 to the value of the co-channel RF protection ratio.

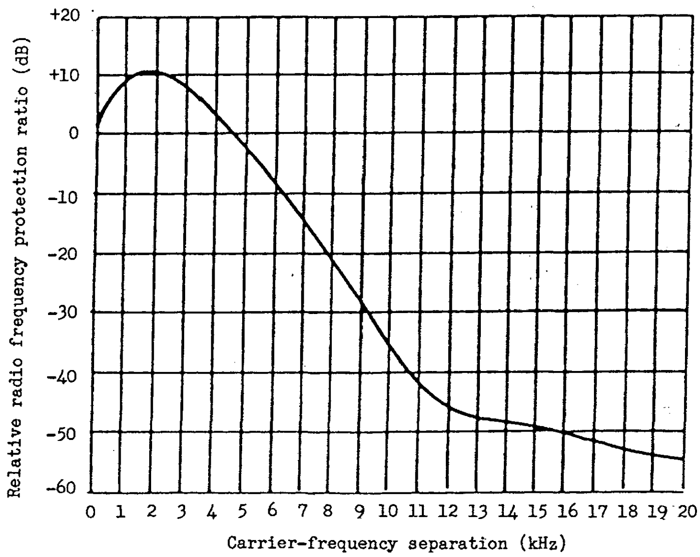


FIGURE /‾C_7

Relative value of the radio-frequency protection ratio as a function of the carrier-frequency separation

. . . .

3.6 Use of synchronized transmitters

3.6.1 The use of synchronized transmitters, where appropriate, is an efficient means of economizing frequency spectrum. When synchronized transmitters are utilized the carrier frequency difference shall be 0.1 Hz or less for broadcasting the same programme to partially overlapping or non-overlapping service areas.

3.6.2 Protection ratios in the range of 3 to 11 dB give satisfactory reception with a carrier frequency difference of 0.1 Hz or less. For planning purposes a value of 8 dB shall be used.

When the synchronized transmitters are driven by a common oscillator and use antennas which have similar vertical radiation characteristics a lower protection ratio of 3 dB shall be adopted for planning.

ANNEX 3

3.1 Double sideband (DSB) system specifications

After a review of administrations' proposals and the study of this matter by the CCIR, the Conference adopted the following Double Sideband (DSB) System specifications.

3.1.1 Transmission characteristics

3.1.1.1 Audio-frequency bandwidth

The upper limit of the audio bandwidth of the transmitter shall not exceed 4.5 kHz and the lower limit shall be 150 Hz with lower frequencies attenuated at a slope of 6 dB per octave.

3.1.1.2 Necessary bandwidth

The necessary bandwidth is twice the audio-frequency bandwidth.

3.1.1.3 Characteristics of modulation processing

The audio signal shall be processed such that the modulating signal retains a dynamic range of not less than 20 dB. Excessive amplitude compression, together with improper peak limitation, will lead to excessive out-of-band radiation and thus to adjacent channel interference, and shall therefore be avoided.

3.1.2 Channel spacing

(For the text already adopted see Document 93, Annex 4.)

3.1.3 Nominal carrier frequencies

(For the text already adopted see Document 93, Annex 4.)

3.1.4 Receiver characteristics

3.1.4.1 Overall selectivity of the receiver

The overall selectivity of the receiver as shown in Figure [1] below, shall be used for planning purposes.

3.1.4.2 Noise limited sensitivity of the receiver

(Text will follow.)

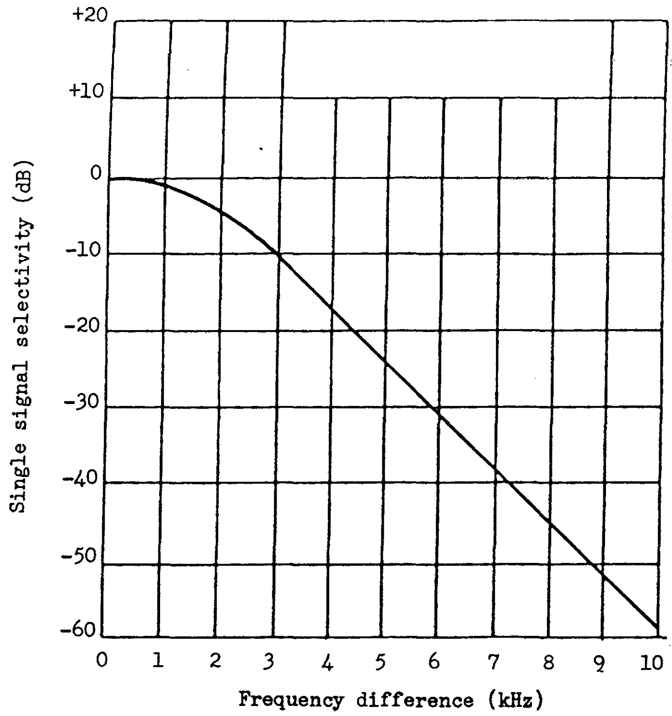


FIGURE [1]

Overall frequency response of the reference receiver

. . . .

3.5 Antennas and power

The combined effects of transmitter power and antenna characteristics which determine the equivalent isotropic radiated power (e.i.r.p.) are the overall consideration which is significant in computations for HF broadcasting planning purposes. The selection of power and associated antennas should be based on the use of the most directional antenna possible appropriate to the broadcasting requirement. The power required must be as low as possible to achieve broadcasting objectives.

3.5.1 Characteristics of antennas to be used for planning

(Text will follow.)

3.5.2 Transmitter power and equivalent isotropic radiated power appropriate for satisfactory service

The propagation prediction method described in section 3.3.1 shall be used to determine the appropriate transmitter power to achieve satisfactory service. The appropriate transmitter power varies with the propagation conditions which in turn are functions of diurnal, seasonal, and solar cycle period and geographic location.

(Additional texts will follow pending Committee 4 actions.)

ANNEX 4

(Text of Note 1 on page three of Document 107, concerning the definitions "minimum usable field strength" and "usable field strength" :)

Note 1 - The terms "minimum usable field strength" and "usable field strength" refer to specified field strength values to be achieved by a wanted signal in order to obtain the required reception quality.

In determining whether these requirements are met, the 50% (median) level of a fading signal is taken as the appropriate characteristic.

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PLENARY MEETING

FIRST REPORT OF COMMITTEE 4

TO THE PLENARY MEETING

Up to 24 January 1984 Committee 4 met four times, and adopted the text of Chapter 2 (Definitions) and parts of the text of Chapter 3 (Technical criteria) of the report of the first session of the Conference.

These texts are contained in Documents 93, 107 and 119 which were submitted to the Editorial Committee for subsequent submission to the Plenary Meeting.

These texts were adopted unaminously with the exception of the median value of man-made noise power mentioned in Document 119, Annex 1, paragraph 3.2.2.2. In that case the USSR delegation expressed the right to revert to this subject in the Plenary.

J. RUTKOWSKI
Chairman of Committee 4

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COMMITTEE 4

FIFTH REPORT OF WORKING GROUP 4A TO COMMITTEE 4

3.2.3.3 Calculation of fading allowance for different percentages of time

Fading allowances for other percentages of the time may be expressed in terms of, at the decile deviation, F_{90}, by the expression

$$F_x = c. F_{90}$$

where F_x is the deviation for x% of time.

Values of c for x in the range 50-90% are given in Table /‾3.2.3.3-I_7

TABLE /‾3.2.3.3-I_7

The parameter c

x (%)	c
50	0
60	0.18
70	0.36
80	0.63
90	1

L.W. BARCLAY
Chairman of Working Group 4A

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

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COMMITTEE 4

SIXTH REPORT OF WORKING GROUP 4A

REPORT TOPIC 3.2.1

3.2.1 The method to be used to determine the sky-wave field strength for HF broadcast planning purposes

3.2.1.1 Introduction

The field strength prediction method is in two parts : for ranges up to 7,000 km and for ranges beyond 9,000 km. In the interval, 7,000 to 9,000 km, an interpolation procedure is used.

3.2.1.2 Ionospheric parameters

Values of selected ionospheric parameters (foE, foF2 and M(3000)F2) are needed together with the derived parameters (E-layer basic MUF and F-layer basic MUF) in order to determine the field strength of sky-wave modes reflected from the ionosphere. For total path lengths between 0 and 4,000 km, the basic MUF of an E mode is predicted. For all path lengths the basic MUF for the F2 mode is predicted. Where appropriate the higher of the two values gives the basic MUF for the path.

The vertical radiation angle is also needed in the calculation of sky-wave field strength. The vertical radiation angle is used to determine the appropriate mode of propagation and is also used in conjunction with the antenna gain to determine the proper field strength.

The transmitting antennas in use will have gains which vary with the vertical radiation angle and some antennas, intended for shorter distance broadcasting, radiate very poorly at low angles. It is important to associate the antenna gain at the appropriate radiation angle with the propagation prediction for that particular mode.

3.2.1.2.1 E-layer parameters

3.2.1.2.1.1 E-layer data

For paths up to 2000 km foE is evaluated at the path mid-point. For ranges greater than 2000 km foE is evaluated at two control points, each 1000 km along the path from the transmitter and receiver respectively. At these points the solar zenith angle χ, in degrees, is determined, then :

$$foE = 0.9 \left[(180 + 1.44R_{12})\cos \chi'\right]^{0.25} \text{ MHz}$$

where : $\chi' = \chi$ for $0 \leq \chi \leq 80$; $\chi' = 90 - \dfrac{e^{0.13(116 - \chi)}}{10.8}$ for $80 < \chi < 116$

$\chi' = 89.907$ for $\chi \geq 116$

R_{12} is the 12 month running mean sunspot number

3.2.1.2.1.2 E-layer basic MUF prediction (E(D) MUF)

The foE value at the mid-point of the path (for paths up to 2000 km) or the lower of the foE values at the two control points (for paths longer than 2000 km) is taken for the computation of the E-layer basic MUF.

The MUF for a path of length D is given as :

$$E(D)MUF = foE. \sec i_{110}$$

With i_{110} = angle of incidence at a height of 110 km evaluated in accordance with Report 252.

3.2.1.2.1.3 E-layer screening frequency (f_s)

The foE value at the middle point of the path (for paths up to 2,000 km), or the higher one of the foE values at the two control points 1,000 km from each end of the path (for paths longer than 2,000 km), is taken for calculation of E-layer screening frequency.

$$f_s = 1.05 \text{ foE} \sec \varphi_s$$

in which $\varphi_s = \arc\sin \left[\frac{R \quad \cos\Delta_F}{R \quad + 110} \right]$

R is the radius of the Earth, 6,371 km,

Δ_F is the vertical radiation angle for F2-layer mode (see section 3.2.1.2.3)

3.2.1.2.2 F-layer parameters

3.2.1.2.2.1 F2-layer data

Numerical maps of the parameters foF2 and M(3000)F2, for solar index values R_{12} = 0 and 100, and for each month are presented in Report 340. This prediction method uses the Oslo coefficients to determine the values of foF2 and M(3000)F2 for the required locations and times. It may be desirable to calculate in advance, values of these parameters at specific grid intervals of latitude, longitude and times and to use an interpolation procedure to obtain values for the required location and time between appropriate grid points. The use of a grid may be appropriate for other ionospheric parameters as well.

3.2.1.2.2.2 F2-layer basic MUF prediction (F2(D)MUF)

3.2.1.2.2.2.1 For paths up to 4,000 km

F2-layer basic MUF is calculated from

$$F2(ZERO)MUF = foF2 + f_H/2$$

$$F2(4000)MUF = 1.1 \text{ foF2.M(3000)F2}$$

where f_H is the electron gyro-frequency given in terms of parameters of the Earth's magnetic field. A numerical representation is available in Report 340.

At the midpoint of the great-circle path between the transmitter and receiver determine the above values for the solar index values $R_{12} = 0$ and $R_{12} = 100$. Interpolate or extrapolate linearly for required index values between $R_{12} = 0$ and 150. For higher sunspot activity use $R_{12} = 150$.

Interpolate for the length of the path using the relationship :

$$F2(D)MUF = F2(ZERO)MUF + \left[F2(4000)MUF - F2(ZERO)MUF \right] \cdot M(D)$$

where $M(D) = 1.64 \cdot 10^{-7} D^2$ for $0 \leq D < 800$ and

$$M(D) = 1.26 \cdot 10^{-14} D^4 - 1.3 \cdot 10^{-10} D^3 + 4.1 \cdot 10^{-7} D^2 - 1.2 \cdot 10^{-4} D$$

for $800 \leq D \leq 4000$.

where D is in km.

This gives the median F2-layer basic MUF.

3.2.1.2.2.2.2 For paths longer than 4,000 km

For these paths (which may be the longer great-circle path), control points are taken at 2,000 km from each end of the path. At these points, values of F2(4000)MUF, interpolating for sunspot number, are determined and the lower value is selected. This gives the median F2-layer basic MUF.

3.2.1.2.3 Vertical radiation angle

Radiation angle is taken into account in the prediction of field strength. It is given, approximately, by :

$$\Delta = \arctan\left(\cot \frac{d}{2R} - \frac{R}{R + h'} \operatorname{cosec} \frac{d}{2R}\right)$$

where

d = hop length of an n hop mode given by $d = D/n$

h' = 110 km for the E-layer or h' is as given in 3.2.1.3.1.1 for the F2-layer.

In the method for shorter path lengths (section 3.2.1.3.1) the radiation angles calculated are used in the determination of antenna gain. For the longer path lengths the appropriate procedure is described in section 3.2.1.3.2.

3.2.1.3 The prediction of the median field strength

3.2.1.3.1 Method for path lengths of 0 to 7,000 km

CCIR Report 252-2 details the geometrical considerations, the reflection areas used and the method of performing ray-path calculations.

The procedure is based on the ray-path geometry with mirror reflections in the ionosphere. The method determines the field strengths of the two strongest modes propagated via the F2 region and the strongest mode propagated via the E region. The resultant field strength from these modes is obtained by power addition. In circumstances where a low-order F2 mode is screened by the E-layer, as determined in the ray-path calculations, or where an antenna is specified which only radiates sufficiently at high angles, the next higher-order mode must be considered.

It is recognized that multi-hop E region propagation suffers substantial absorption losses and E modes are not considered at ranges beyond 4,000 km.

The appropriate inclusion of these concepts into a computer implementation for practical planning purposes is in accordance with the following procedure.

3.2.1.3.1.1 For the path length, d(km), determine the minimum number of hops for an F2 region mode. This is given approximately as ((the integer part of d ÷ 4,000) + 1) or better, by calculating the ray-path geometry using the height hpF2 given by :

$$hpF2 = \frac{1490}{M(3000)F2} - 176 \quad km$$

The reflection height h', which is a function of time, location and path length, is used for the ray-path calculations for F2-modes. It is given by :

$$h' = 358 - (11 - 100a)\left(18.8 - \frac{320}{x^5}\right) + ad\left(0.03 + \frac{14}{x^4}\right) \quad km$$

or 500 km, whichever is the smaller,

a = 0.04 or (1/M(3000)F2) - 0.24, whichever is the larger and

x = foF2/foE, determined at the control point with the lowest value of foF2, or 2, whichever is the larger.

3.2.1.3.1.2 For the given mode, determine the vertical radiation angle from section 3.2.1.2.3 and then determine the transmitting antenna gain G_t at that angle and the appropriate azimuth, relative to an isotropic antenna.

3.2.1.3.1.3 Compute the median field strength for that mode using the formula :

$$E_{ts} = 136.6 + P_t + G_t + 20 \log f - L_{bf} - L_i - L_m - L_g - L_h - 12.2^* \quad dB(1 \mu V/m)$$

where f is the transmitting frequency in MHz and P_t is the transmitter power in dB relative to 1 kW. L_{bf} is the basic free space transmission loss in dB, given by :

$$L_{bf} = 32.45 + 20 \log f + 20 \log P'$$

P' is the virtual slant range in km

$$P' = \left[2R \sum_{n} \frac{\sin \frac{d}{2R}}{\cos\left(\Delta + \frac{d}{2R}\right)} \right]$$

L_i is the absorption loss in dB given in CCIR Report 252-2. It is determined for each hop and the results are added. For frequencies above the basic MUF, it continues to vary with frequency and is calculated assuming ray paths similar to those at the MUF.

---

*/ This term contains those effects of sky-wave propagation not otherwise included in this fast simple method. A value of 12.2 dB is recommended based upon data available. It is noted, however, that the value may need to be changed by those implementing this procedure to take account of additional calibrated data which became available./

L_m is the "above-the-MUF" loss. For frequencies, f, above the basic MUF (f_b) of a given mode :

$$L_m = 130 \left(\frac{f}{(f_b)} - 1 \right)^2 \quad \text{dB}$$

TABLE 1

L_h for paths less than 2,500 km

G.M. LAT.	01-04LMT	04-07LMT	07-10LMT	10-13LMT	13-16LMT	16-19LMT	19-22LMT	22-01LMT
	WINTER (NOVEMBER, DECEMBER, JANUARY, FEBRUARY in the Northern Hemisphere) (MAY, JUNE, JULY, AUGUST in the Southern Hemisphere)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
45-50	0.1	0.3	0.6	0.0	0.1	0.1	0.3	0.1
50-55	0.6	0.8	1.6	0.1	0.3	0.6	1.0	0.3
55-60	1.5	2.1	4.4	0.7	0.8	2.2	2.5	1.3
60-65	4.8	8.2	10.5	2.7	1.6	5.7	7.3	5.2
65-70	6.7	11.0	13.5	3.0	1.7	5.8	8.6	6.0
70-75	5.7	7.9	10.7	1.7	0.9	3.6	4.1	4.0
75-80	2.5	5.0	7.1	0.9	0.3	1.9	2.3	2.0
	EQUINOX (MARCH, APRIL, SEPTEMBER, OCTOBER)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.0	0.1	0.2	0.1	0.1	0.3	0.2	0.1
45-50	0.4	0.4	0.9	0.6	0.4	1.3	0.9	0.8
50-55	1.0	1.0	2.7	1.8	1.2	2.7	2.1	2.1
55-60	2.0	3.0	6.2	3.7	2.6	4.5	4.0	5.0
60-65	4.7	5.0	12.0	7.5	5.6	7.8	9.0	11.8
65-70	6.8	11.6	19.6	8.8	6.3	7.8	10.3	14.6
70-75	4.9	11.7	20.0	6.2	3.3	4.9	7.7	9.5
75-80	2.0	7.5	9.2	3.9	1.6	3.0	4.2	4.1
	SUMMER (MAY, JUNE, JULY, AUGUST in the Northern Hemisphere) (NOVEMBER, DECEMBER, JANUARY, FEBRUARY in the Southern Hemisphere)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.1	0.1	0.0	0.1	0.1	0.2	0.1	0.0
45-50	0.5	0.4	0.5	0.4	0.5	1.1	1.0	0.4
50-55	1.3	1.1	1.4	1.0	1.1	3.0	2.9	0.7
55-60	2.9	2.4	3.0	2.6	2.9	5.8	5.8	1.8
60-65	6.0	4.1	6.0	5.3	4.3	8.4	7.6	4.3
65-70	6.0	4.6	7.3	5.0	4.2	7.2	8.8	5.0
70-75	3.7	3.8	5.0	3.5	3.2	4.8	6.0	3.4
75-80	2.4	2.8	3.1	2.7	2.3	3.8	4.3	2.1

TABLE 2

L_h for paths greater than 2,500 km

G.M. LAT.	01-04LMT	04-07LMT	7-10LMT	10-13LMT	13-16LMT	16-19LMT	19-22LMT	22-01LMT
	WINTER (NOVEMBER, DECEMBER, JANUARY, FEBUARY in the Northern Hemisphere) (MAY, JUNE, JULY, AUGUST in the Southern Hemisphere)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-50	0.1	0.1	0.1	0.0	0.1	0.1	0.2	0.2
50-55	0.4	0.4	0.2	0.0	0.4	0.4	0.9	0.8
55-60	1.1	1.8	0.9	0.2	1.2	1.4	2.0	2.3
60-65	3.3	6.2	2.6	1.3	2.6	3.4	3.6	7.6
65-70	5.5	6.4	4.1	2.0	4.1	3.6	4.4	9.9
70-75	3.9	4.6	3.3	1.3	4.0	2.2	3.1	8.0
75-80	2.2	3.2	1.9	0.7	2.7	1.2	1.2	2.9
	EQUINOX (MARCH, APRIL, SEPTEMBER, OCTOBER)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0
45-50	0.2	0.2	0.3	0.2	0.1	0.5	0.6	0.4
50-55	0.5	0.6	0.5	0.6	0.5	1.6	1.8	1.1
55-60	1.0	1.3	1.3	1.7	1.3	3.4	3.8	2.4
60-65	2.9	3.8	4.2	4.1	2.9	6.3	8.4	7.3
65-70	4.3	5.6	6.4	5.1	4.4	6.3	9.2	9.3
70-75	3.0	4.7	5.0	3.0	2.4	3.4	5.4	4.8
75-80	1.3	1.9	2.2	0.8	0.8	0.8	1.2	1.1
	SUMMER (MAY, JUNE, JULY, AUGUST in the Northern Hemisphere) (NOVEMBER, DECEMBER, JANUARY, FEBRUARY in the Southern Hemisphere)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
45-50	0.5	0.3	0.4	0.2	0.4	0.1	0.6	0.5
50-55	1.1	1.1	1.1	0.6	1.2	0.4	1.9	1.3
55-60	2.5	2.9	2.6	1.1	2.5	1.2	3.8	2.9
60-65	4.9	7.5	6.2	2.2	3.8	2.6	5.2	5.0
65-70	5.0	7.8	6.1	2.3	3.8	2.7	4.8	5.0
70-75	3.2	5.4	3.4	1.5	2.2	0.9	2.6	3.2
75-80	2.0	4.3	1.5	1.1	0.8	0.1	0.9	1.4

L_m is independent of the number of hops, but is limited to a value of 81 dB.

L_g is the ground reflection loss at intermediate reflection points. It is given as 2 dB for each intermediate ground reflection, i.e. :

for one hop paths $L_g = 0$;

two hop paths $L_g = 2$ dB;

three hop paths $L_g = 4$ dB.

L_h is the factor to allow for auroral and other signal losses and is given in Tables 1 and 2 using the methods given in Report 252-2 to determine the local mean time, the geomagnetic latitude and the locations at which it is applied.

3.2.1.3.1.4 Repeat the procedure of 3.2.1.3.1.2 and 3.2.1.3.1.3 using successively higher order modes (increasing the number of hops by one each time) until the predicted mode field strength reaches a maximum. Select the two strongest F2 region modes, noting the field strength and radiation angles.

3.2.1.3.1.5 For the E region the lowest order mode is 1E for ranges 0 - 2,000 km and 2E for ranges 2,000 to 4,000 km. The E mode radiation angle and field strength are again obtained as in section 3.2.1.2.3 and section 3.2.1.3.1.3.

3.2.1.3.1.6 Repeat the E mode calculations for successively higher modes until a maximum is found.

3.2.1.3.1.7 The resultant of combining the field strengths of the two strongest F2 modes and the strongest E mode is obtained by calculating the square root of the sum of the squares of the numerical values of the field strengths.

3.2.1.3.2 <u>Method for path lengths greater than 9,000 km</u>

At long ranges, generally with low radiation angles, the method of prediction using geometric ray-hops is inadequate at present. The method used for long distances is based on an empirical fit of observations. In this method the antenna gain term, G_{tl}, is the greatest value of antenna gain in dBi which occurs in the range of vertical radiation angles from 0^0 to 10^0 at the appropriate azimuth.

The overall median field strength is given by :

$$E_{tl} = E_o\left(1 - \frac{(f_M+f_H)^2}{(f_M+f_H)^2 + (f_L+f_H)^2}\left(\frac{(f_L+f_H)^2}{(f+f_H)^2} + \frac{(f+f_H)^2}{(f_M+f_H)^2}\right)\right) - 36.4 + P_t + G_{tl} + G_{ap} - 0.8^* \quad \text{dB}\left(\frac{1\mu V}{m}\right)$$

$E_o = 139.6 - 20 \log P'$, and the height used in the determination of P' is 300 km.

It is assumed within this procedure that there is a hypothetical ray path with a number of equal length hops, each less than 4,000 km.

---

*[This term contains those effects of sky-wave propagation not otherwise included in the method. A value of 0.8 dB is recommended based upon data available. It is noted however that this value may need to be changed by those implementing this procedure to take account of additional calibrated data which became available.]

G_{ap} is the increase in field strength due to focussing at long distances. In the case of propagation to very long distances with D, the great-circle distance between transmitter and receiver, greater than $\pi R/2$, this focussing is taken into account by means of the following formula :

$$G_{ap} = -20 \log \left(\left| 1 - \frac{n\pi R}{D} \right| \right) \qquad \text{dB}$$

for
$$\left(\frac{2n-1}{2}\right) \pi R < D < \left(\frac{2n+1}{2}\right) \pi R \qquad \text{with } n = 1 \text{ and } 2.$$

As G_{ap} tends to infinity for $D = n\pi R$ it is limited arbitrarily to the value of 30 dB.

f_M is the upper limit frequency. It is determined separately for the first and last hops of the path and the lower value is taken.

$$f_M = K \cdot f_b \qquad \text{MHz}$$

$$K = 1.2 + W \frac{f_b}{f_{b,\ noon}} + X\left(\sqrt[3]{\frac{f_{b,\ noon}}{f_b}} - 1\right) + Y\left(\frac{f_{b,\ min}}{f_{b,\ noon}}\right)^2$$

f_b is the basic MUF determined by the method given in section 3.2.1.2.2.2.

$f_{b,\ noon}$ is the value of f_b for a time corresponding to local noon at the control point

$f_{b,\ min}$ is the lowest value of f_b for the hop which occurs during the 24 hours

W, X and Y are given in Table 3. The azimuth of the great-circle path is determined at the centre of the whole path and this angle is used for linear interpolation in angle between the east-west and north-south values.

TABLE 3

Values W, X, Y used for the determination of the correction factor K

	W	X	Y
East-west	0.1	1.2	0.6
North-south	0.2	0.2	0.4

f_L is the lower limit frequency when the path is in daylight

$$f_L = \left(5.3 \cdot I \left[\frac{(1 + 0.009 R_{12}) \sum_{2N} \cos^{\frac{1}{2}} \chi}{\cos i_{90} \ln \left(\frac{9.5 \cdot 10^6}{P'}\right)} \right]^{\frac{1}{2}} - f_H\right) \cdot A_W \qquad \text{MHz}$$

In the summation, χ is determined for each traverse of the ray path through the height of 90 km.

when $\chi > 90^{\circ}$, $\cos^{\frac{1}{2}}\chi$ is taken as zero

i_{90} is the angle of incidence at a height of 90 km

I is given in Table 4.

A_W is a winter-anomaly factor determined at the path mid-point which is unity for geographic latitudes 0 to 30° and at 90° and reaches the maximum values given in Table 5 at 60°. The values at intermediate latitudes are found by linear interpolation.

As the path progressively becomes dark the values of f_L are calculated until the time t_n when $f_L \leq 2f_{LN}$ where $f_{LN} = \sqrt{\frac{D}{3000}}$ (MHz). During the subsequent three hours f_L is calculated from $f_L = 2f_{LN}e^{-0.23t}$ where t is the time in hours after t_n. For the remainder of the night hours $f_L = f_{LN}$ until the time when the daylight equation gives a higher value.

TABLE 4

Values of I used in the equation for f_L

Latitudes		Month											
Terminal 1	Terminal 2	J	F	M	A	M	J	J	A	S	O	N	D
>35°N	>35°N	1.1	1.05	1	1	1	1	1	1	1	1	1.05	1.1
>35°N	35°N-35°S	1.05	1.02	1	1	1	1	1	1	1	1	1.02	1.05
>35°N	>35°S	1.05	1.02	1	1	1.02	1.05	1.05	1.02	1	1	1.02	1.05
35°N-35°S	35°N-35°S	1	1	1	1	1	1	1	1	1	1	1	1
35°N-35°S	>35°S	1	1	1	1	1.02	1.05	1.05	1.02	1	1	1	1
>35°S	>35°S	1	1	1	1	1.05	1.1	1.1	1.05	1	1	1	1

TABLE 5

Values of the winter-anomaly factor, A_W, at 60° geographic latitude used in the equation for f_L

Month

hemisphere	J	F	M	A	M	J	J	A	S	O	N	D
Northern	1.30	1.15	1.03	1	1	1	1	1	1	1.03	1.15	1.30
Southern	1	1	1	1.03	1.15	1.30	1.30	1.15	1.03	1	1	1

3.2.1.3.3 Method for path lengths between 7,000 and 9,000 km

In this range of distances, the field strengths E_{ts} and E_{tl} are determined by both of the above procedures and the resultant is found by appropriate mathematical interpolation. The interpolation procedure is given as :

$$E_{ti} = E_{ts} + \frac{D-7000}{2000}(E_{tl} - E_{ts}) \quad dB(1\mu V/m)^{*}$$

L.W. BARCLAY
Chairman of Working Group 4A

*/ Taking account of the data that became available, those charged with implementing this procedure may consider an alternative form for this interpolation./

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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COMMITTEE 4

EIGHTH REPORT OF WORKING GROUP 4B TO COMMITTEE 4

The texts reproduced in Annexes 1 and 2 to this Report were considered in Working Group 4B and are submitted to Committee 4 for approval.

Y. TADOKORO
Chairman of Working Group 4B

ANNEX 1

THEORETICAL CAPACITY OF THE HFBC BANDS

The theoretical capacity of the HFBC bands is dependent on a variety of factors. These include the radio-frequency protection ratio, transmitter powers, the antenna directivities and the assignment method.

Also important for the channel capacity is the time period and the frequency band considered. Based on calculations accomplished by several administrations and utilizing the data of the IFRB, the average capacity (available number of stations/channel at a given time) was generally found to be in the range of three to four.

The capacity decreases in the higher frequency bands and for higher RF protection ratios. The range of capacity is from one to seven.

In general no single value for the capacity of any band can be determined since the capability to accommodate requirements is subject to factors which would vary from one schedule to another.

ANNEX 2

3.9 Specifications and progressive introduction of an SSB system

Considering the advantages of SSB transmission, such as :

- a more efficient utilization of the frequency spectrum by a reduction of interference;
- the capability of improving the required protection ratio between adjacent channels in the case of a sufficient carrier reduction;
- the capability of improving the quality of reception, in particular under poor propagation conditions (selective fading), with SSB receivers;
- the possiblity to produce the same sideband power as a current DSB transmitter with less capital and operational costs,

the Conference adopted the following Single Sideband (SSB) system specifications under the assumption of a progressive introduction of receivers with synchronous demodulation. With respect to a necessary transition period from DSB to SSB, some consideration must also be given to the reception of SSB signals with reduced carrier by receivers with envelope detection. At the end of the transition, all of the advantages of SSB transmissions mentioned above could then be realized.

3.9.1 SSB system specification

3.9.1.1 Audio-frequency bandwidth

The upper limit of the audio bandwidth of the transmitter shall not exceed 4.5 kHz with a further slope of attenuation of 35 dB/kHz and the lower limit shall be 150 Hz with lower frequencies attenuated at a slope of 6 dB per octave.

3.9.1.2 Necessary bandwidth

The necessary bandwidth is equal to the audio-frequency bandwidth.

3.9.1.3 Characteristics of modulation processing

The audio signal shall be processed such that the modulating signal retains a dynamic range of not less than 20 dB. Excessive amplitude compression, together with improper peak limitation, will lead to excessive out-of-band radiation and thus to adjacent channel interference, and shall therefore be avoided.

3.9.1.4 Channel spacing

During the transition period, the channel spacing for SSB shall be 10 kHz. In the interest of spectrum conservation, during the transition period, it is permissible to interleave DSB and SSB transmissions midway between two adjacent channels, i.e. 5 kHz separation between carrier frequencies, to different geographical areas.

After the end of the transition period the channel spacing and carrier frequency separation shall be 5 kHz.

3.9.1.5 Nominal carrier frequencies

Carrier frequencies for SSB shall be integral multiples of 5 kHz.

3.9.1.6 Sideband to be emitted

The upper sideband shall be used.

3.9.1.7 Suppression of the unwanted sideband

With respect to the relative RF protection ratio, the degree of suppression of the unwanted sideband (lower sideband) and of intermodulation products in that part of the transmitter spectrum shall be at least 35 dB relative to the wanted sideband signal level. Because of the large difference of signal amplitudes in adjacent channels in practice, however, a greater suppression is recommended, (e.g. 50 dB in the exciter producing the SSB signal at low power level and 40 dB suppression of unwanted intermodulation products in the RF power amplifier of the transmitter).

3.9.1.8 Degree of carrier reduction (relative to peak envelope power)

During the transition period the carrier reduction of the SSB emission shall be 6 dB, to allow SSB transmissions to be received by conventional DSB receivers with envelope detection without significant deterioration of the reception quality.

At the end of the transition period the carrier reduction of the SSB emission shall become 12 dB.

3.9.1.9 Frequency tolerance

The frequency tolerance of the SSB carriers shall be ± 10 Hz*.

*Note - This frequency tolerance is acceptable only under the assumption that future SSB receivers will be equipped with a device locking the locally re-inserted carrier for synchronous demodulation to the carrier of the SSB emission. (See also paragraph 3.9.1.11.)

3.9.1.10 Overall selectivity of the receiver

The reference receiver shall have an overall bandwidth of 4 kHz, with a slope of attenuation of 35 dB/kHz*.

*Note - Other combinations of bandwidth and slope of attenuation as given below are possible with the same relative RF protection ratio of about -27 dB at 5 kHz carrier difference.

Slope of Attenuation	SSB Receiver Audio-Frequency Bandwidth
25 dB/kHz	3300 Hz
15 dB/kHz	2700 Hz

3.9.1.11 Detection system of the SSB receiver

SSB receivers shall be equipped with a synchronous demodulator, using for the carrier acquisition a method whereby a carrier is regenerated by means of a suitable control loop which pulls the receiver to the incoming carrier. Such receivers must work equally well with conventional DSB transmissions and with SSB transmissions having a carrier reduced to 6 or 12 dB relative to peak envelope power.

3.9.1.12 Equivalent sideband power

During the transition period an equivalent SSB emission is one giving the same loudness level as the corresponding DSB emission, when it is received by a DSB receiver with envelope detection. This is achieved when the sideband power of the SSB emission is 3 dB larger than the total sideband power of the DSB emission. (The peak envelope power of the equivalent SSB emission as well as the carrier power are the same as that of the DSB emission.)

After the end of the transition period, the equivalent sideband power can be reduced by 3 dB.

3.9.1.13 RF protection ratios

Assuming that the SSB and DSB emissions correspond to the technical characteristics specified above the following RF protection ratios shall be applied :

- during the transition period :

RF co-channel protection ratio

Due to the need to increase the radiated sideband power by 3 dB in the case of equivalent SSB emissions, there is a consequent need to make an allowance of the same 3 dB in the co-channel protection ratio for the case of a wanted DSB signal interfered with by an SSB signal, if the same quality of reception is to be maintained.

Relative RF protection ratios :

(For the following protection ratios SSB emissions with equivalent sideband power are assumed.)

a) If a wanted DSB signal is received by a conventional DSB receiver with envelope detection which is interfered with by an SSB emission.

According to the resulting RF protection ratio, reception of the wanted DSB signal in the lower channel at for example $\Delta F = -5$ kHz will be impaired by about 1 dB, while under the same conditions reception of the wanted DSB signal in the upper adjacent channel at $\Delta F = +5$ kHz will be impaired by about 4 dB in comparison to the present RF protection ratios, as specified in Figure [C] of paragraph 3.3.2.

The corresponding value for $\Delta F = \pm 10$ kHz will be -32 dB.

b) For the case of a wanted SSB signal interfered with by a DSB signal, values of Figure [C] of paragraph 3.3.2 shall be used.

c) In case of a wanted SSB signal interfered with by an SSB signal, the values mentioned in a) above shall be applied.

- after the end of the transition period (both wanted and interfering signals are SSB signals)

RF co-channel protection ratio :

The RF protection ratio is the same as that applied for the DSB system.

Relative RF protection ratios :

Relative RF protection ratios shall be as shown in Figure [E]

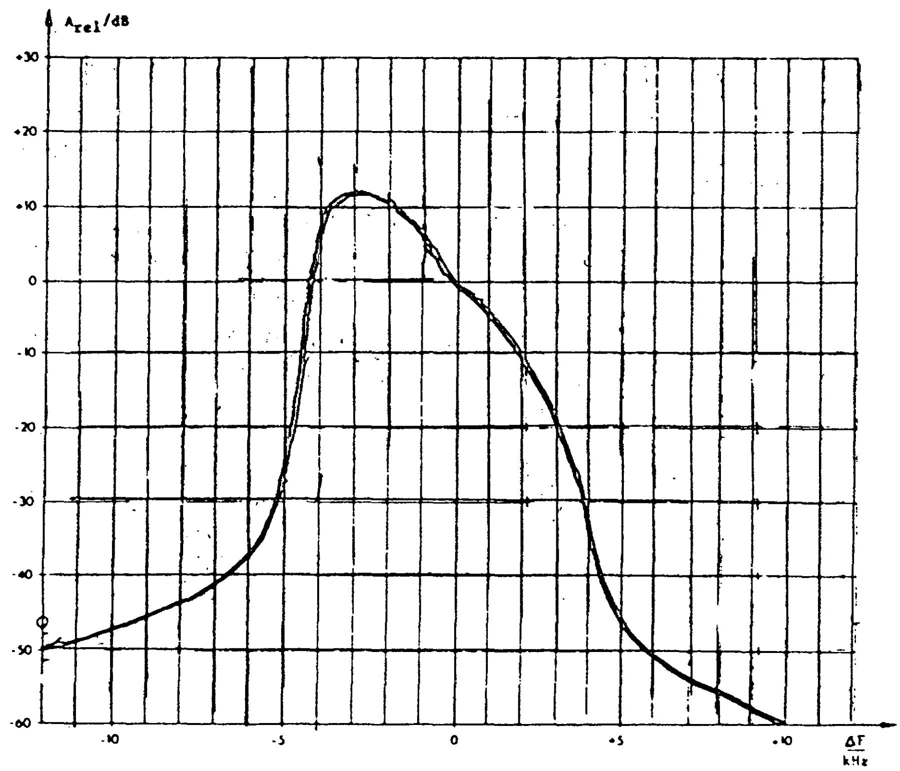

FIGURE [E]

RF protection ratios A_{rel} is given with respect to the frequency difference ΔF between the wanted carrier f_w and the interfering carrier f_i

$$\Delta F = f_w - f_i$$

Thus negative ΔF describes interference from the upper adjacent channel.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

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COMMITTEE 4

NINTH REPORT OF WORKING GROUP 4B

TO COMMITTEE 4

Working Group 4B considered the proposals concerning the value of "reference usable field strength". The Group could not take a unanimous decision on the subject.

About half of the delegation which expressed their opinion was in favour of fixing the reference level at the minimum usable field strength value. The other half preferred, for the determination of the reference level, the value :

$$E_{ref} = E_{min} + 3 \text{ dB}$$

The Working Group decided to ask Committee 4 to take the decision on the above subject.

Y. TADOKORO
Chairman of Working Group 4B

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Corrigendum 1 to
Document 125-E
2 April 1984
Original : English

COMMITTEE 4

SUMMARY RECORD

OF THE

FIFTH MEETING OF COMMITTEE 4

1. Paragraph 4.5

Replace the paragraph by the following :

"4.5 The delegate of Italy reconfirmed the proposal he had made in Working Group 4B, in support of the New Zealand proposal."

2. Paragraph 4.6

Insert "Portugal" between "Poland" and "the United States".

3. Paragraph 4.11

Delete "Portugal".

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

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30 January 1984
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COMMITTEE 4

SUMMARY RECORD

OF THE

FIFTH MEETING OF COMMITTEE 4

(TECHNICAL CRITERIA)

Wednesday, 25 January 1984, at 1405 hrs

Chairman : Mr. J. RUTKOWSKI (People's Republic of Poland)

Subjects discussed :		Document
1.	Approval of the summary record of the third meeting	103
2.	Fifth and sixth reports of Working Group 4A	121, 122
3.	Eighth report of Working Group 4B	123
4.	Ninth report of Working Group 4B	124

1. Approval of the summary record of the third meeting (Document 103)

The summary record of the third meeting was approved.

2. Fifth and sixth reports of Working Group 4A (Documents 121 and 122)

2.1 The Chairman of Working Group 4A introduced Document 121 containing section 3.2.3.3, which had been inadvertently omitted from Document 110 approved by the Working Group at its previous meeting.

Document 121 was approved.

2.2 The Chairman of Working Group 4A, introducing Document 122, said that the document was essentially based on material relating to the determination of sky-wave field strength to be found in the CCIR Report to the Conference. The Working Group had added a further section to the CCIR text and had carried out some redrafting with a view to clarifying the intention of the method. Referring to the footnotes appearing in square brackets on pages 4, 8 and 11 of the document, he said that although a decision as to the procedure to be used for doing the small amount of additional work involved remained to be determined by Committee 5, the need for that work to be done was clear; accordingly, the square brackets could, in his view, be removed in each case.

2.3 The delegate of the United States suggested that the word "became" appearing in each of the footnotes should be amended to read "become".

2.4 The Chairman of Working Group 4A agreed with that suggestion.

The amendment was accepted.

2.5 The delegate of Brazil said that his delegation intended at a later stage to put forward a proposal relating to the three footnotes.

2.6 The Chairman said that, in view of the remark just made by the delegate of Brazil and of the fact that a decision by Committee 5 on the procedure to be used was still pending, the three footnotes should for the present remain in square brackets.

It was so agreed.

2.7 The delegate of the United Kingdom, referring to section 3.2.1.3.2, proposed that the words "from 0° to 10°" in the last line of the first paragraph should be amended to read "from 0° to 8°".

It was so agreed.

Document 122, as amended, was approved.

3. Eighth report of Working Group 4B (Document 123)

3.1 The Chairman of Working Group 4B, introducing the document, said that the Working Group hoped at its next meeting to produce some additional material relating to the technical aspect of the transition period with regard to SSB. That material should eventually be attached to the document under consideration.

3.2 The Chairman said that Annex 1 to Document 123 was to be included in the appropriate part of the Conference Report under a number to be allocated by the Editorial Committee.

3.3 The delegate of Japan proposed that Figure [E] in Annex 2 should be reversed and that the corresponding amendments should be made in paragraph a) of 3.9.1.13 of Annex 2 of the document, "-5 kHz" in the second line becoming "+5 kHz" and "+5 kHz" in the fourth line becoming "-5 kHz".

3.4 The delegate of Sweden remarked that if the amendments suggested by the delegate of Japan were accepted, the word "negative" in the last line of Annex 2 on page 6, describing Figure [E], should be amended to read "positive".

3.5 The Chairman of Sub-Working Group 4B-4 said that the amendments proposed by the delegates of Japan and Sweden were not matters of substance and could be carried out without any difficulty.

Those amendments were accepted.

3.6 The delegate of Japan questioned the correctness of the value of -32 dB appearing in paragraph a) of section 3.9.1.13.

3.7 The Chairman of Sub-Working Group 4B-4 said -32 dB was the absolute value; the impairment value was, indeed, lower. Accordingly, the last sentence of paragraph a) of section 3.9.1.13 should read : "The corresponding value for $\Delta F = \pm 10$ kHz will be 3 dB of impairment."

It was so agreed.

3.8 The delegate of Syria, referring to section 3.9.1.4, proposed that the words "shall be 10 kHz" at the end of the first sentence should be replaced by the words "shall be the same as for DSB" and that the second sentence, which merely reproduced the wording of Annex 4 to Document 93, should be deleted in order to avoid ambiguity.

3.9 The delegate of the United Kingdom drew attention to Document 115, in which the section on channel spacing for DSB appeared under section 3.1.5. In his view, a cross-reference to that section should be included in section 3.9.1.4 dealing with channel spacing for SSB.

3.10 After a discussion in which the Chairman, the Chairman of Working Group 4B, the delegate of the Netherlands and the delegate of Qatar took part, the Chairman of Sub-Working Group 4B-4 said that two specifications, one for DSB and one for SSB, would be valid during the transition period. The specification governing channel spacing for DSB was as stated in section 3.1.5 of Document 115. The specification for SSB should be stated separately in section 3.9.1.4. In his view, the wording of the section as it appeared in Document 123 did not require any change.

3.11 The delegate of Paraguay proposed that the words "it is" be replaced by the words "would be" before the word "permissible" in 3.9.1.4 of Document 123.

3.12 The Chairman believed that such an amendment might be injudicious.

In the light of the discussion, he suggested that the text of 3.9.1.4 be approved as it stood with the addition of an asterisk at the end and the inclusion of a footnote reading "See also section 3.1.5".

3.13 The delegate of the Federal Republic of Germany supported the Chairman's suggestion. He added that in order to eliminate all misunderstanding the words "after the transitional period" would have to be added at the end of 3.1.5 in Document 115 but since it had already been issued as a Blue Document the proposal would have to be made in Plenary Meeting.

The Chairman's suggestion concerning 3.9.1.4 was approved.

3.14 The delegate of France said that in the French version the text of 3.9.1.4 would have to be aligned with the wording used in Annex 4 in Document 93.

Document 123, as amended, was approved and the Editorial Committee was requested to number the section in Annex 1.

4. Ninth report of Working Group 4B (Document 124)

4.1 The Chairman of Working Group 4B, presenting its ninth report concerning the value of "reference usable field strength", explained that opinion had been more or less equally divided in the Working Group and Committee 4 itself would have to take the final decision.

4.2 The delegate of New Zealand proposed the adoption of $E_{ref} = E_{min} + 3$ dB. A transmission which just provided E_{min} would provide the desired quality assessment grade only in the absence of all interference which was unrealistic and could not be assumed at the stage of planning a broadcasting system. Moreover, the actual interference level could not be used as it would not be known until a frequency was selected and all of the other transmissions on that frequency and adjacent frequencies were known. Furthermore, the use of the actual interference level might result in a progressive round after round power increase throughout the whole system.

The technical parameters, audio-frequency signal-to-noise ratio and the co-channel protection ratio were both based on subjective measurements and were the minimum values to achieve a given value of quality assessment grade with each effect considered in isolation. The resulting two values caused equal annoyance to listeners and the chosen value of interference was comparable with the chosen value of noise. The annoyance caused by the chosen minimum value of the co-channel protection ratio was equivalent to adding the noise corresponding to the minimum audio-frequency signal-to-noise ratio thus reducing the latter by 3 dB. If the target quality assessment grade was to be obtained at the required reliability, then transmitted power must be based on basic broadcast reliability + 3 dB. Therefore, for calculating the power required, E_{ref} should be used and not E_{min} when $E_{ref} = E_{min} + 3$ dB.

4.3 The delegate of Canada said that although previously he had favoured a reference level at the minimum usable field strength value, he could now support the New Zealand proposal.

4.4 The delegate of Brazil said that if the signal-to-interference ratio required to accommodate all requirements went down to 17 dB or lower the protection ratio that would have to be accepted would be such that interference would have no bearing on the final quality. The reasoning put forward by the New Zealand delegate to justify a value of + 3 dB might be acceptable if noise and interference were at the same level but that would only occur in an ideal world and he doubted whether with that value for the reference level would be achievable in many regions because no transmitter would be powerful enough. Therefore it would be wiser to fix the reference level at the minimum usable field strength.

4.5 The delegate of Italy withdrew the proposal he had made in Working Group 4B, in favour of the New Zealand proposal.

4.6 The delegates of the USSR, the German Democratic Republic, Poland, the United States, the Czechoslovak Socialist Republic and Bulgaria endorsed the New Zealand statement and supported the value $E_{ref} = E_{min} + 3$ dB.

4.7 The delegate of the United Kingdom welcomed the explanation given by the New Zealand delegate and considered that the value + 3 dB was technically appropriate because it would balance the effects of interference and noise. Comments had been made about the danger of setting all standards for each parameter at a low level which, when combined, might result in an unacceptable service. The possibility of having to consider reducing the protection ratio by reviewing the values of all parameters would not be ruled out by adopting the value of + 3 dB.

4.8 The delegate of China agreed with the delegate of Brazil : a value of 3 dB would increase the level of interference throughout the world. The Brazilian proposal in Document 55 (B/55/15) seemed reasonable. There was no reason why the Conference should not follow the decision taken at the Region 2 Broadcasting Conference by adopting reference level at the minimum usable field strength value.

4.9 The delegates of the Islamic Republic of Pakistan, Indonesia, the Islamic Federal Republic of the Comoros, Mexico and Argentina agreed with the delegate of China.

4.10 The delegate of Venezuela said the Committee should be careful about dealing with each parameter in isolation lest it arrived at a negative result through excessive caution. The Brazilian proposal was the most reasonable and no technical argument had been advanced by the New Zealand delegate to justify his choice of 3 dB rather than some other value. Of course, the Conference might have to review the position at a later stage but in the meantime he favoured $E_{ref} = E_{min}$.

4.11 The delegates of Portugal, Algeria, Mauritania, Chile, the Islamic Republic of Iran and Malaysia also favoured a value of $E_{ref} = E_{min}$.

4.12 The delegate of Ghana said that, unless a definite reference level was fixed for the whole system, each administration would choose what suited its requirements best. The value of $E_{ref} = E_{min} + 3$ dB would have to be accepted.

4.13 The delegate of Burundi agreed with the delegates of Brazil and China. The value + 3 dB was an arbitrary one and might entail unnecessary expenditure due to increases in transmitter power which the Committee should strive to prevent.

4.14 The delegate of Cameroon said that clearly opinion was as divided in Committee as it had been in Working Group 4B and to save time a decision should be reached by show of hands.

4.15 The delegate of France said that a possible compromise solution was indicated by the United Kingdom delegate's remark that the value of $E_{ref} = E_{min} + 3$ dB could be reconsidered later if necessary. He therefore proposed that the Committee should adopt the figure of + 3 dB and note at the same time that it would be reconsidered in the light of planning requirements.

4.16 The Chairman said that he had understood the United Kingdom delegate to mean that the figure could be reviewed and possibly revised during the Committee's remaining discussions on minimum technical parameters. That possibility was still open.

4.17 The delegate of the Netherlands said that E_{ref} had to be greater than E_{min} to allow for variations in receiver sensitivity, interference and other factors. Moreover, a very low figure would make no allowance for the lack of flexibility in existing transmitters. An increase of about 3 dB over E_{min} was required to avoid a dangerous situation.

4.18 The delegate of India said that every effort should be made to keep transmitter power as low as possible so as to avoid increasing interference, pollution of the electro-magnetic spectrum and other problems such as spurious emissions and harmonics. Since no logical reason had been given for raising E_{ref} above E_{min}, he wished to reiterate his delegation's support for the position taken by the delegates of Brazil and China. Where it was in fact necessary to raise E_{ref} above E_{min}, the process should not start at + 3 dB but from the level of $E_{ref} = E_{min}$.

4.19 The delegate of the United Kingdom said there appeared to be some misunderstanding of the proposal that E_{ref} should be set at E_{min} + 3 dB. Its purpose was to enable the required quality of service to be safeguarded by providing a margin to offset the effects of interference. The alternative proposal made no allowance for the effects of interference on the quality of service.

4.20 The delegate of Yugoslavia said that other parameters such as the protection ratio took account of interference. He therefore supported the delegates of Brazil and China.

4.21 The Chairman said that the Committee should make every effort to avoid settling such controversial issues by vote. Several delegations had expressed a wish for further informal consultations on the subject, for which there had so far been little time. He therefore proposed that the Committee should defer its decision until 30 January so as to allow time for informal consultations aimed at finding acceptable compromise solutions to the problem under discussion and any other controversial issues.

4.22 The delegate of Burundi said that the Committee's decision should not be deferred. Administrations ought to be pressed to use the lowest possible transmitter powers. If E_{ref} had to be raised to allow for interference, it should only be increased starting from the value $E_{ref} = E_{min}$.

4.23 The delegate of the United States pointed out that E_{ref} was only one of four interrelated factors. A hasty decision on its value would preclude the adjustments to all four factors which were needed to make them acceptable to administrations. He therefore supported the Chairman's proposal to allow time for consultations, with a view to producing a package proposal by 30 January which would put the issue in proper perspective.

4.24 The delegate of Norway agreed that the value of E_{ref} and the interrelated parameters still under discussion in Working Group 4B should be treated together as a package. He therefore also supported the Chairman's proposal that the Committee defer a decision pending consultations.

4.25 The Chairman said that there seemed to be a chance of reaching consensus on a compromise solution if the decision was deferred. The Committee was expected to conclude its work on 31 January and deferment of a decision until 30 January would not prevent it from doing so.

4.26 The Chairman of the Conference agreed that the course of action proposed by the Chairman and supported by the delegates of the United States and Norway offered the best solution to the Committee's difficulties.

4.27 The delegate of India inquired what mechanism, if any, was to be established to guide the proposed consultations, and pointed out that other matters on which there were disagreements also needed careful consideration.

4.28 The Chairman said it was not his intention to establish any sort of formal mechanism. There was still much misunderstanding about the various parameters and their interrelationship. The best chance of finding solutions was not by formal discussions in meetings but by delegations making use of every moment to clarify their positions through informal bilateral and multilateral contacts.

4.29 The delegate of India asked if the Chairman proposed to organize the informal consultations himself or to leave it to delegations to do so. In the latter case, he hoped that the Chairman would take responsibility for arranging informal meetings so as to ensure that the desired results were achieved in time.

4.30 The Chairman said that while he intended to be one of the mediators, he was also asking the Chairmen of Working Groups and Sub-Working Groups to initiate consultations and did not exclude similar initiatives by the Heads of interested delegations.

4.31 The delegate of the USSR said that he fully supported the Chairman's proposals. It would not be reasonable to place the responsibility for informal consultations on the Chairman alone. They must be multilateral and involve the Chairmen of Working Groups and Heads of Delegations as well. With a collective effort by everyone, agreed solutions to the problems facing the Committee could be achieved.

4.32 The Chairman said that, if he heard no objection, he would take it that the Committee agreed to defer decisions on the value of reference usable field strength (E_{ref}) and other controversial issues until 30 January 1984, pending the outcome of informal consultations.

It was so decided.

The meeting rose at 1655 hours.

The Co-Secretaries :

G. KOVACS

G. ROSSI

The Chairman :

J. RUTKOWSKI

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Addendum 2 to
Document 126-E
3 February 1984
Original : English

COMMITTEE 6

FOURTH SERIES OF TEXTS FROM COMMITTEE 4 TO COMMITTEE 6

In paragraph 3.2.1.1, add a second sentence :

"Because of the diurnal variations in ionospheric conditions, predictions shall be made for times of day with an interval not exceeding one hour."

J. RUTKOWSKI
Chairman of Committee 4

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Addendum 1 to
Document 126-E
26 January 1984
Original : English

COMMITTEE 6

Please add to the footnotes on pages 4 and 8 the following paragraph :

/ It should also be taken into account that an improved result may be obtained by considering the use of a term which varies with distance or geographical area. /

J. RUTKOWSKI
Chairman of Committee 4

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 126-E
25 January 1984
Original : English

COMMITTEE 6

FOURTH SERIES OF TEXTS FROM
COMMITTEE 4 TO THE EDITORIAL COMMITTEE
(Source : Documents 121, 122, 123)

The texts reproduced in Annexes 1 to 4 to this document were adopted in Committee 4 and are hereby submitted to the Editorial Committee.

J. RUTKOWSKI
Chairman of Committee 4

Annexes : 4

ANNEX 1

3.2.3.3 Calculation of fading allowance for different percentages of time

Fading allowances for other percentages of the time may be expressed in terms of, at the decile deviation, F_{90}, by the expression

$$F_x = c.\ F_{90}$$

where F_x is the deviation for x% of time.

Values of c for x in the range 50-90% are given in Table /‾3.2.3.3-I_7

TABLE /‾3.2.3.3-I_7

The parameter c

x (%)	c
50	0
60	0.18
70	0.36
80	0.63
90	1

ANNEX 2

3.2.1 The method to be used to determine the sky-wave field strength for HF broadcast planning purposes

3.2.1.1 Introduction

The field strength prediction method is in two parts : for ranges up to 7,000 km and for ranges beyond 9,000 km. In the interval, 7,000 to 9,000 km, an interpolation procedure is used.

3.2.1.2 Ionospheric parameters

Values of selected ionospheric parameters (foE, foF2 and M(3000)F2) are needed together with the derived parameters (E-layer basic MUF and F-layer basic MUF) in order to determine the field strength of sky-wave modes reflected from the ionosphere. For total path lengths between 0 and 4,000 km, the basic MUF of an E mode is predicted. For all path lengths the basic MUF for the F2 mode is predicted. Where appropriate the higher of the two values gives the basic MUF for the path.

The vertical radiation angle is also needed in the calculation of sky-wave field strength. The vertical radiation angle is used to determine the appropriate mode of propagation and is also used in conjunction with the antenna gain to determine the proper field strength.

The transmitting antennas in use will have gains which vary with the vertical radiation angle and some antennas, intended for shorter distance broadcasting, radiate very poorly at low angles. It is important to associate the antenna gain at the appropriate radiation angle with the propagation prediction for that particular mode.

3.2.1.2.1 E-layer parameters

3.2.1.2.1.1 E-layer data

For paths up to 2000 km foE is evaluated at the path mid-point. For ranges greater than 2000 km foE is evaluated at two control points, each 1000 km along the path from the transmitter and receiver respectively. At these points the solar zenith angle χ, in degrees, is determined, then :

$$foE = 0.9\left[(180 + 1.44R_{12})\cos\chi'\right]^{0.25} \text{ MHz}$$

where : $\chi' = \chi$ for $0 \le \chi \le 80$; $\chi' = 90 - \dfrac{e^{0.13(116-\chi)}}{10.8}$ for $80 < \chi < 116$

$\chi' = 89.907$ for $\chi \ge 116$

R_{12} is the 12 month running mean sunspot number

3.2.1.2.1.2 E-layer basic MUF prediction (E(D) MUF)

The foE value at the mid-point of the path (for paths up to 2000 km) or the lower of the foE values at the two control points (for paths longer than 2000 km) is taken for the computation of the E-layer basic MUF.

The MUF for a path of length D is given as :

$$E(D)MUF = foE. \sec i_{110}$$

With i_{110} = angle of incidence at a height of 110 km evaluated in accordance with Report 252.

3.2.1.2.1.3 E-layer screening frequency (f_s)

The foE value at the middle point of the path (for paths up to 2,000 km), or the higher one of the foE values at the two control points 1,000 km from each end of the path (for paths longer than 2,000 km), is taken for calculation of E-layer screening frequency.

$$f_s = 1.05 \text{ foE} \sec \varphi_s$$

in which $\varphi_s = \arc\sin \left[\frac{R \quad \cos\Delta_F}{R \quad + 110} \right]$

R is the radius of the Earth, 6,371 km,

Δ_F is the vertical radiation angle for F2-layer mode (see section 3.2.1.2.3)

3.2.1.2.2 F-layer parameters

3.2.1.2.2.1 F2-layer data

Numerical maps of the parameters foF2 and M(3000)F2, for solar index values R_{12} = 0 and 100, and for each month are presented in Report 340. This prediction method uses the Oslo coefficients to determine the values of foF2 and M(3000)F2 for the required locations and times. It may be desirable to calculate in advance, values of these parameters at specific grid intervals of latitude, longitude and times and to use an interpolation procedure to obtain values for the required location and time between appropriate grid points. The use of a grid may be appropriate for other ionospheric parameters as well.

3.2.1.2.2.2 F2-layer basic MUF prediction (F2(D)MUF)

3.2.1.2.2.2.1 For paths up to 4,000 km

F2-layer basic MUF is calculated from

$$F2(ZERO)MUF = foF2 + f_H/2$$

$$F2(4000)MUF = 1.1\ foF2.M(3000)F2$$

where f_H is the electron gyro-frequency given in terms of parameters of the Earth's magnetic field. A numerical representation is available in Report 340.

At the midpoint of the great-circle path between the transmitter and receiver determine the above values for the solar index values $R_{12} = 0$ and $R_{12} = 100$. Interpolate or extrapolate linearly for required index values between $R_{12} = 0$ and 150. For higher sunspot activity use $R_{12} = 150$.

Interpolate for the length of the path using the relationship :

$$F2(D)MUF = F2(ZERO)MUF + \left[F2(4000)MUF - F2(ZERO)MUF\right] \cdot M(D)$$

where $M(D) = 1.64 \cdot 10^{-7}D^2$ for $0 \leq D < 800$ and

$$M(D) = 1.26 \cdot 10^{-14}D^4 - 1.3 \cdot 10^{-10}D^3 + 4.1 \cdot 10^{-7}D^2 - 1.2 \cdot 10^{-4}D$$

for $800 \leq D \leq 4000$.

where D is in km.

This gives the median F2-layer basic MUF.

3.2.1.2.2.2.2 For paths longer than 4,000 km

For these paths (which may be the longer great-circle path), control points are taken at 2,000 km from each end of the path. At these points, values of F2(4000)MUF, interpolating for sunspot number, are determined and the lower value is selected. This gives the median F2-layer basic MUF.

3.2.1.2.3 Vertical radiation angle

Radiation angle is taken into account in the prediction of field strength. It is given, approximately, by :

$$\Delta = \arctan\left(\cot\frac{d}{2R} - \frac{R}{R + h'}\operatorname{cosec}\frac{d}{2R}\right)$$

where

d = hop length of an n hop mode given by $d = D/n$

h' = 110 km for the E-layer or h' is as given in 3.2.1.3.1.1 for the F2-layer.

In the method for shorter path lengths (section 3.2.1.3.1) the radiation angles calculated are used in the determination of antenna gain. For the longer path lengths the appropriate procedure is described in section 3.2.1.3.2.

3.2.1.3 The prediction of the median field strength

3.2.1.3.1 Method for path lengths of 0 to 7,000 km

CCIR Report 252-2 details the geometrical considerations, the reflection areas used and the method of performing ray-path calculations.

The procedure is based on the ray-path geometry with mirror reflections in the ionosphere. The method determines the field strengths of the two strongest modes propagated via the F2 region and the strongest mode propagated via the E region. The resultant field strength from these modes is obtained by power addition. In circumstances where a low-order F2 mode is screened by the E-layer, as determined in the ray-path calculations, or where an antenna is specified which only radiates sufficiently at high angles, the next higher-order mode must be considered.

It is recognized that multi-hop E region propagation suffers substantial absorption losses and E modes are not considered at ranges beyond 4,000 km.

The appropriate inclusion of these concepts into a computer implementation for practical planning purposes is in accordance with the following procedure.

3.2.1.3.1.1 For the path length, d(km), determine the minimum number of hops for an F2 region mode. This is given approximately as ((the integer part of d ÷ 4,000) + 1) or better, by calculating the ray-path geometry using the height hpF2 given by :

$$hpF2 = \frac{1490}{M(3000)F2} - 176 \quad km$$

The reflection height h', which is a function of time, location and path length, is used for the ray-path calculations for F2-modes. It is given by :

$$h' = 358 - (11 - 100a)\left(18.8 - \frac{320}{x^5}\right) + ad\left(0.03 + \frac{14}{x^4}\right) \quad km$$

or 500 km, whichever is the smaller,

a = 0.04 or (1/M(3000)F2) - 0.24, whichever is the larger and

x = foF2/foE, determined at the control point with the lowest value of foF2, or 2, whichever is the larger.

3.2.1.3.1.2 For the given mode, determine the vertical radiation angle from section 3.2.1.2.3 and then determine the transmitting antenna gain G_t at that angle and the appropriate azimuth, relative to an isotropic antenna.

3.2.1.3.1.3 Compute the median field strength for that mode using the formula :

$$E_{ts} = 136.6 + P_t + G_t + 20 \log f - L_{bf} - L_i - L_m - L_g - L_h - 12.2^* \quad dB(1\mu V/m)$$

where f is the transmitting frequency in MHz and P_t is the transmitter power in dB relative to 1 kW. L_{bf} is the basic free space transmission loss in dB, given by :

$$L_{bf} = 32.45 + 20 \log f + 20 \log P'$$

P' is the virtual slant range in km

$$P' = \left[2R \sum_{n} \frac{\sin \frac{d}{2R}}{\cos\left(\Delta + \frac{d}{2R}\right)}\right]$$

*/ This term contains those effects of sky-wave propagation not otherwise included in this fast simple method. A value of 12.2 dB is recommended based upon data available. It is noted, however, that the value may need to be changed by those implementing this procedure to take account of additional calibrated data which become available./

L_i is the absorption loss in dB given in CCIR Report 252-2. It is determined for each hop and the results are added. For frequencies above the basic MUF, it continues to vary with frequency and is calculated assuming ray paths similar to those at the MUF.

L_m is the "above-the-MUF" loss. For frequencies, f, above the basic MUF (f_b) of a given mode :

$$L_m = 130 \left(\frac{f}{(f_b)} - 1 \right)^2 \quad \text{dB}$$

L_m is independent of the number of hops, but is limited to a value of 81 dB.

L_g is the ground reflection loss at intermediate reflection points. It is given as 2 dB for each intermediate ground reflection, i.e. :

for one hop paths $L_g = 0$;

two hop paths $L_g = 2$ dB;

three hop paths $L_g = 4$ dB.

L_h is the factor to allow for auroral and other signal losses and is given in Tables 1 and 2 using the methods given in Report 252-2 to determine the local mean time, the geomagnetic latitude and the locations at which it is applied.

3.2.1.3.1.4 Repeat the procedure of 3.2.1.3.1.2 and 3.2.1.3.1.3 using successively higher order modes (increasing the number of hops by one each time) until the predicted mode field strength reaches a maximum. Select the two strongest F2 region modes, noting the field strength and radiation angles.

3.2.1.3.1.5 For the E region the lowest order mode is 1E for ranges 0 - 2,000 km and 2E for ranges 2,000 to 4,000 km. The E mode radiation angle and field strength are again obtained as in section 3.2.1.2.3 and section 3.2.1.3.1.3.

3.2.1.3.1.6 Repeat the E mode calculations for successively higher modes until a maximum is found.

3.2.1.3.1.7 The resultant of combining the field strengths of the two strongest F2 modes and the strongest E mode is obtained by calculating the square root of the sum of the squares of the numerical values of the field strengths.

3.2.1.3.2 <u>Method for path lengths greater than 9,000 km</u>

At long ranges, generally with low radiation angles, the method of prediction using geometric ray-hops is inadequate at present. The method used for long distances is based on an empirical fit of observations. In this method the antenna gain term, G_{tl}, is the greatest value of antenna gain in dBi which occurs in the range of vertical radiation angles from 0^0 to 8^0 at the appropriate azimuth.

TABLE 1

L_h for paths less than 2,500 km

G.M. LAT.	01-04LMT	04-07LMT	07-10LMT	10-13LMT	13-16LMT	16-19LMT	19-22LMT	22-01LMT
	WINTER (NOVEMBER, DECEMBER, JANUARY, FEBRUARY in the Northern Hemisphere) (MAY, JUNE, JULY, AUGUST in the Southern Hemisphere)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
45-50	0.1	0.3	0.6	0.0	0.1	0.1	0.3	0.1
50-55	0.6	0.8	1.6	0.1	0.3	0.6	1.0	0.3
55-60	1.5	2.1	4.4	0.7	0.8	2.2	2.5	1.3
60-65	4.8	8.2	10.5	2.7	1.6	5.7	7.3	5.2
65-70	6.7	11.0	13.5	3.0	1.7	5.8	8.6	6.0
70-75	5.7	7.9	10.7	1.7	0.9	3.6	4.1	4.0
75-80	2.5	5.0	7.1	0.9	0.3	1.9	2.3	2.0
	EQUINOX (MARCH, APRIL, SEPTEMBER, OCTOBER)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.0	0.1	0.2	0.1	0.1	0.3	0.2	0.1
45-50	0.4	0.4	0.9	0.6	0.4	1.3	0.9	0.8
50-55	1.0	1.0	2.7	1.8	1.2	2.7	2.1	2.1
55-60	2.0	3.0	6.2	3.7	2.6	4.5	4.0	5.0
60-65	4.7	5.0	12.0	7.5	5.6	7.8	9.0	11.8
65-70	6.8	11.6	19.6	8.8	6.3	7.8	10.3	14.6
70-75	4.9	11.7	20.0	6.2	3.3	4.9	7.7	9.5
75-80	2.0	7.5	9.2	3.9	1.6	3.0	4.2	4.1
	SUMMER (MAY, JUNE, JULY, AUGUST in the Northern Hemisphere) (NOVEMBER, DECEMBER, JANUARY, FEBRUARY in the Southern Hemisphere)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.1	0.1	0.0	0.1	0.1	0.2	0.1	0.0
45-50	0.5	0.4	0.5	0.4	0.5	1.1	1.0	0.4
50-55	1.3	1.1	1.4	1.0	1.1	3.0	2.9	0.7
55-60	2.9	2.4	3.0	2.6	2.9	5.8	5.8	1.8
60-65	6.0	4.1	6.0	5.3	4.3	8.4	7.6	4.3
65-70	6.0	4.6	7.3	5.0	4.2	7.2	8.8	5.0
70-75	3.7	3.8	5.0	3.5	3.2	4.8	6.0	3.4
75-80	2.4	2.8	3.1	2.7	2.3	3.8	4.3	2.1

TABLE 2

L_h for paths greater than 2,500 km

G.M. LAT.	01-04LMT	04-07LMT	7-10LMT	10-13LMT	13-16LMT	16-19LMT	19-22LMT	22-01LMT
	WINTER (NOVEMBER, DECEMBER, JANUARY, FEBUARY in the Northern Hemisphere) (MAY, JUNE, JULY, AUGUST in the Southern Hemisphere)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-50	0.1	0.1	0.1	0.0	0.1	0.1	0.2	0.2
50-55	0.4	0.4	0.2	0.0	0.4	0.4	0.9	0.8
55-60	1.1	1.8	0.9	0.2	1.2	1.4	2.0	2.3
60-65	3.3	6.2	2.6	1.3	2.6	3.4	3.6	7.6
65-70	5.5	6.4	4.1	2.0	4.1	3.6	4.4	9.9
70-75	3.9	4.6	3.3	1.3	4.0	2.2	3.1	8.0
75-80	2.2	3.2	1.9	0.7	2.7	1.2	1.2	2.9
	EQUINOX (MARCH, APRIL, SEPTEMBER, OCTOBER)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0
45-50	0.2	0.2	0.3	0.2	0.1	0.5	0.6	0.4
50-55	0.5	0.6	0.5	0.6	0.5	1.6	1.8	1.1
55-60	1.0	1.3	1.3	1.7	1.3	3.4	3.8	2.4
60-65	2.9	3.8	4.2	4.1	2.9	6.3	8.4	7.3
65-70	4.3	5.6	6.4	5.1	4.4	6.3	9.2	9.3
70-75	3.0	4.7	5.0	3.0	2.4	3.4	5.4	4.8
75-80	1.3	1.9	2.2	0.8	0.8	0.8	1.2	1.1
	SUMMER (MAY, JUNE, JULY, AUGUST in the Northern Hemisphere) (NOVEMBER, DECEMBER, JANUARY, FEBRUARY in the Southern Hemisphere)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
45-50	0.5	0.3	0.4	0.2	0.4	0.1	0.6	0.5
50-55	1.1	1.1	1.1	0.6	1.2	0.4	1.9	1.3
55-60	2.5	2.9	2.6	1.1	2.5	1.2	3.8	2.9
60-65	4.9	7.5	6.2	2.2	3.8	2.6	5.2	5.0
65-70	5.0	7.8	6.1	2.3	3.8	2.7	4.8	5.0
70-75	3.2	5.4	3.4	1.5	2.2	0.9	2.6	3.2
75-80	2.0	4.3	1.5	1.1	0.8	0.1	0.9	1.4

The overall median field strength is given by :

$$E_{t1} = E_o\left(1 - \frac{(f_M+f_H)^2}{(f_M+f_H)^2 + (f_L+f_H)^2}\left(\frac{(f_L+f_H)^2}{(f+f_H)^2} + \frac{(f+f_H)^2}{(f_M+f_H)^2}\right)\right) - 36.4 + P_t + G_{tl} + G_{ap} - 0.8^{*} \quad \text{dB}\left(\frac{1\mu V}{m}\right)$$

E_o = 139.6 - 20 log P', and the height used in the determination of P' is 300 km.

It is assumed within this procedure that there is a hypothetical ray path with a number of equal length hops, each less than 4,000 km.

G_{ap} is the increase in field strength due to focussing at long distances. In the case of propagation to very long distances with D, the great-circle distance between transmitter and receiver, greater than $\pi R/2$, this focussing is taken into account by means of the following formula :

$$G_{ap} = -20 \log\left(\left|1 - \frac{n\pi R}{D}\right|\right) \quad \text{dB}$$

for

$$\left(\frac{2n-1}{2}\right)\pi R < D < \left(\frac{2n+1}{2}\right)\pi R \qquad \text{with } n = 1 \text{ and } 2.$$

As G_{ap} tends to infinity for $D = n\pi R$ it is limited arbitrarily to the value of 30 dB.

f_M is the upper limit frequency. It is determined separately for the first and last hops of the path and the lower value is taken.

$$f_M = K \cdot f_b \qquad \text{MHz}$$

$$K = 1.2 + W\frac{f_b}{f_{b,\,noon}} + X\left(\sqrt[3]{\frac{f_{b,\,noon}}{f_b}} - 1\right) + Y\left(\frac{f_{b,\,min}}{f_{b,\,noon}}\right)^2$$

f_b is the basic MUF determined by the method given in section 3.2.1.2.2.2.

$f_{b,\,noon}$ is the value of f_b for a time corresponding to local noon at the control point

$f_{b,\,min}$ is the lowest value of f_b for the hop which occurs during the 24 hours

W, X and Y are given in Table 3. The azimuth of the great-circle path is determined at the centre of the whole path and this angle is used for linear interpolation in angle between the east-west and north-south values.

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*[This term contains those effects of sky-wave propagation not otherwise included in the method. A value of 0.8 dB is recommended based upon data available. It is noted however that this value may need to be changed by those implementing this procedure to take account of additional calibrated data which become available.]

TABLE 3

Values W, X, Y used for the determination of the correction factor K

	W	X	Y
East-west	0.1	1.2	0.6
North-south	0.2	0.2	0.4

f_L is the lower limit frequency when the path is in daylight

$$f_L = \left(5.3 \cdot I \left[\frac{(1 + 0.009R_{12}) \sum_{in} \cos^{\frac{1}{2}} \chi}{\cos i_{90} \ln \left(\frac{9.5 \cdot 10^6}{P'}\right)} \right]^{\frac{1}{2}} - f_H\right) \cdot A_W \quad \text{MHz}$$

In the summation, χ is determined for each traverse of the ray path through the height of 90 km.

when $\chi > 90^\circ$, $\cos^{\frac{1}{2}}\chi$ is taken as zero

i_{90} is the angle of incidence at a height of 90 km

I is given in Table 4.

A_W is a winter-anomaly factor determined at the path mid-point which is unity for geographic latitudes 0 to 30° and at 90° and reaches the maximum values given in Table 5 at 60°. The values at intermediate latitudes are found by linear interpolation.

As the path progressively becomes dark the values of f_L are calculated until the time t_n when $f_L \leq 2f_{LN}$ where $f_{LN} = \sqrt{\frac{D}{3000}}$ (MHz). During the subsequent three hours f_L is calculated from $f_L = 2f_{LN}e^{-0.23t}$ where t is the time in hours after t_n. For the remainder of the night hours $f_L = f_{LN}$ until the time when the daylight equation gives a higher value.

TABLE 4

Values of I used in the equation for f_L

Latitudes		Month											
Terminal 1	Terminal 2	J	F	M	A	M	J	J	A	S	O	N	D
>35°N	>35°N	1.1	1.05	1	1	1	1	1	1	1	1	1.05	1.1
>35°N	35°N-35°S	1.05	1.02	1	1	1	1	1	1	1	1	1.02	1.05
>35°N	>35°S	1.05	1.02	1	1	1.02	1.05	1.05	1.02	1	1	1.02	1.05
35°N-35°S	35°N-35°S	1	1	1	1	1	1	1	1	1	1	1	1
35°N-35°S	>35°S	1	1	1	1	1.02	1.05	1.05	1.02	1	1	1	1
>35°S	>35°S	1	1	1	1	1.05	1.1	1.1	1.05	1	1	1	1

TABLE 5

Values of the winter-anomaly factor, A_W, at 60° geographic latitude used in the equation for f_L

Month

hemisphere	J	F	M	A	M	J	J	A	S	O	N	D
Northern	1.30	1.15	1.03	1	1	1	1	1	1	1.03	1.15	1.30
Southern	1	1	1	1.03	1.15	1.30	1.30	1.15	1.03	1	1	1

3.2.1.3.3 Method for path lengths between 7,000 and 9,000 km

In this range of distances, the field strengths E_{ts} and E_{tl} are determined by both of the above procedures and the resultant is found by appropriate mathematical interpolation. The interpolation procedure is given as :

$$E_{ti} = E_{ts} + \frac{D-7000}{2000}(E_{tl} - E_{ts}) \quad \text{dB}(1\mu\text{V/m})^{*}$$

*/ Taking account of the data that become available, those charged with implementing this procedure may consider an alternative form for this interpolation. /

ANNEX 3

THEORETICAL CAPACITY OF THE HFBC BANDS

The theoretical capacity of the HFBC bands is dependent on a variety of factors. These include the radio-frequency protection ratio, transmitter powers, the antenna directivities and the assignment method.

Also important for the channel capacity is the time period and the frequency band considered. Based on calculations accomplished by several administrations and utilizing the data of the IFRB, the average capacity (available number of stations/channel at a given time) was generally found to be in the range of three to four.

The capacity decreases in the higher frequency bands and for higher RF protection ratios. The range of capacity is from one to seven.

In general no single value for the capacity of any band can be determined since the capability to accommodate requirements is subject to factors which would vary from one schedule to another.

/ Note to the Editorial Committee : the appropriate place and numbering is to be determined. /

ANNEX 4

3.9 Specifications and progressive introduction of an SSB system

Considering the advantages of SSB transmission, such as :

- a more efficient utilization of the frequency spectrum by a reduction of interference;
- the capability of improving the required protection ratio between adjacent channels in the case of a sufficient carrier reduction;
- the capability of improving the quality of reception, in particular under poor propagation conditions (selective fading), with SSB receivers;
- the possiblity to produce the same sideband power as a current DSB transmitter with less capital and operational costs,

the Conference adopted the following Single Sideband (SSB) system specifications under the assumption of a progressive introduction of receivers with synchronous demodulation. With respect to a necessary transition period from DSB to SSB, some consideration must also be given to the reception of SSB signals with reduced carrier by receivers with envelope detection. At the end of the transition, all of the advantages of SSB transmissions mentioned above could then be realized.

3.9.1 SSB system specification

3.9.1.1 Audio-frequency bandwidth

The upper limit of the audio bandwidth of the transmitter shall not exceed 4.5 kHz with a further slope of attenuation of 35 dB/kHz and the lower limit shall be 150 Hz with lower frequencies attenuated at a slope of 6 dB per octave.

3.9.1.2 Necessary bandwidth

The necessary bandwidth is equal to the audio-frequency bandwidth.

3.9.1.3 Characteristics of modulation processing

The audio signal shall be processed such that the modulating signal retains a dynamic range of not less than 20 dB. Excessive amplitude compression, together with improper peak limitation, will lead to excessive out-of-band radiation and thus to adjacent channel interference, and shall therefore be avoided.

3.9.1.4 Channel spacing

During the transition period, the channel spacing for SSB shall be 10 kHz. In the interest of spectrum conservation, during the transition period, it is permissible to interleave DSB and SSB transmissions midway between two adjacent channels, i.e. 5 kHz separation between carrier frequencies, to different geographical areas.*

* See also section [3.1.2].

After the end of the transition period the channel spacing and carrier frequency separation shall be 5 kHz.

3.9.1.5 Nominal carrier frequencies

Carrier frequencies for SSB shall be integral multiples of 5 kHz.

3.9.1.6 Sideband to be emitted

The upper sideband shall be used.

3.9.1.7 Suppression of the unwanted sideband

With respect to the relative RF protection ratio, the degree of suppression of the unwanted sideband (lower sideband) and of intermodulation products in that part of the transmitter spectrum shall be at least 35 dB relative to the wanted sideband signal level. Because of the large difference of signal amplitudes in adjacent channels in practice, however, a greater suppression is recommended, (e.g. 50 dB in the exciter producing the SSB signal at low power level and 40 dB suppression of unwanted intermodulation products in the RF power amplifier of the transmitter).

3.9.1.8 Degree of carrier reduction (relative to peak envelope power)

During the transition period the carrier reduction of the SSB emission shall be 6 dB, to allow SSB transmissions to be received by conventional DSB receivers with envelope detection without significant deterioration of the reception quality.

At the end of the transition period the carrier reduction of the SSB emission shall become 12 dB.

3.9.1.9 Frequency tolerance

The frequency tolerance of the SSB carriers shall be ± 10 Hz*.

*Note - This frequency tolerance is acceptable only under the assumption that future SSB receivers will be equipped with a device locking the locally re-inserted carrier for synchronous demodulation to the carrier of the SSB emission. (See also paragraph 3.9.1.11.)

3.9.1.10 Overall selectivity of the receiver

The reference receiver shall have an overall bandwidth of 4 kHz, with a slope of attenuation of 35 dB/kHz*.

*Note - Other combinations of bandwidth and slope of attenuation as given below are possible with the same relative RF protection ratio of about -27 dB at 5 kHz carrier difference.

Slope of Attenuation	SSB Receiver Audio-Frequency Bandwidth
25 dB/kHz	3300 Hz
15 dB/kHz	2700 Hz

3.9.1.11 Detection system of the SSB receiver

SSB receivers shall be equipped with a synchronous demodulator, using for the carrier acquisition a method whereby a carrier is regenerated by means of a suitable control loop which pulls the receiver to the incoming carrier. Such receivers must work equally well with conventional DSB transmissions and with SSB transmissions having a carrier reduced to 6 or 12 dB relative to peak envelope power.

3.9.1.12 Equivalent sideband power

During the transition period an equivalent SSB emission is one giving the same loudness level as the corresponding DSB emission, when it is received by a DSB receiver with envelope detection. This is achieved when the sideband power of the SSB emission is 3 dB larger than the total sideband power of the DSB emission. (The peak envelope power of the equivalent SSB emission as well as the carrier power are the same as that of the DSB emission.)

After the end of the transition period, the equivalent sideband power can be reduced by 3 dB.

3.9.1.13 RF protection ratios

Assuming that the SSB and DSB emissions correspond to the technical characteristics specified above the following RF protection ratios shall be applied :

- during the transition period :

RF co-channel protection ratio

Due to the need to increase the radiated sideband power by 3 dB in the case of equivalent SSB emissions, there is a consequent need to make an allowance of the same 3 dB in the co-channel protection ratio for the case of a wanted DSB signal interfered with by an SSB signal, if the same quality of reception is to be maintained.

Relative RF protection ratios :

(For the following protection ratios SSB emissions with equivalent sideband power are assumed.)

a) If a wanted DSB signal is received by a conventional DSB receiver with envelope detection which is interfered with by an SSB emission.

According to the resulting RF protection ratio, reception of the wanted DSB signal in the lower channel (interfering carrier for example at $\Delta F = +5$ kHz) will be impaired by about 1 dB, while under the same conditions reception of the wanted DSB signal in the upper adjacent channel (interfering carrier for example at $\Delta F = -5$ kHz) will be impaired by about 4 dB in comparison to the present RF protection ratios, as specified in Figure [C] of paragraph 3.3.2.

The corresponding value for $\Delta F = \pm 10$ kHz will be -3 dB impairment.

b) For the case of a <u>wanted SSB signal interfered with by a DSB signal</u>, values of Figure [C] of paragraph 3.3.2 shall be used.

c) In case of a <u>wanted SSB signal interfered with by an SSB signal</u>, the values mentioned in a) above shall be applied.

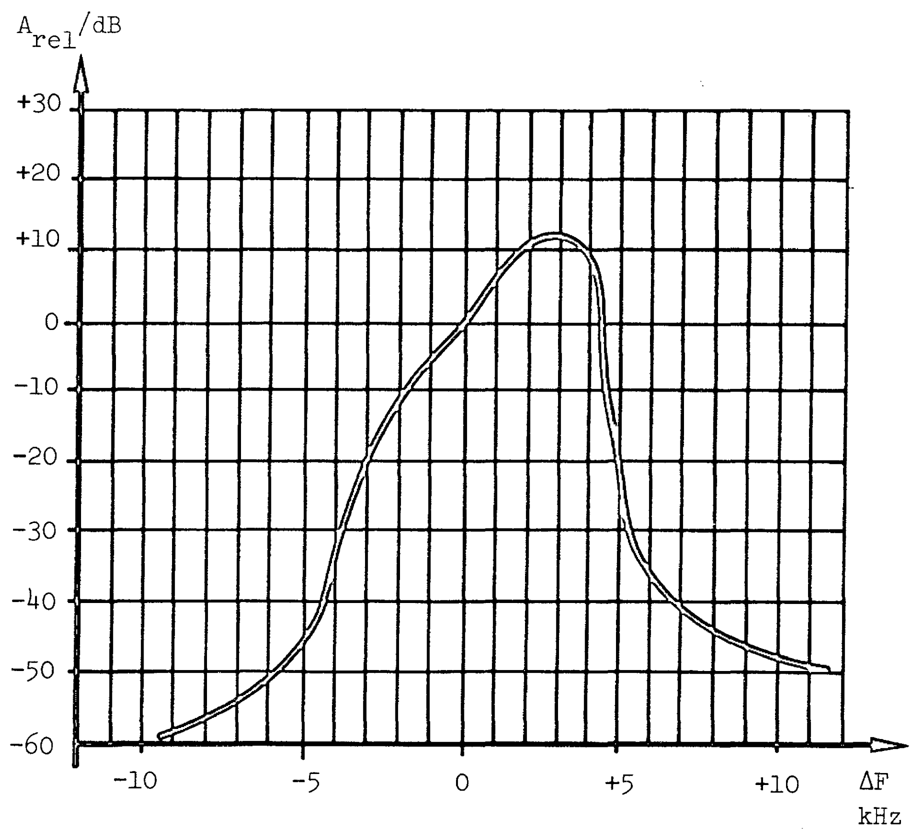
- <u>after the end of the transition period</u> (both wanted and interfering signals are SSB signals)

<u>RF co-channel protection ratio</u> :

The RF protection ratio is the same as that applied for the DSB system.

<u>Relative RF protection ratios</u> :

Relative RF protection ratios shall be as shown in Figure [E]



<u>FIGURE [E]</u>

RF protection ratios A_{rel} is given with respect to the frequency difference ΔF between the wanted carrier f_w and the interfering carrier f_i

$$\Delta F = f_i - f_w$$

Thus positive ΔF describes interference from the upper adjacent channel.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Corrigendum 1 to
Document 127-E
2 April 1984
Original : English

PLENARY MEETING

MINUTES

OF THE

FOURTH PLENARY MEETING

Paragraph 1.3

In the fifth sentence, replace "Latterly, progress seemed to be more encouraging, ..." by "Lately, the progress seemed to be more encouraging, ..."

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 127-E
31 January 1984
Original : English

PLENARY MEETING

MINUTES

OF THE

FOURTH PLENARY MEETING

Thursday, 26 January 1984, at 1610 hrs

Chairman : Mr. K. BJÖRNSJÖ (Sweden)

Subjects discussed :		Document
1.	Oral reports by Chairmen of Committees	
2.	First report of Committee 4	120
3.	First series of texts submitted to the Plenary Meeting for first reading (B.1)	115(Rev.1)
4.	Approval of the Minutes of the third Plenary Meeting	91

1. Oral reports by Chairmen of Committees

1.1 The Chairman of Committee 2 said that a Working Group of that Committee had held two meetings to examine the 86 credentials so far submitted, all of which had been found to be in order. Further meetings would be held to examine the credentials still to be submitted, and delegations which had so far not deposited them were requested to do so within the deadline.

1.2 The Chairman of Committee 3 said that his Committee had held three meetings, the main focus of its work being to review periodically the position of the Conference accounts. The latest position was given in Document 114, which had been received at the meeting held earlier in the day, and an updating should be available early the following week. The Committee had also begun to focus on the provisions in the Convention, notably Article 80 and Resolution 48, which requested conferences to pay due regard to the financial implications of their decisions. Committee 3 had therefore prepared, in Document 98, a Note to the Chairmen of Committees 4 and 5 requesting that the appropriate information in respect of the provisions of Resolution 48 in particular be passed on to Committee 3. So far no comments had been received.

1.3 The Chairman of Committee 5 said that his Committee had held three meetings, and had formed two Working Groups. Working Group 5A had held a number of meetings, but Working Group 5B had held only one, since most of its work depended on the decisions of Working Group 5A, which had formed an ad hoc Group 5A-2 consisting of those delegations with substantive proposals and comments on the main issues before the Conference. Ad hoc Group 5A-2 had held many meetings both day and night tackling the central issues concerned. Progress had been slow because some of the fundamental issues required decisions by delegations with strong views. Latterly, progress seemed to be more encouraging, although there had been no formal indication by the Chairman of the ad hoc Group. However, the Group was expected to make sufficient progress in the very near future to enable Working Groups 5A and 5B and Committee 5 to produce a substantive report for the next Plenary Meeting.

1.4 The Chairman of Committee 6 said that the Plenary had before it Document 115(Rev.1) containing the definitions submitted by Committee 4, and a number of paragraphs on technical criteria. The Editorial Committee had considered it preferable to rearrange the order of the definitions under subject headings to make it easier for the reader. Section 2.11 (Terms Related to Planning) still had to be supplied by Committee 5. Attention was drawn to the footnote in square brackets relating to the introductory sentence of Chapter 2 : Definitions, which had been included pending further indications from Committee 4, since it was not the job of the Editorial Committee to delete any definitions.

2. First report of Committee 4 (Document 120)

2.1 The Chairman of Committee 4 said that the Working Groups of his Committee, by holding three night meetings, had just completed their work. The very slight delay was not expected to affect the final stages of the work of the Committee. The result of the Committee's work so far was contained in Document 115(Rev.1) which comprised the texts contained in Documents 93, 107 and 119.

Both the relevant Working Group and the Committee had had lengthy discussions on man-made noise data (section 3.2.2.2 of Document 115(Rev.1)). For planning purposes, the Recommendation of the CCIR had been curve C, corresponding to rural areas as shown in Figure 1 of CCIR Report 258-4, bearing in mind the requests made by many developing countries. Some delegations had been of the view that man-made noise should not be considered, but it had finally been agreed to adopt a value some 7 dB below curve C. Nevertheless certain delegations had not been in agreement, and the USSR delegation had reserved the right to revert to the subject again in the Plenary, as stated in Document 120.

In the last few days, the Working Groups had encountered difficulties with certain parameters and agreement had been impossible both at Working Group and at Committee level. To avoid taking a final decision by vote, it had been decided that informal discussions should be held with a view to taking a final decision in the Committee at the beginning of the following week, and the necessary mechanisms had been created to make such informal discussions possible. It was to be hoped that with a spirit of cooperation, appropriate decisions could be reached.

2.2 The delegate of the USSR said that his delegation had entered its reservation because the man-made noise value adopted by Committee 4 was not characteristic of the majority of areas.

3. First series of texts submitted to the Plenary Meeting for first reading (B.1) (Document 115(Rev.1))

3.1 Chapter 2 : Definitions

3.1.1 Section 2.1 : Terms relating to emission
Section 2.2 : Terms relating to frequency
Section 2.3 : Terms relating to bandwidth
Section 2.4 : Terms relating to power
Section 2.5 : Terms relating to zones of reception

3.1.1.1 The Chairman of the IFRB said that the existing definitions in the Radio Regulations normally applied to services planned by a conference and it was often not necessary to mention them. If, however, for any reason the present Conference wished to do so, the introductory sentence to Chapter 2 would have to be very precise. The present use of the words "also noted" for something which was obligatory might weaken the meaning, and he therefore suggested that that sentence should be reworded to read :

> "The first session of the Conference considered that the following definitions contained in the Radio Regulations, Geneva, 1979 could be used for the planning of the HF broadcasting service."

A further sentence would then be required, following section 2.5, as follows :

> "The first session also adopted the following definitions which apply solely to the HF broadcasting service."

The footnote stating that the definition was applicable only to the HF broadcasting service could thus be deleted.

3.1.1.2 The delegate of Italy pointed out that if that course of action were adopted, the term "reduced carrier" which did not appear in the Radio Regulations would have to be dealt with separately.

3.1.1.3 The Chairman of the IFRB agreed with that view. The Radio Regulations did contain a definition of "reduced carrier" applying to all services, and if the Conference wished to specify that for the HF broadcasting service it was to be defined as being reduced to 6 dB, it would have to be included in one of the subsequent sections.

3.1.1.4 The Vice-Chairman of Committee 6 recalled the point made by the Chairman of Committee 6 that the definitions could be presented either by subject matter or by separating those which were already in the Radio Regulations from those developed at the present Conference. The Chairman of the IFRB had suggested the latter arrangement but he personally held the view that the former was more suitable for the reader who had not participated in the present Conference.

3.1.1.5 The Chairman of the IFRB observed that he had not referred only to presentation, but also to the weakness of the term "noted". If the presentation was to remain as in Document 115(Rev.1), the definition of "reduced carrier" would require a footnote stating that it referred only to the HF broadcasting service.

3.1.1.6 The representative of the IFRB pointed out that Committee 4, in Documents 93 and 107, had originally submitted the definitions to the Editorial Committee in the form proposed by the Chairman of the IFRB, and that they had subsequently been rearranged by the Editorial Committee.

3.1.1.7 The delegate of the USSR said that drafting matters should not be discussed in the Plenary Meeting. Committee 4 had done the most difficult task in providing the definitions, and their presentation should be left to the Editorial Committee to work on in the light of the Plenary's discussions.

3.1.1.8 The Chairman of Committee 6 said that the points raised by the Chairman of the IFRB had been well taken. However, she would like the Plenary to state its preferences as regards presentation.

3.1.1.9 The Chairman of the IFRB said that if the introductory sentence could be changed and a note inserted stating that a definition referred specifically to the HF broadcasting service, he would withdraw his suggestion.

3.1.1.10 The Chairman of Committee 4 said that the problem might be solved and all ambiguity removed if the two sentences originally proposed by the Chairman of the IFRB were inserted where he had suggested, and the term "reduced carrier" put into a separate section.

3.1.1.11 The Chairman said that there was still the question of the arrangement of the definitions. It seemd that from section 2.6 onwards there were only new definitions and no reference to any definition already in the Radio Regulations. It might be confusing to introduce a sentence between sections 2.5 and 2.6 even though all the definitions in sections 2.6, 2.7, 2.8, 2.9 and 2.10 were to be considered as applying only to HF broadcasting. He therefore suggested that Committee 6 might so indicate in an appropriate manner either by footnotes or an introductory sentence.

It was so agreed.

3.1.2 Section 2.6 : Terms relating to propagation
Section 2.7 : Terms relating to reliability
Section 2.8 : Terms relating to field-strength
Section 2.9 : Terms relating to the ratio of wanted and unwanted signals

Approved.

3.1.3 Section 2.10 : Terms relating to coverage and service area

3.1.3.1 The delegate of the United Kingdom said that use of the word "station(s)" in the definition of service area could lead to confusion, since it was unclear whether the term referred to a transmitting or receiving station, or to a fixed station, etc.

3.1.3.2 The delegate of Algeria shared the view expressed by the delegate of the United Kingdom. Furthermore, he recalled that in Committee 5 the IFRB had indicated that it might encounter substantial difficulties in coordinating the two definitions in section 2.10 with a further definition being developed by Working Group 5A.

3.1.3.3 The Chairman of the IFRB said that the IFRB considered that the definitions in section 2.10 must be examined in conjunction with the definition of "required service area" currently being drafted by Committee 5, and that it was necessary for planning purposes to establish the exact relationship between the three areas. In addition, the definition of "service area" referred to a frequency allotment plan, whereas the relevant Working Group of Committee 5 was not considering such a plan.

3.1.3.4 The Chairman of Committee 4 proposed that a joint meeting of Committees 4 and 5 be convened to discuss the matter since the definitions at issue involved both planning and technical aspects. The definitions in section 2.10 could be placed in square brackets pending the outcome of that meeting.

It was so agreed.

It was further agreed that a new section 2.11 relating to planning, to be supplied by Committee 5, would be inserted at a later stage.

3.2 Chapter 3 : Technical criteria

3.2.1 Section 3.1 : Double sideband (DSB) system specifications

3.2.1.1 Following a discussion involving the delegates of the Federal Republic of Germany, the United Kingdom, the Islamic Republic of Iran and France, from which it emerged that the inclusion of details relating to SSB transmissions in a section dealing almost exclusively with DSB would lead to confusion and at the proposal of the delegates of Brazil and the USSR, it was decided that sections 3.1.2 and 3.1.3 should be referred back to Committee 4 for further consideration.

3.2.1.2 At the proposal of the Chairman of the IFRB, it was decided that section 3.1.1.2 (necessary bandwidth) should also be referred back to Committee 4.

3.2.1.3 The delegates of Chile and Venezuela pointed out that the title of section 3.1.4.2 in Spanish must be aligned with the French text.

Section 3.1 was approved, subject to the above comments.

3.2.2 Section 3.2 : Propagation, radio noise and solar index

3.2.2.1 The delegate of the USSR recalled his delegation's reservations with regard to section 3.2.2.2 (man-made radio noise data) (see paragraph 2.2 above).

3.2.2.2 The delegate of the German Democractic Republic said that his delegation shared the reservations expressed by the USSR with regard to the proposed curve. In that connection, he drew attention to section 3 of CCIR Report 258-4 and section 5 of CCIR Report 322-2.

3.2.2.3 The delegate of Poland said that his delegation shared the reservations expressed by the USSR and the German Democratic Republic.

3.2.2.4 The Director of the CCIR pointed out that the lower-decile deviation in section 3.2.3.1 should be -8 dB.

Section 3.2 was approved, subject to the above comments.

3.2.3 Section 3.3 : Radio-frequency protection ratios

3.2.3.1 Following a remark made by the Chairman of the IFRB, the Chairman of Committee 4 said that the parameters given in the document before the Plenary were desired technical parameters. A separate section on minimum technical parameters, including a minimum protection ratio, would be submitted for approval at a later stage.

Section 3.3 was approved on that understanding.

3.2.4 Section 3.5 : Antennas and power

Approved, subject to one editorial amendment in section 3.5.2.

3.2.5 Section 3.6 : Use of synchronized transmitters

Approved.

4. Approval of the minutes of the third Plenary Meeting (Document 91 + Corr.1)

The minutes of the third Plenary Meeting, as set out in Document 91 and its Corrigendum, which related to the French text only, were approved, subject to correction of an error in the heading under item 2.

The meeting rose at 1745 hours.

The Secretary-General :	The Chairman :
R.E. BUTLER	K. BJÖRNSJÖ

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 128-E
27 January 1984
Original : French

COMMITTEE 3

SUMMARY RECORD

OF THE

THIRD MEETING OF COMMITTEE 3

(BUDGET CONTROL)

Thursday, 26 January 1984, at 0905 hrs

Chairman : Mr. E. DuCHARME (Canada)

Subjects discussed	Document
1. Summary record of the second meeting	95
2. Position of the Conference accounts at 20 January 1984	114

1. <u>Summary record of the second meeting</u> (Document 95)

The summary record of the second meeting was approved.

2. Position of the Conference accounts at 20 January 1984 (Document 114)

2.1 The Secretary introduced Document 114.

Annex 1

- Sub-head I : The IFEB had requested that the estimated expenditure for electronic equipment should not be reduced to 80,000.- Swiss francs. The sum of 100,000.- Swiss francs would therefore be restored in the next estimate.

- Sub-head II : A sum of 180,000.- Swiss francs had been envisaged for recruitment of extra staff during the first three weeks of the Conference. Since no recruitment was needed for the third week, the corresponding credit of 90,000.- Swiss francs was released.

- Sub-head III : On the basis of the first two weeks, the total estimated expenditure was lower than that entered in the budget.

Annex 2

The provisional sum of 85,000.- Swiss francs shown for common services should be replaced by the exact figure of 82,421.- Swiss francs, making a total of some 411,000.- Swiss francs for sections 11.4 and 17. The corresponding limit (value 1 September 1982) was 403,000.- Swiss francs.

Annex 3

Bearing in mind the reduction in expenditure under Annex 2, the difference for 1983 shown in the third column of the Table was 497,000.- Swiss francs instead of 166,000.- Swiss francs.

In answer to a question by the delegate of the United States of America, he said that travel expenses (item 11.422 in the Table in Annex 1) related to the recruitment of interpreters; the estimated figure of approximately 113,000.- Swiss francs would probably not be spent.

A revised version of Document 114 setting out the position at 27 January would be prepared for the coming week.

The meeting rose at 0925 hours.

The Secretary :	The Chairman :
R. PRELAZ	E. DuCHARME

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Corrigendum 2 to
Document 129-E
30 January 1984
Original : English

Source : Documents DT/33, DT/36, 22

COMMITTEE 4

TENTH REPORT OF WORKING GROUP 4B
TO COMMITTEE 4

Replace Annex 1, (pages 1 to 14) by the following Annex 1.

Y. TADOKORO
Chairman of Working Group 4B

Annex : 1

ANNEX 1

3.5.1 Antenna characteristics

In HF broadcasting the antenna is the means by which the radio-frequency energy is directed towards the required service area. The selection of the right type of antenna will enhance the signal in the service area, while reducing radiation in unwanted directions. This will protect other users of the RF spectrum operating on the same channel or adjacent channels to another coverage area. The use of directional antennas with well-defined radiation patterns is thus recommended as far as possible for HF broadcasting.

Non-directional antennas can be used when the transmitter is located within the required service area. In this case the required service area as seen by the transmitter extends over an azimuthal angle greater than 180°.

Directional antennas serve a double purpose. The first is to prevent interference to other users of the spectrum by means of their directivity. The second is to provide sufficient field-strength for the listeners' satisfaction by means of their power gains.

Although rhombic antennas are used for broadcasting, their use should be discouraged because of the size and number of their sidelobes, which could create technically avoidable interference.

3.5.1.1 **Choice of optimal antennas for various types of service**

Fig. [1], an antenna planning chart, gives some general guidelines **for the choice of optimal antennas, and may be helpful for determining the optimum antenna type for a given type of service according to the required distance range. Two different coverage categories are considered in this study:** short distance and medium/long-distance services.

A short distance service is understood here to be within a range of up to about 2000 km. This area can be covered with either a non-directional or a **directional antenna whose beamwidth can be selected according to the sector to be served. In the directional case, both horizontal dipole curtain and logarithmic-periodic antennas can be employed. The latter type is multiband array with a wide operating frequency range, a low-to-medium gain and a large horizontal beamwidth.**

Medium and long distance services can be said to reach distances greater than approximately 2000 km. Such coverage can be provided by antennas whose main-lobe vertical elevation angle is small (6°-13°) and whose horizontal beamwidth is either wide between 65° and 95° (typically 70°) or narrow between 30° and 45° (typically 35°) according to the angular width of the area to be served.

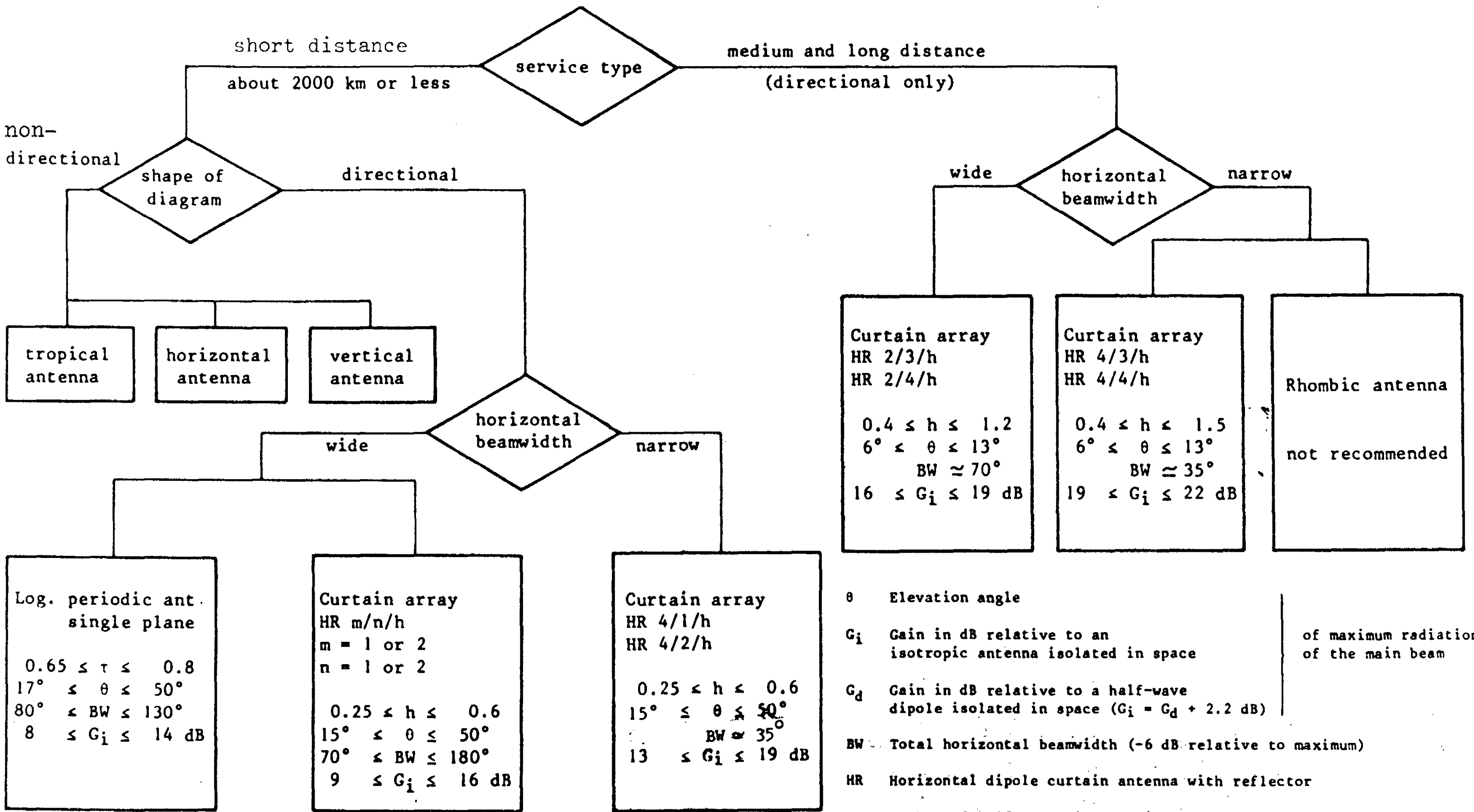
The value of the field-strength in the reception area is influenced by the radiation characteristics of the antennas being used, and this will be optimized if the most suitable type of antenna is used. The direction of radiation of the main lobe of a short-wave antenna, its elevation angle and maximum gain are principally dependent upon the type of array and its height above ground.

The way in which these parameters vary is illustrated in Fig. [II] for horizontal dipole curtain antennas fitted with reflectors and for arrays with most of the commonly-used arrangements of dipoles when operated close to their design frequency. The way in which the maximum gain and elevation angle of the main lobe of rhombic antennas vary with height above ground is also shown.

An illustration of the angle of elevation involved in the propagation of short-wave signals via the F-layer for distances up to 10 000 km is shown in Fig. III. From this figure it can be seen that the angles involved **tend to be less than 10° for all distances beyond 5000 km and angles above about 20° are only suitable for distances of less than 2000 km.** **From** Fig. 8-2 it can be seen that the low angle arrays whose **radiation** is at **a maximum at angles of 10° or less tend to have the highest gains, and that low-gain antennas have their maximum radiation at the high angles most suitable for short-distance services.**

3.5.1.2 A set of representative types of antenna

Antenna patterns used for planning purposes need to take account of practical considerations, they should be standardized for reference purposes and they should be representative of the large range of types of antenna in common use. A set of representative antenna types recommended for planning purposes, based on single band antennas, together with their vertical and azimuthal characteristics are summarized together with the gain (dBi) and elevation angle of maximum radiation (Table [A]). Details of the total horizontal beamwidth (between -6 dB points) for the respective types is also given (Table [B]).



θ	Elevation angle	of maximum radiation of the main beam
G_i	Gain in dB relative to an isotropic antenna isolated in space	
G_d	Gain in dB relative to a half-wave dipole isolated in space ($G_i = G_d + 2.2$ dB)	

BW Total horizontal beamwidth (-6 dB relative to maximum)

HR Horizontal dipole curtain antenna with reflector

m Number of half-wave elements in each row

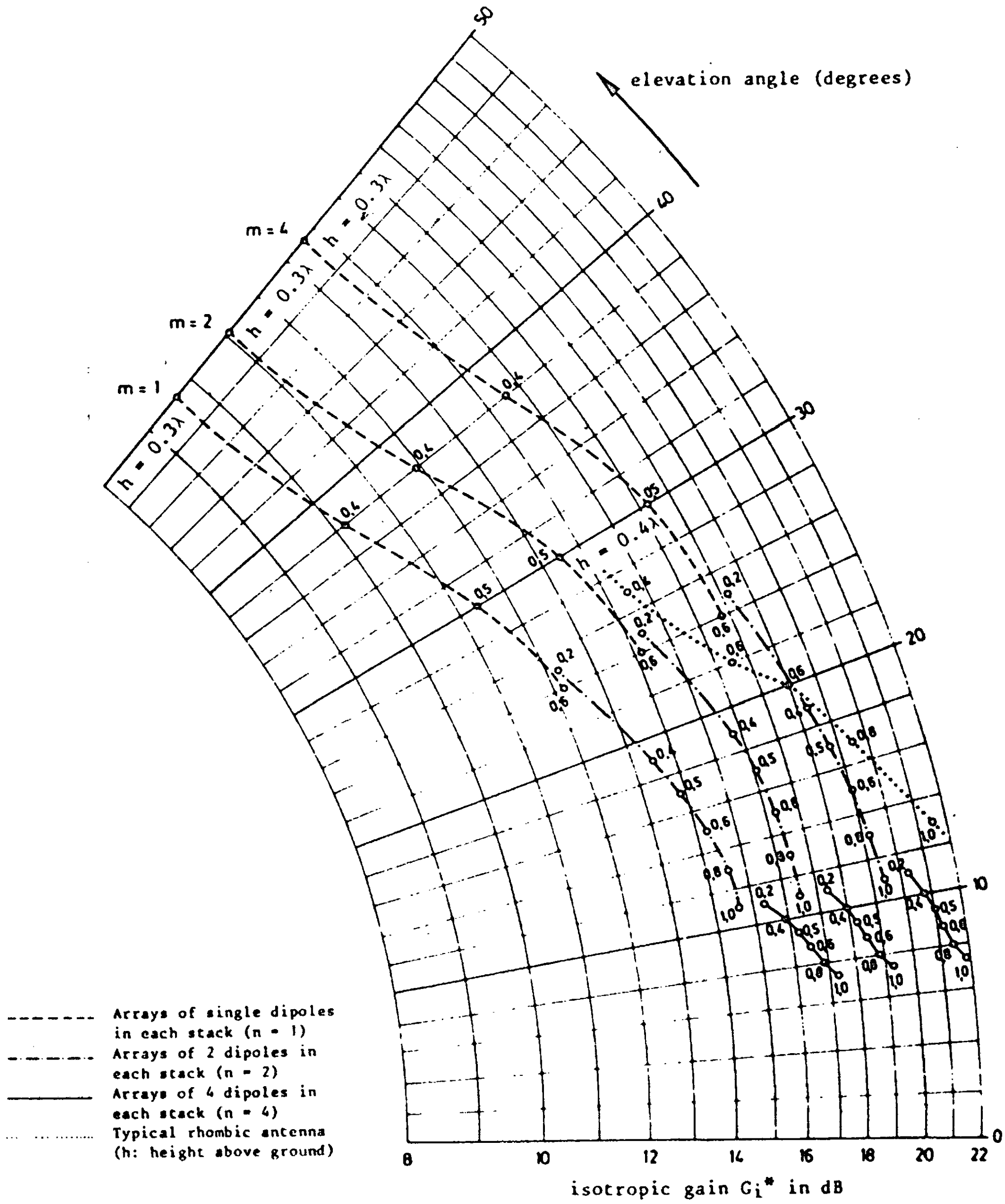
n Number of half-wave elements in each stack

h Height above ground in full wavelengths of the bottom row of elements

τ Taper ratio of log. periodic antenna

FIGURE [I]

Antenna planning chart



Nomenclature according to Appendix 2-7 of the Radio Regulations 1982

HR : horizontal curtain antenna with reflector
m/ : number of half-wave elements in each row
/n/ : number of half-wave elements in each stack (one above the other)
/h : height above ground in full wavelengths of the bottom row of elements, or of typical rhombic antennas

FIGURE II

Variation of maximum gain (dBi) with elevation angle, for horizontal dipole curtain arrays fitted with reflectors and for typical rhombic antennas, above a perfect earth

* $G_i = G_d + 2.2$ dB

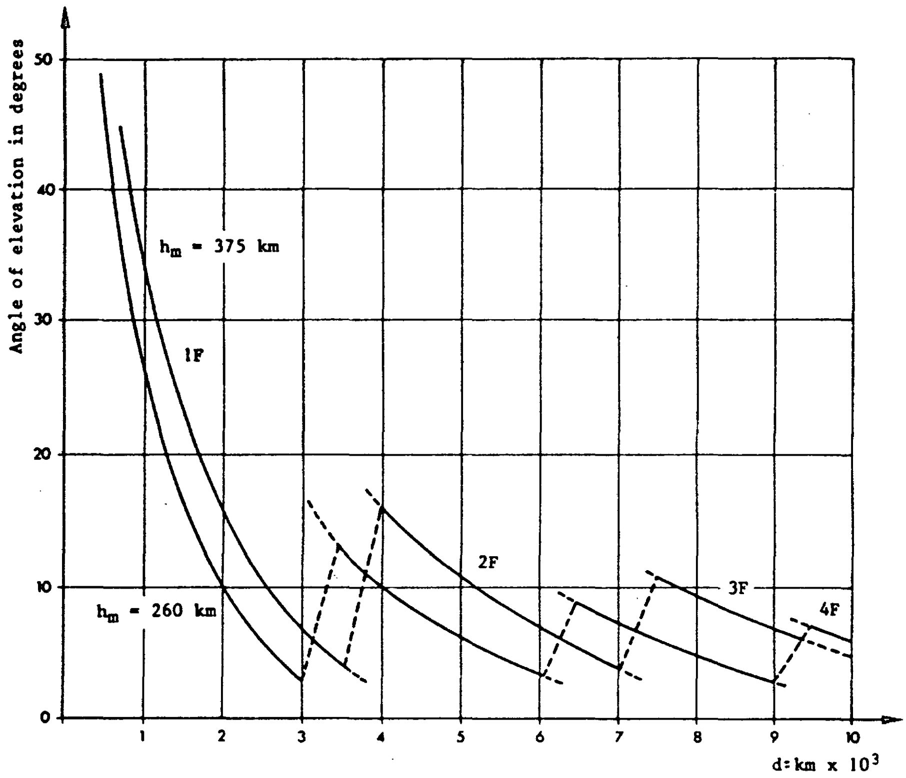


FIGURE III

Variation of elevation angle with distance (d) for representative ionospheric F-layer heights h_m

Principal characteristics of the set of representative types of antenna

TABLE [A]

Gain and elevation angle in the direction of maximum radiation

VERTICAL CHARACTERISTIC TYPE OF ANTENNA ---/m/n/h	IN THE DIRECTION OF MAXIMUM RADIATION					
	AZIMUTHAL CHARACTERISTIC					ELEVATION ANGLE θ (DEGREES)
	HR4 GAIN G_i (dB)*	HR2 GAIN G_i (dB)*	HR1 GAIN G_i (dB)*	H2 GAIN G_i (dB)*	H1 GAIN G_i (dB)*	
-/4/1	22	19				7
-/4/0.8	22	19				8
-/4/0.5	21	19				9
-/3/0.5	20	18				12
-/2/0.5	19	16	14		11	17
-/2/0.3	18	15	13		10	20
-/1/0.5		14	12	11	9	28
-/1/0.3		11	10			44
				9	7	47

---

* $G_i = G_d + 2.2$ dB

TABLE /‾B_7

Total horizontal beamwidth at the elevation angle of maximum radiation (for single band antennas)

TYPE OF ANTENNA ---/m/n/h	TOTAL HORIZONTAL BEAMWIDTH (-6 dB) DEGREES				
	HR4	HR2	HR1	H2	H1
ALL TYPES -/4/1 to -/2/0.5	35	70	108	103	112
-/2/0.3	35	70	110		116
-/1/0.5		74	114	78	126
-/1/0.3		90	180	180	180

For antennas not included in Table /‾A_7 an equivalent representative type whose performance is nearest to that of the antenna under consideration can be determined by reference to Table /‾C_7.

TABLE /‾C_7

Determination of the representative antenna having a radiation pattern most similar to that of any non-representative one, on the basis of the value of the parameters n and h

h	HR m/n/h				H m/n/h	
	n=4	n=3	n=2	n=1	n=2	n=1
h ≥ 0.9	m/4/1	m/4/0.8	m/3/0.5	-	-	-
0.9 > h ≥ 0.65	m/4/0.8	m/4/0.5	m/3/0.5	-	-	-
0.65 > h ≥ 0.4	m/4/0.5	m/3/0.5	m/2/0.5	m/1/0.5	m/2/0.5	m/1/0.5
0.4 > h	m/3/0.5	m/2/0.5	m/2/0.3	m/1/0.3	m/2/0.3	m/1/0.3

m : number of half-wave elements in each row (m=4, 2 or 1, where appropriate)
n : number of half-wave elements in each stack
h : height above ground of the bottom row of elements, expressed in terms of the wavelength at the operating frequency.

3.5.1.3 Multi-band antennas

In the case of multi-band antennas, (curtain and log periodic) a single value of h, an important parameter with regard to the vertical radiation pattern and the angle of maximum radiation, no longer corresponds to the physical height of the bottom row of elements of the antenna over the range of operating frequencies. The equivalent value h' at the required frequency of operation can be found in the following way : in Figure [IV] enter the vertical angle of maximum radiation, taken from the antenna diagram for the respective frequency band, into the ordinate. Choose the curve with the appropriate value of n. Read from the abscissa the equivalent height h'. The equivalent type of antenna can then be determined by entering Table [C], taking this new value of h.

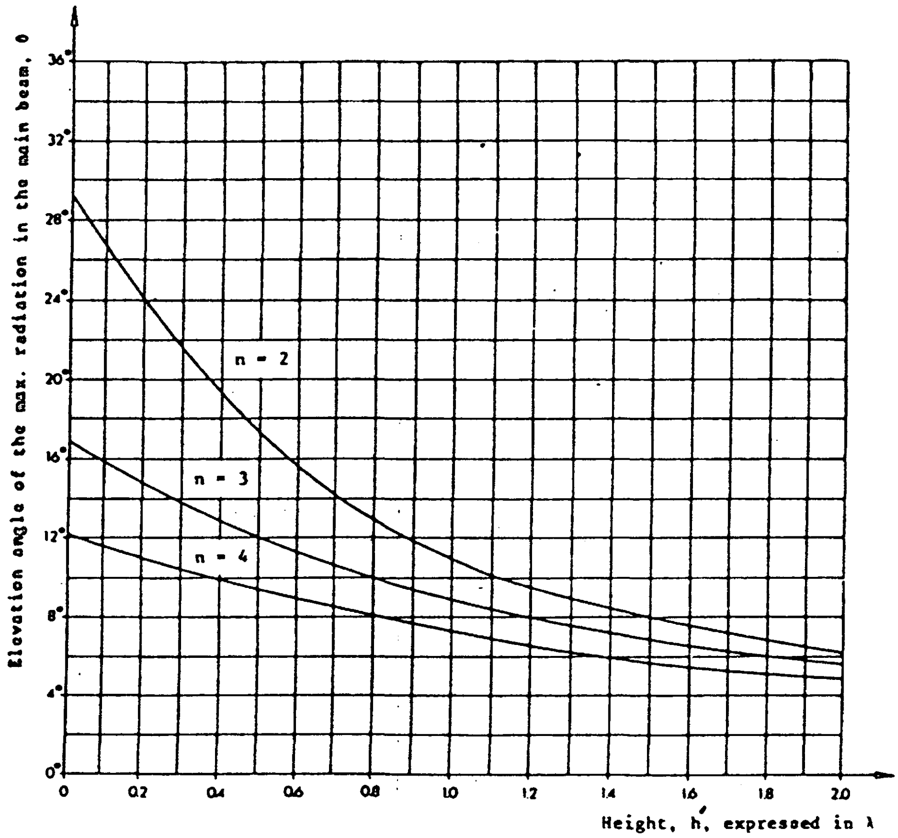


FIGURE [IV]

Diagram enabling the equivalent value of the parameter h to be determined in the case of a multiband antenna having n half-wave elements in each stack

Additional data particularly concerning the azimuthal performance over the operating range of a multi-band antenna, are required for later inclusion in Table [D] as they become available. To achieve this, administrations are encouraged to submit accurate data in the format given in Table [D] during the intersessional period [in order to add supplementary columns in Table [D] to describe the performance of these aerials at the operating frequency limits.]

3.5.1.4 A set of simplified antenna patterns for planning purposes

The vertical pattern and azimuthal pattern of the antennas listed in Table /‾A 7 can each be represented by a set of values of the relative attenuation in dB below maximum gain, each value relative to the maximum radiation in both elevation and azimuth, and to the maximum gain of the array. The attenuation, in dB, relative to maximum gain, for the azimuthal pattern are listed in Table /‾D 7 and those for the vertical pattern are listed in Tables /‾E, F, G 7.

When an antenna is slewed horizontally, the main beam may be considered as unchanged in shape. It can, therefore, be assumed that the azimuth of maximum radiation of the main beam in the slewed mode coincides with the horizontal angle $\psi = 0$ (see paragraph 3.5.1.4) in Table /‾D 7. Representation of radiation outside the main beam is required in a similar tabulated form and the CCIR Secretariat is requested to provide the appropriate values based on the data contained in the CCIR Antenna Handbook.

3.5.1.5 Representation of antenna patterns

Antenna diagrams are conventionally used to represent the spatial radiation distribution of an antenna or an array of antennas. The CCIR uses a sinusoidal projection, also called "SANSON-FLAMSTEAD PROJECTION" where the representation of the hemisphere and the contours are shown in the plane of the paper.

The formulas from which three patterns have been developed are extremely complex.

The 3-dimensional radiation pattern of an antenna can be derived from :

a) the vertical radiation pattern within that plane normal to the horizontal through the azimuth of maximum radiation $G(\theta)|_{\varphi = 0}$,

b) the azimuthal radiation pattern.

These relationships are illustrated in Figure [1].

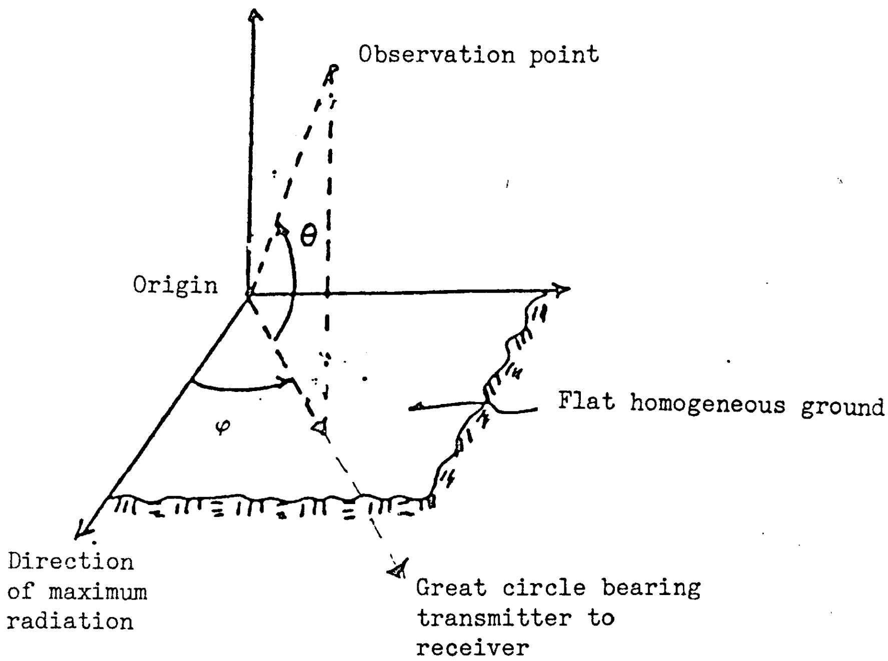


FIGURE [1]

Relationships between the angles θ and φ

For planning purposes it is more convenient and much faster in any computational process to use tabulated information.

A suitable set of antenna patterns in the form of look-up tables has been prepared giving values for the antenna radiation patterns which are in close agreement with those given by the CCIR.

This set of antenna patterns uses a conversion technique to form the true radiation pattern from the separate values of vertical and azimuthal attenuation factors.

It can be shown that by appropriate substitution of $\sin \varphi \cos \theta = \sin \psi$ in the azimuthal components of the full formula, the 3-dimensional radiation pattern of an antenna can be represented by two expressions, one representing the horizontal pattern as a function of ψ and the second, the vertical pattern as a function of θ.

Tables can therefore be constructed showing the attenuation relative to the maximum gain varying with angle. Table [D] represents the horizontal pattern as a function of ψ and Tables [E-G] represent the vertical pattern as a function of θ.

In obtaining the attenuation for any angle of elevation and azimuth, the horizontal angle ψ must be calculated using the following formula.

ψ = arc sin (sin φ cos θ) for $|\varphi| \leq 90^{\circ}$ or

ψ = 180 - arc sin (sin φ cos θ) for $\varphi > 90^{\circ}$

ψ = **-180 - arc sin (sin φ cos θ) for $\varphi < -90^{\circ}$**

where

φ = angular difference between great circle bearing transmitter to receiver and azimuth of maximum radiation of the antenna.

θ = angle of vertical radiation.

The attenuation values for ψ and θ can then be determined from the appropriate tables.

The resulting antenna gain in the required direction is then calculated by summing the attenuation for the appropriate values of θ and ψ (Tables /_ D-G_/) and then subtracting the total attenuation subject to the limitations defined below, from the maximum gain Table /_ A_/ for the appropriate antenna.

Forward Radiation

For angles of elevation below the vertical angle of maximum radiation, the total attenuation should not exceed a value of 30 dB.

For angles of elevation equal to and above the vertical angle of maximum radiation, the resultant antenna gain shall not fall below -8 dBi.

Reverse Radiation

For HR m/n/h antennas, at all angles of elevation the total attenuation should not exceed a value of 30 dB.

TABLE [D]

Antenna attenuation relative to the gain in the direction of maximum radiation, at angles of azimuth relative to the direction of maximum radiation, for planning purposes

Angle (ψ) (degrees)	Azimuthal attenuation (dB)				
	HR4/n/h	HR2/n/h	HR1/n/h	H2/n/h	H1/n/h
0	0	0	0	0	0
5	0.7	0.4	0.3	0.2	0.1
10	2.3	1.0	0.7	0.5	0.2
15	5.1	1.8	1.1	1.2	0.5
20	9.3	2.9	1.6	2.1	0.8
25	16.5	4.0	2.0	3.3	1.2
30	30	5.8	2.8	4.5	1.4
35	20.6	7.8	3.7	6.7	2.6
40	17.2	9.9	4.5	8.7	3.5
45	16.5	12.1	5.1	11.2	4.3
50	17.7	15.1	6.2	13.7	5.0
55	20.2	18.7	7.7	15.0	4.2
60	23.2	22.4	8.8	18.0	4.7
65	26.2	25.8	12.0	25.3	8.9
70	30	30	11.9	29.5	9.8
75	30	30	11.9	30	10.4
80	30	30	15.3	30	15.4
85	30	30	18.7	30	16.3
90	30	30	18.5	30	16.2
				Bi-directional antennas	
95	30	30	18.3		
100	30	30	17.5		
105	30	30	17.2		
110	30	30	16.2		
115	30	30	15.2		
120	27.7	26.9	14.7		
125	26.0	24.5	13.5		
130	25.2	22.6	13.7		
135	25.5	21.2	14.1		
140	27.2	20.0	14.9		
145	30	18.6	14.9		
150	30	18.2	15.2		
155	30	17.5	15.4		
160	23.2	16.7	15.4		
165	19.3	16.1	15.3		
170	16.9	15.5	15.2		
175	15.5	15.2	15.1		
180	15.0	15.0	15.0		

TABLE [E]

Antenna vertical attenuation relative to the gain in the direction of maximum radiation at various angles of elevation for planning purposes (antenna type : HR m/4/h).

Elevation angle (θ) (degrees)	Vertical attenuation (dB)		
	h = 0.5	h = 0.8	h = 1.0
0	30	30	30
3	6.0	4.9	4.2
6	1.3	0.6	0.3
* 8	0.2	0	0.8
9	0	0.1	0.5
12	0.8	2.4	4.3
15	8.1	8.2	15.0
18	8.6	25.0	15.7
21	18.4	16.0	10.6
24	28.7	14.2	12.3
27	24.3	18.8	19.3
30	30	30	30
33	20.1	22.3	30
36	14.6	21.9	26.4
39	12.7	30	16.5
42	13.0	21.0	12.0
45	15.2	14.9	11.5
48	19.7	12.4	12.3
51	27.4	11.8	15.0
54	24.3	12.5	20.2
57	20.1	14.4	29.2
60	18.5	17.2	26.4
63	18.3	21.1	22.7
66	19.2	26.3	21.9
69	20.9	30	22.6
72	23.2	30	24.5
75	26.4	30	27.4
78	30	30	30
81	30	30	30
84	30	30	30
87	30	30	30
90	30	30	30

* The values corresponding to this angle have been inserted to facilitate the evaluation of G_{tl}, as per paragraph 3.2.1.3.2.

TABLE /¯F_7

Antenna vertical attenuation relative to the gain in the direction of maximum radiation, at various angles of elevation, for planning purposes (antenna types : HR m/3/0.5, HR m/2/h, HR m/1/0.5 and HR m/1/0.3)

Elevation angle (θ) (degrees)	Vertical attenuation (dB)				
	m/3/0.5	m/2/h		m/1/0.5	m/1/0.3
		h = 0.3	h = 0.5		
0	30	30	30	30	30
3	7.9	12.3	10.6	14.7	18.2
6	2.8	6.6	5.0	8.8	12.3
* 8	1.1	4.4	3.0	6.6	9.9
9	0.6	3.6	2.2	5.6	9.0
12	0	1.8	0.7	3.6	6.7
15	0.6	0.7	0.7	2.1	5.0
18	2.4	0.1	0.1	1.1	3.7
21	5.4	0.4	0.6	0.5	2.7
24	10.3	0.2	1.8	0.1	1.9
27	18.9	0.8	3.5	0	1.3
30	27.2	1.7	6.0	0.1	0.8
33	20.1	2.9	9.4	0.3	0.5
36	19.9	4.4	14.4	0.8	0.2
39	24.4	6.2	22.0	1.4	0.1
42	30	8.3	21.5	2.2	0
45	22.6	10.9	16.8	3.2	0
48	17.4	13.9	14.6	4.4	0.1
51	15.1	17.4	13.7	5.8	0.2
54	14.1	21.0	13.6	7.3	0.3
57	14.1	25.9	14.1	9.0	0.5
60	14.9	29.3	15.1	11.0	0.7
63	16.2	30	16.6	13.1	1.0
66	18.1	30	18.4	15.1	1.3
69	20.5	30	20.7	16.7	1.6
72	23.2	30	23.5	17.3	1.9
75	25.3	30	26.8	17.2	2.2
78	26.0	30	30	16.8	2.6
81	25.6	30	30	16.4	2.9
84	24.9	30	30	16.1	3.2
87	24.6	30	30	16.1	3.6
90	24.6	30	30	16.1	3.6

* The values corresponding to this angle have been inserted to facilitate the evaluation of G_{tl}, as per paragraph 3.2.1.3.2.

TABLE [G]

Antenna vertical attenuation relative to the gain in the direction of maximum radiation at various angles of elevation, for planning purposes (antenna type : H m/n/h)

Elevation angle (θ) (degrees)	Vertical attenuation (dB)			
	H m/1/0.3	H m/1/0.5	H m/2/0.3	H m/2/0.5
0	30	30	30	30
3	18.4	14.7	12.3	10.6
6	12.5	8.9	6.6	5.0
* 8	10.1	6.6	4.4	3.0
9	9.2	5.7	3.6	2.2
12	7.0	3.6	1.8	0.7
15	5.2	2.2	0.7	0.1
18	3.9	1.2	0.1	0.1
21	2.9	0.5	0	0.7
24	2.1	0.1	0.2	1.8
27	1.5	0.1	0.8	3.5
30	1.0	0.1	1.6	6.0
33	0.7	0.3	2.8	9.4
36	0.4	0.7	4.3	14.3
39	0.2	1.3	6.1	21.9
42	0.1	2.1	8.2	21.3
45	0	3.0	10.7	16.6
48	0	4.1	13.6	14.3
51	0	5.4	17.0	13.3
54	0.1	6.9	21.0	13.1
57	0.2	8.5	25.4	13.6
60	0.3	10.4	28.7	14.5
63	0.4	12.3	29.6	15.8
66	0.6	14.2	29.5	17.5
69	0.7	15.6	29.9	19.7
72	0.8	16.0	30	22.2
75	0.9	15.8	30	25.3
78	1.1	15.1	30	30
81	1.	14.4	30	30
84	1.2	13.9	30	30
87	1.2	13.6	30	30
90	1.4	14.0	30	30

* The values corresponding to this angle have been inserted to facilitate the evaluation of G_{tl}, as per paragraph 3.2.1.3.2.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Corrigendum 1 to
Document 129-E
28 January 1984
Original : English

COMMITTEE 4

TENTH REPORT OF WORKING GROUP 4B
TO COMMITTEE 4

Page 10, replace paragraph 3.5.1.5 by the following :

"3.5.1.5 Representation of antenna patterns

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The formulas from which three patterns have been developed are extremely complex.

The 3-dimensional radiation pattern of an antenna can be derived from :

a) the vertical radiation pattern within that plane normal to the horizontal through the azimuth of maximum radiation $G(\theta)|_{\varphi = 0}$,

b) the azimuthal radiation pattern.

These relationships are illustrated in Figure 8-AI-1.

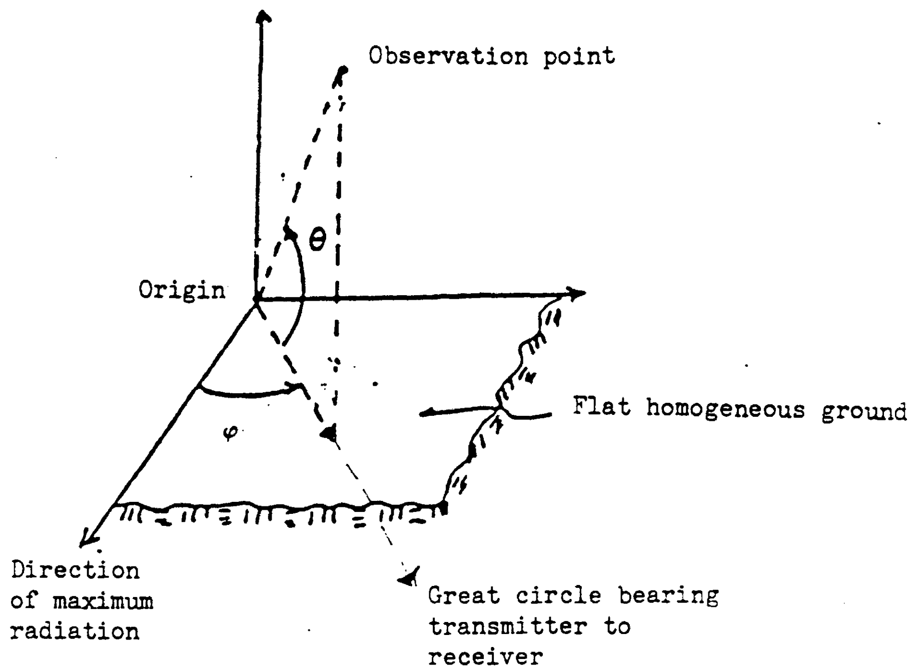

FIGURE 8-AI-1

Relationships between the angles θ and φ

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Tables can therefore be constructed showing the attenuation relative to the maximum gain varying with angle. Table [D] represents the horizontal pattern as a function of ψ and Tables [E-G] represent the vertical pattern as a function of θ.

In obtaining the attenuation for any angle of elevation and azimuth, the horizontal angle ψ must be calculated using the following formula.

$$\psi = \arcsin (\sin \varphi \cos \theta)$$

where

φ = angular difference between great circle bearing transmitter to receiver and azimuth of maximum radiation of the antenna.

θ = angle of vertical radiation.

The attenuation values for ψ and θ can then be determined from the appropriate tables.

The resulting antenna gain in the required direction is then calculated by summing the attenuation for the appropriate values of θ and ψ (Tables [D-G]) and then subtracting the total attenuation subject to the limitations defined below, from the maximum gain Table [A] for the appropriate antenna.

<u>Forward radiation</u>

(First paragraph, underline "total attenuation")

(Second paragraph, underline "resultant antenna gain")

<u>Radiation to rear of antenna</u> (i.e. new title)

(Underline "total attenuation")."

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 129-E
26 January 1984
Original : English

Source : Documents DT/33, DT/36, 22

COMMITTEE 4

TENTH REPORT OF WORKING GROUP 4B
TO COMMITTEE 4

The texts reproduced in Annexes 1 to 3 to this Report were considered in Working Group 4B and are submitted to Committee 4 for approval.

Y. TADOKORO
Chairman of Working Group 4B

Annexes : 3

ANNEX 1

3.5.1 Antenna characteristics

In HF broadcasting the antenna is the means by which the radio-frequency energy is directed towards the required service area. The selection of the right type of antenna will enhance the signal in the service area, while reducing radiation in unwanted directions. This will protect other users of the RF spectrum operating on the same channel or adjacent channels to another coverage area. The use of directional antennas with well-defined radiation patterns is thus recommended as far as possible for HF broadcasting.

Non-directional antennas should be used only if the transmitter location is in the centre of the coverage area. Distances to be served are relatively short. Frequencies used are at the lower end of the spectrum.

Directional antennas serve a double purpose. The first is to prevent interference to other users of the spectrum by means of their directivity. The second is to provide sufficient field-strength for the listeners' satisfaction by means of their power gains.

Although rhombic antennas are used for broadcasting, their use should be discouraged because of the size and number of their sidelobes, which could create technically avoidable interference.

3.5.1.1 Choice of optimal antennas for various types of service

Fig. [1], an antenna planning chart, gives some general guidelines for the choice of optimal antennas, and may be helpful for determining the optimum antenna type for a given type of service according to the required distance range. Two different coverage categories are considered in this study: short distance and medium/long-distance services.

A short distance service is understood here to be within a range of up to about 2000 km. This area can be covered with either a non-directional or a directional antenna whose beamwidth can be selected according to the sector to be served. In the directional case, both horizontal dipole curtain and logarithmic-periodic antennas can be employed. The latter type is multiband array with a wide operating frequency range, a low-to-medium gain and a large horizontal beamwidth.

Medium and long distance services can be said to reach distances greater than approximately 2000 km. Such coverage can be provided by antennas whose main-lobe vertical elevation angle is small (6°-13°) and whose horizontal beamwidth is either wide between 65° and 95° (typically 70°) or narrow between 30° and 45° (typically 35°) according to the angular width of the area to be served.

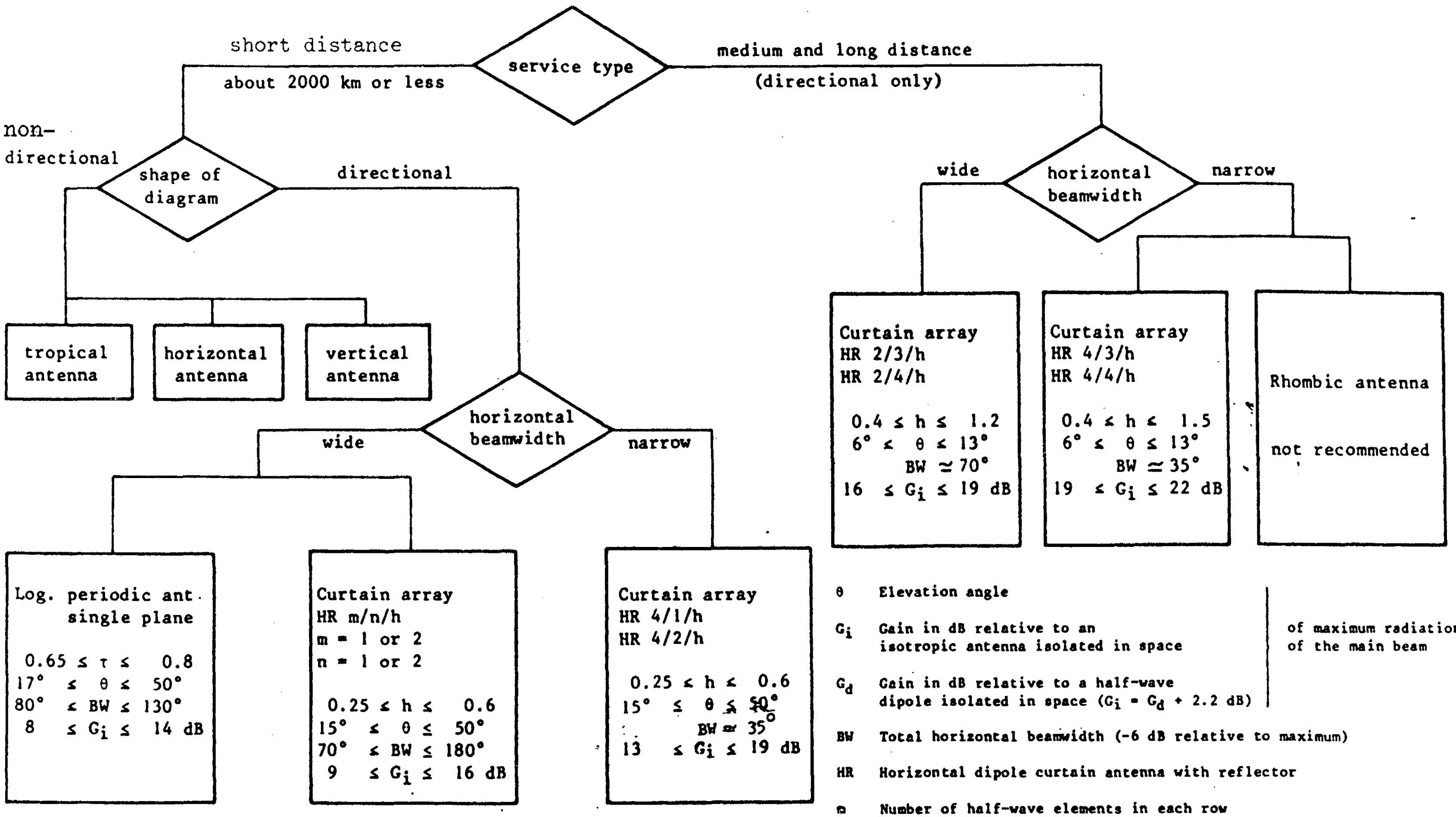
The value of the field-strength in the reception area is influenced by the radiation characteristics of the antennas being used, and this will be optimized if the most suitable type of antenna is used. The direction of radiation of the main lobe of a short-wave antenna, its elevation angle and maximum gain are principally dependent upon the type of array and its height above ground.

The way in which these parameters vary is illustrated in Fig. /‾II_7 for horizontal dipole curtain antennas fitted with reflectors and for arrays with most of the commonly-used arrangements of dipoles when operated close to their design frequency. The way in which the maximum gain and elevation angle of the main lobe of rhombic antennas vary with height above ground is also shown.

An illustration of the angle of elevation involved in the propagation of short-wave signals via the F-layer for distances up to 10 000 km is shown in Fig. III. From this figure it can be seen that the angles involved tend to be less than 10° for all distances beyond 5000 km and angles above about 20° are only suitable for distances of less than 2000 km. From Fig. 8-2 it can be seen that the low angle arrays whose radiation is at a maximum at angles of 10° or less tend to have the highest gains, and that low-gain antennas have their maximum radiation at the high angles most suitable for short-distance services.

3.5.1.2 A set of representative types of antenna

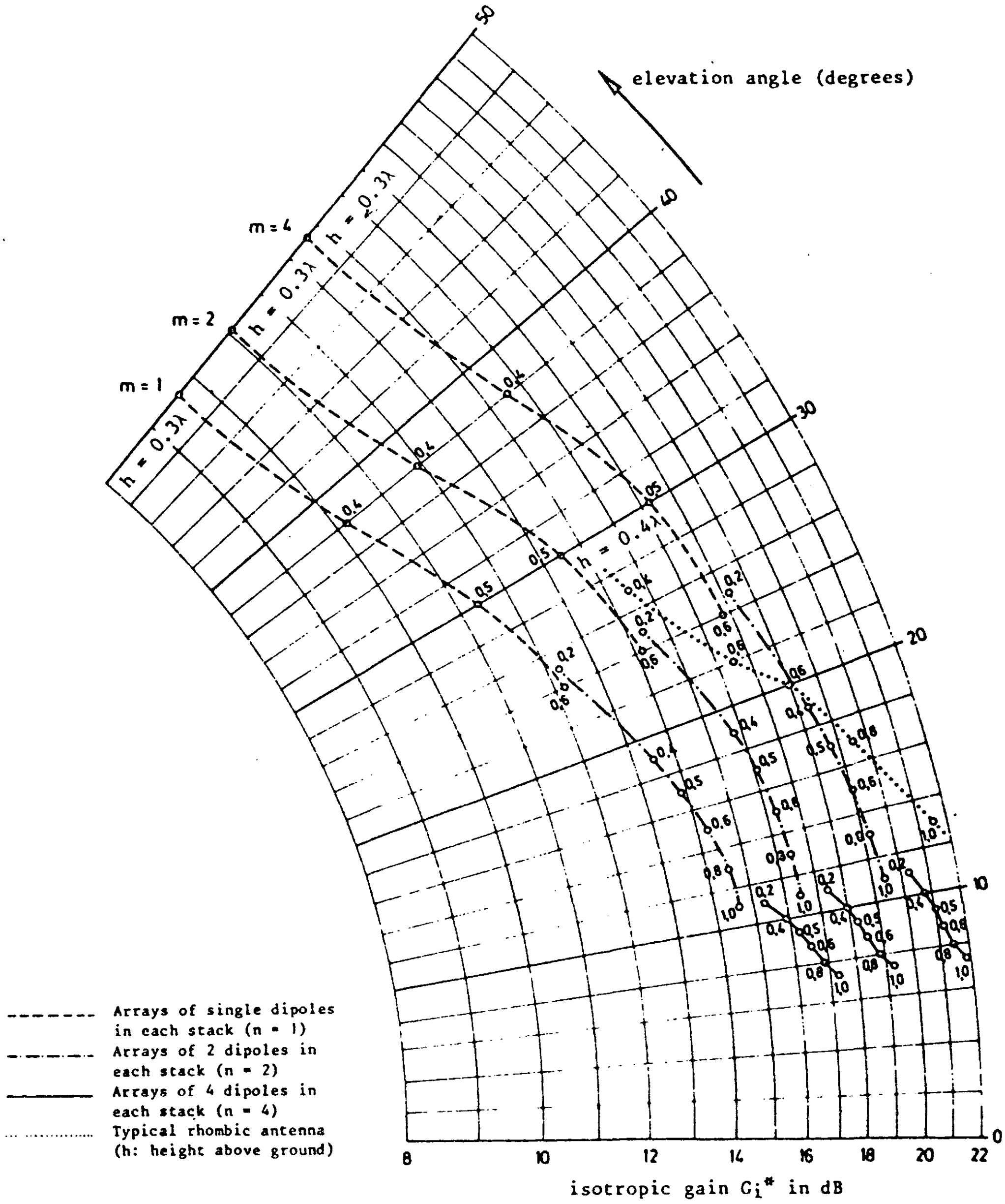
Antenna patterns used for planning purposes need to take account of practical considerations, they should be standardized for reference purposes and they should be representative of the large range of types of antenna in common use. A set of representative antenna types recommended for planning purposes, based on single band antennas, together with their vertical and azimuthal characteristics are summarized together with the gain (dBi) and elevation angle of maximum radiation (Table /‾A_7). Details of the total horizontal beamwidth (between -6 dB points) for the respective types is also given (Table /‾B_7).



θ	Elevation angle	of maximum radiation of the main beam
G_i	Gain in dB relative to an isotropic antenna isolated in space	
G_d	Gain in dB relative to a half-wave dipole isolated in space ($G_i = G_d + 2.2$ dB)	
BW	Total horizontal beamwidth (-6 dB relative to maximum)	
HR	Horizontal dipole curtain antenna with reflector	
m	Number of half-wave elements in each row	
n	Number of half-wave elements in each stack	
h	Height above ground in full wavelengths of the bottom row of elements	
τ	Taper ratio of log. periodic antenna	

FIGURE [I]

Antenna planning chart



Nomenclature according to Appendix 2-7 of the Radio Regulations 1982

HR : horizontal curtain antenna with reflector
m/ : number of half-wave elements in each row
/n/ : number of half-wave elements in each stack (one above the other)
/h : height above ground in full wavelengths of the bottom row of elements, or of typical rhombic antennas

FIGURE II

Variation of maximum gain (dBi) with elevation angle, for horizontal dipole curtain arrays fitted with reflectors and for typical rhombic antennas, above a perfect earth

* $G_i = G_d + 2.2$ dB

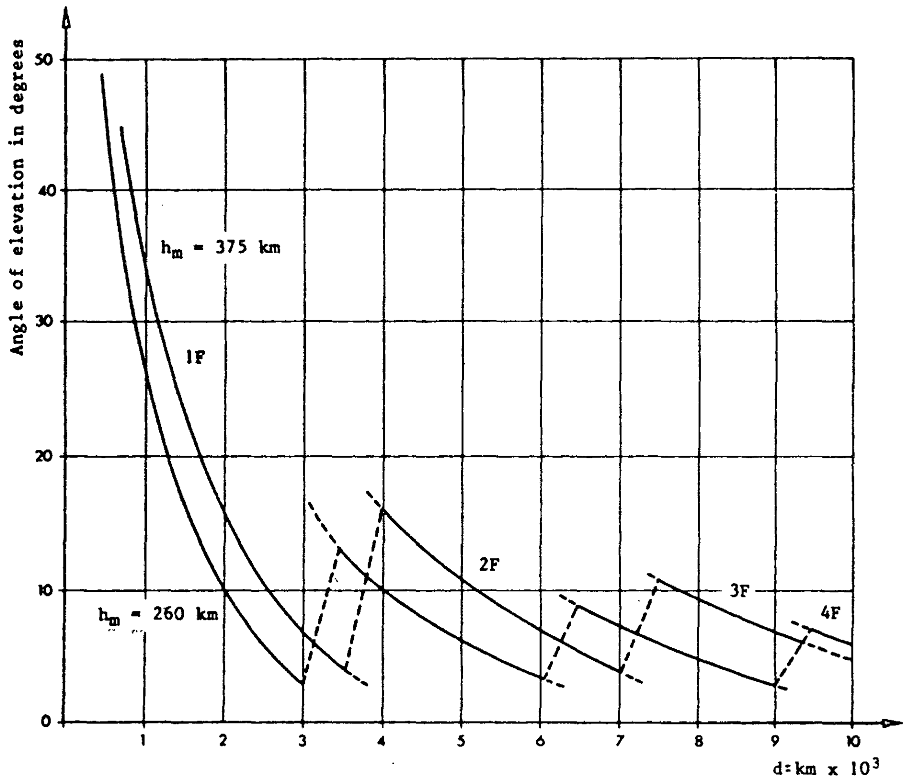


FIGURE III

Variation of elevation angle with distance (d) for representative ionospheric F-layer heights h_m

Principal characteristics of the set of representative types of antenna

TABLE /‾A_7

Gain and elevation angle in the direction of maximum radiation

VERTICAL CHARACTERISTIC TYPE OF ANTENNA ---/m/n/h	IN THE DIRECTION OF MAXIMUM RADIATION					
	AZIMUTHAL CHARACTERISTIC					ELEVATION ANGLE θ (DEGREES)
	HR4 GAIN G_i (dB)*	HR2 GAIN G_i (dB)*	HR1 GAIN G_i (dB)*	H2 GAIN G_i (dB)*	H1 GAIN G_i (dB)*	
-/4/1	22	19				7
-/4/0.8	22	19				8
-/4/0.5	21	19				9
-/3/0.5	20	18				12
-/2/0.5	19	16	14		11	17
-/2/0.3	18	15	13		10	20
-/1/0.5		14	12	11	9	28
-/1/0.3		11	10			44
				9	7	47

* $G_i = G_d + 2.2$ dB

TABLE /‾B_7

Total horizontal beamwidth at the elevation angle of maximum radiation (for single band antennas)

TYPE OF ANTENNA ---/m/n/h	TOTAL HORIZONTAL BEAMWIDTH (-6 dB) DEGREES				
	HR4	HR2	HR1	H2	H1
ALL TYPES -/4/1 to -/2/0.5	35	70	108	103	
-/2/0.3	35	70	110		
-/1/0.5		74	114	78	126
-/1/0.3		90	180	180	180

For antennas not included in Table /‾A_7 an equivalent representative type whose performance is nearest to that of the antenna under consideration can be determined by reference to Table /‾C_7.

TABLE /‾C_7

Determination of the representative antenna having a radiation pattern most similar to that of any non-representative one, on the basis of the value of the parameters n and h

h	HR m/n/h				H m/n/h	
	n=4	n=3	n=2	n=1	n=2	n=1
h ≥ 0.9	m/4/1	m/4/0.8	m/3/0.5	-	-	-
0.9 > h ≥ 0.65	m/4/0.8	m/4/0.5	m/3/0.5	-	-	-
0.65 > h ≥ 0.4	m/4/0.5	m/3/0.5	m/2/0.5	m/1/0.5	m/2/0.5	m/1/0.5
0.4 > h	m/3/0.5	m/2/0.5	m/2/0.3	m/1/0.3	m/2/0.3	m/1/0.3

m : number of half-wave elements in each row (m=4, 2 or 1, where appropriate)
n : number of half-wave elements in each stack
h : height above ground of the bottom row of elements, expressed in terms of the wavelength at the operating frequency.

3.5.1.3 Multi-band antennas

In the case of multi-band antennas, (curtain and log periodic) a single value of h, an important parameter with regard to the vertical radiation pattern and the angle of maximum radiation, no longer corresponds to the physical height of the bottom row of elements of the antenna over the range of operating frequencies. The equivalent value h' at the required frequency of operation can be found in the following way : in Figure /‾IV_/ enter the vertical angle of maximum radiation, taken from the antenna diagram for the respective frequency band, into the ordinate. Choose the curve with the appropriate value of n. Read from the abscissa the equivalent height h'. The equivalent type of antenna can then be determined by entering Table /‾C_/, taking this new value of h.

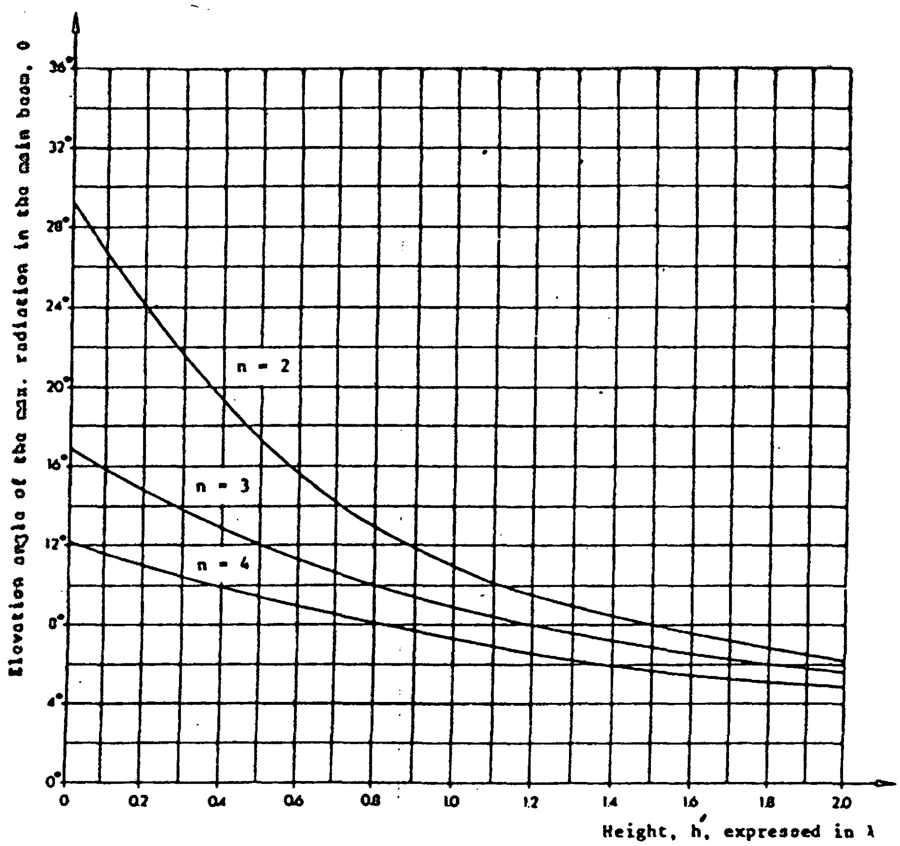


FIGURE /‾IV_/

Diagram enabling the equivalent value of the parameter h to be determined in the case of a multiband antenna having n half-wave elements in each stack

Additional data particularly concerning the azimuthal performance over the operating range of a multi-band antenna, are required for later inclusion in Table /‾D_/ as they become available. To achieve this, administrations are encouraged to submit accurate data in the format given in Table /‾D_/ during the intersessional period [in order to add supplementary columns in Table /‾D_/ to describe the performance of these aerials at the operating frequency limits.]

3.5.1.4 A set of simplified antenna patterns for planning purposes

The vertical pattern and azimuthal pattern of the antennas listed in Table [A] can each be represented by a set of values of the relative attenuation in dB below maximum gain, each value relative to the maximum radiation in both elevation and azimuth, and to the maximum gain of the array. The attenuation, in dB, relative to maximum gain, for the azimuthal pattern are listed in Table [D] and those for the vertical pattern are listed in Tables [E, F, G].

When an antenna is slewed horizontally, the main beam may be considered as unchanged in shape. It can, therefore, be assumed that the azimuth of maximum radiation of the main beam in the slewed mode coincides with the horizontal angle $\psi = 0$ (see paragraph 3.5.1.4) in Table [D]. Representation of radiation outside the main beam is required in a similar tabulated form and the CCIR Secretariat is requested to provide the appropriate values based on the data contained in the CCIR Antenna Handbook.

3.5.1.5 Representation of antenna patterns

In forming the 3-dimensional pattern, the vertical angle θ remains unchanged, but it is necessary to modify the horizontal angle φ (angular difference between great circle bearing transmitter to receiver and azimuth of maximum radiation of the antenna) to a value given by :

$$\psi = \arc\sin(\cos\theta \sin\varphi) \qquad (1)$$

The azimuthal attenuation at angles of elevation other than that corresponding to zero are derived by converting the angle φ into an angle ψ according to formula (1) before extracting the data from the azimuthal attenuation tables.

The resulting gain in any required direction is then calculated by summing the attenuation for the appropriate values of θ and ψ (Tables [D-G]) and then subtracting the total attenuation, subject to the limitations defined below, from the maximum gain (Table [A]) for the appropriate antenna.

Forward radiation

For angles of elevation below the vertical angle of maximum radiation, the total attenuation should not exceed a value of 30 dB.

For angles of elevation equal to and above the vertical angle of maximum radiation, the resultant antenna gain shall not fall below -8 dBi.

Back radiation

For HR m/n/h antennas, at all angles of elevation the total attenuation should not exceed a value of 30 dB.

TABLE [D]

<u>Antenna attenuation relative to the gain in the direction of maximum radiation, for angles of azimuth relative to the direction of maximum radiation</u>

Angle (ψ) (degrees)	Azimuthal attenuation (dB)				
	HR 4/n/h	HR 2/n/h	HR 1/n/h	H2/n/h	H1/n/h
0	0	0	0	0	0
± 5	0.6	0.2	0	0.4	0.2
± 10	1.9	0.6	0.2	0.8	0.5
± 15	4.3	1.2	0.5	1.3	0.8
± 20	8.1	2.0	0.8	2.2	1.2
± 25	15.4	3.3	1.2	3.4	1.5
± 30	40	4.8	1.8	5.2	2.2
± 35	20	6.4	2.4	6.9	3.0
± 40	16.5	8.5	3.2	9.0	3.8
± 45	15.8	11.2	4.1	12	4.8
± 50	17	14.0	5.3	15	5.6
± 55	19	17	6.3	18	6.9
± 60	22	21	7.9	22	8.5
± 65	26	25	9.5	26	10
± 70	30	30	11	31	11
± 75	36	36	13	36	11
± 80	39	40	16	40	12
± 85	40	40	18	40	10
± 90	40	40	20	40	40
± 95	40	40	20	Bi-directional antennas	
± 100	40	40	19		
± 105	39	39	17		
± 110	35	36	16		
± 115	32	32	15.3		
± 120	29	27	15		
± 125	27	25	14.2		
± 130	26	23	14.2		
± 135	26	22	14.2		
± 140	28	20	14.2		
± 145	34	19	14.5		
± 150	40	18	14.5		
± 155	29	17.5	14.5		
± 160	23	16.8	14.5		
± 165	19	16.0	14.5		
± 170	17	15.7	15		
± 175	15.7	15.3	15		
± 180	15	15	15		

TABLE [E]

Antenna vertical attenuation relative to the gain in the direction of maximum radiation, for various angles of elevation (antenna type : HR m/4/h)

Elevation angle (θ) (degrees)	Vertical attenuation (dB)		
	h = 0.5	h = 0.8	h = 1.0
0	40	40	40
3	6	4	4
6	1.8	1.0	0.5
9	0	0.1	0.6
12	1.0	2	4
15	3.9	8	16
18	10	30	16
21	17	19	10.6
24	26	14.2	13
27	24	19	20
30	40	40	40
33	20	23	40
36	9	22	28
39	12.8	30	16
42	13.2	20	12.8
45	15.7	14.8	11.5
48	20	12.5	13
51	25	13.5	14.5
54	25	13	24
57	20	15	30
60	18.5	18	26
63	18.5	21	23
66	19	25	22
69	22	33	24
72	23	38	25
75	27	40	28
78	32	40	32
81	36	40	38
84	40	40	40
87	40	40	40
90	40	40	40

TABLE / F /

Antenna vertical attenuation relative to the gain in the direction of maximum radiation, for various angles of elevation (antenna types : HR m/3/0.5, HR m/2/h, HR m/1/0.5 and HR m/1/0.3)

Elevation angle (θ) (degrees)	Vertical attenuation (dB)				
	m/3/0.5	m/2/h		m/1/0.5	m/1/0.3
		h = 0.3	h = 0.5		
0	40	40	40	40	40
3	8	12	10	13	18
6	3	6	5	8	12
9	1	4	2	6	9
12	0	2	1	4	17
15	1	1	0	2	5
18	3	0	0	1	4
21	6	0	1	1	3
24	10	1	2	0	2
27	18	1	3	0	1
30	25	2	6	0	1
33	20	3	10	0	1
36	20	5	15	1	0
39	25	6	23	1	0
42	40	9	21	2	0
45	23	11	16	3	0
48	17	15	15	5	0
51	15	18	14	6	0
54	14	21	14	7	1
57	15	26	15	9	1
60	15	30	15	11	1
63	16	30	16	13	1
66	18	33	18	15	1
69	20	35	22	15	2
72	23	37	24	15	2
75	25	38	27	15	2
78		40	30	15	3
81		40	38	15	3
84			40	15	4
87				16	4
90					4

TABLE /‾G_7

Antenna vertical attenuation relative to the gain in the direction of maximum radiation, for various angles of elevation (antenna type H m/n/h)

Elevation angle (θ) (degrees)	Vertical attenuation (dB)			
	H m/1/0.3	H m/1/0.5	H m/2/0.3	H m/2/0.5
0	40	40	40	40
3	20	14	12	10
6	13	9.1	7.0	5.1
9	8.8	5.7	3.8	2.1
12	7.2	3.6	1.8	0.9
15	5.3	2.1	0.9	0.2
18	3.7	1.1	0.4	0.1
21	3.0	0.8	0.0	0.8
24	2.1	0.4	0.5	2.0
27	1.7	0.0	1.0	3.5
30	1.0	0.3	1.8	6.0
33	0.8	0.6	2.9	10
36	0.6	0.9	4.1	18
39	0.4	1.5	6.4	21
42	0.2	2.0	7.5	21
45	0.0	3.1	11	16
48	0.0	4.5	14	15
51	0.1	6.0	17	14
54	0.2	7.2	21	13
57	0.3	9.5	25	14
60	0.4	11	26	15
63	0.5	12	28	16
66	0.6	14	29	18
69	0.7	16	30	20
72	0.8	16	32	23
75	1.0	16	35	26
78	1.0	15	37	30
81	1.1	15	40	36
84	1.2	15	40	40
87	1.3	14	40	40
90	1.4	14	40	40

]*

* /‾Note - To be corrected by the CCIR Secretariat._7

ANNEX 2

/ The following text is to be inserted between the first and second paragraphs of section 3.3.1 (Co-Channel protection ratios and frequency tolerances) (Document 115(Rev.1) : /

"Under fading conditions, co-channel protection ratio shall be expressed taking into account an overall circuit reliability of / X /%."

ANNEX 3

3.9.2 Progressive introduction of SSB transmissions (Technical aspects)

3.9.2.1 Transmitters

It should be recognized that :

a) converting an existing DSB transmitter to an SSB transmitter which delivers equivalent sideband power with 6 dB carrier reduction is technically not possible;

b) it is economically unattractive to convert existing conventional DSB transmitters for operation to SSB mode with 6 dB carrier reduction even if 3 dB less sideband power is accepted;

c) it is possible and feasible to convert new designed unconventional DSB transmitters (using amplitude modulation systems such as pulse duration or pulse switch modulation) to SSB mode with 6 dB carrier reduction and the same sideband power as in DSB mode without significant loss of efficiency;

d) with 12 dB carrier reduction also conventional DSB transmitters can, from technical point of view in some cases, be converted to SSB mode and can provide the necessary equivalent sideband power. Whether the conversion is economically attractive will depend on type and age of the transmitter concerned;

[e) the technical and/or economical lifetime of a transmitter can be estimated at twenty years.]

3.9.2.2 Receivers

It should be recognized that :

a) current technological progress within the next ten years will make it possible to produce DSB/SSB receivers in mass for reasonable prices;

b) SSB receivers with the possibility to select either the upper or the lower sideband of a DSB transmission is useful for rejecting adjacent channel interference during the transition period.

[c) the technical and economical lifetime of a receiver is considered to be in the order of ten years;]

d) envelope detection should be abandoned as soon as possible and synchronous demodulation be introduced.

[3.9.2.3 Transition period from technical point of view

Taking into account the lifetime of transmitters and receivers the duration of the transition period could be set at [15 to 20] years.]

3.9.2.4 Evaluation of compatibility aspects of the proposed SSB-system during the transition period

During the transition period, single-sideband transmissions will be mainly received by conventional DSB receivers using envelope detection. To obtain with a conventional DSB receiver using envelope detection the same loudness level with both SSB and DSB, the sideband power of the SSB emission has to be 3 dB larger (equivalent sideband power) than the total sideband power of the DSB emission. Alternatively, if the sideband power of the SSB emission cannot be increased, one has to accept some reduction of the coverage area. Such an SSB emission, however, could replace any of the DSB emissions in the plan without deteriorating the interference situation.

SSB emissions with equivalent sideband power replacing a DSB emission according to the plan will cause a slight increase in adjacent channel interference (e.g. at ± 10 kHz channel spacing the relative RF-protection ratio would be changed by 3 dB from -36 dB to -33 dB) if reception is done in the adjacent channels with a conventional DSB receiver having the selectivity of the DSB reference receiver (see paragraph 3.9.1.13).

/‾In Chapter 3.9.1.13 a 3 dB allowance for co-channel interference between a DSB emission and an SSB emission with equivalent sideband power has been specified. Recent investigation shows, however, that taking into account the effect of coherent demodulation of the two sidebands of a DSB emission in an envelope detector, this allowance should be 0 dB. Further study will be needed on this question during the inter-sessional period._7

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 130-E
26 January 1984
Original : English

COMMITTEE 4

REPORT OF DRAFTING GROUP 4B-1 TO COMMITTEE 4

The text reproduced in Annex was considered in Drafting Group 4B-1 and is hereby submitted to Committee 4 for approval.

L.L. BRADLEY
Chairman of Drafting Group 4B-1

Annex : 1

ANNEX

3.4 Values of minimum usable and reference usable field strength

3.4.1 Minimum usable field strength

The minimum usable field strength shall be determined numerically by using the atmospheric noise data, man-made noise data, or the intrinsic receiver noise level, and by adding to it the value of the required RF signal-to-noise ratio.

3.4.1.1 Atmospheric noise data

For atmospheric noise data see 3.2.2.1.

3.4.1.2 Man-made noise data

For man-made noise data see 3.2.2.2.

3.4.1.3 Intrinsic receiver noise level

The intrinsic receiver noise level E_i^o shall be calculated by :

$$E_i^o \text{ (dB (μV/m))} = E_c \text{ (dB (μV/m))} + 20 \log m - \text{SNR (dB)}$$

where : E_c = noise limited sensitivity of the receiver = [ ]

m = modulation depth = 0.3

SNR = audio frequency signal-to-noise ratio (dB) = [ ]

3.4.1.4 Comparison of the intrinsic noise level, the atmospheric and the man-made noise

In each case the values of atmospheric noise, man-made noise and intrinsic receiver noise intensities shall be compared and the greatest one shall be used.

3.4.1.5 Audio-frequency signal/noise ratio

(Pending on decision of Committee 4.)

3.4.1.6 Radio-frequency signal/noise ratio

The required radio frequency (input) signal-to-noise ratio is approximately 10 dB greater than the required audio (output) signal-to-noise ratio for the reference receiver (AF bandwidth 4 kHz) with 30% modulation of the received signal under stable propagation conditions. The basis for the establishment of this ratio is such that it is not appropriate to consider variability in time.

3.4.2 Reference usable field strength

The reference usable field strength shall be : [ ].

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COMMITTEE 4

India

RF CO-CHANNEL PROTECTION RATIO FOR FLUCTUATING SIGNALS

1. Introduction

RF co-channel protection ratio was estimated to be 27 dB for steady signals from earlier experiments and studies. In order to determine subjectively a margin to be added as allowance to this figure for fluctuating signals, the following investigation was conducted.

2. Details of the investigation

The experimental set-up adopted for this investigation is shown in Figure 1. Samples of fading patterns of HF signals were recorded on a pen and ink recorder and the values at regular intervals (0.5 seconds in this case) were stored in microprocessor memory addresses - the wanted signal pattern and the interfering signal pattern in two separate locations. These were retrieved through a D/A converter as fluctuating control voltages for MOSFET Gain Controlled Amplifiers (GCAs) with a suitable program in the microprocessor.

Samples of recordings, mainly spoken words for the wanted signal and instrumental music and spoken words for the interfering signal, were employed to modulate the signals from two signal generators. Keeping one RF signal (wanted) level constant, the interfering signal generator level was varied in steps. The microprocessor program was used to fluctuate both RF signals and the combined output was picked up in a receiver and recorded on a tape recorder. The interference level was varied in a way so as to produce maximum to negligible effect at the output.

The recording was played back to a set of listeners to determine the acceptable level of interference. Appropriate values of protection ratio for fluctuating signals were found to be as in Table 1.

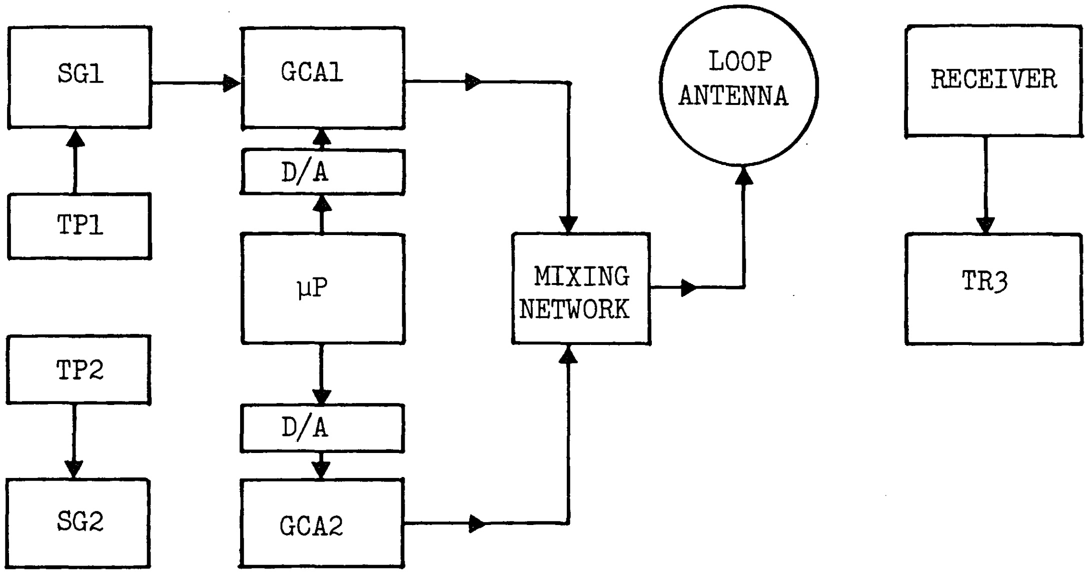
3. Conclusion

90% of the listeners found the value of 32 dB acceptable as RF protection ratio under fluctuating conditions. This would mean an addition of 5 dB to the steady state conditions to get the same satisfaction. 70% of the listeners were satisfied with an allowance of 3 dB only.

TABLE 1

RF protection ratio, under fluctuating conditions, accepted by various percentages of listeners

50%	70%	90%
28 dB	30 dB	32 dB



SG1 } Wanted and interfering
SG2 } Signal generators

TP1 } Tape playback for modulating signals
TP2 } Tape recorder to record
TR3 Receiver output

D/A Digital to analogue converters
μP Microprocessor

<u>FIGURE 1</u>

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Corrigendum 1 to
Document 132-E
30 January 1984
Original : English

COMMITTEE 4

1. Replace the first section (Reception zones) by :

"3.7 Reception zones

In specifying the reception area, this shall be done by referring to a zone, e.g. CIRAF-zone.

CIRAF zones shall be divided into four quadrants NW, NE, SE and SW where it is necessary to define more precisely the service area of a transmission. Any combination of the four quadrants may be used where the service area is greater than one quadrant but less than a whole CIRAF zone. This is achieved by defining an appropriate reference point in each CIRAF-zone with the dividing lines described precisely by the lines of latitude and longitude passing through such a reference point.[1]

Seven maritime broadcasting areas (A to G) are defined as shown in Annex [1].[2]"

2. Two maps, one containing the existing IFRB test points and the other one giving test points spaced 12° (latitude and longitude) are reproduced in Annexes 2 and 3 respectively.

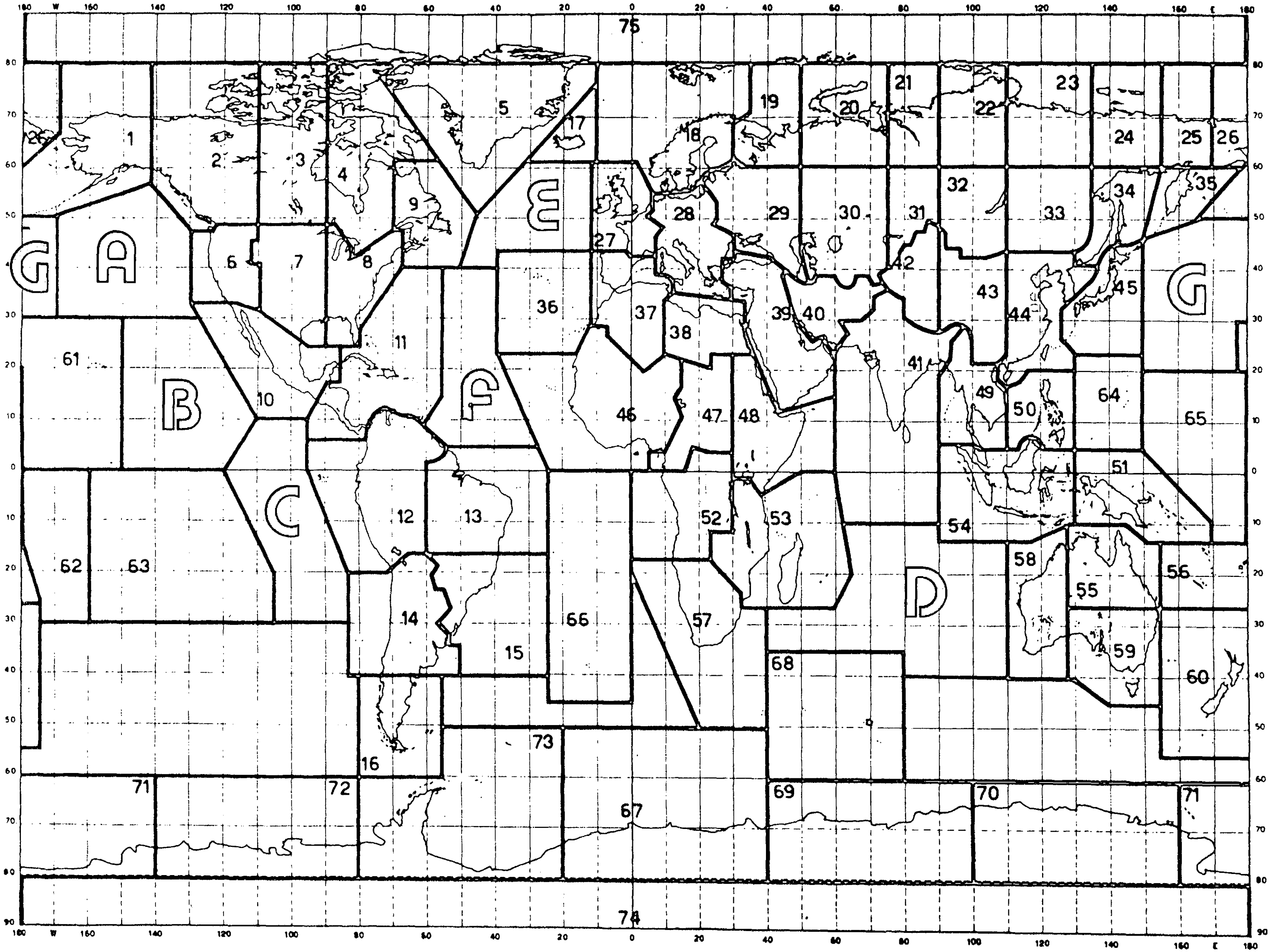
I. JOHNSEN
Chairman of Drafting Group 4B-7

Annexes : 3

Notes :

[1] In specifying the reception area which is smaller than an entire zone or subdivision of a zone it should be indicated, as an exception, by appropriate test points including the maximum service range in km. See Appendix 2 of the Radio Regulations.

[2] Committee 5 may wish to consider the procedures applicable in examining the compatibility of requirements in these maritime broadcasting areas.

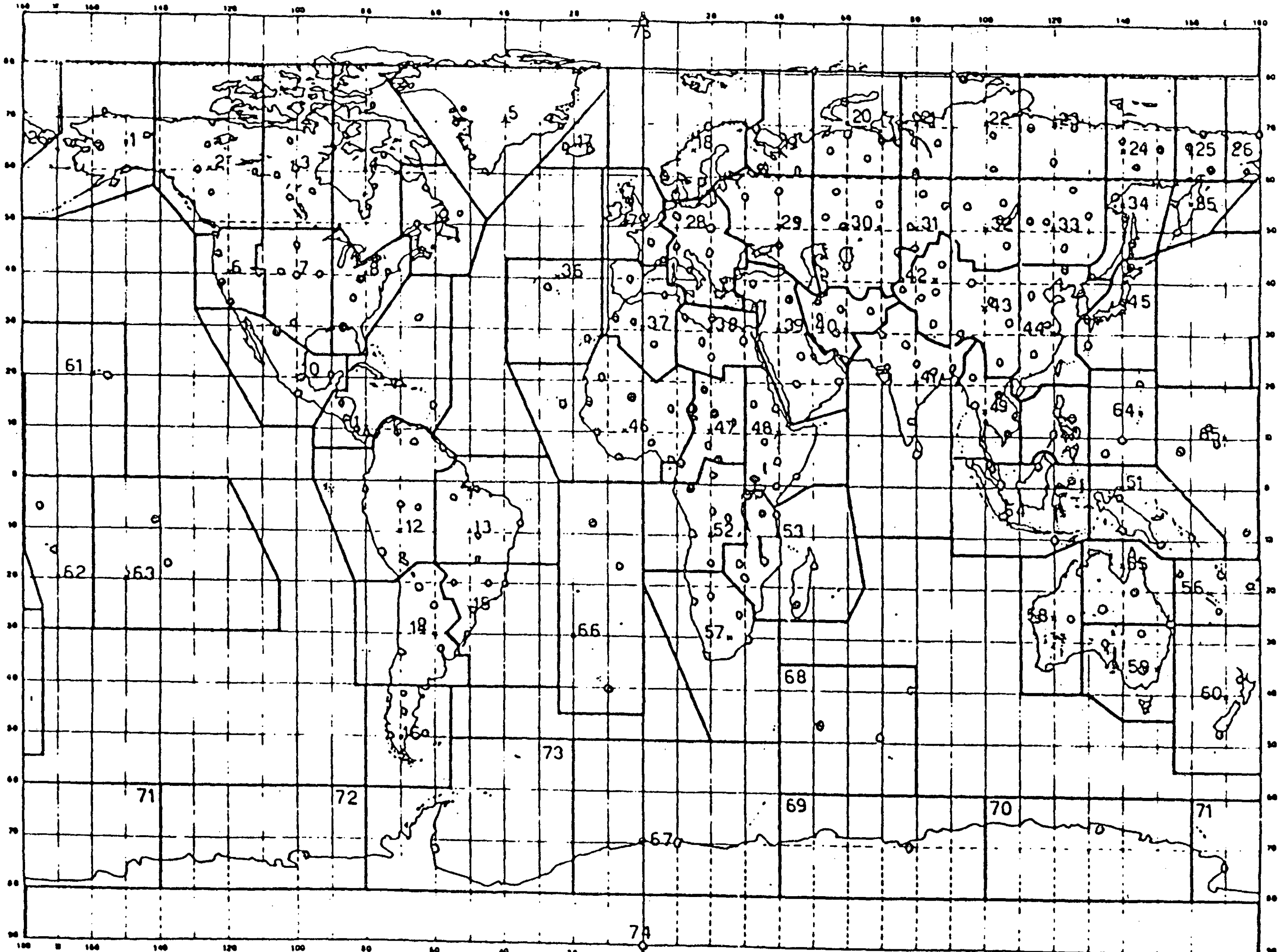


GEOGRAPHICAL ZONES FOR BROADCASTING

- 3 -
HFBC-84/132(Corr.1)-E

ANNEX 2

IFRB TEST POINTS



ZONES GÉOGRAPHIQUES POUR LA RADIODIFFUSION À HAUTES FRÉQUENCES (ZONES CIRAF)

GEOGRAPHICAL ZONES FOR HIGH FREQUENCY BROADCASTING (CIRAF ZONES)

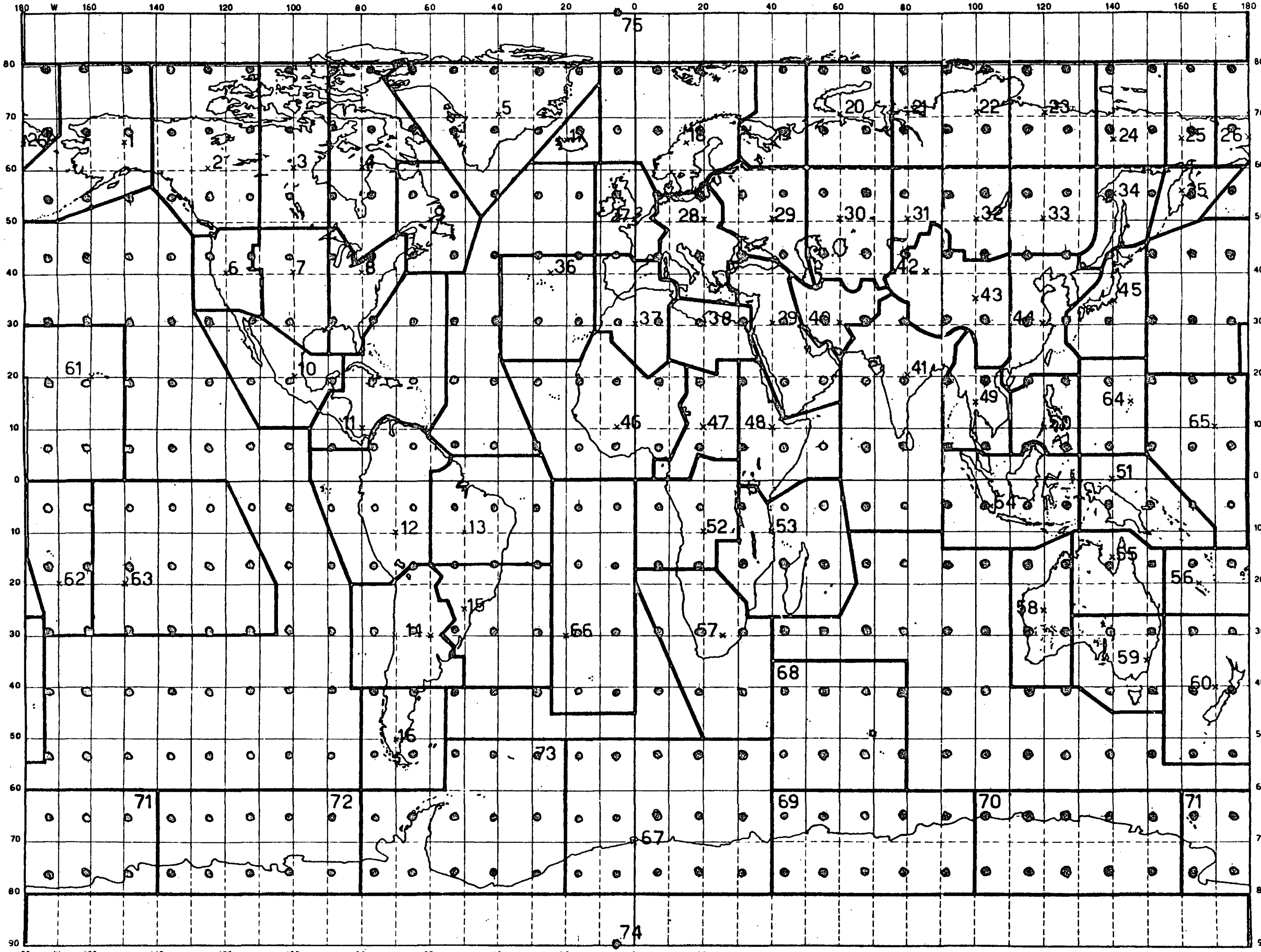
ZONAS GEOGRÁFICAS PARA RADIODIFUSIÓN POR ALTAS FRECUENCIAS (ZONAS CIRAF)

ANNEXE 3 - ANNEX 3 - ANEXO 3

POINTS TESTS ESPACÉS DE 12° EN LATITUDE ET EN LONGITUDE

TEST POINTS SPACED 12° LATITUDE AND LONGITUDE

PUNTOS DE PRUEBA SEPARADOS POR 12° EN LONGITUD Y LATITUD



ZONES GÉOGRAPHIQUES POUR LA RADIODIFFUSION À HAUTES FRÉQUENCES (ZONES CIRAF)

GEOGRAPHICAL ZONES FOR HIGH FREQUENCY BROADCASTING (CIRAF ZONES)

ZONAS GEOGRÁFICAS PARA RADIODIFUSIÓN POR ALTAS FRECUENCIAS (ZONAS CIRAF)

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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COMMITTEE 4

REPORT OF DRAFTING GROUP 4B-7 TO COMMITTEE 4

Reception zones

In specifying the reception area, this shall be done by referring to a zone e.g. CIRAF-zone. By dividing the CIRAF-zones into two sets of halves, i.e. N, S and E, W respectively, it is possible to define more precisely the service area of a transmission.

For maritime areas not currently defined in Appendix 1 of the Radio Regulations, an appropriate notation is required.

/ In specifying the reception area which is smaller than an entire zone or subdivision of a zone it should be indicated as a country or part of a country using symbols from the Preface to the International Frequency List as far as possible and if necessary the maximum service range in km. See Appendix 2 of the Radio Regulations. /

Test points

Based on the recommendation contained in Document 22 (CCIR, page 88), the Group proposes for the purpose of determining test points a uniform grid of points based on an equal spacing in degrees latitude and longitude.

The principal purpose of proposing such a set of points is to ensure that the feasibility of establishing the required service will be evaluated with a prospect of success. If test points only exist outside the intended service area neither the wanted signal nor the ratio of wanted to unwanted signal will be correctly represented.

A basic spacing of 12° latitude and longitude is appropriate.

When setting the datum for the grid of test points, this datum should be selected to ensure minimum coincidence with the CIRAF boundaries. It is recommended that the datum should be 5° West and 5° South. When evaluating circuit performance over a CIRAF area, those test points which coincide with the boundary of the zone are considered to be within the required zone of reception.

To evaluate the service in any compatibility analysis, it is necessary to satisfy a specified performance over a given area. This is achieved by specifying a minimum number / X_{min} / of test points within the service area. If a basic grid of 12° does not provide sufficient tests points then an interleaving subset of test points within the service area is necessary, i.e. a grid of 6° latitude and longitude is required. When a required service area includes more than / X_{max} / number of testpoints distributed over the area, the excessive testpoints shall be disregarded.

If the grid of 6° does not provide sufficient test points for a small well-defined service area, a resolution of 3° latitude and longitude is required.

I. JOHNSEN
Chairman of Drafting Group 4B-7

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Addendum 1 to
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COMMITTEE 4

SEVENTH REPORT OF WORKING GROUP 4A
TO COMMITTEE 4

As agreed in Committee 4 the following additional Table and Figure have been prepared as a basis for discussion. The items offered relate to the possibility of including a second alternative method for calculating overall circuit reliability within paragraph 3.2.4.2, based on r.f. protection ratio; the existing first alternative is based on the required r.f. signal to interference ratio.

Some small editorial amendments would also be required to the text of paragraph 3.2.4.2.

L.W. BARCLAY
Chairman of Working Group 4A

TABLE 2A

Overall circuit reliability

(based on r.f. protection ratio)

STEP	PARAMETER	DESCRIPTION	SOURCE	
1	E_W dB (μV/m)	Median field strength of wanted signal	Prediction Method (section 3.2.1)	
2	$D_U(S)$dB	Upper decile of slow fading signal (DAY-TO-DAY)	(section 3.2.3.2, Table 3.3.3-I)	*
3	$D_L(S)$dB	Lower decile of slow fading signal (DAY-TO-DAY)	(section 3.2.3.2, Table 3.3.3-I)	*
4	$D_U(F)$dB	Upper decile of fast fading signal (within the hour)	5 dB (section 3.2.3.1)	*
5	$D_L(F)$dB	Lower decile of fast fading signal (within the hour)	8 dB (section 3.2.3.1)	*
6	E_i dB (μV/m)	Median field strength of interfering signals E_1, E_2,...E_i	Prediction Method (section 3.2.1)	
7	I dB (μV/m)	Resultant median field strength of interference (see text)	$\sqrt{E_1^2 + E_2^2 + E_3^2 \ldots}$	
8	$D_U(IS)$dB	Upper decile of slow fading interference (Decile of strongest interference)	(section 3.2.3.2, Table 3.3.3-I)	*
9	$D_L(IS)$dB	Lower decile of slow fading interference (Decile of strongest interference)	(section 3.2.3.2, Table 3.3.3-I)	*
10	$D_U(IF)$dB	Upper decile of fast fading interference	5 dB (section 3.2.3.1)	*
11	$D_L(IF)$dB	Lower decile of fast fading interference	8 dB (section 3.2.3.1)	*
12	SIR(50)dB	Median signal to interference ratio	E_W - I	
13	$D_U(SIR)$dB	Upper decile of subjective signal to interference	[ ]	
14	$D_L(SIR)$dB	Lower decile of subjective signal to interference	[ ]	
15	SIR(10)dB	Subjective signal-to-interference ratio exceeded 10% of the time	SIR(50) + $D_U(SIR)$	
16	SIR(90)dB	Subjective signal-to-interference ratio exceeded 90% of the time	SIR(50) - $D_L(SIR)$	
17	RSI dB	Required r.f. protection ratio	(section 3.3.1)	
18	ICR	Circuit reliability in presence of interference only (noise neglected)	See Figure 2	
19	BCR	Basic circuit reliability	See Figure 1	
20	OCR	Overall circuit reliability	Min(ICR, BCR)	

[* Some or all of these steps may not be required dependent upon the decision on steps 13 and 14.]

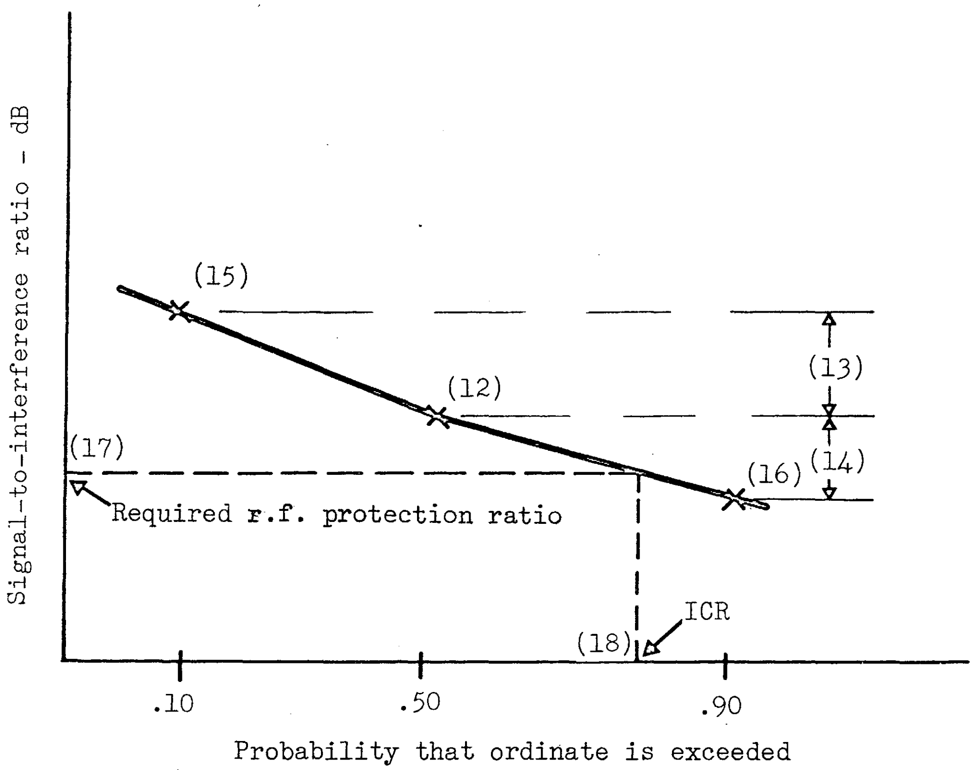
Signal-to-interference ratio - dB
(15)
(12)
(13)
(17)
(16)
(14)
Required r.f. protection ratio
ICR
(18)
.10
.50
.90
Probability that ordinate is exceeded

FIGURE 2A

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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COMMITTEE 4

SEVENTH REPORT OF WORKING GROUP 4A
TO COMMITTEE 4

The texts reproduced in Annexes 1 and 2 to this Report were considered in Working Group 4A and are hereby submitted to Committee 4 for approval.

L.W. BARCLAY
Chairman of Working Group 4A

Annexes : 2

ANNEX 1

3.2.1.4 Optimum frequency band selection

The optimum frequency band for a high frequency broadcasting service is that which has the highest median value of radio-frequency signal-to-noise ratio at the test points in the intended service area.

The optimum combination of bands, if needed by the planning method, is that combination which has the highest value of basic broadcast reliability in the intended service area.

ANNEX 2

3.2.4 Reliability

Note - In this section procedures are given for calculating reception and broadcast reliability in various circumstances. The inclusion of these calculation procedures does not prejudge or comment on the desirability of these circumstances. The square brackets within the text indicate some parts of the procedure which may not be needed.

3.2.4.1 Basic circuit reliability

Two alternative but equivalent methods are presented; the first where the computation of basic circuit reliability is undertaken in terms of the required r.f. signal-to-noise ratio, and the second where the computation is in terms of the minimum usable field strength. The choice between these two equivalent approaches depends upon the parameter chosen for inclusion in the planning method.

The first method includes, in steps (6) to (11), the estimation of the median field strength of the background noise by taking account of contributions of atmospheric noise, man-made noise and intrinsic receiver noise. For the second method a similar estimate is included within the value of the minimum usable field strength.

3.2.4.1.1 Basic circuit reliability using signal-to-noise ratio

The process for calculating basic circuit reliability is indicated in Table 1. The median value of field strength for the wanted signal at step (1) is provided by the field strength prediction method. The upper and lower decile values at steps (2) through (5) are also determined, taking account of long-term (day-to-day) and short-term (within the hour) fading. From steps (6) to (10) consideration is given to atmospheric noise, man-made noise, and intrinsic receiver noise, and at step (11) the median value of field strength for the noise is taken as the greatest of the three components. The values of signal and noise determined at steps (1) and (11) are then combined at step (12) in order to derive the median signal-to-noise ratio, SNR(50).

The upper and lower deciles of signal-to-noise ratio are then calculated in steps (13) and (14) in order to derive the signal-to-noise ratios exceeded for 10% and 90% of the time at steps (15) and (16). The signal-to-noise ratio probability distribution may now be produced, as is shown by Figure 1, where the ratio is plotted in decibels versus the probability that the value of signal-to-noise ratio is exceeded, plotted on a normal probability scale.

Finally, Figure 1 is used to derive the basic circuit reliability (18), which is the value of probability corresponding to the required signal-to-noise ratio (17).

A mathematical treatment of the calucation can be given in terms of probability density functions of both the signal and the noise. These functions are taken to be log normal, as is the resulting distribution for the signal-to-noise ratio.

TABLE 1

Parameters used to compute basic circuit reliability

STEP	PARAMETER	DESCRIPTION	SOURCE
(1)	$E_W(50)$ dB (μV/m)	Median field strength of wanted signal	Prediction method (section 3.2.1)
(2)	$D_U(S)$ dB	Upper decile of slow fading signal (day-to-day)	(section 3.2.3.2, Table 3.3.3-I)
(3)	$D_L(S)$ dB	Lower decile of slow fading signal (day-to-day)	(section 3.2.3.2, Table 3.3.3-I)
(4)	$D_U(F)$ dB	Upper decile of fast fading signal (within the hour)	5 dB (section 3.2.3.1)
(5)	$D_L(F)$ dB	Lower decile of fast fading signal (within the hour)	8 dB (section 3.2.3.1).
(6)	$F_a(A)$	Noise factor for atmospheric noise	Atmospheric noise maps (Report 322-2)
(7)	N_A dB (μV/m)	Median field strength of atmospheric noise	$N_A = F_a(A) - 65.5 + 20 \log f + 10 \log \lambda$ f in MHz, λ in kHz (Report 322-2)
(8)	$F_a(M)$	Noise factor for man-made noise	(section 3.2.2.2)
(9)	N_M dB (μV/m)	Median field strength of man-made noise	As in (7) above
(10)	N_R dB (μV/m)	Intrinsic receiver noise field strength	[ ] dB (μV/m) (section [ ])
(11)	N_T dB (μV/m)	Median field strength of total radio noise	Greatest of N_A, N_M, N_R (section 3.2.2.3)
(12)	SNR(50) dB	Median signal-to-noise ratio	$E_W - N_T$
(13)	D_U(SNR) dB	Upper decile of signal-to-noise ratio	$\sqrt{D_U(S)^2 + D_U(F)^2}$
(14)	D_L(SNR) dB	Lower decile of signal-to-noise ratio	$\sqrt{D_L(S)^2 + D_L(F)^2}$
(15)	SNR(10) dB	Signal-to-noise ratio exceeded 10% of time	SNR(50) + D_U(SNR)
(16)	SNR(90) dB	Signal-to-noise ratio exceeded 90% of time	SNR(50) - D_L(SNR)
(17)	G dB	Required RF signal-to-noise ratio	(section)
(18)	BCR	Basic circuit reliability	[Figure 1]

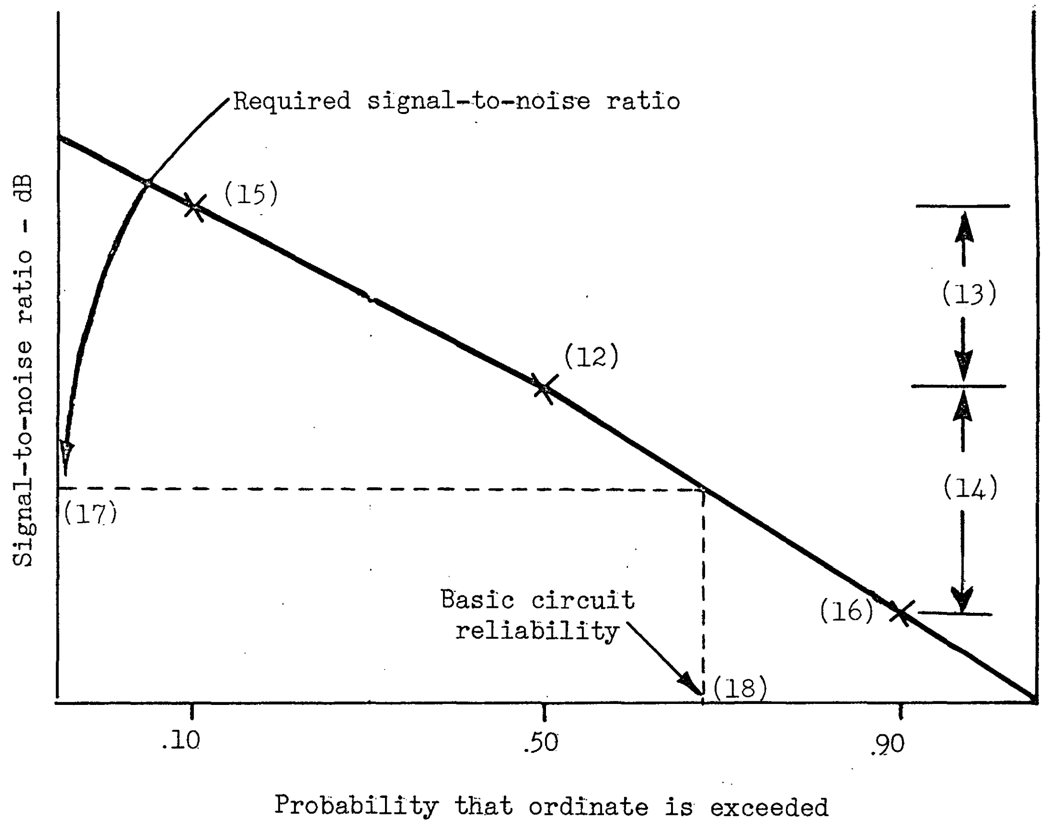

FIGURE 1

The basic circuit reliability is given by the expression :

when $E_W - N_T \leqslant G$: $BCR = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\gamma} \exp(-\tau^2/2)\ d\tau$ dB

$$\gamma = \frac{E_W - N_T - G}{\sigma_L}$$

$$\sigma_L = D_L(SNR)/1.282$$

when $E_W - N_T > G$: $BCR = 0.5 + \frac{1}{\sqrt{2\pi}} \int_{0}^{\gamma} \exp(-\tau^2/2)\ d\tau$ dB

$$\gamma = \frac{E_W - N_T - G}{\sigma_U}$$

$$\sigma_U = D_U(SNR)/1.282$$

3.2.4.1.2 Basic circuit reliability using minimum usable field strength

The process for calculating basic circuit reliability is indicated in Table 1. The median value of field strength for the wanted signal at step (1) is provided by the field strength prediction method. The upper and lower decile values (2) through (5) are also determined, taking account of long-term (day-to-day) and short-term (within the hour) fading. The combined upper and lower deciles of the wanted signal are then calculated in steps (6) and (7) in order to derive the signal levels exceeded for 10% and 90% of the time at steps (8) and (9).

The wanted signal probability distribution, assumed to be log-normal, is illustrated in Figure 1. The signal level is plotted in decibels versus the probability that the value of signal level is exceeded, plotted on a normal probability scale. This distribution is used to obtain the basic circuit reliability (11), which is the value of probability corresponding to the minimum usable field strength (10).

TABLE 1

Parameters used to compute basic circuit reliability

STEP	PARAMETER	DESCRIPTION	SOURCE
(1)	$E_W(50)$ dB (μV/m)	Median field strength of wanted signal	Prediction method (section 3.2.1)
(2)	$D_U(S)$ dB	Upper decile of slow fading signal (day-to-day)	(section 3.2.3.2, Table 3.3.3-I)
(3)	$D_L(S)$ dB	Lower decile of slow fading signal (day-to-day)	(section 3.2.3.2, Table 3.3.3-I)
(4)	$D_U(F)$ dB	Upper decile of fast fading signal (within the hour)	5 dB (section 3.2.3.1)
(5)	$D_L(F)$ dB	Lower decile of fast fading signal (within the hour)	8 dB (section 3.2.3.1)
(6)	$D_U(E_W)$ dB	Upper decile of wanted signal	$\sqrt{D_U(S)^2 + D_U(F)^2}$
(7)	$D_L(E_W)$ dB	Lower decile of wanted signal	$\sqrt{D_L(S)^2 + D_L(F)^2}$
(8)	$E_W(10)$ dB (μV/m)	Wanted signal exceeded 10% of the time	$E_W + D_U(E_W)$
(9)	$E_W(90)$ dB (μV/m)	Wanted signal exceeded 90% of the time	$E_W - D_L(E_W)$
(10)	E_{min} dB (μV/m)	Minimum usable field strength	(section 3.4)
(11)	BCR	Basic circuit reliability	Figure [1]

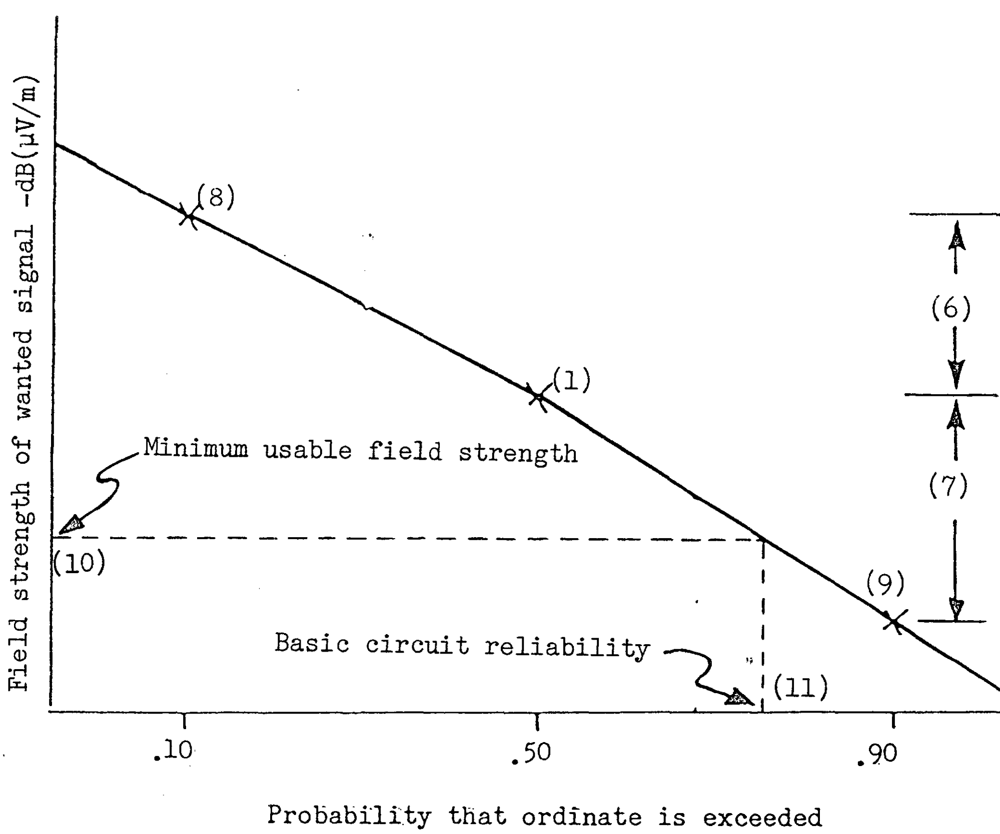
Field strength of wanted signal -dB(µV/m)
(8)
(1)
(6)
(7)
(9)
Minimum usable field strength
(10)
Basic circuit reliability
(11)
.10
.50
.90
Probability that ordinate is exceeded

FIGURE 1

The basic circuit reliability is given by the expression :

when $E_W \leq E_{min}$

$$R_c = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\gamma} \exp(-\tau^2/2)\, d\tau \qquad \text{dB}$$

$$\gamma = \frac{E_W - E_{min}}{\sigma_L}$$

$$\sigma_L = D_L(E_W)/1.282$$

when $E_W > E_{min}$

$$R_c = 0.5 + \frac{1}{\sqrt{2\pi}} \int_{0}^{\gamma} \exp(-\tau^2/2)\, d\tau \qquad \text{dB}$$

$$\gamma = \frac{E_W - E_{min}}{\sigma_U}$$

$$\sigma_U = D_U(E_W)/1.282$$

3.2.4.2 Overall circuit reliability

The method for calculating overall circuit reliability is outlined in Table 2. The median wanted signal level at step (1) is computed by the signal strength prediction method. The upper and lower decile values (2) through (5) take into account long-term (day-to-day) and short-term (within the hour) fading.

The median field strength of interference for each interfering source is obtained from the prediction method in step (6). For a single source of interference the median predicted field strength is used in step (7). For multiple sources of interference, the median field strength is calculated as follows. The field strengths of the interfering signals E_i are listed in decreasing order. Successive r.s.s. additions of the field strengths E_i are computed, stopping when the difference between the resultant field strength and the next field strength is greater than 6 dB. In step (7), the resultant field strength I is taken as the last computed value. The upper and lower decile values (8) through (11) of the strongest interference are selected to take into account short and long-term fading.

The values of the wanted signal and interference determined at steps (1) and (7) are combined at step (12) to derive the median signal-to-interference ratio. The upper and lower deciles of the signal-to-interference ratio are computed in steps (13) and (14) in order to derive the signal-to-interference ratio exceeded for 10% and 90% of the time at steps (15) and (16).

The probability distribution for the signal-to-interference ratio may now be produced as shown in Figure 2. The ratios are presented in decibels on a linear scale with the probability that the value of the signal-to-interference ratio is exceeded on a normal probability scale. In Figure 2, the value of probability corresponding to the required signal-to-interference ratio (17) is the circuit reliability in the presence of only interference (ICR). The <u>overall circuit reliability</u> is the minimum value (20) of ICR (18) and the basic circuit reliability BCR (19).

A mathematical treatment of the calculation of ICR can be given in terms of the probability density distribution of the wanted signal and the interference. These functions are taken to be log normal, as is the resulting distribution of the signal-to-interference ratio.

The parameter ICR is given by the following expression :

when $E_W - I \leqslant RSI$

$$ICR = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\gamma} \exp(-\tau^2/2)\, d\tau$$

$$\gamma = \frac{E_W - I - RSI}{\sigma_L}$$

$$\sigma_L = D_L(SIR)/1.282$$

when $E_W - I > RSI$

$$ICR = 0.5 + \frac{1}{\sqrt{2\pi}} \int_{0}^{\gamma} \exp(-\tau^2/2)\, d\tau$$

$$\gamma = \frac{E_W - I - RSI}{\sigma_U}$$

$$\sigma_U = D_U(SIR)/1.282$$

Values of the various parameters in the above expressions are found on the indicated lines in Table 2.

E_W	line 1
I	line 7
$D_U(SIR)$	line 13
$D_L(SIR)$	line 14
RSI	line 17

TABLE 2

Overall circuit reliability

STEP	PARAMETER	DESCRIPTION	SOURCE
1	E_W dB (µV/m)	Median field strength of wanted signal	Prediction Method (section 3.2.1)
2	$D_U(S)$dB	Upper decile of slow fading signal (DAY-TO-DAY)	(section 3.2.3.2, Table 3.3.3-I)
3	$D_L(S)$dB	Lower decile of slow fading signal (DAY-TO-DAY)	(section 3.2.3.2, Table 3.3.3-I)
4	$D_U(F)$dB	Upper decile of fast fading signal (within the hour)	5 dB (section 3.2.3.1)
5	$D_L(F)$dB	Lower decile of fast fading signal (within the hour)	8 dB (section 3.2.3.1)
6	E_i dB (µV/m)	Median field strength of interfering signals E_1, E_2,...E_i	Prediction Method (section 3.2.1)
7	I dB (µV/m)	Resultant field strength of interference	see text
8	$D_U(IS)$dB	Upper decile of slow fading interference (Decile of strongest interference)	(section 3.2.3.2, Table 3.3.3-I)
9	$D_L(IS)$dB	Lower decile of slow fading interference (Decile of strongest interference)	(section 3.2.3.2, Table 3.3.3-I)
10	$D_U(IF)$dB	Upper decile of fast fading interference	5 dB (section 3.2.3.1)
11	$D_L(IF)$dB	Lower decile of fast fading interference	8 dB (section 3.2.3.1)
12	SIR(50)dB	Median signal to interference ratio	E_W - I
13	$D_U(SIR)$dB	Upper decile of signal-to-interference	$\left[\sqrt{D_U(S)^2+D_U(F)^2+D_L(IS)^2+D_L(IF)^2}\right]$
14	$D_L(SIR)$dB	Lower decile of signal-to-interference	$\left[\sqrt{D_L(S)^2+D_L(F)^2+D_U(IS)^2+D_U(IF)^2}\right]$
15	SIR(10)dB	Signal-to-interference ratio exceeded 10% of the time	SIR(50) + D_U(SIR)
16	SIR(90)dB	Signal-to-interference ratio exceeded 90% of the time	SIR(50) - D_L(SIR)
17	RSI dB	Required S/I ratio	(section)
18	ICR	Circuit reliability in presence of interference only (noise neglected)	See Figure 2
19	BCR	Basic circuit reliability	See Figure 1
20	OCR	Overall circuit reliability	Min(ICR, BCR)

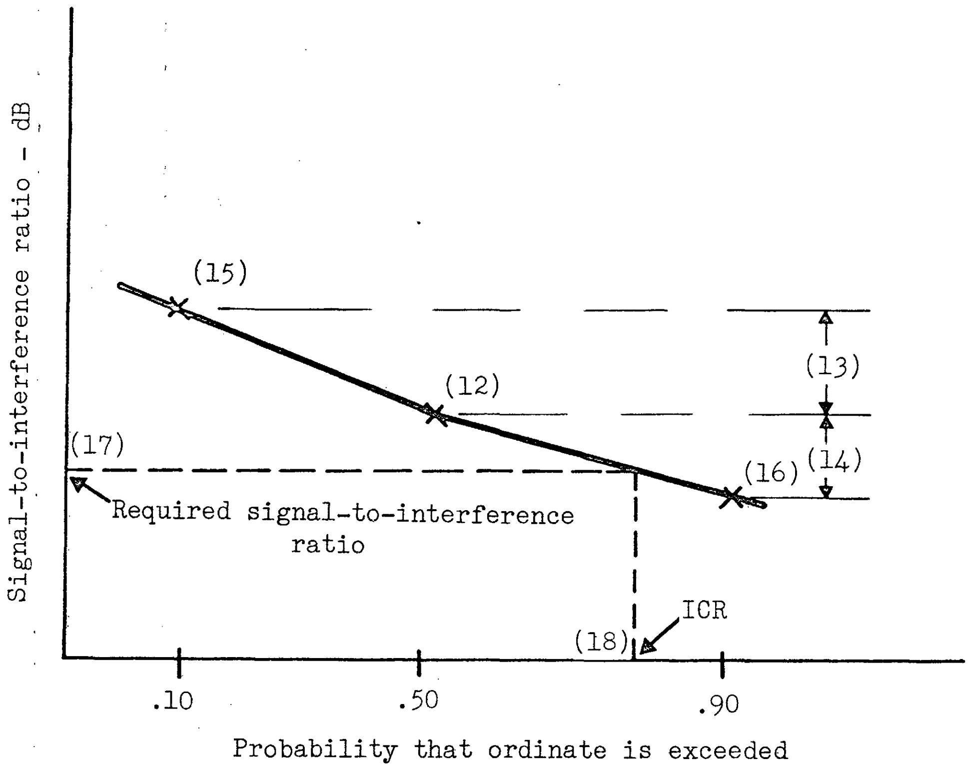

FIGURE 2

3.2.4.3 Basic reception reliability

The method for computing basic reception reliability is outlined in Table 3. For a single frequency, basic reception reliability (BRR) is the same as the basic circuit reliability (BCR) described in the previous section. For multiple frequencies, the interdependence between propagation conditions on different frequencies results in the computation method given in Table 3. In steps 4 and 6, BCR (n) is the basic circuit reliability for frequency n, where n = F_1, F_2, etc. The basic reception reliability is given in step (2) for a single frequency, in step (4) for a set of two frequencies and in step (6) for a set of three frequencies.

TABLE 3

Basic reception reliability

The following parameters are involved :

One frequency operation

Step	Parameter	Description	Source
(1)	BCR (F_1) %	Basic circuit reliability for frequency F_1	Line 18, Table 1(section 3.2.4.1.1) or Line 11, Table 1(section 3.2.4.1.2)
(2)	BRR (F_1) %	Basic reception reliability	BCR (F_1)

Two frequency operation

(3)	BCR (F_2) %	Basic circuit reliability for frequency F_2 where $F_1 < F_2$	Line 18, Table 1(section 3.2.4.1.1) or Line 11, Table 1(section 3.2.4.1.2)
(4)	BRR (F_1) (F_2)	Basic reception reliability (a) where $F_1/F_2 \geqslant 0.9$	$\frac{1}{2}\left(1-\prod_{n=F_1}^{F_2}(1-BCR(n))+Max(BCR(F_1); BCR(F_2))\right)$
		(b) where $F_1/F_2 < 0.9$	$1-\prod_{n=F_1}^{F_2}(1-BCR(n))$

TABLE 3 (continued)

Basic reception reliability

Three frequency operation

Step	Parameter	Description	Source
(5)	BCR (F_3)	Basic circuit reliability for F_3 where $F_1 < F_2 < F_3$	Line 18, Table 1(section 3.2.4.1.1) or Line 11, Table 1(section 3.2.4.1.2)
(6)	BRR (F_1) (F_2) (F_3)	(a) Basic reception reliability for $F_1/F_2 \geqslant 0.9$; $F_2/F_3 \geqslant 0.9$	$\frac{1}{2}(1-\prod_{n=F_1}^{F_3}(1-BCR(n))+Max(BCR(F_1), BCR(F_2), BCR(F_3)))$
		(b) $F_1/F_2 < 0.9$; $F_2/F_3 < 0.9$	$1-\prod_{n=F_1}^{F_3}(1-BCR(n))$
		(c) $\underline{F_1/F_2 \geqslant 0.9;\ F_2/F_3 < 0.9}$ or $\underline{F_1/F_2 < 0.9;\ F_2/F_3 \geqslant 0.9}$	$\frac{(a) + (b)}{2}$

3.2.4.4 Overall reception reliability

The method for computing overall reception reliability is outlined in Table 4. For a single frequency, overall reception reliability (ORR) is the same as the overall circuit reliability (OCR) described in the previous section. For multiple frequencies, the interdependence between propagation conditions on different frequencies results in the computation method given in Table 4. In steps (4) and (6), OCR (n) is the overall circuit reliability for frequency n, where n = F_1, F_2 etc. The overall circuit reliability is given in step (2) for a single frequency, in step (4) for a set of two frequencies and in step (6) for a set of three frequencies.

TABLE 4

Overall reception reliability

The following parameters are involved :

One frequency operation

Step	Parameter	Description	Source
(1)	OCR (F_1) %	Overall circuit reliability for frequency F_1	Line 20, Table 2
(2)	ORR (F_1) %	Overall reception reliability	OCR (F_1)

Two frequency operation

(3)	OCR (F_2) %	Overall circuit reliability for frequency F_2	Line 20, Table 2
(4)	ORR (F_1) (F_2)	Overall reception reliability (a) where $F_1/F_2 \geq 0.9$	$\frac{1}{2}(1-\prod_{n=F_1}^{F_2}(1-OCR(n))+Max(OCR(F_1);\ OCR(F_2)))$
		(b) where $F_1/F_2 < 0.9$	$1-\prod_{n=F_1}^{F_2}(1-OCR(n))$

TABLE 4 (continued)

Overall reception reliability

Three frequency operation

Step	Parameter	Description	Source
(5)	OCR (F_3)	Overall circuit reliability for F_3 where $F_1 < F_2 < F_3$	Line 20, Table 2
(6)	ORR (F_1) (F_2) (F_3)	(a) Overall reception reliability for $F_1/F_2 \geqslant 0.9$; $F_2/F_3 \geqslant 0.9$	$\frac{1}{2}\left(1-\prod_{n=F_1}^{F_3}(1-OCR(n))+Max(OCR(F_1), OCR(F_2), OCR(F_3))\right)$
		(b) $F_1/F_2 < 0.9$; $F_2/F_3 < 0.9$	$1-\prod_{n=F_1}^{F_3}(1-OCR(n))$
		(c) $F_1/F_2 \geqslant 0.9$; $F_2/F_3 < 0.9$ or $F_1/F_2 < 0.9$; $F_2/F_3 \geqslant 0.9$	$\frac{(a) + (b)}{2}$

3.2.4.5 Basic and overall broadcast reliability

The determination of basic broadcast reliability involves sample points within the geographical area of the desired broadcast reception. The basic broadcast reliability is an extension of the basic reception reliability concept to an area instead of a single reception point. The method for computing basic broadcast reliability is outlined in Table 5. In step (1), the basic reception reliabilities BRR (L_1), BRR (L_2), --- BRR (L_N) are computed as described in Table 3 at each sample point L_1, L_2 -- L_N. These values are ranked in step (2) and the basic broadcast reliability is that value associated with a specified percentile.

In a similar way the overall broadcast reliability is computed as described in Table 6 and it is the value associated with a specified percentile X.

Broadcast reliability is associated with the expected performance of a broadcast service at a given hour. For longer periods, computation at one hour intervals is required.

TABLE 5

Basic broadcast reliability

The following parameters are involved :

Step	Parameter	Description	Source
(1)	BRR (L_1), BRR (L_2) --- BRR (L_N)	Basic reception reliability at all receiving locations considered in the broadcast area	Line (2), (4) or (6) as appropriate from Table 3
(2)	BBR (X)	Basic broadcast reliability associated with percentile X	Any percentile chosen from the ranked values from (1)

Note - The broadcast reliability associated with the percentile X depends upon the density and distribution of the test points in the service area.

TABLE 6

Overall broadcast reliability

The following parameters are involved :

Step	Parameter	Description	Source
(1)	ORR (L_1), ORR (L_2) --- ORR (L_N)	Overall reception reliability at all reception locations considered in the broadcast area	Line (2), (4) or (6) as appropriate from Table 4
(2)	OBR (X)	Overall broadcast reliability associated with percentile X	Any percentile chosen from ranked values from (1)

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

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COMMITTEE 4

SUMMARY RECORD

OF THE

SIXTH MEETING OF COMMITTEE 4

(TECHNICAL CRITERIA)

Friday, 27 January 1984, at 0910, 1615 and 2015 hrs

Chairman : Mr. J. RUTKOWSKI (People's Republic of Poland)

Subjects discussed :		Document
1.	Consideration of the seventh report of the Chairman of Working Group 4A	133
2.	Consideration of the tenth report of the Chairman of Working Group 4B	129
3.	Convening of ad hoc Group 4D	-

1. Seventh report of Working Group 4A (Document 133)

1.1 The Chairman of Working Group 4A said that it had completed its work the previous afternoon and had reached as satisfactory agreement as was possible at the current stage of the Conference on the greater part of the subjects with which it had to deal. However, it had had to leave a number of items to be decided by the Committee.

Referring to Annex 1 (Optimum frequency band selection, section 3.2.1.4) he said it had been concluded that the best method for selecting optimum frequency bands was by a quantitative estimate based on radio-frequency signal-to-noise ratio at test points in the intended service area. The text at Annex 1 was a simple statement to that effect which he was submitting to the Committee for approval.

1.2 The delegate of Israel suggested that it might be desirable to add a statement about the antenna which was supposed to be used, since if the optimum antenna was not available in practice, a different mode of propagation at a different angle might provide the optimum result.

1.3 The Chairman of Working Group 4A, supported by the delegate of the United States, said that such a step was unnecessary since the procedure proposed took available equipment and antenna characteristics into account when selecting optimum frequency bands.

1.4 The Chairman said that if there was no concrete proposal for the wording of an amendment and if he heard no objection, he would take it that the Committee wished to approve Annex 1 to Document 133.

It was so decided.

1.5 The Chairman of Working Group 4A drew attention to several particular aspects of Annex 2 (Reliability, section 3.2.4) and to a number of editorial corrections. In considering the six kinds of reliability defined in the annex, the Working Group had had long discussions on many issues. The first point to make was that the Group had felt it desirable to offer two different approaches to the calculation of basic circuit reliability (section 3.2.4.1).

The second point was a technical matter concerning steps (13) and (14) of the procedure for determining overall circuit reliability (item 3.2.4.2, Table 2). The formulas given in square brackets assumed that wanted and interfering signals received on the same frequency and at the same location were uncorrelated. However, the Group believed that the question should be discussed by the Committee before, as he hoped, the square brackets could be removed.

The third point related to the six entries concerned with two frequency and three frequency operation in square brackets in the sections on basic and overall reception reliability (Tables 3 and 4). As indicated by the note on Reliability at section 3.2.4, the calculation procedures contained in those square brackets would not be needed if Committee 5 or the Plenary Meeting decided that the Conference did not wish to consider the cases covered.

A fourth point concerned the value and source for intrinsic receiver noise field strength to be entered in the square brackets at step (10) in the first procedure for computing basic circuit reliability (section 3.2.4.1.1, Table 1). That value still remained to be determined on the basis of the noise limited sensitivity of the receiver, taking account of the signal-to-noise ratio used. Although the parameter needed to be determined and covered in Chapter 3 of the report of the First Session of the Conference, it was not clear where.

Finally, another point which needed to be covered in Chapter 3 of the report was the parameter of the required signal-to-interference ratio used at step (17) in the procedure for calculating overall circuit reliability (section 3.2.4.2, Table 2). The parameter was quantitative and could be calculated but, although it was needed, it had not been discussed. The relationship between it and the protection ratio also needed to be established and covered by Chapter 3 of the report.

1.6 The Chairman said that the question of the value for intrinsic receiver noise field strength could be considered in connection with the report of Drafting Group 4B-1 on values of minimum usable and reference usable field strength (Document 130).

1.7 The Director of CCIR asked for clarification of the time periods to be used in practice in performing the various calculations envisaged in Document 133. The only indication he had found was at the end of Annex 2, in the final sentence of section 3.2.4.5, which referred to the need for computation at one-hour intervals for determining broadcast reliability. It was necessary to state more precisely somewhere in the text at what intervals other calculations were to be carried out. Some such indication was also needed for the process of optimum frequency band selection.

1.8 The Chairman of Working Group 4A confirmed that the only reference in Document 133 to the periodicity of calculations was the one indicated. The Group had assumed that the calculations to be performed related to intervals of time over which ionospheric conditions remained steady and the median level of the wanted signal did not vary. A clarification was clearly needed early in section 3.2 of the report of the First Session and it should be to the effect that, taking account of diurnal and other variations in the ionosphere, it would be appropriate to calculate ionospheric parameters at intervals not exceeding one hour. Shorter intervals were possible, but if the planning method chosen indicated periods of two or more hours, that would be too long to assume that ionospheric characteristics would remain constant. A sentence should be inserted in the text of the report, before the section on reliability, to state that ionospheric parameters needed to be calculated at intervals of one hour.

1.9 The Chairman said he took it that the reference in section 3.2.4.5 to the need for computation at one-hour intervals in the specific case of broadcast reliability could, if necessary, be repeated elsewhere in Chapter 3 of the report, for example, with respect to the ionospheric propagation prediction method. Alternatively, an appropriate note could be inserted wherever necessary to draw attention to the provision in section 3.2.4.5. If he heard no objection, he would take it that the Committee agreed.

It was so decided.

1.10 The Chairman proposed that Annex 2 be considered section by section.

Basic circuit reliability (sections 3.2.4.1 to 3.2.4.1.2)

Sections 3.2.4 to 3.2.4.1.1 were approved.

Table 1 was approved, subject to amendment of 8 dB to read -8 dB at step (5), insertion of the relevant data and removal of square brackets at step (10) and insertion of the appropriate section number at step (17).

Figure 1 and the two equations for basic circuit reliability were approved, subject to deletion of dB from the equations.

Section 3.2.4.1.2 was approved, subject to the amendment of 8 dB to read -8 dB at step (5) and revision of the number in square brackets at step (11) in Table 1 and to the substitution of BCR for R_c and the deletion of dB in the two equations for basic circuit reliability.

1.11 The delegate of India said that the results of subjective tests in real situations suggested that the effects of fading signals at the receiver output would be different from those calculated theoretically. He wished to revert to the figures after the Committee's consideration of overall circuit reliability (section 3.2.4.2).

1.12 The Chairman said that if the point had been raised some years earlier, it would perhaps have been possible to present a better solution based on subjective field tests. However, in the absence of technical information other than that contained in the document, he took it that no objection was being raised to the adoption of the paragraphs considered so far.

Overall circuit reliability (section 3.2.4.2)

1.13 The delegate of Qatar suggested that the formula $I = \sqrt{E_1^2 + E_2^2 + E_3^2 + \ldots}$ should be restored to the source column at step (7) of Table 2, and that the first three sentences of the second paragraph of section 3.2.4.2 be amended to read :

"The median field strength levels (E_i) of each interfering source are obtained from the prediction method in step (6). For a single source of interference the predicted median field strength is used in step (7). For multiple sources of interference, the median field strength is calculated as in step (7)."

1.14 The Chairman of Working Group 4A said that the amendments were acceptable as editorial clarifications, subject to retention of the remainder of the text at those two points.

1.15 The Chairman said a decision would have to be taken on whether or not the square brackets in the source column of steps (13) and (14) in Table 2 should be removed.

1.16 The Chairman of Working Group 4A explained that the formulas in square brackets had been put forward on the assumption, based on available evidence, that the signals dealt with in steps (13) and (14) were not correlated. Such was the majority, but not the unanimous view, in the Working Group.

1.17 The delegate of India considered that the proposed method of evaluating circuit reliability would not offer a solution because the signals in question were sometimes correlated and in certain cases to a large extent. The formulas did not correspond to the real position and as a compromise he proposed that an average be adopted by halving the values, which should satisfy most administrations. In reply to a question by the Chairman, he explained that correlation depended on various factors. The fading process was so complex that it was difficult to determine whether or not correlation had occurred. Some experiments in India had revealed that fading was not an isolated phenomenon confined to a particular region but was the result of interference from several different sources.

1.18 The delegate of the United Kingdom said that in his delegation's view in the overwhelming number of cases the upper and lower decile of signal-to-interference would not be correlated and that the formulas were satisfactory. However, the formulas could be modified to allow for the possibility of correlation. Variations in field strengths were on a small scale and did not depend directly on changes in the ionospheric characteristics themselves but rather on small-scale disturbances in the ionosphere. Although changes in the MUF of the circuit as indicated in the table in section 3.2.3.2 of Document 115(Rev.1) had some bearing on the question, there was no direct relationship between frequency variations and variations in field strength.

The documents prepared by CCIR Study Group 3 might usefully be studied in connection with short-term fading. It had been found that signals were not effectively correlated in the short-term even from a single transmitter to receiving antennas perhaps only 200 to 300 metres apart, so there was no evidence of correlation with short-term fading.

The Indian proposal went too far, as it would signify that the variability of a signal-to-interference ratio was less than the variability of the signal by itself which was hardly credible.

1.19 The delegate of Canada said that in Canada extensive pulse measurements over a long period of years had definitely shown that in those latitudes there was no correlation between signals even when the distance between the receiving antennas was small. However, there could be physical reasons for obtaining different results from those of Indian researchers because conditions of ionization formation would be very different in the two countries.

1.20 The delegate of China proposed the deletion of $+D_L(IS)^2 + D_L(IF)^2$ in step (13) and $+D_U(IS)^2 + D_U(IF)^2$ in step (14) of Table 2 as a compromise which should provide a value that could be used by all administrations.

1.21 The delegate of Iran supported that proposal, which would ensure that the fading allowance of signal-to-interference would not be lower than the signal itself.

1.22 The delegate of the USSR said that in the absence of documentary evidence assumptions had to be made and reliance placed on the experience of administrations. Studies over a long period in the USSR had revealed that signals might be partially correlated if transmission lines were comparable in length and situated within a narrow angle of the azimuth of about 5°-8°, but with slow fading interference the correlation was so small as to be less than 1% so that any change in the formulas proposed for steps (13) and (14) would not produce any significant result and he believed they should be adopted as they stood since they reflected the existing position. However, in order to reach a compromise and take account of a possible correlation between a wanted signal and an interfering signal which could only occur in the case of slow fading interference, he proposed inserting a coefficient of, for example, 0.8 after the third value in the formula for step (14). That step was the most important in the Table.

1.23 The delegate of the United Kingdom said that he supported the compromise proposal just made by the delegate of the USSR, which appeared to be entirely satisfactory.

1.24 The delegate of Algeria supported the Chinese proposal to delete the last two terms of the formulas in steps (13) and (14). The values concerned were insignificant and their insertion in the formulas introduced an unnecessary element of confusion. As to the objection that the Committee could hardly ignore a well-known physical fact, he remarked that the correlation, if any, existed only at the entry to the receiver; the situation at the receiver outlet was different.

1.25 The delegate of the USSR, replying to a point raised in connection with his proposal by the delegate of Burundi, said that the introduction of a coefficient of 0.8 would mean that in 80% of cases there was no correlation between received signal and interference, while in the remaining 20% of cases such correlation existed. The actual coefficient to be adopted was open to discussion, but to exclude the values in question would be technically inelegant and inappropriate for a technical committee.

1.26 The delegate of Poland referred to CCIR Recommendation 411-2, which had been adopted unanimously, and also to section 4.1.2.1 of the CCIR Report to the Conference (Document 22). The Committee could not ignore those documents. The formulas in steps (13) and (14) were correct and he was in favour of maintaining them. However, in order to facilitate the work of the Committee, his delegation was inclined to support the Soviet compromise proposal.

1.27 The delegate of Czechoslovakia also supported the Soviet proposal.

1.28 The Chairman wondered whether the delegate of China and those delegates who had supported his proposal would agree to retain the fast fading factor in the two formulas on the understanding that the problem of slow fading would be dealt with in the manner suggested by the Soviet delegation or in some other fashion. The fast fading factors in the formulas ($D_L(IF)^2$ and $D_U(IF)^2$) were described in steps (10) and (11) of the same table and the corresponding values were 5 dB and 8 dB, respectively.

1.29 The delegate of China said that his proposal to delete the last two terms of the formulas in steps (13) and (14) evidently reflected the views of many administrations and he was not prepared to withdraw it at that stage.

1.30 The Chairman proposed that the Committee should set up an ad hoc Working Group 4C under the chairmanship of the Chairman of Working Group 4A and consisting of the delegates of the USSR, China and India. It would consider the problems arising from steps (13) and (14) of Table 2 of Document 133 and present its conclusions to Committee 4 on Monday, 30 January.

It was decided to set up ad hoc Group 4C with the terms of reference as defined above and with the following membership :

Mr. L.W. Barclay (United Kingdom), Chairman;

Mr. I.A. Tchernov (USSR);

Mr. Wu Xianlun (China);

Mrs. R. Chakrabarty (India).

At the suggestion of the delegate of India, it was agreed that the ad hoc Group should also consider Document 131.

1.31 The Chairman suggested that further consideration of Document 133 should be suspended pending the outcome of the work of ad hoc Group 4C.

It was so agreed.

2. Report of Chairman of Working Group 4B (Document 129)

2.1 The Chairman of Working Group 4B reported that the Working Group had completed its work on the previous day, having held a total of 12 meetings. He thanked all the participating administrations, the Chairman of the Sub-Working Groups and the Working Group's secretaries. Introducing Document 129, he drew attention to the passage in square brackets at the end of section 3.5.1.3. Tables D, E, F and G in section 3.5.1.5 also appeared in square brackets, as did the note at the foot of Table G.

2.2 The delegate of Argentina proposed that paragraph 2 of section 3.5.1 on non-directional antennas be amended by deleting the final sentence and replacing the words "in the centre of the coverage area" by "within the coverage area" to cover the case of countries like his own where in certain cases the transmitter might be as far as 700 km from the service area.

2.3 Those proposals were supported by the delegates of Brazil and of Mexico, who also recommended that the word "only" should be deleted.

2.4 The Director of the CCIR said that that last change might have the effect of indicating a mandatory use of non-directional antennas when located within coverage areas, which was not the intention.

2.5 The Chairman, the representative of the IFRB and the delegate of Israel put forward alternative drafting amendments to meet the concern expressed by the delegate of Argentina.

2.6 The delegate of Algeria thought the problem was due to the tendency to confuse the coverage/service areas of a country with its boundaries. Drafting would be facilitated when the definitions of coverage and service areas had been adopted.

It was finally agreed to set up an ad hoc Group consisting of the delegates of Argentina, Brazil and other interested groups, under the chairmanship of the delegate of Argentina, to reword the paragraph in the light of the opinions expressed.

2.7 The representative of the IFRB said that section 3.5.1.2 had been discussed only briefly in Working Group 4B for lack of time. It concerned the definition of the horizontal beamwidth which had been designated at between -6 dB points, derived from Appendix 2 which had not been revised at WARC-79. For all other terrestrial services covered in Article 12 of Appendix 1 the beamwidth was defined in terms of the -3 dB points by the WARC-79 and he therefore believed that it would be useful from both the economic and the standardization point of view to define similarly the HF broadcasting antennas.

2.8 The delegate of India said that delegates had not had the benefit of IFRB advice when the question had been raised in Sub-Group 4B-2. If the IFRB or CCIR considered that there were advantages in a -3 dB definition, his delegation would have no serious difficulties in agreeing to it.

2.9 The delegates of France, the Federal Republic of Germany, Qatar and Yugoslavia preferred to retain -6 dB since that value was fairly representative.

2.10 The Chairman said that since all but one speaker appeared to favour the -6 dB figure, he would take it that the Committee wished to retain that value.

It was so agreed.

2.11 The Director of the CCIR, referring to the note at the foot of Table G, explained that the corrections involved would be very slight. The values appearing in the table had been taken by the Working Group from diagrams, and it was considered preferable, for the sake of precision, to replace those values by figures from actual computer tabulations.

2.12 The Chairman drew attention to the paragraph under the heading "Back radiation" in section 3.5.1.5, in consequence of which the values in the final version of the tables, which at present reached 40 dB in many cases, would have to be truncated to 30 dB.

2.13 Replying to a question by the Chairman, the Chairman of Working Group 4B said that there had been some discussion in the Working Group concerning equation (1) in section 3.5.1.5, but no specific correction of the text had been proposed.

2.14 The delegate of the Federal Republic of Germany said that Sub-Working Group 4B-2 was in fact preparing a document on the paragraph in question.

2.15 The delegate of the USSR said that serious differences had arisen within Working Group 4B on the subject of the tables in Document 129. For example, Table D differed substantially from Table 8-AI-II of the CCIR Report to the Conference and also failed to correspond to CCIR Recommendation 80. The values of 40 dB appearing in the first column under "Azimuthal attenuation" were at least 20 dB higher than those in Recommendation 80 and were, indeed, practically unrealizable. It had been decided within the Working Group to review the tables, but evidently that had not yet been done. He failed to see what could have happened to justify such a radical divergence from the CCIR values and hoped that the tables would be duly reconsidered. Referring to the paragraph on "Back radiation" in section 3.5.1.5, he wondered whether the sentence concerned was in the nature of a Recommendation. Were administrations being told to change their antennas so that the total attenuation should not exceed a value of 30 dB, and if so, how and at what cost? The paragraph represented another radical revision of a CCIR Recommendation and was, in his view, surprising to say the least.

2.16 The Chairman said that he had understood the sentence in question to mean that the data which should be truncated related to minimum and not to maximum back radiation, which appeared in the tables as 15 dB for an angle of $\pm$ 180°.

The meeting was suspended at 1205 hours and resumed at 1615 hours.

2.17 The Chairman of Sub-Working Group 4B-2 said that his Group was making good progress with the draft text to clarify section 3.5.1.5. In response to the points raised by the delegate of the USSR, he explained that the differences between the figures under consideration and those put forward in the CCIR Report arose because the values in Document 129 related to the maximum attenuation appropriate for the different types of antenna and angle. There had been two views on the treatment of the floor values to be adopted. Working Group 4B had initially proposed that Recommendation 80 should not be taken into account for determining relevant antenna gain and that the figures in the tables should be allowed to fall to the lowest appropriate values. After further discussion, however, Sub-Working Group 4B-2 had agreed that a limit should be established for the floor values and had settled on the figures given in Document 129. Where forward radiation was concerned, for angles above the vertical angle of maximum radiation the gain was limited to the floor value of antenna gain, whereas for angles below the vertical angle of maximum radiation a limit had been set for total attenuation. It had been felt that for certain planning conditions antenna gain should be allowed to fall to values below those resulting from Recommendation 80 for low radiation angles, and to a fixed value of -8 dBi for higher radiation angles.

2.18 The delegate of the USSR said that having examined the matter further, taking into account not only the theoretical aspects of calculations expressed in the tables but also a number of practical considerations relating to the use of antennas, his delegation had come to the conclusion that a compromise might be possible between the values proposed in Document 129 and those based on Document 22 and Recommendation 80. He proposed that in section 3.5.1.5 30 dB should be amended to 25 dB in both cases and -8 dBi changed to -3 dBi. In addition, to make the text clearer the two sub-headings "forward radiation" and "back radiation" might be amended to "radiation in forward space" and "radiation in backward space".

2.19 The delegate of the United Kingdom said that he could go along with that compromise proposal.

2.20 In reply to a query by the delegate of the Netherlands on how the figures in section 3.5.1.5 were to be used, the Chairman of Sub-Working Group 4B-2 said that the new text being drafted would explain how appropriate antenna gain could be calculated as a result of the gain and attenuation derived from the tables.

2.21 The delegate of India, supported by the delegates of Qatar and China, could not agree to the USSR proposal since the figures put forward in Document 129 already constituted a compromise.

2.22 The delegate of Brazil fully agreed that it would be unfair to envisage further compromise on the agreed figures. In particular, he strongly opposed the suggested change from -8 to -3 dBi, since on the basis of its calculations and above all its operational experience Brazil considered that value totally unsuitable for H antennas.

2.23 In the light of the discussion the Chairman proposed that the sub-sections relating to "forward radiation" and "back radiation" be approved with the figures as proposed in Document 129; the remainder of section 3.5.1.5 would remain in square brackets pending submission of the refined text currently under preparation.

It was so agreed.

2.24 The delegate of the USSR said that it was impossible to obtain such deep minima between sidelobes as those given in section 3.5.1.5. His delegation therefore reserved its position on the figures adopted.

2.25 The delegate of France said he thought that when correcting Tables D-G the CCIR should take account of the limits adopted in section 3.5.1.5. In that case, in order not to confuse the theoretical values and those to be used for planning, the titles of the tables in question should read : "Antenna attenuation adopted for planning ...".

2.26 The Director of the CCIR said that since the total attenuation must not exceed 30 dB for forward and back radiation he assumed that the values in the tables must also be truncated to 30 dB.

2.27 The delegate of Qatar, supported by the delegate of the USSR, said that the values in the tables were theoretical values. He thus proposed that the table headings all begin with the words : "Theoretical values of ...".

2.28 The Chairman, the Chairman of Sub-Working Group 4B-2 and the delegate of India recalled that the values in the table had already been truncated to 40 dB in response to the decisions of IWP 10/5. They could thus not be considered as purely theoretical values, particularly since they were also based on a finite value of ground conductivity. If they were further truncated to 30 dB as suggested, however, they would correspond to the values for planning.

2.29 After some discussion, the Chairman proposed that the CCIR review the tables, truncating the values therein to 30 dB, that the wording proposed by the delegate of France be inserted in the table headings, and that the tables be reconsidered in that form in the revised version of Document 129 to be resubmitted at a later stage. In the meantime the tables would remain in square brackets.

It was so agreed.

2.30 The delegate of the USSR said that as a consequence of his comments with regard to the values adopted earlier, his delegation reserved its position. The fact that Document 129 had provoked such a lengthy discussion showed that there were still doubts in delegates' minds. He reiterated that he regretted that the Committee and Working Groups had elected to deviate from the original CCIR proposals.

The meeting was suspended at 1750 hours and resumed at 2015 hours.

Annex 2

2.31 The Chairman of Working Group 4B said that objections had been raised to his proposal of a value of 90% for the co-channel protection ratio, hence the "X" appearing in square brackets.

2.32 The Chairman drew attention to Document 131 submitted by India which appeared to have some bearing on the issue. It presented the protection ratio in terms of dB rather than in terms of circuit reliability.

2.33 The delegate of Yugoslavia preferred to take Document 131 as a basis. In his view the correlation in Annex 2 was incorrect; the RF protection ratio was concerned with subjective effects whereas overall circuit reliability was objective.

2.34 That view was shared by the delegate of China who proposed that the discussion be deferred until Document 131 had been considered.

2.35 -- The Chairman of ad hoc Group 4C said that it was not merely a question of presentation. The suggestion that the Committee might now look at a given number of dB under certain conditions and see how many dB margin could be allowed in the circuit performance was an entirely different way of proceeding, and he feared it might not lead to a coherent set of proposals. He would suggest that the first step was for the Committee to confirm what it meant by circuit reliability.

2.36 The delegate of the USSR agreed with that statement and said that Document 131 did not relate to overall circuit reliability.

2.37 The Chairman said that the sentence as it was formulated had not given rise to discussions in Working Group 4B.

2.38 The delegate of India said that no written text had been available and the proposal read out had been accepted hastily without other aspects being considered. His delegation had indicated its intention to revert to the subject, so he did not feel that the Working Group had really endorsed the text. As shown in Document 131, tests had shown that a margin of 5 dB would be adequate to give the required protection under fading conditions.

2.39 The delegates of Canada and of the Netherlands stressed that overall circuit reliability was a function of the required signal-to-interference ratio and was therefore a fixed parameter.

2.40 The Chairman of Working Group 4B supported that view and said that the work to be done by ad hoc Group 4C, established that morning, would be relevant.

2.41 The Chairman confirmed that the intention when setting up that Group had been to seek a compromise between the formulas given in steps (13) and (14). As he saw it, the mandate of that Group was restricted to a new presentation.

2.42 The Chairman of ad hoc Group 4C observed that it might be wise to expand the terms of reference of the Group to include consideration of overall circuit reliability in terms of protection. The Group would, of course, also consider Document 131.

2.43 The delegate of the USSR proposed that Annex 2 be deleted altogether since overall circuit reliability should be placed elsewhere. Perhaps it should more properly be dealt with by Committee 5 since principles other than those of a technical nature were involved. Indeed, neither the draft structure of the report of the First Session (Document 90) nor the CCIR Report (Document 22) contained parameters for protection ratio with fading signals.

2.44 The Chairman of Working Group 4B drew attention to the definition of circuit reliability in Document 115(Rev.1) which stated the close relation between circuit reliability and signal-to-interference ratio.

2.45 The Chairman suggested that the whole of Annex 2 be left in abeyance pending the outcome of the discussions in ad hoc Group 4C, whose mandate would be expanded as suggested by its Chairman.

It was so agreed.

Annex 3

2.46 The Chairman said the square brackets around sections 3.9.2.1(e), 3.9.2.2(c) and 3.9.2.3 had been so placed pending a final decision by Committee 5, and would have to be settled in the Plenary Meeting. The last paragraph of section 3.9.2.4 had also been placed in square brackets, but could be settled by the Committee.

2.47 The delegate of the Federal Republic of Germany said that as Committee 5 would undoubtedly refer paragraph (e) of section 3.9.2.1 and paragraph (c) of section 3.9.2.2 back to Committee 4, the square brackets around those paragraphs could be deleted.

2.48 The Chairman said that he would prefer to leave the square brackets in for the time being since the paragraphs concerned involved matters other than technical.

It was so agreed.

2.49 The delegate of Morocco, referring to sections 3.9.2.3 and 3.9.2.4, said that the term "transition period" was not among those defined so far, and suggested that a footnote be added to the text containing some explanation. As he understood it, it meant the period of co-existence of DSB and SSB transmissions.

2.50 The Chairman said the matter would best be referred to Committee 5 where all the problems of the transition period were being discussed.

2.51 The Chairman of Working Group 4B drew attention to the close connection between the last paragraph of section 3.9.2.4 and section 3.9.1.13 on RF protection ratios, which stated that an additional 3 dB should be allowed in the total channel protection ratio for a wanted DSB signal interfered with by an SSB signal during the transition period, if the same quality of reception was to be maintained. Section 3.9.2.4, however, in its last paragraph, indicated a 0 dB allowance. Either the two paragraphs should be deleted, or the two brought into line and the apparent contradiction resolved.

2.52 The Chairman proposed that in view of the firm decision that the planning would be based on DSB and that the introduction of SSB was a thing of the future and subject to further study, the square brackets should simply be removed. The delegate of the Federal Republic of Germany supported that proposal, and added that further discussion on the subject should be left to the appropriate CCIR Study Group.

2.53 The delegate of Yugoslavia pointed out that the CCIR in section 13.2.3.1 of its Report (Document 22) had recommended an allowance of 3 dB. He therefore wondered to what study the "recent investigation" referred.

2.54 The Chairman replied that it referred to new information which had come to light as a result of the activity of Working Group 4B, and which would be followed up in the intersessional period.

2.55 The delegate of Japan said that he had no objection to removing the square brackets, but considered that the text would be more acceptable if the word "should" were replaced by "may".

It was so agreed and the square brackets around the last paragraph of section 3.9.2.4 were removed.

Annex 3, as amended, was approved.

3. Convening of ad hoc Group 4D

3.1 The Chairman suggested that ad hoc Group 4D (Minimum parameters) be chaired by Dr. Rao (India).

It was so agreed.

The following delegations indicated their intention to participate : the United Kingdom, the United States, China, the USSR, the Federal Republic of Germany, Canada, Iran, Yugoslavia, Japan and Brazil.

The meeting rose at 2230 hours.

The Co-Secretaries :

G. KOVACS
G. ROSSI

The Chairman :

J. RUTKOWSKI

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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COMMITTEE 4
COMMITTEE 5

Canada

INFORMATION PAPER

FREQUENCY SELECTION : A TECHNIQUE ADAPTABLE TO ALL PLANNING METHODS

1.0 Introduction

Whatever planning method is adopted by the Conference, it must embody an essential element to bring that planning method into operational effectiveness, i.e., a means for the production of broadcasting schedules. The principal objective in performing this task is to determine the frequency channels which are best suited to satisfy each particular request. This objective is best achieved when the frequency selection method is designed to make efficient use of the radio spectrum.

Although there is a wide variety of approaches which can be utilized to assign frequencies on the available channels, it may be possible to identify two such approaches which perform the major functions required when developing a frequency selection procedure.

One method comprises testing all possible mathematical combinations and permutations of the requests, i.e., broadcasting requirements, on the available channels. The disadvantage of this method is that it requires computing time which increases exponentially with the number of requests. Its advantage is that the result is <u>the</u> optimum assignment combination because all such combinations have been tested. The number of possible assignment plans which includes all available combinations is approximately equal to C^n where C is the number of channels and n is the number of requests.

In order to reduce the computation time, and yet achieve the same goal of "spectrum efficiency", a second method has been developed. This second method, comprises slotting, i.e., assigning a position, to each request in turn. A request is tested on all available channels, and assigned to that channel which will result in minimum impact on the other requests not yet assigned. This is an "optimizing" process and it is easier to use than the method described above because at each stage of the computation process an assignment decision is made instead of doing calculations for all combinations. The technique by which this "slotting method" is implemented consists of building a series of matrices which contain the pertinent information on mutual interference among various requests in order to enable the frequency selection process to take place in an "optimizing" fashion. This "slotting" process outlined below is also shown schematically in Appendix 5.

2.0 The Construction of Matrices

The first step is the construction of the interference matrix. (For an illustration of this process see Appendix 1.) This matrix indicates the values of the S/I ratio to expect if two requirements are slotted on the same channel.

The interference matrix is a summary of the propagation calculation results. It shows which requests may interfere with each other and, by consequence, which requests can and which requests cannot be slotted on the same channel. When the target zone covers more than one test point, the S/I ratio is calculated at every test point of the target zone and the worse S/I ratio is retained for inclusion in the interference matrix.

As a second step, the co-channel compatibility matrix should be constructed based on an agreed desired co-channel S/I ratio. (For an illustration of this process see Appendix 2.) The co-channel compatibility matrix illustrates the possibilities of slotting requirements on the same channel and is constructed for the purpose of selecting frequencies.

As a third step the co-channel compatibility matrix should be rendered symmetrical. (For an illustration of this process see Appendix 3.) This is performed for the purpose of achieving computational speed and because of the inherent storage advantages synonomous with the use of the computer.

As a fourth step, the adjacent channel compatibility matrix is constructed. The process is the same as for the construction of the co-channel compatibility matrix, except that the target desired S/I ratio is changed by the value of attentuation corresponding to the selectivity of the receiver. After the target desired adjacent-channel S/I ratio is chosen, the second and third steps of the co-channel compatibility matrix construction are executed to finally obtain the symmetrical adjacent channel compatibility matrix. (For an illustration of this process see Appendix 4.)

A fifth step in this process is represented in Figure 1. It can be seen that the symmetrical co-channel compatibility matrix (Appendix 3) can be combined with the symmetrical adjacent-channel compatibility matrix (Appendix 4) because of the empty spaces in each one. The schematic shown in Figure 1 is called the global, i.e., overall, compatibility matrix because it contains both the co-channel information (in the lower-left portion) and the adjacent-channel information (in the upper-right portion). The global compatibility matrix is the basis of the frequency selection process as it gives a good indication of the spectrum availability situation.

Global Compatibility Matrix

	1	2	3	4	... N
1		AC	AC	AC	
2	CC		AC	AC	
3	CC	CC		AC	
4	CC	CC	CC		
.					
Request Number N					

Request Number

This portion of the matrix indicates if two requests (such as request number 4 and request number 1) are compatible (.TRUE.) or incompatible (.FALSE.) on an adjacent-channel basis.

This portion of the matrix indicates if two requests are compatible (.TRUE.) or incompatible (.FALSE.) on a co-channel basis.

(Figure 1)

3.0 The Slotting Process

Based on the global compatibility matrix the slotting process can be executed. The goal is to find one channel for each request. Each request is slotted on one of the total of C channels available in the given frequency band. The value of C changes with the band chosen.

To "optimize" the process, a request is assigned to the channel that has the minimum effect on the assignment of the remaining requests. For example, if request No. 8 can only go on channel 13 because of incompatibilities on other channels, no other request processed ahead of No. 8 will be slotted on channel 13 if it is not compatible with No. 8. That is, the process is forward-looking.

When a request is slotted on a channel it reduces the number of possibilities for the remaining requests; each slotting action has an impact which is proportional to the number of possibilities it eliminates for the remaining requests.

To find out on which channel a given request should be slotted, it is tested on each channel successively. On each channel the impact is measured on all remaining requests. Finally, upon the completion of these measurements, a decision is taken to slot the request on the channel on which it had the minimum impact.

Requests are neither slotted in a chronological nor in a random order. Request No. 7 can be slotted before request No. 2 or vice versa. The optimum choice should be made, at each stage, among the remaining requests. If a request has the possibility of being slotted on many channels, because it is compatible, it should not be slotted early in the process because it has flexibility; on the other hand, if a request can only be slotted on one of the channels, then it should be slotted immediately, because that single slot could be filled by another request that could be non-compatible. Therefore, requests are slotted in an "optimizing" manner.

In order to permit the evaluation of the impact for the purpose of channel selection and to permit the selection of the requests in the appropriate order, a slotting matrix is constructed. The slotting matrix has N rows where N is the number of requests and C columns where C is the number of available channels in the frequency band (see Figure 2).

The slotting matrix indicates, for each request, whether or not it can be slotted on a given channel. If it can be slotted the matrix will contain the value .TRUE., and if it cannot be slotted, the matrix will contain the value .FALSE.. The decisions about the values are based on what is in the global compatibility matrix. For example, if request No. 3 has been slotted on channel 5 and if request No. 3 is non-compatible on a co-channel basis with request No. 2 (as would be shown in the global compatibility matrix row 3 column 2 = .FALSE.), then it is not possible to slot request No. 2 on channel 5; the slotting matrix should then have a .FALSE. value for request No. 2 on channel 5.

At the beginning of the process, any request can be satisfied on any channel; therefore, the whole matrix is constructed on the basis of .TRUE. values in every position.

Slotting Matrix

	1	2	3	4	5	6	7	... C ---> channels
1	T	T	F	T	T	T	F	
2	T	T	T	T	F	T	T	
3								
4								
5			etc.					
6								
7								
.								
.								
N								

requests

The matrix has N rows by C columns.
N represents the number of requests.
C represents the number of channels.

(Figure 2)

Requests will then be slotted in the order dictated by the principle outlined below in measurement for order. Moreover, a requirement will be assigned to the channel that results in minimum impact as outlined below in measurement of impact. These measurements are used to assign positions to requirements and the process is repeated until all requests are slotted. The slotting matrix is used to keep information on compatibility as the process evolves.

4.0 Measurement for Order

The next request to be processed and slotted will simply be the one with the fewest .TRUE. values in its row in the slotting matrix. For example, if in the slotting matrix, request No. 7 has a total of 3 .TRUE. values, then request 7 would be processed and slotted before request No. 2 if the latter request had a total of 5 .TRUE. values.

5.0 Measurement of Impact

When a request is presumed to be slotted on one channel, it will have an impact on every other request on a co-channel, upper adjacent-channel and lower-adjacent channel basis. The slotting of one request might, in comparison with each other request, turn 3.TRUE. into 3.FALSE. if a co-channel and adjacent-channel incompatibility exists, as indicated by the global compatibility matrix.

The impact of one slotting action in relation to another request is given by the following weighting formula:

$$\text{Impact} = \left(\frac{X}{Y} - 1\right)^2$$

where X is the total number of .TRUE. values the impacted request had previously in the slotting matrix;

where Y is the total number of .TRUE. values the impacted request has afterwards in the slotting matrix.

Y = X - (no. of .FALSE. values which are changed from .TRUE.)

6.0 Conclusions

While it may be argued that this technique does not consider all mathematical permutations and combinations systematically, and, that as a consequenee, cannot be considered as a methodology providing the ultimate solution to the frequency selection process, it is quite proficient in arriving at an optimum solution. In addition, the method considers interference to be taking place on a "two by two" rather than on an aggregate basis. The result is that the consequential operational

S/I ratio is not necessarily equal to the specified desired S/I ratio used in the program. However, this ostensible disadvantage is offset by the fact that the program user could specify at his discretion any value for this S/I ratio and thereby could control the final value of the operational S/I ratio.

The principal advantages of this process are threefold. First, it is systematic and straight-forward which permits its implementation on a computer with its large computational capability and its speed and accuracy. Secondly, the use of "logical" type matrices minimizes the amount of required computer memory storage which is critical for the practical implementation of a method that would be required to handle a large number of requests. Finally, the use of "logical" type variables accelerates the procedure execution, which again has an important practical application in the processing of a large number of requests for HF broadcasting frequencies.

References

1. Bove, F. and L. Tomati, "A Planning Method of Television Broadcasting from Satellites", EBU Technical Review, No. 158, August, 1976), pp.152-162.

2. Chouinard, G. et M. Vachon, "Procédé de Synthèse de Plan par Ordinateur Utilisant une Méthode d'Assignation et de Séléction Inductives", Société Radio Canada, Siège Social de l'Ingénierie, Document présenté au colloque sur la radiodiffusion directe par satellite en préparation pour la CARR de 1983, Ottawa, mai 1981.

3. "A Planning Procedure for the HF Broadcasting Service", Annex III of the Report by the Interim Working Party 10/5 to Study Group 10, Geneva, Switzerland, October 1981, pp. 31-45.

4. "Frequency Selection: A Proposed Technique", paper presented to the First Meeting of Permanent Technical Committee II: Radiobroadcasting of CITEL (Conferencia Inter-Americana de Telecommunicaciones), November 7-11, 1983, Lima, Peru.

Appendices : 5

APPENDIX 1

INTERFERENCE MATRIX

A practical application of the construction of an interference matrix can be demonstrated by the following illustration. If requirement number 3 is slotted on the same channel as requirement number 2, the matrix will provide the following information:

S/I ratio in target zone of requirement 2 caused by number 3 is shown on row 2 column 3;

S/I ratio in target zone of requirement number 3 caused by number 2 is shown on row 3 column 2.

	1	2	3	4	... N —— (requests causing interference)
1		y	y	y	
2	y				
3	y	y			
4					
.					
N					

(desired requests)

y represents the co-channel S/I ratio that would result if there were only one interfering signal.
The matrix has N rows and N columns, "N" representing the number of requests

APPENDIX 2

CO-CHANNEL COMPATIBILITY MATRIX

For each position in the interference matrix there is a corresponding "logical" value in the co-channel compatibility matrix. If when checking in the interference matrix an S/I value is better than the target desired S/I ratio, then the combination is given a logical value .TRUE. in the compatibility matrix. If when checking in the interference matrix an S/I value is worse than the target desired S/I ratio, then the combination is given a logical value .FALSE. in the compatibility matrix.

	1	2	3	4	5	... N —— (requests causing interference)
1		T	F	T	F	...
2	F		T	F	F	...
3	F	F				...
4	F	T	T			
5	.	.	.			
.	.	.	.			
.	.	.	.			
N						

(desired requests)

N represents the number of requests.

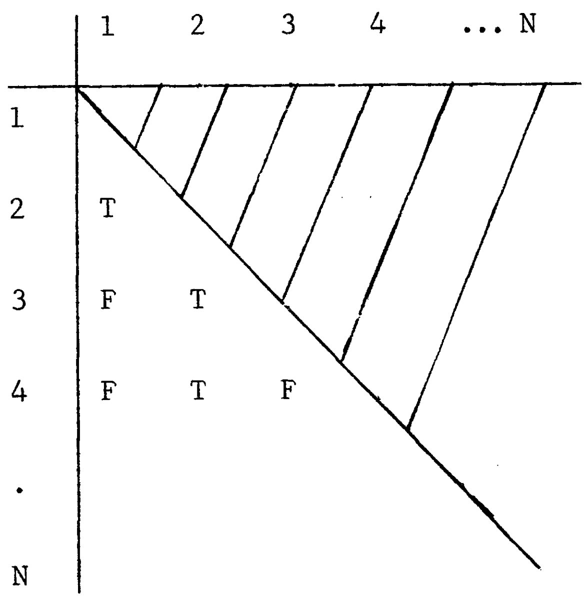
This matrix is a "logical" type, and therefore has certain computational advantages in containing only the logical values .TRUE. or .FALSE. This matrix is, furthermore, the same size as the interference matrix which is N x N where N is the number of requests.

APPENDIX 3

SYMMETRICAL CO-CHANNEL

COMPATIBILITY MATRIX

For each .FALSE. value in the co-channel compatibility matrix the symmetrical position is verified and set at logical value .FALSE. if it is not already. For example, if requirement number 4 is not compatible with requirement number 3, we have to also admit that requirement number 3 is not compatible with requirement number 4. That means that the matrix should be symmetrical with reference to the diagonal. After this process, all the information is contained in one half of the co-channel compatibility matrix and it can be represented as follows:



N represents the number of requests.

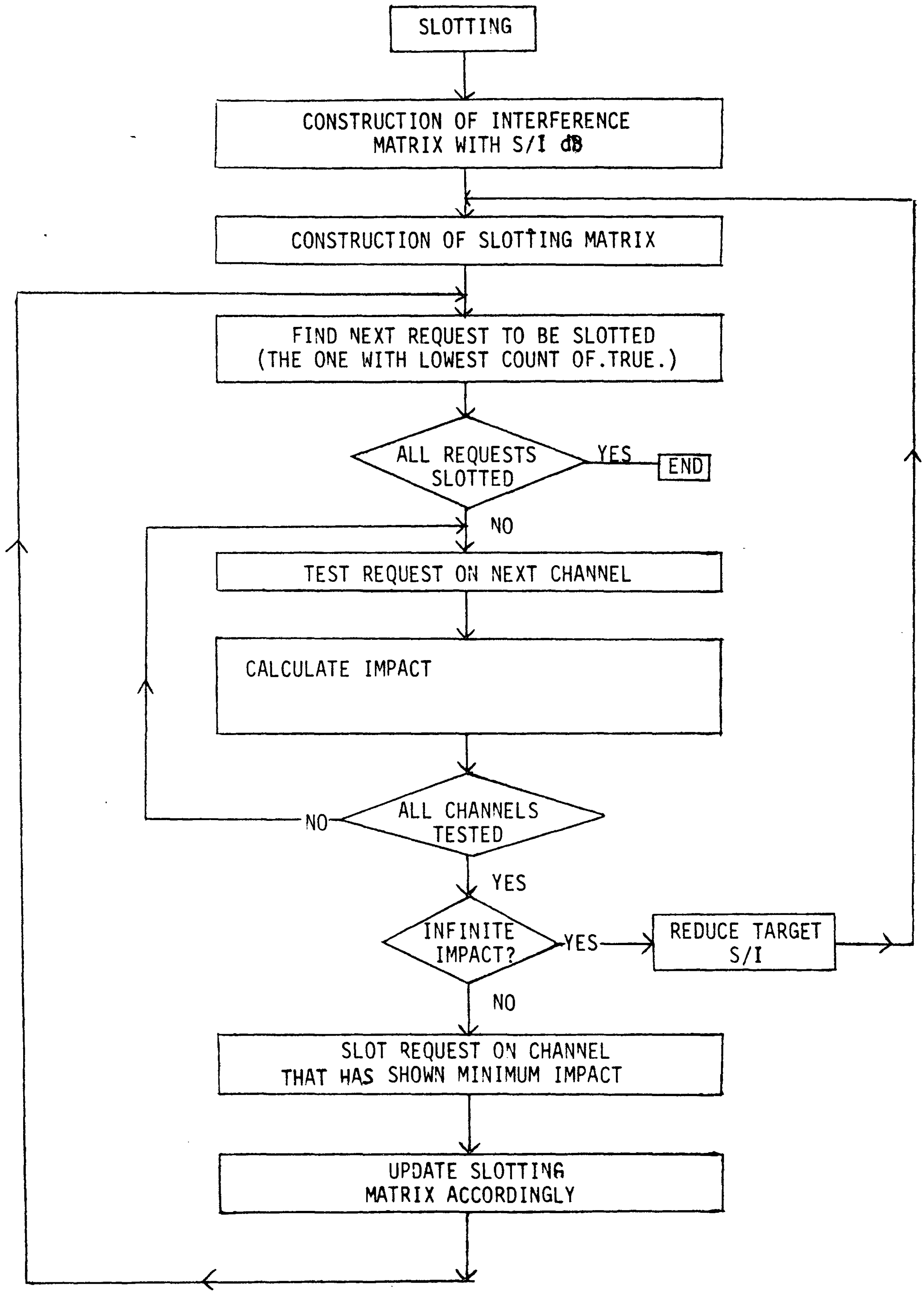
APPENDIX 4

SYMMETRICAL ADJACENT-CHANNEL COMPATIBILITY MATRIX

	1	2	3	4	... N —
1		T	F	T	
2			T	T	
3				T	
4					
.			.		
N			.		

N represents the number of requests.

APPENDIX 5


SLOTTING
CONSTRUCTION OF INTERFERENCE MATRIX WITH S/I dB
CONSTRUCTION OF SLOTTING MATRIX
FIND NEXT REQUEST TO BE SLOTTED (THE ONE WITH LOWEST COUNT OF.TRUE.)
ALL REQUESTS SLOTTED
YES
END
NO
TEST REQUEST ON NEXT CHANNEL
CALCULATE IMPACT
ALL CHANNELS TESTED
NO
YES
INFINITE IMPACT?
YES
REDUCE TARGET S/I
NO
SLOT REQUEST ON CHANNEL THAT HAS SHOWN MINIMUM IMPACT
UPDATE SLOTTING MATRIX ACCORDINGLY

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

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COMMITTEE 4

ELEVENTH REPORT OF WORKING GROUP 4B

TO COMMITTEE 4

The text reproduced in the Annex to this report was discussed in Working Group 4B and is hereby submitted to Committee 4 for further consideration and approval.

Y. TADOKORO
Chairman of Working Group 4B

Annex : 1

ANNEX

3.5.2 Transmitter power and equivalent isotropically radiated power appropriate for satisfactory service

The propagation prediction method described in section /¯3.2.1 7 shall be used to determine the appropriate transmitter power to achieve satisfactory service. The appropriate transmitter power varies with propagation conditions which in turn are functions of the time of day, the season and the solar cycle period as well as the geographical location.

(This text has already been adopted by the Plenary Meeting, see Document 115(Rev.1), page B.1/15(Rev.1).)

(The following additional text is to be added :)

During the first stage of preparation of the requirement, the effective isotropically radiated power required for providing the reference usable field strength ($E_{ref} = E_{min}$ /¯+ 3 dB 7) shall be calculated considering the basic circuit reliability, if necessary)

The reference value of reliability in this case shall be /¯X 7 % to start with.

After having had the initial frequency assignments to all requirements compatibility analysis will be done, /¯but this is a matter of the mandate of Committee 5. 7

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BLUE PAGES

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document No. 137-E
27 January 1984

B.2

PLENARY MEETING

SECOND SERIES OF TEXTS SUBMITTED BY THE
EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for first reading

Source	Document	Title
COM.4	126	Chapter 3 - Paragraph 3.2.1 Paragraph 3.2.3.3 Paragraph 3.9 Paragraph 3.10

Marie HUET
Chairman of Committee 6

Annex : 16 pages

3.2.1 The method to be used to determine the sky-wave field strength for HF broadcast planning purposes

3.2.1.1 Introduction

The field strength prediction method is in two parts : for ranges up to 7,000 km and for ranges beyond 9,000 km. In the interval 7,000 to 9,000 km an interpolation procedure is used.

3.2.1.2 Ionospheric parameters

Values of selected ionospheric parameters (foE, foF2 and M(3000)F2) are needed together with the derived parameters (E-layer basic MUF and F-layer basic MUF) in order to determine the field strength of sky-wave modes reflected from the ionosphere. For total path lengths between 0 and 4,000 km, the basic MUF of an E mode is predicted. For all path lengths the basic MUF for the F2 mode is predicted. Where appropriate the higher of the two values gives the basic MUF for the path.

The vertical radiation angle is also needed in the calculation of sky-wave field strength. The vertical radiation angle is used to determine the appropriate mode of propagation and is also used in conjunction with the antenna gain to determine the proper field strength.

The transmitting antennas in use will have gains which vary with the vertical radiation angle and some antennas, intended for shorter distance broadcasting, radiate very poorly at low angles. It is important to associate the antenna gain at the appropriate radiation angle with the propagation prediction for that particular mode.

3.2.1.2.1 E-layer parameters

3.2.1.2.1.1 E-layer data

For paths up to 2,000 km foE is evaluated at the path mid-point. For ranges greater than 2,000 km foE is evaluated at two control points, each 1,000 km along the path from the transmitter and receiver respectively. At these points the solar zenith angle χ, in degrees, is determined, then :

$$foE = 0.9\left[(180 + 1.44R_{12})\cos\chi'\right]^{0.25} \quad \text{MHz}$$

where : $\chi' = \chi$ for $0 \leq \chi \leq 80$

$$\chi' = 90 - \frac{e^{0.13(116-\chi)}}{10.8} \text{ for } 80 < \chi < 116$$

$$\chi' = 89.907 \text{ for } \chi \geq 116$$

R_{12} is the 12 month running mean sunspot number.

3.2.1.2.1.2 E-layer basic MUF prediction (E(D) MUF)

The foE value at the mid-point of the path (for paths up to 2,000 km) or the lower of the foE values at the two control points (for paths longer than 2,000 km) is taken for the computation of the E-layer basic MUF.

The MUF for a path of length D is given as :

$$E(D)MUF = foE.\ \sec i_{110}$$

With i_{110} = angle of incidence at a height of 110 km evaluated in accordance with CCIR Report 252.

3.2.1.2.1.3 E-layer screening frequency (f_s)

The foE value at the middle point of the path (for paths up to 2,000 km), or the higher of the foE values at the two control points 1,000 km from each end of the path (for paths longer than 2,000 km), is taken for calculation of the E-layer screening frequency.

$$f_s = 1.05\ foE\ \sec \varphi_s$$

in which $\varphi_s = \arc \sin \left[\frac{R \quad \cos\Delta_F}{R \quad + 110}\right]$

R is the radius of the Earth, (6,371 km),

Δ_F is the vertical radiation angle for F2-layer mode (see section 3.2.1.2.3)

3.2.1.2.2 F-layer parameters

3.2.1.2.2.1 F2-layer data

Numerical maps of the parameters foF2 and M(3000)F2, for solar index values R_{12} = 0 and 100 and for each month are presented in CCIR Report 340. This prediction method uses the Oslo coefficients to determine the values of foF2 and M(3000)F2 for the required locations and times. It may be desirable to calculate in advance the values of these parameters at specific grid intervals of latitude, longitude and times and to use an interpolation procedure to obtain values for the required location and time between appropriate grid points. The use of a grid may be appropriate for other ionospheric parameters as well.

3.2.1.2.2.2 F2-layer basic MUF prediction (F2(D)MUF)

3.2.1.2.2.2.1 For paths up to 4,000 km

The F2-layer basic MUF is calculated from

$$F2(ZERO)MUF = foF2 + f_H/2$$

$$F2(4000)MUF = 1.1\ foF2.M(3000)F2$$

where f_H is the electron gyro-frequency given in terms of parameters of the Earth's magnetic field. A numerical representation is available in Report 340 of the CCIR.

At the midpoint of the great-circle path between the transmitter and receiver determine the above values for the solar index values $R_{12} = 0$ and $R_{12} = 100$. Interpolate or extrapolate linearly for required index values between $R_{12} = 0$ and 150. For higher sunspot activity use $R_{12} = 150$.

Interpolate for the length of the path using the relationship :

$$F2(D)MUF = F2(ZERO)MUF + \left[F2(4000)MUF - F2(ZERO)MUF\right] \cdot M(D)$$

where $M(D) = 1.64 \cdot 10^{-7} D^2$ for $0 \le D < 800$ and

$$M(D) = 1.26 \cdot 10^{-14} D^4 - 1.3 \cdot 10^{-10} D^3 + 4.1 \cdot 10^{-7} D^2 - 1.2 \cdot 10^{-4} D$$

for $800 \lesssim D \le 4000$.

where D is in km.

This gives the median F2-layer basic MUF.

3.2.1.2.2.2.2 For paths longer than 4,000 km

For these paths (which may be the longer great-circle path), control points are taken at 2,000 km from each end of the path. At these points, values of F2(4000)MUF, interpolating for sunspot number, are determined and the lower value is selected. This gives the median F2-layer basic MUF.

3.2.1.2.3 Vertical radiation angle

The radiation angle is taken into account in the prediction of field strength. It is given, approximately, by :

$$\Delta = \arctan\left(\cot\frac{d}{2R} - \frac{R}{R + h'}\operatorname{cosec}\frac{d}{2R}\right)$$

where d = hop length of an n hop mode given by $d = \frac{D}{n}$

$h' = 110$ km for the E-layer or h' is as given in 3.2.1.3.1.1 for the F2-layer.

In the method for shorter path lengths (section 3.2.1.3.1) the radiation angles calculated are used in the determination of antenna gain. For the longer path lengths the appropriate procedure is described in section 3.2.1.3.2.

3.2.1.3 The prediction of the median field strength

3.2.1.3.1 Method for path lengths of 0 to 7,000 km

CCIR Report 252-2 details the geometrical considerations, the reflection areas used and the method of performing ray-path calculations.

The procedure is based on the ray-path geometry with mirror reflections in the ionosphere. The method determines the field strengths of the two strongest modes propagated via the F2 region and the strongest mode propagated via the E region. The resultant field strength from these modes is obtained by power addition. In circumstances where a low-order F2 mode is screened by the E-layer, as determined in the ray-path calculations, or where an antenna is specified which only radiates sufficiently at high angles, the next higher-order mode must be considered.

It is recognized that multi-hop E region propagation suffers substantial absorption losses and E modes are not considered at ranges beyond 4,000 km.

The appropriate procedure for incorporating these concepts into a computer program is as follows.

3.2.1.3.1.1 For the path length, d(km), determine the minimum number of hops for an F2 region mode. This is given approximately as ((the integer part of d ÷ 4,000) + 1) or better, by calculating the ray-path geometry using the height hpF2 given by :

$$hpF2 = \frac{1490}{M(3000)F2} - 176 \quad \text{km}$$

The equivalent reflection height h', which is a function of time, location and path length, is used for the ray-path calculations for F2-modes. It is given by :

$$h' = 358 - (11 - 100a)\left(18.8 - \frac{320}{x^5}\right) + ad\left(0.03 + \frac{14}{x^4}\right) \quad \text{km}$$

or 500 km, whichever is the smaller,

a = 0.04 or (1/M(3000)F2) - 0.24, whichever is the larger and

x = foF2/foE, determined at the control point with the lowest value of foF2, or 2, whichever is the larger.

3.2.1.3.1.2 For the given mode, determine the vertical radiation angle from section 3.2.1.2.3 and then determine the transmitting antenna gain G_t at that angle and the appropriate azimuth, relative to an isotropic antenna.

3.2.1.3.1.3 Compute the median field strength for that mode using the formula :

$$E_{ts} = 136.6 + P_t + G_t + 20 \log f - L_{bf} - L_i - L_m - L_g - L_h - 12.2^* \quad \text{dB}(\mu V/m)$$

where f is the transmitting frequency in MHz and P_t is the transmitter power in dB relative to 1 kW. L_{bf} is the basic free space transmission loss in dB, given by :

$$L_{bf} = 32.45 + 20 \log f + 20 \log P'$$

where P' is the virtual slant range in km

$$P' = \left[2R \sum_n \frac{\sin \frac{d}{2R}}{\cos\left(\Delta + \frac{d}{2R}\right)}\right]$$

*/ This term contains those effects of sky-wave propagation not otherwise included in this fast simple method. A value of 12.2 dB is recommended on the basis of the data available. It is noted, however, that the value may need to be changed by those implementing this procedure to take account of additional calibrated data which become available./

/ It should also be taken account that an improved result may be obtained by using a term which varies with distance or geographical area./

L_i is the absorption loss in dB given in CCIR Report 252-2. It is determined for each hop and the results are added. For frequencies above the basic MUF, it continues to vary with frequency and is calculated assuming ray paths similar to those at the MUF.

L_m is the "above-the-MUF" loss. For frequencies, f, above the basic MUF (f_b) of a given mode :

$$L_m = 130 \left(\frac{f}{f_b} - 1 \right)^2 \quad \text{dB}$$

L_m is independent of the number of hops, but is limited to a value of 81 dB.

L_g is the ground reflection loss at intermediate reflection points. It is given as 2 dB for each intermediate ground reflection, i.e. :

for one-hop paths $L_g = 0$;

two-hop paths $L_g = 2$ dB;

three-hop paths $L_g = 4$ dB.

L_h is the factor to allow for auroral and other signal losses and is given in Tables [1 and 2/3.2.1] using the methods given in Report 252-2 to determine the local mean time, the geomagnetic latitude and the locations at which it is applied.

3.2.1.3.1.4 Repeat the procedure of 3.2.1.3.1.2 and 3.2.1.3.1.3 using successively higher order modes (increasing the number of hops by one each time) until the predicted mode field strength reaches a maximum. Select the two strongest F2 region modes, noting the field strength and radiation angles.

3.2.1.3.1.5 For the E region the lowest order mode is 1E for ranges 0 - 2,000 km and 2E for ranges 2,000 to 4,000 km. The E mode radiation angle and field strength are again obtained as in sections 3.2.1.2.3 and 3.2.1.3.1.3.

3.2.1.3.1.6 Repeat the E mode calculations for successively higher modes until a maximum is found.

3.2.1.3.1.7 The resultant of combining the field strengths of the two strongest F2 modes and the strongest E mode is obtained by calculating the square root of the sum of the squares of the numerical values of the field strengths.

3.2.1.3.2 Method for path lengths greater than 9,000 km

At long ranges, generally with low radiation angles, the method of prediction using geometric ray-hops is inadequate at present. The method used for long distances is based on an empirical fit of observations. In this method the antenna gain term, G_{tl}, is the greatest value of antenna gain in dBi which occurs in the range of vertical radiation angles from 0^0 to 8^0 at the appropriate azimuth.

TABLE /‾1/3.2.1_7

L_h for paths less than 2,500 km

GEOM LAT.	01-04LMT	04-07LMT	07-10LMT	10-13LMT	13-16LMT	16-19LMT	19-22LMT	22-01LMT
	WINTER (NOVEMBER, DECEMBER, JANUARY, FEBRUARY in the Northern Hemisphere) (MAY, JUNE, JULY, AUGUST in the Southern Hemisphere)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
45-50	0.1	0.3	0.6	0.0	0.1	0.1	0.3	0.1
50-55	0.6	0.8	1.6	0.1	0.3	0.6	1.0	0.3
55-60	1.5	2.1	4.4	0.7	0.8	2.2	2.5	1.3
60-65	4.8	8.2	10.5	2.7	1.6	5.7	7.3	5.2
65-70	6.7	11.0	13.5	3.0	1.7	5.8	8.6	6.0
70-75	5.7	7.9	10.7	1.7	0.9	3.6	4.1	4.0
75-80	2.5	5.0	7.1	0.9	0.3	1.9	2.3	2.0
	EQUINOX (MARCH, APRIL, SEPTEMBER, OCTOBER)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.0	0.1	0.2	0.1	0.1	0.3	0.2	0.1
45-50	0.4	0.4	0.9	0.6	0.4	1.3	0.9	0.8
50-55	1.0	1.0	2.7	1.8	1.2	2.7	2.1	2.1
55-60	2.0	3.0	6.2	3.7	2.6	4.5	4.0	5.0
60-65	4.7	5.0	12.0	7.5	5.6	7.8	9.0	11.8
65-70	6.8	11.6	19.6	8.8	6.3	7.8	10.3	14.6
70-75	4.9	11.7	20.0	6.2	3.3	4.9	7.7	9.5
75-80	2.0	7.5	9.2	3.9	1.6	3.0	4.2	4.1
	SUMMER (MAY, JUNE, JULY, AUGUST in the Northern Hemisphere) (NOVEMBER, DECEMBER, JANUARY, FEBRUARY in the Southern Hemisphere)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.1	0.1	0.0	0.1	0.1	0.2	0.1	0.0
45-50	0.5	0.4	0.5	0.4	0.5	1.1	1.0	0.4
50-55	1.3	1.1	1.4	1.0	1.1	3.0	2.9	0.7
55-60	2.9	2.4	3.0	2.6	2.9	5.8	5.8	1.8
60-65	6.0	4.1	6.0	5.3	4.3	8.4	7.6	4.3
65-70	6.0	4.6	7.3	5.0	4.2	7.2	8.8	5.0
70-75	3.7	3.8	5.0	3.5	3.2	4.8	6.0	3.4
75-80	2.4	2.8	3.1	2.7	2.3	3.8	4.3	2.1

TABLE [2/3.2.1]

L_h for paths greater than 2,500 km

GEOM LAT.	01-04LMT	04-07LMT	7-10LMT	10-13LMT	13-16LMT	16-19LMT	19-22LMT	22-01LMT
	WINTER (NOVEMBER, DECEMBER, JANUARY, FEBUARY in the Northern Hemisphere) (MAY, JUNE, JULY, AUGUST in the Southern Hemisphere)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-50	0.1	0.1	0.1	0.0	0.1	0.1	0.2	0.2
50-55	0.4	0.4	0.2	0.0	0.4	0.4	0.9	0.8
55-60	1.1	1.8	0.9	0.2	1.2	1.4	2.0	2.3
60-65	3.3	6.2	2.6	1.3	2.6	3.4	3.6	7.6
65-70	5.5	6.4	4.1	2.0	4.1	3.6	4.4	9.9
70-75	3.9	4.6	3.3	1.3	4.0	2.2	3.1	8.0
75-80	2.2	3.2	1.9	0.7	2.7	1.2	1.2	2.9
	EQUINOX (MARCH, APRIL, SEPTEMBER, OCTOBER)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0
45-50	0.2	0.2	0.3	0.2	0.1	0.5	0.6	0.4
50-55	0.5	0.6	0.5	0.6	0.5	1.6	1.8	1.1
55-60	1.0	1.3	1.3	1.7	1.3	3.4	3.8	2.4
60-65	2.9	3.8	4.2	4.1	2.9	6.3	8.4	7.3
65-70	4.3	5.6	6.4	5.1	4.4	6.3	9.2	9.3
70-75	3.0	4.7	5.0	3.0	2.4	3.4	5.4	4.8
75-80	1.3	1.9	2.2	0.8	0.8	0.8	1.2	1.1
	SUMMER (MAY, JUNE, JULY, AUGUST in the Northern Hemisphere) (NOVEMBER, DECEMBER, JANUARY, FEBRUARY in the Southern Hemisphere)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
45-50	0.5	0.3	0.4	0.2	0.4	0.1	0.6	0.5
50-55	1.1	1.1	1.1	0.6	1.2	0.4	1.9	1.3
55-60	2.5	2.9	2.6	1.1	2.5	1.2	3.8	2.9
60-65	4.9	7.5	6.2	2.2	3.8	2.6	5.2	5.0
65-70	5.0	7.8	6.1	2.3	3.8	2.7	4.8	5.0
70-75	3.2	5.4	3.4	1.5	2.2	0.9	2.6	3.2
75-80	2.0	4.3	1.5	1.1	0.8	0.1	0.9	1.4

The overall median field strength is given by :

$$E_{tl} = E_o \left[1 - \frac{(f_M+f_H)^2}{(f_M+f_H)^2 + (f_L+f_H)^2}\left(\frac{(f_L+f_H)^2}{(f+f_H)^2} + \frac{(f+f_H)^2}{(f_M+f_H)^2}\right)\right] - 36.4 + P_t + G_{tl} + G_{ap} - 0.8^* \quad \mathrm{dB}(\mu V/m)$$

$E_o = 139.6 - 20 \log P'$, and the height used in the determination of P' is 300 km.

It is assumed within this procedure that there is a hypothetical ray path with a number of equal length hops, each less than 4,000 km.

G_{ap} is the increase in field strength due to focussing at long distances. In the case of propagation to very long distances with D, the great-circle distance between transmitter and receiver, greater than $\pi R/2$, this focussing is taken into account by means of the following formula :

$$G_{ap} = -20 \log \left(\left|1 - \frac{n\pi R}{D}\right|\right) \quad \mathrm{dB}$$

for

$$\left(\frac{2n-1}{2}\right)\pi R \leq D < \left(\frac{2n+1}{2}\right)\pi R \quad \text{with } n = 1 \text{ and } 2.$$

As G_{ap} tends to infinity for $D = n\pi R$ it is limited arbitrarily to the value of 30 dB.

f_M is the upper limit frequency. It is determined separately for the first and last hops of the path and the lower value is taken.

$$f_M = K \cdot f_b \quad \mathrm{MHz}$$

$$K = 1.2 + W\frac{f_b}{f_{b,noon}} + X\left(\sqrt[3]{\frac{f_{b,noon}}{f_b}} - 1\right) + Y\left(\frac{f_{b,min}}{f_{b,noon}}\right)^2$$

f_b is the basic MUF determined by the method given in section 3.2.1.2.2.2.

$f_{b,noon}$ is the value of f_b for a time corresponding to local noon at the control point

$f_{b,min}$ is the lowest value of f_b for the hop which occurs during the 24 hours

W, X and Y are given in Table 3. The azimuth of the great-circle path is determined at the centre of the whole path and this angle is used for linear interpolation in angle between the east-west and north-south values.

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* [This term contains those effects of sky-wave propagation not otherwise included in the method. A value of 0.8 dB is recommended on the basis of the data available. It is noted however that this value may need to be changed by those implementing this procedure to take account of additional calibrated data which become available.]

[It should also be taken into account that an improved result may be obtained by using a term which varies with distance or geographical area.]

TABLE [3/3.2.1]

Values W, X, Y used for the determination of the correction factor K

	W	X	Y
East-West	0.1	1.2	0.6
North-South	0.2	0.2	0.4

f_L is the lower limit frequency when the path is in daylight

$$f_L = \left(5.3 \cdot I \left[\frac{(1 + 0.009R_{12}) \sum_{2N} \cos^{\frac{1}{2}} \chi}{\cos i_{90} \ln \left(\frac{9.5 \cdot 10^6}{P'}\right)} \right]^{\frac{1}{2}} - f_H\right) \cdot A_w \qquad \text{MHz}$$

In the summation, χ is determined for each traverse of the ray path through the height of 90 km.

when $\chi > 90^\circ$, $\cos^{\frac{1}{2}}\chi$ is taken as zero

i_{90} is the angle of incidence at a height of 90 km

I is given in Table 4.

A_w is a winter-anomaly factor determined at the path mid-point which is unity for geographic latitudes 0 to 30° and at 90° and reaches the maximum values given in Table [5/3.2.1] at 60°. The values at intermediate latitudes are found by linear interpolation.

As the path progressively becomes dark, the values of f_L are calculated until the time t_n when $f_L \leq 2f_{LN}$ where $f_{LN} = \sqrt{\frac{D}{3000}}$ (MHz). During the subsequent three hours f_L is calculated from $f_L = 2f_{LN}e^{-0.23t}$ where t is the time in hours after t_n. For the remainder of the night hours $f_L = f_{LN}$ until the time when the daylight equation gives a higher value.

TABLE ⌈4/3.2.1⌋

Values of I used in the equation for f_L

Latitudes		Month											
Terminal 1	Terminal 2	J	F	M	A	M	J	J	A	S	O	N	D
>35°N	>35°N	1.1	1.05	1	1	1	1	1	1	1	1	1.05	1.1
>35°N	35°N-35°S	1.05	1.02	1	1	1	1	1	1	1	1	1.02	1.05
>35°N	>35°S	1.05	1.02	1	1	1.02	1.05	1.05	1.02	1	1	1.02	1.05
35°N-35°S	35°N-35°S	1	1	1	1	1	1	1	1	1	1	1	1
35°N-35°S	>35°S	1	1	1	1	1.02	1.05	1.05	1.02	1	1	1	1
>35°S	>35°S	1	1	1	1	1.05	1.1	1.1	1.05	1	1	1	1

TABLE ⌈5/3.2.1⌋

Values of the winter-anomaly factor, A_W, at 60° graphical latitude used in the equation for f_L

Month

hemisphere	J	F	M	A	M	J	J	A	S	O	N	D
Northern	1.30	1.15	1.03	1	1	1	1	1	1	1.03	1.15	1.30
Southern	1	1	1	1.03	1.15	1.30	1.30	1.15	1.03	1	1	1

3.2.1.3.3 Method for path lengths between 7,000 and 9,000 km

In this range of distances, the field strengths E_{ts} and E_{tl} are determined by both of the above procedures and the resultant is found by appropriate mathematical interpolation. The interpolation procedure is given as :

$$E_{ti} = E_{ts} + \frac{D-7000}{2000}(E_{tl} - E_{ts}) \quad dB(\mu V/m)^*$$

*⌈Taking account of the data that become available, those responsible for implementing this procedure may consider an alternative form for this interpolation.⌋

/ 3.2.3 Signal fading /

3.2.3.3 Calculation of fading allowances for different percentages of time

Fading allowances for other percentages of the time may be expressed, in terms of the decile deviation F_{90}, by the expression

$$F_x = c.\ F_{90}$$

where F_x is the deviation for x% of time.

Values of c for x in the range 50-90% are given in Table / I/3.2.3.3 /

TABLE / I/3.2.3.3 /

The parameter c

x(%)	c
50	0
60	0.18
70	0.36
80	0.63
90	1

3.9 Specifications and progressive introduction of an SSB system

Considering the advantages of SSB transmission, such as :

- a more efficient utilization of the frequency spectrum by a reduction of interference;
- the capability of improving the required protection ratio between adjacent channels in the case of a sufficient carrier reduction;
- the capability of improving the quality of reception, in particular under poor propagation conditions (selective fading), with SSB receivers;
- the possibility of producing the same sideband power as a current DSB transmitter with less capital and operational costs,

the Conference adopted the following SSB system specifications under the assumption of a progressive introduction of receivers with synchronous demodulation. With respect to a necessary transition period from DSB to SSB, some consideration must also be given to the reception of SSB signals with reduced carrier by receivers with envelope detection. At the end of the transition, all the advantages of SSB transmissions mentioned above could then be realized.

3.9.1 SSB system specification

3.9.1.1 Audio-frequency bandwidth

The upper limit of the audio-frequency bandwidth of the transmitter shall not exceed 4.5 kHz with a further slope of attenuation of 35 dB/kHz and the lower limit shall be 150 Hz with lower frequencies attenuated at a slope of 6 dB per octave.

3.9.1.2 Necessary bandwidth

The necessary bandwidth is equal to the audio-frequency bandwidth.

3.9.1.3 Characteristics of modulation processing

The audio-frequency signal shall be processed so that the modulating signal retains a dynamic range of not less than 20 dB. Excessive amplitude compression, together with improper peak limitation, leads to excessive out-of-band radiation and thus to adjacent channel interference, and is therefore to be avoided.

3.9.1.4 Channel spacing

During the transition period, the channel spacing for SSB shall be 10 kHz. In the interest of spectrum conservation, during the transition period, it is also permissible to interleave SSB transmissions midway between two DSB channels, i.e., with 5 kHz separation between carrier frequencies, provided that the interleaved transmission is not to the same geographical area as either of the transmissions between which it is interleaved (see also section 3.1.2).

After the end of the transition period the channel spacing and carrier frequency separation shall be 5 kHz.

3.9.1.5 Nominal carrier frequencies

Carrier frequencies for SSB shall be integral multiples of 5 kHz.

3.9.1.6 Sideband to be emitted

The upper sideband shall be used.

3.9.1.7 Suppression of the unwanted sideband

With respect to the relative RF protection ratio, the degree of suppression of the unwanted sideband (lower sideband) and of intermodulation products in that part of the transmitter spectrum shall be at least 35 dB relative to the wanted sideband signal level. Because of the large difference of signal amplitudes in adjacent channels in practice, however, a greater suppression is recommended (e.g. 50 dB in the exciter producing the SSB signal at low power level and 40 dB suppression of unwanted intermodulation products in the RF power amplifier of the transmitter).

3.9.1.8 Degree of carrier reduction (relative to peak envelope power)

During the transition period the carrier reduction of the SSB emission shall be 6 dB, to allow SSB transmissions to be received by conventional DSB receivers with envelope detection without significant deterioration of the reception quality.

At the end of the transition period the carrier reduction of the SSB emission shall become 12 dB.

3.9.1.9 Frequency tolerance

The frequency tolerance of the SSB carriers shall be ± 10 Hz*.

*Note - This frequency tolerance is acceptable only under the assumption that future SSB receivers will be equipped with a device locking the locally re-inserted carrier for synchronous demodulation to the carrier of the SSB emission (see also paragraph 3.9.1.11.)

3.9.1.10 Overall selectivity of the receiver

The reference receiver shall have an overall bandwidth of 4 kHz, with a slope of attenuation of 35 dB/kHz*.

*Note - Other combinations of bandwidth and slope of attenuation as given below are possible producing the same relative RF protection ratio of about -27 dB at 5 kHz carrier difference.

Slope of attenuation	SSB receiver audio-frequency bandwidth
25 dB/kHz	3300 Hz
15 dB/kHz	2700 Hz

3.9.1.11 Detection system of SSB receivers

SSB receivers shall be equipped with a synchronous demodulator, using for the carrier acquisition a method whereby a carrier is regenerated by means of a suitable control loop which pulls the receiver to the incoming carrier. Such receivers must work equally well with conventional DSB transmissions and with SSB transmissions having a carrier reduced to 6 or 12 dB relative to peak envelope power.

3.9.1.12 Equivalent sideband power

During the transition period an equivalent SSB emission is one giving the same loudness level as the corresponding DSB emission, when it is received by a DSB receiver with envelope detection. This is achieved when the sideband power of the SSB emission is 3 dB larger than the total sideband power of the DSB emission. (The peak envelope power of the equivalent SSB emission as well as the carrier power are the same as that of the DSB emission.)

After the end of the transition period, the equivalent sideband power can be reduced by 3 dB.

3.9.1.13 RF protection ratios

Assuming that the SSB and DSB emissions correspond to the technical characteristics specified above the following RF protection ratios shall be applied :

- during the transition period :

RF co-channel protection ratio

Given the need to increase the radiated sideband power by 3 dB in the case of equivalent SSB emissions, there is a consequent need to make an allowance of the same 3 dB in the co-channel protection ratio for the case of a wanted DSB signal interfered with by an SSB signal, if the same quality of reception is to be maintained.

Relative RF protection ratios :

(For the following protection ratios SSB emissions with equivalent sideband power are assumed.)

a) If a wanted DSB signal is received by a conventional DSB receiver with envelope detection which is interfered with by an SSB emission.

According to the resulting RF protection ratio, reception of the wanted DSB signal in the lower channel (interfering carrier for example at $\Delta F = +5$ kHz) will be impaired by about 1 dB, while under the same conditions reception of the wanted DSB signal in the upper adjacent channel (interfering carrier for example at $\Delta F = -5$ kHz) will be impaired by about 4 dB in comparison to the present RF protection ratios, as specified in Figure [C/3.3.2] of paragraph 3.3.2.

The corresponding value for $\Delta F = \pm 10$ kHz will be ~3 dB impairment.

b) In the case of a wanted SSB signal interfered with by a DSB signal, values of Figure /‾C/3.3.2_7 of paragraph 3.3.2 shall be used.

c) In the case of a wanted SSB signal interfered with by an SSB signal, the values mentioned in a) above shall be applied.

- After the end of the transition period (both the wanted and the interfering signals are SSB signals)

RF co-channel protection ratio :

The RF protection ratio is the same as that applied for the DSB system.

Relative RF protection ratios :

Relative RF protection ratios shall be as shown in Figure /‾E/3.9.1_7.

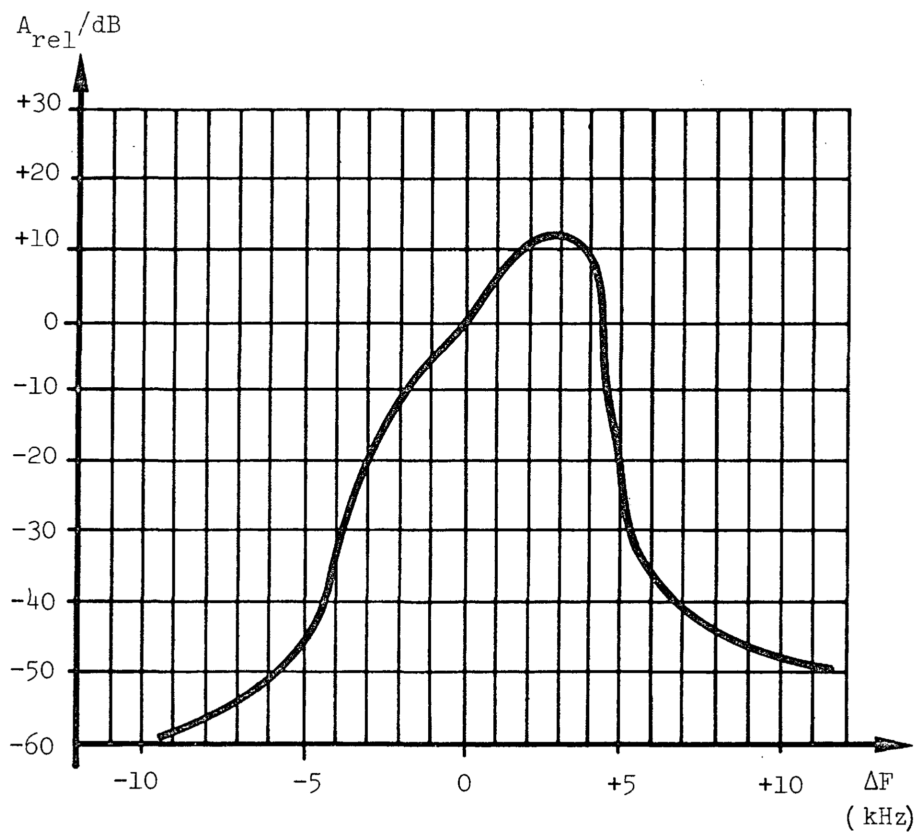

FIGURE /‾E/3.9.1_7

RF protection ratios A_{rel} are given with respect to the frequency difference ΔF between the wanted carrier f_w and the interfering carrier f_i

$$\Delta F = f_i - f_w$$

Thus positive ΔF describes interference from the upper adjacent channel.

3.10 Theoretical Capacity of the HFBC bands

The theoretical capacity of the HFBC bands is dependent on a variety of factors. These include the radio-frequency protection ratio, transmitter powers, the antenna directivities and the assignment method.

The time period and the frequency band considered are also important for the channel capacity. On the basis of calculations carried out by several administrations and utilizing the data of the IFRB, the average capacity (available number of stations/channel at a given time) was generally found to be in the range of three to four.

The capacity decreases in the higher frequency bands and for higher RF protection ratios. The range of capacity is from one to seven.

In general no single value for the capacity of any band can be determined since the capability to accommodate requirements is subject to factors which vary from one schedule to another.

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INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

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R.1

PLENARY MEETING

FIRST SERIES OF TEXTS SUBMITTED BY THE
EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for second reading :

Source	Document	Title
COM.6	B.1/115(Rev.)	Chapter 2 - Definitions

Marie HUET
Chairman of Committee 6

Annex : 5 pages

CHAPTER 2

DEFINITIONS

The First Session of the Conference considered that certain definitions contained in the Radio Regulations, Geneva, 1979 (identified below by their RR number) might be useful for the planning of the high frequency broadcasting service.

It also adopted a number of definitions for the sole purpose of such planning.

2.1 Terms relating to emission

- Emission (RR 132)
- Class of emission (RR 133)
- Single-sideband emission (RR 134)
- Full-carrier single-sideband emission (RR 135)
- Reduced-carrier single-sideband emission (RR 136)
- Suppressed-carrier single-sideband emission (RR 137)
- Out-of-band emission (RR 138)
- Reduced carrier

  Carrier emitted at a power level reduced by at least 6 dB below the peak envelope power.

2.2 Term relating to frequency

- Frequency tolerance (RR 145)

2.3 Term relating to bandwidth

- Necessary bandwidth (RR 146)

2.4 Terms relating to power

- Power (RR 150)
- Peak envelope power (RR 151)
- Mean power (RR 152)
- Carrier power (RR 153)
- Gain of an antenna (RR 154)
- Equivalent isotropically radiated power (e.i.r.p.) (RR 155)
- Effective radiated power (e.r.p.) (RR 156)

2.5 Term relating to zones of reception

- Geographic zones for broadcasting* (Appendix 1 of RR)

* Commonly known as CIRAF zones.

2.6 Terms relating to propagation

- Operational MUF

  The highest frequency that would permit acceptable operation of a radio service between given terminals at a given time under specified working conditions (such as antenna types, transmitter power, class of emission and required signal-to-noise ratio).

- Optimum working frequency (OWF)

  The lower decile of the daily values of operational MUF at a given time over a specified period, usually a month. That is, the frequency that is exceeded by the operational MUF during 90% of the specified period.

- Basic MUF

  The highest frequency by which a radio wave can propagate between given terminals, on a specified occasion, by ionospheric refraction alone.

2.7 Terms relating to reliability

- Circuit reliability

  Probability for a circuit that a specified performance is achieved at a single frequency.

- Reception reliability

  Probability for a receiver that a specified performance is achieved by takin into account all transmitted frequencies.

- Broadcast reliability

  Probability for a service area that a specified performance is achieved by taking into account all transmitted frequencies.

Note 1 - In the above terms circuit means a one-way transmission from one transmitter to one receiving location.

Note 2 - The above terms are preceded by the word "basic" when the background is noise alone and by "overall" when the background is noise and interference.

Note 3 - When the background is noise and interference, the above terms may relate either to the effects of a single interferer or to multiple interference from co-channel and adjacent-channel transmissions.

Note 4 - A given value of signal-to-noise ratio or signal-to-(noise and interference) ratio is the specified performance.

Note 5 - The above terms relate to one or more periods of time which shall be stated.

2.8 Terms relating to field-strength

- Minimum usable field-strength (E_{min})*

  Minimum value of the field-strength necessary to permit a desired reception quality, under specified receiving conditions, in the presence of natural and man-made noise, but in the absence of interference from other transmitters.

- Usable field-strength (E_u)*

  Minimum value of the field-strength necessary to permit a desired reception quality, under specified receiving conditions, in the presence of noise and interference, either in an existing situation or as determined by agreements or frequency plans.

- Reference usable field-strength (E_{ref})

  The agreed value of the usable field-strength that can serve as a reference or basis for frequency planning.

2.9 Terms relating to the ratio of wanted and unwanted signals

- Audio-frequency (AF) signal-to-interference ratio

  The ratio (expressed in dB) between the values of the voltage of the wanted signal and the voltage of the interference, measured under specified conditions*, at the audio-frequency output of the receiver.

- Audio-frequency (AF) protection ratio

  The agreed minimum value of the audio-frequency signal-to-interference ratio considered necessary to achieve a subjectively-defined reception quality.

- Radio-frequency (RF) wanted-to-interfering signal ratio

  The ratio, expressed in dB, between the values of the radio-frequency voltage of the wanted signal and the interfering signal, measured at the input of the receiver under specified conditions**.

---

* The terms "minimum usable field strength" and "usable field strength" refer to the specified field strength values which a wanted signal must have in order to provide the required reception quality.

In determining whether these requirements are met, the median value (50%) of a fading signal should be used.

** The specified conditions include such diverse parameters as : spacing ΔF of the wanted and interfering carrier, emission characteristics (type of modulation, modulation depth, carrier-frequency tolerance, etc.), receiver input level, as well as the receiver characteristics (selectivity, susceptibility to cross-modulation, etc.).

- Radio-frequency (RF) protection ratio

  The value of the radio-frequency wanted-to-interfering signal ratio that enables the audio-frequency protection ratio to be obtained at the output of the receiver under specified conditions*.

- Relative radio-frequency protection ratio

  The difference, expressed in decibels, between the protection ratio when the carriers of the wanted and unwanted transmitters have a frequency difference of ΔF (Hz or kHz) and the protection ratio when the carriers of these transmitters have the same frequency.

- Selectivity of a receiver

  A measure of its ability to discriminate between a wanted signal to which the receiver is tuned and unwanted signals on other frequencies.

- Sensitivity of a receiver

  A measure of its ability to receive weak signals and to produce an output having usable strength and acceptable quality.

- Noise-limited sensitivity of a receiver

  The ability of the receiver's radio-frequency part to receive weak signals. I is equal to the minimum level of the radio-frequency input signal, expressed in dB(μV/m) modulated 30% at the standard reference frequency, which produces in the output power a chosen value of AF signal-to-noise ratio.

2.10 Terms relating to coverage and service area

[Text will follow.]

2.11 Terms relating to planning

[Text will follow.]

---

* The specified conditions include such diverse parameters as : spacing ΔF of the wanted and interfering carrier, emission characteristics (type of modulation, modulation depth, carrier-frequency tolerance, etc.), receiver input level, as well as the receiver characteristics (selectivity, susceptibility to cross-modulation, etc.).

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 139-E
27 January 1984
Original : English

Source : Document 129

COMMITTEE 6

FIFTH SERIES OF TEXTS FROM COMMITTEE 4 TO THE EDITORIAL COMMITTEE

The texts reproduced in Annex to this document were adopted in Committee 4 and are hereby submitted to the Editorial Committee.

J. RUTKOWSKI
Chairman of Committee 4

Annex : 1

ANNEX

3.9.2 Progressive introduction of SSB transmissions (Technical aspects)

3.9.2.1 Transmitters

It should be recognized that :

a) converting an existing DSB transmitter to an SSB transmitter which delivers equivalent sideband power with 6 dB carrier reduction is technically not possible;

b) it is economically unattractive to convert existing conventional DSB transmitters for operation to SSB mode with 6 dB carrier reduction even if 3 dB less sideband power is accepted;

c) it is possible and feasible to convert new designed unconventional DSB transmitters (using amplitude modulation systems such as pulse duration or pulse switch modulation) to SSB mode with 6 dB carrier reduction and the same sideband power as in DSB mode without significant loss of efficiency;

d) with 12 dB carrier reduction also conventional DSB transmitters can, from technical point of view in some cases, be converted to SSB mode and can provide the necessary equivalent sideband power. Whether the conversion is economically attractive will depend on type and age of the transmitter concerned;

[e) the technical and/or economical lifetime of a transmitter can be estimated at twenty years.]

3.9.2.2 Receivers

It should be recognized that :

a) current technological progress within the next ten years will make it possible to produce DSB/SSB receivers in mass for reasonable prices;

b) SSB receivers with the possibility to select either the upper or the lower sideband of a DSB transmission is useful for rejecting adjacent channel interference during the transition period.

[c) the technical and economical lifetime of a receiver is considered to be in the order of ten years;]

d) envelope detection should be abandoned as soon as possible and synchronous demodulation be introduced.

[3.9.2.3 Transition period from technical point of view

Taking into account the lifetime of transmitters and receivers the duration of the transition period could be set at [15 to 20] years.]

3.9.2.4 Evaluation of compatibility aspects of the proposed SSB-system during the transition period

During the transition period, single-sideband transmissions will be mainly received by conventional DSB receivers using envelope detection. To obtain with a conventional DSB receiver using envelope detection the same loudness level with both SSB and DSB, the sideband power of the SSB emission has to be 3 dB larger (equivalent sideband power) than the total sideband power of the DSB emission. Alternatively, if the sideband power of the SSB emission cannot be increased, one has to accept some reduction of the coverage area. Such an SSB emission, however, could replace any of the DSB emissions in the plan without deteriorating the interference situation.

SSB emissions with equivalent sideband power replacing a DSB emission according to the plan will cause a slight increase in adjacent channel interference (e.g. at ± 10 kHz channel spacing the relative RF-protection ratio would be changed by 3 dB from -36 dB to -33 dB) if reception is done in the adjacent channels with a conventional DSB receiver having the selectivity of the DSB reference receiver (see paragraph 3.9.1.13).

In Chapter 3.9.1.13 a 3 dB allowance for co-channel interference between a DSB emission and an SSB emission with equivalent sideband power has been specified. Recent investigation shows, however, that taking into account the effect of coherent demodulation of the two sidebands of a DSB emission in an envelope detector, this allowance may be 0 dB. Further study will be needed on this question during the inter-sessional period.

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COMMITTEE 4

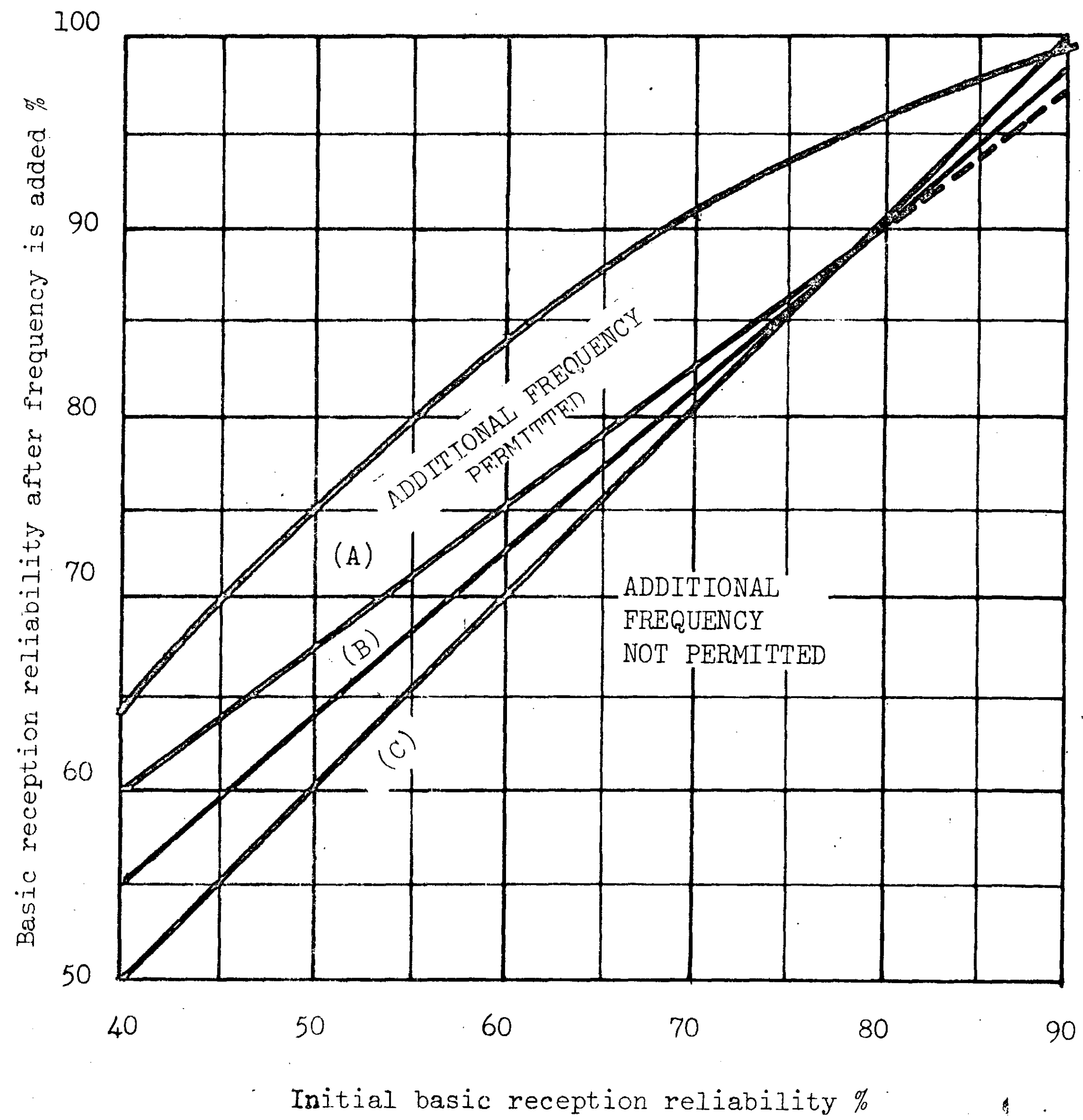

FIGURE [Y]

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COMMITTEE 4

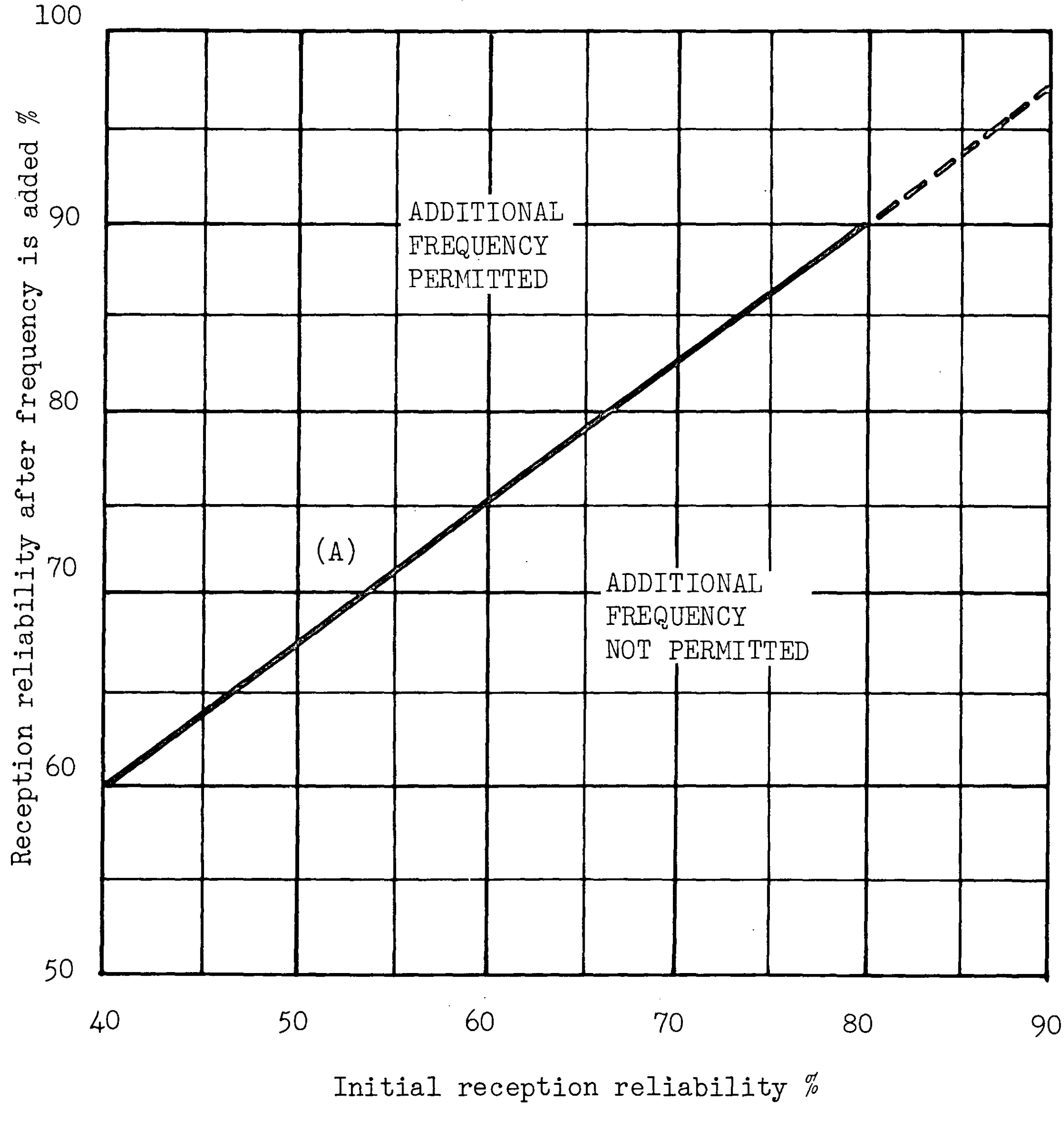

FIGURE [Y]

L.L. BRADLEY
Chairman of Drafting Group 4B-1

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COMMITTEE 4

REPORT FROM DRAFTING GROUP 4B-1
TO COMMITTEE 4

3.8 Maximum number of frequencies required for broadcasting the same programme to the same zone

3.8.1 Introduction

Wherever possible, only one frequency should be used to radiate a particular programme to a given reception area. In certain special circumstances, it may be found necessary to use more than one frequency per programme taking into account the following considerations :

- over certain paths, e.g. very long paths, those passing through the auroral zone, or paths over which the /‾FOT_7 is changing rapidly;
- areas where the depth of the area extending outwards from the transmitter is too great to be served by a single frequency;
- when highly directional antennas are used to maintain satisfactory signal-to-noise ratios, thereby limiting the geographical area covered by such antennas.

The decision to use more than one frequency per programme should be made on the merits of the particular case concerned.

3.8.2 Use of additional frequencies

A method leading to the determination of the minimum number of frequencies needed to achieve specified levels of basic broadcast reliability has been developed. If the calculated basic broadcast reliability does not reach the desired value, it is necessary to consider if a combination of frequencies in separate bands could improve the basic broadcast reliability and if the amount of improvement would justify the use of additional frequencies. If the use of any additional frequencies does not increase the basic broadcast reliability for the specified value, for a specific percentage of test points in the required service area, the original number of frequencies should not be increased.

In cases where the basic /‾circuit/reception_7 reliability obtained with one frequency is less than /‾x_7% a second frequency shall be tested. If the basic reception reliability calculated for two frequencies exceeds the specified limit - Table /‾Y_7, the second frequency may be used. Only in those special cases where the basic reception reliability using two frequencies remains below /‾x_7% the calculation shall be repeated to test for an additional (third) frequency. The justification of these limits is that there should be a considerable improvement of the basic reception reliability in order to permit the use of additional frequencies.

3.8.3 Determination of additional frequencies

Table /‾Y_7 below shall service as a guide in determining the justification for additional frequencies.

TABLE /‾Y_7

[Basic reception reliability* (%)]	[Basic reception reliability with an additional frequency (%)]	Additional frequency to be assigned?
< 40	> 50 ⩽ 50	Yes No
40 - 50	> 60 ⩽ 60	Yes No
50 - 60	> 70 ⩽ 70	Yes No
60 - 70	> 80 ⩽ 80	Yes No
70 - 80	> 90 ⩽ 90	Yes No

* Calculated for one frequency in the first test and for additional frequencies in subsequent tests for any adopted value of reliability in the range of 50 to 90%.

L.L. BRADLEY
Chairman of Drafting Group 4B-1

Annex : 1

ANNEX

TABLE

Basic reception reliabilities of multiple frequency use

Basic reception reliability for an additional frequency (columns); Basic reception reliability (rows); Resulting basic reception reliability (cells)

Basic reception reliability	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0.9	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99
0.8	0.82	0.84	0.86	0.88	0.90	0.92	0.94	0.96	
0.7	0.73	0.76	0.79	0.82	0.85	0.88	0.91		
0.6	0.64	0.68	0.72	0.76	0.80	0.84			
0.5	0.55	0.60	0.65	0.70	0.75				
0.4	0.46	0.52	0.58	0.64					
0.3	0.37	0.44	0.51						
0.2	0.28	0.36							
0.1	0.19								

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COMMITTEE 4

REPORT OF WORKING GROUP 4C
TO COMMITTEE 4

1. Document 133, section 3.2.4.2, Table 2, (page 10, English version)

The group considered the correlation, of both the "within the hour" and the "day to day" variability, between wanted and interfering signals on the same channel. It was concluded that, so far as the objective signal to interference ratio is concerned, the appropriate relationship is :

$$\text{Step 13, } D_u\ (SIR) = \sqrt{D_u\ (S)^2 + D_u\ (F)^2 + \tfrac{1}{2}\ D_L\ (IS)^2 + D_L\ (IF)^2}$$

$$\text{Step 14, } D_L\ (SIR) = \sqrt{D_L\ (S)^2 + D_L\ (F)^2 + \tfrac{1}{2}\ D_u\ (IS)^2 + D_u\ (IF)^2}$$

2. Protection ratio

It was noted that the definitions for protection ratio take account of a subjectively defined reception quality, and thus, in principle, the required RF protection ratio may differ from the required RF wanted-to-interfering signal ratio.

However, it was agreed that when the median RF wanted-to-interfering signal ratio equals the required RF protection ratio, then the RF protection ratio is achieved for 50% of the time. Any differences between the two concepts was thought to lie in the subjective effects of the variability terms. That is, the 90% fading margin for protection ratio might differ from that objectively determined for signal to interference ratio.

3. Document 131

The group examined Document 131 from India and agreed that, as indicated, 5 dB represented the subjectively required 90% fading margin over periods similar to the measurement period. After discussion it was agreed that this ratio also represented the "within the hour" fading margin. However, after protracted discussion Working Group 4C failed to agree on an appropriate ratio or relationship to represent the total fading margin to include the "day to day" variability over monthly or seasonal periods.

L.W. BARCLAY
Chairman of Working Group 4C

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COMMITTEE 4

RECONSIDERATION OF SOME TEXTS OF CHAPTER 3

According to the decision taken by the Plenary Meeting on 26 January 1984, the following paragraphs are submitted to Committee 4 for reconsideration and approval :

3.1.1.2 Necessary bandwidth

The necessary bandwidth is 9 kHz.

3.1.2 Channel spacing

(Add an * at the end of the paragraph and add the following footnote :)

"* Note - For SSB emissions see section 3.9.1.4."

3.1.3 Nominal carrier frequencies

Carrier frequencies shall be integral multiples of 5 kHz.

It is also proposed to reconsider and approve the following paragraph in chapter 3.9.1 (SSB system specification) (see also Document 126, page 14) :

3.9.1.2 Necessary bandwidth

The necessary bandwidth is 4.5 kHz.

J. RUTKOWSKI
Chairman of Committee 4

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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30 January 1984
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COMMITTEE 4

New Zealand

PROPOSALS FOR THE WORK OF THE CONFERENCE

1.0 Introduction.

The following paper has been prepared to address a number of outstanding items which are before Committee 4 for consideration.

The document does not seek to provide definitive answers to questions, but to provide a technique to rationalise the approach to both noise and interference, together with transmitter power as it affects HF broadcasting system design.

Due regard has been taken of input from Administrations and decisions taken at this Conference.

2. Transmitter power and Reference Field Strength (E_{ref}).

2.1 Transmitter power selected on basic broadcast reliability will only provide the quoted reliability in the absence of interference.

2.2 The absence of interference cannot be assumed, nor can the actual level of interference be estimated until a frequency has been established within the selection process. Some allowance must be made for the agreed level of co-channel interference in system design.

2.3 The technical parameters Audio Frequency Signal to Noise Ratio (AF SNR) and Co-Channel Protection Ratio (CCPR) are both based on subjective measurements, and are the minimum values to achieve some value of Quality Assessment Grade (QAG), with each effect considered in isolation.

2.4 The resulting values of AF SNR and CCPR represent values causing equal annoyance of the audience. The chosen value of interference thus compares with the chosen value of noise in annoyance.

2.5 Combining the annoyance due to the chosen minimum value of CCPR is equivalent to adding noise corresponding to the minimum AF SNR, reducing the AF SNR by 3 dB.

2.6 If the target QAG is to be obtained at the required reliability then the transmitted power must be based on basic broadcast reliability, plus 3 dB.

2.7 Equivalently, for power required calculations E_{ref} should be used, not E_{min}, where

$$E_{ref} = E_{min} + 3 \text{ dB}.$$

3. The relationship between SNR, CCPR and QAG.

3.1 Subjective testing done within the CCIR has provided an agreed curve relating CCPR and QAG.

3.2 27 dB is recommended by the CCIR and has been adopted by this Conference as the desired value of CCPR.

3.3 An AF SNR of 30 dB (= 40 dB RF SNR) has been recommended by the CCIR, and can be expected to give about the same QAG as 27 dB CCPR.

Subjective testing done in India has reported that the minimum acceptable AF SNR is 21 dB (= 31 dB RF SNR). This may be compared with the CCPR of 17 dB suggested as the minimum acceptable CCPR.

3.4 Due to signal processing by the receiver and the human ear, it can be concluded that a given RF noise power (N) causes the same level of annoyance as interference which is 13 dB greater.

Using this relationship, noise can be included in interference calculations by ascribing to the noise an equivalent level of interference, the noise equivalent interference power (NEIP); where

$$NEIP = N + 13 \text{ dB}.$$

3.5 The QAG corresponding to a level of NEIP may be found from the QAG versus CCPR curve.

Table 1 allows the necessary signal to noise ratios and CCPR to be determined for any desired value of QAG, under stable conditions.

Under unstable conditions the median values are used to provide the median QAG.

3.6 If noise and interference are both present, then the interference power and the noise equivalent interference power are added (in watts), and the resultant QAG may be found.

NZL/143/1 4. Proposal.

When compatability analysis is done, the median QAG resulting from both noise and interference should be calculated, to allow Administrations to decide whether further compromise of quality or requirements is necessary.

5. References.

1. Doc 115(Rev.1).
2. Doc IWP 10/5-41-E, 7 January 1983.

TABLE 1

Relationship between SNR, CCPR and QAG, under stable conditions

QAG	RF SNR dB	AF SNR dB	CCPR dB	Impairment
4.6	52	42	38.9	
4.4	49	39	35.8	
4.2	46	36	32.7	
4	43	33	29.8	Perceptible, not annoying
3.8	40	30	27	
3.6	38	28	24.4	
3.4	35	25	22.2	
3.3	34	24	21	
3.2	33	23	19.7	
3.05	31	21	18.0	
3	30	20	17	Slightly annoying
2.8	29	19	15.7	
2.7	28	18	15	
2.6	27	17	14.1	
2.4	25	15	12.4	
2.2	24	14	10.7	
2	22	12	9	Annoying

Notes.

1. The CCPR dB figures without decimals are original datum points from CCPR/QAG curve.

2. Values between datum points were calculated by linear interpolation. Values above QAG 3.8 were calculated from the optimum parabola through the datum points. (See Annex 1)

Annex : 1

ANNEX 1

IMPLEMENTATION NOTE

The optimum parabola through the five datum points of the CCPR/QAG curve is :-

$$CCPR = 1.9096\ QAG^2 - 1.112\ QAG + 3.668$$

The maximum deviation from the datum points is 0.518 dB, with an RMS deviation of 0.313 dB.

The inverse function is :-

$$QAG = \frac{0.4023 + \sqrt{CCPR - 3.506}}{1.382}$$

The maximum deviation from the datum points is 0.051 grade, with an RMS deviation of 0.032 grade.

Since these functions smooth out small errors intrinsic to empirical data they are recommended for use instead of tabular representation.

TABLE 2

Smoothed Table 1,
from optimum parabola

Relationship between SNR, CCPR and QAG (under stable conditions.)

QAG	RF SNR dB	AF SNR dB	CCPR dB	Impairment
4.6	51.9	41.9	38.9	
4.4	48.7	38.7	35.7	
4.2	45.7	35.7	32.7	
4	42.8	32.8	29.8	Perceptible, not annoying
3.8	40.0	30.0	27.0	
3.6	37.4	27.4	24.4	
3.4	34.9	24.9	21.9	
3.3	33.8	23.8	20.8	
3.2	32.7	22.7	19.7	
3.05	31.0	21.0	18.0	
3	30.5	20.5	17.5	Slightly annoying
2.8	28.5	18.5	15.5	
2.7	27.6	17.6	14.6	
2.6	26.7	16.7	13.7	
2.4	25.0	15.0	12.0	
2.2	23.5	13.5	10.5	
2	22.1	12.1	9.1	Annoying

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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30 January 1984
Original : French

COMMITTEE 2

THIRD REPORT OF THE WORKING GROUP OF COMMITTEE 2 (CREDENTIALS)

The Working Group of Committee 2 held a third meeting on 30 January 1984 to examine the Credentials of the following delegations :

ANGOLA (People's Republic of)

AUSTRIA

CYPRUS (Republic of)

COLOMBIA (Republic of)

UNITED STATES OF AMERICA

IRAQ (Republic of)

NEW ZEALAND

YEMEN ARAB REPUBLIC

The Credentials of these delegations were all found to be in order.

N. TCHIMINA
Chairman of the Working Group C2-A

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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COMMITTEE 4

United Kingdom

THE REQUIRED FADING ALLOWANCE FOR RF PROTECTION RATIO

Introduction

The definitions as adopted for RF wanted signal-to-interfering signal ratio and for RF protection ratio are identical except that the first relates to the ratio of RF voltages (although it includes receiver characteristics) while the second is for an a.f. signal-to-interference ratio to achieve a subjectively defined reception quality.

Signal variability

Analysis of the variability of signals indicates that a complex range of mechanisms occur and signal variations can be characterized by the time scales involved. For convenience, taking account of the manner in which field strength predictions are prepared, values for signal fading have been adopted for "within the hour" and "day-to-day" periods.

Subjective effects are only important over time periods which affect intelligibility or listener satisfaction, i.e. periods of from one sentence to say five to ten minutes. Within such time scales, bursts of interference, etc., may be acceptable to the listener provided that they are relatively infrequent. Similarly, the short time constants used in broadcast receiver a.g.c. systems can only affect the performance in similar time scales. Subjective effects in the assessment of day-to-day signal and interference variability is confined only to an overall impression by the listener as to the proportion of days during which the required protection ratio was obtained over the broadcast period.

This assessment has been based upon experience and extensive reception reports obtained over many years.

Thus the overall variability must be expressed based on the long-term, day-to-day, decile deviations given in Document 115, paragraph 3.2.3.2. So far as short-term, within the hour, fading is concerned it may just be conceivable that the subjective effects may reduce the necessary decile deviation to 5 dB, to include both signal and interference variations.

Proposal

Using the terminology given in Document 133, Table 2, the following expressions are proposed for the decile deviations for the RF protection ratio :

$$D_U = \sqrt{D_U(S)^2 + D_L(IS)^2 + 5^2}$$

$$D_L = \sqrt{D_L(S)^2 + D_U(IS)^2 + 5^2}$$

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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Source : Documents 130, 133

COMMITTEE 6

SIXTH SERIES OF TEXTS
FROM COMMITTEE 4 TO THE EDITORIAL
COMMITTEE

The texts reproduced in Annexes 1 to 3 to this document were adopted in Committee 4 and are hereby submitted to the Editorial Committee.

J. RUTKOWSKI
Chairman of Committee 4

Annexes : 3

ANNEX 1

3.2.1.4 Optimum frequency band selection

The optimum frequency band for a high frequency broadcasting service is that which has the highest median value of radio-frequency signal-to-noise ratio at the test points in the intended service area.

The optimum combination of bands, if needed by the planning method, is that combination which has the highest value of basic broadcast reliability in the intended service area.

ANNEX 2

3.4 Values of minimum usable and reference usable field strength

3.4.1 Minimum usable field strength

The minimum usable field strength shall be determined numerically by using the atmospheric noise data, man-made noise data, or the intrinsic receiver noise level, and by adding to it the value of the required RF signal-to-noise ratio.

3.4.1.1 Atmospheric noise data

For atmospheric noise data see 3.2.2.1.

3.4.1.2 Man-made noise data

For man-made noise data see 3.2.2.2.

3.4.1.3 Intrinsic receiver noise level

The intrinsic receiver noise level E_i^o shall be calculated by :

$$E_i^o \text{ (dB } (\mu V/m)) = E_c \text{ (dB } (\mu V/m)) + 20 \log m - \text{SNR (dB)}$$

where : E_c = noise limited sensitivity of the receiver = [ ]
m = modulation depth = 0.3
SNR = audio frequency signal-to-noise ratio (dB) = [ ]

3.4.1.4 Comparison of the intrinsic noise level, the atmospheric and the man-made noise

In each case the values of atmospheric noise, man-made noise and intrinsic receiver noise intensities shall be compared and the greatest one shall be used.

3.4.1.5 Audio-frequency signal/noise ratio

(Pending on decision of Committee 4.)

3.4.1.6 Radio-frequency signal/noise ratio

The required radio frequency (input) signal-to-noise ratio is approximately 10 dB greater than the required audio (output) signal-to-noise ratio for the reference receiver (IF bandwidth 4 kHz) with 30% modulation of the received signal under stable propagation conditions. The basis for the establishment of this ratio is such that it is not appropriate to consider variability in time.

3.4.2 Reference usable field strength

The reference usable field strength shall be : [ ].

ANNEX 3

3.5.2 Transmitter power and equivalent isotropically radiated power appropriate for satisfactory service

The propagation prediction method described in section 3.2.1 shall be used to determine the appropriate transmitter power to achieve satisfactory service. The appropriate transmitter power varies with propagation conditions which in turn are functions of the time of day, the season and the solar cycle period as well as the geographical location.

(This text has already been adopted by the Plenary Meeting, see Document 115(Rev.1), page B.1/15(Rev.1).)

(The following additional text is to be added :)

[/‾During the first stage of_7 treatment of the requirement, the equivalent isotropically radiated power appropriate for providing the reference usable field strength (E_{ref} = E_{min} /‾ + 3 dB_/) shall be calculated considering the basic circuit reliability, /‾ if necessary_7.

The reference value of reliability in this case shall be /‾X _7 % to start with.

After having had the initial frequency assignments to all requirements compatibility analysis will be done.]*

/‾* Pending a decision of Committee 5._7

INTERNATIONAL TELECOMMUNICATION UNION

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COMMITTEE 4

SUMMARY RECORD

OF THE

SEVENTH MEETING OF COMMITTEE 4

Monday, 30 January 1984, at 0900 and 1415 hrs

Chairman : Mr. J. RUTKOWSKI (People's Republic of Poland)

Subject discussed :		Document
1.	Report by the Chairman of Drafting Group 4B-1	130
2.	Report by the Chairman of Drafting Group 4B-7	132
3.	Report by the Chairman of ad hoc Group 4C	133
4.	Eleventh report by the Chairman of Working Group 4B	136
5.	Consideration of the second, fourth and ninth reports of Working Group 4B (continued)	99, 104, 124
6.	Report of Drafting Group 4B-1	140

1. Report by the Chairman of Drafting Group 4B-1 (Document 130)

1.1 The Chairman of Drafting Group 4B-1 introduced Document 130 and explained that values had yet to be determined for the intrinsic receiver noise level and the reference usable field strength. In addition, the reference to "AF bandwidth" in the third line of paragraph 3.4.1.6 should be amended to read "IF bandwidth".

1.2 The Chairman suggested that Document 130 should be adopted as it stood, with the values determined after consideration of Documents 99, 104 and 124 to be inserted between square brackets in the places indicated.

It was so decided.

2. Report by the Chairman of Drafting Group 4B-7 (Document 132)

2.1 The Chairman of Drafting Group 4B-7 introduced Document 132, drawing attention to the points in which it differed from Document DT/35 prepared earlier by the Drafting Group. The CIRAF zones were divided into two sets of halves, namely N, S and E, W respectively, instead of four parts as originally intended. The third paragraph of the section entitled "Reception zones" had been placed between square brackets. Lastly, in the paragraph on test points, the X_{min} and X_{max} values had yet to be established.

2.2 Reception zones

2.2.1 The delegate of Brazil, referring to the first paragraph, objected to the division of CIRAF zones into two sets. Division into four quadrants, as proposed earlier, would avoid many difficulties.

2.2.2 He was supported by the delegates of the USSR and the United Kingdom.

2.2.3 At the request of the representative of the IFRB, the Chairman read out the text which the IFRB had proposed for the paragraph in question :

"CIRAF zones shall be divided into four quadrants, NW, NE, SE and SW, where it is necessary to define more precisely the service area of a transmission. Any combination of the four quadrants may be used when the service area is greater than one quadrant but less than a whole CIRAF zone."

The text was approved.

2.2.4 In addition, the delegate of the United Kingdom and the representative of the IFRB suggested that the text of Document DT/35, particularly the first sentence of the second paragraph, should be retained.

It was so decided.

2.2.5 With regard to the second paragraph, the representative of the IFRB observed that Appendix 1 to the Radio Regulations mentioned three major maritime areas which were not defined; the question arose whether those areas would have the same status as the CIRAF zones.

2.2.6 The Chairman said that the present subdivision in the Radio Regulations could be regarded as provisional, and asked whether the Conference was competent to add new CIRAF zones to the existing list. The representative of the IFRB having replied in the affirmative, suggested that a small ad hoc Group (4F) should be set up to work out a subdivision of the areas which had not yet been defined, for submission to the next meeting of Committee 4. The IFRB would participate in the Group together with the delegates of Sweden and Norway. The second paragraph would be placed between square brackets pending submission of the new text.

It was so decided.

2.2.7 With regard to the third paragraph, the delegate of India, supported by the delegates of the USSR, Brazil, Chile, the United Kingdom and China, considered that it would be preferable not to mention any country or part of a country when specifying a very small reception area, since that might cause problems; rather, reference should be made to test points. That measure, which was exceptional, would be needed if administrations had difficulty in meeting the compatibility criteria when they wished to provide a service in areas smaller than a CIRAF-zone quadrant.

2.2.8 The delegate of the USSR and the representative of the IFRB considered that the first paragraph was sufficiently detailed as to make the third paragraph redundant.

2.2.9 The delegate of Brazil, supported by the delegates of Chile and Venezuela, opposed the deletion of the third paragraph, observing that some service areas might overlap two or more CIRAF-zone quadrants and, in the absence of appropriate measurement data, the compatibility analysis would have to be based on all the subdivisions.

2.2.10 The delegate of the USSR said he had made a quick calculation which showed that, with the antennas generally used for HF broadcasting and a transmitter range of 2,000 km, the width of the service area was roughly 1,500 km, whereas that of a CIRAF-zone quadrant was 1,000 km.

2.2.11 He was supported by the representative of the IFRB, who had obtained similar results.

2.2.12 The delegate of Brazil said that areas of 500 km were to be found in the tropics.

2.2.13 The delegate of India pointed out that, owing to the characteristics of certain HR 4/4 horizontal antennas, the reception area was sometimes limited to 400 km.

2.2.14 The Chairman suggested that the paragraph be worded as follows :

"In specifying a reception area which is smaller than an entire zone or subdivision of a zone, that area should, as an exceptional measure, be indicated by means of the appropriate test points, and the maximum service range in km should also be mentioned. See Appendix 2 to the Radio Regulations."

It was so decided.

2.2.15 To meet the concern of the delegate of the USSR, who emphasized the exceptional nature of the measure, the Chairman, supported by the delegate of Brazil, suggested that the text of the third paragraph should be transferred to a footnote.

It was so agreed.

2.3 Test points

2.3.1 The delegate of the USSR said he was surprised to see that Drafting Group 4B-7 had not, as required by its terms of reference, retained the test points adopted by the IFRB. It was to be feared that the new grid would not enable compatibility between areas to be evaluated correctly.

2.3.2 The Chairman of Drafting Group 4B-7, supported by the delegate of Japan, replied that most of the participants in the Drafting Group had considered that it would be more convenient to prepare a new, uniform grid in order to obtain a sufficient number of test points.

2.3.3 The representative of the IFRB, supported by the delegate of Bulgaria, observed that the test points of the new grid would be nearer to the pole than to the equator. The proposal to use a grid of 6° and 3° latitude and longitude if necessary was hardly satisfactory, for it would entail the specification of a very large number of test points, whereas in fact the number of such points should not exceed 450 to 500.

2.3.4 Replying to the delegate of the USSR and the representative of the IFRB, the delegate of the United Kingdom observed that the number of test points obtained in the subdivision of a zone was inadequate when the IFRB procedure was applied. The 12° grid was acceptable as a starting point but, having regard to the subdivision of CIRAF zones, it would be necessary to adopt a grid of 6° or even, in certain zones, 3° in order to obtain a sufficient number of test points within a subdivision.

2.3.5 Replying to the delegates of Bulgaria and Czechoslovakia, who proposed that the test points adopted by the IFRB should be added to the new grid, the representative of the IFRB said that it would be difficult to accommodate both projections (IFRB test points and uniform distribution) on the same map. Comparison would be facilitated if two maps were used, provided they were of the same scale.

2.3.6 The Chairman suggested that consideration of the section relating to test points should be deferred until the new maps had been produced.

It was so agreed.

3. Report by the Chairman of ad hoc Group 4C (Document 133)

3.1 The Chairman of ad hoc Group 4C said that his report on the ad hoc Group's consideration of Document 133 would be available early that afternoon.

4. Eleventh report by the Chairman of Working Group 4B (Document 136)

4.1 Following a discussion on various drafting amendments to the first paragraph of the additional text to be inserted at the end of section 3.5.2, it was decided to adopt the following wording :

[During the first stage of] processing of the requirement, the equivalent isotropically radiated power required for providing the reference usable field strength ($E_{ref} = E_{min}$ [+ 3 dB]) shall be calculated considering the basic circuit reliability, [if necessary].

The reference value of reliability in this case shall be [X] % to start with.

After having had the initial frequency assignments to all requirements a compatibility analysis will be done.

It was also decided to transfer the phrase between square brackets at the end of the third paragraph to a footnote.

The meeting was suspended at 1215 hours and resumed at 1410 hours.

5. Consideration of the second, fourth and ninth reports of Working Group 4B (continued) (Documents 99, 104 and 124)

5.1 The Chairman recalled that consideration of the reports had been suspended in order to give delegations time to seek compromise solutions to a number of problems which had arisen. So far as he was aware, no solution had emerged as yet, and he invited suggestions as to how to proceed with the matter.

5.2 The delegate of the United States said that at least three and possibly four values had been proposed for each of the parameters in question, viz., noise limited receiver sensitivity, AF signal-to-noise ratio and the relationship between reference field strength and minimum field strength. Since the three values were closely interlinked, a "package deal" approach would, in his view, offer the best chance of arriving at a compromise.

5.3 The delegate of the USSR agreed that an integrated approach was called for and indicated that, to his knowledge, some proposals of such a nature were in preparation.

5.4 The Chairman of ad hoc Group 4C said that, as would be seen from the Group's report to be circulated shortly (Document 141), no agreement had been reached on the question of the fading allowance for the RF protection ratio. The item was thus still outstanding and should be added to those listed by the delegate of the United States.

5.5 The Chairman proposed the establishment of an ad hoc Group to consider the items still outstanding.

After discussion, it was decided to set up an ad hoc Group 4G under the chairmanship of Mr. J.J. Bliek (Netherlands) and consisting of the delegations of China, Brazil, USSR, India, Libya, United States of America, Qatar, United Kingdom, France, Japan, Netherlands, Syria, Italy, Thailand, Tanzania, Federal Republic of Germany, Algeria, United Arab Emirates, Yugoslavia, Iran and Canada.

It was further decided that the ad hoc Group's terms of reference should be as follows :

"To submit to Committee 4 compromise proposals concerning the following parameters :

- noise limited receiver sensitivity;
- AF signal-to-noise ratio;
- reference usable field strength; and
- fading allowance for RF protection ratio."

5.6 The delegate of the USSR wondered whether the fourth item in the Working Group's terms of reference was not too highly specialized to be considered in so large a group.

5.7 The Chairman of the Conference emphasized the importance of arriving at a composite agreement on all four parameters and appealed to delegations to show their spirit of cooperation and compromise by working towards that end.

5.8 The delegate of the USSR said that, in view of the appeal just made by the Chairman of the Conference, he withdrew his objection to the inclusion of the fourth item in the terms of reference of ad hoc Working Group 4G.

5.9 The Chairman of Working Group 4D suggested that, in view of the latest developments, meetings of Working Group 4D should be deferred until Working Group 4G had completed its work.

It was so agreed.

6. Report from Drafting Group 4B-1 (Document 140)

6.1 The Chairman of Drafting Group 4B-1, introducing Document 140, said that the document represented a consolidated version of the Swedish proposal put forward in Document 111 and of matter derived from the CCIR Report to the Conference (Document 22). It would be seen that the first two column headings of Table [Y], as well as the whole of the table in the Annex, appeared in square brackets.

The Committee would, furthermore, have to decide whether to remove the square brackets from the expression "FOT" in the first sub-paragraph of the first paragraph of section 3.8.1 or to replace it by another expression. In the second paragraph of section 3.8.2, a decision was required as to whether reference should be made to both circuit reliability and reception reliability or to only one of those parameters. Lastly, a figure should be inserted for the unknown value x% appearing in square brackets in the second and fifth lines of the same paragraph.

6.2 The Chairman of Working Group 4A, referring to the expression "FOT" between square brackets in section 3.8.1, said the actual abbreviation used was not of great consequence. He suggested that the expression "MUF" be substituted.

It was so decided.

6.3 The representative of IFRB felt that the phrase "paths over which the MUF is changing rapidly" was not sufficiently clear to give guidance to the Board as to which paths were involved.

6.4 The Chairman of Drafting Group 4B-1 explained that the phrase used had been taken verbatim from CCIR Report 410. He pointed out that in any case section 3.8.1 was of a general, introductory character, and more specific directives were given in section 3.8.2.

6.5 The representative of the IFRB said that he was satisfied with that explanation. The operative section, as far as guidelines for the Board were concerned, would thus be 3.8.2.

6.6 The Chairman of Working Group 4A drew attention to the words "circuit/reception" between square brackets in the second paragraph of section 3.8.2. Referring to Table 3 on page 12 of Document 133, he noted that the phrase "basic reception reliability" was held to be sufficient to cover cases where only one frequency was used as well as cases where more than one frequency was used. The word "circuit" could therefore be deleted.

It was so decided.

6.7 The Chairman asked what figures the Drafting Group had proposed for the unknown value x% for basic reception reliability in the same paragraph.

6.8 The Chairman of Drafting Group 4B-1 said the Group had not debated the question of what percentages to include, as that question did not come within its terms of reference.

6.9 The delegate of Sweden noted that in Table /¯Y_7 the maximum value in the first column was 80%. He therefore suggested that the figure should be 80%, as advocated in his delegation's proposal (Document 111).

6.10 The delegate of the United States proposed a figure of 90%. He considered that the ranges of values quoted in Table /¯Y_7 were too coarse to serve the purpose, and would prefer a statement to the effect that for a particular frequency assignment to qualify for augmentation by an additional frequency, it should contribute at least 10% to overall reliability.

6.11 The delegates of the USSR and the United Kingdom supported the United States suggestion, the latter explaining that Table /¯Y_7 as it stood would mean that a very small increase in transmitted power would cause a jump from one range of percentages to the next, thus radically affecting the decision on whether or not to assign a second frequency. That was an artificial situation which might cause difficulty.

6.12 The delegate of Sweden said he too could support the United States solution, but felt that the figure of 10% was perhaps too small, at least for very low reception reliabilities. He would prefer a figure of about 20% in the 40% reliability range, decreasing to 10% in the 80% reliability range. It might be preferable to replace Table /¯Y_7 with some kind of diagram.

6.13 The delegate of China suggested that before deciding on a figure, the IFRB should be requested to make trial calculations of reception reliabilities of a variety of circuits, using information contained in the seasonal schedules.

6.14 The representative of the IFRB said that unfortunately it might be difficult to respond to that request, since the Board would not have information as to whether or not administrations were using a second frequency for a programme.

6.15 The delegate of India agreed with the Swedish delegate that Table /¯Y_7 should be recast so that the percentages justifying additional frequencies would vary at different levels of basic reception reliability. There should be a cut-off point at the lower end of the range, as well as at the higher end of the range, beyond which the assigning of an additional frequency would not be held to be justified.

6.16 The delegate of the Federal Republic of Germany agreed that Table /¯Y_7 as it stood was not sufficiently clear to provide guidelines to planners.

6.17 The Chairman summarizing the discussion, said that a number of delegates favoured a non-linear relation, requiring a higher percentage increase in reliability at lower reliability levels : i.e., at a level of 40% reliability the required increase should be 20%, decreasing to 10% at higher levels. It had also been suggested that Table /¯Y_7 should be replaced by a diagram.

6.18 The Chairman of Drafting Group 4B-1 said the United States delegation would be willing to prepare such a diagram for consideration by the Committee. It would then be possible to make the appropriate changes to the wording of section 3.8.2.

6.19 The delegate of Sweden volunteered to help in the drafting of the proposed diagram.

6.20 The Chairman said he took it that the Committee agreed in principle that Table [Y] should be replaced by a diagram depicting non-linear dependence in which the required increase in reliability at the lower values of basic reception reliability would be greater and would decrease for the higher levels of reception reliability. He proposed that Table [Y] should be placed in square brackets pending receipt of the diagram to be submitted by the Chairman of Drafting Group 4B-1.

It was so agreed.

6.21 The delegate of China recalled his suggestion that the IFRB might make trial calculations. For one frequency operation the calculation would be quite simple, but in cases using two or more frequencies for radiating the same programme to the same target area he realized that the IFRB might have difficulties in identifying such transmissions.

6.22 The Chairman pointed out that it was the IFRB's current practice to make an examination only from the point of view of incompatibility, and the formulas for the calculation of reliability contained in Documents 133 and 141 had not yet been adopted by the Committee.

6.23 The representative of the IFRB confirmed that, despite the Board's desire to help, difficulties would be involved. It was true that assumptions could be made concerning the number of frequencies on the same programme, but the point raised by the Chairman was very pertinent because the concept of basic broadcast reliability was a new concept for the IFRB and it had no programmes on it. Even on the basis of assumptions, it could not provide an assessment of improvement in reliability, as suggested by the delegate of China, at least in the short-term. It would, however, be glad to pursue the matter further during the inter-sessional period.

6.24 The Chairman said that while the Chinese delegate's proposal was scientifically sound, it was not possible for the IFRB to carry out the necessary calculations immediately. In view of the short time remaining at its disposal, it was necessary for Committee 4 to reach agreement on the proposals regarding non-linear increase in required reliability. It had been proposed that the required increase should start from 20% for reliabilities of the order of up to 40% and should decrease to not less than 10% for reliabilities of about 80%. The Committee might temporarily agree on that as a logical estimation. It might also include a footnote indicating that the problem required further study and that a final decision should be taken at the second session of the Conference. He proposed that in the meantime the Committee adopt the proposal by the Chairman of Drafting Group 4B-1 to return to the subject when a non-linear diagram would be available.

6.25 The delegates of Syria and of China agreed with that proposal.

6.26 The representative of the IFRB, in response to an offer by the Chinese delegate to provide a footnote regarding trial calculations, said that that might be included in the Resolution to be adopted by the Conference requesting the IFRB to carry out certain tasks during the intersessional period.

It was agreed to defer further consideration of the matter until the Committee's next meeting when a revised version of Document 140 and the text of the proposed footnote were available.

6.27 The Chairman recalled that two proposals had been made for the figure /¯x_7% in Document 140, section 3.8.2, namely 80% and 90%.

6.28 The delegates of Syria, Kenya, Brazil, Venezuela, Egypt, Yugoslavia, Algeria, Indonesia, Japan, Cameroon, Pakistan, Gabon, Tanzania, Chile, Iran, Benin, India, China and Ghana expressed their preference for a figure of 80%.

6.29 The delegates of the USSR, the United Kingdom, Mexico, Bulgaria, the Federal Republic of Germany, Paraguay, Italy, Poland, the United Arab Emirates and Czechoslovakia supported a figure of 90%.

6.30 The Chairman said that as there appeared to be 19 delegations in favour of 80% and 9 in favour of 90%, a final decision would be deferred until the diagram to be provided by the United States delegation was available.

It was so agreed.

The meeting rose at 1700 hours.

Co-Secretaries :

G. KOVACS
G. ROSSI

The Chairman :

J. RUTKOWSKI

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 148-E
3 February 1984
Original : English

PLENARY MEETING

MINUTES
OF THE
FIFTH PLENARY MEETING

Tuesday, 31 January 1984, at 1400 hrs

Chairman : Mr. K. BJÖRNSJÖ (Sweden)

Subjects discussed :		Document
1.	Oral reports by the Chairmen of Committees 4 and 5	-
2.	Second series of texts submitted to the Plenary Meeting for first reading (B.2)	137

1. Oral reports by the Chairmen of Committees 4 and 5

1.1 The Chairman of Committee 4 said that the Committee had made some progress during the period since the previous Plenary Meeting and a number of documents had been forwarded to the Editorial Committee for processing. However, not as much had been achieved as had been hoped; a number of items still remained to be settled. There were, in particular, two controversial issues, one relating to the minimum values of technical parameters requested by Committee 5 and the other to Committee 4's failure so far to reach consensus on a number of parameters. Two ad hoc groups had therefore been set up to deal with those problems and it was hoped that their work would be completed shortly.

1.2 The Chairman of Committee 5 said that owing to the small output of documents from its Working Groups the Committee had met only once during the previous week. Nevertheless, a great deal of hard work had been put in by the Working Groups, in particular by ad hoc Group 5A-2, which had prepared a document that was being discussed by Working Group 5A in an effort to reach a workable compromise on those parts of it that had been the subject of controversy. He regretted the lack of progress in the Committee; delegates would recall, however, that its field of work, planning criteria, was the main issue before the Conference, whose success would depend on finding an acceptable compromise solution to all the problems before it as a whole. Since some of the difficulties being encountered by Committee 4 had arisen as a result of controversy on planning processes and methods, it was proposed to hold a joint meeting of the two Committees to clarify three definitions that concerned them both.

1.3 The Chairman, recalling that the Conference was in its final stages, said that Committees 4 and 5 had both made slower progress than had been scheduled or expected. At the beginning of the Conference many delegates had made promises to make every effort to ensure its success. However during the course of discussions it had appeared that many delegations were continuing to stand firmly by their original positions and displayed little willingness to make compromises. He urged delegates to show the good will they had declared at the start of the Conference and to make an effort to find acceptable solutions. He proposed, with the support of the delegate of Italy, that he, together with the Chairman of Committee 5 and a very small Drafting Group, should endeavour to prepare a text that could serve as a basis for compromise and as an input to the Working Groups.

It was so agreed.

1.4 The delegate of Algeria, while agreeing in principle with that decision, wished to make the following point. There were two categories of users of HF broadcasting services - the big users and the small users. The position that existed at present suited the big users; they had therefore proposed and wished to see very few modifications to it. The small users, on the other hand, did not find the present situation satisfactory and had come to the Conference with proposals for change. The Conference was now in the familiar position where those who wished to make changes were in collision with those who wanted to keep the status quo. The small users had gradually been brought to make concessions and move from their initially firm positions. However, there was a limit to the concessions they alone could make.

2. Second series of texts submitted to the Plenary Meeting for first reading (B.2) (Document 137)

2.1 Chapter 3 - paragraph 3.2.1 : Method to be used to determine the sky-wave field strength for HF broadcast planning purposes

Sections 3.2.1.1 (Introduction) and 3.2.1.2 (Ionospheric parameters) were approved.

Section 3.2.1.3 : Prediction of the median field strength

2.1.1 The Chairman of Committee 4 said that the footnotes to subsections 3.2.1.3.1.3, 3.2.1.3.2 and 3.2.1.3.3 (pages B.2/4, 8 and 10 respectively) referred to the fact that refinements to the formulas concerned might be developed during the intersessionary period. They had been placed in square brackets pending completion of arrangements for the work to be carried out between the two sessions of the Conference. Committee 4 proposed that the square brackets should be retained until those arrangements had been finalized.

2.1.2 The delegate of India said that ambiguities and difficulties should be avoided wherever possible in view of the heavy workloads of the present and the second session of the Conference and the short length of time between the two. In that respect it would perhaps be wise to accept the formulas given for determination of median field strength without further comment. He therefore proposed that the footnotes should be deleted.

2.1.3 The delegate of Brazil said that although he too was concerned about increasing the difficulties of the work to be done during the intersessionary period and by the second session of the Conference, the accuracy of the formulas for determining median field strength was a matter of considerable importance to many countries, including his own. He was therefore unable to accept deletion of the footnotes.

Following a discussion in which the Chairman of Committee 4, the Director of the CCIR and the delegate of India participated, it was agreed that the footnotes should be retained in square brackets pending the outcome of decisions on the organization of work between the first and second sessions of the Conference.

Section 3.2.1.3 was approved subject to that reservation and to a drafting amendment of the final sentence of the Spanish text of the footnotes to subsections 3.2.1.3.1 and 3.2.1.3.2.

2.2 Chapter 3 - paragraph 3.2.3 : Signal fading

Section 3.2.3.3 (Calculation of fading allowances for different percentages of time) was approved.

2.3. Chapter 3 - paragraph 3.9 : Specifications and progressive introduction of an SSB system

2.3.1 The Chairman of Committee 4 proposed and it was agreed that sections 3.9.1.2 and 3.9.1.4 should be placed in square brackets pending redrafting necessitated by decisions taken while adopting technical criteria for double sideband system necessary bandwidth and channel spacing (sections 3.1.1.2 and 3.1.2, B.1/6(Rev.1)).

2.3.2 The Chairman of Committee 6 indicated a number of editorial amendments to the French text of sections 3.9.1.7, 3.9.1.9, 3.9.1.10 and 3.9.1.13 as well as an editorial amendment to the texts of section 3.9.1.13 a).

2.3.3 The delegate of Venezuela proposed an editorial amendment to the Spanish text of section 3.9.1.13 and the delegate of Paraguay to the texts of section 3.9.1.13 b).

2.3.4 The delegate of the Netherlands, supported by the delegate of the Federal Republic of Germany, said that the co-channel protection ratio provisions in section 3.9.1.13 should be considered together with the corresponding provisions in section 3.9.2.4. He therefore proposed that a cross-reference to that section be inserted in the text.

2.3.5 In response to an objection by the delegate of Syria, the Chairman proposed and it was agreed that the suggested cross-reference should be placed in square brackets until both sections came before the Plenary Meeting for consideration in the same document.

Paragraph 3.9 and section 3.9.1 were approved, subject to those amendments.

2.4 Chapter 3 - paragraph 3.10 : Theoretical capacity of the HFBC bands was approved, subject to the replacement of the words "La période" by "L'intervalle de temps" at the beginning of the second paragraph of the French text.

The second series of texts submitted by the Editorial Committee (series B.2) was approved on first reading.

The meeting rose at 1530 hours.

The Secretary-General : R.E. BUTLER

The Chairman : K. BJÖRNSJÖ

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 149-E
6 February 1984
Original : English

COMMITTEE 4

SUMMARY RECORD

OF THE

EIGHTH MEETING OF COMMITTEE 4

(TECHNICAL CRITERIA)

Tuesday, 31 January 1984, at 0910 hrs

Chairman : Mr. J. RUTKOWSKI (People's Republic of Poland)

Subjects discussed :		Document
1.	Approval of the Summary Record of the Fourth Meeting of Committee 4	116
2.	Reconsideration of some texts of Chapter 3 of the report	142
3.	Maximum number of frequencies (continued)	140 + Add.1
4.	Oral report of Chairman of ad hoc Group 4D	

1. Approval of the Summary Record of the Fourth Meeting of Committee 4 (Document 116)

The Summary Record of the Fourth Meeting was approved, subject to some drafting changes (see Corrigendum 1 to Document 116).

2. Reconsideration of some texts of Chapter 3 of the report (Document 142)

2.1 3.1.1.2 (Necessary bandwidth)

2.1.1 The delegate of Yugoslavia considered that the meaning of section 3.1.1.2 would be clearer if the wording from Document 115(Rev.1) which corresponded to that of section 5.1.4 of the CCIR Report (Document 22) were used, namely "The necessary bandwidth is twice the audio-frequency bandwidth, since the latter might be lower than the upper limit of 4.5 kHz".

2.2 The delegate of India supported that remark.

2.3 The Director of the CCIR suggested that the point would be met by rewording the section to read "The necessary bandwidth shall not exceed 9 kHz".

It was so agreed.

In the interests of consistency, it was also agreed to substitute the words "shall not exceed" for the word "is" in section 3.9.1.2.

2.4 3.1.2 (Channel spacing)

2.4.1 The delegate of Syria said that the texts of section 3.1.2 in Document 115(Rev.1) and of section 3.9.1.4 in Document 126 were ambiguous and needed clarification. Planning must be based on DSB transmissions exclusively. The interleaving of SSB transmissions midway between two adjacent channels should not be allowed during the transition period as that would increase adjacent channel and co-channel interference. Following explanations by the Secretary, the Chairman, the Director of the CCIR and the Chairman of the Conference, he said that wording must be included to make it clear that channel spacing for DSB in the same geographical area should be 10 kHz.

2.4.2 The delegate of Yugoslavia added that there was no connection between channel spacing and interleaving since in any event the former would always be 10 kHz and separation between carrier frequencies would not be less than 10 kHz in the same geographical area.

2.4.3 The delegate of Algeria observed that the Syrian amendment presumably applied to section 3.9.1.4, i.e. channel spacing during the transition period.

2.4.4 The delegate of France said that it had emerged from discussions in the Working Group that if wording of the kind proposed were included in section 3.1.2, it might be incorrectly interpreted to mean that the channel spacing on other zones was not 10 kHz. To cover Syria's concerns without introducing such ambiguity he thought it would be more appropriate to insert the sentence "In this case the channel spacing remains 10 kHz" in the note to section 3.9.1.4 of Document 126.

It was so agreed.

3. Maximum number of frequencies (continued) (Document 140 + Add.1)

3.1 The Chairman of Drafting Group 4B-1 noted that, in Figure [Y] in Addendum 1 to Document 140, curve (B) which should have started at the bottom left-hand corner to depict a straight linear 10% increase of reception reliability after the addition of a new frequency has been omitted.

3.2 The Chairman assumed that the omission was due to the lack of support for the idea of linear dependence.

3.3 The delegate of India said the Chairman was correct in that assumption. His own delegation had advocated a lower limit for initial reception reliability at about 50% as that would normally determine the E_{min} value. There was no need for a curve between 40 and 50% or over 80%. It would be logical to start the curve at 75% which would correspond to an initial reception reliability of 50%. The table in the Annex to Document 140 showed a figure of 0.5 for basic reception reliability and with an additional transmitter of the same reliability the resulting basic reception reliability for an additional frequency would be 0.75.

A curve should therefore be plotted in Figure [Y] starting with an increase of about 20% at the lower end of the scale and moving towards a 10% increase at the upper end.

3.4 The delegate of Sweden observed that 0.75 would be an absolute maximum and allowance should be made for lower values of basic reception reliability.

3.5 The delegate of the USSR said it would be preferable to adopt a 10% increase in reliability as justifying the use of a second frequency rather than the values in Figure [Y]. On the other hand, the table in the Annex to Document 140 should be retained as a useful guide. For administrations without powerful transmitters the values in Figure [Y] would not be helpful as a 20% increase in reliability was hardly likely to be attained. His proposal was therefore the more practical.

3.6 The delegate of the United States said that a straight 10% increase in reliability would provide a flexible and logical solution.

3.7 The delegate of Algeria was in favour of retaining Figure [Y], since he was unable to accept a 10% increase in reliability as justifying the use of an additional frequency. An increase of 20% at least should be the figure adopted.

3.8 The Chairman suggested that further consideration of Figure [Y] be deferred to give time for informal consultations as to whether or not it should be retained.

It was so agreed.

4. Oral report of Chairman of ad hoc Group 4D

4.1 The Chairman of ad hoc Group 4D said that at its first meeting his Group had noted Document 106 requesting Committee 4 to establish minimum values of technical parameters below which service could be deemed unusable. Further items such as basic and overall broadcasting reliability and quality assessment grades had been identified for addition to the non-exhaustive list supplied by Committee 5. In carrying out its work the ad hoc Group had encountered two problems. First, it would have to await the outcome of work currently under way on certain desired parameters still outstanding. Secondly, it required guidance regarding the exact nature of its task. Some delegations considered that Committee 4 was being asked to recommend specific values for the minimum parameters, whereas others thought that a range of figures should be provided and that it should be left to Committee 5 to decide on the minimum cut-off values it wished to adopt.

4.2 The Chairman felt that it was clear from Document 106 that Committee 4 should supply Committee 5 with specific figures for the minimum parameters.

4.3 The delegate of the USSR considered that Committee 4, as the Technical Committee, was not competent to recommend specific minimum parameters to Committee 5. It was the prerogative of the Planning Committee and the administrations to decide on the level to which quality of service could be allowed to fall. The Technical Committee should thus merely provide data showing the dependence of quality of service on the different technical parameters.

4.4 The delegate of the United States said that it would be very difficult for Committee 4 to come up with specific minimum values, since it had no criteria on which to base its assessments. It should therefore restrict itself to indicating the effect of various values of the parameters on service quality.

4.5 The delegate of Bulgaria said he shared the view expressed by the delegate of the USSR.

4.6 The Chairman and the delegates of India and Yugoslavia said they considered that the request from Committee 5 was for specific values. That had been the understanding when Document 106 had been discussed and ad hoc Group 4D had been established to supply the required information, and no objections had been raised at that stage.

4.7 The delegate of Algeria agreed that ad hoc Group 4D was to determine specific minimum values below which quality of service became unacceptable. If Committee 4 was considered competent to evaluate and adopt "desired" values, which it obviously was, since a specific desired value for the co-channel protection ratio had been given in section 3.3.1 of Document 115(Rev.1) and had subsequently been approved by the Plenary, then it must clearly be competent to put forward minimum parameters below which quality became "undesirable" or unacceptable. Furthermore, he recalled that some sections of Document 115(Rev.1) had been approved on the understanding that minimum parameters would be included at a later stage.

4.8 The delegate of the USSR proposed that in order to clarify the question the Chairman of Committee 4 should consult the Chairman of Committee 5 and ascertain precisely what was expected in response to Document 106.

It was so agreed.

4.9 The Chairman said with regard to the other difficulty met by ad hoc Group 4D that work on the desired parameters was being conducted in ad hoc Group 4G. In that connection he drew attention to Document 73 and its Addendum (USSR) outlining the relationship between service quality and signal-to-noise ratio, and Document 143 (New Zealand) showing the effect of signal-to-noise and co-channel protection ratios on quality of service. It would be useful for ad hoc Group 4D if those relationships could be considered in Group 4G and if possible produced in the form of graphs comparable to the one already adopted for the desired protection ratio.

4.10 The Chairman of ad hoc Group 4G said that his Group, after examining Documents 73 and 143 at length, had come to the conclusion that it would be extremely difficult to produce directly comparable graphs, since the various data were based on different fundamental parameters. For instance, whereas the agreed curve for the co-channel protection ratio had been derived from the CCIR Report based on a 50% satisfaction of listeners, the data in the new Documents were based on 80% satisfaction. It would thus be more practical to try to develop a compromise package agreeable to all delegations and taking in all the parameters.

4.11 The delegate of China supported that view.

4.12 The delegate of the USSR said that ad hoc Group 4G should suggest compromise figures rather than attempt to provide curves.

4.13 The delegate of Algeria recalled that it had been agreed the previous day that the text of section 3.3 and two columns in Table 1 of Document 143 submitted by New Zealand would have to be reviewed. He too felt that ad hoc Group 4G had been established to reach a compromise on the desired values of the various parameters.

4.14 The Chairman said he took it from the discussion that the results of ad hoc Group 4G would take the form of compromise figures. They would be forwarded directly to Committee 4 as soon as they became available.

The meeting rose at 1200 hours.

Co-Secretaries :

G. KOVACS
G. ROSSI

The Chairman :

J. RUTKOWSKI

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 150-E
31 January 1984

PL = Plenary Meeting
C = Committee
WG = Working Group
DG = Drafting Group

LIST OF DOCUMENTS

(101 to 150)

No.	Origin	Title	Destination
101	WG/4B	Third report of Working Group 4B to Committee 4	C.4
102	WG/4A	Third report of Working Group 4A to Committee 4	C.4
103	C.4	Summary record of the third meeting of Committee 4	C.4
104	WG/4B	Fourth report of Working Group 4B to Committee 4	C.4
105	S.G.	Comments by the IFRB on Intersessional Working Groups	C.5
106	C.5	Note from the Chairman of Committee 5 to the Chairman of Committee 4	C.4
107	C.4	Second series of texts from Committee 4 to the Editorial Committee	C.6
108	G, HOL	Proposal for a further planning principle	C.5
109	WG/4B	Fifth report of Working Group 4B to Committee 4	C.4
110	WG/4A	Fourth report of Working Group 4A to Committee 4	C.4
111	S	Proposals - Maximun number of frequencies	C.4
112	WG/4B	Sixth report of Working Group 4B to Committee 4	C.4
113	WG/4B	Seventh report of Working Group 4B to Committee 4	C.4
114	S.G.	Position of the Conference accounts at 20 January 1984	C.3
115(Rev.1)	C.6	B.1(Rev.1)	PL
116	C.4	Summary record of the fourth meeting of Committee 4	C.4

No.	Origin	Title	Destination
117	C.5	Summary record of the fourth meeting of Committee 5	C.5
118	WG/2A	Second report of the Working Group of Committee 2	C.2
119	C.4	Third series of texts from Committee 4 to the Editorial Committee	C.6
120	C.4	First report of Committee 4 to the Plenary meeting	PL
121	WG/4A	Fifth report of Working Group 4A to Committee 4	C.4
122	WG/4A	Sixth report of Working Group 4A to Committee 4	C.4
123	WG/4B	Eighth report of Working Group 4B to Committee 4	C.4
124	WG/4B	Ninth report of Working Group 4B to Committee 4	C.4
125	C.4	Summary record of the fifth meeting of Committee 4	C.4
126 + Add.1	C.4	Fourth series of texts from Committee 4 to the Editorial Committee	C.6
127	PL	Minutes of the fourth Plenary meeting	PL
128	C.3	Summary record of the third meeting of Committee 3	C.3
129 + Corr.1, 2	WG/4B	Tenth report of Working Group 4B to Committee 4	C.4
130	DG/4B-1	Report of Drafting Group 4B-1 to Committee 4	C.4
131	IND	RF co-channel protection ratio for fluctuating signals	C.4
132 + Corr.1	DG/4B-7	Report of Drafting Group 4B-7 to Committee 4	C.4

No.	Origin	Title	Destination
133	WG/4A	Seventh report of Working Group 4A to Committee 4	C.4
134	C.4	Summary record of the sixth meeting of Committee 4	C.4
135	CAN	Frequency selection - A technique adaptable to all planning methods	C.4, C.5
136	WG/4B	Eleventh report of Working Group 4B to Committee 4	C.4
137	C.6	B.2	PL
138	C.6	R.1	PL
139	C.4	Fifth series of texts from Committee 4 to the Editorial Committee	C.6
140 + Add.1	DG/4B-1	Report from Drafting Group 4B-1 to Committee 4	C.4
141	WG/4C	Report of Working Group 4C to Committee 4	C.4
142	C.4	Reconsideration of some texts of chapter 3	C.4
143	NZL	Proposals	C.4
144	WG/2A	Third report of the Working Group of Committee 2	C.2
145	G	The required fading allowance for RF protection ratio	C.4
146	C.4	Sixth series of texts from Committee 4 to the Editorial Committee	C.6
147	C.4	Summary record of the seventh meeting of Committee 4	C.4
148	PL	Minutes of the fifth Plenary meeting	PL
149	C.4	Summary record of the eighth meeting of Committee 4	C.4
150	S.G.	List of documents	-

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 151-E
30 January 1984
Original : French

BUDGET CONTROL COMMITTEE

Note by the Secretary-General

POSITION OF THE CONFERENCE ACCOUNTS AT 27 JANUARY 1984

In accordance with No. 477 of the International Telecommunication Convention (Nairobi, 1982), a statement of the accounts of the Conference at 27 January 1984 is submitted to the Budget Control Committee for consideration.

The statement shows that expenditure is within the budget limits approved by the Administrative Council.

This document also comprises a statement of expenditure relating to the preparatory work carried out in 1983 for the Conference and a statement of the limits set on expenditure by the Nairobi Plenipotentiary Conference.

R.E. BUTLER
Secretary-General

Annexes : 3

Item No.	Headings	Budget approved by AC	Budget adjusted	Expenditure at 27 January 1984			
				Actual	Committed	Estimated	Total
	Sub-head I - IFRB preparatory work and intersessional work						
11.401	Salaries and related expenses	325,000	340,500	16,832	318,201	14,467	349,500
11.403	Insurance	52,000	58,500	3,152	55,348	-	58,500
11.404	Office space, furniture	20,000	20,000	-	-	20,000	20,000
11.405	Electronic equipment	100,000	100,000	-	-	100,000	100,000
		497,000	519,000	19,984	373,549	134,467	528,000
	Sub-head II - Staff expenditure						
11.421	Salaries and related expenses	1,281,000	1,386,000	11,353	1,131,417	110,230	1,253,000
11.422	Travel (recruitment)	190,000	192,000	9,992	69,442	20,566	100,000
11.423	Insurance	34,000	34,000	2,091	-	30,909	33,000
		1,505,000	1,612,000	23,436	1,200,859	161,705	1,386,000
	Sub-head III - Premises and equipment						
11.431	Premises, furniture, machines	90,000	90,000	-	26,300	50,700	77,000
11.432	Document production	100,000	100,000	4,273	15,000	25,727	45,000
11.433	Office supplies and overheads	40,000	40,000	9,762	9,725	20,513	40,000
11.434	PTT	150,000	150,000	9,572	-	70,428	80,000
11.435	Technical installations	20,000	20,000	-	-	10,000	10,000
11.436	Sundry and unforeseen	10,000	10,000	605	-	9,395	10,000
		410,000	410,000	24,212	51,025	186,763	262,000
	Sub-head IV - Other expenses						
11.441	Report to the 2nd session	15,000	15,000	-	-	15,000	15,000
	Total, Section 11.4	2,427,000 *	2.556,000	67,632	1,625,433	497,935	2,191,000

Excluding common expenditure for conferences and meetings (Section 17), which is estimated at 712,000.- Swiss francs for this Conference (value 1.9.82 : limit 721,000.- Swiss francs)

*) Value 1.9.82 (limit) : 2,454,000.- Swiss francs

ANNEX 2

PREPARATORY WORK CARRIED OUT IN 1983 FOR THE WORLD ADMINISTRATIVE CONFERENCE FOR HF BROADCASTING

Items	Section 11 - Conference	1983 budget*)	1983 accounts
		- Swiss francs -	
	Sub-head I - Staff expenditure		
11.401	Salaries and related expenses	205,700	198,773.40
11.402	Insurance	31,400	35,609.70
	Total, Sub-head I	237,100	234,383.10
	Sub-head II - Other expenses		
11.405	Document production	-	8,265.95
11.410	CCIR preparatory work	270,000	86,385.70
	Total, Sub-head II	270,000	94,651.65
	Total expenditure, Section 11.4	507,100 **)	329,034.75
	Section 17 - Common services	237,000***)	82,421.00
	Total, value 1.9.1982 (limit on expenditure)	734,000	403,000.00

*) 1983 budget, including additional credits
**) i.e. 500,000.- Swiss francs, value 1.1.1983
***) i.e. 230,000.- Swiss francs, value 1.1.1983

ANNEX 3

LIMIT SET BY THE NAIROBI CONFERENCE, 1982, ON EXPENDITURE FOR THE WORLD ADMINISTRATIVE RADIO CONFERENCE FOR THE PLANNING OF THE HF BANDS ALLOCATED TO THE BROADCASTING SERVICE, 1984/86, AND COMPARISON WITH THE CREDITS AUTHORIZED BY THE ADMINISTRATIVE COUNCIL

WARC - HFBC	Sections 11 and 17		
	Limit on expenditure Add.Prot.I	Expenditure entered in the budget	Difference
1983 : Preparatory work	900,000	403,000	497,000
1984 : Preparatory work, cost of the first session and intersessional work	4,100,000	3,175,000	925,000
1985 : Intersessional work	500,000		
1986 : Intersessional work, cost of the second session, immediate post-Conference work	4,500,000		
Totals	10,000,000		

The amounts given in this table correspond to values at 1.9.1982.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 152-E
31 January 1984
Original : English

COMMITTEE 4

Canada

APPROPRIATE EQUIVALENT ISOTROPICALLY RADIATED POWER

This document relates to section 3.5.2 (e.g. Document 136) concerning "Transmitter power and equivalent isotropically radiated power appropriate for satisfactory service". The approach is closely parallel to sections 3.2.4.1 and 3.2.4.2 (see Document 133), where two methods are presented for calculating basic circuit reliability.

1. Introduction

As a first step in preparing a requirement, the equivalent isotropically radiated power necessary to provide the minimum usable field strength must be calculated. This is the absolute minimum e.i.r.p. required, since it is based only on noise, neglecting interference.

Two alternative but equivalent methods are presented; the first where the computation is undertaken in terms of the required r.f. signal-to-noise ratio, and the second where the computation is in terms of the minimum usable field strength. The choice between these two equivalent approaches depends upon the parameter chosen for inclusion in the planning method.

The first method includes the estimation of the median field strength of the background noise by taking account of contributions of atmospheric noise, man-made noise and intrinsic receiver noise. For the second method a similar estimate is included within the value of the minimum usable field strength.

1.1 Appropriate e.i.r.p. using signal-to-noise ratio

The method for calculating appropriate e.i.r.p. is indicated in Table 1. The median value of field strength for the wanted signal at step (1) is provided by the field strength prediction method for e.i.r.p. P_o. The lower decile values at steps (2) and (3) are determined, taking account of long-term (day-to-day) and short-term (within the hour) fading. From steps (4) to (8) consideration is given to atmospheric noise, man-made noise, and intrinsic receiver noise, and at step (9) the median value of field strength for the noise is taken as the greatest of the three components. The values of signal and noise determined at steps (1) and (9) are then combined at step (10) in order to derive the median signal-to-noise ratio, SNR(50).

The lower decile of signal-to-noise ratio is then calculated in step (11) in order to derive the signal-to-noise ratio exceeded for 90% of the time at step (12). This ratio is subtracted from the required radio-frequency signal-to-noise ratio (13) and the difference added to the reference power P_o. The result is the required e.i.r.p. $P(L_1)$ at the reception point (14). Steps (1) through (14) are repeated for all points in the service area (15 etc.), and the appropriate e.i.r.p. chosen as the 90 percentile of $P(L_1)$, $P(L_2)$ etc.

1.2 Appropriate e.i.r.p. using minimum usable field strength

The method for calculating appropriate e.i.r.p. is indicated in Table 2. The median value of field strength for the wanted signal at step (1) is provided by the field strength prediction method. The lower decile values (2) through (3) are also determined, taking account of long-term (day-to-day) and short-term (within the hour) fading. The combined lower decile of the wanted signal is then calculated in step (4) in order to derive the signal level exceeded for 90% of the time at step (5). This value is subtracted from the minimum usable field strength (step 6) and added to the reference power P_o. The result is the required e.i.r.p. at the reception point L_1 in step (7). Steps (1) to (7) are repeated for all reception points in the service area (8) to (9) etc., and the appropriate e.i.r.p. chosen as the 90 percentile of $P(L_1)$, $P(L_2)$, $P(L_3)$ etc.

TABLE 1

Parameters used to compute appropriate e.i.r.p.

STEP	PARAMETER	DESCRIPTION	SOURCE
(1)	$E_W(50)$ dB (μV/m)	Median field strength at reception point L_1 for e.i.r.p. of P_o (dBW)	Prediction method (Chapter /¯3_7)
(2)	$D_L(S)$ dB	Lower decile of slow fading signal (day-to-day)	(Chapter /¯4_7), (Table /¯4-1_7)
(3)	$D_L(F)$ dB	Lower decile of fast fading signal (within the hour)	8 dB (section /¯4.1.2.1_7)
(4)	$F_a(A)$	Noise factor for atmospheric noise	Atmospheric noise maps (Report 322)
(5)	N_A dB (μV/m)	Median field strength of atmospheric noise	$N_A = F_a(A) - 65.5 + 20 \log f + 10 \log b$ f in MHz, b in kHz (Report 322)
(6)	$F_a(M)$	Noise factor for man-made noise	(section /¯ _7) (curve /¯ _7, Report 258-4)
(7)	N_M dB (μV/m)	Median field strength of man-made noise	As in (7) above
(8)	N_R dB (μV/m)	Intrinsic receiver noise field strength	/¯ _7 dB (μV/m) (section /¯ _7)
(9)	N_T dB (μV/m)	Median field strength of total radio noise	Greatest of N_A, N_M, N_R (section /¯4.1.4_7)
(10)	SNR(50) dB	Median signal-to-noise ratio	$E_W - N_T$
(11)	D_L(SNR) dB	Lower decile of signal-to-noise ratio	$\sqrt{D_L(S)^2 + D_L(F)^2}$
(12)	SNR(90) dB	Signal-to-noise ratio exceeded 90% of time	SNR(50) - D_L(SNR)
(13)	G dB	Required RF signal-to-noise ratio	/¯section 7.2.2_7
(14)	$P(L_1)$ dBW	e.i.r.p. at reception point L_1	P + G - SNR (90)
(15)	$P(L_2)$ dBW	e.i.r.p. at reception point L_2	Repeat steps 1 to 14
(16)	$P(L_3)$ dBW etc.	e.i.r.p. at reception point L_3	Repeat steps 1 to 14
(17)	e.i.r.p.(x) dBW	e.i.r.p. associated with percentile x	e.i.r.p. chosen from the ranked values of $P(L_1)$, $P(L_2)$, ... in steps 14, 15, 16, etc.

TABLE 2

Parameters used to compute appropriate e.i.r.p.

STEP	PARAMETER	DESCRIPTION	SOURCE
(1)	$E_W(50)$ dB (μV/m)	Median field strength at reception point L_1 for e.i.r.p. of P_o (dBW)	Prediction method (Chapter 3)
(2)	$D_L(S)$ dB	Lower decile of slow fading signal (day-to-day)	(Chapter 4), (Table 4-1)
(3)	$D_L(F)$ dB	Lower decile of fast fading signal (within the hour)	8 dB (section 4.1.2.1)
(4)	$D_L(E_W)$ dB	Lower decile of wanted signal	$\sqrt{D_L(S)^2 + D_L(F)^2}$
(5)	$E_W(90)$ dB (μV/m)	Signal exceeded 90% of the time	$E_W - D_L(E_W)$
(6)	E_{min} dB (μV/m)	Minimum usable field strength	(section Chapter [ ])
(7)	$P(L_1)$ dBW	e.i.r.p. at reception point L_1	$P_o + E_{min} - E_W(90)$
(8)	$P(L_2)$ dBW	e.i.r.p. at reception point L_2	Repeat steps 1 to 7
(9)	$P(L_3)$ dBW etc.	e.i.r.p. at reception point L_3	Repeat steps 1 to 7
(10)	e.i.r.p. (x) dBW	e.i.r.p. associated with percentile x	e.i.r.p. chosen from the ranked values of $P(L_1)$, $P(L_2)$, ... in steps 7, 8, 9, etc.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 153(Rev.1)-E
31 January 1984
Original : French

COMMITTEES 4 AND 5

Canada, France

CAN/153(Rev.1)/1
F

RESOLUTION

ON THE UNAUTHORIZED USE OF HF BAND FREQUENCIES
ALLOCATED TO SERVICES OTHER THAN BROADCASTING

The World Administrative Radio Conference for the Planning of the HF Bands Allocated to the Broadcasting Service (first session, Geneva, 1984),

considering

a) that Resolution 508 of the World Administrative Radio Conference, 1979 (WARC-79), invited the Administrative Council to take the necessary steps to convene a world administrative radio conference, to be held in two sessions, with a view to planning the HF bands allocated to the broadcasting service;

b) that Resolution 8 of that Conference envisaged the allocation of new frequency bands to the broadcasting service, subject to compliance with the procedures for the transfer of existing assignments outside those bands;

noting

a) that in planning the HF bands allocated to the broadcasting service, account should be taken of a considerable increase in the portions of the spectrum allocated to that service;

b) that in Resolution 309 WARC-79 urged administrations to ensure that stations of services other than the maritime mobile service abstained from using HF frequencies in distress and safety channels and their guardbands and in the bands allocated exclusively to the maritime mobile service;

c) that in Resolution 407 WARC-79 also urged administrations to ensure that stations of services other than the aeronautical mobile (R) service refrained, except under specified conditions, from using frequencies in the bands allocated to this service, which is a safety service;

urges administrations

1. to comply with the provisions laid down in Resolutions 309 and 407 of WARC-79;

2. to ensure that stations of services defined in the Radio Regulations refrain from using frequency bands which have not been allocated to them except under conditions specified in the Radio Regulations and to see to it that such emissions cease as soon as harmful interference is produced;

3. to participate in the monitoring programmes which the IFRB will organize pursuant to Resolutions 309 and 407 of WARC-79 and the present Resolution;

instructs the IFRB

1. to take the necessary steps with a view to the removal by administrations of emissions from stations operating in HF bands which have not been allocated to them, as soon as harmful interference is produced;

2. to collect all available information on out-of-band emissions with a view to its publication by the Secretary-General;

3. to inform the Administrative Council annually of the results achieved in the application of this Resolution;

requests the Administrative Council

to study the matter in the light of the reports prepared by the IFRB and, if necessary, to place it on the agenda of an appropriate world administrative conference.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Corrigendum 1 to
Document 153-E
1 February 1984
Original : French

Canada, France

On page 2, delete the phrase "except in the case referred to in operative paragraph 2 of this Resolution".

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 153-E
31 January 1984
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COMMITTEES 4 AND 5

Canada, France

CAN/153/1
F

RESOLUTION

ON THE UNAUTHORIZED USE OF HF BAND FREQUENCIES
ALLOCATED TO SERVICES OTHER THAN BROADCASTING

The World Administrative Radio Conference for the Planning of the HF Bands Allocated to the Broadcasting Service (HFBC, Geneva, 1984),

considering

a) that Resolution 508 of the World Administrative Radio Conference, 1979 (WARC-79), invited the Administrative Council to take the necessary steps to convene a world administrative radio conference, to be held in two sessions, with a view to planning the HF bands allocated to the broadcasting service;

b) that Resolution 8 of that Conference envisaged the allocation of new frequency bands to the broadcasting service, subject to compliance with the procedures for the transfer of existing assignments outside those bands;

noting

a) that in planning the HF bands allocated to the broadcasting service, account should be taken of a considerable increase in the portions of the spectrum allocated to that service;

b) that in Resolution 309 WARC-79 urged administrations to ensure that stations of services other than the maritime mobile service abstained from using HF frequencies in distress and safety channels and their guardbands and in the bands allocated exclusively to the maritime mobile service;

c) that in Resolution 407 WARC-79 also urged administrations to ensure that stations of services other than the aeronautical mobile (R) service refrained, except under specified conditions, from using frequencies in the bands allocated to this service, which is a safety service;

urges administrations

1. to comply with the provisions laid down in Resolutions 309 and 407 of WARC-79;

2. to ensure that stations of services defined by the Radio Regulations refrain from using the frequency bands which will remain for the time being allocated to other services under these Regulations;

3. to participate in the monitoring programmes which the IFRB will organize pursuant to Resolution 309 of WARC-79 and the present Resolution;

instructs the IFRB

to take the necessary steps to remove from the HF bands emissions by stations operating outside bands allocated to the services to which they belong, except in the case referred to in operative paragraph 2 of this Resolution;

instructs the Secretary-General

to collect all the available information on out-of-band emissions and to inform the Administrative Council annually of the results achieved in the application of this Resolution.

INTERNATIONAL TELECOMMUNICATION UNION

BLUE PAGES

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 154(Rev.1)-E
2 February 1984

B.3(Rev.1)

PLENARY MEETING

THIRD SERIES OF TEXTS SUBMITTED BY THE
EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for first reading :

Source	Document	Title
COM.4	146	Chapter 3.2.1.4 Chapter 3.4
COM.4	139	Chapter 3.9.2

Marie HUET
Chairman of Committee 6

Annex : 4 pages

3.2.1.4 Optimum frequency band selection

The optimum frequency band for a high frequency broadcasting service is that which has the highest median value of radio-frequency signal-to-noise ratio at the test points in the intended service area.

The optimum combination of bands, if needed by the planning method, is that which gives the highest value of basic broadcast reliability in the intended service area.

3.4 Values of minimum usable and reference usable field strength

3.4.1 Minimum usable field strength

The minimum usable field strength shall be determined numerically by using the atmospheric noise data, man-made noise data, or the intrinsic receiver noise level, and by adding to it the value of the required radio-frequency signal-to-noise ratio.

3.4.1.1 Atmospheric radio noise data

See 3.2.2.1.

3.4.1.2 Man-made radio noise data

See 3.2.2.2.

3.4.1.3 Intrinsic receiver noise level

The intrinsic receiver noise level E_i^o shall be calculated by :

$$E_i^o \text{ (dB (µV/m))} = E_c \text{ (dB (µV/m))} + 20 \log m - \text{SNR (dB)}$$

where E_c = noise limited sensitivity of the receiver = 40 dB(µV/m)

m = modulation depth = 0.3

SNR = audio-frequency signal-to-noise ratio = 26 dB.

For these conditions : E_i^o = 3.5 dB(µV/m).

3.4.1.4 Comparison of the intrinsic receiver noise level, the atmospheric and man-made radio noise

In each case the values of atmospheric noise, man-made noise and intrinsic receiver noise intensities shall be compared and the greatest one shall be used.

3.4.1.5 Audio-frequency signal/noise ratio

For planning purposes, the value of the audio-frequency signal/noise ratio shall be 24 dB.

3.4.1.6 Radio-frequency signal/noise ratio

The required radio-frequency (input) signal-to-noise ratio is approximately 10 dB greater than the required audio-frequency (output) signal-to-noise ratio for the reference receiver (IF bandwidth 4 kHz) with 30% modulation of the received signal under stable propagation conditions. The basis for the establishment of this ratio is such that it is not appropriate to consider variability in time.

In these conditions, for planning purposes, the value of the radio frequency signal/noise ratio shall be 34 dB.

3.4.2 Reference usable field strength

The reference usable field strength shall be $E_{ref} = E_{min} + 3$ dB.

3.9.2 Progressive introduction of SSB transmissions (Technical aspects)

3.9.2.1 Transmitters

It should be recognized that :

a) converting an existing DSB transmitter to an SSB transmitter which delivers equivalent sideband power with 6 dB carrier reduction is technically not possible;

b) it is economically unattractive to convert existing conventional DSB transmitters for operation to SSB mode with 6 dB carrier reduction even if 3 dB less sideband power is accepted;

c) it is possible and feasible to convert unconventional DSB transmitters of recent design (using amplitude modulation systems such as pulse duration or pulse switch modulation) to SSB mode with 6 dB carrier reduction and the same sideband power as in DSB mode without significant loss of efficiency;

d) from the technical point of view conventional DSB transmitters can, in some cases, also be converted to SSB mode with 12 dB carrier reduction and can provide the necessary equivalent sideband power. Whether the conversion is economically attractive will depend on the type and age of the transmitter concerned;

[e) the technical and/or economical lifetime of a transmitter can be estimated at twenty years.]

3.9.2.2 Receivers

It should be recognized that :

a) current technological progress will make it possible within the next ten years to mass-produce DSB/SSB receivers at a reasonable price;

b) during the transition period it would be useful to have SSB receivers offering selection of either the upper or the lower sideband of a DSB transmission, in order to reject adjacent channel interference;

[c) the technical and economical lifetime of a receiver is considered to be in the order of ten years;]

d) envelope detection should be abandoned as soon as possible and synchronous demodulation be introduced.

[3.9.2.3 Transition period from technical point of view

Taking into account the lifetime of transmitters and receivers the duration of the transition period could be set at [15 to 20] years.]

3.9.2.4 Evaluation of compatibility aspects of the proposed SSB system during the transition period

During the transition period, SSB transmissions will be mainly received by conventional DSB receivers using envelope detection. To obtain with a conventional DSB receiver using envelope detection the same loudness level with both SSB and DSB, the sideband power of the SSB emission has to be 3 dB higher (equivalent sideband power) than the total sideband power of the DSB emission. Alternatively, if the sideband power of the SSB emission cannot be increased, one has to accept some reduction of the coverage area. Such an SSB emission, however, could replace any of the DSB emissions in the Plan without the interference situation deteriorating.

SSB emissions with equivalent sideband power replacing a DSB emission according to the Plan will cause a slight increase in adjacent channel interference (e.g. at ± 10 kHz channel spacing the relative RF-protection ratio would be changed by 3 dB from -36 dB to -33 dB) if reception is in the adjacent channels with a conventional DSB receiver having the selectivity of the DSB reference receiver (see paragraph 3.9.1.13).

In paragraph 3.9.1.13, a 3 dB allowance for co-channel interference between a DSB emission and an SSB emission with equivalent sideband power has been specified. Recent investigation shows, however, that taking into account the effect of coherent demodulation of the two sidebands of a DSB emission in an envelope detector, this allowance may be 0 dB. Further study will be needed on this question during the inter-sessional period.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 154-E
31 January 1984

B.3

PLENARY MEETING

FOURTH SERIES OF TEXTS SUBMITTED BY THE
EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for first reading :

Source	Document	Title
COM.4	146	Chapter 3.2.1.4 Chapter 3.4
COM.4	139	Chapter 3.9.2

Marie HUET
Chairman of Committee 6

Annex : 4 pages

3.2.1.4 Optimum frequency band selection

The optimum frequency band for a high frequency broadcasting service is that which has the highest median value of radio-frequency signal-to-noise ratio at the test points in the intended service area.

The optimum combination of bands, if needed by the planning method, is that combination which has the highest value of basic broadcast reliability in the intended service area.

ANNEX 2

3.4 Values of minimum usable and reference usable field strength

3.4.1 Minimum usable field strength

The minimum usable field strength shall be determined numerically by using the atmospheric noise data, man-made noise data, or the intrinsic receiver noise level, and by adding to it the value of the required radio-frequency signal-to-noise ratio.

3.4.1.1 Atmospheric radio noise data

See 3.2.2.1.

3.4.1.2 Man-made radio noise data

See 3.2.2.2.

3.4.1.3 Intrinsic receiver noise level

The intrinsic receiver noise level E_i^o shall be calculated by :

$$E_i^o \text{ (dB } (\mu V/m)) = E_c \text{ (dB } (\mu V/m)) + 20 \log m - SNR \text{ (dB)}$$

where E_c = noise limited sensitivity of the receiver = [ ]

m = modulation depth = 0.3

SNR = audio-frequency signal-to-noise ratio (dB) = [ ]

3.4.1.4 Comparison of the intrinsic receiver noise level, the atmospheric and man-made radio noise

In each case the values of atmospheric noise, man-made noise and intrinsic receiver noise intensities shall be compared and the greatest one shall be used.

3.4.1.5 Audio-frequency signal/noise ratio

[Pending on decision of Committee 4.]

3.4.1.6 Radio-frequency signal/noise ratio

The required radio-frequency (input) signal-to-noise ratio is approximately 10 dB greater than the required audio-frequency (output) signal-to-noise ratio for the reference receiver (IF bandwidth 4 kHz) with 30% modulation of the received signal under stable propagation conditions. The basis for the establishment of this ratio is such that it is not appropriate to consider variability in time.

3.4.2 Reference usable field strength

The reference usable field strength shall be [ ].

ANNEX

3.9.2 Progressive introduction of SSB transmissions (Technical aspects)

3.9.2.1 Transmitters

It should be recognized that :

a) converting an existing DSB transmitter to an SSB transmitter which delivers equivalent sideband power with 6 dB carrier reduction is technically not possible;

b) it is economically unattractive to convert existing conventional DSB transmitters for operation to SSB mode with 6 dB carrier reduction even if 3 dB less sideband power is accepted;

c) it is possible and feasible to convert unconventional DSB transmitters of recent design (using amplitude modulation systems such as pulse duration or pulse switch modulation) to SSB mode with 6 dB carrier reduction and the same sideband power as in DSB mode without significant loss of efficiency;

d) from the technical point of view conventional DSB transmitters can, in some cases, also be converted to SSB mode with 12 dB carrier reduction and can provide the necessary equivalent sideband power. Whether the conversion is economically attractive will depend on the type and age of the transmitter concerned;

[e) the technical and/or economical lifetime of a transmitter can be estimated at twenty years.]

3.9.2.2 Receivers

It should be recognized that :

a) current technological progress will make it possible within the next ten years to mass-produce DSB/SSB receivers at a reasonable price;

b) during the transition period it would be useful to have SSB receivers offering selection of either the upper or the lower sideband of a DSB transmission, in order to reject adjacent channel interference;

[c) the technical and economical lifetime of a receiver is considered to be in the order of ten years;]

d) envelope detection should be abandoned as soon as possible and synchronous demodulation be introduced.

[3.9.2.3 Transition period from technical point of view

Taking into account the lifetime of transmitters and receivers the duration of the transition period could be set at [15 to 20] years.]

3.9.2.4 Evaluation of compatibility aspects of the proposed SSB system during the transition period

During the transition period, SSB transmissions will be mainly received by conventional DSB receivers using envelope detection. To obtain with a conventional DSB receiver using envelope detection the same loudness level with both SSB and DSB, the sideband power of the SSB emission has to be 3 dB higher (equivalent sideband power) than the total sideband power of the DSB emission. Alternatively, if the sideband power of the SSB emission cannot be increased, one has to accept some reduction of the coverage area. Such an SSB emission, however, could replace any of the DSB emissions in the Plan without the interference situation deteriorating.

SSB emissions with equivalent sideband power replacing a DSB emission according to the Plan will cause a slight increase in adjacent channel interference (e.g. at ± 10 kHz channel spacing the relative RF-protection ratio would be changed by 3 dB from -36 dB to -33 dB) if reception is in the adjacent channels with a conventional DSB receiver having the selectivity of the DSB reference receiver (see paragraph 3.9.1.13).

In paragraph 3.9.1.13, a 3 dB allowance for co-channel interference between a DSB emission and an SSB emission with equivalent sideband power has been specified. Recent investigation shows, however, that taking into account the effect of coherent demodulation of the two sidebands of a DSB emission in an envelope detector, this allowance may be 0 dB. Further study will be needed on this question during the inter-sessional period.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Corrigendum 1 to
Document 155-E
2 February 1984
Original : English

COMMITTEE 6

Note by Committee 4 to the Editorial Committee

(This corrigendum affects only the Spanish text).

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 155-E
31 January 1984
Original : English

COMMITTEE 6

Note by Committee 4 to the Editorial Committee

1) According to the decision taken by the Plenary Meeting on 26 January 1984, Committee 4 reconsidered paragraphs 3.1.1.2, 3.1.2 and 3.1.3 contained in Document 115(Rev.1) (page B.1/6(Rev.1)) under Chapter 3.1 (DSB system specifications).

The following revised texts are to replace existing texts and are sent to the Editorial Committee for submission to the Plenary Meeting for approval.

"3.1.1.2 Necessary bandwidth

The necessary bandwidth shall not exceed 9 kHz."

"3.1.2 Channel spacing

Channel spacing for double sideband (DSB) shall be 10 kHz.

In the interest of spectrum conservation, it is also permissible to interleave double sideband transmissions midway between two adjacent channels, i.e. with 5 kHz separation between carrier frequencies, provided that the interleaved transmission is not to the same geographical area as either of the transmissions between which it is interleaved.*

* Note - For SSB emissions see section 3.9.1.4."

"3.1.3 Nominal carrier frequencies

Carrier frequencies shall be integral multiples of 5 kHz."

2. In addition to the above, Committee 4 reconsidered paragraphs 3.9.1.2 and 3.9.1.4 contained in Document 137 (page B.2/12) under Chapter 3.9.1 (SSB system specification).

The following revised texts are sent to the Editorial Committee for submission to the Plenary Meeting for approval.

"3.9.1.2 Necessary bandwidth

The necessary bandwidth shall not exceed 4.5 kHz."

"3.9.1.4 Channel spacing

During the transition period, the channel spacing for SSB shall be 10 kHz. In the interest of spectrum conservation, during the transition period, it is also permissible to interleave SSB transmissions midway between two DSB channels, i.e., with 5 kHz separation between carrier frequencies, provided that the interleaved transmission is not to the same geographical area as either of the transmissions between which it is interleaved (see also section 3.1.2).*

After the end of the transition period the channel spacing and carrier frequency separation shall be 5 kHz.

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* Note - In this case the channel spacing remains 10 kHz."

J. RUTKOWSKI
Chairman of Committee 4

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 156-E
6 February 1984
Original : English

COMMITTEES 4 and 5

SUMMARY RECORD

OF THE

FIRST JOINT MEETING OF

COMMITTEE 4 (TECHNICAL CRITERIA) AND

COMMITTEE 5 (PLANNING)

Wednesday, 1 February 1984, at 1400 hrs

Chairman : Mr. J. RUTKOWSKI (People's Republic of Poland)

Subjects discussed :	Document
1. Definitions relating to coverage and service areas	DL/18, DT/20

1. Definitions relating to coverage and service areas (Documents DL/18 and DT/20)

1.1 The Chairman said that the purpose of the joint meeting was to agree upon three definitions. Committee 4 had already agreed upon the definition of coverage area and service area as set out in Document DL/18; however, the definition of required service area had not yet been agreed and he called for comments on the versions in Documents DL/18 and DT/20, the latter put forward by Working Group 5A, and requested by the delegate of Algeria for consideration.

1.2 The delegate of France said that she had no objection to the definition of coverage area but wondered if it were really necessary. The definition of service area was not suitable for the broadcasting service, and she also wondered whether that definition was really needed.

1.3 The delegate of India pointed out that the definitions had already been discussed at previous conferences. They were not new but had been taken from the appropriate CCIR Recommendations. It was difficult at the present stage to foresee all the possibilities that could arise, and it would therefore be safer to retain the definitions so that they could be used if necessary. However, he was prepared to endorse any decision taken by the meeting.

1.4 The Chairman of the IFRB recalled that he had already in Committee 5 raised the question of the service area to be used for planning. He took it that it was the required service area, but the relationship between that area and the service area and between the service area and the coverage area needed to be defined. If the three definitions were retained, an indication of the relationships between each area and how they were to be used in the planning process would be necessary.

1.5 The delegate of the United Kingdom said that there seemed little point in developing a definition just in case it might be needed. It might be left to the second session of the Conference to agree upon the definitions, unless they were needed for intersessional work.

1.6 The Chairman of the IFRB, in connection with possible uses of definitions in other plans, recalled that in the satellite broadcasting plan it had been necessary to define the coverage area as the area covered by the satellite. Within that coverage area a service area had been defined as one in which an administration might request a certain degree of protection. In that planning example there was a relationship between the coverage area and the service area, and it was necessary to define both terms.

In the case of HF broadcasting there was a need to define what administrations must provide as a required service area. However, if a definition of service area were to be provided as well, did that mean that the service area was only a small portion of the required service area in which the planning process should make it possible to ensure the quality of service adopted by the Conference?

Moreover, should it be taken that the required service area must necessarily be within the coverage area? That type of relationship was not covered by the definitions. As far as the Board was concerned, only the third definition was essential. The others were not included in any of the planning processes.

1.7 The delegate of Switzerland proposed that in view of the standpoint of the IFRB the meeting should take a decision on the third definition alone.

1.8 Following a proposal by the delegate of Algeria, the Chairman suggested that the definitions of coverage area and service area not be included in the report of the first session to the second session, but that a note be included to the effect that the second session might wish to adopt such definitions. The meeting could then concentrate on the definition of required service area.

It was so agreed.

1.9 The Chairman drew attention to the definitions of required service area in Document DL/18 and in Document DT/20 (put forward by Working Group 5A).

1.10 The delegate of Algeria explained that the words "and the technical criteria" in DT/20 had been placed in square brackets because the delegate of Guyana and others had expressed doubts that countries with modest means might be unable to comply with the technical criteria adopted by the Conference, which they feared might be mandatory for administrations. That fear would be dispelled if an appropriate decision on proportionately reduced protection were to be taken.

1.11 The delegate of the Islamic Republic of Iran, in reply to the Chairman who had asked whether an administration had the right to ask for quality of service based on the technical criteria adopted, said that under the definition in DT/20 it did have that right.

1.12 In reply to a query by the delegate of Spain as to the reason for the French reservation on the definition in DT/20, the delegate of France replied that she was unable to understand how a service could conform to a method. The definition might be more comprehensible if it read "taking the planning method into consideration" rather than "conforming to the planning method".

1.13 The delegate of Spain then enquired whether it was intended that the request to operate a broadcasting service or the service itself should conform to the planning method.

1.14 The delegate of Algeria said that it was the request that should conform to the planning method. However, if the principle were decided the right wording could easily be found.

1.15 The delegate of the USSR said he would prefer the definition in Document DL/18.

1.16 The delegate of the United Kingdom, supported by the delegate of Brazil, said that the difficulty arose from the inclusion of procedural elements in a definition. The main point was that the request should conform to whatever was eventually agreed upon by the Conference. He therefore suggested the following wording :

> "The area within which an administration proposes to operate a broadcasting service when submitting a requirement in accordance with the provisions to be determined by the Conference".

1.17 The Chairman, summing up, said that two points of view seemed to be emerging : one in favour of a slight change in the text as it appeared in Document DT/20, in which case only a decision concerning the square brackets was required, and the other in the form of the revised definition proposed by the delegate of the United Kingdom and supported by Brazil.

1.18 The delegate of the United Kingdom explained that the purpose of that proposal was to relegate all the elements which had caused difficulties to a general statement about matters that would be associated with a requirement when it was submitted. It also recognized that what was wanted might subsequently undergo some metamorphosis.

1.19 The delegate of the Islamic Republic of Iran thought that the United Kingdom proposal was too vague, and that the word "request" would be better than "propose".

1.20 The delegate of Malawi said that his delegation would earlier have agreed fully with the United Kingdom that the problem arose out of confusing definitions with procedures. However, having heard the revised proposal and subsequent explanation by the delegate of the United Kingdom, the Malawi delegation preferred to revert to the United Kingdom's original contribution based on Document DT/20 and say simply :

> "The area within which an administration requests to operate a broadcasting service".

It would thus be assumed that once a request had been made, there would be a procedure laid down elsewhere.

1.21 The delegates of Argentina, Botswana, Chile, Mexico, Portugal, Switzerland, the United Kingdom, the United States, the USSR and Venezuela supported that proposal. In addition, the delegate of Botswana, supported by the delegate of the USSR, suggested that the word "requests" be replaced by "proposes", and the delegate of the United States suggested that the word "operate" be replaced by the word "provide".

1.22 The Vice-Chairman of the IFRB, replying to a query raised by the delegate of Algeria, said that the IFRB had no trouble with the proposed definition including the words either "operate" or "provide".

1.23 The delegate of the Islamic Republic of Iran expressed concern about leaving so many aspects, such as fulfilment of the necessary criteria, to the IFRB. His delegation would accept the very general definition if the IFRB was satisfied with it, but felt that the necessary details were being avoided.

1.24 The delegate of Malawi said that his proposal had not, as implied, been intended to sidestep the issues. Definitions should as far as possible remain definitions and not be confused with procedures. Furthermore, his delegation had every intention of participating fully in working out the details.

1.25 The delegate of the United Kingdom said that the phrase "requests to operate" was not correct from a linguistic point of view and that "proposes to provide" would be more appropriate. It did not, moreover, imply any sense of compulsion as in the word "requires" proposed by the delegate of Syria.

The Committee decided to adopt the wording "The area within which an administration proposes to provide a broadcasting service.".

It also decided after considerable discussion to leave it to the Editorial Committee to bring the other language versions into line with the English text.

The meeting rose at 1535 hours.

The Secretaries :	The Chairman :
G. KOVACS	J. RUTKOWSKI
G. ROSSI	
J. DA SILVA	

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Corrigendum 2 to
Document 157-E
3 February 1984

Corr.2 to R.2

PLENARY MEETING

SECOND SERIES OF TEXTS SUBMITTED BY THE
EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for second reading :

Source	Document	Title
COM.6	B.2/137	Point : 3.2.1*
COM.4	Add.2 to Document 126	

Note by the Editorial Committee

Replace page R.2/1 by the following.

* Committee 4 has added a text to paragraph 3.2.1.1. The passage in question is indicated by a double vertical line in the margin and should receive a second reading.

Marie HUET
Chairman of Committee 6

Annex : 1 page

3.2 Propagation, radio noises and solar index

3.2.1 The method to be used to determine the sky-wave field strength for HF broadcast planning purposes

3.2.1.1 Introduction

The field strength prediction method is in two parts : for ranges up to 7,000 km and for ranges beyond 9,000 km. In the interval 7,000 to 9,000 km an interpolation procedure is used.

Owing to the diurnal variations in ionospheric conditions, predictions shall be made at different times of day at intervals not exceeding one hour.

3.2.1.2 Ionospheric parameters

Values of selected ionospheric parameters (foE, foF2 and M(3000)F2) are needed together with the derived parameters (E-layer basic MUF and F-layer basic MUF) in order to determine the field strength of sky-wave modes reflected from the ionosphere. For total path lengths between 0 and 4,000 km, the basic MUF of an E mode is predicted. For all path lengths the basic MUF for the F2 mode is predicted. Where appropriate the higher of the two values gives the basic MUF for the path.

The vertical radiation angle is also needed in the calculation of sky-wave field strength. The vertical radiation angle is used to determine the appropriate mode of propagation and is also used in conjunction with the antenna gain to determine the proper field strength.

The transmitting antennas in use will have gains which vary with the vertical radiation angle and some antennas, intended for shorter distance broadcasting, radiate very poorly at low angles. It is important to associate the antenna gain at the appropriate radiation angle with the propagation prediction for that particular mode.

3.2.1.2.1 E-layer parameters

3.2.1.2.1.1 E-layer data

For paths up to 2,000 km foE is evaluated at the path mid-point. For ranges greater than 2,000 km foE is evaluated at two control points, each 1,000 km along the path from the transmitter and receiver respectively. At these points the solar zenith angle X, in degrees, is determined, then :

$$foE = 0.9 \left[(180 + 1.44 R_{12}) \cos \chi' \right]^{0.25} \quad \text{MHz}$$

where :

$$\chi' = \chi \text{ for } 0 \leq \chi \leq 80$$

$$\chi' = 90 - \frac{e^{0.13(116 - \chi)}}{10.8} \text{ for } 80 < \chi < 116$$

$$\chi' = 89.907 \text{ for } \chi \geq 116$$

R_{12} is the 12 month running mean sunspot number.

PINK PAGES

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Corrigendum 1 to
Document 157-E
1 February 1984

Corr.1 to R.2

PLENARY MEETING

SECOND SERIES OF TEXTS SUBMITTED BY THE
EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for second reading :

Source	Document	Title
COM.6	B.2/137	Points : 3.9
		3.9.1
		3.9.1.1
COM.4	155	3.9.1.2*
COM.6	B.2/137	3.9.1.3
COM.4	155	3.9.1.4*

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* Note by the Editorial Committee

Replace page R.2/12 by the following :

Committee 4 has revised these points in accordance with decisions taken by the Plenary Meeting. The passages in question are indicated by a double vertical line in the margin and should receive a second reading.

Marie HUET
Chairman of Committee 6

Annex : three pages

3.9 Specifications and progressive introduction of an SSB system

Considering the advantages of SSB transmission, such as :

- a more efficient utilization of the frequency spectrum by a reduction of interference;
- the capability of improving the required protection ratio between adjacent channels in the case of a sufficient carrier reduction;
- the capability of improving the quality of reception, in particular under poor propagation conditions (selective fading), with SSB receivers;
- the possibility of producing the same sideband power as a current DSB transmitter with less capital and operational costs,

the Conference adopted the following SSB system specifications under the assumption of a progressive introduction of receivers with synchronous demodulation. With respect to a necessary transition period from DSB to SSB, some consideration must also be given to the reception of SSB signals with reduced carrier by receivers with envelope detection. At the end of the transition, all the advantages of SSB transmissions mentioned above could then be realized.

3.9.1 SSB system specifications

3.9.1.1 Audio-frequency bandwidth

The upper limit of the audio-frequency bandwidth of the transmitter shall not exceed 4.5 kHz with a further slope of attenuation of 35 dB/kHz and the lower limit shall be 150 Hz with lower frequencies attenuated at a slope of 6 dB per octave.

3.9.1.2 Necessary bandwidth

The necessary bandwidth shall not exceed 4.5 kHz.

3.9.1.3 Characteristics of modulation processing

The audio-frequency signal shall be processed so that the modulating signal retains a dynamic range of not less than 20 dB. Excessive amplitude compression, together with improper peak limitation, leads to excessive out-of-band radiation and thus to adjacent channel interference, and is therefore to be avoided.

3.9.1.4 Channel spacing

During the transition period, the channel spacing for SSB shall be 10 kHz. In the interest of spectrum conservation, during the transition period, it is also permissible to interleave SSB transmissions midway between two adjacent DSB channels, i.e., with 5 kHz separation between carrier frequencies, provided that the interleaved transmission is not to the same geographical area as either of the transmissions between which it is interleaved (see also section 3.1.2).*

After the end of the transition period the channel spacing and carrier frequency separation shall be 5 kHz.

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* In this case the channel spacing remains 10 kHz.

INTERNATIONAL TELECOMMUNICATION UNION

PINK PAGES

WARC FOR HF BROADCASTING

Document 157-E
31 January 1984

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

PLENARY MEETING

R.2

SECOND SERIES OF TEXTS SUBMITTED BY THE
EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for second reading :

Source	Document	Title
COM.6	B.2/137	Paragraphs : 3.2.1 3.2.3.3 3.9 3.9.1 3.10

Marie HUET
Chairman of Committee 6

Annex : 16 pages

3.2.1. <u>The method to be used to determine the sky-wave field strength for HF broadcast planning purposes</u>

3.2.1.1 <u>Introduction</u>

The field strength prediction method is in two parts : for ranges up to 7,000 km and for ranges beyond 9,000 km. In the interval 7,000 to 9,000 km an interpolation procedure is used.

3.2.1.2 <u>Ionospheric parameters</u>

Values of selected ionospheric parameters (foE, foF2 and M(3000)F2) are needed together with the derived parameters (E-layer basic MUF and F-layer basic MUF) in order to determine the field strength of sky-wave modes reflected from the ionosphere. For total path lengths between 0 and 4,000 km, the basic MUF of an E mode is predicted. For all path lengths the basic MUF for the F2 mode is predicted. Where appropriate the higher of the two values gives the basic MUF for the path.

The vertical radiation angle is also needed in the calculation of sky-wave field strength. The vertical radiation angle is used to determine the appropriate mode of propagation and is also used in conjunction with the antenna gain to determine the proper field strength.

The transmitting antennas in use will have gains which vary with the vertical radiation angle and some antennas, intended for shorter distance broadcasting, radiate very poorly at low angles. It is important to associate the antenna gain at the appropriate radiation angle with the propagation prediction for that particular mode.

3.2.1.2.1 <u>E-layer parameters</u>

3.2.1.2.1.1 <u>E-layer data</u>

For paths up to 2,000 km foE is evaluated at the path mid-point. For ranges greater than 2,000 km foE is evaluated at two control points, each 1,000 km along the path from the transmitter and receiver respectively. At these points the solar zenith angle X, in degrees, is determined, then :

$$foE = 0.9\left[(180 + 1.44R_{12})\cos\chi'\right]^{0.25} \quad \text{MHz}$$

where : $\chi' = \chi$ for $0 \leq \chi \leq 80$

$$\chi' = 90 - \frac{e^{0.13(116-\chi)}}{10.8} \text{ for } 80 < \chi < 116$$

$$\chi' = 89.907 \text{ for } \chi \geq 116$$

R_{12} is the 12 month running mean sunspot number.

3.2.1.2.1.2 E-layer basic MUF prediction (E(D) MUF)

The foE value at the mid-point of the path (for paths up to 2,000 km) or the lower of the foE values at the two control points (for paths longer than 2,000 km) is taken for the computation of the E-layer basic MUF.

The MUF for a path of length D is given as :

$$E(D)MUF = foE. \sec i_{110}$$

With i_{110} = angle of incidence at a height of 110 km evaluated in accordance with CCIR Report 252.

3.2.1.2.1.3 E-layer screening frequency (f_s)

The foE value at the middle point of the path (for paths up to 2,000 km), or the higher of the foE values at the two control points 1,000 km from each end of the path (for paths longer than 2,000 km), is taken for calculation of the E-layer screening frequency.

$$f_s = 1.05 \text{ foE} \sec \varphi_s$$

in which $\varphi_s = \arc\sin \left[\frac{R \quad \cos\Delta_F}{R \quad + 110} \right]$

R is the radius of the Earth, (6,371 km),

Δ_F is the vertical radiation angle for F2-layer mode (see section 3.2.1.2.3)

3.2.1.2.2 F-layer parameters

3.2.1.2.2.1 F2-layer data

Numerical maps of the parameters foF2 and M(3000)F2, for solar index values R_{12} = 0 and 100 and for each month are presented in CCIR Report 340. This prediction method uses the Oslo coefficients to determine the values of foF2 and M(3000)F2 for the required locations and times. It may be desirable to calculate in advance the values of these parameters at specific grid intervals of latitude, longitude and times and to use an interpolation procedure to obtain values for the required location and time between appropriate grid points. The use of a grid may be appropriate for other ionospheric parameters as well.

3.2.1.2.2.2 F2-layer basic MUF prediction (F2(D)MUF)

3.2.1.2.2.2.1 For paths up to 4,000 km

The F2-layer basic MUF is calculated from

$$F2(ZERO)MUF = foF2 + f_H/2$$

$$F2(4000)MUF = 1.1 \text{ foF2.M(3000)F2}$$

where f_H is the electron gyro-frequency given in terms of parameters of the Earth's magnetic field. A numerical representation is available in Report 340 of the CCIR.

At the midpoint of the great-circle path between the transmitter and receiver determine the above values for the solar index values $R_{12} = 0$ and $R_{12} = 100$. Interpolate or extrapolate linearly for required index values between $R_{12} = 0$ and 150. For higher sunspot activity use $R_{12} = 150$.

Interpolate for the length of the path using the relationship :

$$F2(D)MUF = F2(ZERO)MUF + \left[F2(4000)MUF - F2(ZERO)MUF\right] \cdot M(D)$$

where $M(D) = 1.64 \cdot 10^{-7}D^2$ for $0 \leq D < 800$ and

$$M(D) = 1.26 \cdot 10^{-14}D^4 - 1.3 \cdot 10^{-10}D^3 + 4.1 \cdot 10^{-7}D^2 - 1.2 \cdot 10^{-4}D$$

for $800 \leq D \leq 4000$.

where D is in km.

This gives the median F2-layer basic MUF.

3.2.1.2.2.2.2 For paths longer than 4,000 km

For these paths (which may be the longer great-circle path), control points are taken at 2,000 km from each end of the path. At these points, values of F2(4000)MUF, interpolating for sunspot number, are determined and the lower value is selected. This gives the median F2-layer basic MUF.

3.2.1.2.3 Vertical radiation angle

The radiation angle is taken into account in the prediction of field strength. It is given, approximately, by :

$$\Delta = \arctan\left(\cot\frac{d}{2R} - \frac{R}{R + h'}\operatorname{cosec}\frac{d}{2R}\right)$$

where d = hop length of an n hop mode given by $d = \frac{D}{n}$

h' = 110 km for the E-layer or h' is as given in 3.2.1.3.1.1 for the F2-layer.

In the method for shorter path lengths (section 3.2.1.3.1) the radiation angles calculated are used in the determination of antenna gain. For the longer path lengths the appropriate procedure is described in section 3.2.1.3.2.

3.2.1.3 The prediction of the median field strength

3.2.1.3.1 Method for path lengths of 0 to 7,000 km

CCIR Report 252-2 details the geometrical considerations, the reflection areas used and the method of performing ray-path calculations.

The procedure is based on the ray-path geometry with mirror reflections in the ionosphere. The method determines the field strengths of the two strongest modes propagated via the F2 region and the strongest mode propagated via the E region. The resultant field strength from these modes is obtained by power addition. In circumstances where a low-order F2 mode is screened by the E-layer, as determined in the ray-path calculations, or where an antenna is specified which only radiates sufficiently at high angles, the next higher-order mode must be considered.

It is recognized that multi-hop E region propagation suffers substantial absorption losses and E modes are not considered at ranges beyond 4,000 km.

The appropriate procedure for incorporating these concepts into a computer program is as follows.

3.2.1.3.1.1 For the path length, d(km), determine the minimum number of hops for an F2 region mode. This is given approximately as ((the integer part of d ÷ 4,000) + 1) or better, by calculating the ray-path geometry using the height hpF2 given by :

$$hpF2 = \frac{1490}{M(3000)F2} - 176 \quad \text{km}$$

The equivalent reflection height h', which is a function of time, location and path length, is used for the ray-path calculations for F2-modes. It is given by :

$$h' = 358 - (11 - 100a)\left(18.8 - \frac{320}{x^5}\right) + ad\left(0.03 + \frac{14}{x^4}\right) \quad \text{km}$$

or 500 km, whichever is the smaller,

a = 0.04 or (1/M(3000)F2) - 0.24, whichever is the larger and

x = foF2/foE, determined at the control point with the lowest value of foF2, or 2, whichever is the larger.

3.2.1.3.1.2 For the given mode, determine the vertical radiation angle from section 3.2.1.2.3 and then determine the transmitting antenna gain G_t at that angle and the appropriate azimuth, relative to an isotropic antenna.

3.2.1.3.1.3 Compute the median field strength for that mode using the formula :

$$E_{ts} = 136.6 + P_t + G_t + 20 \log f - L_{bf} - L_i - L_m - L_g - L_h - 12.2^* \quad \text{dB}(\mu V/m)$$

where f is the transmitting frequency in MHz and P_t is the transmitter power in dB relative to 1 kW. L_{bf} is the basic free space transmission loss in dB, given by :

$$L_{bf} = 32.45 + 20 \log f + 20 \log P'$$

where P' is the virtual slant range in km

$$P' = \left[2R \sum_{n} \frac{\sin \frac{d}{2R}}{\cos\left(\Delta + \frac{d}{2R}\right)}\right]$$

*/ This term contains those effects of sky-wave propagation not otherwise included in this fast simple method. A value of 12.2 dB is recommended on the basis of the data available. It is noted, however, that the value may need to be changed by those implementing this procedure to take account of additional calibrated data which become available./

/ It should also be taken into account that an improved result may be obtained by using a term which varies with distance or geographical area./

L_i is the absorption loss in dB given in CCIR Report 252-2. It is determined for each hop and the results are added. For frequencies above the basic MUF, it continues to vary with frequency and is calculated assuming ray paths similar to those at the MUF.

L_m is the "above-the-MUF" loss. For frequencies, f, above the basic MUF (f_b) of a given mode :

$$L_m = 130 \left(\frac{f}{f_b} - 1 \right)^2 \quad \text{dB}$$

L_m is independent of the number of hops, but is limited to a value of 81 dB.

L_g is the ground reflection loss at intermediate reflection points. It is given as 2 dB for each intermediate ground reflection, i.e. :

for one-hop paths $L_g = 0$;

two-hop paths $L_g = 2$ dB;

three-hop paths $L_g = 4$ dB.

L_h is the factor to allow for auroral and other signal losses and is given in Tables /‾1 and 2/3.2.1_7 using the methods given in Report 252-2 to determine the local mean time, the geomagnetic latitude and the locations at which it is applied.

3.2.1.3.1.4 Repeat the procedure of 3.2.1.3.1.2 and 3.2.1.3.1.3 using successively higher order modes (increasing the number of hops by one each time) until the predicted mode field strength reaches a maximum. Select the two strongest F2 region modes, noting the field strength and radiation angles.

3.2.1.3.1.5 For the E region the lowest order mode is 1E for ranges 0 - 2,000 km and 2E for ranges 2,000 to 4,000 km. The E mode radiation angle and field strength are again obtained as in sections 3.2.1.2.3 and 3.2.1.3.1.3.

3.2.1.3.1.6 Repeat the E mode calculations for successively higher modes until a maximum is found.

3.2.1.3.1.7 The resultant of combining the field strengths of the two strongest F2 modes and the strongest E mode is obtained by calculating the square root of the sum of the squares of the numerical values of the field strengths.

3.2.1.3.2 Method for path lengths greater than 9,000 km

At long ranges, generally with low radiation angles, the method of prediction using geometric ray-hops is inadequate at present. The method used for long distances is based on an empirical fit of observations. In this method the antenna gain term, G_{tl}, is the greatest value of antenna gain in dBi which occurs in the range of vertical radiation angles from 0^0 to 8^0 at the appropriate azimuth.

TABLE /‾1/3.2.1_7

L_h for paths less than 2,500 km

GEOM LAT.	01-04LMT	04-07LMT	07-10LMT	10-13LMT	13-16LMT	16-19LMT	19-22LMT	22-01LMT
	WINTER (NOVEMBER, DECEMBER, JANUARY, FEBRUARY in the Northern Hemisphere) (MAY, JUNE, JULY, AUGUST in the Southern Hemisphere)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
45-50	0.1	0.3	0.6	0.0	0.1	0.1	0.3	0.1
50-55	0.6	0.8	1.6	0.1	0.3	0.6	1.0	0.3
55-60	1.5	2.1	4.4	0.7	0.8	2.2	2.5	1.3
60-65	4.8	8.2	10.5	2.7	1.6	5.7	7.3	5.2
65-70	6.7	11.0	13.5	3.0	1.7	5.8	8.6	6.0
70-75	5.7	7.9	10.7	1.7	0.9	3.6	4.1	4.0
75-80	2.5	5.0	7.1	0.9	0.3	1.9	2.3	2.0
	EQUINOX (MARCH, APRIL, SEPTEMBER, OCTOBER)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.0	0.1	0.2	0.1	0.1	0.3	0.2	0.1
45-50	0.4	0.4	0.9	0.6	0.4	1.3	0.9	0.8
50-55	1.0	1.0	2.7	1.8	1.2	2.7	2.1	2.1
55-60	2.0	3.0	6.2	3.7	2.6	4.5	4.0	5.0
60-65	4.7	5.0	12.0	7.5	5.6	7.8	9.0	11.8
65-70	6.8	11.6	19.6	8.8	6.3	7.8	10.3	14.6
70-75	4.9	11.7	20.0	6.2	3.3	4.9	7.7	9.5
75-80	2.0	7.5	9.2	3.9	1.6	3.0	4.2	4.1
	SUMMER (MAY, JUNE, JULY, AUGUST in the Northern Hemisphere) (NOVEMBER, DECEMBER, JANUARY, FEBRUARY in the Southern Hemisphere)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.1	0.1	0.0	0.1	0.1	0.2	0.1	0.0
45-50	0.5	0.4	0.5	0.4	0.5	1.1	1.0	0.4
50-55	1.3	1.1	1.4	1.0	1.1	3.0	2.9	0.7
55-60	2.9	2.4	3.0	2.6	2.9	5.8	5.8	1.8
60-65	6.0	4.1	6.0	5.3	4.3	8.4	7.6	4.3
65-70	6.0	4.6	7.3	5.0	4.2	7.2	8.8	5.0
70-75	3.7	3.8	5.0	3.5	3.2	4.8	6.0	3.4
75-80	2.4	2.8	3.1	2.7	2.3	3.8	4.3	2.1

TABLE /¯2/3.2.1_7

L_h for paths greater than 2,500 km

GEOM LAT.	01-04LMT	04-07LMT	7-10LMT	10-13LMT	13-16LMT	16-19LMT	19-22LMT	22-01LMT
	WINTER (NOVEMBER, DECEMBER, JANUARY, FEBUARY in the Northern Hemisphere) (MAY, JUNE, JULY, AUGUST in the Southern Hemisphere)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-50	0.1	0.1	0.1	0.0	0.1	0.1	0.2	0.2
50-55	0.4	0.4	0.2	0.0	0.4	0.4	0.9	0.8
55-60	1.1	1.8	0.9	0.2	1.2	1.4	2.0	2.3
60-65	3.3	6.2	2.6	1.3	2.6	3.4	3.6	7.6
65-70	5.5	6.4	4.1	2.0	4.1	3.6	4.4	9.9
70-75	3.9	4.6	3.3	1.3	4.0	2.2	3.1	8.0
75-80	2.2	3.2	1.9	0.7	2.7	1.2	1.2	2.9
	EQUINOX (MARCH, APRIL, SEPTEMBER, OCTOBER)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0
45-50	0.2	0.2	0.3	0.2	0.1	0.5	0.6	0.4
50-55	0.5	0.6	0.5	0.6	0.5	1.6	1.8	1.1
55-60	1.0	1.3	1.3	1.7	1.3	3.4	3.8	2.4
60-65	2.9	3.8	4.2	4.1	2.9	6.3	8.4	7.3
65-70	4.3	5.6	6.4	5.1	4.4	6.3	9.2	9.3
70-75	3.0	4.7	5.0	3.0	2.4	3.4	5.4	4.8
75-80	1.3	1.9	2.2	0.8	0.8	0.8	1.2	1.1
	SUMMER (MAY, JUNE, JULY, AUGUST in the Northern Hemisphere) (NOVEMBER, DECEMBER, JANUARY, FEBRUARY in the Southern Hemisphere)							
00-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-45	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
45-50	0.5	0.3	0.4	0.2	0.4	0.1	0.6	0.5
50-55	1.1	1.1	1.1	0.6	1.2	0.4	1.9	1.3
55-60	2.5	2.9	2.6	1.1	2.5	1.2	3.8	2.9
60-65	4.9	7.5	6.2	2.2	3.8	2.6	5.2	5.0
65-70	5.0	7.8	6.1	2.3	3.8	2.7	4.8	5.0
70-75	3.2	5.4	3.4	1.5	2.2	0.9	2.6	3.2
75-80	2.0	4.3	1.5	1.1	0.8	0.1	0.9	1.4

The overall median field strength is given by :

$$E_{tl} = E_o \left[1 - \frac{(f_M+f_H)^2}{(f_M+f_H)^2 + (f_L+f_H)^2} \left(\frac{(f_L+f_H)^2}{(f+f_H)^2} + \frac{(f+f_H)^2}{(f_M+f_H)^2} \right) \right] - 36.4 + P_t + G_{tl} + G_{ap} - 0.8^* \quad dB(\mu V/m)$$

$E_o = 139.6 - 20 \log P'$, and the height used in the determination of P' is 300 km.

It is assumed within this procedure that there is a hypothetical ray path with a number of equal length hops, each less than 4,000 km.

G_{ap} is the increase in field strength due to focussing at long distances. In the case of propagation to very long distances with D, the great-circle distance between transmitter and receiver, greater than $\pi R/2$, this focussing is taken into account by means of the following formula :

$$G_{ap} = -20 \log \left(\left| 1 - \frac{n\pi R}{D} \right| \right) \quad dB$$

for

$$\left(\frac{2n-1}{2} \right) \pi R < D < \left(\frac{2n+1}{2} \right) \pi R \qquad \text{with } n = 1 \text{ and } 2.$$

As G_{ap} tends to infinity for $D = n\pi R$ it is limited arbitrarily to the value of 30 dB.

f_M is the upper limit frequency. It is determined separately for the first and last hops of the path and the lower value is taken.

$$f_M = K \cdot f_b \quad MHz$$

$$K = 1.2 + W \frac{f_b}{f_{b,noon}} + X \left(\sqrt[3]{\frac{f_{b,\,noon}}{f_b}} - 1 \right) + Y \left(\frac{f_{b,\,min}}{f_{b,\,noon}} \right)^2$$

f_b is the basic MUF determined by the method given in section 3.2.1.2.2.2.

$f_{b,\,noon}$ is the value of f_b for a time corresponding to local noon at the control point

$f_{b,\,min}$ is the lowest value of f_b for the hop which occurs during the 24 hours

W, X and Y are given in Table 3. The azimuth of the great-circle path is determined at the centre of the whole path and this angle is used for linear interpolation in angle between the east-west and north-south values.

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* /‾This term contains those effects of sky-wave propagation not otherwise included in the method. A value of 0.8 dB is recommended on the basis of the data available. It is noted however that this value may need to be changed by those implementing this procedure to take account of additional calibrated data which become available._7

/‾It should also be taken into account that an improved result may be obtained by using a term which varies with distance or geographical area._7

TABLE /‾3/3.2.1_7

Values W, X, Y used for the determination of the correction factor K

	W	X	Y
East-West	0.1	1.2	0.6
North-South	0.2	0.2	0.4

f_L is the lower limit frequency when the path is in daylight

$$f_L = \left(5.3 \cdot I \left[\frac{(1 + 0.009 R_{12}) \sum_{2N} \cos^{\frac{1}{2}} \chi}{\cos i_{90} \ln \left(\frac{9.5 \cdot 10^6}{P'}\right)} \right]^{\frac{1}{2}} - f_H\right) \cdot A_w \qquad \text{MHz}$$

In the summation, χ is determined for each traverse of the ray path through the height of 90 km.

when $\chi > 90^{\circ}$, $\cos^{\frac{1}{2}}\chi$ is taken as zero

i_{90} is the angle of incidence at a height of 90 km

I is given in Table 4.

A_w is a winter-anomaly factor determined at the path mid-point which is unity for geographic latitudes 0 to 30° and at 90° and reaches the maximum values given in Table /‾5/3.2.1_7 at 60°. The values at intermediate latitudes are found by linear interpolation.

As the path progressively becomes dark, the values of f_L are calculated until the time t_n when $f_L \leq 2f_{LN}$ where $f_{LN} = \sqrt{\frac{D}{3000}}$ (MHz). During the subsequent three hours f_L is calculated from $f_L = 2f_{LN}e^{-0.23t}$ where t is the time in hours after t_n. For the remainder of the night hours $f_L = f_{LN}$ until the time when the daylight equation gives a higher value.

TABLE [4/3.2.1]

Values of I used in the equation for f_L

Latitudes		Month											
Terminal 1	Terminal 2	J	F	M	A	M	J	J	A	S	O	N	D
>35°N	>35°N	1.1	1.05	1	1	1	1	1	1	1	1	1.05	1.1
>35°N	35°N-35°S	1.05	1.02	1	1	1	1	1	1	1	1	1.02	1.05
>35°N	>35°S	1.05	1.02	1	1	1.02	1.05	1.05	1.02	1	1	1.02	1.05
35°N-35°S	35°N-35°S	1	1	1	1	1	1	1	1	1	1	1	1
35°N-35°S	>35°S	1	1	1	1	1.02	1.05	1.05	1.02	1	1	1	1
>35°S	>35°S	1	1	1	1	1.05	1.1	1.1	1.05	1	1	1	1

TABLE [5/3.2.1]

Values of the winter-anomaly factor, A_w, at 60° geographical latitude used in the equation for f_L

Month

hemisphere	J	F	M	A	M	J	J	A	S	O	N	D
Northern	1.30	1.15	1.03	1	1	1	1	1	1	1.03	1.15	1.30
Southern	1	1	1	1.03	1.15	1.30	1.30	1.15	1.03	1	1	1

3.2.1.3.3 Method for path lengths between 7,000 and 9,000 km

In this range of distances, the field strengths E_{ts} and E_{tl} are determined by both of the above procedures and the resultant is found by appropriate mathematical interpolation. The interpolation procedure is given as :

$$E_{ti} = E_{ts} + \frac{D-7000}{2000}(E_{tl} - E_{ts}) \quad dB(\mu V/m)*$$

* [Taking account of the data that become available, those responsible for implementing this procedure may consider an alternative form for this interpolation.]

/̅ 3.2.3 Signal fading /̅

3.2.3.3 Calculation of fading allowances for different percentages of time

Fading allowances for other percentages of the time may be expressed, in terms of the decile deviation F_{90}, by the expression

$$F_x = c.\ F_{90}$$

where F_x is the deviation for x% of time.

Values of c for x in the range 50-90% are given in Table /̅ I/3.2.3.3 /̅

TABLE /̅ I/3.2.3.3 /̅

The parameter c

x(%)	c
50	0
60	0.18
70	0.36
80	0.63
90	1

3.9 Specifications and progressive introduction of an SSB system

Considering the advantages of SSB transmission, such as :

- a more efficient utilization of the frequency spectrum by a reduction of interference;
- the capability of improving the required protection ratio between adjacent channels in the case of a sufficient carrier reduction;
- the capability of improving the quality of reception, in particular under poor propagation conditions (selective fading), with SSB receivers;
- the possibility of producing the same sideband power as a current DSB transmitter with less capital and operational costs,

the Conference adopted the following SSB system specifications under the assumption of a progressive introduction of receivers with synchronous demodulation. With respect to a necessary transition period from DSB to SSB, some consideration must also be given to the reception of SSB signals with reduced carrier by receivers with envelope detection. At the end of the transition, all the advantages of SSB transmissions mentioned above could then be realized.

3.9.1 SSB system specifications

3.9.1.1 Audio-frequency bandwidth

The upper limit of the audio-frequency bandwidth of the transmitter shall not exceed 4.5 kHz with a further slope of attenuation of 35 dB/kHz and the lower limit shall be 150 Hz with lower frequencies attenuated at a slope of 6 dB per octave.

/̲ 3.9.1.2 Necessary bandwidth

New text to follow. _7

3.9.1.3 Characteristics of modulation processing

The audio-frequency signal shall be processed so that the modulating signal retains a dynamic range of not less than 20 dB. Excessive amplitude compression, together with improper peak limitation, leads to excessive out-of-band radiation and thus to adjacent channel interference, and is therefore to be avoided.

/̲ 3.9.1.4 Channel spacing

New text to follow. _7

3.9.1.5 Nominal carrier frequencies

Carrier frequencies for SSB shall be integral multiples of 5 kHz.

3.9.1.6 Sideband to be emitted

The upper sideband shall be used.

3.9.1.7 Suppression of the unwanted sideband

With respect to the relative RF protection ratio, the degree of suppression of the unwanted sideband (lower sideband) and of intermodulation products in that part of the transmitter spectrum shall be at least 35 dB relative to the wanted sideband signal level. Because of the large difference of signal amplitudes in adjacent channels in practice, however, a greater suppression is recommended (e.g. 50 dB in the exciter producing the SSB signal at low power level and 40 dB suppression of unwanted intermodulation products in the RF power amplifier of the transmitter).

3.9.1.8 Degree of carrier reduction (relative to peak envelope power)

During the transition period the carrier reduction of the SSB emission shall be 6 dB, to allow SSB transmissions to be received by conventional DSB receivers with envelope detection without significant deterioration of the reception quality.

At the end of the transition period the carrier reduction of the SSB emission shall become 12 dB.

3.9.1.9 Frequency tolerance

The frequency tolerance of the SSB carriers shall be ± 10 Hz*.

*Note - This frequency tolerance is acceptable only under the assumption that future SSB receivers will be equipped with a device locking the locally re-inserted carrier for synchronous demodulation to the carrier of the SSB emission (see also paragraph 3.9.1.11).

3.9.1.10 Overall selectivity of the receiver

The reference receiver shall have an overall bandwidth of 4 kHz, with a slope of attenuation of 35 dB/kHz*.

*Note - Other combinations of bandwidth and slope of attenuation as given below are possible producing the same relative RF protection ratio of about -27 dB at 5 kHz carrier difference.

Slope of attenuation	SSB receiver audio-frequency bandwidth
25 dB/kHz	3300 Hz
15 dB/kHz	2700 Hz

3.9.1.11 Detection system of SSB receivers

SSB receivers shall be equipped with a synchronous demodulator, using for the carrier acquisition a method whereby a carrier is regenerated by means of a suitable control loop which pulls the receiver to the incoming carrier. Such receivers must work equally well with conventional DSB transmissions and with SSB transmissions having a carrier reduced to 6 or 12 dB relative to peak envelope power.

3.9.1.12 Equivalent sideband power

During the transition period an equivalent SSB emission is one giving the same loudness level as the corresponding DSB emission, when it is received by a DSB receiver with envelope detection. This is achieved when the sideband power of the SSB emission is 3 dB larger than the total sideband power of the DSB emission. (The peak envelope power of the equivalent SSB emission as well as the carrier power are the same as that of the DSB emission.)

After the end of the transition period, the equivalent sideband power can be reduced by 3 dB.

3.9.1.13 RF protection ratios

Assuming that the SSB and DSB emissions correspond to the technical characteristics specified above, the following RF protection ratios shall be applied :

- during the transition period :

RF co-channel protection ratio

Given the need to increase the radiated sideband power by 3 dB in the case of equivalent SSB emissions, there is a consequent need to make an allowance of the same 3 dB in the co-channel protection ratio for the case of a wanted DSB signal interfered with by an SSB signal, if the same quality of reception is to be maintained [(see paragraph 3.9.2.4)].

Relative RF protection ratios :

(For the following protection ratios SSB emissions with equivalent sideband power are assumed.)

a) If a wanted DSB signal is received by a conventional DSB receiver with envelope detection which is interfered with by an SSB emission.

According to the resulting RF protection ratio, reception of the wanted DSB signal in the lower channel (interfering carrier for example at $\Delta F = +5$ kHz) will be impaired by about 1 dB, while under the same conditions reception of the wanted DSB signal in the upper adjacent channel (interfering carrier for example at $\Delta F = -5$ kHz) will be impaired by about 4 dB in comparison to the present RF protection ratios, as specified in Figure [C/3.3.2].

The corresponding value for $\Delta F = \pm 10$ kHz will be -3 dB impairment.

b) In the case of a wanted SSB signal interfered with by a DSB signal, values of Figure /‾C/3.3.2_7 shall be used.

c) In the case of a wanted SSB signal interfered with by an SSB signal, the values mentioned in a) above shall be applied.

- after the end of the transition period (both the wanted and the interfering signals are SSB signals)

RF co-channel protection ratio :

The RF protection ratio is the same as that applied for the DSB system.

Relative RF protection ratios :

Relative RF protection ratios shall be as shown in Figure /‾E/3.9.1_7.

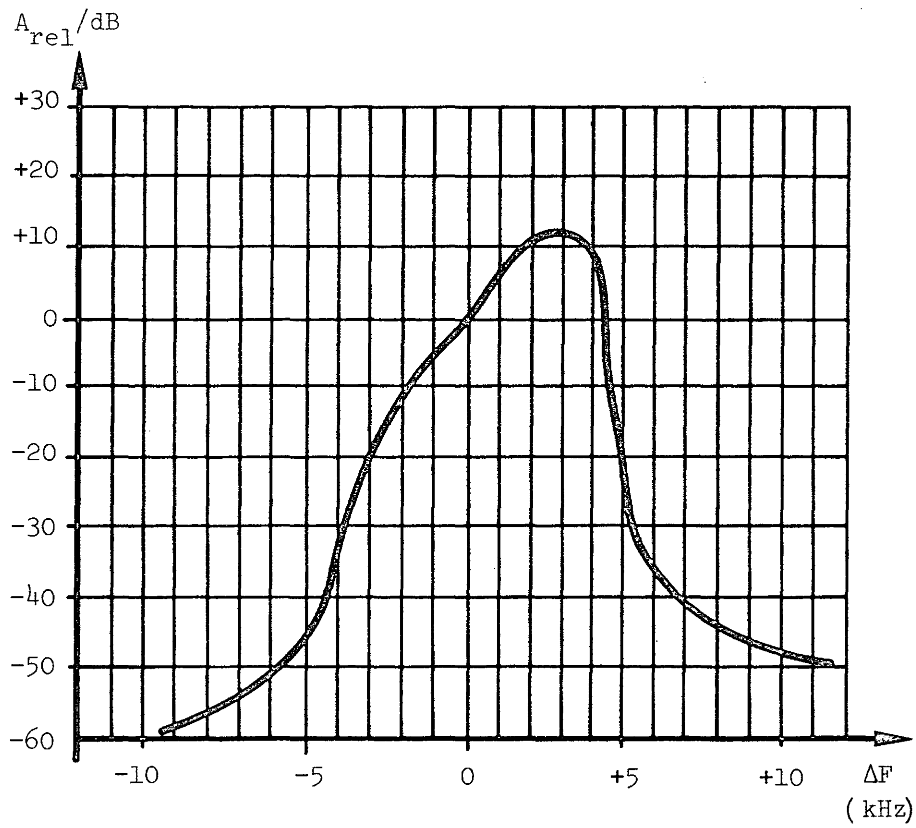

FIGURE /‾E/3.9.1_7

Relative RF protection ratios A_{rel} are given with respect to the frequency difference ΔF between the interfering carrier f_i and the wanted carrier f_w.

$$\Delta F = f_i - f_w$$

Thus positive ΔF describes interference from the upper adjacent channel.

3.10 Theoretical Capacity of the HFBC bands

The theoretical capacity of the HFBC bands is dependent on a variety of factors. These include the radio-frequency protection ratio, transmitter powers, the antenna directivities and the assignment method.

The time period and the frequency band considered are also important for the channel capacity. On the basis of calculations carried out by several administrations and utilizing the data of the IFRB, the average capacity (available number of stations/channel at a given time) was generally found to be in the range of three to four.

The capacity decreases in the higher frequency bands and for higher RF protection ratios. The range of capacity is from one to seven.

In general no single value for the capacity of any band can be determined since the capability to accommodate requirements is subject to factors which vary from one schedule to another.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 158-E
31 January 1984
Original : English

COMMITTEE 4

REPORT OF AD HOC GROUP 4G
TO COMMITTEE 4

According to the terms of reference ad hoc Group 4G has after two meetings reached an agreement on the following parameter values.

a) Noise limited sensitivity of the receiver

40 dB (μV/m)

b) Audio-frequency signal/noise ratio

24 dB

c) Reference usable field strength

$E_{ref} = E_{min} + 3$ dB

The agreement on the above values was unanimously reached with the exception of the delegation of the USSR which reserved its right for further action.

J.J. BLIEK
Chairman of ad hoc Group 4G

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 159-E
7 February 1984
Original : English/French

COMMITTEE 4

SUMMARY RECORD

OF THE

NINTH MEETING OF COMMITTEE 4

(TECHNICAL CRITERIA)

Wednesday, 1 February 1984, at 0900, 1600 and 2000 hrs

Chairman : Mr. J. RUTKOWSKI (People's Republic of Poland)

Subjects discussed :		Document
1.	Maximum number of frequencies (continued)	140 + Add.1(Rev.1)
2.	Report by the Chairman of ad hoc Group 4C	141
3.	Report by the Chairman of Working Group 4A (continued)	133 + Add.1
4.	Reconsideration of section 3.5.1 (Antennas)	Corr.2 to 129(Rev.1)
5.	Report of Drafting Group 4B-7 (Reception zones and test points)	132 + Corr.1
6.	Report by the Chairman of ad hoc Group 4G	158

1. Maximum number of frequencies (continued) (Document 140 + Add.1(Rev.1))

1.1 After an exchange of views on Figure /¯Y_7, submitted by the delegate of Sweden (Add.1(Rev.1)) as a replacement for section 3.8.3, curve A was adopted. Curves B and C would be deleted.

1.2 The delegate of India, supported by the delegate of the United States of America, proposed that only the section of curve A comprised between the lower limit of 50% and the upper limit of 80% should be retained.

1.3 The Chairman, having expressed a wish for a consensus on the matter as soon as possible, the Indian proposal was adopted; the reservations expressed by the delegate of France regarding the 80% limit would be noted.

1.4 It was decided, in the second paragraph of section 3.8.2, to replace :

- "Table /¯Y_7" by "Figure /¯Y_7";

- "... is less than /¯x_7% ..." by "... lies between 50 and 80%" (second line) and "/¯x_7%" by "80%" (fifth line);

- "... a second frequency shall be tested" by "... a first additional frequency shall be tested" and "... additional (third) frequency" by "... second additional frequency".

1.5 In the light of the view expressed by the Chairman of Working Group 4A, it was decided to delete the Annex and to insert a reference to the formula given in Document 133 (Table 3, step 4b)).

1.6 The following footnote, proposed by the delegate of China, was added, between square brackets, to page 1 :

"These criteria may be modified by the second session of the Conference, in the light of the estimates obtained on existing standard broadcasting circuits by the intersessional Working Group and/or the IFRB between the two sessions."

1.7 The delegate of the United States of America proposed that, in Figure /¯Y_7, the upper curve (theoretical limit) should be deleted, as it had been used only as a reference. It was so agreed.

Document 140 (+ Add.1(Rev.1)) was approved, subject to the above amendments.

2. Report by the Chairman of ad hoc Group 4C (Document 141)

2.1 The Chairman of ad hoc Group 4C introduced Document 141 containing the results obtained by the Group.

2.2 Document 133, section 3.2.4.2, Table 2

The ad hoc Group had noted that the "within the hour" variability between the wanted and the interfering signals in the same channel was non-existent, but that there was a correlation for "day-to-day" variability, which was expressed, as a compromise, by a factor of 1/2. That factor had been inserted in the formulae applicable to steps 13 and 14 of Table 2.

The formulae were accepted.

2.3 The Committee took note of the paragraph concerning the protection ratio.

2.4 Document 131

Since no agreement could be reached on a relationship to represent the total fading margin ("day-to-day" variability over monthly or seasonal periods), it was decided to defer consideration of that question.

3. Report by the Chairman of Working Group 4A (continued) (Document 133 + Add.1)

3.1 The Chairman of Working Group 4A noted that the parameters which had just been adopted would be used in the first method of calculating overall circuit reliability based on the signal-to-interference ratio. Consideration now had to be given to establishing a parallel method based on the protection ratio, which would take account of subjective data.

3.2 After an exchange of views in which the Chairman, the delegate of India and the Chairman of Working Group 4A took part, it was decided that the latter would propose a table illustrating the method of calculating circuit reliability based on the protection ratio.

3.3 The Chairman of Working Group 4A submitted to the meeting a proposal in the form of Table 2A in Addendum 1 to Document 133. Table 2A was similar to Table 2, the essential differences being that step 17 referred to the RF protection ratio instead of the required S/I ratio and that in steps 13 and 14 the word "subjective" had been added in order to make allowance for subjective effects in deciding the necessary fading allowance. A blank in square brackets had been left for the relevant formulae in steps 13 and 14 as two opposing views had been expressed on the subject earlier in the Working Group and the problem would have to be resolved by further discussion.

3.4 The Chairman noted that with the adoption of the formulae in section 1 of Document 141, Table 2 had already been approved by the Committee. He invited comment from the Committee on the procedure to be followed with regard to Table 2A.

After a lengthy discussion in which the delegates of the Federal Republic of Germany, China, India, Algeria, Canada, Brazil, France, the Netherlands, New Zealand and the United States of America took part, it was decided that in view of the divergence of views expressed on the subject in the Committee, Table 2A should be returned to ad hoc Group 4C for further discussion.

3.5 The delegate of Algeria noted that the principle of submitting two methods for the calculation of overall circuit reliability to Committee 5 had been agreed in principle by the Committee when the Chairman of Working Group 4A had been asked to prepare an outline of a proposed second method. His delegation regretted that it had been found necessary at the present stage of proceedings to return the matter to a Working Group.

4. Reconsideration of section 3.5.1 (Antennas) (Corr.2 to Document 129(Rev.1))

4.1 The representative of the CCIR indicated the corrections to be made in Corrigendum 2 to Document 129 :

- in Table [B], first line, delete the figure 103 in column H2;

- in the second paragraph of section 3.5.1.4, fourth line, substitute "(see paragraph 3.5.1.5)";

- in the first column of Table /‾D_7, all elevation angle values should be preceded by the sign $\pm$;

- in Table /‾E_7, against the elevation angle of 8^{o}, the value shown in column h = 0.5 should be 0.7;

- in Table /‾G_7, the value shown in column Hm/1/0.3 should be 1.1.

4.2 3.5.1 Antenna characteristics

4.2.1 The delegate of Paraguay said that the Spanish text of the fourth paragraph should be aligned with the English text and that on the second line, the word "importancia" should be replaced by "dimensiones". The delegate of Italy said that the French text should also be aligned.

4.2.2 Referring to the first paragraph of section 3.5.1.1, the delegate of France considered that the term "antenna planning chart" was inappropriate and should be changed. That remark also applied to the title of Figure /‾I_7 on page 4.

4.2.3 The Chairman of Drafting Group 4B-2 suggested using the word "selection". It was decided to submit his comment to the Editorial Committee.

4.2.4 The Chairman pointed out that, in the sixth paragraph, the reference at the beginning of the last sentence should read "Figure 8-II" (provisional numbering).

4.3 Figure /‾I_7 Antenna planning chart

4.3.1 The delegate of Algeria asked whether the log-periodic antennas should not be deleted from the diagram. The Chairman replied that they had to be retained owing to the fact that they were used.

4.4 3.5.1.3 Multi-band antennas

4.4.1 The delegate of China, referring to the end of the last paragraph, proposed the deletion of the phrase between square brackets since, if more accurate values were required, reference should be made to the CCIR Antenna Handbook.

4.4.2 The delegate of Qatar proposed deleting the square brackets but retaining the text.

4.4.3 The delegate of France, supported by the delegates of the Netherlands and India, accepted the Chinese proposal but suggested adding the words "to the CCIR" in the previous sentence after "accurate data".

4.4.4 The delegate of Thailand wondered whether, with slight modifications, the formulae given in the CCIR Handbook might be used on the computer; perhaps they could be improved upon in the intersessional period.

4.4.5 When asked about the implications of the French proposal, the Director of the CCIR said that the calculations required would be complex but feasible.

4.4.6 The delegates of China, Qatar and Thailand supported the proposal.

4.5 3.5.1.5 Representation of antenna patterns

4.5.1 It was agreed to replace "three patterns" in the second paragraph by "these patterns".

4.5.2 In reply to a point raised by the delegate of Brazil, the Chairman of Drafting Group 4B-2 suggested that the sentence preceding Figure /‾1_7 should be amended to read :

"A pictorial representation of the angles θ and φ is given in Figure /‾1_7"

and that a similar change should be made in the title of Figure /‾1_7 on the same page.

It was so agreed.

4.5.3 The delegate of Canada, supported by the Chairman of Drafting Group 4B-2, suggested the deletion of the word "horizontal" in the sentence preceding the formulae.

It was so agreed.

4.6 Table /‾G_7

It was agreed to insert the figure "1.1" in the column headed Hm/1/0.3 against the elevation angle of 81 degrees.

Corrigendum 2 to Document 129 was approved, as amended.

4.7 The Chairman noted that the only part of the original Document 129 still outstanding was Annex 2. Action in that connection would have to be deferred pending a decision on overall circuit reliabilities.

5. Report of Drafting Group 4B-7 (Reception zones and test points) (Document 132 + Corr.1)

5.1 The Chairman of Drafting Group 4B-7 introduced Corrigendum 1 to Document 132 replacing the first section (Reception zones) of Document 132 and drew attention to Annex 1 showing seven maritime broadcasting areas (A-G). The two maps reproduced in Annexes 2 and 3 to Corrigendum 1 related to the second section of Document 132 (Test points).

5.2 The Chairman proposed that the two issues, reception zones and test points, should be dealt with separately. Referring to Annex 1 to Document 132(Corr.1), he enquired whether the fact that some maritime zones in the southern hemisphere were not designated by a letter was intentional or due to inadvertence.

5.3 The Chairman of Drafting Group 4B-7 said that the omission was intentional. Maritime broadcasting areas were defined in order to reflect the needs of the administrations concerned. No particular interest had been expressed with regard to the South Pacific, the South Atlantic and the South Indian Ocean.

5.4 The representative of the IFRB said that the designation of maritime broadcasting areas by letters of the alphabet was only provisional and that eventually the letters would be converted into figures running consecutively to those designating CIRAF zones. With regard to the footnote 2 on page 1 of Document 132(Corr.1), he remarked that, for broadcasting purposes, the population density in maritime areas was very low and the question therefore arose whether those zones should be treated in exactly the same way as CIRAF zones. Lastly, he suggested that the first sentence of section 3.7 should be amended to read as follows : "In specifying the reception area, this shall be done be referring to a CIRAF zone or part of a zone".

5.5 The delegate of Australia proposed that letters should be assigned to the three areas at present left blank on the map in Annex 1.

5.6 The delegate of Chile supported that proposal and said that the new reception zone in the South Pacific should extend between 80 and 110 degrees longitude.

5.7 The representative of the IFRB said that he was not in favour of increasing the number of reception zones unless actually needed. The small number of administrations participating in the Drafting Group suggested that the demand was not great. The establishment of a large number of new zones would only complicate broadcasting requirements.

5.8 The delegates of Mexico and Brazil supported the proposal made by the delegations of Australia and Chile.

5.9 The delegate of Algeria said that, while appreciating the concern of some administrations with the needs of broadcasting to shipping, his delegation feared that the addition of so many new CIRAF zones might have unfavourable repercussions on planning in connection with administrations' needs for broadcasting to inhabited zones. He would confine himself for the present to entering a general reservation and would revert to the issue at a later stage after consultations in Committee 5.

5.10 The delegate of Morocco agreed that there appeared to be no urgent need for defining the three zones in question, but saw little practical difference between defining seven and ten maritime broadcasting areas.

It was agreed to amend the last paragraph of 3.7 to read as follows :

"Ten maritime broadcasting areas (provisionally designated A-J) are defined as shown in Annex 1."

The meeting was suspended at 1210 hours and resumed at 1600 hours.

5.11 The delegate of the USSR said that while the Committee after much discussion, had approved footnote 1 to section 3.7, it had not discussed the matter of the reference point, and he could not agree to new elements being introduced into the text without discussion.

5.12 The Chairman of Drafting Group 4B-7 explained that the third sentence in the second paragraph of section 3.7 was not entirely new but was based on the second paragraph of Document DT/35. The term "reference point" meant a point in the middle of each CIRAF zone through which the new boundaries between each quadrant would pass.

5.13 The delegate of the USSR objected to the Secretariat introducing a new element which had not been agreed to either in the Drafting Group or the Committee and he proposed, therefore, that the sentence in question should be deleted.

5.14 The representative of the IFRB observed that it was intended to explain the way in which CIRAF zones were divided into four and had been reinstated after the Committee had revised its decision by reverting to four quadrants instead of dividing the zones into two sets of halves. The Secretariat had done no more than follow the Drafting Group's instructions; it had not inserted the last sentence of the second paragraph on its own initiative. From the IFRB's point of view the sentence was not essential but if it were dropped the method of dividing CIRAF zones would have to be incorporated in the Board's technical standards.

5.15 The representative of the USSR said that, in the light of that explanation, he could withdraw his objection but wondered whether a new map would be needed to indicate the position of reference points which was not clear from the present text and whether the introduction of such a method would require a change in the Radio Regulations.

5.16 The delegate of the United Kingdom said that the sense would be clearer if the order of the second and third sentences were transposed.

5.17 The delegate of the United States of America said that the relatively non-directional or non-spot beam type of coverage obtained with HF broadcasting would almost never fit into some of the strange shapes resulting from trying to divide CIRAF zones into four quadrants. If an administration decided it needed less than a full CIRAF zone, it could specify the particular portion desired by reference to a number of test points, including maritime areas. They should be judiciously selected by the IFRB and should coincide with the areas in which administrations were interested. The quadrant arrangement would then be unnecessary.

5.18 The delegate of Brazil said he could support the United States of America proposal provided that enough appropriate test points were selected to enable administrations to specify service areas. If the proposal was adopted the words "including the maximum service range in km" would have to be deleted in Note 1 to section 3.7.

5.19 The delegate of the Federal Republic of Germany said the meaning of the second paragraph could be clarified by starting with the clause "If necessary" and transposing the order of the second and third sentences as proposed by the United Kingdom delegate. Administrations should also be required to specify whether the reception area was larger than, or part of, a quadrant by giving reference points.

5.20 The representative of the IFRB said that a conditional clause was important as every CIRAF zone would not be sub-divided unless that was necessary. At present, some fifty countries were notifying by reference to country symbols and not CIRAF zones, but the use of the latter would assist the IFRB, particularly as zones might be smaller than a quarter of a CIRAF zone.

5.21 The delegate of Australia considered that the choice should be optional rather than mandatory and proposed the substitution of the word "may" for "shall" in the first line and the words "may be" for "is" in the fourth line of the second paragraph.

5.22 The representative of the IFRB feared that the Australian amendment might result in confusion by leaving the choice open to administrations.

5.23 The Chairman, supported by the delegates of Brazil and Canada, suggested that the points raised in discussion would be met by re-drafting the first sentence in the second paragraph of section 3.7 to read :

> "If necessary, CIRAF zones may be divided into four quadrants NW, NE, SE and SW to define more precisely the service area of a transmission."

The second and third sentences would be transposed.

That suggestion was approved.

5.24 The delegate of the USSR criticized the reference to CIRAF zones, a term which did not appear in the Radio Regulations. The Chairman pointed out that the expression had already been adopted in the note to the term geographic zones for broadcasting in Document 115(Rev.1).

Test points

5.25 The representative of the IFRB reminded the Committee that the test points in Annex 2 formed part of the IFRB Technical Standards. Under the circumstances, the Board had thought it preferable to leave the definition of test points and allow for future expansion by providing an adequate number of test points for each CIRAF zone and any sub-division of a CIRAF zone for the purposes of technical examination. The number of test points could be increased as the Board's computer facilities improved. That approach was consistent with past policy and would enable the Board to provide tests points where necessary, rather than using a general grid in which many of the test points would be unnecessary.

5.26 The delegates of the USSR and the United States of America were both in favour of the IFRB continuing to designate test points as it had done in the past.

5.27 The delegate of the United Kingdom said that a 12° grid as shown in Annex 3 would not directly replace the test points now being used by the IFRB. Provided the IFRB could provide a sufficient number of test points within a sub-division of a CIRAF zone which administrations could specify as a service area, the United Kingdom would have no difficulty in accepting such a method.

5.28 The delegate of Brazil said that he too could agree to such a method, provided consideration was also given to short-range services and the proposals made by the Brazilian Administration (B/55/6).

At the Chairman's suggestion, it was agreed to establish a small Drafting Group with Mr. Johnsen as Chairman and consisting of the delegates of Brazil, the United Kingdom and the representative of the IFRB, to prepare a text for examination later in the meeting.

The meeting was suspended at 1700 hours and was resumed at 2000 hours.

5.29 The Chairman of Drafting Group 4B-7, introduced the text for section 3.7.2 prepared during the break on the subject of test points, on the basis of the proposal made by the representative of the IFRB and accepted by the Committee.

5.30 In reply to the delegate of Chile, who was not fully satisfied with the way the text had been rendered into Spanish, the Chairman said that the Editorial Committee would make sure that the three language versions were properly aligned.

5.31 The delegate of France considered that it might be advisable to add footnotes to the text to make it clear that the term "an adequate number" of test points meant a number not beyond the information processing capabilities of the IFRB and that the test points currently in use in each CIRAF zone would be taken as the basis from which the final distribution pattern would be built up by adding additional points.

5.32 The Chairman considered that the addition of further qualifications to the text would not greatly assist the IFRB and might lead subsequently to further controversy. The text as it stood made it sufficiently clear that the computer facilities available to the IFRB would be taken into account in determining the number of test points.

5.33 The representative of the IFRB said it was intended to base the network of test points on the existing points in order to avoid too many changes. The Board would add additional points where necessary and appropriate, giving careful consideration to the needs of administrations, especially those with short range services. All Administrations would be notified of any additional test points the IFRB proposed to introduce and any comments and recommendations they made to the Board on those proposals would be taken into account.

5.34 The delegate of Algeria regretted that it was not thought advisable to add further clarification to the text and emphasized the need for the IFRB to take account of world population distribution and countries' needs for short range broadcasting services when considering the distribution of test points in each CIRAF zone.

The text proposed was adopted.

6. Report by the Chairman of ad hoc Group 4G (Document 158)

6.1 The Chairman of ad hoc Group 4G said that although his Group's report was a short one, a great deal of time had been spent on discussion of the parameter values listed. Final agreement had been reached only because there had been willingness to arrive at a compromise in order to speed up the Conference's work. Although the proposals made would of necessity not satisfy all delegations, he felt that in the circumstances they were reasonable and fair.

6.2 The delegate of the USSR said he wished to clarify his position. Between the parameter values for signal-to-noise ratio suggested in the CCIR Report and the lower values proposed by some delegations there was a discrepancy of some 18 dB. In a spirit of compromise he had been willing to accept the half of it resulting for the AF signal-to-noise ratio a value as low as 27 dB, but he could not agree to such a low quality of service as that represented by 24 dB. He therefore wished to reserve his right to take further action.

6.3 The delegate of France felt the last sentence of the Report was not an accurate reflection of the discussion since only some, not all, of the delegations had supported the values indicated. He would prefer "No delegation objected to the proposing of the above-mentioned values, with the exception of the delegation of the USSR ... etc.".

6.4 The delegate of the United States of America supported that view. A number of delegations in the Group had in fact been opposed to the proposals but had not had the opportunity to speak. His own delegation would have preferred not to accept the values, and had only agreed to them for the sake of compromise.

6.5 The delegates of Italy, Brazil, Portugal, Canada, Cameroon and the United Kingdom confirmed that they too were not satisfied with the values proposed, but could accept them for the sake of compromise.

6.6 The delegates of Czechoslovakia, Poland and Bulgaria wished to reserve the right to return to the question at a later stage.

6.7 The delegate of Thailand pointed out that time was short, and that it would be better to settle the question of values now than to re-open it in Plenary. He proposed that, as a further compromise, the value for signal-to-noise ratio should be 25 dB.

6.8 The delegate of Yugoslavia considered it incorrect for a delegation which had been a member of the Group to put forward a new proposal in the full Committee.

6.9 The Chairman noted that there was no support for the proposal by Thailand. He suggested the three parameter values in the report be approved, and that the final sentence be amended to read : "A consensus on the above values was reached, with the exception of the delegations of the USSR, Bulgaria, Poland and Czechoslovakia, which reserved their right for further action."

The document was approved, as amended, for transmission to the Editorial Committee, on the understanding that any reservations in regard to it would be expressed in Plenary.

6.10 The Chairman of ad hoc Group 4G said that the values set out in Document 158 could now be inserted in the relevant places in other documents. In Document 146, for example, the two sets of square brackets in section 3.4.1.3 should be replaced by the values 40 dB (μV/m) and 24 dB respectively; section 3.4.1.5 might read "For stable conditions a value of 24 dB shall be used for planning"; and the reference usable field strength in section 3.4.2 should be $E_{ref} = E_{min} + 3$ dB.

6.11 The delegate of the United States of America, supported by the Chairman, suggested that to save time the meeting should instruct the Secretariat to enter the adopted values in the appropriate places in Committee 4 documents.

6.12 The delegates of New Zealand, China and Japan said that the value to be indicated for the audio-frequency signal-to-noise ratio in section 3.4.1.3 of Document 146 was not the planning value of 24 dB, as had been suggested, but rather the value used as a basis for measurement of the intrinsic receiver noise level. Measurement conditions had been based on IEC Document 315, and hence on a SNR value of 26 dB. That was thus the figure to be inserted in section 3.4.1.3.

6.13 The delegate of India shared that view. With regard to section 3.4.1.5, he felt that the proposed words "for stable conditions" were superfluous since the audio-frequency signal-to-noise ratio was always measured under stable conditions. His delegation supported the proposal to entrust the Secretariat with the task of inserting the values approved in Document 158 into other Committee 4 documents.

6.14 The delegate of Chile said that to avoid any confusion a cross-reference to the relevant IEC publication might be inserted as a footnote to section 3.4.1.3.

6.15 The representative of the IFRB, supported by the delegate of China, pointed out that it was not normal practice for ITU conferences to include such references in their documents and that to do so would set a precedent.

6.16 The delegates of Thailand and Qatar pointed out that since specific values were being given for E_c,m and SNR in section 3.4.1.3, E_i^o would itself be a fixed value. The whole of the suggested text was thus unnecessary, and it was sufficient to state that $E_i^o = 3.5$ µV/m which was the figure obtained by applying the formula.

6.17 After further discussion, the Chairman suggested that in view of the late hour consideration of section 3.4.1.3 it should be deferred. The Secretariat would be instructed to insert the values adopted in Document 158 into Documents 115(Rev.1), 133 and 146, taking into account the comments made above.

It was so agreed.

The meeting rose at 2310 hours.

The Secretaries :

G. KOVACS

G. ROSSI

The Chairman :

J. RUTKOWSKI

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 160-E
1 February 1984
Original : English

Source : (140, Add.1 to 140, 129(Corr.2))

COMMITTEE 6

SEVENTH SERIES OF TEXTS FROM COMMITTEE 4 TO THE EDITORIAL COMMITTEE

The texts reproduced in Annexes 1 and 2 were adopted in Committee 4 and are hereby submitted to the Editorial Committee.

J. RUTKOWSKI
Chairman of Committee 4

Annexes : 2

ANNEX 1

3.8 Maximum number of frequencies required for broadcasting the same programme to the same zone

3.8.1 Introduction

Wherever possible, only one frequency should be used to radiate a particular programme to a given reception area. In certain special circumstances, it may be found necessary to use more than one frequency per programme taking into account the following considerations :

- over certain paths, e.g. very long paths, those passing through the auroral zone, or paths over which the MUF is changing rapidly;

- areas where the depth of the area extending outwards from the transmitter is too great to be served by a single frequency;

- when highly directional antennas are used to maintain satisfactory signal-to-noise ratios, thereby limiting the geographical area covered by such antennas.

The decision to use more than one frequency per programme should be made on the merits of the particular case concerned.

3.8.2 Use of additional frequencies

A method leading to the determination of the minimum number of frequencies needed to achieve specified levels of basic broadcast reliability has been developed. If the calculated basic broadcast reliability does not reach the desired value, it is necessary to consider if a combination of frequencies in separate bands could improve the basic broadcast reliability and if the amount of improvement would justify the use of additional frequencies. If the use of any additional frequencies does not increase the basic broadcast reliability for the specified value, for a specific percentage of test points in the required service area, the original number of frequencies should not be increased.

In cases where the basic reception reliability obtained with one frequency is between 50% and 80%, a first additional frequency shall be tested. If the basic reception reliability calculated for two frequencies exceeds the limit specified in Figure /‾Y/3.8.2_7, the additional frequency may be used. Only in those special cases where the basic reception reliability using two frequencies remains below 80% the calculation shall be repeated to test for an additional second frequency. The justification of these limits is that there should be a considerable improvement of the basic reception reliability in order to permit the use of additional frequencies.*

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* Note 1 - These criteria may be modified by the second session of the Conference in the light of the calculation results obtained on existing typical broadcasting circuits by the intersessional Working Group and/or the IFRB during the intersessional period.

Note 2 - For calculation of the basic reception reliability see paragraph 3.2.4.3.

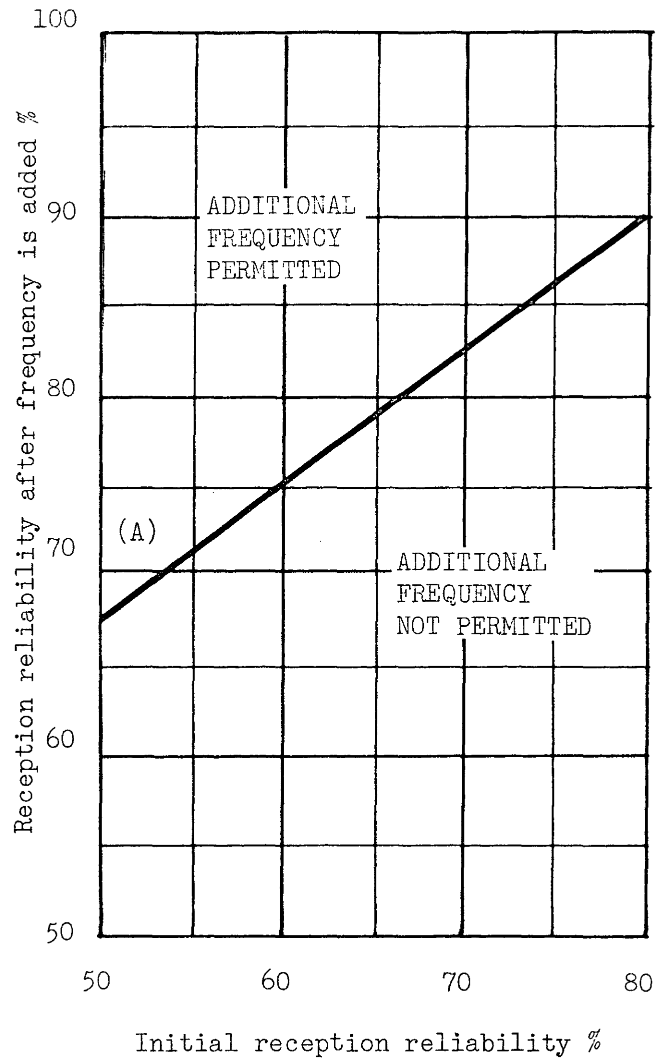


FIGURE /‾Y/3.8.2_7

ANNEX 2

3.5.1 Antenna characteristics

In HF broadcasting the antenna is the means by which the radio-frequency energy is directed towards the required service area. The selection of the right type of antenna will enhance the signal in the service area, while reducing radiation in unwanted directions. This will protect other users of the RF spectrum operating on the same channel or adjacent channels to another coverage area. The use of directional antennas with well-defined radiation patterns is thus recommended as far as possible for HF broadcasting.

Non-directional antennas can be used when the transmitter is located within the required service area. In this case the required service area as seen by the transmitter extends over an azimuthal angle greater than 180°.

Directional antennas serve a double purpose. The first is to prevent interference to other users of the spectrum by means of their directivity. The second is to provide sufficient field-strength for the listeners' satisfaction by means of their power gains.

Although rhombic antennas are used for broadcasting, their use should be discouraged because of the size and number of their sidelobes, which could create technically avoidable interference.

3.5.1.1 **Choice of optimal antennas for various types of service**

A chart in Figure /¯I/3.5.1.2_7 gives some general guidelines for the choice of optimal antennas, and may be helpful for determining the optimum antenna type for a given type of service according to the required distance range. Two different coverage categories are considered in this study: short distance and medium/long-distance services.

A short distance service is understood here to be within a range of up to about 2000 km. This area can be covered with either a non-directional or a directional antenna whose beamwidth can be selected according to the sector to be served. In the directional case, both horizontal dipole curtain and logarithmic-periodic antennas can be employed. The latter type is multiband array with a wide operating frequency range, a low-to-medium gain and a large horizontal beamwidth.

Medium and long distance services can be said to reach distances greater than approximately 2000 km. Such coverage can be provided by antennas whose main-lobe vertical elevation angle is small (6°-13°) and whose horizontal beamwidth is either wide between 65° and 95° (typically 70°) or narrow between 30° and 45° (typically 35°) according to the angular width of the area to be served.

The value of the field-strength in the reception area is influenced by the radiation characteristics of the antennas being used, and this will be optimized if the most suitable type of antenna is used. The direction of radiation of the main lobe of a short-wave antenna, its elevation angle and maximum gain are principally dependent upon the type of array and its height above ground.

The way in which these parameters vary is illustrated in Figure /‾II/3.5.1.2_7 for horizontal dipole curtain antennas fitted with reflectors and for arrays with most of the commonly-used arrangements of dipoles when operated close to their design frequency. The way in which the maximum gain and elevation angle of the main lobe of rhombic antennas vary with height above ground is also shown.

An illustration of the angle of elevation involved in the propagation of short-wave signals via the F-layer for distances up to 10,000 km is shown in Figure /‾III/3.5.1.2_7. From this Figure it can be seen that the angles involved tend to be less than 10° for all distances beyond 5,000 km and angles above about 20° are only suitable for distances of less than 2,000 km. From Figure II it can be seen that the low angle arrays whose radiation is at a maximum at angles of 10° or less tend to have the highest gains, and that low-gain antennas have their maximum radiation at the high angles most suitable for short-distance services.

3.5.1.2 A set of representative types of antenna

Antenna patterns used for planning purposes need to take account of practical considerations, they should be standardized for reference purposes and they should be representative of the large range of types of antenna in common use. A set of representative antenna types recommended for planning purposes, based on single band antennas, together with their vertical and azimuthal characteristics are summarized together with the gain (dBi) and elevation angle of maximum radiation (Table /‾A/3.5.1.2_7). Details of the total horizontal beamwidth (between -6 dB points) for the respective types is also given (Table /‾B/3.5.1.2_7).

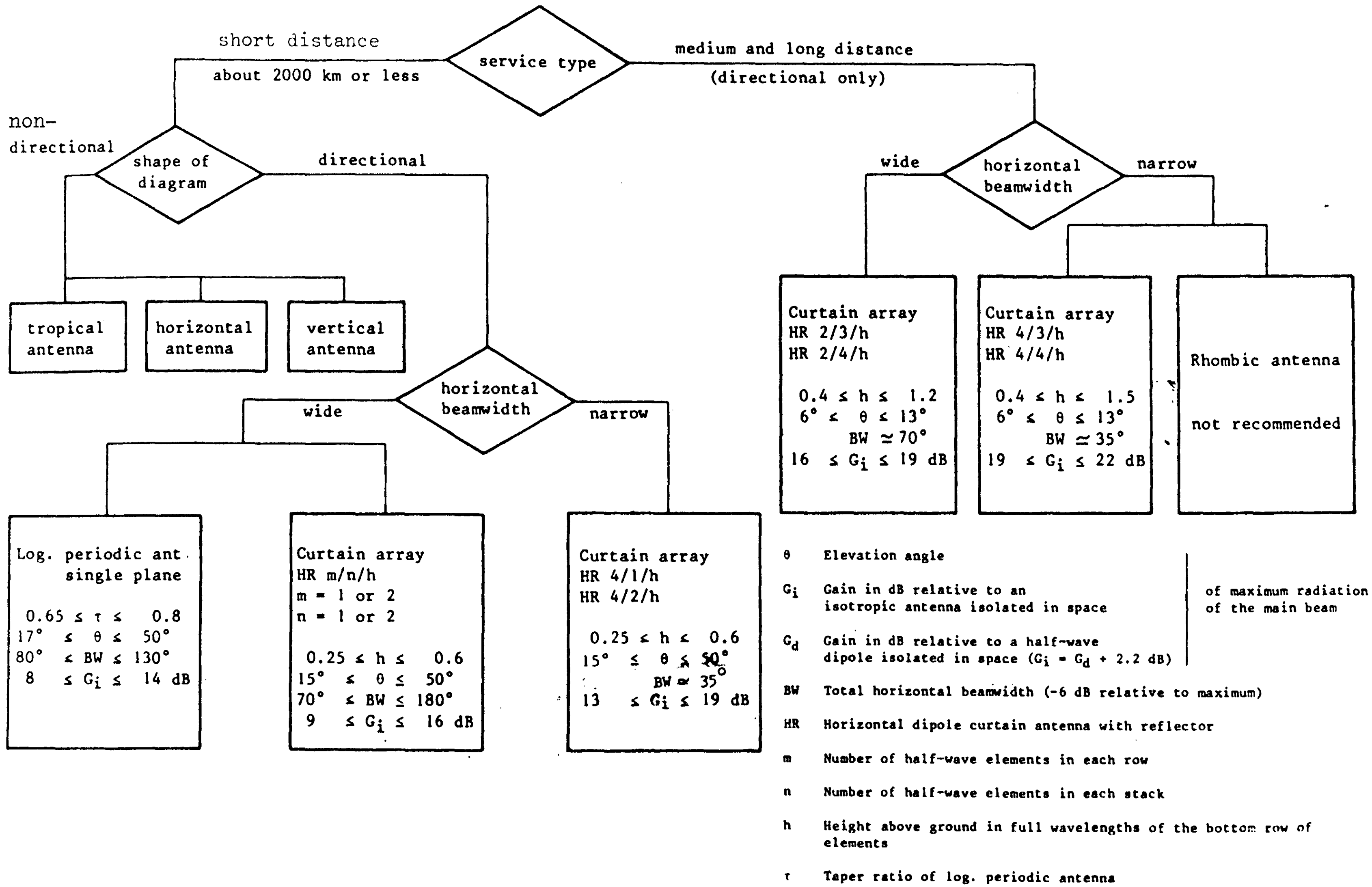
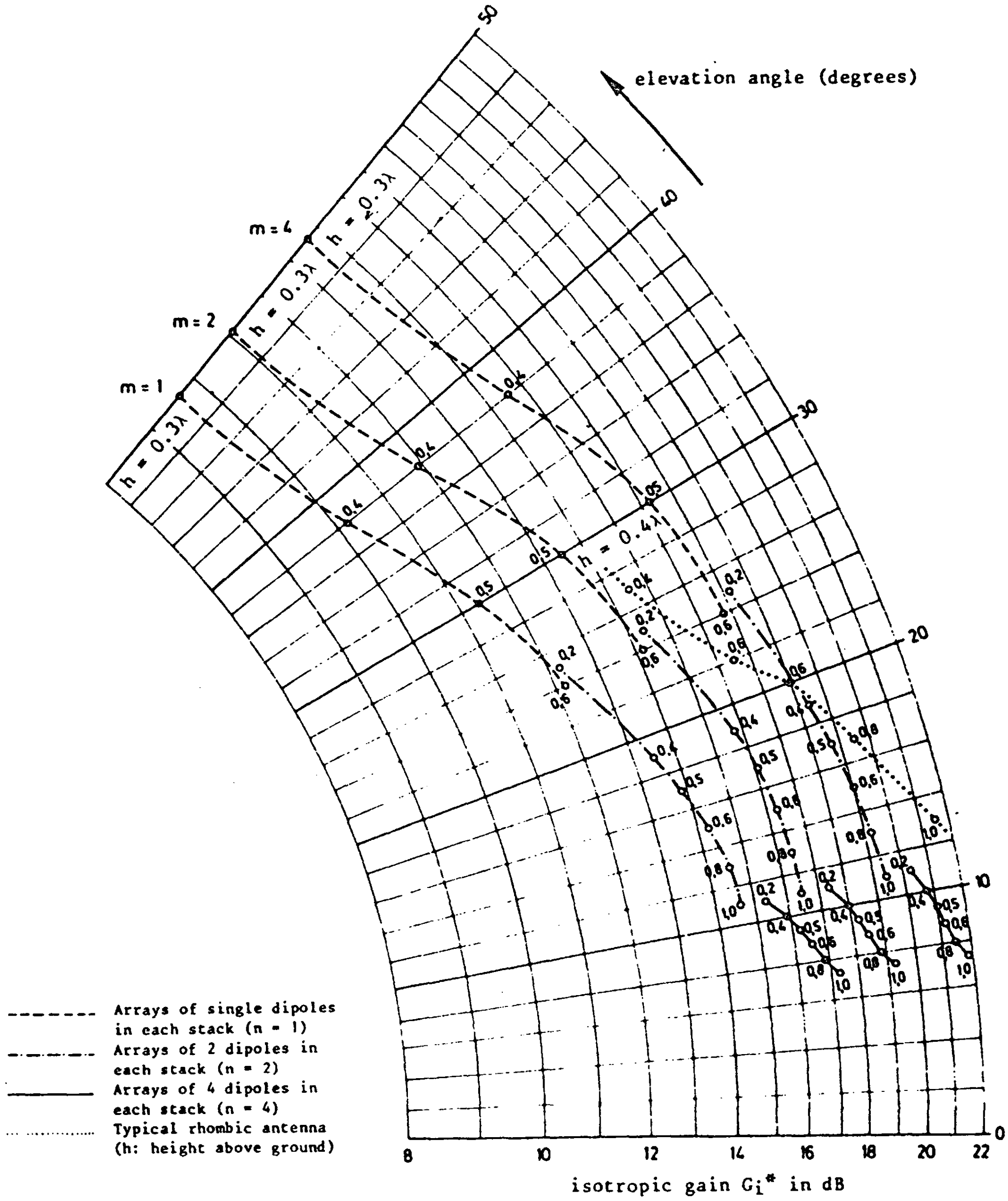


FIGURE [I/3.5.1.2]

Antenna selection chart



Nomenclature according to Appendix 2-7 of the Radio Regulations 1982

HR : horizontal curtain antenna with reflector
m/ : number of half-wave elements in each row
/n/ : number of half-wave elements in each stack (one above the other)
/h : height above ground in full wavelengths of the bottom row of elements, or of typical rhombic antennas

FIGURE /‾II/3.5.1.2_7

Variation of maximum gain (dBi) with elevation angle, for horizontal dipole curtain arrays fitted with reflectors and for typical rhombic antennas, above a perfect earth

* $G_i = G_d + 2.2$ dB

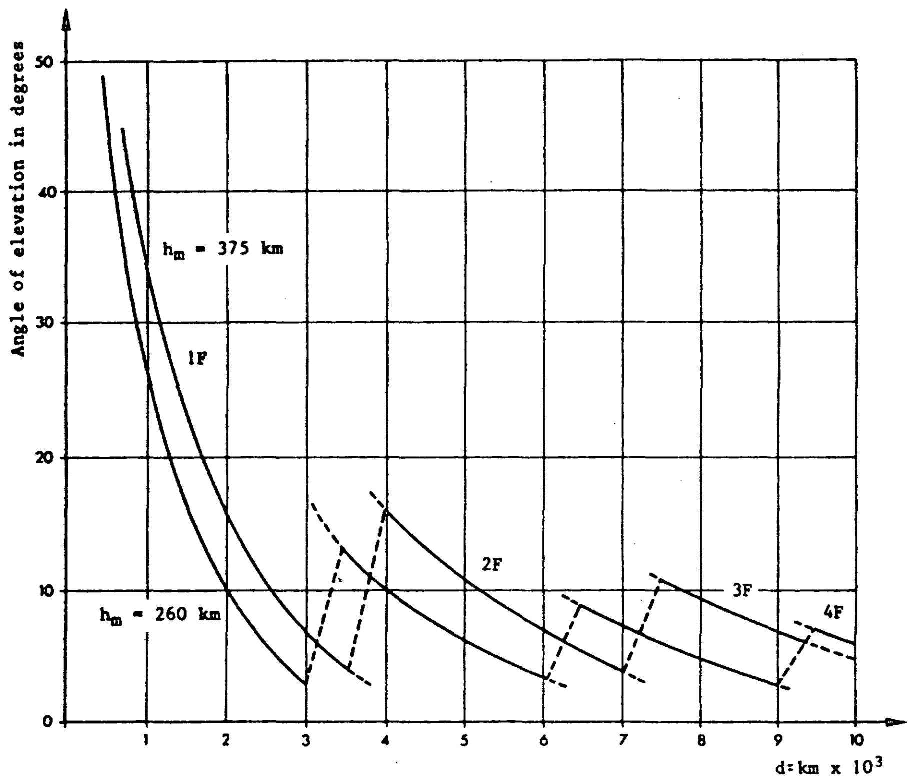


FIGURE /‾III/3.5.1.2_7

Variation of elevation angle with distance (d) for representative ionospheric F-layer heights h_m

Principal characteristics of the set of representative types of antenna

TABLE /‾A/3.5.1.2_7

Gain and elevation angle in the direction of maximum radiation

VERTICAL CHARACTERISTIC TYPE OF ANTENNA ---/m/n/h	IN THE DIRECTION OF MAXIMUM RADIATION					
	AZIMUTHAL CHARACTERISTIC					ELEVATION ANGLE θ (DEGREES)
	HR4 GAIN G_i (dB)*	HR2 GAIN G_i (dB)*	HR1 GAIN G_i (dB)*	H2 GAIN G_i (dB)*	H1 GAIN G_i (dB)*	
-/4/1	22	19				7
-/4/0.8	22	19				8
-/4/0.5	21	19				9
-/3/0.5	20	18				12
-/2/0.5	19	16	14		11	17
-/2/0.3	18	15	13		10	20
-/1/0.5		14	12	11	9	28
-/1/0.3		11	10			44
				9	7	47

* $G_i = G_d + 2.2$ dB

TABLE /‾B/3.5.1.2_7

Total horizontal beamwidth at the elevation angle of maximum radiation (for single band antennas)

TYPE OF ANTENNA ---/m/n/h	TOTAL HORIZONTAL BEAMWIDTH (-6 dB) DEGREES				
	HR4	HR2	HR1	H2	H1
ALL TYPES -/4/1 to -/2/0.5	35	70	108		112
-/2/0.3	35	70	110		116
-/1/0.5		74	114	78	126
-/1/0.3		90	180	180	180

For antennas not included in Table /‾A/3.5.1.2_7 an equivalent representative type whose performance is nearest to that of the antenna under consideration can be determined by reference to Table /‾C/3.5.1.2_7.

TABLE /‾C/3.5.1.2_7

Determination of the representative antenna having a radiation pattern most similar to that of any non-representative one, on the basis of the value of the parameters n and h

h	HR m/n/h				H m/n/h	
	n=4	n=3	n=2	n=1	n=2	n=1
h ≥ 0.9	m/4/1	m/4/0.8	m/3/0.5	-	-	-
0.9 > h ≥ 0.65	m/4/0.8	m/4/0.5	m/3/0.5	-	-	-
0.65 > h ≥ 0.4	m/4/0.5	m/3/0.5	m/2/0.5	m/1/0.5	m/2/0.5	m/1/0.5
0.4 > h	m/3/0.5	m/2/0.5	m/2/0.3	m/1/0.3	m/2/0.3	m/1/0.3

m : number of half-wave elements in each row (m=4, 2 or 1, where appropriate)
n : number of half-wave elements in each stack
h : height above ground of the bottom row of elements, expressed in terms of the wavelength at the operating frequency.

3.5.1.3 Multi-band antennas

In the case of multi-band antennas, (curtain and log periodic) a single value of h, an important parameter with regard to the vertical radiation pattern and the angle of maximum radiation, no longer corresponds to the physical height of the bottom row of elements of the antenna over the range of operating frequencies. The equivalent value h' at the required frequency of operation can be found in the following way : in Figure /‾IV/3.5.1.3_7 enter the vertical angle of maximum radiation, taken from the antenna diagram for the respective frequency band, into the ordinate. Choose the curve with the appropriate value of n. Read from the abscissa the equivalent height h'. The equivalent type of antenna can then be determined by entering Table /‾C/3.5.1.2_7, taking this new value of h.

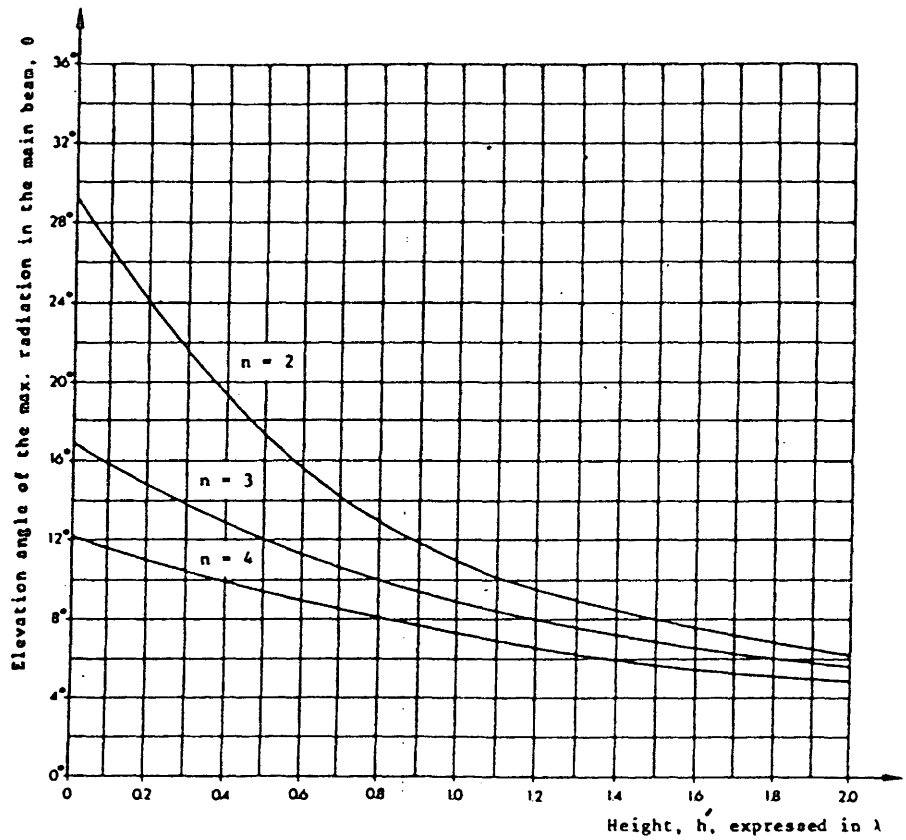


FIGURE /‾IV/3.5.1.3_7

Diagram enabling the equivalent value of the parameter h to be determined in the case of a multiband antenna having n half-wave elements in each stack

Additional data particularly concerning the azimuthal performance over the operating range of a multi-band antenna, are required for later inclusion in Table /‾D/3.5.1.5_7 as they become available. To achieve this, administrations are encouraged to submit to the CCIR accurate data in the format given in Table /‾D/3.5.1.5_7 during the intersessional period.

3.5.1.4 A set of simplified antenna patterns for planning purposes

The vertical pattern and azimuthal pattern of the antennas listed in Table /¯A/3.5.1.2_7 can each be represented by a set of values of the relative attenuation in dB below maximum gain, each value relative to the maximum radiation in both elevation and azimuth, and to the maximum gain of the array. The attenuations, in dB, relative to maximum gain, for the azimuthal pattern are listed in Table /¯D/3.5.1.5_7 and those for the vertical pattern are listed in Tables /¯E, F, G/3.5.1.5_7.

When an antenna is slewed horizontally, the main beam may be considered as unchanged in shape. It can, therefore, be assumed that the azimuth of maximum radiation of the main beam in the slewed mode coincides with the horizontal angle $\psi = 0$ (see paragraph 3.5.1.5) in Table /¯D/3.5.1.5_7. Representation of radiation outside the main beam is required in a similar tabulated form and the CCIR Secretariat is requested to provide the appropriate values based on the data contained in the CCIR Antenna Handbook.

3.5.1.5 Representation of antenna patterns

Antenna diagrams are conventionally used to represent the spatial radiation distribution of an antenna or an array of antennas. The CCIR uses a sinusoidal projection, also called "SANSON-FLAMSTEAD PROJECTION" where the representation of the hemisphere and the contours are shown in the plane of the paper.

The formulas from which these patterns have been developed are extremely complex.

The 3-dimensional radiation pattern of an antenna can be derived from :

a) the vertical radiation pattern within that plane normal to the horizontal through the azimuth of maximum radiation $G(\theta)|_{\varphi = 0^{\circ}}$

b) the azimuthal radiation pattern.

The pictorial representation of the angles θ and φ is given in Figure /‾V/3.5.1.5_7.

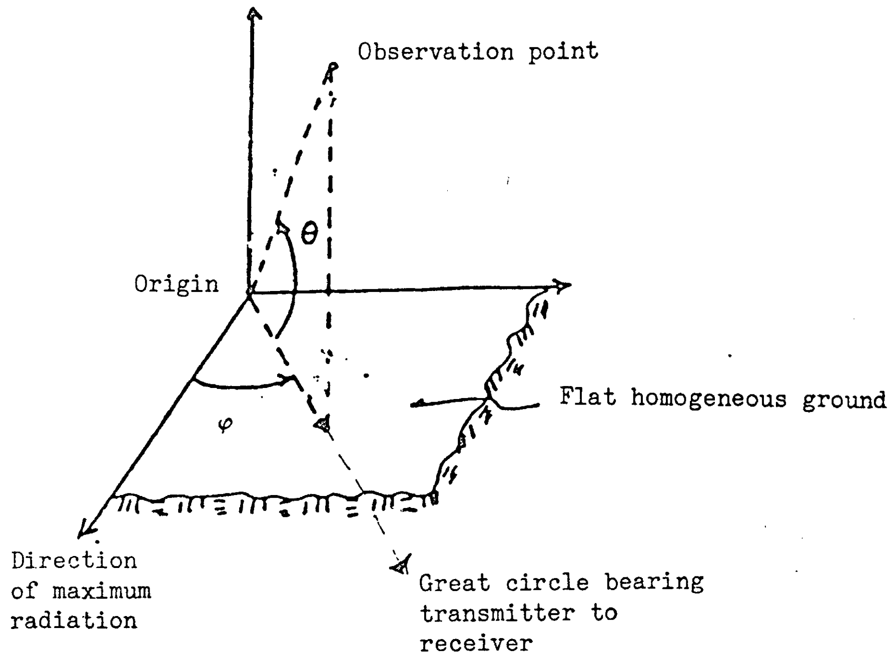


FIGURE /‾V/3.5.1.5_7

Pictorial representation of the angles θ and φ

For planning purposes it is more convenient and much faster in any computational process to use tabulated information.

A suitable set of antenna patterns in the form of look-up tables has been prepared giving values for the antenna radiation patterns which are in close agreement with those given by the CCIR.

This set of antenna patterns uses a conversion technique to form the true radiation pattern from the separate values of vertical and azimuthal attenuation factors.

It can be shown that by appropriate substitution of $\sin \varphi \cos \theta = \sin \psi$ in the azimuthal components of the full formula, the 3-dimensional radiation pattern of an antenna can be represented by two expressions, one representing the horizontal pattern as a function of ψ and the second, the vertical pattern as a function of θ.

Tables can therefore be constructed showing the attenuation relative to the maximum gain varying with angle. Table /‾D/3.5.1.5_7 represents the horizontal pattern as a function of ψ and Tables /‾E-G/3.5.1.5_7 represent the vertical pattern as a function of θ.

In obtaining the attenuation for any angle of elevation and azimuth, the angle ψ must be calculated using the following formula :

ψ = arc sin (sin φ cos θ) for $|\varphi| \leq 90°$ or

ψ = 180 - arc sin (sin φ cos θ) for $\varphi > 90°$

ψ = -180 - arc sin (sin φ cos θ) for $\varphi < -90°$

where

φ = angular difference between great circle bearing transmitter to receiver and azimuth of maximum radiation of the antenna.

θ = angle of vertical radiation.

The attenuation values for ψ and θ can then be determined from the appropriate tables.

The resulting antenna gain in the required direction is then calculated by summing the attenuation for the appropriate values of θ and ψ (Tables /‾D-G/3.5.1.5_7) and then subtracting the total attenuation subject to the limitations defined below, from the maximum gain (Table /‾A/3.5.1.2_7) for the appropriate antenna.

Forward Radiation

For angles of elevation below the vertical angle of maximum radiation, the total attenuation should not exceed a value of 30 dB.

For angles of elevation equal to and above the vertical angle of maximum radiation, the resultant antenna gain shall not fall below -8 dBi.

Reverse Radiation

For HR m/n/h antennas, at all angles of elevation the total attenuation should not exceed a value of 30 dB.

TABLE /‾D/3.5.1.5_7

Antenna attenuation relative to the gain in the direction of maximum radiation, at angles of azimuth relative to the direction of maximum radiation, for planning purposes

Angle (ψ) (degrees)	Azimuthal attenuation (dB)				
	HR4/n/h	HR2/n/h	HR1/n/h	H2/n/h	H1/n/h
0	0	0	0	0	0
±5	0.7	0.4	0.3	0.2	0.1
±10	2.3	1.0	0.7	0.5	0.2
±15	5.1	1.8	1.1	1.2	0.5
±20	9.3	2.9	1.6	2.1	0.8
±25	16.5	4.0	2.0	3.3	1.2
±30	30	5.8	2.8	4.5	1.4
±35	20.6	7.8	3.7	6.7	2.6
±40	17.2	9.9	4.5	8.7	3.5
±45	16.5	12.1	5.1	11.2	4.3
±50	17.7	15.1	6.2	13.7	5.0
±55	20.2	18.7	7.7	15.0	4.2
±60	23.2	22.4	8.8	18.0	4.7
±65	26.2	25.8	12.0	25.3	8.9
±70	30	30	11.9	29.5	9.8
±75	30	30	11.9	30	10.4
±80	30	30	15.3	30	15.4
±85	30	30	18.7	30	16.3
±90	30	30	18.5	30	16.2
				Bi-directional antennas	
±95	30	30	18.3		
±100	30	30	17.5		
±105	30	30	17.2		
±110	30	30	16.2		
±115	30	30	15.2		
±120	27.7	26.9	14.7		
±125	26.0	24.5	13.5		
±130	25.2	22.6	13.7		
±135	25.5	21.2	14.1		
±140	27.2	20.0	14.9		
±145	30	18.6	14.9		
±150	30	18.2	15.2		
±155	30	17.5	15.4		
±160	23.2	16.7	15.4		
±165	19.3	16.1	15.3		
±170	16.9	15.5	15.2		
±175	15.5	15.2	15.1		
±180	15.0	15.0	15.0		

TABLE /‾E/3.5.1.5_7

Antenna vertical attenuation relative to the gain in the direction of maximum radiation at various angles of elevation for planning purposes (antenna type : HR m/4/h).

Elevation angle (θ) (degrees)	Vertical attenuation (dB)		
	h = 0.5	h = 0.8	h = 1.0
0	30	30	30
3	6.0	4.9	4.2
6	1.3	0.6	0.3
* 8	0.7	0	0.8
9	0	0.1	0.5
12	0.8	2.4	4.3
15	8.1	8.2	15.0
18	8.6	25.0	15.7
21	18.4	16.0	10.6
24	28.7	14.2	12.3
27	24.3	18.8	19.3
30	30	30	30
33	20.1	22.3	30
36	14.6	21.9	26.4
39	12.7	30	16.5
42	13.0	21.0	12.0
45	15.2	14.9	11.5
48	19.7	12.4	12.3
51	27.4	11.8	15.0
54	24.3	12.5	20.2
57	20.1	14.4	29.2
60	18.5	17.2	26.4
63	18.3	21.1	22.7
66	19.2	26.3	21.9
69	20.9	30	22.6
72	23.2	30	24.5
75	26.4	30	27.4
78	30	30	30
81	30	30	30
84	30	30	30
87	30	30	30
90	30	30	30

* The values corresponding to this angle have been inserted to facilitate the evaluation of G_{t1}, as per paragraph 3.2.1.3.2.

TABLE /‾F/3.5.1.5_7

Antenna vertical attenuation relative to the gain in the direction of maximum radiation, at various angles of elevation, for planning purposes (antenna types : HR m/3/0.5, HR m/2/h, HR m/1/0.5 and HR m/1/0.3)

Elevation angle (θ) (degrees)	Vertical attenuation (dB)				
	m/3/0.5	m/2/h h = 0.3	m/2/h h = 0.5	m/1/0.3	m/1/0.5
0	30	30	30	30	30
3	7.9	12.3	10.6	18.2	14.7
6	2.8	6.6	5.0	12.3	8.8
* 8	1.1	4.4	3.0	9.9	6.6
9	0.6	3.6	2.2	9.0	5.6
12	0	1.8	0.7	6.7	3.6
15	0.6	0.7	0.7	5.0	2.1
18	2.4	0.1	0.1	3.7	1.1
21	5.4	0.4	0.6	2.7	0.5
24	10.3	0.2	1.8	1.9	0.1
27	18.9	0.8	3.5	1.3	0
30	27.2	1.7	6.0	0.8	0.1
33	20.1	2.9	9.4	0.5	0.3
36	19.9	4.4	14.4	0.2	0.8
39	24.4	6.2	22.0	0.1	1.4
42	30	8.3	21.5	0	2.2
45	22.6	10.9	16.8	0	3.2
48	17.4	13.9	14.6	0.1	4.4
51	15.1	17.4	13.7	0.2	5.8
54	14.1	21.0	13.6	0.3	7.3
57	14.1	25.9	14.1	0.5	9.0
60	14.9	29.3	15.1	0.7	11.0
63	16.2	30	16.6	1.0	13.1
66	18.1	30	18.4	1.3	15.1
69	20.5	30	20.7	1.6	16.7
72	23.2	30	23.5	1.9	17.3
75	25.3	30	26.8	2.2	17.2
78	26.0	30	30	2.6	16.8
81	25.6	30	30	2.9	16.4
84	24.9	30	30	3.2	16.1
87	24.6	30	30	3.6	16.1
90	24.6	30	30	3.6	16.1

* The values corresponding to this angle have been inserted to facilitate the evaluation of G_{tl}, as per paragraph 3.2.1.3.2.

TABLE /‾G/3.5.1.5_7

Antenna vertical attenuation relative to the gain in the direction of maximum radiation at various angles of elevation, for planning purposes (antenna type : H m/n/h)

Elevation angle (θ) (degrees)	Vertical attenuation (dB)			
	H m/1/0.3	H m/1/0.5	H m/2/0.3	H m/2/0.5
0	30	30	30	30
3	18.4	14.7	12.3	10.6
6	12.5	8.9	6.6	5.0
* 8	10.1	6.6	4.4	3.0
9	9.2	5.7	3.6	2.2
12	7.0	3.6	1.8	0.7
15	5.2	2.2	0.7	0.1
18	3.9	1.2	0.1	0.1
21	2.9	0.5	0	0.7
24	2.1	0.1	0.2	1.8
27	1.5	0.1	0.8	3.5
30	1.0	0.1	1.6	6.0
33	0.7	0.3	2.8	9.4
36	0.4	0.7	4.3	14.3
39	0.2	1.3	6.1	21.9
42	0.1	2.1	8.2	21.3
45	0	3.0	10.7	16.6
48	0	4.1	13.6	14.3
51	0	5.4	17.0	13.3
54	0.1	6.9	21.0	13.1
57	0.2	8.5	25.4	13.6
60	0.3	10.4	28.7	14.5
63	0.4	12.3	29.6	15.8
66	0.6	14.2	29.5	17.5
69	0.7	15.6	29.9	19.7
72	0.8	16.0	30	22.2
75	0.9	15.8	30	25.3
78	1.1	15.1	30	30
81	1.1	14.4	30	30
84	1.2	13.9	30	30
87	1.2	13.6	30	30
90	1.4	14.0	30	30

* The values corresponding to this angle have been inserted to facilitate the evaluation of G_{tl}, as per paragraph 3.2.1.3.2.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 161-E
1 February 1984
Original : French

COMMITTEE 5

REPORT OF WORKING GROUP 5A TO COMMITTEE 5

The text reproduced in the annex was considered in Working Group 5A and is hereby submitted to Committee 5 for approval.

M. OUHADJ
Chairman of Working Group 5A

Annex : 1

ANNEX

GRADUAL INTRODUCTION OF SSB

(Planning aspects)

[1.] The eventual changeover to SSB will make for efficient utilization of the spectrum. Voluntary SSB transmissions may, however, be permitted in lieu of planned DSB transmissions, without increasing the level of interference caused to DSB transmissions appearing in the Plan.

Taking account of the fact that the criteria of compatibility between DSB and SSB are not yet completely known* and of the economic implications, this session is of the opinion that :

[1.1] The second session of the Conference should fix the date of the beginning of the transition period.

[1.2] The duration of the transition period may be fixed at 20 years, and consideration must be given to the timely availability of necessary receivers.

The date of the cessation of DSB emissions will thus become known when the second session fixes the date referred to in [1.1] above.

[2.] SSB should be introduced in the same bands as are used for DSB. It has also been recognized that no channels should be reserved exclusively for SSB.

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* [See 3.9.2.4.]

INTERNATIONAL TELECOMMUNICATION UNION

PINK PAGES

WARC FOR HF BROADCASTING

Document 162-E
1 February 1984

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

R.3

PLENARY MEETING

THIRD SERIES OF TEXTS SUBMITTED BY THE
EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for second reading :

Source	Document	Title
COM.6	B.1/115(Rev.1) 155	Chapter 3 : 3.1 3.1.1 3.1.2 3.1.3 3.1.4 3.2.2 3.2.3 3.2.5 3.3 3.3.1 3.3.2

Marie HUET
Chairman of Committee 6

Annex : nine pages

Note of Committee 6

The texts submitted to the Plenary Meeting in second reading include certain passages which have been revised by Committee 4 in accordance with the decisions of the Plenary Meeting.

The passages in question, which should be the subject of two readings, are indicated by a double vertical line in the margin.

CHAPTER 3

TECHNICAL CRITERIA

3.1 Double sideband (DSB) system specifications

After a review of administrations' proposals and the study of this matter by the CCIR, the Conference adopted the following double sideband (DSB) system specifications.

3.1.1 Transmission characteristics

3.1.1.1 Audio-frequency bandwidth

The upper limit of the audio-frequency bandwidth of the transmitter shall not exceed 4.5 kHz and the lower limit shall be 150 Hz, with an attenuation of 6 dB per octave for frequencies lower than 150 Hz.

3.1.1.2 Necessary bandwidth

The necessary bandwidth shall not exceed 9 kHz.

3.1.1.3 Characteristics of modulation processing

The audio-frequency signal shall be processed so that the modulating signal retains a dynamic range of not less than 20 dB. Excessive amplitude compression, together with improper peak limitation, leads to excessive out-of-band radiation and thus to adjacent channel interference, and is therefore to be avoided.

3.1.2 Channel spacing

Channel spacing for double sideband (DSB) shall be 10 kHz.

In the interest of spectrum conservation, it is also permissible to interleave double sideband transmissions midway between two adjacent channels, i.e. with 5 kHz separation between carrier frequencies, provided that the interleaved transmission is not to the same geographical area as either of the transmissions between which it is interleaved.*

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* For SSB emissions see section 3.9.1.4.

3.1.3 Nominal carrier frequencies

Carrier frequencies shall be integral multiples of 5 kHz.

3.1.4 Receiver characteristics

3.1.4.1 Overall selectivity of the receiver

The overall selectivity of the receiver as shown in Figure [1/3.1.4] below, shall be used for planning purposes.

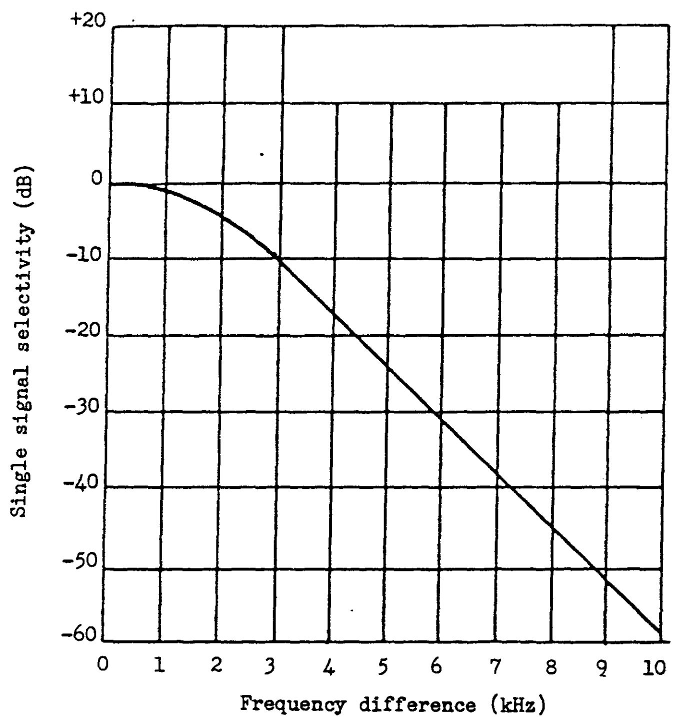


FIGURE [1/3.1.4]

Overall frequency response of the reference receiver

3.1.4.2 Noise limited sensitivity of the receiver

[Text will follow.]

/̄ 3.2 Propagation, radio noise and solar index _7

3.2.1 /̄ Published in Document 157, pages R.2/1 - R.2/10. _7

3.2.2 Atmospheric and man-made radio noise data

3.2.2.1 Atmospheric radio noise data

The hourly median values of atmospheric noise intensity as contained in CCIR Report 322-2 are adopted.

The method of implementation of the data may be :

- a direct calculation as required based upon a numerical representation of the maps;
- a grid representation similar to that currently in use by the IFRB, except that the grid should have a size of 10° latitude by 15° longitude in all parts of the world;
- the precalculation of values appropriate for each test point.

The option selected should be such as to minimize the calculation time required during the operation of the planning method.

3.2.2.2 Man-made radio noise data

The median value of the man-made noise power (F_{am}) to be adopted, expressed in dB above thermal noise at T_o = 288K, is given by :

$$F_{am} = 60.4 - 28.15 \log f$$

where f is the frequency in MHz.

3.2.2.3 The combination of atmospheric and man-made noise

In each case the values of atmospheric noise and man-made noise intensities shall be compared and the greater one shall be used.

3.2.3 Signal fading

3.2.3.1 Short-term (within the hour) fading

The upper-decile amplitude deviation from the median of a single signal is to be taken as 5 dB and the lower-decile deviation is to be taken as -8 dB.

.2.3.2 Long-term (day-to-day) fading

The magnitude of the long-term fading, as determined by the ratio of the operating frequency to the basic MUF, is given in Table ⁄ I.3.2.3 ⁄.

TABLE ⁄ I/3.2.3 ⁄

Decile deviations from the predicted monthly median value of signal field strength, in dB, arising from day-to-day variability

Corrected geomagnetic latitude[1]	< 60°		≥ 60°	
Transmitting frequency/ predicted basic MUF	Lower decile	Upper decile	Lower decile	Upper decile
≤ 0.8	-8	6	-11	9
1.0	-12	8	-16	11
1.2	-13	12	-17	12
1.4	-10	13	-13	13
1.6	-8	12	-11	12
1.8	-8	9	-11	9
2.0	-8	9	-11	9
3.0	-7	8	-9	8
4.0	-6	7	-8	7
≥ 5.0	-5	7	-7	7

[1] If any point on that part of the great circle which passes through the transmitter and the receiver and which lies between control points located 1,000 km from each end of the path reaches a corrected geomagnetic latitude of 60° or more, the values for ≥ 60° have to be used. The relationship of corrected geomagnetic latitude to the geographical coordinates is shown in Figures ⁄ 1 and 2/3.2.3 ⁄.

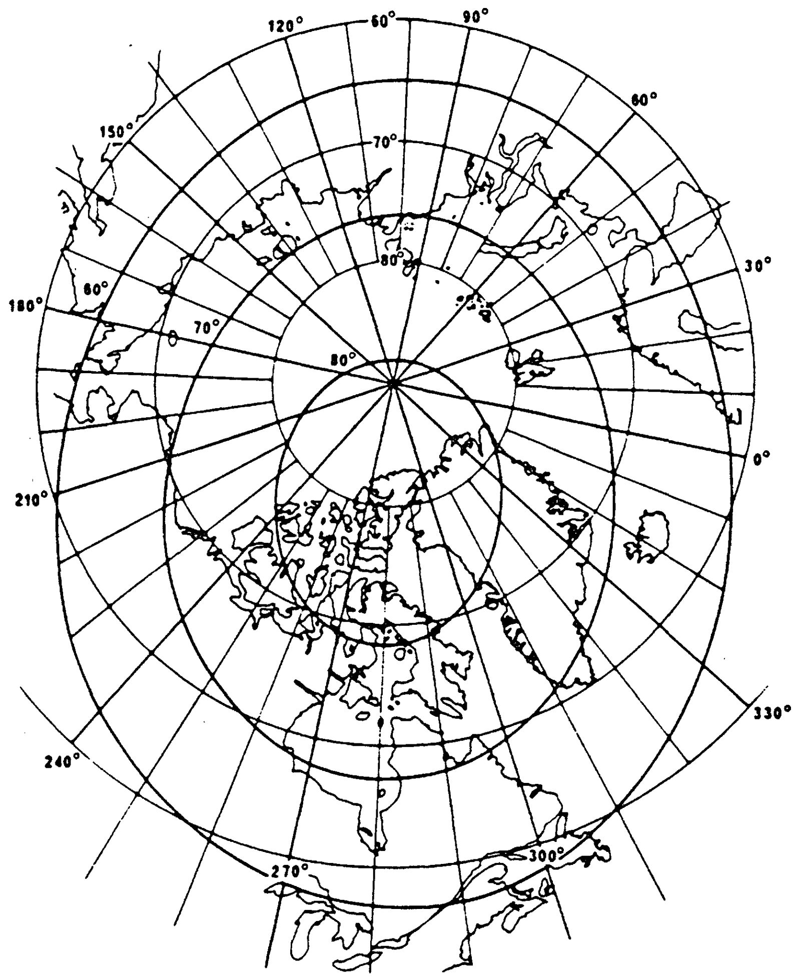


FIGURE [1/3.2.3]

Corrected geomagnetic latitude in the northern hemisphere

(Geographic latitude and longitude are also displayed for reference)

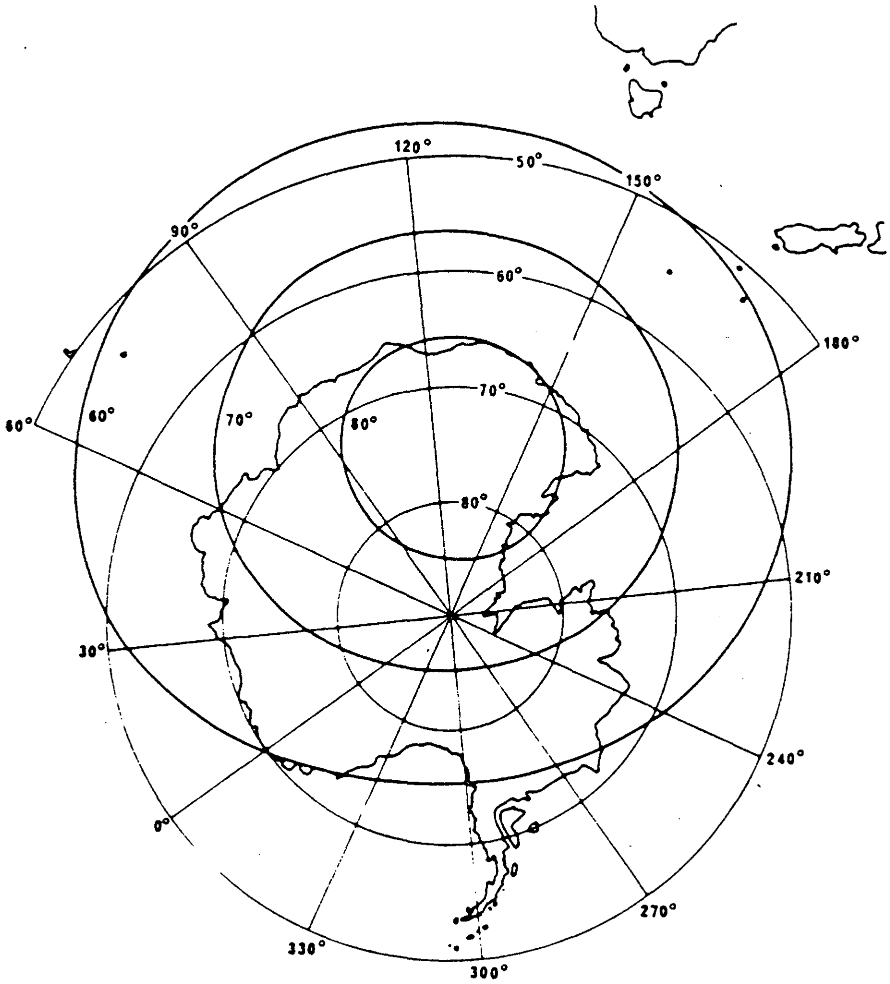


FIGURE [2/3.2.3]

Corrected geomagnetic latitude in the southern hemisphere

(Geographic latitude and longitude are also displayed for reference)

3.2.5 Values of the appropriate solar index and the seasonal periods on the basis of which planning shall be carried out.

3.2.5.1 Seasonal divisions of the year and representative months

The year shall be sub-divided into four seasons for propagation prediction purposes. These seasons are listed in the Table [I/3.2.5]. When predictions are made for a single month to represent a season, the month selected shall be as indicated in the second column of the Table.

TABLE [I/3.2.5]

Season	Representative month
November-February	January
March-April	April
May-August	July
September-October	October

3.2.5.2 Solar index values

[Text will follow.]

3.3 Radio-frequency protection ratios

After a careful review of administrations' proposals and the extensive study of this matter by the CCIR, the Conference adopted Recommendations which take account of subjective tests comparing the quality of listener satisfaction for various protection ratio levels. The decisions taken also took account of the fact that the number of requirements and the limited amount of allocated spectrum space would require a reduction of the desired protection ratio commensurate with the number of requirements to be satisfied. With these considerations in mind, the following decisions were made.

3.3.1 Co-channel protection ratios and frequency tolerances

For stable conditions where the frequency difference between wanted and unwanted carriers does not exceed 100 Hz, the value of 27 dB is adopted as a value to be achieved if feasible. If this protection ratio value is unobtainable, the values in Figure [B/3.3.1] provide planners with advice on the resultant quality of service when protection ratios are less than 27 dB.

Transmitter frequency tolerances are contained in Appendix 7 of the Radio Regulations. To make sure that the frequency difference between wanted and unwanted carriers referred to above does not exceed 100 Hz, administrations are urged to use a frequency tolerance of no more than ± 50 Hz.

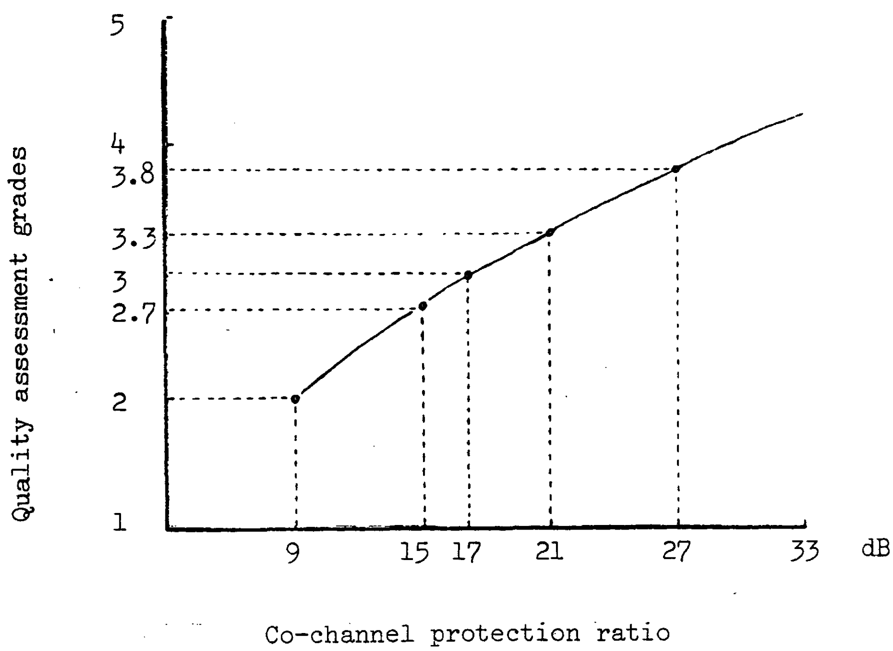


FIGURE [B/3.3.1]

Relationship between reception quality and co-channel RF protection ratio

Table /‾C/3.3.1_/ indicates the five quality and impairment assessment grades.

TABLE /‾C/3.3.1_/

Quality	Impairment
5 Excellent 4 Good 3 Fair 2 Poor 1 Bad	5 Imperceptible 4 Perceptible, but not annoying 3 Slightly annoying 2 Annoying 1 Very annoying

3.3.2 Relative values of protection ratio as a function of carrier frequency separation

Once a value for the co-channel radio-frequency protection ratio has been determined, the radio-frequency protection ratio, expressed as a function of the carrier frequency spacing, shall be determined by adding the value given in the curve in Figure /‾C/3.3.2_/ to the value of the co-channel RF protection ratio.

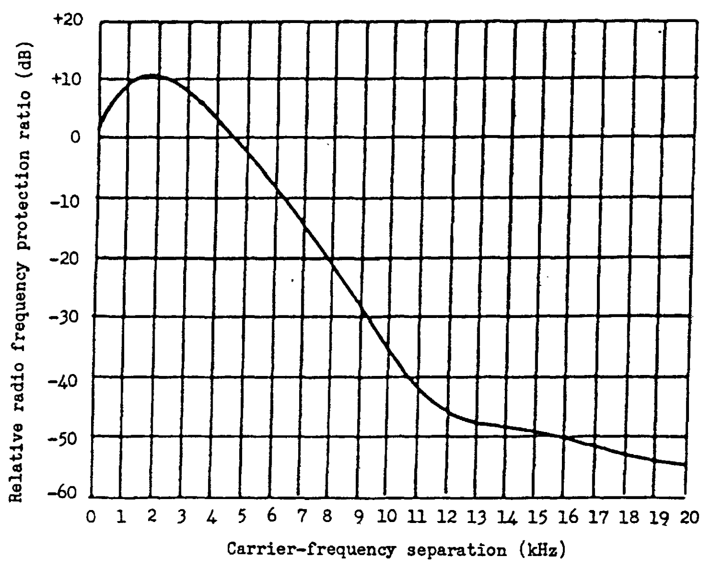


FIGURE /‾C/3.3.2_/

Relative value of the radio-frequency protection ratio as a function of the carrier-frequency separation

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 163-E
1 February 1984
Original : English

COMMITTEE 6

NOTE BY COMMITTEES 4 AND 5
TO THE EDITORIAL COMMITTEE

In considering the definitions relating to coverage and service area, Committees 4 and 5 decided to delete the definitions contained in Document 115(Rev.1) for the "coverage area" and the "service area" and adopted the following definition :

"Required service area (in HF broadcasting)

The area within which an administration proposes to provide a broadcasting service."

The Editorial Committee is asked to submit this definition to the Plenary Meeting for further approval.

Mr. IRFANULLAH
Chairman of Committee 5

J. RUTKOWSKI
Chairman of Committee 4

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 164-E
7 February 1984
Original : French

COMMITTEE 3

SUMMARY RECORD

OF THE

FOURTH MEETING OF COMMITTEE 3

(BUDGET CONTROL)

Thursday, 2 February 1984, at 1410 hrs

Chairman : Mr. E. DuCHARME (Canada)

Subjects discussed :		Document
1.	Summary Record of the Third Meeting	128
2.	Position of the Conference accounts at 27 January 1984	151
3.	Draft report of Committee 3 to the Plenary Meeting	DT/40
4.	Date of the next meeting	74

1. Summary Record of the Third Meeting (Document 128)

The Summary Record of the Third Meeting was approved.

2. Position of the Conference accounts at 27 January 1984 (Document 151)

2.1 The Secretary introduced the document.

Annex 1

Subhead I :

In accordance with the decision taken at the second meeting, the credit of 100,000 Swiss francs provided in the budget for electronic equipment had been reinstated at the request of the IFRB.

Subhead II :

The estimate for supernumerary staff had been reduced by 90,000 Swiss francs. With regard to travel expenses, initially estimated at 200,000 Swiss francs, provision was now being made for a credit of only 100,000 Swiss francs. Thus the overall difference in relation to the adjusted budget was approximately 220,000 Swiss francs.

Subhead III :

Savings had also been made in expenditure on premises and equipment. The margin in relation to the budgeted amount of 410,000 Swiss francs was currently 150,000 Swiss francs.

The totality of the adjusted Conference budget, i.e. 2,556,000 Swiss francs, would probably not be used. There would be a margin of 365,000 Swiss francs, and further savings might be possible.

Annex 2

The final total for section 17 was 82,421 Swiss francs. Total expenditure for 1983 (limit value, i.e. on 1 September 1982) amounted to 403,000 Swiss francs, or 331,000 Swiss francs less than the 1983 budget.

Annex 3

The difference for 1983 given in the third column of the table was currently 497,000 Swiss francs. Thus only about 50% of the credits had been used.

2.2 The delegate of Japan observed that total expenditure under Subhead I of Annex 1 exceeded the amount given in the adjusted budget by 9,000 Swiss francs. He asked whether the ITU's accounting system made any allowance for such excess expenditure.

2.3 The Secretary said that, under the Financial Regulations of the Union, spending in excess of the credits entered against a subhead was not directly authorized; if expenditure was higher than the credits provided, the Administrative Council had to be informed and justification provided. With regard to item 11.401, he explained that the IFRB had considered it essential to issue a special contract to one official, on the understanding that a corresponding saving would be made on intersessional work. However, as only an estimate was involved, the related particulars did not appear in Annex 1, and it had been assumed that the totality of the credits authorized by the Administrative Council for intersessional work would be used. However, he was convinced that the credit of 519,000 Swiss francs would not be exceeded.

2.4 In reply to the delegate of the United States of America, who asked whether the amounts saved in 1983 could be made available to the Conference in 1984, 1985 and 1986, the Secretary said that credits which had not been used in 1983 would not be available to the Secretary-General in 1984. However, the Administrative Council at its 1984 session could enter the amounts concerned in the budget for 1985, in accordance with Additional Protocol I to the International Telecommunication Convention (Nairobi, 1982).

3. Draft report of Committee 3 to the Plenary Meeting
(Document DT/40)

3.1 The Secretary introduced the draft report to the Plenary Meeting, which was based on the reports of previous conferences. However, it was the first to be submitted since the entry into force of the Nairobi Convention and one important addition had been made to the terms of reference of the Budget Control Committee, namely, point c), in respect of which a note had already been addressed to the Chairmen of Committees 4 and 5.

Sections 1 to 4 of the draft report followed the pattern of past years. The difference between the (adjusted) credit allocated by the Administrative Council and the total estimated amount to be charged to the ordinary budget for the Conference would have to be inserted in section 3. Section 5 would be completed at a later stage. The name of the Inter-American Association of Broadcasters should be added to the list in section II.4 of Annex 3.

3.2 The Chairman observed that the Committee would probably need to hold more than five meetings. In addition, the second part of the comments recorded in paragraph 2.1 of the Summary Record of the First Meeting (Document 63) concerning the facilities available to delegates should be added to section I of the draft report.

4. Date of the next meeting (Document 74)

4.1 The Chairman noted that, pursuant to Resolution 48 and Article 80 of the Convention, Committee 3 could not complete its work until Committee 5 had held its last meeting. He would therefore request the Steering Committee to take the necessary action.

It was so agreed.

The meeting rose at 1435 hours.

The Secretary :
R. PRELAZ

The Chairman :
E. DuCHARME

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 165-E
8 February 1984
Original : English

COMMITTEE 4

SUMMARY RECORD

OF THE

TENTH AND LAST MEETING OF COMMITTEE 4

(TECHNICAL CRITERIA)

Thursday, 2 February 1984, at 1055 hrs and 1405 hrs

Chairman : Mr. J. RUTKOWSKI (People's Republic of Poland)

Subjects discussed :		Document
1.	Report of the Chairman of ad hoc Group 4C	141, 133(Add.1)
2.	Report of the Chairman of Working Group 4A (continued)	133
3.	Report of the Chairman of ad hoc Group 4G	DL/20
4.	Report of the Chairman of ad hoc Group 4D	-
5.	Appropriate equivalent isotropically radiated power	152
6.	Tenth report of Working Group 4B to Committee 4 (continued)	129
7.	Document 135 (Canada)	135
8.	Completion of the work of the Committee	-

1. Report of Chairman of ad hoc Group 4C (Documents 141, 133(Add.1))

1.1 The Chairman of ad hoc Group 4C said that the Group had met that morning and had had a very full discussion, but had not been able to reach a unanimous conclusion. As he had previously reported, the ad hoc Group had considered whether the protection ratio including subjective factors was different from the objective measurement of signal-to-interference ratio. Not all members had been convinced, but the majority had agreed that a difference did exist and that it was appropriate to take it into account. At that morning's meeting, two delegations had supported the view that 5 dB, as proposed by the delegation of India (Document 131) should be added to the steady state protection ratio before going on to consider the additional effects of signal fading (in the hour or from day-to-day variation). Another two delegations had thought that it might be sufficient to take the 5 dB to represent all the fading with no other allowances, but it had finally been agreed that some additional allowance for day-to-day fading was necessary and it had been proposed that another 5 dB be allowed for that, the total r.m.s. value would therefore be 7 dB.

The debate had continued, with very different views being expressed, and for a time it had appeared that a slightly amended version of the United Kingdom proposal in Document 145 might prove acceptable. Towards the end of the meeting, however, another compromise had been found which, though not accepted by all, was agreeable to the majority. That consisted in redrafting steps 13 and 14 in Table 2A (Document 133(Add.1)) as follows :

Step	Description	Source	
13	10% fading allowance	10 dB (< 60° corrected geomagnetic latitude) 14 dB (≥ 60° corrected geomagnetic latitude)	*
14	90% fading allowance	10 dB (< 60° corrected geomagnetic latitude) 14 dB (≥ 60° corrected geomagnetic latitude)	*

coupled with a firm recommendation that those values would only be acceptable if the maximum reliability allowed for in the planning process were 80%. The inclusion of a footnote, similar to Note 1 to section 3.2.3.2 of Document 115(Rev.1) was also stated necessary, and possibly a cross reference to the associated maps. From Document 121, which gave the variation of the probability distribution, it would be seen that for 80% of the time those numbers were effectively reduced to 0.63 of their value at 90%. That reduced the effect of any small error in a statistically acceptable way and made it easier to accept the compromise proposal.

If the proposal were accepted, it would be necessary to modify Table 2A in Document 133(Add.1) by deleting steps 2-5 and 8-11 and renumbering the whole Table. While the proposal was not entirely satisfactory, it was the best compromise which ad hoc Group 4C had been able to achieve.

1.2 The delegate of India expressed his appreciation of the efforts mady by the Chairman of ad hoc Group 4C to evolve a reasonable compromise, and said that in a spirit of cooperation his delegation could accept it.

1.3 The delegate of China said that the great majority of participants at the ad hoc Group meeting had accepted that compromise solution. He warmly supported it, while reaffirming his delegation's intention of cooperating in all the Conference's future work.

1.4 The delegate of Brazil said that his delegation, which had not taken part in the work of the ad hoc Group, could accept the compromise solution proposed.

1.5 In the absence of objections, the Chairman declared the proposal adopted and said that Table 2A would be redrafted by the Secretariat with the help of the Chairman of ad hoc Group 4C.

1.6 The delegate of Iran suggested that Figure 2 in section 3.2.4.2 (Document 133) needed to be redrawn in the light of the decision taken.

1.7 The Chairman of ad hoc Group 4C pointed out that the decisions related to the alternative method described in Addendum 1, but agreed that Figure 2A needed to be redrawn. He asked for latitude to make drafting changes to section 3.2.4.2 in order to make it clear that two different methods were being presented for approval so that Committee 5 would have a choice.

In reply to a suggestion by the representative of the IFRB, he said that he was unable to add any technical guidance on the advantages and disadvantages of the two methods to assist Committee 5 in making its choice. He could only point out that the first method used the objective criterion of the radio-frequency signal-to-interference ratio, while the second was based on the radio-frequency protection ratio and took subjective factors into account.

1.8 The Chairman said that the planning method needed to be known before any further decisions could be made.

2. Report of the Chairman of Working Group 4A (continued) (Document 133)

2.1 Section 3.2.4.3 (Basic reception reliability)

2.1.1 The Chairman of Working Group 4A introduced section 3.2.4.3 (Annex 2 to Document 133). He explained that the square brackets at steps (4) and (6) of Table 3 simply indicated that the procedures they enclosed might not be needed. They should therefore be retained pending a decision whether the procedures were to be used in the planning method or not. If the section was approved, Committee 5 or the Plenary Meeting would need to take a clear decision on the matter.

2.1.2 The Chairman said that if he heard no objection, he would take it that the Committee wished to approve the section.

Section 3.2.4.3 was approved.

2.2 Section 3.2.4.4 (Overall reception reliability)

2.2.1 The Chairman of Working Group 4A introduced section 3.2.4.4 (Annex 2 to Document 133). He said that the method described was similar to the one just approved for determining basic reception reliability. The square brackets at steps (4) and (6) of Table 4 should be retained for the same reasons as those in Table 3.

2.2.2 The Chairman said that if he heard no objection, he would take it that the Committee wished to approve the section.

Section 3.2.4.4 was approved.

2.3 Section 3.2.4.5 (Basic and overall broadcast reliability)

2.3.1 The Chairman of Working Group 4A introduced section 3.2.4.5 (Annex 2 to Document 133), outlining the method for determining basic and overall broadcast reliability, He pointed out that at step (1) in Tables 5 and 6, the term "broadcast area" used in the description of the parameters might need to be made more precise. The reliability to be specified at step (2) of those tables would be determined by the planning method.

2.3.2 The delegate of Brazil said, with reference to the second paragraph of section 3.2.4.5, that it might be difficult to associate overall broadcast reliability with a specified percentile in areas with only one or two test points.

2.3.3 The Chairman said that the problem might be solved by the decision about increasing the number of test points taken on 1 February. Alternatively, a single test point might suffice for a very small area.

2.3.4 The delegate of Algeria proposed that the terms used to describe the area covered should be placed in square brackets pending a final definition of the concept of required service area. He also asked if it was proposed to produce French and Spanish equivalents of the English acronyms used to designate the parameters in all three language versions of the section.

2.3.5 The Chairman said he thought there had been unanimous acceptance of the definition of required service area agreed by the joint meeting of Committees 4 and 5 on 1 February and contained in Document 163. The section could therefore use that term. If any delegation still had reservations, they could be raised when the text went to the Plenary Meeting for first reading. There was no objection to the term being placed in square brackets in the meantime.

As for the designation of parameters, it was a matter of convenience for programming work that only one set of acronyms be used. However, as the delegate of Algeria had pointed out, it was important that a note be inserted in all language versions to explain the fact and so avoid unnecessary confusion. If there were no other objections, he would take it that the Committee wished to approve the section.

Section 3.2.4.5 was approved, subject to the amendments indicated.

2.4 The Chairman said that the Committee had thus completed its consideration and approval of Document 133.

3. Report of Chairman of ad hoc Group 4G (Document DL/20)

3.1 The Chairman introduced the note contained in Document DL/20 which he had prepared in order to clarify the situation with regard to certain passages in square brackets in Documents 115(Rev.1), 133 and 146 consequent upon the decision to adopt the parameters proposed by ad hoc Group 4G. The addition of a sentence at the end of section 3.4.1.6 in Document 146 was proposed. The fourth, fifth and sixth paragraphs of section 3.5.2 would remain in square brackets, only those around "+ 3 dB" in the third line being removed.

3.2 The Chairman of ad hoc Group 4G, referring to step 17 of Table 1, section 3.2.4.1.1, in Document 133 suggested that the value "34 dB" should be inserted as well as the section number specified in the Chairman's note.

It was so agreed.

It was decided to incorporate the contents of Document DL/20, thus amended, in a white document to be transmitted to the Editorial Committee.

4. Report of Chairman of ad hoc Group 4D

4.1 The Chairman said that the Group had terminated its work after holding three meetings. Four items for which minimum values might be established in addition to the non-exhaustive list of parameters in Document 106 had been identified. At the conclusion of its work the Group had been divided on the main issue before it and had been prevented by lack of time from progressing towards a compromise solution. The Committee would thus have to choose between two alternative solutions, or else decide to forward both alternatives to Committee 5.

The first solution, advocated by some of the administrations participating in the Group, would consist of informing Committee 5 that Committee 4 lacked the necessary technical information in order to establish the minimum values requested by Committee 5, at the same time drawing the attention of Committee 5 to the curve in Figure B/3.3.1 in Document 115(Rev.1) (Relationship between reception quality and co-channel RF protection ratio) as well as to the curve in Figure 2, Document 73(Add.1) (AF signal-to-noise ratio), indicating in the same curve the quality assessment grade corresponding to the AF signal-to-noise ratio of 24 dB. Attention should also be drawn to Figure C/3.3.2 in Document 115(Rev.1), which was considered to provide useful information on the relationship between quality assessment grade and impairment assessment grade.

The other view held within the Group was that Committee 4, as a technical committee, should provide at least some of the information required by Committee 5. Delegations subscribing to that view had agreed on the following minimum parameters : co-channel protection ratio : 17 dB (no fading margin need be given); AF signal-to-noise ratio : 19 dB; man-made noise could be neglected; overall basic reliability : 50% for both broadcasting and reception; quality assessment grade : between 2 and 3, but closer to 3; noise limited sensitivity of the receiver : 40 dB V/m.

Replying to a point raised by the Chairman, he said that the Group had briefly considered the proposals by New Zealand (Document 143) but had not found that the information contained in Tables 1 and 2 added anything of substance to what already appeared in Documents 115(Rev.1) and 73(Add.1). RF signal-to-noise ratio could be calculated simply by adding 10 dB to the AF signal-to-noise ratio value.

4.2 The Chairman suggested that the Committee might wish to adopt both alternatives by submitting to Committee 5, on the one hand, the curves mentioned in connection with the first alternative by the Chairman of ad hoc Group 4D, and, on the other hand, some if not all of the minimum values proposed by the advocates of the second solution.

4.3 The delegate of the United States of America said that to endorse minimum values on which unanimity had not been reached in ad hoc Group 4D would be a dangerous step. The Committee should not override the views of administrations which did not accept those minimum values.

4.4 The delegate of Algeria congratulated the Chairman of ad hoc Group 4D on presenting a clear report in the face of considerable difficulties. His delegation preferred the second alternative as being closer to the Group's terms of reference, but would not object to the adoption of both alternatives if a majority of the Committee's members so desired. He recalled that at a previous meeting he had questioned the correctness of figures contained in Table 1 of Document 143, which therefore should not be forwarded to Committee 5.

4.5 The delegates of India and Pakistan endorsed the Algerian delegate's view.

4.6 The delegate of the United Kingdom, referring to the second alternative, remarked that, in his opinion, there was no need to specify that man-made noise could be neglected; now that a value for intrinsic noise had been agreed, that parameter would always be ignored in any case, and a reference to it in connection with minimum values might prove confusing. Secondly, he considered that the fading margin would have to continue to be specified in order to calculate whether 50% reliability had been achieved. Thirdly, a co-channel protection ratio of 17 dB surely corresponded to a quality assessment grade of 3 and not to one between 2 and 3. All in all, he took the view that it would be more helpful to Committee 5 simply to provide the curves, and therefore endorsed the views expressed by the delegate of the United States of America.

4.7 The delegates of the Federal Republic of Germany, France and Italy agreed with the delegates of the United States of America and the United Kingdom that only the first alternative - that of forwarding a set of curves to Committee 5 - should be adopted.

4.8 The delegate of the Netherlands also supported that view. In his opinion, the curve derived from Document 143 was valid but should be corrected for 50% overall basic reliability instead of 80%, so as to make it comparable with the curve for co-channel interference.

4.9 The delegate of Yugoslavia said that the co-channel protection ratio of 17 dB took account of the absence of an additional allowance for fading. There was no contradiction between that value and a minimum quality assessment grade "between 2 and 3, but closer to 3," which corresponded to a co-channel protection ratio of 15 dB. Like the delegate of Algeria, he preferred the second alternative, but would not be strongly opposed if the Committee decided to forward also to Committee 5 the curve in Document 73(Add.1) and Figures B/3.3.1 and C/3.3.2 in Document 115(Rev.1).

4.10 The delegate of the USSR said that he was in favour of the first option; it would complicate planning to give minimum values as in the second option. If, for instance, the minimum value of the protection ratio was 17 dB and difficulties arose at the planning stage, the protection ratio might have to be decreased to, for example, 12 dB, which would be impossible; for it would not be acceptable to go below that minimum value. Some administrations might be able to accept a lower value for the protection ratio only if their requirements were met. In his view the Committee would be making a mistake if it recommended a minimum value, for it had absolutely no technical foundation for so doing.

4.11 The delegate of Algeria expressed surprise at those comments. He quoted paragraph 2 of Document 106, in which Committee 5 had requested Committee 4 to establish, in addition to the desired values, the minimum values of the technical parameters below which the service could be deemed unusable. Below those values, therefore, there would be no planning and no service.

4.12 In reply to the delegate of Yugoslavia who asked whether the second session would have the power to change values established by the first session, the Chairman said that each session was sovereign.

Summarizing the discussion, he said that opinions in the Committee were still divided, but a solution might easily be found on some points. For instance the 17 dB proposed for the co-channel protection ratio corresponding to the quality of 3 was a value already being used by the IFRB, though arguably it might be improved. As to the overall reception reliability of about 50%, the Committee had in fact already agreed that 50% was the minimum value to be used for determination of a second frequency. A figure had also been agreed for noise-limited sensitivity.

The two major problems that still created serious difficulties for a number of delegations were the fading margin and man-made noise. He suggested that delegations should hold informal discussions to solve those problems.

4.13 Following the informal consultations held at the suggestion of the Chairman, the delegate of India put forward a compromise proposal. Committee 4 should indicate two curves (those in Document 115(Rev.1) and Addendum 1 to Document 73) and indicate a few parameters that could be considered as minimum, namely, the co-channel protection ratio under suitable conditions, which should be 17 dB; the AF signal-to-noise ratio, which should be 19 dB; reliability, which should be 50%; and quality assessment grade which should be approximately 3.

4.14 The delegate of Algeria pointed out that in addition to the reasons he had already given for preferring minimum values, the curve in Document 73(Add.1) resulted from experiments in a single country, with 80 or 90% of listeners. He could, if necessary, agree to the inclusion of that curve if it were rectified by taking account of agreed satisfactory parameters, namely, the relationship between the degree of satisfactory quality and the 24 dB agreed for the audio-frequency signal-to-noise ratio.

Although he was prepared to accept the Indian compromise if the Committee endorsed it, he wished the record to show that his delegation preferred the minimum value solution.

4.15 The delegate of the United States of America said that it made little difference whether the values were shown in a list or, as the Indian delegate wished, as a dot on a curve : the problem was the lack of adequate criteria to make a judgment on a minimum value. It would do a great deal of harm to the planning process to make such a subjective judgment based on practically no criteria and he was not in favour of adopting such a solution.

4.16 The delegate of the USSR said that the compromise proposed did not alter his view that there was no technical foundation for indicating minimum values. He could not agree to the proposal.

4.17 The delegates of Yugoslavia and Brazil said that they could support the Indian proposal.

4.18 The delegate of Bulgaria considered that only the curves and not the minimum values should be sent to Committee 5.

4.19 The delegate of Canada pointed out that it was almost impossible to set a minimum acceptable value for all administrations because of the lack of technical criteria to be used. It should be suggested that if Committee 5 required a precise value it could be obtained on the basis of the curves provided by Committee 4.

4.20 The delegate of China agreed with the Indian compromise proposal, which was reasonable and would allow the Conference to achieve its goal.

Some delegations had expressed concern at the use of minimum values but it was clear that their adoption would not alter the decisions adopted previously in Document 154(Rev.1), (B.3/2).

The problem could be solved by asking Committee 5 to specify the use of the minimum values proposed by Committee 4.

4.21 The delegate of the United Kingdom said that he too was concerned at the proposal for specific mention of minimum values.

4.22 The Chairman said that delegations still appeared to be divided in their view of the compromise proposed. He therefore regretfully suggested that he should report to the Plenary and to Committee 5 that no solution could be agreed upon. It would then be for the Chairman of Committee 5 to reopen the matter if he wished.

4.23 The delegate of Algeria requested the Chairman, in his report to Committee 5 and to the Plenary, to indicate in detail the two proposals put forward and the comments made on each. Despite efforts on one side at a compromise, taking into account the concerns expressed on the margin of fading and the quality of service, there had been no corresponding effort on the other side. He requested that a detailed description of the work of Working Group 4D, with values and curves, be given in the Chairman's report.

4.24 The Chairman replied that that was his intention.

4.25 The delegate of the USSR said that the comment made by the delegate of Algeria to the effect that the effort had been completely one-sided was not very appropriate and such sentiments could not really be included in the report.

4.26 The Chairman, to avoid any misunderstandings, summed up the essence of his report to Committee 5 and the Plenary as follows :

"Committee 4, having analyzed various options of minimum values within ad hoc Group 4D, considered the following compromise proposal :

Co-channel RF protection ratio under stable conditions : 17 dB;

AF signal-to-noise ratio : 19 dB;

reliability : 50%;

quality of reception : 3."

(Those values would be accompanied by a reference to the curve showing the relationship between the quality of reception and the co-channel RF protection ratio, which had already been adopted (Document 115) and the diagram contained in Document 73(Add.1) would be attached.)

That compromise proposal had been supported by six delegations (possibly listed) but five delegations had strongly objected to give the minimum values, being of the opinion that limiting values should not be shown; those delegations were, however, in favour of showing the dependence of quality from the parameters selected, e.g. protection ratio, SNR, etc.

Since there were no objections, he took it that the Committee agreed to that approach.

5. Appropriate equivalent isotropically radiated power (Document 152)

5.1 The delegate of Canada, introducing the document, said that it related to section 4.2.3.4.2.3 in Document DT/39, on power, and to section 3.5.2 in Annex 3 to Document 146 on transmitted power and equivalent isotropically radiated power appropriate for satisfactory service. Neither of those documents contained clear instructions as to how the appropriate calculations could be made. Document 152, on the other hand, provided two procedures for calculating the minimum required equivalent isotropic radiated power, which closely parallelled those presented in Document 133 for computing the basic circuit reliability, in that one method was based on the desired signal-to-noise ratio and the other was based on the minimum usable field strength. The e.i.r.p. obtained from either method provided the minimum necessary power to provide a service, since it assumed no interference. The Canadian delegation believed that Document 152 contained information which would be valuable to the Conference, and might usefully be incorporated as an additional part to section 3.5.2.

In view of the lack of time, the Canadian delegation did not press for an immediate discussion but requested that the document be noted for consideration during the intersessional activities if proper consideration at the present Committee 4 meeting was impossible.

5.2 The Chairman invited the Chairman of Working Group 4A to say whether, in his opinion, section 3.5.2, part of which was in square brackets pending a decision of Committee 5, might be completed by the Canadian proposal.

5.3 The Chairman of Working Group 4A said that the Canadian approach basically provided an adaptation of the procedure contained in Document 146, without mentioning reliability but assuming a reference value of reliability of 90%, enabling the e.i.r.p. to be calculated directly instead of through a series of calculations. A sentence might usefully be added to the end of the section 3.5.2 in square brackets, indicating the existence of an appropriate method for calculating e.i.r.p., and then including the Canadian document from paragraph 1.1 onwards.

5.4 The delegate of Burundi said that in his view it was extremely difficult to consider Document 152 without first completing Document 146.

5.5 The Chairman replied that the purpose of the Canadian document was to clarify the section of Document 146 at present in suspension.

5.6 The delegate of Canada agreed with that view. The paper provided an addition to section 3.5.2 as it appeared in Annex 3 of Document 146 with the necessary changes to the introduction similar to those suggested by the Chairman of Working Group 4A. The method as presented computed the minimum appropriate e.i.r.p. and to that extent was based on E_{min} as opposed to E_{ref}. Some adjustment might be necessary if the present text of Document 146 was accepted. The second approach was easily adaptable by using E_{ref} if desired.

5.7 The delegate of Algeria asked what would happen to the Canadian method if at the planning level it was considered necessary to reduce the criteria to solve the planning problems.

5.8 The delegate of Canada replied that the methods presented in Document 152 were quite general and the results would depend on the input parameters. The method was not locked in to any particular values for the parameters.

5.9 The delegate of the United States of America said that the Canadian document appeared at first sight to offer some attractive methods for making the calculations, although further consideration was undoubtedly needed to determine which method was most suitable. It certainly deserved careful study and evaluation, particularly bearing in mind that the last part of section 3.5.2 of Document 146 had been placed in square brackets primarily because of concern as to the planning method and its appropriateness. He therefore recommended that it be brought to the attention either of the Planning Group or the Intersessional Group to ensure adequate treatment in view of the lack of time in Committee 4.

5.10 The delegate of the USSR said that Document 137, which had already been adopted, contained adequate methods for calculation of the e.i.r.p. on the basis of reliability and in view of the lack of time he wondered whether another method would not merely create more problems, even though the method appeared to be a good one.

5.11 The delegate of the United Kingdom agreed that there was no time to answer the questions raised by the document. He therefore suggested that the Committee retain the text as it appeared in Document 146 even though no details of the calculation method were provided.

5.12 The Chairman said that it was clearly not possible to discuss the Canadian document properly if Committee 4 was to finish its work at the present meeting. He therefore invited the Canadian delegation to take the necessary steps to ensure that the problem was properly discussed at a later stage of the planning process.

5.13 The delegate of Canada expressed his appreciation for the brief period given for discussion and had no objections to the method proposed by the Chairman. His delegation hoped to develop its approach further and present it to the intersessional work of the Conference.

6. Tenth report of Working Group 4B to Committee 4 (Document 129) (continued)

6.1 The Chairman said that the Committee still had to take a decision in respect of Annex 2 to Document 129, which had been placed in square brackets because of doubts as to where it should be inserted. In view of the fact that it was a very general statement and had caused real problems when first discussed, he proposed that Annex 2 be deleted.

It was so decided.

7. Document 135 (Canada)

Document 135 proposed by the delegate of Canada for information on frequency selection was noted by Committee 4.

8. Completion of the work of the Committee

8.1 The Chairman announced that the Committee had now completed its work. He expressed his warmest thanks to all delegations for the spirit of cooperation and great efforts they had made, particularly the Chairmen of the Working Groups, ad hoc Groups and Drafting Groups and those members of the Secretariat whose hard work had contributed to bringing the Committee's work to an end.

8.2 The delegate of the United States of America expressed sincere appreciation for the work of the Chairman and for his excellent advice and good management. He invited all delegations to show their appreciation by a standing ovation.

8.3 The Chairman expressed his thanks and declared the meeting closed.

The meeting rose at 1700 hours.

The Co-Secretaries :

G. KOVACS
G. ROSSI

The Chairman :

J. RUTKOWSKI

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 166-E
1 February 1984
Original : English

COMMITTEE 6

EIGHTH SERIES OF TEXTS FROM
COMMITTEE 4 TO THE EDITORIAL COMMITTEE

The texts reproduced in Annex to this document were adopted in Committee 4 and are hereby submitted to the Editorial Committee.

J. RUTKOWSKI
Chairman of Committee 4

Annex

ANNEX

3.7 Reception zones and test points

3.7.1 Reception zones

In specifying the reception area, this shall be done by referring to a CIRAF-zone, or part of a zone.

If necessary, CIRAF-zones may be divided into four quadrants NW, NE, SE and SW to define more precisely the service area of a transmission. This is achieved by defining an appropriate reference point in each CIRAF-zone with the dividing lines described precisely by the lines of latitude and longitude passing through such a reference point. Any combination of the four quadrants may be used where the service area is greater than one quadrant but less than a whole CIRAF-zone.[1]

Ten maritime broadcasting areas (provisionally designated as A to J) are defined as shown in Annex /‾A_7.[2]

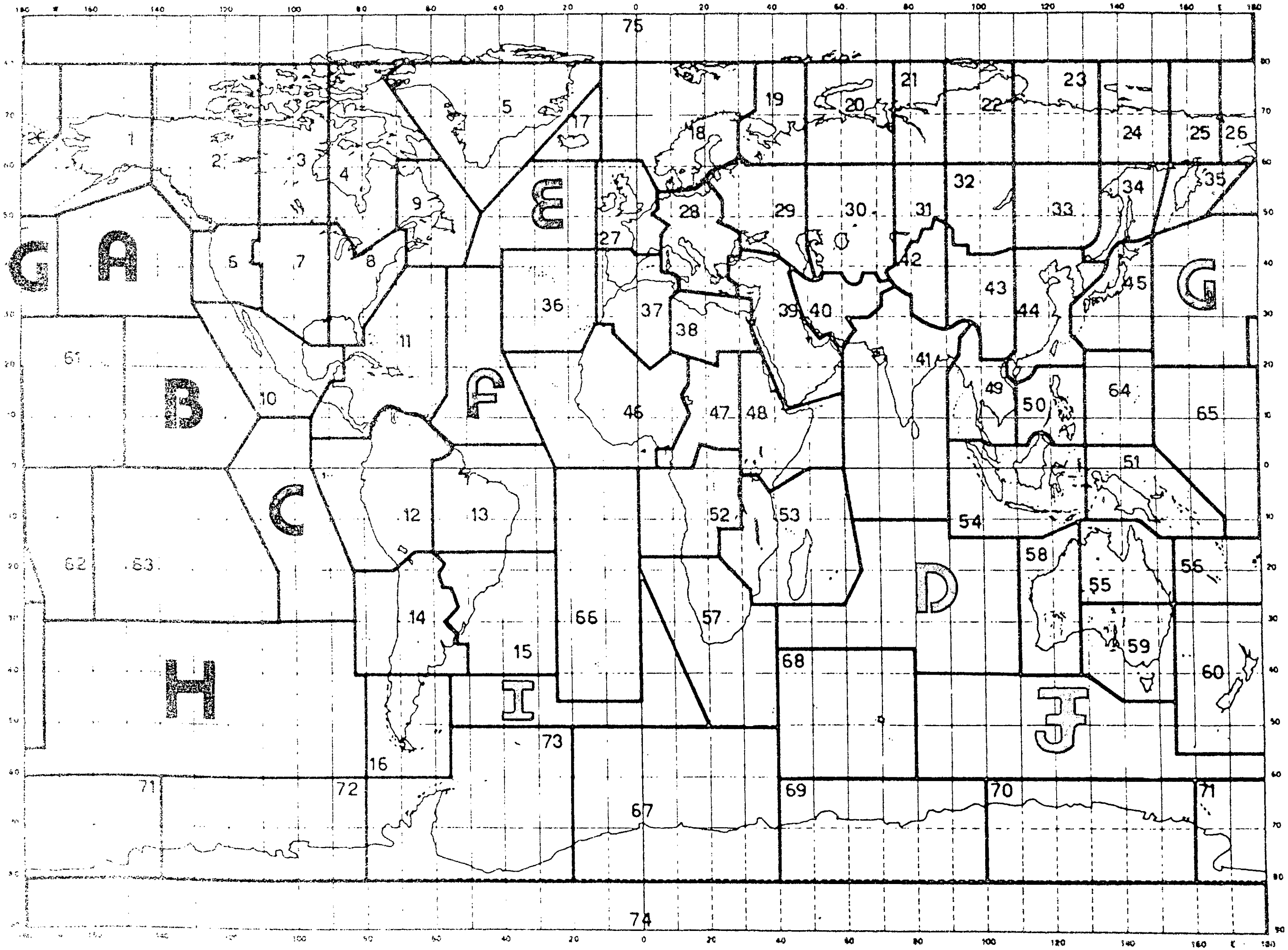
3.7.2 Test points

The IFRB shall provide for the purposes of the technical examination an adequate number of test points distributed throughout each CIRAF-zone and where appropriate, subdivisions of CIRAF-zones. These test points shall form part of the IFRB Technical Standards which will be distributed for comment by administrations (Nos. 1001 and 1001.1 of the Radio Regulations).

As the computer facilities available to the IFRB improve, the Board shall make further improvements by increasing the number of test points.

Note 1 - In specifying the reception area which is smaller than an entire zone or subdivision of a zone it should be indicated, as an exception, by appropriate test points including the maximum service range in km. See Appendix 2 of the Radio Regulations.

Note 2 - Committee 5 may wish to consider the procedures applicable in examining the compatibility of requirements in these maritime broadcasting areas.



GEOGRAPHICAL ZONES FOR BROADCASTING

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Corrigendum 1 to
Document 167-E
2 February 1984
Original : English

COMMITTEE 5

Note by the Chairman of Committee 4
to the Chairman of Committee 4

(This Corrigendum affects the French text only.)

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 167-E
1 February 1984
Original : English

COMMITTEE 5

Note by the Chairman of Committee 4
to the Chairman of Committee 5

Committee 4 considered and adopted the texts reproduced in Annex to this document concerning section 3.7 of the Report (Reception zones). The Committee asked me to draw the attention of Committee 5 to the fact that some maritime broadcasting areas were defined and that Committee 5 might wish to consider the procedure applicable to requirements for these areas (see Note 2 under 3.7.1).

J. RUTKOWSKI
Chairman of Committee 4

Annex : 1

ANNEX

3.7 Reception zones and test points

3.7.1 Reception zones

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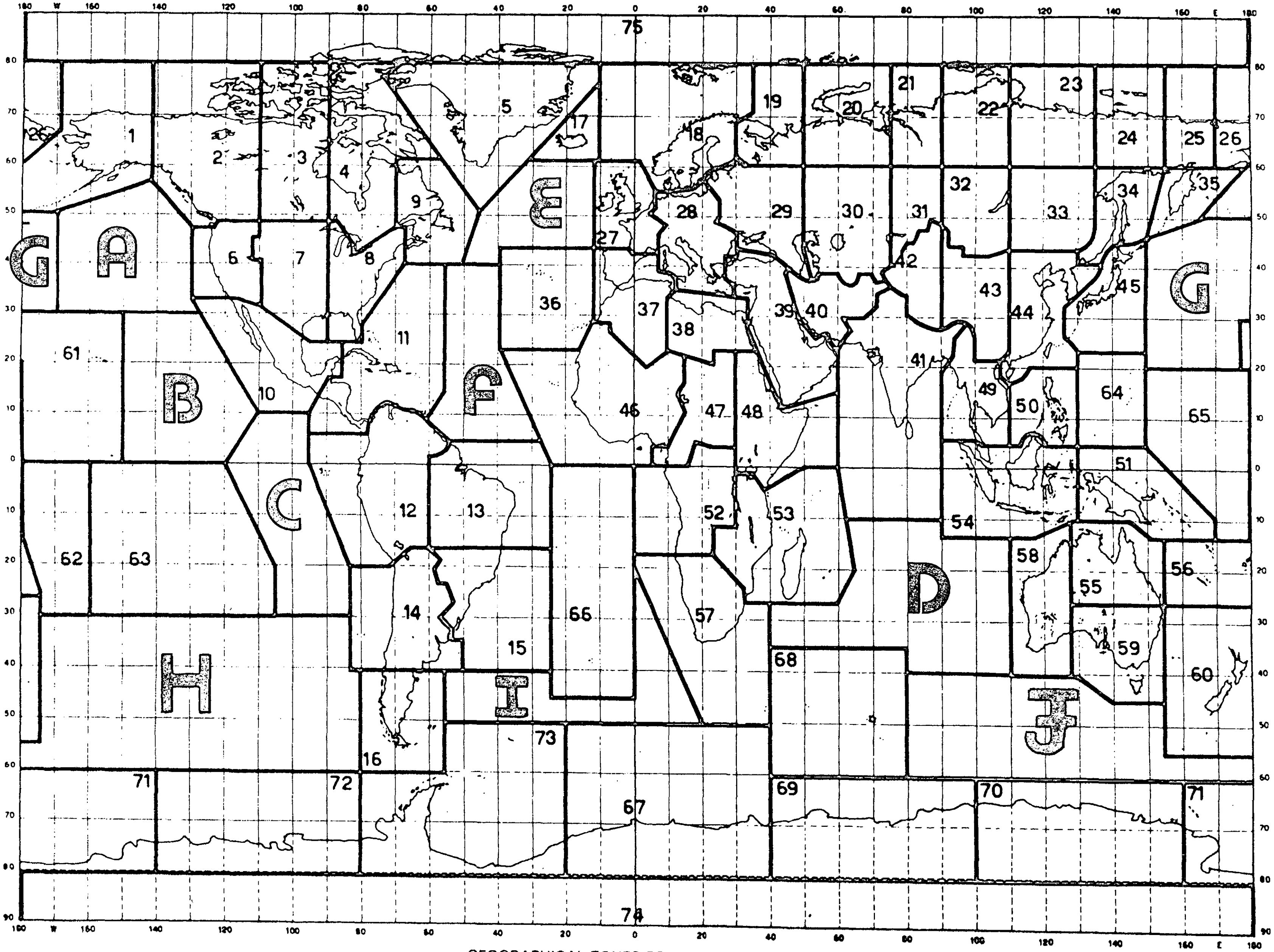


GEOGRAPHICAL ZONES FOR BROADCASTING

BLUE PAGES

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 168-E
2 February 1984

B.4

PLENARY MEETING

FOURTH SERIES OF TEXTS SUBMITTED BY THE
EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for first reading :

Source	Document	Title
COM.4	160	Chapter 3.5 - Antennas and power
		Chapter 3.8 - Maximum number of frequencies required for broadcasting the same programme to the same zone

Marie HUET
Chairman of Committee 6

Annex : 17 pages

3.5 Antennas and power

The combined effect of transmitter power and antenna characteristics which determines the equivalent isotropically radiated power (e.i.r.p.) is the main factor in computations for HF broadcasting planning. The most directional antenna possible which is appropriate to the broadcasting requirement should be chosen when selecting power and associated antennas. The power required must be as low as possible to achieve broadcasting objectives.

3.5.1 Antenna characteristics

In HF broadcasting the antenna is the means by which the radio-frequency energy is directed towards the required service area. The selection of the right type of antenna will enhance the signal in this area, while reducing radiation in unwanted directions. This will protect other users of the radio-frequency spectrum operating on the same channel or adjacent channels to another service area. The use of directional antennas with well-defined radiation patterns is thus recommended as far as possible.

Non-directional antennas can be used when the transmitter is located within the required service area. In this case the required service area as seen by the transmitter extends over an azimuthal angle greater than 180°.

Directional antennas serve a double purpose. The first is to prevent interference to other users of the spectrum by means of their directivity. The second is to provide sufficient field-strength for satisfactory reception by means of their power gains.

Although rhombic antennas are used, they should be discouraged because of the size and number of their sidelobes, which could create technically avoidable interference.

3.5.1.1 Choice of optimum antennas for various types of service

A chart in Figure [I/3.5.1.2] gives some general guidelines for the choice of optimum antennas for a given type of service according to the required distance range. Two different categories are considered : short distance and medium/long-distance services.

A short distance service is understood here to have a range of up to about 2,000 km. The corresponding area can be covered with either a non-directional or a directional antenna whose beamwidth can be selected according to the sector to be served. In the case of directional antennas, both horizontal dipole curtain and logarithmic-periodic antennas can be employed. The latter type is multiband array with a wide operating frequency range, a low-to-medium gain and a large horizontal beamwidth.

Medium and long distance services can be considered to reach distances greater than approximately 2,000 km. Such coverage can be provided by antennas whose main-lobe elevation angle is small (6°-13°) and whose horizontal beamwidth - depending on the area to be served - is either wide between 65° and 95° (generally 70°) or narrow between 30° and 45° (generally 35°).

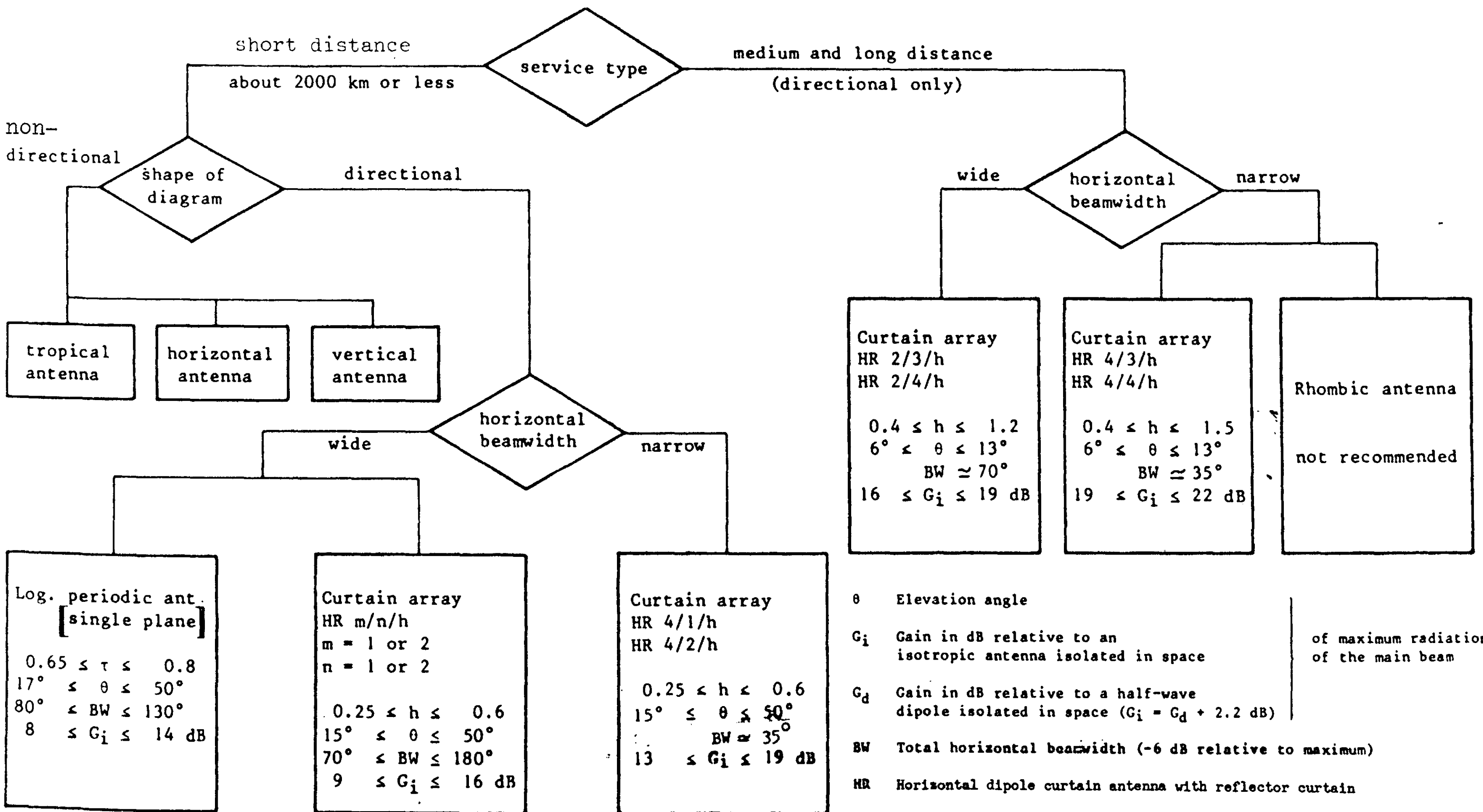
The value of the field-strength in the reception area is influenced by the radiation characteristics of the antennas, and this will be optimized if the most suitable type of antenna is used. The direction of radiation of the main lobe of a short-wave antenna, its elevation angle and maximum gain are principally dependent upon the type of array and its height above ground.

Figure /¯II/3.5.1.2_7 illustrates the way in which these parameters vary for horizontal dipole curtain antennas fitted with reflectors and for arrays with most of the commonly-used arrangements of dipoles when operated close to their design frequency. The way in which the maximum gain and elevation angle of the main lobe of rhombic antennas vary with height above ground is also shown.

Figure /¯III/3.5.1.2_7 shows the angle of elevation involved in the propagation of short-wave signals via the F-layer for distances up to 10,000 km. It can be seen that the angles tend to be less than 10° for all distances beyond 5,000 km and angles above about 20° are only suitable for distances of less than 2,000 km. Figure /¯II/3.5.1.2_7 shows that low angle arrays whose maximum radiation is at angles of 10° or less tend to have the highest gains, and that low-gain antennas have their maximum radiation at the high angles most suitable for short-distance services.

3.5.1.2 A set of representative types of antenna

Antenna patterns used for planning purposes need to take account of practical considerations; they should be standardized for reference purposes and they should be representative of the large range of types of antenna in common use. For a set of representative antenna types recommended for planning purposes, based on single band antennas, Table /¯A/3.5.1.2_7 indicates, according to the vertical and azimuthal characteristics, the gain (dBi) and the elevation angle of maximum radiation. Details of the total horizontal beamwidth (between -6 dB points) for the different types of antenna are also given in Table /¯B/3.5.1.2_7.



θ Elevation angle

G_i Gain in dB relative to an isotropic antenna isolated in space — of maximum radiation of the main beam

G_d Gain in dB relative to a half-wave dipole isolated in space ($G_i = G_d + 2.2$ dB) — of maximum radiation of the main beam

BW Total horizontal beamwidth (-6 dB relative to maximum)

HR Horizontal dipole curtain antenna with reflector curtain

m Number of half-wave elements in each row

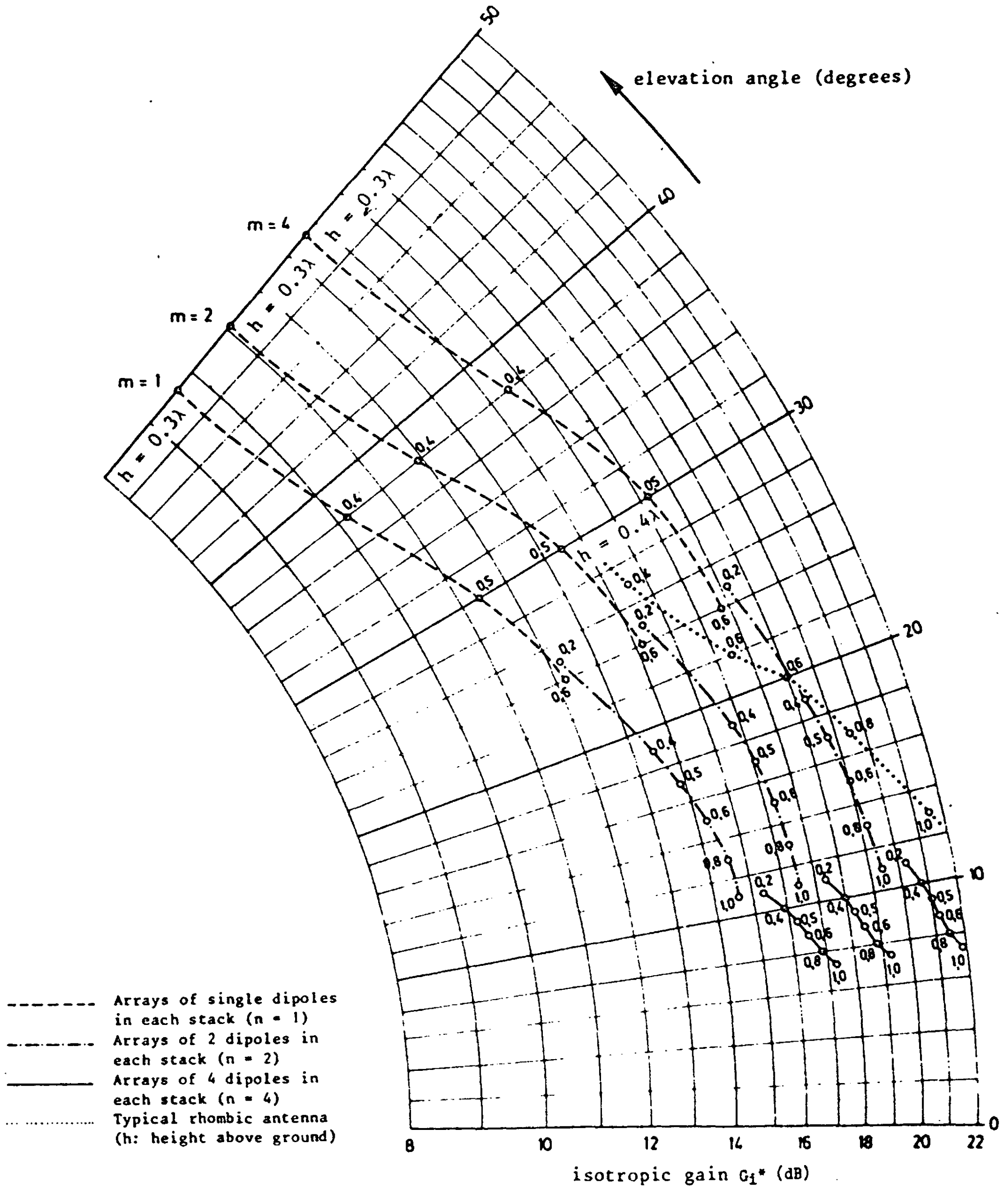
n Number of half-wave elements in each stack (one above the other)

h Height above ground in full wavelengths of the bottom row of elements

τ Taper ratio of log. periodic antenna

FIGURE /¯I/3.5.1.2_7

Antenna selection chart



Nomenclature according to Appendix 2, page 7 of the Radio Regulations (1982 edition)

HR : horizontal dipole curtain antenna with reflector curtain
m/ : number of half-wave elements in each row
/n/ : number of half-wave elements in each stack (one above the other)
/h : height above ground in full wavelengths of the bottom row of elements, or of typical rhombic antennas

FIGURE /¯II/3.5.1.2_7

Variation of maximum gain (dBi) with elevation angle, for horizontal dipole curtain arrays fitted with reflectors and for typical rhombic antennas, above a perfect earth

* $G_i = G_d + 2.2$ dB

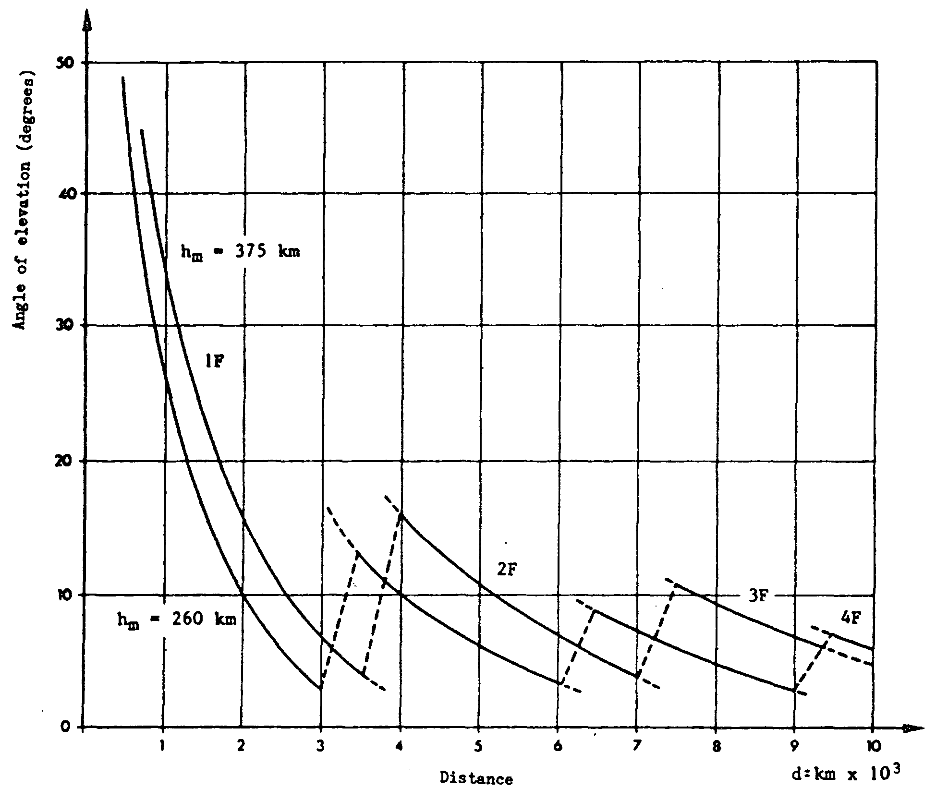


FIGURE [III/3.5.1.2]

Variation of elevation angle with distance (d) for representative F-layer heights h_m

Principal characteristics of the set of representative types of antenna

TABLE /‾A/3.5.1.2_7

Gain and elevation angle in the direction of maximum radiation

TYPE OF ANTENNA / VERTICAL CHARACTERISTIC ---/m/n/h	IN THE DIRECTION OF MAXIMUM RADIATION					
	AZIMUTHAL CHARACTERISTIC					ELEVATION ANGLE θ (DEGREES)
	HR4 GAIN G_i (dB)*	HR2 GAIN G_i (dB)*	HR1 GAIN G_i (dB)*	H2 GAIN G_i (dB)*	H1 GAIN G_i (dB)*	
-/4/1	22	19				7
-/4/0.8	22	19				8
-/4/0.5	21	19				9
-/3/0.5	20	18				12
-/2/0.5	19	16	14		11	17
-/2/0.3	18	15	13		10	20
-/1/0.5		14	12	11	9	28
-/1/0.3		11	10			44
				9	7	47

* $G_i = G_d + 2.2$ dB

TABLE /‾B/3.5.1.2_7

Total horizontal beamwidth at the elevation angle of maximum radiation (for single band antennas)

TYPE OF ANTENNA / ---/m/n/h	TOTAL HORIZONTAL BEAMWIDTH (-6 dB) DEGREES				
	HR4	HR2	HR1	H2	H1
ALL TYPES -/4/1 to -/2/0.5	35	70	108		112
-/2/0.3	35	70	110		116
-/1/0.5		74	114	78	126
-/1/0.3		90	180	180	180

For antennas not included in Table /‾A/3.5.1.2_7 the equivalent representative type whose performance is nearest to that of the antenna under consideration can be determined by reference to Table /‾C/3.5.1.2_7.

TABLE /‾C/3.5.1.2_7

Determination of the representative antenna having a radiation pattern most similar to that of any non-representative one, on the basis of the value of the parameters n and h

h	HR m/n/h				H m/n/h	
	n=4	n=3	n=2	n=1	n=2	n=1
h ≥ 0.9	m/4/1	m/4/0.8	m/3/0.5	-	-	-
0.9 > h ≥ 0.65	m/4/0.8	m/4/0.5	m/3/0.5	-	-	-
0.65 > h ≥ 0.4	m/4/0.5	m/3/0.5	m/2/0.5	m/1/0.5	m/2/0.5	m/1/0.5
0.4 > h	m/3/0.5	m/2/0.5	m/2/0.3	m/1/0.3	m/2/0.3	m/1/0.3

(m=4, 2 or 1, where appropriate)

3.5.1.3 Multi-band antennas

In the case of multi-band antennas, (curtain and log periodic) a single value of h, an important parameter with regard to the vertical radiation pattern and the angle of maximum radiation, no longer corresponds to the physical height of the bottom row of elements of the antenna over the range of operating frequencies. The equivalent value h at the required frequency of operation can be found in the following way : in Figure [IV/3.5.1.3] enter the vertical angle of maximum radiation, taken from the antenna diagram for the respective frequency band, into the ordinate. Choose the curve with the appropriate value of n. Read from the abscissa the equivalent height h. The equivalent type of antenna can then be determined by entering this new value of h in Table [C/3.5.1.2].

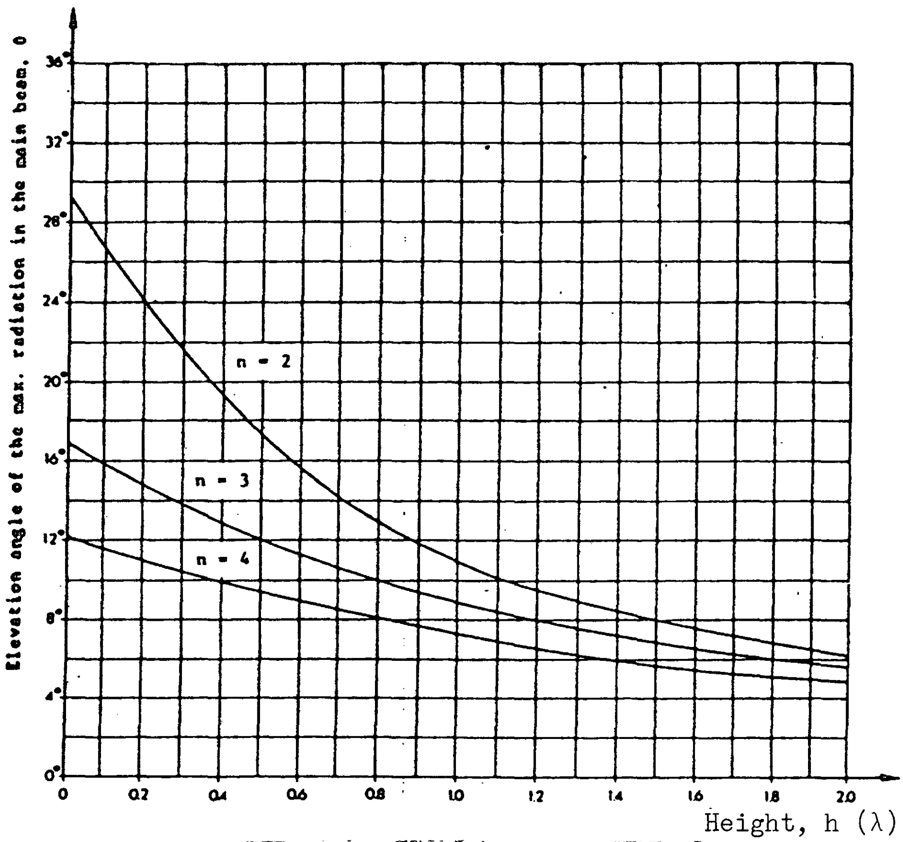


FIGURE [IV/3.5.1.3]

Diagram enabling the equivalent value of the parameter h to be determined for a multiband antenna having n half-wave elements in each stack

Additional data relating particularly to the azimuthal performance over the operating range of a multi-band antenna are required for later inclusion in Table /‾D/3.5.1.5_7 as they become available. Between the two sessions, therefore, administrations are requested to submit to the CCIR accurate data in the format given in Table /‾D/3.5.1.5_7.

3.5.1.4 Simplified antenna patterns for planning purposes

The vertical pattern and azimuthal pattern of the antennas listed in Table /‾A/3.5.1.2_7 can be represented by values of the relative attenuation in dB below maximum gain, each value being relative to the maximum radiation in both elevation and azimuth and to the maximum gain of the array. The attenuations, in dB, relative to maximum gain, for the azimuthal pattern are listed in Table /‾D/3.5.1.5_7 and those for the vertical pattern are listed in Tables /‾E, F, G/3.5.1.5_7.

When an antenna is slewed horizontally, the main beam may be considered as unchanged in shape. It can, therefore, be assumed that the azimuth of maximum radiation of the main beam in the slewed mode coincides with the horizontal angle $\psi = 0$ (see paragraph 3.5.1.5) in Table /‾D/3.5.1.5_7. The radiation outside the main beam should be represented in a similar tabulated form and the CCIR Secretariat is requested to provide the appropriate values, based on the data contained in the CCIR Antenna Handbook.

3.5.1.5 Representation of antenna patterns

Antenna diagrams are conventionally used to represent the spatial radiation distribution of an antenna or an array of antennas. The CCIR uses a sinusoidal projection, called "SANSON-FLAMSTEAD PROJECTION" where the hemisphere and the contours are represented in a single plane.

The formulas from which these patterns have been developed are extremely complex.

The three-dimensional radiation pattern of an antenna can be derived from :

a) the vertical radiation pattern within the plane normal to the horizontal plane comprising the azimuth of maximum radiation $G(\theta)|_{\varphi = 0^\circ}$

b) the azimuthal radiation pattern.

For graphic representation of the angles θ and φ is given in Figure /‾V/3.5.1.5_7.

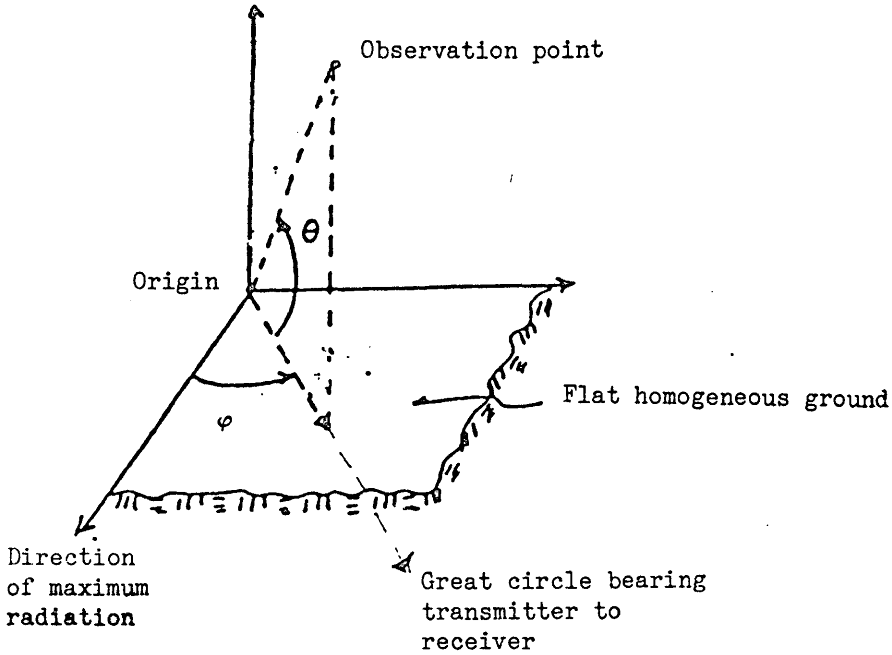


FIGURE /‾V/3.5.1.5_7

Graphic representation of the angles θ and φ

For planning purposes it is more convenient and much faster in any computation process to use tabulated information.

A suitable set of antenna patterns in the form of reference tables has been prepared giving values for the antenna radiation patterns which are in close agreement with those given by the CCIR.

This set of antenna patterns uses a conversion technique to obtain the true radiation pattern from the respective values of vertical and azimuthal attenuation factors.

It can be shown that by appropriate substitution of $\sin \varphi \cos \theta = \sin \psi$ in the azimuthal components of the full formula, the three-dimensional radiation pattern of an antenna can be represented by two expressions, one representing the horizontal pattern as a function of ψ and the other representing the vertical pattern as a function of θ.

Tables can therefore be compiled showing the attenuation relative to the maximum gain varying with angle. Table /‾D/3.5.1.5_7 represents the horizontal pattern as a function of ψ and Tables /‾E, F, G/3.5.1.5_7 represent the vertical pattern as a function of θ.

In obtaining the attenuation for any angle of elevation and azimuth, the angle ψ must be calculated using the following formula :

ψ = arc sin (sin φ cos θ) for $|\varphi| \leq 90°$ or

ψ = 180 - arc sin (sin φ cos θ) for $\varphi > 90°$

ψ = -180 - arc sin (sin φ cos θ) for $\varphi < -90°$

where

φ = angular difference between great circle bearing transmitter to receiver and azimuth of maximum radiation of the antenna.

θ = angle of vertical radiation.

The attenuation values for ψ and θ can then be determined from the appropriate tables.

The resulting antenna gain in the required direction is then calculated by summing the attenuation for the appropriate value of θ and ψ (Tables /̄D, E, F, G/3.5.1.5_7) and then subtracting the total attenuation subject to the limitations defined below from the maximum gain (Table /̄A/3.5.1.2_7) for the antenna concerned.

Forward Radiation

For angles of elevation less than the vertical angle of maximum radiation, the total attenuation should not exceed a value of 30 dB.

For angles of elevation equal to or greater than the vertical angle of maximum radiation, the resultant antenna gain shall not fall below -8 dBi.

Reverse Radiation

For HR m/n/h antennas, at all angles of elevation, the total attenuation should not exceed a value of 30 dB.

TABLE /‾D/3.5.1.5_7

Antenna attenuation relative to the gain in the direction of maximum radiation, at angles of azimuth relative to the direction of maximum radiation, for planning purposes

Angle (ψ) (degrees)	Horizontal attenuation (dB)				
	HR4/n/h	HR2/n/h	HR1/n/h	H2/n/h	H1/n/h
0	0	0	0	0	0
±5	0.7	0.4	0.3	0.2	0.1
±10	2.3	1.0	0.7	0.5	0.2
±15	5.1	1.8	1.1	1.2	0.5
±20	9.3	2.9	1.6	2.1	0.8
±25	16.5	4.0	2.0	3.3	1.2
±30	30	5.8	2.8	4.5	1.4
±35	20.6	7.8	3.7	6.7	2.6
±40	17.2	9.9	4.5	8.7	3.5
±45	16.5	12.1	5.1	11.2	4.3
±50	17.7	15.1	6.2	13.7	5.0
±55	20.2	18.7	7.7	15.0	4.2
±60	23.2	22.4	8.8	18.0	4.7
±65	26.2	25.8	12.0	25.3	8.9
±70	30	30	11.9	29.5	9.8
±75	30	30	11.9	30	10.4
±80	30	30	15.3	30	15.4
±85	30	30	18.7	30	16.3
±90	30	30	18.5	30	16.2
				Bidirectional antennas	
±95	30	30	18.3		
±100	30	30	17.5		
±105	30	30	17.2		
±110	30	30	16.2		
±115	30	30	15.2		
±120	27.7	26.9	14.7		
±125	26.0	24.5	13.5		
±130	25.2	22.6	13.7		
±135	25.5	21.2	14.1		
±140	27.2	20.0	14.9		
±145	30	18.6	14.9		
±150	30	18.2	15.2		
±155	30	17.5	15.4		
±160	23.2	16.7	15.4		
±165	19.3	16.1	15.3		
±170	16.9	15.5	15.2		
±175	15.5	15.2	15.1		
±180	15.0	15.0	15.0		

TABLE /‾E/3.5.1.5_7

Antenna vertical attenuation relative to the gain in the direction of maximum radiation at various angles of elevation, for planning purposes (antenna type : HR m/4/h).

Elevation angle (θ) (degrees)	Vertical attenuation (dB)		
	h = 0.5	h = 0.8	h = 1.0
0	30	30	30
3	6.0	4.9	4.2
6	1.3	0.6	0.3
* 8	0.7	0	0.8
9	0	0.1	0.5
12	0.8	2.4	4.3
15	8.1	8.2	15.0
18	8.6	25.0	15.7
21	18.4	16.0	10.6
24	28.7	14.2	12.3
27	24.3	18.8	19.3
30	30	30	30
33	20.1	22.3	30
36	14.6	21.9	26.4
39	12.7	30	16.5
42	13.0	21.0	12.0
45	15.2	14.9	11.5
48	19.7	12.4	12.3
51	27.4	11.8	15.0
54	24.3	12.5	20.2
57	20.1	14.4	29.2
60	18.5	17.2	26.4
63	18.3	21.1	22.7
66	19.2	26.3	21.9
69	20.9	30	22.6
72	23.2	30	24.5
75	26.4	30	27.4
78	30	30	30
81	30	30	30
84	30	30	30
87	30	30	30
90	30	30	30

* The values corresponding to this angle have been inserted to facilitate the evaluation of G_{t1}, as per paragraph 3.2.1.3.2.

TABLE /‾F/3.5.1.5_7

Antenna vertical attenuation relative to the gain in the direction of maximum radiation, at various angles of elevation, for planning purposes (antenna types : HR m/3/0.5, HR m/2/h, HR m/1/0.5 and HR m/1/0.3)

Elevation angle (θ) (degrees)	Vertical attenuation (dB)				
	m/3/0.5	m/2/h		m/1/h	
		h = 0.3	h = 0.5	h = 0.3	h = 0.5
0	30	30	30	30	30
3	7.9	12.3	10.6	18.2	14.7
6	2.8	6.6	5.0	12.3	8.8
* 8	1.1	4.4	3.0	9.9	6.6
9	0.6	3.6	2.2	9.0	5.6
12	0	1.8	0.7	6.7	3.6
15	0.6	0.7	0.7	5.0	2.1
18	2.4	0.1	0.1	3.7	1.1
21	5.4	0.4	0.6	2.7	0.5
24	10.3	0.2	1.8	1.9	0.1
27	18.9	0.8	3.5	1.3	0
30	27.2	1.7	6.0	0.8	0.1
33	20.1	2.9	9.4	0.5	0.3
36	19.9	4.4	14.4	0.2	0.8
39	24.4	6.2	22.0	0.1	1.4
42	30	8.3	21.5	0	2.2
45	22.6	10.9	16.8	0	3.2
48	17.4	13.9	14.6	0.1	4.4
51	15.1	17.4	13.7	0.2	5.8
54	14.1	21.0	13.6	0.3	7.3
57	14.1	25.9	14.1	0.5	9.0
60	14.9	29.3	15.1	0.7	11.0
63	16.2	30	16.6	1.0	13.1
66	18.1	30	18.4	1.3	15.1
69	20.5	30	20.7	1.6	16.7
72	23.2	30	23.5	1.9	17.3
75	25.3	30	26.8	2.2	17.2
78	26.0	30	30	2.6	16.8
81	25.6	30	30	2.9	16.4
84	24.9	30	30	3.2	16.1
87	24.6	30	30	3.6	16.1
90	24.6	30	30	3.6	16.1

* The values corresponding to this angle have been inserted to facilitate the evaluation of G_{tl}, as per paragraph 3.2.1.3.2.

TABLE /̄ G/3.5.1.5 _7

Antenna vertical attenuation relative to the gain in the direction of maximum radiation at various angles of elevation, for planning purposes (antenna type : H m/n/h)

Elevation angle (θ) (degrees)	Vertical attenuation (dB)			
	H m/1/0.3	H m/1/0.5	H m/2/0.3	H m/2/0.5
0	30	30	30	30
3	18.4	14.7	12.3	10.6
6	12.5	8.9	6.6	5.0
* 8	10.1	6.6	4.4	3.0
9	9.2	5.7	3.6	2.2
12	7.0	3.6	1.8	0.7
15	5.2	2.2	0.7	0.1
18	3.9	1.2	0.1	0.1
21	2.9	0.5	0	0.7
24	2.1	0.1	0.2	1.8
27	1.5	0.1	0.8	3.5
30	1.0	0.1	1.6	6.0
33	0.7	0.3	2.8	9.4
36	0.4	0.7	4.3	14.3
39	0.2	1.3	6.1	21.9
42	0.1	2.1	8.2	21.3
45	0	3.0	10.7	16.6
48	0	4.1	13.6	14.3
51	0	5.4	17.0	13.3
54	0.1	6.9	21.0	13.1
57	0.2	8.5	25.4	13.6
60	0.3	10.4	28.7	14.5
63	0.4	12.3	29.6	15.8
66	0.6	14.2	29.5	17.5
69	0.7	15.6	29.9	19.7
72	0.8	16.0	30	22.2
75	0.9	15.8	30	25.3
78	1.1	15.1	30	30
81	1.1	14.4	30	30
84	1.2	13.9	30	30
87	1.2	13.6	30	30
90	1.4	14.0	30	30

* The values corresponding to this angle have been inserted to facilitate the evaluation of G_{t1}, as per paragraph 3.2.1.3.2.

3.8 Maximum number of frequencies required for broadcasting the same programme to the same zone

3.8.1 Introduction

Wherever possible, only one frequency should be used to broadcast a particular programme to a given reception area. In certain special circumstances, it may be found necessary to use more than one frequency per programme, i.e. :

- over certain paths, e.g. very long paths, those passing through the auroral zone, or paths over which the MUF is changing rapidly;
- areas where the depth of the area extending outwards from the transmitter is too great to be served by a single frequency;
- when highly directional antennas are used to maintain satisfactory signal-to-noise ratios, thereby limiting the geographical area covered by the station concerned.

The decision to use more than one frequency per programme should be made on the merits of the particular case concerned.

3.8.2 Use of additional frequencies

A method has been developed for determining the minimum number of frequencies needed to achieve specified levels of basic broadcast reliability. If the calculated basic broadcast reliability does not reach the desired value, it is necessary to consider whether it could be improved by a combination of frequencies in separate bands and whether the improvement would justify the use of additional frequencies. If the use of additional frequencies does not increase the basic broadcast reliability to reach the specified value, for a specific percentage of test points in the required service area, the original number of frequencies should not be increased.

In cases where the basic reception reliability obtained with one frequency is between 50% and 80%, a first additional frequency shall be tested. If the basic reception reliability calculated for two frequencies exceeds the limit specified in Figure /‾Y/3.8.2_7, the additional frequency may be used. Only in those special cases where the basic reception reliability using two frequencies remains below 80% shall the calculation be repeated to test for an additional second frequency. The reason for these limits is to ensure that additional frequencies are only used if there is a considerable improvement in the basic reception reliability.*

---

* /‾Note 1 - These criteria may be modified by the second session of the Conference in the light of the calculation results relating to existing typical broadcasting circuits obtained by the intersessional Working Group and/or the IFRB during the intersessional period._7

Note 2 - For calculation of the basic reception reliability see paragraph 3.2.4.3.

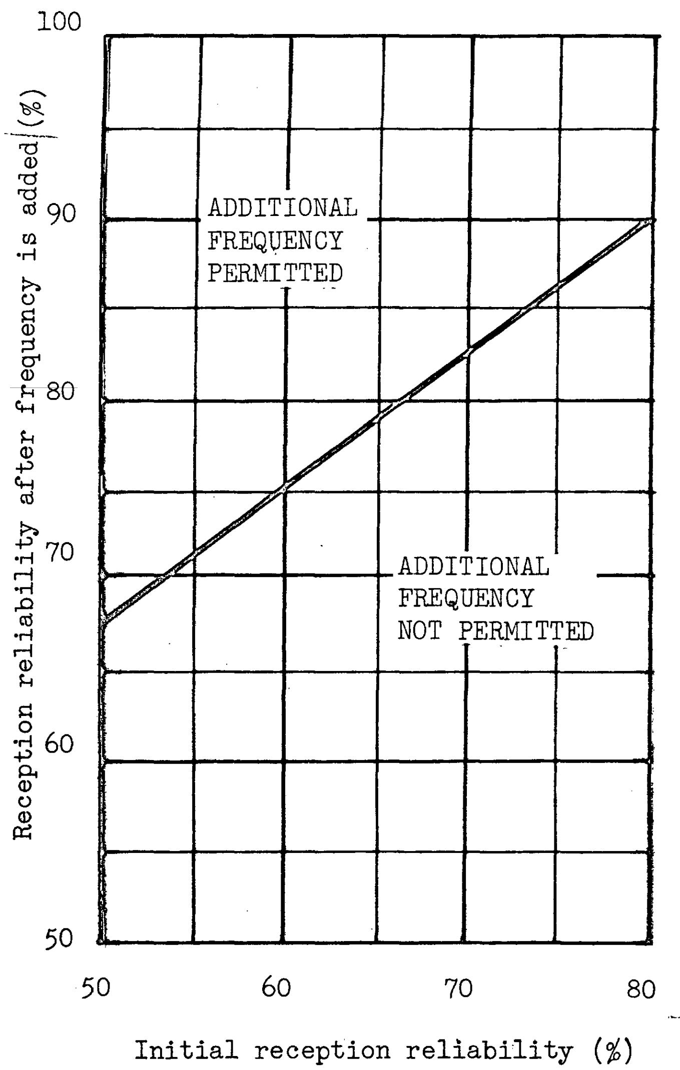


FIGURE /‾Y/3.8.2_7

INTERNATIONAL TELECOMMUNICATION UNION

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COMMITTEE 5

SECOND REPORT OF WORKING GROUP 5A

TO COMMITTEE 5

The text reproduced in the Annex was considered in Working Group 5A and is hereby submitted to Committee 5 for approval.

M. OUHADJ
Chairman of Working Group 5A

Annex : 1

CHAPTER 4

4. Planning principles and method

Having considered the proposals of administrations on planning principles and methods, the first session of the Conference concluded that the planning of the high frequency broadcasting service shall be based on four seasonal plans to be developed annually or semi-annually using requirements submitted / periodically / by the administrations. The seasonal plans shall be developed on the basis of the following principles and planning method.

4.1 Planning principles

4.1.1 In accordance with the International Telecommunication Convention and with the Radio Regulations annexed thereto, the planning of the high frequency bands allocated to the broadcasting service shall be based on the principle of equal rights of all countries, large or small to have equitable access to these bands and to utilize them in accordance with the decisions taken by this Conference. Planning shall also attempt to reach an efficient utilization of these frequency bands, while taking into account the technical and economical constraints that may exist in certain cases.

4.1.2 On the basis of the above, the following planning principles shall be applied.

4.1.2.1 All the / requirements /, current or future, formulated by the administrations, shall be taken into account and be treated on an equitable basis, so as to guarantee the equality of rights covered in paragraph 1 above and to ensure a satisfactory service to every administration.

4.1.2.2 All the / requirements /, national and international, shall be treated on an equal basis, with due consideration of the differences between these two kinds of / requirements /.

4.1.2.3 The planning procedure will attempt to ensure, as far as practicable, the continuity of the utilization of a frequency or of a frequency band. However, such frequency continuity should not prevent equal and technically optimum treatment of all / requirements /.

4.1.2.4 The periodical planning process shall be based solely on the / requirements / that will become operational during the planning period. It shall furthermore be flexible to take into account new / requirements / and modifications to the existing / requirements /, in accordance with the modification procedures to be adopted by the Conference.

4.1.2.5 The planning procedure shall be based on DSB transmissions. Voluntary SSB transmissions may however be permitted in lieu of planned DSB transmissions, without increasing the level of interference caused to DSB transmissions appearing in the Plan.

4.1.2.6 For efficient spectrum utilization, only one frequency should be used, whenever possible, to satisfy a given / requirement / to a given / required service area / and in any case the number of frequencies used should be the minimum necessary to provide satisfactory reception.

4.1.2.7 Further planning principles / to be developed /.

4.2 Planning method

4.2.1 Overview of planning method

[To be developed]

4.2.2 Definition of a broadcasting requirement

A requirement notified by an administration to provide a broadcasting service at specified periods of time to a specified reception area from a particular transmitter station.

4.2.3 Description of the individual steps of the automated system

4.2.3.1 Step 1 - Requirements file

a) [To be developed]

b) The above files shall contain :

Basic characteristics

1) name of the transmitting station

2) geographical coordinates of the transmitting station

3) symbol country or geographical area in which the transmitting station is located

4) required service area

5) hours of operation (UTC)

6) range of antenna characteristics

7) transmitter power (dBW)

8) class of emission

Optional supplementary characteristics

1) preferred frequency (in kHz)

2) preferred frequency band (in MHz)

3) equipment limitations

4) ranges of power capabilities

5) possible use of synchronized transmitters

4.2.3.2 Step 2 - Broadcast requirements for the season under consideration

The broadcast requirements to be used for each season shall be those contained in the Requirements File which are to be operational during the season under consideration and which are confirmed and, if necessary, modified by the administration, in accordance with the modification procedures of /‾4.2.3.1_7.

4.2.3.3 Step 3 - Propagation analysis and selection of the appropriate frequency band

The propagation model described in /‾paragraph 3.2_7 will be used to calculate for each requirement and for the season and the different hours, the /‾optimum working frequency_7 and the /‾basic circuit reliability_7. Based on the results of the above calculations, the appropriate frequency band(s) for each requirement at the different times will be selected.

However, if an administration has indicated equipment limitations, these limitations are to be taken into account in the selection of the appropriate frequency band.

If the required basic circuit reliability cannot be met during any time with a single frequency band, then a second frequency band shall be selected as long as the administration has indicated the capability to operate in two frequency bands simultaneously. (See Chapter /‾ _7, section /‾ _7.)

4.2.3.4 Step 4 - Rules to be applied to requirements in a given run

4.2.3.4.1 Optimization

The system must be optimized to ensure the maximum possible utilization of all available channels.

4.2.3.4.2 Preferred frequency

In accordance with the planning principles and without imposing constraint on planning, the following shall be applied in the seasonal plans :

1) administrations may indicate the preferred frequency;

2) efforts shall be made during the planning process in order to include the preferred frequency in the plan;

3) if not possible, efforts shall be made in order to select a frequency which is as close as possible to the preferred one in the same band;

4) otherwise, the automated system shall be used to select the appropriate frequencies, permitting to accommodate the maximum number of requirements, taking into account the constraints of technical characteristics of equipment.

4.2.3.4.3 Equipment constraint

The system shall take into account the technical constraints of the equipment, i.e. :

4.2.3.4.3.1 Frequency

a) When the administration indicates that its facilities can operate only on a limited number of fixed specified frequencies the process in steps 5, 6 and 7 shall be applied to one of these frequencies and should the final step result in an incompatibility the adjustment process (step 10) shall try another one of these frequencies. The plan shall contain the frequency from this limited number of frequencies which will have the lesser degree of incompatibilities.

b) If two of such requirements indicate the same frequency which after analysis results in an incompatibility the situation is referred to the administration(s) concerned.

4.2.3.4.3.2 Frequency band

a) When the administration indicates that its facilities can operate only in a given frequency band, only frequencies from that band shall be included in the plan.

b) When an administration indicates a preferred frequency band, the system shall try to select a frequency from this preferred frequency band. If this is not possible, frequencies from the closest band shall be tried. Otherwise, the system will select frequencies from the appropriate band taking into account the equipment constraints covered in paragraph [ ].

4.2.3.4.3.3 Power

a) When an administration indicates only a single power level due to equipment constraints, that power shall be used in the planning process.

b) When an administration indicates several possible power values, the appropriate power shall be used to achieve the [basic circuit reliability]

4.2.3.4.3.4 Antenna

When the administration indicates that its antenna can operate only in a given frequency band, only frequencies from that band shall be included in the plan.

4.2.3.4.4 Limitation of frequency change

For the indicated time block of each requirement, frequency changes should be essentially limited to those necessitated by propagation factors. Frequency changes due to incompatibilities may also be permitted. In these cases, the number of frequency changes during any contiguous period of operation shall be limited to the minimum necessary.

4.2.3.4.5 [Rules to be applied to congested areas]

/ To be developed. /

4.2.3.5 Step 5 - Selection of technical characteristics

The system shall be designed so that in those cases where administrations communicate the power and characteristics which may vary in given ranges, it selects the values for these characteristics to be used within the indicated ranges.

4.2.3.6 Step 6 - Compatibility analysis and frequency selection

/ To be developed. /

4.2.3.7 Step 7 - Reliability analysis

The method described in section / / shall be used to calculate the / overall broadcast reliability /.

4.2.3.8 Step 8 - Criteria and requirements met

The requirements for the season under consideration will be analyzed to determine if they are satisfied with the agreed criteria as contained in section / /.

4.2.3.9 Step 9 - Seasonal plan

The timing of publication and the means of securing administrations' comments on seasonal plans will be considered by the second session of the Conference.

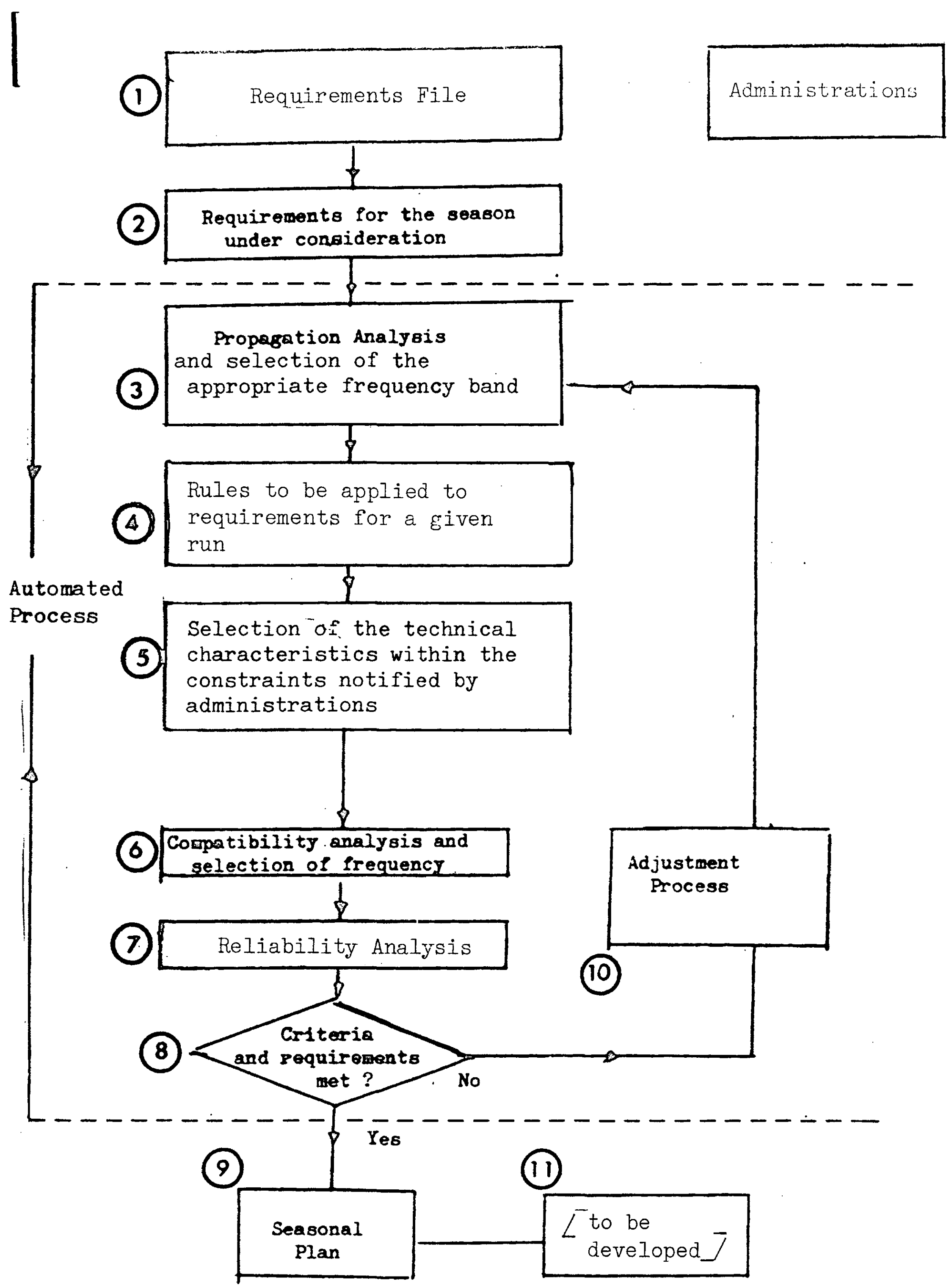

FIGURE [ ]

Flowchart of the automated process

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COMMITTEE 6

Note by Chairman of Committee 4 to the Editorial Committee

The Editorial Committee is requested to amend Documents 115(Rev.1) and 146 according to the following decisions of Committee 4.

Document 115(Rev.1)

- page B.1/7(Rev.1), section 3.1.4.2, replace the square brackets by :

"The value of the noise limited sensitivity of the receiver for planning purposes shall be 40 dB μV/m."

Document 146

- page 3, section 3.4.1.3, put for E_c = noise limited sensitivity of the receiver "40 dB(μV/m)" and for SNR = audio frequency signal-to-noise ratio "26 dB" and add "for these conditions $E_i{}^o$ = 3.5 dB μV/m".

- section 3.4.1.5, put :

"The value of the audio frequency signal/noise ratio for planning purposes shall be 24 dB."

- section 3.4.1.6, add at the end :

"For these conditions the value of the radio-frequency signal/noise ratio shall be 34 dB for planning purposes."

- section 3.4.2, replace the square brackets by "$E_{ref} = E_{min}$ + 3 dB"

- page 4, section 3.5.2, paragraph 4, third line, remove the square brackets around "+ 3 dB".

J. RUTKOWSKI
Chairman of Committee 4

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Corrigendum 1 to
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COMMITTEE 6

AMENDMENTS TO DOCUMENT 171

Please replace :

- page 3, in Table [1/3.2.4.1], step (7) : "β" by "b" (twice);

- page 9, in the last paragraph "Table [2/3.2.4.1]" by "Table [3/3.2.4.2]";

- pages 15 and 16, in Table [5/3.2.4.3] in the column : Source,
  in steps (1), (3) and (5) : ["Table 1" by "Table 1/3.2.4.1"
  or
  "Table 1" by "Table 2/3.2.4.1"];

- pages 18 and 19, in Table [6/3.2.4.4] in the column : Source,
  in steps (1), (3) and (5) : "Line 20, Table 2" by ["Line 20, Table 3/3.2.4.2
  or
  Line 12, Table 4/3.2.4.2"];

- Page 21, in Table [7/3.2.4.5] in the column : Source,
  in step (1) : "Table 3" by "Table 5/3.2.4.3";

- Page 21, in Table [8/3.2.4.5] in the column : Source,
  in step (1) : "Table 4" by "Table 6/3.2.4.4".

Replace also the diagram contained in Figure [3/3.2.4.2] by the diagram contained in Figure 2 of Document 133 (page 11). (The replaced diagram is labelled Figure [3/3.2.4.2] as now.).

J. RUTKOWSKI
Chairman of Committee 4

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

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COMMITTEE 6

NINTH SERIES OF TEXTS FROM COMMITTEE 4
TO THE EDITORIAL COMMITTEE

The text reproduced in Annex to this document was adopted in Committee 4 and is hereby submitted to the Editorial Committee.

J. RUTKOWSKI
Chairman of Committee 4

Annex : 1

ANNEX

3.2.4 Reliability*

/ Note 1 - In this section procedures are given for calculating reception and broadcast reliability in various circumstances. The inclusion of these calculation procedures does not prejudge or comment on the desirability of these circumstances. The square brackets within the text indicate some parts of the procedure which may not be needed. /

3.2.4.1 Basic circuit reliability

Two alternative but equivalent methods are presented; the first where the computation of basic circuit reliability is undertaken in terms of the required r.f. signal-to-noise ratio, and the second where the computation is in terms of the minimum usable field strength. The choice between these two equivalent approaches depends upon the parameter chosen for inclusion in the planning method.

The first method includes, in steps (6) to (11), the estimation of the median field strength of the background noise by taking account of contributions of atmospheric noise, man-made noise and intrinsic receiver noise. For the second method a similar estimate is included within the value of the minimum usable field strength.

3.2.4.1.1 Basic circuit reliability using signal-to-noise ratio

The process for calculating basic circuit reliability is indicated in Table / 1/3.2.4.1 /. The median value of field strength for the wanted signal at step (1) is provided by the field strength prediction method. The upper and lower decile values at steps (2) through (5) are also determined, taking account of long-term (day-to-day) and short-term (within the hour) fading. From steps (6) to (10) consideration is given to atmospheric noise, man-made noise, and intrinsic receiver noise, and at step (11) the median value of field strength for the noise is taken as the greatest of the three components. The values of signal and noise determined at steps (1) and (11) are then combined at step (12) in order to derive the median signal-to-noise ratio, SNR(50).

The upper and lower deciles of signal-to-noise ratio are then calculated in steps (13) and (14) in order to derive the signal-to-noise ratios exceeded for 10% and 90% of the time at steps (15) and (16). The signal-to-noise ratio probability distribution may now be produced, as is shown by Figure 1, where the ratio is plotted in decibels versus the probability that the value of signal-to-noise ratio is exceeded, plotted on a normal probability scale.

Finally, Figure / 1/3.2.4.1 / is used to derive the basic circuit reliability (18), which is the value of probability corresponding to the required signal-to-noise ratio (17).

A mathematical treatment of the calculation can be given in terms of probability density functions of both the signal and the noise. These functions are taken to be log normal, as is the resulting distribution for the signal-to-noise ratio.

---

* Note 2 - Abreviations of the English terms are used in the formulas throughout the three languages in order to facilitate the practical implementation of the methods described in this section.

TABLE [1/3.2.4.1]

Parameters used to compute basic circuit reliability

STEP	PARAMETER	DESCRIPTION	SOURCE
(1)	$E_W(50)$ dB (μV/m)	Median field strength of wanted signal	Prediction method (section 3.2.1)
(2)	$D_U(S)$ dB	Upper decile of slow fading signal (day-to-day)	(section 3.2.3.2, Table 3.3.3-I)
(3)	$D_L(S)$ dB	Lower decile of slow fading signal (day-to-day)	(section 3.2.3.2, Table 3.3.3-I)
(4)	$D_U(F)$ dB	Upper decile of fast fading signal (within the hour)	5 dB (section 3.2.3.1)
(5)	$D_L(F)$ dB	Lower decile of fast fading signal (within the hour)	-8 dB (section 3.2.3.1)
(6)	$F_a(A)$	Noise factor for atmospheric noise	Atmospheric noise maps (Report 322-2)
(7)	N_A dB (μV/m)	Median field strength of atmospheric noise	$N_A = F_a(A) - 65.5 + 20 \log f + 10 \log \beta$ f in MHz, β in kHz (Report 322-2)
(8)	$F_a(M)$	Noise factor for man-made noise	(section 3.2.2.2)
(9)	N_M dB (μV/m)	Median field strength of man-made noise	As in (7) above
(10)	N_R dB (μV/m)	Intrinsic receiver noise field strength	3.5 dB (μV/m) (section 3.4.1.3)
(11)	N_T dB (μV/m)	Median field strength of total radio noise	Greatest of N_A, N_M, N_R (section 3.2.2.3)
(12)	SNR(50) dB	Median signal-to-noise ratio	$E_W - N_T$
(13)	$D_U(SNR)$ dB	Upper decile of signal-to-noise ratio	$\sqrt{D_U(S)^2 + D_U(F)^2}$
(14)	$D_L(SNR)$ dB	Lower decile of signal-to-noise ratio	$\sqrt{D_L(S)^2 + D_L(F)^2}$
(15)	SNR(10) dB	Signal-to-noise ratio exceeded 10% of time	$SNR(50) + D_U(SNR)$
(16)	SNR(90) dB	Signal-to-noise ratio exceeded 90% of time	$SNR(50) - D_L(SNR)$
(17)	G dB	Required RF signal-to-noise ratio	34 dB (section 3.4.1.6)
(18)	BCR	Basic circuit reliability	Figure [1/3.2.4.1]

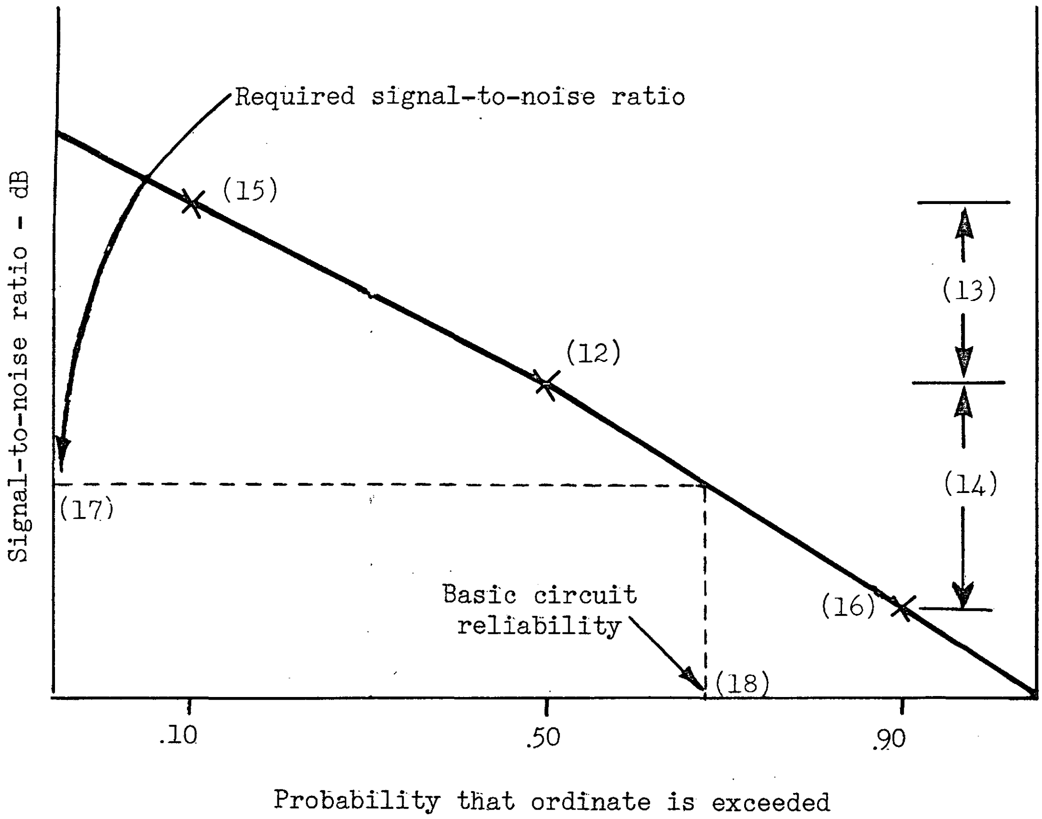


FIGURE [1/3.2.4.1]

The basic circuit reliability is given by the expression :

$$\text{when } E_W - N_T \leqslant G : \text{BCR} = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\gamma} \exp(-\tau^2/2)\, d\tau$$

$$\gamma = \frac{E_W - N_T - G}{\sigma_L}$$

$$\sigma_L = D_L(\text{SNR})/1.282$$

$$\text{when } E_W - N_T > G : \text{BCR} = 0.5 + \frac{1}{\sqrt{2\pi}} \int_{0}^{\gamma} \exp(-\tau^2/2)\, d\tau$$

$$\gamma = \frac{E_W - N_T - G}{\sigma_U}$$

$$\sigma_U = D_U(\text{SNR})/1.282$$

3.2.4.1.2 Basic circuit reliability using ~~minimum~~ usable ~~field strength~~

The process for calculating basic circuit reliability is indicated in Table /‾2/3.2.4.1_7. The median value of field strength for the wanted signal at step (1) is provided by the field strength prediction method. The upper and lower decile values (2) through (5) are also determined, taking account of long-term (day-to-day) and short-term (within the hour) fading. The combined upper and lower deciles of the wanted signal are then calculated in steps (6) and (7) in order to derive the signal levels exceeded for 10% and 90% of the time at steps (8) and (9).

The wanted signal probability distribution, assumed to be log-normal, is illustrated in Figure /‾2/3.2.4.1_7. The signal level is plotted in decibels versus the probability that the value of signal level is exceeded, plotted on a normal probability scale. This distribution is used to obtain the basic circuit reliability (11), which is the value of probability corresponding to the minimum usable field strength (10).

TABLE [2/3.2.4.1]

Parameters used to compute basic circuit reliability

STEP	PARAMETER	DESCRIPTION	SOURCE
(1)	$E_W(50)$ dB (μV/m)	Median field strength of wanted signal	Prediction method (section 3.2.1)
(2)	$D_U(S)$ dB	Upper decile of slow fading signal (day-to-day)	(section 3.2.3.2, Table 3.3.3-I)
(3)	$D_L(S)$ dB	Lower decile of slow fading signal (day-to-day)	(section 3.2.3.2, Table 3.3.3-I)
(4)	$D_U(F)$ dB	Upper decile of fast fading signal (within the hour)	5 dB (section 3.2.3.1)
(5)	$D_L(F)$ dB	Lower decile of fast fading signal (within the hour)	-8 dB (section 3.2.3.1)
(6)	$D_U(E_W)$ dB	Upper decile of wanted signal	$\sqrt{D_U(S)^2 + D_U(F)^2}$
(7)	$D_L(E_W)$ dB	Lower decile of wanted signal	$\sqrt{D_L(S)^2 + D_L(F)^2}$
(8)	$E_W(10)$ dB (μV/m)	Wanted signal exceeded 10% of the time	$E_W + D_U(E_W)$
(9)	$E_W(90)$ dB (μV/m)	Wanted signal exceeded 90% of the time	$E_W - D_L(E_W)$
(10)	E_{min} dB (μV/m)	Minimum usable field strength	(section 3.4)
(11)	BCR	Basic circuit reliability	Figure [2/3.2.4.1]

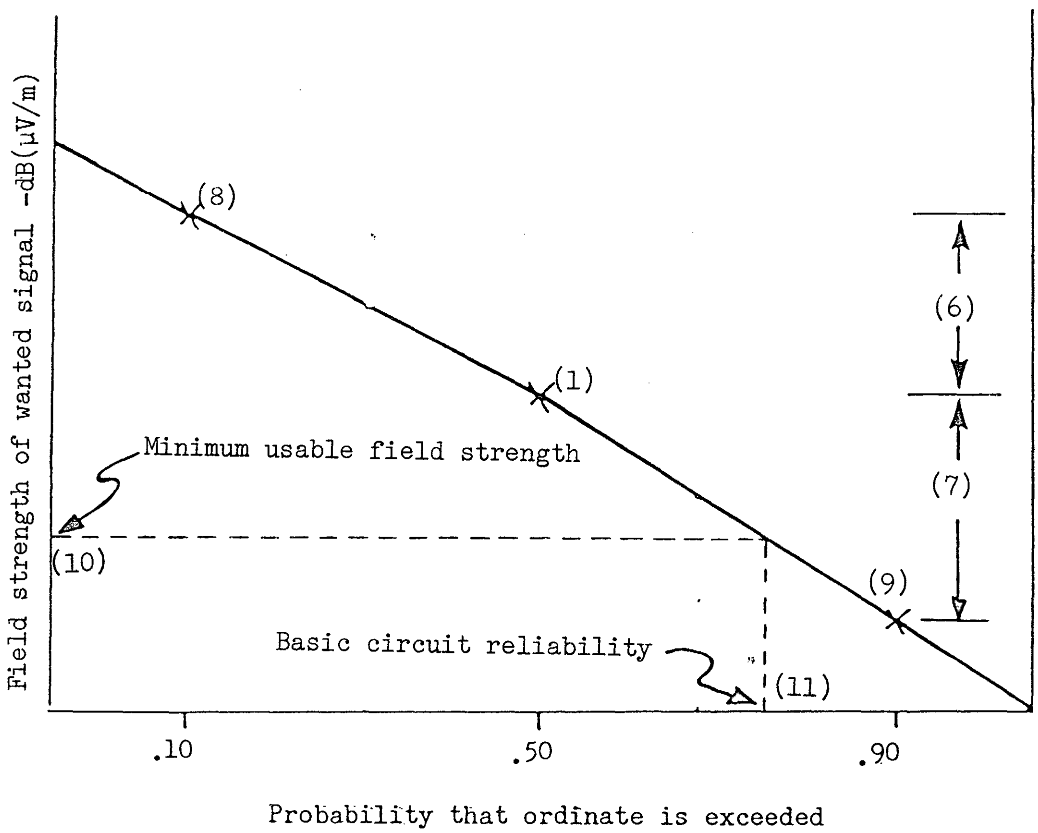


FIGURE /¯2/3.2.4.1_7

The basic circuit reliability is given by the expression :

when $E_W \leq E_{min}$

$$BCR = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\gamma} \exp(-\tau^2/2)\, d\tau$$

$$\gamma = \frac{E_W - E_{min}}{\sigma_L}$$

$$\sigma_L = D_L(E_W)/1.282$$

when $E_W > E_{min}$

$$BCR = 0.5 + \frac{1}{\sqrt{2\pi}} \int_{0}^{\gamma} \exp(-\tau^2/2)\, d\tau$$

$$\gamma = \frac{E_W - E_{min}}{\sigma_U}$$

$$\sigma_U = D_U(E_W)/1.282$$

3.2.4.2 Overall circuit reliability

Two methods are given for calculating overall circuit reliability : the first is based upon the specification of an objectively determined value at the required signal-to-interference ratio, while the second is based on the required RF protection ratio which includes subjective effects.

3.2.4.2.1 Overall circuit reliability using signal-to-interference ratio

The method is outlined in Table /¯3/3.2.4.2_7. The median wanted signal level at step (1) is computed by the signal strength prediction method. The upper and lower decile values (2) through (5) take into account long-term (day-to-day) and short-term (within the hour) fading.

The median field strength levels (E_i) of each interfering source is obtained from the prediction method in step (6). For a single source of interference the predicted median field strength is used in step (7). For multiple sources of interference, the median field strength is calculated as follows. The field strengths of the interfering signals E_i are listed in decreasing order. Successive r.s.s. additions of the field strengths E_i are computed, stopping when the difference between the resultant field strength and the next field strength is greater than 6 dB. In step (7), the resultant field strength I is taken as the last computed value. The upper and lower decile values (8) through (11) of the strongest interference are selected to take into account short and long-term fading.

The values of the wanted signal and interference determined at steps (1) and (7) are combined at step (12) to derive the median signal-to-interference ratio. The upper and lower deciles of the signal-to-interference ratio are computed in steps (13) and (14) in order to derive the signal-to-interference ratio exceeded for 10% and 90% of the time at steps (15) and (16).

The probability distribution for the signal-to-interference ratio may now be produced as shown in Figure /‾3/3.2.4.2_7. The ratios are presented in decibels on a linear scale with the probability that the value of the signal-to-interference ratio is exceeded on a normal probability scale. In Figure /‾3/3.2.4.2_7, the value of probability corresponding to the required signal-to-interference ratio (17) is the circuit reliability in the presence of only interference (ICR). The <u>overall circuit reliability</u> is the minimum value (20) of ICR (18) and the basic circuit reliability BCR (19).

A mathematical treatment of the calculation of ICR can be given in terms of the probability density distribution of the wanted signal and the interference. These functions are taken to be log normal, as is the resulting distribution of the signal-to-interference ratio.

The parameter ICR is given by the following expression :

when $E_W - I \leqslant RSI$

$$ICR = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\gamma} \exp(-\tau^2/2)\, d\tau$$

$$\gamma = \frac{E_W - I - RSI}{\sigma_L}$$

$$\sigma_L = D_L(SIR)/1.282$$

when $E_W - I > RSI$

$$ICR = 0.5 + \frac{1}{\sqrt{2\pi}} \int_{0}^{\gamma} \exp(-\tau^2/2)\, d\tau$$

$$\gamma = \frac{E_W - I - RSI}{\sigma_U}$$

$$\sigma_U = D_U(SIR)/1.282$$

Values of the various parameters in the above expressions are found on the indicated lines in Table /‾2/3.2.4.1_7.

E_W	line 1
I	line 7
$D_U(SIR)$	line 13
$D_L(SIR)$	line 14
RSI	line 17

TABLE /‾3/3.2.4.2_7

Overall circuit reliability

STEP	PARAMETER	DESCRIPTION	SOURCE
1	E_W dB (μV/m)	Median field strength of wanted signal	Prediction Method (section 3.2.1)
2	$D_U(S)$dB	Upper decile of slow fading signal (DAY-TO-DAY)	(section 3.2.3.2, Table I/3.3.3)
3	$D_L(S)$dB	Lower decile of slow fading signal (DAY-TO-DAY)	(section 3.2.3.2, Table I/3.3.3)
4	$D_U(F)$dB	Upper decile of fast fading signal (within the hour)	5 dB (section 3.2.3.1)
5	$D_L(F)$dB	Lower decile of fast fading signal (within the hour)	-8 dB (section 3.2.3.1)
6	E_i dB (μV/m)	Median field strength of interfering signals $E_1, E_2, \ldots E_i$	Prediction Method (section 3.2.1)
7	I dB (μV/m)	Resultant field strength of interference (see text)	$I = \sqrt{E_1^2 + E_2^2 + E_3^2 + \ldots}$
8	$D_U(IS)$dB	Upper decile of slow fading interference (Decile of strongest interference)	(section 3.2.3.2, Table 3.3.3-I)
9	$D_L(IS)$dB	Lower decile of slow fading interference (Decile of strongest interference)	(section 3.2.3.2, Table 3.3.3-I)
10	$D_U(IF)$dB	Upper decile of fast fading interference	5 dB (section 3.2.3.1)
11	$D_L(IF)$dB	Lower decile of fast fading interference	-8 dB (section 3.2.3.1)
12	SIR(50)dB	Median signal to interference ratio	$E_W - I$
13	$D_U(SIR)$dB	Upper decile of signal-to-interference	$\sqrt{D_U(S)^2 + D_U(F)^2 + \frac{1}{2}D_L(IS)^2 + D_L(IF)^2}$
14	$D_L(SIR)$dB	Lower decile of signal-to-interference	$\sqrt{D_L(S)^2 + D_L(F)^2 + \frac{1}{2}D_U(IS)^2 + D_U(IF)^2}$
15	SIR(10)dB	Signal-to-interference ratio exceeded 10% of the time	$SIR(50) + D_U(SIR)$
16	SIR(90)dB	Signal-to-interference ratio exceeded 90% of the time	$SIR(50) - D_L(SIR)$
17	RSI dB	Required S/I ratio	(section)
18	ICR	Circuit reliability in presence of interference only (noise neglected)	See Figure /‾3/3.2.4.2_7
19	BCR	Basic circuit reliability	See Figure /‾1 or 2/3.2.4.1_7
20	OCR	Overall circuit reliability	Min(ICR, BCR)

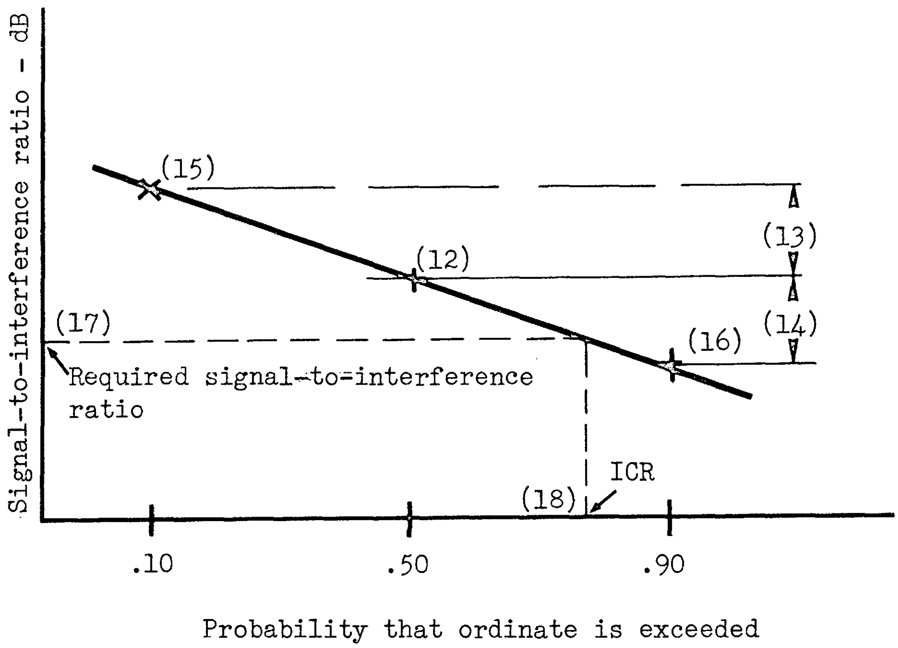


FIGURE [3/3.2.4.2]

3.2.4.2.2 Overall circuit reliability using protection ratio

The method is outlined in Table [4/3.2.4.2]. The median wanted signal level at step (1) is computed by the signal strength prediction method.

The median field strength levels (E_i) of each interfering source is obtained from the prediction method in step (2). For a single source of interference the predicted median field strength is used in step (3). For multiple sources of interference, the median field strength is calculated as follows. The field strengths of the interfering signals E_i are listed in decreasing order. Successive r.s.s. additions of the field strengths E_i are computed, stopping when the difference between the resultant field strength and the next field strength is greater than 6 dB. In step (3), the resultant field strength I is taken as the last computed value.

The values of the wanted signal and interference determined at steps (1) and (3) are combined at step (4) to derive the median signal-to-interference ratio. The 10% and 90% fading allowances are included in steps (5) and (6) in order to derive the signal-to-interference ratio exceeded for 10% and 90% of the time at steps (7) and (8).

The probability distribution for the signal-to-interference ratio may now be produced as shown in Figure /‾4/3.2.4.2_7. The ratios are presented in decibels on a linear scale with the probability that the value of the signal-to-interference ratio is exceeded on a normal probability scale. In Figure /‾4/3.2.4.2_7, the value of probability corresponding to the required signal-to-interference ratio (9) is the circuit reliability in the presence of only interference (ICR). The <u>overall circuit reliability</u> is the minimum value (12) of ICR (10) and the basic circuit reliability BCR (11).

The mathematical treatment of the calculation of ICR is similar to that given in paragraph 3.2.4.2.1.

TABLE /‾4/3.2.4.2_7

Overall circuit reliability

STEP	PARAMETER	DESCRIPTION	SOURCE
1	E_W dB (μV/m)	Median field strength of wanted signal	Prediction Method (section 3.2.1)
2	E_i dB (μV/m)	Median field strength of interfering signals $E_1, E_2, \ldots E_i$	Prediction Method (section 3.2.1)
3	I dB (μV/m)	Resultant field strength of interference (see text)	$I = \sqrt{E_1^2 + E_2^2 + E_3^2 + \ldots}$
4	SIR(50)dB	Median signal to interference ratio	$E_W - I$
5	D_U(SIR)dB	10% fading allowance	10 dB(<60°), 14 dB(≥60°)[1,2]
6	D_L(SIR)dB	90% fading allowance	10 dB(<60°), 14 dB(≥60°)[1,2]
7	SIR(10)dB	Subjective signal-to-interference ratio exceeded 10% of the time	SIR(50) + D_U(SIR)
8	SIR(90)dB	Subjective signal-to-interference ratio exceeded 90% of the time	SIR(50) - D_L(SIR)
9	RSI dB	Required r.f. protection ratio	(section 3.3.1)
10	ICR	Circuit reliability in presence of interference only (noise neglected)	See Figure /‾4/3.2.4.2_7
11	BCR	Basic circuit reliability	See Figure /‾1 or 2/3.2.4.1_7
12	OCR	Overall circuit reliability	Min(ICR, BCR)

1 Note 1 - If any point on that part of the great circle which passes through the transmitter and the receiver and which lies between control points located 1,000 km from each end of the path reaches a corrected geomagnetic latitude of 60° or more, the values for ⩾ 60° have to be used. The relationship of corrected geomagnetic latitude to the geographical coordinates is shown in Figures /‾1 and 2/3.2.4.1_7 of paragraph 3.2.3.2.

2 Note 2 - These values apply for overall circuit reliabilities not exceeding 80%.

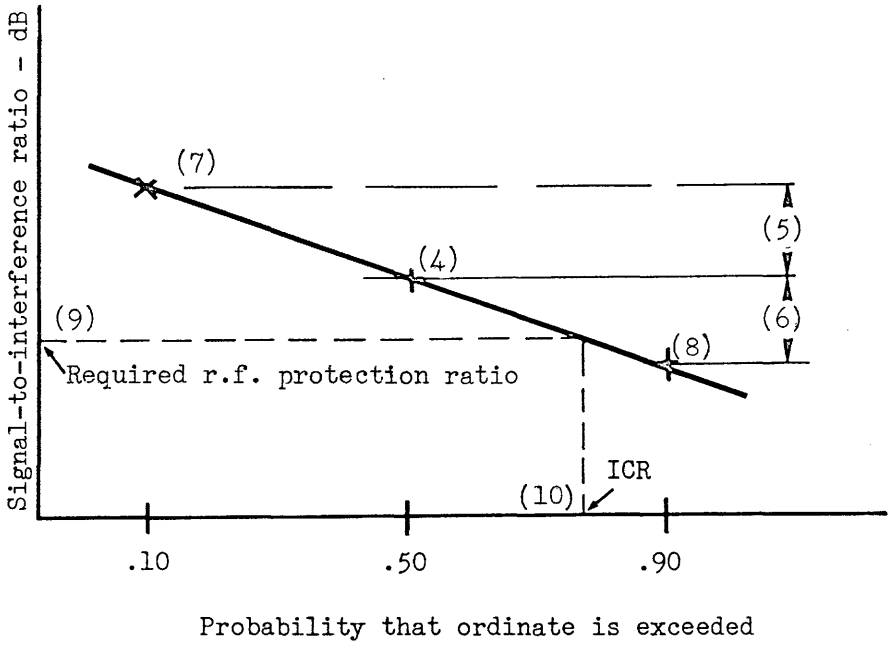


FIGURE /‾4/3.2.4.2_7

3.2.4.3 Basic reception reliability

The method for computing basic reception reliability is outlined in Table /‾5/3.2.4.3_7. For a single frequency, basic reception reliability (BRR) is the same as the basic circuit reliability (BCR) described in the previous section. For multiple frequencies, the interdependence between propagation conditions on different frequencies results in the computation method given in Table /‾5/3.2.4.3_7. In steps (4) and (6), BCR (n) is the basic circuit reliability for frequency n, where n = F_1, F_2, etc. The basic reception reliability is given in step (2) for a single frequency, in step (4) for a set of two frequencies and in step (6) for a set of three frequencies.

TABLE [5/3.2.4.3]

Basic reception reliability

The following parameters are involved :

One frequency operation

Step	Parameter	Description	Source
(1)	BCR (F_1) %	Basic circuit reliability for frequency F_1	Line 18, Table 1(section 3.2.4.1.1) or Line 11, Table 1(section 3.2.4.1.2)
(2)	BRR (F_1) %	Basic reception reliability	BCR (F_1)

Two frequency operation

(3)	BCR (F_2) %	Basic circuit reliability for frequency F_2 where $F_1 < F_2$	Line 18, Table 1(section 3.2.4.1.1) or Line 11, Table 1(section 3.2.4.1.2)
(4)	BRR (F_1) (F_2)	Basic reception reliability (a) where $F_1/F_2 \geqslant 0.9$	$\frac{1}{2}(1-\prod_{n=F_1}^{F_2}(1-BCR(n))+Max(BCR(F_1), BCR(F_2)))$
		(b) where $F_1/F_2 < 0.9$	$1-\prod_{n=F_1}^{F_2}(1-BCR(n))$

TABLE [5/3.2.4.3] (continued)

Basic reception reliability

Three frequency operation

Step	Parameter	Description	Source
(5)	BCR (F_3)	Basic circuit reliability for F_3 where $F_1 < F_2 < F_3$	Line 18, Table 1(section 3.2.4.1.1) or Line 11, Table 1(section 3.2.4.1.2)
(6)	BRR (F_1) (F_2) (F_3)	(a) Basic reception reliability for $F_1/F_2 \geqslant 0.9$; $F_2/F_3 \geqslant 0.9$	$\frac{1}{2}(1-\prod_{n=F_1}^{F_3}(1-BCR(n))+Max(BCR(F_1), BCR(F_2), BCR(F_3)))$
		(b) $F_1/F_2 < 0.9$; $F_2/F_3 < 0.9$	$1-\prod_{n=F_1}^{F_3}(1-BCR(n))$
		(c) $F_1/F_2 \geqslant 0.9$; $F_2/F_3 < 0.9$ or $F_1/F_2 < 0.9$; $F_2/F_3 \geqslant 0.9$	$\frac{(a) + (b)}{2}$

3.2.4.4 Overall reception reliability

The method for computing overall reception reliability is outlined in Table [6/3.2.4.4]. For a single frequency, overall reception reliability (ORR) is the same as the overall circuit reliability (OCR) described in the previous section. For multiple frequencies, the interdependence between propagation conditions on different frequencies results in the computation method given in Table [6/3.2.4.4]. In steps (4) and (6), OCR (n) is the overall circuit reliability for frequency n, where $n = F_1$, F_2 etc. The overall reception reliability is given in step (2) for a single frequency, in step (4) for a set of two frequencies and in step (6) for a set of three frequencies.

TABLE [6/3.2.4.4]

Overall reception reliability

The following parameters are involved :

One frequency operation

Step	Parameter	Description	Source
(1)	OCR (F_1) %	Overall circuit reliability for frequency F_1	Line 20, Table 2
(2)	ORR (F_1) %	Overall reception reliability	OCR (F_1)

Two frequency operation

(3)	OCR (F_2) %	Overall circuit reliability for frequency F_2	Line 20, Table 2
(4)	ORR (F_1) (F_2)	Overall reception reliability (a) where $F_1/F_2 \geq 0.9$	$\frac{1}{2}(1-\prod_{n=F_1}^{F_2}(1-OCR(n))+Max(OCR(F_1);\ OCR(F_2)))$
		(b) where $F_1/F_2 < 0.9$	$1-\prod_{n=F_1}^{F_2}(1-OCR(n))$

TABLE /‾6/3.2.4.4_7 (continued)

Overall reception reliability

Three frequency operation

Step	Parameter	Description	Source
(5)	OCR (F_3)	Overall circuit reliability for F_3 where $F_1 < F_2 < F_3$	Line 20, Table 2
(6)	ORR (F_1) (F_2) (F_3)	(a) Overall reception reliability for $F_1/F_2 \geqslant 0.9$; $F_2/F_3 \geqslant 0.9$	$\frac{1}{2}(1-\prod_{n=F_1}^{F_3}(1-OCR(n))+Max(OCR(F_1), OCR(F_2), OCR(F_3)))$
		(b) $F_1/F_2 < 0.9$; $F_2/F_3 < 0.9$	$1-\prod_{n=F_1}^{F_3}(1-OCR(n))$
		(c) $F_1/F_2 \geqslant 0.9$; $F_2/F_3 < 0.9$ or $F_1/F_2 < 0.9$; $F_2/F_3 \geqslant 0.9$	$\frac{(a) + (b)}{2}$

3.2.4.5 Basic and overall broadcast reliability

The determination of basic broadcast reliability involves sample points within the required service area. The basic broadcast reliability is an extension of the basic reception reliability concept to an area instead of a single reception point. The method for computing basic broadcast reliability is outlined in Table [7/3.2.4.5]. In step (1), the basic reception reliabilities BRR, (L_1), BRR (L_2), --- BRR (L_N) are computed as described in Table [5/3.2.4.3] at each sample point L_1, L_2 ---L_N. These values are ranked in step (2) and the basic broadcast reliability is that value associated with a specified percentile.

In a similar way the overall broadcast reliability is computed as described in Table [8/3.2.4.5] and it is the value associated with a specified percentile X.

Broadcast reliability is associated with the expected performance of a broadcast service at a given hour. For longer periods, computation at one-hour intervals is required.

TABLE [7/3.2.4.5]

Basic broadcast reliability

The following parameters are involved :

Step	Parameter	Description	Source
(1)	BRR (L_1), BRR (L_2) --- BRR (L_N)	Basic reception reliability at all receiving locations considered in the required service area	Line (2), (4) or (6) as appropriate from Table 3
(2)	BBR (X)	Basic broadcast reliability associated with percentile X	Any percentile chosen from the ranked values from (1)

Note - The broadcast reliability associated with the percentile X depends upon the density and distribution of the test points in the required service area.

TABLE 8 [8/3.2.4.5]

Overall broadcast reliability

The following parameters are involved :

Step	Parameter	Description	Source
(1)	ORR (L_1), ORR (L_2) --- ORR (L_N)	Overall reception reliability at all reception locations considered in the required service area	Line (2), (4) or (6) as appropriate from Table 4
(2)	OBR (X)	Overall broadcast reliability associated with percentile X	Any percentile chosen from ranked values from (1)

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Corrigendum 1 to
Document 172-E
3 February 1984
Original : English

COMMITTEE 5
and for information
to the
PLENARY MEETING

Note by Chairman of Committee 4
to the Chairman of Committee 5

Replace the penultimate paragraph by the following :

"No consensus could be obtained on the proposal; six delegations pronounced in favour of it, and five others strongly opposed to give the fixed values of minimum parameters being of the opinion that their acceptance might harm the planning process but they may agree to show the above-mentioned diagrams."

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 172-E
2 February 1984
Original : English

COMMITTEE 5
and for information
to the
PLENARY MEETING

Note by Chairman of Committee 4
to the Chairman of Committee 5

In reply to the Note from the Chairman of Committee 5 to the Chairman of Committee 4 (Document 106), and having analyzed various options of minimum values of the technical parameters within the framework of the ad hoc Group 4D, the Chairman of that ad hoc Group presented to Committee 4 the following compromised proposal :

"Minimum values of technical parameters :

- Co-channel RF protection ratio under stable conditions : 17 dB
- Audio-frequency signal/noise ratio : 19 dB
- Overall/basic reliability
  (both broadcast or reception reliability) : 50%
- Quality assessment grade : 3

The above set of parameters should be accompanied by a reference to the diagram of Figure [B/3.3.1] in Document 115(Rev.1) (page 13) showing the relationship between the reception quality and the co-channel RF protection ratio, already adopted, and the diagram contained in Addendum 1 to Document 73 and reproduced in the annex to this note."

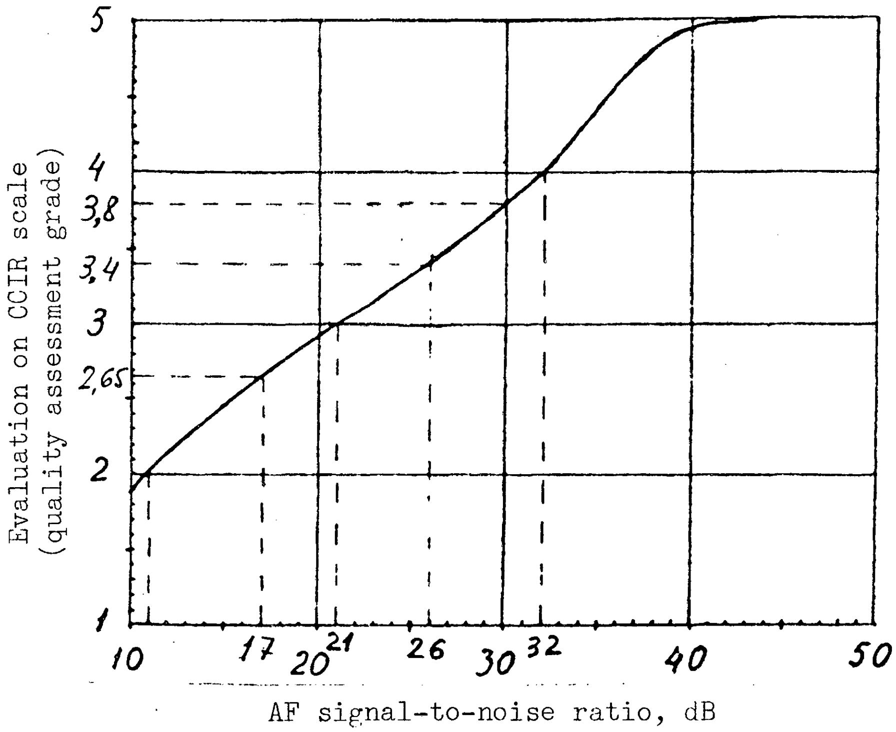
No consensus would be obtained on the proposal; six delegations pronounced in favour of it, and five others strongly opposed it, being of the opinion that the acceptance might harm the planning process.

Committee 4 decided to send a note on this subject to Committee 5 and, for information, to the Plenary Meeting.

J. RUTKOWSKI
Chairman of Committee 4

Annex : 1

ANNEX


5
4
3,8
3,4
3
2,65
2
1
Evaluation on CCIR scale
(quality assessment grade)
10
17
20
21
26
30
32
40
50
AF signal-to-noise ratio, dB

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 173-E
2 January 1984
Original : English

COMMITTEE 4

REPORT OF AD HOC WORKING GROUP 4D TO COMMITTEE 4

1. The ad hoc Working Group 4D held three meetings and considered the possibility of indicating the minimum value for some of the technical parameters below which the service could be considered as unusable as this information was required by Committee 5 (Document 106). In addition to the non-exhaustive list of items indicated in Document 106, the Group identified the following parameters which could be examined for this purpose :

a) quality assessment grade (QAG);

b) overall broadcast reliability;

c) basic broadcast reliability;

d) noise limited sensitivity of the receiver.

2. There were two divergent views in the Group on this matter as indicated below.

2.1 One view was that Committee 4 does not have the required technical information/ basis for indicating the minimum values desired by Committee 5. It would be desirable for Committee 4 to draw the attention of Committee 5 to the curve in Figure B/3.3.1 on page 13 of Document 115(Rev.1) for their information regarding the relationship between co-channel protection ratio and QAG. The curve in Add.1 to Document 73 could also be provided to Committee 5 for 80% listeners' satisfaction for speech programme. The QAG corresponding to 24 dB may also be indicated in the figure for indicating the relationship between AF signal-to-noise ratio and QAG. Table C/3.3.1 on page 14 of Document 115(Rev.1) could be brought to the attention of Committee 5 for indicating the relationship between quality assessment grade and impairment assessment grade. Those who are of the view considered that there was no possibility of providing any other information to Committee 5.

2.2 Another view was that Committee 4, which is a technical committee, should be able to provide the information required by Committee 5 and that the information on the various items could be as given below :

2.2.1 Co-channel protection ratio under stable conditions : 17 dB

2.2.2 Co-channel protection ratio under fading conditions : 17 dB

2.2.3 AF signal-to-noise ratio : 19 dB

2.2.4 Man-made noise : can be neglected

2.2.5 Overall/base reliability (both broadcast and reception reliability : 50% (median value)

2.2.6 Quality assessment grade : between 2 and 3, but closer to 3

3. Committee 4 may consider the two alternatives presented in paragraphs 2.1 and 2.2 before taking a decision in the matter.

M.K. RAO
Chairman of ad hoc Working Group 4D

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 174-E
9 February 1984
Original : English

PLENARY MEETING

MINUTES

OF THE

SIXTH PLENARY MEETING

Friday, 3 February 1984, at 1440 hrs

Chairman : Mr. K. BJÖRNSJÖ (Sweden)

Subjects discussed :		Document
1.	Oral report by the Chairman of Committee 4	-
2.	Third series of texts submitted to the Plenary Meeting for first reading (B.3(Rev.1))	154(Rev.1)
3.	Fourth series of texts submitted to the Plenary Meeting for first reading (B.4)	168
4.	Oral report by the Chairman of Committee 5	-
5.	Approval of the Minutes of the Fourth Plenary Meeting	127

1. Oral report by the Chairman of Committee 4

1.1 The Chairman of Committee 4 stated that the Committee had the previous day completed the work on all items allocated to it. He was grateful to all delegations, particularly those of developing countries which had found it difficult to accept some of the compromise solutions reached, for their cooperation. In large measure, agreement had been reached on technical parameters apart from certain details concerning which reservations had been entered.

1.2 The Chairman thanked Committee 4 and its Chairman for completing its work within the prescribed time-limit.

2. Third series of texts submitted to the Plenary Meeting for first reading (B.3(Rev.1)) (Document 154(Rev.1))

2.1 Section 3.2.1.4 - Optimum frequency band selection

2.1.1 The Chairman of Committee 6 said that in both paragraphs of the section the word "intended" should be corrected to read "required".

2.1.2 The Chairman of the IFRB, making a general observation, said that in the short time available the Board had reviewed the technical criteria and methods of calculation proposed by Committee 4 and had concluded that some of the procedures were extremely complex and would greatly increase the IFRB's workload and probably that of administrations when preparing seasonal plans and calculating incompatibilities. The criteria specified would require a whole series of calculations when applied to a considerable number of cases.

Section 3.2.1.4, as amended, was approved.

2.2 Section 3.4 - Values of minimum usable and reference usable field strength
Section 3.4.1 - Minimum usable field strength
Section 3.4.1.1 - Atmospheric radio noise data
Section 3.4.1.2 - Man-made radio noise data
Section 3.4.1.4 - Comparison of the intrinsic receiver noise level, the atmospheric and man-made radio noise

Approved.

2.3 Section 3.4.1.3 - Intrinsic receiver noise level
Section 3.4.1.5 - Audio-frequency signal/noise

2.3.1 The representative of the IFRB observed that some explanation was needed of the differing values for the audio-frequency signal-to-noise ratio in sections 3.4.1.3 and 3.4.1.5. It should be made clear in the former that 26 dB was the chosen value for determining the intrinsic receiver noise level.

2.3.2 The Chairman of Committee 4 agreed that the apparent inconsistency should be clarified and proposed that an explanatory footnote be attached to section 3.4.1.3 by placing an asterisk after the figure 26 dB. That value had been chosen by the Committee because it was a standard value used for measurements of intrinsic receiver noise level according to IEC standards.

The value of 24 dB for planning purposes in section 3.4.1.5 had been adopted after prolonged discussion in Committee.

2.3.3 The delegate of the United Kingdom said there was no need to indicate how the intrinsic receiver noise level was calculated. The section could be shortened to read : "The intrinsic receiver noise level E_i^o shall be 3.5 dB(μV/m)".

2.3.4 The representative of the IFRB questioned whether the text of section 3.4.1.3, if amended in that way, would be consistent with the definition of noise-limited sensitivity of a receiver adopted in Document 115(Rev.1).

2.3.5 The delegate of the USSR, supported by the delegate of Japan, said the text submitted by Committee 4 after prolonged deliberation should be approved without change.

2.3.6 The Director of the CCIR observed that a value for the signal-to-noise ratio had to be included to be consistent with the definition of the intrinsic receiver noise level used by the CCIR and IEC.

2.3.7 The delegate of Colombia said that, as section 3.4.1.3 dealt with special types of receivers, the values set out in section 7.1.3 of the CCIR Report (Document 22) should be used.

2.3.8 The Chairman of Committee 4 said that the values in section 3.4.1.3 were not for special receivers but were based on measurements made in several countries for an average receiver according to IEC standards that had been examined by the Intersessional Working Party 10/5.

2.3.9 The Chairman suggested that further consideration of section 3.4.1.3 be deferred pending the formulation of a text for the footnote suggested by the Chairman of Committee 4.

It was so agreed.

2.3.10 The delegate of the USSR considered that the figure of 24 dB in section 3.4.1.5 which was 6 dB lower than that recommended by the CCIR was too low and would adversely affect the quality of broadcasts.

2.3.11 The delegate of Syria agreed with the USSR delegate : 24 dB would not ensure good reception and a value of 27 dB would be preferable.

2.3.12 The delegate of the German Democratic Republic recalled that his delegation had proposed a value of 26 dB as a compromise.

2.3.13 The delegates of Algeria, Brazil, Mexico, India, Qatar and Colombia proposed that the figure of 24 dB be retained in section 3.4.1.5 so as not to disturb the compromise reached as part of a package after lengthy discussions in Committee 4.

It was so agreed.

Section 3.4.1.5 was approved.

2.4 Section 3.4.1.6 - Radio-frequency signal/noise ratio
Section 3.4.2 - Reference usable field strength

Approved.

2.5 Section 3.9.2.1 - Transmitters
Section 3.9.2.2 - Receivers
Section 3.9.2.3 - Transition period from the technical point of view

2.5.1 The Chairman of Committee 6 said that the English term "pulse switch modulation" had been used in the French and Spanish versions of section 3.9.2.1, paragraph c) because it was such a new type of modulation that no exact translation could be found for the other two languages.

At the suggestion of the Chairman of Committee 4, it was agreed to delete the words "or pulse switch modulation".

2.5.2 The Chairman of Committee 4 said that the texts in section 3.9.2.1, paragraph e), in section 3.9.2.2, paragraph c) and in section 3.9.2.3 had been left in square brackets pending the decision of Committee 5 concerning the time-limits for the introduction of SSB transmissions which had administrative as well as technical aspects.

2.5.3 The delegate of the Islamic Republic of Iran wondered whether the proposals being put forward by Committee 5 in regard to the texts in square brackets were likely to be acceptable to Committee 4.

2.5.4 The Chairman of Committee 5 drew attention to the report of Working Group 5A to Committee 5 (Document 161), which contained two proposals in regard to the duration of the transition period. That report would be considered by Committee 5 the following afternoon. The other two questions had not, to his recollection, been dealt with by the Working Group.

2.5.5 The Chairman of Committee 4 did not think there was likely to be any divergence of view between Committees 4 and 5 on the three issues mentioned. Working Group 5A had proposed fixing the transition period at 20 years, which was not in contradiction with what was proposed in section 3.9.2.1, paragraph e), for transmitters, and did not conflict with Committee 4's view that the period should be 15 to 20 years. Nor should the question of receivers be considered as controversial, since Committee 4 had held that the lifetime of a receiver was in the order of ten years.

Sections 3.9.2.1, 3.9.2.2 and 3.9.2.3 were approved.

2.6 Section 3.9.2.4 - Evaluation of compatibility aspects of the proposed SSB system during the transition period

2.6.1 The delegate of Syria proposed the deletion of the penultimate sentence in the third paragraph of section 3.9.2.4 because the matter was to be studied further during the intersessional period.

2.6.2 The Chairman of Committee 4 pointed out that the Committee had decided to draw attention to the question of the effect of coherent demodulation of the two sidebands of a DSB emission in an envelope detector as it needed further investigation since the plan would be based on DSB transmission.

Section 3.9.2.4 was approved without change.

The third series of texts submitted by the Editorial Committee (B.3) was approved, as amended, on first reading.

3. Fourth series of texts submitted to the Plenary Meeting for first reading (B.4) (Document 168)

3.1 Chapter 3.5 - Antennas and power

3.1.1 Section 3.5.1 - Antenna characteristics

3.1.1.1 The Chairman of the Editorial Committee drew the meeting's attention to minor editorial corrections required to sections 3.5.1.2 and 3.5.1.5 and to Figure [I/3.5.1.2].

With regard to the appropriateness of transferring the formula $G_i = G_d + 2.2$ dB to the text of section 3.5.1.2, it was decided after some discussion that it would be more suitable to leave the formula where it appeared in the document, namely, as a footnote to Figure [II/3.5.1.2].

3.1.1.2 The Chairman of Committee 4 said it had been brought to his attention that the meaning of the paragraph in section 3.5.1.5 beginning "The resulting antenna gain ..." was not perfectly clear. He proposed that the paragraph should be placed in square brackets pending the preparation of more suitable wording.

It was so agreed.

Chapter 3.5, section 3.5.1, as so amended, was approved.

3.2 Chapter 3.8 - Maximum number of frequencies required for broadcasting the same programme to the same zone

3.2.1 Section 3.8.1 - Introduction

Approved.

3.2.2 Section 3.8.2 - Use of additional frequencies

3.2.2.1 The Chairman of the IFRB drew the meeting's attention to the fact that the terms "specific percentage of test points" in the first paragraph, "basic reception reliability" in the second paragraph and "existing typical broadcasting circuits" in Note 1 were insufficiently clear for the purposes of the IFRB and might cause difficulties in its future work.

3.2.2.2 The Chairman of Committee 4 said that in the case of the first paragraph, the text had been redrafted several times so that it was not surprising if ambiguities had crept in. He proposed that the text be placed in square brackets pending an attempt to provide a clearer text for submission to the Plenary Meeting.

3.2.2.3 The delegate of Brazil noted that a matter of substance would be involved in any attempt to spell out what was meant by a "specific percentage" of test points. Revision of that paragraph was thus not a matter to be left solely to the Editorial Committee.

3.2.2.4 The Chairman of Committee 4 said that what had been meant in the second paragraph by basic reception reliability was defined elsewhere, in a text to be considered by the next Plenary Meeting. That definition would perhaps provide enough clarification for the IFRB's purposes. With regard to the footnote, which had been placed in square brackets pending decisions on the way the intersessional work was to be arranged, he explained that the relevant calculations could not be made during the present Conference because appropriate computer programs were not yet available. The term "existing typical broadcasting circuits" had been used to indicate that the IFRB could select a number of examples to serve as the basis for the calculations to be carried out in the intersessional period. The second session of the Conference would then be in a position to use the results to review the limits of circuit reliability and the criteria for the selection of further frequencies.

3.2.2.5 The delegate of the USSR noted that in the case of the second paragraph, Note 1 and, more particularly, Figure /‾Y/3.8.2_7, no questions of substance were involved in the points on which clarification was sought. No changes that were not of an editorial nature should therefore be made to those texts.

3.2.2.6 In the light of the discussion, the Chairman proposed that an ad hoc Group PL-B consisting of the delegates of Brazil, China, France, India and the United States and the Chairman of Committee 4, should be set up under the chairmanship of Mr. Barclay (United Kingdom) to consider the whole of section 3.8.2 including the figure and prepare a suitable text for submission to the next Plenary Meeting, bearing in mind that apart from the first paragraph no substantive changes were to be made to the text. The present text would be placed in square brackets pending the outcome of that discussion.

It was so agreed.

The fourth series of texts submitted by the Editorial Committee (B.4) was approved, as amended, on first reading.

4. Oral report by the Chairman of Committee 5

4.1 The Chairman of Committee 5 said he was sorry to have to report that despite the many hours of hard work put in by ad hoc Group 5A-2, no agreement had yet been reached on the question of choice of planning method. On the key issue - namely, how to deal with the congestion resulting when requirements exceeded the availability of channels for a particular target area and a particular time-block - it had not been possible to reach a compromise, and indeed viewpoints had become strongly polarized. Disagreement was focussed on how to interpret the concept of equitability of access to the spectrum. One group of administrations, large users of the spectrum, insisted that that concept implied equal treatment for all the requirements of each administration, regardless of the number of those requirements. The other group, small users of the spectrum, felt equally strongly that their own requirements should not be made to suffer from the larger requirements of others, and insisted on guarantees of quality and reliability for meeting minimum requirements only. Those two opposing viewpoints had been thoroughly debated and no useful purpose would be served by discussing them further. Since ad hoc Group 5A-2 would need to complete its work by the afternoon of Saturday, 4 February, he suggested that it should now confine itself to finalizing the remaining items on its agenda, and indicate in its report to Working Group 5A those problem areas for which it had not been possible to find solutions.

4.2 The delegate of the Islamic Republic of Iran said he had understood that at the last meeting of ad hoc Group 5A-2 there had been some improvement in the position. He suggested that the Group's Chairman should be asked to make his own report to the Plenary Meeting on how matters stood.

4.3 The delegate of Algeria also considered that the feeling in ad hoc Group 5A-2 had been that progress was being made towards, at least, a tentative solution. If discussions could begin again from the point at which they had been broken off, there might be some hope of reaching agreement.

4.4 The delegate of India supported that suggestion.

4.5 The Chairman of ad hoc Group 5A-2 said that although it was true that the Group had made some progress, thanks to the goodwill and spirit of compromise shown by all, there were still fundamental differences of view on the basic issue. At the last meeting, three separate positions on that issue had been put forward, and until those three positions had been reconciled, it was difficult to see how work could proceed. In reply to a suggestion by the delegate of Venezuela, he agreed to prepare a brief summary of the three positions mentioned for presentation to the Group's next meeting.

4.6 The Chairman said the situation was a most unfortunate one. He strongly urged members of ad hoc Group 5A-2 to make every possible effort to arrive at a compromise solution on this vital issue. Failure to do so would mean that the Conference would not be able to achieve its goals, with serious consequences for the whole future of radio communications.

5. Approval of the Minutes of the Fourth Plenary Meeting (Document 127)

The Minutes of the Fourth Plenary Meeting, as set out in Document 127, were approved, subject to a minor editorial amendment (see Corrigendum 1 to Document 127).

The meeting rose at 1745 hours.

The Secretary-General : R.E. BUTLER

The Chairman : K. BJÖRNSJÖ

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 175-E
3 February 1984
Original : English

PLENARY MEETING

SECOND REPORT OF COMMITTEE 4
TO THE PLENARY MEETING

On Thursday, 2 February 1984, Committee 4 concluded its work according to the terms of reference defined in Document 59.

Between 24 January 1984 (date of the first report of Committee 4 to the Plenary) and 2 February 1984, Committee 4 approved all the remaining texts of Chapter 3 of the report of the first session of the Conference.

Documents 126, 139, 146, 155, 160, 163, 166 and 171 containing these texts were submitted to the Editorial Committee for subsequent submission to the Plenary Meeting.

When adopting the documents above, the following reservations were made :

- on paragraph 3.8.2 (Document 160, Annex 1) by the delegation of France;
- on paragraph 3.5.1.5 (Document 160, Annex 2) by the delegation of the USSR; and
- on paragraph 3.7.1 (Document 166) by the delegation of Algeria.

In addition to the above, the values of the Noise limited sensitivity of the receiver, the Audio-frequency signal/noise ratio and the Reference usable field strength (contained in the Note from Committee 4 to the Editorial Committee, Document 170) were adopted as a compromise.

The consensus on these values was, however, reached without the agreement of four delegations (URS, BUL, POL, TCH) which reserved the right to revert to this subject in the Plenary Meeting.

J. RUTKOWSKI
Chairman of Committee 4

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 176-E
3 February 1984
Original : English

COMMITTEE 5

Kingdom of the Netherlands

PROPOSAL REPLACING HOL/25/1

DRAFT RESOLUTION

Relating to the Avoidance of Harmful Interference with a View to Improving the Use of the HF Bands Allocated to the Broadcasting Service

The World Administrative Radio Conference for the Planning of the HF Bands Allocated to the Broadcasting Service (First Session, Geneva, 1984)

considering

a. Article 10 (no. 79 and no. 80) of the International Telecommunication Convention, concerning the duties of the IFRB;

b. Article 35 (no. 158) of the International Telecommunication Convention, concerning the avoidance of harmful interference;

c. Article 54 (no. 209) of the International Telecommunication Convention, concerning instructions to the IFRB by a World Administrative Radio Conference;

d. Article 20 of the Radio Regulations, concerning the international monitoring system;

noting

1. that harmful interference, is increasingly having a serious negative impact on the planning and use of frequency channels available for high frequency broadcasting, even in areas at considerable distance from the source of interference;

2. that broadcasting on channels adjacent to those being affected directly is also subject to interference

3. that a considerable number of high frequency broadcasting channels in various parts of the world are rendered useless due to harmful interference;

recognizing

1. that it is desirable for more detailed information on the extent and impact of all forms of harmful interference, to be available before the second session of the conference;

2. that an increase in the number of stations participating in the international monitoring system and a more effective use of the information obtained from such stations would be of considerable assistance;

urges administrations

to avoid all forms of harmful interference;

instructs the IFRB in accordance with the Radio Regulations

1) to organize monitoring programmes in the bands allocated to the high frequency broadcasting service with a view to identifying stations causing harmful interference;
2) to seek, as appropriate, the cooperation of administrations in identifying the sources of emissions in these bands which cause harmful interference and to give this information to administrations;
3) to inform the second session of the conference on the results of the program referred to in 1 and 2.

invites administrations

to take part in monitoring programmes set up by the IFRB in accordance with the provisions of this Resolution.

INTERNATIONAL TELECOMMUNICATION UNION

BLUE PAGES

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 177-E
3 February 1984

B.5

PLENARY MEETING

FIFTH SERIES OF TEXTS SUBMITTED BY THE
EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for first reading :

Source	Document	Title
COM.4	163	Definitions : 2.10
COM.4	170	Chapter 3 : 3.1.4.2
COM.4	107	Chapter 3 : 3.2.5.2
COM.4	146 + 170	Chapter 3 : 3.5.2
COM.4	166	Chapter 3 : 3.7

Marie HUET
Chairman of Committee 6

Annex : 5 pages

/ CHAPTER 2 - Definitions /

2.10 Term relating to the service area

- Required service area (in HF broadcasting)

  The area within which an administration proposes to provide a broadcasting service.

/ CHAPTER 3 - Technical criteria /

3.1.4.2 Noise limited sensitivity of the receiver

The value of the noise limited sensitivity of the receiver for planning purposes shall be 40 dB(μV/m).

/‾3.2.5 Values of the appropriate solar index and the seasonal periods on the basis of which planning should be carried out _7

3.2.5.2 Solar index values

3.2.5.2.1 The 12-month running mean sunspot number R_{12} shall be the solar index to be used for planning.

3.2.5.2.2 /‾ The reference values of R_{12} to be used for planning shall be the five values given in Table /‾II/3.2.5_7. This Table also states the range of applicability of each of the reference values.

When a seasonal plan is to be selected from the set of plans prepared in accordance with the reference values of R_{12}, the applicable plan shall be selected on the basis of the lowest value of R_{12} predicted for any of the months in that season.*

TABLE /‾II/3.2.5_7

Selection of R_{12} index values for planning

Index values	Range of applicability of predicted R_{12}
5	0-14
30	15-44
60	45-74
90	75-104
120	105 and above

_7

/‾The seasonal plan shall be prepared in accordance with the values of R_{12} predicted for the period. The lowest value of R_{12} predicted for any of the months in that season shall be used._7*

* Note 1 - The first alternative relates to a planning method which produces plans for a period of more than one year ahead; the second relates to a planning method which produces plans for periods up to one year ahead. Only one of these options will be retained according to the method chosen.

Note 2 - Predicted values of the 12-month running mean sunspot number R_{12} are prepared for periods up to six and twelve months ahead of the current month. The predicted values are obtainable from the CCIR Secretariat.

3.5.2 Transmitter power and equivalent isotropically radiated power appropriate for satisfactory service

The propagation prediction method described in section 3.2.1 shall be used to determine the appropriate transmitter power to achieve satisfactory service. The appropriate transmitter power varies with propagation conditions which in turn are functions of the time of day, the season and the solar cycle period as well as the geographical location.

* /_This text has already been adopted by the Plenary Meeting, see Document 115(Rev.1 page B.1/15(Rev.1). The following additional text is to be added :_7

[/_During the first stage of_7 treatment of the requirement, the equivalent isotropically radiated power appropriate for providing the reference usable field strength ($E_{ref} = E_{min} + 3$ dB) shall be calculated considering the basic circuit reliability /_if necessary_7.

The reference value of reliability in this case shall be /_X_7% to start with.

After the initial frequency assignments to all requirements are known, a compatibility analysis will be carried out.]*

/_** Pending a decision of Committee 5._7

3.7 Reception zones and test points

3.7.1 Reception zones

In specifying the reception area, reference shall be made to a CIRAF zone, or a part thereof.

If necessary, CIRAF zones may be divided into four quadrants NW, NE, SE and SW to define more precisely the service area of a transmission. This is achieved by defining an appropriate reference point in each CIRAF zone with the dividing lines described precisely by the lines of latitude and longitude passing through such a reference point. Any combination of the four quadrants may be used where the service area is greater than one quadrant but less than a whole CIRAF zone.[1]

Ten maritime broadcasting areas (provisionally designated as A to J) are defined as shown in Annex [A/3.7.2].[2]

3.7.2 Test points

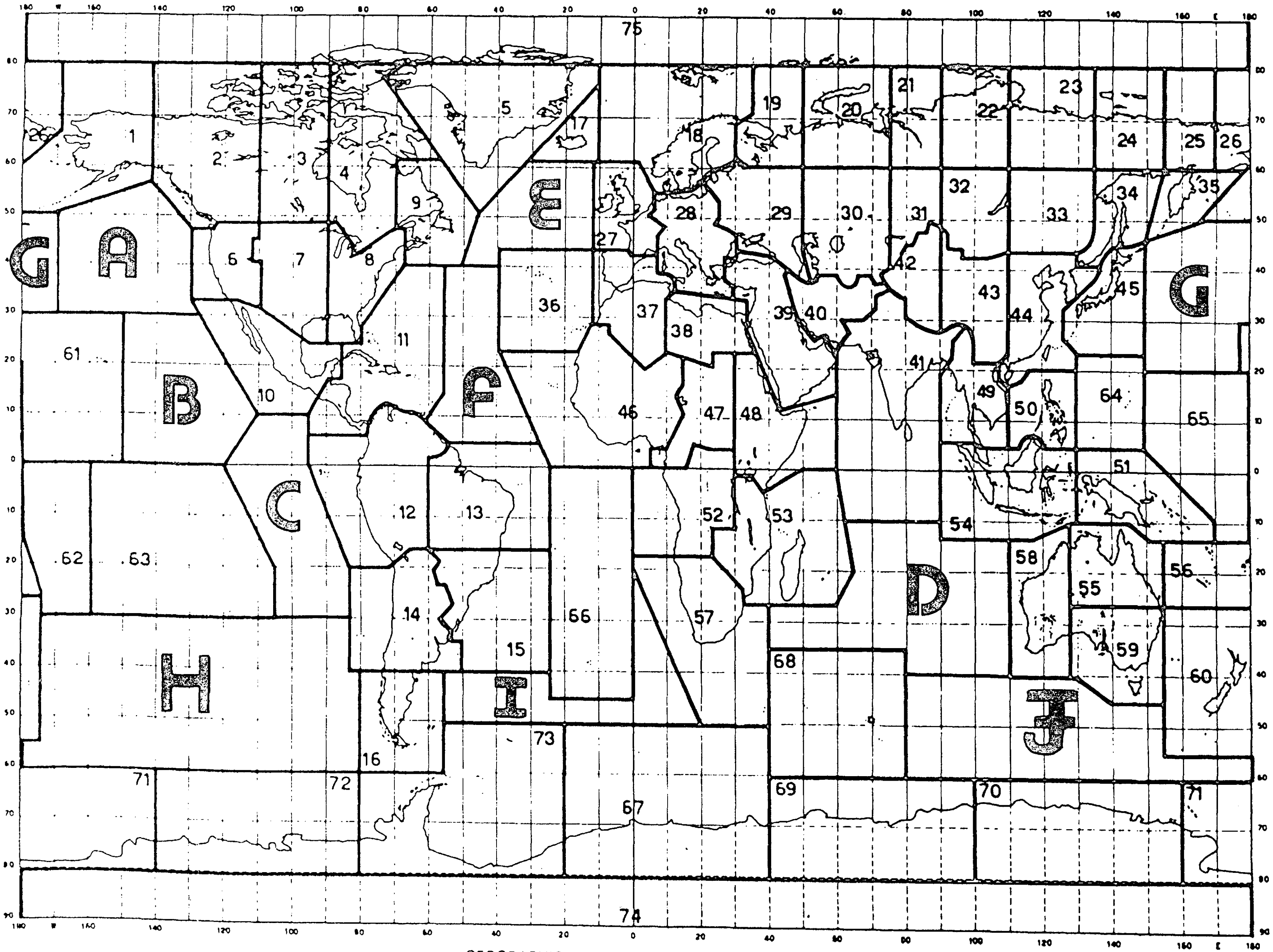
For the purposes of the technical examination the IFRB shall determine an adequate number of test points distributed throughout each CIRAF zone and, where appropriate, subdivisions of CIRAF zones. These test points shall form part of the IFRB Technical Standards and will be distributed for comment by administrations (Nos. 1001 and 1001.1 of the Radio Regulations).

As the computer facilities available to the IFRB improve, the Board shall make further improvements by increasing the number of test points.

Note 1 - In exceptional cases when it is necessary to specify a reception area which is smaller than an entire zone or a subdivision of a zone, this may be done by using appropriate test points and specifying the maximum service range in km. See Appendix 2 of the Radio Regulations.

Note 2 - It may be desirable to consider the procedures applicable in examining the compatibility of requirements in these maritime broadcasting areas.

(IN ACCORDANCE WITH THE ANNEX TO APPENDIX 1 OF THE RADIO REGULATIONS)



GEOGRAPHICAL ZONES FOR BROADCASTING

ANNEX [A/3.7.2]

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 178-E
3 February 1984
Original : French

COMMITTEE 2

FOURTH REPORT OF THE WORKING GROUP OF COMMITTEE 2 (CREDENTIALS)

The Working Group of Committee 2 held a fourth meeting on 3 February 1984 to examine the Credentials of the following delegations :

BOLIVIA (Republic of)

CONGO (People's Republic of the)

COSTA RICA *

KUWAIT (State of)

MEXICO

MONACO

UKRAINIAN SOVIET SOCIALIST REPUBLIC

ROMANIA (Socialist Republic of)

VENEZUELA (Republic of)

ZIMBABWE (Republic of)

The Credentials of these delegations were all found to be in order.

N. TCHIMINA
Chairman of the Working Group C2-A

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* Provisional Credentials

PINK PAGES
Corrigendum 1 to
Document 179-E
7 February 1984

R.4(Corr.1)

PLENARY MEETING

FOURTH SERIES OF TEXTS SUBMITTED BY THE
EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for second reading :

Source	Document	Title
COM.4	192	Chapter 3 - Technical criteria

Replace pages R.4/2 and R.4/13 by the following.*

Marie HUET
Chairman of Committee 6

* Note by the Editorial Committee

Committee 4 has revised these points in accordance with decisions taken by the Plenary Meeting. The passages in question are indicated by a double vertical line in the margin and should receive a second reading.

Annex : 3 pages

3.4 Values of minimum usable and reference usable field strength

3.4.1 Minimum usable field strength

The minimum usable field strength shall be determined numerically by using the atmospheric noise data, man-made noise data, or the intrinsic receiver noise level, and by adding to it the value of the required radio-frequency signal-to-noise ratio.

3.4.1.1 Atmospheric radio noise data

See 3.2.2.1.

3.4.1.2 Man-made radio noise data

See 3.2.2.2.

3.4.1.3 Intrinsic receiver noise level

The intrinsic receiver noise level E_i^o shall be calculated by :

$$E_i^o \text{ (dB (µV/m))} = E_c \text{ (dB (µV/m))} + 20 \log m - \text{SNR (dB)}$$

where E_c = noise limited sensitivity of the receiver = 40 dB(µV/m)

m = modulation depth = 0.3

SNR = audio-frequency signal-to-noise ratio = 26 dB.*

For these conditions : E_i^o = 3.5 dB(µV/m).

3.4.1.4 Comparison of the intrinsic receiver noise level, the atmospheric and man-made radio noise

In each case the values of atmospheric noise, man-made noise and intrinsic receiver noise intensities shall be compared and the greatest one shall be used.

3.4.1.5 Audio-frequency signal/noise ratio

For planning purposes, the value of the audio-frequency signal/noise ratio shall be 24 dB.

* The value of the signal-to-noise ratio in this paragraph is the value used for the measurements of the noise-limited sensitivity of the receiver carried out in accordance with CCIR Report 617-2 (this value is not to be confused with the value of the AF signal-to-noise ratio recommended for planning purposes in 3.4.1.5).

3.4.1.6 Radio-frequency signal/noise ratio

The required radio-frequency (input) signal-to-noise ratio is approximately 10 dB greater than the required audio-frequency (output) signal-to-noise ratio for the reference receiver (IF bandwidth 4 kHz) with 30% modulation of the received signal under stable propagation conditions. The basis for the establishment of this ratio is such that it is not appropriate to consider variability in time.

In these conditions, for planning purposes, the value of the radio frequency signal/noise ratio shall be 34 dB.

3.4.2 Reference usable field strength

The reference usable field strength shall be $E_{ref} = E_{min} + 3$ dB.

In obtaining the attenuation for any angle of elevation and azimuth, the angle ψ must be calculated using the following formula :

ψ = arc sin (sin φ cos θ) for $|\varphi| \leq 90°$ or

ψ = 180 - arc sin (sin φ cos θ) for $\varphi > 90°$

ψ = -180 - arc sin (sin φ cos θ) for $\varphi < -90°$

where

φ = angular difference between great circle bearing transmitter to receiver and azimuth of maximum radiation of the antenna.

θ = angle of vertical radiation.

The attenuation values for ψ and θ can then be determined from the appropriate tables.

The antenna gain in the required direction is then calculated as follows :

Step 1 - Sum the attenuations for the appropriate values of θ and ψ (Tables /‾D, E, F, G/3.5.1.5_7).

Step 2 - If appropriate, according to the conditions in a) i) and b) i) given below, limit the total attenuation obtained in step 1 to a value not exceeding 30 dB.

Step 3 - Subtract the total attenuation from the maximum gain (Table /‾A/3.5.1.2_7) for the antenna under consideration and, if appropriate according to condition a) ii) given below, limit the resultant antenna gain to a value not below -8 dBi.

a) Forward radiation

i) For angles of elevation less than the vertical angle of maximum radiation, the total attenuation should not exceed a value of 30 dB.

ii) For angles of elevation equal to or greater than the vertical angle of maximum radiation, the resultant antenna gain shall not fall below -8 dBi.

b) Reverse radiation

i) For HR m/n/h antennas, at all angles of elevation, the total attenuation should not exceed a value of 30 dB.

INTERNATIONAL TELECOMMUNICATION UNION

PINK PAGES

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 179-E
3 February 1984

R.4

PLENARY MEETING

FOURTH SERIES OF TEXTS SUBMITTED BY THE
EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for second reading :

Source	Document	Title
COM.6	B.4/168 B.3/154(Rev.1) B.1/115(Rev.1)	Chapter 3 - Technical criteria Paragraphs : 3.2.1.4 3.4 3.5 to 3.5.1.5 3.6 3.9.2

Marie HUET
Chairman of Committee 6

Annex : 20 pages

3.2.1.4 Selection of optimum frequency band

The optimum frequency band for a high frequency broadcasting service is that which has the highest median value of radio-frequency signal-to-noise ratio at the test points in the required service area.

The optimum combination of bands, if needed by the planning method, is that which gives the highest value of basic broadcast reliability in the required service area.

3.4 Values of minimum usable and reference usable field strength

3.4.1 Minimum usable field strength

The minimum usable field strength shall be determined numerically by using the atmospheric noise data, man-made noise data, or the intrinsic receiver noise level, and by adding to it the value of the required radio-frequency signal-to-noise ratio.

3.4.1.1 Atmospheric radio noise data

See 3.2.2.1.

3.4.1.2 Man-made radio noise data

See 3.2.2.2.

3.4.1.3 Intrinsic receiver noise level

The intrinsic receiver noise level E_i^o shall be calculated by :

$$E_i^o \text{ (dB (µV/m))} = E_c \text{ (dB (µV/m))} + 20 \log m - \text{SNR (dB)}$$

where E_c = noise limited sensitivity of the receiver = 40 dB(µV/m)

m = modulation depth = 0.3

SNR = audio-frequency signal-to-noise ratio = 26 dB. [*]

For these conditions : E_i^o = 3.5 dB(µV/m).

3.4.1.4 Comparison of the intrinsic receiver noise level, the atmospheric and man-made radio noise

In each case the values of atmospheric noise, man-made noise and intrinsic receiver noise intensities shall be compared and the greatest one shall be used.

3.4.1.5 Audio-frequency signal/noise ratio

For planning purposes, the value of the audio-frequency signal/noise ratio shall be 24 dB.

3.4.1.6 Radio-frequency signal/noise ratio

The required radio-frequency (input) signal-to-noise ratio is approximately 10 dB greater than the required audio-frequency (output) signal-to-noise ratio for the reference receiver (IF bandwidth 4 kHz) with 30% modulation of the received signal under stable propagation conditions. The basis for the establishment of this ratio is such that it is not appropriate to consider variability in time.

In these conditions, for planning purposes, the value of the radio frequency signal/noise ratio shall be 34 dB.

3.4.2 Reference usable field strength

The reference usable field strength shall be $E_{ref} = E_{min} + 3$ dB.

[*] [Note will follow.]

3.5 Antennas and power

The combined effect of transmitter power and antenna characteristics which determines the equivalent isotropically radiated power (e.i.r.p.) is the main factor in computations for HF broadcasting planning. The most directional antenna possible which is appropriate to the broadcasting requirement should be chosen when selecting power and associated antennas. The power required must be as low as possible to achieve broadcasting objectives.

3.5.1 Antenna characteristics

In HF broadcasting the antenna is the means by which the radio-frequency energy is directed towards the required service area. The selection of the right type of antenna will enhance the signal in this area, while reducing radiation in unwanted directions. This will protect other users of the radio-frequency spectrum operating on the same channel or adjacent channels to another service area. The use of directional antennas with well-defined radiation patterns is thus recommended as far as possible.

Non-directional antennas can be used when the transmitter is located within the required service area. In this case the required service area as seen by the transmitter extends over an azimuthal angle greater than 180°.

Directional antennas serve a double purpose. The first is to prevent interference to other users of the spectrum by means of their directivity. The second is to provide sufficient field-strength for satisfactory reception by means of their power gains.

Although rhombic antennas are used, they should be discouraged because of the size and number of their sidelobes, which could create technically avoidable interference.

3.5.1.1 Choice of optimum antennas for various types of service

A chart in Figure [I/3.5.1.2] gives some general guidelines for the choice of optimum antennas for a given type of service according to the required distance range. Two different categories are considered : short distance and medium/long-distance services.

A short distance service is understood here to have a range of up to about 2,000 km. The corresponding area can be covered with either a non-directional or a directional antenna whose beamwidth can be selected according to the sector to be served. In the case of directional antennas, both horizontal dipole curtain and logarithmic-periodic antennas can be employed. The latter type is multiband array with a wide operating frequency range, a low-to-medium gain and a large horizontal beamwidth.

Medium and long distance services can be considered to reach distances greater than approximately 2,000 km. Such coverage can be provided by antennas whose main-lobe elevation angle is small (6^{o}-13^{o}) and whose horizontal beamwidth - depending on the area to be served - is either wide between 65^{o} and 95^{o} (generally 70^{o}) or narrow between 30^{o} and 45^{o} (generally 35^{o}).

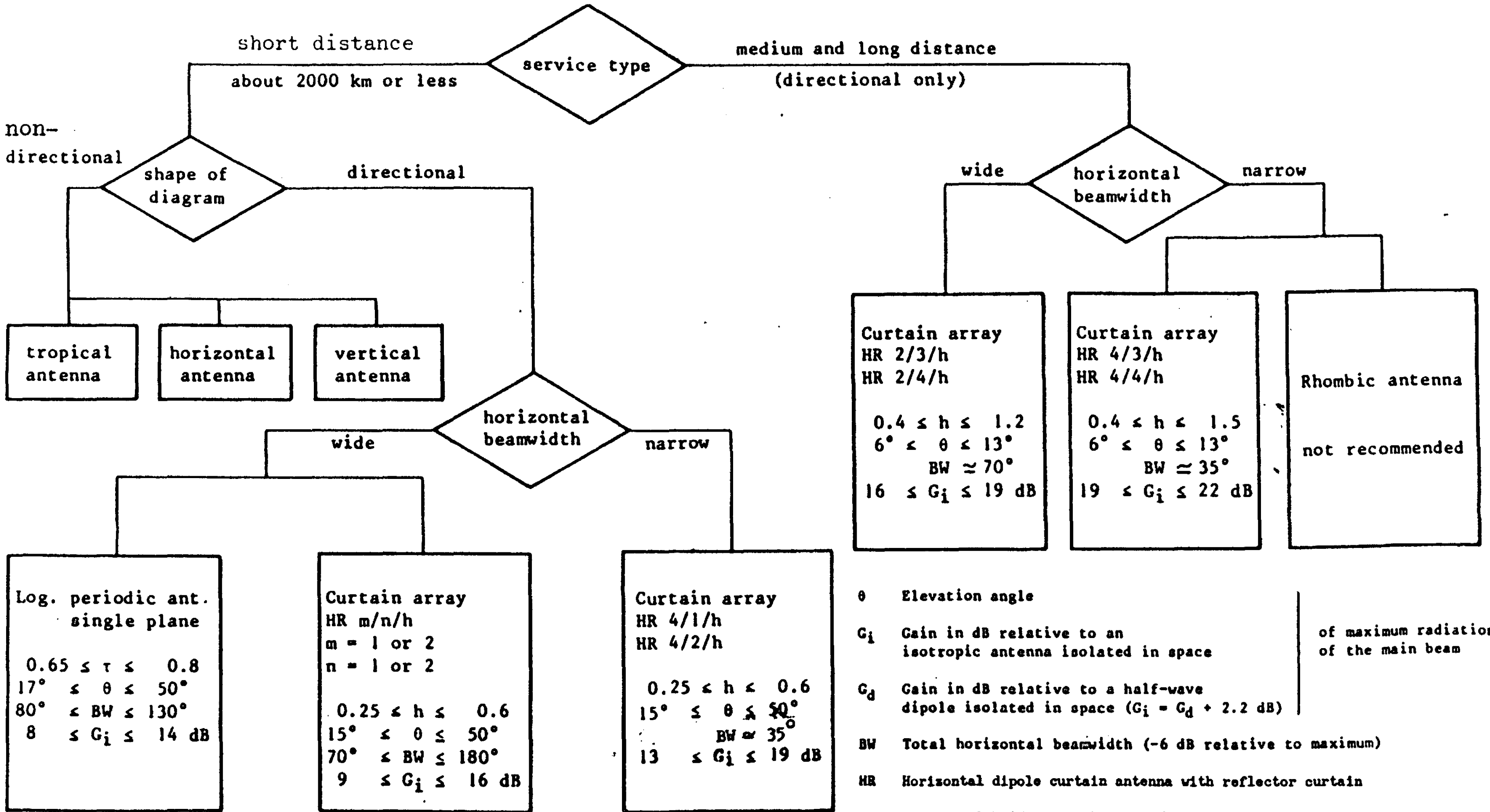
The value of the field-strength in the reception area is influenced by the radiation characteristics of the antennas, and this will be optimized if the most suitable type of antenna is used. The direction of radiation of the main lobe of a short-wave antenna, its elevation angle and maximum gain are principally dependent upon the type of array and its height above ground.

Figure [II/3.5.1.2] illustrates the way in which these parameters vary for horizontal dipole curtain antennas fitted with reflectors and for arrays with most of the commonly-used arrangements of dipoles when operated close to their design frequency. The way in which the maximum gain and elevation angle of the main lobe of rhombic antennas vary with height above ground is also shown.

Figure [III/3.5.1.2] shows the angle of elevation involved in the propagation of short-wave signals via the F-layer for distances up to 10,000 km. It can be seen that the angles tend to be less than 10^{o} for all distances beyond 5,000 km and angles above about 20^{o} are only suitable for distances of less than 2,000 km. Figure [II/3.5.1.2] shows that low angle arrays whose maximum radiation is at angles of 10^{o} or less tend to have the highest gains, and that low-gain antennas have their maximum radiation at the high angles most suitable for short-distance services.

3.5.1.2 <u>A set of representative types of antenna</u>

Antenna patterns used for planning purposes need to take account of practical considerations; they should be standardized for reference purposes and they should be representative of the large range of types of antenna in common use. For a set of representative antenna types recommended for planning purposes, based on single band antennas, Table [A/3.5.1.2] indicates, according to the vertical and azimuthal characteristics, the gain and the elevation angle of maximum radiation. Details of the total horizontal beamwidth (between -6 dB points) for the different types of antenna are also given in Table [B/3.5.1.2].



θ Elevation angle

G_i Gain in dB relative to an isotropic antenna isolated in space

G_d Gain in dB relative to a half-wave dipole isolated in space ($G_i = G_d + 2.2$ dB)

(of maximum radiation of the main beam)

BW Total horizontal beamwidth (-6 dB relative to maximum)

HR Horizontal dipole curtain antenna with reflector curtain

m Number of half-wave elements in each row

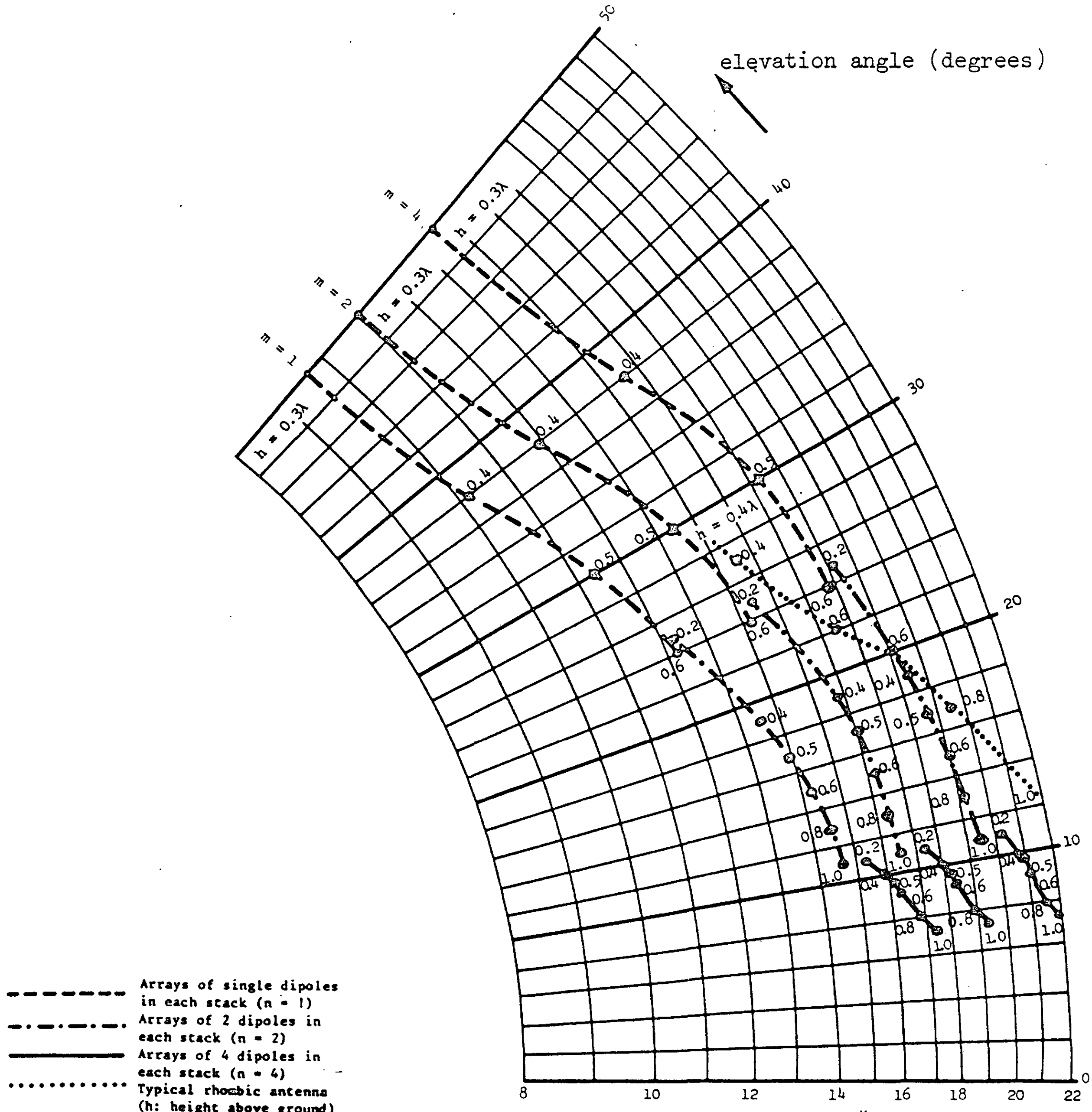
n Number of half-wave elements in each stack (one above the other)

h Height above ground in full wavelengths of the bottom row of elements

τ Taper ratio of log. periodic antenna

FIGURE [I/3.5.1.2]

Antenna selection chart



Nomenclature according to Appendix 2, page 7 of the Radio Regulations (1982 edition)

HR : horizontal dipole curtain antenna with reflector curtain
m/ : number of half-wave elements in each row
/n/ : number of half-wave elements in each stack (one above the other)
/h : height above ground in full wavelengths of the bottom row of elements, or of typical rhombic antennas

FIGURE /¯II/3.4.1.2_7

Variation of maximum isotropic gain with elevation angle, for horizontal dipole curtain arrays fitted with reflectors and for typical rhombic antennas, above a perfect earth

* $G_i = G_d + 2.2$ dB

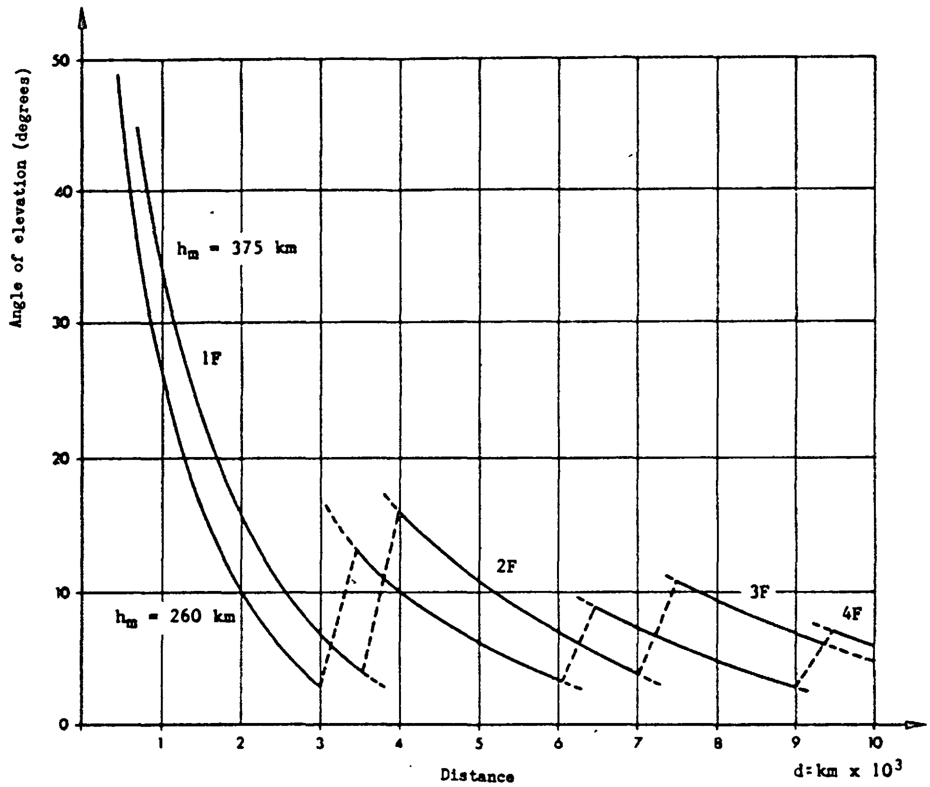


FIGURE [III/3.5.1.2]

Variation of elevation angle with distance for representative F-layer heights h_m

Principal characteristics of the set of representative types of antenna

TABLE /‾A/3.5.1.2_7

Gain and elevation angle in the direction of maximum radiation

TYPE OF ANTENNA / VERTICAL CHARACTERISTIC ---/m/n/h	IN THE DIRECTION OF MAXIMUM RADIATION					
	AZIMUTHAL CHARACTERISTIC					ELEVATION ANGLE θ (DEGREES)
	HR4 GAIN G_i (dB)*	HR2 GAIN G_i (dB)*	HR1 GAIN G_i (dB)*	H2 GAIN G_i (dB)*	H1 GAIN G_i (dB)*	
-/4/1	22	19				7
-/4/0.8	22	19				8
-/4/0.5	21	19				9
-/3/0.5	20	18				12
-/2/0.5	19	16	14		11	17
-/2/0.3	18	15	13		10	20
-/1/0.5		14	12	11	9	28
-/1/0.3		11	10			44
				9	7	47

---

* $G_i = G_d + 2.2$ dB

TABLE /‾B/3.5.1.2_7

Total horizontal beamwidth at the elevation angle of maximum radiation (for single band antennas)

TYPE OF ANTENNA / –/m/n/h	TOTAL HORIZONTAL BEAMWIDTH (-6 dB) (DEGREES)				
	HR4	HR2	HR1	H2	H1
ALL TYPES -/4/1 to -/2/0.5	35	70	108		112
-/2/0.3	35	70	110		116
-/1/0.5		74	114	78	126
-/1/0.3		90	180	180	180

For antennas not included in Table /‾A/3.5.1.2_7 the equivalent representative type whose performance is nearest to that of the antenna under consideration can be determined by reference to Table /‾C/3.5.1.2_7.

TABLE /‾C/3.5.1.2_7

Determination of the representative antenna having a radiation pattern most similar to that of any non-representative one, on the basis of the value of the parameters n and h

h	HR m/n/h				H m/n/h	
	n=4	n=3	n=2	n=1	n=2	n=1
h ≥ 0.9	m/4/1	m/4/0.8	m/3/0.5	-	-	-
0.9 > h ≥ 0.65	m/4/0.8	m/4/0.5	m/3/0.5	-	-	-
0.65 > h ≥ 0.4	m/4/0.5	m/3/0.5	m/2/0.5	m/1/0.5	m/2/0.5	m/1/0.5
0.4 > h	m/3/0.5	m/2/0.5	m/2/0.3	m/1/0.3	m/2/0.3	m/1/0.3

(m=4, 2 or 1, where appropriate)

3.5.1.3 <u>Multi-band antennas</u>

In the case of multi-band antennas, (curtain and log periodic) a single value of h, an important parameter with regard to the vertical radiation pattern and the angle of maximum radiation, no longer corresponds to the <u>physical</u> height of the bottom row of elements of the antenna over the range of operating frequencies. The equivalent value h at the required frequency of operation can be found in the following way : in Figure [IV/3.5.1.3] enter the vertical angle of maximum radiation, taken from the antenna diagram for the respective frequency band, into the ordinate. Choose the curve with the appropriate value of n. Read from the abscissa the equivalent height h. The equivalent type of antenna can then be determined by entering this new value of h in Table [C/3.5.1.2].

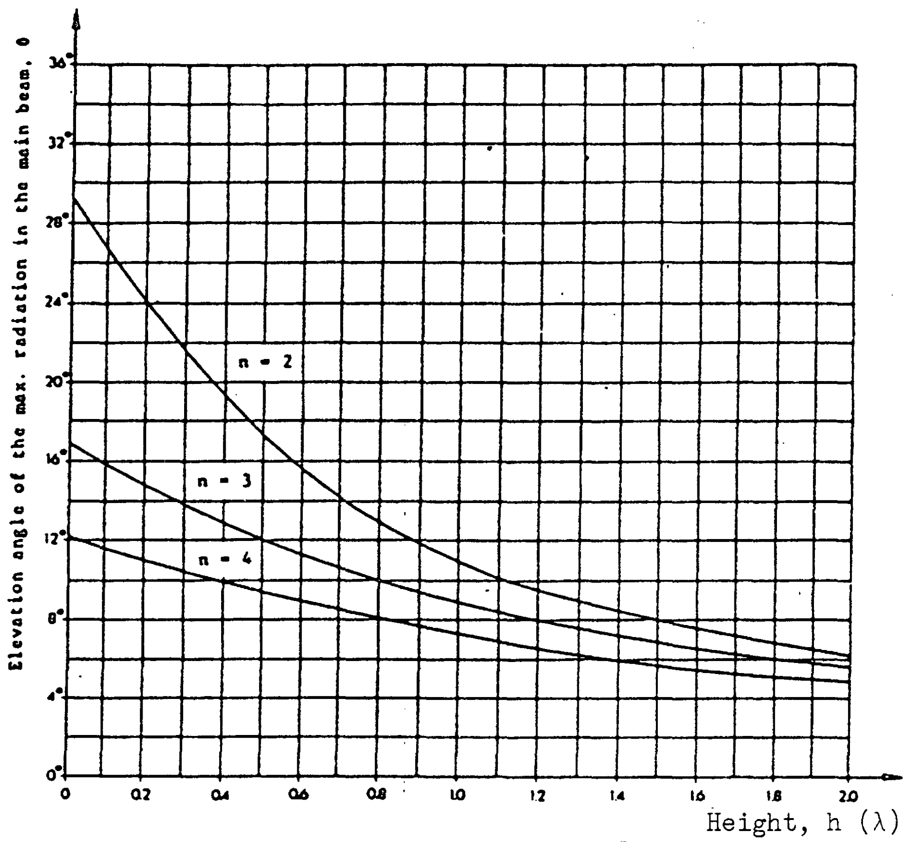


FIGURE [IV/3.5.1.3]

<u>Diagram enabling the equivalent value of the parameter h to be determined for a multiband antenna having n half-wave elements in each stack</u>

Additional data relating particularly to the azimuthal performance over the operating range of a multi-band antenna are required for later inclusion in Table /‾D/3.5.1.5_7 as they become available. Between the two sessions, therefore, administrations are requested to submit to the CCIR accurate data in the format given in Table /‾D/3.5.1.5_7.

3.5.1.4 Simplified antenna patterns for planning purposes

The vertical pattern and azimuthal pattern of the antennas listed in Table /‾A/3.5.1.2_7 can be represented by values of the relative attenuation in dB below maximum gain, each value being relative to the maximum radiation in both elevation and azimuth and to the maximum gain of the array. The attenuations, in dB, relative to maximum gain, for the azimuthal pattern are listed in Table /‾D/3.5.1.5_7 and those for the vertical pattern are listed in Tables /‾E, F, G/3.5.1.5_7.

When an antenna is slewed horizontally, the main beam may be considered as unchanged in shape. It can, therefore, be assumed that the azimuth of maximum radiation of the main beam in the slewed mode coincides with the horizontal angle $\psi = 0$ (see paragraph 3.5.1.5) in Table /‾D/3.5.1.5_7. The radiation outside the main beam should be represented in a similar tabulated form and the CCIR Secretariat is requested to provide the appropriate values, based on the data contained in the CCIR Antenna Handbook.

3.5.1.5 Representation of antenna patterns

Antenna diagrams are conventionally used to represent the spatial radiation distribution of an antenna or an array of antennas. The CCIR uses a sinusoidal projection, called "SANSON-FLAMSTEAD PROJECTION" where the hemisphere and the contours are represented in a single plane.

The formulas from which these patterns have been developed are extremely complex.

The three-dimensional radiation pattern of an antenna can be derived from :

a) the vertical radiation pattern within the plane normal to the horizontal plane comprising the azimuth of maximum radiation $G(\theta)|_{\varphi = 0^{\circ}}$

b) the azimuthal radiation pattern.

For graphic representation of the angles θ and φ is given in Figure /‾V/3.5.1.5_7.

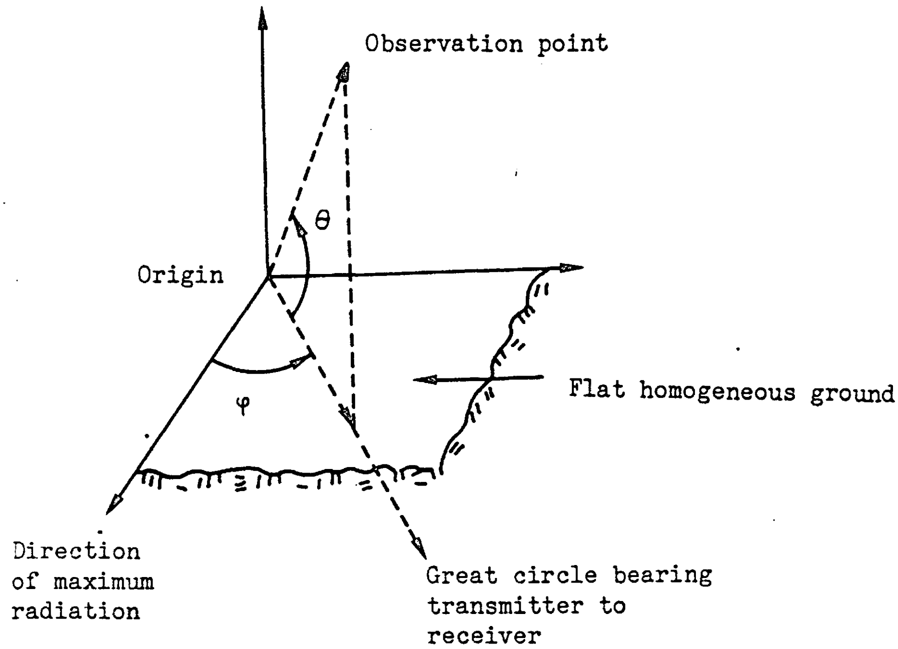


FIGURE /‾V/3.5.1.5_7

Graphic representation of the angles θ and φ

For planning purposes it is more convenient and much faster in any computation process to use tabulated information.

A suitable set of antenna patterns in the form of reference tables has been prepared giving values for the antenna radiation patterns which are in close agreement with those given by the CCIR.

This set of antenna patterns uses a conversion technique to obtain the true radiation pattern from the respective values of vertical and azimuthal attenuation factors.

It can be shown that by appropriate substitution of $\sin \varphi \cos \theta = \sin \psi$ in the azimuthal components of the full formula, the three-dimensional radiation pattern of an antenna can be represented by two expressions, one representing the horizontal pattern as a function of ψ and the other representing the vertical pattern as a function of θ.

Tables can therefore be compiled showing the attenuation relative to the maximum gain varying with angle. Table /‾D/3.5.1.5_7 represents the horizontal pattern as a function of ψ and Tables /‾E, F, G/3.5.1.5_7 represent the vertical pattern as a function of θ.

In obtaining the attenuation for any angle of elevation and azimuth, the angle ψ must be calculated using the following formula :

ψ = arc sin (sin φ cos θ) for $|\varphi| \leq 90^\circ$ or

ψ = 180 - arc sin (sin φ cos θ) for $\varphi > 90^\circ$

ψ = -180 - arc sin (sin φ cos θ) for $\varphi < -90^\circ$

where

φ = angular difference between great circle bearing transmitter to receiver and azimuth of maximum radiation of the antenna.

θ = angle of vertical radiation.

The attenuation values for ψ and θ can then be determined from the appropriate tables.

[The resulting antenna gain in the required direction is then calculated by summing the attenuation for the appropriate value of θ and ψ (Tables /‾D, E, F, G/3.5.1.5_7) and then subtracting the total attenuation subject to the limitations defined below from the maximum gain (Table /‾A/3.5.1.2_7) for the antenna concerned.]*

Forward Radiation

For angles of elevation less than the vertical angle of maximum radiation, the total attenuation should not exceed a value of 30 dB.

For angles of elevation equal to or greater than the vertical angle of maximum radiation, the resultant antenna gain shall not fall below -8 dBi.

Reverse Radiation

For HR m/n/h antennas, at all angles of elevation, the total attenuation should not exceed a value of 30 dB.

* This text will be revised.

TABLE [D/3.5.1.5]

Antenna attenuation relative to the gain in the direction of maximum radiation, at angles of azimuth relative to the direction of maximum radiation, for planning purposes

Angle (ψ) (degrees)	Horizontal attenuation (dB)				
	HR4/n/h	HR2/n/h	HR1/n/h	H2/n/h	H1/n/h
0	0	0	0	0	0
±5	0.7	0.4	0.3	0.2	0.1
±10	2.3	1.0	0.7	0.5	0.2
±15	5.1	1.8	1.1	1.2	0.5
±20	9.3	2.9	1.6	2.1	0.8
±25	16.5	4.0	2.0	3.3	1.2
±30	30	5.8	2.8	4.5	1.4
±35	20.6	7.8	3.7	6.7	2.6
±40	17.2	9.9	4.5	8.7	3.5
±45	16.5	12.1	5.1	11.2	4.3
±50	17.7	15.1	6.2	13.7	5.0
±55	20.2	18.7	7.7	15.0	4.2
±60	23.2	22.4	8.8	18.0	4.7
±65	26.2	25.8	12.0	25.3	8.9
±70	30	30	11.9	29.5	9.8
±75	30	30	11.9	30	10.4
±80	30	30	15.3	30	15.4
±85	30	30	18.7	30	16.3
±90	30	30	18.5	30	16.2
				Bidirectional antennas	
±95	30	30	18.3		
±100	30	30	17.5		
±105	30	30	17.2		
±110	30	30	16.2		
±115	30	30	15.2		
±120	27.7	26.9	14.7		
±125	26.0	24.5	13.5		
±130	25.2	22.6	13.7		
±135	25.5	21.2	14.1		
±140	27.2	20.0	14.9		
±145	30	18.6	14.9		
±150	30	18.2	15.2		
±155	30	17.5	15.4		
±160	23.2	16.7	15.4		
±165	19.3	16.1	15.3		
±170	16.9	15.5	15.2		
±175	15.5	15.2	15.1		
±180	15.0	15.0	15.0		

TABLE /‾E/3.5.1.5_7

Antenna vertical attenuation relative to the gain in the direction of maximum radiation at various angles of elevation, for planning purposes (antenna type : HR m/4/h).

Elevation angle (θ) (degrees)	Vertical attenuation (dB)		
	h = 0.5	h = 0.8	h = 1.0
0	30	30	30
3	6.0	4.9	4.2
6	1.3	0.6	0.3
* 8	0.7	0	0.8
9	0	0.1	0.5
12	0.8	2.4	4.3
15	8.1	8.2	15.0
18	8.6	25.0	15.7
21	18.4	16.0	10.6
24	28.7	14.2	12.3
27	24.3	18.8	19.3
30	30	30	30
33	20.1	22.3	30
36	14.6	21.9	26.4
39	12.7	30	16.5
42	13.0	21.0	12.0
45	15.2	14.9	11.5
48	19.7	12.4	12.3
51	27.4	11.8	15.0
54	24.3	12.5	20.2
57	20.1	14.4	29.2
60	18.5	17.2	26.4
63	18.3	21.1	22.7
66	19.2	26.3	21.9
69	20.9	30	22.6
72	23.2	30	24.5
75	26.4	30	27.4
78	30	30	30
81	30	30	30
84	30	30	30
87	30	30	30
90	30	30	30

* The values corresponding to this angle have been inserted to facilitate the evaluation of G_{tl}, as per paragraph 3.2.1.3.2.

TABLE [F/3.5.1.5]

Antenna vertical attenuation relative to the gain in the direction of maximum radiation, at various angles of elevation, for planning purposes (antenna types : HR m/3/0.5, HR m/2/h, HR m/1/0.5 and HR m/1/0.3)

Elevation angle (θ) (degrees)	Vertical attenuation (dB)				
	m/3/0.5	m/2/h		m/1/h	
		h = 0.3	h = 0.5	h = 0.3	h = 0.5
0	30	30	30	30	30
3	7.9	12.3	10.6	18.2	14.7
6	2.8	6.6	5.0	12.3	8.8
* 8	1.1	4.4	3.0	9.9	6.6
9	0.6	3.6	2.2	9.0	5.6
12	0	1.8	0.7	6.7	3.6
15	0.6	0.7	0.7	5.0	2.1
18	2.4	0.1	0.1	3.7	1.1
21	5.4	0.4	0.6	2.7	0.5
24	10.3	0.2	1.8	1.9	0.1
27	18.9	0.8	3.5	1.3	0
30	27.2	1.7	6.0	0.8	0.1
33	20.1	2.9	9.4	0.5	0.3
36	19.9	4.4	14.4	0.2	0.8
39	24.4	6.2	22.0	0.1	1.4
42	30	8.3	21.5	0	2.2
45	22.6	10.9	16.8	0	3.2
48	17.4	13.9	14.6	0.1	4.4
51	15.1	17.4	13.7	0.2	5.8
54	14.1	21.0	13.6	0.3	7.3
57	14.1	25.9	14.1	0.5	9.0
60	14.9	29.3	15.1	0.7	11.0
63	16.2	30	16.6	1.0	13.1
66	18.1	30	18.4	1.3	15.1
69	20.5	30	20.7	1.6	16.7
72	23.2	30	23.5	1.9	17.3
75	25.3	30	26.8	2.2	17.2
78	26.0	30	30	2.6	16.8
81	25.6	30	30	2.9	16.4
84	24.9	30	30	3.2	16.1
87	24.6	30	30	3.6	16.1
90	24.6	30	30	3.6	16.1

* The values corresponding to this angle have been inserted to facilitate the evaluation of G_{tl}, as per paragraph 3.2.1.3.2.

TABLE /‾G/3.5.1.5_7

Antenna vertical attenuation relative to the gain in the direction of maximum radiation at various angles of elevation, for planning purposes (antenna type : H m/n/h)

Elevation angle (θ) (degrees)	Vertical attenuation (dB)			
	H m/1/0.3	H m/1/0.5	H m/2/0.3	H m/2/0.5
0	30	30	30	30
3	18.4	14.7	12.3	10.6
6	12.5	8.9	6.6	5.0
* 8	10.1	6.6	4.4	3.0
9	9.2	5.7	3.6	2.2
12	7.0	3.6	1.8	0.7
15	5.2	2.2	0.7	0.1
18	3.9	1.2	0.1	0.1
21	2.9	0.5	0	0.7
24	2.1	0.1	0.2	1.8
27	1.5	0.1	0.8	3.5
30	1.0	0.1	1.6	6.0
33	0.7	0.3	2.8	9.4
36	0.4	0.7	4.3	14.3
39	0.2	1.3	6.1	21.9
42	0.1	2.1	8.2	21.3
45	0	3.0	10.7	16.6
48	0	4.1	13.6	14.3
51	0	5.4	17.0	13.3
54	0.1	6.9	21.0	13.1
57	0.2	8.5	25.4	13.6
60	0.3	10.4	28.7	14.5
63	0.4	12.3	29.6	15.8
66	0.6	14.2	29.5	17.5
69	0.7	15.6	29.9	19.7
72	0.8	16.0	30	22.2
75	0.9	15.8	30	25.3
78	1.1	15.1	30	30
81	1.1	14.4	30	30
84	1.2	13.9	30	30
87	1.2	13.6	30	30
90	1.4	14.0	30	30

* The values corresponding to this angle have been inserted to facilitate the evaluation of G_{t1}, as per paragraph 3.2.1.3.2.

3.6 Use of synchronized transmitters

3.6.1 The use of synchronized transmitters, where appropriate, is an efficient means of economizing frequency spectrum. When synchronized transmitters are used, the carrier frequency difference shall be 0.1 Hz or less when the same programme is broadcast to partially overlapping or non-overlapping service areas.

3.6.2 Protection ratios in the range of 3 to 11 dB give satisfactory reception when the carrier frequency difference is 0.1 Hz or less. For planning purposes a value of 8 dB shall be used.

When the synchronized transmitters are driven by a common oscillator and use antennas with similar vertical radiation characteristics, a lower protection ratio of 3 dB shall be adopted for planning.

3.9.2 Progressive introduction of SSB transmissions (Technical aspects)

3.9.2.1 Transmitters

It should be recognized that :

a) converting an existing DSB transmitter to an SSB transmitter which delivers equivalent sideband power with 6 dB carrier reduction is technically not possible;

b) it is economically unattractive to convert existing conventional DSB transmitters for operation to SSB mode with 6 dB carrier reduction even if 3 dB less sideband power is accepted;

c) it is possible and feasible to convert unconventional DSB transmitters of recent design (using amplitude modulation systems such as pulse duration modulation) to SSB mode with 6 dB carrier reduction and the same sideband power as in DSB mode without significant loss of efficiency;

d) from the technical point of view conventional DSB transmitters can, in some cases, also be converted to SSB mode with 12 dB carrier reduction and can provide the necessary equivalent sideband power. Whether the conversion is economically attractive will depend on the type and age of the transmitter concerned;

/ e) the technical and/or economical lifetime of a transmitter can be estimated at twenty years. /

3.9.2.2 Receivers

It should be recognized that :

a) current technological progress will make it possible within the next ten years to mass-produce DSB/SSB receivers at a reasonable price;

b) during the transition period it would be useful to have SSB receivers offering selection of either the upper or the lower sideband of a DSB transmission, in order to reject adjacent channel interference;

/ c) the technical and economical lifetime of a receiver is considered to be in the order of ten years; /

d) envelope detection should be abandoned as soon as possible and synchronous demodulation be introduced.

/ 3.9.2.3 Transition period from technical point of view

Taking into account the lifetime of transmitters and receivers the duration of the transition period could be set at / 15 to 20 / years. /

3.9.2.4 Evaluation of compatibility aspects of the proposed SSB system during the transition period

During the transition period, SSB transmissions will be mainly received by conventional DSB receivers using envelope detection. To obtain with a conventional DSB receiver using envelope detection the same loudness level with both SSB and DSB, the sideband power of the SSB emission has to be 3 dB higher (equivalent sideband power) than the total sideband power of the DSB emission. Alternatively, if the sideband power of the SSB emission cannot be increased, one has to accept some reduction of the coverage area. Such an SSB emission, however, could replace any of the DSB emissions in the Plan without the interference situation deteriorating.

SSB emissions with equivalent sideband power replacing a DSB emission according to the Plan will cause a slight increase in adjacent channel interference (e.g. at ± 10 kHz channel spacing the relative RF-protection ratio would be changed by 3 dB from -36 dB to -33 dB) if reception is in the adjacent channels with a conventional DSB receiver having the selectivity of the DSB reference receiver (see paragraph 3.9.1.13).

In paragraph 3.9.1.13, a 3 dB allowance for co-channel interference between a DSB emission and an SSB emission with equivalent sideband power has been specified. Recent investigation shows, however, that taking into account the effect of coherent demodulation of the two sidebands of a DSB emission in an envelope detector, this allowance may be 0 dB. Further study will be needed on this question during the inter-sessional period.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

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FOR INFORMATION

Note by the Observer of the United Nations

At its most recent annual session in June/July 1983, the Committee on Information of the United Nations General Assembly recommended that the Secretary-General should be requested to present to the Committee's 1984 session a comprehensive report on the viability of a world-wide United Nations short-wave broadcasting network. On 15 December 1983 this recommendation was approved and affirmed by the General Assembly in its resolution 38/82 B, entitled "Questions relating to information".

The interest of the United Nations in the acquisition of an international short-wave broadcasting facility dates back to the early days of the Organization, when the General Assembly in 1946 approved the establishment of a Department of Public Information in the United Nations Secretariat, it endorsed the following recommendation :

> The United Nations should also have its own radio broadcasting station or stations, with the necessary wavelengths, both for communication with Members and with branch offices, and for the origination of United Nations programmes.

In addition, the United Nations and the International Telecommunication Union, in 1947, concluded an Agreement under which the Union recognized that it is important that the United Nations shall benefit by the same rights as the Members of the Union for operating telecommunication services, and the United Nations undertook to operate the telecommunication services under its control in accordance with the terms of the International Telecommunication Convention and the regulations annexed thereto. This Agreement is referred to in the International Telecommunication Convention.

While over the following years the United Nations engaged in short-wave broadcasting for point-to-point operational communications, the idea of a United Nations-owned and operated world-wide short-wave broadcasting network for public information purposes remained dormant. Instead, the United Nations leased for its radio programmes a limited amount of broadcast time on existing national short-wave transmitters, among others those of the Voice of America.

However, the rapid expansion of international short-wave broadcasting during the 1960's and 1970's gave rise to calls in the General Assembly for a reappraisal of this situation, and in 1980 the General Assembly requested the Secretary-General to prepare on an urgent basis, for consideration by the Committee on Information, the technical, financial and legal studies regarding international short-wave broadcasts by the United Nations using its own facilities and frequencies.

The Secretary-General submitted the requested report early in 1982. The report outlined a decentralized United Nations short-wave broadcasting system, with transmissions undertaken from the headquarters of the United Nations regional commissions in Addis Ababa, Bangkok, Santiago and Baghdad. It suggested that the system might be on the air for some 240 hours a week in a variety of languages, using 250 kw transmitters. The report further estimated the one-time acquisition cost of the system at $28,000,000 with annual operating costs (including staff) in the area of $13,000,000. The General Assembly responded by requesting the Secretary-General to report further to the Committee on Information at its 1983 session on the viability of a world-wide United Nations short-wave network, its regional segments and its pertinent frequencies, as well as on the alternative solution of continuing to rent broadcast time on existing national short-wave transmitters.

In 1983, the Secretary-General provided the Committee with an interim report on the subject, confined mainly to the question of the viability of a world-wide United Nations short-wave network and to the possible transmission schedules of the regional segments of such a network. The question of viability was answered in the affirmative from a legal point of view, on the basis of technical considerations, and in terms of the potential audience justifying the expenditure involved. The forthcoming 1984 report will deal with the construction, staffing and operational requirements of such a network, its pertinent frequencies, the alternative of continuing to rent broadcast time on existing national short-wave transmitters, and the costs of a centralized network as compared to those of the decentralized option outlined in the Secretary-General's 1982 report.

It then will be up to the Committee on Information, and subsequently the General Assembly, to pronounce themselves on this major project.

INTERNATIONAL TELECOMMUNICATION UNION

BLUE PAGES

WARC FOR HF BROADCASTING

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B.6

PLENARY MEETING

SIXTH SERIES OF TEXTS SUBMITTED BY THE
EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for first reading :

Source	Document	Title
COM.4	171 + Corr.1	3.2.4 Reliability

Marie HUET
Chairman of Committee 6

Annex : 20 pages

3.2.4 Reliability*

[Note - In this section procedures are given for calculating reception and broadcast reliability in various circumstances. The inclusion of these calculation procedures does not prejudge or constitute the expression of an opinion on the desirability of these circumstances. The square brackets within the text indicate parts of the procedure which may not be needed.]

3.2.4.1 Basic circuit reliability

Two alternative but equivalent methods are presented; in the first the computation of basic circuit reliability is undertaken in terms of the required radio-frequency signal-to-noise ratio; in the second the computation is in terms of the minimum usable field strength. The choice between these two equivalent approaches depends upon the parameter chosen for inclusion in the planning method.

The first method includes, in steps (6) to (11), the estimation of the median field strength of the background noise by taking account of contributions of atmospheric noise, man-made noise and intrinsic receiver noise. For the second method a similar estimate is included within the value of the minimum usable field strength.

3.2.4.1.1 Calculation of basic circuit reliability using signal-to-noise ratio

The process for calculating basic circuit reliability is indicated in Table [1/3.2.4.1]. The median value of field strength for the wanted signal at step (1) is provided by the field strength prediction method. The upper and lower decile values at steps (2) through (5) are also determined, taking account of long-term (day-to-day) and short-term (within the hour) fading. From steps (6) to (10) consideration is given to atmospheric noise, man-made noise, and intrinsic receiver noise, and at step (11) the median value of field strength for the noise is taken as the greatest of the three components. The values of signal and noise determined at steps (1) and (11) are then combined at step (12) in order to derive the median signal-to-noise ratio, SNR(50).

The upper and lower deciles of signal-to-noise ratio are then calculated in steps (13) and (14) in order to derive the signal-to-noise ratios exceeded for 10% and 90% of the time at steps (15) and (16). The signal-to-noise ratio probability distribution may now be determined from Figure [1/3.2.4.1] which indicates the ratio (in decibels) versus the probability that the value of signal-to-noise ratio is exceeded (plotted on a normal probability scale).

Figure [1/3.2.4.1] is also used to derive the basic circuit reliability (18), which is the value of probability corresponding to the required signal-to-noise ratio (17).

A mathematical treatment of the calculation can be given in terms of probability density functions of both the signal and the noise. These functions are taken to be log normal, as is the resulting distribution for the signal-to-noise ratio.

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* Abbreviations of the English terms are used in the formulas throughout the three languages in order to facilitate the practical implementation of the methods described in this section.

TABLE [1/3.2.4.1]

Parameters used to compute basic circuit reliability

STEP	PARAMETER	DESCRIPTION	SOURCE
(1)	$E_W(50)$ dB (μV/m)	Median field strength of wanted signal	Prediction method (section 3.2.1)
(2)	$D_U(S)$ dB	Upper decile of slow fading signal (day-to-day)	(section 3.2.3.2, Table I/3.2.3)
(3)	$D_L(S)$ dB	Lower decile of slow fading signal (day-to-day)	(section 3.2.3.2, Table I/3.2.3)
(4)	$D_U(F)$ dB	Upper decile of fast fading signal (within the hour)	5 dB (section 3.2.3.1)
(5)	$D_L(F)$ dB	Lower decile of fast fading signal (within the hour)	-8 dB (section 3.2.3.1)
(6)	$F_a(A)$	Noise factor for atmospheric noise	Atmospheric noise maps (CCIR Report 322-2)
(7)	N_A dB(μV/m)	Median field strength of atmospheric noise	$N_A = F_a(A) - 65.5 + 20 \log f + 10 \log b$ f in MHz, b in kHz (CCIR Report 322-2)
(8)	$F_a(M)$	Noise factor for man-made noise	(section 3.2.2.2)
(9)	N_M dB(μV/m)	Median field strength of man-made noise	As in (7) above
(10)	N_R dB(μV/m)	Intrinsic receiver noise field strength	3.5 dB (μV/m) (section 3.4.1.3)
(11)	N_T dB(μV/m)	Median field strength of total radio noise	Greatest value of N_A, N_M, N_R (section 3.2.2.3)
(12)	SNR(50) dB	Median signal-to-noise ratio	$E_W - N_T$
(13)	D_U(SNR) dB	Upper decile of signal-to-noise ratio	$\sqrt{D_U(S)^2 + D_U(F)^2}$
(14)	D_L(SNR) dB	Lower decile of signal-to-noise ratio	$\sqrt{D_L(S)^2 + D_L(F)^2}$
(15)	SNR(10) dB	Signal-to-noise ratio exceeded 10% of time	SNR(50) + D_U(SNR)
(16)	SNR(90) dB	Signal-to-noise ratio exceeded 90% of time	SNR(50) - D_L(SNR)
(17)	C dB	Required RF signal-to-noise ratio	34 dB (section 3.4.1.6)
(18)	BCR	Basic circuit reliability	Figure [1/3.2.4.1]

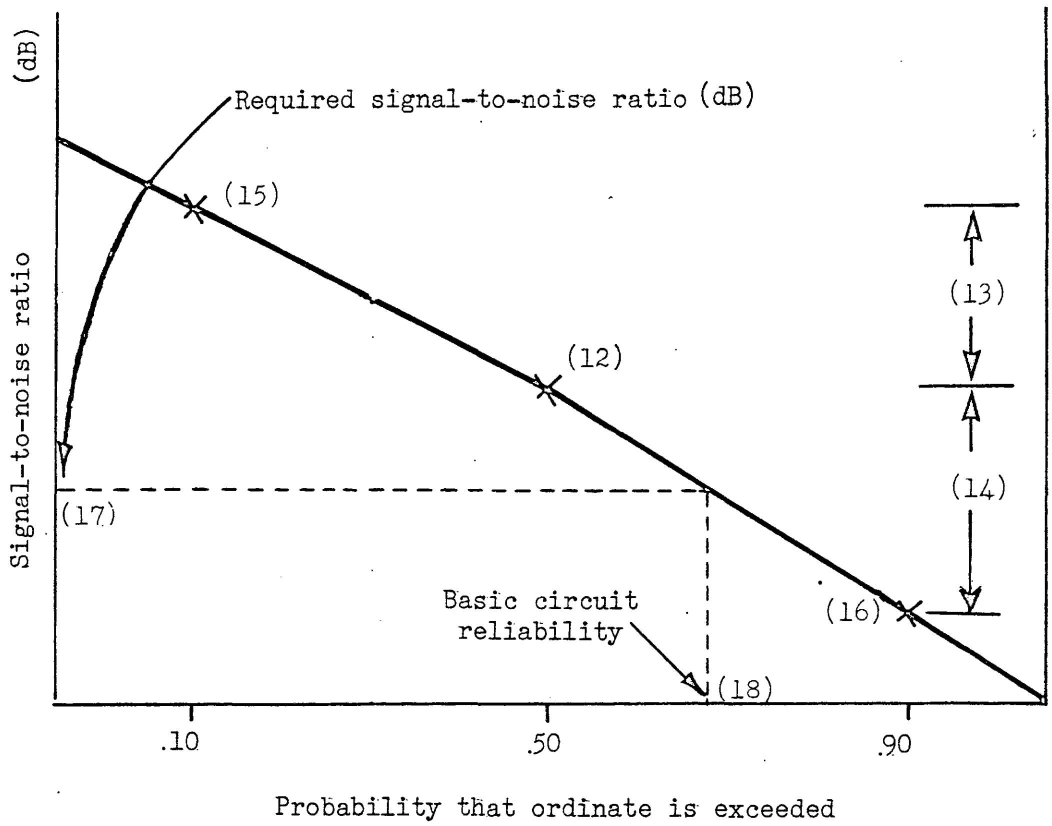


FIGURE [1/3.2.4.1]

The basic circuit reliability is given by the expression :

when $E_W - N_T \leq G$:

$$BCR = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\gamma} \exp(-\tau^2/2)\, d\tau$$

$$\text{where} \quad \gamma = \frac{E_W - N_T - G}{\sigma_L}$$

$$\sigma_L = D_L(SNR)/1.282$$

when $E_W - N_T > G$:

$$BCR = 0.5 + \frac{1}{\sqrt{2\pi}} \int_{0}^{\gamma} \exp(-\tau^2/2)\, d\tau$$

$$\text{where} \quad \gamma = \frac{E_W - N_T - G}{\sigma_U}$$

$$\sigma_U = D_U(SNR)/1.282$$

3.2.4.1.2 Calculation of basic circuit reliability using minimum usable field strength

The process for calculating basic circuit reliability is indicated in Table /¯2/3.2.4.1_7. The median value of field strength for the wanted signal at step (1) is determined by the field strength prediction method. The upper and lower decile values (2) through (5) are also determined, taking account of long-term (day-to-day) and short-term (within the hour) fading. The combined upper and lower deciles of the wanted signal are then calculated in steps (6) and (7) in order to derive the signal levels exceeded for 10% and 90% of the time at steps (8) and (9).

The wanted signal probability distribution, assumed to be log-normal, is illustrated in Figure ⌈¯2/3.2.4.1_7, which indicates the signal level (in decibels) versus the probability that the value of signal level is exceeded (plotted on a normal probability scale). This distribution is used to obtain the basic circuit reliability (11), which is the value of probability corresponding to the minimum usable field strength (10).

TABLE [2/3.2.4.1]

Parameters used to compute basic circuit reliability

STEP	PARAMETER	DESCRIPTION	SOURCE
(1)	$E_W(50)$ dB (μV/m)	Median field strength of wanted signal	Prediction method (section 3.2.1)
(2)	$D_U(S)$ dB	Upper decile of slow fading signal (day-to-day)	(section 3.2.3.2, Table I/3.2.3)
(3)	$D_L(S)$ dB	Lower decile of slow fading signal (day-to-day)	(section 3.2.3.2, Table I/3.2.3)
(4)	$D_U(F)$ dB	Upper decile of fast fading signal (within the hour)	5 dB (section 3.2.3.1)
(5)	$D_L(F)$ dB	Lower decile of fast fading signal (within the hour)	-8 dB (section 3.2.3.1)
(6)	$D_U(E_W)$ dB	Upper decile of wanted signal	$\sqrt{D_U(S)^2 + D_U(F)^2}$
(7)	$D_L(E_W)$ dB	Lower decile of wanted signal	$\sqrt{D_L(S)^2 + D_L(F)^2}$
(8)	$E_W(10)$ dB (μV/m)	Wanted signal exceeded 10% of the time	$E_W + D_U(E_W)$
(9)	$E_W(90)$ dB (μV/m)	Wanted signal exceeded 90% of the time	$E_W - D_L(E_W)$
(10)	E_{min} dB (μV/m)	Minimum usable field strength	(section 3.4)
(11)	BCR	Basic circuit reliability	Figure [2/3.2.4.1]

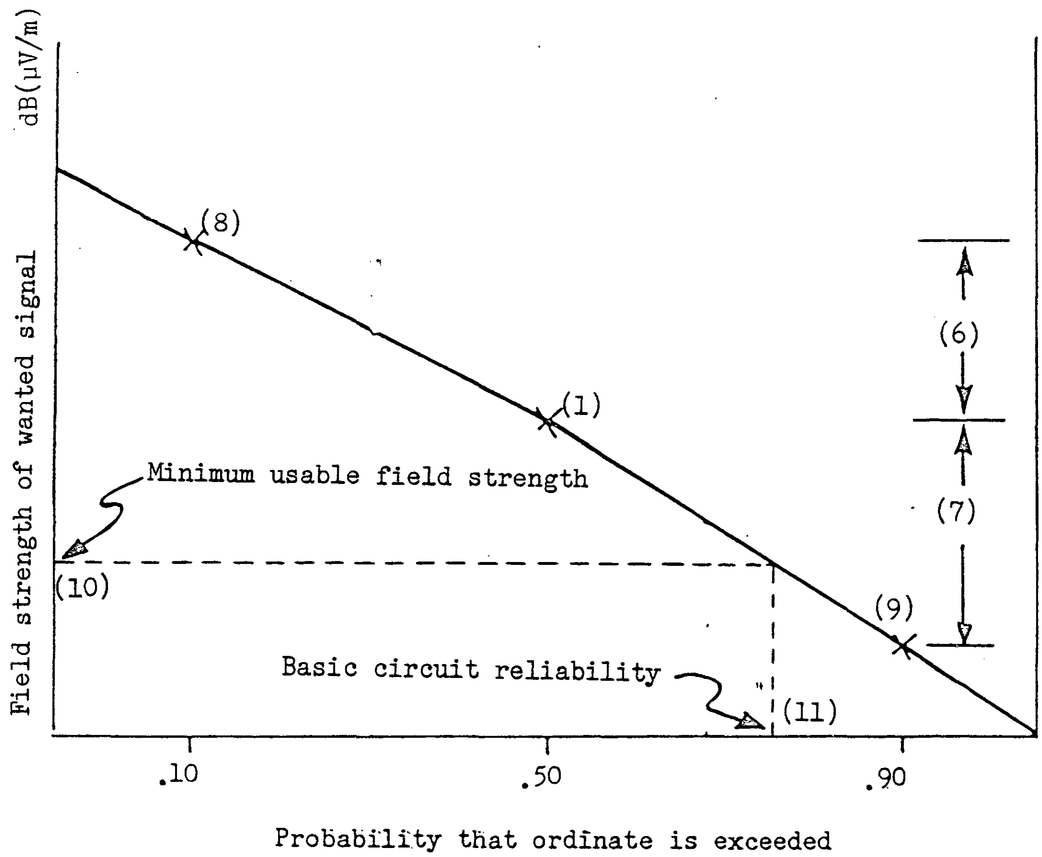


FIGURE /‾2/3.2.4.1_7

The basic circuit reliability is given by the expression :

when $E_W \leq E_{min}$

$$BCR = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\gamma} \exp(-\tau^2/2)\, d\tau$$

where $\gamma = \dfrac{E_W - E_{min}}{\sigma_L}$

$$\sigma_L = D_L(E_W)/1.282$$

when $E_W > E_{min}$

$$BCR = 0.5 + \frac{1}{\sqrt{2\pi}} \int_{0}^{\gamma} \exp(-\tau^2/2)\, d\tau$$

where $\gamma = \dfrac{E_W - E_{min}}{\sigma_U}$

$$\sigma_U = D_U(E_W)/1.282$$

3.2.4.2 Overall circuit reliability

Two methods are given for calculating overall circuit reliability : the first is based upon the specification of an objectively determined value at the required signal-to-interference ratio, while the second is based on the required radio-frequency protection ratio which includes subjective effects.

3.2.4.2.1 Calculation of overall circuit reliability using signal-to-interference ratio

The method is outlined in Table /‾3/3.2.4.2_7. The median wanted signal level at step (1) is computed by the signal strength prediction method. The upper and lower decile values (2) through (5) take into account long-term (day-to-day) and short-term (within the hour) fading.

The median field strength levels (E_i) of each interfering source is obtained from the prediction method in step (6). For a single source of interference the predicted median field strength is used in step (7). For multiple sources of interference, the median field strength is calculated as follows. The field strengths of the interfering signals E_i are listed in decreasing order. Successive r.s.s. additions of the field strengths E_i are computed, stopping when the difference between the resultant field strength and the next field strength is greater than 6 dB. In step (7), the resultant field strength I is taken as the last computed value. The upper and lower decile values (8) through (11) of the strongest interference are selected to take into account short and long-term fading.

The values of the wanted signal and interference determined at steps (1) and (7) are combined at step (12) to derive the median signal-to-interference ratio. The upper and lower deciles of the signal-to-interference ratio are computed in steps (13) and (14) in order to derive the signal-to-interference ratio exceeded for 10% and 90% of the time at steps (15) and (16).

The probability distribution for the signal-to-interference ratio may now be determined as shown in Figure /‾3/3.2.4.2_7, which indicates the ratios (in decibels) on a linear scale versus the probability that the value of the signal-to-interference ratio is exceeded (on a normal probability scale). In Figure /‾3/3.2.4.2_7, the value of probability corresponding to the required signal-to-interference ratio (17) is the circuit reliability in the presence of interference only (ICR). The overall circuit reliability is the minimum value (20) of ICR (18) and the basic circuit reliability BCR (19).

A mathematical treatment of the calculation of ICR can be given in terms of the probability density distribution of the wanted signal and the interference. These functions are taken to be log normal, as is the resulting distribution of the signal-to-interference ratio.

The parameter ICR is given by the following expression :

when $E_W - I \leqslant RSI$:

$$ICR = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\gamma} \exp(-\tau^2/2)\, d\tau$$

$$\text{where } \gamma = \frac{E_W - I - RSI}{\sigma_L}$$

$$\sigma_L = D_L(SIR)/1.282$$

when $E_W - I > RSI$

$$ICR = 0.5 + \frac{1}{\sqrt{2\pi}} \int_{0}^{\gamma} \exp(-\tau^2/2)\, d\tau$$

$$\text{where } \gamma = \frac{E_W - I - RSI}{\sigma_U}$$

$$\sigma_U = D_U(SIR)/1.282$$

Values of the various parameters in the above expressions are found on the lines indicated below Table /‾3/3.2.4.2_7.

E_W	line 1
I	line 7
D_U(SIR)	line 13
D_L(SIR)	line 14
RSI	line 17

TABLE /‾3/3.2.4.2_7

Overall circuit reliability

STEP	PARAMETER	DESCRIPTION	SOURCE
1	E_W dB(μV/m)	Median field strength of wanted signal	Prediction method (section 3.2.1)
2	D_U(S)dB	Upper decile of slow fading signal	(section 3.2.3.2, Table I/3.2.3)
3	D_L(S)dB	Lower decile of slow fading signal	(section 3.2.3.2, Table I/3.2.3)
4	D_U(F)dB	Upper decile of fast fading signal (within the hour)	5 dB (section 3.2.3.1)
5	D_L(F)dB	Lower decile of fast fading signal (within the hour)	-8 dB (section 3.2.3.1)
6	E_i dB(μV/m)	Median field strength of interfering signals E_1, E_2,...E_i	Prediction method (section 3.2.1)
7	I dB(μV/m)	Resultant field strength of interference (see text)	$I = \sqrt{E_1^2 + E_2^2 + E_3^2 + \ldots}$
8	D_U(IS)dB	Upper decile of slow fading interference (decile of strongest interference)	(section 3.2.3.2, Table I/3.2.3)
9	D_L(IS)dB	Lower decile of slow fading interference (decile of strongest interference)	(section 3.2.3.2, Table I/3.2.3)
10	D_U(IF)dB	Upper decile of fast fading interference	5 dB (section 3.2.3.1)
11	D_L(IF)dB	Lower decile of fast fading interference	-8 dB (section 3.2.3.1)
12	SIR(50)dB	Median signal to interference ratio	E_W - I
13	D_U(SIR)dB	Upper decile of signal-to-interference	$\sqrt{D_U(S)^2 + D_U(F)^2 + \frac{1}{2}D_L(IS)^2 + D_L(IF)^2}$
14	D_L(SIR)dB	Lower decile of signal-to-interference	$\sqrt{D_L(S)^2 + D_L(F)^2 + \frac{1}{2}D_U(IS)^2 + D_U(IF)^2}$
15	SIR(10)dB	Signal-to-interference ratio exceeded 10% of the time	SIR(50) + D_U(SIR)
16	SIR(90)dB	Signal-to-interference ratio exceeded 90% of the time	SIR(50) - D_L(SIR)
17	RSI dB	Required S/I ratio	(section /‾ _7)
18	ICR	Circuit reliability in presence of interference only (without noise)	See figure /‾3/3.2.4.2_7
19	BCR	Basic circuit reliability	See figure /‾1 or 2/3.2.4.1_7
20	OCR	Overall circuit reliability	Min(ICR, BCR)

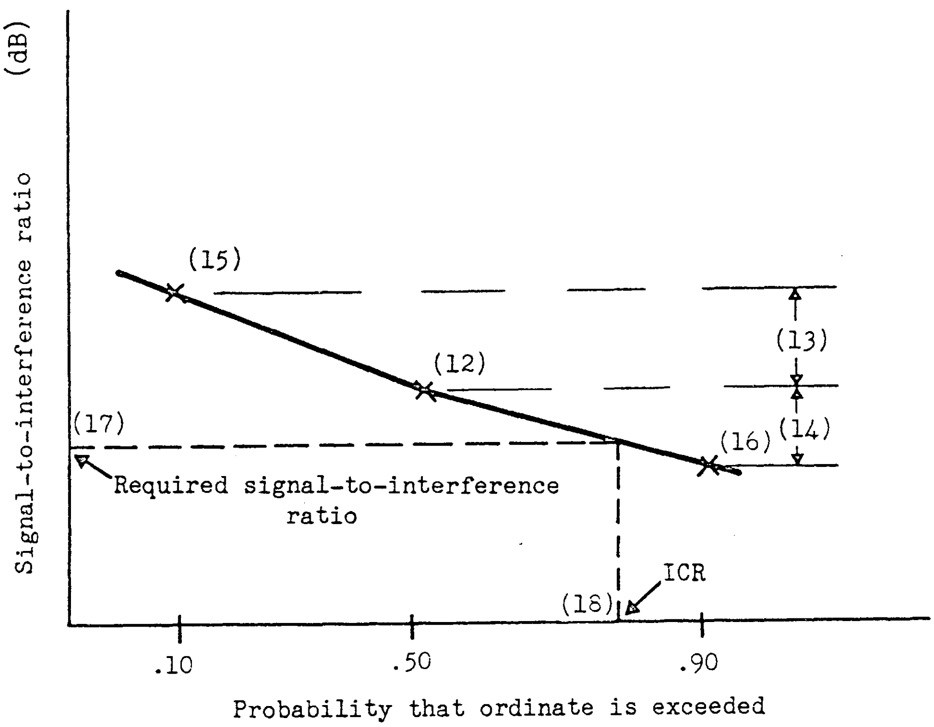


FIGURE /‾3/3.2.4.2_7

3.2.4.2.2 Calculation of overall circuit reliability using protection ratio

The method is outlined in Table /‾4/3.2.4.2_7. In step (1), the median wanted signal level is computed by the signal strength prediction method.

In step (2), the median field strength levels (E_i) of each interfering source are obtained from the prediction method. In step (3), for a single source of interference the predicted median field strength is used; for multiple sources of interference the median field strength is calculated as follows : the field strengths of the interfering signals E_i are listed in decreasing order. Successive r.s.s. additions of the field strengths E_i are computed, stopping when the difference between the resultant field strength and the next field strength is greater than 6 dB. In step (3), the resultant field strength I is taken as the last computed value.

The values of the wanted signal and interference determined in steps (1) and (3) are combined in step (4) to derive the median signal-to-interference ratio. The 10% and 90% fading allowances are included in steps (5) and (6) in order to derive the signal-to-interference ratio exceeded for 10% and 90% of the time in steps (7) and (8).

The probability distribution for the signal-to-interference ratio may now be determined as shown in Figure /¯4/3.2.4.2_7. The ratios are presented in decibels on a linear scale versus the probability that the value of the signal-to-interference ratio is exceeded on a normal probability scale. In Figure /¯4/3.2.4.2_7, the value of probability corresponding to the required signal-to-interference ratio (9) is the circuit reliability in the presence of interference only (ICR). The overall circuit reliability (OCR, step (12)) is the minimum value of either ICR (step (10)) or BCR (step (11)), whichever produces the lower value.

The mathematical treatment of the calculation of ICR is similar to that given in paragraph 3.2.4.2.1.

TABLE /‾4/3.2.4.2_7

Overall circuit reliability

STEP	PARAMETER	DESCRIPTION	SOURCE
1	E_W dB (μV/m)	Median field strength of wanted signal	Prediction method (section 3.2.1)
2	E_i dB (μV/m)	Median field strength of interfering signals E_1, E_2,...E_i	Prediction method (section 3.2.1)
3	I dB (μV/m)	Resultant field strength of interference (see text)	$I = \sqrt{E_1^2 + E_2^2 + E_3^2 + \ldots}$
4	SIR(50)dB	Median signal to interference ratio	$E_W - I$
5	D_U(SIR)dB	10% fading allowance	10 dB(<60°), 14 dB(≥60°)[1,2]
6	D_L(SIR)dB	90% fading allowance	10 dB(<60°), 14 dB(≥60°)[1,2]
7	SIR(10)dB	Subjective signal-to-interference ratio exceeded 10% of the time	SIR(50) + D_U(SIR)
8	SIR(90)dB	Subjective signal-to-interference ratio exceeded 90% of the time	SIR(50) - D_L(SIR)
9	RSI dB	Required RF protection ratio	(section 3.3.1)
10	ICR	Circuit reliability in presence of interference only without (noise)	See figure /‾4/3.2.4.2_7
11	BCR	Basic circuit reliability	See figure /‾1 or 2/3.2.4.1_7
12	OCR	Overall circuit reliability	Min(ICR, BCR)

Note 1 - If any point on that part of the great circle which passes through the transmitter and the receiver and which lies between control points located 1,000 km from each end of the path reaches a corrected geomagnetic latitude of 60° or more, the values for ⩾ 60° have to be used. The relationship of corrected geomagnetic latitude to the geographical coordinates is shown in figures /‾1 and 2/3.2.4.1_7 of paragraph 3.2.3.2.

Note 2 - These values apply for overall circuit reliabilities not exceeding 80%.

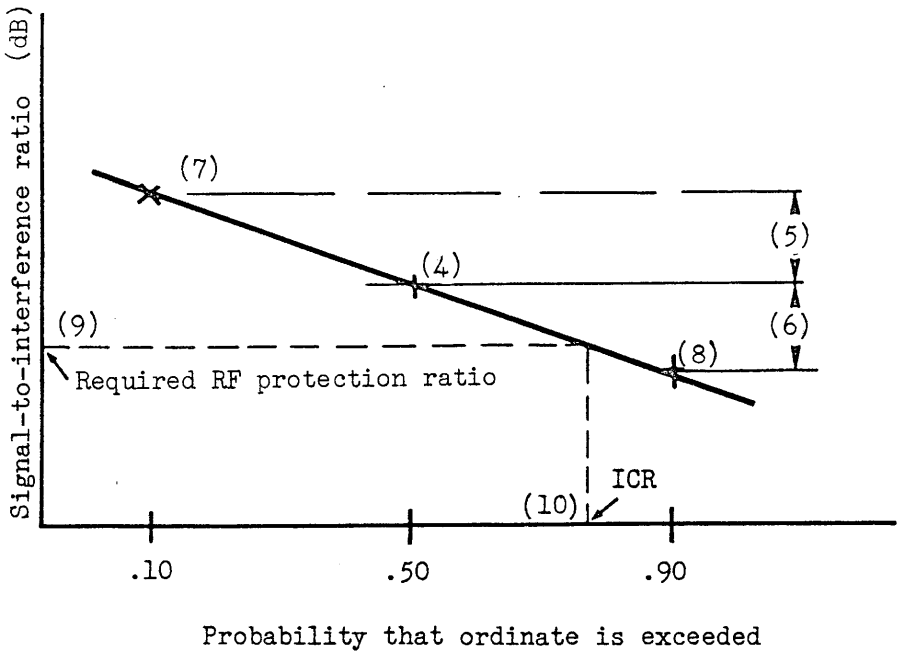


FIGURE /¯4/3.2.4.2_7

3.2.4.3 Basic reception reliability

The method for computing basic reception reliability is outlined in Table /¯5/3.2.4.3_7. With a single frequency, basic reception reliability (BRR) is the same as the basic circuit reliability (BCR) defined in the previous section. With multiple frequencies, the interdependence between propagation conditions at different frequencies leads to the computation method given in Table /¯5/3.2.4.3._7. In steps (4) and (6), BCR (n) is the basic circuit reliability for frequency n, where n = F_1, F_2, etc. The basic reception reliability is obtained in step (2) for a single frequency, in step (4) for a set of two frequencies and in step (6) for a set of three frequencies.

TABLE [5/3.2.4.3]

Basic reception reliability

The following parameters are involved :

Single-frequency operation

Step	Parameter	Description	Source
(1)	BCR (F_1) %	Basic circuit reliability for frequency F_1	Line 18, Table 1/3.2.4.1 or Line 11, Table 2/3.2.4.1
(2)	BRR (F_1) %	Basic reception reliability	BCR (F_1)

Two-frequency operation

Step	Parameter	Description	Source
(3)	BCR (F_2) %	Basic circuit reliability for frequency F_2 where $F_1 < F_2$	Line 18, Table 1/3.2.4.1 or Line 11, Table 2/3.2.4.1
(4)	BRR (F_1) (F_2) %	Basic reception reliability (a) $F_1/F_2 \geqslant 0.9$	$\left[\frac{1}{2}\left\{1-\prod_{n=F_1}^{F_2}(1-BCR(n))+Max(BCR(F_1),\ BCR(F_2))\right\}\right]$
		(b) $F_1/F_2 < 0.9$	$1-\prod_{n=F_1}^{F_2}(1-BCR(n))$

TABLE [5/3.2.4.3] (continued)

Basic reception reliability

Three-frequency operation

Step	Parameter	Description	Source
(5)	BCR (F_3) %	Basic circuit reliability for F_3, where $F_1 < F_2 < F_3$	Line 18, Table 1/3.2.4.1 or Line 11, Table 2/3.2.4.1
(6)	BRR $(F_1)(F_2)(F_3)$ %	Basic reception reliability (a) $F_1/F_2 \geqslant 0.9$; $F_2/F_3 \geqslant 0.9$	$\frac{1}{2}\left\{1-\prod_{n=F_1}^{F_3}(1-BCR(n))+Max(BCR(F_1), BCR(F_2), BCR(F_3))\right\}$
		(b) $F_1/F_2 < 0.9$; $F_2/F_3 < 0.9$	$1-\prod_{n=F_1}^{F_3}(1-BCR(n))$
		(c) $F_1/F_2 \geqslant 0.9$; $F_2/F_3 < 0.9$ or $F_1/F_2 < 0.9$; $F_2/F_3 \geqslant 0.9$	$\frac{(a)+(b)}{2}$

3.2.4.4 Overall reception reliability

The method for computing overall reception reliability is outlined in Table [6/3.2.4.4]. With a single frequency, overall reception reliability (ORR) is the same as the overall circuit reliability (OCR) defined in the previous section. With multiple frequencies, the interdependence between propagation conditions at different frequencies leads to the computation method given in Table [6/3.2.4.4]. In steps (4) and (6), OCR (n) is the overall circuit reliability for frequency n, where n = F_1, F_2, etc. The overall reception reliability is obtained in step (2) for a single frequency, in step (4) for a set of two frequencies and in step (6) for a set of three frequencies.

TABLE [6/3.2.4.4]

Overall reception reliability

The following parameters are involved :

Single-frequency operation

Step	Parameter	Description	Source
(1)	OCR (F_1) %	Overall circuit reliability for frequency F_1	Line 20, Table 3/3.2.4.2 or Line 12, Table 4/3.2.4.2
(2)	ORR (F_1) %	Overall reception reliability	OCR (F_1)

Two-frequency operation

(3)	OCR (F_2) %	Overall circuit reliability for frequency F_2	Line 20, Table 3/3.2.4.2 or Line 12, Table 4/3.2.4.2
(4)	ORR (F_1) (F_2) %	Overall reception reliability (a) $F_1/F_2 > 0.9$	$\frac{1}{2}\left\{1-\prod_{n=F_1}^{F_2}(1-OCR(n))+Max(OCR(F_1);\ OCR(F_2))\right\}$
		(b) $F_1/F_2 < 0.9$	$1-\prod_{n=F_1}^{F_2}(1-OCR(n))$

TABLE [6/3.2.4.4] (continued)

Overall reception reliability

Three-frequency operation

Step	Parameter	Description	Source
(5)	OCR (F_3) %	Overall circuit reliability for F_3, where $F_1 < F_2 < F_3$	Line 20, Table 3/3.2.4.2 or Line 12, Table 4/3.2.4.2
(6)	ORR (F_1) (F_2) (F_3) %	Overall reception reliability (a) $F_1/F_2 \geq 0.9$; $F_2/F_3 \geq 0.9$	$\frac{1}{2}\left\{1-\prod_{n=F_1}^{F_3}(1-OCR(n))+Max(OCR(F_1), OCR(F_2), OCR(F_3))\right\}$
		(b) $F_1/F_2 < 0.9$; $F_2/F_3 < 0.9$	$1-\prod_{n=F_1}^{F_3}(1-OCR(n))$
		(c) $F_1/F_2 \geq 0.9$; $F_2/F_3 < 0.9$ or $F_1/F_2 < 0.9$; $F_2/F_3 \geq 0.9$	$\frac{(a)+(b)}{2}$

3.2.4.5 Basic and overall broadcast reliability

The determination of basic broadcast reliability involves the use of test points within the required service area. The basic broadcast reliability is an extension of the basic reception reliability concept to an area instead of a single reception point. The method for computing basic broadcast reliability is outlined in Table /¯7/3.2.4.5_7. In step (1), the basic reception reliabilities BRR, (L_1), BRR (L_2), --- BRR (L_N) are computed as described in Table /¯5/3.2.4.3_7 at each test point L_1, L_2 ---L_N. These values are ranked in step (2) and the basic broadcast reliability is the value associated with a specified percentile.

In a similar way, the overall broadcast reliability is computed as described in Table /¯8/3.2.4.5_7 and it is the value associated with a specified percentile X.

Broadcast reliability is associated with the expected performance of a broadcast service at a given hour. For periods longer than an hour, computation at one-hour intervals is required.

TABLE [7/3.2.4.5]

Basic broadcast reliability

The following parameters are involved :

Step	Parameter	Description	Source
(1)	BRR (L_1), BRR (L_2) --- BRR (L_N) %	Basic reception reliability at all reception points considered in the required service area	Line (2), (4) or (6), as appropriate, from Table 5/3.2.4.3
(2)	BBR (X) %	Basic broadcast reliability associated with percentile X	Any percentile chosen from the values ranked from (1)

Note - The broadcast reliability associated with the percentile X depends upon the density and distribution of the test points in the required service area.

TABLE 8 [8/3.2.4.5]

Overall broadcast reliability

The following parameters are involved :

Step	Parameter	Description	Source
(1)	ORR (L_1), ORR (L_2) --- ORR (L_N) %	Overall reception reliability at all reception points considered in the required service area	Line (2), (4) or (6), as appropriate, from Table 6/3.2.4.4
(2)	OBR (X) %	Overall broadcast reliability associated with percentile X	Any percentile chosen from the values ranked from (1)

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 182-E
4 February 1984
Original : English

Source : (169, 161, 176)

COMMITTEE 6

FIRST SERIES OF TEXTS FROM

COMMITTEE 5 TO THE EDITORIAL COMMITTEE

The texts reproduced in Annexes 1, 2 and 3 were adopted in Committee 5 and are hereby submitted to the Editorial Committee.

Mr. IRFANULLAH
Chairman of Committee 5

Annexes : 3

ANNEX 1

CHAPTER 4

4. Planning principles and method

4.1 Planning principles

4.2 Planning method

4.2.1 Overview of method

4.2.2 Definition of a broadcasting requirement

4.2.3 Description of the individual steps of the automated system

4.2.3.1 Step 1 - Requirements file

4.2.3.2 Step 2 - Broadcasting requirements for the season under consideration

4.2.3.3 Step 3 - Propagation analysis and selection of the appropriate frequency band

4.2.3.4 Step 4 - Rules to be applied to broadcasting requirements in a given run

4.2.3.4.1 Optimization

4.2.3.4.2 Preferred frequency

4.2.3.4.3 Equipment constraint

4.2.3.4.3.1 Frequency

4.2.3.4.3.2 Frequency band

4.2.3.4.3.3 Power

4.2.3.4.3.4 Antenna

4.2.3.4.4 Limitation of frequency change

4.2.3.4.5 Rules to be applied to congested areas

4.2.3.5 Step 5 - Selection of technical characteristics

4.2.3.6 Step 6 - Compatibility analysis and frequency selection

4.2.3.7 Step 7 - Reliability analysis

4.2.3.8 Step 8 - Criteria and requirements met ?

4.2.3.9 Step 9 - Seasonal plan

4. Planning principles and method

Having considered the proposals of administrations on planning principles and methods, the first session of the Conference concluded that the planning of the high frequency broadcasting service shall be based on four seasonal plans to be developed annually or semi-annually using broadcasting requirements submitted /¯periodically_7 by the administrations. The seasonal plans shall be developed on the basis of the following principles and planning method.

4.1 Planning principles

4.1.1 In accordance with the International Telecommunication Convention and with the Radio Regulations annexed thereto, the planning of the high frequency bands allocated to the broadcasting service shall be based on the principle of equal rights of all countries, large or small to have equitable access to these bands and to utilize them in accordance with the decisions taken by this Conference. Planning shall also attempt to reach an efficient utilization of these frequency bands, while taking into account the technical and economical constraints that may exist in certain cases.

4.1.2 On the basis of the above, the following planning principles shall be applied.

4.1.2.1 All the broadcasting requirements, current or future, formulated by the administrations, shall be taken into account and be treated on an equitable basis, so as to guarantee the equality of rights covered in paragraph 1 above and to ensure a satisfactory service to every administration.

4.1.2.2 All the broadcasting requirements, national and international, shall be treated on an equal basis, with due consideration of the differences between these two kinds of broadcasting requirements.

4.1.2.3 The planning procedure will attempt to ensure, as far as practicable, the continuity of the utilization of a frequency or of a frequency band. However, such frequency continuity should not prevent equal and technically optimum treatment of all broadcasting requirements.

4.1.2.4 The periodical planning process shall be based solely on the broadcasting requirements that will become operational during the planning period. It shall furthermore be flexible to take into account new broadcasting requirements and modifications to the existing broadcasting requirements, in accordance with the modification procedures to be adopted by the Conference.

4.1.2.5 The planning procedure shall be based on DSB transmissions. Voluntary SSB transmissions may however be permitted in lieu of planned DSB transmissions, without increasing the level of interference caused to DSB transmissions appearing in the Plan.

4.1.2.6 For efficient spectrum utilization, only one frequency should be used, whenever possible, to satisfy a given broadcasting requirement to a given required service area and in any case the number of frequencies used should be the minimum necessary to provide satisfactory reception.

4.1.2.7 Further planning principles /¯to be developed_7.

4.2 Planning method

4.2.1 Overview of planning method

/ To be developed /

4.2.2 Definition of a broadcasting requirement

A requirement indicated by an administration to provide a broadcasting service at specified periods of time to a specified reception area from a particular transmitter station.

4.2.3 Description of the individual steps of the automated system

4.2.3.1 Step 1 - Requirements file

a) / To be developed /

b) The above file shall contain :

Basic characteristics

1) name of the transmitting station

2) geographical coordinates of the transmitting station

3) symbol of the country or geographical area in which the transmitting station is located

4) required service area

5) hours of operation (UTC)

6) range of antenna characteristics

7) transmitter power (dBW)

8) class of emission

Optional supplementary characteristics

1) preferred frequency (in kHz)

2) preferred frequency band (in MHz)

3) equipment limitations

4) ranges of power capabilities

5) possible use of synchronized transmitters

4.2.3.2 Step 2 - Broadcast requirements for the season under consideration

The broadcasting requirements to be used for each season shall be those contained in the Requirements File which are to be operational during the season under consideration and which are confirmed and, if necessary, modified by the administration, in accordance with the modification procedures of [4.2.3.1].

4.2.3.3 Step 3 - Propagation analysis and selection of the appropriate frequency band

The propagation prediction method described in [paragraph 3.2] will be used to calculate for each requirement and for the season and the different hours, the [optimum working frequency] and the [basic circuit reliability]. Based on the results of the above calculations, the appropriate frequency band(s) for each requirement at the different times will be selected.

However, if an administration has indicated equipment limitations, these limitations are to be taken into account in the selection of the appropriate frequency band.

If the required [basic circuit reliability] cannot be met during any time with a single frequency band, then a second frequency band shall be selected as long as the administration has indicated the capability to operate in two frequency bands simultaneously. (See Chapter [ ], section [ ].)

4.2.3.4 Step 4 - Rules to be applied to requirements in a given run

4.2.3.4.1 Optimization

The system must be optimized to ensure the maximum possible utilization of all available channels.

4.2.3.4.2 Preferred frequency

In accordance with the planning principles and without imposing constraints on planning, the following shall be applied in the seasonal plans :

1) administrations may indicate the preferred frequency;

2) efforts shall be made during the planning process in order to include the preferred frequency in the plan;

3) if not possible, efforts shall be made in order to select a frequency which is as close as possible to the preferred one in the same band.

Otherwise, the automated system shall be used to select the appropriate frequencies, permitting to accommodate the maximum number of requirements, taking into account the constraints of technical characteristics of equipment.

4.2.3.4.3 Equipment constraint

The system shall take into account the technical constraints of the equipment, i.e. :

4.2.3.4.3.1 Frequency

a) When the administration indicates that its facilities can operate only on a limited number of fixed specified frequencies the process in steps 5, 6 and 7 shall be applied to one of these frequencies and should the final step result in an incompatibility the adjustment process (step 10) shall try another one of these frequencies. The plan shall contain the frequency from this limited number of frequencies which will have the lesser degree of incompatibilities.

b) If two such broadcasting requirements indicate the same frequency which after analysis results in an incompatibility the situation is referred to the administration(s) concerned.

4.2.3.4.3.2 Frequency band

a) When the administration indicates that its facilities can operate only in a given frequency band, only frequencies from that band shall be included in the plan.

b) When an administration indicates a preferred frequency band, the system shall try to select a frequency from this preferred frequency band. If this is not possible, frequencies from the closest band shall be tried. Otherwise, the system will select frequencies from the appropriate band taking into account the equipment constraints covered in paragraph [ ].

4.2.3.4.3.3 Power

a) When an administration indicates only a single power level due to equipment constraints, that power shall be used in the planning process.

b) When an administration indicates several possible power values, the appropriate power shall be used to achieve the [basic circuit reliability].

4.2.3.4.3.4 Antenna

When the administration indicates that its antenna can operate only in a given frequency band, only frequencies from that band shall be included in the plan.

4.2.3.4.4 Limitation of frequency change

For the indicated time block of each broadcasting requirement, frequency changes should be essentially limited to those necessitated by propagation factors. Frequency changes due to incompatibilities may also be permitted. In these cases, the number of frequency changes during any contiguous period of operation shall be limited to the minimum necessary.

4.2.3.4.5 [Rules to be applied to congested areas]

/ To be developed. /

4.2.3.5 Step 5 - Selection of technical characteristics

The system shall be designed so that in those cases where administrations communicate the power and characteristics which may vary in given ranges, it selects the values for these characteristics to be used within the indicated ranges.

4.2.3.6 Step 6 - Compatibility analysis and frequency selection

/ To be developed. /

4.2.3.7 Step 7 - Reliability analysis

The method described in section / / shall be used to calculate the / overall broadcast reliability /.

4.2.3.8 Step 8 - Criteria and requirements met

The broadcasting requirements for the season under consideration will be analyzed to determine if they are satisfied with the agreed criteria as contained in section / /.

4.2.3.9 Step 9 - Seasonal plan

The timing of publication and the means of securing administrations' comments on seasonal plans will be considered by the second session of the Conference.

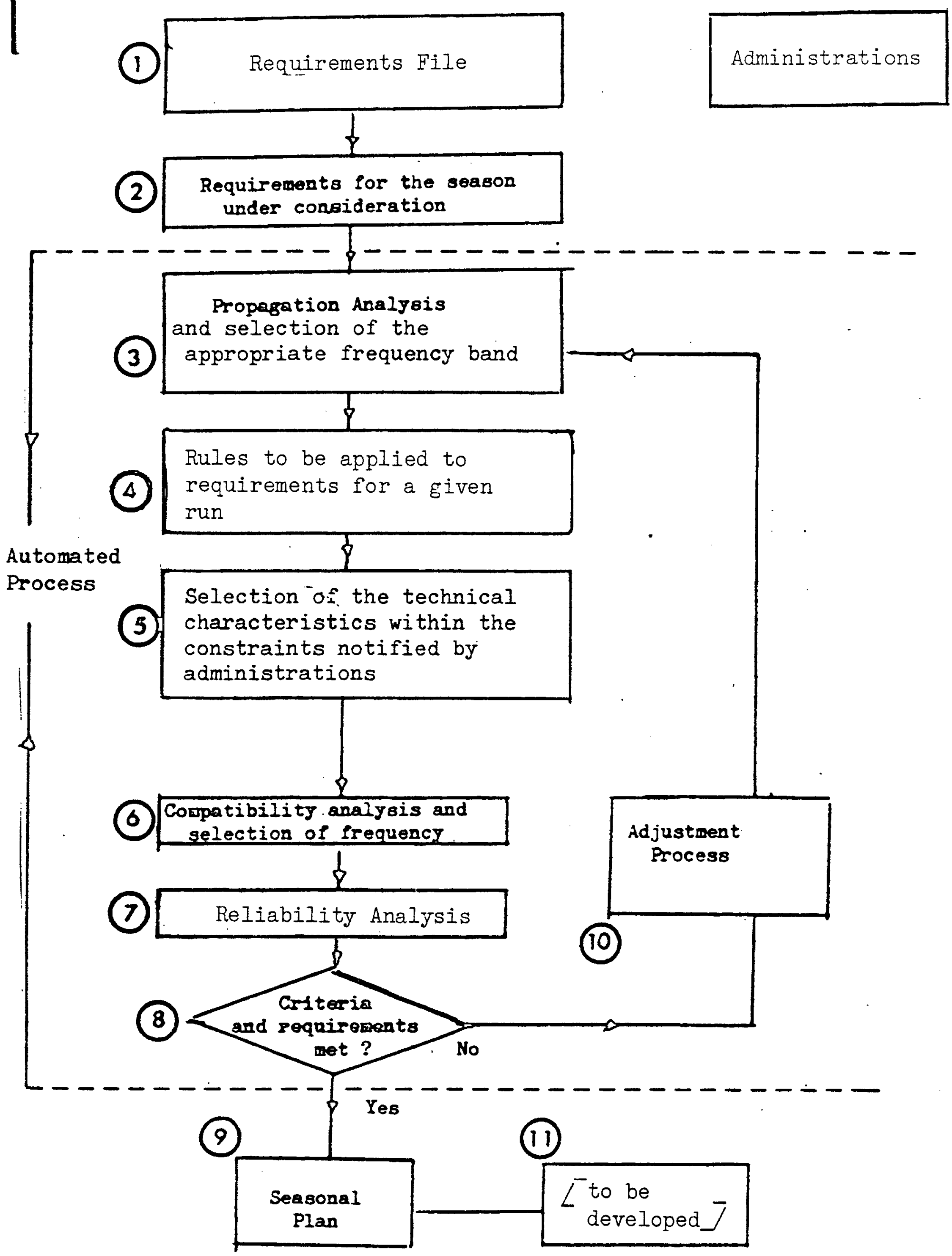


FIGURE [ ]

Flowchart of the automated process

ANNEX 2

PROGRESSIVE INTRODUCTION OF SSB

(Planning aspects)

[1.] The eventual changeover to SSB will make for efficient utilization of the spectrum. Voluntary SSB transmissions may, however, be permitted in lieu of planned DSB transmissions, without increasing the level of interference caused to DSB transmissions appearing in the Plan.

Taking account of the fact that the criteria of compatibility between DSB and SSB are not yet completely known* and of the economic implications, this session is of the opinion that :

[1.1] The second session of the Conference should fix the date of the beginning of the transition period as well as the duration of the said period.**

[1.2] The duration of the transition period may be fixed at 20 years, and consideration must be given to the timely availability of necessary receivers.

The date of the cessation of DSB emissions will thus become known when the second session fixes the date referred to in [1.1] above.

[2.] SSB should be introduced in the same bands as are used for DSB. It has also been recognized that no channels should be reserved exclusively for SSB.

* [See 3.9.2.4.]

** [See 3.9.1.8]

ANNEX 3

RESOLUTION COM5/1

Relating to the Avoidance of Harmful Interference with a View to Improving the Use of the HF Bands Allocated to the Braodcasting Service

The World Administrative Radio Conference for the Planning of the HF Bands Allocated to the Broadcasting Service (First Session, Geneva, 1984)

considering

a) Article 4 (No. 19) of the International Telecommunication Convention, concerning the purposes of the Union;

b) Article 10 (No. 79 and No. 80) of the International Telecommunication Convention, concerning the duties of the IFRB;

c) Article 35 (No. 158) of the International Telecommunication Convention, concerning the avoidance of harmful interference;

d) Article 54 (No. 209) of the International Telecommunication Convention, concerning instructions to the IFRB by a World Administrative Radio Conference;

e) Article 20 of the Radio Regulations, concerning the international monitoring system;

f) Article 18 of the Radio Regulations concerning measures against interference (No. 1798);

g) Article 22 of the Radio Regulations concerning the procedure in case of harmful interference;

noting

1. that harmful interference has a negative impact on the use of the frequency spectrum in general and on the use of frequency channels available for high frequency broadcasting in particular;

2. that broadcasting on channels adjacent to those being affected directly may also be subject to interference;

3. that a considerable number of high frequency broadcasting channels in various parts of the world are rendered useless due to harmful interference;

recognizing

1. that it is desirable for more detailed information on the extent and impact of harmful interference to be available before the second session of the Conference;

2. that an increase in the number of stations participating in the international monitoring system and a more effective use of the information obtained from such stations would be of considerable assistance;

urges administrations

to avoid harmful interference;

instructs the IFRB in accordance with the Radio Regulations

1. to organize monitoring programmes in the bands allocated to the high frequency broadcasting service with a view to identifying stations causing harmful interference;

2. to seek, as appropriate, the cooperation of administrations in identifying the sources of emissions which cause harmful interference and to give this information to administrations;

3. to inform the second session of the Conference on the results of the programme referred to in 1 and 2;

invites administrations

1. to take part in monitoring programmes set up by the IFRB in accordance with the provisions of this Resolution;

2. to give special attention to the procedures in Article 22 of the Radio Regulations in the event of harmful interference.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 183-E
4 February 1984
Original : English

PLENARY MEETING

FIRST REPORT OF COMMITTEE 5

TO THE PLENARY MEETING

On Saturday, 4 February 1984, Committee 5 examined Documents 161, 169 and 176 which were submitted to the Editorial Committee for subsequent submission to the Plenary Meeting.

Mr. IRFANULLAH
Chairman of Committee 5

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 184-E
5 February 1984
Original : English/French

COMMITTEE 5

Note by the Secretary-General

At the request of the International Frequency Registration Board, I transmit the attached document for the consideration of the Conference.

R.E. BUTLER
Secretary-General

CONSIDERATIONS BY THE IFRB ON THE
INTERSESSIONAL PROGRAMME OF WORK

1. In its report to the Conference (Document 6), the Board included in Part C estimates concerning the work to be carried out between the two sessions based mainly on the methods it uses at present and on adaptation of certain results of the CCIR.

2. At this stage of the Conference, following adoption of the results arrived at by Committee 4 (Technical criteria), the Board finds that the technical criteria and procedures are much more complex than was expected. Even if the Board introduces simplifications where a high degree of precision appears to be unnecessary, the means required to develop the software are far in excess of the estimates made in the document mentioned above.

3. At this stage of the Conference, the Board can make no more than an approximate estimate of the volume of work involved in :

- processing requirements;
- developing the software required for the planning method;
- developing the software required for testing the planning method.

4. The attached diagram shows a possible timetable for the work to be carried out between the two sessions. It shows that when account is taken :

- of the length of the administrative procedures for the recruitment of additional staff to prepare the second session;
- of a period of about six months for administrations to examine the IFRB report;
- a three-month period to test and use the software;

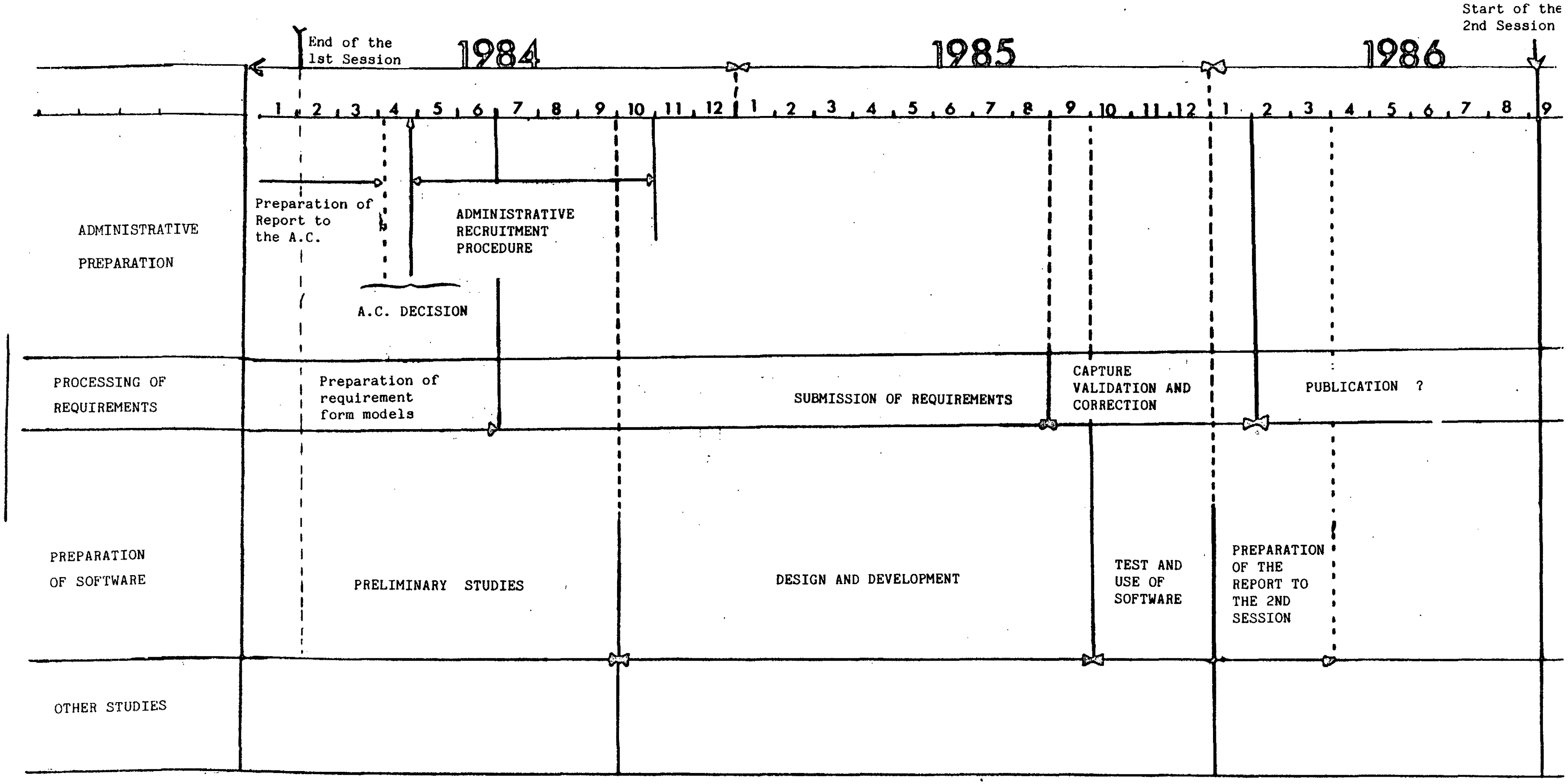
only some twelve months will remain to develop the entire system, i.e. :

- to define and adopt the structure of the system;
- to develop the detailed analysis;
- to prepare the computer programs and test them.

5. This twelve month period should suffice to develop a simple system. It would not be enough to develop a complex system of the scope foreseen in the report of the first session of the Conference. As soon as the complexity of a system increases, it becomes difficult, whatever the manpower available, to develop it in a short time insofar as the functions described above cannot be superimposed.

A. BERRADA
Chairman of the IFRB

<u>Annex</u> : 1 diagram


End of the 1st Session
1984
1985
1986
Start of the 2nd Session
1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9
ADMINISTRATIVE PREPARATION
Preparation of Report to the A.C.
ADMINISTRATIVE RECRUITMENT PROCEDURE
A.C. DECISION
PROCESSING OF REQUIREMENTS
Preparation of requirement form models
SUBMISSION OF REQUIREMENTS
CAPTURE VALIDATION AND CORRECTION
PUBLICATION ?
PREPARATION OF SOFTWARE
PRELIMINARY STUDIES
DESIGN AND DEVELOPMENT
TEST AND USE OF SOFTWARE
PREPARATION OF THE REPORT TO THE 2ND SESSION
OTHER STUDIES

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 185-E
5 February 1984
Original : English

COMMITTEE 5

SUPPLEMENTARY PROPOSAL BY THE KINGDOM OF THE NETHERLANDS AND THE UNITED KINGDOM

Introduction

1. Document 108 was submitted in accordance with item 4.2.5 of the agenda of this Conference. In discussion of the document by Working Group 5A-2 on 5 February the principle of Document 108 - with two amendments that were accepted by the Netherlands and the United Kingdom - was supported by seven delegations, three opposed the principle and one requested clarification to assist understanding. Recognizing the substantial progress made by the Conference since Document 108 was submitted on 20 January, the following clarification and a draft text for adoption by the Conference are now submitted.

Clarification

2. The broadcasting service using the HF bands is unique because, under the new concept being developed by the Conference, it will in future be operated in accordance with seasonal plans to be prepared by a central automated system in the hands of the IFRB. The seasonal plans are expected to be of only two or four months duration, and experience has shown that the general procedures of Article 22 of the Radio Regulations relating to harmful interference cannot react quickly enough within cycles of this short duration. Any administration using a frequency in accordance with a seasonal plan and experiencing harmful interference must, as a matter of urgent operational necessity, be able to seek prompt action to remedy the situation. One such course of action would be to request the assistance of the IFRB in finding another frequency. If another frequency can be found it must not reduce the level of reliability of other assignments in the current seasonal plan. The Netherlands and the United Kingdom therefore propose that a text be included in the report of this Conference in order that this operational necessity be reflected in the intersessional work on the automated system and in the development of procedures by the next session of the Conference.

Proposed text

3. In the event of harmful interference to an HF broadcasting service which is using an assignemnt in accordance with a current seasonal plan, the administration concerned shall have the right to request the prompt assistance of the IFRB in finding another frequency to help restore that service to the level of reliability achieved in the plan. Any new frequency proposed by the IFRB shall not adversely affect the seasonal plan in operation. The central automated system must have the capability to respond, as far as possible, to such requests from administrations and there will be a need for associated provisions in the regulatory procedures which will be developed by the next sesson of the Conference.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 186-E
5 February 1984
Original : English

COMMITTEE 5

Note by the Secretary-General

At the request of the International Frequency Registration Board, I transmit the attached document for the consideration of the Conference.

R.E. BUTLER
Secretary-General

IFRB NOTE ON POINT 2 OF DOCUMENT DT/43(Rev.1)

Having examined the paragraph 4.1.2.2 of Document 169 the Board considers that national and international uses shall be treated equally. However consideration shall be given to the differences between these two uses of requirements. The proposed point in square brackets in item 2 of Document DT/43(Rev.1) leads to understand that the consideration to be given to the national use is with respect to the longer hours of operation.

1. When applying Document DT/43(Rev.1) together with paragraph 4.1.2.2 in the congested area the Board will act as follows :

2. a) if the duration of the two requirements are equal, and the possible solution would consist in reducing the hours of operation, the two requirements would be treated equally;

b) if a possible solution to resolve an incompatibility would be for one of the requirements to be satisfied in another band, the longer requirement would be given first consideration for not changing the band;

c) in resolving incompatibilities in a given zone and in a given band, the system shall be designated to as far as possible insure a continuity of frequency use for requirements having the longer continuous hours of operation.

3. The Board is of the opinion that if the Conference wants to afford any priority to national uses, it should state it explicitly and indicate the rules to be applied.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 187-E
10 February 1984
Original : English

PLENARY MEETING

MINUTES
OF THE
SEVENTH PLENARY MEETING

Monday, 6 February 1984, at 1410 hrs

Chairman : Mr. K. BJÖRNSJÖ (Sweden)

Subjects discussed :		Document
1.	Second report of Committee 4	175
2.	First report of Committee 5	183
3.	Fifth series of texts submitted to the Plenary Meeting for first reading (B.5)	177
4.	Sixth series of text submitted to the Plenary Meeting for first reading (B.6)	181

1. Second report of Committee 4 (Document 175)

1.1 The Chairman of Committee 4 introduced the second report of Committee 4 (Document 175).

1.2 The delegate of the USSR said that the reference to a reservation by his delegation with regard to paragraph 3.5.1.5 (Document 160, Annex 2), appearing in the second sub-paragraph of the fourth paragraph of the report, was incorrect and should be deleted.

That statement was noted.

The second report of Committee 4 to the Plenary Meeting was noted.

2. First report of Committee 5 (Document 183)

2.1 The Chairman of Committee 5, introducing the first report of Committee 5 (Document 183), said the documents referred to in the report (Documents 161, 169 and 176) were incorporated in Document 182 and would be appearing as a Blue Document shortly.

The first report of Committee 5 to the Plenary Meeting was noted.

3. Fifth series of texts submitted to the Plenary Meeting for first reading (B.5)

3.1 The Chairman of Committee 6, introducing Document 177, said that the heading of section 3.2.5 had been left in square brackets because a decision affecting it was still pending in Committee 5; no decision by the Plenary Meeting was required in that connection at the present stage. Referring to the first paragraph of section 3.5.2 she said that the vertical line appearing to the left of the paragraph indicated that the text had already been adopted by the Plenary Meeting.

3.2 The Chairman of Committee 4 said that the source of Document 163 (Definitions : 2.10) on the cover page of the document should be given as "COM4/COM5" to reflect the fact that the document emanated from a joint meeting of the two Committees.

Sections 2.10 and 3.1.4.2

Approved.

Section 3.2.5

3.3 The Chairman of Committee 4 said that the two parts of section 3.2.5.2.2 represented alternative options, only one of which would be retained depending on the decision taken in Committee 5.

Approved, on that understanding.

Section 3.5.2

3.4 The Chairman of Committee 4, referring to the last three paragraphs of section 3.5.2, said that Committee 4 had considered that the issues involved were not only technical but also procedural and should therefore be decided upon by Committee 5. The reference value of reliability mentioned in the penultimate paragraph had been left as [X]% for the same reason. The Chairman indicated that a second asterisk should be added at the end of the square bracket around the whole passage.

3.5 The delegate of India suggested that the Chairman of the Conference and the Chairman of Committee 4 might send a joint note to the Chairman of Committee 5 listing all the points still outstanding in documents emanating from Committee 4 on which Committee 5 was asked to take action.

3.6 The delegate of Algeria suggested that the Chairman of Committee 4 should be present at discussions in Committee 5 on the points in question.

It was so agreed.

Section 3.7

3.7 The delegate of Algeria, referring to section 3.7.1 said that he did not doubt the usefulness of establishing maritime broadcasting areas but feared that coverage of the new zones might add to the congestion of the spectrum for services to land areas. It would be interesting to hear the reaction of the IFRB to the establishment of maritime broadcasting areas. He wondered whether the Conference might not adopt a decision to the effect that the coverage of maritime zones should not lead to an increase in incompatibilities.

3.8 The delegate of India said that his delegation in Committee 4 had not objected to the establishment of maritime broadcasting areas because it recognized the legitimate interest of some administrations in broadcasting to their ships in those areas. However, he agreed with the delegate of Algeria that the establishment of maritime areas must not create additional incompatibilities for already existing services.

3.9 The Chairman of the IFRB said that he could not express any views on the advisability of establishing maritime broadcasting zones but could only draw attention to Note 2. Unless procedures specially applicable to the maritime areas were created, those areas would have to be treated in exactly the same way as existing CIRAF zones. If the decision to establish the zones was adopted, they should not, for technical reasons, be designated by letters but by numbers.

3.10 The delegate of Norway, supported by the delegate of Greece, said that he was in favour of the text as it stood. It was unlikely that the number of requirements in the areas concerned would be very large or would lead to additional congestion. The question of developing new procedures applicable to maritime broadcasting areas might be considered at the second session of the Conference.

3.11 The delegate of Brazil said that he shared the concern expressed by the Algerian and Indian delegations. The difficulty might perhaps be solved by adding some wording to Note 2 to the effect that under the procedures to be evolved for examining the compatibility of requirements in maritime broadcasting areas, the requirements in land areas should be given priority, or, in other words, that a different procedure should be applied to maritime areas.

3.12 The delegate of Algeria suggested that Note 2 should be incorporated in the text of section 3.7.1 and should be amended to read approximately as follows :

"Procedures applicable for examining the compatibility of requirements in these maritime broadcasting areas should be adopted in such a manner that the coverage of these zones does not increase the congestion of the frequency spectrum resulting from the coverage of other zones."

3.13 The delegate of India suggested that the sentence might read :

"The procedures applicable for examining the compatibility of requirements in these maritime broadcasting areas shall ensure that requirements for the land area CIRAF zones are not adversely affected."

3.14 The delegate of Syria supported the Indian proposal.

3.15 The delegate of the United States pointed out that requirements were already directed to maritime zones at the present time. Recognizing the need for a better identification of those zones did not in any way imply an increase or decrease in congestion. The adoption of special procedures applicable to maritime broadcasting areas would violate a fundamental planning principle by giving some CIRAF zones priority over other CIRAF zones.

3.16 The delegate of Norway, supported by the delegate of Spain, said that it would be difficult at the present stage to gauge the impact of the inclusion of maritime broadcasting zones on compatibility calculations. He was opposed to the Algerian and Indian proposals and favoured the maintenance of the text as it stood.

3.17 The Chairman of Committee 4 pointed out that in the general layout of the report of the Conference, already adopted, a clear distinction was drawn between the determination of reception zones and planning principles. He wondered whether comments on procedure did not, in fact, relate to the consideration of chapters other than the one now under consideration.

3.18 The delegate of Denmark agreed with the point made by the delegate of the United States and supported the view expressed by the delegate of Norway. He noted that, in accordance with the request made by the Chairman of the IFRB, the letters A-J should be replaced by numbers.

3.19 The delegate of Algeria said that he had no objection to having the matter referred to Committee 5. However, the point he had raised was an important one and should be taken into consideration at some stage. Even without the addition of the new zones, the Conference was having great difficulty in resolving the main problem before it, that of congestion. There was a risk that, if maritime broadcasting areas were established, it would prove impossible to cover the requirements of national land zones. He continued to feel that a different status should be given to maritime areas.

3.20 The delegate of the Islamic Republic of Iran suggested that the item should be referred to Committee 5.

3.21 The Chairman drew attention to Document 167 which contained a note by the Chairman of Committee 4 to the Chairman of Committee 5 referring section 3.7.1 and Note 2 to that Committee. Thus, a possiblity of amending the section still existed.

3.22 The delegate of Venezuela, supported by the delegates of Brazil, Paraguay, Argentina, Mexico and Chile, proposed to add the following sentence at the end of the second paragraph of section 3.7.1 :

"Also this form of description may be used where the service area includes parts of different CIRAF zones."

As a consequence, the first paragraph of section 3.7.1 should be amended to read :

"... Reference shall be made to CIRAF zones, or parts thereof".

The amendments were approved, subject to editorial changes.

3.23 The Chairman of the IFRB suggested that after adoption of the amendments to section 3.7.1, Note 1, which had given rise to great difficulties, might now be deleted or, if retained, be amended by deleting the reference to appropriate test points and mentioning an azimuth.

3.24 The delegate of Brazil, supported by the delegate of Venezuela, was in favour of retaining it. His administration considered the CIRAF zones suitable as a starting point, but had requested the inclusion of several additional test points in the zones covering Brazilian territory in order to facilitate a more appropriate definition of the service areas of its domestic services (B/55/60). It had been very difficult, and in some cases impossible, for his Administration to define some national service areas with existing test points. His delegation having understood the difficulties which the Board would have with various ideas considered, had accepted section 3.7.2 and Note 1, in view of the point made by the Board representative in Committee 4 that problems presented by Brazil could be properly considered and resolved on the basis of the text adopted.

After a short discussion it was agreed to amend Note 1 to read :

"In exceptional areas where it is necessary to specify a reception area which is smaller than an entire zone or a sub-division of a zone, this may be done by specifying an azimuth and a maximum service range in km. See Appendix 2 of the Radio Regulations."

3.25 The delegate of the Islamic Republic of Iran asked what was meant by "an adequate number of test points" in section 3.7.2.

3.26 The Chairman of the IFRB replied that the total number of test points being used by the IFRB was 312. The Board was not in a position to use more than 500 test points for the time being, but in developing the technical standards to apply the decisions of the Conference it would probably be using between 400 and 500 test points. If the ITU computer facilities were improved the Board would probably increase the number of test points.

3.27 The delegate of India suggested that since a final decision on section 3.7.1 was to be taken by Committee 5, the sentence relating to maritime protection areas should be placed in square brackets. Moreover, pending the decision of Committee 5, the letter designations in the annex should be maintained.

Section 3.7 was approved, as amended.

Note 1 was approved, as amended, and it was agreed that section 3.7.1 should remain in square brackets pending the decision of Committee 5.

The fifth series of texts submitted by the Editorial Committee was approved, as amended, on first reading.

4. Sixth series of texts submitted to the Plenary Meeting for first reading (B.6) (Document 181)

4.1 The Chairman of Committee 6, introducing Document 181, pointed out a typing error in the French text of the heading of Table 1/3.2.4.1, which should read :

"Paramètres utilisés pour calculer la fiabilité de référence de circuit."

Moreover, the first sentence in the note under section 3.2.4 should be amended to read :

"Ce paragraphe propose des méthodes pour le calcul de la fiabilité de réception et de la fiabilité de radiodiffusion ...".

4.2 The Chairman drew attention to the Note in square brackets in section 3.2.4.

4.3 The Chairman of the IFRB asked which of the two alternative methods for calculating basic circuit reliability, the first in terms of the required radio frequency signal-to-noise ratio, the second in terms of the minimum usable field strength, was to be used to prepare the software required by the Conference.

4.4 The Chairman of Committee 4 replied that in the absence of data on planning methods from Committee 5, Committee 4 had decided to show two methods in every case and leave it to Committee 5 or the Plenary to make a choice depending on the planning approach adopted by Committee 5.

4.5 In reply to the Chairman's question as to whether there were any preferences for the alternative calculation methods, the delegate of Italy suggested that the method that was simpler for the IFRB should be chosen.

4.6 The Chairman of the IFRB said that the second method was preferable in computing basic circuit reliability since it could save a whole minor stage of calculation. Moreover, since the first method used the table on page 9 of Document 181 which contained a signal-to-interference ratio for which Committee 4 had not worked out an appropriate calculation, the second method would also be preferable in calculating overall circuit reliability.

The second method of calculation was adopted.

4.7 Section 3.2.4

It was decided to retain the table and footnote and place the text in square brackets pending consideration of the tables in sections 3.2.4.3 and 3.2.4.4.

4.8 Section 3.2.4.1

It was decided to retain the title but delete the text, which, was only explanatory.

4.9 Section 3.2.4.1.1

It was decided to delete the title, text, table, figure and formulas as a result of the decision to adopt the second method of calculation.

4.10 Section 3.2.4.1.2

The title was amended by deleting the words "using minimum field strength".

4.10.1 The Chairman of Committtee 4 drew attention to the following errors in the formulas :

$E_W \leq E_{min}$ should read $E_W \geq E_{min}$,

$E_W > E_{min}$ should read $E_W < E_{min}$

and $$BCR = 0.5 + \frac{1}{\sqrt{2\pi}} \int_0^{\gamma} \exp(-\tau^2/2)\, d\tau$$

should read $$BCR = \frac{1}{\sqrt{2\pi}} \int_{\infty}^{\gamma} \exp(-\tau^2/2)\, d\tau$$

4.10.2 The Chairman of Committee 6 suggested that with those corrections, the presentation of the formulas might be simplified.

It was therefore agreed to place the formulas in square brackets, pending simplification by the Chairman of Committee 4, and review them at the second reading.

4.11 Section 3.2.4.2

It was decided to retain the title and delete the text.

4.12 Section 3.2.4.2.1

It was decided to delete the table, figure, text and formulas.

4.13 Section 3.2.4.2.2

It was decided to amend the title by deleting the words "using protection ratio".

4.13.1 The delegate of the United Kingdom said that as a result of the decision to retain only the second method of calculation, some changes would be needed in the last paragraph, which referred back to section 3.2.4.2.1.

It was agreed that the calculations of ICR parameters deleted from section 3.2.4.2.1 would have to be reintroduced, and that the Chairman of Committee 4 would prepare a suitable text for the second reading.

4.14 Section 3.2.4.3

4.14.1 The delegate of India, referring to the expression in square brackets in step 4 of the Table for two-frequency operation and to similar expressions in subsequent tables, some of which contemplated the possible use of three frequencies in the same band, said that his delegation considered that such situations had been covered by the Technical Committee in order to show what the possibilities were, but in view of the planning methodology and perception of the problems in Committee 5, there was an obvious need to ensure that for any given requirement not more than one frequency was assigned within the same band. His delegation therefore proposed that all such expressions in square brackets, both in the tables under discussion and in subsequent tables in section 3.2.2.4.4, be deleted, since they served no purpose.

4.14.2 The Chairman of Committee 4 explained that Committee 4 had been obliged to give the mathematical principles for the various possibilities. However, they had been left in square brackets at the request of a number of delegations pending an administrative decision by Committee 5. If Committee 5 were to decide that a second frequency in the same band should not be allowed, the formulas would automatically be deleted.

4.14.3 The delegate of the United Kingdom said that his delegation would prefer to retain the expressions because when the time came to satisfy the requirements of all administrations, there might be no choice but to use more than one frequency in the same band.

4.14.4 The delegate of China supported the Indian proposal, and drew attention to section 3.8.2 in Document 168 which referred to the need to consider whether, when the calculated broadcast reliability did not reach the desired value, it could be improved by a combination of frequencies in separate bands. Care should be taken to ensure consistency between the two documents.

4.14.5 The delegates of Albania, Algeria, Argentina, Brazil, Chile, Indonesia, Iran, Iraq, Libya, Mauritania, Mexico, Pakistan, Syria, Tunisia, Venezuela, Yugoslavia, Zambia and Zimbabwe also supported the Indian proposal.

4.14.6 The delegate of the Federal Republic of Germany supported the United Kingdom's view. There was no contradiction between the two documents as had been implied, and the additional formula might prove to be necessary at the second session of the Conference.

4.14.7 The delegates of Bulgaria, Czechoslovakia, German Democratic Republic, Israel, Poland, Portugal, Ukrainian SSR and USSR also supported the United Kingdom's position.

4.14.8 The Chairman said that since there appeared to be a considerable majority in favour of deleting the upper formula, it would have to be deleted, and the text would consequently only cover the case where the ratio between the frequencies was below 0.9.

It was so decided.

4.14.9 The Chairman of Committee 4 said that as a result of the decision to retain only one calculation method, some changes would be needed in the fourth column relating to lines 18 and 11, which would be done in time for the second reading.

4.14.10 The Chairman added that as far as step 4 was concerned, only the words "basic reception reliability", the formula under (b) and the lower formula in the fourth column would be retained.

The table on two-frequency operation, as amended, was approved.

4.14.11 The delegate of the United Kingdom expressed his dissatisfaction with that situation. Committee 4 had worked very hard to produce a systematic set of equations which would be useful in the planning of telecommunications networks and which had all too quickly been deleted. Those formulas had been accurate and precise and might be needed in the future. He reserved his right to revert to the issue later on.

4.14.12 The delegate of Thailand also expressed his reservation. He wondered what formula would now be used in the specific case in which frequencies from the adjacent 13 and 15 MHz HF bands produced a ratio in excess of 0.9.

4.14.13 The delegate of India said that the objection had not been to the use of two frequencies in the same band but to the fact that the use of two frequencies in that way would not contribute to any justifiably significant increase in reliability. The exceptional case referred to by Thailand, therefore, in terms of reliability, would not justify changing the rule.

4.14.14 The delegate of the USSR said that his delegation maintained its view. The formula was a very useful one and if there was a need for a second frequency it should be catered for. His delegation would therefore reserve its position on the decision taken.

4.14.15 The delegate of the Ukrainian SSR fully supported the views expressed by the delegates of the United Kingdom and USSR and maintained its earlier opinion. It would also reserve its position.

4.14.16 The delegates of Israel, Portugal and the United States said that their delegations also wished to enter reservations.

4.15 The Chairman said that consequential amendments would also have to be made in step 5, in the Table on three frequency operation, by deleting the reference to line 18, and in step 6 by deleting the cases in square brackets.

4.15.1 The Chairman of Committee 4 said that much as he regretted having to delete those formulas, the necessary amendments would be made for the second reading.

4.16 Section 3.2.4.4

4.16.1 The Chairman said that the same amendments should be made in the tables as had been made in those in section 3.2.4.3, following the decision to maintain the use of only one frequency in any band.

4.16.2 The delegate of the USSR said that the situation was quite different from the earlier one and the earlier error of deleting one formula need not be repeated.

4.16.3 The delegate of India, supported by the delegate of the Islamic Republic of Iran, confirmed that the deletions should be made. In the case of overall reception reliability, which took into account the impact of interference, it was even more necessary to ensure against the multiple use of frequencies, since such use could only set up a chain reaction and the interference situation would worsen.

4.16.4 The Chairman said that unless there were any objections, he would take it that the same deletions would be made in the tables as in the previous ones, that the same delegations would be in favour of the decision, that the same delegations would be against it, and that the same reservations would be entered.

It was so agreed.

4.16.5 The Chairman of Committee 4 said that the tables now contained certain inconsistencies, notably with the 0.9 limit. To avoid any ambiguities therefore it might be easier to use an expression such as "in the other frequency band allocated to broadcasting services" rather than referring to a limit of 0.9.

4.16.6 The delegate of India said that in borderline cases the IFRB would be able to use its discretion and proceed accordingly, but any serious problems might be solved, for example, by modifying the 0.9 to 0.91. In any event, his delegation maintained its basic view.

4.16.7 The Chairman said that the Plenary could not decide on another value at the present stage.

It was therefore agreed that instead of using the ratio 0.9, a statement would be included on the lines proposed by the Chairman of Committee 4, who would prepare the necessary text for the second reading.

4.17 Section 3.2.4.5

4.17.1 The Chairman of Committee 4 said that the percentile x referred to in the second paragraph should be placed in square brackets pending a decision by Committee 5.

It was so agreed.

4.17.2 Table 7 : Basic broadcasting reliability

Table 8 : Overall broadcast reliability

It was agreed to place the percentile x in column 3 of step 2 of both tables in square brackets pending a decision by Committee 5.

4.18 The Chairman invited the Plenary to reconsider section 3.2.4 - Reliability - which had been placed in square brackets pending a decision on the square brackets in the tables.

4.19 The Chairman of Committee 4 said that in the light of the decisions taken, the Note could be deleted. The footnote, however, was to remain.

It was so agreed.

Subject to the reservations expressed, the sixth series of texts submitted by the Editorial Committee was approved, as amended, on first reading.

The meeting rose at 1735 hours.

The Secretary-General :
R.E. BUTLER

The Chairman :
K. BJÖRNSJÖ

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 188-E
8 February 1984
Original : English

COMMITTEE 2

SUMMARY RECORD

OF THE

SECOND MEETING OF COMMITTEE 2

(CREDENTIALS)

Monday, 6 February 1984, at 1035 hrs

Chairman : Mr. N. TCHIMINA (Gabonese Republic)

Subjects discussed :	Document
1. Summary Record of the First Meeting	62
2. First to fourth reports of Working Group 2A	92, 118, 144, 178
3. Fifth (oral) report by the Chairman of Working Group 2A	-
4. Draft report to the Plenary Meeting	DT/42

1. Summary Record of the First Meeting (Document 62)

1.1 The Summary Record of the First Meeting (Document 62) was approved.

2. First to fourth reports of Working Group 2A (Documents 92, 118, 144 and 178)

The first to fourth reports of Working Group 2A were approved.

3. Fifth (oral) report by the Chairman of Working Group 2A

3.1 The Chairman, speaking as Chairman of Working Group 2A said that the Group had met to examine the provisional credentials deposited by the delegation of the Somali Democratic Republic and had found them to be in order.

4. Draft report to the Plenary Meeting (Document DT/42)

4.1 The Chairman, introducing the Committee's draft report to the Plenary Meeting (Document DT/42), said that as a result of Working Group 2A's fifth report, the Somali Democratic Republic should be added to the countries whose provisional credentials had been found to be in order (Annex, list 2) and deleted from those which had not deposited credentials (Annex, list 4).

4.2 The delegate of the United States enquired about the procedure for dealing with credentials deposited after the date of the report.

4.3 The Chairman said that paragraph 4 of the report gave the procedure which was to be recommended to the Plenary Meeting. Any changes to the lists in the Annex to the report would be made automatically and announced at subsequent Plenary Meetings.

4.4 In reply to a request for clarification from the delegate of the United States, the Secretary-General explained that all Members had the right to participate in the Conference, whether they were entitled to vote or not. But under the terms of the Convention, some of them had been disqualified from voting from the outset and they had been listed in Document 40 and Revs. If formal votes were taken, the attention of the bodies concerned would be drawn to those delegations attending which had lost the right to vote.

The Committee's task was simply to verify the credentials submitted to it. Under No. 390 of the Convention, it was those delegations not already disqualified from voting which could exercise their right to vote on a provisional basis pending the Plenary Meeting's decision on the Committee's report.

4.5 The delegate of the United States suggested that it might be desirable to submit a paper or an information note on the subject of membership and voting rights to the meeting of the Administrative Council due in April 1984. In view of the ITU's wish for universal participation in its work, particular mention might be made of the need to extend the period for accession to the Nairobi Convention without loss of the right to vote, since some Members which had not signed the Convention had thereby lost their right to vote in a way which was not typical of the United Nations system as a whole.

4.6 The Secretary-General said that he would hesitate to submit such a paper to the Administrative Council unless a Member specifically asked to have the subject added to its agenda. The issue would arise in any case in connection with the proposed establishment of a group of experts to consider if the Union should have a permanent Constitution or Charter instead of being operated on the renewable Convention system. The question of accession was inseparable from that of the renewable Convention system. There had been fourteen months for Members not present at the signing of the Convention to accede to it before its entry into force. Those which had signed had a further two years in which to deposit instruments of ratification before losing their right to vote. Governments could of course accede to the Convention at any time.

4.7 The delegate of the United States said that, in the circumstances, it seemed preferable to put the subject of his delegation's concern in the form of a document to the proposed group of experts, rather than add it to the Administrative Council's agenda.

4.8 The Chairman, agreeing with the delegate of the United States, said that if he heard no objection, he would take it that the Committee wished to approve its draft report to the Plenary Meeting.

Document DT/42, as orally revised, was approved.

The meeting rose at 1120 hours.

The Secretary :

R. MACHERET

The Chairman :

N. TCHIMINA

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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COMMITTEE 5

United States of America

ADDITIONAL ALTERNATIVE FOR DEALING WITH INCOMPATIBLE REQUIREMENTS

In the extensive deliberations of ad hoc Group 5A-2, an alternative rule for dealing with incompatible requirements was discussed and received the support of a number of administrations. This proposed rule appeared as Option B in Document DL/17(Rev.1). For reasons that are not clear this option did not appear as an alternative to be considered in Document DT/43(Rev.1).

Since the alternative is based on the principle of equal rights of all countries adopted in planning principle 4.1.1 of Document DT/39, it is vital that this alternative be discussed fully by Committee 5, along with the other alternatives contained in paragraph 6 of Document DT/43(Rev.1). This alternative is as follows.

If in a given frequency band, reception area and time block it is not possible to satisfy all requirements with the quality criteria adopted by the Conference, it is necessary to reduce the criteria to a level that will satisfy all requirements uniformly. Those administrations which cannot agree to the reduced quality of broadcasting may propose improvements or request alternative frequencies in another band or at another time block, and their requests must, where possible, be satisfied without adversely affecting the plan.

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COMMITTEE 6

Note by the Chairman of ad hoc Group PL-B
to the Editorial Committee

According to the decision taken by the Plenary Meeting on 3 February 1984, ad hoc Group PL-B reconsidered section 3.8.2 together with the captions for Figure Y/3.8.2 contained in Document 168 (pages 16 and 17).

The revised text, reproduced in Annex to this note, is sent to the Editorial Committee for further submission to the Plenary Meeting for approval.

L.W. BARCLAY
Chairman of ad hoc Group PL-B

Annex : 1

ANNEX

3.8.2 Use of additional frequencies*

The number of frequencies needed to achieve the specified level of basic broadcast reliability shall be determined by the method given below. If the calculated basic broadcast reliability for a single frequency does not reach the adopted value, it is necessary to consider whether it could be improved by a combination of frequencies in separate bands and whether the improvement would justify the use of additional frequencies.

In cases where the basic broadcast reliability obtained with one frequency is between 50% and 80%, an additional frequency shall be tested.** If the basic broadcast reliability calculated for two frequencies exceeds the limit specified in Figure [Y/3.8.2], the additional frequency may be used.

In those special cases where the basic broadcast reliability using two frequencies remains below 80% the calculation procedure above shall be repeated to test for a third frequency.

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* [Note 1 - These criteria may be modified by the second session of the Conference in the light of the calculation results relating to existing typical broadcasting circuits obtained by the intersessional Working Group and/or the IFRB during the intersessional period.]

** Note 2 - For calculation of the basic broadcast reliability see paragraph 3.2.4.5.

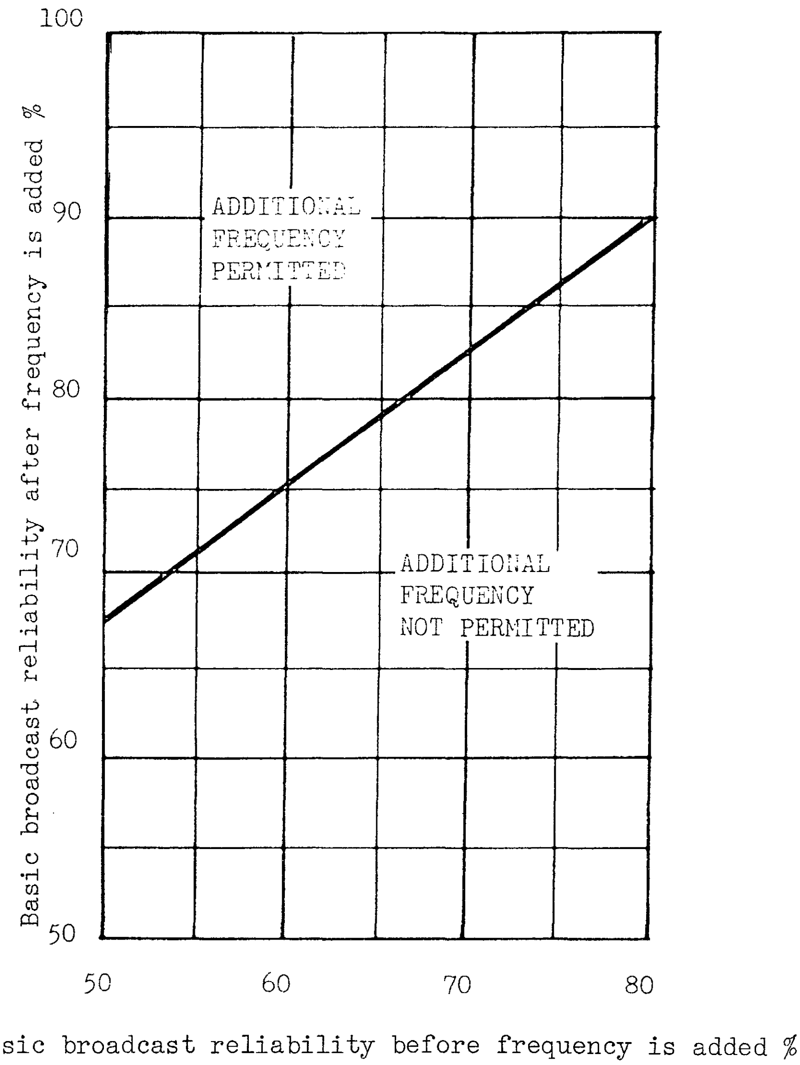

FIGURE /‾Y/3.8.2_7

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Corrigendum 2 to
Document 191-E
9 February 1984
Original : French

AMENDMENTS TO THE

REPORT OF COMMITTEE 2 TO THE PLENARY MEETING

Following the oral report by the Vice-Chairman of Committee 2 to the ninth Plenary Meeting, the following changes should be made in the Annex to Document 191 :

Section 1

Add ZAMBIA (Republic of)

Section 3

Add GUYANA

Section 4

Delete GUYANA and ZAMBIA (Republic of)

F. KRÁLÍK
Vice-Chairman of Committee 2

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Corrigendum 1 to
Document 191-E
7 February 1984
Original : French

AMENDMENTS TO THE
REPORT OF COMMITTEE 2 TO THE PLENARY MEETING

1. Following the oral report by the Chairman of Committee 2 to the eighth Plenary Meeting, the following changes should be made in the Annex to Document 191 :

Section 2

Add EL SALVADOR (Republic of) and GUATEMALA (Republic of)

Section 3

Add PERU

Section 4

Delete EL SALVADOR (Republic of), GUATEMALA (Republic of) and PERU

2. Following a request of the Delegate of Cameroon the name of his country, which appears in paragraph 1 of the Annex should read :

CAMEROON (Republic of) instead of CAMEROON (United Republic of)

N. TCHIMINA
Chairman of Committee 2

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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PLENARY MEETING

REPORT OF COMMITTEE 2 TO THE PLENARY MEETING

CREDENTIALS

1. Terms of reference of the Committee

The terms of reference of the Committee are set out in Document 59.

2. Meetings

The Committee met twice, on 11 January and 6 February 1984.

At its first meeting, it set up a Working Group consisting of the Chairman and Vice-Chairman of the Committee and one delegate from the Federal Republic of Germany, from Malaysia and from Venezuela to verify delegations' credentials in accordance with Article 67 of the International Telecommunication Convention, Nairobi (1982)

3. Conclusions

The conclusions reached by the Committee are reproduced in the Annex attached hereto and submitted to the Plenary Meeting for approval.

4. Final remark

The Committee recommends that the Plenary Meeting authorize the Chairman and Vice-Chairman of Committee 2 to verify the credentials received after the date indicated in the present report and to report to the Plenary Meeting on the matter.

N. TCHIMINA
Chairman of Committee 2

Annex : 1

ANNEX

1. Credentials found to be in order, deposited by the delegations of countries having the right to vote

ALGERIA (People's Democratic Republic of)
GERMANY (Federal Republic of)
ANGOLA (People's Republic of)
SAUDI ARABIA (Kingdom of)
ARGENTINE REPUBLIC
AUSTRALIA
AUSTRIA
BANGLADESH (People's Republic of)
BELGIUM
BENIN (People's Republic of)
BYELORUSSIAN SOVIET SOCIALIST REPUBLIC
BOTSWANA (Republic of)
BRAZIL (Federative Republic of)
BULGARIA (People's Republic of)
BURUNDI (Republic of)
CAMEROON (United Republic of)
CANADA
CHILE
CHINA (People's Republic of)
CYPRUS (Republic of)
VATICAN CITY STATE
COLOMBIA (Republic of)
CONGO (People's Republic of the)
KOREA (Republic of)
IVORY COAST (Republic of the)
CUBA
DENMARK
EGYPT (Arab Republic of)
SPAIN
UNITED STATES OF AMERICA
ETHIOPIA
FINLAND
FRANCE
GABONESE REPUBLIC
GREECE
HUNGARIAN PEOPLE'S REPUBLIC
INDIA (Republic of)
INDONESIA (Republic of)
IRAN (Islamic Republic of)
IRAQ (Republic of)
IRELAND
ISRAEL (State of)
ITALY
JAMAICA
JAPAN
JORDAN (Hashemite Kingdom of)

KENYA (Republic of)
KUWAIT (State of)
LIBYA (Socialist People's Libyan Arab Jamahiriya)
LUXEMBOURG
MALAYSIA
MALAWI
MALI (Republic of)
MOROCCO (Kingdom of)
MEXICO
MONACO
NORWAY
NEW ZEALAND
OMAN (Sultanate of)
PAKISTAN (Islamic Republic of)
PAPUA NEW GUINEA
PARAGUAY (Republic of)
NETHERLANDS (Kingdom of the)
POLAND (People's Republic of)
PORTUGAL
QATAR (State of)
SYRIAN ARAB REPUBLIC
GERMAN DEMOCRATIC REPUBLIC
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA
UKRAINIAN SOVIET SOCIALIST REPUBLIC
ROMANIA (Socialist Republic of)
UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND
RWANDESE REPUBLIC
SINGAPORE (Republic of)
SRI LANKA (Democratic Socialist Republic of)
SWEDEN
SWITZERLAND (Confederation of)
SURINAME (Republic of)
SWAZILAND (Kingdom of)
TANZANIA (United Republic of)
CZECHOSLOVAK SOCIALIST REPUBLIC
THAILAND
TUNISIA
TURKEY
UNION OF SOVIET SOCIALIST REPUBLICS
VENEZUELA (Republic of)
VIET NAM (Socialist Republic of)
YEMEN ARAB REPUBLIC
YEMEN (People's Democratic Republic of)
YUGOSLAVIA (Socialist Federal Republic of)
ZIMBABWE (Republic of)

Conclusion : The delegations of these countries are entitled to vote

2. Provisional credentials found to be in order, deposited by the delegations of countries having the right to vote (see No. 383 of the Convention)

COSTA RICA
PHILIPPINES (Republic of the)
SOMALI DEMOCRATIC REPUBLIC

Conclusion : The delegations of these countries are entitled to vote

3. Credentials found to be in order, deposited by the delegations of countries which do not have the right to vote (see Document 40 + Rev.)

ALBANIA (Socialist People's Republic of)
BOLIVIA (Republic of)
COMOROS (Islamic Federal Republic of the)
HONDURAS (Republic of)
LIBERIA (Republic of)
MAURITANIA (Islamic Republic of)

Conclusion : The delegations of these countries are not entitled to vote

4. Delegations attending the Conference which have not deposited credentials

AFGHANISTAN (Democratic Republic of)
*CENTRAL AFRICAN REPUBLIC
EL SALVADOR (Republic of)
*UNITED ARAB EMIRATES
ECUADOR
GAMBIA (Republic of the)
GHANA
GUATEMALA (Republic of)
*GUYANA
*MADAGASCAR (Democratic Republic of)
NIGERIA (Federal Republic of)
*PERU
*SENEGAL (Republic of)
ZAIRE (Republic of)
ZAMBIA (Republic of)

Conclusion : The delegations of these countries are not entitled to vote

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* Appears in the list of countries which have lost their right to vote (see Document 40 + Rev.)

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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COMMITTEE 6

Note by the Chairman of Committee 4
to the Editorial Committee

According to the decision taken by the Plenary Meeting on 3 February 1984, the editorial amendments reproduced in Annex to this note, regarding the paragraph in square brackets appearing in Document 168 section 3.5.1.5, page 11, is sent to the Editorial Committee for further submission to the Plenary Meeting for approval.

J. RUTKOWSKI
Chairman of Committee 4

Annex : 1

ANNEX

1. Replace paragraph in square brackets on page 11, beginning "The resulting antenna gain ..." with the following :

"The resulting antenna gain in the required direction is then calculated as follows.

Step 1 - Sum the attenuation for the appropriate values of θ and ψ (Tables [D, E, F, G/3.5.1.5]).

Step 2 - If appropriate, according to the conditions in a) i) and b) i) given below, limit the total attenuation obtained in Step 1 to a value not exceeding 30 dB.

Step 3 - Subtract the total attenuation from the maximum gain (Table [A/3.5.1.2]) for the antenna concerned and, if appropriate, according to condition a) ii) given below, limit the resultant antenna gain to a value not below -8 dBi.".

2. Add the following labels to the reported text.

"a) Forward radiation

i) For angles of elevation less than the vertical angle of maximum radiation, the total attenuation should not exceed a value of 30 dB.

ii) For angles of elevation equal to or greater than the vertical angle of maximum radiation, the resultant antenna gain shall not fall below -8 dBi.

b) Reverse radiation

i) For HR m/n/h antennas, at all angles of elevation, the total attenuation should not exceed a value of 30 dB.".

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 193-E
6 February 1984
Original : English/French

Source : DT/39, DT/41, DT/43(Rev.1), DT/47, DT/49, DT/50

COMMITTEE 5

THIRD AND LAST REPORT OF WORKING GROUP 5A
TO COMMITTEE 5

The texts contained in Annexes 2 to 7 are submitted to Committee 5 for study and approval.

An overview of the discussions held during the 19th and 20th meetings of Working Group 5A is given in Annex 1.

M. OUHADJ
Chairman of Working Group 5A

Annexes : 7

ANNEX 1

Document DT/20 :

In considering this document the Working Group was of the opinion that it was not necessary to provide definitions of the terms :

National broadcasting station
International broadcasting station

Although Working Group 5A was in favour of defining the following terms, it postponed consideration of them :

National HF broadcasting
International HF broadcasting

Document DT/39 : (see Annex 2)

No agreement could be reached on an appropriate text for 4.2.1. The two options given in DT/39 are therefore reproduced in Annex 2.

Document DT/41 : (see Annex 3)

After a lengthy discussion the text of 4.2.3.1 given in Annex 3 was adopted.

Document DT/43(Rev.1) : (see Annex 4)

- Paragraphs [1], [3] and [4] were adopted as given in Annex 4.

- Paragraph [2] was adopted with the reservations of the following Administrations : BUL, D, HOL, I, UK, USA.

- The United Kingdom Administration proposed that the words "for national purposes" should be deleted.

In this connection the IFRB has prepared Document 186.

- Paragraph [5] remains in square brackets noting in particular that its content is related to [6].

- Paragraph [6]

a) Most of the administrations which took the floor were in favour of alternative A as given in Annex 4.

The following Administrations objected to the adoption of this text and reserved the right to revert to the matter in Committee 5 :

D, BLR, BUL, USA, F, GUY, HNG, POL, POR, DDR, UKR, G, URS.

b) The Administrations of the United States of America and the Soviet Union favoured alternative C.

c) The Administration of the Federal Republic of Germany considered alternative C complementary to alternative A. That view was shared by the Administrations of Italy and Japan.

d) The Administration of France expressed its preference for alternative B.

e) The Administration of Papua New Guinea asked for 24 hours in which to come to a decision. The Administrations of France and Italy shared its concern.

f) The United States Administration considered that alternative C bore no relation to alternatives A and B and should be allocated the number 7. It claimed, moreover, that no decision had been taken with regard to the adoption of alternative A.

g) Working Group 5A decided to defer consideration of paragraph [5] and the footnote (An.) pending a decision by Committee 5 on paragraph [6].

In view of the foregoing, Working Group 5A decided to submit alternatives A, B and C to Committee 5 for consideration.

Document DT/47 : (see Annex 5)

Principle 4.1.2.7 : see the three proposals

a) Most of the administrations which took the floor were in favour of proposal No. 3.

One administration spoke in favour of proposal No. 2.

b) The United States Administration expressed concern about the content of this principle and proposed that the document should be referred to Committee 5 for consideration.

After discussion and in view of the foregoing, Working Group 5A decided to submit the matter to Committee 5 for consideration.

Document DT/49 : (see Annex 6)

Document DT/50 : (see Annex 7)

These two documents were not examined by Working Group 5A due to lack of time.

ANNEX 2

4.2.1 Overview of planning method (Option A)

[After considering the various proposals to the Conference, the first session decided to adopt the planning method which is described in a summary manner in Figure /‾ 7. The detailed description of each step of the process is contained in section 4.2.3.]

[4.2.1 Overview of planning method (Option B)

After considering the various proposals to the Conference, the first session decided to adopt a planning method containing four basic parts :

1) a requirements file containing present and future broadcasting requirements of administrations;

2) an automated process for generating the seasonal schedules;

3) a modification procedure*;

4) a coordination procedure* with administrations for their final action and acceptance of the proposed schedules.

---

* These procedures are to be developed at the second session.]

ANNEX 3

4.2.3.1 Step 1 - Requirements file

The operational and projected broadcasting requirements and associated facilities submitted by administrations for a period of [3 years*] will be used to create the requirements file.

This file will be updated in accordance with the procedures to be developed at the second session (see 4.1.2.4).

---

* The second session could revise this value, if necessary.

ANNEX 4

4.2.3.4.5 Rules for dealing with incompatible requirements

/‾1._7 If the automated system cannot satisfy all requirements in a certain band, for a certain CIRAF zone or part of a CIRAF zone in a specific period of time, even after all possibilities of adjustments are exhausted, it shall identify administrations whose requirements cannot be completely satisfied with the agreed overall broadcasting reliability adopted by the Conference.

/‾2._7 In so doing account shall be taken of the principle in 4.1.2.2 and in particular the need for longer transmission hours for national purposes.

/‾3._7 The Board will suggest changes which will be useful for the administrations concerned and that would reduce congestion (see 4.1.1).

/‾4._7 Administrations which do not reply within a period to be determined by the second session or which refuse any modification shall be deemed to accept any reduced overall reliability that may result from the planning process.

[/‾5._7 The system shall then endeavour to satisfy all requirements with a /‾lower_7 /‾adopted by the Conference_7 overall broadcasting reliability.]

ALTERNATIVE A

/‾6._7 If all the requirements cannot be satisfied with the overall broadcasting reliability adopted by the Conference the system shall guarantee this value to as many requirements as possible, equally divided over all administrations involved and shall include the remaining requirements in the Plan with a lower degree of reliability as close as possible to the value adopted by the Conference without adversely affecting the requirements satisfied with the value adopted by the Conference.

ALTERNATIVE B

/‾6._7 If all the requirements cannot be satisfied with the overall broadcasting reliability of x to be determined the system shall guarantee this value x to as many requirements as possible, /‾equally_7 /‾proportionally_7 divided over all administrations involved and shall include the remaining requirements in the Plan with a lower degree of reliability as close to x as possible, without adversely affecting the requirements already satisfied to the value x.

ALTERNATIVE C

/‾6._7 Those administrations which cannot agree to the resulting reduced quality of service may propose improvements or may consolidate their requirements, or may request alternative frequencies in another band or at another time block and their request must where possible be satisfied, without reducing the level of quality of other requirements below the minimum agreed to at the Conference.

[Note: It is the understanding of the Chairman that the following sentence was deleted from /‾1_7:

it being understood that the already satisfied requirements have been /‾equally_7 /‾proportionally_7 distributed among all administrations.]

ANNEX 5

OTHER PLANNING PRINCIPLES

Proposal No. 1

4.1.2.7 Those broadcasting requirements for which, through lack of the requisite technical facilities, the agreed reference usable field strength is not ensured in the required service area, could obtain proportionally reduced protection against interference within the limits to be determined by the 2nd session*.

---

* For the purposes of Intersessional work, the protected field strength shall be limited to the minimum field strength. In cases where the Board finds it possible to use a lower value it may do so and indicate in its report, the impact of such a reduction.

Proposal No. 2

4.1.2.7 Those broadcasting requirements for which, through lack of the requisite technical facilities, the agreed reference usable field strength is not ensured in the required service area, could obtain proportionally reduced protection against interference within the limits to be determined by the 2nd session*.

---

* For the purposes of Intersessional work, the protected field strength shall be limited to the minimum field strength, corresponding to the minimum value of S/N adopted by the Conference /̄ see Document 173 ̲7. In cases where the Board finds it possible to use a lower value it may do so and indicate in its report, the impact of such a reduction.

Proposal No. 3

4.1.2.7 To process those broadcasting requirements for which, through lack of the requisite technical facilities, the agreed reference usable field strength is not ensured in the required service area, the field strength to be protected shall be limited to the minimum field strength corresponding to the minimum value of S/N adopted by the Conference /̄ see Document 173 ̲7.*

---

* For the purposes of Intersessional work and where the Board finds it possible, it will use a lower value and indicate in its report, the impact of such a reduction.

Remaining principles not discussed in Working Group 5A

4.1.2.8 **In a first stage of the equitable application of the planning procedure an attempt will be made to include the highest possible number of the formulated requirements. Limitations could be imposed on the remaining requirements if their inclusion in the planning process leads to a deterioration of the situation.**

4.1.2.9 In order to ensure efficient utilization of the HF bands and sufficient flexibility in planning, the agreed planning method should contain appropriate provisions to guarantee the necessary protection for "minimum requirements" of all countries in any of the future plans, irrespective of the overall number of requirements.

ANNEX 6

SEVENTH REPORT OF AD HOC GROUP 5A-2 TO WORKING GROUP 5A

Ad hoc Group 5A-2 was not able to resolve the basis on which the automated planning should commence.

ALTERNATIVE 1

A given broadcasting requirement should be satisfied by the minimum number of frequencies needed to achieve the quality criteria adopted by the Conference (see 2.6 of Document DT/10(Rev.2)).

ALTERNATIVE 2

Each requirement should be treated and one frequency found for the relevant time block in the appropriate band.

If after reliability evaluations, frequencies for the indicated time blocks do not meet the quality criteria adopted by the Conference, supplementary frequencies should be selected in subsequent rounds without disturbing previous selections.

ANNEX 7

EIGHTH REPORT OF AD HOC GROUP 5A-2 TO WORKING GROUP 5A

The following work was not completed on the flowchart due to the lack of resolution on section 4.2.1 of Document DT/39/Document 169.

4.2.3.10 Step 10 - Adjustment process

The application of steps 3 to 8 indicates adjustments to be applied. These adjustments will be implemented in several loops which will be derived within the software process.

4.2.3.11 Step 11 - Further automated adjustments

This step will identify if there is any requirement for which any further automated adjustments are possible.

4.2.3.12 Step 12 - Requirements meeting criteria

The system will identify all those requirements which meet the agreed criteria. These requirements and their frequency assignment will be entered into the Seasonal plan.

4.2.3.13 Step 13 - Requirements not meeting criteria

The system will identify those requirements where the agreed criteria could not be met by the automated adjustment process.

4.2.3.14 Step 14 - Board action

The Board will analyze the results of step 13 in order to identify the problem areas with the objective of formulating recommendations to administrations.

4.2.3.15 Step 15 - Coordination

The Board will communicate its recommendations from step 14 to the appropriate administrations. The detailed procedure relating to this step should be considered by the second session including the time schedules.

4.2.3.16 Step 16 - Entries in the plan

The requirements for which the criteria cannot be met as identified in step 14 will be entered in the Seasonal plan. However those entries shall be identified as not having satisfied the criteria and are subject to recommendations by the Board to the administrations.

4.2.3.17 Step 17 - Additional procedures

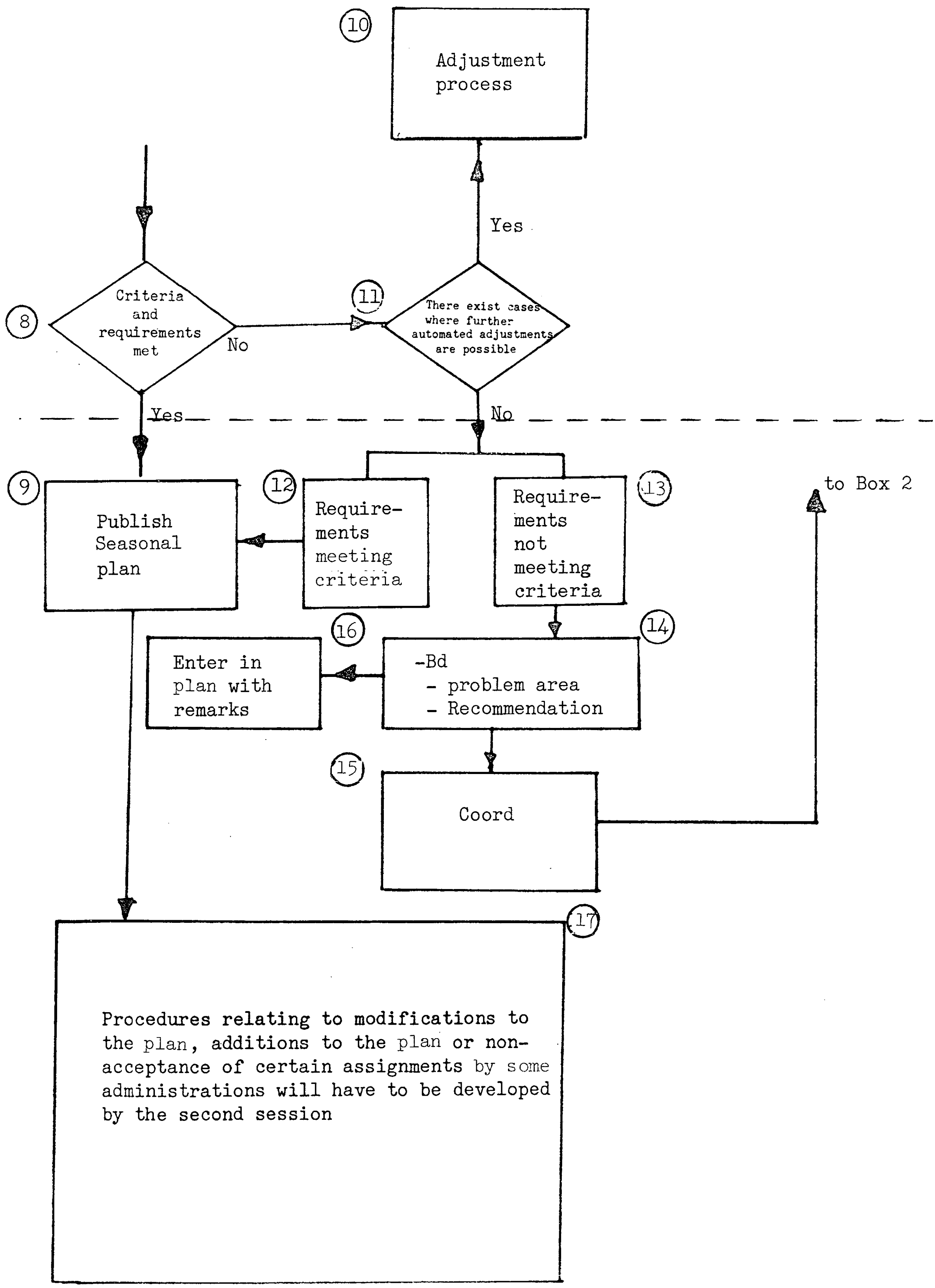
In considering the planning method the first session identified that there may be a need for additional procedures to deal with :

a) modifications to the Seasonal plan after it has been published;

b) the inclusion of additional requirements in the Seasonal plan after it has been published;

c) the situation where certain administrations may be unable to accept the frequency assignments included in the Seasonal plan for some reason.

The first session is of the view that this is a matter for consideration by the second session.


10
Adjustment process
Yes
8
Criteria and requirements met
No
11
There exist cases where further automated adjustments are possible
Yes
No
9
Publish Seasonal plan
12
Require-ments meeting criteria
Require-ments not meeting criteria
13
to Box 2
16
Enter in plan with remarks
-Bd
- problem area
- Recommendation
14
15
Coord
17
Procedures relating to modifications to the plan, additions to the plan or non-acceptance of certain assignments by some administrations will have to be developed by the second session

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 194-E
6 February 1984
Original : French

BUDGET CONTROL COMMITTEE

Note by the Secretary-General

POSITION OF THE CONFERENCE ACCOUNTS AT 3 FEBRUARY 1984

In accordance with No. 477 of the International Telecommunication Convention (Nairobi, 1982), a statement of the accounts of the Conference at 3 February 1984 is submitted to the Budget Control Committee for consideration.

The statement shows that expenditure is within the budget limits approved by the Administrative Council.

This document also comprises a statement of expenditure relating to the preparatory work carried out in 1983 for the Conference and a statement of the limits set on expenditure by the Nairobi Plenipotentiary Conference.

R.E. BUTLER
Secretary-General

Annexes : 3

ANNEX 1

Section 11.4

WORLD RADIO CONFERENCE HFBC-84

Item No.	Headings	Budget approved by AC	Budget adjusted	Expenditure at 3 February 1984			
				Actual	Committed	Estimated	Total
	Sub-head I - IFRB preparatory work and intersessional work						
11.401	Salaries and related expenses	325,000	340,500	16,832	318,201	14,467	349,500
11.403	Insurance	52,000	58,500	3,152	55,348	-	58,500
11.404	Office space, furniture	20,000	20,000	-	-	20,000	20,000
11.405	Electronic equipment	100,000	100,000	-	-	100,000	100,000
		497,000	519,000	19,984	373,549	134,467	528,000
	Sub-head II - Staff expenditure						
11.421	Salaries and related expenses	1,281,000	1,386,000	11,353	1,126,775	89,872	1,228,000
11.422	Travel (recruitment)	190,000	192,000	12,483	66,689	10,828	90,000
11.423	Insurance	34,000	34,000	2,091	-	30,909	33,000
		1,505,000	1,612,000	25,927	1,193,464	131,609	1,351,000
	Sub-head III - Premises and equipment						
11.431	Premises, furniture, machines	90,000	90,000	162	26,138	40,700	67,000
11.432	Document production	100,000	100,000	7,743	20,000	15,257	43,000
11.433	Office supplies and overheads	40,000	40,000	9,762	9,725	15,513	35,000
11.434	PTT	150,000	150,000	10,520	-	29,480	40,000
11.435	Technical installations	20,000	20,000	-	-	10,000	10,000
11.436	Sundry and unforeseen	10,000	10,000	4,208	-	5,792	10,000
		410,000	410,000	32,395	55,863	116,742	205,000
	Sub-head IV - Other expenses						
11.441	Report to the 2nd session	15,000	15,000	-	-	15,000	15,000
	Total, Section 11.4	2,427,000 *	2,556,000	78,306	1,622,876	397,818	2,099,000

Excluding common expenditure for conferences and meetings (Section 17), which is estimated at 712,000.- Swiss francs for this Conference (value 1.9.82 : limit 721,000.- Swiss francs)

*) Value 1.9.82 (limit) : 2,454,000.- Swiss francs

ANNEX 2

PREPARATORY WORK CARRIED OUT IN 1983 FOR THE
WORLD ADMINISTRATIVE CONFERENCE FOR HF BROADCASTING

Items	Section 11 - Conference	1983 budget*)	1983 accounts
		- Swiss francs -	
	Sub-head I - Staff expenditure		
11.401	Salaries and related expenses	205,700	198,773.40
11.402	Insurance	31,400	35,609.70
	Total, Sub-head I	237,100	234,383.10
	Sub-head II - Other expenses		
11.405	Document production	-	8,265.95
11.410	CCIR preparatory work	270,000	86,385.70
	Total, Sub-head II	270,000	94,651.65
	Total expenditure, Section 11.4	507,100 **)	329,034.75
	Section 17 - Common services	237,000***)	82,421.00
	Total, value 1.9.1982 (limit on expenditure)	734,000	403,000.00

*) 1983 budget, including additional credits
**) i.e. 500,000.- Swiss francs, value 1.1.1983
***) i.e. 230,000.- Swiss francs, value 1.1.1983

ANNEX 3

LIMIT SET BY THE NAIROBI CONFERENCE, 1982, ON EXPENDITURE FOR THE WORLD ADMINISTRATIVE RADIO CONFERENCE FOR THE PLANNING OF THE HF BANDS ALLOCATED TO THE BROADCASTING SERVICE, 1984/86, AND COMPARISON WITH THE CREDITS AUTHORIZED BY THE ADMINISTRATIVE COUNCIL

WARC - HFBC	Sections 11 and 17		
	Limit on expenditure - Add.Prot.I	Expenditure entered in the budget	Difference
1983 : Preparatory work	900,000	403,000	497,000
1984 : Preparatory work, cost of the first session and intersessional work	4,100,000	3,175,000	925,000
1985 : Intersessional work	500,000		
1986 : Intersessional work, cost of the second session, immediate post-Conference work	4,500,000		
Totals	10,000,000		

The amounts given in this table correspond to values at 1.9.1982.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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COMMITTEE 5

Note by the Chairman of the Conference and the Chairman of Committee 4 to the Chairman of Committee 5

In addition to the request contained in Document 167, Committee 5 is asked to take appropriate actions on the following items :

in section 3.2.4 (Document 181 refers)

- to determine a reference value [Y%] for the overall broadcast reliability as a general criterion for planning purposes;

- to determine a specified percentile [X] of test point within the required service area to be taken into account when considering broadcast reliabilities (both basic and overall) (see pages 19 and 20 of Document 181);

in section 3.2.5.2 (Solar index values)

- to chose one of the options contained in sub-section 3.2.5.2.2 between square brackets (Document 177, page 2);

in section 3.5.2 (Transmitter power ...) (Document 177, page 3)

- to decide whether power calculations are to be included in the planning method; and if yes

- to determine a reference value [X%] of basic circuit reliability for power calculation purposes;

in section 3.9.2 (Progressive introduction of SSB transmissions) (Document 154(Rev.1), page 3)

- agree to removing the square brackets around the paragraphs 3.9.2.1.e, 3.9.2.2.c and 3.9.2.3; and

- to determine the duration of the transition period mentioned in paragraph 3.9.2.3.

K. BJÖRNSJÖ
Chairman of the Conference

J. RUTKOWSKI
Chairman of Committee 4

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 196-E
8 February 1984
Original : French/English

COMMITTEE 5

SUMMARY RECORD

OF THE

FIFTH MEETING OF COMMITTEE 5

(PLANNING)

Saturday, 4 February 1984, at 1405 hrs

Chairman : Mr. IRFANULLAH (Islamic Republic of Pakistan)

Subjects discussed :		Document
1.	Approval of the summary record of the fourth meeting of Committee 5	177
2.	Proposal replacing HOL/25/1	176
3.	Reports of Working Group 5A	161, 169
4.	Organization of work	-

1. Approval of the summary record of the fourth meeting of Committee 5 (Document 117)

The summary record was approved.

2. Proposal replacing HOL/25/1 (Document 176)

2.1 In view of the importance of the resolution in Document 176 and the little time remaining before the end of the Conference, the delegates of Portugal, Bolivia, Turkey, Norway, the Federal Republic of Germany, Uruguay, Japan, Egypt, France, Belgium, Austria, Argentina, Italy, Venezuela and Mexico urged that the document be adopted at the present meeting and transmitted to the Plenary Meeting.

2.2 Also supporting the resolution, the delegate of Canada said that his country had submitted a similar draft (CAN/4/22) based on a resolution adopted by CITEL (Region 2), and the delegate of Israel said that his Administration was one of the major victims of interference.

2.3 The delegate of Botswana raised the question of deliberate interference with which everyone was familiar. In his view, the problem required the earliest possible solution.

2.4 The delegate of Algeria, supported by the delegates of Saudi Arabia, Tunisia, Libya, Qatar, the United Arab Emirates, Iraq and Mauritania, said that he would prefer the document to be made generally acceptable by first transmitting it for improvement to the Working Group in charge of intersessional work, whose terms of reference covered the question.

2.5 At the request of the delegate of the Federal Republic of Germany, the following new preambular paragraph a) was inserted in the draft Resolution :

"Article 4 (No. 19) of the International Telecommunication Convention on the purposes of the Union."

The other preambular paragraphs were renumbered accordingly.

2.6 The delegate of Algeria finally concurred with the opinion expressed by most speakers. While he had no substantive objections, he proposed several amendments which were not opposed by the delegate of the Netherlands who sponsored the resolution.

The draft resolution in Document 176 was approved subject to the amendments indicated (see Resolution COM5/1 - Annex 3 to Document 182).

2.7 The delegates of Poland and Syria expressed reservations which were noted.

3. Reports of Working Group 5A (Documents 161 and 169)

3.1 The Chairman of Working Group 5A said that his Group had met several times since the last meeting of Committee 5 and had studied inter alia the introduction of SSB (Document 161). He favoured the co-existence of DSB and SSB in the same bands, without any bands being reserved exclusively for SSB. The delegations of Venezuela and Brazil had reserved the right to revert to these issues in Committee 5.

Replying to the Chairman of the Conference, who asked whether Working Group 5A had taken into account the outcome of the work of Committee 4 concerning the introduction of SSB, particularly compatibility criteria, he said that Working Group 5A had arrived independently at comparable solutions.

3.2 The Chairman of Committee 4 said that his Committee had established compatibility criteria for the introduction of SSB, indicating that they could be improved. A final decision on the duration of the transition period should be taken by Committee 5 having regard to the useful life of receivers, which had been estimated at ten years although industry would doubtless need time to adapt to SSB.

3.3 The delegate of the Federal Republic of Germany asked where Document 161 was to be inserted in the report and pointed out that some sentences seemed to duplicate other parts of the report.

3.4 The delegate of Paraguay queried the meaning of the word "planned" in the second line of paragraph 1. He understood that it referred to DSB transmissions at present in use.

3.5 The Chairman of the IFRB suggested that the word "planned" and its equivalents in the other two working languages should be deleted.

3.6 The delegate of India, supported by the delegate of Syria, objected on the ground that SSB emissions had to be authorized in the plan for DSB emissions.

3.7 At the suggestion of the Chairman, the delegate of Paraguay accepted the text of paragraph 1 in Document 161.

3.8 The delegate of the Netherlands, supported by the delegate of Paraguay, proposed the addition of the following words at the end of paragraph 1.1 : "after which no transmitter incapable of SSB transmission must be installed".

3.9 The delegate of the Islamic Republic of Iran wondered whether such an amendment was necessary since it seemed premature to fix the date on which the transition period should end.

3.10 The delegate of Switzerland recalled that his delegation had expressed reservations concerning paragraphs 1.1 and 1.2 in Working Group 5A.

3.11 The delegate of Brazil, supported by the delegates of Venezuela, Paraguay, Mexico, Argentina and Colombia, proposed the addition of the words "and the duration of that period" at the end of paragraph 1.1. Transmitter and receiver manufacturers would need precise dates whereas paragraph 1.2 merely stated : "The duration of the transition period may be fixed at 20 years".

3.12 The Chairman of Working Group 5A said that he could support the Brazilian proposal. He wished to stress, however, that paragraphs 1.1 and 1.2 were not in any way contradictory.

3.13 The delegate of Yugoslavia said that his delegation was satisfied with the text of Document 161 in its present form.

3.14 The delegate of Kenya was of the view that the starting date for the transition period should be set by the second session of the Conference.

3.15 The delegate of the Netherlands said he supported the idea behind the Brazilian proposal, which could easily be combined with his own suggestion.

3.16 The delegate of Morocco said that paragraphs 1.1 and 1.2 might give rise to different interpretations. His delegation felt that in order to overcome that potential difficulty the transition period should be clearly defined, possibly in a footnote.

3.17 The delegate of Italy agreed that it would be difficult for people who had not participated in the Conference to understand the exact nature of the transition period. Any definition given here, however, must be in accordance with the provisions approved in Committee 4. Hence the simplest solution would be for the footnote suggested by the delegate of Morocco to take the form of a cross-reference to section 3.9.1.8 of pink Document 157.

3.18 The delegate of Morocco said that his delegation would be fully satisfied with that solution.

3.19 After further discussion, the Chairman proposed that the meeting adopt the amendment put forward by Brazil, which had received wide support, along with the proposed footnote to read "See section 3.9.1.8 of Document 157". No objections were raised.

Document 161 was thus approved, as amended.

3.20 The Chairman of Working Group 5A introduced Document 169 relating to planning principles and on administrations' proposals. The document reflected the problems still outstanding after long discussions in Working Group 5A. Not all principles had as yet been approved and the proposed method was still incomplete. In particular, the flow chart at the end of the document was still in square brackets, and the delegations of the Byelorussian SSR, Brazil, Bulgaria, Colombia, the German Democratic Republic, Poland, Czechoslovakia, the Ukrainian SSR and the USSR had reserved their position on section 4.2.2 relating to the definition of a broadcasting requirement.

Section 4.1 : Planning principles

3.21 The delegate of the Islamic Republic of Iran said that the square brackets around the words "required service area" in section 4.1.2.6 could be deleted, that term having now been defined. With regard to section 4.1.2.7, it must be clearly understood that there were other principles still pending to be inserted at a later stage.

Section 4.2 : Planning method

3.22 The delegate of Finland said that the planning method was incomplete. It was unclear how it would work, and there were still certain technical difficulties to be solved. His delegation was thus not prepared to approve the parts of the method set out in section 4.2 until the whole method had been defined.

3.23 The delegate of Qatar proposed that in section 4.2.3.3 the word "model" should be changed to "prediction method", the words "sun spot number" should be inserted before "season and different hours", the words "/ optimum working frequency /" should be replaced by "/ basic MUF /", and the square brackets around "basic circuit reliability" should be deleted.

3.24 The delegate of Finland supported the use of the words "prediction method" instead of "model", but was not quite sure that he could support the proposed amendment to "optimum working frequency" and "basic circuit reliability". It was not clear how those could be circulated in cases where the required service area contained more than one CIRAF-zone.

3.25 The Chairman of the IFRB pointed out that in paragraph 3.2.1 (Document 137) reference was made to the field strength prediction method. So far as the remainder of the delegate of Qatar's amendment was concerned, he had not yet had time to study in detail the Committee 4 document. He was, however, satisfied with section 4.2.3.3 which was a general formulation and referred to paragraph 3.2, which gave all the details. Paragraph 3.2.1.4 (Document 154(Rev.1)) dealt with optimum frequency band selection and how it should be calculated.

It was agreed that the word "model" in section 4.2.3.3 should be changed to "prediction method".

3.26 The delegate of Canada said that the words "basic circuit reliability" in the first line of the third sub-paragraph of 4.2.3.3 should be in square brackets, as they were in the remainder of that section. He enquired whether it was now possible to select an appropriate term such as "basic circuit reliability" or "basic broadcasting reliability" and remove the square brackets.

The Chairman of the IFRB having explained that the correct term was "basic circuit reliability", the delegate of Canada said he was satisfied by the explanation although in some cases a broadcasting requirement might involve more than one circuit.

3.27 At the proposal of the delegate of Italy, it was agreed that paragraph 4) in section 4.2.3.4.2 should become a separate paragraph.

3.28 In reply to a question by the delegate of the Islamic Republic of Iran, the Chairman of Working Group 5A said that the most appropriate place for the insertion of the paragraph would be at the end of section 4.2.3.4.2.

3.29 The delegate of Brazil said that in the light of what had been approved in sections 4.2.3.1, 4.2.3.3 and 4.2.3.4.3, his delegation withdrew its earlier reservations with regard to section 4.2.2.

3.30 The delegate of Colombia said that his delegation also withdrew its reservation with regard to section 4.2.2 since administrations would be allowed to supplement the basic characteristics of their requirements with other optional characteristics.

3.31 The delegate of the United Kingdom, speaking as Vice-Chairman of the Editorial Committee, indicated that that Committee might find it necessary to make some very minor drafting changes so as to give proper expression to the decisions just taken regarding Document 169.

On that understanding, Document 169 was approved, as amended.

4. Organization of work

4.1 The delegate of Yugoslavia, supported by the delegates of the Islamic Republic of Iran, China, India and Brazil, stressing the crucial importance for the success of the Conference of the work on planning methods which had been allocated to ad hoc Group 5A-2 and deploring the slow progress made so far, proposed that the remainder of ad hoc Group 5A-2's work should be dealt with in Working Group 5A, where more delegations would have an opportunity to participate in the discussion.

4.2 The delegate of the USSR, supported by the delegate of the United States, suggested that ad hoc Group 5A-2 be allowed to hold a final meeting as already scheduled for the following morning.

4.3 The Chairman of the Conference said that the Steering Committee had already decided that the last meeting of Working Group 5A should be held on the morning of Monday, 6 February, so it seemed appropriate that the last meeting of ad hoc Group 5A-2 should take place on Sunday morning. The Steering Committee would consider the situation further at its meeting on the evening of Monday, 6 February.

The meeting rose at 1735 hours.

The Secretary :	The Chairman :
J. DA SILVA	Mr. IRFANULLAH

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 197(Rev.1)-E
7 February 1984
Original : English

COMMITTEE 5

Note by the Secretary-General

At the request of the International Frequency Registration Board, I transmit the attached document for the consideration of the Conference.

R.E. BUTLER
Secretary-General

Annex : 1

ANNEX

COMMENTS OF THE IFRB IN RELATION TO DOCUMENT DT/47

In relation to the proportionally reduced protection which is contained in the first principle of Document DT/47, the Board understands the process of calculating the protection to be afforded as follows :

1. The reference field strength :

$$E_{ref} = E_{min} + 3 \text{ dB}$$

is used only for the purposes of calculating the required power.

2. The Basic Circuit Reliability is to be calculated at any test point within the required service area where the wanted field strength is equal to or greater than E_{min} (BCR $\geq$ 0.5). Test points where E_{min} is not reached for 50% of the time are disregarded.

3. If in any frequency band the Basic Circuit Reliability is less than 0.5 at all the test points of the required service area, the Conference may decide exceptionally to afford a proportionally reduced protection.

3.1 In this situation, the Board requests the Conference to

- clearly identify those cases to which this exception applies;

- indicate the rules to be applied to such cases.

3.2 For the above situations the Board proposes that the overall broadcast reliability shall be calculated at all test points where the median wanted field strength is

$$E \geqslant E_{min} - [Z] \text{ dB.}$$

In such cases the "required protection ratio" used in the calculations of the overall broadcast reliability (step (9) of Table 4/3.2.4.2 and Figure 4/3.2.4.2 of section 3.2.4.2.2 in the calculation of O.C.R.) shall be reduced by [Z]* dB.

*) Note - The Board is of the opinion that [Z] should be decided by this session on a definitive or provisional basis in order to assess the impact of this principle on planning. It is to be brought to mind that if [Z] is large and if the application of this exception is not limited to few cases it will be impossible to produce a plan.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 197-E
6 February 1984
Original : English

COMMITTEE 5

Note by the Secretary-General

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R.E. BUTLER
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In relation to the proportionally reduced protection which is contained in the first principle of Document DT/47, the Board understands the process of calculating the protection to be afforded as follows :

1) The reference field strength :

$$E_{ref} = E_{min} + 3 \text{ dB}$$

is used only for the purposes of calculating the required power.

2) The Basic Circuit Reliability is to be calculated at any test point within the required service area where the wanted field strength is equal to or greater than E_{min}. Test points where E_{min} is not reached are disregarded.

3) Should the Conference decide to exceptionally afford protection in cases where E_{min} is not reached the Board would request the Conference to :

- clearly identify those cases to which this exception applies;
- indicate the rules to be applied to such cases.

4) If the Conference adopts these views, a possible text for this principle is as follows :

"The overall broadcast reliability shall be calculated on the basis of those test points within the required service area where the field strength is equal to or greater than E_{min}. However in the cases noted below, the above reliability shall be calculated at all test points where the field strength is :

$$E \geqslant E_{min} - [X] \text{ dB."}$$

The cases to which this principle applies are :

(To be developed.)

Note - The Board is of the opinion that X should be decided by this session on a definitive or provisional basis in order to asses the impact of this principle on planning. It is to be brought to mind that if X is large and if the application of this exception is not limited to few cases it will be impossible to produce a plan.

BLUE PAGES

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Corrigendum 2 to
Document 198-E
10 February 1984

B.7(Corr.2)

PLENARY MEETING

SEVENTH SERIES OF TEXTS SUBMITTED BY THE
EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for first reading :

Source	Document	Title
COM.5	182	Resolution COM5/1

Note of Committee 6 : Following the decision of the Plenary Meeting, the text of Resolution COM5/1 is resubmitted to the Plenary Meeting.

Marie HUET
Chairman of Committee 6

Annex : 2 pages

RESOLUTION COM5/1

Relating to the Avoidance of Harmful Interference with a View to Improving the Use of the HF Bands Allocated to the Broadcasting Service

The World Administrative Radio Conference for the Planning of the HF Bands Allocated to the Broadcasting Service (First Session, Geneva, 1984),

considering

a) Article 4 (No. 19) of the International Telecommunication Convention concerning the purposes of the Union;

b) Article 10 (Nos. 79 and 80) of the International Telecommunication Convention concerning the duties of the IFRB ;

c) Article 35 (No. 158) of the International Telecommunication Convention concerning the avoidance of harmful interference;

d) Article 54 (No. 209) of the International Telecommunication Convention concerning the instructions which may be given to the IFRB by a world administrative radio conference;

e) Article 20 of the Radio Regulations concerning the international monitoring system;

f) Article 18 (No. 1798) of the Radio Regulations concerning measures against interference;

g) Article 22 of the Radio Regulations concerning the procedure in cases of harmful interference;

noting

a) that harmful interference has a negative impact on the use of the frequency spectrum in general and on the use of frequency channels available for high frequency broadcasting in particular;

b) that broadcasting on channels adjacent to those being affected directly may also be subject to interference;

c) that a considerable number of high frequency broadcasting channels in various parts of the world are rendered useless by harmful interference;

recognizing

a) that it is desirable for more detailed information on the extent and impact of harmful interference to be available before the second session of the Conference;

b) that an increase in the number of stations participating in the international monitoring system and a more effective use of the information obtained from such stations would be of considerable assistance;

urges administrations

to avoid harmful interference;

instructs the IFRB

in accordance with the Radio Regulations,

1. to organize monitoring programmes in the bands allocated to the high frequency broadcasting service with a view to identifying stations causing harmful interference;

2. to seek, as appropriate, the cooperation of administrations in identifying the sources of emissions which cause harmful interference and to provide this information to administrations;

3. to inform the second session of the Conference of the results of the activities referred to in 1 and 2 above;

invites administrations

1. to take part in monitoring programmes set up by the IFRB in accordance with the provisions of this Resolution;

2. to apply the provisions of Article 22 of the Radio Regulations.

INTERNATIONAL TELECOMMUNICATION UNION

BLUE PAGES

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Corrigendum 1 to
Document 198-E
8 February 1984

Corr.1 to B.7

PLENARY MEETING

SEVENTH SERIES OF TEXTS SUBMITTED BY THE
EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for first reading :

Source	Document	Title
COM.5	203	Chapter 4 - Planning principles and method

Replace page B.7/3 by the following : (except for paragraphs 4.1.2.6 and 4.1.2.7).

Marie HUET
Chairman of Committee 6

Annex : 2 pages

4.2 Planning method

4.2.1 Overview of planning method

After considering the various proposals to the Conference, the first session decided to establish the planning method which is described in Figure /‾ 7. The detailed description of each step of the planning process is contained in section 4.2.3. The procedures associated with this method will be developed at the second session on the basis of proposals submitted by administrations.

4.2.2 Definition of a broadcasting requirement

A requirement indicated by an administration to provide a broadcasting service at specified periods of time to a specified reception area from a particular transmitting station.

4.2.3 Description of the individual steps of the processing system

4.2.3.1 Step 1 - Requirements file

a) The requirements file will be created on the basis of data relating to operational and projected broadcasting requirements and the associated facilities submitted by administrations over a period of three years.*

This file will be updated in accordance with the procedures to be developed at the second session (see 4.1.2.4).

b) This file shall contain :

Basic characteristics

1) name of the transmitting station

2) geographical coordinates of the transmitting station

3) symbol of the country or geographical area in which the transmitting station is located

4) required service area

5) hours of operation (UTC)

6) range of antenna characteristics

7) transmitter power (dBW)

8) class of emission

* The second session could change this period, if necessary.

Optional supplementary characteristics

1) preferred frequency (in kHz)

2) preferred frequency band (in MHz)

3) equipment limitations

4) ranges of power capabilities

5) possible use of synchronized transmitters

INTERNATIONAL TELECOMMUNICATION UNION

BLUE PAGES

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 198-E
7 February 1984

B.7

PLENARY MEETING

SEVENTH SERIES OF TEXTS SUBMITTED BY THE
EDITORIAL COMMITTEE TO THE PLENARY MEETING

The following texts are submitted to the Plenary Meeting for first reading :

Source	Document	Title
COM.5	182	Chapter 3 - Progressive introduction of SSB (Planning aspects)
		Chapter 4 - Planning principles and method
		Resolution COM5/1

Marie HUET
Chairman of Committee 6

Annex : 9 pages

/ CHAPTER 3 - Technical criteria /

3.9.3 Progressive introduction of SSB (Planning aspects)

3.9.3.1 The eventual changeover to SSB will make for efficient utilization of the spectrum. SSB transmissions which administrations may wish to make may, however, be permitted in lieu of planned DSB transmissions, provided that the level of interference caused to DSB transmissions appearing in the Plan is not increased.

Since the criteria of compatibility between DSB and SSB are not yet completely known* and in view of the economic implications, this session is of the opinion that :

3.9.3.1.1 The second session of the Conference should fix the date of the beginning of the transition period as well as the duration of this period.**

3.9.3.1.2 The duration of the transition period may be fixed at 20 years (and consideration will have to be given to the timely availability of the receivers required).

The date of the cessation of DSB emissions will therefore be known once the second session has fixed the date referred to in 3.9.3.1.1 above.

3.9.3.2 SSB should be introduced in the same bands as are used for DSB. It has also been recognized that no channels should be reserved exclusively for SSB.

* / See 3.9.2.4. /

** / See 3.9.2. /

CHAPTER 4

PLANNING PRINCIPLES AND METHOD

Having considered the proposals of administrations on planning principles and method, the first session of the Conference concluded that the planning of the high frequency broadcasting service shall be based on four seasonal plans to be prepared annually or semi-annually using broadcasting requirements submitted [periodically] by the administrations. The seasonal plans shall be prepared on the basis of the following principles and planning method.

4.1 Planning principles

4.1.1 In accordance with the International Telecommunication Convention and with the Radio Regulations annexed thereto, the planning of the high frequency bands allocated to the broadcasting service shall be based on the principle of equal rights of all countries, large or small, to equitable access to these bands and to utilize them in accordance with the decisions taken by this Conference. In planning, an attempt shall also be made to achieve an efficient utilization of these frequency bands, account being taken of the technical and economical constraints that may exist in certain cases.

4.1.2 On the basis of the foregoing, the following planning principles shall be applied.

4.1.2.1 All the broadcasting requirements, current or future, formulated by the administrations, shall be taken into account and be treated on an equitable basis, so as to guarantee the equality of rights referred to in paragraph [4.1.1] above and to enable each administration to provide a satisfactory service.

4.1.2.2 All the broadcasting requirements, national and international, shall be treated on an equal basis, with due consideration of the differences between these two kinds of broadcasting requirements.

4.1.2.3 In the planning procedure, an attempt shall be made to ensure, as far as practicable, the continuity of the utilization of a frequency or of a frequency band. However, such continuity should not prevent equal and technically optimum treatment of all broadcasting requirements.

4.1.2.4 The periodical planning process shall be based solely on the broadcasting requirements to become operational during the planning period. It shall furthermore be flexible to take into account new broadcasting requirements and modifications to the existing broadcasting requirements, in accordance with the modification procedures to be adopted by the Conference.

4.1.2.5 The planning procedure shall be based on DSB transmissions. SSB transmissions which administrations might wish to make may, however, be permitted in lieu of planned DSB transmissions, provided that the level of interference caused to DSB transmissions appearing in the Plan is not increased.

4.1.2.6 For efficient spectrum utilization, whenever possible, only one frequency should be used to meet a given broadcasting requirement in a given required service area and in any case the number of frequencies used should be the minimum necessary to provide satisfactory reception.

4.1.2.7 Further planning principles /̲ to be developed_/.

4.2 Planning method

4.2.1 Overview of planning method

/̲ To be developed_/

4.2.2 Definition of a broadcasting requirement

A requirement indicated by an administration to provide a broadcasting service at specified periods of time to a specified reception area from a particular transmitting station.

4.2.3 Description of the individual steps of the processing system

4.2.3.1 Step 1 - Requirements file

a) /̲ To be developed_/

b) This file shall contain :

Basic characteristics

1) name of the transmitting station

2) geographical coordinates of the transmitting station

3) symbol of the country or geographical area in which the transmitting station is located

4) required service area

5) hours of operation (UTC)

6) range of antenna characteristics

7) transmitter power (dBW)

8) class of emission

Optional supplementary characteristics

1) preferred frequency (in kHz)

2) preferred frequency band (in MHz)

3) equipment limitations

4) ranges of power capabilities

5) possible use of synchronized transmitters

4.2.3.2 Step 2 - Broadcast requirements for the season under consideration

The broadcasting requirements to be used for each season shall be those contained in the Requirements File which are to become operational during the season under consideration and which are confirmed and, if necessary, modified by the administration, in accordance with the procedure described in [4.2.3.1].

4.2.3.3 Step 3 - Propagation analysis and selection of the appropriate frequency band

The propagation prediction method described in [paragraph 3.2] will be used to calculate for each requirement, for the season and for the different times, the [optimum working frequency] and the [basic circuit reliability]. The appropriate frequency band(s) for each requirement at the different times will be selected on the basis of the results of the above calculations.

However, if an administration has indicated equipment limitations, they are to be taken into account in the selection of the appropriate frequency band.

If, at any time, the required [basic circuit reliability] cannot be achieved with a single frequency band, a second frequency band shall be selected as long as the administration has indicated its ability to operate in two frequency bands simultaneously. (See Chapter [ ], section [ ].)

4.2.3.4 Step 4 - Rules to be applied to broadcasting requirements in a given run

4.2.3.4.1 Optimization

The system must be optimized to ensure the maximum possible utilization of all available channels.

4.2.3.4.2 Preferred frequency

In accordance with the planning principles and without imposing constraints on planning, the following provisions shall be applied in the seasonal plans :

1) administrations may indicate the preferred frequency;

2) during the planning process, attempts shall be made to include the preferred frequency in the plan;

3) if this is impossible, attempts shall be made to select a frequency which is as close as possible to the preferred frequency in the same band.

Otherwise the automated system shall be used to select the appropriate frequencies in such a way as to accommodate the maximum number of requirements, taking into account the constraints imposed by the technical characteristics of the equipment.

4.2.3.4.3 Equipment constraint

The system shall take into account the technical constraints imposed by the equipment, namely :

4.2.3.4.3.1 Frequency

a) When an administration indicates that its facilities can operate only on a limited number of fixed specified frequencies, the process in steps 5, 6 and 7 shall be applied to one of these frequencies; should the final step result in an incompatibility, the adjustment process (step 10) shall try another of these frequencies. The plan shall contain that frequency among this limited number of frequencies which has the least degree of incompatibility.

b) If two such broadcasting requirements indicate the same frequency which, after analysis, results in an incompatibility, the case is referred to the administration(s) concerned.

4.2.3.4.3.2 Frequency band

a) When an administration indicates that its facilities can operate only in a given frequency band, only frequencies from that band shall be included in the plan.

b) When an administration indicates a preferred frequency band, the system shall attempt to select a frequency from this band. If this is impossible, frequencies from the nearest band shall be tried. Otherwise the system will select frequencies from the appropriate band, taking into account the equipment constraints referred to in paragraph /   /.

4.2.3.4.3.3 Power

a) When an administration indicates only a single power value due to equipment constraints, it shall be used in the planning process.

b) When an administration indicates several possible power values, the appropriate value shall be used to achieve the / basic circuit reliability /.

4.2.3.4.3.4 Antenna

When an administration indicates that its antenna can operate only in a given frequency band, only frequencies from that band shall be included in the plan.

4.2.3.4.4 Limitation of frequency change

For the time block indicated for each broadcasting requirement, frequency changes should be essentially limited to those due to propagation factors. Frequency changes due to incompatibilities may also be permitted. In these cases, the number of frequency changes during any contiguous periods of operation shall be limited to the minimum necessary.

4.2.3.4.5 /_Rules to be applied to congested areas_7

/_To be developed._7

4.2.3.5 Step 5 - Selection of technical characteristics

The system shall be designed in such a way that, in cases where administrations communicate the power and characteristics which may vary in given ranges, the values to be used for these characteristics may be selected within the indicated ranges.

4.2.3.6 Step 6 - Compatibility analysis and frequency selection

/_To be developed._7

4.2.3.7 Step 7 - Reliability analysis

The method described in section /_ _7 shall be used to calculate the /_overall broadcast reliability_7.

4.2.3.8 Step 8 - Criteria and requirements met

The broadcasting requirements for the season under consideration will be analyzed to ascertain whether they have been met in conformity with the agreed criteria contained in section /_ _7.

4.2.3.9 Step 9 - Seasonal plan

The timing of publication and the means of securing administrations' comments on seasonal plans will be considered by the second session of the Conference.

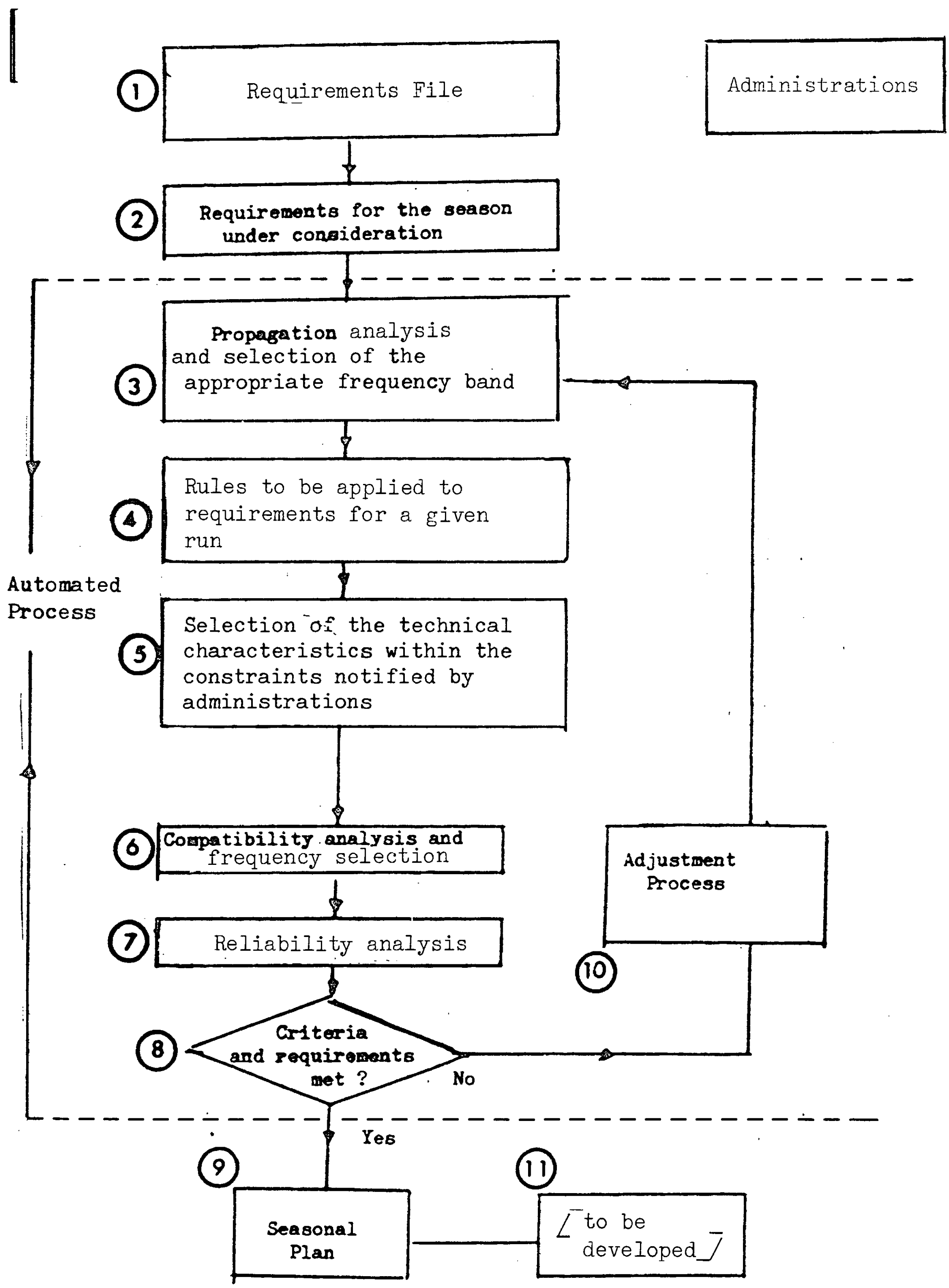

FIGURE / /

Flowchart of the automated process

ANNEX 3

RESOLUTION COM5/1

Relating to the Avoidance of Harmful Interference with a View to Improving the Use of the HF Bands Allocated to the Broadcasting Service

The World Administrative Radio Conference for the Planning of the HF Bands Allocated to the Broadcasting Service (First Session, Geneva, 1984),

considering

a) Article 4 (No. 19) of the International Telecommunication Convention concerning the purposes of the Union;

b) Article 10 (Nos. 79 and 80) of the International Telecommunication Convention concerning the duties of the IFRB ;

c) Article 35 (No. 158) of the International Telecommunication Convention concerning the avoidance of harmful interference;

d) Article 54 (No. 209) of the International Telecommunication Convention concerning the instructions which may be given to the IFRB by a world administrative ratio conference;

e) Article 20 of the Radio Regulations concerning the international monitoring system;

f) Article 18 (No. 1798) of the Radio Regulations concerning measures against interference;

g) Article 22 of the Radio Regulations concerning the procedure in cases of harmful interference;

noting

a) that harmful interference has a negative impact on the use of the frequency spectrum in general and on the use of frequency channels available for high frequency broadcasting in particular;

b) that broadcasting on channels adjacent to those being affected directly may also be subject to interference;

c) that a considerable number of high frequency broadcasting channels in various parts of the world are rendered useless by harmful interference;

recognizing

a) that it is desirable for more detailed information on the extent and impact of harmful interference to be available before the second session of the Conference;

b) that an increase in the number of stations participating in the international monitoring system and a more effective use of the information obtained from such stations would be of considerable assistance;

urges administrations

to avoid harmful interference;

instructs the IFRB

in accordance with the Radio Regulations,

1. to organize monitoring programmes in the bands allocated to the high frequency broadcasting service with a view to identifying stations causing harmful interference;

2. to seek, as appropriate, the cooperation of administrations in identifying the sources of emissions which cause harmful interference and to give this information to administrations;

3. to inform the second session of the Conference of the results of the activities referred to in 1 and 2 above;

invites administrations

1. to take part in monitoring programmes set up by the IFRB in accordance with the provisions of this Resolution;

2. to give special attention to the procedures in Article 22 of the Radio Regulations applicable in the event of harmful interference.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 199-E
6 February 1984
Original : English

COMMITTEE 5

Federal Republic of Germany, Australia, Denmark, United States of America, Finland, Jamaica, Japan, Norway, Portugal and United Kingdom of Great Britain and Northern Ireland

OBJECTIVE TESTING AND EVALUATION OF PLANNING METHODS

The above-named administrations consider that it would be premature and unwise for this Conference to adopt, against the wishes of many administrations, a single planning method. The absence of any evidence of the practicality or success of a particular method establishes an urgent need for objective testing and evaluation of various methods. Based upon the results obtained, the next session of the Conference can then select and adopt the best planning method. Accordingly the above-named administrations submit the proposal at Annex and urge its adoption by the Conference.

Annex : 1

ANNEX

STEPS IN THE DEVELOPMENT OF RULES
FOR DEALING WITH UNSATISFIED REQUIREMENTS

1. It is highly probable that even with the improved frequency utilization that will result from a changeover from Article 17 to a centralized, automated system of frequency planning there will still be occasions when the broadcasting requirements of administrations will exceed the capacity of the HF broadcasting bands. Rules will be necessary to deal with this situation.

2. Recognizing the difficulty of devising rules that would be acceptable to all administrations if they were at this stage to be regarded as definitive, or were to prejudge the success of an automated assignment system that has yet to be developed, or were to breach any point of principle that is important to administrations, an alternative approach is necessary. The alternative suggested for discussion is a set of "Provisional Rules" which could be tested and evaluated during the intersessional period by the IFRB and a Group of Experts from administrations. A report to the second session of the WARC would then help administrations to select and adopt the best set of rules that would serve all administrations equally. A set of "Provisional Rules" if adopted must be on the clear understanding that they do not limit administrations' freedom of action in preparing for or submitting proposals to the second session of the WARC.

3. The Provisional Rules proposed are as follows :

3.1 If the automated system cannot satisfy all requirements in a certain band, for a certain reception zone or part of a zone, in a specific period of time, even after all possibilities of adjustment within the automated system have been exhausted, the following methods shall be tested and evaluated :

a) Plan to satisfy, with the overall broadcasting reliability adopted by the Conference, as many requirements as possible, divided among all the administrations involved, first on an equal basis and second on a proportional basis. Include the remaining requirements in a Plan with a lower degree of reliability that is as close as possible to the value adopted by the Conference but without adversely affecting those requirements previously satisfied.

b) Plan to satisfy, with an overall broadcasting reliability of [x] (a variable to be evaluated by the system) for as many requirements as possible, divided among all the administrations involved, first on an equal basis, and second on a proportional basis. Include the remaining requirements in a Plan with a lower degree of reliability as close to [x] as possible without adversely affecting the requirements previously satisfied to the value of [x].

c) Progressively reduce the overall broadcasting reliability adopted by the Conference to a level needed to accommodate all requirements in a Plan. In so doing, evaluate the impact of adjusting other variables, e.g. signal/interference protection ratio, any flexibility inherent in the statement of administrations' requirements and the possibility of adjustments in terms of time blocks, frequency bands and other technical characteristics.

d) The impact of different frequency assignment strategies, e.g. segregating high power from low power and long distance from short distance requirements.

e) Such other techniques as the IFRB and experts from administrations may consider potentially useful.

3.2 The extent of testing any or all of these possibilities is a matter for technical judgement, however, in the conduct of the tests, the other texts adopted by the first session of the WARC shall be taken into account.

3.3 An objective report on the results of these tests and evaluations shall be submitted to the second session of the WARC.

3.4 Administrations should be invited to consider this report in preparing for the second session of the WARC.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document 200-E
8 February 1984

PL = Plenary meeting
C = Committee
WG = Working Group

LIST OF DOCUMENTS

(151 to 200)

No.	Origin	Title	Destination
151	S.G.	Position of the Conference accounts at 27 January 1984	C.3
152	CAN	Appropriate equivalent isotropically radiated power	C.4
153(Rev.1)	CAN, F	Resolution on the unauthorized use of HF band frequencies allocated to services other than broadcasting	C.4, C.5
154(Rev.1)	C.6	B.3	PL
155	C.4	Note by Committee 4 to the Editorial Committee	C.6
156	C.4, C.5	Summary record of the first joint meeting of Committees 4 and 5	C.4, C.5
157 + Corr.1 + Corr.2	C.6	R.2	PL
158	ad hoc WG/4G	Report of the ad hoc Working Group 4G to Committee 4	C.4
159	C.4	Summary record of the ninth meeting of Committee 4	C.4
160	C.4	Seventh series of texts from Committee 4 to the Editorial Committee	C.6
161	WG/5A	Report of Working Group 5A to Committee 5	C.5
162	C.6	R.3	PL
163	C.4, C.5	Note by Committees 4 and 5 to the Editorial Committee	C.6
164	C.3	Summary record of the fourth meeting of Committee 3	C.3
165	C.4	Summary record of the tenth meeting of Committee 4	C.4
166	C.4	Eight series of texts from Committee 4 to the Editorial Committee	C.6
167	C.4	Note by the Chairman of Committee 4 to the Chairman of Committee 5	C.5

No.	Origin	Title	Destination
168	C.6	B.4	PL
169	WG/5A	Second report of Working Group 5A to Committee 5	C.5
170	C.4	Note by Chairman of Committee 4 to the Editorial Committee	C.6
171 + Corr.1	C.4	Ninth series of texts from Committee 4 to the Editorial Committee	C.6
172 + Corr.1	C.4	Note by the Chairman of Committee 4 to the Chairman of Committee 5	C.5, PL
173	ad hoc WG/4D	Report of ad hoc Working Group 4D to Committee 4	C.4
174	PL	Minutes of the sixth Plenary meeting	PL
175	C.4	Second report of Committee 4 to the Plenary meeting	PL
176	HOL	Draft Resolution relating to the Avoidance of Harmful Interference with a View to Improving the Use of the HF Bands Allocated to the Broadcasting Service	C.5
177	C.6	B.5	PL
178	WG/2A	Fourth report of the Working Group 2A to Committee 2	C.2
179 + Corr.1	C.6	R.4	PL
180	U.N.	Information document	-
181	C.6	B.6	PL
182	C.5	First series of texts from Committee 5 to the Editorial Committee	C.6
183	C.5	First report of Committee 5 to the Plenary meeting	PL
184	S.G.	Considerations by the IFRB on the inter-sessional programme of work.	C.5
185	HOL, G	Supplementary proposals by the Kingdom of the Netherlands and the United Kingdom	C.5

No.	Origin	Title	Destination
186	S.G.	IFRB note on point 2 of Document DT/43(Rev.1)	C.5
187	PL	Minutes of the seventh Plenary meeting	PL
188	C.2	Summary record of the second meeting of Committee 2	C.2
189	USA	Additional alternative for dealing with incompatible requirements	C.5
190	ad hoc Group PL-B	Note by the Chairman of ad hoc Group PL-B to the Editorial Committee	C.6
191 + Corr.1	C.2	Report of Committee 2 to the Plenary meeting	PL
192	C.4	Note by the Chairman of Committee 4 to the Editorial Committee	C.6
193	WG/5A	Third and last report of Working Group 5A to Committee 5	C.5
194	S.G.	Position of the Conference accounts at 3 February 1984	C.3
195	Chairmen of Conference and Committee 4	Note by the Chairman of the Conference and the Chairman of Committee 4 to the Chairman of Committee 5	C.5
196	C.5	Summary record of the fifth meeting of Committee 5	C.5
197(Rev.1)	S.G.	Comments of the IFRB in relation to Document DT/47	C.5
198	C.6	B.7	PL
199	D, AUS, DNK, USA, FNL, JMC, J, NOR, POR and G	Objective testing and evaluation of planning methods	C.5
200	S.G.	List of documents	–