PLANNING METHODS

AN APPROACH TO DETERMINING BASIC STATION PARAMETERS PROPOSAL BY CANADA

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1. Introduction

The approach outlined in this section is for use in the design phase of the planning procedure where new Medium Frequency (MF) stations are being introduced into an already congested MF environment in a specified geographic area. It should not be used as a formal frequency assignment procedure as it does not take into account exactly the propagation models to be used in such an undertaking.

The method gives a simple way of determining permissible radiation levels between a new proposed station and existing protected stations. It is an iterative procedure where the basic daytime and night-time radiation patterns of each new station are determined, one after the other, in order of the station's national priority - each new station protecting all existing stations and any new stations with a higher ranking priority. The procedure is not dependent on the use of any particular set of propagation curves. The set of curves used to generate Figures 1 and 2 shown in Figures 6 and 7 were included in the Proposed Technical Basis for the First Session of the Regional Administrative MF Broadcasting Conference (Region 2) drawn up at a joint CITEL/ITU meeting in Sao Paulo, Brazil, 14-19 January, 1980.

While the method is simple, it allows for treatment of directional as well as omnidirectional stations and refers to other refinements which can be included at the user's discretion. Analysis of the results of the procedure indicates that permissible radiations to provide the required protection levels are predicted to within about 10% of their rigorously calculated values.

The proposed method can be adapted to use computer techniques in planning an overall design.

2. Objective of the Procedure

This procedure assumes that the areas requiring new MF services have already been determined, and that each proposed new

service has been assigned a station class (A, B or C) and a priority, ranking it among the needs for all new services on a national basis. Under the above assumptions, the objective of this paper is to develop a simple procedure which can be adapted for use on a computer or a programmable calculator, for determining the best frequency and the basic technical parameters for a large number of new stations, one by one, according to their class and priority ranking. It is further assumed that these new stations will operate in a specified geographic area in the already crowded MF environment.

3. Overview of the Planning Process

Due to the large existing inventory of MF stations, for Region 2 planning from a zero base would be impractical.

As the first stage in the planning process, each administration should determine its nation's additional MF radio station needs; define the location and coverage requirement for each need; and assign a priority to each need. Subsequently all administrations should meet to identify incompatibilities which would then be resolved. These stages are outside the scope of this document which covers only the intermediate design state.

The final objective of a planning process is to make the most efficient use of the limited spectrum to obtain the desired coverage. This must be accomplished by stations operating within the internationally accepted parameters and meeting the technical rules for protection to other stations.

The approach presented in this paper involves the selection of the appropriate frequency and the determination of permissible radiation.

3.1 Selection of the Appropriate Frequency

It is assumed that the class of station and the priority of any additional transmitter is predetermined. On the basis of this assumption it will then be necessary to determine, for the station under consideration, the frequency channel or channels in which the amount of already existing interference is minimum. This search may be necessary in the entire MF band or in part of it depending on the particular request. Frequently, several channels might be appropriate for use at the site considered, because their various interference levels do not differ substantially from one another.

Because of the multiple choices that may exist at the various transmitter sites, it may be useful to start the selection of frequency assignments at the site having the lowest number of choices and continue in the order of increasing number of choices. Before an assignment has been fixed, however, it is useful to verify whether or not this frequency is still appropriate for the remaining transmitters still to be considered. The frequency having the least effect on the remaining transmitters should be assigned.

In view of the fact that the greatest difficulty will arise when fitting in class A stations, it is felt appropriate to deal with them at the beginning. Class B and C stations should be dealt with subsequently in this order of sequence.

3.2 Determination of Permissible Radiation

Once a suitable frequency has been found in a location for a new station, a calculation is then made of permissible radiation in each direction to protect other existing stations from both night and daytime interference caused by the new station. The permissible radiation in each direction will then determine the shape of a

directional pattern or the maximum radiation of an omnidirectional antenna which should be used to provide protection to these other stations.

4. Outline of Proposed Method

The method provides an estimate of the permissible radiation level from a new proposed station at a specified location operating on a given frequency. Protection must be provided to existing stations at their protected contours. In general, several different contours must be considered: daytime ground-wave contour, night-time groundwave contour, and (for class A stations) night-time sky-wave contour. For a first approximation, the assumptions given in the next section are adequate. Better estimates can be developed which will recognize specific station parameters, more precise conductivity values, etc; however, a much greater level of effort is required to develop these estimates.

The appropriate protection ratio (summarized in Table 2) is applied at the contour to determine the permissible signal level from the proposed station (ground-wave in the daytime, sky-wave at night). These signal levels have been used in developing the appended curves shown in Figures 1 and 2 from which permissible radiations at the pertinent azimuths can be read directly.

5. Method

5.1 Explanation of Curves

5.1.1 FIGURE 1 - Sky-wave curves

Curves 1, 3 and 4 of Figure 1 indicate the permissible radiation at a given distance between a proposed station and any protected (existing or proposed) station. Curve 2 indicates the

permissible radiation at given distances from the protected contour. When a Class B or C station is protected using the 50% Root Sum Square (RSS) method (see Appendix C), the RSS value in mV/m is used as a multiplying factor on the value from curve 2 to give the permissible radiation. This planning method uses 50% sky-wave propagation curves, and a 26dB co-channel protection ratio. This permits a realistic assessment of the service area that is protected from night-time interference.

5.1.2 FIGURE 1-A - Correction factor for 10% of the time (for Class A only)

Whenever the interfering signal level is not to be exceeded more than 10% of the time, the value of permissible radiation from Figure 1 should be reduced by the appropriate factor from Figure 1-A which is dependent on the geomagnetic latitude of the mid-point between the two stations.

5.1.3 FIGURE 2 - Ground-wave curves

The four curves shown indicate the permissible radiation at a given distance between a proposed station on 1000 kHz and a protected contour of 500 uV/m for different average values of conductivity over the path. To improve precision there could be a separate figure for each frequency range on the propagation curves and further curves for other values of conductivity. This improvement in precision would not unduly increase the effort needed to use this method.

The curves are drawn to cover first adjacent channel protection, i.e. 0 db protection to the 500 uV/m contour and hence can also be used directly to determine the distance to the protected 500 uV/m contour when radiation is known. For other protection requirements, the value of permissible radiation from the curves should be multiplied by the appropriate factors from the table at the bottom of Figure 2.

5.2 Assumptions used to determine distance to protected contours in Curves 1, 3 and 4 of Figure 1 are given in Appendix D.

5.3 Application of Methods

5.3.1 Sky-wave

From Figure 1 choose the appropriate curve (Curve 1, 3 or 4 depending on whether the protected station is Class A, B or C respectively). Using the station-to-station distance along the horizontal axis, read the permissible radiation from the vertical axis. Permissible radiations are at the pertinent range of vertical angles of departure as determined from Columns I-2 and I-3 of Table 1.

Record the permissible radiation and, if a directional antenna is proposed, the pertinent azimuth (a polar plot is suggested).

Repeat the previous two steps for any other co-channel station whose protection may affect the operating parameters of the proposed station.

5.3.2 Ground-wave

Determine the weighted mean conductivity over the path from the proposed station to the protected contour as follows:

$$C \text{ mean} = \frac{C_1 d_1 + C_2 d_2 + \ldots . C_n d_n}{d_1 + d_2 + \ldots . + d_n}$$

where the path is broken down into segments of distance d_1 to d_n and conductivities C_1 to C_n.

Enter the graph for the appropriate frequency range (Figure 2 is based on 1000 kHz) using the curve nearest the mean conductivity determined above at the distance corresponding to the denominator above along the vertical axis and read permissible radiation from the horizontal axis.

Apply the appropriate multiplying factor as described in paragraph 5.1.2 and record the permissible radiation, and, if a directional antenna is proposed, the pertinent azimuth.

Repeat the above three steps for any other station whose ground-wave protection may affect the operating parameters of the proposed station.

5.3.3 Determination of Station Parameters

For an omnidirectional system, divide the lowest value of permissible radiation recorded by the characteristic radiation for the antenna height and ground system proposed (as read from Figure 5 and multiplied by 1.609), and square this division to get the permissible station power in kilowatts.

For a directional antenna system, the recorded values of permissible radiation and azimuths provide the outer limits for the antenna pattern. A simple refinement to define protection requirements over the protected contour is to extend the permissible radiation over the arc from the proposed station to the limits of the protected contour. The protected contour can be approximated from the values in 5.2, or determined from the appropriate propagation curves depending on the degree of accuracy needed.

The paper SEM/REG/RADIF-18 Use of Directional Arrays in Canada, presented by J.A. Jarvis at the July 1979 Brasilia seminar, describes a method which can be used to obtain exact antenna system parameters using the limiting points from the previous paragraph, together with the limitations defined by service needs.

Daytime and night-time limitations can be either combined or separated, depending on service requirements or economic limitations. The easiest type of directional system to construct and maintain uses only one pattern. Next in ease of construction and maintenance, and often superior in service, is the directional-by-night/omnidirectional-by-day system. A two pattern system is the most complex, but allows optimum service in a highly populated area with many stations.

APPENDIX A

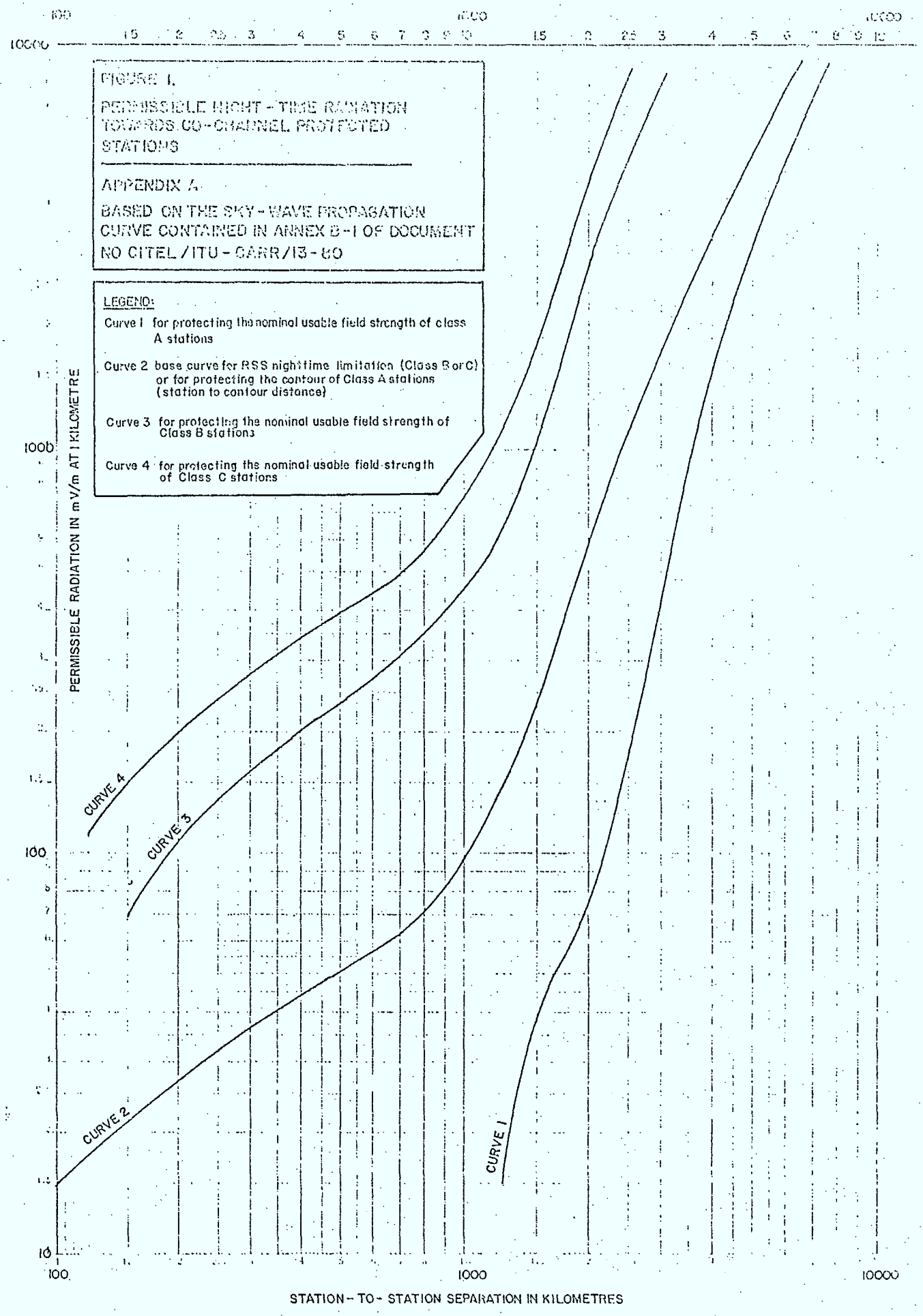
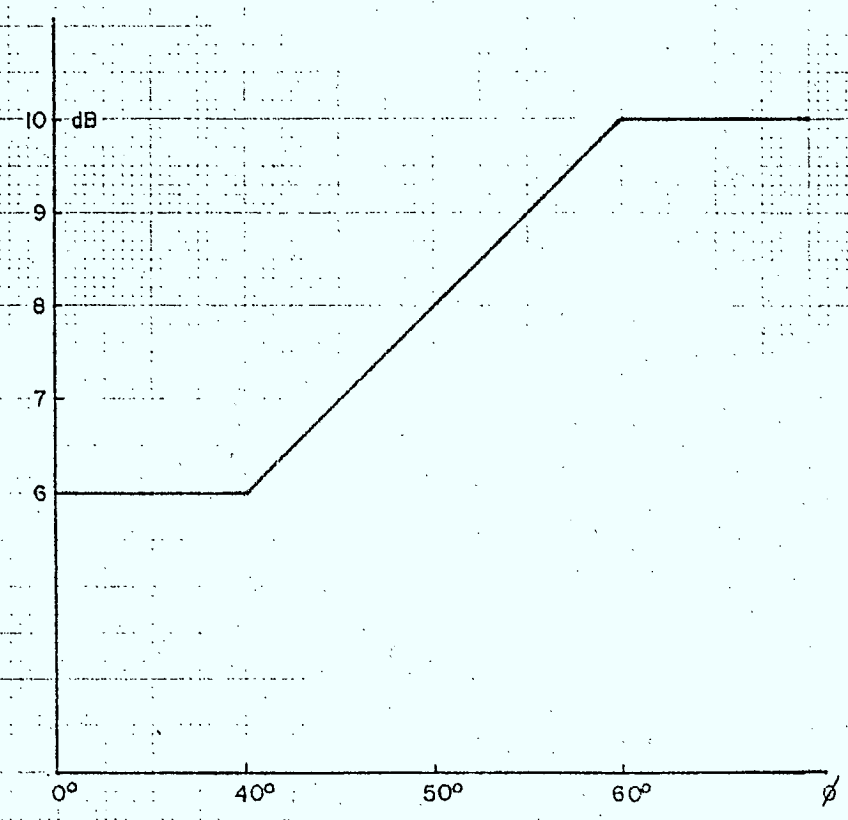


FIGURE 1.
PERMISSIBLE NIGHT - TIME RADIATION TOWARDS CO-CHANNEL PROTECTED STATIONS
APPENDIX A
BASED ON THE SKY-WAVE PROPAGATION CURVE CONTAINED IN ANNEX B-1 OF DOCUMENT NO CITEL/ITU-CARR/13-80
LEGEND:
Curve 1 for protecting the nominal usable field strength of class A stations
Curve 2 base curve for RSS nighttime limitation (Class B or C) or for protecting the contour of Class A stations (station to contour distance)
Curve 3 for protecting the nominal usable field strength of Class B stations
Curve 4 for protecting the nominal usable field strength of Class C stations
PERMISSIBLE RADIATION IN mV/m AT 1 KILOMETRE
STATION-TO-STATION SEPARATION IN KILOMETRES
CURVE 1
CURVE 2
CURVE 3
CURVE 4
100
1000
10000
10

FIGURE I-A

CORRECTION TO FIGURE I TO CONVERT FROM 50% TO 10% OF THE TIME

CORRECTION APPORTEE A LA FIGURE I POUR FAIRE LA CONVERSION DE 50 p.cent A 10 p.cent DU TEMPS



MEAN GEOMAGNETIC LATITUDE

LATITUDE GÉOMAGNÉTIQUE MOYENNE

Fig. 2 Permissible radiation based on groundwave propagation curves contained in Annexe B-1 of Document CITEL/ITU-CARR/13-80

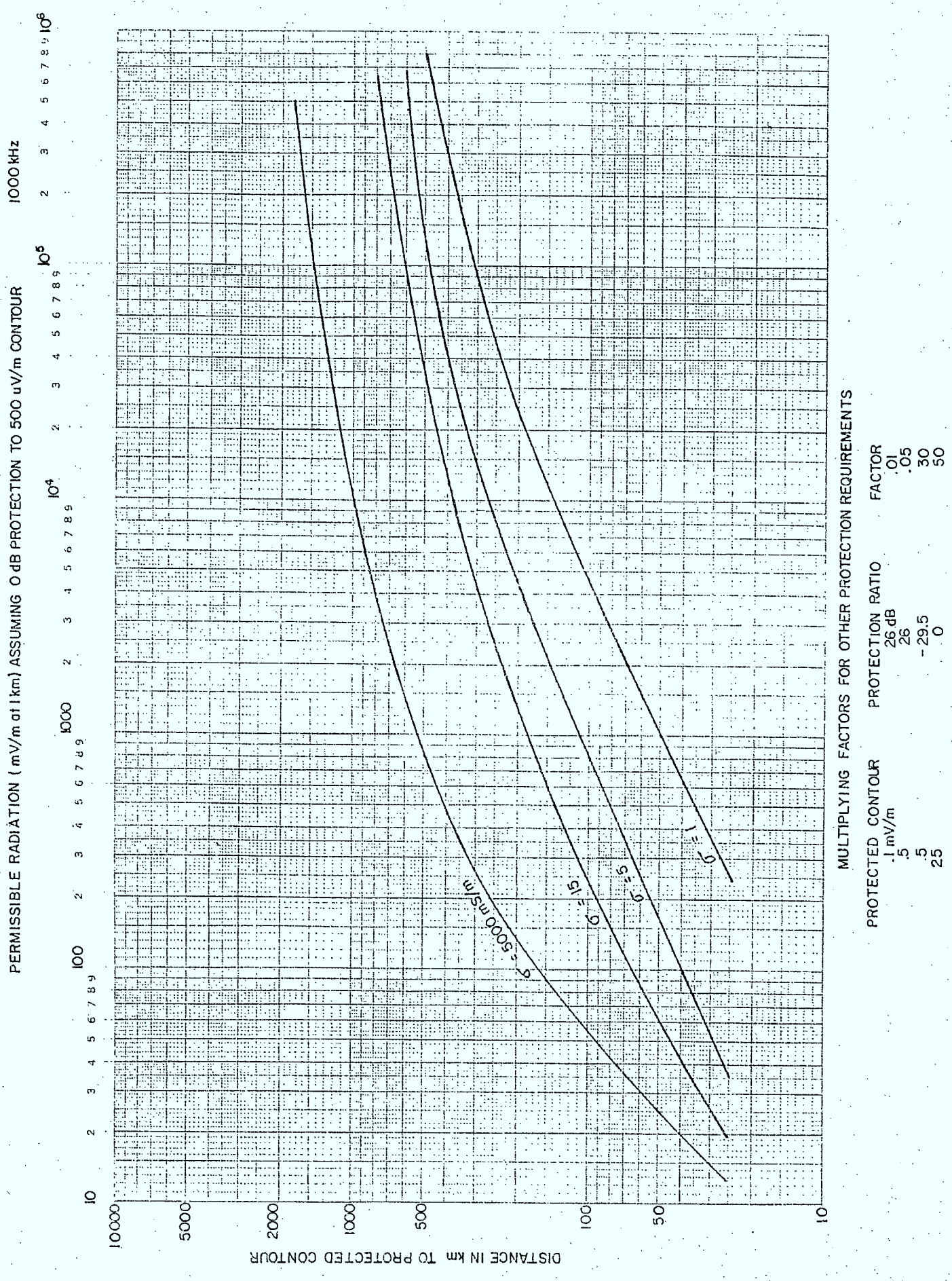


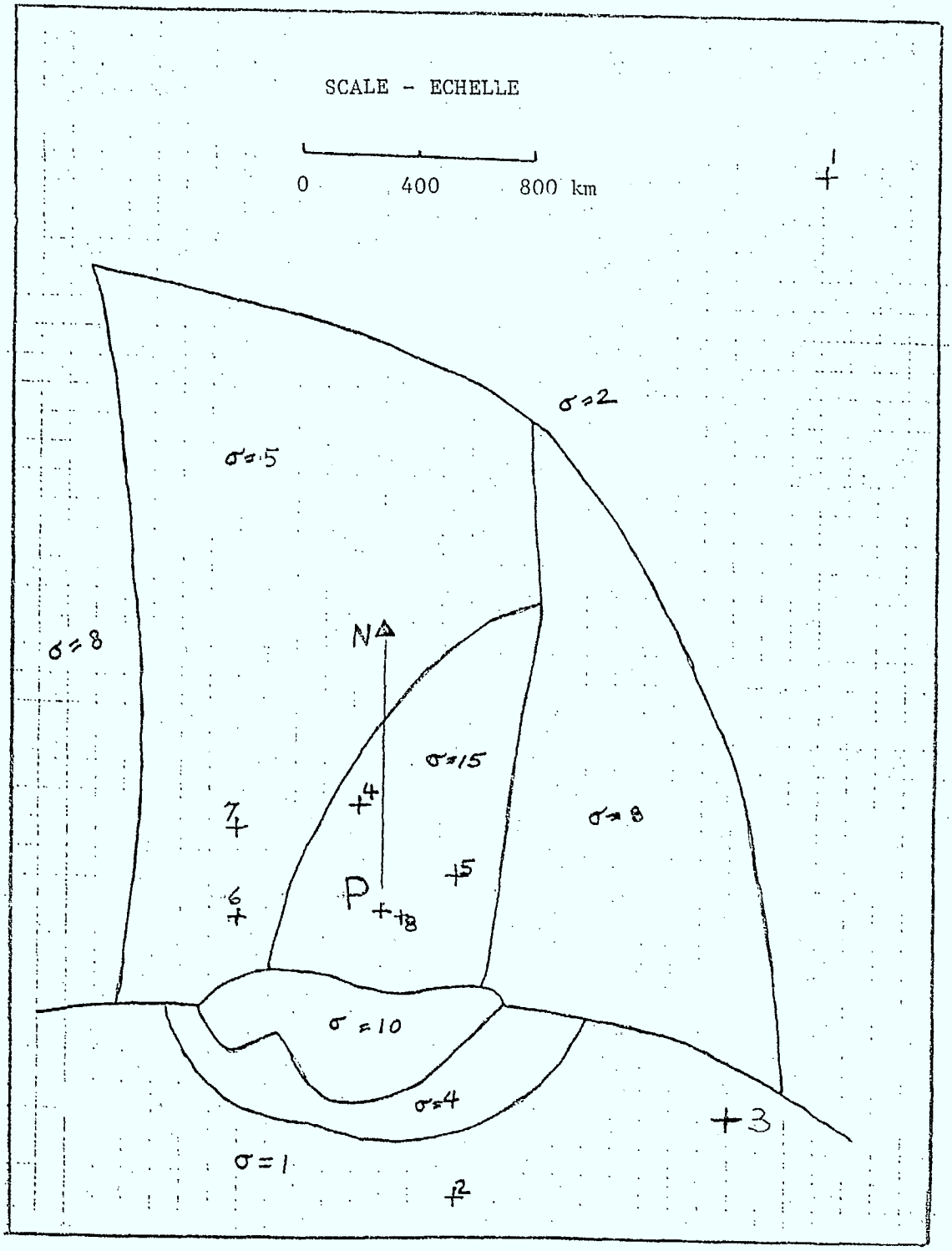
FIG. 3.

CARTE DE L'EMPLACEMENT DES STATIONS ET

DE LA CONDUCTIVITE DU SOL (d'après l'Annexe B)

MAP OF STATION LOCATIONS AND GROUND CONDUCTIVITIES

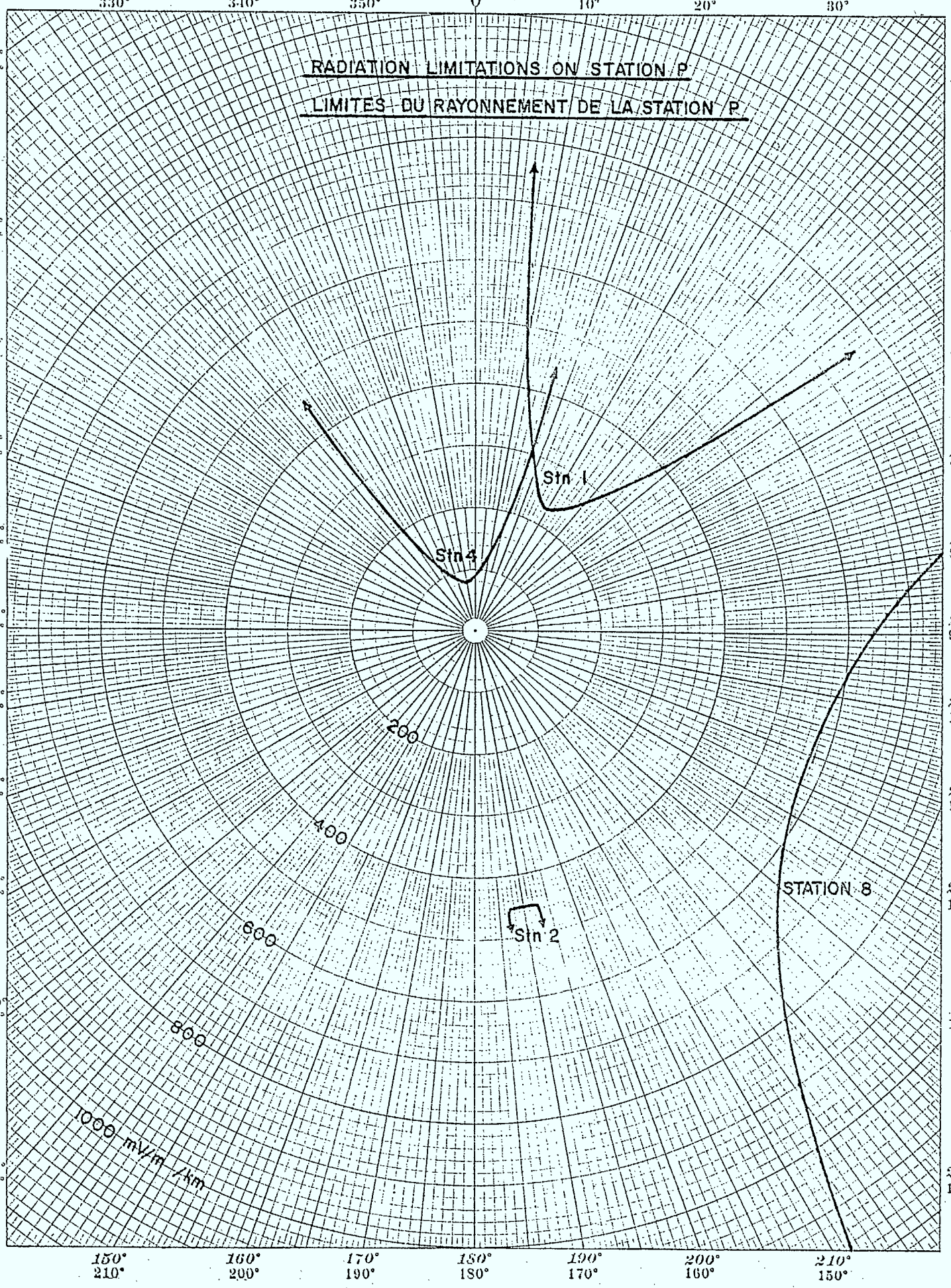
(from Appendix B)



Legend σ = conductivity mS/m
conductivité

Légende + location of station n
emplacement de la station n

FIG. 4


RADIATION LIMITATIONS ON STATION P
LIMITES DU RAYONNEMENT DE LA STATION P
0
30° 330°
20° 340°
10° 350°
350° 10°
340° 20°
330° 30°
40° 320°
50° 310°
60° 300°
70° 290°
80° 280°
90° 270°
100° 260°
110° 250°
120° 240°
130° 230°
140° 220°
150° 210°
160° 200°
170° 190°
180° 180°
190° 170°
200° 160°
210° 150°
Stn 1
Stn 4
Stn 2
STATION 8
200
400
600
800
1000 mV/m/km

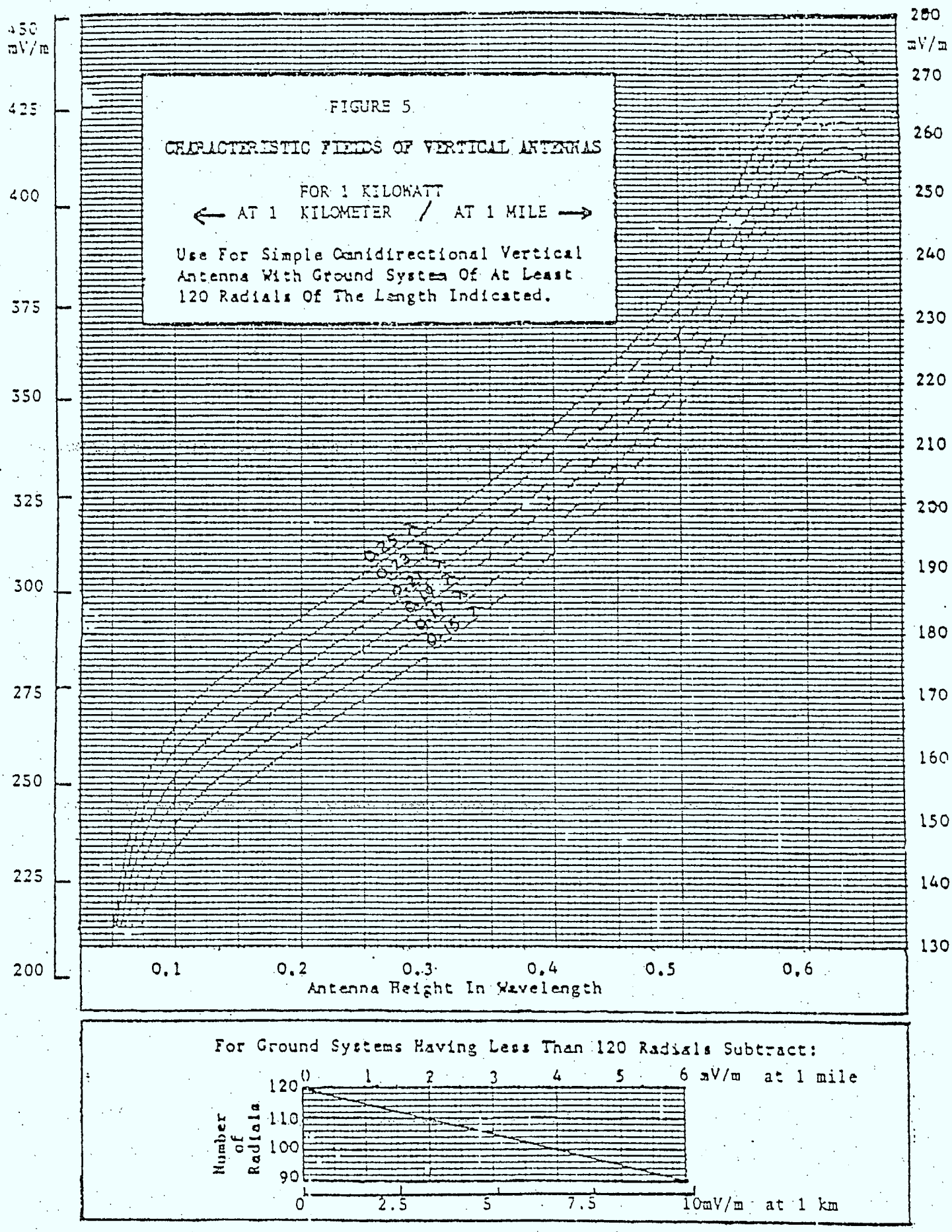


FIGURE 5
CHARACTERISTIC FIELDS OF VERTICAL ANTENNAS
FOR 1 KILOWATT
← AT 1 KILOMETER / AT 1 MILE →
Use For Simple Omnidirectional Vertical Antenna With Ground System Of At Least 120 Radials Of The Length Indicated.
450 mV/m
425
400
375
350
325
300
275
250
225
200
280 mV/m
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
0.1
0.2
0.3
0.4
0.5
0.6
Antenna Height In Wavelength
For Ground Systems Having Less Than 120 Radials Subtract:
0 1 2 3 4 5 6 mV/m at 1 mile
Number of Radials
120
110
100
90
0 2.5 5 7.5 10mV/m at 1 km

Figure 6

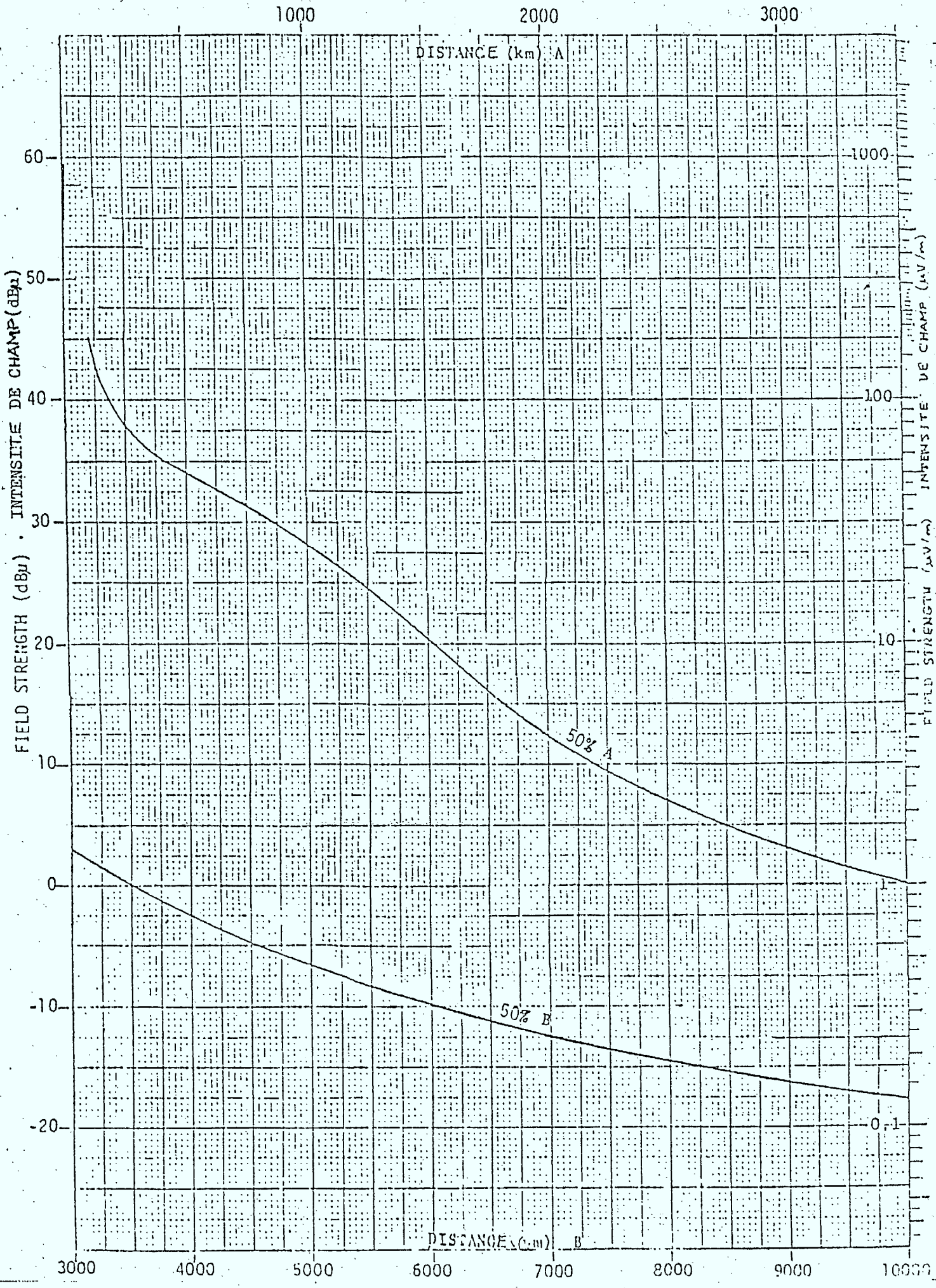
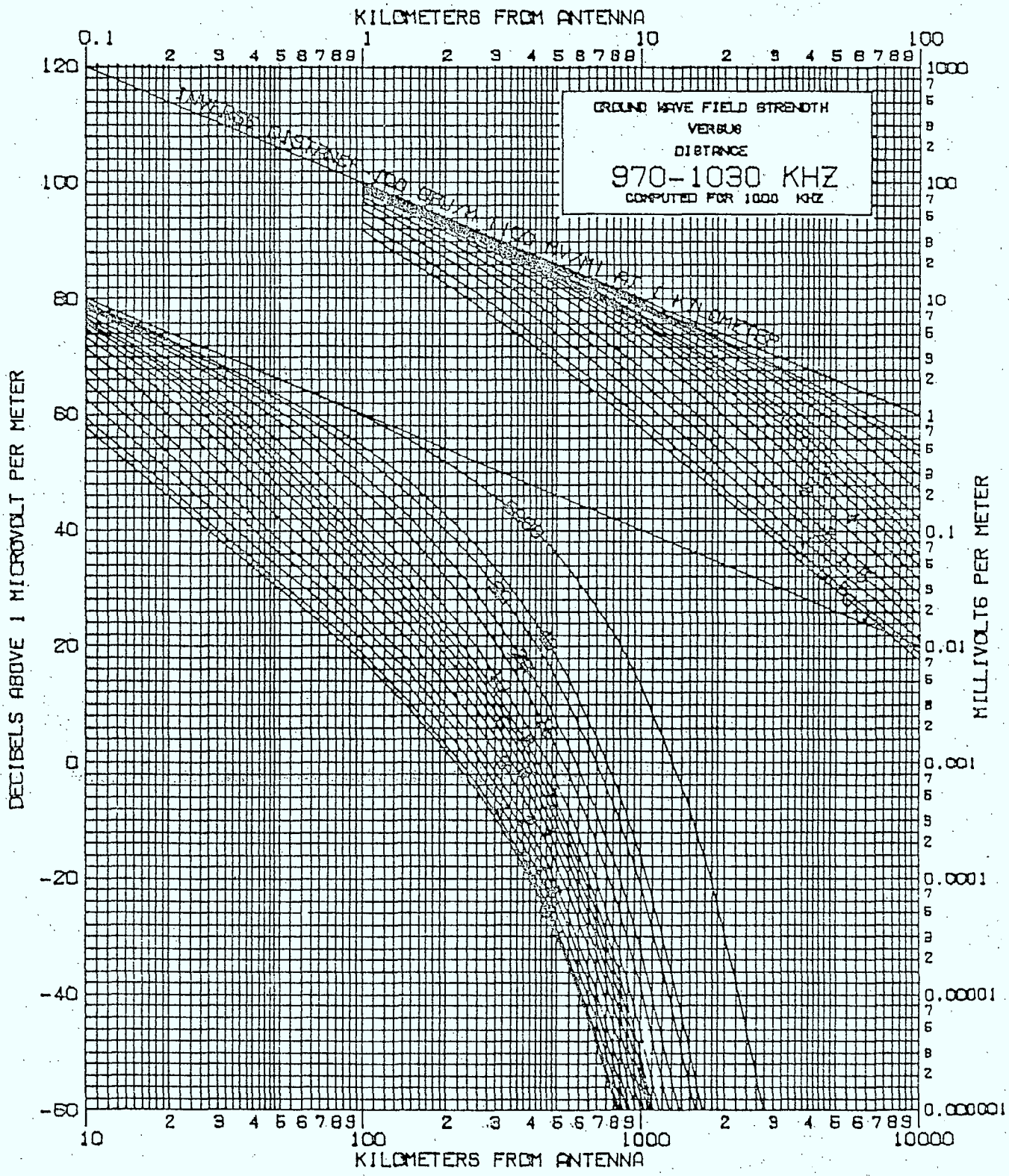

1000
2000
3000
DISTANCE (km) A
60
50
40
30
20
10
0
-10
-20
FIELD STRENGTH (dBμ) · INTENSITE DE CHAMP (dBμ)
1000
100
10
1
0.1
FIELD STRENGTH (μV/m) · INTENSITE DE CHAMP (μV/m)
50% A
50% B
DISTANCE (km) B
3000
4000
5000
6000
7000
8000
9000
10000

FIGURE 7



THE CURVES ARE LABELLED WITH THE GROUND CONDUCTIVITIES
IN MILLI-SIEMENS/METER. ALL CURVES EXCEPT THE 5000 MS/M(SEA WATER)
CURVE ARE DERIVED FOR A RELATIVE DIELECTRIC CONSTANT OF 15.
THE SEA WATER CURVE IS DERIVED FOR A DIELECTRIC CONSTANT OF 80.

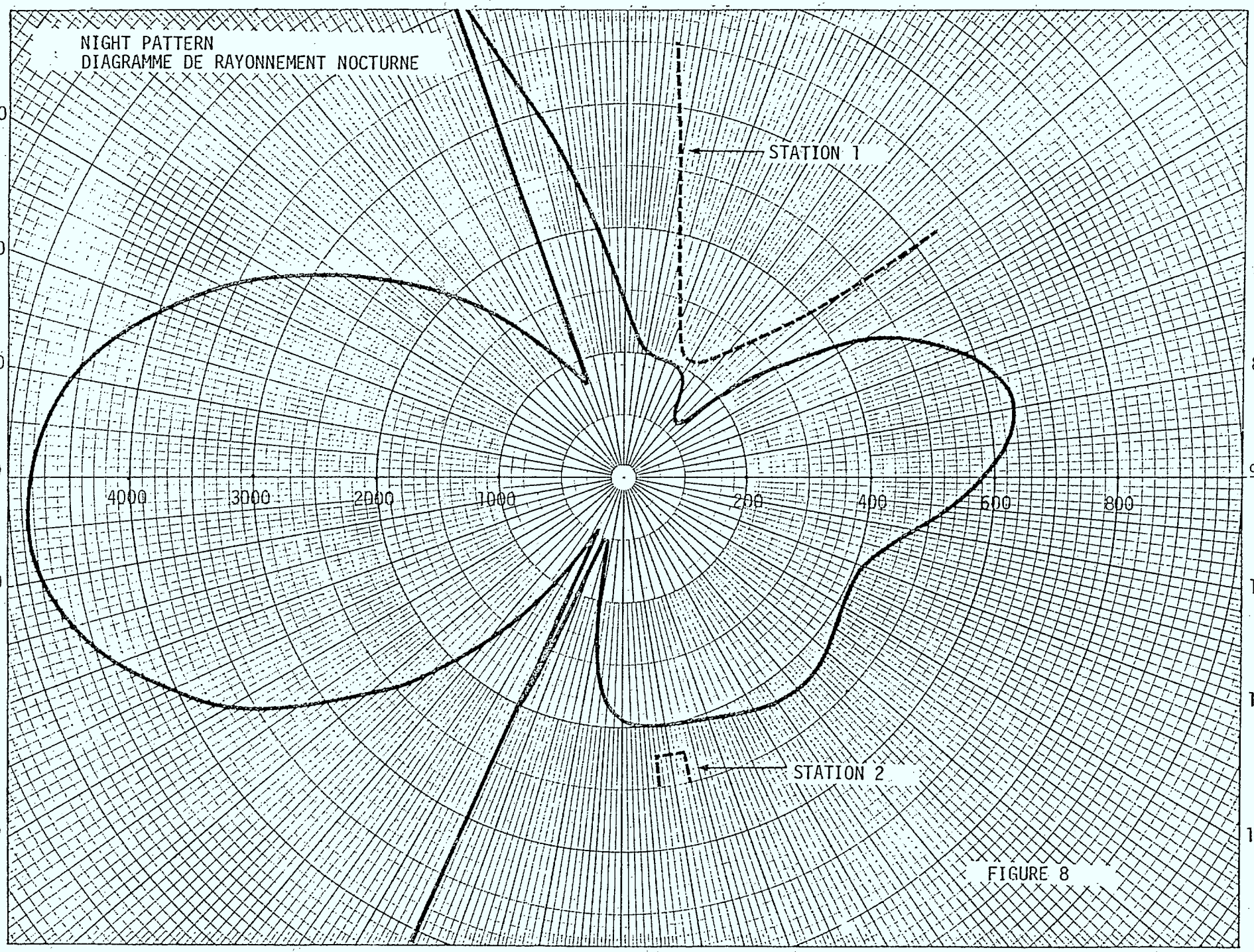

NIGHT PATTERN
DIAGRAMME DE RAYONNEMENT NOCTURNE
STATION 1
STATION 2
310
320
330
340
350
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260
270
280
290
300
4000
3000
2000
1000
200
400
600
800

FIGURE 8

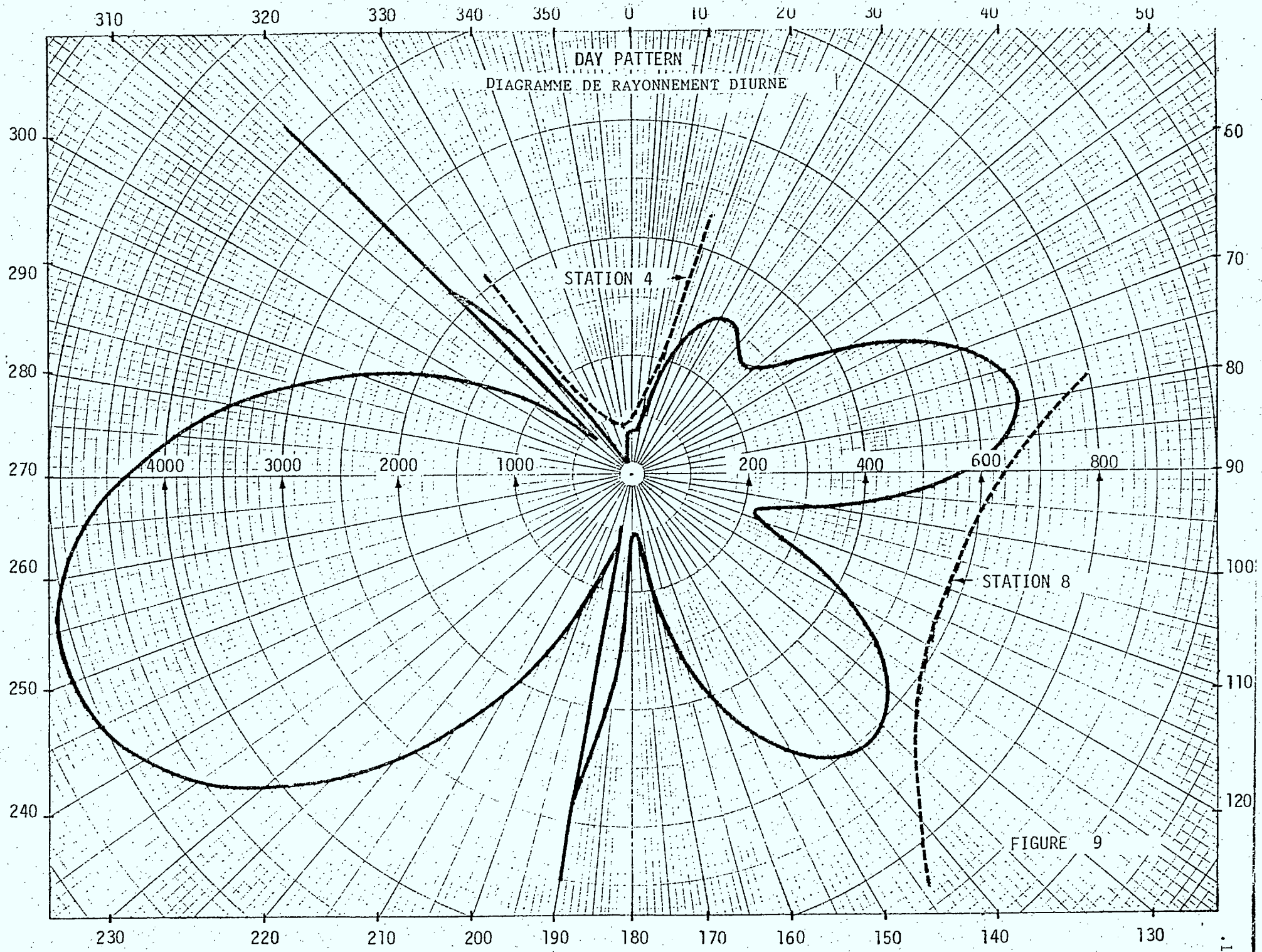

DAY PATTERN
DIAGRAMME DE RAYONNEMENT DIURNE
STATION 4
STATION 8
4000
3000
2000
1000
200
400
600
800
310
320
330
340
350
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260
270
280
290
300

FIGURE 9

APPENDIX B

Example

This Appendix gives an example of the method described above. The appended map (Figure 3) shows the stations to be protected by a proposed station to serve City P on frequency 1000 kHz. Azimuths are referred to true North.

Also on 1000 kHz are:

- Station 1 at 3000 km, azimuth 30°, Class A
- Station 2 at 1000 km, azimuth 170°, Class B
- Station 3 at 1500 km, azimuth 120°, Class C
- Station 4 at 400 km, azimuth 350°, Class B, day only

On 990 kHz are:

- Station 5 at 300 km, azimuth 60°, Class C
- Station 6 at 500 km, azimuth 270°, Class B

On 1010 kHz is:

- Station 7 at 600 km, azimuth 300°, Class A

On 980 kHz is:

- Station 8 at 205 km, azimuth 110°, Class B

These stations produce the following limitations on the proposed station, assuming that the 10% correction is applied only in protecting Class A stations:

Station 1 - At 30° azimuth and 1.5° vertical angle (from Table 1) from Curve 1 of Figure 1: 454 mV/m. Since Station 1 is Class A this value should be reduced by the correction factor in Figure 1-A. If we assume the mean geomagnetic latitude is less than 40° the correction is 6dB or 2 i.e. the permissible radiation is 227 mV/m.

Station 2 - At 170° azimuth and 9.3°vertical angle, from Curve 3 of Figure 1: 452 mV/m.

Station 3 - At 120° azimuth and 4.0° vertical angle, from Curve 4 of Figure 1: 1870 mV/m.

These three stations are too far away to limit daytime radiation.

Station 4 - Assuming typical class B station (see Appendix D) the radiation is 307 x $\sqrt{10}$ = 971 mV/m at 1 km. From the 15 mS/m curve of Figure 2 the protected contour lies at a distance from station 4 of: 180 km.
Thus the distance to the protected contour from the proposed station is: 400 - 180 = 220 km.
From the 15 mS/m curve and the multiplying factor table the permissible radiation at 350° is: 1530 x .05 = 76.5mVm.

Station 5 - Assuming typical Class C station (see Appendix D) the radiation is 307 x $\sqrt{0.5}$ = 217 mV/m at 1 km. Thus, from the 15 mS/m curve, the protected contour lies at a distance from station 5 of: 96 km.
The distance to the protected contour from the proposed station is: 300 - 96 = 204 km.
The permissible radiation at 60° is: 1300 mV/m.

Station 6 - As for station 4, the radiation is 971 mV/m at 1 km. From the 5 mS/m curve, the protected contour lies at a distance from Station 6 of: 100 km.
From the 15 mS/m curve, the distance to the protected contour from the proposed station is: 500 - 100 = 400 km.
The permissible radiation at 270° is: 11500 mV/m.

These values are too large to be of significance.

Station 7 - Assuming typical Class A station (see Appendix D) the radiation is 385 x $\sqrt{50}$ = 2722 mV/m. From the 5 mS/m curve the protected contour lies at a distance from station 7 of: 150 km.
The distance to the protected contour from the proposed station is: 600 - 150 = 450 km.
As for Station 6, the permissible radiation is too large to cause a restriction.

Station 8 - As for Station 4, the protected contour lies at a distance from Station 8 of: 180 km.
The distance to the protected contour from the proposed station is: 205 - 180 = 25 km.
The permissible radiation at 110° is: 19.6 x 30 = 588 mV/m.

When these limitations are recorded it becomes apparent that, unless a power level of less than 100 watts is suitable for daytime service needs, a directional antenna system is required. Hence it would be practical to determine the arcs of protection. The simplified means is to take the arc-sine of the distance to the protected contour divided by the station-to-station distance. For Station 1 the arc-sine is: 1170/3000 = 23°

A further refinement of determining the permissible radiation at the contour extremes might also be useful. In this case the distance to the protected contour becomes: 2760 km.

From curve 2 of Figure 1 the permissible radiation is: 1430 mV/m at 1 km. This should again be reduced by the factor from Figure 1-A of 6dB or 2 to a permissible radiation of 715 mVm.

For Station 2 the arc-sine is: 50/1000 = 3°.

For Station 3 no refinement needed.

For Station 4 the arc-sine is: 180/400 = 26.7°.

At this extreme the protected contour is at: 357 km
and the permissible radiation is: 7800 x .05 = 390 mV/m.

Station 5 - no refinement needed.

For Station 8, the arc-sine is: 180/205 = 61.4°.

At this angle the distance is: 98 km
and the permissible radiation is: 230 x 30 = 6900 mV/m.

At 30° from the station-to-station azimuth, the distance is: 30 km
and the permissible radiation is: 25.5 x 30 = 765 mV/m.

Station Design

The pattern limitations require a wide null to the north and a narrow null to the south, with modest restrictions at 110° and 250° if a station power of 5 kW or greater is required. The minimum radiation requirements for service should be added to Figure 4 and a pattern determined to meet these and the protection requirements. For maximum service, a daytime pattern which need not consider protections

to stations 1, 2 and 3 and a night-time pattern which need not protect Station 4 could be designed. As shown below a 50 kilowatt station with maximum daytime service over a wide arc to the south and maximum night-time service over a fairly wide arc to the north-west using six vertical radiators is feasible.

Pattern Design

The permissible radiation is tightly limited over relatively wide arcs in the northerly and north easterly directions for day and night services respectively. Other limitations are not as restricting but must be considered if powers over 1 kW are contemplated.

If powers of 50 kW are desired for both night-time and day-time operation patterns have been calculated using the computer program TOWOR. These are shown in figures 8 and 9 and are based on the use of the same six towers for the two patterns.

If powers of 5 or 10 kW were considered, the number of towers could be reduced. For omni-directional operations powers would be limited to around 100 watts daytime and about 500 watts for night-time.

Further Flexibility with RSS Calculations

With an RSS method of determining usable field strength incorporating the 50% exclusion rule described in Appendix C, it is often possible to increase radiation without noticeably increasing interference. Let us assume that there is another Class B station 800 km south of Station 2 (which we ignored because we would automatically be protecting it while protecting Station 2) which has a directional 10 kW operation and radiates 800 mV/m towards Station 2. This situation would cause a signal level at Station 2 of: .275 mV/m.

The signal strength caused by Stations 1 and 3 is less than 50% of this value. Therefore, the RSS night-time limitation value for Station 2 is: 0.275 x 20 = 5.5 mV/m.

From Curve 2 of Figure 1 the permissible radiation toward Station 2 is: 97.9 x 4.12 = 538 mV/m.

This would allow better service to the south, and possibly a decrease in the number of required radiators.

APPENDIX C

METHODS OF CALCULATION OF ROOT SUM SQUARE (RSS) NIGHT-TIME LIMITATION OF A CLASS B OR A CLASS C STATION

The interference from two or more sky-wave signals to a desired signal is taken to be the root sum square (RSS) value of such interfering field intensities. Calculation is accomplished by considering the signals, in order of decreasing magnitude, adding the squares of the values and extracting the square root of the sum, excluding those signals which are less than 50% of the RSS value of the higher signals already included. The RSS value will not be considered to be increased when a new interfering signal is added which is less than 50% of the RSS value of interference from existing stations and which is, at the same time, less than the smallest signal included in the RSS value of interference from existing stations. However, when the existing RSS value is less than the value of the nominal usable field strength, the incoming station's signal may be included in the RSS calculation, provided that the night-time limitation is not increased above the nominal usable field strength for the class of station concerned.

The above calculations of the interfering signal will be based on site-to-site separation.

In order to resolve the incompatibilities between station assignments, it is possible to simplify the procedure taking into consideration only the five largest values assuming that these values are in decreasing order of magnitude (see example below).

Let us assume the following field strengths in uV/m:

140, 125, 130, 65, 52

If we put them in decreasing order, we have

140, 130, 125, 65, 52

Let us calculate the RSS value applying the 50% exclusion rule:

$$RSS_1 = 140^2 + 130^2 = 19600 + 16900 = 191 \text{ uV/m}$$

If we take one half of the above RSS value, we have:

$$\tfrac{1}{2} RSS_1 = 95.5 \text{ uV/m}$$

This value is less than the third field strength

95.5 uV/m 125 uV/m

Let us now calculate a new RSS value including the third field strength.

$$RSS_2 = 140^2 + 130^2 + 125^2 = 228.3 \text{ uV/m}$$

If we apply the 50% exclusion rule again we obtain:

$$\tfrac{1}{2} RSS_2 = 114.1 \text{ uV/m}$$

and if we compare this value with the fourth field strength, we will see that

114.5 uV/m 65 uV/m

In fact, in this example, we see that only three values are considered as interfering field strengths. The remaining field strengths are not considered as objectionable interference.

APPENDIX D

ASSUMPTIONS USED TO DETERMINE DISTANCES TO PROTECTED CONTOURS

For Class A stations

- The night-time protected contour corresponds to 500 uV/m sky-wave 50% of the time.
- The protected station operates with a station power of 50 kW.
- The protected station uses an omni-directional antenna of height 0.5λ and a ground system of radius 0.25λ. From Fig. 5 the characteristic field strength of the station is 385 mV/m at 1 km.
- The distance to the 500 uV/m contour using these assumptions is 1170 km from Figure 6.

For Class B stations

- The protected contour is the nominal usable field strength for a class B station, i.e. the 2500 uV/m ground-wave contour (night-time) or the 500 uV/m ground-wave contour (daytime).
- The protected station operates with a station power of 10 kW.
- The protected station uses an antenna of height 0.25λ and a ground system of radius 0.25λ. From Fig. 5 the characterisic field strength of the station is 307 mV/m at 1 km.
- The ground conductivity is 5 mS/m and the frequency is 1000 kHz.

- The distance to the 2500 uV/m contour using these assumptions is 54 km and to the 500 uV/m contour is 107 km from Figure 7.

For Class C stations

- The night-time protected contour is the nominal usable field strength for a class C station, i.e. the 4000 uV/m ground-wave contour.
- The protected station operates with a station power of 500 W.
- The protected station uses an antenna of height 0.25 λ and a ground system of radius 0.25λ. From Fig. 5, the characteristic field strength of the station is 307 mV/m at 1 km.
- The ground conductivity is 5 mS/m and the frequency is 1000 kHz.
- The distance to the 4000 uV/m contour using these assumptions is 20 km from Figure 7.

APPENDIX E

ADDITIONAL GROUND WAVE PROTECTION REQUIREMENTS

1. Receiver Oscillator Radiation Taboo

The mechanism which causes this taboo is the radiation of the local oscillator in radio receivers. A radio receiver tuned to frequency f will radiate in its vicinity at a frequency of f plus the intermediate frequency (IF). Therefore, any radio station assigned to this higher frequency f+ IF would experience interference to its reception in the same community, from the receivers of listeners tuned to the station at frequency f.

To protect against this form of interference requires a 0 db protection ratio at the ground wave 500 uV/m contour between the protected station and the signal of any new proposed station. This is identical to the protection levels required for the first adjacent channel.

2. Receiver Image Taboo

The mechanism which causes this taboo is the lack of image frequency rejection in most common MF receivers. A receiver tuned to frequency f will also receive a signal at f plus twice the intermediate frequency.

To protect against this interference mechanism requires the same level of protection as for the first adjacent channel or the receiver oscillator radiation taboo.

- This material is also noted in Table 2.

APPENDIX F

GUIDELINES FOR ASSIGNING A CLASS TO A STATION

The following guidelines offer a method of deciding the class that is appropriate for each station. The method closely follows the definition of each class of station, and thus yields a result that is both logical and defensible.

Class A: A class A station is intended to provide coverage over extensive primary and secondary service areas and is protected against interference accordingly. Therefore, a class A station should have a transmitter power of 10 kW or more and should have a secondary service area that is protected against sky-wave interference.

Class B: A class B station is intended to provide coverage over one or more population centres and the rural areas contiguous to them, located in its primary service area, and is protected against interference accordingly. Therefore, a class B station would have a transmitter power greater than 1 kW and up to 50 kW, and would not have a secondary service area that is protected against sky-wave interference. A station having a transmitter power of 1 kW or less would also qualify as class B provided its RSS night-time limitation is less than 4000 uV/m using the 10% sky-wave curves shown in Figure 6.

Class C: A class C station is intended to provide coverage over a city or town and the contiguous suburban areas located in its primary service area, and is protected against interference accordingly. Therefore, a class C station should have a power of 1 kW or less except in areas of high atmospheric noise or of low conductivity where 5 kW could be employed daytime, provided that protection is maintained to other stations. Night-time power in all cases should not exceed 1 kW.

APPENDIX G

TABLES 1 AND 2

TABLEAU 1

TABLE 1

ANGLE DE DÉPART EN FONCTION DE LA DISTANCE

ANGLE OF DEPARTURE VS DISTANCE

DISTANCE (km)	ANGLE (Deg)
50	75.3
100	62.2
150	51.6
200	43.3
250	36.9
300	31.9
350	27.9
400	24.7
450	22.0
500	19.8
550	18.0
600	16.3
650	14.9
700	13.7
750	12.6
800	11.7
850	10.8
900	10.0
950	9.3
1000	8.6
1050	8.0
1100	7.4
1150	6.9
1200	6.4

DISTANCE (km)	ANGLE (Deg)
1250	5.9
1300	5.4
1350	5.0
1400	4.6
1450	4.3
1500	3.9
1550	3.5
1600	3.2
1650	2.9
1700	2.6
1750	2.3
1800	2.0
1850	1.7
1900	1.5
1950	1.2
2000	1.0
2050	.7
2100	.5
2150	.2
2200	.0
2250	.0
2300	.0
2350	.0
2400	.0

TABLE 2

SUMMARY OF GROUND WAVE PROTECTION REQUIREMENTS

	PROTECTED CONTOUR	PROTECTION RATIO	INTERFERING CONTOUR
Co-channel Daytime Class A	100 uV/m	26 dB	5 uV/m
Co-Channel Daytime Class B & C	500 uV/m	26 dB	25 uV/m
Daytime & Night-time First Adjacent Channel Receiver Oscillator Radiation Taboo * Receiver Image Taboo **	500 uV/m	0 dB	500 uV/m
Daytime & Night-time Second Adjacent Channel	500 uV/m	-29.5 dB	15,000 uV/m
Daytime & Night-time Third Adjacent Channel	25,000 uV/m	0 dB	25,000 uV/m

* frequency plus or minus 450 or 460 kHz
** frequency plus or minus 910, 920 or 930 kHz