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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Document DL/1-E
10 January 1984

DRAFT

AGENDA

OF THE

MEETING OF HEADS OF DELEGATIONS

Tuesday, 10 January 1984, at 1030 hrs

(Room 2)

		Document No.
1.	Opening by the Secretary-General and designation of the Chairman of the meeting	-
2.	Approval of the agenda of the meeting	-
3.	Proposals for the election of the Chairman of the Conference	-
4.	Proposals for the election of the Vice-Chairmen of the Conference	-
5.	Conference structure	DT/1
6.	Proposals for the election of the Chairmen and Vice-Chairmen of the Committees	-
7.	Draft agenda of the first Plenary Meeting	DT/2
8.	Allocation of documents to Committees (draft)	DT/3
9.	Other business	

R.E. BUTLER
Secretary-General

Document DL/2-E
11 January 1984
Original : English/
French/
Spanish

COMMITTEE 4

DRAFT

REPORT 892 (MOD I)

COMPUTATION OF RELIABILITY FOR HF RADIO SYSTEMS

(Study Programme 28D/6)

(1982)

1. Introduction

The basic parameter given by most HF propagation prediction methods is the signal power or field strength. However, as is pointed out e.g. in Report 729 and in the Supplement to Report 252-2, signal-strength data are not sufficient to fully quantify the performance of a radio service.

A parameter which may conveniently be defined and used as a figure-of-merit is the ~~service~~ reception reliability. This is defined as the probability ~~that a specified value of signal-to-noise ratio is achieved or exceeded with a single frequency or by a combination of frequencies for a specified service.~~ for a single receptor that a specified performance is achieved by taking into account all transmitted frequencies. Related parameters are the circuit and mode reliabilities, defined respectively for a single frequency and a single propagation mode. These and other terms required for the purposes of this report are defined in ~~Annex~~ Appendix I.

Information on mode, circuit and ~~service~~ reception reliabilities is valuable in assessing such factors as the most important propagation modes for antenna-design optimization, preferred combinations of frequencies, and necessary transmitter powers to achieve a desired service specification.

The ability of a service to operate satisfactorily requires also that it perform adequately in the presence of co-channel and adjacent channel interference, as well as background noise. Related to the circuit and ~~service~~ reliabilities are the corresponding circuit and ~~service~~ reliabilities ~~(versus noise and interference)~~ expressed in terms of probabilities of exceeding a specified signal/(noise and interference) threshold.

overall reception reception

Hence, accurate methods are required to estimate the above parameters and ways need developing to use such data in radio system performance assessment studies. At the present time there are no agreed procedures which have been validated. This Report summarizes the current position and outlines the various methods in use.

2. Computation of mode reliability

Mode reliability R_m is defined in Appendix I. In many cases it may be approximated as the probability that a specified value of signal-to-noise ratio is achieved or exceeded by a specified mode at a single frequency for a single circuit. On the assumption that the probability of mode reflection is independent of signal strength:

$$R_m = P_r \cdot P(S/N) \qquad (1)$$

where P_r is the mode availability and $P(S/N)$ is the mode performance achievement. Equation (1) may be used to estimate R_m where $P(S/N)$ is determined from a signal-strength prediction procedure giving the median field strength for a sample restricted to those cases when reflection is judged to occur (e.g. the method of Report 252-2). Alternatively where the signal prediction gives the median for the whole of the time of interest (e.g. the methods of Report 894 and the Supplement to Report 252-2),

$$R_m = P'(S/N) \qquad (2)$$

where $P'(S/N)$ is the fraction of time that the signal-to-noise ratio exceeds the specified value. In the determination of $P(S/N)$ or $P'(S/N)$ the characteristics of the background noise may be obtained, for example, from Reports 322 and 258.

P_r is given from ——— § 4.2 of the Supplement to Report 252-2 as:

(i) for $f \leq f_m$

$$P_r = 1.3 - \frac{0.8}{1 + \left(\frac{1 - \frac{f}{f_m}}{1 - F_\ell} \right)} \leq 1 \qquad (3a)$$

(ii) for $f > f_m$

$$P_r = \frac{0.8}{1 + \left(\frac{\frac{f}{f_m} - 1}{F_u - 1} \right)^{-0.3}} \geq 0 \qquad (3b)$$

where f = wave frequency
f_m = monthly median mode basic MUF
F_u = ratio of the upper decile to the median mode basic MUF
and F_ℓ = ratio of the lower decile to the median mode basic MUF

If mode reliability is evaluated over a given month at a particular hour of day, then from equations of Bradley and Bedford [1976]:

(i) for $S/N \leq (S/N)_m$

$$P(S/N) = 1.3 - \frac{0.8}{1 + \left(\frac{(S/N)_m - S/N}{G_\ell} \right)} \leq 1 \qquad (4a)$$

(ii) for $S/N > (S/N)_m$

$$P(S/N) = \frac{0.8}{1 + \left(\frac{S/N - (S/N)_m}{G_u} \right)} - 0.3 \geq 0 \qquad (4b)$$

where (S/N) = specified value of signal-to-noise ratio (dB)

and $(S/N)_m$ = estimated monthly median signal-to-noise ratio (dB)

On the assumption that the signal and noise amplitude variations are uncorrelated:

$$G_u = \sqrt{S_{uh}^2 + S_{ud}^2 + N_{\ell h}^2 + N_{\ell d}^2} \quad (dB) \qquad (5a)$$

and

$$G_\ell = \sqrt{S_{\ell h}^2 + S_{\ell d}^2 + N_{uh}^2 + N_{ud}^2} \quad (dB) \qquad (5b)$$

with

$S_{uh}(N_{uh})$ = signal (noise) upper decile deviation from the hourly median field strength arising from within-an-hour changes (dB)

$S_{\ell h}(N_{\ell h})$ = signal (noise) lower decile deviation from the hourly median field strength arising from within-an-hour changes (dB)

$S_{ud}(N_{ud})$ = signal (noise) upper decile deviation from the monthly median field strength arising from day-to-day changes (dB)

$S_{\ell d}(N_{\ell d})$ = signal (noise) lower decile deviation from the monthly median field strength arising from day-to-day changes (dB).

Calculations showing the dependence on frequency of mode reliability have been presented by Bradley and Lockwood [1982] for the case when signal transmission loss includes a term for 'above-the-MUF' loss dependent on the ratio of the wave frequency to the mode basic MUF and another term for the absorption loss in decibels inversely proportional to the square of frequency. The analysis provides a way of combining the effects of day-to-day changes in basic MUF affecting mode support with the day-to-day changes in the other loss terms. Bradley [1983] has shown that for frequencies above the monthly median basic MUF, mode support is the dominant factor controlling mode reliability.

3. Methods of computation of HF circuit reliability in terms of signal-to-noise ratio

For the general case of n possible modes labelled i, j, k,... where $q_{ijk...s}$ is the probability that all r modes labelled i, j, k...s are simultaneously present and $P_{ijk...s}$ is the probability that these modes together when present lead to the required signal/noise ratio being exceeded, the circuit reliability R_c is given [CCIR, 1982-86] as:

$$R_c = \sum_{1}^{n_{C_1}} q_i P_i + \sum_{1}^{n_{C_2}} q_{ij} P_{ij} + \ldots\ldots\ldots + \sum_{1}^{n_{C_r}} q_{ijk\ldots s} P_{ijk\ldots s}$$

$$+ \ldots\ldots + q_{123\ldots n} P_{123\ldots n} \qquad (6)$$

The circuit reliability depends not only on the separate mode availabilities and signal/noise achievement probabilities, but also on the correlation among the mode occurrences and the correlation among the mode strengths. The likelihood of three or more modes having comparable amplitudes with each mode contributing significantly to the circuit reliability is low and so in practice the most important case is that when only two modes are considered. Equation (6) then gives:

$$R_c = q_1 P_1 + q_2 P_2 + q_{12} P_{12} \qquad (7)$$

Unfortunately the evaluation of equation (7) involves double integral expressions for q_{12} and P_{12} making this too lengthy a procedure for routine prediction applications. Accordingly, simplified and approximate methods are required.

Several methods are available to estimate the circuit reliability under specified working conditions.

3.1 *Method 1 (HFMUFES)*

Barghausen *et al.* [1969] compute the circuit reliability as the product of the maximum value for each of P_r and $P_{S/N}$. The two values P_r and $P_{S/N}$ used in the computation do not need to be associated with the same mode of propagation.

3.2 *Method 2 (IONCAP)*

In the IONCAP prediction programme, the combined signal power for all modes is computed by summing the powers in each mode. This summation assumes that the signals propagated via different modes exhibit random phases with respect to each other. The signal-to-noise ratio is taken to have as its mean value the difference of the means for the signal and the noise, and as its variance the sum of the variances of the signal and the noise. The circuit reliability is calculated as the percentage of days within a month that the signal-to-noise ratio equals or exceeds that required. In this method no account is directly taken of the fraction of days when the modes are reflected by the ionosphere. The assumption inherent in this conveniently simple approach is that adopted values of day-to-day variations of signal power based on observed data automatically include allowances for ionospheric variability affecting mode support.

3.3 *Method 3*

In the method described by Chernov [1969a], circuit reliability (versus noise and interference) is calculated assuming that the interference is significantly greater than the noise. The statistical laws of signal and interference distributions are taken into consideration as well as prediction uncertainties in estimates of the median power flux-densities of both the signal and interference.

3.4 *Method 4*

In this method, circuit reliability is calculated by averaging between two extremes, one of which is an under-estimate and the other of which is an over-estimate. The under-estimate is the reliability $P_r \cdot P_{S/N}$ of the single mode with the largest reliability, ignoring all other modes. The over-estimate is the assumption that all modes are statistically independent, so that the probability of successful communication by at least one mode is equal to one minus the product of the probabilities that each mode fails to provide communication. In the absence of adequate information concerning the correlation between modes, averaging these two estimates appears to provide a reasonable single estimate of circuit reliability.

3.5 *Method 5 (CRC)*

A method used with the CRC (Canadian) prediction system combines the modes being propagated in a different way [Petrie, 1981]. Based on the premise that reflection of a high order hop necessitates reflection of lower order hops, the probability density of signal power can be computed for various combination of modes. The mean signal power for each combination is determined by summing the appropriate individual powers. This summation assumes that the signals propagated via different modes are independent

The resultant distribution function for the signal power *P(S)* for all combinations of modes is determined by summing the distribution functions for each of the combinations. From a knowledge of the distribution function of the noise power *P(N)* the circuit reliability is computed for a required signal-to-noise ratio, based on the assumption that *P(S)* is independent of *P(N)*. Signal and noise powers are both assumed to have normal distributions.

3.6 *Method 6 (Maslin)*

Maslin [1978] has discussed possible approaches to the summation of mode reliabilities for different modes in order to give estimates of circuit reliability. Signal powers are additive assuming the separate components have random relative phases. In general, a correct allowance for ionospheric reflection of the signal must assume some degree of correlation between the different modes which depends on the spatial correlation between day-to-day ionization changes. Expressions are given for the case of uncorrelated modes and modes of given correlation coefficient.

3.7 Method 7 [CCIR, 1982-86]

This method [CCIR, 1982-86] assumes that daily values of basic MUF and signal/noise ratio (expressed in decibels) follow a normal distribution. An approximation is applied for the bivariate normal distribution and the signal power from the separate modes is assumed to sum, ignoring any correlation in strength. The fraction of occasions that the signal/noise ratio exceeds that specified when the separate mode contributions do not is also ignored. When the mode MUF's have correlation coefficient ρ_{12}, then equation (7) becomes:

$$R_c = Q_1 P_1 + Q_2 P_2 \left\{ 1 - \left[\rho_{12}^2 + (1 - \rho_{12}^2) Q_1 \right] P_1 \right\} \qquad (8)$$

Here Q_1 is the probability that mode 1 is present either alone or together with mode 2 and Q_2 is the probability that mode 2 is present either alone or together with mode 1. The modes are chosen so that Q_1 exceeds Q_2.

In the case of two F_2 modes it is suggested that equation (8) be used with $\rho_{12} = 0.8$.

For modes reflected from different layers (except the case of the E and F_1 layers), these are taken as uncorrelated ($\rho_{12} = 0$) giving :

$$R_c = Q_1 P_1 + Q_2 P_2 (1 - Q_1 P_1) \qquad (9)$$

For two completely correlated modes ($\rho_{12} = 1$), such as two E modes or an E and F_1 mode, then equation (8) simplifies to:

$$R_c = Q_1 P_1 + Q_2 P_2 (1 - P_1) \qquad (10)$$

4. Comparison of methods of determining circuit reliability

For assumed χ^2 variations of day-to-day values of basic MUF and of the composite of all other loss factors, comparisons of values of circuit reliability given by the method of Bradley and Lockwood [1982] in the case when only one mode is present, have been compared with corresponding figures given by methods 1 and 2. Results for method 2 generally agree to within 0.1, but method 1, based on the product of two probabilities, seriously underestimates the reliability at frequencies above the monthly median basic MUF.

The circuit reliabilities calculated by methods 1, 4 and 5 were compared for a variety of assumed signal levels and signal-to-noise ratios for 2 or 3 modes. For ease of computation, a normal distribution function was used to describe the day-to-day variation of the signal power about the monthly median value for all three methods. In all computations the monthly standard deviations of the signal and of the noise were each assumed to be 7 dB. The median difference and its associated upper and lower decile range between the reliability computed by method 5 and by both of the other methods are as follows:

TABLE I

	Method 5-Method 1	Method 5-Method 4
Median difference	+0.01	0.00
Upper decile range	0.06	0.03
Lower decile range	0.13	0.06

While the median differences are small for both cases, the decile ranges for method 1 are nearly double those for method 4. The computation time for method 5 is considerably longer than that for methods 1 and 4.

Method 3, which takes the interference into account, gives lower values of reliability than other methods which do not allow for interference.

5. Computation of ~~service~~ reception reliability

HF ~~service~~ reliability is analogous to circuit reliability, but assumes that either a choice may be made among several frequency assignments or that a combination of frequencies may be used. Several methods that have been suggested for the calculation of ~~service~~ reliability are outlined below.

5.1 *Method 3*

When transmitting the same information at several frequencies simultaneously, this method estimates the probability of satisfactory reception on at least one frequency by supposing that the signal/(noise and interference) ratios at the different frequencies are uncorrelated [Chernov, 1969b]. This assumption holds particularly when interference from other stations is present.

5.2 *Method 4*

In a manner analogous to the calculation of circuit reliability, pessimistic and optimistic estimates of ~~service~~ reception reliability are computed for each set of frequencies being considered for a HF circuit.

For each set, the circuit reliabilities possible on each frequency are examined for a specific period and the maximum reliability is selected. This underestimates the ~~service~~ reception reliability because it assumes no contribution from any other frequency. An optimistic value of the ~~service~~ reception reliability can be computed by assuming that the circuit reliabilites for each frequency are independent. The estimated ~~service~~ reception reliability is taken as the average of these two values.

5.3 *Method 5*

To compute ~~service~~ reception reliability for various combinations of frequencies, this method uses basic mode information, based on the additional assumption that reflection at one frequency via a given mode implies reflection at a lower frequency via the same mode.

6. Operational use of reliability estimates

The ~~service~~ reception reliability information obtained in one of the above way may be used to choose appropriate frequency bands for the required high frequency service. The optimum single frequency is determined by computing for each frequency the average circuit reliability for the time periods considered and selecting the frequency having the maximum average reliability.

The optimum one-, two-, three-band, etc. complement, without considering interference is chosen to be the one that has the maximum average ~~service~~ reception reliability over the trial periods being considered. The reliabilities determined for these complements may then be compared. That complement which achieves the required reliability with the minimum number of frequency bands may be selected to satisfy the particular high frequency service requirement.

For frequency assignment, the effect of interference must be considered, and overall circuit and ~~service~~ reception reliabilities (versus noise and interference) may be used (see Annex I). Assignments within the bands identified previously may be made in such a way as to maximize the overall ~~service~~ reception reliability (versus noise and interference).

7. Summary

Several methods to compute the circuit and ~~service~~ reception reliabilities of a HF radio system have been reviewed in this report. These methods require further investigation, concerning both their accuracy and the ease with which they may be implemented in prediction methods.

REFERENCES

BARGHAUSEN, A. F., FINNEY, J. W., PROCTOR, L. L. and SCHULTZ, L. D. [1969] Predicting long-term operational parameters of high-frequency sky-wave telecommunication systems, ESSA Tech. Rep. ERL 110-ITS 78, US Govt. Printing Office, Washington, DC 20402.

BRADLEY, P.A. [1983] Signal and noise variability in high frequency sky-wave radio service planning. AGARD Conf. Proc. No. CP332, 10-1 to 10-13. Propagation effects of frequency sharing and interference. Ed. H. Soicher.

BRADLEY, P.A. and BEDFORD, C. [1976] Prediction of HF circuit availability. Electron. Lett., 12, 32-33.

BRADLEY, P. A. and LOCKWOOD, M. [1982] Simplified estimation of HF sky-wave signal intensity and mode reliability IEE Conf. Proc. No. 206, 60-67.

CHERNOV, Yu. A. [1969a] Nadiodznost kanala radioveshania (Broadcasting channel reliability) *Trudy NIIR*, 1, 131-139

CHERNOV, Yu. A. [1969b] Nadiodznost setei radioveshania na corotkih i srednih volnah (Reliability of broadcasting networks for HF and MF transmissions) *Trudy NIIR*, 2, 115-123

MASLIN, N. M. [1978] The calculation of circuit reliability when a number of propagation modes are present CCIR WP 6/1, Doc. 79.

PETRIE, L. E. [1981] Selection of a best frequency complement for HF communications. Communications Research Centre, Dept. of Communications Contract Report No. OER80-00339, Ottawa, Ontario, Canada.

CCIR Documents

[1982-86]: 6/45 (China/United Kingdom).

APPENDIX I

For the purposes of this Report, the following definitions are appropriate :

1. Terms relevant to the operation and design of HF radio systems

Reliability

Probability that a specified performance is achieved.

Circuit reliability

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

Reception reliability

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

Service reliability

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

Note 1.- 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 2.- 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 3.- For many applications it is convenient to adopt a given value of signal-to-background ratio as the specified performance.

Note 4.- The above terms relate to one or more periods of time which should be stated.

Note 5.- For a given radio service the definitions contained above may need to be adapted to the requirements of that service.

2. Terms relevant to prediction techniques

Mode reliability

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

Mode availability

Probability for a single circuit that a single mode at a single frequency can propagate by ionospheric refraction alone.

Mode performance achievement

Probability for a single circuit that a specified performance is achieved by a single mode at a single frequency given that the mode can propagate by ionospheric refraction alone.

Note.- Notes 3 and 4 of ——— § 1 apply.

J. RUTKOWSKI
Chairman of Committee 4

Document No. DL/3-E
17 June 1983
English only

REPORT OF AD HOC DRAFTING GROUP ON NECESSARY BANDWIDTH TO WORKING GROUP 4B

The Drafting Group met for the purpose of proposing a text for section 3.8 of Annex 8 to Appendix 30. The input documents were Documents Nos. 11, 13, 15, 20 and DT/7.

The necessary bandwidths considered are as follows for :

- 625 line systems in Regions 1 and 3 : 27 MHz;
- 525 line systems in Region 3 : 27 MHz.

In Region 2, the plan is based on a channel bandwidth of 24 MHz, /~but different bandwidths may be implemented in accordance with the provisions of these Final Acts~/.

(The Administration of France wishes to provide documentation to the Conference for planning purposes concerning the performance of their intended signals in a Region 2 environment.)

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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French

PL-A

Note by the Chairman

I attach herewith a draft outline structure of the report of the first session of the Conference. The section dealing with technical criteria has been drafted in some detail bearing in mind the need for Committee 4 to have it as quickly as possible. Other sections would need to be similarly drawn up in due course.

K. BJÖRNSJO
Chairman

Annex : 1

ANNEX

DRAFT STRUCTURE OF THE REPORT ON THE FIRST SESSION OF THE CONFERENCE

1. Introduction (Preamble - Background of the Conference)

(to be drafted)

2. Technical criteria

2.1 Definitions

2.2 Propagation, radio noise and solar indices

2.2.1 Methods to be used to predict field strength, optimum frequencies

2.2.2 Data on atmospheric and man-made radio noise

2.2.3 Other HF propagation factors which affect the planning of broadcasting services

2.2.4 Values of appropriate solar indices and seasonal periods to serve as a basis for planning

2.3 Specifications of a DSB system, transmission characteristics, including modulation standards and audio-frequencies, receiver characteristics

2.4 Audio-frequency protection ratio and channel spacing

2.5 Minimum usable and nominal field strength values required for satisfactory service

2.6 Antennas and powers :

2.6.1 Antenna characteristics

2.6.2 Transmitter power and effective radiated power to ensure satisfactory service

2.7 Maximum number of frequencies to be used for broadcasting the same programme to the same zone

2.8 Use of synchronized transmitters

2.9 Reception zones

2.10 SSB system specifications and technical aspects of the progressive introduction of SSB transmissions

2.10.1 SSB system specifications

2.10.2 Programme for the progressive introduction of SSB transmissions

3. Planning principles and method

4. Work to be done between the two sessions of the Conference

Annexes (to include : Resolutions, Recommendations and a list of ITU Member countries which participated in the first session)

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

Document DL/5-E
12 January 1984

PL-A

Note by the Secretary-General

I attach herewith for information copies of the Table of Contents of the Reports of the following Conferences :

1. EARC for the Aeronautical Service (R) - First Session 1964;
2. RARC for LF/MF Broadcasting (Regions 1 and 3) - First Session 1974;
3. RARC for MF Broadcasting (Region 2) - First Session 1980.

R.E. BUTLER
Secretary-General

Annexes : 3

ANNEX 1

EXTRAORDINARY ADMINISTRATIVE RADIO CONFERENCE
FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN
FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

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REGIONAL ADMINISTRATIVE LF/MF
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REGIONAL ADMINISTRATIVE MF BROADCASTING CONFERENCE (REGION 2) FIRST SESSION, BUENOS AIRES, 1980

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* Not published in the present Report

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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COMMITTEE 3

Information Note to Chairmen of Committees 4 and 5

At its first meeting, Committee 3 took particular note of Article 80 and Resolution 48 of the Convention which were conveniently reproduced in Document 41 by the Secretary-General. The Committee recognized that under these provisions of the Convention, conferences were required to, inter alia, before adopting Resolutions or taking decisions which are likely to result in additional and unforeseen demands upon the budgets of the Union :

1) prepare and take into account estimates of the additional demands made on the budgets of the Union;

2) where two or more proposals are involved, arrange them in an order of priority;

3) prepare and submit to the Administrative Council a statement of the estimated budgetary impact, together with a summary of the significance and benefit to the Union of financing the implementation of those decisions and an indication of priorities where appropriate.

Based on these provisions of the Convention, Committee 3 has taken account of the fact that the first session will generally not be taking decisions that will have a long term budgetary impact, and has concluded that the main budgetary impact from the first session will most likely be related to the inter-sessional work of the IFRB, the requirement for studies to be undertaken by the CCIR especially if these studies require an early completion date and cannot be done within the regular CCIR study period, and any other inter-sessional activities such as the establishment of a Group of Experts.

Based on this conclusion, Committee 3 recommends that, in their work Committees 4 and 5 should :

1) be prudent in their identification of any inter-sessional activities which will have a budgetary impact;

2) in the event that decisions are taken which may have a budgetary impact, send an information note to Committee 3 at the earliest opportunity describing the nature of the decision and if possible providing an outline of the estimated cost of implementing the decision.

E.D. DUCHARME
Chairman of Committee 3

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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AD-HOC GROUP 5A-2

Please find below a list of topics for discussion :

1) Is there going to be a Master List?

2) What is the period of validity?

3) Is the List open or closed?

4) What is the machinery for subsequent Lists?

5) What should be in the List?

6) Should the Conference examine the compatibilities?

7) What machinery should be put in place to solve the incompatibilities for the first List?

8) What machinery should be put in place to solve the incompatibilities in subsequent Lists?

9) How to use the Master List to produce the periodical Plan?

G.H. RAILTON
Chairman of ad-hoc Group 5A-2

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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20 January 1984
Original: English

AD HOC 5A-2 GROUP

Participants in Ad-Hoc 5A2 Group

Algeria, Argentina, Brazil, Canada, China, United States, India, Iran, Japan, Papua New Guinea, Netherlands, United Kingdom, Senegal, USSR.

Terms of reference

Based on the documents submitted from Administrations taking into account the findings of Working Group 5A. Ad-Hoc 5A-2 Group will prepare a working document giving a single planning method.

Propose a text for the principles that have not yet been adopted: 2.3, 2.4, 2.8, 2.10 and 2.11 from Document No. DT/10 (Rev.1).

C.H. Railton
Chairman of Ad-Hoc 5A-2 Group

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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DRAFTING GROUP 4A-2

BASIC CIRCUIT RELIABILITY

The process for calculating basic circuit reliability is indicated in Table 1. The monthly median of hourly median wanted signal level at step (1) is provided by the signal strength prediction method. The upper and lower decile values ((2) through (5)) are also provided, taking account of long-term (day-to-day) and short-term (within the hour) fading. From steps (6) to (10) consideration is given to :

i) atmospheric noise;

ii) man-made noise;

iii) intrinsic receiver noise;

and at step (11) the monthly median field strength of hourly median noise intensity is taken as the greatest of the three components. The values of signal and noise desired at steps (1) and (11) are then combined at step (12) in order to derive the monthly median of hourly median signal-to-noise ratio, SNR(50).

At step (13), $D(N_T)$ describes the variability of the radio noise and a value of 3 dB is taken for both the upper and lower decile. The upper and lower deciles of signal-to-noise ratio are then calculated in steps (14) and (15) in order to derive the signal-to-noise ratios exceeded for 10% and 90% of days (steps (16) and (17)). 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 (19), which is the value of probability corresponding to the required signal-to-noise ratio (18).

A mathematical treatment of the calculation can be given in terms of probability density functions of 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 dB (μV/m)	Median field strength of wanted signal	Prediction method (Chapter [3])
(2)	$D_U(S)$ dB	Upper decile of slow fading signal (day-to-day)	(Chapter [4]), (Table [4-1])
(3)	$D_L(S)$ dB	Lower decile of slow fading signal (day-to-day)	(Chapter [4]), (Table [4-1])
(4)	$D_U(F)$ dB	Upper decile of fast fading signal (within the hour)	[8] dB (section [4.1.2.1])
(5)	$D_L(F)$ dB	Lower decile of fast fading signal (within the hour)	[5] dB (section [4.1.2.1])
(6)	$F_a(A)$	Noise factor for atmospheric noise	Atmospheric noise maps (Report 322)
(7)	N_A dB (μV/m)	Median field strength of atmospheric noise	65.5-20 log f + 10 log f (Report 322)
(8)	$F_a(M)$	Noise factor for man-made noise	(section [ ]) (curve [ ], Report 258-4)
(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	[43] 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 (7), (9), (10). (section [414])
(12)	SNR(50) dB	Median signal-to-noise ratio	$E_W - N_T$
(13)	$D(N_T)$ dB	Decile of total radio noise	[3] dB
(14)	$D_U(SNR)$ dB	Upper decile of signal-to-noise ratio	$\sqrt{D_U(S)^2 + D_U(F)^2 + D(N_T)^2}$
(15)	$D_L(SNR)$ dB	Lower decile of signal-to-noise ratio	$\sqrt{D_L(S)^2 + D_L(F)^2 + D(N_T)^2}$
(16)	SNR(10) dB	Signal-to-noise ratio exceeded 10% of time	SNR(50) + $D_U(SNR)$
(17)	SNR(90) dB	Signal-to-noise ratio exceeded 90% of time	SNR(50) - $D_L(SNR)$
(18)	Q dB	Required signal-to-noise ratio	[section 7.2.2]
(19)	R_c%	Basic circuit reliability	[Figure 1]

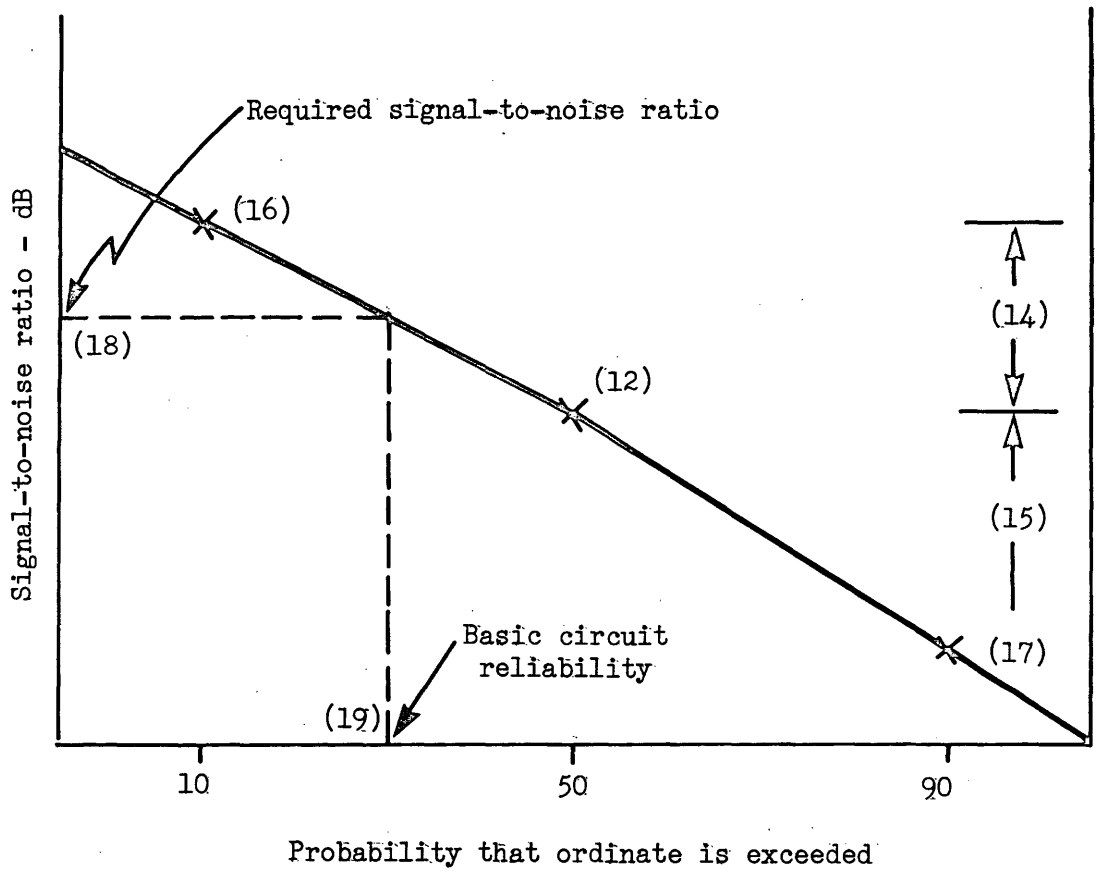
Required signal-to-noise ratio
(16)
(18)
(12)
(14)
(15)
(17)
Basic circuit reliability
(19)
Signal-to-noise ratio - dB
10
50
90
Probability that ordinate is exceeded

FIGURE 1

When $E_W - N_T \leq G$, the circuit reliability is given by the expression :

$$R_c = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\gamma} \ell^{-t^2/2} \, dB$$

$$\gamma = \frac{E_W - N_T - G}{\sigma_L}$$

$$\sigma_L = D_L(SNR)/1.282$$

When $E_W - N_T > G$, the circuit reliability is given by the expression :

$$R_c = .5 + \frac{1}{\sqrt{2\pi}} \int_{o}^{\gamma} \ell^{-t^2/2} \, dB$$

$$\gamma = \frac{E_W - N_T - G}{\sigma_U}$$

$$\sigma_U = D_U(SNR)/1.282$$

TABLE 2

Overall circuit reliability

	DESCRIPTION	SOURCE
1	Median field strength of wanted signal	Prediction Met. Chapter 3
2	Upper decile of slow fading signal (DAY-TO-DAY)	Prediction Met. Chapter 3
3	Lower decile of slow fading signal (DAY-TO-DAY)	Prediction Met. Chapter 3
4	Upper decile of fast fading signal (within the hour)	Chapter 4 section 4.1.2.1
5	Lower decile of fast fading signal (within the hour)	Chapter 4 section 4.1.2.1
6	Median field strength of unwanted signal or interference $I_m = \sqrt{I_1^2 + I_2^2 + I_3}$	Prediction Chapter 3
7	Upper decile of slow fading interference (Decile of strongest interference)	Prediction Chapter 3
8	Lower decile of slow fading interference (Decile of strongest interference)	Prediction Chapter 3
9	Upper decile of fast fading interference	Chapter 4 section 4.1.2.1
10	Lower decile of fast fading interference	Chapter 4 section 4.1.2.1
11	Median signal to interference ratio	1 - 6
12	Upper decile of signal-to-interference	$\sqrt{(2)^2 + (4)^2 + (8)^2 + (10)^2}$
13	Lower decile of signal-to-interference	$\sqrt{(3)^2 + (5)^2 + (7)^2 + (9)^2}$
14	Signal-to-interference ratio exceeded 90% of the time	11 - 13
15	Signal-to-interference ratio exceeded 10% of the time	11 + 12
16	Required S/I ratio	Chapter 6 section 6.1.2
17	Circuit reliability in presence of interference	See Figure 2
18	Basic circuit reliability	See Figure 1
19	Overall circuit reliability	Min of 17 and 18

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
(2)	BRR (F_1) %	Basic reception reliability	(1)

Two frequency operation

(3)	BCR (F_2) %	Basic circuit reliability for frequency F_2	Line 18, Table 1
(4)	BRR (F_1) (F_2)	Basic reception reliability (F_1) + (F_2) in same band	Greater of (1) or (3)
(5)	BRR (F_1); (F_2)	Basic reception reliability (F_1) + (F_2) in different bands	$\frac{(1) + (3) - (1)\,(3) + (4)}{2}$

TABLE 3 (continued)

Basic reception reliability

Three frequency operation

Step	Parameter	Description	Source
(6)	BCR (F_3)	Basic circuit reliability for F_3	Line 18, Table 1
(7)	BRR (F_1) (F_2) (F_3)	Basic reception reliability all frequencies in the same band	Greater of (1), (3) or (6)
(8)	BRR (F_1) (F_2); (F_3)	Basic reception reliability F_1 + F_2 in same band F_3 in different band	$\frac{(4) + (6) - (4)\ (6) + (7)}{2}$
(9)	BRR (F_1); (F_2); (F_3)	Basic reception reliability F_1; F_2 + F_3 all in different bands	$\frac{1 - [1 - (1)]\ [1 - (3)]\ [1 - (6)] + (7)}{2}$

TABLE 4

Overall reception reliability

One frequency operation

Step	Parameter	Description	Source
(1)	OCR (F_1)	Overall circuit reliability for F_1	Table 2
(2)	ORR (F_1)	Overall reception reliability for F_1	(1)

Two frequency operation

(3)	OCR (F_2)	Overall circuit reliability for F_2	Table 2
(4)	ORR (F_1); (F_2)	Overall reception reliability for F_1 and F_2 in same band or different bands	$\frac{(1) + (3) - (1)\,(3) + \text{Max}\ [(1), (3)]}{2}$

Three frequency operation

(5)	OCR (F_3)	Overall circuit reliability for F_3	Table 2
(6)	ORR (F_1); (F_2); (F_3)	Overall reception reliability for F_1, F_2, F_3 in same band or different bands	$\frac{1 - [1 - (1)][1 - (3)][1 - (5)] + \text{Max}\ [(1), (3), (5)]}{2}$

TABLE 5

Basic broadcast reliability

The following parameters are involved :

Step	Parameter	Description	Source
(1)	BRR $L_1 -- L_N$	Basic reception reliability at all receiving locations considered in the broadcast area	Line (2); (5) or (9) as appropriate from Table 3
(2)	BBR (X)	Basic broadcast reliability associated with percentile X	Any percentile chosen from the ranked values from (1)

TABLE 6

Overall broadcast reliability

The following parameters are involved :

Step	Parameter	Description	Source
(1)	ORR $L_1 -- L_N$	Overall reception reliability at all reception locations considered in the broadcast area	Appropriate line 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

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AD HOC GROUP 5A-2

SYNTHESIS OF DISCUSSIONS OF THE FIRST TWO MEETINGS OF AD HOC GROUP 5A-2

Ad hoc Group 5A-2 has met twice and has addressed the following questions.

- Is there going to be a Master List?
- What is the period of validity?
- Is the List open or closed?
- What is the machinery for subsequent Lists?
- Should the Conference (Second Session) examine the compatibilities?

In discussing the above questions the related subjects were also to some extent discussed. Arising from the discussions the following points are extracted from the Chairman's notes of the proceedings. They do not represent firm conclusions but areas where agreement appeared to be forthcoming.

a) There was general agreement that the HF Broadcasting Schedule should be prepared on a seasonal basis and that the IFRB should carry out this process once or twice a year.

b) A Master List may be a useful tool in the planning process, however, its utility will depend on the planning method adopted. Some planning methods do not require a Master List while for others it is fundamental.

c) Such a Master List could not be fully closed nor fully open. Some modification procedure would be required to allow flexibility yet preserve the guarantee of service to existing users.

d) There appeared agreement that the List should be closed at least for a period equal to the period of duration of the HF Broadcasting Schedule. That is six months to one year.

e) The validity of the List should, as envisaged in some planning proposals, be between one and five years.

f) The method of revalidation of any List would be dependent on the time frames involved. If a List was five years long then a short coordination conference would be a possible solution should the situation demand it. For short periods automatic optimization along with coordination of the submitted /requirements/ would provide the new Lists.

g) The Second Session of the Conference should draw up changes to the Radio Regulations based on the planning method and the technical criteria established at this Conference. The planning principles should not be open for review.

h) One viewpoint was that the planning method adopted should be open to review at the Second Session. The other viewpoint was that apart from some "streamlining" the planning method should not be open for review but the technical criteria adjusted to ensure that the planning method could accommodate the / requirements / of administrations.

i) The Second Session should test the planning method.

j) One viewpoint was that the first four Broadcast Schedules should be open for coordination as the Conference provides a suitable multilateral coordination forum. Another viewpoint was that a larger number of Broadcast Schedules should be tested for agreement by all parties. There was also a viewpoint that the Second Session should not attempt coordination of Broadcast Schedules.

k) The computer requirements and the financial requirements will have to be taken into account in the establishment of the planning method.

G.H. RAILTON
Chairman of ad hoc Group 5A-2

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PRINCIPLES TO BE DISCUSSED

2.3 The treatment of the requirements referred to in paragraphs 2.1 and 2.2 above could require the definition of a unit of measure that may serve the purpose of evaluating their degree of satisfaction.

2.4 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.

2.8 AUT/15/2 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.

2.10 a) A.12.1.1.4 Proportionally restricted protection

Those 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 only proportionally reduced protection.

2.10 b) B/55/19 4. Proportionally restricted protection

Those requirements for which, through lack of the requisite technical facilities, the agreed field strength used as a basis for planning (Emin) is not ensured in the required service area, could obtain only proportionally reduced protection. (Provided that the technical criteria would be adopted compatibly with the different economical situation of the countries.)

2.11 IRA/56/27, paragraph 5 :

5. Submission of realistic requirements

All administrations should realistically submit their minimum requirements to the Conference, necessary limitation may be laid down by the Conference if required so.

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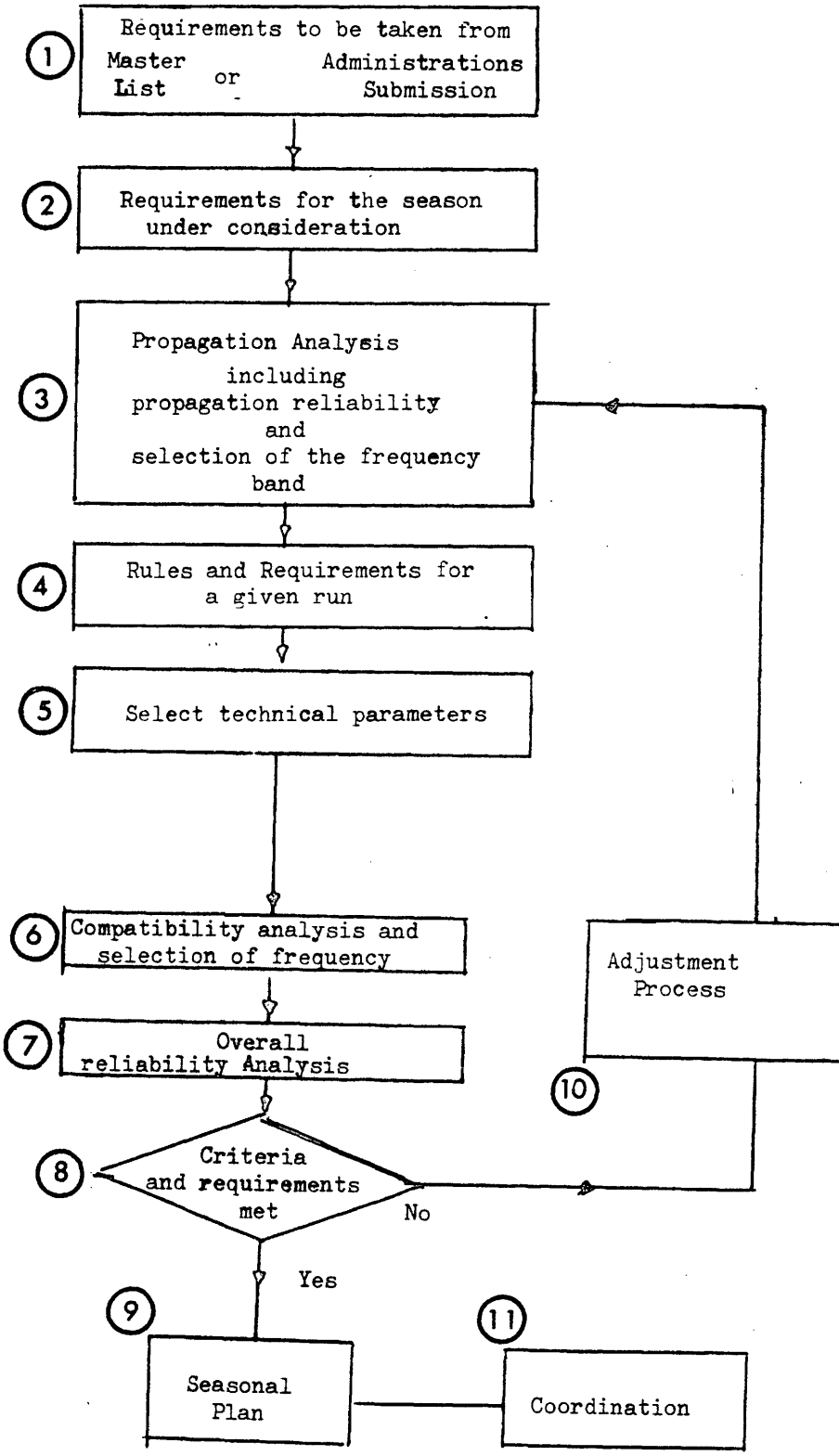
French

AD-HOC GROUP 5A2

SUMMARY PROCESS FOR DEVELOPPING A SEASONAL PLAN



G.H. RAILTON
Chairman of Ad-Hoc Group 5A2

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

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AD HOC GROUP 4B-7

Draft

REPORT OF DRAFTING GROUP 4B-7

TO WORKING GROUP 4B

After lengthy discussion, the Group proposes for the purpose of determining test points a grid of points based on a spacing of 10/3 degrees in latitude and longitude for areas of land between 60°N and 60°S and a less dense grid over the polar regions and maritime areas. Figure 1 is an example of such a grid superimposed on a world map sub-divided into CIRAF zones. There are approximately 2,000 points on this map.

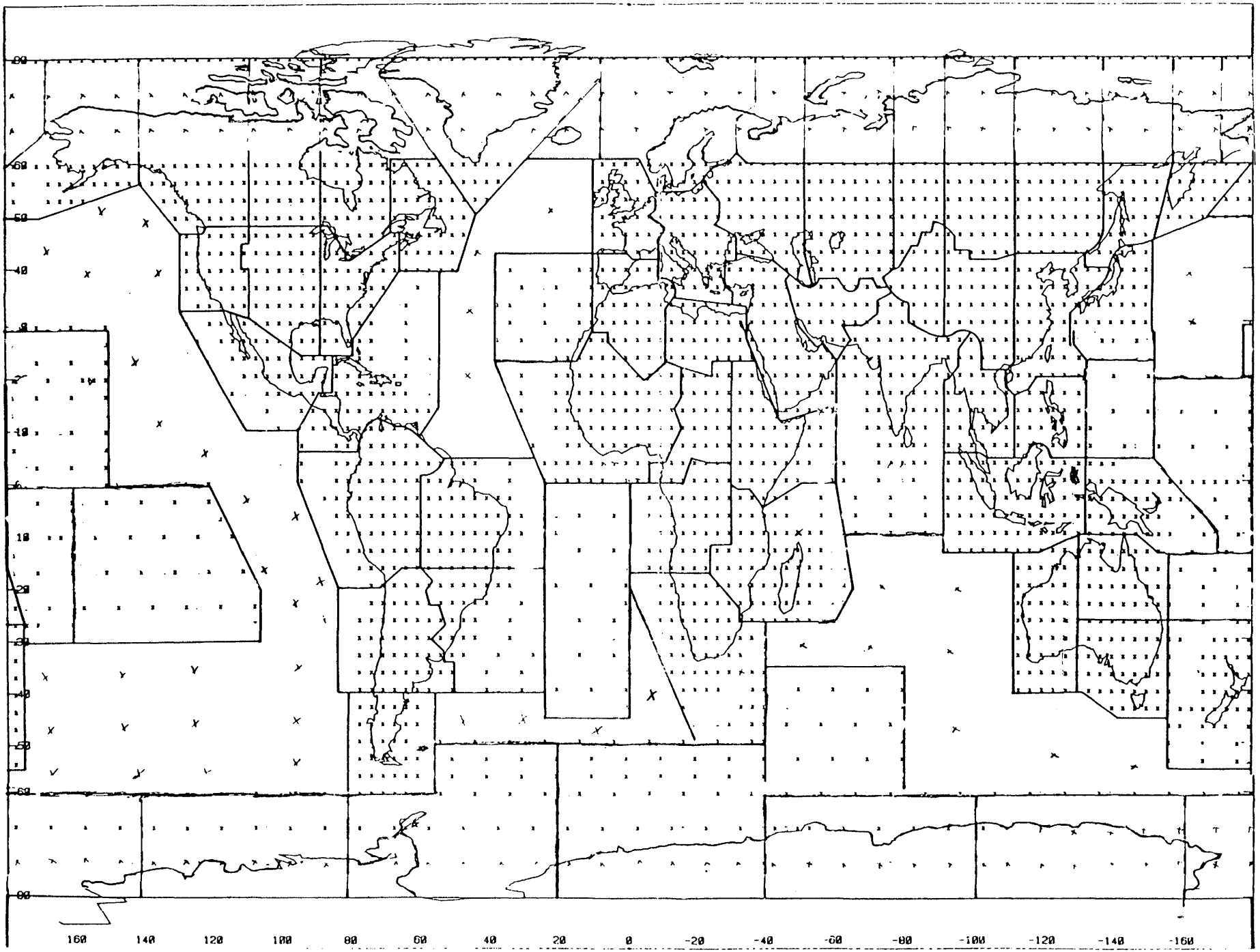
The principle purpose of proposing such a set of points is to ensure that the feasibility of establishing the required service will be evaluated with a prospect of success. If test points only exist outside the intended service area neither the wanted signal nor the ratio of wanted to unwanted signal will be correctly represented.

By sub-dividing the CIRAF zones, it will be possible to define more precisely the service area of a transmission. A sufficient number of test points within these sub-divisions will therefore ensure that a realistic evaluation of the service will be made.

The smallest sub-division of a reception zone proposed is one-fourth. 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 reference points. For geographic areas not currently defined in Appendix I of the Radio Regulations an appropriate description is required.

For short range services it is appropriate to consider all the points associated with the intended service area. For longer distance services and services which cover a large geographical area e.g. several CIRAF zones, it will be necessary to evaluate circuit performance to a subset of the total number within the service area e.g. selected points around the periphery and also within the service area.

I. JOHNSEN
Chairman of Drafting Group 4B-7


160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

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WORKING GROUP 4B

TRANSMITTER POWER

1. At the very beginning of broadcasting requirement, /somebody/ should calculate transmitter power which is enough to reach the value of the E_{ref} (reference field-strength) (E_{min} + 3 dB or E_{min}), considering a basic circuit reliability, if necessary.

2. After having had the initial frequency assignments to all requirements, compatibility analysis for a particular transmitter will be done, but this is a matter of the mandate of Committee 5.

3. When the reliability is calculated /X/% should be taken as a reference value.

Y. TADOKORO
Chairman of Working Group 4B

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

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Addendum 1 to
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AD HOC GROUP 5A-2

In the event of No. 8, each administration may claim a maximum overall broadcasting time with the quality of service adopted by the Conference; this maximum overall time will be determined by the saturation due to the Zone, the schedule or the frequency band. Beyond that maximum overall time, it will no longer be possible to satisfy all requirements in the same conditions of quality.

In this way, account will be taken, where appropriate, of the need to satisfy first the requirements of administrations whose requested overall broadcasting time is the least, all zones being considered together.

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AD HOC GROUP 5A-2

1. The system must be optimized to ensure the maximum possible utilisation of all available channels.

2. The system must take into account the technical constraints of equipment.

3. The system must also take into account the frequency preferences indicated by administrations (see DT/37).

4. Each 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 DT/10 (Rev.2)).

5. For the indicated time block of each requirement frequency changes should be limited to those necessitated by propagation factors.

6. Each requirement should be treated and one frequency found for the relevant time block in the appropiate band.

7. 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.

8. If it is not possible to satisfy all requirements with the quality criteria adopted by the Conference:

a) either, there should be a uniform reduction in quality to the level necessary to satisfy all requirements;

OR

b) some requirements will necessarily have to accept a lower quality.

9. In the event of No. 8, a certain minimum quantity of requirements of each administration should be guaranteed satisfaction with the quality criteria adopted by the Conference. This quantity should be related to the overall quantity of each administrations requirements or to the total volume of global requirements.

10. In the event of No. 8, administrations which choose to list their requirements in an order for processing should have them treated in that order.

11. In the event of alternative 8b), the special problems facing administrations having limited facilities or requirements should be taken into account.

12. If after a seasonal plan has been completed an administration requests further frequencies they should be provided only if they do not affect the seasonal plan.

13. Continuity of frequency availability between seasonal plans when desired should as far as possible be assured. (see 2.3 of DT/10(Rev.2)).

G.H. RAILTON
Chairman of AD HOC Group 5A-2

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

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AD HOC GROUP 5A-2

Draft

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 seasonal plans to be developed 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.

4.2 Planning method

4.2.1 Overview of planning method

After considering the various proposals to the Conference, the first session decided to adopt for the planning method the 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.

4.2.2 Definition of a broadcasting requirement

/_to be developed_7 /_see Document DT/38_7

4.2.3 Description of the individual steps of the automated system

4.2.3.1 Step 1 - Requirements file

a) A file containing the operational and projected broadcasting requirements from /_7 to /_7 shall be created in order to permit the second session to test the planning method, assess the bands occupancy and, if required, improve the appropriate parts of the planning method.

This file will be used to create a "requirements file" to be updated on a periodical basis.

Prior to each planning period, administrations shall confirm and, if necessary modify their broadcasting requirement appearing in the "Requirement File". These confirmed requirements will be used for the preparation of the Seasonal plans.

b) The above files shall contain as a minimum the following information :

Basic characteristics

1) name of the transmitting station

2) geographical coordinates

3) country symbol or the geographical area in which the station is situated

4) receiving zone

5) hours of operation (UTC)

6) range of antenna characteristics

7) transmitter power (dBW)

8) class of emission

/Optional/ /supplementary/ characteristics

1) preferred frequency or frequencies (in kHz)

2) preferred frequency bands (in MHz)

3) equipment limitations

4) adjustable power capabilities

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.

4.2.3.3 Step 3 - Propagation analysis and selection of the appropriate frequency band

The propagation model 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 a preferred frequency band as a technical constraint (equipment or antenna) which limits the use of any frequency bands, then this band shall be used in lieu of the calculated band without determining the basic circuit reliability. /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./

4.2.3.4 Step 4 - Rules for the selection of frequencies

4.2.3.4.1 Optimization

The automated system shall be developed in such a way that all the available channels in each band shall be equally loaded and with the assignments on all channels having approximately the same protection.

4.2.3.4.2 Equipment constraint

The system shall take into account the technical constraints of the equipment, i.e. :

4.2.3.4.2.1 Frequency

a) When the administration indicates that its facilities can operate only on a single fixed specified frequency, this frequency shall be included in the plan without consideration of its basic circuit reliability.

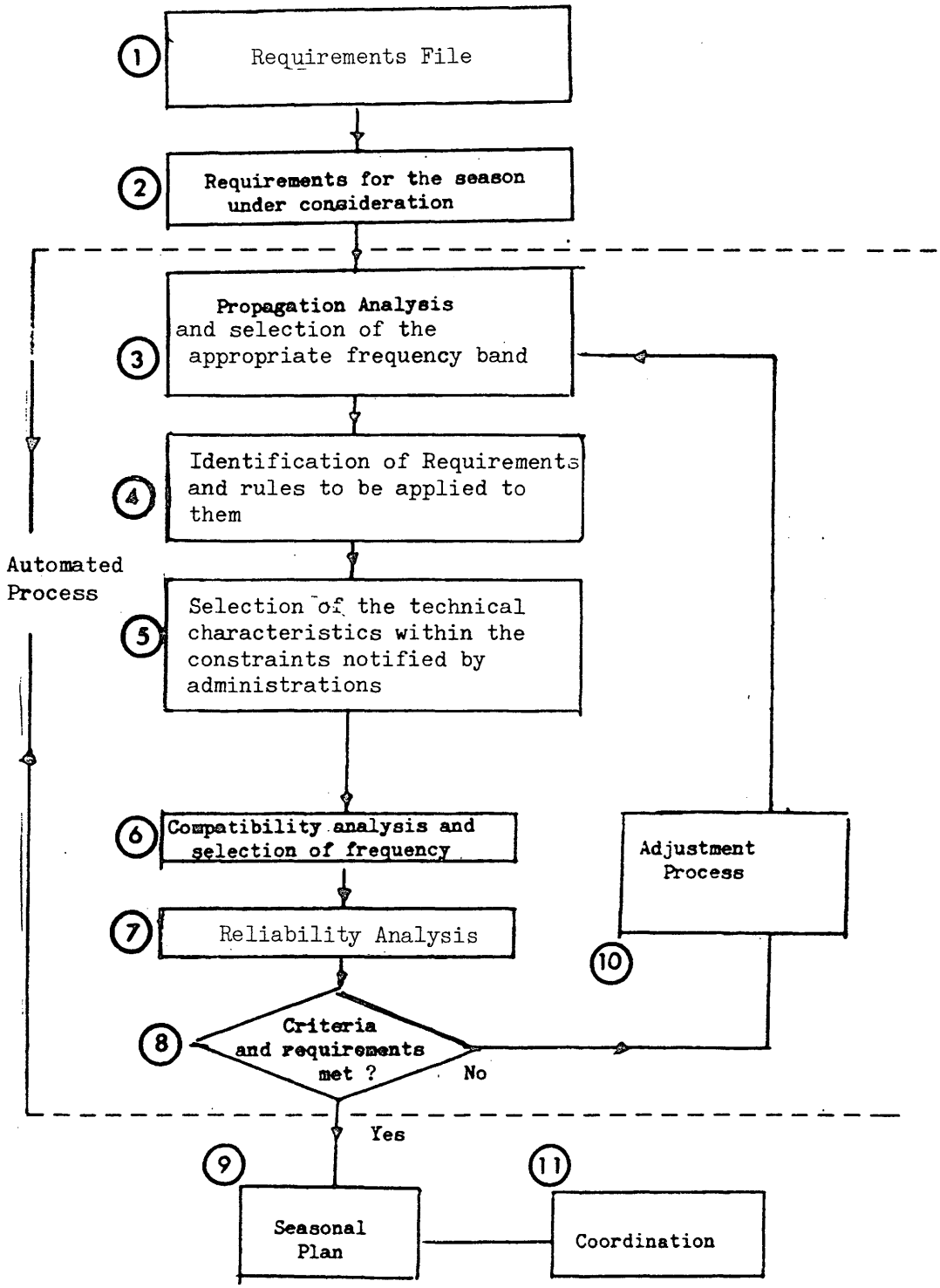
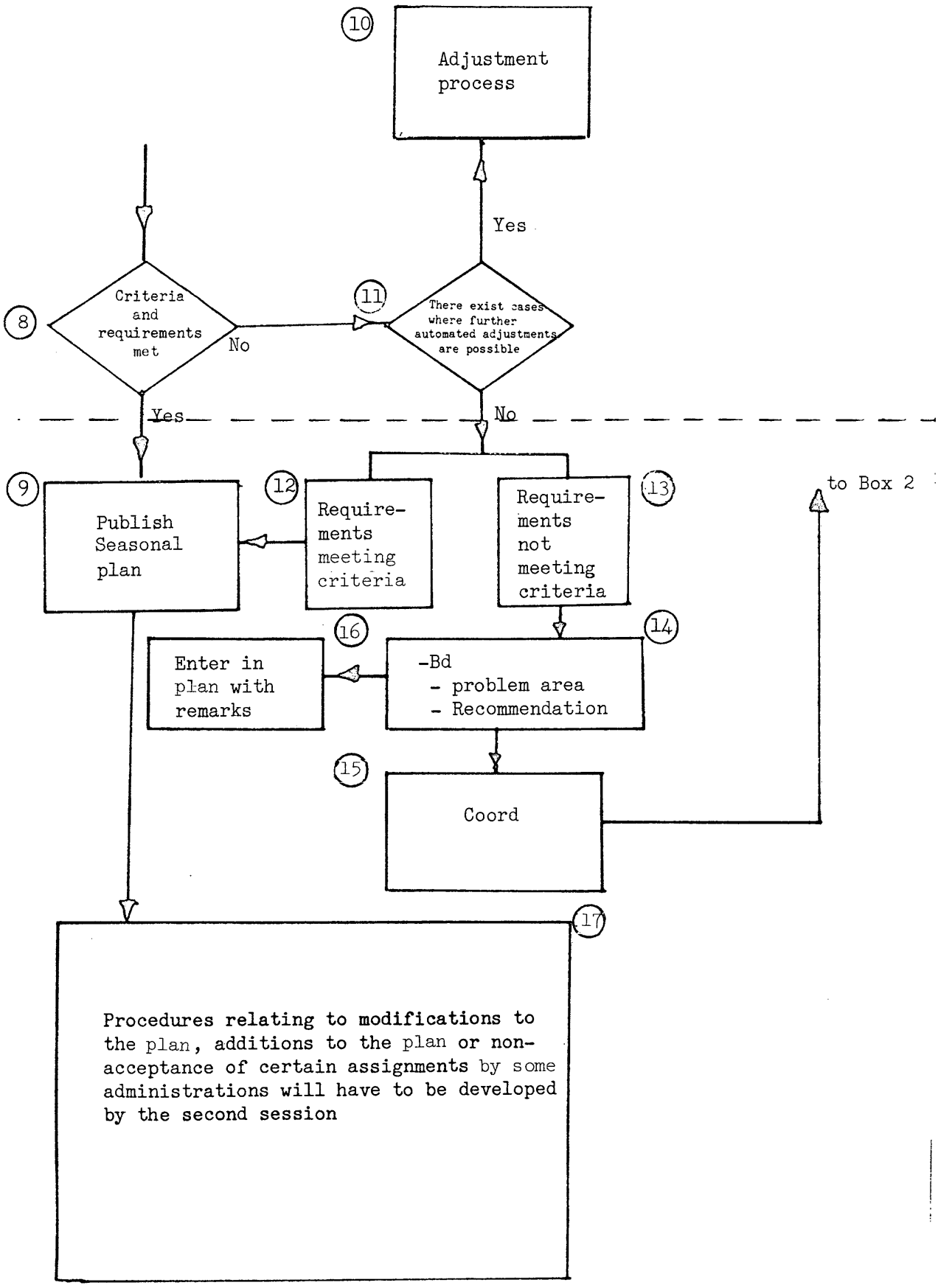


FIGURE /7

Planning method


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
13
Require-ments not meeting criteria
to Box 2
16
Enter in plan with remarks
14
-Bd
- problem area
- Recommendation
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

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.

b) 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 compatibilites.

c) 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;

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.

4.2.3.4.2.2 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, without consideration of the basic circuit reliability.

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 /_7.

4.2.3.4.2.3 Power

a) When an administration indicates only the nominal power, 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_7.

4.2.3.4.2.4 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.

4.2.3.4.3 Limitation of frequency change

In order to limit the number of frequency changes for each requirement only to those necessitated by propagation factors, the system will start by selecting the frequency band permitting to achieve the required basic circuit reliability. If the band so selected permits to achieve the required basic circuit reliability for only a part of the notified hours of operation (part A), this part will be processed to the end in order to calculate the overall broadcast reliability. This part A of the requirement will then be reduced only if part of it which is incompatible with other requirements can be appropriately covered in another band together with the remaining part B of the requirement. The same applies if more than two bands are required to cover the requirement with the appropriate criteria.

When a requirement has a continuous large number of hours of operation it may have to use another frequency in the same band or in another band if part of its hours of operation is incompatible with other requirements.

4.2.3.4.4 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 will be analyzed to determine if all requirements are satisfied with the agreed criteria as contained in section / /.

4.2.3.9 Step 9 - Seasonal plan

The Board will publish the Seasonal plan at the appropriate time as determined by the second session.

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.

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

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AD HOC GROUP 5A-2

RULES FOR DEALING WITH INCOMPATIBILITIES

Option A

1. If it is not possible to 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 for adjustments are exhausted, the following procedure should be followed :

a) In case the number of administrations with a requirement exceeds the number of available channels in that band, the protection ratio should be reduced. If it is not possible to accommodate all requirements even when the lowest agreed protection ratio has been reached a further uniform reduction will be necessary to accommodate all requirements.

b) In case the number of administrations is less than the number of available channels, but the number of requirements is higher (some administrations may have more than one requirement), the following procedure should be followed :

b)1) - as many requirements as possible, equally divided over all administrations involved, shall be satisfied at the /minimum/ /maximum/ level of quality agreed by the Conference, thus guaranteeing a certain number of requirements with /this maximum/ /an acceptable/ level of quality for each administration involved;

b)2) - /in so doing, account will be taken, where appropriate, of the need to satisfy first the requirements of administrations whose requested overall broadcasting time is the least, within the zone under consideration for international service and within all the zones for the national service/ ;

b)3) - the remaining requirements should be accommodated, with a lower level of quality, without adversely affecting the first group of requirements.

c) Those administrations which cannot agree to the lower level of quality, (see a) and b)3)) may propose improvements or request alternative frequencies in another band or on another time block. These requests should be satisfied, where possible, without adversely affecting the plan.

Option B

2. 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 down to a level in order to satisfy all requirements. Those administrations which cannot agree to the reduced quality of broadcasting may request alternative frequencies in another band or at another time block, and their requests must where possible be satisfied.

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AD HOC GROUP 5A-2

RULES FOR DEALING WITH INCOMPATIBILITIES

Ad hoc Group 5A-2 in discussing sections 8 and 9 of DL/15 have identified the following approaches.

A. If it is not possible to satisfy all requirements in a certain CIRAF zone in a specified time block and in a certain frequency band with the quality criteria adopted by the Conference, each administration may claim a maximum overall broadcasting time with the quality of service adopted by the Conference; this maximum overall time will be determined by the saturation due to the Zone, the schedule or the frequency band. Beyond that maximum overall time, it will no longer be possible to satisfy all requirements in the same conditions of quality.

In this way, account will be taken, where appropriate, of the need to satisfy first the requirements of administrations whose requested overall broadcasting time is the least, all zones being considered together.

B. If it is not possible to satisfy all requirements in a certain CIRAF zone in a specified time block and in a certain frequency band with the quality criteria adopted by the Conference, a certain minimum quantity of requirements of each administration should be guaranteed satisfaction with the quality criteria adopted by the Conference.

C. 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 down to a level in order to satisfy all requirements. Those administrations which cannot agree to the reduced quality of broadcasting may request alternative frequencies in another band or at another time block, and their requests must where possible be satisfied.

D. If it is not possible to 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 for adjustments, indicated by the administrations involved, in the requirement form are exhausted, the following procedure should be followed :

a) In case the number of administrations with a requirement exceeds the number of available channels in that band, the protection ratio should be reduced. If it is not possible to accommodate all requirements even when the lowest agreed protection ratio has been reached a further uniform reduction will be necessary to accommodate all requirements.

b) In case the number of administrations is less than the number of available channels, but the number of requirements is higher (some administrations may have more than one requirement), the following procedure should be followed :

- as many requirements as possible, equally divided over all administrations involved, should be satisfied at the minimum level of quality agreed by the Conference, thus guaranteeing a certain number of requirements with an acceptable level of quality for each administration involved;

- the remaining requirements should be accommodated, with a lower level of quality, without adversely affecting the first group of requirements.

These are put forward for the consideration of ad hoc Group 5A-2.

G.H. RAILTON
Chairman of ad hoc Group 5A-2

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

FIRST SESSION, GENEVA, JANUARY/FEBRUARY 1984

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Source : Documents 115(Rev.1), 88

DEFINITIONS 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." (Document 115(Rev.1))

- "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." (Document 115(Rev.1))

- "Required service area (in HF broadcasting)

  The area within which an administration requires a grade of service conforming to the agreed technical criteria.

  Note - The area is to be described by the administration submitting the requirement." (Document 88)

J. RUTKOWSKI
Chairman of Committee 4

Mr. IRFANULLAH
Chairman of Committee 5

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

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AD HOC GROUP 5A-2

RULES FOR DEALING WITH UNSATISFIED REQUIREMENTS

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 having the greatest total usage. The Board shall consult these administrations requesting them to reduce or shift their hours of operation, modify the characteristics of their transmissions or propose a different frequency band. Administrations which do not reply within seven days or which refuse any modification shall be deemed to accept any reduced overall reliability that may result from the planning process. The system shall then endeavour to satisfy all requirements with a lower overall broadcasting reliability. If all the requirements cannot be satisfied with an overall broadcasting reliability of /x to be determined/ the system shall guarantee this value /x/ 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.

G.H. RAILTON
Chairman of ad hoc Group 5A-2

INTERNATIONAL TELECOMMUNICATION UNION

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COMMITTEE 4

Note by Chairman 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 133

- page 4, section 3.2.4.1.1, Table 1, step 10, replace the square brackets by "3.5 dB μV/m" and add "(section 3.4.1.3)".

- step 17, put into the brackets "(section 3.4.1.6)".

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° = 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

INTERNATIONAL TELECOMMUNICATION UNION

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AD HOC GROUP 5A-2

PLANNING METHOD

I wish to suggest the following six points for discussion :

1) the HFBC planning shall be based on the periodical preparation, publication and acceptance by administrations of two seasonal plans corresponding to six months;

2) the HFBC planning shall use broadcasting requirements communicated by administrations;

3) the seasonal plans shall use the operational and projected HFBC requirements which are contained in a "requirements file" and which are confirmed by administrations at an appropriate time for their bringing into use during the seasons concerned;

4) at an appropriate date before the preparation of a pair of seasonal plans, administrations may update the "requirements file" and shall confirm those requirements to be contained in the pair of seasonal plans under consideration. The second session of the Conference may develop a procedure to update the "requirements file" if it considers it necessary;

5) a three year "requirements file" shall be prepared before the second session which may use it to verify the planning method and, if required, introduce minor improvements to it;

6) each six months, plans covering two seasons shall be prepared using mainly an automated system.

G.H. RAILTON
Chairman of ad hoc Group 5A-2

INTERNATIONAL TELECOMMUNICATION UNION

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AD HOC GROUP 5A-2

STEPS TO BE FOLLOWED TO ESTABLISH RULES FOR DEALING WITH UNSATISFIED REQUIREMENTS

1. It is 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 pre-judge 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 inter-sessional period. A report to the main session of the WARC would then help administrations to adopt a definitive set of rules that would best serve all administrations. 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 Main 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 CIRAF zone or part of a zone, in a specific period of time, even after all possibilities of system adjustments have been exhausted, the system shall test and evaluate the following possibilities :

a) a progressive reduction of the quality criteria to the level necessary to accommodate all broadcasting requirements;

b) the adjustment of administrations' requirements in terms of frequency bands, operating hours and technical characteristics;

c) the impact of different frequency assignment strategies, e.g. segregating high power from low power and long distance from short distance requirements;

d) the impact of different quality criteria for different classes of broadcasting requirements, e.g. for smaller users vis-à-vis larger users related to a minimum on a proportion of their requirements;

e) such other possibilities 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 Preparatory 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 Main Session of the WARC.

3.4 Administrations should be invited to consider this report in preparing for the Main Session of the WARC.

G.H. RAILTON
Chairman of ad hoc Group 5A-2

INTERNATIONAL TELECOMMUNICATION UNION

WARC FOR HF BROADCASTING

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Note by the Chairman

I attach herewith for consideration a draft preamble for the report of the first session of the Conference.

K. BJÖRNSJÖ
Chairman

Annex : 2 pages

DRAFT

PREAMBLE

(1) The World Administrative Radio Conference (Geneva, 1979), through its Resolution No. 508, resolved that the use of the HF bands allocated to the broadcasting service should be the subject of planning by a world administrative radio conference and invited the Administrative Council to take all necessary steps for the convening of the conference. It also resolved that the conference should be held in two sessions and that

- the first session should establish the technical parameters to be used for planning and the principles governing the use of the HF bands allocated to the broadcasting service and should decide the planning principles to be used and the method of planning to be adopted by the second session: and that

- the second session should carry out the planning according to the principles and the method established at the first session and should review and, where necessary, revise the relevant provisions of the Radio Regulations relating to broadcasting in the HF bands.

(2) The Administrative Council at its 36th (1981) session proposed that the first session of the Conference be held in Geneva for five weeks in January/February 1984. It also drew up a tentative agenda for this first session. Following a consultation with the Members of the Union, the Administrative Council, at its 37th (1982) session, modified this agenda. This modified conference agenda was on further consultation approved by a majority of the Members of the Union.

(3) In conformity with Resolution No. 1 of the Union's Plenipotentiary Conference (Nairobi, 1982), the Administrative Council, at the opening meeting of its 38th session (Nairobi, 1982), adopted Resolution No. 874 confirming the agenda of the first session of the conference to be opened on 10 January 1984 for five weeks, in Geneva.

(4) Consequently, the first session of the World Administrative Radio Conference for the Planning of HF Bands Allocated to the Broadcasting Service was held in Geneva from 10 January to 10 February 1984.

(5) This first session, in accordance with its terms of reference as contained in its agenda, decided:

(a) - to adopt the present report for submission to the second session of the Conference;

(b) - to establish the guidelines for the intersessional work to be carried out by the IFRB and the CCIR before the commencement of the second session of the Conference (including the time schedules for the completion of this work) as indicated in Chapters 3 and 4 of, and Resolution No. XX and Recommendation No. AA annexed to, the present report;

(c) - to urge administrations to submit to the Union their requirements, for use in planning, in the form referred to and within the time limit indicated in Chapter 4 of, and Resolution No. YY annexed to, the present report;

(d) - to invite the Administrative Council to consider the resources and facilities required for the intersessional work /, as well as the tentative agenda for the second session of the Conference,/ as indicated in Resolution(s) No(s) ..... /respectively/ annexed to the present report;

(e) - to adopt also Resolution(s) /and Recommendation(s)/ No(s) ..... annexed to the present report; and

(f) - to request the Secretary-General to bring the present report to the attention of the Administrations of all the Members of the Union.

(6) At its ..... and ..... Plenary Meetings, the First Session also took note of the declarations submitted in writing by a number of delegations concerning the present report and contained in Annex .. to the present report.