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Spectrum Management and Telecommunications Policy
Broadcasting Procedures and Rules

Part 3: Application Procedures and Rules for FM Broadcasting Undertakings

Contains the following Amendments:

Canada

Aussi disponible en français - RPR, partie 3

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SECTION A INTERNATIONAL AGREEMENTS

Within 320 km of the Canada-United States border, FM broadcasting allotments and assignments in Canada are subject to the terms of the ***"Agreement Between the Government of Canada and the Government of the United States of America Relating to the FM Broadcasting Service and the Associated Working Arrangement"*** of 1991. The Agreement was amended in June 1997 according to the terms of the "***Changes to the 1991 Working Agreement Between the Government of Canada and the Government of the United Sates of America Relating to the FM Broadcasting Service***".

The working arrangement between the Federal Communications Commission (FCC) and the Department states the basis upon which both Administrations propose to consider responses to border area allotments and assignments. It also defines technical criteria for the notification of FM allotments and assignments. Acceptance of such allotments or assignments shall be obtained from the United States before authorization to implement the Canadian proposals is granted.

It should be noted that applications for new assignments or changes in facilities of existing Canadian stations, within 320 km of the common border, have to meet both domestic and bilateral criteria.

It should also be noted that under the revised agreement, US LPFMs are defined with an ERP of 250 Watts and an interfering contour (34 dBμV/m) whose maximum extension is 60 km. The Department has decided to maintain the existing definitions for Canadian LPFMs per section D.

SECTION B PREPARATION OF TECHNICAL SUBMISSIONS SUPPORTING APPLICATIONS FOR FM BROADCASTING STATIONS USING PRIMARY ASSIGNMENTS

B-1 APPLICATION REQUIREMENTS

B-1.1 Requirements

B-1.1.1 This Section outlines the departmental forms that shall be submitted when applying for a primary FM assignment other than low and very low power. It also applies to applications where Subsidiary Communication Multiplex Operation (SCMO) is proposed.

B-1.1.2 An application for a broadcasting certificate shall be made on departmental **Form IC 2358,** ***"Application for a Broadcasting Certificate FM (Frequency Modulation) New Undertaking"***. An application for changes to an existing station requires the submission of **Form IC 2361,** ***"Application for Broadcasting Certificate FM - Change of Facilities"***. An application form for a broadcasting licence is obtainable from the Canadian Radio-television and Telecommunications Commission (CRTC). The two applications shall be filed simultaneously.

B-1.1.3 All necessary forms may be obtained from the departmental web site or any Regional or District Office. Addresses for Regional and District Offices are provided in **Radiocommunication Information Circular No. 66** ***"Addresses and Telephones Numbers of Regional and District Offices"***.

B-1.1.4 A complete technical submission shall include the following:

(a) two copies of the appropriate **Form IC 2358** or **IC 2361**;

(b) four copies of an engineering brief in suitable loose-leaf binders with identifying labels. The brief should be carefully prepared and include all the detailed technical information as outlined in Section B-2;

(c) two copies of the departmental **Form IC 2374,** ***"Notice of Retention of a Broadcasting Engineering Consultant"*** (refer to **BPR-1,** Section 1.2);

(d) One copy of departmental **Form IC 2586EA,** ***"Preliminary Environmental Information, Municipal/Land-Use Consultation and Aeronautical Site Clearance Attestation"***.

(e) one reproducible copy of a map showing the pertinent field strength contours (refer to **BPR-1,** Section 3) and another one showing the "comparative contours" for change of facilities applications or AM to FM conversions.

B-1.1.5 The applicant shall comply with the applicable Transport Canada and Nav Canada requirements for aeronautical obstruction clearance and land use and/or construction proposals. Transport Canada **Form 26-0427** entitled ***"Aeronautical Obstruction Clearance Form"*** and Nav Canada form ***"Land Use Proposal Submission Form"*** must be submitted for clearance to the district office of Transport Canada and Nav Canada. The necessary forms and submission information may be obtained from the respective district offices.

B-2 ENGINEERING BRIEF SECTIONS

The order of material presented in the engineering brief should be maintained as listed below to simplify processing in the Department. The metric system known as SI (Système International) shall be used throughout the engineering brief.

B-2.1 Title Page

The title page should include the submission title, project or reference number, date, name and address of applicant, name of consultant and location of the station. The following parameters of the proposal shall also be listed: frequency, maximum and average effective radiated power (ERP) and effective antenna height above average terrain (EHAAT).

B-2.2 Table of Contents (Index)

To be prepared as a cross-reference to pages and sections of the brief.

B-2.3 Summary Sheet

To be prepared as per **Appendix 2** attached.

B-2.4 Main Section of Brief

B-2.4.1 Introduction - A general statement of the purpose of the brief in relation to the application, including the principal centre(s) to be served with the proposed grade of service.

B-2.4.2 Discussion - There should be a discussion on the design considerations necessary to accomplish the applicant's objectives, including the location of site, and choice of frequency (here the consultant should be guided by the requirements set forth in Section C).

B-2.4.3 Interference Analysis - An analysis of interference to related station(s) and allotment(s) is required as detailed in Sections C-1, C-5 and C-6.

B-2.4.4 Assumptions and Sources of Information - List and explain all assumptions and sources of information used in compiling the engineering brief.

B-2.4.5 Transmitter - The intent to use a type-approved transmitter(s) in accordance with ***Technical Standards and Requirements for FM Broadcasting Transmitters (BETS-6)*** shall be made clear, either by specifying the make, model and type-approval number, or by a statement that the transmitter will be type-approved prior to on-air operation. The rated power of the transmitter shall be specified.

B-2.4.6 Description of Antenna System

The following details are required:

Antenna - Manufacturer, type, number of bays (if applicable) power gain and vertical radiation pattern. For directional antennas, the horizontal pattern is also required.

Transmission Line - Manufacturer, type, length in metres, and efficiency.

Combiner - Manufacturer and operational characteristics.

Polarization - Horizontal, vertical, circular or elliptical polarization as proposed.

B-2.4.7 Ancillary Equipment - All other equipment shall be listed.

B-2.4.8 Determination of the location of Service Contours - The location of service contours shall be determined by the method as detailed in Section C-3 and Section 3 of **BPR-1**. The contours to be determined are: 3 mV/m (70 dBμV/m) and 0.5 mV/m (54 dBμV/m) .

In cases where proposed FM stations are located in areas of mountainous terrain or in the proximity of other natural obstacles, an additional analysis will be necessary to establish more realistic locations for the service contours. In preparing contour maps for these cases, the contours as determined from the standard method (refer to Section C-3) above should also be shown on the map with broken lines.

B-2.4.9 Special Analyses and Undertakings Relative to Interference to Other Broadcast Services - Analyses shall be submitted with appropriate undertakings made in regard to all potential interference situations with other broadcasting stations as a result of the operation of the proposed FM facility. The following are some examples of interference possibilities with other broadcasting services which should be explored for each proposal:

(a) "Ghost" reflections of television signals from the new FM antenna structure (refer to Section C-7, **BPR-4**);

(b) distortion of AM radiation patterns by the new FM tower located in the vicinity of an AM antenna array;

(c) isolation of AM, TV and FM transmissions, where such services are co-located;

(d) interference to television service due to harmonics of the FM operation (Section C-6.1);

(e) interference to TV channel 6 from broadcasting stations on FM channels 201 to 220 (Section C-6.2);

(f) intermodulation with other broadcasting services in the vicinity of the proposed station (Section C-5);

(g) assessment and control of maximum field strengths for FM broadcasting stations: the 100 and 115 dBμV/m contours shall be determined and shown on a suitable map (Section C-5);

(h) the use of third or fourth adjacent channels allotted to the same centre (Section C-1.6);

(i) interference to low power and very low power FM assignments. Although these are unprotected assignments, they should be notified of potential interference to their service. Such notification shall be made by letter to the affected broadcaster with a copy forwarded to the Department.

Note: The potential interference under (a) shall be assessed when the proposed antenna structure is in excess of 30 metres and within a distance of 500 metres of a TV station.

B-2.4.10 RF Exposure Analysis - The applicant shall provide an RF exposure analysis (refer to **BPR-1**, Section 8.2).

B-2.4.11 Environmental Assessment - The applicant shall comply with the requirements of the environment assessment procedure of **BPR-1**, Section 8.1.

B-2.4. 12 Notification to Municipalities/Land-Use Authorities - The applicant shall notify the municipalities/land-use authorities.

B-2.5 Antenna Location and Diagrams

The location of all structures and antenna sites that are of relevance to the analyses undertaken for the purpose of the application shall be provided in the engineering brief. Furthermore, should the actual location differ from that specified in the brief, the Department shall be informed accordingly.

An elevation diagram of the structure and transmitting antenna as per **Appendix 3** and a block diagram of major units of the transmitting system is to be included in the engineering brief.

B-2.6 Vertical Radiation Pattern

The vertical radiation pattern of the antenna (relative field versus degrees below the horizontal) shall be plotted in rectangular coordinates from 0 to 90° below the horizontal.

B-2.7 Horizontal Radiation Pattern

If a directional antenna is employed, the horizontal radiation pattern is required. True north and r.m.s. field shall also be clearly indicated on polar plots of the horizontal radiation pattern. If the application is approved, the pattern shall be certified by means of range tests, scale-modelling or other recognized engineering methods. The margin of accuracy shall also be provided. It is the responsibility of the applicant to ensure that the antenna selected for installation, as certified by the manufacturer, meets all the requirements of the proposed broadcasting undertaking.

Note: Title blocks shall be placed on radiation patterns for directional antenna systems since in some instances, for areas along the Canada-USA border, it may be necessary to submit this material separately when notifying the assignment to the US Federal Communications Commission (FCC). The title block shall include the identification of the station, frequency, maximum and average ERP and date.

B-2.8 Profiles of Ground Elevation

For the preparation of profile radials, refer to "Contour Determination" in Section C-3.

B-2.9 Maps

B-2.9.1 A map (scale 1:50,000) shall be provided with the proposed antenna site marked thereon and its geographical co-ordinates (latitude and longitude) shown.

B-2.9.2 A map showing the service area contours as required in Section B-2.4.8, shall be provided. For further details concerning the preparation of maps for engineering briefs, refer to Section 3 ***"Preparation of Field Strength Contour Maps"*** in **BPR-1**.

B-2.9.3 Maps shall be based on the NAD83 datum.

B-3 APPLICATIONS FOR MULTIPLEX OPERATIONS

B-3.1 Application Requirements

An FM broadcasting undertaking wishing to initiate Subsidiary Communication Multiplex Operations (SCMO), including Radio Broadcast Data System (RBDS) operations, shall submit the following information to the Department for an amendment to the broadcasting certificate.

(a) a description of the programme source and the method of modulating the multiplex subcarrier(s);

(b) the frequency or frequencies of the multiplex subcarrier(s);

(c) a description of the means used to ensure that the technical requirements are being adequately met;

B-3.2 SCMO applications that are not related to broadcasting and have provisions for third-party communications services are authorized under the ***Radiocommunication Act*** and ***Radiocommunication Regulations***. These are subject to authorization fees. The policy provisions for the use of multiplex services are outlined in the spectrum policy document entitled ***"Spectrum Policy Provisions to Permit the Use of Digital Radio Broadcasting Installations to Provide Non-Broadcasting Services (SP-1452)"***. The authorization procedure is published in the **Client Procedures Circular CPC-2-1-03** entitled: ***"Licensing Radiocommunication System Using FM Subsidiary Communication Multiplex Operation (FM/SCMO) or Digital Radio Broadcasting (DRB) Installations"***.

B-4 TECHNICAL OPERATION OF BROADCAST TRANSMITTER PLANTS

A description of the technical equipment in compliance with the minimum requirements specified in Section 5.3 of **BPR-1** shall be submitted prior to on-air tests for the approved facility. If unattended operation is proposed, a statement that the unattended operation meets the minimum requirements of Section 5.3 of **BPR-1** is required.

B-5 ON-AIR TESTING PROCEDURE

When the construction of the authorized facilities is complete, notice of on-air testing shall be given to the District Office Manager at least three weeks (unless otherwise specified in the letter of authority) prior to transmission tests. Departmental permission from the District Office is required for testing.

During on-air tests, identification of the station shall be made preferably at fifteen minute intervals, giving as a minimum the call sign, frequency and location of the station. In the case of re-broadcasting stations without capability to originate the aforementioned information, the broadcaster will be responsible for making the public aware that the new station is being tested. As an example, a notice could be placed in the local press which would explain that the broadcaster should be contacted in the event of interference difficulties that might develop. The broadcaster shall implement any instruction given by departmental representatives at the district, regional or headquarters level.

The required scope and duration of such on-air emission tests will depend to a large extent on the potential for interference that might be caused to existing broadcasting stations or other radio services. Such details of the testing shall be agreed upon with the local District Office Manager shortly after the issuance of the letter of authority.

Following successful on-air tests, the applicant shall certify to the Department under the signature of a qualified licensed professional engineer that the station is ready to commence operation in accordance with the approved technical submission. Permission shall then be requested to commence normal broadcasting operations.

B-6 FM/NAV/COM COMPATIBILITY

B-6.1 Preamble

Aeronautical radio-navigation and communications (NAV/COM) services in North America are assigned in the frequency band 108 - 137 MHz, upper adjacent to the FM band. As a result, there exists a potential for interference to these aeronautical services.

B-6.2 Types of Interference Mechanisms

B-6.2.1 Type A interference - normally radiated by FM stations.

(a) Type A_1 - spurious emissions generated by a single transmitter or intermodulation products generated by multiplexed transmitters, falling in the aeronautical frequency bands.

(b) Type A_2 - FM sideband energy falling in the aeronautical frequency bands (only from FM transmitters operating near 108 MHz).

B-6.2.2 Type B interference - normally generated in the aeronautical receiver.

(a) Type B_1 - intermodulation generated as a result of two or more FM signals whose product falls on a wanted RF channel in use by the aeronautical receiver. Note that at least one FM signal must be large enough to drive the receiver into non-linearity.

(b) Type B_2 - overload of the RF section of an aeronautical receiver due to one or more FM signals, leading to desensitization.

Protection criteria are found in **Appendix 8.**

B-6.3 Interference Analysis

B-6.3.1 Each application for an FM transmitting undertaking (primary or secondary assignment) is subject to an FM/NAV/COM compatibility analysis. Depending on the result, the following may take place:

(a) if no interference is predicted, it is presumed that compatibility exists,

(b) if the potential for interference is low, a conditional technical acceptance is granted subject to:

- monitoring during on-air testing of the station, or occasionally,

- flight tests during on-air testing of a station in complex electromagnetic environments,

(c) if the potential for interference is high, the engineering brief is considered not acceptable and the application is returned.

B-6.3.2 When conditional technical acceptance is given, the applicant is notified accordingly. If the application is approved by the CRTC (also conditionally), the letter of authority issued by the Department will specify the testing and monitoring that will necessitate the broadcaster's full cooperation. The letter of authority will also specify the period required as notice to the Department before the on-air testing takes place. Adherence to the terms of the notice is mandatory.

B-6.3.3 The FM station shall test at the authorized parameters and pass the monitoring and/or flight tests before it is authorized to start normal scheduled broadcasting. However, if interference is detected, remedial measures shall be taken to eliminate the interference. If interference is not eliminated, authority for scheduled on-air broadcasting will be denied.

B-6.3.4 If interference to NAV/COM facilities is caused by the FM station during scheduled on-air broadcasting, the holder of the broadcasting certificate will take remedial measures to eliminate the interference, even to the extent of closing down the station, if so requested by the Department.

B-6.4 Interference Prediction Model

Compatibility analyses and interpretation of the results are performed by departmental staff and NavCan.

The Department has prescribed protection criteria and developed an interference prediction model (**Appendix 8**) that is used for FM and aeronautical frequency assignments.

SECTION C TECHNICAL REQUIREMENTS FOR THE ESTABLISHMENT OF FM BROADCASTING STATIONS USING PRIMARY ALLOTMENTS

C-1 ALLOTMENT PRINCIPLES

This Section pertains to the technical requirements for the allotment and protection of FM channels and for the prediction of coverage for FM broadcasting stations in Canada.

C-1.1 Definitions

C-1.1.1 Allocation

The International Telecommunications Union (ITU) uses the word 'allocation' in reference to the provision of a band of frequencies for a particular purpose or service.

C-1.1.2 Allotment

An 'allotment' is the provision of a specific channel for a particular community. Where **BPR-3** make reference to the "Table of Allotments" it should be understood that this refers to channels identified in the department's database with the banner "AL". The Department no longer publishes a separate document with this information.

C-1.1.3 Assignment

An 'assignment' is the authorized use of an allotment by an FM station.

C-1.1.4 Primary Assignment

A primary assignment is a protected assignment authorized or operating on an allotment with one of the classes listed in Section C-1.1.14, i.e., A1, A, B1, B, C1 or C.

C-1.1.5 Secondary Assignment

A secondary assignment is an unprotected assignment authorized or operating on a channel in accordance with Sections E or G, i.e., LPFM or VLPFM.

C-1.1.6 Effective Radiated Power (ERP)

The effective radiated power (ERP) is the product of the transmitter output power, the transmission line (and combiner) efficiency and the power gain of the antenna relative to a half-wave dipole.

C-1.1.7 Effective Height of the Antenna above Average Terrain (EHAAT)

The effective height of the antenna above average terrain (EHAAT) is the average of the antenna heights above the average terrain (HAATs) for eight radials spaced every 45 degrees of azimuth starting with true north. The height of the antenna above average terrain (HAAT) is the height of the centre of radiation of the antenna above the average elevation of the terrain between 3 to 16 km from the antenna for each radial.

C-1.1.8 Maximum Permissible Parameters

Maximum permissible parameters are the values of the maximum ERP and the associated EHAAT for the six classes of stations listed in Section C-1.1.14.

C-1.1.9 Operating Parameters

The operating parameters are the values of the ERP and EHAAT at which an FM station is authorized to operate.

C-1.1.10 Limited Allotment

A limited allotment is a channel on which an FM station, for purposes of protection, is required to operate with less than maximum parameters. A limitation may apply in one or more directions.

C-1.1.11 Unlimited Allotment

An unlimited allotment is a channel on which a station may operate with maximum parameters. Any allotment, on which a station could operate with maximum parameters by virtue of spacing, may qualify as an unlimited allotment and may be co-ordinated as such.

C.1.1.12 Antenna Pattern

For horizontal non-directional patterns, variations shall be contained within the ± 2 dB limit from the average value (perfect circle). If these limits are exceeded, the pattern is considered directional.

C-1.1.13 FM Channels

FM broadcast channels are allotted in the band 88 to 108 MHz with 200 kHz spacing. The channel centre frequencies begin at 88.1 MHz (Channel 201) and continue in successive steps up to and including 107.9 MHz (Channel 300).

C-1.1.14 Classification and Maximum Permissible Parameters of Allotments and Assignments

The class of an FM channel is defined by the maximum permissible ERP and the associated EHAAT. The FM classes are as follows:

Class A1 : a maximum ERP or 250 W with an EHAAT of 100 metres.
Class A : a maximum ERP of 6 kW with an EHAAT of 100 metres.
Class B1 : a maximum ERP of 25 kW with an EHAAT of 100 metres.
Class B : a maximum ERP of 50 kW with an EHAAT of 150 metres.
Class C1 : a maximum ERP of 100 kW with an EHAAT of 300 metres.
Class C : a maximum ERP of 100 kW with an EHAAT of 600 metres.

The maximum ERP is calculated using the maximum value of radiation from the antenna in the plane of maximum radiation (i.e. beam tilt) and in the direction of maximum radiation for directional antennas.

An assignment made on an allotment having any of the above class designations is considered to be a "primary" assignment. An unprotected assignment made on an allotment having any of the above class designation is considered a secondary assignment.

C-1.1.15 Minimum Operating Parameters

The minimum operating parameters of a class are the lower limits of the operating parameters allowed for that class, and they are as follows:

Class A1 : an ERP of 51 W with no minimum on EHAAT.
Class A : an ERP of 251 W with an EHAAT of 100 metres or equivalent.
Class B1 or B : an ERP of 3 kW with an EHAAT of 150 metres or equivalent
Class C1 or C : an ERP of 20 kW with an EHAAT of 300 metres or equivalent

For class A, B1, B, C and C1 stations, the calculated (F50,50) 1 mV/m contour remains at the same location when equivalent parameters are used.

For directional antenna patterns, the ERP values above relate to the maximum value of the pattern.

Unless exceptional circumstances warrant it, an FM assignment shall be designed to operate above the minima defined in this paragraph. Applications proposing the under-utilisation of a channel may be required to reduce class.

C-1.1.16 Antenna Height and Power Equivalence

Where antenna heights exceed the values shown in C-1.1.14, the effective radiated power shall be reduced to provide equivalence with the maximum or other permissible parameters. In addition, where applicable, it is required that the interference zone for equivalent parameters not exceed that determined by the F(50,10) propagation curves using the maximum or other permissible parameters.

Equivalence requires that the 1 mV/m contour remains at the same location. In calculating equivalence, the EHAAT should be used to determine the permissible ERP. Note that equivalence based on individual HAATs in the eight standard azimuths is not acceptable. Where a limitation is concerned, the HAAT in the pertinent direction (either derived from a terrain profile in the standard manner or interpolated from the two adjacent standard HAATs) should be used to determine the permissible ERP.

Although equivalence permits the EHAAT to exceed the maximum for the class with a reduction in ERP, it must be noted that the reverse is not permitted. Specifically, under no circumstances may the maximum ERP for the class be exceeded.

C-1.1.17 Permissible Interference to Unassigned Allotments Due to Short Spacing

Proposed assignments may not produce an interference area within the following radii of unassigned allotments, assuming that the allotment would be assigned at maximum parameters for its class:

Class A1:	a distance of 12 km.
Class A (L72) limited to 3 kW:	a distance of 24 km
Class A:	a distance of 28 km
Class B1:	a distance of 39 km.
Class B:	a distance of 50 km.
Class C1:	a distance of 72 km.
Class C:	a distance of 86 km.

The above should not be interpreted as a reduction in the 0.5 mV/m contour to the reduced radii for unassigned allotments. Rather, when making an interference analysis (as per **Appendix 6**), the interference area and the service contour at the reduced extension should be tangential.

If an unassigned short-spaced allotment is already limited and the 0.5 mV/m contour extends beyond the above distances, interference areas are permitted to distances down to the values outlined above. However, if the 0.5 mV/m contour extends less than the above radii, no further interference is permitted.

C-1.1.18 Service Contours and Coverage Requirements

The service contours of a primary FM assignment are the 0.5 mV/m (54 dBμV/m) and 3 mV/m (70 dBμV/m) contours. The distance from the station to the service contours is determined using the F(50,50) curves in Figure 1 of the **Appendix 1** and Section C-3 on contour determination.

(a) A minimum field strength of 3 mV/m is required for satisfactory service to principal target centres, where a target centre is any populated area defined as city, town, locality, etc. as per Natural Resources Canada maps. If however, the service requirements are for a regional station and the applicant specifically states that this is the purpose of the station, the 3 mV/m contour is not required and should not appear on the contour map.

(b) A minimum field strength of 0.5 mV/m (54 dBμV/m) is required for satisfactory service to secondary target centres, where the reception is achieved by outdoor receiving antennas. A target centre is any populated area defined as city, town, locality, etc. as per Natural Resources Canada maps. For a regional station, the 0.5 mV/m (54 dBμV/m) contour is the only contour required for service.

The dBμV/m is the field strength in dB above one microvolt per metre (1 μV/m).

C-1.1.19 Protected Contour

The protected contour of a primary FM assignment is the 0.5 mV/m (54 dBμV/m) contour. This contour is protected up to the maximum distances indicated in Section C-1.2.2 for unlimited allotments. When the FM assignment uses a limited allotment, protection is defined by the limitation(s). Other conditions which can limit the distance to the protected contour are given in Sections C-1.1.17 and C-1.2.

C-1.1.20 Interfering Signal Contour

The interfering signal contour of a primary FM assignment is the maximum signal value permitted at the protected contours of other allotments and assignments (refer to Section C-1.3). The distance to the interference contour is determined using the F(50,10) curves of Figure 2 of **Appendix 1**. For distances less than 15 km, the F(50,50) curves of Figure 1 of **Appendix 1** may be used. Note that when antenna beam tilt is proposed, the ERP in the plane of tilt shall be used.

C-1.1.21 Antenna Beam Tilt (Electrical and Mechanical)

Antenna beam tilt is the inclination in degrees of the horizontal radiation pattern of the antenna which causes the maximum radiation to occur at an angle below the horizontal plane. The beam tilt may be achieved by mechanical or electrical means. The maximum permissible ERP, as defined in C-1.1.14 and C-1.1.16 shall not be exceeded in either the horizontal or tilt planes.

C-1.1.22 Polarization

The polarization of the radiated signal is the orientation of the electric component of the electromagnetic field as radiated from the transmitting antenna. Circular polarization is normally used, however, horizontal, vertical or elliptical polarization may also be used. Where vertical polarization only is used, justification shall be provided. In any plane of polarization the ERP shall not exceed that defined in C-1.1.14 and C-1.1.16.

C-1.1.23 Distances to Various Contours

The distances to various contours, including service, interfering or equivalence contours, can be calculated with the F(50,50) and F(50,10) curves of **Appendix 1** or with the Department's F50M software. However, if there is a disagreement between the two methods, the results obtained with the F50M software will prevail

C-1.2 Allotment Principles (Domestic)

For border area allotment and assignment, refer to: "**Agreement Between the Government of Canada and the Government of the United States of America Relating to the FM Broadcasting Service and the Associated Working Agreement**" .

The Agreement was amended in June 1997 according to the terms of the "***Changes to the 1991 Working Agreement Between the Government of Canada and the Government of the United Sates of America Relating to the FM Broadcasting Service***".

C-1.2.1 The distance to the protected service contour of FM allotments and assignments shall be based on maximum allowable parameters and shall be determined from the F(50,50) curves attached for the appropriate field strength contours listed below.

C-1.2.2 Protection is only afforded to land areas and shall not extend beyond the following distances from the transmitting site.

Class	Distance (km) to the 0.5 mV/m (54 dBµV/m) Contour
A1	18
A	38
B1	51
B	65
C1	86
C	97

The protection distance for Class C stations is based on an ERP of 100 kW and an EHAAT of 450 metres.

Class C channels, whose 0.5 mV/m contour extends beyond 97 km are permitted if protection to related assignments and allotments is provided.

C-1.2.3 The protected contour of an unoccupied limited allotment is determined using the limited parameters in all directions or in the direction(s) of limitation where applicable. Protection should be provided on the basis of a practical directional antenna meeting the limitation(s).

C-1.2.4 Where the protected contour extends beyond the boundary of the country in which the allotment is located, protection will be provided only to land areas, including islands, lying within that country. In this case, overlap of the interfering and the protected service contours may be acceptable provided that the interference zone does not fall within these areas. **Appendix 6** describes the procedure to determine the interference zone.

C-1.3 Protection Ratios and Permissible Interfering Signals

C-1.3.1 Protection ratios and the corresponding permissible interfering field strength levels (F(50,10)) at the protected contour of another frequency related assignment or allotment are given in the following table:

D/U Protection		
Channel Relationship	**Ratio (dB)**	**Field Strength**
Co-channel	20	0.05 mV/m (34 dBμV/m)
First adjacent	6	0.25 mV/m (48 dBμV/m)
Second adjacent	-26	10 mV/m (80 dBμV/m)

C-1.4 Domestic Separation Distances Between Co-channel and Adjacent Channel Allotments

Table C-1 specifies the minimum separation distances in kilometres for all classes of channel assignments, using the protected contour levels as shown in Section C-1.2 and the interfering signal levels shown in Section C-1.3.

The appropriate contours for Class C channels are based on an ERP of 100 kW and an EHAAT of 450 metres

For the purposes of international coordination, refer to separation distances of the "***Changes to the 1991 Working Agreement Between the Government of Canada and the Government of the United Sates of America Relating to the FM Broadcasting Service***".

Class A1	**Co-channel**	78					
	200 kHz	45					
	400 kHz	22					
	10.6/10.8 MHz	4					
Class A	**Co-channel**	131	151				
	200 kHz	78	97				
	400 kHz	42	47				
	10.6/10.8 MHz	7	10				
Class B1	**Co-channel**	164	184	197			
	200 kHz	98	118	131			
	400 kHz	55	60	63			
	10.6/10.8 MHz	9	12	24			
Class B	**Co-channel**	189	209	222	236		
	200 kHz	117	137	150	164		
	400 kHz	68	73	77	84		
	10.6/10.8 MHz	12	15	24	24		
Class C1	**Co-channel**	223	243	256	270	291	
	200 kHz	148	168	181	195	216	
	400 kHz	90	95	99	106	119	
	10.6/10.8 MHz	19	22	40	40	48	
Class C	**Co-channel**	238	258	271	285	306	317
	200 kHz	166	186	199	213	234	245
	400 kHz	111	116	120	127	141	157
	10.6/10.8 MHz	26	32	40	40	48	48
	Relationship	**Class A1**	**Class A**	**Class B1**	**Class B**	**Class C1**	**Class C**

TABLE C-1: Table of Minimum Domestic Separation Distances (km)

C-1.5 Short Spaced Allotments and Assignments

C-1.5.1 Allotments and assignments in the table of FM allotments which do not meet the Table of Minimum Separation Distances may be subject to an interference zone within their 0.5 mV/m contour (maximum parameter conditions). Interference zones should be drawn as shown in **Appendix 6** for the following cases:

(a) for an allotment or an assignment, the protected contour should be determined using the co-ordinates shown in the Canadian table of FM broadcasting allotments and should be in accordance with Section C-1.2;

(b) where limitations are indicated in the table of FM allotments, limited parameters should be used in the pertinent direction(s) instead of maximum permissible parameters.

Terrain factors may be considered where the intervening terrain justifies this use. Any recognized engineering method may be used. However, in case of conflict, the Department will resolve the matter by using the terrain program in its database.

The reverse process shall also be covered in the engineering brief i.e. the interference zone(s) from the related allotment(s) or assignment(s) shall be shown as a hatched area.

C-1.5.2 For new or changed assignments, based on a short spaced allotment in the table of allotments, the proposal should be designed to limit interference. Where the affected allotment is:

(a) unassigned - protection is normally required to the maximum extent of the 0.5 mV/m contour for its class or in accordance with Section C-1.5.1 above;

(b) assigned - protection as in C-1.5.1 above is required. An increase in interference zone may be proposed only if both parties are in agreement (refer to Section C-1.5.4 for procedural details). In such cases, the Department may refer the issue to the CRTC for Public Hearing, or deny the application based on spectrum management consideration.

C-1.5.3 For proposed short spaced assignments or allotments, predicated on proposed channels which are not in the table of FM allotments and, where the affected allotment is:

(a) unassigned - protection is normally required to the maximum extent of the 0.5 mV/m contour for its class. However, protection in accordance with Section C-1.1.17 may be proposed provided it is accompanied by a study indicating that the objective cannot be met by other less drastic measures such as a directional antenna, limitation, etc.;

(b) assigned - protection is normally required to the maximum extent of the 0.5 mV/m contour for its class. However, if an interference zone is proposed, the agreement of the affected licensee shall be obtained (refer to Sections C-1.5.4 and C-1.5.5 for procedural details).

C-1.5.4 (a) In all above cases, interference zones that fall over water may be disregarded.

(b) Where an allotment or assignment is proposed to be limited, the limitation is calculated by determining the allowable ERP and associated HAAT which provide protection to the related allotment or assignment. Normally, the associated HAAT is calculated by linear interpolation between the HAATs of the standard radials adjacent to the pertinent radial. If a disagreement exists in the calculation of this HAAT due to irregular intervening terrain, the terrain profile shall be as determined by the Department.

C-1.5.5 (a) In all cases of short-spacing(s) to an assignment(s), the applicant shall send a copy of the engineering brief with a covering letter to the affected station(s) licensee(s), preferably at the date of filing the application or immediately after the CRTC has issued a Notice of Public Hearing.

The affected licensee has 30 days after receipt of the engineering brief to reply, if so desired. The applicant should therefore send the letter to the affected licensee with a copy of the brief early enough so that the affected licensee may be in a position to reply at the latest 10 days before the start of the Public Hearing. Should the thirty-day response time fall beyond this deadline, the Department will not send technical comments to the CRTC. It is important to note that, in this case, the applicant is taking the risk of having the application withdrawn and shall assume full responsibility for it.

A copy of this letter and the postal or messenger receipt, as proof of delivery, shall be sent to the Department. The letter shall advise the affected licensee of the proposed short-spacing and interference zone where applicable, and shall emphasize that the licensee's comments shall be submitted to the Department no later than thirty days after receipt of the engineering brief. Where the affected licensee offers an objection, the application may not be accepted by the Department(refer to paragraph (b) below). If no reply is received within the specified period, the Department will assume that the affected licensee agrees with the proposal.

(b) The affected licensee shall use the criteria contained herein together with established engineering practices in the analysis the licensee will conduct. The Department will review the licensee's response and will reserve the right to make an independent decision concerning the disposition of the application.

C-1.5.6 Short-spacing in the Canada-US Coordination Zone

The domestic rules relating to the 2nd and 3rd adjacent channels differ from the ones in the Canada/US FM Broadcasting agreements. When interference is caused by a US assignment, applicable domestic protection rules may be used to determine the interference zone within the 0.5 mV/m contour of the Canadian assignment

C-1.6 Channels Separated by 600 and 800 kHz

C-1.6.1 For FM stations separated by 600 or 800 kHz and operating in the same area may interfere with each other. Interference may occur at locations where the field strength differential exceeds 30 dB. (60 dBμV/m contour equivalence can be used for different antenna heights). Co-location (same site) of upper and lower (left and right) 3rd adjacent channels is to be studied on a case-by-case basis.

C-1.6.2 A new station can be implemented within the 80 dBμV/m contour of an incumbent station separated by 600 or 800 kHz if its 100 dBμV/m contour is completely enclosed within the 80 dBμV/m contour of the incumbent station and if the proposed class is equal or lower than the class of the incumbent station.

C-1.6.3 If an incoming station is located such that its calculated 100 dBμV/m contour intercepts or overlaps the geographical zone between the 80 dBμV/m contour and the protected 54 dBμV/m contour of another station with frequency separation of 600 or 800 kHz, the incoming station is responsible for remedying complaints of interference related to the reception of the incumbent station within the incoming station's 100 dBμV/m contour.

Class	Distance (km) to the 80 dBμV/m Contour
A1	4
A	9
B1	13
B	19
C1	31
C	37

C-1.6.4 New stations are not protected against interference from incumbent stations separated by 600 kHz or 800 kHz with overlapping service contours, except for the requirements under Section C-5.6.

C-2 CHANGES TO THE TABLE OF ALLOTMENTS

When an FM service is being contemplated for a particular area and the Canadian FM broadcasting table of allotments does not contain a suitable unoccupied allotment, changes to the table of allotments may be proposed by an applicant.

C-2.1 Types of Changes

The following types of changes are envisaged, separately or in combination, concerning the addition or reclassification of an allotment:

(a) adding or changing an allotment without affecting any other allotment;

(b) adding or changing an allotment at the expense of short spacing an existing allotment or assignment. In this case, the short-spacing and its resulting interference may be accepted without limitations or a channel limitation may be required to avoid interference. Where an assignment is concerned, the licensee's comments on the proposed limitation shall be sought (refer to Section C-2.3.3). Where an allotment is concerned, refer to Section C-1.1.17;

(c) adding or changing an allotment at the expense of reclassifying an existing allotment or assignment. Where the reclassification of an assignment is proposed, the licensee's comments on the proposed reclassification shall be sought (refer to Section C-2.3.3);

(d) adding or changing an allotment at the expense of deleting an existing allotment;

(e) adding or changing an allotment at the expense of changing the frequency of an allotment or an assignment, in the latter case the licensee's agreement shall be obtained (refer to Section C-2.3.3); and

(f) moving an allotment to an area and replacing the shifted allotment with a suitable replacement.

Note: The lowering of the class of existing allotments should be avoided unless exceptional circumstances warrant it.

C-2.2 Impact on the Table of Allotments

It is noted that some of the changes in C-2.1 may have a positive impact in one area but a negative impact in another area. If the Department accepts the changes, it would report to the CRTC on the technical aspects of the changes and their impact on the provisions of the table of allotments provided the proposal is based on a complete application. These changes would be considered conditionally technically acceptable pending a decision by the CRTC. Any changes to the table of allotments that may be required as the result of such applications would not be made until the Department declares them technically acceptable and the CRTC approves the application.

C-2.3 Application Requirements

C-2.3.1 When an application for a new FM undertaking requires modifications to the table of allotments, the applicant may consult with the Department regarding these modifications prior to the formal filing of an application. Where pertinent, the study shall show that the coverage objective of the proposal cannot be achieved by less drastic measures such as through the use of a limited allotment and/or directional antenna, etc.

C-2.3.2 Any application proposing to change the frequency of an assignment will be found to be incomplete unless it is accompanied by proof that the station affected agrees to the change.

C-2.3.3 Applicants proposing to limit or reclassify a channel occupied by an assignment shall send a copy of the engineering brief, with a covering letter, to the licensee of the affected station, preferably at the date of filing the application or immediately after the CRTC has issued a Notice of Public Hearing. The affected licensee has 30 days after receipt of the engineering brief to reply, if so desired.

The applicant should therefore send the letter to the affected licensee with a copy of the brief early enough so that the affected licensee may be in a position to reply at the latest 10 days before the start of the Public Hearing. Should the thirty-day response time fall beyond this deadline, the Department will not send technical comments to the CRTC. It is important to note that, in this case, the applicant is taking the risk of having the application withdrawn and shall assume full responsibility for it.

A copy of this letter and the postal or messenger receipt, as proof of the delivery, shall be sent to the Department. The letter shall advise the licensee of the proposed limitation or reclassification and shall emphasize that any representations the licensee may wish to make to the Department shall be submitted no later than thirty days after receipt of the engineering brief. Where the affected licensee offers an objection, the application may be returned by the Department. However, the Department reserves the right to make an independent decision concerning the disposition of the application. If no reply is received within the specified period, it will be assumed that there is no objection.

C-2.3.4 An applicant may accept interference within the station's 0.5 mV/m contour from an existing assignment or from a future assignment on a existing allotment provided that the engineering brief states that the applicant does not intend to serve the affected area. The extent of the interference area shall be calculated in accordance with **Appendix 6** and shall be shown as a hatched area on the proposed station's coverage map.

C-2.4 Incompatibilities

In all of the cases described in C-2.1, problems can arise when changes to the plan of allotments proposed by one applicant are not compatible with changes proposed by another applicant. It should be noted that incompatibilities can occur even when the proposed service areas are geographically well separated. The Department encourages applicants to co-operate in the search for an early solution to problems of incompatibility. In this regard, the Department will, without divulging the details of the proposed changes, make any incompatibilities known to each of the applicants involved, urging their resolution prior to consideration of the applications by the CRTC.

C-2.5 Allotment Planning

C-2.5.1 Applications for modifications to the Canadian table of FM allotments may be made with, or independently from an application for an assignment. In either case, documentation in respect to the allotment change(s) shall be submitted.

C-2.5.2 An assignment does not convey a right, real or implied, to a station licensee for continued protection of the licensee's class of station if the operating parameters fall into a lower class. In such cases, the assignment may be reduced to a lower class to facilitate additional allotments and assignments.

C-2.5.3 The Department may make changes to the Canadian table of FM allotments which are independent of any application received. It will also take independent decisions, based on maximizing efficient spectrum usage, in its role as spectrum manager.

C-3 CONTOUR DETERMINATION

C-3.1 Introduction

All applications for new stations or for changes to an existing antenna or transmitter are required to show the service contours. For determining the service area of a broadcast station, two field strength contours are required. These are the 0.5 mV/m and 3 mV/m contours which indicate the approximate extent of coverage over average terrain in the absence of interference from other FM stations. Under actual conditions, the true coverage may vary greatly from these estimates because the terrain over any specific path is expected to be different from the average terrain on which the propagation curves are based.

C-3.2 Prediction of Coverage

C-3.2.1 Details of the calculations and pertinent data for determining the field strength contours are to be presented in the engineering brief as follows:

(a) the calculation of the ERP;

(b) the sources of information (such as maps) for arriving at the HAATs;

(c) if in unique circumstances, such as locations in mountainous terrain, a method other than that outlined herein is used for determining the service area contours, a detailed analysis with profile data should be included;

(d) a table shall be included as illustrated in the following example:

Radial No.	Azimuth (deg.)	ERP (kW)	HAAT (metres)	Distance to 3 mV/m Contour (km)	Distance to 0.5 mV/m Contour (km)
1	0	20	191	32	64
2	45	20	207	34	64
3	90	20	232	35	66
4	135	20	336	43	81
5	180	20	282	39	72
6	225	20	200	32	64
7	270	20	311	40	76
8	315	20	296	40	74

C-3.2.2 The table should be based on eight radials taken at 45° intervals from true north to determine the HAATs and the EHAAT. For each radial, a profile graph shall be drawn extending outward from the proposed site for a distance of 16 km, even if the radial extends beyond the international border. The eight graphs should be plotted separately, on rectangular co-ordinate paper with the distance in kilometres as the abscissa and the elevation in metres above mean sea level as the ordinate. The graph should reflect the topography of the profile accurately.

Where the applicant proposes the use of a site for which the average elevation of terrain for each of the eight standard radials has been determined previously and is a matter of record with the Department, the plotted graphs may be omitted and the established data on average elevation of terrain may be used to determine the HAAT values.

C-3.2.3 The average elevation above sea level of the 13 km distance between 3 and 16 kilometres from the antenna site should be determined. This may be obtained by measuring the median elevation (that exceeded for 50 % of the distance) in sectors and averaging those values or by averaging a large number of equally spaced points. The number of points required and their spacing should allow an adequate representation of the terrain. Conflict situations will be resolved by the Department using the "point-to-point" prediction method.

C-3.2.4 The HAAT is defined as the height of the antenna centre of radiation above sea level minus the average terrain elevation calculated above. However, when a part of the 3 to 16 km portion of a radial extends over large bodies of water or over the territory of the United States, only that part of the radial extending from the 3 km sector to the outermost portion of land area within Canada covered by the radial shall be employed in the computation of HAAT.

C-3.2.5 Additional radials shall be included relative to the principal centre(s) to be served where desirable and, particularly in cases of rough terrain. This is done even if the centre under consideration is more than 16 km from the antenna site. However, the additional radials should not be included in the determination of the station's EHAAT.

C-3.2.6 The following data is to be indicated for each radial graph:

(a) radial number and azimuth,

(b) height of antenna above sea level,

(c) average elevation of terrain for the particular radial,

(d) HAAT for the radial.

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-3.2.7 In predicting the distances to the field strength contours, the F(50,50) curves of **Appendix 1** should be used. The F(50,50) curves represent the field strength at 9.1 m above ground which is exceeded for 50 % of the time at 50 % of the locations as measured in decibels above one microvolt per metre. The curves are based on an effective power of one kilowatt radiated from a half-wave dipole in free space, which produces an unattenuated field strength at one kilometre of about 107 dB above one microvolt per metre (221.8 millivolts per metre).

C-3.3 The Location of Service Contours

C-3.3.1 The distances to the 0.5 mV/m and 3 mV/m contours shall be predicted by using the ERP in the plane of maximum radiation, the HAATs in the direction of the eight standard radials and the F(50,50) propagation curves. In the case of directional antennas, the ERP values in the direction of the eight standard radials should be used.

C-4 COMPUTATION OF DISTANCE AND AZIMUTH

C-4.1 Where transmitter sites have been established, the actual co-ordinates of the transmitter sites shall be used as reference points. If a transmitter site has not been established, the community's reference co-ordinates (the co-ordinates of the centre of the city) shall be used unless the co-ordinates have been specified in the table of allotments.

C-4.2 The distance between reference points is considered to be the length of the hypotenuse of a right angle triangle, one side of which is the difference in latitude of the reference points and the other side the difference in longitude of the two reference points, and shall be computed as follows:

(a) convert latitude and longitude into degrees and decimal parts of a degree. Determine the middle latitude of the two reference points (average the latitudes of the two points);

$$LATM = \frac{LAT1 + LAT2}{2}$$

(b) determine the number of km per degree of latitude difference for the actual middle latitude in (a) above;

$$LATK = 111.108 - 0.566 \cos (2LATM)$$

(c) determine the number of km per degree of longitude difference for the actual middle latitude in (a) above;

$$LONGK = 111.391 \cos (LATM) - 0.095 \cos (3LATM)$$

(d) determine the North-South distance in km;

$$LAT = LATK (LAT1 - LAT2)$$

(e) determine the East-West distance in km;

$$LONG = LONGK (LONG1 - LONG2)$$

(f) determine the distance between the reference points by the square root of the sum of the squares of the distances obtained;

$$DIST = \sqrt{LAT^2 + LONG^2}$$

where:

LAT1 & LONG1 = co-ordinates of the first location in decimal degrees,
LAT2 & LONG2 = co-ordinates of the second location in decimal degrees,
LATM = middle latitude between points,
LATK = km per degree of latitude difference,
LONGK = km per degree of longitude difference,
LAT = north-south distance in km,
LONG = east-west distance in km, and
DIST = distance between two reference points in km.

In computing the above, sufficient decimal figures shall be used to determine the distance to the nearest kilometre. The method for computing distances provides adequate accuracy for determining distances less than 350 km.

C-4.3 The azimuth or the bearing between true north and the radial connecting one reference point to the other, shall be calculated as follows:

(a) convert latitude and longitude into degrees and decimal parts of a degree;

(b) determine the arc length in degrees between the two reference locations;

$$d = \arccos [\sin (LAT2) \sin (LAT1) + \cos (LAT2) \cos (LAT1) \cos (LONG1 - LONG2)]$$

(c) calculate the bearing (if the second location is west of the initial location, subtract the result from 360°; i.e., 360 - BEAR),

$$BEAR = \arccos \left(\frac{\sin (LAT2) - \sin (LAT1) \cos (d)}{\cos (LAT1) \sin (d)} \right)$$

where:

LAT1, LAT2, LONG1 & LONG2 are as specified in Section C-4.2;

d = arc length between locations in decimal degrees;
BEAR = angle between true north (0 degrees) and the connecting radial in decimal degrees.

In computing the above, sufficient decimal figures shall be used to determine the bearing to the nearest degree.

C-5 ASSESSMENT AND CONTROL OF HIGH FIELD STRENGTH OF FM BROADCASTING STATIONS

C-5.1 Introduction

Service requirements and constraints related to the siting of FM broadcasting stations may result in high signal strength levels in populated areas. Under these conditions, FM receivers, as well as other radio frequency devices, are susceptible to signal overload and intermodulation (IM) interference. High signal strength levels may also cause equipment malfunctions in non-radio frequency devices. To avoid or to minimize such problems, it is necessary to assess the potential for interference.

C-5.2 Purpose

The purpose of this sub-section is to:

- identify the analysis required from applicants in determining interference potential,
- define the responsibilities of broadcasters in response to interference complaints,
- detail the procedure to be followed by applicants in notifying municipal/land-use authorities of the station's proposed location (refer to Section C-5.5.2).

The requirements of this sub-section apply to all applications for the issue or amendment of broadcasting certificates for FM broadcasting stations using primary frequency assignments.

C-5.3 Requirements for Interference Analyses and Population Estimates

In addition to the departmental requirements contained in Section B-2 pertaining to the engineering brief, interference analyses as per Sections C-5.3.1 and C-5.3.2 are required. In specific cases, the Department may accept a common assessment for co-located stations, diplexed or otherwise.

C-5.3.1 Assessment of High Field Strength Levels and Population Estimates

An applicant for a new station or for changes to an existing station shall submit an estimate of the population within the 115 and 100 dBμV/m contours. The location of these contours shall be determined using the appropriate F(50,50) field strength curves and shown on a suitable map. For distances of less than 1.5 km, the free space formula should be utilized (refer to Section C-5.4.2).

Every attempt shall be made to keep the population within the 115 and 100 dBμV/m contours to a minimum. The Department reserves the right to request changes to the antenna site, to the antenna height, to the antenna itself, or to the radiated power to reduce the population within these high signal level contours.

C-5.3.2 Intermodulation Products

It is necessary to identify the frequency of all third order IM products of the type 2f1 - f2 and f1 ± f2 ± f3, resulting from the combination of assigned and available frequencies allotted in the table of FM allotments to the centre(s) to be served. Only those channels having 0.5 mV/m or greater signal strength over any such centre need to be considered. If any such frequency product falls on or are within 200 kHz of Canadian FM channels allotted or assigned to said centre(s), then interference may exist and the following documentation shall be prepared and submitted to the Department:

(a) where the 0.5 mV/m (54 dBμV/m) contours of existing Canadian stations overlap the 115 dBμV/m or the 100 dBμV/m contours of the applicant's proposed station, and where the reception of such stations may be affected by IM products as calculated above, an estimate of the population within all overlapping zones shall be included;

(b) in addition, centres within the 0.5 mV/m (54 dBμV/m) contour of the applicant's proposed station which may encounter IM interference to its reception shall be identified;

(c) an estimate of the population within the 70 dBμV/m (3 mV/m) and the 54 dBμV/m (0.5 mV/m) contours shall be submitted.

The applicant shall also include a rationale for the choice of the proposed station's parameters in light of the analyses above. The Department reserves the right to request further analysis and justification or amendments when, in its opinion, these are warranted.

C-5.4 Method for Calculating High Field Strength Contours

C-5.4.1 The antenna radiation patterns, vertical and horizontal (if antenna is directional), are normally supplied by the antenna manufacturer. In predicting high field strength contours, the ERP should be based on the appropriate antenna vertical plane radiation pattern for the azimuthal direction concerned.

C-5.4.2 For distances less than 1.5 km from the transmitting site, the field strength should be determined from the following free space formula:

$$F = 137 + 10 \log (ERP) - 20 \log(d)$$

where:

F : is the field strength in dBμV/m (dB above one microvolt per metre);

ERP: is the effective radiated power in Watts at the pertinent depression angle;

d : is the slant distance (in metres) between the centre of radiation of the antenna and the receiving location.

C-5.4.3 For distances between 1.5 and 4 kilometres, the field strength should be determined from the F(50,50) curves. Use the height of the antenna radiation centre with respect to the location under consideration.

C-5.4.4 For distances beyond 4 kilometres, the field strength should be determined from the F(50,50) curves using the pertinent HAAT.

C-5.4.5 Whenever F(50,50) curves are being used, the antenna height and the distance from the tower should be used to determine the depression angle from Figure 3 of **Appendix 1**. The ERP for that direction shall be determined by the depression angle and the vertical pattern information of the antenna. For the horizontal directional pattern, the power shall also be adjusted according to the azimuth selected.

C-5.4.6 High field strength prediction may involve nulls in the vertical radiation pattern which shall be taken into consideration. The distances (d_i) along the ground where the field strength due to a vertical pattern null is at minimum, can be calculated by the following relationship.

$$d_i = \frac{H}{\tan(\theta_i + A)}$$

where:

A and θ_i are the beam tilt angle and the angles corresponding to the different nulls in the vertical pattern respectively (both in degrees).

H = height (in metres) to radiation centre of antenna;

d_i = distances in metres along ground.

For values of $\theta_i + A \leq 10°$:

$$d_i = \frac{57.3H}{\theta_i + A}$$

C-5.5 Broadcaster's Responsibilities

The broadcaster will accept responsibility to:

- remedy *valid* complaints of interference to radio frequency devices within the 115 dBμV/m contour (refer to Section C-5.6 for list of complaints judged *not valid* by the Department), and

- provide technical advice to complainants, located between the 115 dBμV/m contour and the service contours of the station, concerning appropriate action to resolve interference problems attributed to the station, and

- keep the appropriate District Office of the Department fully informed of all complaints received and action taken.

C-5.5.1 Broadcaster's Commitment

All applicants shall comply with the following commitment which outlines the responsibilities of the broadcasters with respect to the high field strength contours. The commitment is included in the standard departmental application form:

"In the event a broadcasting certificate is issued as a result of this application, the holder of the broadcasting certificate agrees to take prompt and appropriate action to correct overload and/or blanketing interference and any other type of interference to radio frequency devices inside the 115 dBμV/m contour of the station, bearing all corrective costs involved, unless such complaints are of a type judged not valid by the Department. Where interference occurs in areas between the 115 dBμV/m contour and the service contours of the station, the holder of the broadcasting certificate agrees to provide technical advice to complainants by suggesting appropriate remedial action to resolve interference problems attributed to the station".

C-5.5.2 Municipal/Land-Use Authorities Notification and Consultation

An applicant for a new station or for changes to an existing station shall communicate its intentions in a notice to local municipal/land-use authorities within an area enclosed but not limited to the 115 dBμV/m contour.

The purpose of the notice is to give the municipal/land-use authorities an opportunity to consider the implication of the proposed antenna structure and site. This notice shall also include a sketch of the building, the proposed tower(s) and antennas, with sufficient detail and dimension to give a pictorial representation of the total structure.

Changes to existing stations that do not modify the structure and its attachments nor change the location of the 115 dBμV/m contour need not be communicated to the local municipal/land-use authorities.

The notice shall include the following information:

(a) a statement to indicate that a broadcasting station is planned for the municipality and that, if approved, the operation of the station would be subject to federal regulations for which a broadcasting licence from the CRTC and a broadcasting certificate from the Department are required;

(b) a map showing the transmitter site and the location of the 115 dBμV/m contour. This shall be accompanied by a statement to say that should interference to radio frequency devices occur inside this contour, the applicant would be responsible for corrective action in remedying the complaints, unless such interference complaints are deemed to be not valid by the Department. A list of complaints normally considered not valid by the Department is given in Section C-5.6, and shall be included with the statement. In addition, the statement shall indicate that the applicant will provide advice by suggesting appropriate remedial action to resolve valid complaints of interference caused by the station when such complaints originate from the area between the 115 dBμV/m contour and the station's service contours;

(c) a statement to indicate that, if subsequent building development occurs inside the 115 dBμV/m contour, which could give rise to interference complaints, or if new or existing devices are added or re-located inside the contour, the applicant would not be expected to assume responsibility for corrective action for such new entrants; and

(d) a statement to indicate that the performance of some radio frequency, as well as some non-radio frequency devices, may be degraded by high signal strengths from the station because of design limitations such as inadequate or improper shielding of the devices.

The notice is to be filed with each municipal/land-use authority with sufficient lead time to permit it to consider the impact of the proposal. Insufficient lead time could delay the processing of the application by the Department and may also cause the CRTC to reschedule this item for a later Public Hearing. A copy of this notice is to be filed with the Department's District Office.

The municipal/land-use authorities may file a written objection to the proposed facilities with the appropriate departmental District Office. The Department expects the municipal/land-use authorities to make its view known as quickly as possible.

The Department expects the applicant and the municipal/land-use authorities to resolve all problems and objections. Failing this, the Department will consider all factors pertaining to the application, as well as the municipal authorities comments and render a final decision.

To inform the Department of the status of the municipal/land-use authorities notification and consultation process, the applicant shall submit copy of departmental **Form IC 2586EA, *"Preliminary Environmental Information, Municipal/Land-Use Consultation and Aeronautical Site Clearance Attestation"*** with its application.

The municipal consultation process must be completed before a radio authorization may be issued.

C-5.5.3 Sharing of Responsibility

Within the 115 dBμV/m contour of co-located or near co-located FM stations, should a new station experience problems of overloading, blanketing or IM interference or cause such problems to the reception of other broadcasting stations, all stations involved shall assume their appropriate share of the responsibility to remedy such problems.

C-5.6 List of Complaints Judged Not Valid by the Department

The following list identifies the types of complaints judged not valid by the Department and for which the broadcaster is not responsible for remedial action:

(a) where the complaint is attributed to the use of a malfunctioning or mistuned receiver or an improperly installed or defective antenna system;

(b) where the complaint involves non-radio frequency devices such as computers, microprocessors, calculators, audio or video tape recorders, record or disc players, electronic organs, hi-fi amplifiers etc.;

(c) where the complaint is attributed to the desired signal being received at a location outside the coverage area of the station;

(d) where the complaint is attributed to the desired signal not being favourably received because of adverse local propagation conditions or building penetration losses;

(e) where the complaint involves the reception of signals originating from outside of Canada;

(f) where the complaint involves the malfunction of radio frequency devices that are located inside the 115 dBμV/m contour, if the devices were introduced within the contour after the station started operating with the new facilities;

(g) where the complaint involves a high gain receiving antenna and/or an antenna booster amplifier intended for reception of distant stations which, as a consequence, overloads the receiver or creates intermodulation in the amplifier output;

(h) where the complaint is attributed to overload interference in radio receivers that are located outside the 115 dBμV/m contour (except for requirements under Section C-1.6);

(i) any other complaint which, in the judgement of the Department, is considered not valid.

C-6 POTENTIAL INTERFERENCE TO TV FROM FM BROADCASTING STATION ASSIGNMENTS

These guidelines identify a number of potential interference situations involving FM and television reception and establish appropriate requirements applicable to each situation.

C-6.1 Second Harmonic Interference

Second harmonic radiation from FM transmitters may cause objectionable interference to the reception of TV signals on Channels 7-13 in areas where the TV signal level is relatively low compared to the FM signal. Present standards in Canada require that the second harmonics of FM transmitters be attenuated 80 dB or more below the level of unmodulated carrier, depending on the operating power. In areas where the ratio of FM to TV signals is quite large, the relative level of the FM second harmonic may interfere with TV reception. Since there are a number of cases where such second harmonic relationships exist in the present table of allotments for FM and TV, care may need to be exercised in selecting sites for new stations in order to avoid high ratios of FM to TV signal levels which might result in objectionable interference.

In circumstances where it is difficult to avoid the aforementioned channel relationships, the brief shall indicate that the applicant's is aware of the situation and shall include an undertaking from the applicant that complaints of interference will be investigated and appropriate measures will be taken to remedy the situation at the applicant's own expense.

C-6.2 Interference to Channel 6 from FM Broadcasting Stations on Channels 201-220

C-6.2.1 To minimize possible interference to TV Channel 6 from FM transmissions on channels 201-220 inclusive, it is required that the FM and TV signal strengths at TV receiver locations not exceed certain levels. To achieve this objective, the siting of FM stations and their power levels, in relation to TV Channel 6, have to be considered.

Interference to TV Channel 6 depends on the frequency separation and the levels of both the FM and TV signal strengths. To minimize interference, it is desirable to equalize the ratio of the FM to TV signal strengths at all receiver locations and therefore co-location or near co-location of the FM and TV stations is highly recommended. Near co-located means within 400 m of the TV ch. 6 transmitter site.

Alternatively if co-location or near co-location is not possible, an FM transmitter site outside the service contour of the TV station may be considered.

C-6.2.2 FM stations on channel numbers 201-220, that are co-located or near co-located with a TV station on channel 6, shall have ERP (horizontally polarized component) ratios that do not exceed the values of Table C-2, provided that both antennas have similar heights. If the height of the FM antenna differs by 30 metres or more from the height of the TV antenna, the power of the FM shall be adjusted to take into account the difference in height of both antennas. Where directional antenna patterns are used, the FM to TV ERP ratios shall not exceed those given in Table C-2 at any azimuth.

Channel	FM/NTSC TV (dB)	FM/DTV (dB)	Channel	FM/NTSC TV (dB)	FM/DTV (dB)
201	-9.0	+17	211	-4.0	+40
202	-7.5	+25	212	-3.4	+40
203	-6.2	+31	213	-2.4	+40
204	-5.0	+40	214	-1.3	+40
205	-4.4	+40	215	0.0	40
206	-4.4	+40	216	+1.5	40
207	-4.4	+40	217	+3.5	40
208	-4.4	+40	218	+6.0	+40
209	-4.4	+40	219	+8.8	+40
210	-4.4	+40	220	+11.5	+40

TABLE C-2: Permissible FM to TV Power Ratio for FM channels 201 to 220 inclusive, when co-located or near co-located with TV channel 6.

NOTE 1: The NTSC TV power is the ERP of the visual power and is referenced to the RMS of sync. peak. The FM power is the ERP and is referenced to the RMS Power.

NOTE 2: The FM to NTSC TV power ratios are based on a quality of a TV picture defined as a ITU-R picture impairment Grade of 4.0 and the FM to TV signal ratio at the receiver is taken at a TV receiver input signal of -25 dBm. The ratio applies to 70 % of all receiver locations.

The FM to TV power ratios shown are for horizontal polarization of the TV and FM stations. If beam tilt is to be used for either the TV or FM, the maximum power(s) at the beam tilt angle(s) is (are) to be used. If elliptical polarization is used for the FM, the FM power for the vertical polarized component may be up to 6 dB greater than the horizontal component.

FM to NTSC TV power ratios in excess of the values shown in the above table may be allowed when there is no resident population near the FM transmitting site or when indoor receiving antennas are used. For such cases, the applicant shall demonstrate that the NTSC TV channel 6 signal at the receiver input in the viewers' homes is less than -25 dBm. The FM to NTSC TV power ratio can be increased by selecting a lower TV receiver input signal level. The protection to NTSC TV channel 6 from an FM signal at various frequencies and at various TV receiver input levels of the channel 6 signal is shown in **Appendix 7**.

C-6.2.3 For FM stations located outside the protected contour of channel 6, the permissible horizontally polarized field strength of the proposed FM station, at the protected contour of the TV station shall not exceed the value shown in the Table C-3, using the F(50,10) propagation curves. If elliptical polarization is used for the FM, the field strength level of the vertical polarized component may be up to 6 dB greater than the horizontal component.

Channel	Field (dBμV/m) at the Grade B NTSC	Field (dBμV/m) at the 35 dBμV/m contour of DTV	Channel	Field (dBμV/m) at the Grade B NTSC	Field (dBμV/m) at the 35 dBμV/m contour of DTV
201	57	51	211	78	75
202	60	59	212	78	75
203	63	66	213	79	75
204	66	75	214	81	75
205	70	75	215	82	75
206	74	75	216	84	75
207	77	75	217	86	75
208	77	75	218	89	75
209	77	75	219	92	75
210	78	75	220	95	75

TABLE C-3: Permissible Field Strength Levels of FM Channels 201 to 220 incl. at Grade B contour of TV channel 6

NOTE: For NTSC TV, the above table is derived on the basis of an FM to TV channel 6 ratio at a TV receiver input signal level of -65 dBm. This is equivalent to the field strength obtained at the Grade B contour. The value in the table includes a 6 dB directivity discrimination for the antenna together with a quality of TV picture defined as a ITU-R picture impairment Grade of 4.0.

C-7 TECHNICAL REQUIREMENTS FOR MULTIPLEX OPERATIONS

C-7.1 Preamble

The following technical requirements govern the use of multiplex sub-carrier transmissions by frequency modulated broadcasting stations in the 88-108 MHz band for purposes of providing subcarrier services other than stereophonic broadcasting. These requirements set forth the technical standards to be followed by applicants in establishing a multiplex operation.

C-7.2 Definitions

C-7.2.1 Multiplex sub-carrier. A sub-carrier having a frequency within the range 20-99 kHz of the FM baseband and which is modulated with the subsidiary communication information.

C-7.3 Multiplex Transmission Standards

C-7.3.1 Any form of modulation may be used on any SCMO subcarrier except for RBDS (refer to C-7.3.6).

C-7.3.2 More than one subsidiary communications sub-carrier may be used simultaneously provided that:

- during stereophonic or monophonic transmission, multiplexed sub-carriers shall be within the baseband frequency range of 53 to 99 kHz;
- during periods when no broadcast programs are transmitted, multiplexed sub-carriers may be within the baseband frequency range of 20 to 99 kHz.

C-7.3.3 During stereophonic or monophonic program transmissions, the modulation of the carrier by the arithmetic sum of all multiplex sub-carriers below 76 kHz may not exceed 10 % (7.5 kHz) and modulation of the carrier by the arithmetic sum of all multiplex sub-carriers above 76 kHz may not exceed 10 % (7.5 kHz). Modulation of the carrier by the arithmetic sum of all multiplex sub-carriers may not exceed 20 % referenced to 75 kHz deviation. When more than one subcarrier is used, the total modulation may be increased by 0.5 % for each 1 % sub-carrier injection modulation, and under no circumstances may the total modulation of the carrier exceed 110 % (82.5 kHz peak deviation).

C-7.3.4 During periods when no broadcast programmes are being transmitted, the modulation of the carrier by the arithmetic sum of all multiplex sub-carriers above 76 kHz may not exceed 10 % (7.5 kHz) and the modulation of the carrier by the arithmetic sum of all sub-carriers may not exceed 30 % referenced to 75 kHz (22.5 kHz peak deviation).

C-7.3.5 During monophonic or stereophonic programme transmission, the cross-talk, within the range of 50 Hz to 53 kHz caused by all multiplex sub-carriers, shall be at least 60 dB below the 100 % modulation (75 kHz peak deviation) reference.

C-7.3.6 Broadcasting undertakings that wish to transmit Radio Broadcast Data System (RBDS) shall use the RBDS standard of the US National Radio Systems Committee (NRSC). The specifications of the NRSC standard are available from the National Association of Broadcasters (NAB), Washington, DC, USA.

The 57 kHz sub-carrier (54.6-59.4 kHz occupied bandwidth) in the base band of the FM signal is reserved for RBDS applications using the NRSC standard.

C-8 DIRECTIONAL ANTENNAS

C-8.1 Directional antennas may be used by stations operating on unlimited allotments, but their use shall not prevent future increases up to the maximum parameters. Directional antennas may also be used by stations occupying or proposing the use of limited allotments to render protection to co-channel and adjacent channel stations.

C-8.2 The ratio of maximum to minimum fields of a directional antenna system shall not be greater than 20 dB except where signal reflections due to local terrain will present a reception problem or where other circumstances such as large body of water exist. The radiation from a directional antenna shall not vary from the notified radiation pattern by more than ± 2 dB. Where limitations are involved, the radiation in the direction(s) of protection shall not exceed the limitation. For antenna patterns not meeting this tolerance, the radiation shall be reduced accordingly.

The notified radiation pattern shall include the effect of the mounting structure, the margin of accuracy, and shall be certified by the manufacturer or the supplier.

C-9 TRANSMITTER LOCATIONS

C-9.1 FM station transmitters shall be located to serve the principal centre to which the channel is assigned. Transmitter sites shall be located so that the separations are not less than those set forth in Section C-1.4 except when specifically agreed to in accordance with Section C-1.5.

SECTION D PREPARATION OF TECHNICAL SUBMISSIONS SUPPORTING APPLICATIONS FOR LOW POWER FM (LPFM) BROADCASTING STATIONS

D-1 APPLICATION PROCEDURE

D-1.1 Preamble

This Section outlines the procedure to be followed in preparing and submitting technical information required in support of applications for low power FM stations using standard FM channels on an unprotected non-interfering basis (such a low power FM assignment is considered to be a secondary station).

D-1.2 Requirements

D-1.2.1 An application for a broadcasting certificate shall be made on departmental **Form IC 2377,** ***Application for a Broadcasting Certificate Low Power Frequency Modulation (FM)***. The applicant may also submit a separate engineering brief in accordance with Section D-2. An application form for a broadcasting licence can be obtained from the Canadian Radio-television and Telecommunication Commission (CRTC). The two applications shall be filed simultaneously.

D-1.2.2 All necessary forms may be obtained from the departmental web site or any Regional or District Office. Addresses for Regional and District Offices are provided in **Radiocommunications Information Circulars No. 66 "Addresses and Telephones Numbers of Regional and District Offices"**.

D-1.2.3 A complete technical submission shall include the following:

(a) Two copies of departmental **Form IC 2377** should be submitted when applying for a new station or a change of technical facilities of an existing station. The **Form IC 2377** also contains an abbreviated technical submission which should be presented as the engineering brief if the minimum separation distances of Tables E-1 and E-2 are complied with. Otherwise, a complete engineering brief (four copies) should be submitted in accordance with Section D-2;

(b) two copies of departmental **Form IC 2374,** ***Notice of Retention of a Broadcasting Engineering Consultant*** advising the Department of the retention of a broadcast engineering consultant in respect to technical design and brief preparation should be submitted by the applicant, prior to the filing of the application. The Department will, if advised in writing by the applicant, also process engineering briefs prepared by qualified technical staff (**BPR-1**, Section 1.2);

(c) one copy of departmental **Form IC 2586EA,** ***Preliminary Environmental Information, Municipal/Land-Use Consultation and Aeronautical Site Clearance Attestation.***

D-1.2.4 The applicant shall comply with the applicable Transport Canada and Nav Canada requirements for aeronautical obstruction clearance and land use and/or construction proposals. Transport Canada **Form 26-0427** entitled ***"Aeronautical Obstruction Clearance Form"*** and Nav Canada form ***"Land Use Proposal Submission Form"*** must be submitted for clearance to the district office of Transport Canada and Nav Canada. The necessary forms and submission information may be obtained from the respective district offices.

D-1.3 Municipal/Land-Use Authorities Consultation

An applicant for a new station or for changes to an existing station shall communicate its intention in a notice to local municipal/land-use authorities.

The purpose of the notice is to give the authorities an opportunity to consider the implication of the proposed antenna structure and site. This notice shall also include a sketch of the building, the proposed tower(s) and antennas, with sufficient detail and dimension to give a pictorial representation of the total structure.

The notice is to be filed with each municipal/land-use authority with sufficient lead time to permit it to consider the impact of the proposal. Insufficient lead time could delay the processing of the application by the Department and may also cause the CRTC to reschedule this item for a later Public Hearing. A copy of this notice is to be filed with the Department's District Office.

Changes to existing stations that do not modify the structure and its attachments need not be communicated to the local municipal/land-use authorities

The municipal/land-use authorities may file a written objection to the proposed facilities with the appropriate departmental District Office. The Department expects the municipal/land-use authorities to make its view known as quickly as possible.

The Department expects the applicant and the municipal/land-use authorities to resolve all problems and objections. Failing this, the Department will consider all factors pertaining to the application, as well as the municipal authorities comments and render a final decision.

To inform the Department of the status of the municipal/land-use authorities notification and consultation process, the applicant shall submit copy of departmental **Form IC 2586EA, *"Preliminary Environmental Information, Municipal/Land-Use Consultation and Aeronautical Site Clearance Attestation"*** with its application

The municipal consultation process must be completed before a radio authorization may be issued.

D-2 ENGINEERING BRIEF SECTIONS

D-2.1 Summary Sheet

This will show the submission title, type of station proposed, name and address of applicant, name of the technical representative, transmitting channel proposed, location of proposed broadcasting station and submission date.

D-2.2 Introduction

This will consist of a general statement of the purpose of the brief relative to the application. The programming source(s), method of programming feed and network affiliation shall be indicated.

D-2.3 Transmitting Channel

A brief interference analysis in support of the transmitting channel selected should be included in the brief, with particular reference to its relation to existing FM assignments and allotted channels under the table of FM allotments. This analysis should demonstrate that no interference will be caused by or to the service of authorized stations using standard parameters or low power stations now being received in the area. Moreover, every effort should be made to avoid affecting the off-air receiving systems of neighbouring broadcasting undertakings.

D-2.4 Received Channel (Using off-air pick-up)

An analysis shall be provided to demonstrate the suitability of the received signal level. If the station to be received is in operation, the analysis shall include an assessment of the quality and reliability of the received signal by such means as field strength measurements combined, where possible, with a subjective analysis using an FM receiver. Detailed point-to-point propagation and interference analyses using recognized engineering methods should also be supplied.

D-2.5 System Description and Design

A description of the major components of the system, including a block diagram, shall be provided.

D-2.6 Equipment

D-2.6.1 Receiving and Transmitting Antennas - Antenna specifications including the type, manufacturer, gain relative to a half-wave dipole and radiation patterns shall be supplied. The orientation of the transmitting antenna shall be indicated.

D-2.6.2 Transmitting Equipment - The transmitting unit shall be type-approved. The intent to use a type-approved transmitter(s) shall be made clear, either by specifying the make, model and type-approval number, or by a statement that the transmitter will be type-approved prior to on-air operation. The rated power shall be specified.

D-2.6.3 Transmission Lines - Antenna line specifications shall be supplied including manufacturer, type and length.

D-2.6.4 Power Supply - This shall include a description of the primary and, where available, standby methods of supplying power to the installation.

D-2.7 Service Area Calculations and Contour Map

Calculations determining the service area and a contour map, prepared as outlined in Section E-3, shall be submitted.

D-2.8 Predicted Quality of Service

A statement shall be made concerning the quality and reliability of the proposed service as evaluated per Section E-2.

SECTION E TECHNICAL REQUIREMENTS FOR THE ESTABLISHMENT OF LOW POWER FM STATIONS ON UNPROTECTED CHANNELS

E-1 TECHNICAL CRITERIA

E-1.1 Conditions

E-1.1.1 Definitions

A low power FM (LPFM) station is a secondary assignment operating on an unprotected channel.

E-1.1.2 Power

The effective radiated power (ERP) in any direction shall not exceed 50 Watts. The ERP is equal to the transmitter power supplied to the antenna multiplied by the relative gain (dipole) of the antenna in a given direction.

E-1.1.3 Antenna

Normally the maximum transmitting antenna height is 60 metres when the ERP is 50 Watts. Should the transmitting antenna height exceed 60 metres, the ERP and height, when plotted on Figure 1 of **Appendix 4**, should fall below or to the left of the curve. In this procedure, transmitting antenna height (HAAT) is the height of the radiation centre of the antenna above the arithmetic average of the elevation of the terrain measured in metres from 0 to 5 kilometres along four standard radials at 0, 90, 180 and 270 degrees from true north.

E-1.1.4 Coverage and Protection

An LPFM station provides service only within its 3 mV/m (70 dBμV/m) contour. Service may also be provided within the 0.5 mV/m (54 dBμV/m) (see Section E-1.3.3).

Under no circumstances shall the 3 mV/m contour extend beyond a distance of eight kilometres in any direction from the antenna site even if this requires a reduction in the ERP.

E-1.1.5 Transmitter

The transmitter shall be a model which has been type-approved under ***Technical Standards and Requirements for FM Broadcasting Transmitters (BETS-6).***

E-1.1.6 Special Applications

In mountainous terrain locations, where the transmitting antenna height is more than 300 metres above the elevation of the community to be served, it may not be possible to provide an adequate service under the conditions in Section E-1.1.3 above. In such cases, additional studies may be required by the Department to demonstrate that the existing stations and allotments shall be protected from interference. In addition, the Department will consider proposals with parameters engineered to provide adequate service to the centre to be served with the following limiting conditions:

(a) the effective radiated power shall not exceed 50 Watts in any direction;

(b) the 3 mV/m contour shall not extend beyond a distance of eight kilometres from the transmitting site.

E-1.2 Status with Regard to Interference to and from other Stations

E-1.2.1 LPFM stations will be considered as secondary assignments. In other words, except as provided for in Section E-1.4, LPFM stations shall not create interference to primary FM broadcasting stations, whether established before or after them. Conversely, an LPFM station is not entitled to protection from interference by normally functioning primary FM stations. LPFM stations are assigned on a protected basis from each other according to their date of notification.

E-1.2.2 Interference to and from existing stations and allotments is not deemed to exist if the distance separation requirements set forth in Section E-1.3.2 are met.

E-1.2.3 The Department may require an LPFM station to take remedial action if the calculated protection ratio at the protected contour of an existing primary station is not provided, or if a change in channel allotments results in the prediction of interference to the new allotment from the LPFM station. In the latter case, it is expected that the applicant for the primary station will consider, calculate and notify the interference impact to the LPFM station. Normally it is expected that only a frequency change by the LPFM station would be necessary but cessation of operation by the LPFM station would be required if no other suitable remedial action is practicable. An LPFM station would not be expected to cease operation to protect a vacant allotment.

E-1.2.4 Should a new primary station or one which has changed parameters cause interference to an LPFM station but not receive any, the latter may either accept the interference or make application to change its operation to alleviate the interference. Interference should be deemed to exist when the desired to undesired field strength ratios of 10 to 1, 2 to 1, 1 to 100 from co-channel, first and second adjacent channels, respectively, are not met. These ratios may be determined from F(50,50) field strength curves for the desired signal and F(50,10) field strength curves for the undesired signal, or by any recognized engineering method.

E-1.3 Choice of Frequency

E-1.3.1 Channels in the band 88 to 108 MHz are assigned on the basis of 200 kHz separations with carrier frequencies every odd 100 kHz. For convenience, these channels are numbered consecutively from 201 to 300.

E-1.3.2 A frequency shall be chosen which meets the distance separations from existing stations and allotments as shown in Table E-1:

Frequency Relationship (difference)	Class of Station							
	A1	A	B1	B	C1	C	LPFM	VLPFM
Co-Channel	50	70	83	97	124	144	17	15
1st adjacent	32	52	65	79	100	111	10	8
2nd adjacent	20	40	53	66	88	109	5	5

TABLE E-1: Minimum Separations (km) required to provide interference-free (3 mV/m) coverage.

Minimum separation distances with respect to Class C allotments or assignments are based on an ERP of 100 kW and an EHAAT of 450 m.

E-1.3.3 The separations in Table E-1 are based on LPFMs giving protection to the 0.5 mV/m of Class A1, A, B1, B, C1 and C stations, and in return, receiving protection from other LPFMs to at least the 3 mV/m contour. While not mandatory, the following Table E-2 shows the required separations for an LPFM station from an LPFM and other classes of stations to provide interference-free coverage up to the 0.5 mV/m contour. Applicants are encouraged to select channels which provide the separations given in Table E-2 whenever possible.

Frequency Relationship (difference)	Class of Station							
	A1	A	B1	B	C1	C	LPFM	VLPFM
Co-Channel	70	122	154	179	215	231	42	23
1st adjacent	37	69	88	109	140	159	24	15
2nd adjacent	20	40	53	66	88	109	13	11

TABLE E-2: Minimum Separations (km) required to provide interference-free 0.5 mV/m coverage.

E-1.3.4 Tables E-1 and E-2 separations are based on an ERP of 50 Watts with an antenna height of 60 metres for LPFM stations and maximum permissible parameters for other stations. Minimum separation distances with respect to Class C allotments and assignments are based on an ERP of 100 kW and an EHAAT of 450 m.

E-1.3.5 One systematic method of determining which channels are available is outlined in **Appendix 5**.

E-1.3.6 For applications with the special conditions as described in Section E-1.1.6, a frequency shall be chosen which meets the limiting conditions identified in that section.

E-1.4 Channels Separated by 600 kHz

E-1.4.1 FM stations separated by 600 kHz and operating in the same area may interfere with each other. Interference may occur at locations where the field strength differential typically exceeds 30 dB. (60 dBμV/m contour equivalence can be used for different antenna heights). Co-location (same site) of upper and lower (left and right) 3rd adjacent channels is to be studied on a case-by case basis.

E-1.4.2 If an incoming station is located such that its calculated 100 dBμV/m contour intercepts or overlaps the geographical zone between the 80 dBμV/m contour and the protected 54 dBμV/m contour of another station, the incoming station is responsible for remedying complaints of interference related to the reception of the incumbent station.

E-1.4.3 New stations are not protected against interference from stations separated by 600 kHz with overlapping service contours.

E-1.5 Separations Less than the Minimum

If it is impossible to find a frequency which meets all the minimum distance separations to primary FM stations, a submission based on separations, none of which are more than eight kilometres short of the distances in Table E-1, may be considered only when the mutual consent of all stations involved and departmental approval are obtained. In such cases, a licensed broadcast engineering consultant shall conduct a detailed channel search and will determine and plot on a map the theoretical interference zones as well as the interference-free coverage.

E-2 QUALITY OF RE-BROADCAST SIGNAL

E-2.1 An applicant for a re-broadcasting LPFM station shall provide assurance that the transmitted signal will be of acceptable technical quality.

E-2.2 If the signal is to be picked up "off-air" or by a microwave link, an analysis of the propagation path over which the signal is to be received and an estimate of the level and signal-to-noise ratio of the received signal which will be exceeded 99 % of the time shall be provided.

E-2.3 Section E-2.2 above does not apply during night-time if the signal received "off-air" is transmitted by an AM station. In such cases an estimate of the quality obtainable under night-time conditions will be sufficient.

E-2.4 If the programme material is to be provided by a microwave link an estimate of the signal-to-noise ratio is required. For microwave programme links, application should be made to the appropriate Regional Office.

E-2.5 If more than one re-broadcasting station is involved, the signal-to-noise ratios at the preceding stations in the chain shall be taken into consideration.

E-3 COVERAGE PREDICTIONS

E-3.1 Estimates shall be made of the predicted coverage and submitted with the application. The F(50,50) field strength curves in Figures 2 and 3 of **Appendix 4** should be used to determine the distance to the 0.5 and 3 mV/m contours as follows:

(a) in areas of relatively smooth terrain, the distance to each contour should be determined in the direction of the four standard radials and one radial in the direction of the principal centre to be served using the transmitting antenna height in the pertinent direction;

(b) in areas of mountainous terrain or in the proximity of other natural obstacles, the distance to each contour should be determined in at least the four standard directions plus one each in the direction of the centres to be served using the transmitting antenna height in the pertinent direction. When a directional antenna is proposed, the ERP in the pertinent direction should be used.

When a directional antenna is proposed, the ERP in the pertinent direction should be used.

E-3.2 Suitable point-to-point type field strength calculations may be used to replace or supplement the above Paragraph E-3.1(b) if the irregularity of the terrain justifies the use of such techniques.

E-3.3 The coverage predictions should be presented in tabular form and on a suitably detailed map with the transmitting site marked and the 0.5 and 3 mV/m contours labelled. The map referred to in D-1.2.4 would be suitable, supplemented by a map of the adjacent area if necessary.

When interference zones are predicted, as per E-1.4, they shall be shown on the contour map as hatched areas.

SECTION F PREPARATION OF TECHNICAL SUBMISSIONS SUPPORTING APPLICATIONS FOR VERY LOW POWER FM (VLPFM) BROADCASTING STATIONS IN SMALL REMOTE COMMUNITIES

Very low power FM stations shall only be established in those communities which are both outside the major urban/suburban areas and which are remote in the sense of lacking access to a complete range of Canadian broadcasting services. These stations shall use FM channels on an unprotected non-interfering basis with an ERP of 10 Watts or less.

F-1 APPLICATION PROCEDURE

F-1.1 Application Form

An application for a broadcasting certificate shall be made on departmental **Form IC 2389,** ***"Application for a Broadcasting Certificate Very Low Power FM (VLPFM) or Very Low Power Television (VLPTV) in Small Remote Communities"***. Two copies of this form should be submitted. An application form for a broadcasting licence can be obtained from the Canadian Radio-television and Telecommunication Commission (CRTC). The two applications shall be filed simultaneously.

All necessary forms may be obtained from the departmental web site or any Regional or District Office. Addresses for Regional and District Offices are provided in **Radiocommunications Information Circulars No. 66 "Addresses and Telephones Numbers of Regional and District Offices".**

F-1.2 Antenna Site and Aeronautical Clearance

The applicant shall comply with the applicable Transport Canada and Nav Canada requirements for aeronautical obstruction clearance and land use and/or construction proposals. Transport Canada **Form 26-0427** entitled ***"Aeronautical Obstruction Clearance Form"*** and Nav Canada form "***Land Use Proposal Submission Form***" must be submitted for clearance to the district office of Transport Canada and Nav Canada. The necessary forms and submission information may be obtained from the respective district offices.

One copy of departmental **Form IC 2586EA,** ***"Preliminary Environmental Information, Municipal/Land-Use Consultation and Aeronautical Site Clearance Attestation"*** shall also be completed.

F-1.3 Municipal/Land-Use Authorities Consultation

An applicant for a new station or for changes to an existing station shall submit a notice to local municipal/land-use authorities.

The purpose of the notice is to advice the municipality/land-use authorities of the applicant's intention and to give the authorities an opportunity to consider the implication of the proposed antenna structure and site. This notice shall also include a sketch of the building, the proposed tower(s) and antennas, with sufficient detail and dimension to give a pictorial representation of the total structure.

The notice is to be filed with each municipal/land-use authority with sufficient lead time to permit it to consider the impact of the proposal. Insufficient lead time could delay the processing of the application by the Department and may also cause the CRTC to reschedule this item for a later Public Hearing. A copy of this notice is to be filed with the Department's District Office.

Changes to existing stations that do not modify the structure and its attachments need not be communicated to the local municipal/land-use authorities

The municipal/land-use authorities may file a written objection to the proposed facilities with the appropriate departmental District Office. The Department expects the municipal/land-use authorities to make its view known as quickly as possible.

The Department expects that the applicant and the municipal/land-use authorities to resolve all problems and objections. Failing this, the Department will consider all factors pertaining to the application, as well as the municipal comments, and render a final decision.

To inform the Department of the status of the municipal/land-use authorities notification and consultation process, the applicant shall submit copy of departmental **Form IC 2586EA, *"Preliminary Environmental Information, Municipal/Land-Use Consultation and Aeronautical Site Clearance Attestation"*** with its application

The municipal consultation process must be completed before a radio authorization may be issued

SECTION G TECHNICAL REQUIREMENTS FOR THE ESTABLISHMENT OF VERY LOW POWER FM STATIONS (VLPFM) IN SMALL REMOTE COMMUNITIES

G-1 TECHNICAL CRITERIA

G-1.1 Conditions

G-1.1.1 Power

The ERP shall not exceed 10 Watts. The ERP is equal to the transmitter power supplied to the antenna multiplied by the relative gain (dipole) of the antenna in a given direction.

G-1.1.2 Antenna Parameters

The maximum antenna height above ground shall not exceed 30 metres.

G-1.1.3 Equipment

Recommended minimum technical standards for the transmitter are outlined in ***Technical Standards and Requirements for FM Transmitters Operating in Small Remote Communities (BETS-8).***

G-1.1.4 Service

Because of the nominal cost and the limited capability of the equipment, the quality of the signal provided may be limited. Service is only provided to the 3 mV/m contour.

G-1.2 Selection of Frequency

In selecting a channel, care should be taken to minimize the disruption of the existing pattern of off-air reception of distant stations in the community. The channel selected shall comply with the minimum distance separations shown in Table G-1.

Frequency Relationship	Separation between stations (km)							
	VLP	LP	A1	A	B1	B	C1	C
Co-channel	8	15	32	52	75	94	122	142
First Adjacent	5	8	24	44	57	71	92	103
Second Adjacent	3*	4	20	40	53	67	88	109

TABLE G-1: Minimum distance separations between VLPFM stations and primary and low power stations.

Note: Distance marked with an asterisk(*) may be eliminated if stations are co-sited. The frequency of the transmitted signal shall correspond to the carrier frequency specified for allotted channels.

G-1.3 Interference

G-1.3.1 Interference to and from Other Stations

Very Low Power FM (VLPFM) stations are not protected from interference caused by primary FM stations and by low power FM (LPFM) stations. Very low power stations shall not cause interference to any new or existing stations, and such stations are only entitled to protection from other very low power stations established in accordance with this Section. Protection of VLPFM stations applies at the 3 mV/m contour.

G-1.3.2 Remedial Measures

Should the operation of a very low power station established in accordance with this section cause interference to existing broadcasting stations or to other radio services, remedial measures shall be taken by the licensee even to the extent of closing down the station if another suitable channel cannot be found. These remedial measures also apply to the protection of future broadcasting stations established in accordance with new or existing allotments.

G-1.4 Service and Coverage Guidelines

The signal strength normally required to provide a satisfactory service to the low density population areas is the 3 mV/m contour. As a guideline, for a 10 Watt ERP using an antenna at a height of 30 metres above ground, the distance from the transmitter to the above contour is estimated to be slightly over 2 km (non-directional antenna with a gain of 0 dB).

G-1.5 Channels Separated by 600 kHz

Refer to Section E-1.4 for requirements relating to channels separated by 600 kHz.

SECTION H PREPARATION OF TECHNICAL SUBMISSIONS SUPPORTING APPLICATIONS FOR FM RE-BROADCASTING STATIONS

H-1 APPLICATION PROCEDURE

H-1.1 Preamble

This section outlines the procedure to be followed in preparing and submitting technical information required in support of applications for full time re-broadcasting stations.

H-1.2 Conditions of Assignment

Full time re-broadcasting stations may be assigned in areas within the protected contour of the originating station where the signal of the originating station is deficient (i.e. field strengths less than 0.5 mV/m due to terrain factors such as shadowing, multipath propagation, etc.

Full time re-broadcasting stations may be assigned as Low Power or Very Low Power FM (LPFM or VLPFM) stations or they may be assigned as "on-channel" boosters.

As LPFM or VLPFM, these stations are only assigned between the 3 mV/m and the 0.5 mV/m contours of the originating station, in accordance with Sections D and E, on an unprotected, non-interfering basis.

As "on-channel" boosters these stations use the same frequency as that of the originating station. Moreover, the 0.5 mV/m contour shall not extend beyond the 0.5 mV/m contour of the originating station and the ERP shall not exceed 10 % of the ERP of the originating station.

H-1.3 Requirements

An application for a broadcasting certificate for a full time re-broadcasting station shall be made in accordance with the requirements of Sections C, D and E. For on-channel booster applications, no analysis need be submitted on the minimum separation distances to other FM stations. However, an analysis on the quality of service to be provided is required. Both types of re-broadcasting station applications are subject to an FM/NAV/COM compatibility analysis.

APPENDIX 1
Figure 1

Estimated Field Strength Exceeded at 50% of the Potential Receiver Locations for at Least 50% of the Time at a Receiving Antenna Height of 9.1 m.

Estimation de l'intensité de champ dépassée à 50% des emplacements récepteurs possibles, pour au moins 50% du temps, pour une hauteur d'antenne réceptrice de 9,1 m.

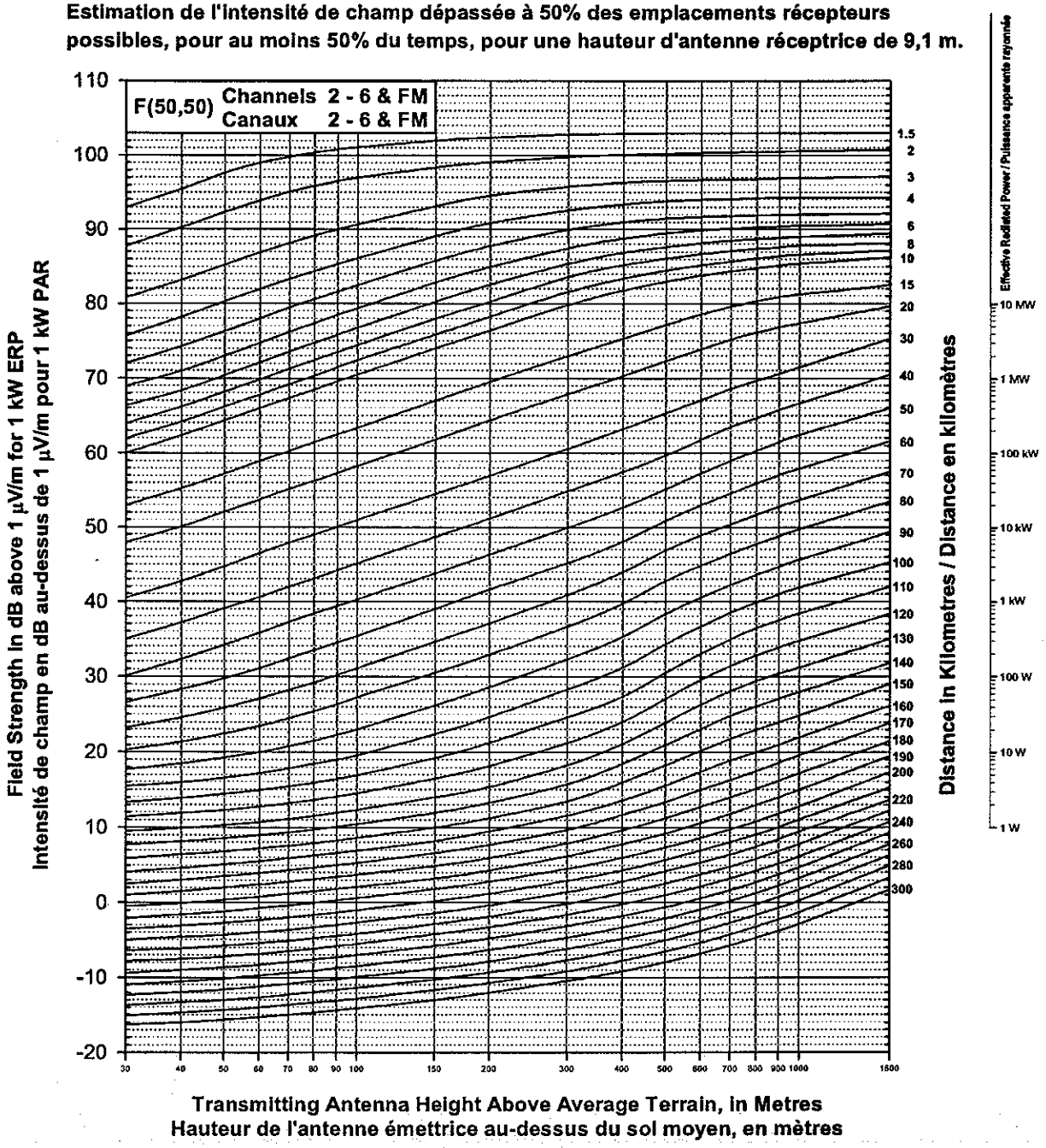
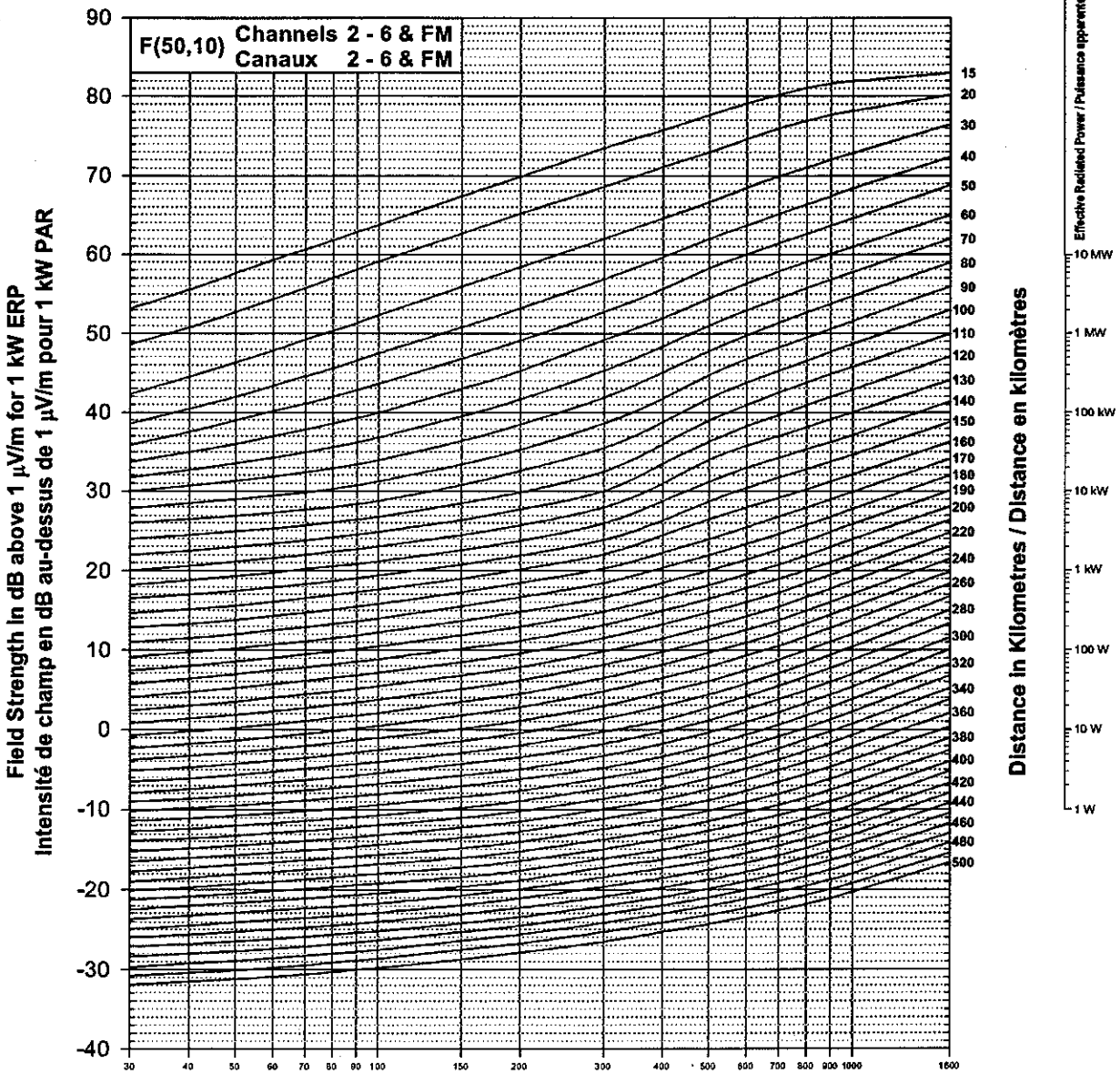


Figure 2

Estimated Field Strength Exceeded at 50% of the Potential Receiver Locations for at Least 10% of the Time at a Receiving Antenna Height of 9.1 m.

Estimation de l'intensité de champ dépassée à 50% des emplacements récepteurs possibles, pour au moins 10% du temps, pour une hauteur d'antenne réceptrice de 9,1 m.



APPENDIX 2
SUMMARY SHEET

APPLICANT:_____

STATION: **NEW** ☐ **CHANGE** ☐

STATION LOCATION:_____

STATION CALL SIGN:_____

ANTENNA CO-ORDINATES:
N. LAT. ° ' "
W. LONG. ° ' "

TRANSMITTER POWER: _____ **kW:**
LINE EFFICIENCY:_____**%**

ANTENNA POWER GAIN: **MAXIMUM** _____
AVERAGE _____

ERP: MAXIMUM _____ **kW (Horizontal/Vertical/circular Polarization)**
AVERAGE _____ **kW (Horizontal/Vertical/circular Polarization)**

AT BEAM TILT _____ **kW Maximum**
AT BEAM TILT _____ **kW Average**

EHAAT:_____ **METRES**

RCAMSL:_____ **METRES**

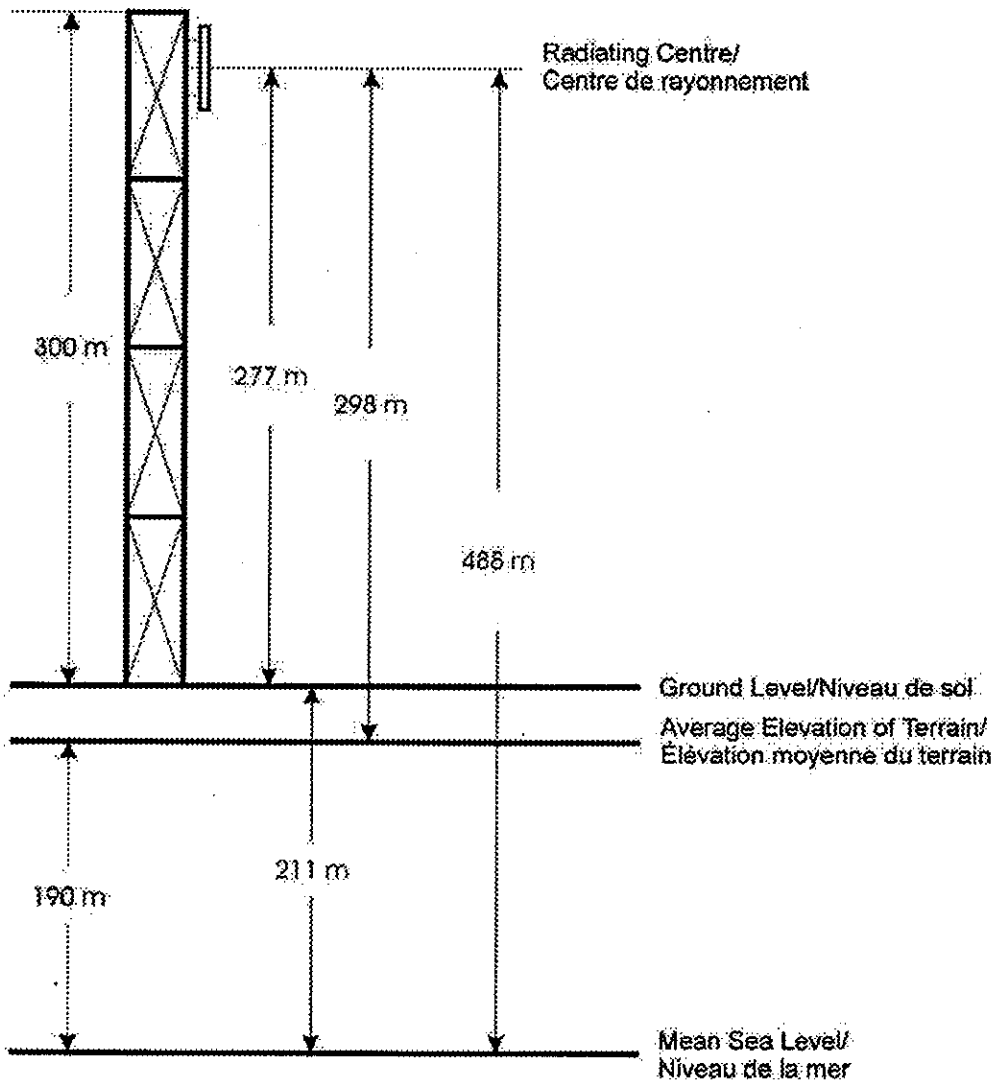
CHANNEL NUMBER:_____

FREQUENCY:_____ **MHz**

CLASS OF STATION:_____

MODES: MONO ( ), STEREO ( ), UNATTENDED ( ), AUTOMATIC ( ), SCMO ( )

APPENDIX 3



ELEVATION DIAGRAM OF TYPICAL TOWER AND TRANSMITTING ANTENNA

APPENDIX 4
ANNEXE 4
Figure 1

PARAMETERS EQUIVALENT TO AN EFFECTIVE RADIATED POWER OF 50 WATTS AT A TRANSMITTING ANTENNAA HEIGHT OF 60 METERS
PARAMÈTRES ÉQUIVALENTS À UNE PUISSANCE APPARENTE RAYONNÉE DE 50 WATTS POUR UNE HAUTEUR DE L'ANTENNE ÉMETTRICE DE 60 MÈTRES

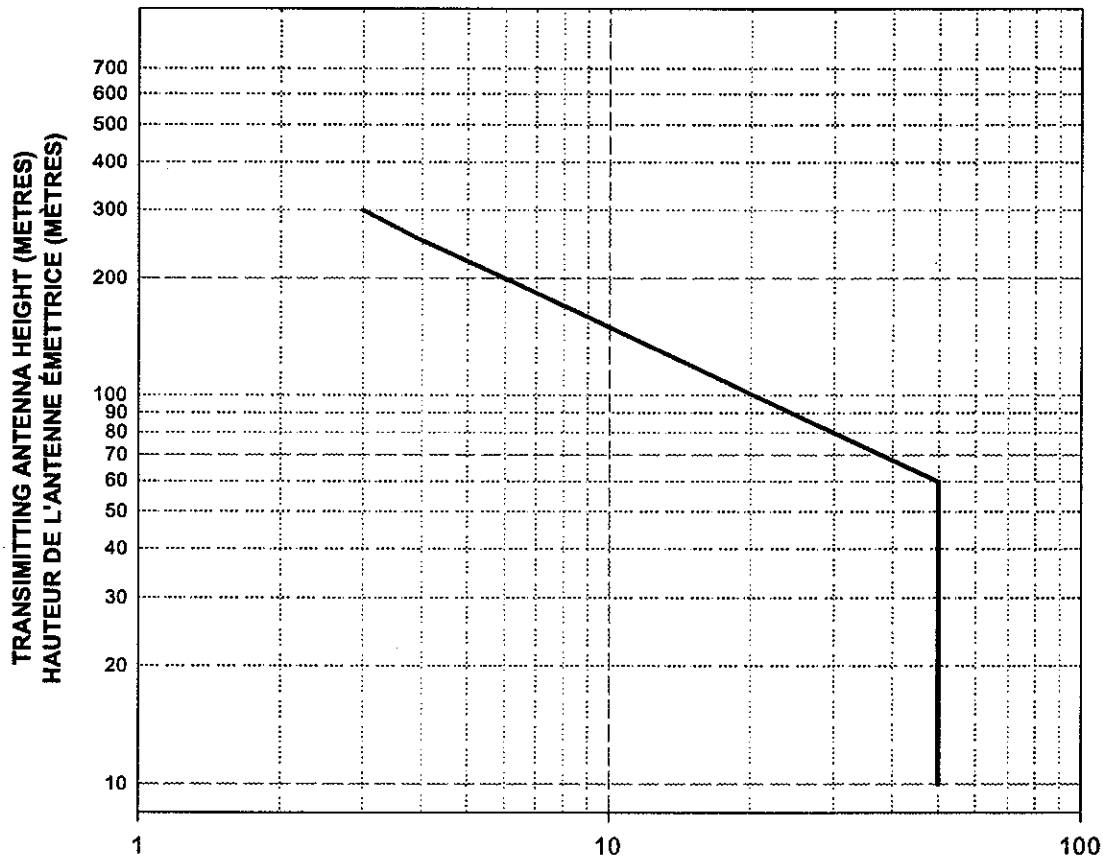
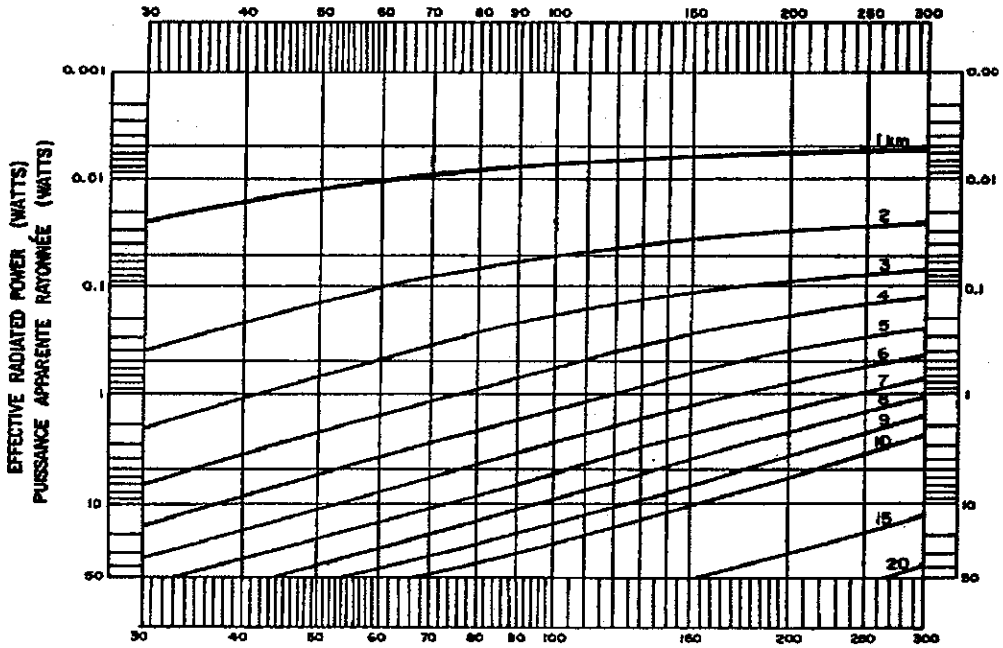


Figure 2

0.5 MILLIVOLT PER METRE CONTOUR CALCULATOR

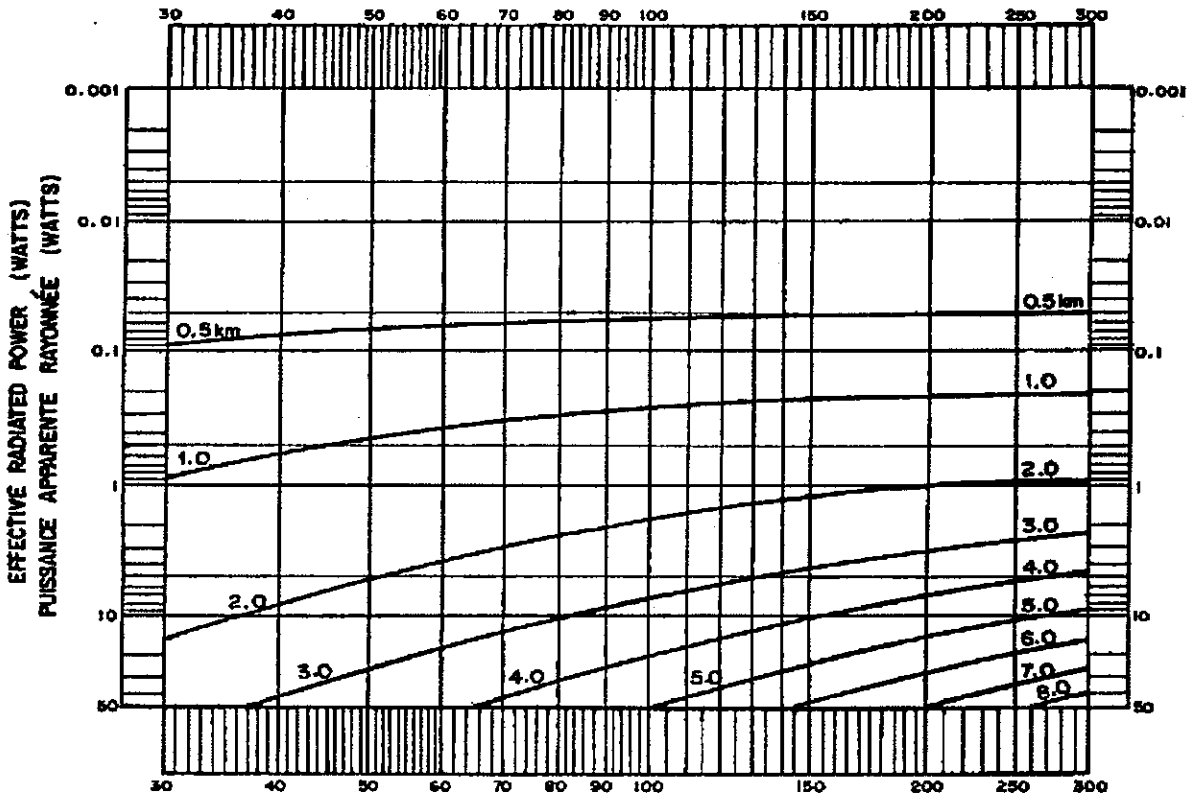


TR

ANSMITTING ANTENNA HEIGHT (METRES)

Figure 3

3 MILLIVOLT PER METRE CONTOUR CALCULATOR



TRANSMITTING ANTENNA HEIGHT (METRES)

APPENDIX 5

SYSTEMATIC METHOD FOR DETERMINING LPFM CHANNEL AVAILABILITY

The following presents a systematic method for making a channel search.

(a) List the numbers 201 to 300. Channels 201 to 220 should not be considered if there is reception of TV channel 6 in the proposed coverage area, or if there is a channel 6 allotment within 95 km of the LPFM transmitting site. If there is a limitation on the parameters of a channel 6 allotment, this distance may be somewhat reduced. Departmental advice can be sought in this regard.

(b) On a suitable map, draw a circle centred at the proposed antenna site with a radius of 144 km (3 mV/m) if Table E-1 is used, or 231 km if Table E-2 is used.

(c) Using the Canadian table of FM allotments starting at channel 201 and working up, check for centres located within the circle in (b). Measure on the map the distance to these centres and, using either Table E-1 and or Table E-2, eliminate those channels which allotments to that centre would preclude; e.g. a centre 90 km distant has an allotment listed as 250B. From Table E-1 under Class B, the required separation for co-channel operation is 97 km, but for first adjacent channels it is only 79 km. Thus channel 250 is eliminated from the list in (a). If 0.5 mV/m coverage is wanted, from Table E-2, the required separation for first adjacent channels is 109 km. Thus channels 249, 250 and 251 cannot be used in this example.

(d) If there are available channels after eliminating those affected by Canadian allotments, check whether the circle in (b) encloses any US territory. If there are still available channels, select one and enter it under Section 2 of the application form as part of the required technical data.

(e) If no channels are available using Table E-2, repeat from Step (b) using Table E-1.

(f) If no channels are available, based on Table E-1, check whether any channel is eliminated by being less than 8 km short of any required separation, excluding those to other LPFM stations (see Section E-1.4). A proposal based on such a channel might be considered acceptable under these circumstances.

(g) If there are still no channels available, the services of a broadcast engineering consultant should be retained to perform a channel search.

APPENDIX 6

PROCEDURE TO DETERMINE INTERFERENCE ZONE

On an appropriately scaled map plot the transmitter sites and do the following:

1. Plot the protected service contour for the assignment or allotment to be protected, based on the maximum or other permissible parameters, as shown in Section C-1.2.

2. Plot the interfering contour for the proposed assignment or allotment based on its proposed parameters in accordance with the interfering signal levels as shown in Section C-1.3.

3. Mark the two points where the contours intersect.

4. Repeat steps 1, 2 and 3 except increase the value of each contour while maintaining the same protection ratio until the protected and interfering contours are tangential.

5. Draw a line joining the intersection points obtained above. The area contained within this line and the protected service contour drawn in step 1 defines the interference zone.

Example

The following example shows the interference zone between an existing Class B station and a proposed Class A station which are short-spaced and on the same channel (co-channel).

1. The protected service contour from Section C-1.2 is 54 dBμV/m which extends to 65 km.

2. The interfering contour from Section C-1.3 is 34 dBμV/m. (The extent of this contour will vary depending on the proposed operating facilities).

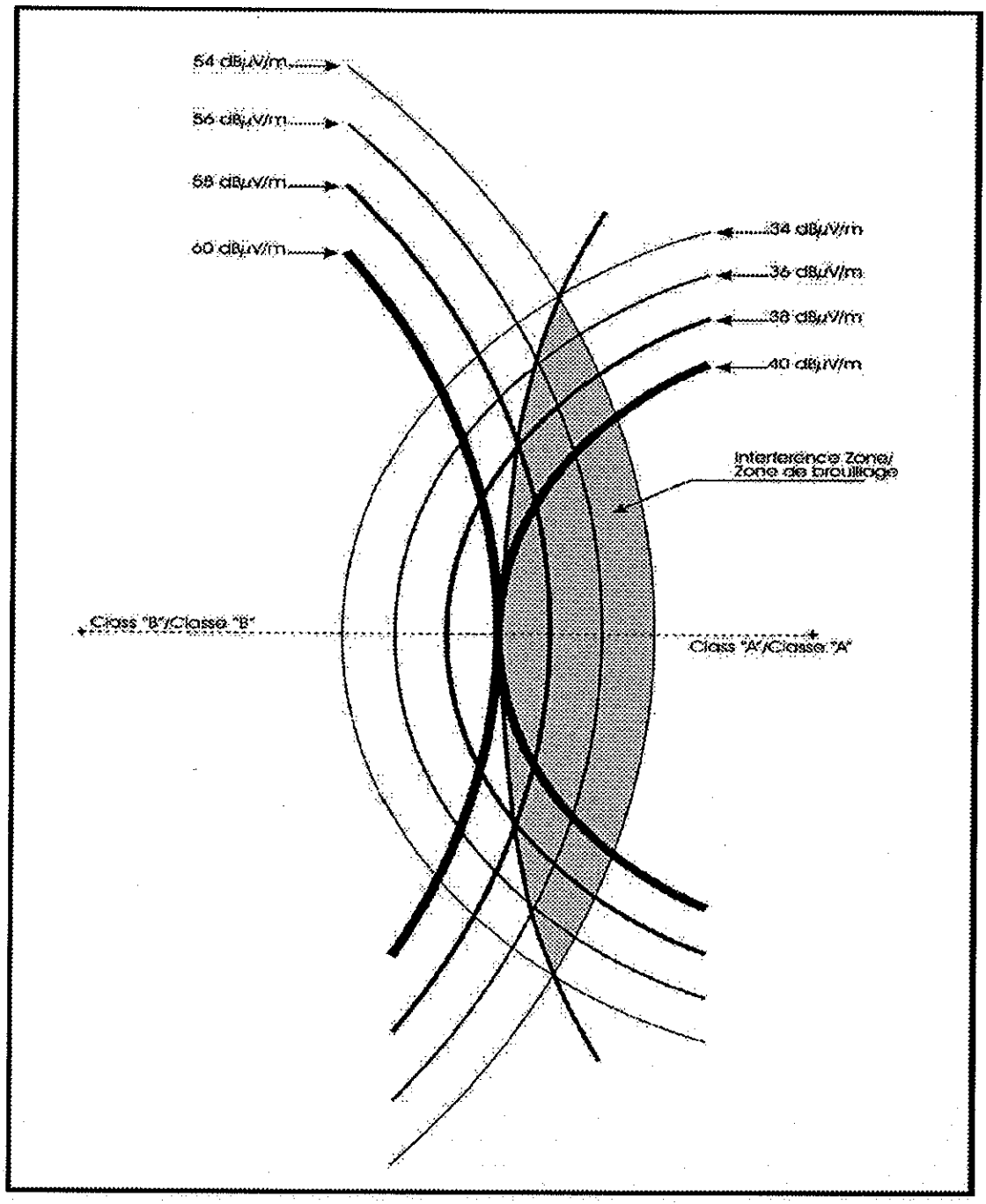
3. Mark the two points where the contours intersect.

4. Plot the 56 dBμV/m service contour and the 36 dBμV/m interfering contour and mark the two points of intersection. Continue to increase the value of the contours, plot them, and mark the intersection points until the contours are tangent.

5. Draw a line joining the intersection points obtained above. The area contained within this curve and the protected service contour drawn in step 1 defines the interference zone. This area is shown in grey in Figure 1.

Figure 1

INTERFERENCE ZONE



APPENDIX 7

PROCEDURE FOR DETERMINING FM TO TV CHANNEL 6 PROTECTION REQUIREMENTS

Purpose

To define the factors and to present a method for determining the protection requirements for TV channel 6 from FM Broadcasting stations on channels 201 to 220 when co-located with TV channel 6 and when located outside the Grade B contour of TV channel 6.

TV Channel 6 Receiver Measurements

Laboratory measurements were taken on a number of TV receivers to determine the level at which the interference from FM signals on channels 201-220 was viewed as being just perceptible. The results are shown in Figure 1 of this appendix. The data showed an improvement of approximately 6 dB over earlier data. The curves of Figure 1 show the average FM to TV channel protection ratio for TV receivers for a picture quality of just perceptible interference. Since the protection varies with the level of the TV signal, separate curves are shown for different TV input levels.

FM to TV Channel 6 Protection

The protection to TV channel 6 from FM stations is related to their field strength ratio by the following formula:

$$F_u - F_d = P_r + G_r + A_d - L \qquad (1)$$

where: F_u is the FM undesired signal and F_d is the desired TV signal levels both in dBμV/m;
P_r is the protection ratio in dB obtained from the receiver measurement;
G_r is the value in dB to be added (or subtracted) to change the TV grade of picture from the just perceptible interference value to a specified picture quality;

A_d is the TV receiving antenna discrimination against the FM signals in dB;

L is the adjustment made in dB with respect to the percentage of locations where the field strength level will be above the stated value.

Co-located FM and TV Stations

For co-located FM and TV stations, the field strength of the TV signal will be very high in the vicinity of the TV antenna and therefore outdoor receiving antennas are not normally used. Measurement tests have indicated that the maximum TV signal into the receiver, using an indoor antenna, does not usually exceed -25 dBm. The reduced antenna size (rabbit ears) and its reduced height above ground, limit the actual level.

The receiver level of -25 dBm has been used to derive the FM to TV protection ratios as shown in Table C-2. It is recognized that a TV receiver input level of less than -25 dBm could be used, when justified, by the type of receiving antenna and possible shielding effect of the type of buildings where the receivers are located. The "antenna system gain" (antenna gain over any losses) can be as low as -29 dB (loss) for an antenna at a height of 2 metres. This would place the receiver input signal at -38 dBm for an incident field of 115 dBμV/m, as determined from the F(50,50) field strength curves.

For co-located FM and TV transmitter sites, the TV receiving antenna provides no discrimination against the FM transmissions for horizontal polarization. For this case, the antenna discrimination factor is zero. The FM power for vertical polarization can be increased 6 dB above the value determined for horizontal polarization.

The picture quality for coverage inside the Grade A contour is defined as a picture of acceptable quality for at least 70 % of the receiving locations and 90 % of the time. Using the ITU-R five point impairment scale, this acceptable quality has been equated to a picture impairment Grade of 4.0.

Since the laboratory measurements on the TV receivers were performed using an interference criterion of just perceptible or a picture impairment Grade of 4.5, a correction of 3 dB is required to change to a picture impairment Grade of 4.0. Since it is proposed to protect 70 % of the receiver locations, which is the same percentage of receiver locations as used in the definition of the Grade A contour, a 5 dB correction factor is used for "L" to equate the 50 % used in the measurements (median value of the ratio) to 70 % of protected receiver locations. Table C-2 has been derived using the above factors in equation (1).

FM Stations Outside the Grade B Contour

For FM stations located outside the Grade B contour, the B contour ($F_d = 47$ dBμV/m) is protected and the FM to Channel 6 field strength values shown in Table C-3 have been calculated using the formula in equation (1) with the following considerations: the FM to TV channel 6 protection ratio (P_r) is based on measured values for a TV receiver input of -65 dBm; for the antenna discrimination, a value of 6 dB is used. This value represents the performance of an average outdoor antenna as used at locations near the Grade B contour.

The picture quality for coverage within the Grade B contour is defined as a picture of acceptable quality for at least 50 % of the receiving locations and 90 % of the time. The acceptable quality has been equated to "interference is not annoying". Since it is desirable to have an interference which does not degrade the picture, ITU-R picture impairment Grade of 4.0 is used.

To change a ITU-R impairment Grade of 4.5, which is the condition under which the TV receivers were measured, to an impairment Grade of 4.0, a value of 3 dB for G_r is used.

"L" in the equation represents the adjustment made in dB with respect to the percentage of locations in excess of 50 %. By using the F(50,10) propagation curves, and since the interference value is exceeded for 50 % of the locations and 10 % of the time, the value of "L" is zero. Table C-3 has been derived using the above factors in the formula of equation (1).

Step by Step Procedure

For determining the maximum power of the FM station, when co-located with a TV Channel 6, the following are the steps:

(1) using Table C-2, which shows the permissible power ratio for FM channels 201 to 220 included, select the FM to TV power ratio for the proposed FM channel;

(2) using the ERP of the TV station, determine the power of the FM station by adding the power ratio in step 1 to the ERP of the TV station as converted to dB. If the TV antenna pattern is directional, the permissible FM power shall be calculated for the different azimuths;

(3) if the FM antenna height differs by 30 metres or more from the height of the TV antenna, the ERP of the FM antenna shall be adjusted to correspond to its equivalent value.

The equivalent value is calculated by the following procedure: using the FM ERP as determined in step 2 and the EHAAT for the TV station, determine the distance to the FM 100 dBμV/m contour using the F(50,50) field strength curves. Using the same curves, determine the FM ERP that will place the 100 dBμV/m contour at this same distance using the EHAAT of the FM station.

For determining the maximum power (ERP) of the FM station, when the station is located outside the Grade B contour of the channel 6 TV station, the following are the steps involved:

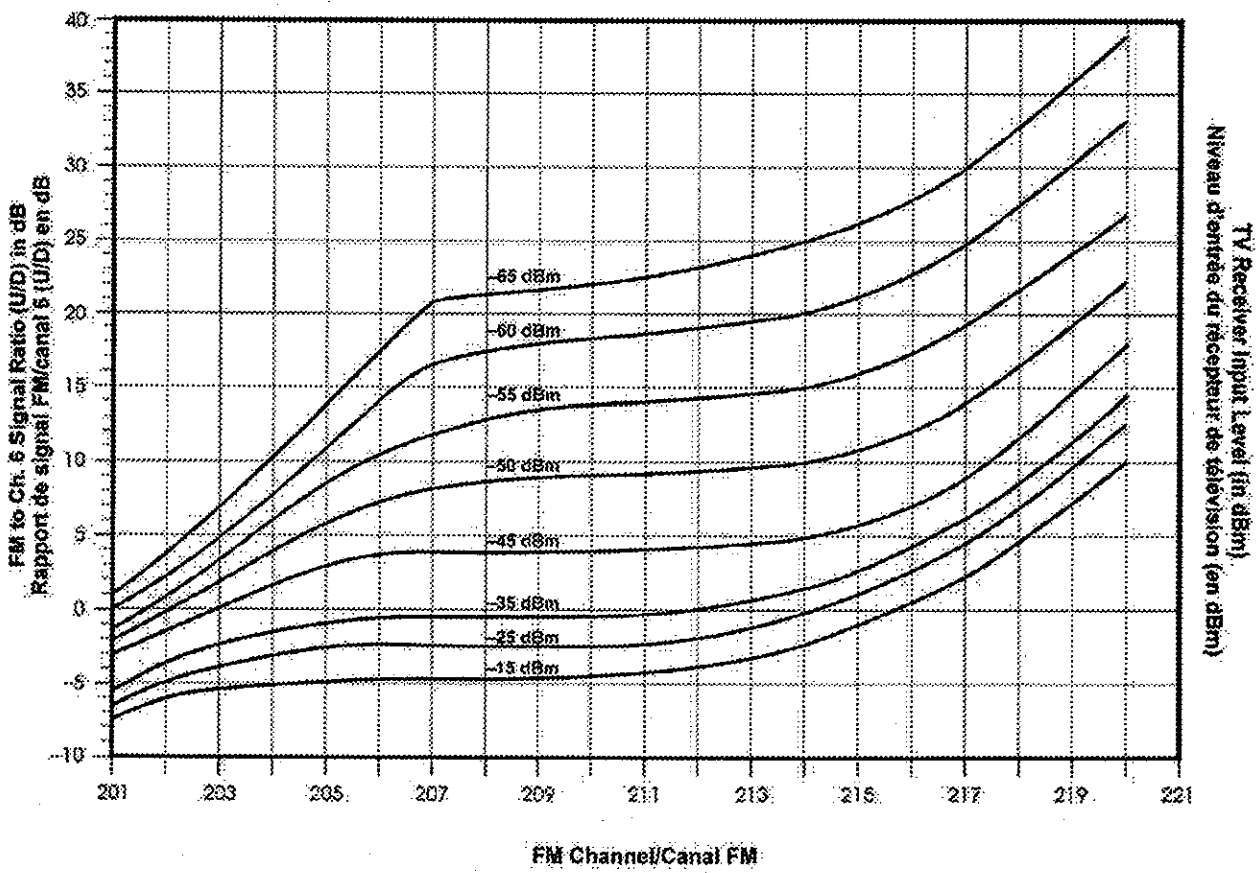
1) Using Table C-3, which shows the permissible FM field strength level, select the field strength level of the proposed FM channel;

2) from the field strength level in step 1 above, determine the maximum ERP using the F(50,10) propagation curves and the EHAAT of the station. The ERP represents the maximum radiation in the direction of the channel 6 Grade B contour.

FIGURE 1

FM/CHANNEL 6

PROTECTION RATIOS
(Just Perceptible Interference)



APPENDIX 8

PROTECTION CRITERIA
FM/NAV/COM

1. INTERFERENCE MECHANISMS AND COMPATIBILITY CRITERIA

(a) Type A_1 interference

For the analysis of type A_1 interference, the following two categories of spurious emissions exist:

- spurious emissions resulting from an intermodulation process caused at the transmitter site, e.g. by multiple transmitters feeding the same antenna;

- other spurious emissions

Where the actual frequency of the spurious emission is known, Table I gives the values of protection ratio used for frequency differences up to 200 kHz from aeronautical frequencies (radionavigation and radiocommunication). Type A_1 interference need not be considered for frequency differences greater than 200 kHz.

TABLE I

Frequency difference between spurious emission and NAV/COM signal (in kHz)	Protection ratio (in dB)
0	17
50	10
100	-4
150	-19
200	-38

(b) Type A_2 interference

The protection ratio values used are given in TABLE II.

TABLE II

Frequency difference between NAV signal and broadcasting signal (kHz)	Protection ratio (in dB)
150	-41
200	-50
250	-59
300	-68

A frequency difference less than 150 kHz cannot occur. For frequency differences greater than 300 kHz, this type of interference need not be considered.

Note: FM sound broadcasting stations may in some Regions employ compression techniques and/or provide services on subcarrier frequencies up to 99 kHz. Combinations of these practices, especially when associated with a carrier deviation larger than ± 75 kHz, may result in 0 to 10 dB increase in susceptibility to A_2 type interference of an ILS receiver. Also, type A_2 interference need not be considered for COM receivers.

(c) Type B_1 interference

Third-order intermodulation products of the form:

(1) $f_{intermod} = 2f_1 - f_2$ (two-signal case) or

(2) $f_{intermod} = f_1 + f_2 - f_3$ (three-signal case)

with $f_1 > f_2 > f_3$,

generated in the airborne ILS or VOR receiver will cause an unacceptable degradation of receiver performance, if $f_{intermod}$ coincides with the frequency of the wanted signal and if the inequalities given below are fulfilled.

Intermodulation of the second order is irrelevant and intermodulation of a higher order than three has not been considered.

(1) Two-signal case

$$2\left(N_1 - 20\log\frac{\max(0.4;108.1-f_1)}{0.4}\right) +$$

$$N_2 - 20\log\frac{\max(0.4;108.1-f_2)}{0.4} + 120 \geq 0$$

(2) Three-signal case

$$N_1 - 20\log\frac{\max(0.4;108.1-f_1)}{0.4} +$$

$$+ N_2 - 20\log\frac{\max(0.4;108.1-f_2)}{0.4} +$$

$$+ N_3 - 20\log\frac{\max(0.4;108.1-f_3)}{0.4} + 126 \geq 0$$

N_1, N_2 and N_3 have the following meaning:

N_1: level (dBm) of the broadcasting signal of frequency f_1 (MHz) at the input of the NAV receiver;

N_2: level (dBm) of the broadcasting signal of frequency f_2 (MHz) at the input of the NAV receiver;

N_3: level (dBm) of the broadcasting signal of frequency f_3 (MHz) at the input of the NAV receiver.

max (0.4; 108.1 - f) means either 0.4 or 108.1 - f, whichever is greater.

Frequency offset conditions

When the intermod product falls close to the frequency of the wanted signal, a correction is applied to each signal level which is a function of the frequency difference between the NAV signal and the intermodulation product. This correction is given in TABLE III.

$N_{1,2,3}$ (corrected) = $N_{1,2,3}$ - correction term.

TABLE III

Frequency difference between NAV signal and intermodulation product (kHz)	Correction term (in dB)
0	0
±50	2
±100	8
±150	16
±200	26

For frequency differences beyond ± 200 kHz, type B_1 interference need not be considered. For COM receivers, the Venn diagram method shall be used.

(d) Type B_2 interference

TABLE IV contains maximum permitted levels of broadcasting signals at the input to the airborne ILS or VOR receiver.

TABLE IV

Frequency of broadcasting signal (MHz)	Level (in dBm)
107.9	-20
106	-5
102	5
≤100	10

For intermediate values, the maximum permitted level is determined by linear interpolation. For COM receivers, the level of any FM signal should not exceed -10 dBm.

2. SELECTION OF AERONAUTICAL TEST POINTS

For a test point height of:

- 2450 m ASL for ILS,
- 12200 m ASL for VOR,

TABLE V gives separation distances between a broadcasting station with given ERP and frequency and the test point of an aeronautical radionavigation station beyond which it is considered unlikely that the service of the aeronautical station could be affected. The more critical requirements are those for A_1 and B_1: the higher of the two separation distances is shown in Table V.

In general, broadcasting stations which are:

- more than 500 km from a VOR/COM test point,
- more than 255 km from an ILS test point, or
- beyond the radio line-of-sight from a VOR or ILS test point,

are considered as being unlikely to affect the service of that aeronautical radionavigation station.

TABLE V

Separation distance (km) between a test point of a radionavigation station and an FM broadcasting station beyond which the aeronautical service is unlikely to be affected.

Effective radiated power of broadcasting station		Broadcasting station frequency (MHz)						
		≤100	102	104	105	106	107	107.9
(dBW)	(kW)	distance (km)						
55	300	125	210	400	500	500	500	500
50	100	75	120	230	340	500	500	500
45	30	40	65	125	190	310	500	500
40	10	25	40	70	105	180	380	500
35	3	20	20	40	60	95	210	500
30	1	20	20	25	35	55	120	370
25	0.3	20	20	20	20	30	65	200
20	0.1	20	20	20	20	20	40	115
≤15	≤0.030	20	20	20	20	20	20	65

3. COMPATIBILITY ASSESSMENTS

For the purpose of compatibility assessment, an interference prediction model, based on the compatibility criteria given in Section 1 of this appendix is used.

Accordingly, I propose that this Note, with its attachment, and your affirmative reply, shall constitute an Agreement to amend the 1991 Agreement which shall enter into force on the date of your reply.

Accept, Excellency, the renewed assurances of my highest consideration.

For the Secretary of State:

Donya B. McCann

Attachment:

Amendment to the Working Arrangement

Proposed Changes to the 1991 FM Working Arrangement

1. In the Preamble, the date in parentheses at the end of the first sentence which reads "1989" shall read "1991".

2. In section 5.2.1, add a Class A1 with effective radiated power of 0/2[illegible] kilowatts and an antenna height above average terrain of 1[illegible] meters. Change the effective radiated power for Class A from [illegible] to 6 kilowatts. In the parenthetical expression, delete the last sentence beginning "Canadian Class A1 shall...".

3. In section [illegible].4, replace the table of "Minimum Distance Separation Requirements" with the attached table, and delete the last sentence of the text within parentheses, which begins "Canadian Class A1 shall...".

4. In section 5.5.2, the text within parentheses which reads "see 5.2.1" shall read "see 5.2.2.".

5. In section 5.2, end the sentence after "300" and delete the rest of the current text.

6. In section 5.3, change the effective radiated power from 50 to 250 watts [illegible] the interference contour from 32 to 60 km.

7. In section 5.4., replace the existing text with, "For coordination purposes, all proposals for such stations whose interference contour (34 dBu) would extend beyond the common border need to be referred for concurrence.".

8. In section 5.1.1 and 5.4, replace "the Department of Communications" with "Industry Canada".

9. In section 5.2.2.1, add Class A1 with a field strength of 0.5 mV/m (54 dBu) and a maximum distance of 18 km. Change the maximum distance of Class A from 33 to 38 km. Delete the last sentence of the text within parentheses, which begins "Canadian Class A1 shall...".

10. In section 5.2.2.3, add Class A1 to the classes listed.

2.4 Minimum distance separation

MINIMUM DISTANCE SEPARATION REQUIREMENTS
(in kilometres)

Relation	Co-Channel 0 kHz	Adjacent Channels 200kHz	400kHz	600kHz	I.F. 10.6/10.8 MHz
A1-A1	78	45	24	20	
A1-A	131	78	44	40	4
A1-B1	164	98	57	53	7
A1-B	190	117	71	67	9
A1-C1	223	148	92	88	12
A1-C	227	162	103	99	19
					26
A-A	151	98	51	42	
A-B1	184	119	64	55	10
A-B	210	137	78	69	12
A-C1	243	168	99	90	15
A-C	247	182	110	101	22
					29
B1-B1	197	131	70	57	
B1-B	223	149	84	71	24
B1-C1	256	181	106	92	24
B1-C	259	195	116	103	40
					40
B-B	237	164	94	74	
B-C1	271	195	115	95	24
B-C	274	209	125	106	40
					40
C1-C1	292	217	134	101	
C1-C	302	230	144	111	48
					48
C-C	306	241	153	113	
					48

(U.S. Class C2 shall be considered as Class B for the purposes of the above table)

Canadian Embassy

Ambassade du Canada

No. UNEC 0195

Washington, D.C., July 9, 1997

Madam,

I have the honour to refer to your Note dated July 9, 1997, with its attachment, which reads as follows:

"I have the honor to refer to the Exchange of Notes (November 26, 1990 and February 25, 1991) constituting an Agreement between the Government of the United States of America and the Government of Canada concerning the use of the 88 to 108 megahertz frequency band for frequency modulation broadcasting (FM) (hereinafter referred to as the "1991 Agreement") and to discussions between representatives of both Governments concerning revisions to the Working Arrangement "*Working Arrangement for the allotment and assignment of FM broadcasting channels under the Agreement between the Government of Canada and the Government of the United States of America relating to the FM broadcasting service*", which forms an integral part of that Agreement. In the interests of improved use of the FM Broadcasting Band, I propose that certain provisions of the Working Arrangement for the allotment and assignment of FM broadcasting channels be amended in accordance with the attachment to this Note.

.../2

Accordingly, I propose that this Note, with its attachment, and your affirmative reply, shall constitute an Agreement to amend the 1991 Agreement which shall enter into force on the date of your reply.

Accept, Excellency, the renewed assurances of my highest consideration."

I have the further honour to inform you that the Government of Canada accepts the proposals contained in your Note and attachment. Accordingly, your Note and this reply, which is equally authentic in English and French, shall constitute an Agreement to amend the 1991 Agreement which shall enter into force on the date of this Note.

Accept the renewed assurances of my highest consideration.

Raymond Chrétien

Ambassador

Attachment:
Amendment to the Working Arrangement

The Honourable Madeleine K. Albright
Secretary of State
Washington, D.C. 20520

Proposed Changes to the 1991 FM Working Arrangement

1. In the Preamble, the date in parentheses at the end of the first sentence which reads "1989" shall read "199[illegible]".

2. In section 2.2.1, add a Class A1 with effective radiated power of 0/25 kilowatts and an antenna height above average terrain of 100 meters. Change the effective radiated power for Class A from 3 to [illegible] kilowatts. In the parenthetical expression, delete the last sentence beginning "Canadian Class A1 shall...".

3. In section 2.4, replace the table of "Minimum Distance Separation Requirements" with the attached table, and delete the last sentence of the text within parentheses, which begins "Canadian Class A1 shall...".

4. In section 3.5.2, the text within parentheses which reads "see 5.2.1" shall read "see 5.2.2.".

5. In section 4.2, end the sentence after "300" and delete the rest of the current text.

6. In section 4.3, change the effective radiated power from 50 to 250 watts and the interference contour from 32 to 60 km.

7. In section 4.4, replace the existing text with, "For coordination purposes, all proposals for such stations whose interference contour (34 dBu) would extend beyond the common border need to be referred for concurrence.".

8. In sections 5.1.1 and 5.4, replace "the Department of Communications" with "Industry Canada".

9. In section 5.2.2.1, add Class A1 with a field strength of 0.5 mV/m (54 dBu) and a maximum distance of 18 km. Change the maximum distance of Class A from 33 to 38 km. Delete the last sentence of the text within parentheses, which begins "Canadian Class A1 shall...".

10. In section 5.2.2.3, add Class A1 to the classes listed.

2.4 Minimum distance separation

MINIMUM DISTANCE SEPARATION REQUIREMENTS
(in kilometres)

Co-Channel	Adjacent Channels			I.F.
Relation	0 kHz	200kHz	400kHz	600kHz	10.6/10.8 MHz
A1-A1	78	45	24	20	4
A1-A	131	78	44	40	7
A1-B1	164	98	57	53	9
A1-B	190	117	71	67	12
A1-C1	223	148	92	88	19
A1-C	227	162	103	99	26
A-A	151	98	51	42	10
A-B1	184	119	64	55	12
A-B	210	137	78	69	15
A-C1	243	168	99	90	22
A-C	247	182	110	101	29
B1-B1	197	131	70	57	24
B1-B	223	149	84	71	24
B1-C1	256	181	106	92	40
B1-C	259	195	116	103	40
B-B	237	164	94	74	24
B-C1	271	195	115	95	40
B-C	274	209	125	106	40
C1-C1	292	217	134	101	48
C1-C	302	230	144	111	48
C-C	306	241	153	113	48

(U.S. Class C2 shall be considered as Class B for the purposes of the above table.)

Canadian Embassy Ambassade du Canada

n° UNEC 0195

Washington, D.C., le 9 juillet 1997

Madame,

J'ai l'honneur de me référer à votre Note du 9 juillet 1997, avec la pièce qui y est annexée, et qui, en français, se lit comme suit :

"J'ai l'honneur de me référer à l'Échange de Notes (des 26 novembre 1990 et 25 février 1991) constituant un Accord entre le gouvernement des États-Unis d'Amérique et le gouvernement du Canada concernant l'utilisation de la bande de fréquences de 88 à 108 mégahertz pour la radiodiffusion en modulation de fréquence (FM) (ci-après dénommé « l'Accord de 1991 ») ainsi qu'aux entretiens qui ont eu lieu entre les représentants des deux gouvernements au sujet de la révision de l'Arrangement de travail « *Entente officieuse relative à l'allotissement et à l'assignation des canaux de radiodiffusion FM selon l'Accord entre le gouvernement du Canada et le gouvernement des États-Unis d'Amérique relatif au service de radiodiffusion FM* », lequel fait partie intégrante de l'Accord. Dans l'intérêt d'un meilleur emploi de la bande de diffusion FM, je propose que certaines dispositions de l'Arrangement de travail concernant l'allotissement et l'assignation des canaux de radiodiffusion FM soient modifiées comme il est indiqué dans la pièce annexée à la présente.

.../2

Aussi ai-je l'honneur de proposer que la présente Note, avec la pièce qui y est annexée, et votre réponse affirmative, constituent un Accord modifiant l'Accord de 1991, entrant en vigueur à la date de votre réponse.

Je vous prie d'agréer, Excellence, l'assurance renouvelée de ma considération la plus haute."

J'ai en outre l'honneur de vous informer que le gouvernement du Canada accepte les propositions contenues dans votre Note et la pièce qui y est annexée. En conséquence, votre Note et la présente réponse, dont les versions française et anglaise font également foi, constituent un Accord modifiant l'Accord de 1991, lequel entre en vigueur à la date de la présente Note.

Je vous prie d'agréer, Madame, l'assurance renouvelée de ma considération la plus haute.

Raymond Chrétien

L'Ambassadeur

Pièce annexée :
Modification à l'Arrangement de travail

L'honorable Madeleine K. Albright
Secrétaire d'État
Washington, D.C. 20520

Proposition de modification à l'Arrangement de travail FM de 1991

1. Dans le Préambule, remplacer la date entre parenthèses à la fin de la première phrase, à savoir « 1989 », par la suivante : « 1991 ».

2. Au point 2.2.1, ajouter une classe A1, de puissance apparente rayonnée de 0/25 kilowatts et de hauteur d'antenne au-dessus du sol moyen de 100 mètres. Faire passer la puissance apparente rayonnée de la classe A de 3 à 6 kilowatts. À l'alinéa *in fine* entre parenthèses, supprimer la dernière phrase commençant par « La classe A1 au Canada sera... »

3. Au point 2.4, remplacer le tableau des distances minimales de séparation, intitulé « Distances minimales requises », par le tableau ci-joint et supprimer la dernière phrase de la disposition *in fine* entre parenthèses commençant par « La classe A1 au Canada sera... »

4. Au point 3.5.2, remplacer la disposition *in fine* entre parenthèses, à savoir « (voir 5.2.1) », par la suivante : « (voir 5.2.2) ».

5. Au point 4.2, terminer la phrase après "FMFP" et supprimer le reste du texte actuel.

6. Au point 4.3, faire passer la puissance apparente rayonnée de 50 à 250 watts et le contour de brouillage de 32 à 60 km.

7. Au point 4.4, remplacer le texte actuel par le suivant : « Aux fins de la coordination, tous les projets de stations dont le contour de brouillage (34 dBu) s'étendrait au-delà de la frontière commune doivent faire l'objet d'une demande d'approbation ».

8. Aux points 5.1.1 et 5.4, remplacer les termes « le ministère des Communications » par les termes « Industrie Canada ».

9. Au point 5.2.2.1, ajouter la classe A1, avec une intensité de champ de 0,5 mV/m (54 dBu) et une distance maximale de 18 km. Faire passer la distance maximale de la classe A de 33 à 38 km et supprimer la dernière phrase du texte, *in fine*, entre parenthèses, commençant par : « La classe A1 au Canada sera... ».

10. Au point 5.2.2.3, ajouter la classe A1 aux classes qui y sont énumérées.

2.4 Distances minimales de séparation

DISTANCES MINIMALES DE SÉPARATION REQUISES
en kilomètres

	Même canal	Canaux adjacents			F.I.
Relation	0 kHz	200kHz	400kHz	600kHz	10.6/10.8 MHz
A1-A1	78	45	24	20	4
A1-A	131	78	44	40	7
A1-B1	164	98	57	53	9
A1-B	190	117	71	67	12
A1-C1	223	148	92	88	19
A1-C	227	162	103	99	26
A-A	151	98	51	42	10
A-B1	184	119	64	55	12
A-B	210	137	78	69	15
A-C1	243	168	99	90	22
A-C	247	182	110	101	29
B1-B1	197	131	70	57	24
B1-B	223	149	84	71	24
B1-C1	256	181	106	92	40
B1-C	259	195	116	103	40
B-B	237	164	94	74	24
B-C1	271	195	115	95	40
B-C	274	209	125	106	40
C1-C1	292	217	134	101	48
C1-C	302	230	144	111	48
C-C	306	241	153	113	48

(Aux fins du tableau ci-dessus, la classe C2 des États-Unis sera considérée comme la classe B.)

ALL ENGR's

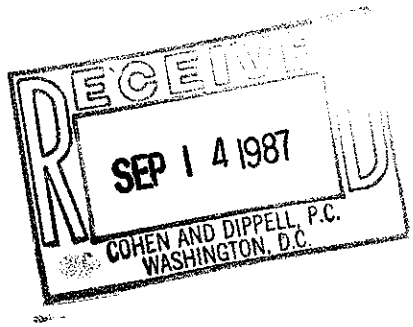
Government of Canada
Department of Communications
300 Slater Street
Ottawa, Ontario
K1A 0C8

Gouvernement du Canada
Ministère des Communications
300 rue Slater
Ottawa (Ontario)
K1A 0C8

Your file Votre référence

Our file Notre référence

3525-3 (DBC-E)



September 8, 1987

Dear Sir:

We are forwarding herewith the following document pertaining to broadcast assignments:

Broadcast Procedure 13 - Issue 2 Provisional dated August 6, 1987.

le 8 septembre 1987

Monsieur,

Vous trouverez ci-joint un document concernant les assignations de radiodiffusion:

Procédure sur la radiodiffusion 13 - 2e édition provisoire daté le 6 août 1987.

Gestionnaire
Service d'information technique
Direction de la réglementation
de radiodiffusion

B. Ivankiw
Manager
Technical Information Services
Broadcasting Regulation Branch

Canada

Government of Canada
Department of Communications

Gouvernement du Canada
Ministère des Communications

BP-13
ISSUE 2
PROVISIONAL

BROADCAST PROCEDURE

PROTECTION AND COVERAGE RULES FOR PRIMARY FM BROADCASTING STATIONS

EFFECTIVE DATE :
AUGUST 6, 1987

BROADCASTING REGULATION BRANCH

PR-13
2e ÉDITION
PROVISOIRE

PROCÉDURE SUR LA RADIODIFFUSION

RÈGLES DE PROTECTION ET DE ZONE DE SERVICE DES STATIONS DE RADIODIFFUSION FM PRIMAIRES

MISE EN VIGUEUR :
LE 6 AOÛT 1987

DIRECTION GÉNÉRALE DE LA RÉGLEMENTATION DE LA RADIODIFFUSION

Protection and Coverage Rules for Primary FM Broadcasting Stations

1. INTRODUCTION

1.1 Purpose

This procedure pertains to the rules for the allotment, assignment and protection of primary FM channels in Canada and for the prediction of coverage. Secondary low power and very low power FM assignments are covered separately under Broadcast Procedures 14 and 15 respectively.

1.2 General

This procedure applies domestically only. The "Working Arrangement for Allotment and Assignment of FM Broadcasting Channels 201-300 Under the Canadian-U.S.A. FM Broadcasting Agreement of 1984" governs the acceptance of channel allotments and assignments proposed by either country in the area lying within 320 km of the common border. The Working Arrangement contains a list, which is updated from time to time, of Canadian and U.S.A. FM allotments within the area specified.

2. DEFINITIONS

2.1 Allocation

The International Telecommunications Union (ITU) uses the word 'allocation' in reference to the provision of a band of frequencies for a particular purpose or service.

2.2 Allotment

An 'allotment' is the provision of a specific channel to a particular community. A list of current Canadian FM allotments is published by the Department.

2.3 Assignment

An 'assignment' is the authorized use of an allotment by an FM station.

2.4 Primary Assignment

A primary assignment is a protected assignment authorized or operating on an allotted channel with one of the classes listed in Section 2.13.

2.5 Secondary Assignment

A secondary assignment is an unprotected assignment authorized or operating on a channel in accordance with Broadcast Procedures 14 (for low power) and 15 (for very low power).

2.6 Effective Radiated Power (ERP)

The effective radiated power (ERP) is the product of the transmitter output power, the transmission line (and combiner) efficiency and the total power gain of the antenna relative to a half-wave dipole.

2.7 Effective Height of the Antenna above Average Terrain (EHAAT)

The effective height of the antenna above average terrain (EHAAT) is the average of the antenna heights above the average terrain (HAAT) for eight radials spaced every 45 degrees of azimuth starting with true north. The height of the antenna above average terrain (HAAT) is the height of the radiation centre of the antenna above the average elevation of the terrain between 3 to 16 km from the antenna.

2.8 Maximum Permissible Parameters

The maximum permissible parameters are the values of the maximum ERP and the associated EHAAT for the four classes of stations as listed in Sections 2.13 and 2.15.

2.9 Operating Parameters

Operating parameters are the approved value of ERP and EHAAT at which an FM station operates.

2.10 Limited Allotment

A limited allotment is a channel on which an FM station, for purposes of protection, is required to operate with less than maximum permissible parameters. A limitation may apply in all directions or in one or more pertinent directions.

2.11 Unlimited Allotment

An unlimited allotment is a channel on which a station may operate with maximum permissible parameters. Any allotment on which a station could operate with maximum parameters by virtue of spacing, may qualify as an unlimited allotment and may be co-ordinated as such.

2.12 FM Channels

FM broadcast channels are allotted in the band 88 to 108 MHz with 200 kHz spacing. The channel centre frequencies begin at 88.1 MHz (Channel 201) and continue in successive steps up to and including 107.9 MHz (Channel 300).

2.13 Classification and Maximum Permissible Parameters of Allotments and Assignments

The class of an FM channel is defined by the maximum permissible ERP and the associated EHAAT. FM classes and their maximum permissible parameters are as follows:

Class A : a maximum ERP of 3 kW with an EHAAT of 100 metres.
Class B : a maximum ERP of 50 kW with an EHAAT of 150 metres.
Class C1: a maximum ERP of 100 kW with an EHAAT of 300 metres.
Class C : a maximum ERP of 100 kW with an EHAAT of 600 metres.

The maximum ERP is calculated from the maximum value of radiation from the antenna in the plane of maximum radiation and in the direction of maximum radiation for directional antennas.

An assignment made on an allotment having any of the above class designations is considered to be a primary assignment. An unprotected assignment made on an allotment having any of the above class designations is considered a secondary assignment.

2.14 Minimum Operating Parameters

The minimum operating parameters of a class are the lower limits of the operating parameters allowed for that class, and they are as follows:

Class A : an ERP of 500 W with an EHAAT of 100 metres or equivalent*.
Class B : an ERP of 3 kW with an EHAAT of 150 metres or equivalent*.
Class C and C1 : an ERP of 20 kW with an EHAAT of 300 metres or equivalent*.

2.15 Antenna Height and Power Equivalence

Where antenna heights exceed those values shown in 2.13, the effective radiated power shall be reduced to provide equivalence* with the maximum or other permissible parameters. In addition, where applicable, it is required that the interference zone for equivalent parameters not exceed that determined by the F(50,10) propagation curves using the maximum or other permissible parameters.

2.16 Permissible Interference to Unassigned Allotments Due to Short Spacing

Proposed assignments may not produce an interference area within the following radii of unassigned allotments, assuming that the allotment would be assigned at maximum parameters for its class:

Class A : a distance of 24 km.
Class B : a distance of 50 km.
Class C1: a distance of 72 km.
Class C : a distance of 86 km.

If an unassigned allotment is already limited and the 0.5 mV/m protected contour extends beyond the above distances, interference areas are permitted at distances down to the values outlined above. However, if the 0.5 mV/m contour extends less than the above radii, no further interference is permitted.

* Equivalence means that the 1 mV/m contours remain at the same location as determined using the F(50,50) propagation curves.

When an allotment is eventually proposed for an assignment, interference would depend on the antenna site selected. In such cases the applicant shall accept the resulting interference and, where applicable, meet the requirements of Section 3.4.2.

The above should not be interpreted as considering the protected 0.5 mV/m contour at the reduced radii. Rather, when making an interference analysis (as per Annex 1), the interference contour and the service contour at the reduced extension should be tangential.

2.17 Service Contours

The service contours of a primary FM assignment are the 0.5 mV/m (54 dBu) and 3 mV/m (70 dBu) contours. The distance from the station to the service contours is determined using the F(50,50) curves in Figure 1 of the Annex 2.

(a) A minimum field strength of 3 mV/m is required for satisfactory service to primary target centres*.

(b) A minimum field strength of 0.5 mV/m is required for satisfactory service to secondary target centres*, where the reception is achieved by outdoor receiving antennas.

The dBu is the field strength in dB above one microvolt per metre (1 uV/m).

2.18 Protected Contour

The protected contour of a primary FM assignment is the 0.5 mV/m (54 dBu) contour. The radius of this contour is calculated by using the F(50,50) curves of Figure 1 of the Annex 2 and it is protected up to the maximum distances indicated in Section 3.1.1. When the FM assignment uses less than maximum parameters defined for its class, protection is given in Section 3.1.1. Conditions which can limit the distance to the protected contour are given in Sections 2.16 and 3.1.

* Any populated area defined as city, town, locality etc... as per Energy, Mines and Resources Canada maps.

2.19 Interfering Signal Contour

The interfering signal contour of a primary FM assignment is the maximum signal value permitted at the protected contours of other allotments and assignments (refer to Section 3.2.1). The distance to the interference contour is determined using the F(50,10) curves of Figure 2 of the Annex 2. For distances less than 15 km, the F(50,50) curves of Figure 1 may be used.

2.20 Antenna Beam Tilt (Electrical and Mechanical)

Antenna beam tilt is the inclination in degrees of the horizontal radiation pattern of the antenna which causes the maximum radiation to occur at an angle below the horizontal plane. The beam tilt may be achieved by tilting the main axis of the antenna, i.e. mechanical beam tilt, or by shaping the pattern by electrical means. The maximum permissible ERP, as defined in 2.13 and 2.15 shall not be exceeded in either the horizontal or tilt planes.

2.21 Polarization

The polarization of the radiated signal is the orientation of the electric component of the electromagnetic field as radiated from the transmitting antenna. Circular polarization is normally used, however, horizontal, vertical or elliptical polarization may also be used. Where vertical polarization only is used, justification shall be provided. In any plane of polarization the ERP shall not exceed that defined in 2.13 and 2.15.

3. ALLOTMENT PRINCIPLES (Domestic)

(For international channel relationships refer to; "Working Arrangement for Allotment and Assignment of FM Broadcast Channels 201-300").

3.1 The Protected Contour

Subject to the provisions listed in this Section, FM allotments are protected to their 0.5 mV/m contour. This contour is determined by using the F(50,50) propagation curves of Figure 1 in Annex 2 together with the ERP and the HAAT for each of the eight radials. For very irregular terrain, the local topography may be taken into account in calculating the contour.

3.1.1 Protection is only afforded to land areas and shall not extend beyond the following distances from the transmitting site;

Class	Distance	Field Strength
A	33 km	0.5 mV/m (54 dBu)
B	65 km	0.5 mV/m (54 dBu)
C1	86 km	0.5 mV/m (54 dBu)
C	97 km	0.5 mV/m (54 dBu)*

* Based on an ERP of 100 kW and a EHAAT of 450 metres.

Class C channels, whose 0.5 mV/m contour extends beyond 97 km, are permitted if protection to related assignments and allotments is provided.

3.1.2 The protected contour of an unoccupied limited allotment is determined using the limited parameters in all directions or in the direction(s) of limitation where applicable. Protection should be provided on the basis of a practical directional antenna meeting the limitation(s).

3.1.3 Where the protected contour extends beyond the boundary of the country in which the allotment is located, protection will be provided only to land areas, including islands, lying within that country. In this case, overlap of the interfering and the protected service contours may be acceptable provided that the interference zone does not fall within these areas. Annex 1 describes the procedure to determine the interference zone.

3.2 Protection Ratios and Permissible Interfering Signals

3.2.1 Protection ratios and the corresponding permissible interfering field strength levels (F(50,10)) at the protected contour of another frequency related assignment or allotment are given in the following table:

Channel relationship	D/U Protection Radio (dB)	Field strength
Co-channel	20	0.05 mV/m (34 dBu)
First adjacent	6	0.25 mV/m (48 dBu)
Second adjacent	-20	5.00 mV/m (74 dBu)
Third adjacent	-40	50.00 mV/m (94 dBu)

3.3 Separation Distances Between Co-channel and Adjacent Channel Allotments

The following table specifies the minimum separation distances in kilometres for the four classes of channel assignments, using the protected contour levels as shown in Section 3.1.1 and the interfering signal levels shown in Section 3.2.1, (the appropriate contours for class C channels are based on an ERP of 100 kW and an EHAAT of 450 metres).

Minimum Separation Distances (in km) between Co-channel and Adj. Channel Assignments.

Channel Relationship			Class A	Class B	Class C1	Class C
	Class A	Co-Channel	132	206	239	254
		200 kHz	85	132	164	182
		400 kHz	45	76	98	109
		600 kHz	37	69	90	101
		10.6/10.8 MHz	8	16	32	32
	Class B	Co-Channel		237	271	286
		200 kHz		164	195	214
		400 kHz		94	115	126
		600 kHz		74	95	106
		10.6/10.8 MHz		24	40	40
	Class C1	Co-Channel			292	307
		200 kHz			217	235
		400 kHz			134	144
		600 kHz			101	111
		10.6/10.8 MHz			48	48
	Class C	Co-Channel				318
		200 kHz				246
		400 kHz				155
		600 kHz				115
		10.6/10.8 MHz				48

3.4 Short Spaced Allotments and Assignments

3.4.1 Allotments and assignments in the Plan which do not meet the Table of Minimum Separation Distances may be subject to an interference zone within their 0.5 mV/m contour (maximum parameters conditions). Interference zones should be drawn as shown in Annex 1 for the following cases:

(a) for an allotment or an assignment, the protected contour should be determined using the co-ordinates shown in the Canadian FM Broadcasting Allotment Plan and should be in accordance with Section 3.1.1;

(b) where limitations are indicated in the Plan, limited parameters should be used in the pertinent direction(s) instead of maximum permissible parameters.

Terrain factors may be considered where the intervening terrain justifies this use. Any recognized engineering method may be used. However, in case of conflict, the Department will resolve the matter by using the terrain program in its data base.

The reverse interference process shall also be covered in the engineering brief i.e. the interference zone(s) from the related allotment(s) or assignment(s) shall be shown.

3.4.2 For new or changed assignments, based on a short spaced allotment in the Plan, the proposal should be designed to limit interference. Where the related allotment is:

(a) unassigned - protection is normally required to the maximum extent of the 0.5 mV/m contour for its class or in accordance with Section 3.4.1 above;

(b) assigned - protection as in 3.4.1 above is required. An increase in interference zone may be proposed only if both parties are in agreement (refer to Section 3.4.4 for procedural details). In such cases, the Department may refer the issue to the CRTC for Public Hearing, or deny the application based on spectrum management consideration.

3.4.3 For proposed short spaced assignments or allotments, predicated on proposed channels which are not in the Plan, where the related allotment is:

(a) unassigned - protection is normally required to the maximum extent of the 0.5 mV/m contour for its class. However, protection in accordance with Section 2.16 may be proposed provided it is accompanied by a study indicating that the objective cannot be met by other less drastic measures such as directional antenna, limitation, etc.;

(b) assigned - protection is normally required to the maximum extent of the 0.5 mV/m contour for its class. However, if an interference zone is proposed, the agreement of the affected licensee shall be obtained (refer to Section 3.4.4 for procedural details).

3.4.4 (a) In all above cases, interference zones that fall over water may be disregarded.

(b) Where applicable, the applicant shall send a copy of the engineering brief together with a covering letter to the affected station(s) no later than the date of filing the application. A copy of this letter and the postal or messenger receipt, as proof of delivery, shall be sent to the Department. The letter shall advise the licensee of the proposed interference zone and shall emphasize that the licensee's agreement shall be submitted to the Department no later than six weeks after receipt of the engineering brief. Where the affected licensee offers an objection, the application will not be accepted by the Department. If no reply is received within the specified period, the Department will assume that the affected licensee agrees with the proposal.

(c) Where an allotment or assignment is proposed to be limited, the limitation is calculated by determining the allowable ERP and associated HAAT which provide protection to the related allotment or assignment. Normally, the associated HAAT is calculated by linear interpolation between the HAATs of the standard radials adjacent to the pertinent radial. If a disagreement exists in the calculation of this HAAT due to irregular intervening terrain, the terrain profile shall be as determined by the Department.

3.5 Channels Separated by 800 kHz

3.5.1 For FM stations separated by 800 kHz, and operating in the same area, the limited selectivity of some nearby receivers can cause a potential interference problem. It is therefore recommended that such stations be co-located or near co-located, in order to equalize the desired to undesired field strength ratios at all receiving locations.

3.5.2 If an incoming station is located such that its calculated 100 dBu service contour intercepts or overlaps the 80 dBu service contour of another existing station, an analysis shall be made for those potential interference areas where the field strength difference exceeds 20 dB. The reverse interference process should also be covered in the engineering brief.

3.5.3 Where the analysis results in areas of potential interference, the population within the area must be counted and a justification for the site selected shall appear in the engineering brief. In addition the applicant shall send a copy of the engineering brief together with a covering letter to the other station, no later than the date of filing the application. A copy of this letter and the postal or messenger receipt, as proof of the delivery of the letter, shall be sent to the Department. The letter shall advise the licensee of the proposed potential receiver interference problem and shall emphasize that any representations the licensee might wish to make to the Department shall be submitted no later than six weeks after receipt of the engineering brief. If no reply is received within the specified period, the Department will assume that the affected licensee agrees with the proposal.

4. COMPUTATION OF DISTANCE AND AZIMUTH

4.1 Where transmitter sites have been established the distance shall be determined using the co-ordinates of the transmitter sites. If a transmitter site has not been established the community's reference co-ordinates (the co-ordinates of the centre of the city) shall be used unless the co-ordinates have been fixed and outlined in the Allotment Plan.

4.2 The distance between reference points is considered to be the length of the hypotenuse of a right angle triangle, one side of which is the difference in latitude of the reference points and the other side the difference in longitude of the two reference points, and shall be computed as follows:

a) convert latitude and longitude into degrees and decimal parts of a degree. Determine the middle latitude of the two reference points (average the latitudes of the two points);

$$LATM = \frac{LAT1 + LAT2}{2}$$

b) determine the number of km per degree of latitude difference for the actual middle latitude in (a) above;

$$LATK = 111.108 - 0.566 \cos (2\ LATM)$$

c) determine the number of km per degree of longitude difference for the actual middle latitude in (a) above;

$$LONGK = 111.391 \cos (LATM) - 0.095 \cos (3\ LATM)$$

d) determine the North-South distance in km;

$$LAT = LATK\ (LAT1 - LAT2)$$

e) determine the East-West distance in km;

$$LONG = LONGK\ (LONG1 - LONG2)$$

f) determine the distance between the reference points by the square root of the sum of the squares of the distances obtained,

$$DIST = (LAT^2 + LONG^2)^{1/2}$$

where:

LAT1 & LONG1 = co-ordinates of one location in decimal degrees,
LAT2 & LONG2 = co-ordinates of second location in decimal degrees,
LATM = middle latitude between points,
LATK = km per degree of latitude difference,
LONGK = km per degree of longitude difference,
LAT = north-south distance in km,
LONG = east-west distance in km, and
DIST = distance between two reference points in km.

In computing the above, sufficient decimal figures shall be used to determine the distance to the nearest km. The method for computing distances provides adequate accuracy for determining distances less than 350 km.

4.3 The azimuth or the bearing between true north and the radial connecting one reference point to the other, shall be calculated as follows:

a) convert latitude and longitude into degrees and decimal parts of a degree;

b) determine the arc length in degrees between the two reference locations;

$$d = \cos^{-1}[\sin(LAT2)\sin(LAT1) + \cos(LAT2)\cos(LAT1)\cos(LONG1-LONG2)]$$

c) calculate the bearing (if the second location is west of the initial location, subtract the result from 360^{o}; i.e., 360 - BEAR),

$$BEAR = \cos^{-1}\left[\frac{\sin(LAT2) - \sin(LAT1)\cos(d)}{\cos(LAT1)\sin(d)}\right]$$

where:

LAT1, LAT2, LONG1 & LONG2 are as specified in Section 4.2;

d = arc length between locations in decimal degrees;
BEAR = angle between true north (0 degrees) and the connecting radial in decimal degrees.

In computing the above, sufficient decimal figures shall be used to determine the bearing to the nearest degree.

5. DIRECTIONAL ANTENNAS

5.1 Directional antennas may be used by stations operating on unlimited allotments, but their use shall not prevent future increases to maximum parameters. Directional antennas may also be used by stations occupying or proposing the use of limited allotments to render protection to other co-channel and adjacent channel stations.

5.2 The ratio of maximum to minimum fields of a directional antenna shall not be greater than 20 dB except where signal reflections due to local terrain will present a reception problem. The radiation from a directional antenna shall not exceed the notified radiation pattern value. The notified radiation pattern shall include the effect of the mounting structure and shall be certified by the manufacturer or the supplier.

5.3 Where limitations are involved, variations of the pattern shape in direction(s) of protection(s) shall not exceed 0, -2 dB. For antenna patterns not meeting this tolerance, the radiation shall be reduced accordingly. In all other directions, the radiation may not vary from the notified pattern value by more than 2 dB.

6. TRANSMITTER LOCATIONS

FM station transmitters shall be so located to serve the primary community to which the channel is assigned and to ensure the overall effectiveness of the Allotment Plan. Transmitter sites shall be located so that the separations are not less than those set forth in Section 3.3 except when specifically agreed to in accordance with Section 3.4.

To prevent continuous exposure of the general public to non-ionizing radiation, the site shall be selected such that no resident population is exposed to excessive power flux density levels. An analysis shall be submitted by the applicant which demonstrates that total sum of the power flux density will not exceed the Health and Welfare Canada radiation standard for the population residing in the vicinity of the transmitter.

7. CHANGES TO THE TABLE OF ALLOTMENTS

When an FM service is being contemplated for a particular area and the Canadian FM Broadcasting Allotment Plan does not contain a suitable unoccopied allotment, changes to the allotment plan may be proposed by applicants.

7.1 Types of changes

The following types of changes are envisaged, separately or in combination, concerning the addition or upgrading of an allotment:

a) adding or changing an allotment without affecting any other allotment;

b) adding or changing an allotment at the expense of short spacing an existing allotment or assignment, two cases may occur. The short-spacing and its resulting interference may be accepted without limitations or a channel limitation may be required to avoid interference. Where an assignment is concerned, the licensee's comments on the proposed limitation shall be sought. (Refer to Section 7.3.3). Where an allotment is concerned, refer to Section 2.16;

c) adding or changing an allotment at the expense of reclassifying an existing allotment or assignment. Where the reclassification of an assignment is proposed, the licensee's comments on the proposed reclassification shall be sought. (Refer to Section 7.3.3);

d) adding or changing an allotment at the expense of deleting an existing allotment;

e) adding or changing an allotment at the expense of changing the frequency of an allotment or an assignment, in the latter case the licensee's agreement shall be obtained (refer to Section 7.3.3); and

f) moving an allotment to an area and replacing the shifted allotment with a suitable replacement.

7.2 Impact on the Plan

It is noted that some of the changes in 7.1 may have a positive impact on the Plan in one area but a negative impact in another area. If the Department accepts the changes technically acceptable, it would report to the CRTC on the technical aspects of the changes and their impact on the provisions of the Plan provided the proposal is based on a complete application. These changes would be considered conditionally technically acceptable pending a decision by the CRTC. Any changes to the Plan that may be required as the result of such applications would not be made until the Department declares them technically acceptable and the CRTC approves the application.

7.3 Application Requirement

7.3.1 When an application for a new FM undertaking requires modifications to the Plan, the applicant may consult with the Department regarding these modifications prior to the formal filing of applications. Where pertinent, the study shall show that the coverage objective of the proposal cannot be achieved by less drastic measures such as through the use of a limited allotment and/or directional antenna, etc...

7.3.2 Any application proposing to change the frequency of an assignment will be found to be incomplete unless it is accompanied by proof that the station affected agrees to the change.

7.3.3 Applicants proposing to limit or reclassify the channel occupied by an assignment shall send a copy of the engineering brief, with a covering letter, to the licensee of the affected station, no later than the date of filing the application. The letter shall advise the licensee of the proposed limitation or reclassification and shall emphasize that any representations the licensee may wish to make to the Department shall be submitted no later than six weeks after receipt of the engineering brief. A copy of this letter and the postal or messenger receipt as proof of delivery is required by the Department before such an application is complete. If no reply is received within the specified period, it will be assumed that there is no objection.

7.3.4 An applicant may accept interference within its 0.5 mV/m contour from an existing assignment or from a future assignment on an existing allotment provided that the engineering brief states that the applicant does not intend to serve the affected area. The extent of the interference area shall be calculated in accordance with Annex 1 and shall be shown as a hatched area on the proposed station's coverage map.

7.4 Incompatibilities

In all of the cases described in 7.1, problems can arise when changes to the Plan proposed by one applicant are not compatible with changes proposed by another applicant. It should be noted that incompatibilities can occur even when the proposed service areas are geographically well separated. The Department encourages applicants to co-operate in the search for early solution to problems of incompatibility. In this regard, the Department will, without devulging the details of the proposed changes, make any incompatibilities known to each of the applicants involved, urging their resolution prior to consideration of the applications by the CRTC.

8. NOTIFICATIONS

Under the Canada-U.S.A. FM Agreement, all proposed changes to allotments and assignments in Canada within 320 kilometres of the United States border must be notified to the FCC under the terms of the associated Working Arrangement.

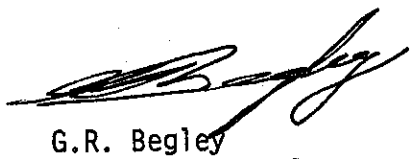
9. ALLOTMENT PLANNING

9.1 Applications for modifications to the Canadian FM Broadcasting Allotment Plan may be made with, or independently from an application for an assignment. In either case, documentation in respect to the allotment change(s) shall be submitted.

9.2 An assignment does not convey a right, real or implied, to a station licensee for continued protection of the licensee's class of station if the operating parameters fall into a lower class. In such cases the assignment may be reduced to a lower class to facilitate additional allotments and assignments.

9.3 The Department may make changes to the Canadian FM Broadcasting Allotment Plan which are independent of any application received. It will also take decisions, based on technical consideration, in its role as spectrum manager.

Issued under the authority of the
Minister of Communications



G.R. Begley
Director General
Broadcasting Regulation Branch

Annex 1

Procedure to Determine Interference Zone

On an appropriately scaled map plot the transmitter sites and do the following:

1. Plot the protected service contour for the assignment or allotment to be protected, based on the maximum or other permissible parameters, as shown in Section 3.1.

2. Plot the interfering contour for the proposed assignment or allotment based on its proposed parameters in accordance with the interfering signal levels as shown in Section 3.2.

3. Mark the two points where the contours intersect.

4. Repeat steps 1, 2 and 3 except increase the value of each contour while maintaining the same protection ratio until the protected and interfering contours are tangential.

5. Draw a line joining the intersection points obtained above. The area contained within this line and the protected service contour drawn in step 1 defines the interference zone.

Example

The following example shows the interference zone between an existing class B station and a proposed class A station which are short-spaced and on second-adjacent channels.

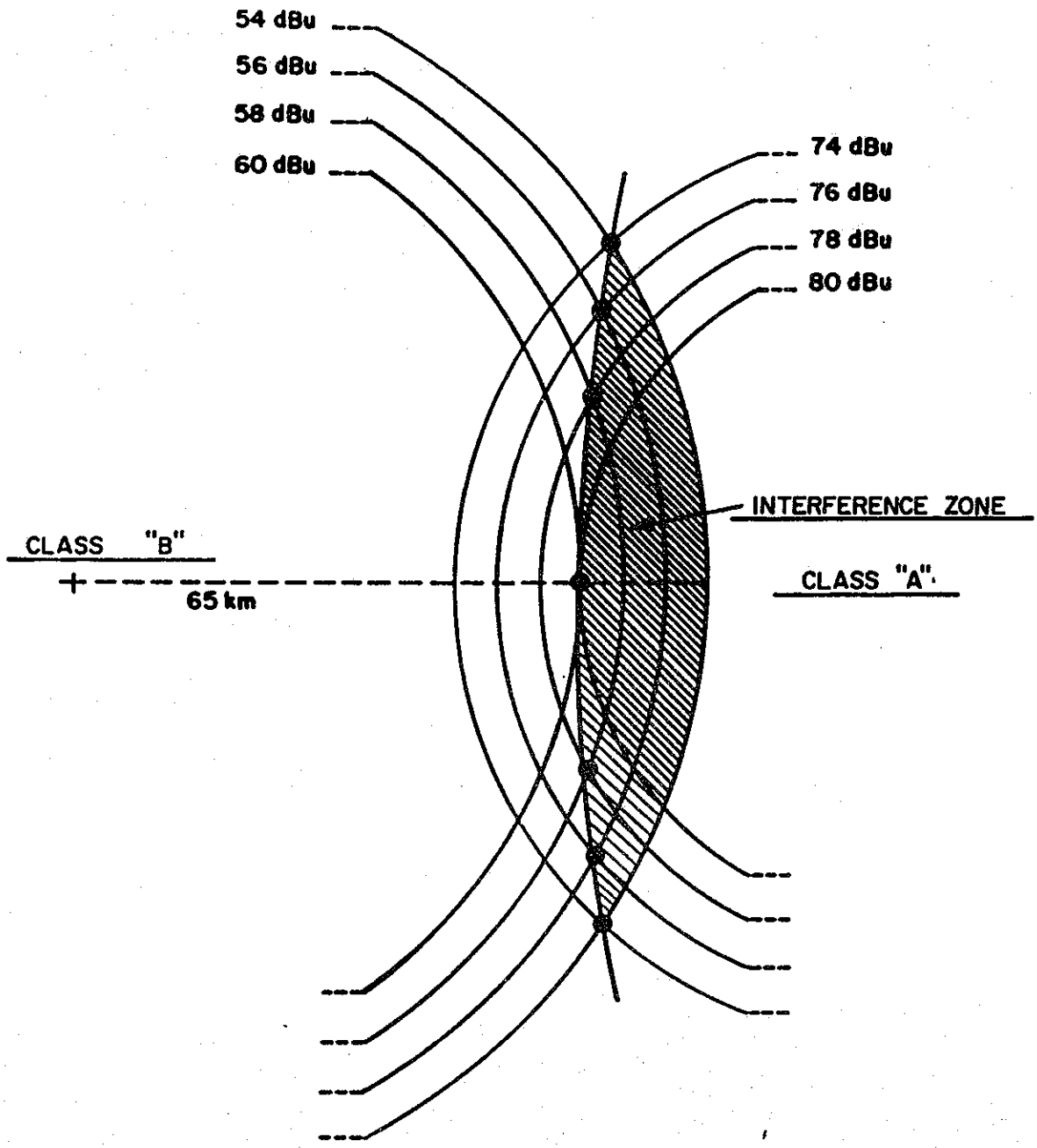
1. The protected service contour from Section 3.1 is 54 dBu which extends to 65 km.

2. The interfering contour from Section 3.2 is 74 dBu. (The extent of this contour will vary depending on the proposed operating facilities).

3. Mark the two points where the contours intersect.

4. Plot the 56 dBu service contour and the 76 dBu interfering contour and mark the two points of intersection. Continue to increase the value of the contours, plot them, and mark the intersection points until the contours are tangent.

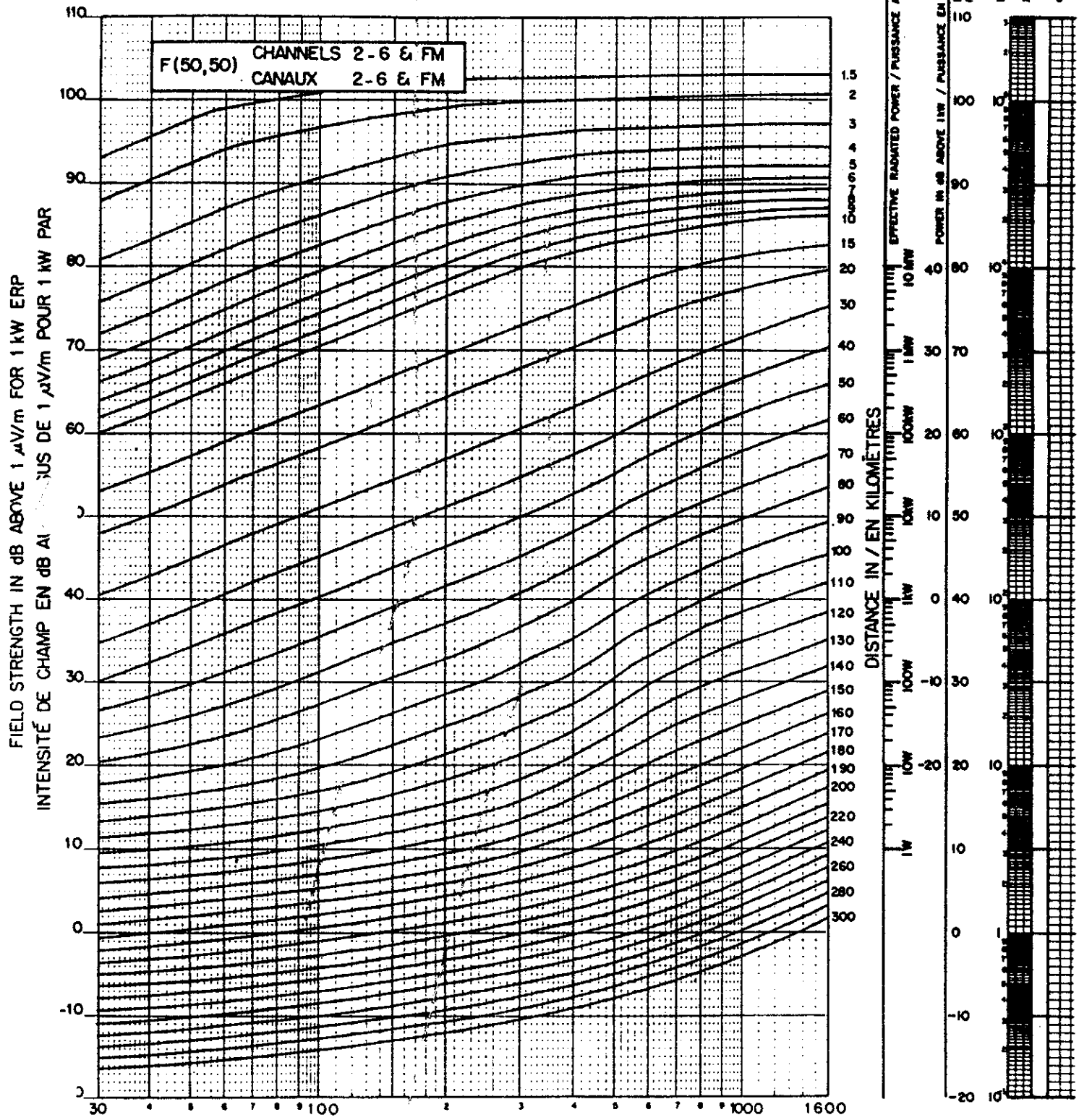
5. Draw a line joining the intersection points obtained above. The area contained within this line and the protected service contour drawn in step 1 defines the interference zone. This area is shown cross-hatched in the drawing.



Annex 2
Annexe 2
Figure 1

ESTIMATED FIELD STRENGTH EXCEEDED AT 50 % OF THE POTENTIAL RECEIVER LOCATIONS AT LEAST 50 % OF THE TIME AT A RECEIVING ANTENNA HEIGHT OF 9.1 METRES.

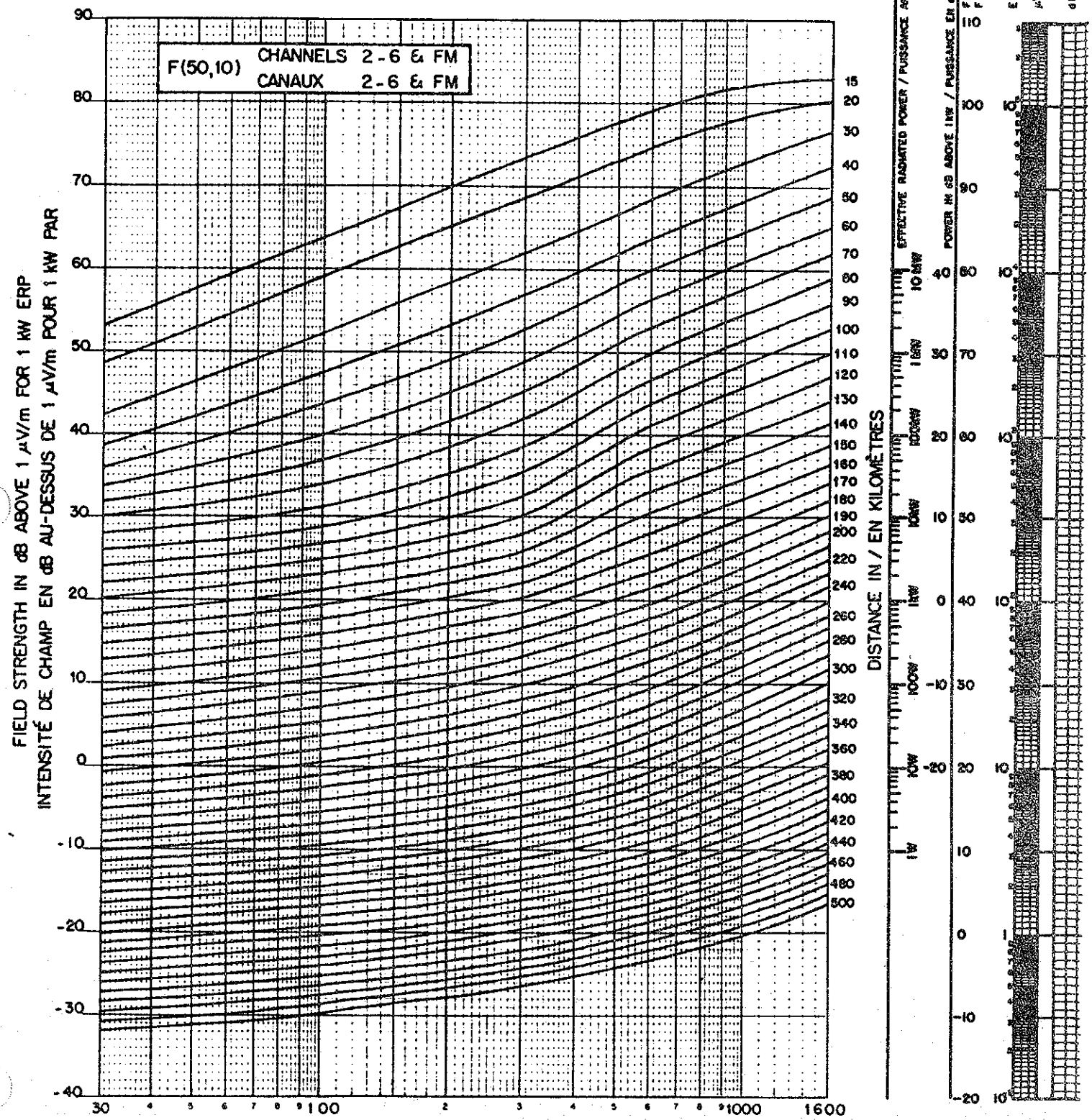
ESTIMATION DE L'INTENSITÉ DE CHAMP DÉPASSÉE A 50 % DES EMPLACEMENTS RÉCEPTEURS POSSIBLES, POUR AU MOINS 50 % DU TEMPS, POUR UNE ANTENNE RÉCEPTRICE DE 9,1 MÈTRES.



Annex 2
Annexe 2
Figure 2

ESTIMATED FIELD STRENGTH EXCEEDED AT 50 % OF THE POTENTIAL RECEIVER LOCATIONS FOR AT LEAST 10 % OF THE TIME AT A RECEIVING ANTENNA HEIGHT OF 9.1 METRES.

ESTIMATION DE L'INTENSITÉ DE CHAMP DÉPASSÉE A 50 % DES EMPLACEMENTS RÉCEPTEURS POSSIBLES, POUR AU MOINS 10 % DU TEMPS, POUR UNE ANTENNE RÉCEPTRICE DE 9,1 MÈTRES



September 7, 1984

WORKING ARRANGEMENT

FOR

ALLOTMENT AND ASSIGNMENT OF FM BROADCASTING CHANNELS 201-300

UNDER THE

CANADIAN-U.S.A. FM BROADCASTING AGREEMENT OF 1947

1. PREAMBLE

Mutual undertakings concerning the allotment and assignment of FM Broadcasting Channels by Canada and the United States in the area lying within 320 kilometers of their common border are set out in the Canadian-U.S.A. FM Broadcasting Agreement of 1947. That Agreement continues pursuant to its terms to govern the consideration and acceptance or rejection of border area channel allotments and assignments proposed in either country. The arrangement set out herein, which in no way derogates from the Canadian-U.S.A. FM Broadcasting Agreement of 1947, states the basis upon which the Canadian and U.S.A. Administrations propose to consider responses to border area FM channel allotments and assignments proposed by the other country.

2. BASIC PRINCIPLES

2.1 Channel designation

FM broadcast channels are allotted in the band 88 to 108 MHz and are 200 kHz wide. Their center frequencies begin at 88.1 MHz and continue in successive steps up to and including 107.9 MHz as set forth in Annex I. FM allotments are classified and assigned in accordance with 2.2, and made in accordance with 2.4.

2.2 Classification and Maximum Parameters of Allotments and Assignments

2.2.1 The classes and maximum parameters are as follows:

Classes	Effective Radiated Power	Antenna Height Above Average Terrain
A	3 kilowatts	100 meters
B1	25 kilowatts	100 meters
B	50 kilowatts	150 meters
C1	100 kilowatts	300 meters
C	100 kilowatts	600 meters

(U.S Class C2 will be considered as Class B for the purposes of the above table.)

2.2.2 The maximum effective radiated power (ERP) in any plane of polarization must not exceed the maximum ERP for its class.

2.3 Antenna heights and equivalence

2.3.1 Where antenna heights exceed those shown in 2.2.1, the effective radiated power will be reduced to provide equivalence with maximum parameters. Equivalence means that the 1 mV/m (60 dBu) contour remains at the same location as that determined by the attached F(50,50) propagation curves and the maximum parameters for the class of the assignment. Moreover, it is required that the interference contour for equivalent parameters not exceed that determined by the attached F(50,10) propagation curves and the maximum parameters allowed. Where limited allotments are concerned, the agreed upon parameters will be used instead of maximum allowable parameters.

Where assignments are concerned, (existing or proposed) transmitting site co-ordinates should be used to determine equivalence. For allotments, city reference coordinates should be used.

2.3.2 Existing stations operating with parameters in excess of those specified for the classes in 2.2.1 may continue to operate as previously notified or with equivalent parameters.

2.4 Minimum distance separation

MINIMUM DISTANCE SEPARATION REQUIREMENTS
in kilometers

Relation	Co-Channel	Adjacent Channels			I.F.
	0 kHz	200 kHz	400 kHz	600 kHz	10.6/10.8 MHz
A - A	132	85	45	37	8
A - B1	180	113	62	54	16
A - B	206	132	76	69	16
A - C1	239	164	98	90	32
A - C	242	177	108	100	32
B1- B1	197	131	70	57	24
B1- B	223	149	84	71	24
B1- C1	256	181	106	92	40
B1- C	259	195	116	103	40
B - B	237	164	94	74	24
B - C1	271	195	115	95	40
B - C	274	209	125	106	40
C1- C1	292	217	134	101	48
C1- C	302	230	144	111	48
C - C	306	241	153	113	48

(U.S. Class C2 will be considered as Class B for the purposes of the above table.)

2.5 Transmitter locations

An FM transmitter site will be so located as to serve the city to which the channel is assigned and to promote the overall efficiency of the allotment plan. Transmitter sites will be located so that the separations are not less than those set forth in 2.4 except when specifically agreed to by each Administration.

2.6 Computation of distance and azimuth

2.6.1 Where transmitter sites have been established the distance will be determined using the coordinates of the transmitter sites. If a transmitter site has not been established, the community's reference coordinates will be used.

2.6.2 The distance between reference points is considered to be the length of the hypotenuse of a right-angle triangle, one side of which is the difference in latitude of the reference points and the other side the difference in longitude of the two reference points, and will be computed as follows:

2.6.2.1 Convert latitude and longitude into degrees and decimal parts of a degree. Determine the middle latitude of the two reference points (average the latitudes of the two points).

$$LATM = \frac{LAT1 + LAT2}{2}$$

2.6.2.2 Determine the number of kilometers per degree of latitude difference for the determined middle latitude.

$$LATK = 111.108 - 0.566 \cos (2\ LATM)$$

2.6.2.3 Determine the number of kilometers per degree of longitude difference for the determined middle latitude.

$$LONGK = 111.391 \cos (LATM) - 0.095 \cos (3\ LATM)$$

2.6.2.4 Determine the north-south distance in kilometers.

$$LAT = LATK\ (LAT1 - LAT2)$$

2.6.2.5 Determine the east-west distance in kilometers.

$$LONG = LONGK\ (LONG1 - LONG2)$$

2.6.2.6 Determine the distance between the reference points by the square root of the sum of the squares of the distances obtained.

$$DIST = (LAT^2 + LONG^2)^{1/2}$$

Where:

LAT1 & LONG1 = coordinates of one location in decimal degrees;
LAT2 & LONG2 = coordinates of second location in decimal degrees;
LATM = middle latitude between points;
LATK = kilometers per degree of latitude difference;
LONGK = kilometers per degree of longitude difference;
LAT = north-south distance in kilometers;
LONG = east-west distance in kilometers; and
DIST = distance between two reference points in kilometers

In computing the above, sufficient decimal figures will be used to determine the distance to the nearest kilometer.

2.6.3 When it is necessary to calculate the angle or azimuth between true north and the connecting radial from one reference point to another, the following procedure will apply:

2.6.3.1 Convert latitude and longitude into degrees and decimal parts of a degree.

2.6.3.2 Determine the arc length in degrees between the two reference locations.

$$d = \cos^{-1}\left[\sin(LAT2)\sin(LAT1) + \cos(LAT2)\cos(LAT1)\cos(LONG1 - LONG2)\right]$$

2.6.3.3 Calculate the azimuth. (If the second location is west of the initial location, substract the result from 360°; i.e., 360 - AZM).

$$AZM = \cos^{-1}\left[\frac{\sin(LAT2) - \sin(LAT1)\cos(d)}{\cos(LAT1)\sin(d)}\right]$$

Where:

LAT1 & LONG1 = coordinates of initial location in decimal degrees;
LAT2 & LONG2 = coordinates of second location in decimal degrees;
d = arc length between locations in decimal degrees;
AZM = angle between true north (0 degrees) and the connecting radial in decimal degrees in clockwise direction.

In computing the above, sufficient decimal figures will be used to determine the azimuth to the nearest degree.

3. ALLOTMENTS AND ASSIGNMENTS

3.1 Allotment and Assignment Tables

Tables A and B contain all Canadian and U.S. allotments and primary assignments on Channels 201-300 made to communities within 320 kilometers of the common border.

198.88 MILES

3.2 Primary Assignments

A primary assignment is a protected assignment authorized or operating on an allotted channel with one of the classes listed in section 2.2.1.

3.3 Secondary Assignments

A secondary assignment is an unprotected assignment authorized or operating on a channel in accordance with section 4.

3.4 Unlimited Allotment

An unlimited allotment is one on which a station may operate with maximum parameters for its class. Any allotment on which a station, by virtue of spacing, could operate with maximum parameters may qualify as an unlimited allotment and may be coordinated as such.

3.5 Specially negotiated short-spaced allotments

3.5.1 In particular instances, unlimited allotments at less than the minimum spacings may be acceptable to both countries as specially negotiated short-spaced allotments and will be identified in the Tables with an asterisk (*).

3.5.2 Limited allotments may be specially negotiated to require assignments to operate with less than maximum parameters. Specific limitations on antenna height and power calculated in the pertinent direction (see para 5.2.1) are indicated by note designations in the Tables.

3.5.3 New or changes to short-spaced assignments must not result in an interference or an increase in existing interference to the related station's protected service contour unless specifically agreed to by the two Administrations.

3.5.4 New or changes to short-spaced assignments must be notified in accordance with section 5.2 and must be approved by the other Administration before they can be implemented.

3.6 Directional antennas

Directional antennas operated by stations occupying limited allotments may be used to render protection to other co-channel and adjacent channel stations. In the direction of limitation, a station using a directional antenna may not exceed the notified pattern values. In all other directions, the radiation may not exceed the notified pattern value by more than 2 dB. Moreover, the ratio of maximum to minimum fields of a directional antenna should not be greater than 20 dB. Directional antennas may also be used by stations operating on unlimited allotments, but their use will not prevent future increases to maximum allowable parameters.

4. LOW POWER FM STATIONS

The conditions for the operation of low power FM stations (LPFM) are as follows:

4.1 LPFM stations are secondary assignments which operate on a non-interference no-protection basis with respect to existing or future primary assignments. However, they are assigned on a protected basis with respect to each other according to their date of notification.

4.2 LPFM assignments may be made on any channel from 201 to 300, whether or not the channels are listed in the FM Allotment Tables attached.

4.3 LPFM stations may be allowed an effective radiated power not to exceed 50 watts in any direction and an interference contour (34 dBu) not to exceed 32 km subject to 4.1 and 4.2 above.

4.4 For coordination purposes, only proposals for such stations within 32 kilometers of the common border need be referred for concurrence.

4.5 Should any interference be caused by an LPFM station, the offending station must immediately change to a suitable channel or cease operation. The use of a channel by an LPFM station shall not prejudice in any manner the use of this channel for a primary assignment.

5. PROCEDURES

5.1 Changes in the Tables of Allotments

5.1.1 Proposed allotments may be presumed to be acceptable if they do not exceed the maximum permissible parameters, and conform to the Table of Minimum Distance Separations set out in this Arrangement. However, as provided by the Agreement, each Administration may, within forty-five (45) days of receipt of a proposed allotment, object thereto. The objection will state, with as much particularity as the circumstances permit, the basis for the objection taken. The proposing Administration may then have an opportunity to meet the stated objections by suitable amendments of its proposal. Proposed allotments to which objection is made will be subject to further negotiations at the request of the proposing Administration.

5.1.2 Under certain circumstances, proposed allotments which do not conform to the Table of Minimum Distance Separations set out in this Arrangement may be negotiated. A proposed allotment under these circumstances may normally be considered acceptable for negotiations if objectionable interference would not be caused within the protected service contour of existing co-channel and adjacent channel allotments or assignments (except LPFM's). The following standards will be used to determine the existence of objectionable interference:

5.1.2.1 The distance to the protected service contour of FM allotments and assignments will be determined from the F(50,50) curves attached for the appropriate field strength contours listed below.

Class	Field Strength	Maximum Distance
A	0.5 mV/m (54 dBu)	33 km
B1	0.5 mV/m (54 dBu)	51 km
B	0.5 mV/m (54 dBu)	65 km
C1	0.5 mV/m (54 dBu)	86 km
C	0.8 mV/m (58 dBu)	97 km

(U.S. Class C2 allotments and assignments will be considered as Class B allotments and assignments for the purposes of this document.)

5.1.2.2 The interfering field strength contour will be determined from the F(50,10) propagation curves attached, except when the resultant distance is less than 15 kilometers, in which case the F(50,50) curves will be used.

5.1.2.3 Objectionable interference will be considered to exist if the following interfering contours of classes A, B, B_1 and C_1 overlap the protected service contour:

Channel relationship	Field strength
Co-channel	0.05 mV/m (34 dBu)
First adjacent	0.25 mV/m (48 dBu)
Second adjacent	5.00 mV/m (74 dBu)
Third adjacent	50.00 mV/m (94 dBu)

Where the interfering contour is from a Class C channel allotment or assignment, the following signal strength contours will be used:

Channel relationship	Field strength
Co-channel	0.08 mV/m (38 dBu)
First adjacent	0.40 mV/m (52 dBu)
Second adjacent	8.00 mV/m (78 dBu)
Third adjacent	80.00 mV/m (98 dBu)

5.1.2.4 Where the protected contour extends beyond the boundary of the country in which the allotment is located, protection will be provided only to land areas, including islands, lying within that country. In this case, overlap of the interfering and the protected service contours may be acceptable provided that the interference zone does not fall within these areas. Annex II describes the procedure to determine the interference zone.

5.2 Assignment Notifications

5.2.1 Notification of station assignments or changes in operating parameters of existing stations must set out the actual operating parameters which will be employed. These may be less than the maxima permitted for the allotted channels. The use of lesser operating parameters initially will not preclude the later use of the parameters on which the allotment was accepted. If a limited assignment is being notified, the antenna height above average terrain for all connecting

radials between it and the assignments and allotments to which it is short spaced will be supplied. Each of these antenna heights is to be calculated by interpolating between the antenna heights above average terrain of the two standard radials that are adjacent to the connecting radial.

5.2.2 Notifications of assignments will contain the following information:

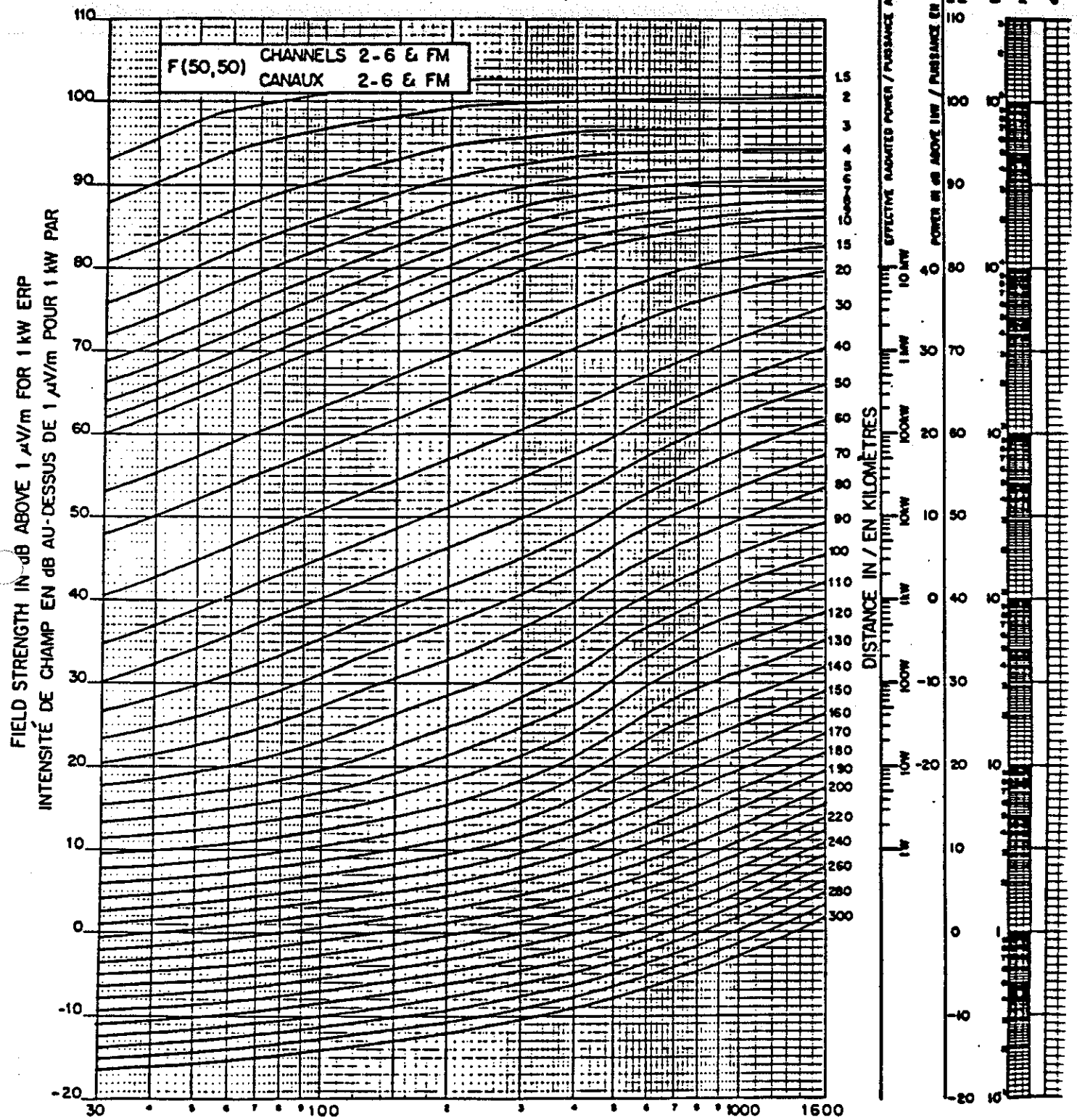
City, State or Province
Transmitter location (Latitude and Longitude)
Channel Number and Class of Station
Channel Frequency
Call Sign
Antenna
(i) Height of center of radiation above average terrain (3 - 16 km)
(ii) Height of the center of radiation above average terrain of the two adjacent standard radials if limited assignment is proposed.
Effective radiated power
(i) Horizontal pattern if a directional antenna is proposed.

5.3 Negotiations

Negotiations concerning allotments and assignments will normally consist of an exchange of letters between the Broadcasting Regulation Branch of the Department of Communications of Canada and the Mass Media Bureau of the Federal Communications Commission of the United States of America. In the event that the matter cannot be resolved by correspondence, a meeting will be arranged.

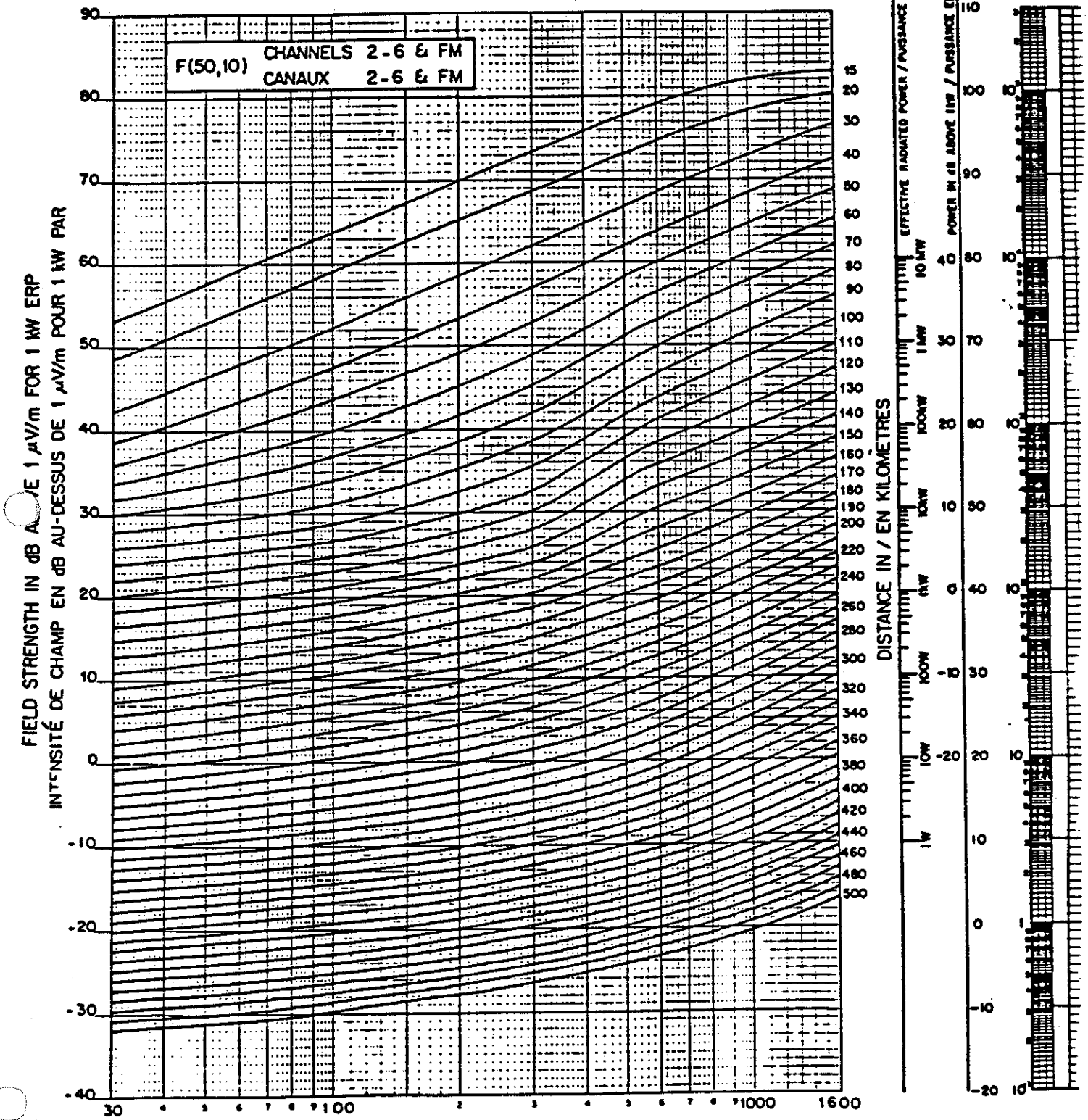
ESTIMATED FIELD STRENGTH EXCEEDED AT 50 % OF THE POTENTIAL RECEIVER LOCATIONS FOR AT LEAST 50 % OF THE TIME AT A RECEIVING ANTENNA HEIGHT OF 9.1 METRES.

ESTIMATION DE L'INTENSITÉ DE CHAMP DEPASSÉE A 50 % DES EMPLACEMENTS RÉCEPTEURS POSSIBLES, POUR AU MOINS 50 % DU TEMPS, POUR UNE ANTENNE RÉCEPTRICE DE 9,1 MÈTRES.



ESTIMATED FIELD STRENGTH EXCEEDED AT 50 % OF THE POTENTIAL RECEIVER LOCATIONS FOR AT LEAST 10 % OF THE TIME AT A RECEIVING ANTENNA HEIGHT OF 9.1 METRES.

ESTIMATION DE L'INTENSITÉ DE CHAMP DEPASSÉE A 50 % DES EMPLACEMENTS RÉCEPTEURS POSSIBLES, POUR AU MOINS 10 % DU TEMPS, POUR UNE ANTENNE RÉCEPTRICE DE 9,1 MÈTRES



ANNEX I

Frequency (MHz)	Channel No.
88.1	201
88.3	202
88.5	203
88.7	204
88.9	205
89.1	206
89.3	207
89.5	208
89.7	209
89.9	210
90.1	211
90.3	212
90.5	213
90.7	214
90.9	215
91.1	216
91.3	217
91.5	218
91.7	219
91.9	220
92.1	221
92.3	222
92.5	223
92.7	224
92.9	225
93.1	226
93.3	227
93.5	228
93.7	229
93.9	230
94.1	231
94.3	232
94.5	233
94.7	234
94.9	235
95.1	236
95.3	237
95.5	238
95.7	239
95.9	240
96.1	241
96.3	242
96.5	243
96.7	244
96.9	245
97.1	246
97.3	247
97.5	248
97.7	249
97.9	250
98.1	251
98.3	252
98.5	253
98.7	254
98.9	255
99.1	256
99.3	257
99.5	258
99.7	259
99.9	260
100.1	261
100.3	262
100.5	263
100.7	264
100.9	265
101.1	266
101.3	267
101.5	268
101.7	269
101.9	270
102.1	271
102.3	272
102.5	273
102.7	274
102.9	275
103.1	276
103.3	277
103.5	278
103.7	279
103.9	280
104.1	281
104.3	282
104.5	283
104.7	284
104.9	285
105.1	286
105.3	287
105.5	288
105.7	289
105.9	290
106.1	291
106.3	292
106.5	293
106.7	294
106.9	295
107.1	296
107.3	297
107.5	298
107.7	299
107.9	300

Annex II

Procedure to Determine Interference Zone

On an appropriately scaled map plot the transmitter sites and do the following:

1. Plot the protected service contour for the assignment or allotment to be protected based on maximum parameters in accordance with 5.1.2.1. If the assignment or allotment is limited, the agreed upon parameters shall be used instead of maximum parameters.

2. Plot the interfering contour for the proposed assignment or allotment based on its proposed parameters in accordance with 5.1.2.2 and 5.1.2.3.

3. Mark the two points where the contours intersect.

4. Repeat steps 1, 2, and 3 except increase the value of each contour while maintaining the same protection ratio until the protected and interfering contours are tangential.

5. Draw a line joining the intersection points obtained above. The area contained within this line and the protected service contour drawn in step 1 defines the interference zone.

Example

The following example shows the interference zone between an existing class B station and a proposed class A station which are short-spaced and on second-adjacent channels.

1. The protected service contour from 5.1.2.1 is 54 dBu which extends to 65 km.

2. The interfering contour from 5.1.2.3 is 74 dBu. (The extent of this contour will vary depending on the proposed operating facilities).

3. Mark the two points where the contours intersect.

4. Plot the 56 dBu service contour and the 76 dBu interfering contour and mark the two points of intersection. Continue to increase the value of the contours, plot them, and mark the intersection points until the contours are tangent.

5. Draw a line joining the intersection points obtained above. The area contained within this line and the protected service contour drawn in step 1 defines the interference zone. This area is shown cross-hatched in the drawing.