INTERIM WORKING ARRANGEMENT BETWEEN THE FEDERAL COMMUNICATIONS COMMISSION AND THE DEPARTMENT OF COMMUNICATIONS RELATING TO THE AM BROADCASTING SERVICE IN THE MEDIUM FREQUENCY BAND

This document describes a general understanding between the Federal Communications Commission (FCC), USA and the Department of Communications (DOC), Canada, concerning AM broadcasting in the medium frequency band 1605 to 1705 kHz. This understanding is based on discussions between representatives of the two Governments regarding the desirability of the United States and Canada signing an Agreement concerning the use of the 1605-1705 kHz band, ensuing from decisions taken at the International Telecommunication Union Regional Administrative Radio Conference, Rio de Janeiro, June 1988.

A draft text of an Agreement (May 1990 version attached) regarding the mutual use of this band has been developed. At the same time, however, both the DOC and FCC are in the process of reviewing potential improvements to the AM service, both in the existing band and the expanded band. Not wishing to preclude the findings of these studies from influencing any final Agreement governing the use of the AM expanded band, the two Administrations will apply the provisions in the attached draft Agreement as an Interim Working Arrangement.

Both Administrations will coordinate all proposals individually. During such coordinations, the Administrations may, by mutual agreement, modify the applications of provisions of the Interim Working Arrangement (in particular the provisions relating to the required distance for adjacent channel protection).

This Interim Working Arrangement will take effect upon signature by both administrations, and will remain in effect until the entry into force of a binding Agreement covering the use of the 1605-1705 kHz band or until notice of termination is given by either Administration.

Roy Stewart
Chief, Mass Media Bureau

Date: February 28, 1991

Michael Binder
Assistant Deputy Minister
Research and Spectrum

Date: December 28, 1990

AGREEMENT BETWEEN THE GOVERNMENT OF CANADA AND THE GOVERNMENT OF THE UNITED STATES OF AMERICA RELATING TO THE AM BROADCASTING SERVICE IN THE MEDIUM FREQUENCY BAND AND THE DRAFT AGREEMENT BETWEEN THE GOVERNMENT OF CANADA AND THE GOVERNMENT OF THE UNITED STATES OF AMERICA RELATING TO THE AM BROADCASTING SERVICE IN THE BAND 1605-1705 kHz

The Government of Canada and the Government of the United States of America desiring to continue their mutual understanding and cooperation in the matter of AM broadcasting, to ensure efficient and equitable utilization of the frequency band 1605 to 1705 kHz allocated to this service, and to ensure compatibility with AM broadcasting stations in the band 1575 to 1605 kHz, have agreed as follows:

Article 1

Definitions

1. For the purpose of the Agreement, the following terms shall have the meanings defined below:

1.1 **Administrations:** The Federal Communications Commission of the United States or the Department of Communications of Canada.

1.2 **Agreement:** This Instrument and its Annexes.

1.3 **Allotment:** Entry in the Plan of a broadcasting channel designated for use by an administration for the AM broadcasting service in an allotment area under the conditions specified in the Plan. Each allotment included in the Plan may be used for one or more assignments using the technical criteria specified in Annex 1 to the Agreement.

1.4 **Allotment Area:** Specifically defined geographical area within a country, to which one or more channels are allotted, as indicated in Part B of the Plan.

1.5 **Assignment:** Authorization given by an administration for a radio station to use a radio frequency channel under the conditions specified in the agreement.

1.6 **IFRB:** The International Frequency Registration Board.

1.7 **Ottawa 1984 Agreement:** Agreement Between the Government of Canada and the Government of the United States of America Relating to the AM Broadcasting Service in the Medium Frequency Band, Ottawa, 1984.

1.8 **Plan:** The Allotment Plan in Annex 4 and the associated provisions of the Agreement.

1.9 **Priority channel:** An allotted channel on which assignments are exempted from compliance with the requirements of Article 6. These are channel 8 (1680 kHz) for the USA and channel 3 (1630 kHz) for Canada.

1.10 **Radio Regulations:** The Radio Regulations of the International Telecommunication Union.

1.11 **Region 2:** The geographical area defined in No. 394 of the Radio Regulations (Geneva, 1979).

1.12 **Rio 88 Agreement:** Regional Agreement for the Use of the Band 1605-1705 kHz in Region 2, Rio de Janeiro, 1988.

1.13 **Standardized parameters:** The power, antenna system, characteristic field strength and separation distance which were used as a basis in the development of the allotment Plan (see Section 1, Annex 2).

Article 2

Frequency Bands and Services

2.1 The provisions of the Agreement shall be applied to the broadcasting service in the frequency band 1605-1705 kHz. They shall also be applied to ensure compatibility between broadcasting stations in the above-noted band and in the 1575-1605 kHz band segment.

2.2 The 1605-1705 kHz band shall be used exclusively for the AM broadcasting service. However, existing non-broadcast stations in the 1605-1705 kHz band may continue to operate only on the basis of not causing interference to and not receiving protection from broadcasting stations. These conditions also apply to existing U.S. travellers information stations operating on 1610 kHz which do not comply with the provision of Section 5.2.2 of Article 5. Interference from the above stations shall be deemed to occur when a complain is notified by one of the administrations. Also, future travellers information stations may operate on a non-interference no-protection basis.

Article 3

Adoption of the Plan

3.1 The Plan was developed based upon standardized parameters given in Annex 2. The Plan appears in Annex 4 to the Agreement.

3.2 Broadcasting station assignments shall be brought into service only when in conformity with the Plan and under the conditions specified in the Agreement.

Article 4

Procedure for Modification of the Plan

4.1 By mutual agreement of the two administrations, allotment channels and areas may be modified.

4.2 In accordance with the Rio 88 Agreement, the administrations shall inform the IFRB of the agreed changes.

Article 5

Implementation of the Plan, Procedures for the Notification of Frequency Assignments

5.1 Implementation of the Plan

An administration may at any time:

5.1.1 Make assignments corresponding to any of its allotments, at one or more locations within the respective allotment area, with characteristics which do not exceed the standardized parameters given in Section 1 of Annex 2.

5.1.2 Make assignments corresponding to any of its allotments, at one or more locations within the respective allotment area, with non-standardized parameters, provided that the limits specified in Section 3 of Annex 2 are not exceeded. If they are exceeded, the agreement of the other administration shall be obtained.

5.1.3 Make assignments corresponding to any of its allotments at one or more locations which do not meet the adjacent channel criteria of Section 2 of Annex 2, relative to an adjacent channel allotment of another administration, subject to the application of the procedure contained in Article 6.

5.1.4 Make an assignment to a station located anywhere in its territory on any channel not allotted to it in the area concerned, provided that the limits specified in Section 4 of Annex 2 are not exceeded. If they are exceeded, the agreement of the other administration shall be obtained.

5.2 Notification of Assignments

Wherever an administration intends to bring into use an assignment to a station of the broadcasting service in conformity with this Agreement, it shall notify the data specified in Annex 3 to the other administration, first ensuring that:

5.2.1 **with assignments corresponding to allotted channels,**

5.2.1.1 for a station using non-standardized parameters, the field strength at any point in an allotment area in which the same channel is allotted to the other administration does not exceed the limits specified in Section 3 of Annex 2.

5.2.1.2 when the station does not meet the criteria of Section 2 of Annex 2 relative to an adjacent channel allotment of the other administration, the coordination procedure contained in Article 6 has been applied.

5.2.2 **with assignments on non-allotted channels,**

the field strength at any location of an allotment area to which the same channel is allotted does not exceed the limits specified in Section 4 of Annex 2.

Article 6

Procedure for the Coordination of Broadcasting Stations Which Do Not Meet the Adjacent Channel Criteria of Section 2, Annex 2

6.1 An administration proposing to bring into use an assignment on its own priority channel is exempt from the requirements of this Article.

6.2 An administration proposing to bring into use an assignment which does not meet the criteria in Section 2 of Annex 2, relative to an adjacent channel allotment of the other administration, shall seek the latter's agreement.

6.3 The administration proposing to bring the assignment into use shall send the information listed in Annex 3 of the Agreement. If the receiving administration's adjacent channel allotment is a priority channel, that administration may object to the proposed assignment on the basis that its use of that priority channel may be unduly restricted. In such cases, the procedure in Section 6.6 through 6.8 below does not apply.

6.4 The date on which the other administration receives the copy of the request for agreement shall be considered as the date of commencement of this procedure.

6.5 The administration receiving this information shall examine it with a view to ensuring that the use of its adjacent channel allotment would not be adversely affected.

6.6 Upon receipt of a request for agreement, the administration that receives the request shall examine the matter and shall, within 90 days:

- either give its agreement to the proposed use, or

- communicate the characteristics of its existing or planned assignments (representing current or future applications) that may affect the proposed assignment or be affected by it, and if possible suggest means by which both needs may be accommodated, in which case an additional 30 days to respond will be allowed.

6.7 If, following the period specified in Section 6.6, the proposing administration has received no reply, the administration which has received the request will be deemed to have given its agreement, either with standardized parameters or with non-standardized parameters, provided that the proposed station does not cause any more interference than a station operating on the border with standardized parameters.

6.8 If agreement is not reached with nine months of the initial date of receipt, all the stations concerned, except those which were previously agreed to, may be permitted to operate only with characteristics not exceeding the standardized parameters in the direction of the other country. Under these circumstances both administrations shall be deemed to accept any interference that may result from the simultaneous operation of their stations. If interference to an assignment has already been accepted by application of this procedure, interference should be (or if the station is operating, shall be) confined to the area already subject to interference. By mutual agreement the nine-month period may be extended for a fixed period of time depending on the progress being made.

Article 7

Requirements to Ensure Compatibility Between Broadcasting Assignments and Allotments in the Adjacent Bands 1575-1605 kHz and 1605-1705 kHz

7.1 Proposed assignments on 1610 or 1620 kHz shall provide protection to assignments on 1590 and 1600 kHz using the technical criteria of the Ottawa 1984 Agreement.

7.2 Proposed assignments on 1590 or 1600 kHz shall provide protection to assignments on 1610 and 1620 kHz using the technical criteria of this Agreement.

7.3 Proposed assignments on 1590 or 1600 kHz shall also be subject to the adjacent channel co-ordination procedure in Article 6 of this Agreement with respect to allotments on 1610 and 1620 kHz.

7.4 The 25 mV/m contour of proposed assignments on 1580 to 1630 kHz shall not overlap the 25 mV/m contour of another assignment in that range whose frequency is separated by 30 kHz or less.

7.5 Field strength calculations shall be based on Graph 19 in the Ottawa 1984 Agreement for assignments on 1580 to 1600 kHz and on Figure 2.1 in this Agreement for assignments on 1610 to 1630 kHz.

Article 8

Groundwave Field Strength Measurements

8.1 The technical criteria contained in the Agreement provide for protection from groundwave interference through the use of theoretical calculations based on the values of ground conductivity referred to in Chapter 2 of Annex 1. Nevertheless, it is recognized that in some situations such calculations may not properly reflect actual conditions where the conductivity along a specific path differs from the value shown on the conductivity map.

8.2 Therefore, field strength measurements made within a station's own country, in accordance with Appendix 2 to Annex 1, may be employed in these situations to justify an assignment based on measured conductivity values.

8.3 If a station whose parameters were accepted on the basis of measurements submitted in accordance with this Article is found to cause interference within the range of azimuths covered by the data submitted, then that station shall reduce its radiation in the pertinent directions to the levels permitted by calculations using the conductivity map, or to such levels as may be mutually agreed upon by both Administrations.

8.4 Resolution of interference complaints

8.4.1 When a station believes that it is experiencing objectionable interference above the level previously accepted from a station in the other country, it shall inform its own Administration. After verification, the interference complaint shall be referred to the other administration. The station believed to be the cause of the interference shall be required immediately to verify its authorized operation (including measuring field strength at permanent monitoring points if appropriate) and make any adjustments necessary to resume its authorize operation. The station shall, within 10 days of receipt of the complaint, advise its Administration of the action taken. The responsible Administration shall immediately advise its counterpart of the station's status including corrective measures taken. If, after completion of the above steps, the complaining station is still experiencing objectionable interference above the level previously accepted anywhere within its protected contour, field strength measurements shall be taken in accordance with Appendix 2 to Annex 1.

8.4.2 The Administration responsible for the complaining station shall review the field strength measurement data and, if satisfied that it is well founded, shall forward the complaint to the other Administration. If that Administration is not satisfied

that the complaint is valid, it shall advise the other Administration of the reasons therefor, in order to facilitate discussions. If the Administration which receives the complaint is satisfied that it is valid on the basis of the referred data, it shall:

(a) evaluate the measurement data as promptly as possible, but in no event later than 20 days after receipt;

(b) forward the measurement data to the station causing the interference;

(c) notify the station to take any necessary action to eliminate the interference or to prove that it is operating as authorized. The station shall comply as soon as possible within a time period not to exceed 30 days;

(d) if necessary corrective action has not been taken within 30 days, order the interfering station to reduce its power at once by any amount necessary, including cessation of operation, to eliminate the interference;

(e) refuse authority to resume normal operation until the necessary action specified in (c) and (d) above has been taken.

8.4.3 Since actual ground conductivities over specific paths may vary from the values indicated in the Atlas of Ground Conductivity identified in Chapter 2 of Annex 1, interference may be experienced even if the station causing the interference is operating in accordance with notified parameters. In such circumstances, except as noted in Section 8.3, no action will be required as long as the station can demonstrate that is is operating as authorized. However, each Administration shall endeavour, in cooperation with the other, to mitigate such interference.

Article 9

Amendment of the Annexes

Except for modifications to the Plan, which are governed by Article 4, the Annexes hereto may be amended by exchange of letters directly between the administrations. The adoption of such amendments shall be notified to the Department of External Affairs of Canada and the Department of State of the United States of America by the Administration of each country.

Article 10

Denunciation of the Agreement

10.1 Either country may denounce the Agreement at any time by a notification sent to the other country.

10.2 Denunciation shall become effective one year after the date on which the other country receives the notification of denunciation.

Article 11

Entry into Force of the Agreement

The Agreement shall enter into force on [1 July 1990] at 0001 hours UTC.

Annex 1

Technical Data to be Used in the Application of the Agreement

Chapter 1

Definitions, Symbols and Units

1.1 Definitions

In addition to the definitions given in the Radio Regulations, the following definitions and symbols apply:

1.1.1 Broadcasting channel (AM)

A part of the frequency spectrum, equal to the necessary bandwidth of AM sound broadcasting stations, and characterized by the nominal value of the carrier frequency located at its center.

1.1.2 Nominal usable field strength (E_{nom})

Agreed minimum value of the field strength required to provide satisfactory reception, under specified conditions, in the presence of atmospheric noise, man-made noise and interference from other transmitters. The value of nominal usable field strength has been employed as the reference for planning.

1.1.3 Service area

The area delimited by the contour within which the calculated level of the groundwave field strength is protected from objectionable interference in accordance with the provisions of Chapter 3.

1.1.4 Border

For protection purposes, the border of a country shall be deemed to encompass only its land area, which includes its islands.

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

The ratio (expressed in decibels) between the values of the voltage of the wanted signal and the voltage of the interfering signal, measured under specified conditions, at the audio-frequency output of the receiver. These specified conditions include various parameters such as the frequency separation between the wanted carrier and the interfering carrier, the emission characteristics (type

and percentage of modulation, etc.), levels of input and output of the receiver and its characteristics (selectivity, sensitivity to intermodulation, etc.).

1.1.6 Audio-frequency (AF) protection ratio

Agreed minimum value of the audio-frequency signal-to-interference ratio corresponding to a subjectively defined reception quality.

1.1.7 Radio-frequency (RF) signal-to-interference ratio

The ratio (expressed in decibels) between the values of the radio-frequency voltage of the wanted signal and of the interfering signal, measured at the input of the receiver under specified conditions. These specified conditions include various parameters such as the frequency separation between the assigned frequency of the wanted signal and the assigned frequency of the interfering signal, the emission characteristics (type and percentage of modulation, etc.). levels of input and output of the receiver and its characteristics (selectivity, sensitivity to intermodulation, etc.)

1.1.8 Radio-frequency (RF) protection ratio

The radio-frequency signal-to-interference ratio which, in well-defined conditions, makes it possible to obtain the audio-frequency protection ratio at the output of a receiver. These specified conditions include various parameters such as the frequency separation between the assigned frequency of the wanted signal and the assigned frequency of the interfering signal, the emission characteristics (type and percentage of modulation, etc.), levels of input and output of the receiver and its characteristics (selectivity, sensitivity to intermodulation, etc.).

1.1.9 Daytime operation

Operation between the times of sunrise and sunset at the transmitter site.

1.1.10 Nighttime operation

Operation between the times of sunset and sunrise at the transmitter site.

1.1.11 Station power

Unmodulated carrier power supplied to the antenna.

1.1.12 Groundwave

Electromagnetic wave which is propagated along or near the surface of the Earth and which has not been reflected by the ionosphere.

1.1.13 Skywave

Electromagnetic wave which has been reflected by the ionosphere.

1.1.14 Skywave field strength, 10% of the time

The skywave field strength during the reference hour which is exceeded for 10% of the nights of the year. The reference hour is the period of one hour beginning one and a half hours after sunset and ending two and a half hours after sunset at the midpoint of the short great-circle path.

1.1.15 Characteristic field strength (E_c)

The field strength, at a reference distance of 1 km in a horizontal direction, of the groundwave propagated along perfectly conducting ground for 1 kW station power, taking into account losses in a real antenna.

Note 1: The gain (G) of the transmitting antenna relative to an ideal short vertical antenna is given in dB by the equation:

$$G = 20 \log \frac{E_c}{300} \qquad (1)$$

where E_c is expressed in mV/m.

Note 2: The effective monopole radiated power (e.m.r.p.) is given in dB (kW) by the following equation:

$$\text{e.m.r.p.} = 10 \log P_t + G \qquad (2)$$

where P_t is the station power (kW).

1.2 Symbols and units

Hz:	hertz
kHz:	kilohertz
W:	watts
kW:	kilowatts

mV/m:	millivolt/meter
μV/m:	microvolt/meter
dB:	decibel
dB(μV/m):	decibels with respect to 1 μV/m
dBW:	decibels with respect to 1 watt
dB (kW):	decibels with respect to 1 kW
mS/m:	millisiemens/meter
σ:	ground conductivity

Chapter 2

Propagation

2.1 Groundwave propagation

2.1.1 Ground conductivity

When required in the application of Annex 2 for groundwave propagation calculations in the band 1605-1705 kHz, use shall be made of the current edition of the Atlas of Ground Conductivity as described in the Ottawa 1984 Agreement, Annex 2, Chapter 2.

2.1.2 Field strength curves for groundwave propagation

The curves shown in Figure 2.1 shall be used for determining groundwave propagation in the frequency range 1605-1705 kHz; these curves are computed for 1655 kHz.

The curves are labelled with ground conductivities in millisiemens/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 relative dielectric constant of 80.

2.1.3 Calculation of groundwave field strength

When necessary, using the Atlas of Ground Conductivity, the relevant conductivity or conductivities for the chosen path are determined. If only one conductivity is representative, the method for homogeneous paths is used. If several conductivities are involved, the method for non-homogeneous paths is used.

2.1.3.1 Homogeneous paths

The vertical component of the field strength for a homogeneous path is represented in Figure 2.1 as a function of distance, for various values of ground conductivity.

The distance in kilometers is shown on a logarithmic scale on the abscissa. The field strength is shown on a linear scale on the ordinate in decibels above 1 μV/m. The graph is standardized for a characteristic field strength of 100 mV/m corresponding to an effective monopole radiated power (e.m.r.p.) of -9.5 dB relative to 1 kW. The straight line marked "100 mV/m at 1 km" is the field strength on the assumption that the antenna is erected on a surface of perfect conductivity.

For omnidirectional antenna systems having a different characteristic field strength, correction must be made according to either of the following equations:

$$E = E_O \; x \; \frac{E_c}{100} \; x \; \sqrt{P}$$

if field strengths are expressed in mV/m, or:

$$E = E_0 + E_c - 100 + 10 \log P$$

if field strengths are expressed in dB (μV/m).

For directional antenna systems, correction must be made according to either of the following equations:

$$E = E_0 \; x \; \frac{E_R}{100}$$

if field strengths are expressed in mV/m, or:

$$E = E_0 + E_R - 100$$

if field strengths are expressed in dB (μV/m),

where:

E: resulting field strength

E_0: field strength read from Figure 2.1

E_R: actual field strength at a particular azimuth at 1 km

E_c: characteristic field strength

P: station power in kW.

Figure 2.2 consists of three pairs of scales to be used with Figure 2.1. Each pair contains one scale labelled in decibels and another in millivolts per meter. Each pair can be cut out and trimmed as a unit to be used as sliding ordinate scales. The scales allow graphical conversion between decibels and millivolts per meter, and are used to make graphical determinations of field strengths. Other methods of making calculations on Figure 2.1 may be used, including the use of dividers to adjust for values of E_R that differ from 100 mV/m at 1 km. However, any method used will follow steps similar to those described below.

For both omnidirectional and directional antenna systems the value of E_R must be found. For omnidirectional systems, E_R can be determined by using either of the following equations:

$$E_R = E_C \sqrt{P}$$

if field strengths are expressed in mV/m, or:

$$E_R = E_c + 10 \log P$$

if field strengths are expressed in dB (μV/m).

To determine the field strength at a given distance, the scale is placed at that distance with the 100 dB (μV/m) point of the scale resting on the appropriate conductivity curve. The value of E_R is then found on the scale and the point on the underlying graph (which lies underneath the E_R point of the scale) yields the field strength at the given distance.

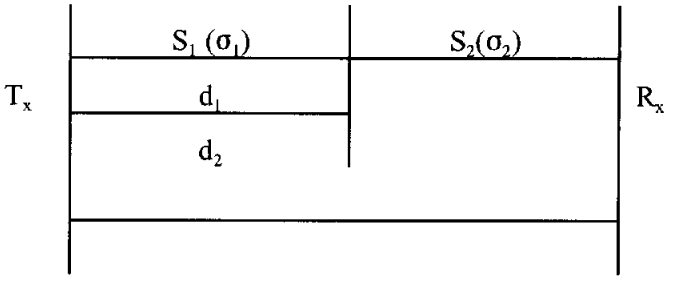
To determine the distance at a given field strength, the E_R value is found on the sliding scale and that point is placed directly at the level of the given field strength on the graph. The scale is then moved horizontally until the 100 dB (μV/m) point of the scale coincides with

the applicable conductivity curve. The distance may then be read from the abscissa of the graph.

2.1.3.2 Non-homogeneous paths

In this case, the equivalent distance or Kirke method shall be used. To apply this method, Figure 2.1 can also be used.

Consider a path whose sections S_1 and S_2 have lengths d_1 and $(d_2 - d_1)$, and conductivities σ_1 and σ_2 respectively, as shown on the following figure:



The method is applied as follows:

(a) taking section S_1 first, we read the field strength corresponding to conductivity σ_1 at distance d_1 on figure 2.1;

(b) as the field strength remains constant at the point of discontinuity, the value immediately after the discontinuity must be equal to that obtained in (a) above. As the conductivity of the second section is σ_2, the curve corresponding to conductivity σ_2 gives the equivalent distance to that which would be obtained at the same field strength arrived at in (a). This equivalent distance is d. Distance d is larger than d_1 when σ_2 is larger than σ_1. Otherwise d is less than d_1;

(c) the field strength at the real distance d_2 is determined by taking the corresponding curve for conductivity σ_2 and reading off the field strength obtained at the equivalent distance $d + (d_2 - d_1)$;

(d) for successive sections with different conductivities, procedures (b) and (c) are repeated.

N.B. THE ORIGINAL FOR THIS FIGURE WILL BE MADE AVAILABLE LATER BY THE FCC.

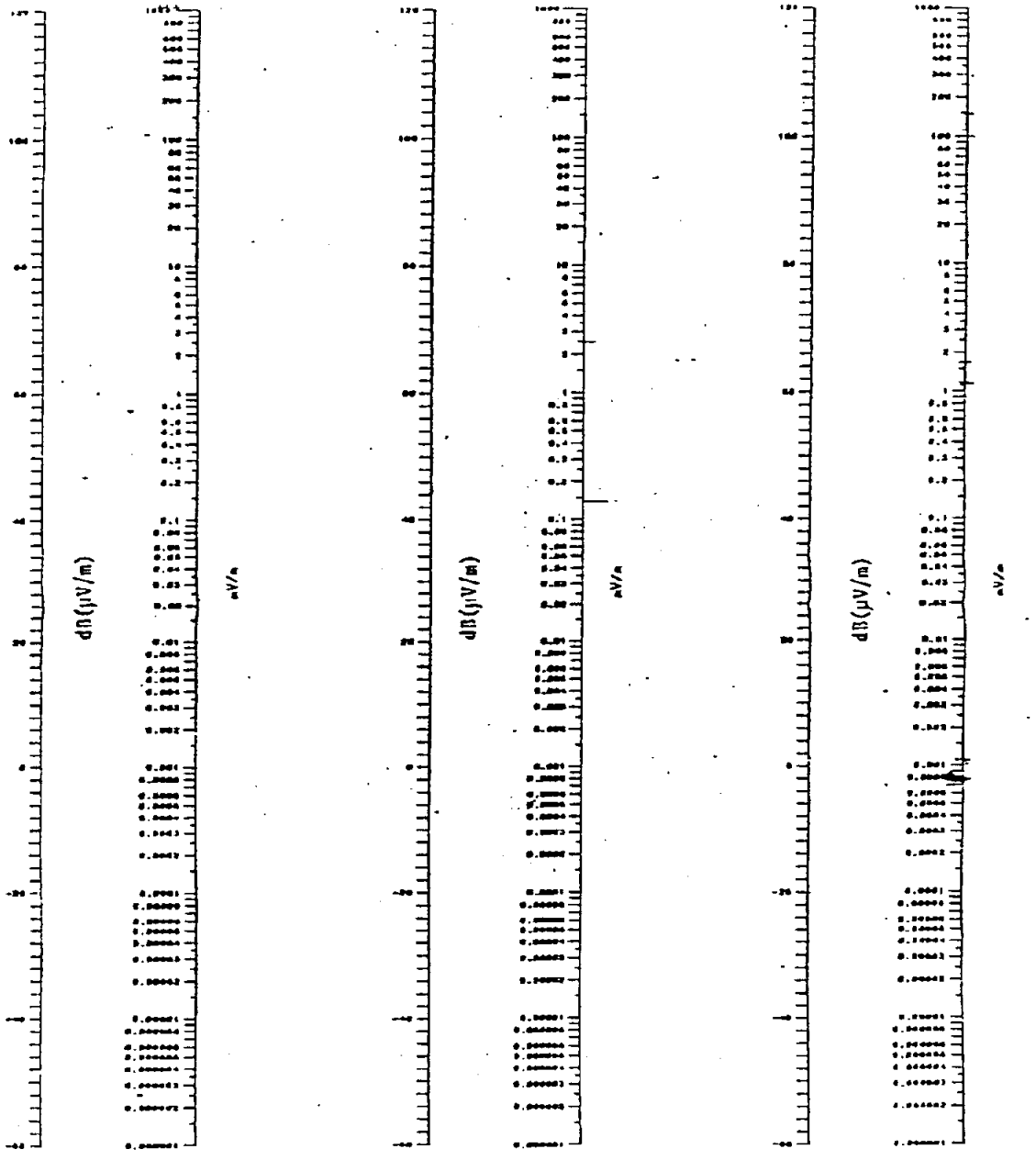


Figure 2.2 - Scales for use with Figure 2.1

2.2 Skywave propagation

The calculation of skywave field strength shall be conducted in accordance with the procedure given below. Skywave propagation is considered to be significant at night only.

2.2.1 List of symbols

d: short great-circle path distance (km);

E_c: characteristic field strength (mV/m) at 1 km for 1 kW);

$f(\theta)$: ratio of vertical to horizontal plane field strength at elevation angle θ;

f: frequency (kHz);

F: unadjusted annual median skywave field strength, in dB (μV/m);

F_c: field strength read from Table 2.1 for a characteristic field strength of 100 mV/m;

F(10): skywave field strength, 10% of the time, in dB (μV/m);

P: station power (kW);

θ: elevation angle from the horizontal (degrees).

2.2.2 General procedures

Radiation in the horizontal plane of an omnidirectional antenna fed with 1 kW (characteristic field strength E_c) is determined from design data.

Figure 2.3 which shows the characteristic field strength of an antenna based on a 1 ohm resistance loss, shall be used for calculations to determine a realistic value of E_c. The E_c submitted by administrations shall be within $\pm$10% of that value.

Elevation angle θ is given by

$$\theta = \text{arc tan } [0.00752 \cot \frac{d}{444.54}] - \frac{d}{444.54} \text{ degrees} \quad (1)$$

$$0^o \leq \theta \leq 90^o$$

It is assumed that the Earth is a smooth sphere with an effective radius of 6,367.6 km and that reflections occur from an ionospheric height of 96.5 km.

The ratio $f(\theta)$ for a pertinent elevation angle θ is calculated by means of the equation in section 1.(a) of Attachment A of Appendix 1.

The product $E_c f(\theta) \sqrt{P}$ is thus determined for an omnidirectional antenna. For a directional antenna $E_c f(\theta) \sqrt{P}$ may be determined from the radiation pattern. $E_c f(\theta) \sqrt{P}$ is the field strength at 1 km at the appropriate elevation angle and azimuth.

The unadjusted annual median skywave field strength F is given by:

$$F = F_c + 20 \log \frac{E_c f(\theta) \sqrt{P}}{100} \quad dB(\mu V/m) \qquad (2)$$

where F_c is taken from Table 2.1, using, if necessary, linear interpolation of the field strength expressed in μV/m.

Note: Values of F_c in Table 2.1 are normalized to 100 mV/m at 1 km, corresponding to an effective monopole radiated power (e.m.r.p.) of - 9.5 dB (kW).

For distances greater than 4250 km, it should be noted that F_c can be expressed by:

$$F_c = \frac{231}{3 + d/1000} - 27.5 \quad dB(\mu V/m) \qquad (3)$$

2.2.3 Skywave field strength, 10% of the time

This is given by:

$$F(10) = F \quad dB(\mu V/m) \qquad (4)$$

2.2.4 Sunrise and sunset time

The local time of sunrise and sunset shall be determined for various geographical latitudes and for each month of the year. The time is the local meridian time at the point concerned and shall be converted to the appropriate standard time.

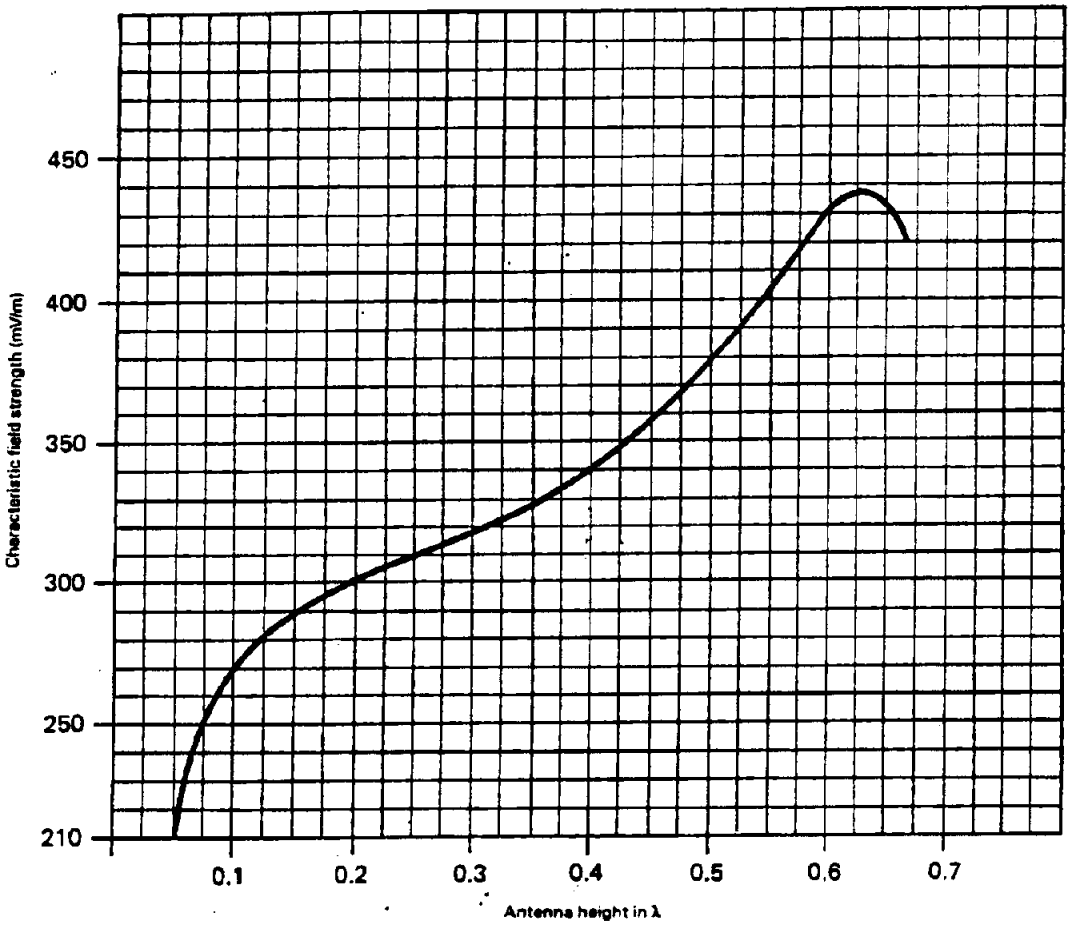


FIGURE 2.3 *Characteristic field strength of an antenna, based on a 1 ohm resistance loss*

Table 2.1 - Skywave field strength vs distance (0 to 10,000 km) for a characteristic field strength of 100 mV/m

d (km)	F (dB(μV/m)) 10%	F (μV/m) 10%
0-200	47.28	231.24
250	45.79	194.77
300	44.75	172.87
350	43.86	155.89
400	43.13	143.38
450	42.46	132.78
500	41.92	124.72
550	41.40	117.51
600	40.94	111.43
650	40.45	105.37
700	39.94	99.32
750	39.32	92.46
800	38.73	86.41
850	38.18	81.13
900	37.51	75.08
950	36.83	69.40
1000	36.14	64.15
1050	35.44	59.18
1100	34.79	54.86
1150	33.98	50.01
1200	33.25	45.97
1250	32.50	42.15
1300	31.71	38.48
1350	30.90	35.09
1400	30.08	31.93
1450	29.25	29.01
1500	28.42	26.37
1550	27.59	23.94
1600	26.66	21.53
1650	25.75	19.39
1700	24.87	17.53
1750	24.04	15.92
1800	23.28	14.57
1850	22.52	13.36
1900	21.78	12.28
1950	21.05	11.28

Table 2.1 (continued)

d (km)	F (dB(μV/m)) 10%	F (μV/m) 10%
2000	20.34	10.40
2100	19.15	9.07
2200	18.05	7.99
2300	16.92	7.00
2400	16.13	6.40
2500	15.09	5.68
2600	14.16	5.10
2700	13.32	4.65
2800	12.58	4.25
2900	11.81	3.89
3000	11.11	3.59
3100	10.45	3.34
3200	9.78	3.09
3300	9.18	2.89
3400	8.57	2.69
3500	8.02	2.51
3600	7.47	2.36
3700	6.92	2.21
3800	6.41	2.08
3900	5.92	1.98
4000	5.48	1.88
4100	4.99	1.78
4200	4.54	1.68
4300	4.10	1.61
4400	3.67	1.53
4500	3.26	1.46
4600	2.85	1.38
4700	2.46	1.33
4800	2.07	1.28
4900	1.70	1.21
5000	1.33	1.16
5100	0.98	1.13
5200	0.63	1.08
5300	0.29	1.03
5400	-0.04	1.00
5500	-0.37	0.95
5600	-0.68	0.93
5700	-0.99	0.90
5800	-1.29	0.85
5900	-1.59	0.83

Table 2.1 (end)

d (km)	F (dB(μV/m)) 10%	F (μV/m) 10%
6000	-1.88	0.80
6200	-2.43	0.75
6400	-2.97	0.70
6600	-3.48	0.68
6800	-3.97	0.63
7000	-4.44	0.60
7200	-4.90	0.58
7400	-5.33	0.55
7600	-5.75	0.53
7800	-6.15	0.50
8000	-6.54	0.48
8200	-6.92	0.45
8400	-7.28	0.43
8600	-7.63	0.43
8800	-7.97	0.40
9000	-8.29	0.38
9200	-8.61	0.38
9400	-8.91	0.35
9600	-9.21	0.35
9800	-9.50	0.33
10000	-9.77	0.33

Chapter 3

Broadcasting Standards and Transmission Characteristics

3.1 Channel spacing

The Plan is based on a channel spacing of 10 kHz and carrier frequencies which are integral multiples of 10 kHz, beginning at 1610 kHz.

3.2 Class of emission

The Plan is based on double-sideband amplitude modulation with full carrier A3E.

Classes of emission other than A3E may also be used, for instance to accommodate stereophonic systems, on condition that the energy level outside the necessary bandwidth does not exceed that normally expected in A3E emission.

3.3 Bandwidth of emission

The plan is based on a necessary bandwidth of 10 kHz for which only 5 kHz audio bandwidth can be obtained. However, the protection ratios selected allow operation with 20 kHz occupied bandwidth without an appreciable increase in interference. Stations operating on the frequency 1700 kHz shall take into account No. 343 of the Radio Regulations.

3.4 Frequency tolerance

The frequency tolerance shall be 10 Hz.

3.5 Nominal usable field strength (E_{nom})

Daytime: 0.5 mV/m

Nighttime: 7.1 mV/m

3.6 Protection ratio

3.6.1 Co-channel protection ratio

The co-channel protection ratio is 26 dB.

3.6.2 Adjacent channel protection ratio

- the protection ratio for the first adjacent channel is 0 dB;
- the protection ratio for the second adjacent channel is -29.5 dB.

Chapter 4

Radiation Characteristics of Transmitting Antennas

In carrying out the calculations indicated in Chapter 2, the following shall be taken into account.

4.1 Omnidirectional antennas

The characteristic field of a simple vertical antenna may be determined from Section 2.2.2.

4.2 Directional antennas

The procedures for calculating theoretical, expanded and augmented (modified expanded) directional antenna patterns are given in Attachment A of Appendix 1.

4.3 Top-loaded or sectionalized antennas

4.3.1 Calculation procedures are given in Attachment A of Appendix 1.

4.3.2 Stations may employ top-loaded or sectionalized towers, either because of space limitations or to vary the radiation characteristics from those of a simple vertical antenna. This may be done to achieve the desired coverage or to reduce interference.

4.3.3 An administration using top-loaded or sectionalized antennas shall supply information concerning the tower structure of the antennas. The appropriate equation in Section 1(b) or 1(c) of Attachment A of Appendix 1 should be employed to determine the vertical radiation characteristics of the antennas. Other equations may also be proposed by an administration for determining the vertical radiation characteristics of the antennas of that administration, subject to the agreement of the other administration.

Appendix 1

(to Annex 1)

Calculation of Directional Antenna Patterns

This Appendix contains the method for calculating radiation for directional antenna systems in order to determine the presence or absence of objectionable interference between stations in the two countries.

1. Definitions

The terms Theoretical Pattern, Expanded Pattern and Modified Pattern refer to directional antenna radiation patterns as defined in Attachment A to this Appendix.

2. Use of expanded patterns or modified patterns

The expanded pattern or the modified pattern shall be used for all stations with directional antenna systems for calculating values of field intensities, limits, contours and permissible values of radiation for the determination of the presence or absence of objectionable interference.

3. Coordination procedure for cases of reduced design tolerance

Assignments involving radiation patterns with reduced design tolerance as defined in Attachment A shall be coordinated between the administrations in advance of formal notification. In the coordination of such proposed assignments, the information required in Attachment B shall be submitted in addition to the information required for notification purposes in paragraph 5 below. Protection from objectionable interference from subsequent assignments (or proposals to modify the Plan) shall begin on the date this information is transmitted. The criteria for determining acceptable values of reduced tolerance of such proposals are defined in Attachment C which may be amended by exchange of letters directly between the administrations as prediction techniques improve. Attachment C also defines the time frame within which the coordination will be effected dependent upon the complexity of the system. If an objection to a proposal is filed within the time frame specified, the proposal shall not be notified until suitably revised and recoordinated, although protection from subsequent assignments shall be retained for up to 120 days pending revision.

4. Adjustment and maintenance of radiation patterns

The administrations shall ensure that the radiation emitted from directional stations does not exceed notified values of radiation (Expanded or Modified Patterns) in any direction toward the other country. At the time of initial adjustment, and as often as necessary thereafter, sufficient field strength measurements shall be made on each directional station to establish that it has been properly adjusted. In addition, each station shall follow a routine monitoring program whereby periodic measurements of pertinent array parameters (including field strength measurements if required by Attachment B) are made to demonstrate that the array is maintained within authorized values.

5. Notification of technical information

The description of the directional antenna notified using the appropriate part of Annex 3 shall include all technical data necessary to calculate the Theoretical Pattern, Expanded Pattern, or Modified Pattern. It shall also include five values of radiation and azimuth and vertical angle to permit verification of the pattern, as well as values of the theoretical RMS radiation and "Q".

Notification of an operation with a reduced "Q" shall be clearly identified and shall include additional information in accordance with Attachment B, or shall clearly identify, by reference, any additional information previously submitted.

Attachment A

Formulae for Calculation of Radiation from Directional Antenna Systems

1. Theoretical Pattern

$$E(\emptyset,\ominus)_{th} = \left| K \sum_{i=1}^{n} F_i \; f(\ominus)_i \; \overline{\left| S_i \cos \ominus \cos(\emptyset_i - \emptyset) + \psi_i \right|} \right|$$

$$E_{rss} = K \sum_{i=1}^{n} F_i^2$$

where

$E(\emptyset,\ominus)_{th}$ ..... is the theoretical inverse distance field radiation (mV/m) produced by the array at the horizontal angle $\emptyset$ measured from a reference azimuth and at the vertical angle $\ominus$ measured from the horizontal.

E_{rss} ..... is the theoretical root - sum - square of field intensities.

n ..... is the number of towers in the array.

K ..... is a pattern sizing constant related to the notified theoretical RMS radiation of the array.

F_i ..... is the ratio of the field produced by tower i, with respect to the field produced by a reference tower in the array.

S_i ..... is the spacing in electrical degrees of tower i from a reference point.

$\emptyset_i$ ..... is the horizontal angle measured from the reference direction clockwise to a line passing through the reference point and tower i.

ψ_i ..... is the electrical phase angle in degrees of the current in tower i with respect to the phasing of current in a reference tower.

G_i ..... is the height in electrical degrees of tower i.

$f(\ominus)_i$ ..... is the vertical radiation characteristic for tower i where sinusoidal current distribution is assumed.

(a) For a typical uniform cross-section vertical radiator,

$$f(\ominus)_i = \frac{\cos(G_i \sin\ominus) - \cos G_i}{(1 - \cos G_i)\cos\ominus}$$

(b) for a top-loaded vertical radiator,

$$f(\ominus)_i = \{\cos B \bullet \cos(A \sin\ominus) - \sin\ominus \bullet \sin B \bullet \sin(A \sin\ominus) - \cos(A + B)\} \div (\cos\ominus \bullet [\cos B - \cos(A + B)])$$

where:

A is the physical height of the radiator, in electrical degrees.
B is the difference, in electrical degrees, between the apparent electrical height G, (based on current distribution) and the actual physical height of the radiator.

G is the apparent electrical height: A + B.

See Figure 1.

(c) for a sectionalized vertical radiator,

$$\begin{aligned} f(\ominus)_i = {} & \{\sin\Delta \bullet [\cos B \cos(A \sin\ominus) - \cos G] \\ & + \sin B \bullet [\cos D \cos(C \sin\ominus) \\ & - \sin\ominus \bullet \sin D \bullet \sin(C \sin\ominus) \\ & - \cos\Delta \bullet \cos(A \sin\ominus)]\} \\ & + \{\cos\ominus \bullet [\sin\Delta \bullet (\cos B - \cos G) \\ & + \sin B \bullet (\cos D - \cos\Delta)]\} \end{aligned}$$

where: A is the physical height in electrical degrees, of the lower section of the radiator,

B is the difference between the apparent electrical height (based on current distribution) in electrical degrees of the lower section of the radiator and the physical height of the lower section of the radiator.

C is the physical height of the entire radiator, in electrical degrees,

D is the difference between the apparent electrical height of the radiator (based on current distribution of the upper section) and the physical height of the entire radiator. D will be zero if the sectionalized tower is not top-loaded.

G = A + B

$H = C + D$

$\Delta = H - A$

See Figure 2

(d) Alternative formulas for use in computing f(⊖) for top-loaded and sectionalized towers may be employed provided they are accompanied by a complete derivation and sample calculations.

2. Expanded Radiation Pattern

$$E(\emptyset,\ominus)_{exp} = 1.05\sqrt{E(\emptyset,\ominus)^2 th + Q^2}$$

Q is normally 0.025 g (⊖) E_{rss} or 10.0g(⊖)$\sqrt{P_{kW}}$

whichever is greater, where P_{kW} is the station power. A lower value of Q may be notified if the criteria for reduced design tolerance in Attachment B are met. One kW will be used for stations operating with less than one kW.

If antenna height (G) is less than 180 degrees, g(⊖) = f (⊖) where f(⊖) is calculated using the shortest tower in the array. If antenna height (G) is equal to or greater than 180 degrees,

$$g(\ominus) = \frac{\sqrt{f(\ominus)^2 + 0.0625}}{1.030776}$$

where f(⊖) is calculated using the shortest tower in the array.

Note: The vertical radiation formula for ~~high towers and the~~ shortest tower method for unequal towers apply only in the calculation of Q.

3. Modified Radiation Pattern

The Modified Pattern is a pattern developed by augmentation of the Expanded Pattern by increasing the Theoretical Pattern RMS radiation and/or by sector expansion by use of:

$$E(\emptyset,\ominus)_{Mod} = \sqrt{E(\emptyset,\ominus)^2 Exp + A\left[g(\ominus)\cos\frac{180\,dA}{S}\right]^2}$$

where

$E(\emptyset, \ominus)_{Exp}$ ..... is the Expanded Pattern radiation at a particular azimuth and elevation, before augmentation.

$E(\emptyset, \ominus)_{Mod}$ ..... is the radiation in the direction specified in $E(\emptyset,\ominus)_{Exp}$, after augmentation.

A = $E(\emptyset,\ominus)^2_{Mod} - E(\emptyset,\ominus)^2_{Exp}$ where $E(\emptyset,\ominus)_{Mod}$ and $E(\emptyset,\ominus)_{Exp}$ are fields in the horizontal plane at the main azimuth of augmentation ($\ominus$ = zero degrees).

S ..... is the angular range or span over which augmentation is applied, with the span centered over the main azimuth of augmentation. Overlap of spans of augmentation is permitted, in which case the overlapping augmentations are added in quadrature.

dA ..... is the absolute value of the horizontal angle between the azimuth at which the augmented pattern value is computed, and the main azimuth or center of span of augmentation; dA cannot exceed S.

2

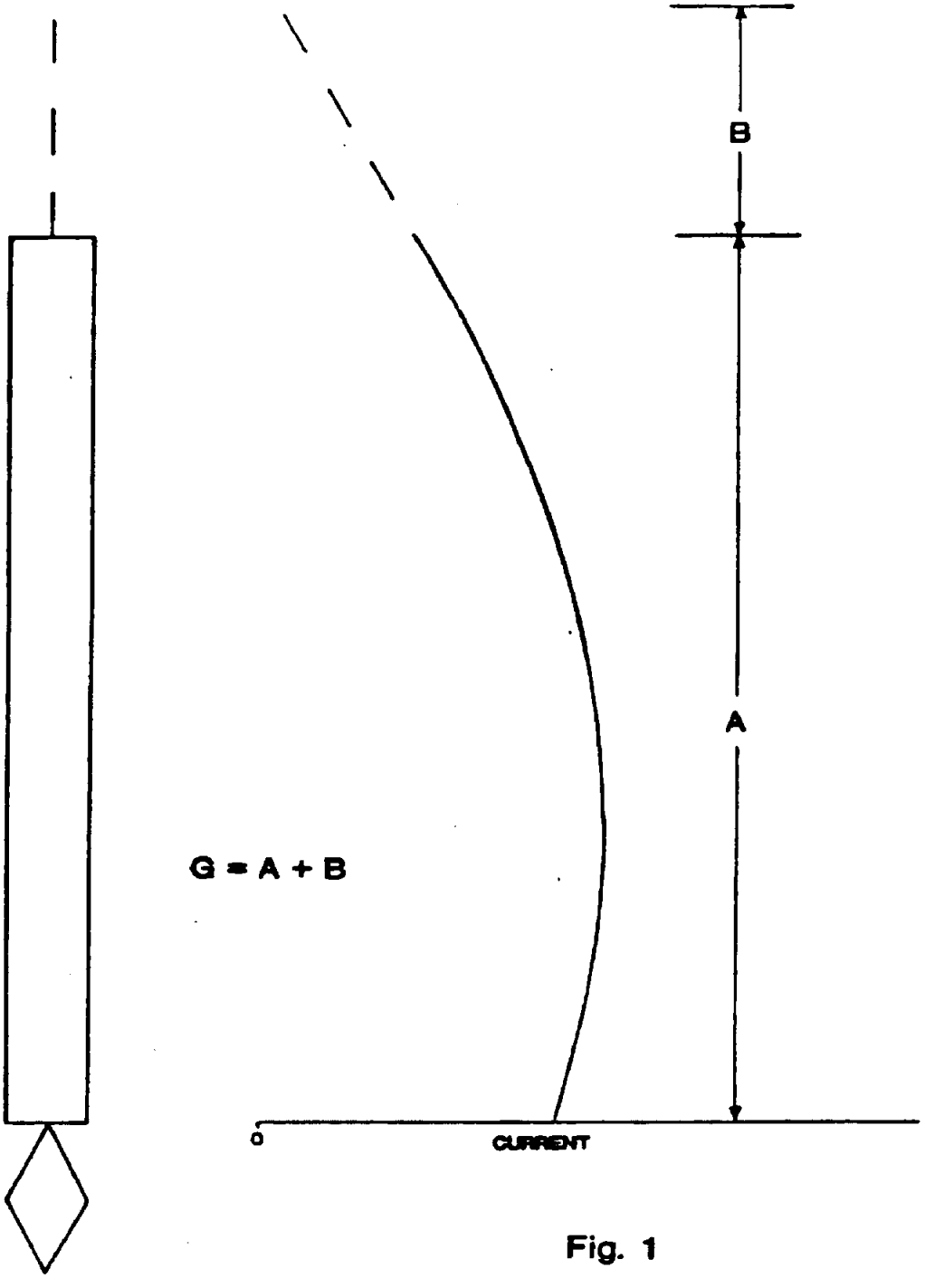


Fig. 1

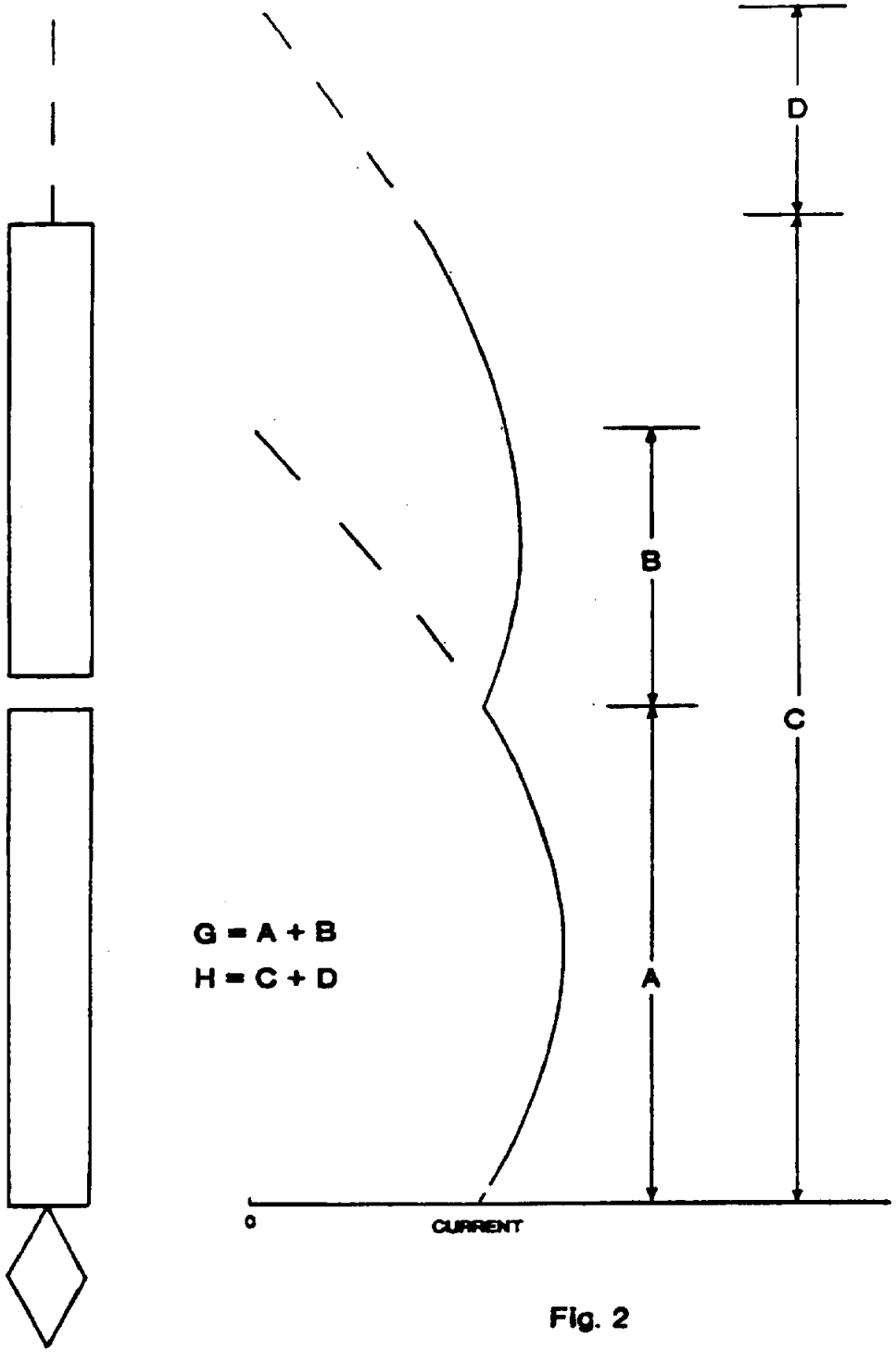


Fig. 2

Attachment B

Criteria for Reduced Design Tolerance

1. The normally notified parameters of the array, the reduced tolerance Q and the accuracy of the current and phase monitoring systems in detecting change shall be submitted, except as provided for in Attachment C.

2. Proposed radiation fields requiring consideration of a reduced tolerance (Q) below that provided for in Attachment A shall be approved only when the notifying administration has given assurance that the following precautions would be taken:

2.1 Site

The proposed antenna site must be suitable in all respects for establishment of the antenna system so that scattering or residual reradiation from structures on or near the site would be of sufficiently low magnitude so as not to preclude the adjustments of the measured radiation pattern to within the proposed pattern.

Topographical maps of sufficient scale to reveal detailed terrain features within the immediate vicinity of the proposed transmitter site shall be submitted. Aerial photographs, taken in clear weather at appropriate altitudes and angles or photographs taken in eight different directions from an elevated position on the ground, enabling clear identification of all structures in the vicinity of the proposed site shall be submitted.

In addition, a description must be included of the physical terrain, of all metal structures, towers, transmitting facilities, power lines, railroad tracks, etc. within 2 km of the site. On highly directional arrays, distances beyond 2 km shall be considered. The details of all proposed detuning procedures shall be provided.

2.2 Array

An analysis to demonstrate that the electrical and physical design of the array would ensure the necessary stability to maintain the notified pattern is required. Such designs would require specialized equipment and components. Moreover, the design should avoid electrical parameters known to present instability problems such as operating resistances between -5 and +5 ohms, antennas other than base fed, tower spacings less than 70 degrees, and ratios of ^{E}rss/^{E}RMS greater than 2.

The description of the ground system, including special features such as counter-poises if employed, would also be supplied.

A description should be included of any special methods employed to counteract or minimize the effects of climatic changes on the performance of the array.

2.3 Monitoring Systems and Adjustment of the Array

A description of the proposed current and phase monitoring system, including the electrical components and physical design details with a specific evaluation of the ultimate accuracy of the system in detecting changes in current amplitudes or phase relationships, specifically, that the phase/current sampling lines for the antenna monitor have identical physical and electrical characteristics, a low temperature/phase coefficient and have equal lengths subject to the same environmental conditions is required.

In particular, the manufacturer, model number, resolution, and accuracy of the antenna monitor shall be specified. Sample current devices used to feed the antenna monitor shall be installed at or near the current maximum of each tower of the array. A statement should be included specifying the tolerance limits within which the operation parameters (amplitude and phase) will be maintained.

An analysis to determine what levels of system deviation would cause radiation to exceed notified values in any direction toward the other country must be submitted.

The monitoring system must be capable of detecting system deviations equal to or less than half of those which would result in radiation which would exceed the proposed or notified values.

The proposed procedure for monitoring the radiation pattern in the field shall be described and the location of the monitoring points shall be specified. Monitoring points shall be located mainly at azimuths of minimum radiation (nulls) and shall have to adequately monitor the actual radiation pattern of the proposed station toward the other country. Based on the proof of performance, maximum limits of measured field strengths at these monitoring points should be established to assure maintenance of the actual radiation pattern within notified radiation limits toward the other country. The frequency of measurements at these monitoring points shall be at least weekly during the first month of station operation and at least monthly thereafter.

When monitoring point field strength or operating parameter values in excess of the tolerance limits described above are observed, the station concerned shall immediately reduce power or readjust the array to restore radiation to within authorized limits. Except for emergency operation, testing, maintenance or other temporary operation, full power operation shall not resume until the array has been properly readjusted.

2.4 Proofs of Performance

A complete proof of performance shall be conducted on all new installations and on existing installations changing radiation patterns including measurements taken in the nondirectional mode (to establish conductivity) as well as in the directional mode. Measurement point locations for both the nondirectional and directional modes shall be identical and located along a sufficient number or radials corresponding to pattern nulls and maximums (three or more radials per major lobe) to accurately establish the radiation pattern. Where practicable, measurements along each radial should be taken at intervals of approximately two-tenth km up to three km from the antenna excluding points obviously within the induction field of the antenna system, at intervals of approximately 1 km from three to ten km and at intervals of approximately 3 km from ten to 30 km from the antenna. The results should be carefully analyzed utilizing the ground wave field strength curves from Figure 2.1 of Chapter 2.

Attachment C

Guidelines for the Co-ordination of Proposed AM Broadcasting Stations Involving Reduced Design Tolerance

1. Time Frame to Effect Co-ordination

Except for systems rated as "slightly below standard tolerance", the time frame to respond may vary from 60 to 150 days depending on the complexity of the proposed system. A method to rate systems by degree of complexity shall be developed. In the meantime, the administration submitting the proposal will estimate the time required to reply. This estimated time period may be extended by mutual consent at the request of the other administration if further information is required or if the extent of study required has been underestimated.

2. Submission of Information

Except for systems rated as "slightly below standard tolerance", the information referred to in attachment B paragraph 1 shall be transmitted.

3. Determination of Acceptable Values of Reduced Tolerance

In cases involving values of radiation less than those provided by the expanded pattern, expected values of radiation above theoretical radiation values shall be calculated using the two computer routines currently used in both administrations which calculate "stability radiation patterns" for a given variance of phase angles and field ratios. The values of variation used in the routines shall be at least twice the expected resolution of the antenna monitoring system. For systems rated "slightly below standard tolerance", the values of variation will be one degree in phase and one per cent in field ratios. Grounds exist for objection whenever using either routine, the resultant value of radiation in the pertinent directions exceeds that notified.

4. Systems Slightly Below Standard Tolerance

A system is considered slightly below standard tolerance if the reduced quadrature component Q in the horizontal plane is less than $10\sqrt{P_{kW}}$, but greater than $0.025\ E_{rss}$, as these terms are defined in Attachment A, and there would be no interference calculated with a one degree variation in phase and a one per cent variation in field ratios. These systems would be expected to be sited at locations relatively free from sources of re-radiation, to have adequate precautions taken to minimize effects of temperature variation, and to undertake satisfactory monitoring. However, the approval of the system and the assurance of maintenance within tolerance shall be the responsibility of the notifying Administration only and the submission of the information referred to in attachment B will not be required. The data specified in Part II of Annex 3, plus the reduced Q, shall be referred at least 30 days in advance of notification. If

the administration receiving the proposal does not concur with the "slightly below standard tolerance" rating, it shall advise the notifying administration by telex or telephone, providing the reason for its opinion and requesting a different rating. If the notifying administration is unable to show that the "slightly below standard tolerance" rating is appropriate, it shall: provide information as in Attachment B, or provide a revision to make the rating appropriate or withdraw the proposal.

Annex 2

Criteria Used to Determine when the Services of the other Administration are Affected

1. Standardized parameter values

1.1 A 1 kW station power;

1.2 A non-directional antenna with an electrical height of 90 degrees;

1.3 A characteristics field strength of 310 mV/m at 1 km;

1.4 Standardized co-channel separation distance between allotment areas of 500 km.

2. Adjacent channel criteria

In the application of Article 6 and Section 5.2.1 of Article 5, an administration proposing to bring into use an assignment on an allotted channel in a border area shall seek the agreement of the other administration if the field strength produced by the proposed assignment within the neighbouring adjacent channel allotment area of the other administration exceeds the daytime nominal usable field strength reduced by the applicable protection ratio expressed in dB, as prescribed in Sections 3.5 and 3.6 of Annex 1, respectively.

3. Use of non-standardized parameters on allotted channels

In the application of Sections 5.1.2 and 5.2.1 of Article 5, an administration is affected if the skywave or groundwave field strength in any part of its allotment area (500 km from the border or beyond) on the same channel, calculated using notified characteristics, exceeds the field strength that would result from a station using standardized parameters located at the standardized distance from the allotment area being considered for protection. Additionally, the 25 μV/m daytime groundwave contour shall not extend further into the other country than would the 25 μV/m contour of a standardized parameter station located at any point along the border.

4. Use of non-allotted channels - Protection of allotment areas

In the application of Section 5.2.2 of Article 5 of the Agreement, an administration is considered to be affected if the skywave or groundwave field strength in any part of its co-channel allotment area, calculated using notified characteristics, exceeds the E_{nom} reduced by the appropriate protection ratio. For groundwave interference, the calculation shall be made using the Atlas of Ground Conductivity. However, in the case of sea or mixed paths, the groundwave field strength produced at the boundary of the allotment area shall not exceed

the field strength that would be produced by a station with standardized parameters located at the standardized distance, using the uniform conductivity value of 5000 mS/m.

5. General provisions

5.1 In no case shall the station power of a broadcasting station exceed 10 kW.

5.2 The effect of each interfering transmitter shall be evaluated separately, and interference from other transmitters shall not be taken into account in determining the maximum permitted signal strength from each transmitter.

5.3 When the E_{nom} contour of a broadcasting station extends beyond the border of the country, the actual field strength calculated at the border shall be used to evaluate the permitted interference levels, using the appropriate protection ratios.

5.4 Land areas, which include islands of the same country within the contour of the nominal usable field strength (E_{nom}) of broadcasting assignments shall be protected.

Annex 3

Data for the Notification of Broadcasting Assignments in Application of Article 5, Section 5.2

Part I

Basic Information to be Notified

For the purpose of this Agreement, it is acceptable to notify using computer printout or files as long as the information below is provided in a mutually agreed format. To facilitate electronic data exchange, the numbering scheme followed here is made to match the Ottawa 1984 Agreement.

Item No.*

01 **Administration**

Indicate the name of the administration;

02 **Assigned frequency (kHz)**

03 **Name of transmitting station**

Indicate the name of the locality or the name by which the station is known;

04 **Call sign**

08 **Country**

09 **Geographical coordinates of the transmitting station**

Indicate the geographical coordinates (longitude and latitude) of the transmitting antenna site in degrees, minutes and seconds;

---

* Some item numbers are not used throughout the annex in order to correspond with the form used for the Ottawa 1984 Agreement.

11 **Indicate the reason for the notification:**

(a) New assignment;

(b) Modification of the characteristics of an existing assignment;

(c) Cancellation of an assignment.

13 Indicate the date of bringing into service or the date of cessation of operation;

DAYTIME OPERATION

21 **Station power (kW)**

Indicate the carrier power supplied to the antenna for daytime operation;

25 **r.m.s. value of radiation (mV/m at 1 km) for daytime station power**

26 **Antenna type**

Indicate here the type of antenna used for daytime operation. Use the symbols as follows:

A - Simple omnidirectional antenna;

B - Directional antenna (complete Part II);

1 - Top-loaded omnidirectional antenna (complete Part IV);

2 - Sectionalized omnidirectional antenna (complete Part IV).

27 **Simple vertical antenna electrical height**

Indicate here the electrical height, in degrees, for a simple vertical antenna in use for daytime operation;

NIGHTTIME OPERATION

31 **Station power (kW)**

Indicate the carrier power supplied to the antenna for nighttime operation;

35 **r.m.s. value of radiation (mV/m) at 1 km) for nighttime station power**

36 **Antenna type**

Indicate the type of antenna used for nighttime operation (use the symbols in item No. 26 above);

37 **Simple vertical antenna electrical height**

Indicate here the electrical height, in degrees, for a simple vertical antenna in use for nighttime operation;

44 **Remarks**

Indicate here any necessary additional information, such as the identification of the synchronized network to which the station belongs. If shared time operation is intended, indicate in this box and identify the other assignment involved.

FORM FOR THE APPLICATION OF ARTICLE 5 OF THE AGREEMENT
CHARACTERISTICS OF A REGION 2 BROADCASTING STATION IN THE BAND 1605-1705 kHz

PART I GENERAL INFORMATION

01 Administration | FORM No. | Date

Assigned frequency (kHz)		02	
Transmitting Station	Name of the station	03	
	Call sign	04	
Country		08	
Geographical coordinates of the transmitting station		09	W ° ' " N ° ' "

11 a) New assignment ☐ b) Modification of an assignment ☐ c) Cancellation of an assignment ☐

13 Date of bringing into service or cessation of operation Y M D

STATION PARAMETERS	DAYTIME OPERATION	NIGHT-TIME OPERATION
Station power (kW)	21	31
r.m.s. value of radiation for station power (mV/m at 1 km)	25	35
Antenna type	26	36
Simple vertical antenna electrical height (degrees)	27	37

44 Remarks

Part II

Information on Directional Antennas Consisting of Vertical Conductors

Instructions for completing the form

Variable No.
or Box No.

01 Indicate the name of the transmitting station.

02 Country.

03 Indicate the hours of operation for which the given characteristics of the antenna are applicable. The symbols D or N shall be used to indicate that the station operates for the daytime or night-time period respectively. When the same operation is used day and night, enter D and N.

04 Indicate the total number of towers constituting the array.

Column No.

05 Indicate the serial number of towers, as they will be described in columns 06 to 12.

06 Indicate here the ratio of the tower field to the field from the reference tower.

07 Indicate here, in degrees, the positive or negative difference in the phase angle of the field from the tower with respect to the field from the reference tower.

08 Indicate in degrees the electrical spacing of the tower from the reference point, defined in column 10.

09 Indicate, in degrees from True North, the orientation of the tower from the reference point indicated in column 10.

10 Define the reference point as follows:

0 = where the spacing and orientation are shown with respect to a common reference point which is generally the first tower.

1 = where the spacing and orientation are shown with respect to the previous tower.

Column No.

11 Indicate the electrical height (degrees) of the tower under consideration.

12 **Tower structure**

Indicate the structure of each tower using the following code:

0 = simple vertical antenna
1 = top-loaded antenna
2 = sectionalized antenna

Codes 1 and 2 are used in Part IV to indicate the characteristics of the various structures. They are also used for the identification of the appropriate formula for vertical radiation in Appendix 1 to Annex 1.

Variable No.
or Box No.

14 r.m.s. value of radiation (mV/m at 1 km)

15 Type of pattern: T = theoretical
E = expanded
M = augmented (modified expanded).

16 Special quadrature factor for expanded and augmented (modified expanded) patterns in mV/m at 1 km (to replace the normal expanded pattern quadrature factor when special precautions are taken to ensure pattern stability).

17 Supplementary information.

FORM FOR THE APPLICATION OF ARTICLE 5 OF THE AGREEMENT

CHARACTERISTICS OF A REGION 2 BROADCASTING STATION

IN THE BAND 1605-1705 kHz

PART II

DISCRIPTION OF A DIRECTIONAL ANTENNA CONSISTING OF VERTICAL CONDUCTORS

Form No. | Date

(01) Name of transmitting station | (02) Country | (03) Hours of operation | (04) Total number of towers

(05) Tower No	(06) Tower field ratio	(07) Phase difference of the field (degrees)	(08) Tower spacing (electrical degrees)	(09) Tower orientation (degrees)	(10) Definition point indicator	(11) Height of tower (electrical degrees)	(12) Tower structure
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

(14) r.m.s. value of theoretical radiation	(15) Type of pattern (T, S or M)	(16) Special quadrature factor
mV/m at 1 km		mV/m at 1 km

(17) SUPPLEMENTARY INFORMATION

Part III

Additional Information for Directional Antennas with Augmented (Modified Expanded) Patterns

1. Part II contains the information for directional antenna systems operating with theoretical and expanded patterns. However, some stations operate with augmented (modified expanded) directional antenna patterns. In these cases, additional calculations are performed, once the expanded radiation is calculated, to determine the radiation from the augmented (modified expanded) directional antenna pattern. Part III contains the additional parameters required for augmented (modified expanded) patterns.

2. If Part III is submitted, a corresponding Part II must also be submitted.

3. Part III should be submitted only if Box 15 of Part II contains the symbol "M" for "augmented (modified expanded)".

Box No.

01 Indicate the name of the transmitting station.

02 Country.

03 Indicate the hours of operation for which the antenna characteristics given are applicable. The symbols D or N shall be used to indicate that the station operates for the daytime and night-time period respectively. When the same operation is used day and night, enter D and N.

04 Indicate the total number of augmentations which are used. It must be 1 or greater than 1.

Column No.

05 Indicate the serial number of the augmentations, as they will be described in columns 06, 07 and 08 (see section 2 of Attachment A, Appendix 1 to Annex 1).

Box No.

06 Indicate the radiation at the central azimuth of augmentation. This value should always be equal to or greater than the value from the theoretical pattern.

07 Indicate the central azimuth of augmentation. This is the centre of the span.

08 Indicate the total span of the augmentation. Half of the span will be on each side of the central azimuth of augmentation. Spans may overlap; if so, augmentations are processed clockwise according to the central azimuth of augmentations.

09 Supplementary information. Indicate any supplementary information concerning augmented (modified expanded) patterns. If a supplementary sheet has been used for further augmentations, please indicate in this box.

FORM FOR THE APPLICATION OF ARTICLE 5 OF THE AGREEMENT

CHARACTERISTICS OF A REGION 2 BROADCASTING STATION IN THE BAND 1605-1705 kHz

PART III

ADDITIONAL INFORMATION FOR DIRECTIONAL ANTENNAS WITH AUGMENTED (MODIFIED EXPANDED) PATTERNS TO BE SUBMITTED WHENEVER THE SYMBOL M IS ENTERED IN PART II BOX 15

Form No. | Date

(01) Name of transmitting station | (02) Country | (03) Hours of operation | (04) Total number of augmentations

(05) Augmentation No	(06) Radiation of central azimuth of augmentation (mV/m at 1 km)	(07) Central azimuth of augmentation (degrees)	(08) Total span of augmentation (degrees)
01			
02			
03			
04			
05			
06			
07			
08			
09			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

(09) SUPPLEMENTARY INFORMATION

Supplementary Information for Top-Loaded or Sectionalized Towers used for Omnidirectional and Directional Antenna Systems

1. Where an omnidirectional antenna is top-loaded or sectionalized, a 1 or a 2 will have been entered in Part I Box 26 and/or 36. Proceed as for a single tower of a directional antenna.

2. When an antenna tower of a directional antenna is either top-loaded or sectionalized, column 12 of Part II will contain either a 1 for top-loaded or 2 for sectionalized. This numeral describes the particular type of top-loaded or sectionalized antenna used, as described below:

Box No.

01 Name of the station.

02 Country.

03 Indicate the hours of operation for which the given characteristics of the antenna are applicable. The symbols D or N shall be used to indicate that the station operates for the daytime or night-time period respectively. When the same operation is used day and night, enter D and N.

Column No.

04 Tower number.

Columns 5 to 8 contain the values of four characteristics of the elements constituting a top-loaded or sectionalized antenna. Each of these columns may contain a figure representing the value of a given characteristic as described below:

05	**Code used in Col. 12** Part II	**Description of the characteristic for which a value is given in the column. (These values are used in the equations given in Appendix 1 of Annex 1).**
	1	Electrical height of the antenna tower (degrees).
	2	Height of lower section (degrees) dipole (degrees).

06	**Code used in Col. 12** (Part II)	**Description of the characteristics for which a value is given in the column. (These values are used in the equations given in Appendix 1 of Annex 1).**

	1	Difference between apparent electrical height (based on current distribution) and actual height (degrees).
	2	Difference between apparent electrical height of lower section (based on current distribution) and actual height of lower section (degrees).
07	**Code used in Col. 12** Part II	**Description of the characteristic for which a value is indicated in the column. (These values are used in the equations contained in Appendix 1 of Annex 1).**
	1	Blank
	2	Total height of antenna (degrees)
08	**Code used in Col. 12** Part II	**Description of the characteristics for which a value is indicated in the column. (These values are used in the equations entered in Appendix 1).**
	1	Blank
	2	Difference between apparent electrical height (based on current distribution) of the total tower and the actual height of the total tower (degrees).

FORM FOR THE APPLICATION OF ARTICLE 5 OF THE AGREEMENT

CHARACTERISTICS OF A REGION 2 BROADCASTING STATION IN THE BAND 1605-1705 kHz

PART IV

SUPPLEMENTARY INFORMATION FOR TOP-LOADED OR SECTIONALIZED TOWERS USED FOR:

A) DIRECTIONAL ANTENNA SYSTEMS FOR TOWERS ENTERED IN PART II AS TOP-LOADED OR SECTIONALIZED (COLUMN 12), OR

B) NON-DIRECTIONAL ANTENNA TOWERS ENTERED IN PART I AS TOP-LOADED OR SECTIONALIZED (COLUMN 26 OR 36.)

Form No. Date

01 Name of transmitting station

02 Country

03 Hours of operation

04 Tower number	05 A	06 B	07 C	08 D

Annex 4

Allotment Plan for the Broadcasting Service in the Band 1605-1705 kHz

4.1 Within the standardized distance from the border, the allotted channels are:

- for Canada, channels 1, 3, 5, 7 and 9.

- for the U.S.A., channels 2, 4, 6, 8 and 10.

Beyond the 500 km standardized distance, both administrations are allotted all ten channels.

The border is defined in Section 1.1.4 of Annex 1.

4.2 The following table gives the relationship between channel number and frequency.

Channel number	Corresponding frequency to be assigned (kHz)
1	1610
2	1620
3	1630
4	1640
5	1650
6	1660
7	1670
8	1680
9	1690
10	1700