Regional Administrative Conference
for FM Sound Broadcasting in the VHF Band
(Region 1 and certain countries concerned in Region 3)
First Session, Geneva, 1982

REPORT TO THE SECOND SESSION OF THE CONFERENCE

(See Resolution A)

General Secretariat
of the
International Telecommunication Union
Geneva, 1982

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FIRST SESSION OF THE
REGIONAL ADMINISTRATIVE CONFERENCE
FOR FM SOUND BROADCASTING IN THE
VHF BAND (REGION 1 AND CERTAIN
COUNTRIES CONCERNED IN REGION 3)
Geneva, 1982

Geneva, 17 September 1982

The Chairman
of the Second Session of the
Regional Administrative Conference
for FM Sound Broadcasting in the
VHF Band

Dear Sir,

In accordance with the provisions of Resolution A adopted at the First Session of the Regional Administrative Conference for FM Sound Broadcasting in the VHF Band, Geneva, 1982, I enclose the Report of the First Session for transmission to the Second Session of the Conference.

Marie HUET

Chairman of the First Session

Annex referred to

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INTRODUCTION

In its Resolution No. 510, the World Administrative Radio Conference (Geneva, 1979), considering the extension of the primary allocation to the broadcasting service in Region 1 from 87.5 to 100 MHz to 87.5 to 108 Mhz and that in some countries the band 100 to 108 MHz is allocated on a permitted basis to the mobile, except aeronautical mobile (R), service and also to the fixed service, decided that a Regional Administrative Conference, to be held in two sessions, should be convened to draw up an agreement for Region 1 and the countries concerned in Region 3 and an associated plan for sound broadcasting in the band 87.5 to 108 MHz for Region 1 and for parts of Afghanistan and Iran which are contiguous with Region 1. The WARC-79 instructed the Administrative Council to take the necessary measures for the convening of this Conference.

At its 35th session, the Administrative Council decided, in its Resolution No. 852 (amended at the 36th session) that the First Session would be convened in Geneva on 23 August 1982 for a period of four weeks to prepare :

- the technical bases for the frequency assignment plan to be established in the Second Session and the mutual sharing criteria for the sound broadcasting service and the other services;

- the form in which the requirements for frequency assignments should be notified and the fixing of the final date by which the requirements should be notified to the IFRB.

The First Session of the Regional Administrative Conference for FM Sound Broadcasting in the VHF Band (Region 1 and certain countries concerned in Region 3) was thereupon convened and in accordance with its agenda prepared the present Report to the Second Session of the Conference.

The technical criteria and the planning methods were largely founded upon the work of the CCIR presented in its Report to the First Session.

Apart from the technical criteria peculiar to the broadcasting service (propagation curves, channel spacing, protection ratios, etc.), the Conference at its First Session examined the question of compatibility with the other services in the same frequency band or in adjacent bands, in accordance with item 1.9 of its agenda. It gave particular attention to the problem of protecting the aeronautical radionavigation services and took steps to ensure that account would be taken of this need in the planning activities at the Second Session.

This Report contains a number of Resolutions and Recommendations. The general Resolutions are concerned, on the one hand, with the assistance that administrations might give to the IFRB during the period between the two sessions and, on the other hand, the assistance which the IFRB might give to developing countries in dealing with problems of compatibility with the aeronautical radionavigation service. Recommendations to the CCIR are concerned with two areas where it would be necessary to have additional information for the Second Session : firstly, propagation in the Middle East and in Africa; secondly, technical parameters of the equipment of aeronautical services and of FM sound broadcasting transmitters.

With a view to the efficient preparation of the Second Session and, in the light of the different tasks assigned to the administrations and the IFRB, a detailed work programme and a schedule of the tasks to be performed were drawn up. In view of the fact that a large number of requirements to be planned by the Second Session are expected, a method for helping the administrations to formulate their requirements has been established and it has been decided that the IFRB will be responsible for the preliminary calculations.

All the planning principles and methods, technical criteria and guidelines necessary to enable the administrations and the IFRB to perform their work are clearly defined in the present Report so that the Second Session will be able to commence the planning process as soon as its work begins and to fulfil its mandate within the period stipulated by the Administrative Council.

CHAPTER 1

DEFINITIONS

The following definitions used in this Report supplement those contained in the Convention and in Chapter 1 of the Radio Regulations.

1.1 Coverage area

The area within which the field strength of the wanted transmitter is equal to or greater than the usable field strength.

In this area the protection against interference is provided for 99% of time.

Note 1 : The field strength of the wanted transmitter is derived from the propagation curve relating to 50% of locations and for 50% of time.

Note 2 : The usable field strength is calculated by the simplified multiplication method,[1] tropospheric interference being derived from the propagation curves relating to 50% of locations and for 1% of time, and steady interference being derived from propagation curves relating to 50% of locations and for 50% of the time.

1.2 Service area

The part of the coverage area in which the administration has the right to demand that the agreed protection conditions be provided.

1) However, for comparison purposes, the power sum method will be used, in the area from the Shatt-al-Arab to the Gulf of Oman, at the request of administrations concerned.

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CHAPTER 2

PROPAGATION

2.1 Propagation curves for VHF broadcasting

2.1.1 General

The propagation curves represented in Figures 2.1 to 2.9 based on CCIR Recommendation 370-4 are intended for use in the planning of the broadcasting service. They relate field strength to path length with the equivalent transmitting antenna height as a parameter for various percentages of time from 50% to 1% in various climatic regions. They represent the field strength exceeded at 50% of locations, and apply to both horizontal and vertical polarization.

With respect to oversea paths the curves are presented in terms of cold sea and warm sea in order to allow for the different propagation characteristics encountered in these conditions. Over warm seas the phenomenon of ducting or extreme super-refractivity is more frequently encountered and hence trans-horizon interference is common, but propagation over both warm and cold seas shows considerably less attenuation than does propagation over land for time percentages less than median in most cases. This is evident from the Figures. It will be appreciated that the definition of warm sea and cold sea has to be based on statistical data and so is to a certain extent arbitrary, but experience indicates that the following definitions would be appropriate for the application of the curves set out in this Chapter :

Warm sea Seas, oceans and other substantial bodies of water (i.e., one at least that can encompass a circle of 100 km diameter) at latitudes less than 23.5 degrees N or S, but also including the entirety of the Mediterranean, the Black Sea, the Red Sea, and the area extending from the Shatt-al-Arab to and including the Gulf of Oman (see also paragraph 2.1.2 below);

Cold sea Seas, oceans, and other substantial bodies of water (i.e., one at least that can encompass a circle of 100 km diameter) at latitudes greater than 23.5 degrees N or S, but excluding the Mediterranean, the Black Sea, the Red Sea and the area extending from the Shatt-al-Arab to the Gulf of Oman.

2.1.2 Super-refractivity and ducting areas

Although the area from the Shatt-al-Arab to the Gulf of Oman is included in the general classification of warm sea as defined above in paragraph 2.1.1, experience indicates that extreme super-refractivity (ducting) conditions may be encountered there on an even greater scale than in other warm sea areas. This may also be the case for the Red Sea, the Eastern Mediterranean, and maritime areas of West Africa. The member organizations of Gulfvision are at present engaged in a systematic measurement programme with the participation of the ITU, investigating both atmospheric refractivity conditions and associated radio propagation over great distances, with a view to clearly defining the conditions prevailing in the area from the Shatt-al-Arab to the Gulf of Oman.

Although the measurement programme has been in progress since 1981, it is not yet concluded and so it has not been possible to propose modifications to the propagation data submitted to the First Session of the Conference. However, it is expected that definitive results will be available during 1983, and it is anticipated that Gulfvision will be in a position to contribute in this regard to the Second Session. It should therefore be understood that the above warm sea classification is tentative at this time, and certain curves may well need to be modified or added to when the measurement results have been analyzed.

2.1.3 Application of the curves

The values of field strengths given in curves, Figures 2.1 to 2.9, are those exceeded for 50%, 10%, 5% and 1% of the time. They are expressed in decibels relative to 1 μV/m and correspond to an effective radiated power of 1 kW.

The 50% time Figure shall be used for determination of coverage areas and the 1% time Figures shall be used for interference calculations. In the case of steady interference the 50% time Figure should be used.

The effective height of the transmitting antenna is defined as its height over the average level of the ground between distances of 3 km and 15 km from the transmitter in the direction of the receiver. The height of the receiving antenna is assumed to be 10 m above local terrain.

The curves given in Figures 2.1 to 2.9 correspond to effective transmitter antenna heights from 37.5 to 1,200 metres. Additional curves for effective antenna heights of 20 m and 10 m may be derived from the 37.5 m curve by applying correction factors of -10 dB and -19.5 dB for distances up to 50 km and -4.5 dB and -9.5 dB for distances in excess of 100 km with linear interpolation for intermediate distances. To obtain field strength values corresponding to effective transmitter antenna heights (h_1) of less than 10 m the values derived for 10 m shall be used. To obtain field strength values corresponding to effective transmitter antenna heights in excess of 1,200 m, the field strength at a distance of x km from the transmitter may be taken to be the same as the field strength given by the curve for a transmitting antenna height of 300 m at a distance of $(x + 70 - 4.1\sqrt{h_1})$km. This is subject to the condition that the free space field strength is not exceeded.

2.1.3.1 Location variability

The curves given are representative for 50% of locations, the percentage which shall be used for planning purposes. Corrections for other percentages of locations are given for further information in Annex A.

2.1.3.2 Terrain irregularity correction

The curves for propagation over land refer to the kind of irregular rolling terrain found in many parts of Region 1. For planning purposes and interference calculations, no terrain irregularity correction shall be made.

The application of this correction factor is however described in Annex A.

2.1.3.3 Receiving antenna height correction

The propagation curves are for a receiving antenna height of 10 m above the local terrain. If the receiving antenna height is reduced from 10 m to 3 m, a 9 dB reduction in the field strength shall be applied.

2.1.3.4 Mixed land/sea path calculations

When the propagation path is partially over land and partially over sea, the following method shall be used for interpolation between the appropriate land and sea curves.

Let

$E_{L,\ t}$: field strength for land path equal in length to the mixed path for t% of the time,

$E_{S,\ t}$: field strength for sea path equal in length to the mixed path for t% of the time,

$E_{M,\ t}$: field strength for mixed path for t% of the time,

d_S : length of sea path,

d_T : length of total path.

The field strength for the mixed path ($E_{M,\ t}$) is then determined by using the formula :

$$E_{M,\ t} = E_{L,\ t} + \frac{d_S}{d_T} \left[E_{S,\ t} - E_{L,\ t} \right]$$

2.2 VHF propagation curves for the aeronautical mobile service

The curves in Figures 2.10 represent basic transmission loss as a function of distance for 5%, 50% and 95% of the time for a range of antenna heights at a frequency of 125 MHz. The propagation model used is based on a considerable amount of experimental data and assumes horizontal polarization over a smooth earth with an effective earth-radius factor k of 4/3 with some compensation at high altitudes, and with fading characteristics representative of a temperate continental climate.

The following points are to be noted :

- the antenna heights shown vary from 15 m to 20,000 m covering both ground station and aircraft heights;

- for interpolation the following formula is proposed :

$$L_b = L_{b1} + \left[(L_{b2} - L_{b1}).\log(x/x_1) \right] / \log(x_2/x_1)$$

where L_b is the basic transmission loss to be calculated at the distance considered for height x and L_{b1}, L_{b2}, x_1 and x_2 are the corresponding losses and heights at the same distance on the curves between which interpolation is required;

- to conform with the propagation curves for the broadcasting service (Figures 2.1 to 2.9) an ordinate scale in terms of field strength for 1 kW radiated from a half-wave dipole has been added.

2.3 VHF propagation curves for the land mobile service

Propagation curves for the land mobile service operating in the VHF bands are given in Figures 2.11 and 2.12. These have been derived from the broadcasting propagation curves of Figures 2.2 and 2.3, with appropriate corrections for a mobile station antenna height of 3 m. A correction of 9 dB is applied for distances up to 50 km and of 4.5 dB for distances greater than 100 km, with linear interpolation for intermediate distances.

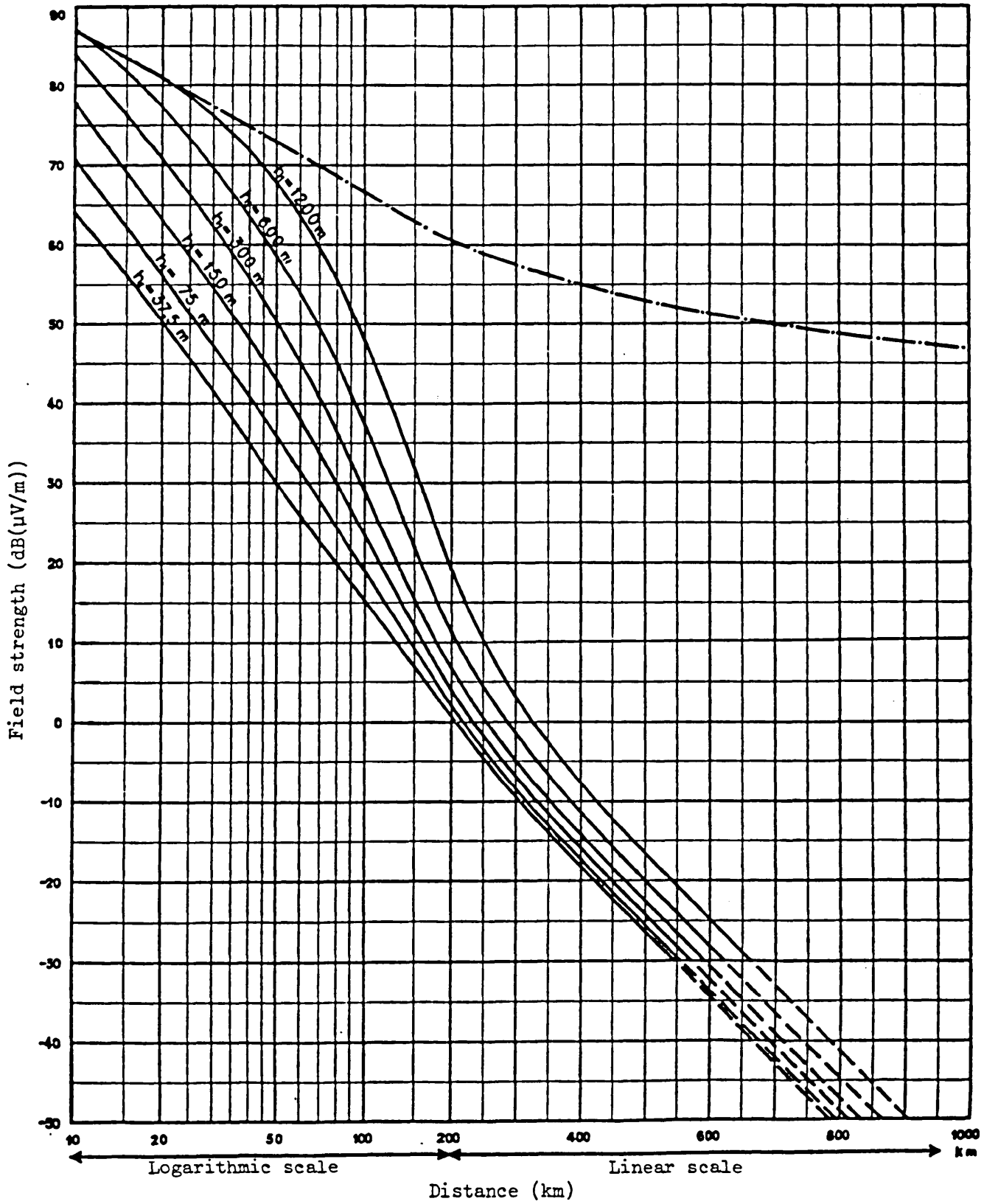

Figure 2.1 - Field strength (dB(μV/m)) for 1 kW e.r.p.

Frequency : 30 to 250 MHz; Land and sea;
50% of the time; 50% of the locations; h_2 = 10 m
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PROPAGATION CURVES FOR THE BROADCASTING SERVICE

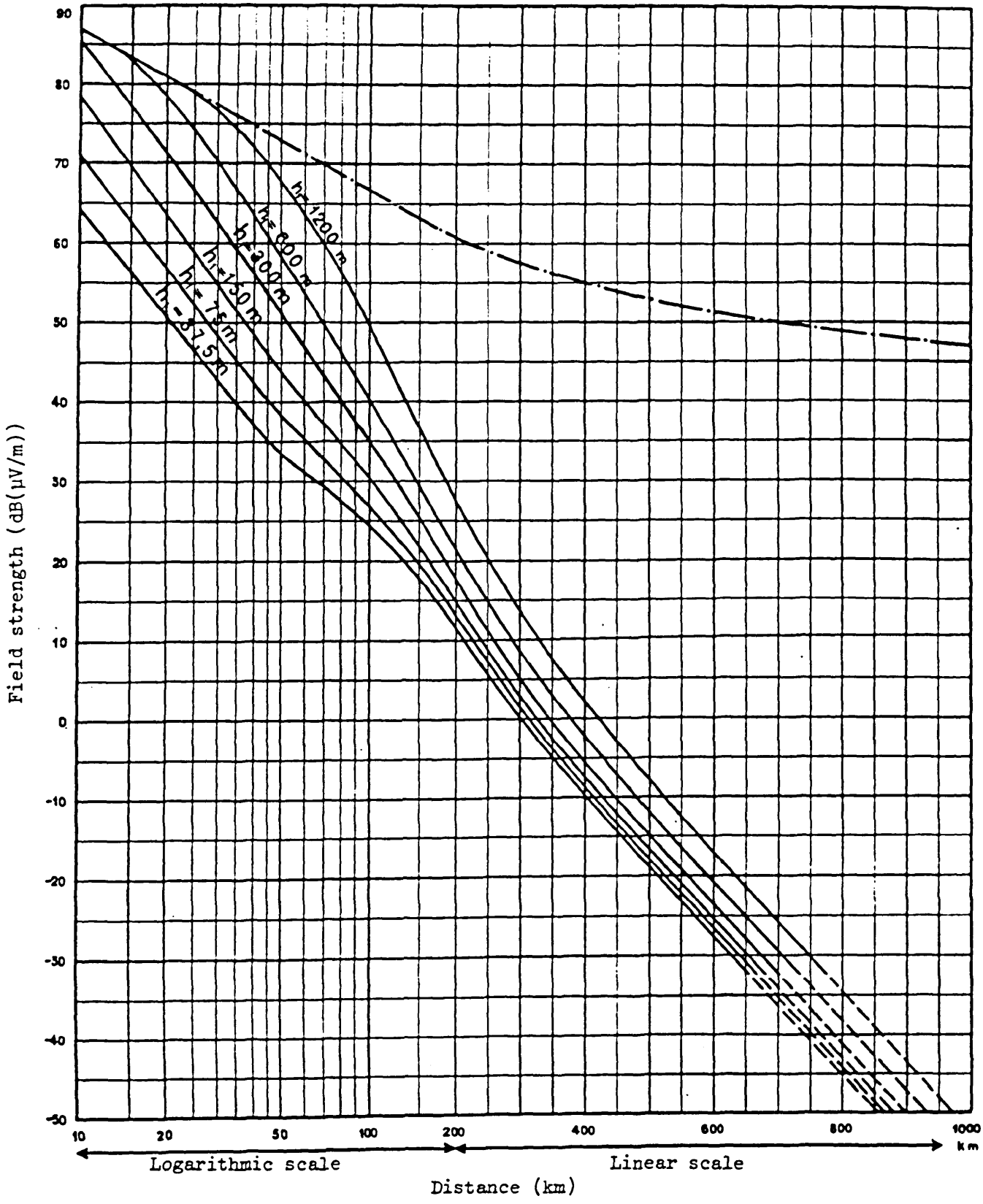

Figure 2.2 - Field strength (dB(μV/m)) for 1 kW e.r.p.

Frequency : 30 to 250 MHz : Land and cold sea;
10% of the time; 50% of the locations; h_2 = 10 m
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PROPAGATION CURVES FOR THE BROADCASTING SERVICE

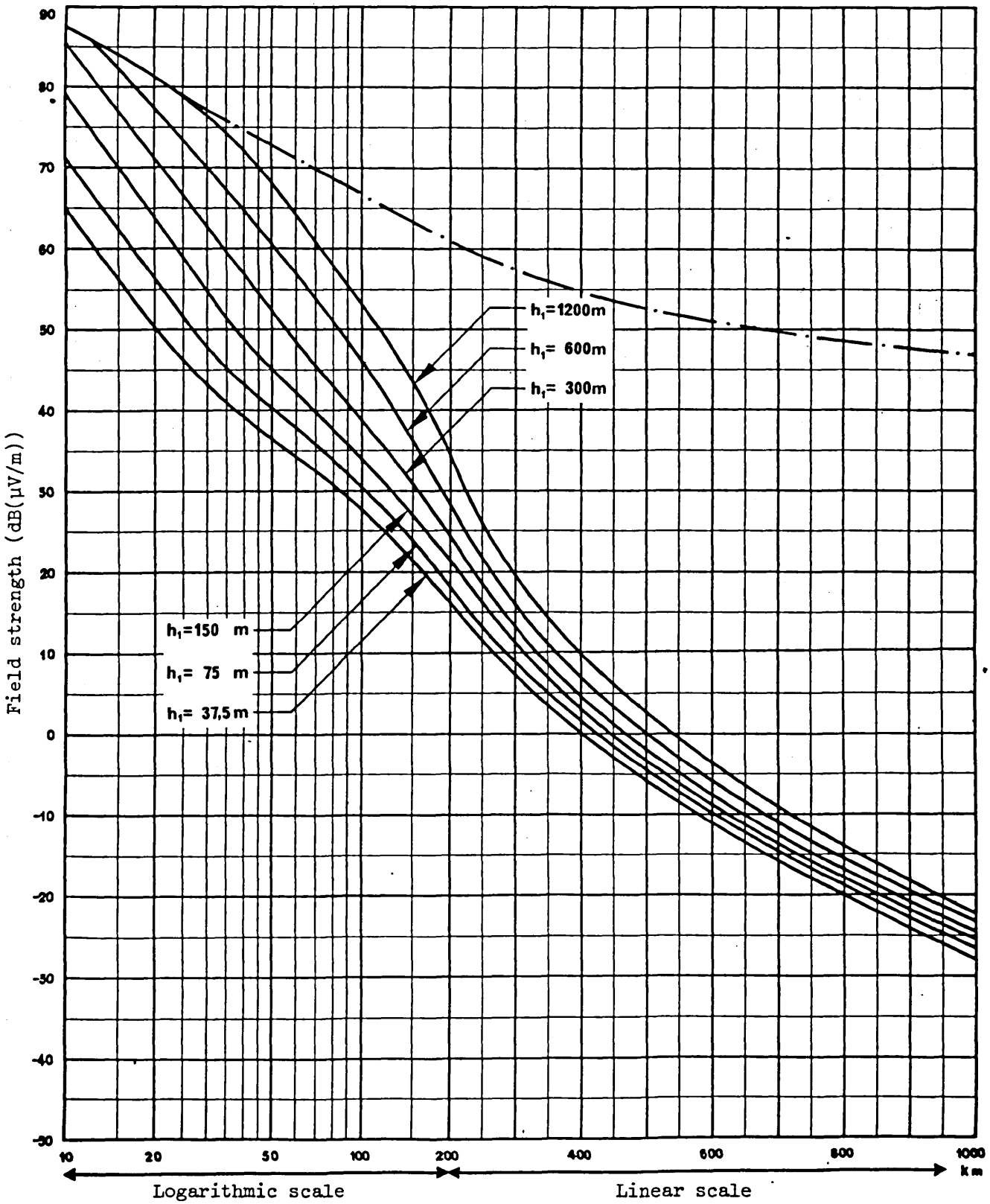

Figure 2.3 - Field strength (dB(μV/m)) for 1 kW e.r.p.

Frequency : 30 to 250 MHz; Warm sea;
10% of the time; 50% of the locations; h_2 = 10 m
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PROPAGATION CURVES FOR THE BROADCASTING SERVICE

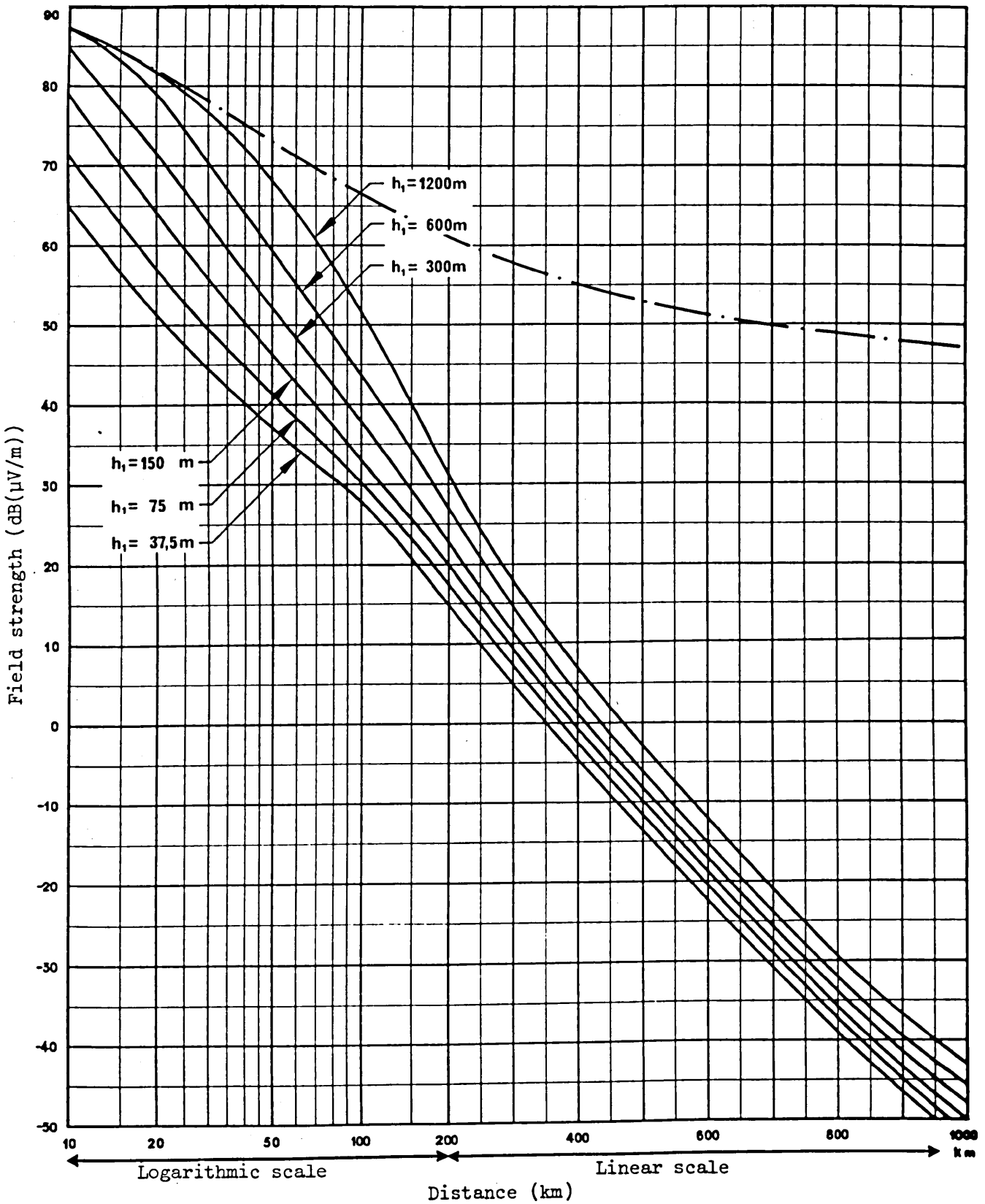

Figure 2.4 - Field strength (dB(μV/m)) for 1 kW e.r.p.

Frequency : 30 to 250 MHz; Cold sea;
5% of the time; 50% of the locations; h_2 = 10 m
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PROPAGATION CURVES FOR THE BROADCASTING SERVICE

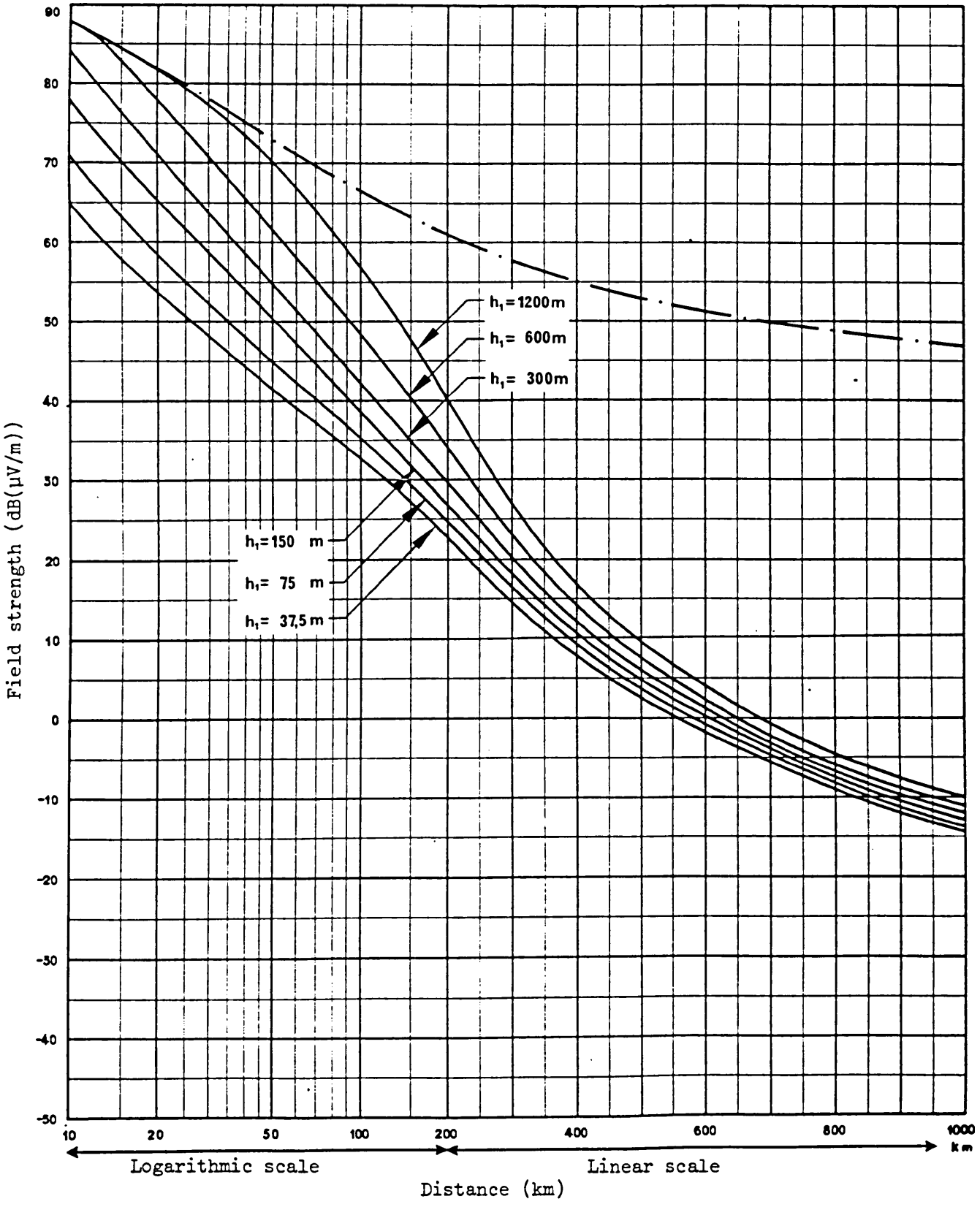

Figure 2.5 - Field strength (dB(μV/m)) for 1 kW e.r.p.

Frequency : 30 to 250 MHz; Warm sea;
5% of the time; 50% of the locations; h_2 = 10 m
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PROPAGATION CURVES FOR THE BROADCASTING SERVICE

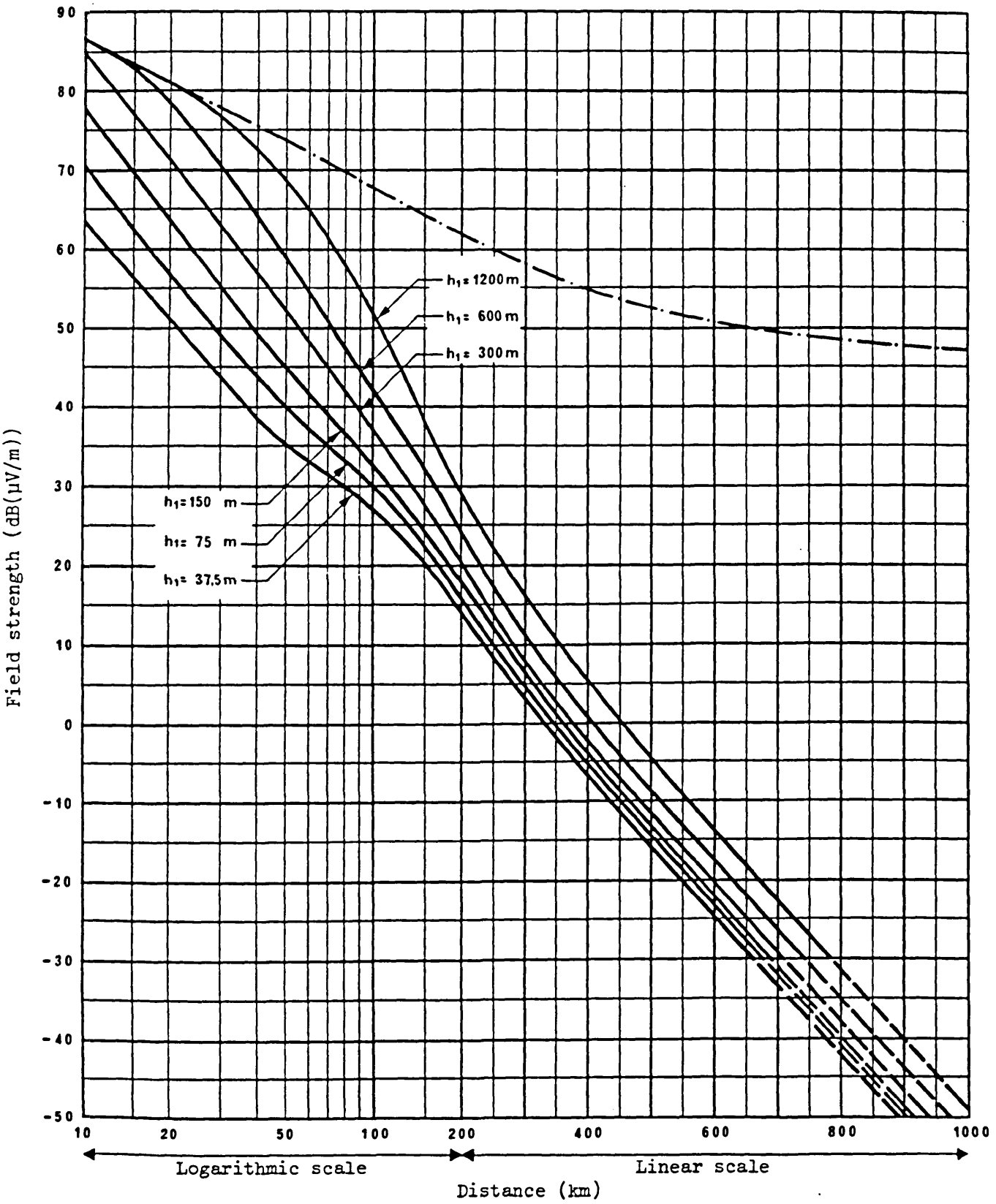

Figure 2.6 - Field strength (dB(μV/m)) for 1 kW e.r.p.

Frequency : 30 to 250 MHz; Land;
5% of the time; 50% of the locations; h_2 = 10 m
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PROPAGATION CURVES FOR THE BROADCASTING SERVICE

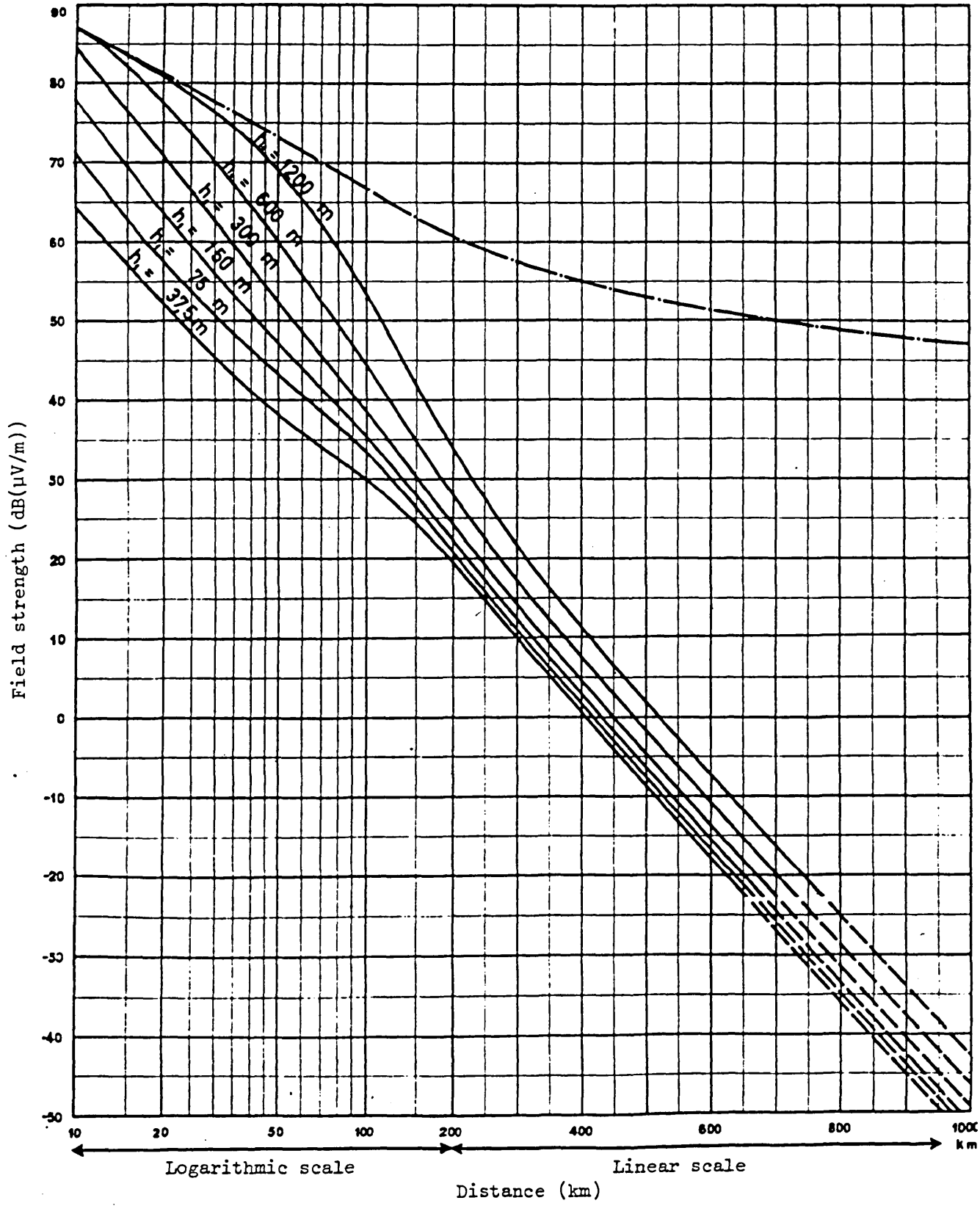

Figure 2.7 - Field strength (dB(μV/m)) for 1 kW e.r.p.

Frequency : 30 to 250 MHz; Land;
1% of the time; 50% of the locations; h_2 = 10 m
·—·—·—·—· Free space

PROPAGATION CURVES FOR THE BROADCASTING SERVICE

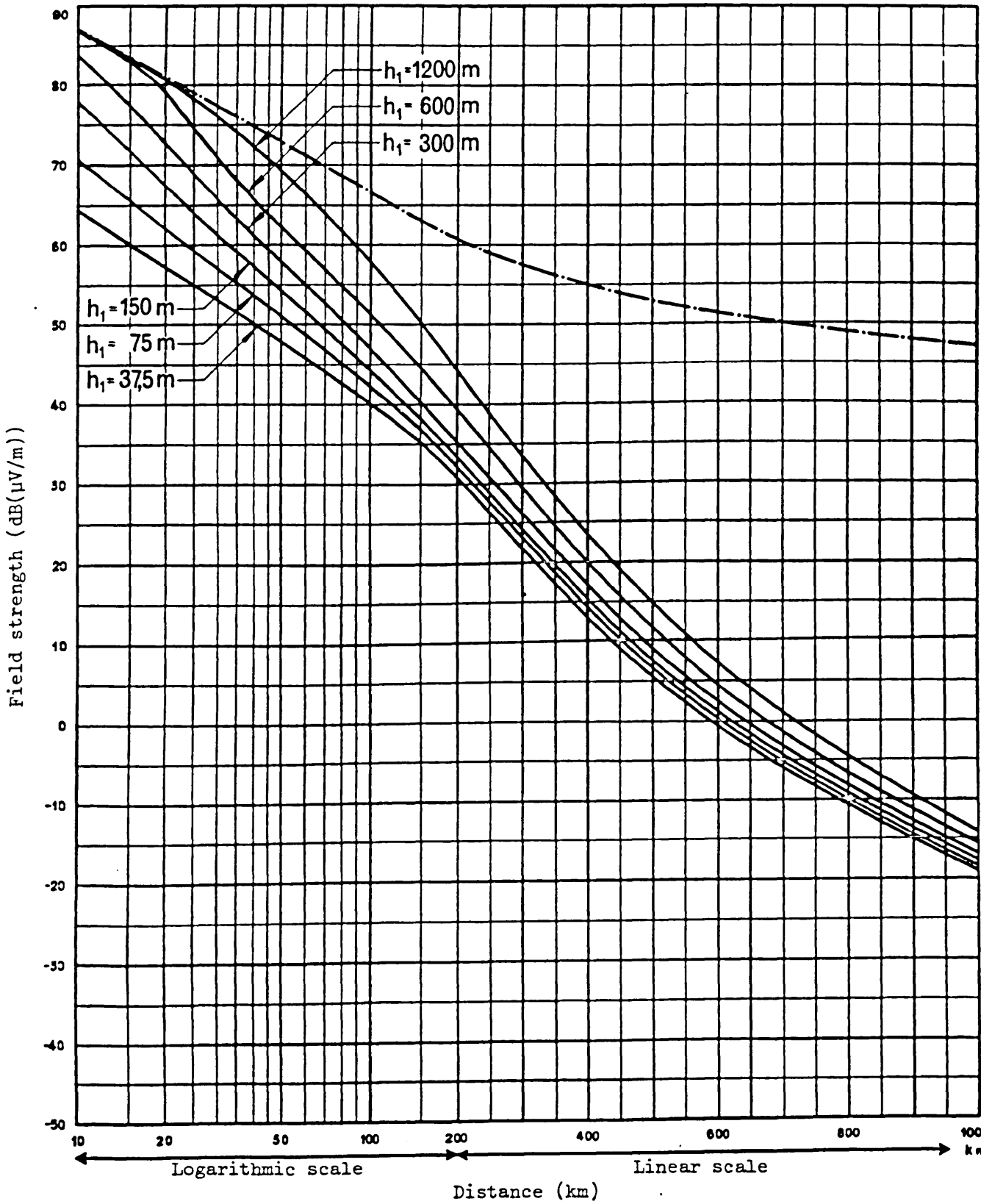

Figure 2.8 - Field strength (dB(µV/m)) for 1 kW e.r.p.

Frequency : 30 to 250 MHz; Cola sea;
1% of the time; 50% of the locations; h_2 = 10 m
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PROPAGATION CURVES FOR THE BROADCASTING SERVICE

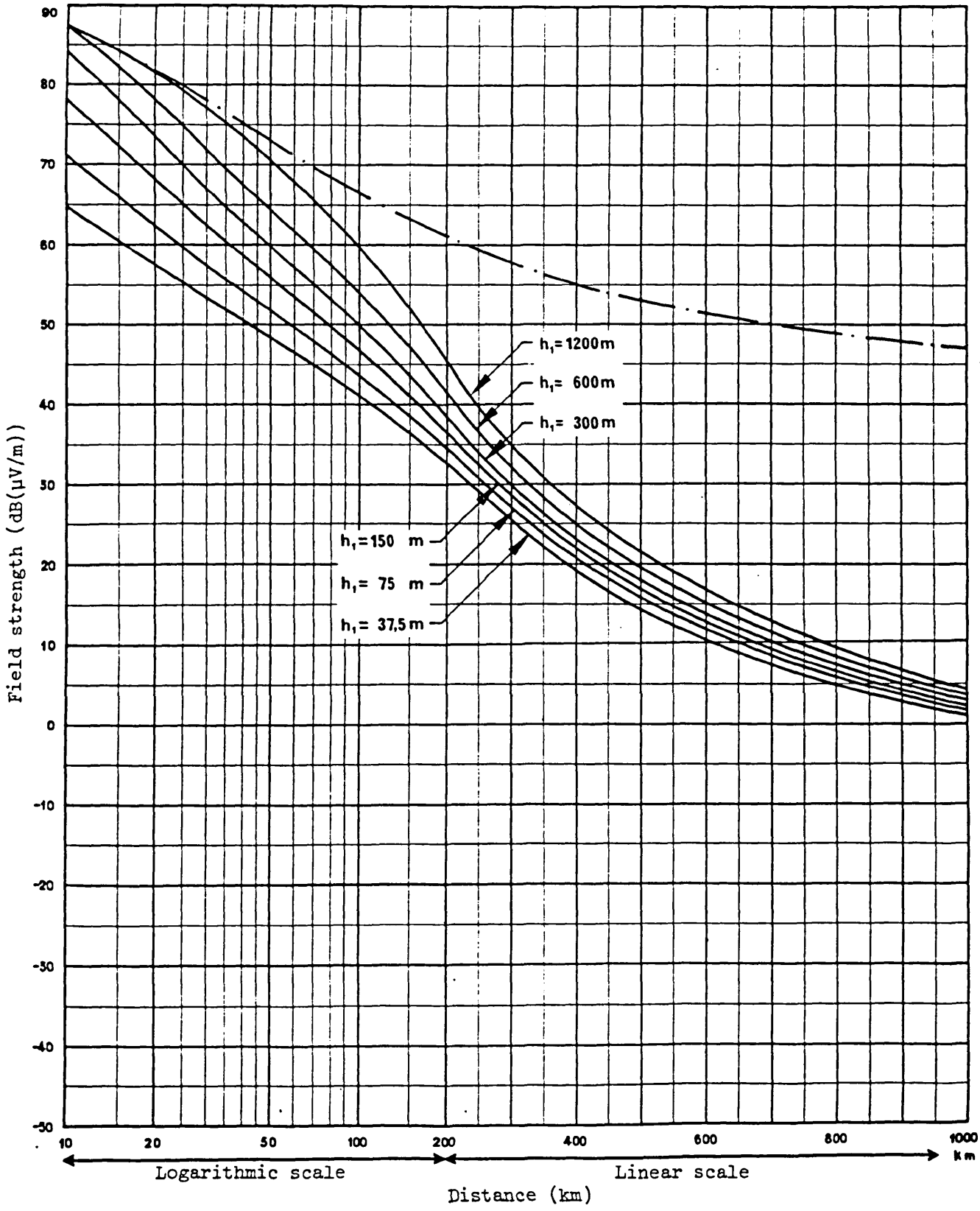

Figure 2.9 - Field strength (dB(μV/m)) for 1 kW e.r.p.

Frequency : 30 to 250 MHz; Warm sea;
1% of the time; 50% of the locations; h_2 = 10 m
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PROPAGATION CURVES FOR THE BROADCASTING SERVICE

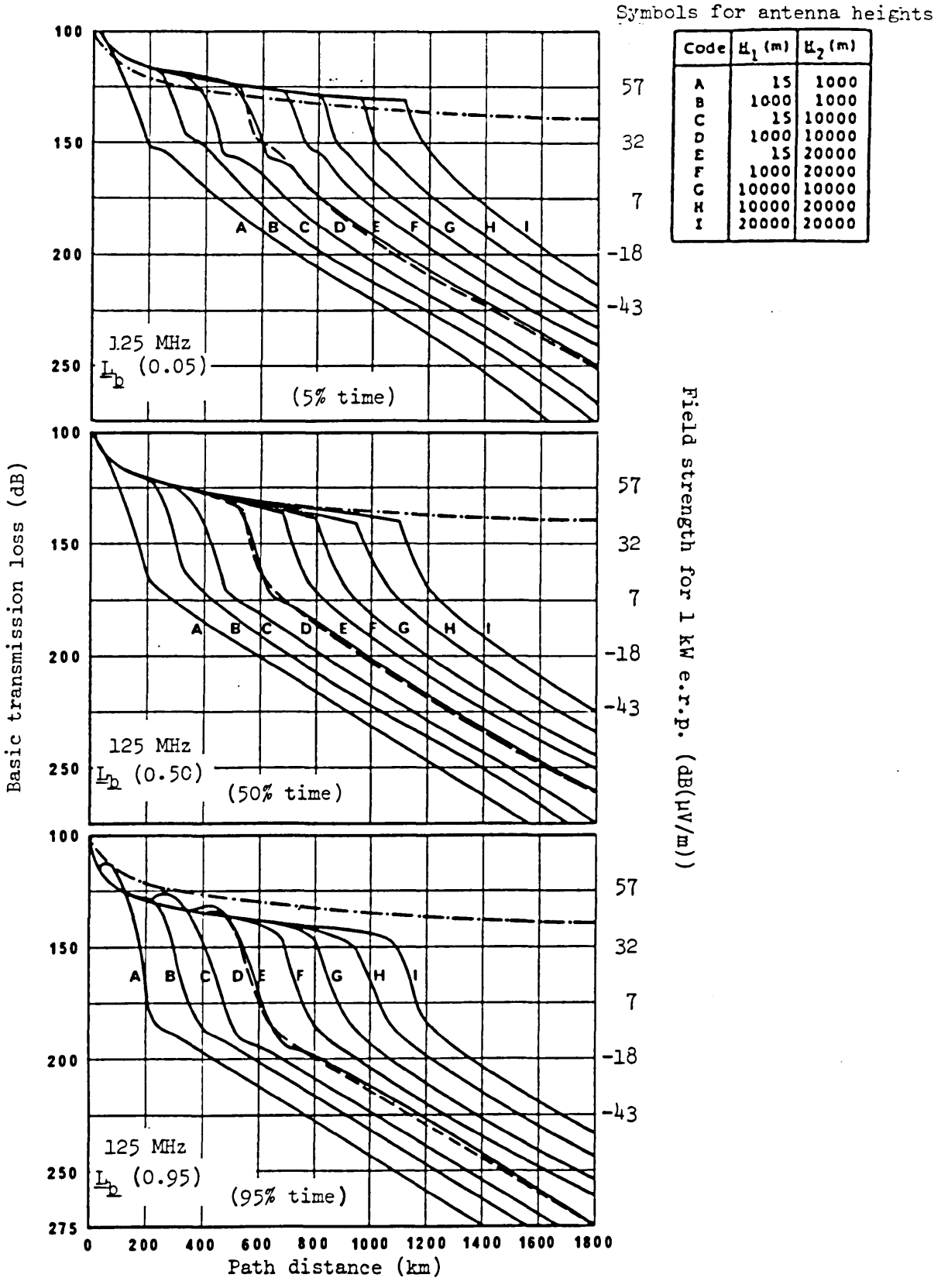

Figure 2.10 - Basic transmission loss at 125 MHz for 5%, 50% and 95% of the time

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PROPAGATION CURVES FOR THE AERONAUTICAL MOBILE SERVICE

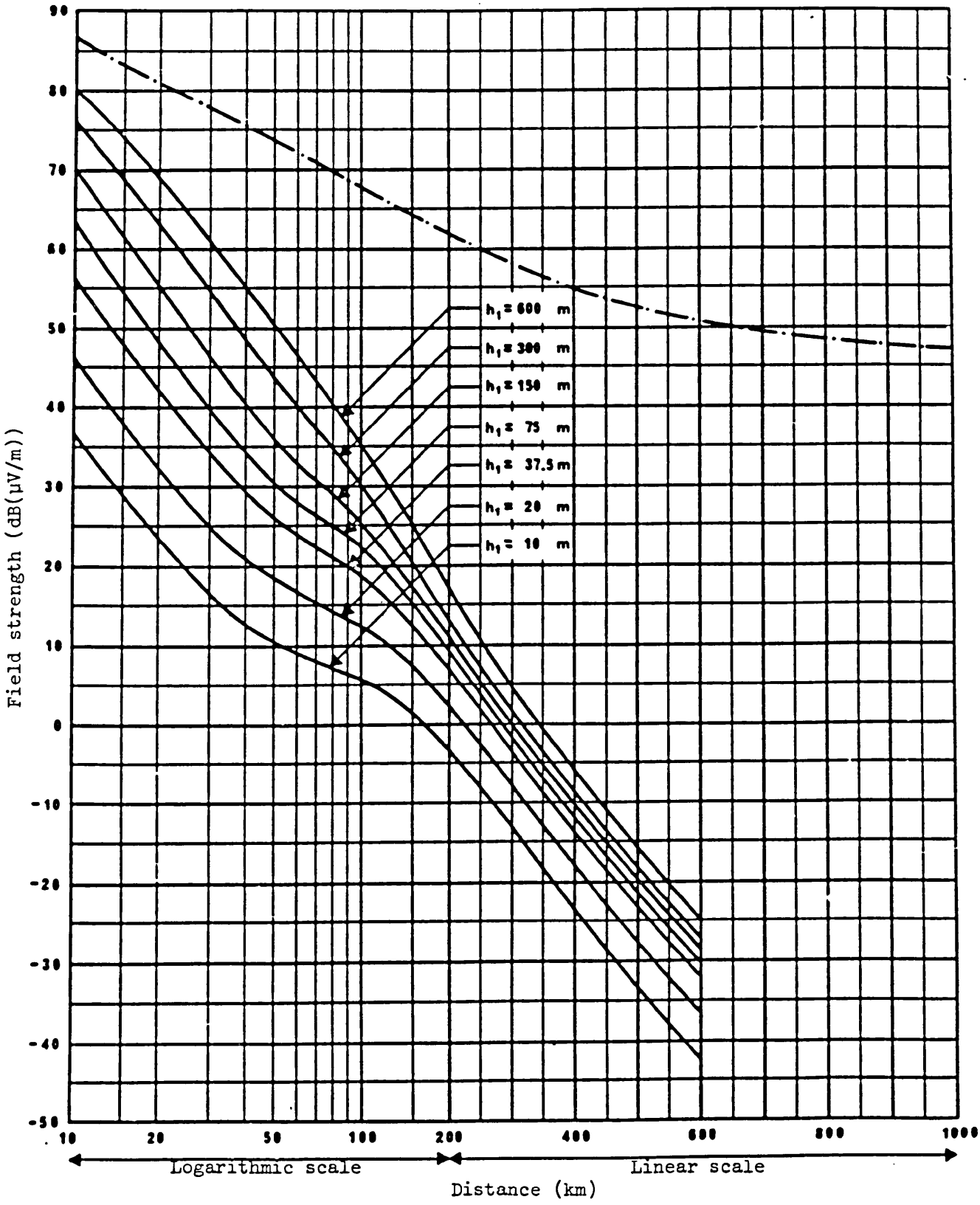

Figure 2.11 - Field strength (dB(μV/m)) for 1 kW e.r.p.

Frequency : 30 to 250 MHz, land, and cold sea;
10% of the time; 50% of the locations; h_2 = 3 m
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PROPAGATION CURVES FOR THE LAND MOBILE SERVICE

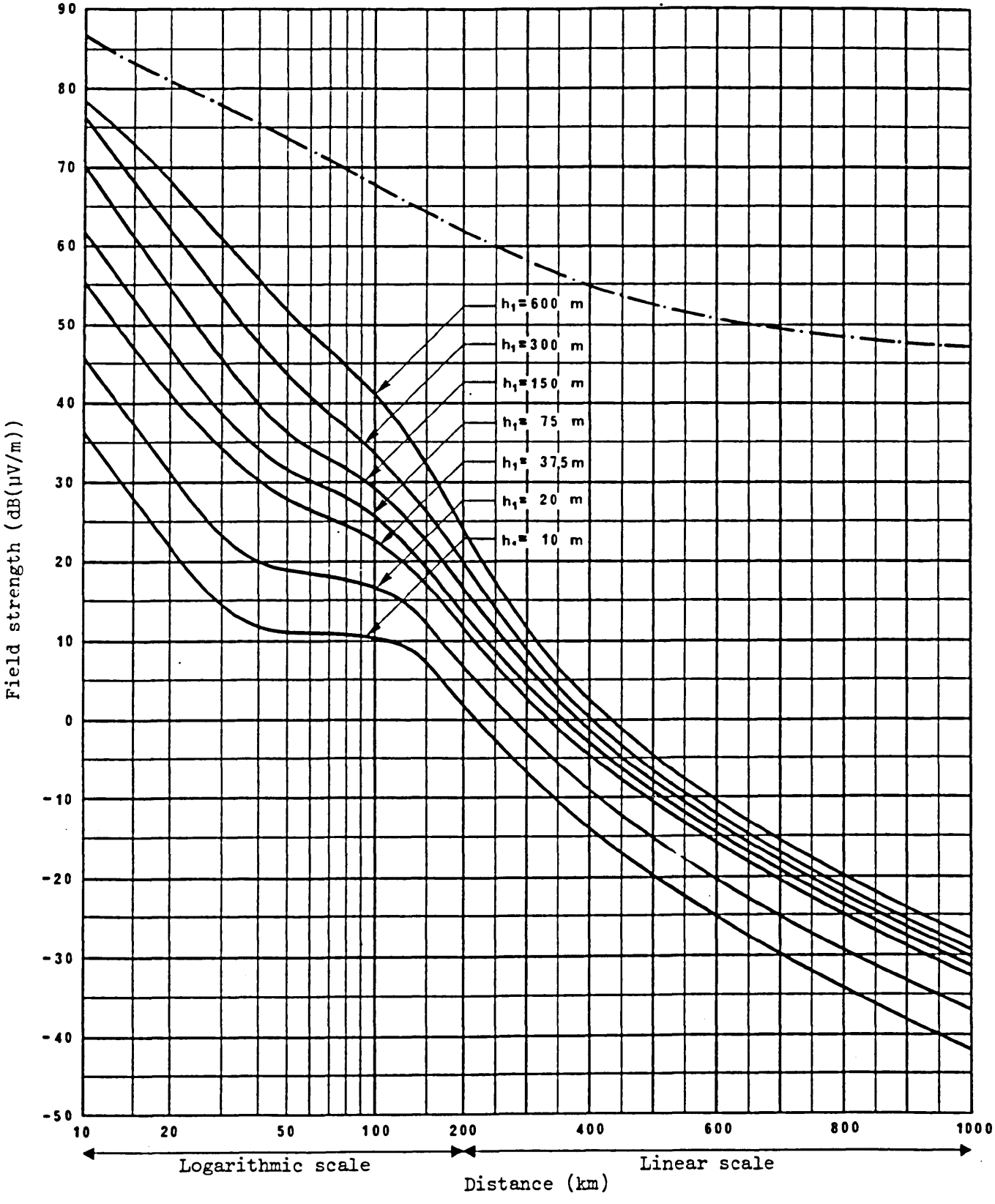

Figure 2.12 - Field strength (dB(μV/m)) for 1 kW e.r.p.

Frequency : 30 to 250 MHz; Warm sea;
10% of the time; 50% of the locations; h_2 = 3 m

·— ·— ·— Free space

PROPAGATION CURVES FOR THE LAND MOBILE SERVICE

CHAPTER 3

TECHNICAL STANDARDS AND TRANSMISSION CHARACTERISTICS

3.1 Channel spacing

A uniform channel spacing of 100 kHz shall be used in principle for both monophonic and stereophonic emissions.

The nominal carrier frequencies shall in principle be integral multiples of 100 kHz.

3.2 Modulation standards

Planning shall be based on the following transmission standards*) :

3.2.1 Monophonic transmissions

The radio-frequency signal consists of a carrier, frequency modulated by the sound signal to be transmitted, with a maximum frequency deviation of ±75 kHz or ±50 kHz after pre-emphasis.

The pre-emphasis characteristic of the sound signal is identical to the admittance-frequency curve of a parallel resistance-capacitance circuit having a time constant of 50 µs.

3.2.2 Stereophonic transmissions

The radio-frequency signal consists of a carrier, frequency modulated by a baseband signal according to the specifications of the polar-modulation system or of the pilot-tone system. The maximum frequency deviation is ±50 kHz for the polar-modulation system and ±75 KHz or ±50 kHz for the pilot-tone system.

The pre-emphasis characteristics of the sound signals M and S are identical to the admittance-frequency curve of a parallel resistance-capacitance circuit having a time constant of 50 µs.

3.2.3 Supplementary signal transmission

Supplementary signals may be added to both monophonic or stereophonic transmissions by means of sub-carriers, provided that the maximum carrier frequency deviation and protection ratio relevant to the corresponding monophonic or stereophonic transmission are not exceeded.

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*) For further information see CCIR Recommendation 450-1.

3.3 Protection ratios

3.3.1 The radio-frequency protection ratios required to give satisfactory monophonic reception for 99% of the time, in systems using a maximum frequency deviation of ±75 kHz, are those given by the curve M2 in Figure 3.1. For steady interference, it is desirable to provide the higher degree of protection, shown by the curve M1 in Figure 3.1 The protection ratios at important frequency spacing values are also given in Table I.

The corresponding values for monophonic systems using a maximum frequency deviation of ±50 kHz are given in Figure 3.2.

The radio-frequency protection ratios required to give satisfactory stereophonic reception for 99% of the time, for transmissions using the pilot-tone system and a maximum frequency deviation of ±75 kHz, are given by curve S2 in Figure 3.1. For steady interference, it is desirable to provide a higher degree of protection, shown by curve S1 in Figure 3.1. The protection ratios at important frequency spacing values are also given in Table I.

The radio-frequency protection ratios for satisfactory reception in the case of tropospheric interference (99% of time), or for steady interference for monophonic transmissions and for stereophonic transmissions using the pilot-tone system, or the polar modulation system with a maximum frequency deviation of ±50 kHz are given by Table II.

The radio-frequency protection ratios for satisfactory stereophonic reception in the case of tropospheric interference (99% of time), or for steady interference where the wanted and interfering transmitters use different maximum frequency deviations, are given in Table III.

The protection ratios for stereophonic broadcasting assume the use of a low-pass filter following the frequency-modulation demodulator in the receiver designed to reduce interference and noise at frequencies greater than 53 kHz in the pilot-tone system and greater than 46.25 kHz in the polar-modulation system. Without such a filter or an equivalent arrangement in the receiver, the protection-ratio curves for stereophonic broadcasting cannot be met, and significant interference from transmissions in adjacent or nearby channels is possible.

Data systems or other systems providing supplementary information, if introduced, should not cause more interference to monophonic and stereophonic services than is indicated by the protection-ratio curves in Figure 3.1*). It is not considered practicable in the planning to provide additional protection to data systems or other systems providing supplementary information.

Note : The protection ratios for steady interference provide approximately 50 dB signal-to-noise ratio. (Weighted quasi-peak measurement according to Recommendation No. 468 of the CCIR, with a reference signal at maximum frequency deviation.)**)

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*) For further information see CCIR Report 463.

**) For further information see CCIR Report 796.

3.3.2 Calculation of nuisance field

To apply the protection-ratio curves of Figure 3.1 it is necessary to determine whether, in the particular circumstances, the interference is to be regarded as steady or tropospheric*). A suitable criterion for this is provided by the concept of "nuisance field" which is the field strength of the interfering transmitter (at its pertinent e.r.p.) enlarged by the relevant protection ratio.

Thus, the nuisance field for steady interference is given by the formula

$$E_t = P + E(50,50) + A_s$$

and the nuisance field for tropospheric interference is given by the formula

$$E_t = P + E(50,T) + A_t$$

where

P : e.r.p. (dB(1 kW)) of the interfering transmitter;
A : radio-frequency protection ratio (dB);
E(50,T) : field strength (dB(μV/m)) of the interfering transmitter, normalized to 1 kW, and exceeded during T% of the time,

and where indices s and t indicate steady or tropospheric interference respectively.

The protection-ratio curve for steady interference is applicable when the resulting nuisance field is stronger than that resulting from tropospheric interference.

i.e. $E_s \geqslant E_t$
This means that A_s should be used in all cases when :
$E(50,50) + A_s \geqslant E(50,T) + A_t$.

*) For further information see Recommendation 412-3 of the CCIR.

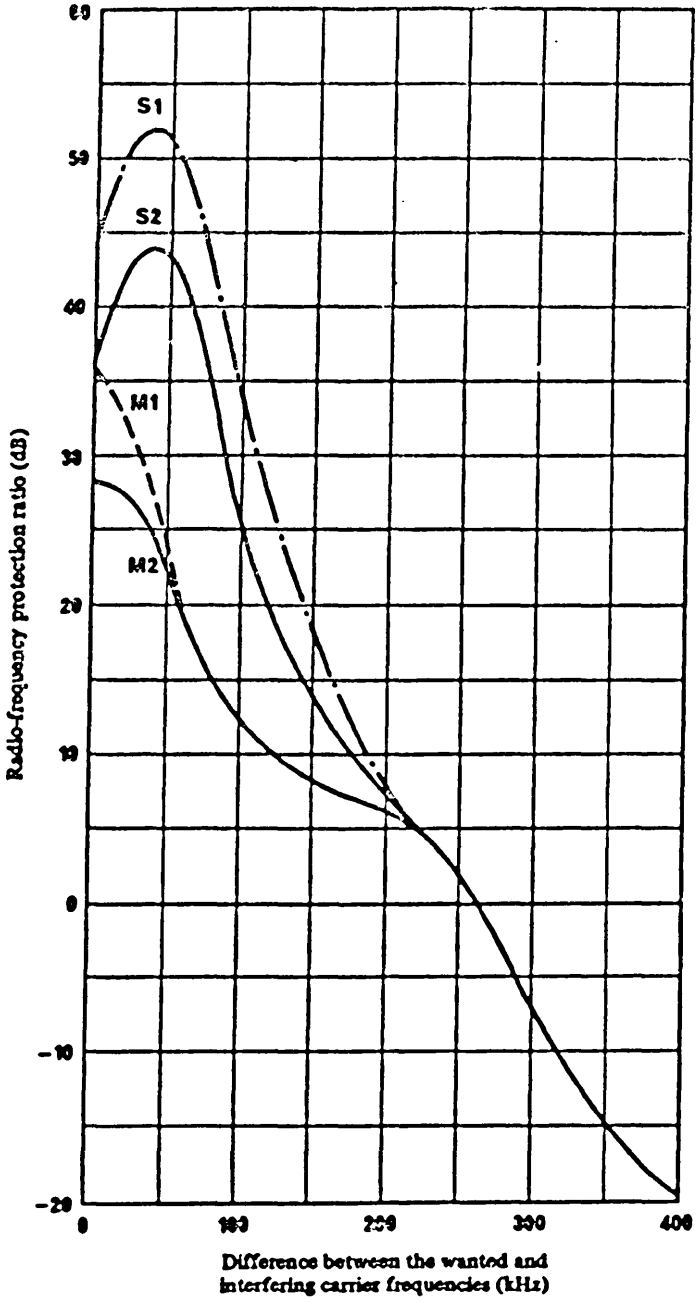

FIGURE 3.1 – *Radio-frequency protection ratio required by broadcasting services in band 8 (VHF) at frequencies between 87.5 MHz and 108 MHz using a maximum frequency deviation of ± 75 kHz*

Curve M1 : monophonic broadcasting; steady interference

Curve M2 : monophonic broadcasting; tropospheric interference (protection for 99% of the time)

Curve S1 : stereophonic broadcasting; steady interference

Curve S2 : stereophonic broadcasting; tropospheric interference (protection for 99% of the time)

TABLE I

Frequency spacing, (kHz)	Radio-frequency protection ratio (dB) using a maximum frequency deviation ± 75 kHz			
	Monophonic		Stereophonic	
	Steady interference	Tropospheric interference	Steady interference	Tropospheric interference
0	36	28	45	37
25	31	27	51	43
50	24	22	51	43
75	16	16	45	37
100	12	12	33	25
150	8	8	18	14
200	6	6	7	7
250	2	2	2	2
300	- 7	- 7	- 7	- 7
350	-15	-15	-15	-15
400	-20	-20	-20	-20

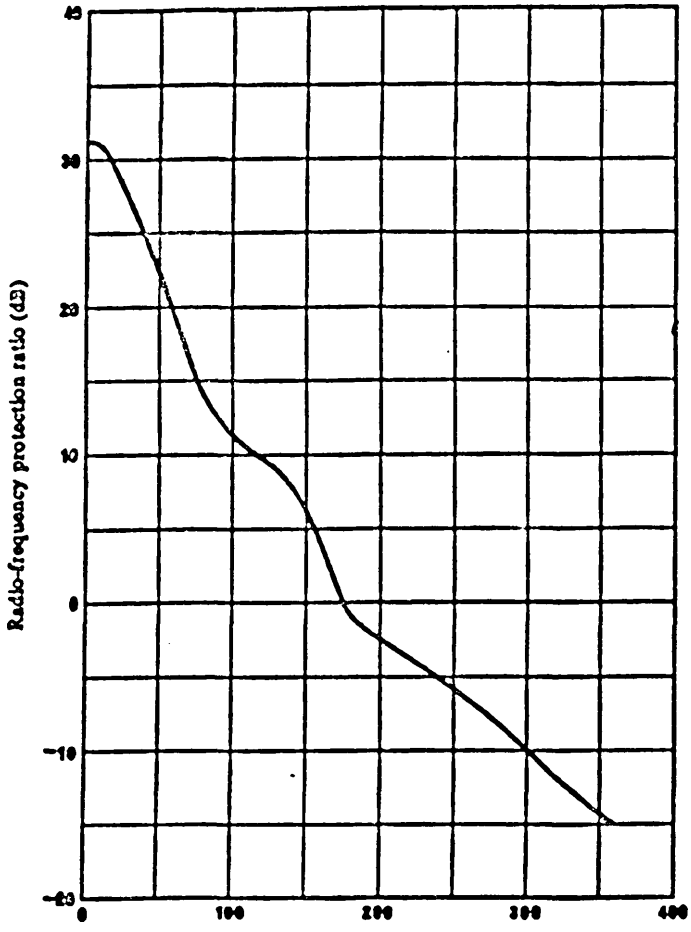

FIGURE 3.2 – *Radio-frequency protection ratios for monophonic sound broadcasting in band 8 (VHF) using a maximum frequency deviation of ± 50 kHz*

Tropospheric interference (protection for 99% of the time)

TABLE II

Frequency spacing (kHz)	Radio frequency protection ratio (dB) using a maximum frequency deviation ± 50 kHz			
	Monophonic		Stereophonic	
	Steady interference	Tropospheric interference	Steady interference	Tropospheric interference
0	-	32	-	41
100	-	12	-	25
200	-	-2.5	7	-
300	-	-10	-7	-
400	-	-	-	-

Note : Some of the figures and gaps in this table may be revised at the next Interim Meeting of the CCIR.

TABLE III

Frequency spacing (kHz)	Maximum frequency deviation Wanted transmitter ± 50 kHz Interfering transmitter ± 75 kHz		Maximum frequency deviation Wanted transmitter ± 75 kHz Interfering transmitter ± 50 kHz	
	Radio frequency protection ratio (dB) stereophonic		Radio frequency protection ratio (dB) stereophonic	
	Steady interference	Tropospheric interference	Steady interference	Tropospheric interference
0	-	41	45	37
100	-	25	33	25
200	7	-	7	7
300	-7	-	-7	-7
400	-	-	-20	-20

Note : Some of the figures and gaps for interference to systems using a maximum frequency deviation of ± 50 kHz may be revised at the next Interim Meeting of the CCIR.

3.4 Minimum usable field strength

The planning shall be based on the following median values of the minimum usable field strength (measured 10 m above ground level) :

for the monophonic service :

48 dB (μV/m) in rural areas

for the stereophonic service :

54 dB (μV/m) in rural areas.

These values shall be applied for systems with a maximum frequency deviation of ±50 KHz or ±75 KHz.

3.5 Maximum radiated power

There is no need to specify maximum power limits provided countries do not use powers in excess of those necessary to provide the required quality of national service (see No. 2666 of the Radio Regulations).

3.6 Characteristics of transmitting and receiving antennas - polarization

3.6.1 Transmitting antennas

The maximum effective radiated power and, in the case of directional antennas, the azimuth(s) relative to true north together with the azimuths of the -3 dB points anti-clockwise and clockwise respectively from the azimuth of the maximum, shall be indicated in accordance with Appendix 1 of the Radio Regulations (section D, column 9).

The attenuation (dB) with respect to the maximum value of the effective radiated power shall be specified at 10° intervals in a clockwise direction starting at true north. Where it is not possible to provide information in this detail, administrations should provide the values at 30° intervals in a clockwise direction starting at true north.

In the case of mixed polarized transmissions the effective radiated powers and radiation patterns of the horizontally and vertically polarized components are to be specified separately.

3.6.2 Receiving antennas

The directivity curve of Figure 3.3*) is to be used for the planning of stereophonic sound services, the antenna being assumed to be at a height of 10 m above ground. For monophonic services an omnidirectional antenna shall be assumed. Together with the use of the appropriate protection ratios this should ensure comparable coverages for both stereophonic and monophonic services.

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*) For further information see CCIR Recommendation 599.

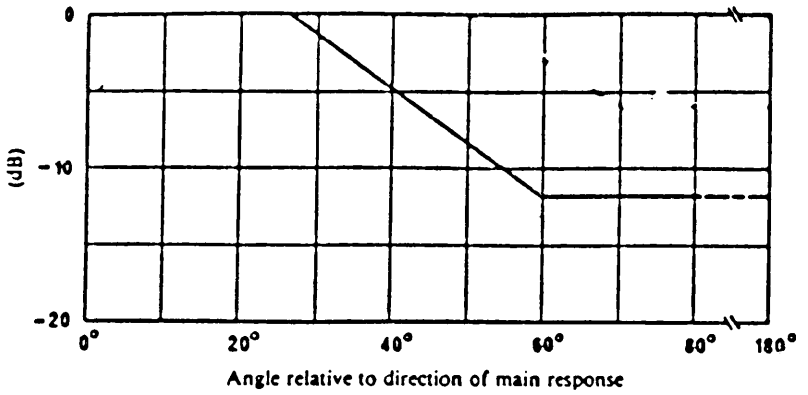

Figure 3.3 – *Discrimination obtained by the use of directional receiving antennas*

stereophonic-sound broadcasting

Note 1 : It is considered that the discrimination shown will be available at the majority of antenna locations in built-up areas. At clear sites in open country, slightly higher values will be obtained.

Note 2 : The curve in Figure 3.3 is valid for signals of vertical or horizontal polarization, when both the wanted and the unwanted signals have the same polarization.

3.6.3 Polarization

Administrations shall be free to choose which polarizations are to be used in their countries.*)

3.6.3.1 Polarization discrimination

Polarization discrimination shall not be taken into account in the planning procedure except in specific cases with the agreement of affected administrations. In such cases a value of 10 dB for orthogonal polarization discrimination may be used.

3.7 Receiver sensitivity and selectivity

Receiver sensitivity and selectivity are taken into account by the values of the minimum usable field strength, (see paragraph 3.4) and the radio frequency protection ratios (see paragraph 3.3).

*) For further information see CCIR Report 464.

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CHAPTER 4

FREQUENCY SHARING BETWEEN SOUND BROADCASTING AND TELEVISION

4.1 Introduction

Several countries are operating television transmitters using the D/SECAM system in the band 87.5 to 100 MHz.

4.2 Television broadcasting (D/SECAM) suffering interference from FM sound broadcasting

Protection ratios for the D/SECAM system suffering interference from FM sound broadcasting are given in Figure 4.1, which refers to tropospheric interference.*)

4.3 FM sound broadcasting suffering interference from television broadcasting (D/SECAM)

Protection ratios for FM sound broadcasting suffering interference from television broadcasting (D/SECAM) are given in Table 1 and Figure 4.2.**)

*) For further information see CCIR Report 306-4.

**) For further information see CCIR Report 947.

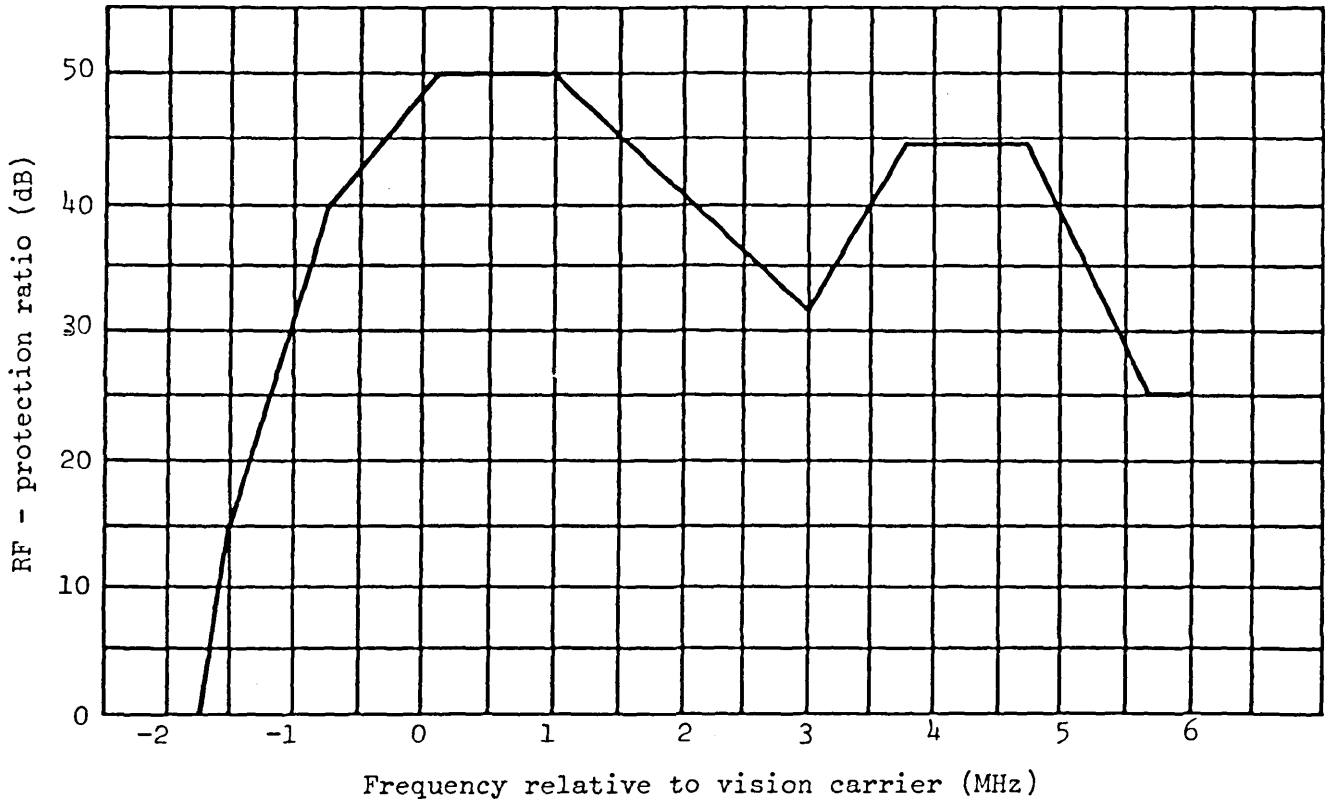


Figure 4.1 - D/SECAM television system
Protection ratio in the case of frequency-modulated sound broadcasting tropospheric interference

TABLE 1

Radio-frequency protection ratio required by FM sound broadcasting against interference from D/SECAM television transmissions in the band 87.5 to 100 MHz

(Steady interference)

Wanted signal frequency (MHz) relative to vision carrier	RF-protection ratio (dB)	
	mono	stereo
-2.0	-30	-12
-1.0	-2	18
-0.5	0	20
-0.15	19	25
-0.1	24	35
-0.05	30	50
0.0	35	45
0.05	30	50
0.1	24	35
0.15	19	31
0.25	10	25
0.5	0	20
1.0	-1	20
2.0	-3	18
3.0	-4	17
4.0	-5	15
4.18	8	25
4.25	10	26
4.41	10	26
4.48	8	25
4.7	-5	15
5.0	-15	0
6.0	-25	-5
6.25	-13	-6
6.3	-5	5
6.4	6	26
6.45	15	40
6.475	25	43
6.5	28	35
6.525	25	43
6.55	15	40
6.6	6	26
6.7	-3	0
7.0	-30	-13

Note 1.- For tropospheric interference (protection 99% of the time) these values may be reduced by 8 dB.

Note 2.- Values for frequencies from 0.5 to 4 MHz are greatly affected by picture content. The figures given are for a test pattern and are representative of the on-the-air test picture transmissions.

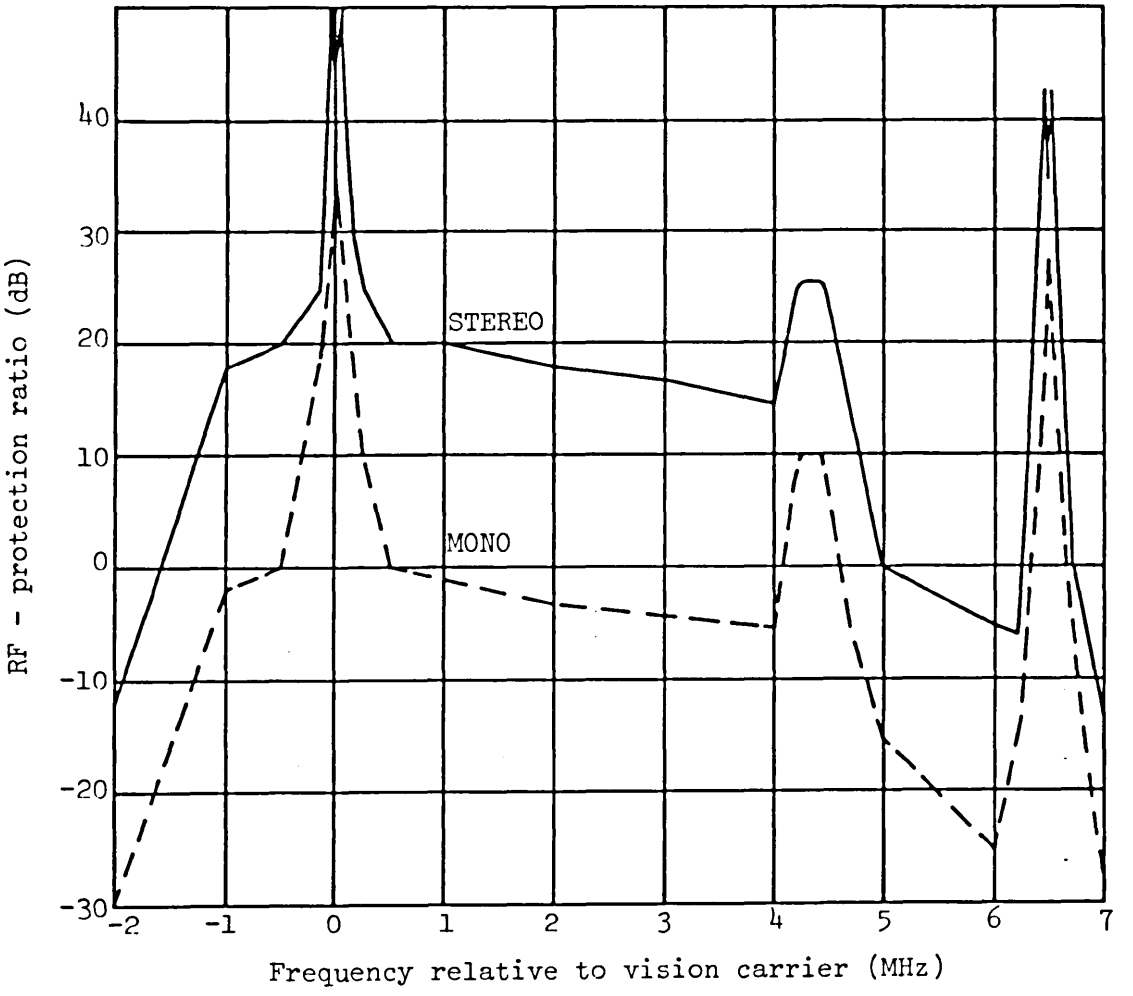


Figure 4.2 - Radio-frequency protection ratio required by FM sound broadcasting against interference from D/SECAM television transmissions in the band 87.5 to 100 MHz (steady interference)

Note For tropospheric interference (protection 99% of the time) these values may be reduced by 8 dB.

CHAPTER 5

COMPATIBILITY WITH OTHER SERVICES

5.1 Sharing criteria between the FM sound broadcasting service and the land mobile service in the band 87.5 to 108 MHz

In the table of frequency allocations of the Radio Regulations the bands 87.5 to 100 and 100 to 108 MHz are allocated in Region 1 to Broadcasting on a primary basis and in some countries also to the mobile service on a permitted basis, namely :

a) in the band 87.5 to 88 MHz, to the land mobile service, on a permitted basis and subject to agreement obtained under the procedures set forth in Article 14 of the Radio Regulations;

b) in the band 104 to 108 MHz, to the mobile, except aeronautical mobile (R) service, on a permitted basis until 31 December 1995;

c) in the band 97.6 to 102.1 MHz, to the land mobile service, on a permitted basis until 31 December 1989.

The sharing criteria for the protection of the land mobile service in the band 97.6 to 102.1 MHz is already the subject of an agreement amongst the administrations concerned and affected.

The sharing criteria for the protection of the land mobile service in the bands 87.5 to 88 MHz and 104 to 108 MHz shall be the following :

Field strength to be protected : 15 dB (μV/m) at a height of 3 m

Protection ratio : See Table below

Frequency separation between carriers of the two services (kHz)	Protection ratio for AM land mobile services (dB)	Protection ratio for FM land mobile services (dB)
0	18	8
25	16	6
50	4.5	- 5.5
75	- 7.5	-17.5
100	-17.5	-27.5

Propagation data to be used for sharing calculations	: see paragraph 2.3 of Chapter 2
Percentage of locations to be protected	: 50%
Percentage of time to be protected	: 90%
Polarization discrimination for horizontal polarized broadcasting emission	: 18 dB Base Station 8 dB Mobile Station

The sharing criteria to protect the broadcasting service from interference from the land mobile service within or immediately adjacent to the coverage area of the broadcasting transmitter should be the following :

Minimum carrier frequency separation required in the same geographical area	: 500 kHz
Protection ratio	: see Figure 5.1 hereafter*)

*) For further information see CCIR Report 659.

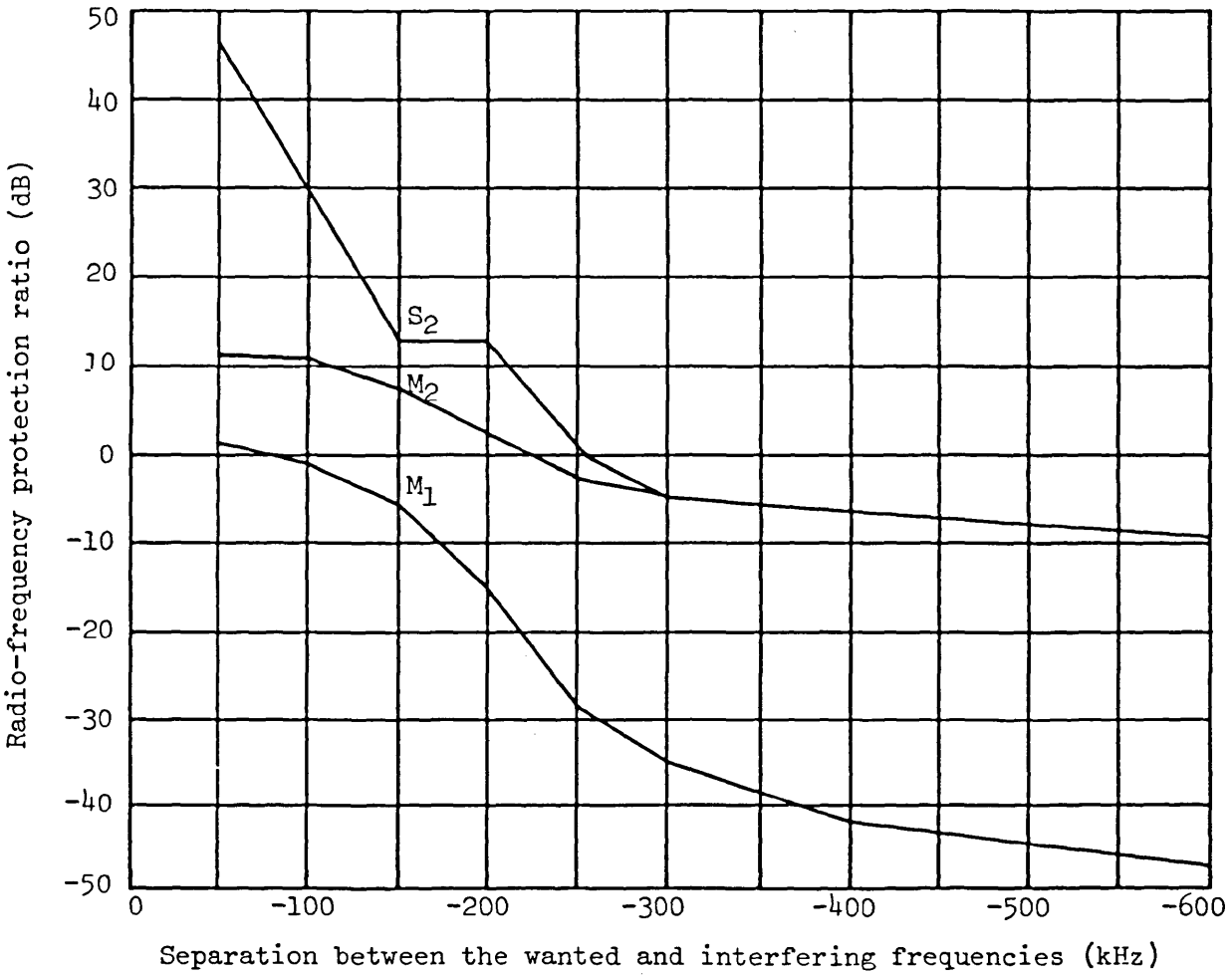


Figure 5.1 - RF protection ratios for a monophonic or stereophonic FM emission with interference by an FM or AM narrow-band emission. Steady interference. (Average curves for the ratios measured on domestic receivers.)

Curve M_1 : monophonic reception (unwanted signal : FM, modulation index m = 1)

M_2 : monophonic reception (unwanted signal : AM, modulation depth m = 95%, receiver input voltage 1 mV)

S_2 : stereophonic reception (unwanted signal : AM, modulation depth m = 95%, receiver input voltage 1 mV)

5.2 Sharing criteria between the FM sound broadcasting service and the fixed service in the band 87.5 to 108 MHz

The basic criteria can be those as established for the land mobile service (see paragraph 5.1 in this chapter). The field strength to be protected, the height gain factor and the effect of the directivity of the antenna in the fixed service are for condiseration between the administrations concerned.

5.3 Compatibility between the broadcasting service in the band 87.5 to 108 MHz and the aeronautical services in the bands 108 to 137 MHz

5.3.1 Interference mechanisms

5.3.1.1 Type A interference - Due to radiation at frequencies in the aeronautical band

1) Variously described as "in-band" or "on-ohannel", caused by spurious emissions (including intermodulation products) at the transmitter station. This is generally a low-level effect and can be regarded as harmful interference, as defined in the Radio Regulations in cases where the level is sufficient to affect the performance of avionics receivers. No rejection can be provided at the airborne receiver and suppression at source (including the choice of broadcast assignment) and/or distance separation are the only practical solutions.

2) Interference to ILS channels near to the 108 MHz band edge due to out-of-band emissions from broadcasting stations operating on carrier frequencies in the last 200 kHz (approximately) in the upper end of the broadcasting band.

5.3.1.2 Type B interference - Due to radiation at frequencies outside the aeronautical band

These comprise the following :

1) Intermodulation generated in the receiver.

2) Desensitization in the RF section of the receiver.

The two effects are caused by relatively high signals (80 dB μV/m and above) producing non-linear operation in the RF stages of the airborne receiver. Intermodulation products may be generated producing an interfering signal at the same frequency as, or near to, the wanted signal in addition to causing a desensitization of the receiver's gain response.

5.3.2 Protection of ILS localizer

5.3.2.1 Protected volume and field strength

The internationally agreed system characteristics for the ILS system are specified in ICAO Annex 10. The system standards for service volume and minimum field strength are reproduced below and define the protection limits for these parameters :

1) a service volume as indicated in Figure 5.2;

2) a minimum field strength of 40 µV/m (32 dB µV/m) over the whole of the service volume specified above (the special case of a broadcasting station inside the ILS service area is covered in paragraph 5.3.2.2.5);

3) where the operational conditions require the use of the ILS back beam, the volume to be protected indicated in Figure 5.2 is also defined. The maximum dimensions of this volume are normally 10 nautical miles (18.5 km) and 6250 ft. (1905 m).

5.3.2.2 Protection criteria

The following figures have been derived from the results of bench tests on a number of typical ILS localizer receivers in current use. They are considered to be suitable for the purpose of calculating the maximum values of broadcast signals which will be compatible with ILS systems.

5.3.2.2.1 Type A 1 Protection ratio

At frequency coincidence : 17 dB

±50 kHz from frequency coincidence : 10 dB

±100 kHz from frequency coincidence : 5 dB

±150 kHz from frequency coincidence : 2 dB

±200 kHz from frequency coincidence : -1 dB

A condition of frequency coincidence exists when the centre frequency of the intermodulation product is the same as that of an ILS localizer channel.

The figures above take into account multiple interference entries resulting from FM broadcast emissions.

A graph of the values above is given in Figure 5.3.

5.3.2.2.2 Type A 2

The ratio of 17 dB for the frequency coincidence case of Type A 1 interference may be used as the basis for interference assessments of Type A 2. Insufficient data are available to define the typical energy levels of FM broadcasting transmissions between 200 and 500 kHz from the carrier. Further studies within national administrations are necessary to define the levels at frequencies spaced by 50 kHz over this range. The reference bandwidth for such studies should be that of a typical ILS receiver.

5.3.2.2.3 Type B 1

Only third-order intermodulation products are considered below, because in practice no unacceptable degradation of receiver performance due to fifth or higher order intermodulation is likely to occur.

The intermodulation threshold criteria are derived for a single intermodulation product. In cases where two or more intermodulation products may be generated on the receiving frequency, linear addition of the powers of the intermodulation products may be assumed.

If none of the broadcasting signals exceeds a level of -25 dBm at the receiver input, it may, in general, be assumed that no unacceptable degradation of receiver performance will occur due to intermodulation on any ILS channel. For higher levels, a more detailed examination is required based on the following criteria, which apply when the third-order product has a frequency in the ILS channel concerned.

i) Third-order intermodulation involving two unwanted signals

Third-order intermodulation products of the form

$$2 f_1 - f_2 = f_a \qquad (f_1 > f_2)$$

generated in ILS localizer receivers may cause unacceptable degradation of receiver performance if

$$1.71 N_1 + N_2 + 60 \geq 0$$

where N_1 and N_2 are the levels, in dBm, of the two broadcasting signals at the frequencies f_1 and f_2 respectively at the receiver input and f_a is the receiving frequency.

A graphical presentation of this intermodulation threshold criterion is given in Figure 5.4.

This criterion is derived from measurements carried out on a number of receivers in current use.

Frequency separations between the wanted ILS localizer signal and the higher of the frequencies of the unwanted signals used in the measurements were of the order of 2 to 5 MHz.

The intermodulation response of some receivers has been reported to be substantially dependent also on the frequency separation ($f_a - f_1$) and/or (108 MHz (band-edge) - f_1), whilst in some other cases only a small amount of frequency dependence has been observed. The intermodulation threshold criterion should therefore be applied with caution in cases where the frequency differences involved are very small.

ii) Third-order intermodulation involving three unwanted signals

Third-order intermodulation products of the form

$$f_1 + f_2 - f_3 = f_a \quad (f_1 > f_3;\ f_2 > f_3)$$

generated in ILS localizer receivers may cause unacceptable degradation of receiver performance if

$$N_1 + N_2 + N_3 + 73 \geq 0$$

where N_1, N_2 and N_3 are the levels, in dBm, of the three broadcasting signals at the frequencies f_1, f_2 and f_3, respectively, at the receiver input and f_a is the receiving frequency.

This criterion is a theoretical extension for three unwanted signals and it assumes the same level of the intermodulation product as for the case of two unwanted signals.

Sufficient measurement results from which an empirical criterion could be derived for the three signal case, are not yet available.

5.3.2.2.4 Type B 2 (Desensitization of ILS localizer receivers)

An unacceptable degradation of ILS localizer receiver performance may be caused, due to desensitization, if the level of a broadcasting signal exceeds -20 dBm at the receiver input on a frequency near the band edge (108 MHz).

For broadcasting signal frequencies from 108 MHz to 106 MHz the threshold level increases linearly from -20 dBm to -5 dBm.

Sufficient measurement results are not available for frequencies below 106 MHz, where a constant threshold level of -5 dBm should therefore be assumed.

In order to determine a possible desensitization of ILS localizer receivers caused by more than one broadcasting signal, linear power summation of the signal levels may be used.

5.3.2.2.5 Inside ILS service area conflict

In situations where the broadcasting site is located within an area below the protected volume as specified at 5.3.2.1 above, no general rules can be stated since each situation will differ in respect of the interference threat, the point at which the interference is most serious and the pattern and density of air operations within the service area.

Study and assessment on a case-by-case basis by national aviation and broadcasting authorities concerned will be necessary to refine and evaluate the individual character of each conflict situation encountered. The material in Annex B may be used as guidance in these studies.

In cases where an administration confirms that an assessment for a particular ILS made using the criteria in paragraph 5.3.2.2 is satisfactory to establish compatibility, the general rules may be applied in this case.

5.3.3 Protection of VOR

5.3.3.1 Protected volume and field strength

1) The protected volume of the VOR should be that volume promulgated in appropriate aeronautical documents as modified by radio horizon effects at the lower flight levels.

2) A minimum field strength of 90 μV/m (39 dB μV/m), as specified in paragraph 3.3.4.2 of Volume I of Annex 10 of the ICAO Convention, over the volume in 1) above should be protected.

5.3.3.2 Protection criteria

Only a limited amount of bench test data is available to assess the protection criteria of VOR receivers from FM broadcasting signals. Present information suggests that the behaviour of VOR receivers is not dissimilar to that for ILS for the four interference modes studied, as in many cases the two systems have common antennas and common circuitry up to and including the second detector.

Further study is necessary to confirm and refine the present data (see Recommendation CC). In the meantime first order estimates of compatibility may be made by the application of the criteria for ILS, including the treatment of conflicts inside the service area.

5.3.4 Protection of VHF communications

The following results have been derived from a limited series of bench testing on a few typical receivers and include information from CCIR Report 929.

5.3.4.1 Protected volume and field strength

1) The protected volume for a VHF communication channel should be that volume promulgated in appropriate aeronautical documents as modified by radio horizon effects at the lower flight levels.

2) The minimum specified field strength is 75 μV/m (37 dB μV/m) and this level should be protected throughout the service volume in 1) above. The protection criteria will, in most cases, ensure that inadvertent squelch operation will not take place.

5.3.4.2 Protection criteria

5.3.4.2.1 Type A 1

For this interference mode a protection ratio of 17 dB at carrier coincidence has been derived from available test data. No data are available on the relaxation of this figure for frequency offsets.

5.3.4.2.2 Type A 2

Due to the separation of 10 MHz between the lowest assignable VHF communications channel and the broadcasting band edge of 108 MHz, no account need be taken of this effect.

5.3.4.2.3 Type B 1

Only third order intermodulation products of the form

$$2f_1 - f_2 = f_a \quad (f_1 > f_2)$$

or

$$f_1 + f_2 - f_3 = f_a$$

need to be considered, because no unacceptable degradation of receiver performance due to fifth and higher order intermodulation is likely to occur in practice. In the equations above f_1, f_2 and f_3 are the frequencies of the broadcasting signals and f_a is the receiving frequency.

If none of the broadcasting signals exceeds at the receiver input a level of -10 dBm, it may be assumed that no unacceptable degradation of receiver performance will occur due to intermodulation on any VHF communications channel.

Using the conversion factor described in paragraph 5.3.5 and assuming free space propagation, this threshold level is reached at a distance of 2.8 km from a broadcasting station with an effective radiated power of 100 kW and a frequency between 100 MHz and 108 MHz.

In cases where the threshold level of -10 dBm is exceeded, reference should be made to Annex C, where a method for assessing areas of interference is described.

5.3.4.2.4 Type B 2 (Desensitization of VHF communications receivers)

An unacceptable degradation of VHF communications receiver performance may be caused, due to desensitization, if the level of a broadcasting signal exceeds -10 dBm at the receiver input.

In order to determine a possible desensitization caused by more than one broadcasting signal, linear power summation of the signal levels may be assumed.

Using the conversion factor described in paragraph 5.3.5 and assuming free space propagation, this threshold level is reached at a distance of 2.8 km from a broadcasting transmitter with an e.r.p. of 100 kW and a frequency between 100 MHz and 108 MHz. In the case of three co-sited broadcasting transmitters each with an e.r.p. of 100 kW and frequencies between 100 MHz and 108 MHz, the desensitization distance would be 4.8 km.

5.3.5 Conversion factors between signal levels at receiver input and corresponding field strength values

5.3.5.1 Unwanted signals between 87.5 MHz and 108 MHz

The levels of unwanted signals at the receiver's input may be converted to corresponding field strength values at the receiving antenna, or vice versa, by using the equations below.

5.3.5.1.1 ILS localizer and VOR receivers

$$E(dB\mu V/m) = N(dBm) + 121 + (108 - f(MHz))$$

for frequencies $f < 108$ MHz.

This equation is based on the assumption of an isotropic receiving antenna and a frequency dependent attenuation of 3 dB + 1 dB/MHz below 108 MHz, due mainly to antenna characteristics.

5.3.5.1.2 VHF communications receivers

$$E(dB\mu V/m) = N(dBm) + 128$$

for $100 \text{ MHz} \leq f \leq 108 \text{ MHz}$, or

$$E(dB\mu V/m) = N(dBm) + 128 + 2(100 - f(MHz))$$

for $87.5 \text{ MHz} \leq f < 100 \text{ MHz}$.

These equations are based on the assumption of an isotropic receiving antenna, a constant attenuation of 10 dB for frequencies between 100 MHz and 108 MHz and a frequency dependent attenuation of 10 dB + 2 dB/MHz for frequencies below 100 MHz, due mainly to antenna characteristics.

5.3.5.2 Signals between 108 MHz and 137 MHz

The level of a signal at the receiver input may be converted to the corresponding field strength value, or vice versa, by using the equation :

$$E(dB\mu V/m) = N(dBm) + 118$$

for 108 MHz < f < 137 MHz.

Although the conversion factor would theoretically give an increase from about 118 dB at 108 MHz to about 120 dB at 137 MHz, a constant factor of 118 dB is considered sufficient for practical purposes.

This conversion factor assumes an isotropic receiving antenna and a lossless feeder.

5.3.6 Propagation conditions

Free space propagation conditions*) may be assumed for the study of compatibility with the aeronautical service. Calculations may be based on line-of-sight signals only. In certain situations Figure 2.10 in Chapter 2 may be applied.

In arriving at the above criteria the interfering signals are assumed to have the same polarization (vertical or horizontal) as the navigation system. If, instead, the broadcasting station has a different polarization, there should in theory be some reduction of received interfering signal levels, but provisionally it is proposed that no allowance is made. If an equal power in the other plane of polarization is added at the transmitter (e.g. circular polarization) an allowance should be made by adding 1 dB to the effective radiated power of the polarization component in the same plane as that used by the navigation system.

5.3.7 Implications to the broadcasting service of the need to provide sufficient compatibility with the aeronautical radionavigation service in the bands 108 to 118 MHz

5.3.7.1 General

In order to meet the protection criteria which are essential to protect the aeronautical radionavigation service from the mechanisms of interference identified in section 5.3.1 of this chapter, there are four principle means by which the broadcasting service could contribute towards a practical solution to the compatibility problem. These are elaborated upon in sections 5.3.7.2 to 5.3.7.5. There is also the possibility that the general aeronautical requirements can be relaxed in specific cases. Further improvements in the characteristics of airborne installations are desirable. These aspects are dealt with in section 5.3.8.

*) For further information see CCIR Recommendation 525.

5.3.7.2 Limiting the effective radiated power of the broadcasting station

For all modes of interference a reduction in interfering power can be achieved by reducing the broadcasting station power. However, since the broadcasting power is set by the coverage requirement, such a reduction would directly reduce the coverage or the quality of reception within the same coverage area.

5.3.7.3 Set minimum separation distance between the broadcasting transmitter site and the aeronautical service volume

This is the most effective way of gaining sufficient attenuation of the broadcasting signal to meet the aeronautical service protection criteria (see Annex D).

In many instances there will be little or no choice in the location of the broadcasting transmitting station, e.g. airports located near major cities. For economic reasons the use of existing broadcasting transmitting station sites for new services may also be essential. Thus, in many cases, distance is not a variable which can simply be set to suit the compatibility criteria.

5.3.7.4 Improve filtering of broadcasting transmitters

Spurious emissions from broadcasting transmitters must meet the requirements of the Radio Regulations, i.e. Appendix 8. An important case is intermodulation interference generated at broadcasting transmitter sites which can be reduced by fitting improved combining filters and paying careful engineering attention to all possible sources of non-linearity following the output stages of the transmitters. Through such measures it is technically feasible to reduce the radiated power of the third order intermodulation products to -85 dB relative to the effective radiated power. It is also technically feasible to fit improved filters on the output of transmitters to improve suppression of other spurious emissions to the order of -90 dB. In view of the additional cost, these values should only be applied in those situations where problems of compatibility with the aeronautical service demand it. There may be a need in some cases for an even greater suppression of spurious emissions from the broadcasting stations than the values indicated above.

5.3.7.5 Arrange broadcasting service frequency plan to minimize interference to the aeronautical radionavigation service

There are two ways in which the placement of broadcasting assignments within the plan can add to, or reduce, the burden of solving compatibility problems with the aeronautical radionavigation service. The first is how far below 108 MHz the broadcasting assignment is placed. The second is the particular combination of carriers chosen. This latter factor is pertinent to the two interference mechanisms where the generation of intermodulation products is the cause of the interference.

5.3.7.5.1 Frequency separation between the broadcasting service assignment and the aeronautical radionavigation service assignment

The aeronautical radionavigation service airborne receiving equipment has some rejection of out-of-band signals due mainly to antenna characteristics, and may be assumed to provide 3 dB plus one dB for each MHz down from 108 MHz. This rejection characteristic may be applied to all the type B modes of interference.

The interference due to out-of-band emissions from a FM broadcasting station is reduced the further a broadcasting assignment is placed below 108 MHz.

5.3.7.5.2 Relationship between two or more broadcasting carriers in the same service area of the aeronautical radionavigation station

By programming the mathematical relationship for the intermodulation frequencies into a computer, it is possible to predict frequencies on which the most significant of these interference frequencies (i.e. third order products) will fall. This would apply to products radiated from the transmitter site or produced in the aeronautical receiver. Thus, in theory, it is feasible to choose the assignments at a particular multi-channel broadcasting transmitter site or combination of nearby sites such that all the intermodulation interference frequencies do not coincide with any assignments of nearby aeronautical radionavigation systems. However, this implies that spurious emissions from the broadcasting service will fall in the unused portions of the aeronautical band in that specific location. From a purely broadcasting viewpoint unless this is possible, it would impose severe constraints on broadcasting assignments and hence militate against the efficient use of the spectrum in the band 87.5 to 108 MHz.

5.3.7.5.3 Practical limitations in arranging the broadcasting service frequency plan to minimize interference to the aeronautical radionavigation service

On the broadcasting side, the task of arranging a set of compatible assignments within the broadcasting service will be very difficult. Imposing constraints in order to meet the aeronautical radionavigation service protection requirements will add to the complexity of the task and the time needed to make a plan. Indeed it would be a quite formidable task for information on all ILS and VOR systems to be submitted to the Conference and be taken comprehensively into account in the planning process. On the aeronautical radionavigation service side, there would naturally be a preference to preserve the efficiency of use of their spectrum, i.e. for the protection criteria to be applied across the whole band rather than the actual aeronautical assignment which may exist at present. In particular, if harmful interference resulting from implementing a broadcasting plan falls in the band 108 to 118 MHz between existing aeronautical channels, it will inhibit the possibility of replanning the aeronautical band and of being able to provide new assignments to meet future growth.

From the foregoing, it can be seen that it is highly desirable to limit to the absolute minimum the number of compatibility problems with the aeronautical radionavigation service for which the Regional Broadcasting Conference is asked to find special frequency planning solutions.

5.3.8 Factors within the aeronautical radionavigation and aeronautical mobile (R) services which may facilitate compatibility

There are no general measures in the immediate future within the aeronautical service which would ease the compatibility problem, although in the longer term it is in the interest of both the broadcasting and the aeronautical services for the aeronautical service airborne receivers to be significantly improved in respect of interference immunity.

Meanwhile, in each individual situation, factors may exist which could provide an easement of the situation. These factors include :

a) terrain effects, e.g. shielding,

b) higher signal levels in particular parts of the service volume,

c) typical operational heights in use,

d) acceptable constraints on a part of the aeronautical band which is not in use and need not be protected, in accordance with the full criteria, in a particular individual location,

e) change of aeronautical frequency assignments at a specific location. (This is unlikely to be possible in some countries due to the tight constraints within the aeronautical band.)

f) radiation pattern of the broadcasting station in the direction of the aeronautical service volume.

Where such easements do appear feasible, an acceptable assurance of aircraft safety may require ground and perhaps airborne measurements of signal levels under appropriate conditions. For all such situations a case by case examination by an administration or administrations is necessary. Consideration also needs to be given by administrations to the problem of blocking and desensitization of airborne receivers when aircraft fly close to broadcasting transmitting station sites. Within a limited volume around such a site it is impossible to meet the necessary protection criteria. One solution for the communications case might be for such zones to be published and for aircraft to avoid them or at least be made aware of the interference situation within such zones. However, again case by case treatment by administrations, taking the operational situation fully into account, is the only way to determine whether this approach is consistent with the very important air safety considerations.

5.3.9 Studies to be undertaken

5.3.9.1 The Second Session of the Conference, when establishing the regulatory procedures whereby the broadcasting plan can be subsequently modified, will need to include steps to ensure that the necessary degree of protection is afforded to the aeronautical service in the band 108 to 137 MHz.

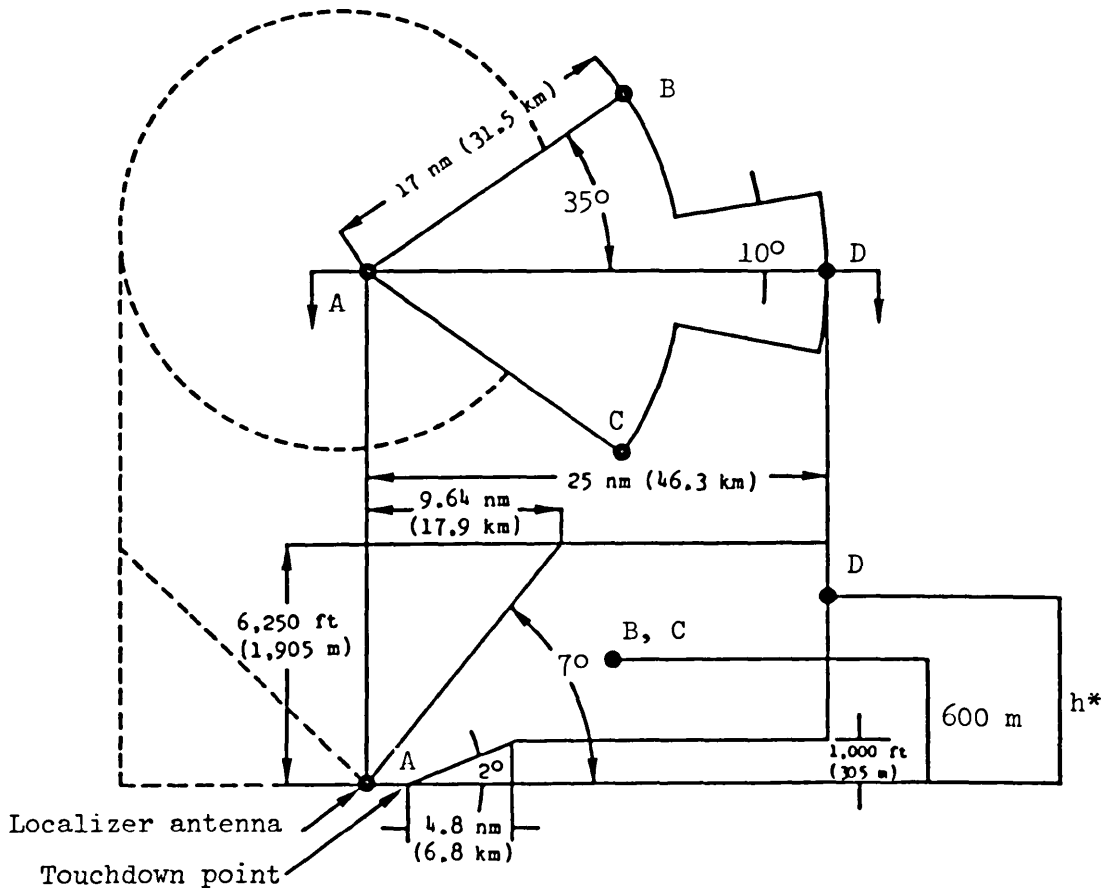
5.3.9.2 The values for the compatibility criteria established at this Session are the least stringent possible for planning purposes with present equipment in use in the broadcasting and aeronautical services. Even so, in some areas they are likely to unduly inhibit the development of both services and improvements in certain characteristics of equipment in these services would ease the planning constraints. The various interference modes lead broadly to equal constraints (see Annex D). Therefore in order to progressively ease the compatibility problems, improvement generally of the same order are needed for both services. But where interference arises from two broadcasting transmitter sites (type B interference), then improvements in the performance of the aeronautical service airborne equipment alone would ease the compatibility constraints. (For additional information see Annex E).

In order to examine this prospect, urgent studies are requested of the CCIR. These studies are set out in Recommendations CC and DD. If the CCIR can quantify the improvements possible in the equipment of both services, then, subject, to study by administrations on the economic and operational implications, the Second Session of the Conference should take these into account in planning. The Conference will also need to take into account a suitable time period for these improvements in equipment performance to be brought about also taking into account the practical issues involved and the important safety considerations in respect of the aeronautical services. A concept would then arise that certain broadcasting assignments having compatibility constraints could be planned but not implemented until a date set by the Second Session of the Conference for the new compatibility criteria to come into force.

5.3.9.3 The attention of ICAO should be drawn to the pressing need to promote a programme of improving the out-of-band rejection of airborne receivers, in particular, rejection of signals in the broadcasting service band below 108 MHz.

5.3.10 Conclusion

A difficult and complex problem arises in attempting to plan the introduction of the broadcasting service, which in general employs high radiated power, in a band adjacent in the radio frequency spectrum to a band used by a service which uses much lower powers and features sensitive receiving systems for important safety of life purposes. The problem is made worse by the fact that, in order to meet the coverage requirements, the broadcasting transmitting stations are often near and in some cases within the service volume of the aeronautical service systems. The full severity of the problem will not become clear until administrations have undertaken the case by case studies that have been recommended in paragraph 5.3.9. At this stage it may be tentatively concluded that full exploitation of the new spectrum allocated by WARC 1979 to the broadcasting service may be constrained in some areas by the need to provide the essential protection to the aeronautical safety services. Significant alleviation of these constraints may be expected only when improvements in the relevant characteristics of the equipment of the aeronautical and broadcasting services can be effected.



Note : The dash line shows the limits of ILS back beam protection volume which may have to be considered; in this case, the range and height are indicated.

● (A, B, C, D) : test points for the ILS localizer

* (h) : altitude to be indicated by the Administration (see paragraph, 6.3, Annex J)

Figure 5.2 - ILS localizer protection volume

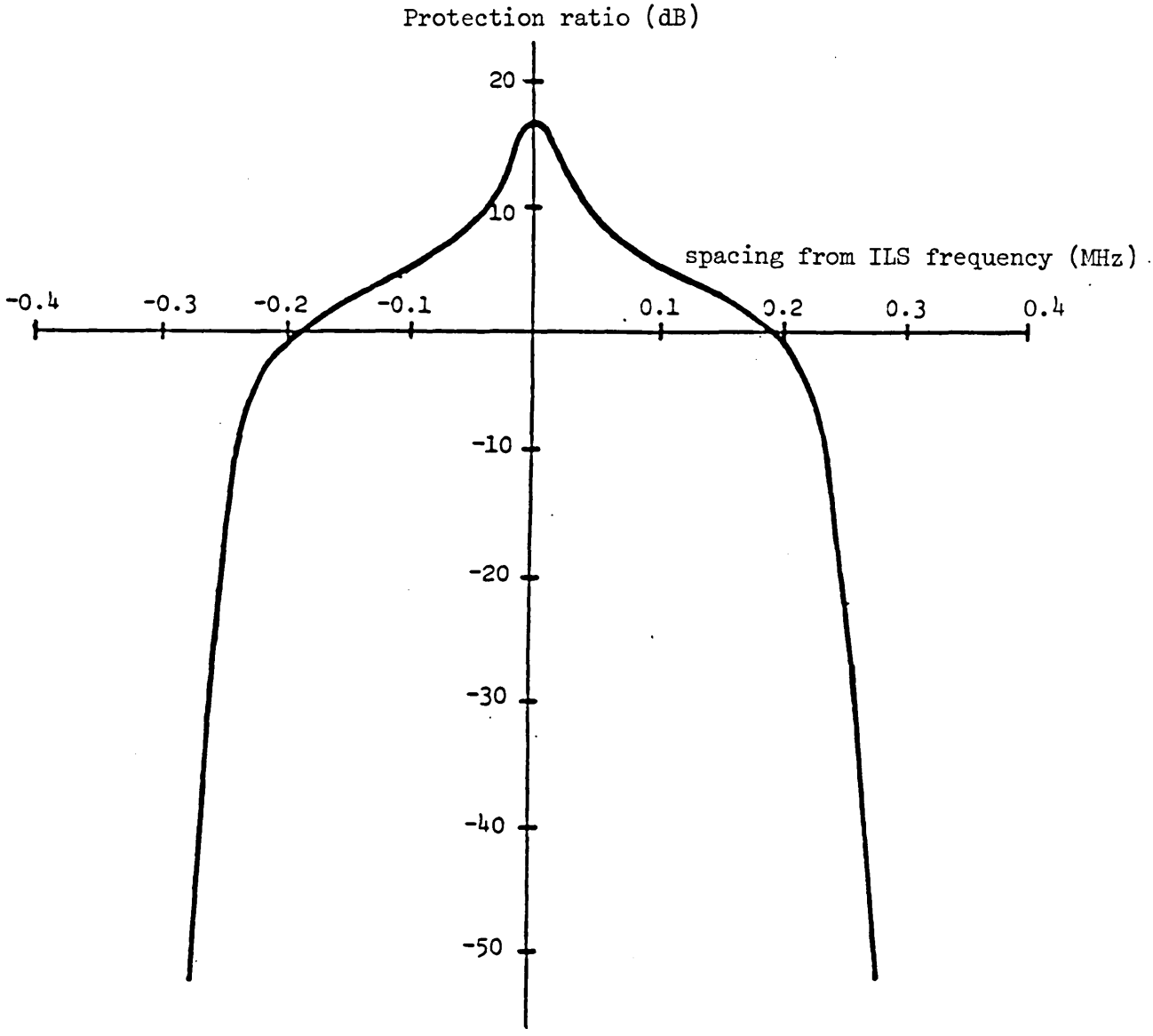


Figure 5.3 - Protection ratio for Type A 1) interference

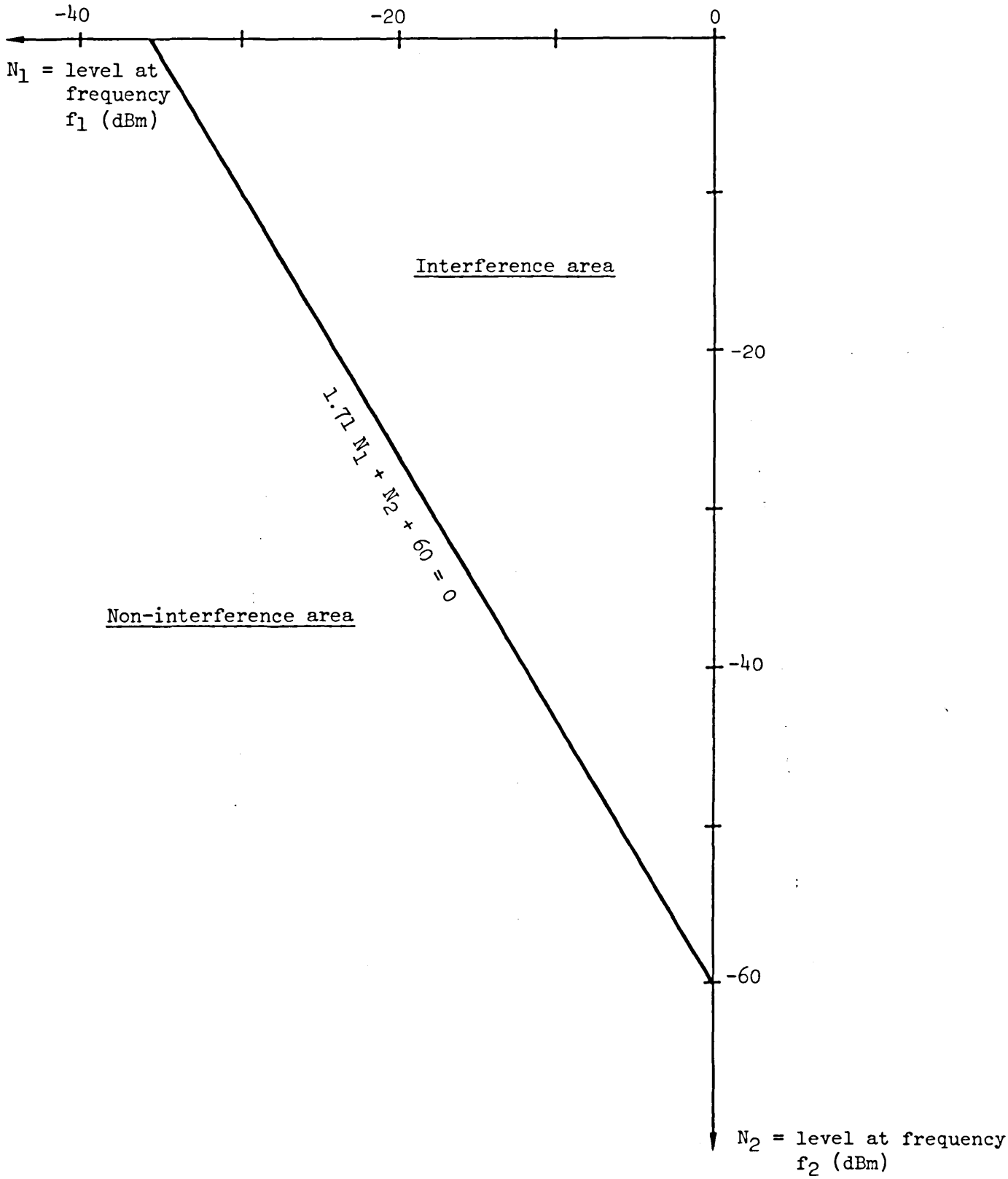


Figure 5.4 - Intermodulation threshold criterion
$f_1 > f_2$

CHAPTER 6

PLANNING METHOD

6.1 Planning principles

6.1.1 The Second Session of the Conference will be required to establish a frequency assignment plan in the band 87.5 to 108 MHz for the countries of Region 1 and for parts of Afghanistan and Iran which are contiguous with Region 1. The planning process shall use the inventory of requirements communicated by administrations to the IFRB in accordance with the decisions of the First Session of the Conference.

Note : Considering the particular geographical situation of Iran, and taking into account the complexity of the areas adjacent to Region 1 and the extent of interference calculations, the Administration of the Islamic Republic of Iran may communicate its requirements based on a country-wide planning scheme.

6.1.2 In processing a requirement, the concept of providing broadcasting services to the required service area should be applied, while recognizing equal rights for all countries with regard to the use of the band 87.5 to 108 MHz for broadcasting. The planning should be carried out in such a manner as to respect the rights of each country to organize its broadcasting service in the most appropriate way in conformity with its specific needs (such as the peculiarities of its geography, its socio-political systems - multinational and multilingual composition of its population, federalism, local information systems, etc.) and to choose the characteristics of its stations in order to attain an appropriate coverage of all its territory. In this case, planning may, according to the country, be based on either a system of national coverage or a system of multiple regional or local coverages, or a combination of these systems. Some countries may base their national planning on co-siting of television stations and FM sound broadcasting stations. For the application of the principle of equal rights among countries and in order to take into account the diversity of systems of national, regional or local coverage, that each country may prefer, the concept of "equivalent national coverage"*) will be introduced. Every country will have assured rights to the same number of equivalent national coverages. Joint planning of low-power and high-power stations near border areas will give rise to specific problems which will probably not be covered by general planning methods. Especially, the use on either side of a border of networks made up of low-power stations and networks made up of high-power stations may lead to less efficient use of the spectrum.

*) Due to the variety of requirements (several national coverages in some countries, multiple regional or local coverages in other countries), it is necessary to express an equivalent national coverage which should correspond approximately to a number of total coverages obtained taking account of the coverages of all stations in a given country. The total number of coverages so obtained would be of the order of 6 to 7.

6.1.3 During the planning process, all requirements shall be processed in the same manner according to the technical evaluation procedure adopted by the Conference. In accordance with Resolution No. 510 of WARC 1979, in the planning of the band 87.5 to 108 MHz in Region 1 and parts of Afghanistan and Iran which are contiguous to Region 1, the following conditions shall be observed :

- this new plan should in no way affect existing or planned assignments to television stations in the band 87.5 to 100 MHz made in accordance with the Regional Agreement, Stockholm, 1961; and

- this new plan in the band 87.5 to 100 MHz should not result in the deterioration of the service areas of those existing sound broadcasting stations operating in accordance with the Regional Agreement, Stockholm, 1961, which are situated in the coordination area with countries using this band for television in accordance with the Regional Agreement, Stockholm, 1961.

The radio equipment used by aircraft for landing and navigation purposes, which operates in the adjacent band 108 to 118 MHz, may be subject to harmful interference from nearby broadcasting stations operating in the band 87.5 to 108 MHz if the frequencies of these stations are not selected with care; such interference can put human life at risk.

6.1.4 During the planning process, all proposed assignments shall be open to discussion for bilateral or multilateral negotiation among the administrations concerned, which may be conducted either directly or through the IFRB, on the understanding that those administrations may be requested to modify the characteristics of their stations.

6.1.5 In Africa, taking into account the modifications introduced in the planning criteria (such as the channel spacing and the degree of implementation of the Geneva 1963 Plan), the systematic planning will cover the entire band 87.5 to 108 MHz. This planning will be based on the theoretical network method. To this end, a lattice using a nominal station separation will be established and used as a guide for the choice of appropriate channels. It is recommended, in order to facilitate subsequent coordination among the countries concerned, that the Agreement should include in an appropriate manner the channels which may be selected by the countries which may not be present at the Second Session and which had not submitted their requirements.

6.1.6 In Europe, a radical change in the existing situation would gradually lead to modifications which would affect the area to be protected and make it difficult or even impossible to observe the constraints imposed by Resolution No. 510 of WARC 1979.

It is desirable that administrations communicate their requirements in the band 87.5 to 100 MHz by taking into account their existing stations which operate in accordance with the Radio Regulations and the Regional Agreement, Stockholm, 1961. During the Second Session every appropriate effort shall therefore be made to incorporate in the Plan :

a) sound broadcasting stations in accordance with the Regional Agreement, Stockholm, 1961, which have been notified to the IFRB by 1 December 1983; the incorporation of such stations shall start with the sound broadcasting stations which are situated in the coordination area with countries using this band for TV in accordance with the Regional Agreement, Stockholm, 1961, in order to permit countries in Africa and the Middle East*) to take them into account in accordance with Resolution No. 510 of WARC 1979;

b) other stations appearing in the Plan and other planned stations for which the procedures of the Regional Agreement, Stockholm, 1961, have been successfully applied by 1 December 1983; and

c) requirements from administrations not party to the Regional Agreement, Stockholm, 1961, notified to the IFRB by 1 December 1983.

Countries parties to the Regional Agreement, Stockholm, 1961, which, in the Plan annexed to this Agreement, in the band 87.5 to 100 MHz, have entries for television stations only, can submit requirements for assignments to FM sound broadcasting stations in this band, as provided in Resolution No. 510 of WARC 1979.

Modifications to the existing assignments shall be carried out, where necessary, as far as possible, during the planning process without conflicting with Resolution No. 510 to ensure the equal rights of countries and remedy existing inequalities and incompatibilities. In the band 100 to 108 MHz, planning will be initially based on the theoretical lattice network method. To this end, a lattice using a nominal station separation will be established and used to assist in the choice of appropriate channels in preliminary planning.

6.1.7 **Different planning methods in Africa and the Middle East, on the one hand, and in the rest of the planning area, on the other hand, will require adaptation and resolution of incompatibilities on the basis of equal rights among all countries concerned. In resolving these incompatibilities between** sound broadcasting stations, **the status of such stations resulting from the application of the Regional Agreements (Stockholm, 1961, and Geneva, 1963) should not be taken into account unless there is an agreement amongst all the administrations concerned in the interval between the two Sessions of the Conference, or during the Second Session.** (See Resolution C).

6.1.8 When selecting the frequencies and characteristics for their stations in regions bordering countries which have selected different lattices, administrations shall take account of the incompatibilities that are likely to result from the use of different lattices.

Every effort shall be made to reduce these incompatibilities and where they occur to resolve them by bilateral or multilateral discussions, preferably before the Second Session of the Conference.

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*) For the purpose of this Chapter, the "Middle East" is intended to cover the countries of the Arabian Peninsula, Afghanistan, Iran and the Asian part of the European Broadcasting Area excluding Turkey.

6.2 Planning criteria

6.2.1 The planning at the Second Session shall be based on stereophonic reception with fixed receiving installations having a directional antenna at a height of 10 metres above ground with a front-to-back ratio of 12 dB. Suitable provisions shall be made for the inclusion of additional sub-carriers (see paragraph 3.6.2).

6.2.2 There shall be no lower power limit for the stations to be included in the Plan. However, consideration will be given to an appropriate planning step for inclusion of low power stations in the Plan. Adequate protection, nevertheless, must be assured to every station included in the Plan irrespective of its power.

6.2.3 No segment of the frequency band 87.5 to 108 MHz shall be set aside for low power channels.

Note : However, some countries in the Middle East may wish to consider the possibility of setting aside a small part of the band 87.5 to 108 MHz to be used by low power networks or low power stations, subject to agreement among the administrations concerned and without this having an impact on planning in other areas.

6.2.4 The existing or planned stations of the permitted services in the band 87.5 to 108 MHz shall not be taken into account during planning of the broadcasting service at the Second Session of the Conference.

6.3 Planning methods

6.3.1 Planning will be a complex procedure involving a number of steps. Among these the following four steps are essential :

1) the use of the lattice planning method by the administrations to select appropriate frequencies for assignment to given stations (Annex F);

2) the preliminary analysis of the draft plan obtained so far by means of a simplified computation method (Annex G) together with the examination of incompatibilities with the television service in the band 87.5 to 100 MHz (Annex I), interference to radio equipment used by aircraft for landing and navigation purposes in the band 108 to 118 MHz (Annex J) and incompatibilities with the fixed or mobile service in Region 3 (Annex K);

3) the inclusion of low-power networks and low-power stations in, and the refinement of, the draft plan by the method of foremost priority (Annex H) followed by negotiations among administrations concerned;

4) analysis of the draft plan using a more complex computation method in the case of critical assignments (Annex G) together with the examination of incompatibilities with other services, as in step 2 (Annexes I, J and K).

In the course of the planning procedure some of the above steps may have to be repeated, as appropriate. In particular, step 4 will need to be repeated after introduction of modifications resulting from bilateral and multilateral consultations during the Second Session of the Conference.

6.3.2 After establishment of the plan a full evaluation of the interference and protection conditions may be considered necessary by the Second Session in order to provide reference values to be used for subsequent modifications of or additions to the plan.

6.3.3 In the preparation of a frequency plan in the band 87.5 to 108 MHz for the countries of Region 1 and for parts of Afghanistan and Iran, the two following planning methods shall broadly be used :

1) regular lattice planning with linear channel distribution scheme;

2) method of foremost priority (planning by trial and error).

The efficiency of the two methods will depend on circumstances which may vary considerably from one part of the planning area to the other. For instance, in Europe it is likely that frequency assignments in the band 87.5 to 100 MHz to VHF/FM transmitters will only be subject to slight modifications in a restricted number of cases in most of the countries, whereas in the remaining part of the planning area an assignment plan for the entirety of sound-broadcasting transmitters will have to be established.

6.3.4 The lattice planning method, the use of which is described in Annex F, would be a powerful tool in the latter case, but it would be of little use in the former case.

When use is made of lattice planning, it is desirable to apply the same channel distribution scheme throughout the planning area; nevertheless, on account of the variation of conditions within the area, it is considered appropriate to use two different channel distribution schemes.

The main advantage of this method is that the whole planning area can be subdivided at the beginning into sub-areas of adequate size and shape. This will permit planning to start simultaneously in various parts of the planning area. A further advantage is that the method permits the quick assignment of large numbers of frequencies to non-constrained transmitters. This is due to the fact that within a theoretical channel distribution scheme mutual interference is reduced to the minimum practicable and that in its adaptation to a practical situation interference will be increased only slightly.

However, the applicability of the method is restricted to networks with transmitters of similar power and effective antenna height and hence a comparable interference potential. The method should, therefore, not be used for the assignment of frequencies to low-power transmitters in an environment of numerous high-power transmitters. It may also fail to be applicable if a large number of constraints has to be respected, such as the protection against the origination of annoying intermodulation frequencies.

6.3.5 The method of foremost priority is described in Annex H.

The advantage of this method is that all the constraints to be respected in every individual case can be taken into account. However, the method is time-consuming and its reliability is only guaranteed when a computer is used. Nevertheless, there can be no doubt that in parts of the planning area, and in parts of the band, conditions will be found in which the use of this method will be the only resort.

6.3.6 Because of the limited time that will be available for planning purposes during the Second Session of the Conference, it is felt that both methods should go together. The lattice planning method shall be used in the first instance to help in preliminary planning, for the whole band 87.5 to 108 MHz in Africa and the Middle East, and for the band 100 to 108 MHz in the rest of the planning area. However, further planning may require the use of the method of foremost priority, especially in the planning of the most difficult cases and in the refinement procedure. In this respect it may well happen that planning outside Africa and the Middle East, while providing protection to the aeronautical radionavigation service, will have to be considered as a difficult case.

It is also necessary to protect the aeronautical mobile (R) service, taking into account the safety aspects involved.

It is up to administrations to consider the incompatibilities between the aeronautical mobile (R) service and the sound broadcasting service in preparation of their requirements. The interim planning process will be based on the assumption that there will be no serious problems of incompatibility. However, as the extent of the problems is still unknown the Second Session may wish to determine the more precise application of the protection necessary.

6.3.7 Considering the size of the area to be planned, the expected large number of requirements to be included in the plan and the complexity of the planning task, preparatory work must be carried out by the IFRB in the period between the two sessions. This would make it possible to provide administrations with preliminary results of calculations before the opening of the Second Session of the Conference. For the reasons mentioned above the following procedure is suggested :

6.3.7.1 The lattice method will be used as soon as possible after the First Session of the Conference with a view to helping administrations in formulating their requirements in an orderly manner. It will assist mainly the developing countries which are not able to attend the present Session.

6.3.7.2 In Africa and the Middle East, a lattice with a channel distribution of 31 channels (see Figure 6.1) will be used to permit between six and seven coverages in the band 87.5 to 108 MHz.

6.3.7.3 In the rest of the planning area, it is forseen that :

- administrations may communicate their requirements in the band 87.5 to 100 MHz as they result from the application of the Regional Agreement, Stockholm, 1961; and

- a lattice with a channel distribution of 79 channels (see Figure 6.2) will be used for preliminary planning of the band 100 to 108 MHz.

6.3.7.4 When using a channel distribution scheme, countries in a given area may decide not to include low-power stations in the lattice scheme. These low-power stations will be treated at a later stage before or during the Second Session of the Conference, so that, at the end of the Second Session, all frequency assignments will have been made whatever the power of the transmitter.

6.3.7.5 For the purpose of applying the regular channel distribution schemes detailed in Figure 6.1 in Africa and the Middle East or in Figure 2 in the remaining part of the planning area[1)], the two tables of Annex L shall provide the information necessary to relate channel numbers and frequencies in the two areas. For the purpose of completing the requirement forms, and in bilateral or multilateral negotiations, frequencies only should be used in order to avoid any ambiguity.

It should be noted that in Europe channel 0 (100.0 MHz) will primarily be used, where wanted, at the same parts of the area as channel 79. Adaptation to frequency assignments below 100.0 MHz (for which no channel numbers are specified in Europe) may, however, require some special arrangements to be made, particularly as regards channels 0 to 3.

6.3.8 There may be incompatibilities between FM sound broadcasting stations in the band 87.5 to 100 MHz in Afghanistan, Iran and a part of Turkey on the one hand, and TV stations of the U.S.S.R. located in the border areas of these countries on the other hand. These Administrations should therefore coordinate their relevant stations by bilateral or multilateral negotiations, preferably before submitting their requirements to the IFRB on the basis of equal rights without a priority to either of the above uses. The protection referred to in considering f) of Resolution No. 510 applies only to TV stations which are in conformity with the Regional Agreement, Stockholm, 1961.

Incompatibilities between VHF/FM broadcasting stations and TV stations in conformity with the Regional Agreement, Stockholm, 1961 in the band 87.5 to 100 MHz are treated in Annex I.

With respect to the countries mentioned above, incompatibilities between VHF/FM broadcasting and other TV stations shall be treated by using the criteria given in Chapter 4 of this Report.

Note 1 : In Mongolia, the band 87.5 to 100 MHz will be used for television stations.

Note 2 : The lattice with a channel distribution of 79 channels shall be used in the band 100 to 108 MHz throughout the territory of Turkey. The selection of channels in the band 87.5 to 100 MHz for the part of Turkey not covered by the Regional Agreement, Stockholm, 1961 will be made by the Administration without necessarily using any lattice method.

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1) The channel distribution schemes of Figures 6.1 and 6.2 shall be applied in such a way that for Africa and the Middle East the lower lefthand apex of Figure 6.1 is adjusted to the westernmost apex of each lattice unit; for the remainder of the planning area the lower lefthand apex of Figure 6.2 is adjusted to the southernmost apex of each lattice unit.

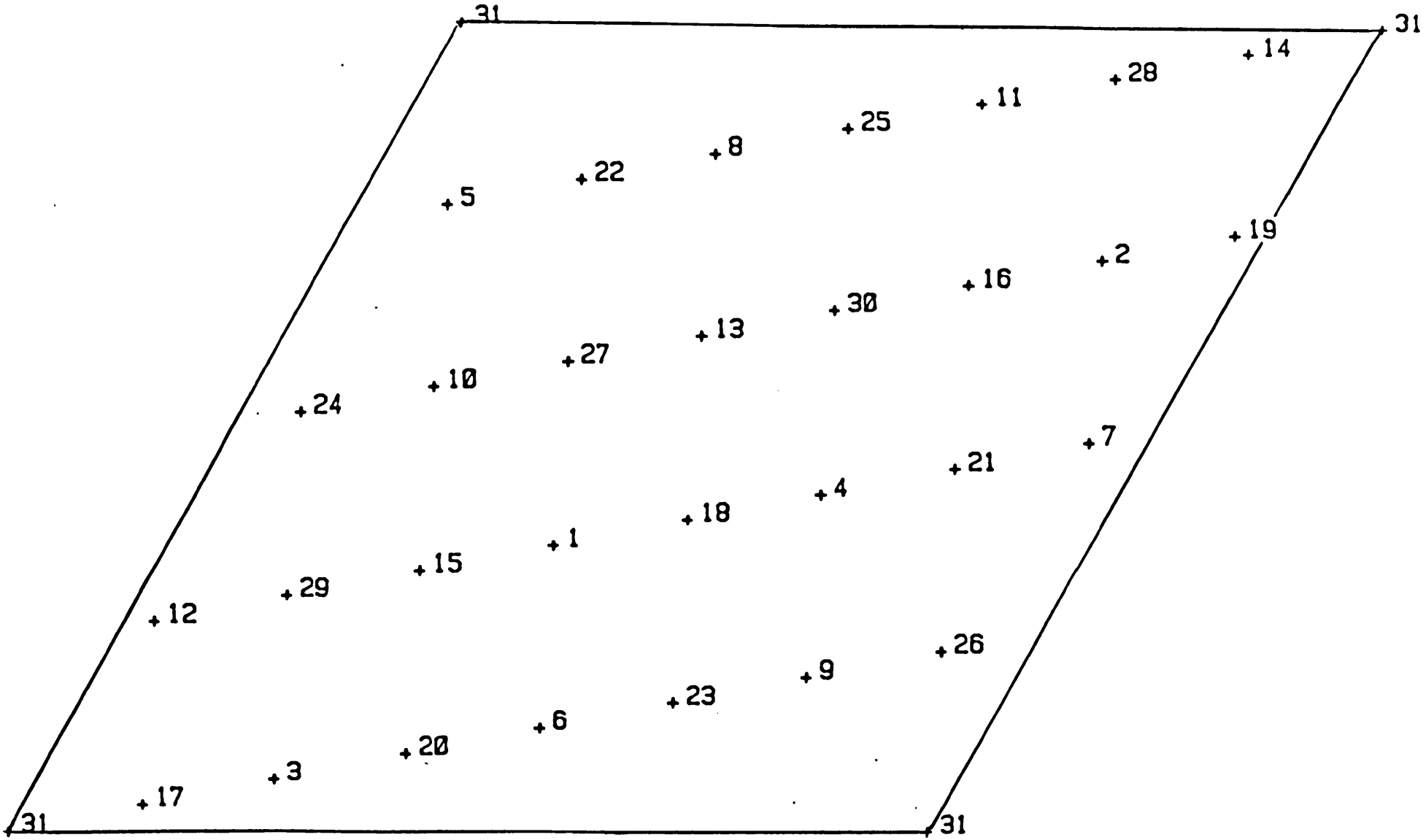

Figure 6.1 - Channel distribution scheme in the Africa-Middle East area between 87.5 and 108 MHz

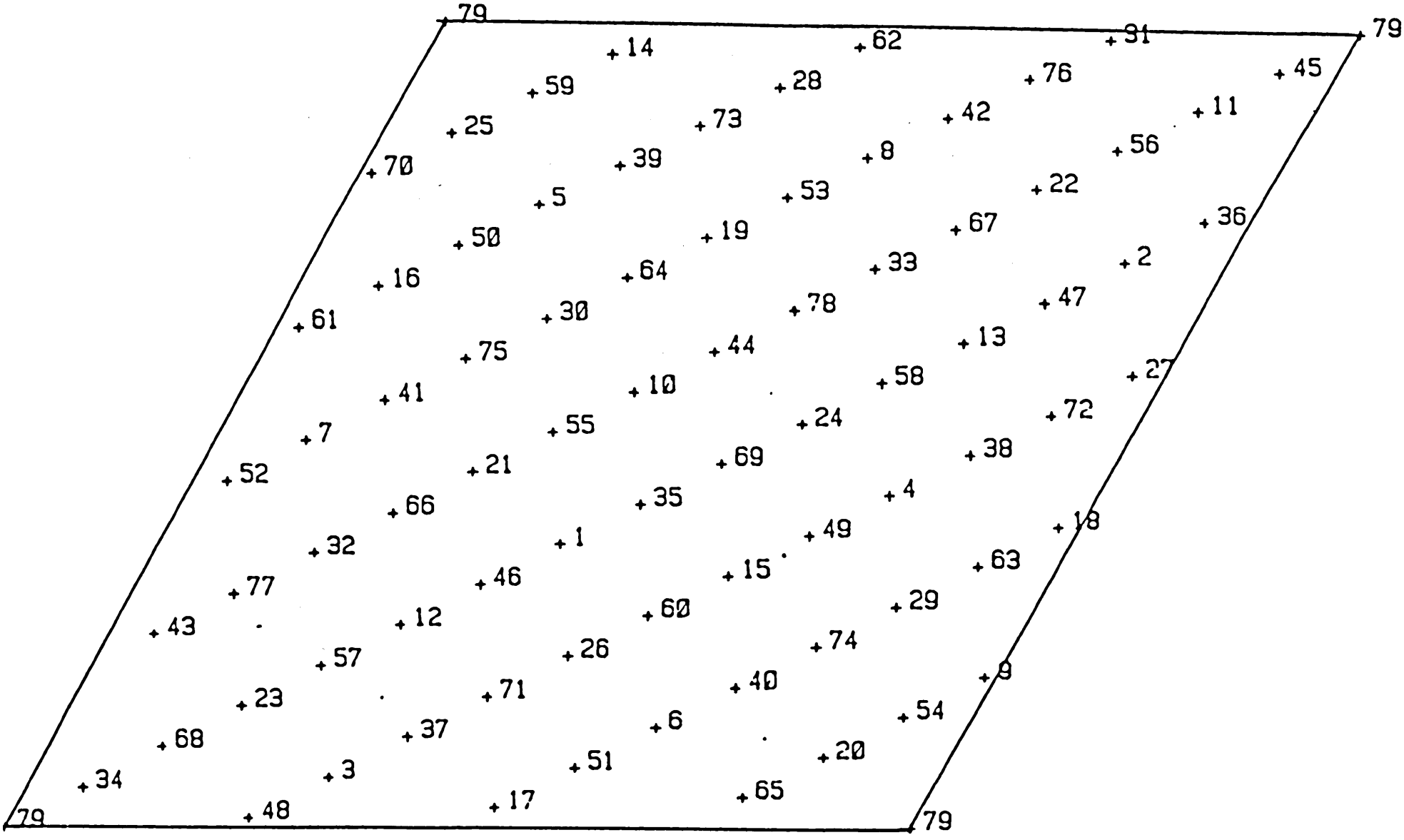

Figure 6.2 - Channel distribution schemes in the remainder of the planning area between 100 and 108 MHz

6.4 Technical constraints on frequency planning

6.4.1 When for economic reasons, use is made of a common antenna for several VHF/FM broadcast transmissions, the minimum frequency spacing should not be less than 1.8 MHz. However, in particular cases where no frequencies can be assigned which satisfy the above constraint, administrations may adopt lower spacing but not less than 0.8 MHz. This would be more acceptable when using low power so that the use of a common transmitting antenna is still possible. When high power is used, separate transmitting antennas may become necessary.

6.4.2 The use of VHF/FM broadcast transmissions separated in frequency by from 10.6 to 10.8 MHz shall be avoided in common coverage areas. Other separations from 10.5 to 10.9 MHz should also be avoided.

This constraint is necessary because :

- local oscillator radiation from a receiver tuned to the lower frequency transmission may interfere with a nearby receiver tuned to the higher frequency transmission;

- intermodulation products at the receiver intermediate frequency may be generated within a receiver.

6.4.3 It is recommended to administrations that, when preparing their requirements for VHF/FM stations, they consider the following interference problems.

6.4.3.1 Difficulties could arise if the frequency spacings of co-sited VHF transmissions are equal to the duplex separation of the land mobile service, operating outside the band 87.5 to 108 MHz, in the area concerned.

6.4.3.2 Local oscillator radiation from television receivers operating in the band 47 to 68 MHz may cause interference to VHF receivers; and harmonic radiation from VHF receiver local oscillators may cause interference to television receivers operating in the band 174 to 230 MHz.

6.4.3.3 It may be advantageous, in certain cases, to minimize the number of intermodulation frequencies generated by co-sited VHF/FM transmitters. This can be achieved if equal frequency spacings are adopted. However, to avoid intermodulation in receivers and Cable Antenna Television Systems, it may be desirable to avoid using equal frequency spacings for high power transmitters sited close to areas of high population density.

6.4.3.4 A potential problem may be that of local oscillator radiation from domestic receivers tuned to a frequency in the band 87.5 to 108 MHz falling in the adjacent aeronautical radionavigation band.

CHAPTER 7

FREQUENCY REQUIREMENTS FROM ADMINISTRATIONS AND INVENTORY OF REQUIREMENTS

7.1 Forms to be used by administrations in submitting their requirements for frequency assignments in the band 87.5 to 108 MHz

Form A to be used for submission of a requirement for a frequency assignment for an FM Sound Broadcasting Station (see page 69);

Form A1 to be used for indicating the azimuthal variation of the total effective radiated power in the horizontal plane and the effective antenna height, of a station concerning which a Form A has been submitted (see page 70);

Form A2 to be used for indicating the azimuthal variation in the effective radiated power of the horizontal component (HC) and the vertical component (VC) in the horizontal plane, for a station concerning which a Form A has been submitted (see page 71).

7.2 Date for submission of requirements

The inventory of requirements will consist of data communicated to the IFRB before 1 February 1984 in response to a Circular-letter*) which the Board shall send to administrations after the First Session of the Conference and not later than 31 December 1982.

Requirements shall be submitted in one of the following forms :

- on the forms for submission mentioned in paragraph 7.1 above;
- in the form of a computer magnetic tape as specified in an annex to the IFRB Circular-letter*). Such magnetic tapes must be accompanied by a printed text which the Board shall regard as the reference document.

On 1 October 1983, the Board shall send a letter indicating that administrations may communicate their requirements. The time limit for submission shall be 31 January 1984.

At the beginning of January 1984, the Board shall send a telegram to remind administrations which have not yet submitted their requirements.

In the case of administrations which have not replied, the IFRB shall consider the data :

1. in the Master International Frequency Register (MIFR),
2. in a Plan, or
3. resulting from the application of the theoretical network.

If necessary, administrations shall also use the form B set out in page 78 to convey the constraints relating to aeronautical radionavigation stations.

See Figure 7.1, page 66.

*) Circular-letter No. 529 of 15 December 1982.

7.3 Processing of requirements by the IFRB

After validating them, the IFRB shall enter all the requirements in a file with a view to establishing an inventory of requirements, on the basis of which the interference calculations and incompatibility checks will be made.

When the requirement corresponds to an assignment which has been notified in accordance with the Radio Regulations to the IFRB, or which is in conformity with the Regional Agreement, Stockholm, 1961, the status of this assignment will be inserted by the IFRB when publishing the inventory of requirements. Different symbols will indicate the recording in the Master Register and the conformity with the Regional Agreement, Stockholm, 1961.

The IFRB shall send to each administration in duplicate, as soon as possible and not later than 30 April 1984, a separate printed list of the requirements of the administration concerned.

Administrations shall check the data on their stations and shall communicate to the IFRB not later than 30 June 1984 any material errors they may have detected and the information relative to aeronautical stations that may be adversely affected (see form C, page 80).

The IFRB shall check these corrections and carry them into the inventory of requirements.

See Figure 7.1, page 66.

7.4 Despatch of inventory of requirements and notification of calculation results to administrations

In view of the foreseeable volume of requirements, the IFRB shall publish the complete and the corrected inventories of requirements in the form of microfiches and shall send them in duplicate to administrations, the former by 30 April 1984 and the latter by 31 July 1984.

On the basis of the corrected inventory of requirements, the IFRB shall effect the calculations described in Chapter 6 and shall send to administrations in duplicate the results of its calculations in the form of microfiches by 31 July 1984 at the latest.

The inventory of requirements and the results of calculations can be sent by the IFRB on magnetic tape to the administration having so requested, in the format of the ITU computer system. This format will be notified to the administration concerned.

See Figure 7.1, page 66.

7.5 Assistance to administrations by the IFRB

See Resolutions B and D.

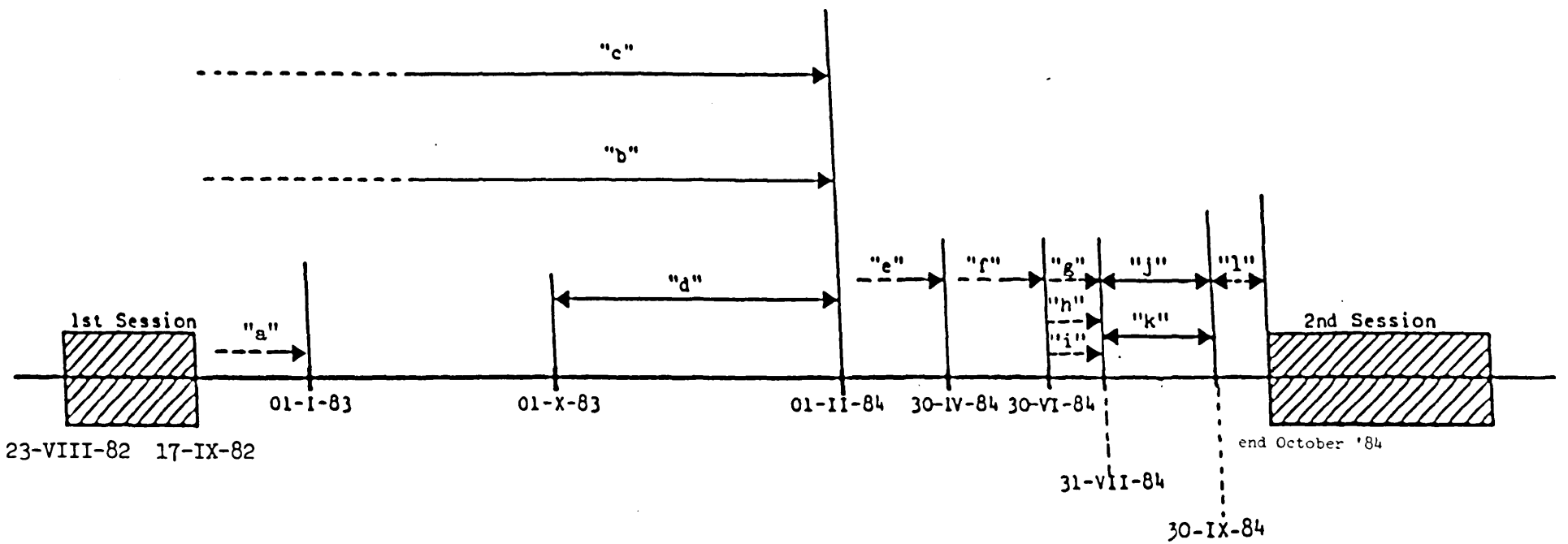

Figure 7.1 - Schedule of operations to be carried out in the interval between the First and Second Sessions

Explanation of Figure 7.1

"a" The IFRB, by Circular-letter*), invites the administrations concerned to notify their requirements within the time limits and in the manner approved by the Conference at its First Session, and sends model forms.

"b" In planning their requirements, administrations shall observe the planning principles and methods approved by the First Session of the Conference. Wherever possible they shall establish contacts with neighbouring countries with a view to preparing coordinated requirements which will facilitate the task of the Second Session of the Conference.

"c" The IFRB prepares and finalizes the computer programs it considers necessary to perform the tasks entrusted to it by the Conference and to facilitate the work of the Second Session of the Conference. The following tasks have been identified :

- C.1 storage of requirements;
- C.2 establishment of the inventory and classification of requirements by frequency, sub-band and country;
- C.3 publication of the complete inventory, or parts of it, according to countries, groups of countries and sub-bands;
- C.4 provisional choice of suitable frequencies, in accordance with the planning principles and methods, in cases where the desired frequency is not entered on the form;
- C.5 calculations of interference and incompatibility and publication of the results;
- C.6 compilation of statistics.

"d" Administrations submit their requirements to the IFRB on the forms mentioned in paragraph 7.1 and if necessary they attach the forms regarding constraints, as set out on page 78.

"e" The IFRB sends in duplicate to each administration the part of the basic inventory containing the list of its requirements in printed form and the complete inventory of requirements on microfiche.

"f" Each administration notifies the IFRB of any material errors detected, and if necessary sends the form set out on page 80.

"g" The IFRB sends in duplicate to administrations the corrected inventory of requirements with appropriate observations.

"h" The IFRB executes the corresponding programs in the order indicated in point "c" above.

"i" The IFRB sends in duplicate to administrations the results of its calculations (see paragraphs 3.1, 3.2 and 3.3 of Annex G and paragraphs 5 and 6 of Annex I to this Report) as they become available. The corrected basic inventory and the results of the calculations form a document for the Second Session.

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*) Circular-letter No. 529 of 15 December 1982.

"j" Administrations study this information and, with a view to resolving incompatibilities, propose modifications[1)] to their requirements for submission to the Second Session or to the IFRB, as appropriate; if necessary, administrations enter into bilateral or multilateral coordination beforehand.

"k" The IFRB receives the proposed modifications[1)] designed to resolve incompatibilities and includes them in an "addendum" which it submits, if possible accompanied by a report, to the Second Session.

"l" The IFRB shall use the modified[1)] inventory of requirements in order to carry out the remaining calculations, referred to in paragraphs 4, 7, 8 and 9 of Annex G to this Report, and present the results during the first days of the Second Session. Modifications[1)] communicated after 1 October 1984 shall be dealt with by the Second Session.

The schedule is as follows :

Period		Activity
Up to 31 December 1982	:	"a"
Up to 1 February 1984	:	"b" and "c"
1 October 1983 - 1 February 1984	:	"d"
By 30 April 1984	:	"e"
By 30 June 1984	:	"f"
By 31 July 1984	:	"g", "h" and "i"
1 August 1984 - 30 September 1984	:	"j" and "k"
1 October 1984 - end October 1984	:	"l"

1) Modifications are limited to changes in the characteristics of the requirements initially communicated and are intended to improve the Plan.

REGIONAL ADMINISTRATIVE CONFERENCE FOR FM SOUND BROADCASTING IN THE BAND 87.5 TO 108 MHz
SECOND SESSION

FORM A
FOR SUBMISSION OF A FREQUENCY ASSIGNMENT REQUIREMENT TO THE IFRB

(01) ADMINISTRATION ____ ADMIN. SERIAL No. ____ (00) IFRB SERIAL No. ____

(02) Name of transmitting station	(03) Country	(04) Longitude Degrees	E/W	Min.	Latitude Degr.	N/S	Min.	(05) Altitude of site a.s.l. (m)	(06) Height of antenna a.g.l. (m)

(07) Polariz.	(08) Maximum effective radiated power (e.r.p.) Total (kW)	Hor. comp. (HC) (kW)	Vert. comp. (VC) (kW)	(09) Direct.	(10) Maximum effective antenna height (m)	(11) System

(12) Radiation characteristics for a directive antenna

Total e.r.p. (kW)	Azimuth (Degrees)	Azimuths of −3 dB points (Degrees)	Effective antenna height (m)
		—	
		—	
		—	
		—	

(12a) Sectors or directions of restricted e.r.p.

Sectors or directions (Degrees)	Total e.r.p. (kW)
—	
—	
—	
—	

(12b) Sectors or directions with restricted effective antenna height

Sectors or directions (Degrees)	Effective antenna height (m)
—	
—	
—	
—	

(13) Antenna pattern

Form A1 supplied	Diagram

(14) Desired frequency ____ MHz

(15) Coord.

(21) SUPPLEMENTARY INFORMATION

REGIONAL ADMINISTRATIVE CONFERENCE FOR FM SOUND BROADCASTING IN THE BAND 87.5 TO 108 MHz
SECOND SESSION

FORM A1

AZIMUTHAL VARIATION OF THE TOTAL EFFECTIVE RADIATED POWER IN THE HORIZONTAL PLANE AND OF THE EFFECTIVE ANTENNA HEIGHT

(01) ADMINISTRATION ____ ADMIN. SERIAL No. ____ (00) IFRB SERIAL No. ____

(02) Name of transmitting station ____ (03) Country ____ (14) Desired frequency ____ MHz

(31)

AZIMUTH (degrees)	0	10	20	30	40	50	60	70	80
Attenuation with respect to maximum value of total ERP									
Effective antenna height (m)									
AZIMUTH (degrees)	90	100	110	120	130	140	150	160	170
Attenuation with respect to maximum value of total ERP									
Effective antenna height (m)									
AZIMUTH (degrees)	180	190	200	210	220	230	240	250	260
Attenuation with respect to maximum value of total ERP									
Effective antenna height (m)									
AZIMUTH (degrees)	270	280	290	300	310	320	330	340	350
Attenuation with respect to maximum value of total ERP									
Effective antenna height (m)									

REGIONAL ADMINISTRATIVE CONFERENCE FOR FM SOUND BROADCASTING IN THE BAND 87.5 TO 108 MHz
SECOND SESSION

FORM A2

AZIMUTHAL VARIATION OF THE EFFECTIVE RADIATED POWER OF THE HORIZONTAL COMPONENT (HC) AND THE VERTICAL COMPONENT (VC) IN THE HORIZONTAL PLANE

(01) ADMINISTRATION ____ ADMIN. SERIAL No. ____ (00) IFRB SERIAL No. ____

(02) Name of transmitting station ____ (03) Country ____ (14) Desired frequency ____ MHz

(32)

AZIMUTH (degrees)		0	10	20	30	40	50	60	70	80	90	100	110
Attenuation with respect to maximum value of ERP (dB)	HC												
	VC												
AZIMUTH (degrees)		120	130	140	150	160	170	180	190	200	210	220	230
Attenuation with respect to maximum value of ERP (dB)	HC												
	VC												
AZIMUTH (degrees)		240	250	260	270	280	290	300	310	320	330	340	350
Attenuation with respect to maximum value of ERP (dB)	HC												
	VC												

INSTRUCTIONS FOR FILLING OUT FORM A AND IF REQUIRED FORMS A1 AND A2

The instructions for filling out the form refer to boxes 01 to 15, box 21, and, if required forms A1 and A2. Box 00 is for the use of the IFRB and should be left blank. Provision has been made on the form for the administration to enter its reference number in the box entitled ADMIN. SERIAL No.

Form A (See page 69)

Submission of a requirement for a frequency assignment for an FM Sound Broadcasting Station

Box No.

00 IFRB SERIAL No.

For IFRB use only.

01 Administration

Indicate the country symbol designating the administration submitting the requirement for the frequency assignment. Use a symbol from Table No. 1 of the Preface to the International Frequency List.

02 Name of transmitting station

Give the name by which the station is, or will be, known.

Limit the number of letters and numerals to a total of 20.

Insert each letter or number in a separate space, starting from the first space on the left. In the case of compound names, one space should be left blank between each part of the name.

03. Country

Indicate, by symbol, the country or geographical area in which the station is, or will be, located. Use a symbol from Table No. 1 of the Preface to the International Frequency List.

04 Longitude and latitude of the transmitting antenna site

Give the geographical coordinates, in degrees and minutes of the site of the transmitting antenna; seconds should be rounded to the nearest minute. Use the symbols E or W, N or S, as appropriate.

05 Altitude of site above sea level (a.s.l.)

Indicate the altitude (in meters) above sea level of the site of the transmitting antenna.

06 Height of the antenna above ground level (a.g.l.)

Indicate the height (in meters) of the geometrical centre of the antenna above ground level.

Box No.

07 Polarization

Indicate the polarization of radiation by using the following symbols:

H Horizontal

V Vertical

M Mixed

If different linear polarizations are used in different azimuthal directions, Form A2 (page 71) shall be used and the letter M shall be inserted in box 07.

08 Maximum effective radiated power (e.r.p.)

- Column "total"

  In the case of horizontal or vertical polarization, indicate the maximum effective radiated power, in kW.

  In the case of mixed polarization, this value is the maximum value of the sum of the effective radiated power of the horizontally and vertically polarized components, in kW.

- Column "horizontal component (HC)"

  In the case of mixed polarization, indicate the maximum effective radiated power of the horizontally polarized component, in kW.

- Column "vertical component (VC)"

  In the case of mixed polarization, indicate the maximum effective radiated power of the vertically polarized component, in kW.

09 Directivity of radiation

Indicate ND in the case of omnidirectional radiation or, in the case of directional radiation, indicate D in the right-hand box.

10 Maximum effective antenna height

Indicate the maximum value of effective height of the transmitting antenna, in metres, irrespective of azimuth. This height is defined as the maximum height of the centre of the antenna above the average level of the ground between distances of 3 and 15 km from the transmitter. A minus sign is to be entered in the first position at the left of the box when the value of the effective antenna height arrived at in the above manner is negative.

Box No.

11 System

Indicate the system of transmission by using the following symbols:

1. Monophonic (maximum frequency deviation ±75 kHz)
2. Monophonic (maximum frequency deviation ±50 kHz)
3. Stereophonic, polar modulation system (maximum frequency deviation ±50 kHz)
4. Stereophonic, pilot-tone system (maximum frequency deviation ±75 kHz)
5. Stereophonic, pilot-tone system (maximum frequency deviation ±50 kHz)

12 Radiation characteristics for a directive antenna

For each of the maxima of radiation, indicate:

- total effective radiated power, in kW;
- azimuth in degrees, clockwise from True North;
- the azimuths of the -3 dB points anticlockwise and then clockwise from the azimuth of maximum radiation;
- effective antenna height, positive or negative, in metres in the indicated azimuth.

12a Sectors or directions of restricted e.r.p.

If there exists a restriction on the e.r.p. in certain sectors, indicate in the first column the azimuth limits of these sectors and in the second column the maximum value of the total e.r.p. in these sectors in kW. If the restrictions relate to one direction only, enter the azimuth in the left part of the first column.

12b Sectors or directions with restricted effective antenna height

If there exist restrictions of the effective antenna height, positive or negative, in certain sectors, indicate as above the directions concerned and the maximum values within these sectors.

If the restriction relates to one direction only, enter the azimuth in the left part of the first column.

13 Antenna pattern

Indicate by an X in the appropriate box when either:

- the information required in Form A1 has been provided;
- the antenna radiation diagram, in the horizontal plane, has been furnished.

Box No.

14 Desired frequency

Indicate, if appropriate, the frequency desired for assignment. If there is no preference for a specified frequency, boxes 14 and 15 should be left blank (Chapter 6 "Planning Method" of the Report refers).

15 Coordination of the requirement and status of the related assignment

When the requirement with the characteristics contained in the form has been successfully coordinated with a view to submission, insert the relevant country symbols in the "coord" box. When the coordination concerns more than five countries, insert symbol x on the first line of the "coord" box and list the countries in a separate annex.

When the requirement corresponds to an assignment which has been notified to the IFRB in accordance with the Radio Regulations or which is in conformity with the Regional Agreement, Stockholm 1961, the status of this assignment will be inserted by the IFRB when publishing the inventory of requirements.

21 Supplementary information

Indicate when the requirement is intended to replace an assignment in one of the Plans (Stockholm, 1961 or Geneva, 1963) and/or in the Master International Frequency Register.

Furthermore, indicate any additional, pertinent information regarding this requirement which may be of use in planning (for instance, the preferred part of the band 87.5 to 108 MHz). If necessary, attach additional sheet.

Form A1 (see page 70)

Azimuthal variation of the total effective radiated power in the horizontal plane and of the effective antenna height

Provision has been made on the forms for an administration to enter its reference number in the box entitled ADMIN. SERIAL No. This reference number shall be the same as the one entered in the corresponding form A.

Box No.

00 IFRB SERIAL No.

For IFRB use only.

01 Administration

Indicate the country symbol designating the administration submitting the requirement for the frequency assignment. Use a symbol from Table No. 1 of the Preface to the International Frequency List.

This country symbol shall be the same as the one in box 01 of the corresponding form A

Box. No.

02 Name of transmitting station

Give the name by which the station is, or will be, known.

Limit the number of letters and numerals to a total of 20.

Insert each letter or number in a separate space, starting from the first space on the left. In the case of compound names, one space should be left blank between each part of the name.

This name shall be the same as the one in box 02 of the corresponding form A.

03 Country

Indicate, by symbol, the country or geographical area in which the station is, or will be, located. Use a symbol from Table No. 1 of the Preface to the International Frequency List.

This symbol shall be the same as the one in box 03 of the corresponding form A.

14 Desired frequency

Indicate, if appropriate, the frequency desired for assignment. If there is no preference for a specified frequency, box 14 should be left blank, (Chapter 6 "Planning Method" of the Report refers).

This frequency shall be the same as the one entered in box 14 of the corresponding form A.

31 Indicate, for each azimuth shown or at least every 30 degrees, starting at 0 degrees:

- for a directive antenna, the attenuation in dB with respect to the maximum value of the total effective radiated power,
- for directive antenna and non-directional antenna, the effective antenna height in metres.

A minus sign is to be entered in the first position at the left of the box when the value of the effective antenna height is negative.

Administrations should endeavour to provide the information required in this box for existing antennas.

Form A2 (see page 71)

Azimuthal variation of the effective radiated power of the Horizontal Component (HC) and the Vertical Component (VC) in the horizontal plane

Provision has been made on the form for an administration to enter its reference number in the box entitled ADMIN. SERIAL No. This reference number shall be the same as the one entered in the corresponding form A.

Box No.

00 IFRB SERIAL No.

For IFRB use only.

01 Administration

Indicate the country symbol designating the administration submitting the requirement for the frequency assignment. Use a symbol from Table No. 1 of the Preface to the International Frequency List.

This country symbol shall be the same as the one in box 01 of the corresponding form A.

02 Name of transmitting station

Give the name by which the station is, or will be, known.

Limit the number of letters and numerals to a total of 20.

Insert each letter or number in a separate space, starting from the first space on the left. In the case of compound names, one space should be left blank between each part of the name.

This name shall be the same as the one in box 02 of the corresponding form A.

03 Country

Indicate, by symbol, the country or geographical area in which the station is, or will be, located. Use a symbol from Table No. 1 of the Preface to the International Frequency List.

This symbol shall be the same as the one in box 03 of the corresponding form form A.

14 Desired frequency

Indicate, if appropriate, the frequency desired for assignment. If there is no preference for a specified frequency, box 14 should be left blank (Chapter 6 "Planning Method" of the Report refers).

This frequency shall be the same as the one entered in box 14 of the corresponding form A.

32 In the case of mixed polarization, indicate, for each azimuth shown or at least every 30 degrees, starting at 0 degrees, the attenuation in dB with respect to the maximum value of effective radiated power of the Horizontal Component (HC) or Vertical Component (VC) respectively.

REGIONAL ADMINISTRATIVE CONFERENCE FOR FM SOUND BROADCASTING IN THE BAND 87.5 TO 108 MHz

SECOND SESSION

FORM B

FOR SUBMISSION OF FREQUENCY PLANNING CONSTRAINTS RELATING TO COMPATIBILITY BETWEEN SOUND BROADCASTING AND AERONAUTICAL RADIONAVIGATION SERVICES [1]

01 ADMINISTRATION	ADM. SERIAL No.	00 IFRB SERIAL No.

AERONAUTICAL RADIONAVIGATION STATION

41 Frequency: ____ MHz

42 Name of the station: ____

43 Country: ____

44

Longitude			Latitude		
Degrees	E/W	Min.	Degr.	N/S	Min.

1) See Annex J of the present report.

INSTRUCTIONS FOR FILLING OUT FORM B

Submission of frequency planning contraints relating to compatibility between sound broadcasting and aeronautical radionavigation services

The instructions for filling out the form refer to boxes 01 and 41 to 44. Box 00 is for the use of the IFRB and should be left blank. Provision has been made on the form for an administration to enter its reference number in the box entitled ADMIN. SERIAL No.

Box No.

00 IFRB SERIAL No.

For IFRB use only.

01 Administration

Indicate the country symbol designating the administration submitting the frequency planning constraint. Use a symbol from Table No. 1 of the Preface to the International Frequency List.

41 Frequency

Indicate the frequency of the aeronautical radionavigation station which may be affected by broadcasting stations.

42 Name of the station

Give the name by which the aeronautical radionavigation station is known.

Limit the number of letters and numerals to a total of 20.

Insert each letter or number in a separate space, starting from the first space on the left. In the case of compound names, one space should be left blank between each part of the name.

43 Country

Indicate, by symbol, the country or geographical area in which the aeronautical radionavigation station is located. Use a symbol from Table No. 1 of the Preface to the International Frequency List.

44 Longitude and latitude

Give the geographical coordinates, in degrees and minutes of the site of the aeronautical radionavigation transmitting antenna; seconds should be rounded to the nearest minute. Use the symbols E or W, N or S, as appropriate.

REGIONAL ADMINISTRATIVE CONFERENCE FOR FM SOUND BROADCASTING IN THE BAND 87.5 TO 108 MHz SECOND SESSION

FORM C

FOR SUBMISSION OF DATA FOR CALCULATION OF INCOMPATIBILITIES BETWEEN SOUND BROADCASTING AND AERONAUTICAL RADIONAVIGATION SERVICES [1]

01 ADMINISTRATION	ADM. SERIAL No.	00 IFRB SERIAL No.

AERONAUTICAL RADIONAVIGATION STATION

51 Frequency	52 Name of the station	53 Country
MHz		

54 Longitude			Latitude			55 Type	56 Height of antenna a.s.l. (m)
Degrees	E W	Min.	Degr.	N S	Min.	☐ ILS ☐ VOR	

57 TEST POINTS

	57a Azimuth (degrees)	57b Distance (km)	57c Altitude (m)
1			
2			
3			
4			

58 BROADCASTING STATIONS which are likely to affect the aeronautical radionavigation station:

	58a Country	58b Name of the station	58c IFRB Serial No.	58d Frequency (MHz)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

1) See Annex J of the present report.

INSTRUCTIONS FOR FILLING OUT FORM C

Submission of data for calculation of incompatibilities between sound broadcasting and aeronautical radionavigation services

The instructions for filling out the form refer to boxes 01 and 51 to 58d. Box 00 is for the use of the IFRB and should be left blank. Provision has been made on the form for an Administration to enter its reference number in the box entitled ADMIN. SERIAL No.

Box No.

00 IFRB SERIAL No.

For IFRB use only.

01 Administration

Indicate the country symbol designating the administration submitting the data for calculation of incompatibilities between sound broadcasting and aeronautical radionavigation services. Use a symbol from Table No. 1 of the Preface to the International Frequency List.

51 Frequency

Indicate the frequency of the aeronautical radionavigation station, which is likely to be affected by broadcasting stations.

52 Name of the station

Give the name by which the aeronautical radionavigation station is known.

Limit the number of letters and numerals to a total of 20.

Insert each letter or number in a separate space, starting from the first space on the left. In the case of compound names, one space should be left blank between each part of the name.

53 Country

Indicate, by symbol, the country or geographical area in which the aeronautical radionavigation station is located. Use a symbol from Table No. 1 of the Preface to the International Frequency List.

54 Longitude and latitude

Give the geographical coordinates, in degrees and minutes of the site of the aeronautical radionavigation transmitting antenna; seconds should be rounded to the nearest minute. Use symbols E or W, N or S, as appropriate.

55 Type

Enter an x in the appropriate box to indicate the type of the aeronautical radionavigation station.

Box No.

56 Height of antenna

Indicate the hight (in meters) of the geometrical centre of the aeronautical radionavigation antenna above sea level.

57 Test points

57a Azimuth

Indicate the azimuth from the aeronautical radionavigation station to the test point in degrees (clockwise) from True North.

57b Distance

Indicate the distance between the aeronautical radionavigation station and the test point (in km).

57c Altitude

Indicate the altitude (in meters) of the test point above sea level.

58 Broadcasting stations which are likely to affect the aeronautical radionavigation station

58a Country

Indicate, by symbol, the country or geographical area in which the broadcasting station which is likely to affect the aeronautical radionavigation station is located.

58b Name of the station

Give the name by which the broadcasting station which is likely to affect the aeronautical radionavigation station is known.

Limit the number of letters and numerals to a total of 20.

Insert each letter or number in a separate space, starting from the first space on the left. In the case of compound names, one space should be left blank between each part of the name.

58c IFRB Serial No.

Give the serial number of the broadcasting station which is likely to affect the aeronatical radionavigation station. The serial number can be found in the inventory of requirements published by the IFRB.

58d Frequency

Indicate the frequency of the broadcasting station which is likely to affect the aeronautical radionavigation station (in MHz).

ANNEX A

SUPPLEMENTARY PROPAGATION DATA

CORRECTION FACTORS

(see Chapter 2)

This annex gives supplementary propagation data as well as the correction factors which can be applied to the basic curves to improve the accuracy of predictions.

For the Second Session of the Conference these various factors should not be used, although some administrations may wish to take them into account in particular cases in order to facilitate bilateral negotiations with the aim of achieving mutually satisfactory solutions.

1. Correction for various location percentages

The curves in Figures 2.1 to 2.9 are representative of 50% of locations. Figure 2.13 shows the correction (in dB) to be applied for other percentages of receiving locations.

2. Terrain irregularity correction

A parameter Δh is used to define the degree of terrain irregularity. It represents the difference between the altitudes exceeded for 10% and 90% of the terrain over propagation paths at distances between 10 and 50 km from the transmitter (see Figure 2.15).

The curves for propagation over land refer to the kind of irregular rolling terrain found in Region 1 for which a value of Δh of 50 m is considered appropriate.

Figure 2.14 gives corrections for other values of Δh.

3. Receiver terrain correction (terrain clearance angle)

The location correction in paragraph 1 above can be applied only on a statistical basis. If more precision is required for predicting the field strength in a specific small receiving area a correction may be based on a "terrain clearance angle". This angle θ is measured at a point chosen to be representative of the reception area; it is defined as the angle between the horizontal plane passing through the receiving antenna and the line from this antenna which clears all obstacles within 16 km in the direction of the transmitter. The example in Figure 2.16 indicates the sign convention, which is negative if the line to the obstacles is above the horizontal. Figure 2.17 indicates the correction, as a function of the angle θ, to be applied to the prediction for 50% of locations. If this correction is applied, the location correction of paragraph 1 (Figure 2.13) may no longer be applicable.

Corrections for terrain clearance angles outside the range -5° to 0.5°, are not given in Figure 2.17, because of the smaller number of paths concerned in the study. However, they may be obtained tentatively by linear extrapolation of the curve in Figure 2.17 and limiting values of 30 dB at 1.5° and -40 dB at -15°, subject to the condition that the free-space field strength is not exceeded.

CCIR References (Volume V)

- Recommendation 370-4
- Report 239-5
- Recommendation 529
- Report 567-2
- Recommendation 528-1

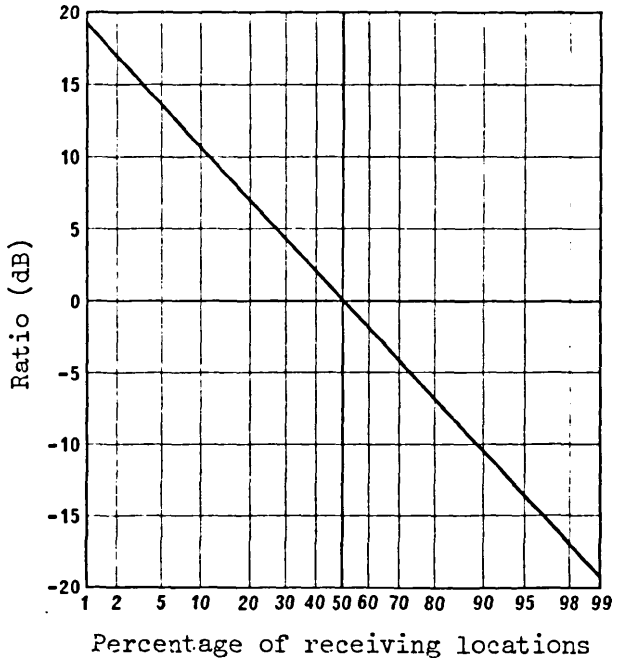


Figure 2.13 - Ratio (dB) of the field strength for a given percentage of the receiving locations to be the field strength for 50% of the receiving locations

Frequency : 30 to 250 MHz

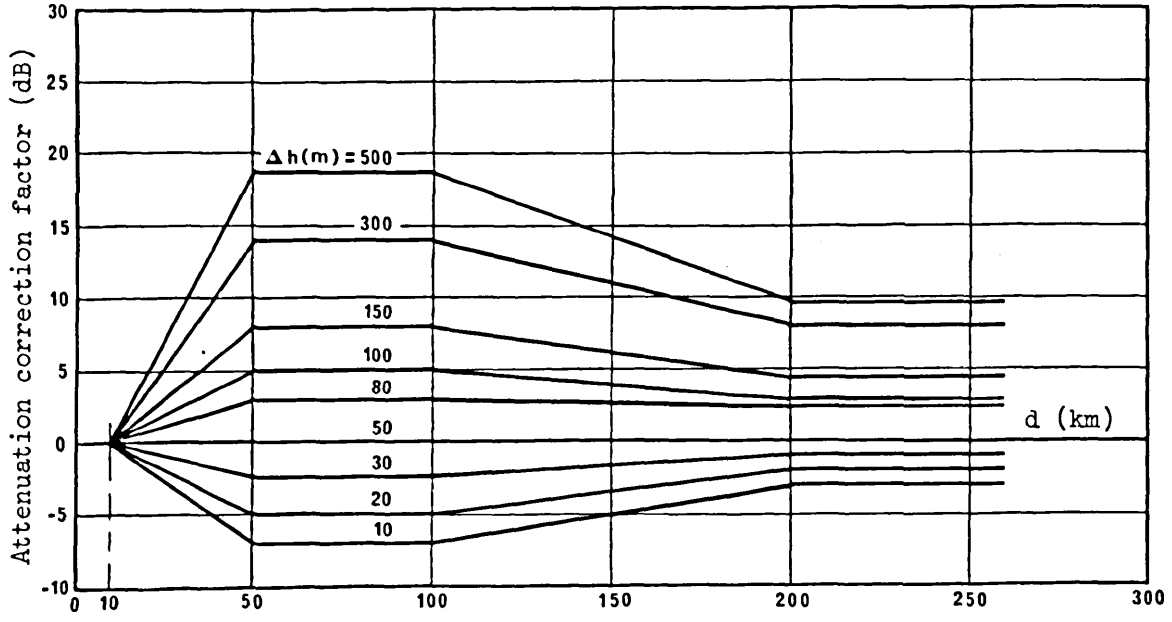


Figure 2.14 - Attenuation correction factor as a function of the distance from the transmitter for various values of Δh

Frequency : 80 to 250 MHz

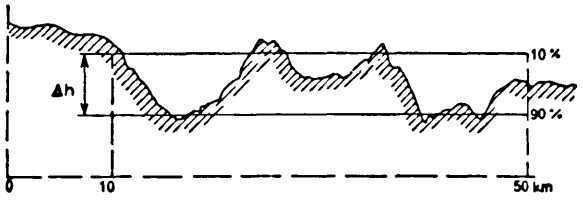
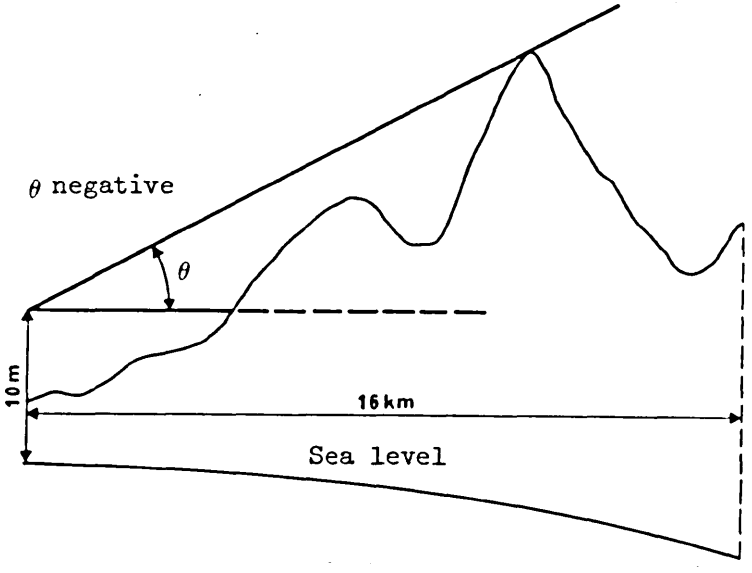


Figure 2.15 - Definition of the parameter Δh



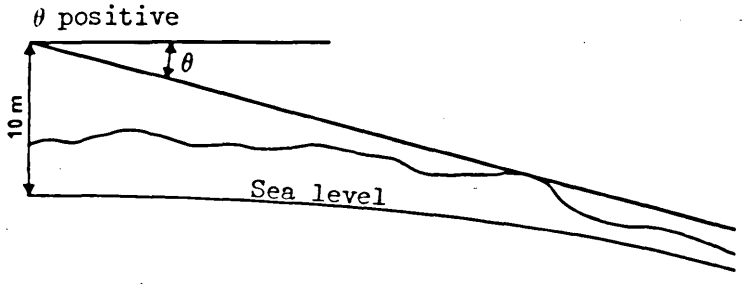


Figure 2.16 - Terrain clearance angle

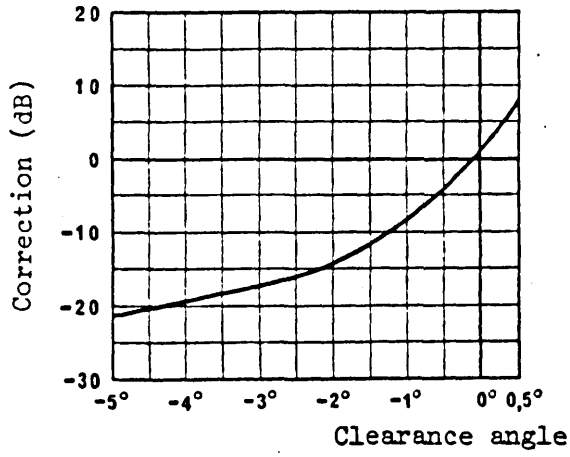


Figure 2.17 - Receiving terrain clearance angle correction (VHF)

ANNEX B

GUIDELINES FOR EXAMINATION OF CONFLICT SITUATIONS FOR THE CASE OF BROADCAST STATIONS WITHIN AN AREA BELOW THE PROTECTED VOLUME

(see Chapter 5, paragraph 5.3.2.2.5)

For these situations (paragraph 5.3.2.2.5) it appears possible to state basic guidelines which may be used and added to as necessary in particular cases where the conflict contains features with a more significant potential to interfere with air operations.

These basic guidelines are :

1) a minimum protection figure as defined in paragraph 5.3.2.2 enhanced where necessary by a further margin to take account of the proximity of broadcast stations to the ILS course sector;

2) special measures may be necessary where the worst effect of the predicted interference is experienced in the sector from 6 nautical miles to the touch-down point and along the runway, and in the case of back beam operation out to a similar point in the reverse direction. The category, or expected future category of ILS operation is an important factor in deciding whether the broadcast station is acceptable. Further protection will be necessary in most instances particularly in the case of interference due to Type A 1;

3) the higher figure of 100 microvolts per metre for the wanted field strength as specified in Annex 10 of the ICAO Convention may be used as the basis where it has been established and confirmed under all operational conditions;

4) in respect of air operations particular points to be considered are :

   a) the intersection of interference areas with the ILS course sector and their effect on aircraft within this sector,

   b) mandatory approach procedures, radar vectoring paths and areas of higher density of use,

   c) the volume within which a harmful interference may be experienced in relation to the effect of the interference on automatically coupled systems;

5) where it can assist resolution, and to refine the assessment, account may be taken of secondary technical features including the following :

a) vertical radiation diagram of the broadcasting antenna,

b) terrain effects,

c) higher nominal ILS signals in particular parts of the service volume as confirmed by measurement.

ANNEX C

METHOD FOR ASSESSING AREAS OF INTERFERENCE

(see Chapter 5, paragraph 5.3.4.2.3)

By assuming a lossless isotropic receiver antenna, no line loss and free space propagation loss*), contour distances corresponding to received power levels of -10, -20, and -30 dBm can be calculated using the following formula :

$$d = \frac{\log^{-1}\left(\frac{e.i.r.p. - P - C - L_R}{20}\right)}{f}$$

where :

d : contour radius in nautical miles or in kilometres.

C : 37.8 for d in nautical miles, or 32.4 for d in kilometres.

e.i.r.p. : equivalent isotropic radiated power of the FM station in dBm (e.i.r.p. = e.r.p. + 2.15 dB).

f : FM centre frequency in MHz.

P : contour power level desired, either -10, -20, or -30 dBm.

L_R : avionics antenna out-of-band rejection in dB

Out-of-band avionic antenna rejection (L_R) can be found as follows :

For a navigation antenna :

L_R = 3 dB plus 1 dB/MHz below 108 MHz

For a communication antenna :

L_R = 10 dB for FM signals from 100 to 108 MHz

or :

L_R = 10 dB plus 2 dB/MHz below 100 MHz for FM signals from 87.5 to 100 MHz

The out-of-band antenna rejection value (L_R) is subject to wide variations which are a function of airborne antennas and installation differences.

Graphical examples for the application of this method are given in CCIR Report 929 (Figures 1 and 2).

---

*) Free space loss closely approximates median transmission loss curves when transmitter and receiver are within line-of-sight (LOS). LOS for an aircraft about 1500 m (5000 feet) would be a minimum of 87 nautical miles (160 km) regardless of FM station antenna height.

ANNEX D

MINIMUM DISTANCES FOR PRINCIPAL MODES OF INTERFERENCE BASED ON CRITERIA SET OUT IN PARAGRAPHS 5.3.2 TO 5.3.7 AND WITH 85 dB REJECTION OF SPURIOUS EMISSIONS AT THE BROADCASTING STATIONS

(see Chapter 5, paragraphs 5.3.7.3 and 5.3.9.2)

a) Third-order intermodulation products radiated by transmitter assuming 85 dB rejection of spurious emisssions

Transmitter e.r.p. (kW)	Distance (km) for :	
	ILS	VOR
100	22	10
50	15.5	7
10	7.0	3.2
1	2.2	1
Protected field strength, dB(μV/m)	32	39
Protection ratio, dB	17	17

b) Intermodulation in receiver : equal field strengths
(applies to $2f_1 - f_2$ or $f_1 + f_2 - f_3$ for examples given)

MHz, f_1, f_2, f_3	108, 105, 102		102, 98, 90	
System	ILS	VOR	ILS	VOR
Permitted field strength dB(μV/m)	100	102	108	110
e.r.p. (kW)	Distance (km)			
100	22	18	9	7.0
50	15.5	13	6.2	5.0
10	7.0	5.6	2.8	2.2
1	2.2	1.8	0.9	0.7

c) Desensitization

Frequency, MHz	108	107	106	100
Permitted power at receiver input (dBm)	-20	-12.5	-5	-5
Permitted field strength dB(μV/m)	101	109.5	118	124
e.r.p (kW)	Distance (km) for ILS or VOR			
100	20	7.4	2.8	1.4
50	14	5.2	2.0	1.0
10	6	2.2	0.9	0.45
1	2	0.7	0.3	0.14

ANNEX E

IMPROVEMENTS IN EQUIPMENT

(see Chapter 5, paragraph 5.3.9.2)

1. Interference to airborne equipment from Type "A" mechanisms cannot practically be reduced by improvements in aeronautical receivers. No benefit can therefore be assumed in planning.

2. Interference effects due to Type "B" mechanisms could be reduced by improvement in the airborne antenna and receiver design particularly in respect of front end rejection characteristics. Factors such as overall cost of replacement, the performance environment within the aircraft and implementation time scale must be taken into account in any improvement programme. Extended time scales for a sufficient re-equipment to assure new parameters in planning are likely because of economic and operational factors.

3. CCIR Report 929 (paragraphs 4.2.1 to 4.2.3) discusses current equipment, expected improvements and future system characteristics; studies are continuing within the CCIR on this subject.

4. The broadcasting authorities should make efforts to reduce the level of spurious emissions in the band 108 to 137 MHz (particularly third-order intermodulation products) from broadcasting transmitters. A level significantly lower than that required in Appendix 8 of the Radio Regulations would considerably reduce the problem of interference.

5. Aeronautical authorities should make efforts to improve the out-of-band rejection characteristics of airborne receiving equipment in the band 87.5 to 108 MHz. National and international organizations concerned with avionics equipment should cooperate in promoting a programme to achieve this with a view to the earliest practical implementation. However, full implementation could take considerable time.

ANNEX F

LATTICE PLANNING METHOD

(see Chapter 6, paragraphs 6.3.1 and 6.3.4)

1. In this Annex the use of the lattice planning method is explained, whereas its theory is described in CCIR Report 944. The basic idea of this planning method is the repeated use of a geometrically regular channel distribution scheme over a vast area. As only channel distribution schemes are selected, which are optimized in terms of coverage by reducing interference within the network to the minimum, it can be assumed that their repeated use would result in a plan which, after some further refinement, might be acceptable to everyone. However, compatibility problems with other services cannot automatically be taken into account when using the lattice planning method.

2. Although the use of one single channel distribution scheme would permit a high degree of efficient spectrum utilization, conditions may prevail in the area to be planned which suggest the use of different schemes in different parts of the area. Actually the situation in Africa and the countries of the Middle East is considerably different from that in the remaining part of the planning area. Whilst in the countries of the former area, planning may start from scratch, in Europe the plan for the television service in the band 87.5 to 100 MHz for Eastern European countries will have to be retained and be respected when assigning frequencies to VHF/FM sound broadcasting transmitters. It is for this reason that two different channel distribution schemes will be used, one for Africa and the Middle East in the band 87.5 to 108 MHz and the other for the remaining part of the planning area in the band 100 to 108 MHz.

3. The lattices will have to be carefully adapted to one another in order to limit any reduction in spectrum utilization efficiency to the minimum. Geographical separation of the two areas over a given sector will be provided by part of the Mediterranean Sea. Nevertheless, some difficulties will persist and become particularly important in areas where there is no, or nearly no, geographical separation.

4. To enable the lattice planning method, to be applied in practice, it is useful to subdivide the planning area into sub-areas in such a way that they are similar in shape to the lattice selected, i.e. in principle, rhombic, and that the number of transmitter or transmitter sites within each sub-area does not exceed the number (31 or 79 respectively) of available channels. In preparation of the planning procedure the two different lattices selected for Africa and the Middle East and for the remainder of the planning area were drawn on to a map. This map is reproduced below in 12 parts*) (see pages 96 to 107).

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*) The Açores and Madeira, which cannot be shown on the small-scale maps below, will be included in the same planning area as Portugal, i.e. the 79-channel area.

The lattices in maps 1 to 6 are to be applied in Africa and the Middle East. The side length of each rhombic area element is 480 km. The lattices in maps 7 to 12 are to be applied in the remainder of the planning area; the side length of each area element is 240 km.

These lattices are intended for use at the initial stage of the planning procedure.

5. The lattices selected for Africa and the Middle East and for the remainder of the planning area contain 31 or 79 channels, respectively. In Africa and the Middle East it will be possible to provide between 6 and 7 coverages; this would seem to satisfy the needs of the vast majority of the countries in the area. In the remaining part of the planning area this scheme would permit assignments to be made to transmitters in order to provide 2 or 3 coverages between 100 and 108 MHz in accordance with the requirements that will be specified.

6. In this respect it is assumed that in Africa and the Middle East the average distance between neighbouring transmitter sites is of the order of 80 to 100 km which, with 31 channels available per coverage, would correspond to a distance between transmitter sites using the same channel of approximately 445 to 555 km (co-channel distance). In preparatory planning it is, thus, appropriate to apply the channel distribution scheme by entering it in a geographical map which is covered by a rhombic coordinate system having 480 km unit distances which correspond to the assumed co-channel distance. From this map administrations will be able to select appropriate frequencies for assignment to the transmitters at the nearest site. It should be noted that the assignment of one frequency from the theoretical scheme corresponds in reality to the assignment of a group of six channels which are separated from one another. Needless to say, each frequency channel taken from the scheme can only be assigned once in that particular sub-area. It is worth mentioning that departures from the assignment procedure described would be admissible, e.g. in order to assign two groups of three frequencies each to two neighbouring transmitter sites although, in the theoretical lattice these six frequencies are derived from one and the same lattice point. Moreover, it needs to be stated that after assignment of a group of six frequencies to six transmitters at the same site, the major planning constraints will automatically be respected.

The groups of six channels that may thus be obtained at the same site must respect the following constraints :

a) a separation of 10.7 ± 0.2 MHz (receiver intermediate frequency) between channels is to be avoided;

b) spacing is to be arranged so as to avoid intermodulation products falling in channels used at the same site.

7. In the remaining part of the planning area, the average distance between co-channel transmitters is of the order of 240 km. In this area, where a 79 channel distribution scheme will be applied in the band 100 to 108 MHz, it is more difficult to respect the planning constraints; as two or more frequencies are, after adequate distortion of the theoretical lattice, to be assigned to transmitters sharing the same site, it has to be verified that in every case the separations between frequencies would permit the use of multiplexers if this is desired. Moreover, there will be absolutely no means of systematically avoiding frequencies having a separation in the range of 10.7 $\pm$ 0.2 MHz, with respect to VHF/FM broadcast transmitters in the frequency band 87.5 to 100 MHz at the same site. Consequently, this particular constraint will need extensive checking.

Note 1 : The Administration of Cyprus indicated that a 31 channel distribution scheme will be used in that country.

Note 2 : The figures in this Annex are intended to show the size and orientation of the rhomboids, and reference points which will enable the IFRB to prepare more accurate maps to an appropriate scale. These will be sent to administrations by 31 December 1982 with the Circular-letter*) referred to in paragraph 7.2.

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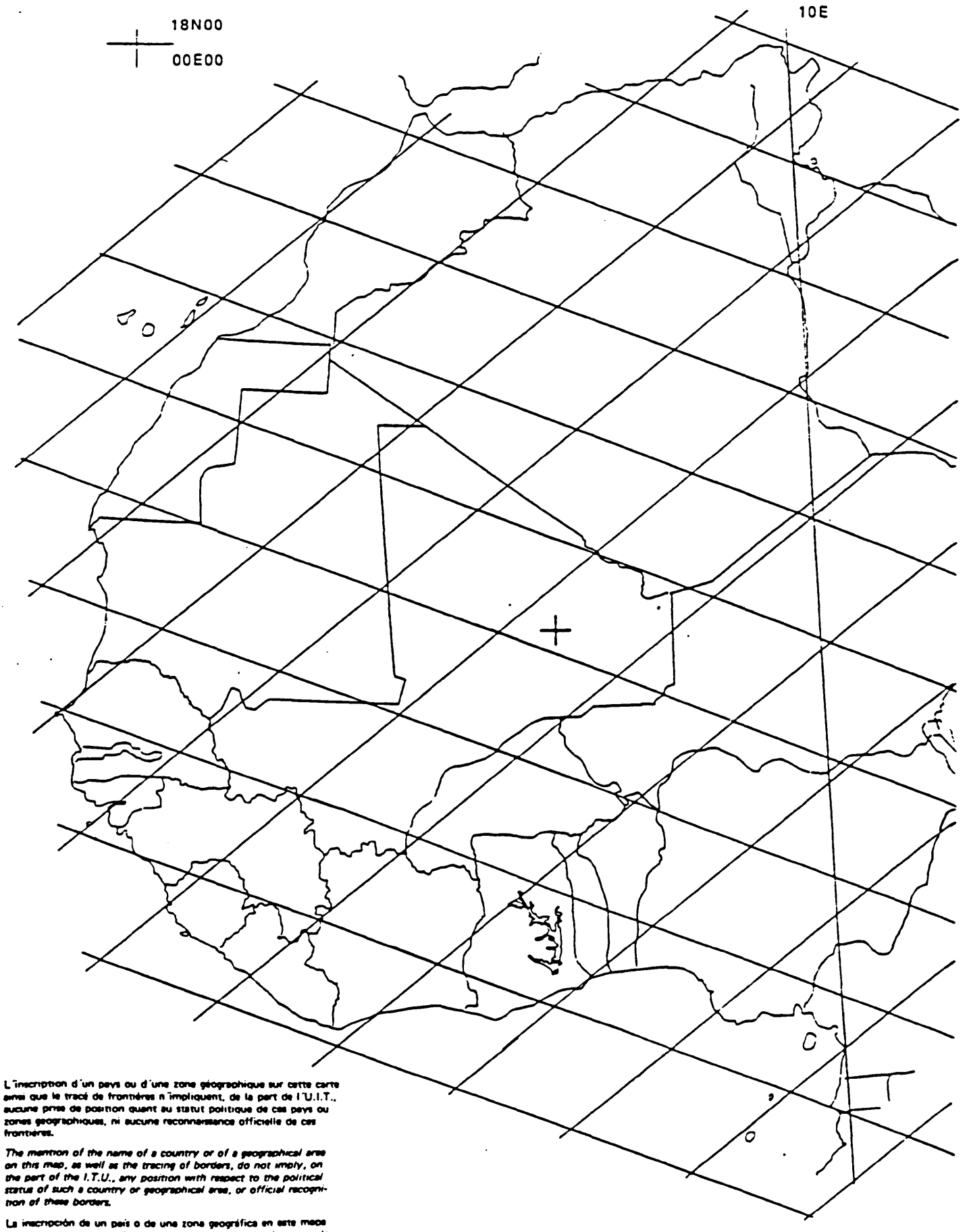
*) See Circular-letter No. 592 of 15 December 1982.



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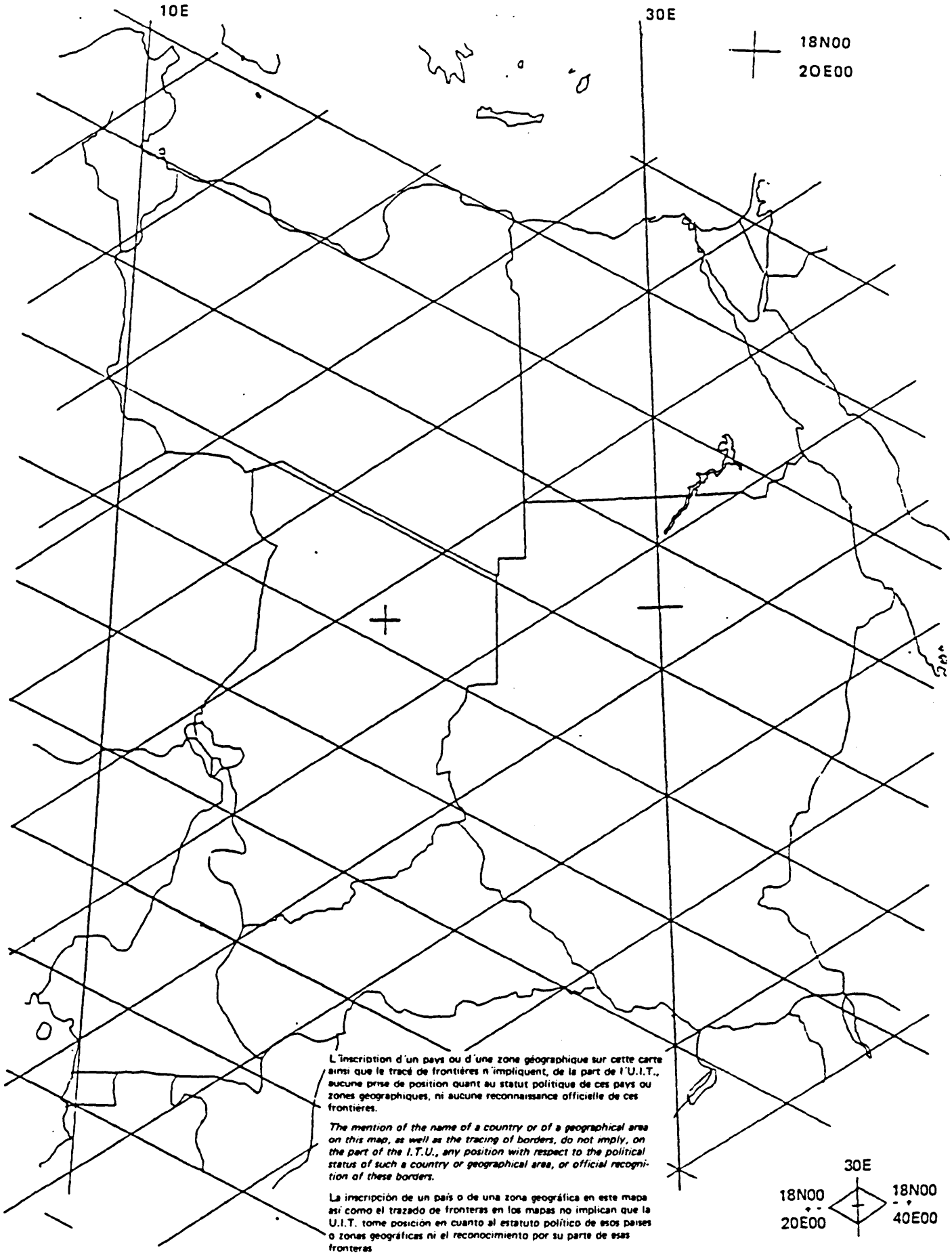
La inscripción de un país o de una zona geográfica en este mapa así como el trazado de fronteras en los mapas no implican que la U.I.T. tome posición en cuanto al estatuto político de esos países o zonas geográficas ni el reconocimiento por su parte de esas fronteras.

CARTE 1 – MAP 1 – MAPA 1



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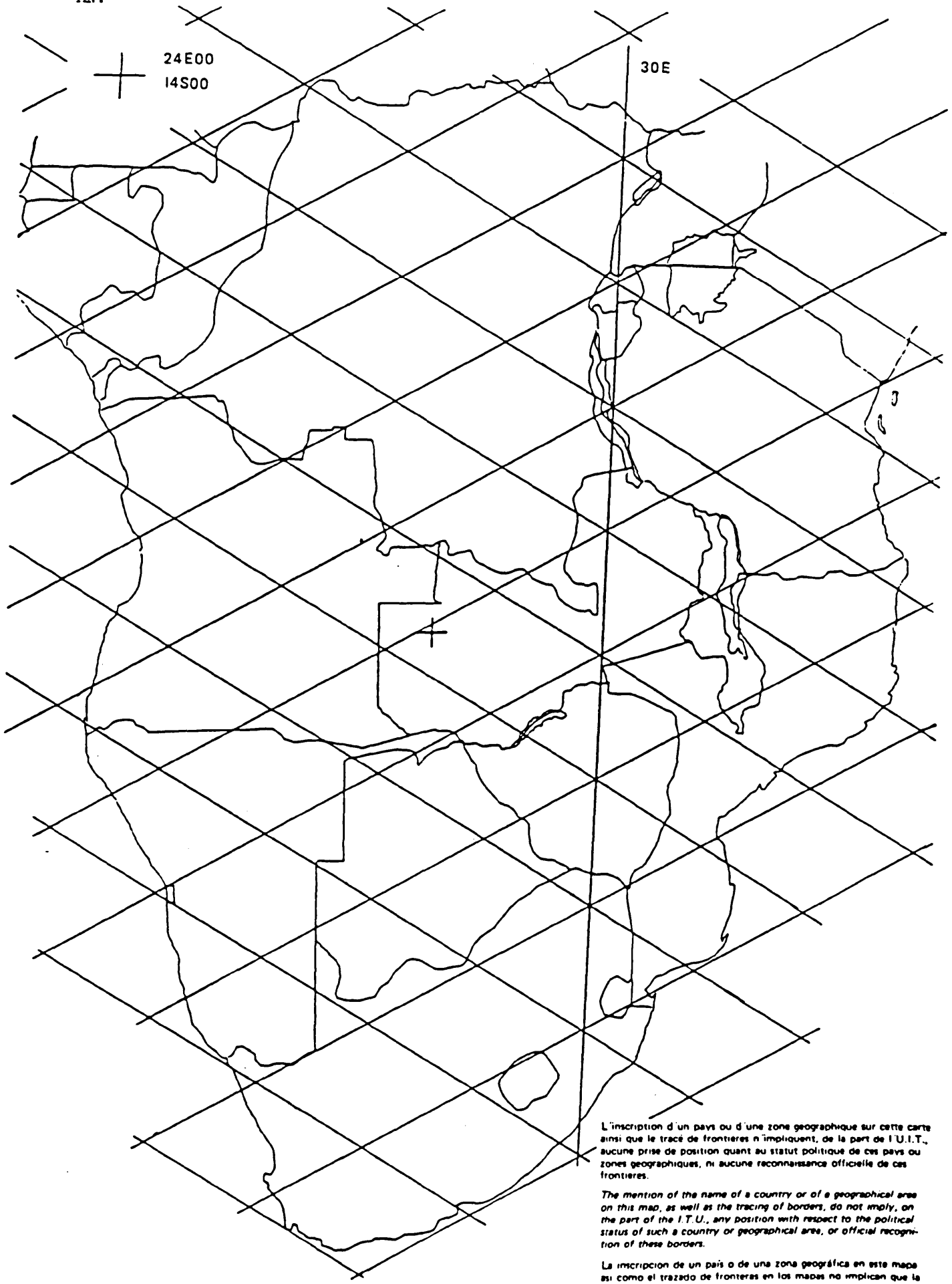
CARTE 2 – MAP 2 – MAPA 2



CARTE 3 – MAP 3 – MAPA 3

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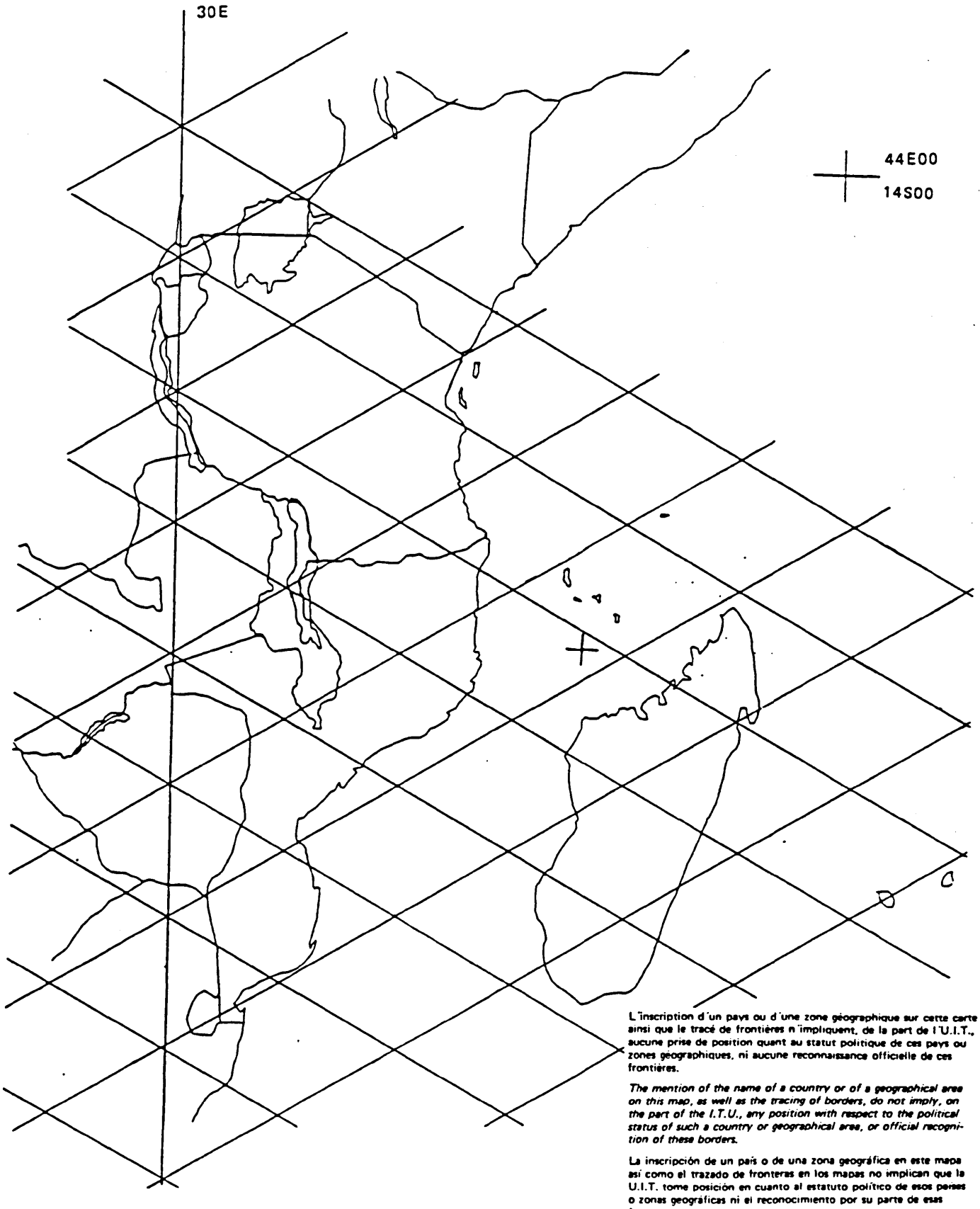

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CARTE 4 – MAP 4 – MAPA 4

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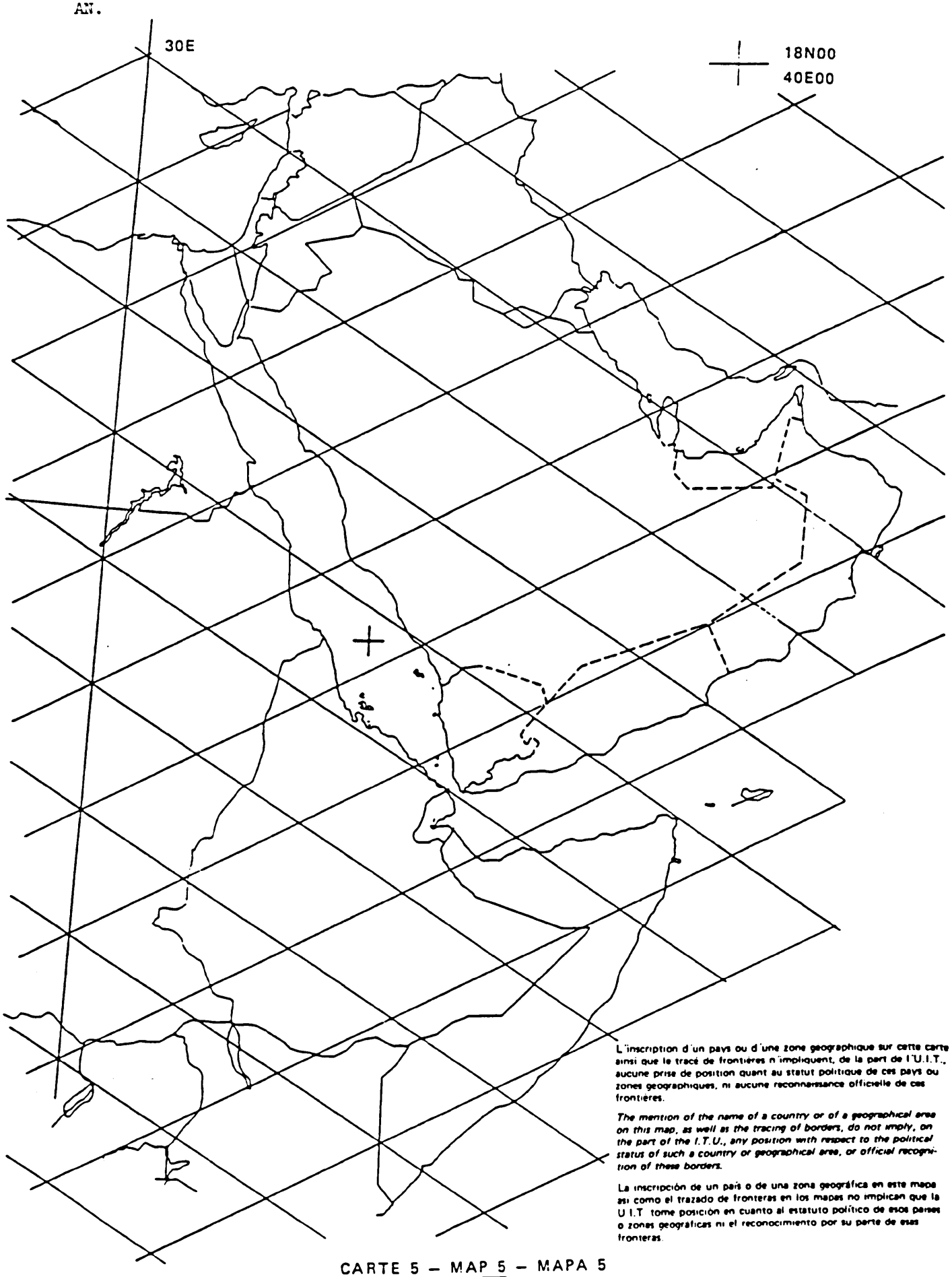

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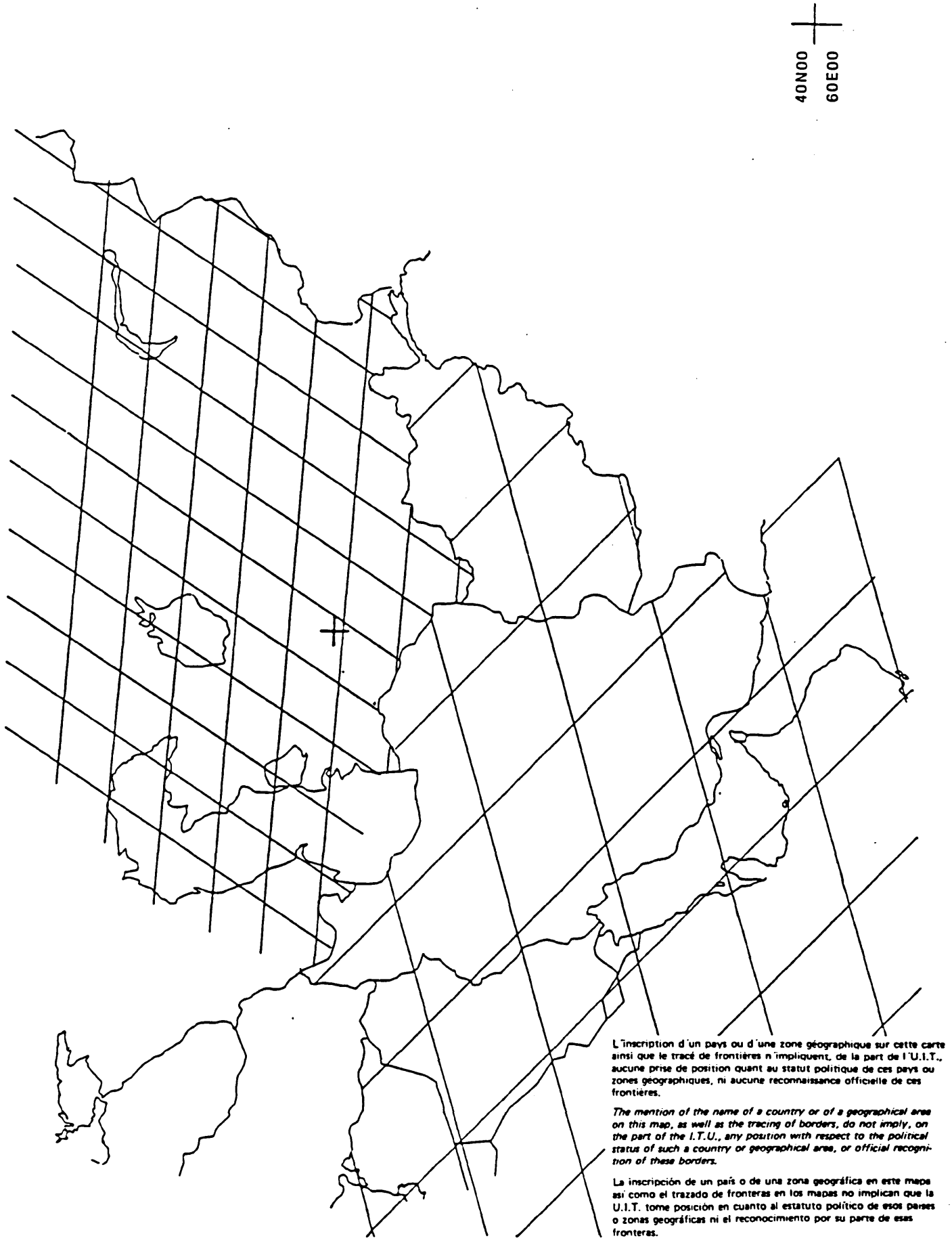
CARTE 5 – MAP 5 – MAPA 5



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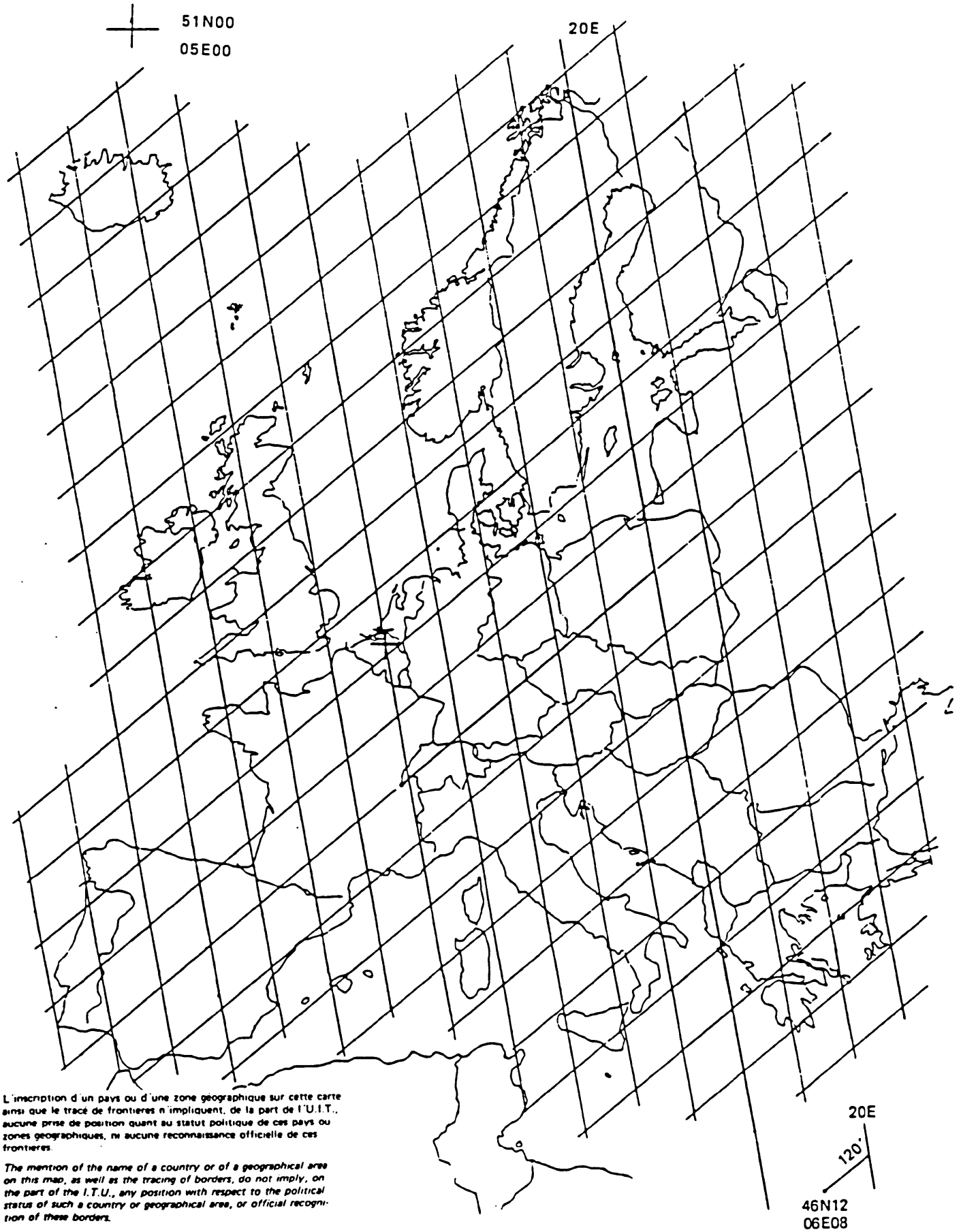
CARTE 6 – MAP 6 – MAPA 6



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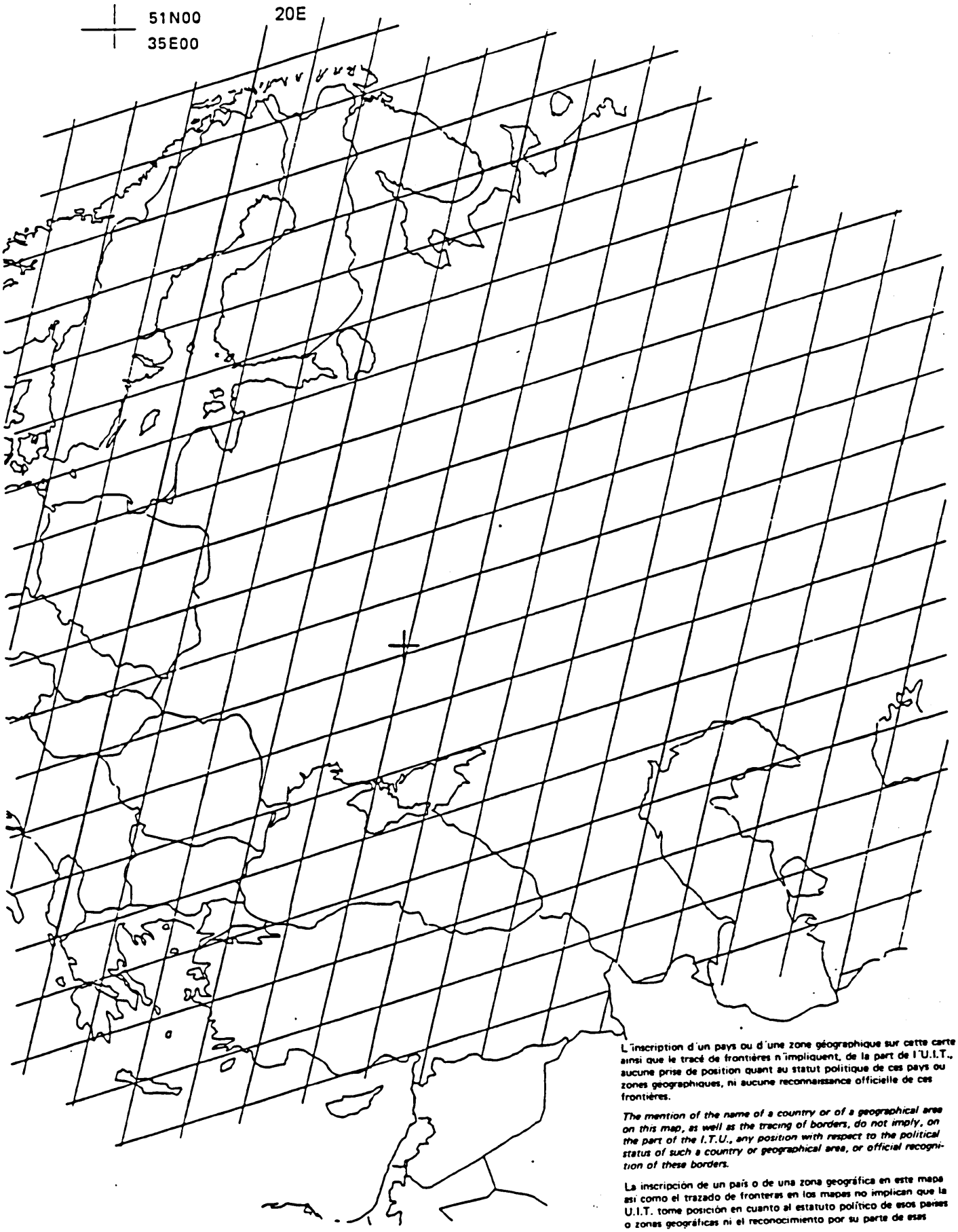
CARTE 7 – MAP 7 – MAPA 7



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CARTE 8 – MAP 8 – MAPA 8

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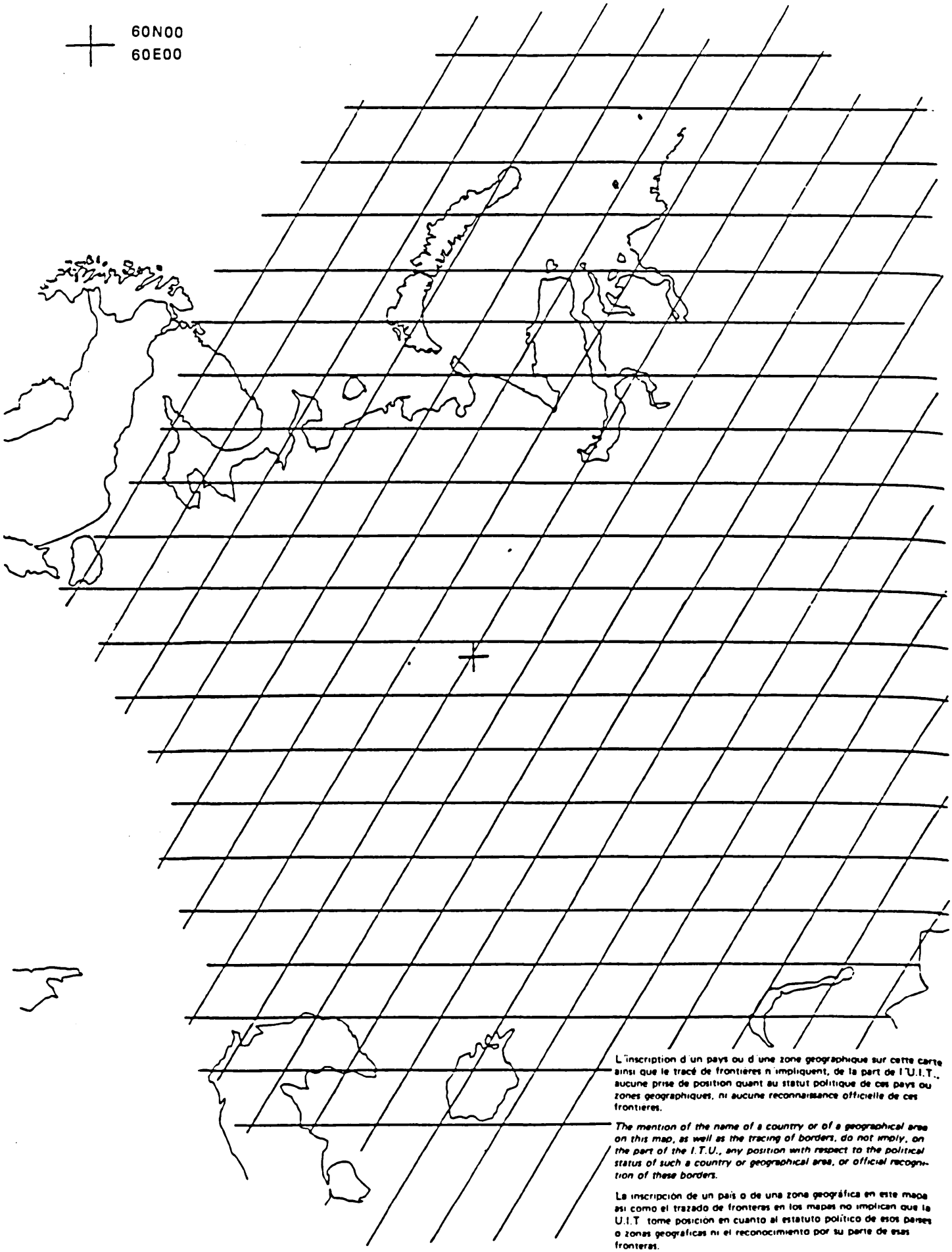

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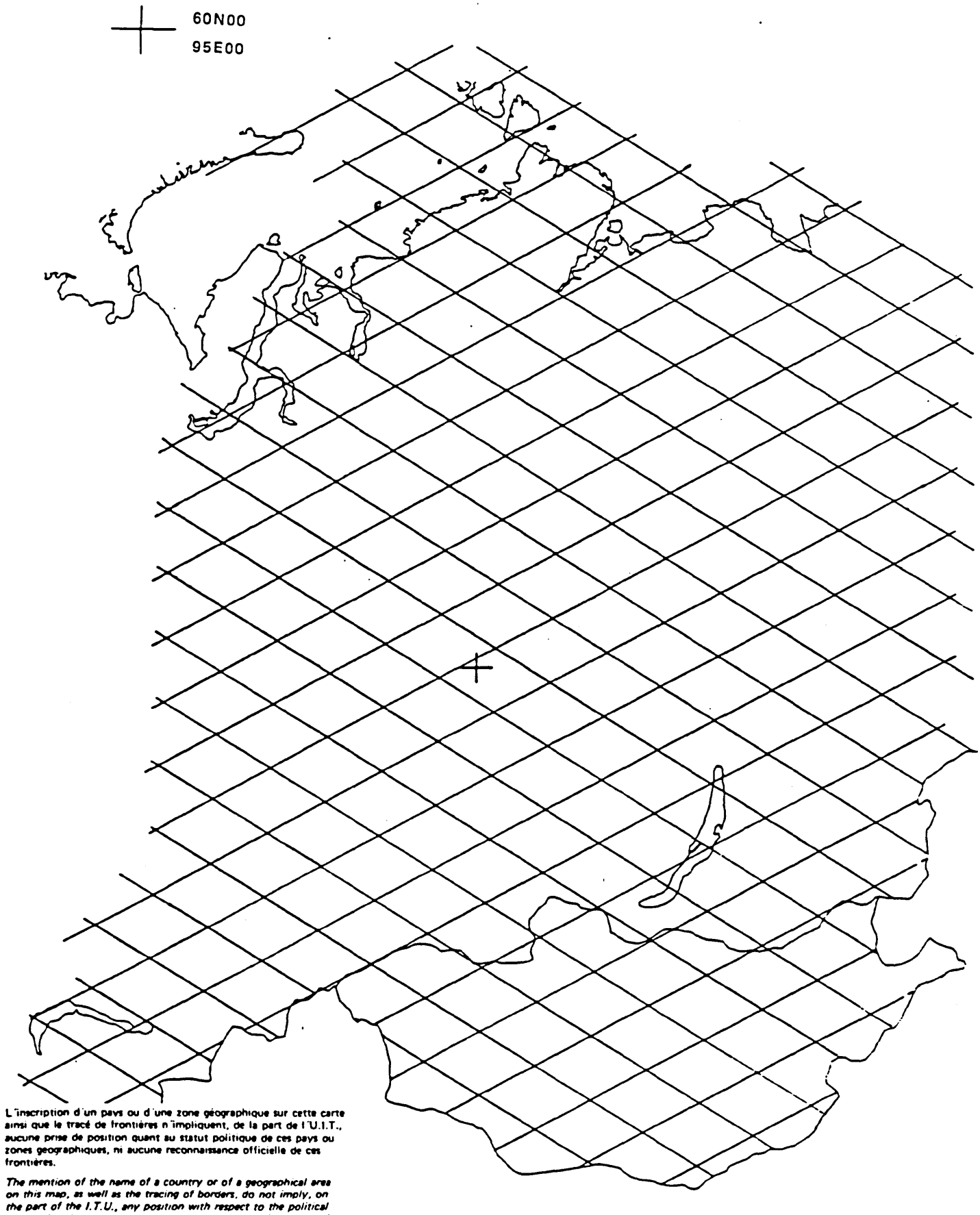
CARTE 9 – MAP 9 – MAPA 9



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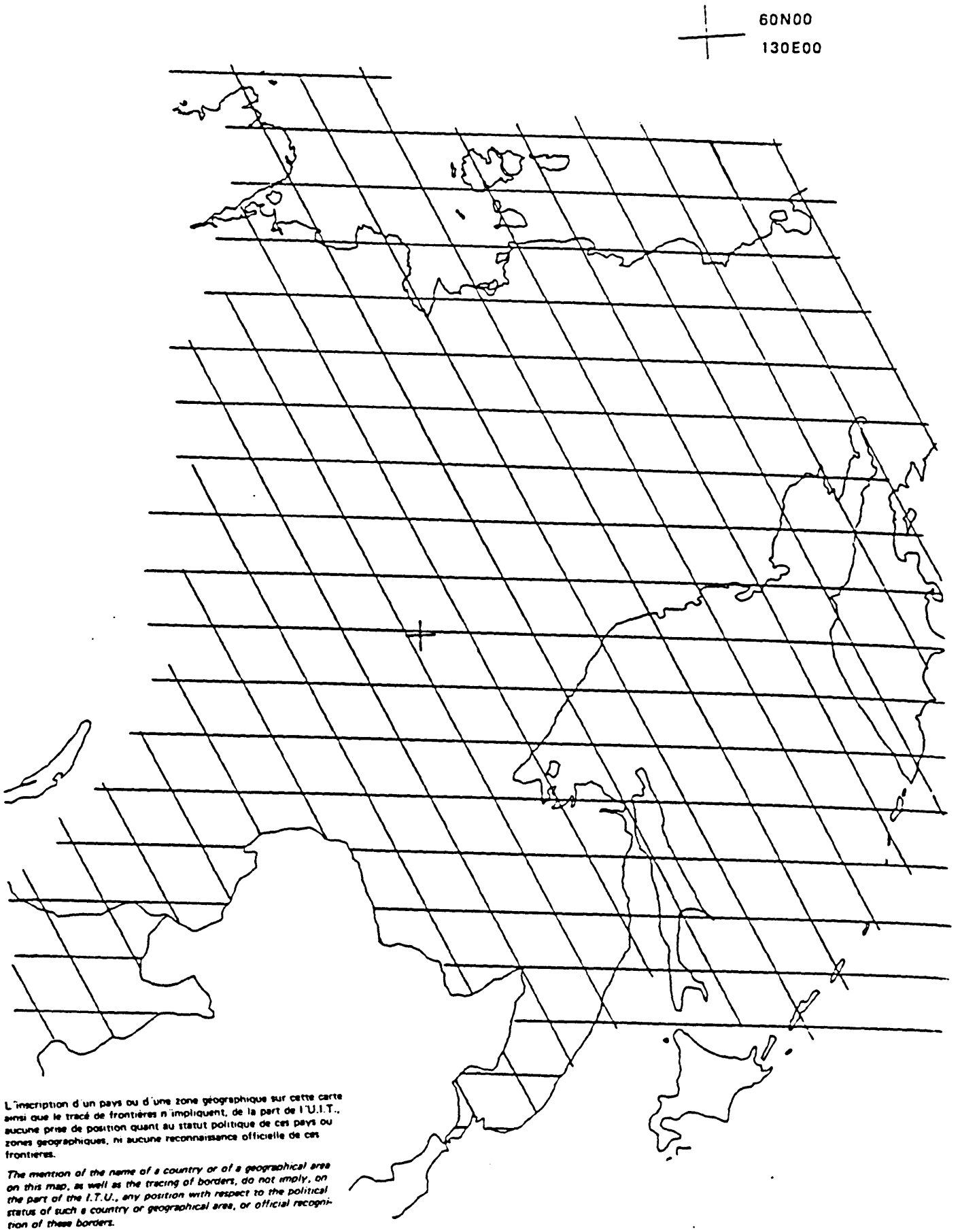
CARTE 10 – MAP 10 – MAPA 10



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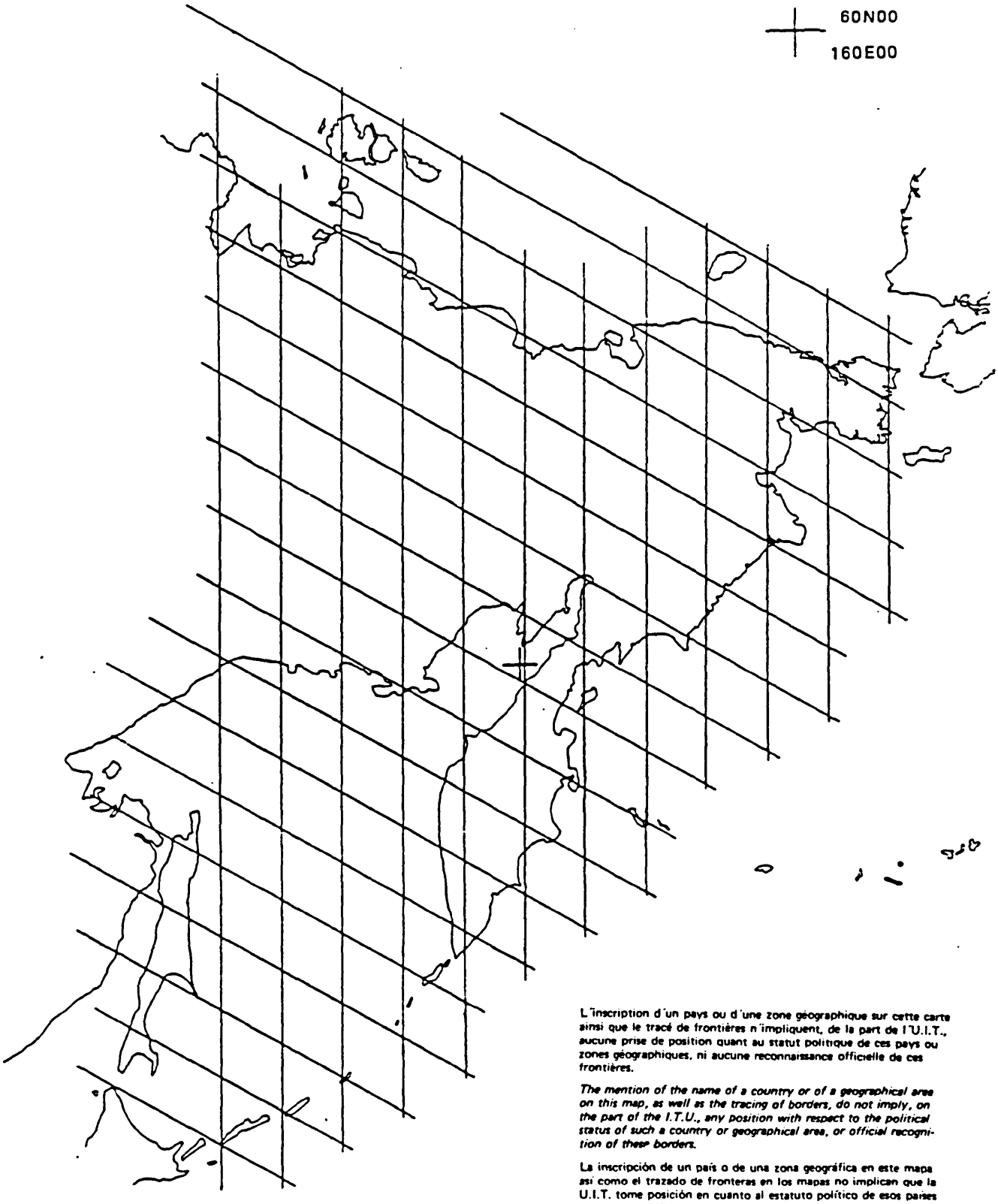
CARTE 11 – MAP 11 – MAPA 11



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CARTE 12 – MAP 12 – MAPA 12

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ANNEX G

ANALYSIS OF THE PLAN

(see Chapter 6, paragraph 6.3.1)

1. Introduction

The plan will be analysed on the basis of the data bank to be set up by the IFRB from information supplied by administrations or entered by the IFRB for those administrations which did not supply information.

2. Method of analysis

In each analysis the nuisance field from each potentially interfering transmitter shall be calculated at the site of the wanted transmitter according to the method given in paragraph 3.3.2 of this Report.

The usable field strength, E_u, shall then be calculated by the simplified multiplication method*) taking into account the 20 largest values of nuisance field, specified to one decimal place. For preliminary calculations, the simplified multiplication method will be used for the whole of the planning area; however, for comparison purposes, power sum method will be used in the area from the Shatt-al-Arab to the Gulf of Oman, at the request of administrations concerned.

2.1 Preliminary analysis

The above calculations shall be carried out in a preliminary analysis, in which no account shall be taken of the receiving antenna discrimination.

2.2 Final analysis

In the final analysis the coverage area of a transmitter shall be evaluated by additional calculations. These calculations, in which account is taken of the receiving antenna discrimination, determine on each of 36 radials at 10° intervals the distance at which the field strength from that transmitter is equal to E_u. In the case of low power stations, the number of intervals may be reduced.

From experience gained so far, it is to be expected that E_u values on the coverage contour, obtained in the final analysis, will, on average, be approximately 8 dB lower than the corresponding E_u at the transmitter site (determined in the preliminary analysis).

3. First preliminary analysis for each administration

3.1 During the first preliminary analysis of requirements, only those transmitters shall be considered which have a maximum e.r.p. of not less than 100 W (20 dBW) and for which a frequency has been specified by the administration as part of its requirement.

*) An example of the simplified multiplication method is given in Annex M.

3.2 The values of E_u will be calculated in a preliminary analysis for those requirements mentioned in 3.1 as submitted by the administration. Moreover, the arithmetic mean of all values of E_u (dB (μV/m)) shall be calculated together with their standard deviation.

3.3 For all transmitters having unsatisfactory assignments, that is those for which the value of E_u exceeds the mean by more than 10 dB, and for transmitters exceeding 100 W e.r.p. without the indication of a preferred frequency, a further study shall be carried out as a preliminary analysis. E_u shall be calculated for each channel as if the transmitter were assigned each channel in turn in the frequency band 87.5 to 108 MHz.

4. Examination of incompatibilities and frequency planning constraints

At the time of the third preliminary and the final analysis and, as regards incompatibilities with TV stations, at the time of the first preliminary analysis, the following will be examined for each transmitter :

- incompatibility with television stations in the band 87.5 to 100 MHz (Annex I);
- interference to radio equipment used by aircraft for landing and navigation purposes which operates in the band 108 to 118 MHz (Annex J);
- incompatibility with the fixed or mobile services in Region 3 (Annex K);
- frequency spacing between 10.5 and 10.9 MHz for transmitters separated by no more than D (km) = 10 log ($e.r.p._{max}$/1000). $E.r.p._{max}$ is the higher power of the two transmitters involved and is expressed in watts. If $e.r.p._{max}$ is 1000 W or less, D = 0;
- for transmitters having identical site coordinates and identical antenna height above ground level, a frequency spacing of less than 1.8 MHz or, if they have only identical site coordinates, a frequency spacing of less than 0.8 MHz.[1)]

5. Presentation of results

The following information will be presented to each administration for its transmitters.

---

1) The preparatory work to be carried out in this respect between the two sessions of the Conference will be limited to the identification of transmitters having identical site coordinates.

5.1 For each transmitter :

- the value of E_u at the transmitter site;
- a list of the six largest sources of interference together with their nuisance fields and bearings from the wanted transmitter site;
- a list of transmitters for which this transmitter appears as one of the six largest sources of interference, together with the corresponding nuisance fields and the bearings (azimuth) of these transmitters from the transmitter site.

5.2 For all of its transmitters :

- the mean value and standard deviation of all values of E_u;
- a graphical presentation (see Figure 1 of Annex H) of the values of E_u for each channel in the band 87.5 to 108 MHz for each transmitter having an unsatisfactory assignment (see paragraph 3.3 above);
- lists of transmitters which have incompatibilities with other services or which contravene the frequency planning constraints (see paragraph 4 above).

6. Proposed modifications to the requirements

After studying the results of the calculations, administrations will propose appropriate modifications to their requirements with a view to resolving incompatibilities. These modifications, which will be submitted to the Second Session, will, if the administrations consider it necessary, be the subject of bilateral or multilateral coordination. Administrations may request the IFRB to provide them with values of E_u calculated for each channel in respect of their stations with an E_u exceeding the mean value by more than 5 dB or in respect of stations identified as incompatible with other services or which contravene the frequency planning constraints.

Administrations shall bring these proposed modifications to the notice of the IFRB by 30 September 1984. If no change is desired, the IFRB shall be informed by the same date.

7. Second preliminary analysis

The requirements including the proposed modifications will be analysed (as in paragraph 2.1 above) and administrations will be presented with results excluding the graphical presentations for all stations which have been affected in any way.

8. Inclusion of low power transmitters

If no frequency is included in the requirement form for a low power transmitter, the value of E_u for all channels will be calculated (see paragraph 3.3 above) at the site of the low power transmitter, in order that the IFRB may tentatively select an appropriate frequency.

9. Third preliminary analysis

The draft plan will be analysed (as in paragraph 2.1 above) and results will be presented to administrations having low power transmitters or having transmitters affected by the inclusion of low power transmitters.

10. Second Session of the Conference

During the Second Session of the Conference, administrations may wish to make changes to requirements resulting from bilateral or multilateral negotiations. The effect of such changes will be analysed from time to time and the results will be published.

It should be possible to provide a coverage analysis (see paragraph 2.2 above) in the case of difficult problems, at the request of an administration.

11. Determination and publication of coverage areas resulting from the Plan

Subsequent to the Conference the coverage areas of all transmitters in the plan shall be determined in a final analysis (see paragraph 2 above) and the results shall be published. For each transmitter this information shall consist of 36 radial distances, together with the corresponding E_u values.

ANNEX H

METHOD OF FOREMOST PRIORITY

(see Chapter 6, paragraphs 6.3.1 and 6.3.5)

1. The method of foremost priority consists in assigning to the transmitter for which the number of appropriate frequencies is smallest the most favourable among these frequencies (worst transmitter - best frequency). This means that frequencies are successively assigned to every transmitter following the order of decreasing difficulty in terms of interference. For every transmitter in sequence a frequency is selected which suffers least interference and produces the smallest amount practicable of additional interference. This procedure is repeated until all transmitters have obtained a frequency. It goes without saying that in this procedure account has to be taken of all constraints.

2. Obviously, this method can be time consuming and its reliability may only be guaranteed when a computer is used. The use of a high-speed computer can provide important assistance in this procedure and may, in fact, be the only resort in some cases.

3. It will at first be necessary to discover, by way of an appropriate analysis (see Annex G), the deficiencies of an assignment plan by computing the usable field strength, checking the constraints to be respected and applying the compatibility procedures. Unsatisfactory frequency assignments, i.e. those whose usable field strength exceeds the average value in that country by more than 10 dB, or assignments which are incompatible with other services, will be identified in this way and the transmitters will be included in the list to which the method of foremost priority will have to be applied. In the following step, computing and plotting of the usable field strength as a function of frequency for the sites of such transmitters (see Figure 1 of this Annex) may be useful. Graphical presentations of this type are particularly useful when more than one frequency is to be found for the same site. In general, those frequencies may be considered most appropriate for which the lowest values of usable field strength are shown. This implies, however, that their use is compatible with other services and that the planning constraints are respected.

4. It may be clear from the above explanations that the graphical presentation of the usable field strength as a function of frequency might also successfully be used to find frequencies for assignment to transmitters for which no frequency was assigned in the first step of the planning procedure (i.e. during the use of the lattice planning method), e.g. for low-power transmitters.

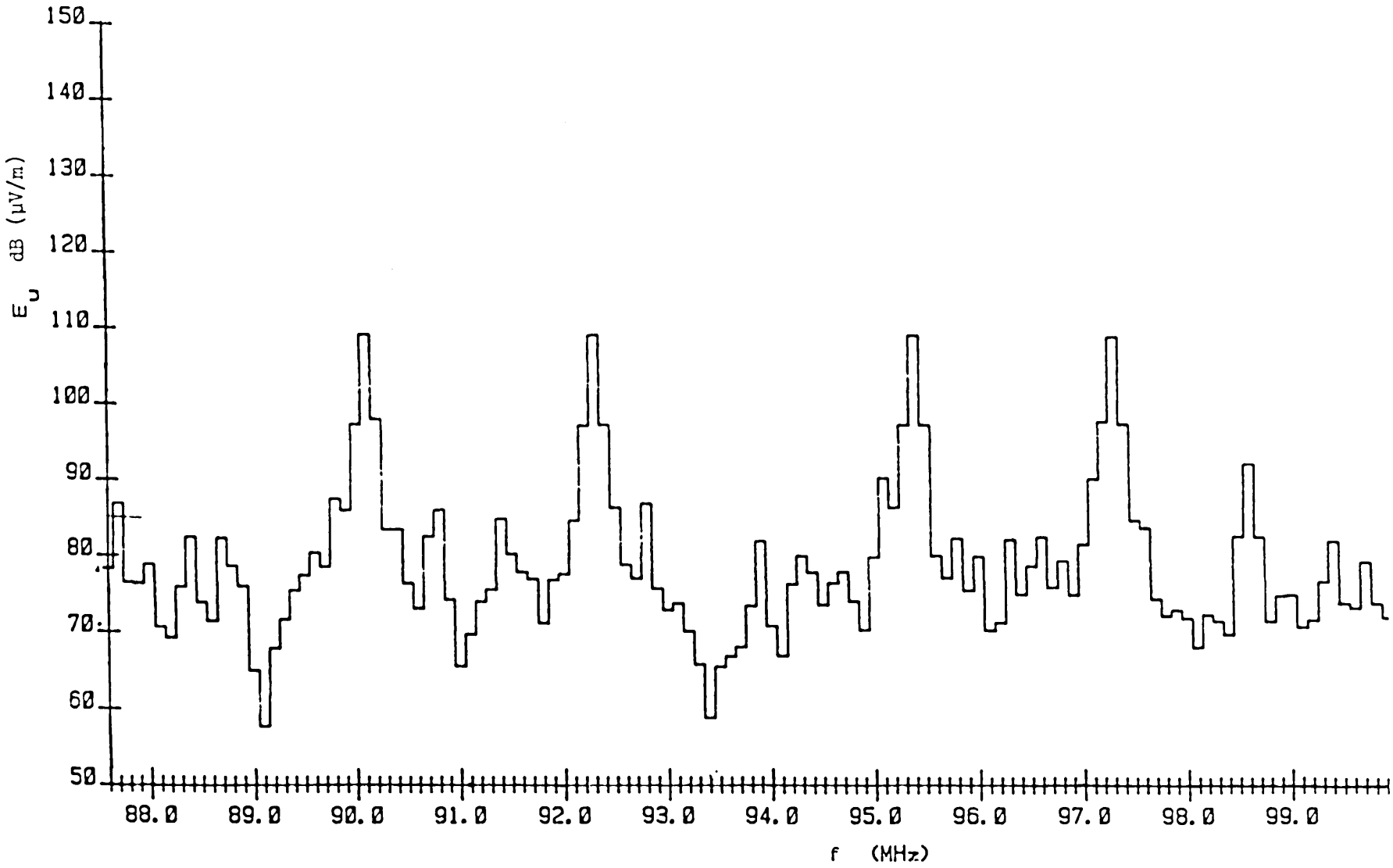

Figure 1 - Example of chart indicating values of usable field strength for each channel in the band 87.5 to 100 MHz

ANNEX I

COMPATIBILITY WITH TELEVISION STATIONS AND
PROTECTION TO SOUND BROADCASTING STATIONS
WITHIN THE COORDINATION AREA IN THE BAND 87.5 TO 100 MHz

(see Chapter 6, paragraphs 6.3.1 and 6.3.8)

1. Introduction

Requirements will be processed in accordance with the data bank to be set up by the IFRB from information supplied by administrations, or entered by the IFRB for those administrations which did not supply information.

2. Compatibility assessment

All sound broadcasting requirements in the coordination area with countries using this band for television in accordance with the Regional Agreement, Stockholm, 1961, will be assessed for compatibility with television stations.

3. Protection to sound broadcasting stations within the coordination area

Calculations will have to be carried out to verify that there is no deterioration in the service areas of existing sound broadcasting stations which are operating in accordance with the Regional Agreement, Stockholm, 1961 (notified to IFRB before 1 December 1983) and which are situated in the coordination area with countries using this band for television in accordance with the Regional Agreement, Stockholm, 1961. For comparison purposes, the reference situation (as described in paragraph 6 below) is to be used as a basis.

4. Coordination area

A sound broadcasting station is considered to be situated in the coordination area when its distance from the nearest point of the border of the country using this band for television in accordance with the Regional Agreement, Stockholm, 1961, is less than the distance given in Table B of Annex 1 of the Agreement.

5. Comparison

For the purpose of assessing compatibility with television stations (see paragraph 2 above) or protection to service areas of existing sound broadcasting transmitters (see paragraph 3 above), the existing situation shall be used as a reference situation and be compared with the new plan in the course of its development. To permit these comparisons it will be necessary to calculate (as in paragraph 8 below) the usable field strength (E_u) for all television transmitters and all existing sound broadcasting stations (as in paragraphs 2 and 3 above) at a number of test locations (not more than 12) within the existing service area, to be specified by the administrations concerned.

6. Reference situation

All existing or planned assignments to television, or sound broadcasting, stations in the band 87.5 to 100 MHz appearing in the Regional Plan, Stockholm, 1961 and those for which the procedure of the Regional Agreement, Stockholm , 1961, has been successfully applied before 1 December 1983 shall be taken into account. The sound broadcasting stations in Region 3 and in the part of Turkey not covered by the Regional Agreement, Stockholm, 1961 which are operating in accordance with the Radio Regulations and notified before 1 December 1983 to the IFRB shall be included in the reference situation. The calculation for the reference situation need only be made once.

7. Situation resulting from planning

All existing or planned assignments to television stations (as in paragraph 6 above) and all sound broadcasting transmitters in the draft plan shall be taken into account.

8. Usable field strength for a transmitter at the specified test location

8.1 The nuisance field from each interfering transmitter shall be calculated as in 3.3.2 of Chapter 3 using, in principle, propagation curves for 1% of the time and the appropriate protection ratio taken :

8.1.1 for the wanted television transmitter,

- from Table 1 below for interference from a television transmitter, or
- from Figure 4.1 for interference from a sound broadcasting transmitter;

8.1.2 for a wanted sound broadcasting transmitter,

- from Table 1 below and Figure 4.2 for interference from a television transmitter, using protection ratio values for tropospheric interference, or
- from paragraph 3.3 of Chapter 3 for interference from a sound broadcasting transmitter.

8.2 Receiving antenna discrimination shall be taken

- from Figure 1 of this Annex for a wanted television transmitter;
- from Figure 3.3 for a wanted sound broadcasting transmitter.

8.3 In the case of orthogonal polarization a discrimination value of 10 dB shall be applied for a wanted television transmitter. No polarization discrimination shall be applied for a wanted sound broadcasting transmitter.

8.4 The interference contribution of each interfering transmitter is the value of the nuisance field derived in paragraph 8.1 above, including any discrimination value derived in paragraphs 8.2 and 8.3 above.

8.5 The usable field strength E_u shall be calculated from the individual interference contributions using the simplified multiplication method, taking into account the 20 largest (either TV or sound broadcasting) contributions and specified to one decimal place.

9. Result of examination

An incompatibility with a television station or a deterioration of the service area of a sound broadcasting station only exists if any value of Eu obtained (as in paragraph 8 above), in accordance with paragraph 7 above, exceeds the corresponding value of E_u in the reference situation defined in paragraph 6 above by more than 0.5 dB.

TABLE 1

Protection ratios, in dB, for colour television*)

Offset (multiples of 1/12 line-frequency)	0	1	2	3	4	5	6	7	8	9	10	11	12
Co-channel Transmitter stability = 500 Hz (non-precision offset)	45	44	40	34	30	28	27	28	30	34	40	44	45
Lower adjacent channel	-6												
Upper adjacent channel	+4												

*) For further information see CCIR Report 306-4.

RECEIVING ANTENNA DISCRIMINATION - CCIR RECOMMENDATION 419

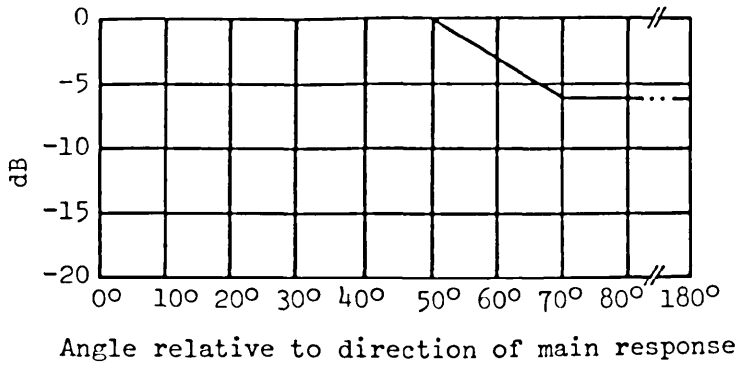

Figure 1 - Discrimination obtained by the use of a directional receiving antenna for the television stations in the band 87.5 to 100 MHz

ANNEX J

COMPATIBILITY BETWEEN VHF BROADCASTING STATIONS AND STATIONS OF THE AERONAUTICAL RADIONAVIGATION AND AERONAUTICAL MOBILE (R) SERVICES

(see Chapter 6, paragraph 6.3.1)

1. The calculation method and criteria contained in this Annex shall be used for analyzing the Plan before and during the Second Session of the Conference. If the stations of the broadcasting service and of the aeronautical services belong to one and the same country, administrations may use this method or any other method they consider useful. This Annex will make it possible to determine whether there is likely to be any incompatibility between stations belonging to different countries. The resolution of such incompatibilities through bilateral or multilateral negotiations will be based on criteria and methods accepted by the administrations concerned.

2. To ensure compatibility between broadcasting stations in the band 87.5 to 108 MHz and aeronautical radionavigation stations in the band 108 to 118 MHz and stations of the aeronautical mobile (R) service in the band 118 to 137 MHz the following procedure shall be applied :

2.1 When an administration defines its requirements with a view to communicating them to the IFRB, it may apply the coordination contour concept referred to in paragraph 3 below to identify and to indicate in an additional note the specific frequency planning constraints which are essential to ensure compatibility in each case with the aeronautical radionavigation service. These additional constraints shall be met as far as possible during the Second Session of the Conference when the plan is drawn up.

For the submission of the above-mentioned constraints, the form B set out on page 78 of this Report.

2.2 At a later stage, when an administration receives the inventory of requirements established by the IFRB (not later than 30 April 1984), it should use the coordination contour mentioned in paragraph 3 below to identify the broadcasting stations of other countries which are likely to affect the operation of any ILS or VOR station. The administration should determine the test points for its ILS and VOR stations in accordance with paragraph 4 below and it should communicate to the IFRB by 30 June 1984 the geographical coordinates of the station sites together with the azimuth, distance and height of each test point using the form C set out on page 80 of this Report.

2.3 The IFRB shall apply the software to be supplied to it by an administration to determine whether the protection criteria defined in paragraph 5 below have been met, and it shall include the results in the general analysis of the Plan.

2.4 Administrations shall endeavour through bilateral and multilateral negotiations to resolve incompatibilities using the criteria and methods they consider most appropriate.

3. Coordination contour around an aeronautical radionavigation station

3.1 For type A interference, administrations should calculate and draw on a suitable map the coordination contour; to obtain this contour, a circle of 125 km*) radius is drawn around all the test points of each radionavigation station to be protected. Broadcasting stations outside the outer resulting contour are considered as not being likely to affect the aeronautical radionavigation station under consideration.

The calculations of the interfering field strength at the test points will permit the identification of those broadcasting stations that need a detailed consideration by administrations.

3.2 For type B interference, if any broadcasting station within the above contour is causing at the nearest test point an interference greater than -25 dBm receiver input power, an intermodulation computer program shall be used to identify those broadcasting stations that need detailed consideration by administrations.

4. Test points

While applying paragraph 6 below for the resolution of incompatibilities administrations shall, in a second step, carry out interference calculations at test points.

In view of the large number of calculations necessary to assess compatibility, in practice these calculations can be limited to a small number of test points on national territory at which the conditions are considered to be the most difficult. In order to be able to apply data processing methods, the following procedure for the choice of test points is recommended.

The test points chosen by the administration shall be communicated to the IFRB where required using the form C set out on page 80 of this Report.

4.1 ILS (Instrument landing system)

4.1.1 If the broadcasting station is not in the area below the service volume defined in Chapter 5, paragraph 5.3.2.1, the points A, B, C defined in Figure 5.1 shall be used together with point D as indicated by the responsible administration.

4.1.2 If the broadcasting station is within the area below the ILS service volume, a case-by-case assessment is necessary (see Chapter 5, paragraph 5.3.2.2.5). Unless otherwise specified the field strength shall be calculated at a distance of 100 m from the broadcasting antenna, and using the direction of maximum e.r.p. if not otherwise specified.

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*) This value is based on the assumptions that the broadcasting station only just meets the limits for spurious emissions as set down in Appendix 8 of the Radio Regulations, and that there is a broadcasting antenna gain of 10 dB, a minimum field strength to be protected of 32 dB (μV/m) and a protection ratio of 17 dB.

4.2 VOR (VHF Omnidirectional radio range)

4.2.1 If the broadcasting station is not in the VOR service area, the 4 cardinal points (N, E, S and W) of the circle forming the boundary of the service areas at a height of 1,000 m above the VOR shall be chosen.

4.2.2 If the broadcasting station is in the VOR service area, a case-by-case assessment is necessary (see Chapter 5, paragraph 5.3.3.2). Unless otherwise specified the field strength shall be calculated at a distance of 300 m from the antenna of the broadcasting station, and using the direction of maximum e.r.p. if not otherwise specified.

4.3 VHF communications

Service volumes vary widely. Initially, for the sake of simplicity, the 4 cardinal points 30 km from the land station in the aeronautical mobile (R) service at a height of 1,000 m above the land station shall be considered unless alternative test points are indicated by the responsible administration.

VHF communication for route purposes may be treated on a case-by-case basis depending on the operational significance.

5. Analysis of incompatibilities

The IFRB shall use the information relating to test points together with the inventory of requirements in order to assess the incompatibilities using the following criteria.

5.1 Propagation

Calculations shall be limited to the test points in line-of-sight from the broadcasting station, it being assumed that the effective earth's radius is 4/3 of the actual radius. Calculations shall be made using free space propagation conditions and e.r.p. in the horizontal plane. No account should be taken of polarization differences, except in special cases (e.g. circular polarization) as indicated in Chapter 5, paragraph 5.3.6.

5.2 Protection cirteria for the aeronautical radionavigation service

The field strength of every broadcasting station in the band 87.5 to 108 MHz within the outer resulting coordination contour of an aeronautical radionavigation station shall be calculated at the test points as an interfering signal and compared with the following minimum field strengths :

- ILS : 40 µV/m (32 dB(µV/m))
- VOR : 90 µV/m (39 dB(µV/m))

The calculations shall indicate :

- those cases for which the ratio of the minimum field strength to the calculated interfering signal reduced by 85 dB is lower than 17 dB,
- those broadcasting transmitters which cause at the test point an interference exceeding -25 dBm corresponding to an interfering field strength derived from the following formula :

$$E\ dB(\mu V/m) = N(dBm) + 121 + (108 - f(MHz))$$

where f is the frequency of the broadcasting station.

5.3 Publication of the results

The publication of the results of the calculations shall indicate for each incompatibility :

a) the identification of the aeronautical radionavigation station affected;

b) the identification of the broadcasting stations giving rise to the incompatibilities;

c) the value in decibels by which the required protection ratio is not met at the nearest test point to the broadcasting station;

d) the value of interferences exceeding -25 dBm at the nearest test point to the broadcasting station;

e) the frequencies of those broadcasting stations which are likely to contribute to intermodulation interference.

6. Resolution of incompatibilities

6.1 When the broadcasting station is within the coordination contour referred to in paragraph 3 of this Annex a detailed compatibility analysis shall be undertaken by the administrations. In many cases, this may be achieved within national coordination machinery, but in some cases a joint analysis will need to take place between administrations of neighbouring countries.

The first stage in the analysis should be to determine whether, for each mode of interference set out in Chapter 5, paragraph 5.3.1 and by applying the measures set out in Chapter 5, paragraphs 5.3.7.2 to 5.3.7.4, a compatibility exists between the two services. For example by applying the values set out in Chapter 5, paragraph 5.3.7.4 the coordination zone around the broadcasting station reduces to the values set down in the following Table.

Coordination zone around a broadcasting station with 85 dB rejection of spurious emmissions

e.r.p. (kW)	200	150	100	50	10	1
distance(km)	31	27	22	15.5	7.0	2.2

Where such compatibility exists, planning of the broadcasting frequency assignments can proceed without constraints imposed by the need to protect the aeronautical radionavigation service.

6.2 For those countries having a large number of both broadcasting stations and aeronautical radionavigation stations, the application of the methods set out in paragraphs 3 and 6.1 of this Annex by manual means will constitute a huge workload. Computer methods can contribute significantly to reducing the task and rapidly identifying the conflict situations. Where such computer methods are used it would be of greatest value if the results could identify :

1) those broadcasting stations which do not affect the aeronautical service in any way;

2) those which require additional filtering and identifying the necessary degree of suppression of spurious emissions;

3) those requiring frequency planning solutions.

6.3 In cases where incompatibility still cannot be resolved, a more detailed case-by-case study should be undertaken applying the factors set out in Chapter 5, paragraph 5.3.8. By this means, it may be possible further to eliminate problem cases.

6.4 For each individual case still without a solution, the administrations should determine, taking account of future expansion of the aeronautical radionavigation service, whether protection in the service volume is required for a limited number of channels or over the entire band 108 to 118 MHz. In the first case the administration should then calculate whether the particular measures set out in Chapter 5, paragraph 5.3.7.5 could provide a solution.

6.5 Where compatibility is clearly only feasible through broadcasting frequency planning solutions, the administration, when submitting its requirements, shall indicate in a supplementary note to the IFRB what particular frequency planning constraints are needed in order to ensure compatibility with the aeronautical radionavigation service for each individual case. These supplementary constraints shall be deemed as requirements to be satisfied in planning during the Conference to the extent feasible.

6.6 During the broadcasting service planning there will be a need for a computer analysis facility specifically intended to identify any broadcasting assignments which do not meet the compatibility requirements for the aeronautical radionavigation stations indicated by administrations to the IFRB under paragraph 6.5 above.

6.7 If, after following the procedures set out in 6.1 to 6.5 above, a solution is still not arrived at, then the only possible solution may be to choose another site for the broadcasting station. It is conceivable in some situations that this may not be feasible; in this case such an assignment can be included in the Plan only with appropriate reservations due to an unresolved incompatibility with the aeronautical radionavigation service.

ANNEX K

COMPATIBILITY BETWEEN VHF BROADCASTING STATIONS
AND STATIONS OF FIXED AND MOBILE SERVICES

(see Chapter 6, paragraph 6.3.1)

1. The assessment of incompatibilities with the fixed and mobile services in Region 3, shall be made at the boundary between Regions 1 and 3 applying the sharing criteria contained in Chapter 5, paragraphs 5.1 and 5.2.

2. The Administrations of Afghanistan and Iran will use the form given in Appendix 1 to the Radio Regulations to inform the IFRB of those stations of the fixed and mobile services in their countries that have to be taken into account during the planning procedure.

ANNEX L

(see Chapter 6, paragraph 6.3.7.5)

TABLE 1

Correspondence between channel numbers and frequencies for use in Africa and Middle East

	A	B	C	D	E	F
1	87.6	90.7	93.9	97.2	100.7	104.3
2	87.7	90.8	94.0	97.3	100.8	104.4
3	87.8	90.9	94.1	97.4	100.9	104.5
4	87.9	91.0	94.2	97.5	101.0	104.6
5	88.0	91.1	94.3	97.6	101.1	104.7
6	88.1	91.2	94.4	97.7	101.2	104.8
7	88.2	91.3	94.5	97.8	101.3	104.9
8	88.3	91.4	94.6	97.9	101.4	105.0
9	88.4	91.5	94.7	98.0	101.5	105.1
10	88.5	91.6	94.8	98.1	101.6	105.2
11	88.6	91.7	94.9	98.2	101.7	105.3
12	88.7	91.8	95.0	98.3	101.8	105.4
13	88.8	91.9	95.1	98.4	101.9	105.5
14	88.9	92.0	95.2	98.5	102.0	105.6
15	89.0	92.1	95.3	98.6	102.1	105.7
16	89.1	92.2	95.4	98.7	102.2	105.8
17	89.2	92.3	95.5	98.8	102.3	105.9
18	89.3	92.4	95.6	98.9	102.4	106.0
19	89.4	92.5	95.7	99.0	102.5	106.1
20	89.5	92.6	95.8	99.1	102.6	106.2
21	89.6	92.7	95.9	99.2	102.7	106.3
22	89.7	92.8	96.0	99.3	102.8	106.4
23	89.8	92.9	96.1	99.4	102.9	106.5
24	89.9	93.0	96.2	99.5	103.0	106.6
25	90.0	93.1	96.3	99.6	103.1	106.7
26	90.1	93.2	96.4	99.7	103.2	106.8
27	90.2	93.3	96.5	99.8	103.3	106.9
28	90.3	93.4	96.6	99.9	103.4	107.0
29	90.4	93.5	96.7	100.0	103.5	107.1
30	90.5	93.6	96.8	100.1	103.6	107.2
31	90.6	93.7	96.9	100.2	103.7	107.3

Additional channels : 93.8 - 97.0 - 97.1 - 100.3 - 100.4 - 100.5
100.6 -103.8 -103.9 - 104.0 - 104.1 - 104.2
107.4 -107.5 -107.6 - 107.7 - 107.8 - 107.9

TABLE 2

Correspondence between channel numbers and frequencies
for use in the planning area other than Africa and the Middle East

Channel/ Canal	Frequency Fréquence Frecuencia	Channel/ Canal	Frequency Fréquence Frecuencia	Channel/ Canal	Frequency Fréquence Frecuencia	Channel/ Canal	Frequency Fréquence Frecuencia	Channel/ Canal	Frequency Fréquence Frecuencia
No.	MHz	No.	MHz	No.	MHz	No.	MHz	No.	MHz
0	100.0	16	101.6	32	103.2	48	104.8	64	106.4
1	100.1	17	101.7	33	103.3	49	104.9	65	106.5
2	100.2	18	101.8	34	103.4	50	105.0	66	106.6
3	100.3	19	101.9	35	103.5	51	105.1	67	106.7
4	100.4	20	102.0	36	103.6	52	105.2	68	106.8
5	100.5	21	102.1	37	103.7	53	105.3	69	106.9
6	100.6	22	102.2	38	103.8	54	105.4	70	107.0
7	100.7	23	102.3	39	103.9	55	105.5	71	107.1
8	100.8	24	102.4	40	104.0	56	105.6	72	107.2
9	100.9	25	102.5	41	104.1	57	105.7	73	107.3
10	101.0	26	102.6	42	104.2	58	105.8	74	107.4
11	101.1	27	102.7	43	104.3	59	105.9	75	107.5
12	101.2	28	102.8	44	104.4	60	106.0	76	107.6
13	101.3	29	102.9	45	104.5	61	106.1	77	107.7
14	101.4	30	103.0	46	104.6	62	106.2	78	107.8
15	101.5	31	103.1	47	104.7	63	106.3	79	107.9

ANNEX M

PRACTICAL APPLICATION OF THE SIMPLIFIED MULTIPLICATION METHOD

(see Annex G, paragraph 2)

The usable field strength is determined for a specified coverage probability (with respect to time and location) and depends on the values of the nuisance fields.

$$E_{si} = P_i + E_{ni}\,(50, T) + A_i + B_i$$

where : E_{si} : the nuisance field of the i^{th} transmitter corrected by the discrimination factor of the receiving antenna.

P_i : the e.r.p. in dB(kW), of the i-th unwanted transmitter;

$E_{ni}\,(50, T)$: the field strength, in dB(μV/m), normalized to an e.r.p. of 1 kW, of the i-th unwanted transmitter. The field strength is exceeded at 50 % of the locations during at least T % (e.g. 1 %) of the time;

A_i : the radio-frequency protection ratio associated with the i-th unwanted transmitter, expressed in dB;

B_i : the receiving antenna discrimination, expressed in dB.

Appropriate account of the effect of multiple interference can be taken by the use of statistical computation methods among which the simplified multiplication method is the least complex. With this method the usable field-strength E_u can be calculated by way of iteration from :

$$p_c = \prod_{i=1}^{n} L(E_u - E_{si})$$

where : p_c : the coverage probability (e.g. 50 % of locations, (100 - T) % of time);

$L(x)$: the probability integral for a normal distribution.

1. Calculation by computer

The calculation of the usable field strength with the simplified multiplication method is based on the probability integral for a normal distribution :

$$L(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{t^2}{2}}\,dt$$

This integration however can be avoided in the practical calculation in replacing it by a polynomial approximation as follows :

$$L(x) = 1 - \tfrac{1}{2}(1 + a_1 x + a_2 x^2 + a_3 x^3 + a_4 x^4)^{-4} + \varepsilon(x)$$

with $a_1 = 0.196854$

$a_2 = 0.115194$

$a_3 = 0.000344$

$a_4 = 0.019527$

$\varepsilon(x)$ represents the error between the approximation and the exact value, received by the probability integral. Since $|\varepsilon(x)|$ is less than $2.5 \cdot 10^{-4}$ this error can be neglected.

The above approximation may also be used to calculate the multiple interference with the simplified multiplication method.

2. Manual calculation

In the following the basic material for the manual calculation of the usable field strength in applying the simplified multiplication method is given.*

The manual calculation needs only additions, subtractions, multiplications, divisions and the reading of a value from Table I.

An example with five interfering transmitters is given in Table II.

Experience has shown that it is expedient to begin with a value for E_u, which is 6 dB larger than the largest of the E_{si} values. If the difference between 0.5** and the result (product of the 5 values of $L(x_i)$) equals Δ, it is appropriate to modify the value of E_u by $\frac{\Delta}{0.05}$ to obtain a better approximation. The whole process can be repeated to receive better accuracy.

Table II shows, that even after the first step the difference to the precise value is in the order of 0.2 dB.

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* For further details see CCIR Report 945.

** 0.5 represents the coverage probability for 50% of locations.

TABLE I – *Probability integral* $\varphi(x) = \frac{2}{\sqrt{2\pi}} \int_0^x [\exp(-t^2/2)]\, dt$

x	$\varphi(x)$	x	$\varphi(x)$	x	$\varphi(x)$	x	$\varphi(x)$
0.00	0.0000	0.60	0.4515	1.20	0.7699	1.80	0.9281
01	0.0080	61	0.4581	21	0.7737	81	0.9297
02	0.0160	62	0.4647	22	0.7775	82	0.9312
03	0.0239	63	0.4713	23	0.7813	83	0.9328
04	0.0319	64	0.4778	24	0.7850	84	0.9342
0.05	0.0399	0.65	0.4843	1.25	0.7887	1.85	0.9357
06	0.0478	66	0.4907	26	0.7923	86	0.9371
07	0.0558	67	0.4971	27	0.7959	87	0.9385
08	0.0638	68	0.5035	28	0.7995	88	0.9399
09	0.0717	69	0.5098	29	0.8029	89	0.9412
0.10	0.0797	0.70	0.5161	1.30	0.8064	1.90	0.9426
11	0.0876	71	0.5223	31	0.8098	91	0.9439
12	0.0955	72	0.5285	32	0.8132	92	0.9451
13	0.1034	73	0.5346	33	0.8165	93	0.9464
14	0.1113	74	0.5407	34	0.8198	94	0.9476
0.15	0.1192	0.75	0.5467	1.35	0.8230	1.95	0.9488
16	0.1271	76	0.5527	36	0.8262	96	0.9500
17	0.1350	77	0.5587	37	0.8293	97	0.9512
18	0.1428	78	0.5646	38	0.8324	98	0.9523
19	0.1507	79	0.5705	39	0.8355	99	0.9534
0.20	0.1585	0.80	0.5763	1.40	0.8385	2.00	0.9545
21	0.1663	81	0.5821	41	0.8415	05	0.9596
22	0.1741	82	0.5878	42	0.8444	10	0.9643
23	0.1819	83	0.5935	43	0.8473	15	0.9684
24	0.1897	84	0.5991	44	0.8501	20	0.9722
0.25	0.1974	0.85	0.6047	1.45	0.8529	2.25	0.9756
26	0.2041	86	0.6102	46	0.8557	30	0.9786
27	0.2128	87	0.6157	47	0.8584	35	0.9812
28	0.2205	88	0.6211	48	0.8611	40	0.9836
29	0.2282	89	0.6265	49	0.8638	45	0.9857
0.30	0.2358	0.90	0.6319	1.50	0.8664	2.50	0.9876
31	0.2434	91	0.6372	51	0.8690	55	0.9892
32	0.2510	92	0.6424	52	0.8715	60	0.9907
33	0.2586	93	0.6476	53	0.8740	65	0.9920
34	0.2661	94	0.6528	54	0.8764	70	0.9931
0.35	0.2737	0.95	0.6579	1.55	0.8789	2.75	0.9940
36	0.2812	96	0.6629	56	0.8812	80	0.9949
37	0.2886	97	0.6680	57	0.8836	85	0.9956
38	0.2961	98	0.6729	58	0.8859	90	0.9963
39	0.3035	99	0.6778	59	0.8882	95	0.9968
0.40	0.3108	1.00	0.6827	1.60	0.8904	3.00	0.99730
41	0.3182	01	0.6875	61	0.8926	10	0.99806
42	0.3255	02	0.6923	62	0.8948	20	0.99863
43	0.3328	03	0.6970	63	0.8969	30	0.99903
44	0.3401	04	0.7017	64	0.8990	40	0.99933
0.45	0.3473	1.05	0.7063	1.65	0.9011	3.50	0.99953
46	0.3545	06	0.7109	66	0.9031	60	0.99968
47	0.3616	07	0.7154	67	0.9051	70	0.99978
48	0.3688	08	0.7199	68	0.9070	80	0.99986
49	0.3759	09	0.7243	69	0.9090	90	0.99990
0.50	0.3829	1.10	0.7287	1.70	0.9109	4.00	0.99994
51	0.3899	11	0.7330	71	0.9127		
52	0.3969	12	0.7373	72	0.9146	4.417	$1-10^{-5}$
53	0.4039	13	0.7415	73	0.9164		
54	0.4108	14	0.7457	74	0.9181	4.892	$1-10^{-6}$
0.55	0.4177	1.15	0.7499	1.75	0.9199	5.327	$1-10^{-7}$
56	0.4245	16	0.7540	76	0.9216		
57	0.4313	17	0.7580	77	0.9233		
58	0.4381	18	0.7620	78	0.9249		
59	0.4448	19	0.7660	79	0.9265		
0.60	0.4515	1.20	0.7699	1.80	0.9281		

TABLE II

1. Approximation E_u = 78 dB					σ_n = 8.3 dB
i	E_{si} (dB)	$z_i = E_u - E_{si}$ (dB)	$x_i = \frac{z_i}{\sigma_n \sqrt{2}}$	$\varphi(x_i)$ (from Table I)	$L(x_i) = \frac{\varphi(x_i)}{2} + \frac{1}{2}$
1	64	14	1.19	0.7660	0.8830
2	72	6	0.51	0.3899	0.6950
3	60	18	1.53	0.8740	0.9370
4	50	28	2.39	0.9831	0.9916
5	45	33	2.81	0.9950	0.9975
					$\prod_{i=1}^{5} L(x_i) = 0.5688$
					$\frac{\Delta}{0.05} = \frac{0.5 - 0.5688}{0.05} = -1.38$ dB
2. Approximation E_u = 76.62 dB					
1	64	12.62	1.08	0.7199	0.8600
2	72	4.62	0.39	0.3035	0.6518
3	60	16.62	1.42	0.8444	0.9222
4	50	26.62	2.26	0.9762	0.9881
5	45	31.62	2.69	0.9929	0.9965
					$\prod_{i=1}^{5} L(x_i) = 0.5090$
					$\frac{\Delta}{0.05} = \frac{0.5 - 0.5090}{0.05} = -0.18$ dB
3. Approximation E_u = 76.44 dB					
1	64	12.44	1.06	0.7109	0.8555
2	72	4.44	0.38	0.2961	0.6481
3	60	16.44	1.40	0.8385	0.9193
4	50	26.44	2.25	0.9756	0.9878
5	45	31.44	2.68	0.9927	0.9964
					$\prod_{i=1}^{5} L(x_i) = 0.5016$
					$\frac{\Delta}{0.05} = \frac{0.5 - 0.5016}{0.05} = -0.03$ dB

*The 4th approximation yields E_u = 76.44 − 0.03 = 76.41 dB.
This value can be considered as sufficiently exact.

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RESOLUTION A

REPORT OF THE FIRST SESSION

The Regional Administrative Conference for FM Sound Broadcasting in the VHF band (Region 1 and certain countries concerned in Region 3) (First Session, Geneva, 1982),

considering

that in accordance with Resolution No. 852 of the Administrative Council the First Session of the Conference was entrusted with :

- preparation of the technical bases for the frequency assignment Plan to be established in the Second Session, and

- determination of the form in which the requirements of the Union's Members for frequency assignments in Region 1 and in the parts of Afghanistan and Iran adjacent to that Region should be notified and fixing of the final date by which the requirements should be sent to the ITU;

resolves

to approve the Report of the First Session of the Conference;

instructs

1. the Chairman of the First Session of Conference to transmit under her signature the Report of the First Session to the Second Session of the Conference;

2. the Secretary-General to transmit the Report of the First Session to all administrations in Region 1, to the Administrations of Afghanistan and Iran and to the international organizations which have participated in the First Session of the Conference.

RESOLUTION B

IFRB ACTIVITIES BETWEEN THE FIRST AND SECOND SESSIONS OF THE CONFERENCE

The Regional Administrative Conference for FM Sound Broadcasting in the VHF Band (Region 1 and certain countries concerned in Region 3) (First Session, Geneva, 1982),

considering

a) that the current Session has adopted a programme of instructing the IFRB to draw up the List of Requirements and to carry out incompatibility calculations on the basis of this List;

b) that the IFRB will have to develop the computer programs needed to perform the tasks mentioned in Chapter 7 of the Report of the current Session;

c) that some administrations have developed or will develop software relating to incompatibility calculations;

recognizing

a) that this activity represents an additional burden of work for the IFRB, which has limited means at its disposal to prepare for the Second Session of the Conference;

b) that the Administrative Council at its 37th session (1982) made limited provision in Resolution No. 870 for fixed-term staff for the preparation of administrative radio conferences;

resolves

1. to invite the administrations which have prepared computer programs applicable to the relevant studies listed in the Report of the current Session to communicate these programs to the IFRB and, if necessary, to second computer specialists to the IFRB for short periods in order to adapt the programs to the ITU computer;

2. to invite the IFRB to perform between the First and Second Sessions of the Conference the tasks mentioned in the Report of the current Session as far as possible, and to send the results to administrations;

3. to invite the IFRB to provide administrations with such assistance as may be requested of it for the submission of requirements and the preparation of the Second Session of the Conference;

4. to draw the attention of the Administrative Council to the facilities deemed necessary to enable the IFRB to carry out the tasks mentioned above.

RESOLUTION C

CONDITIONS GOVERNING THE APPLICATION OF THE PROCEDURE PROVIDED FOR IN ARTICLE 4 OF THE REGIONAL AGREEMENT, STOCKHOLM, 1961

The Regional Administrative Conference for FM Sound Broadcasting in the VHF Band (Region 1 and certain countries concerned in Region 3) (First Session, Geneva, 1982),

considering

a) that Resolution No. 510 of WARC 1979 imposes on FM sound broadcasting stations in the band 87.5 to 100 MHz constraints intended to protect the TV stations which are in conformity with the Regional Agreement, Stockholm, 1961;

b) that, in order not to change radically the existing situation in the band 87.5 to 100 MHz, this Session adopted different planning methods in Africa and the Middle East on one hand, and in the rest of the planning area on the other hand;

c) it is desirable that administrations communicate their requirements in the band 87.5 to 100 MHz by taking into account their existing stations operating in accordance with the Radio Regulations and the Regional Agreement, Stockholm, 1961;

d) that some countries parties to the Regional Agreement, Stockholm, 1961, may need to apply the procedure of Article 4 of the Agreement in the period between the two sessions of the Conference in order to modify the characteristics of their station or to add new stations;

e) that such modifications may affect the requirements to be submitted by the other countries parties to the Regional Agreement, Stockholm, 1961;

resolves

1. that as from 15 October 1982, in order to comply with the planning principles adopted by this Session, the following provisions shall be applied for sound broadcasting stations in the band 87.5 to 100 MHz;

1.1 an administration applying the procedure of Article 4 of the Regional Agreement, Stockholm, 1961, with respect to the Asian and African countries which have assignments in the Regional Plan, shall communicate to the IFRB a copy of the request sent in application of paragraph 1.1.1 of the above Article;

1.2 the above administrations whose agreement has been sought shall communicate to the IFRB a copy of their decision on the matter within the time limits prescribed in Article 4 of the Agreement;

1.3 the IFRB shall publish in accordance with paragraph 1.4 of Article 4 of the Agreement the information received in application of paragraph 1.3 of Article 4 of the Agreement only when it receives a formal acceptance of the modification by those administrations affected among the countries referred to in sub-paragraph 1.1 above;

1.4 cases for which the IFRB cannot proceed with the publication shall be reported to the Second Session of the Conference;

2. that the Second Session of the Conference be requested to consider the cases reported to it by the IFRB, on the basis of bilateral or multilateral negotiations among the countries concerned;

recommends

to the administrations referred to in resolves 1.1 and administrations of the other countries parties to the Regional Agreement, Stockholm, 1961, to initiate coordination of their present and planned requirements prior to the Second Session of the Conference.

RESOLUTION D

ASSISTANCE OF THE IFRB TO COUNTRIES OF AFRICA AND THE MIDDLE EAST

The Regional Administrative Conference for FM Sound Broadcasting in the VHF Band (Region 1 and certain countries concerned in Region 3) (First Session, Geneva, 1982),

considering

a) that it has decided that protection should be ensured for aeronautical radionavigation stations in the band 108 to 118 MHz and for stations of the aeronautical mobile (R) service in the band 118 to 137 MHz;

b) that the calculation procedures and methods adopted by the First Session are based principally on the efforts which administrations must make to estimate and resolve interference levels and that the publication of information on aeronautical stations is confined to the indication of a small number of test points;

c) that the developing countries may have difficulty in determining interference levels and that some of these countries may not be represented at the Second Session of the Conference;

d) that ICAO has detailed information on the aeronautical radionavigation stations operating in these countries,

resolves

1. that the countries of Africa and the Middle East may request the IFRB to assist them in calculating the levels of interference that broadcasting stations might cause to aeronautical radionavigation and aeronautical mobile stations;

2. that the IFRB should be invited to assist the above-mentioned countries in assessing interference and, for that purpose, to seek the cooperation of ICAO, particularly with a view to obtaining detailed information on stations of the aeronautical radionavigation service.

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RECOMMENDATION AA

CONTINUATION OF CERTAIN PROPAGATION STUDIES RELEVANT TO THE USE OF BAND 87.5 TO 108 MHz IN REGION 1

The Regional Administrative Conference for FM Sound Broadcasting in the VHF Band (Region 1 and certain countries concerned in Region 3) (First Session, Geneva, 1982),

considering

a) that the World Administrative Radio Conference, Geneva, 1979, in Resolution No. 510 requested the CCIR to study, as a matter of urgency, the necessary technical bases required for this Conference;

b) that the CCIR in response provided a report on technical bases that included, inter alia, a chapter on propagation, and that this chapter has been adopted subject to obtaining further information on the subjects referred to hereunder;

c) that further information on propagation, in particular relating to ducting propagation in certain areas, thought to be particularly subject to this phenomenon is considered necessary;

d) that the data indicating that radio propagation characterisitics over land and over sea are identical under certain circumstances also need to be verified;

requests the CCIR

1. to continue its collaboration, as a matter of urgency, in the propagation and radiometeorological measurement campaign at present being carried out in the area from the Shatt-al-Arab to the Gulf of Oman and any other such programmes being carried out in other relevant areas;

2. to continue studying the relationship between propagation over land and over sea for 50% and 10% of the time;

3. to prepare a further report, based on this collaboration and these studies, in good time for the Second Session of the Conference;

recommends that administrations collaborate with the CCIR, as a matter of urgency and within the limits of their capabilities, by sending it contributions relating to the aforementioned studies;

and requests the Second Session of the Conference to reconsider the relevant paragraphs of section 2.1.1, and also Figures 2.1, 2.2, 2.11 and 2.12, of the Report of the First Session in the light of the further report of the CCIR and also to consider, if it sees fit, the production, for planning purposes, of separate propagation curves for extreme super-refractivity conditions.

RECOMMENDATION BB

NEED FOR CERTAIN PROPAGATION STUDIES RELEVANT TO THE USE OF BAND 87.5 TO 108 MHz IN THE AFRICAN CONTINENT

The Regional Administrative Conference for FM Sound Broadcasting in the VHF Band (Region 1 and certain countries concerned in Region 3) (First Session, Geneva, 1982),

considering

a) that the World Administrative Radio Conference, Geneva, 1979, in Resolution No. 510 requested the CCIR to study, as a matter of urgency, the necessary technical bases required for this present Conference;

b) that the CCIR in response provided a report on such necessary technical bases that included, inter alia, a chapter on propagation, and that this chapter has been adopted subject to the necessity for obtaining further information on the subjects referred to hereunder;

c) that the World Administrative Radio Conference, Geneva, 1979, likewise adopted Resolution No. 5 and Recommendation No. 68 which deal respectively with technical cooperation with the developing countries in the study of propagation in tropical areas, and with studies and prediction of radio propagation and radio noise;

d) that the XVth Plenary Assembly of the CCIR, Geneva, 1982, adopted Resolution No. 79 dealing with the need, inter alia, for scientists and engineers from developing countries to be encouraged to carry out studies at first hand on propagation topics;

e) that further information on propagation in Africa, in particular relating to ducting propagation in all areas thought to be particularly subject to this phenomenon is considered to be necessary;

f) that verification is likewise necessary, relative to Africa, of the data indicating that radio propagation characteristics over land and over sea are identical under certain circumstances;

requests the CCIR

1. to undertake, as a matter of urgency, all propagation and radiometeorological measurements that can be made in and around the African continent;

2. to continue studying the relationship between propagation over land and over sea for 50%, 10% and 1% of the time;

3. to prepare a further report, based on such measurements and on these studies, in good time for the Second Session of the Conference;

recommends that African Administrations collaborate with the CCIR, as a matter of urgency and within the limits of their possibilities, by sending it contributions relating to the aforementioned activities;

requests the Second Session of the Conference to reconsider the relevant paragraphs and figures of the Report of the present First Session in the light of this further report of the CCIR and also to consider, if it sees fit, the production, for planning purposes, of separate propagation curves for African conditions;

and invites the regional telecommunication and broadcasting organizations in Africa, as a matter or urgency, within the limit of possibilities to participate in the above-mentioned studies.

RECOMMENDATION CC

IMMUNITY TO INTERFERENCE OF AIRBORNE RECEIVING EQUIPMENT USED BY THE AERONAUTICAL RADIONAVIGATION SERVICE OPERATING IN THE FREQUENCY BAND 108 TO 118 MHz FROM THE FM BROADCASTING SERVICE OPERATING IN THE FREQUENCY BAND 87.5 TO 108 MHz

The Regional Administrative Conference for FM Sound Broadcasting in the VHF Band (Region 1 and certain countries concerned in Region 3) (First Session, Geneva, 1982),

considering

a) Resolution No. 510, Recommendations Nos. 66 and 704 of the WARC-79 and provisions of Nos. 300, 301 and 311 of the Radio Regulations;

b) that this Session has established some criteria for the protection of the aeronautical services but these would appear to constrain in some areas of Region 1 the full exploitation of the frequency band 100 to 108 MHz;

c) that in the other ITU Regions the potential danger of interference due to the lack of adequate immunity standards for the aeronautical services has been reported;

noting the practical equipment design problems and operational constraints within the aeronautical services;

recommends that the CCIR

1. studies as a matter of urgency :

1.1 with the retention of existing airborne receiving equipment, by how much can the value of immunity to FM sound broadcasting interference of that equipment be improved over those values established at this Session?

1.2 by the replacement of existing airborne equipment by new better performance airborne equipment, by how much the value of immunity to FM sound broadcasting interference of that equipment can be improved over those values established at this Session?

2. finalizes these studies

2.1 contained in paragraph 1.1 preferably by 31 January 1983 and not later than April 1983;

2.2 contained in paragraph 1.2 at the earliest practical date;

3. report at short intervals to administrations the progress of their studies;

invites

1. the Secretary-General of the ITU to bring this Recommendation to the attention of ICAO, and to invite their collaboration in the studies;

2. administrations to participate actively in these studies as a matter of priority and to provide the CCIR with expert guidance on this matter.

RECOMMENDATION DD

LEVEL OF SPURIOUS EMISSIONS FALLING IN THE FREQUENCY BANDS ALLOCATED TO THE AERONAUTICAL SERVICES BETWEEN 108 AND 137 MHz FROM FM BROADCASTING STATIONS OPERATING IN THE FREQUENCY BAND 87.5 TO 108 MHz

The Regional Administrative Conference for FM Sound Broadcasting in the VHF Band (Region 1 and certain countries concerned in Region 3) (First Session, Geneva, 1982),

considering

a) Resolution No. 510, Recommendations Nos. 66 and 704 of the WARC-1979 and provision of No. 301 of the Radio Regulations;

b) that spurious emissions in accordance with the limits in the Radio Regulations (Appendix 8) will give considerable compatibility problems between the FM broadcasting service (87.5 to 108 MHz) and the aeronautical services (108 to 137 MHz);

c) that no practicable equipment measures can be taken by the aeronautical services involved (which are safety services) to reduce these compatibility problems;

d) that this Session has established some criteria for the protection of the aeronautical services involved but these would appear to constrain in some areas in Region 1 full exploitation of the frequency band 100 to 108 MHz by the broadcasting service;

recommends that the CCIR

1. carries out studies in order to determine the maximum suppression of spurious emissions, particularly intermodulation products, from the broadcasting transmitting stations into the aeronautical frequency bands between 108 and 137 MHz which can be maintained continuously in all operational conditions of the broadcasting service;

2. finalizes these studies by April 1983, if possible and 1 September 1983 at the latest;

invites administrations in Region 1 and certain administrations in Region 3 to participate actively in these studies and to provide the CCIR with expert guidance on this matter.

LIST OF MEMBERS WHICH PARTICIPATED IN THE FIRST SESSION

(in the alphabetical order of the French version of the country names)

AFGHANISTAN (Democratic Republic of)

ALBANIA (Socialist People's Republic of)

ALGERIA (Algerian Democratic and Popular Republic)

GERMANY (Federal Republic of)

ANGOLA (People's Republic of)

SAUDI ARABIA (Kingdom of)

AUSTRIA

BAHRAIN (State of)

BELGIUM

BOTSWANA (Republic of)

BULGARIA (People's Republic of)

CAMEROON (United Republic of)

CYPRUS (Republic of)

VATICAN CITY STATE

CONGO (People's Republic of the)

IVORY COAST (Republic of the)

DENMARK

EGYPT (Arab Republic of)

UNITED ARAB EMIRATES

SPAIN

FINLAND

FRANCE

GABON REPUBLIC

GREECE

GUINEA (People's Revolutionary Republic of)

UPPER VOLTA (Republic of)

HUNGARIAN PEOPLE'S REPUBLIC

IRAN (Islamic Republic of)

IRELAND

ISRAEL (State of)

ITALY

JORDAN (Hashemite Kingdom of)

KENYA (Republic of)

KUWAIT (State of)

LESOTHO (Kingdom of)

LIBYA (Socialist People's Libyan Arab Jamahiriya)

LUXEMBOURG

MADAGASCAR (Democratic Republic of)

MALI (Republic of)

MOROCCO (Kingdom of)

MONACO

MONGOLIAN PEOPLE'S REPUBLIC

NIGER (Republic of the)

NORWAY

OMAN (Sultanate of)

NETHERLANDS (Kingdom of the)

POLAND (People's Republic of)

PORTUGAL

QATAR (State of)

SYRIAN ARAB REPUBLIC

GERMAN DEMOCRATIC REPUBLIC

ROMANIA (Socialist Republic of)

UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND

RWANDA (Republic of)

SAN MARINO (Republic of)

SENEGAL (Republic of the)

SWEDEN

SWITZERLAND (Confederation of)

SWAZILAND (Kingdom of)

CZECHOSLOVAK SOCIALIST REPUBLIC

TOGOLESE REPUBLIC

TUNISIA

TURKEY

UNION OF SOVIET SOCIALIST REPUBLICS

YEMEN ARAB REPUBLIC

YUGOSLAVIA (Socialist Federal Republic of)

ZAIRE (Republic of)

Printed in Switzerland