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Spectrum Management and Telecommunications

Broadcasting Procedures and Rules

Part 4: Application Procedures and Rules for Television Broadcasting Undertakings

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Canada

Contents

Section A: International Agreements

Within 400 km of the Canada-United States border, television broadcasting allotments and assignments in Canada are subject to the terms of the *Working Arrangement for Allotment and Assignment of VHF and UHF Television Broadcasting Channels* under the Canadian-U.S.A. Television Agreement of 1990.

The Working Arrangement between the Federal Communications Commission (FCC) and Industry Canada (formerly Department of Communications) states the basis upon which both Administrations consider responses to border area allotments and assignments. It also defines technical criteria for the notification of television allotments and assignments. The working arrangement also contains lists of the Canadian and U.S.A. allotments within their respective coordination zones. These lists are updated annually.

Within 370 km of French Territories of Saint-Pierre and Miquelon, the establishment of television undertakings in the band 174-216 MHz (channels 7-13) in Canada is subject to the terms of the Memorandum of Understanding between l'Office de Radiodiffusion-Télévision Française and Industry Canada.

Multipoint Distribution Television Systems (MDS-TV) in the 2596-2686 MHz frequency band, that are within 80 km of the Canada/United States border, shall comply with the domestic criteria and the agreement of understanding between Canada and the U.S.A. The terms of the agreement are contained in the document entitled *General FCC/DOC Understanding Concerning the Co-ordination of the 2500-2686 MHz Band within 80 km (50 miles) of the USA/Canada Border*, dated March 23, 1989. Due to channel sharing in certain border city locations, the number of channels available for use in Canada will be limited. In these areas, the channels will be shared between the broadcasting and the fixed services in a manner which differs from those set out in Table 1 of the Appendix 11. As an example, undertakings in the Windsor, Ontario area are to use the following polarizations:

- channel groups A, B, C and D and channels G-3 and G-4 vertical polarization,

- channel groups E, F and H and channels G-1 and G-2 horizontal polarization.

Section B: Preparation of Technical Submissions Supporting Applications for TV Broadcasting Stations Using Primary Assignments[1]

B-1. Application Requirements

An application to Industry Canada for a broadcasting certificate shall be accompanied by an application to the Canadian Radio-television and Telecommunications Commission (CRTC) for a broadcasting licence, unless the application is exempted from CRTC licensing requirements. The two applications shall be filed simultaneously.

[1] TV assignments other than low power and very low power stations (refer to Section C-1).

Although the CRTC has established criteria to exempt certain categories of TV broadcasting from its licensing requirements, the Department, because of spectrum management needs, maintains its requirements for the submission of technical applications.

B-1.1 Requirements

B-1.1.1 This section outlines the documentation that shall be submitted when applying for a primary TV assignment.

B-1.1.2 An application for a broadcasting certificate shall be made on departmental form IC-3050A, *Application for a Broadcasting Certificate for a Regular Power Undertaking*. An application form for a broadcasting licence is obtainable from the Canadian Radio-television and Telecommunications Commission (CRTC).

All necessary forms may be obtained from the departmental website at http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf06066.html.

When submitting an application to the Department electronically, the applicant shall use the following e-mail address: DBCE-APPS@ic.gc.ca.

The documentation to include is the following:

- the appropriate application form;

- the electronic brief (PDF format), including any required maps prepared in accordance with BPR-1;

- contours (MapInfo format: *.DAT/*.ID/*.MAP/*.TAB or GIS format: *.MIF,*.MID) (see section 3);

- form (in PDF format) IC-3052B entitled *Commitment Form*.

It is the responsibility of the applicant submitting the application to ensure that all electronic documents submitted have the necessary signatures.

The Department reserves the right to request a signed attestation to verify the authenticity of an application and may hold the processing of the application until a satisfactory attestation has been received.

When submitting an application on paper, the following documentation shall be included

(a) two copies of the appropriate Form IC-3050A;

(b) one copy 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) one copy of the departmental Form IC-3052B, *Commitment Form* (refer to BPR-1, Section 1.2);

(d) 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 the change of facilities.

B-1.1.3 All proposed antenna structures whether new or modified, low or full power, must comply with the requirements of CPC-2-0-03 and Section 2 of BPR-1. In addition to meeting the requirements on site sharing, land-use consultation and public consultation, applicants must also fulfill other important obligations, including: compliance with Health Canada's Safety Code 6 guideline for the protection of the general public, compliance with radio frequency immunity criteria, notification of nearby broadcasting stations, environmental considerations and Transport Canada/NAV CANADA aeronautical safety responsibilities.

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 (with offset), 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 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 primary 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 assignments and allotments 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 certified transmitter(s) in accordance with the *Broadcasting Equipment Technical Standards 4* (BETS-4) shall be made clear, either by specifying the make, model and certificate number, or by a statement that the transmitter will be certified 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, model number, number of sections (if applicable), beam tilt, power gain and vertical radiation pattern. For directional antennas, the horizontal pattern is required.

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

- Combiner — Manufacturer and operational characteristics should be provided.

- Polarization — Horizontal, 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 the Grade A and Grade B contours.

In cases where proposed TV 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 location 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 in broken lines.

B-2.4.9 When a television rebroadcasting station feed using off-air reception (or a combination of off-air reception and microwave links) from an existing station is proposed, the engineering brief should specify the type of feed and give a description of the system.

B-2.4.10 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 TV 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 nearby structures (Section C-7);

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

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

(d) assessment and control of maximum field strengths for TV broadcasting stations: the 105 dBu contour (channels 2 to 6) or the 115 dBu contour (channels 7 to 69) shall be determined and shown on a suitable map (Section C-5);

(e) interference to TV channel 6 from broadcasting stations on FM channels 201 to 220 (Section C-6.2, BPR-3);

(f) interference to low-power and very low power TV 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 Industry Canada.

Note: To assess the potential interference under (a), the engineering brief shall list all structures in excess of 30 metres that are located within a distance of 500 metres of the proposed TV station.

B-2.5 Diagrams

An elevation diagram of structure and transmitting antenna as per Appendix 3 and a block diagram of major units of the transmitting system are 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 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. When a directional pattern is proposed, the brief should contain a letter from the manufacturer stating that the proposed pattern can be achieved.

Note: Title blocks shall be placed on radiation patterns for directional antenna systems since in some instances, for areas along the Canada-United States border, it may be necessary to submit this material separately when notifying the assignment to the U.S. FCC. The title block shall include the identification of the station, frequency, maximum 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 coordinates (latitude and longitude) shown.

B-2.9.2 A map showing the Grade A and Grade B service 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-3. 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 at the latest 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-4. Requirements for the Establishment of Ancillary Signals

B-4.1 Ancillary Signals in the Vertical Blanking Interval

Stations proposing to insert signals into the vertical blanking interval (VBI) should refer to Section 4 in *Broadcast Transmission Standard 3* (BTS-3). If only Ghost Cancelling Reference (GCR) signals are planned, approval to transmit these signals is not required. If other signals and services are planned, a description of the type, location and signal or data format should be provided. The analysis should also show that no harmful interference is caused to the reception of regular television service. If a service within the VBI is intended for the reception by the general public, notification to the CRTC is required prior to the transmission of the signal.

B-4.2 Stereophonic and Multiplex Subcarriers in the Aural Baseband

B-4.2.1 Purpose

This section outlines the technical requirements for stereophonic and multiplex operation in the aural baseband of the television transmitter. TV broadcasting stations proposing stereophonic and/or multiplex subcarriers shall meet the requirements of this section and *Broadcast Transmission Standard 3* (BTS-3), when the station operates the aural transmitter in a stereophonic or multiplex mode.

B-4.2.2 Use of Aural Baseband Subcarriers

TV broadcast stations may transmit subcarriers and signal within the composite baseband of the aural transmitter for the following purposes:

(a) stereophonic, biphonic, quadraphonic, etc., sound programs;

(b) transmission of signals relating to the operation of the station such as relaying broadcast material, remote cueing, order messages and telemetry signals from the transmitting plant;

(c) transmission of pilot or control signals to enhance the station's program service such as activation of noise reduction decoders in receivers, for any other receiver control purpose, or for program alerting and program identification;

(d) subsidiary communications services;

(e) any other services authorized.

B-4.2.3 Stereophonic Aural and Multiplex Subcarrier Operation

A broadcasting station may transmit multichannel aural programs upon installation of multichannel sound equipment. Prior to the commencement of multichannel broadcasting, the equipment and transmission system shall be measured to ensure compliance with the requirements of this section and *Broadcast Transmission Standard 3* (BTS-3).

Multiplex subcarriers may be transmitted on a non-interference basis to broadcast programming. Transmissions shall comply with the requirements of this section and *Broadcast Transmission Standard 3* (BTS-3).

Subsidiary communications services are those transmitted within the TV aural baseband signal but do not necessarily include services relating to the main program broadcast.

The holder of the broadcasting certificate should retain control over all transmitted material with the right to reject any material deemed inappropriate or undesirable.

B-4.2.4 Definitions

The definitions applicable to multichannel television sound transmission appear in *Broadcast Transmission Standard 3* (BTS-3).

B-4.2.5 Changes in Equipment

The addition of stereophonic or subcarrier generators to a type-approved transmitter is acceptable.

Mechanical or electrical alterations and adjustments to existing approved transmitters to accommodate stereophonic sound or subcarrier operation will be permitted provided that the following conditions are met:

(a) the stereophonic or subcarrier generator is designed for interfacing with the transmitter;

(b) alterations and adjustments to the transmitter are based on the recommendations of the transmitter manufacturer and are implemented by qualified persons;

(c) performance measurements shall be made to ensure that the system satisfies the applicable requirements of *Broadcast Transmission Standard 3* (BTS-3);

(d) the transmitter, after alteration shall be certified by a professional engineer to be capable of equaling or bettering the performance requirements of the original approval specification.

B-4.3 Digital Data in the Active Video Portion

Undertakings proposing to insert digital data in the active video portion of the television signal should refer to Section 5 in *Broadcast Transmission Standard 3* (BTS-3). The stations may only use data insertion methods that have been approved in advance by Industry Canada. The technical criteria for advance approval of methods are as follows:

(a) the insertion of the data shall not cause objectionable degradation to any portion of the image, to the sound or to the program-related data (close captioning) components of the TV transmission.

(b) emissions outside the authorized 6 MHz television channel shall continue to comply with the limits as outlined in *Broadcasting Equipment Technical Standards 4* (BETS-4). Also, interference to the reception of co-channel and adjacent channel stations should not increase as a result of the insertion of the data.

B-4.4 Application Requirements

Licensees of TV broadcasting undertakings wishing to initiate vertical blanking interval signals, digital data services in the active video portion of the TV signal or multiplex subcarrier operations for broadcast purposes shall notify the intended use to the CRTC prior to the transmission of the signal. The Department requires a letter indicating the intended use. The letter to the Department shall include details of the use of the vertical blanking interval signal, the method of data insertion in the active video portion or on the multiplex subcarrier system and a statement that the proposed facilities will meet the requirements set out in this section and *Broadcast Transmission Standard 3* (BTS-3).

B-4.5 On-Air Testing and Broadcasting Certificate Amendment for VBI and Multiplex Subcarrier Operations

Prior to scheduled on-air testing of vertical blanking interval signals, multiplex subcarriers or stereophonic operation, the licensee shall test and certify that the installation meets the requirements of this Section.

On-air operation may commence following satisfactory testing. The Department will accordingly amend the broadcasting certificate upon notification.

In the event that the quality of the main or the stereophonic transmissions is impaired by the vertical blanking interval signal(s) or the multiplex subcarrier(s), the licensee is required to take corrective measures to eliminate the impairment. Use of any vertical blanking interval signal or multiplex subcarrier shall not interfere with main channel nor with stereophonic operation.

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 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 15-minute intervals, giving as a minimum the call sign, channel and location of the station. In the case of rebroadcasting 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 headquarter 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 Manager soon after the issuance of the letter of authority.

Following successful on-air rests, the applicant's consultant shall certify to the Department that the station is ready to commence operation in accordance with the approved technical submission and request permission to commence normal broadcasting schedule.

Section C: Technical Requirements for the Establishment of TV Broadcasting Stations Using Primary Allotments

C-1. Basic Principles for the Allotment of VHF and UHF Channels

This section pertains to the technical requirements for the allotment and protection of VHF and UHF channels and for the prediction of coverage for TV broadcasting stations in Canada.

C-1.1 Definitions

C-1.1.1 Allocation

The International Telecommunication 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. A list of current Canadian allotments is published by the Department.

C-1.1.3 Assignment

An ‘assignment’ is the authorized use of an allotment by a TV station.

C-1.1.4 Primary Assignment

A primary assignment is a protected station assignment authorized or operating on an allotment.

C-1.1.5 Secondary Assignment

A secondary assignment is an unprotected assignment authorized or operating on a channel in accordance with Section E or G, i.e. LPTV or VLPTV.

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 total 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 Television Channels

The frequencies allocated to broadcasting are designated by a channel number with each channel having 6 MHz bandwidth as follows:

Band	Channels	Frequencies (in MHz)
VHF	2 to 4 inclusive	54 - 72
VHF	5 and 6	76 - 88
VHF	7 to 13 inclusive	174 - 216
UHF	14 to 69 inclusive	470 - 806

Frequency band 608-614 MHz, channel 37, is allocated to the Radio Astronomy Service, and is not available for broadcasting.

C-1.1.9 Maximum Permissible Parameters

Maximum ERP values and the associated EHAATs permitted on an allotted channel are as follows:

	VHF CHANNELS 2-6	VHF CHANNELS 7-13	UHF CLASS A	UHF CLASS B	UHF CLASS C
ERP (kW)	100	325	10	100	1000
EHAAT (m)	300	300	100	150	300

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

For UHF stations, the maximum ERP values shall normally be reduced in accordance with the graph in Figure 7 of Appendix 1 when the EHAAT is in excess of the maximum value. As a special case, on class C allotments, super parameter stations are permitted an ERP of up to 5000 kW and an EHAAT in excess of 300 m (refer to Section C-1.7 and Table 1, Appendix 8).

For VHF stations, the maximum ERP value shall not be exceeded. Higher EHAAT values may be accepted for VHF and super parameter UHF stations, provided that the appropriate F(50,10) interfering signal levels at the protected contour of co-channel allotments do not exceed those provided in Section C-1.4. In any event where the EHAAT exceeds 600 m, the ERP for an unlimited allotment or assignment shall be reduced so that the distance to the F(50,10) interfering contour (46 dBu) is equal to that resulting from the maximum permitted ERP for the channel proposed and an EHAAT of 600 metres.

C-1.1.10 Minimum Operating Parameters for UHF

The minimum operating parameters of a class of UHF assignments are the lower limits of the operating parameters or their equivalents[2] allowed for that class, and they are as follows:

	CLASS A	CLASS B	CLASS C
ERP (kW)	3	20	100
EHAAT (m)	100	150	300

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

[2] The calculated Grade B contour remains at the same location when equivalent parameters are used.

C-1.1.11 Limited Allotment

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

C-1.1.12 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 coordinated as such.

C-1.1.13 Antenna Pattern

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

C-1.1.14 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 Section C-1.1.9 shall not be exceeded in either the horizontal or tilt planes.

C-1.1.15 Grade A Contour

The Grade A corresponds to a specific value of ambient median field strength existing 9.1 metres above ground. This signal level is deemed to be sufficiently strong, in the absence of interference from other stations and with due consideration given to man-made noise typical of urban environment, to provide a picture which the median observer would classify as of adequate quality, assuming a receiving installation (antenna, transmission line and receiver) typical of suburban or not too distant areas. This signal level is strong enough to provide an adequate quality of picture at least 90% of the time, at the best 70% of receiving locations. The Grade A contour is the geographic limit within which the median field strength equals or exceeds the Grade A value.

C-1.1.16 Grade B Contour

The Grade B corresponds to a specific value of ambient median field strength existing 9.1 metres above ground. This signal level is deemed to be adequate, in the absence of man-made noise or interference from other stations, to provide a picture which the median observer would classify as of satisfactory quality, assuming a receiving installation (antenna, transmission line and receiver) considered to be typical of outlying or near-fringe areas. This signal level is strong enough to provide a satisfactory quality of picture at least 90% of the time, at the best 50% of receiving locations. The Grade B contour is the geographic limit within which the median field strength equals or exceeds the Grade B value.

C-1.1.17 Service Contours

The service contours of a TV station are the Grade A and Grade B contours. The Grade A and Grade B contours are the boundaries or contours at which the field strength of a TV station, as determined using the appropriate F(50,50) propagation curves, are as follows:

Channels	Grade A	Grade B
VHF 2 - 6	68 dBu	47 dbu
VHF 7 - 13	71 dBu	56 dBu
UHF 14 - 69	74 dBu	64 dBu

The Grade A and Grade B contour values include the adjustments made with respect to different percentages of time (from 90% to 50%) and receiving location (from 70% to 50%) values indicated in Sections C-1.1.15 and C-1.1.16.

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

C-1.1.18 Operating Parameters

The operating parameters are the approved values of the ERP and EHAAT at which a TV station operates.

C-1.1.19 Protected Contour

(a) **For VHF:** The protected contour is the Grade B contour but not exceeding a distance of 89 and 82 km for channels 2-6 and 7-13 respectively. The distance to the Grade B contour is determined using F(50,50) curves in Figures 1 and 3 of Appendix 1 and Section C-3.

(b) **For UHF:** The protected contour is the Grade B contour but not exceeding a distance of 25, 45 and 70 km for class A, B and C channels respectively. The distance to the Grade B contour is determined using the F(50,50) curves in Figure 5 of Appendix 1 and Section C-3.

C-1.1.20 Interfering Contour

The interfering contour is the signal level permitted at the protected contour of other allotments and assignments. The distance to the interference contour for co-channel stations is determined using the F(50,10) curves in Figures 2, 4 and 6 of Appendix 1. For all other relationships refer to Table 1, 2 or 3 of Appendix 8. For distances less than 15 km the F(50,50) curves in Figures 1, 3 and 5 of Appendix 1 shall be used.

Note that when antenna beam tilt is proposed, the ERP in the plane of tilt shall be used.

C-1.1.21 Polarization

The polarization of the radiated signal is the orientation of the electric component of the electromagnetic field as radiated from the transmitting antenna.

C-1.1.22 Zones

For the purposes of international agreement, Canada is divided into two zones. A description and map of Zones 1 and 2 for Canada and the U.S.A. are shown in Appendix 10.

C-1.1.23 Frequency Offset

To reduce the effect of interference between co-channel stations, TV stations are assigned a frequency which is offset by 0, -10 kHz or +10 kHz from the nominal visual carrier frequency of the channel. The nominal frequency offset for each allotment is shown in the *Canadian Television Channel Allotment Plan*.

TV stations may also use precision frequency offset in accordance with Section C-1.3, where the visual carrier frequency is controlled by phase-locking or frequency stabilization at precise frequency offset of 10,010 Hz or 20,020 Hz with respect to another co-channel station.

C-1.1.24 Distances to Various Contours

In this Procedure, 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 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

C-1.2.1 Subject to the provisions listed below, TV allotments and assignments are protected to their Grade B contour, unless otherwise indicated. The Grade B contour is determined using F(50,50) propagation curves together with the ERP and HAAT for each of the eight radials. However, for irregular terrain, the local topography may be taken into account in calculating the location of the protected contour. The interfering signal is defined as in Section C-1.1.20 and the permissible co-channel interfering signal levels are listed in Section C-1.4. In determining the interfering signal towards the protected contour of a domestic allotment, the HAAT and the ERP for the pertinent azimuth(s) between the two allotments shall be used.

The separation distances required are shown in Sections C-1.5, C-1.6 and C-1.8, and the maximum permissible parameters are listed in Section C-1.7.

C-1.2.2 The Grade B contour is only protected to a maximum distance of 89 km for channels 2-6 or 82 km for channels 7-13. For channels 14-69, it is protected to a maximum distance of 25 km for class A channels, 45 km for class B channels and 70 km for class C channels.

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 Precision Frequency Offset

To maintain the precise frequency difference, as outlined in Section C-1.1.23, both stations require frequency stabilization within ± 2 Hz. The applicant of the incoming station is responsible for any arrangements with the licensee of the affected station. A proposal for a precise offset frequency shall include a summary of the arrangements made or the discussions undertaken with the affected station. In addition, the applicant shall send a copy of the engineering brief with a covering letter to the affected station licensee preferably at the date of filing the application or immediately after the CRTC has issued a Notice of Public Hearing[3]. 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 arrangements or the discussions undertaken and shall emphasize that any representations that the licensee might 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 not be accepted 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-1.4 Permissible Interfering Signals for Co-channel Allotments

C-1.4.1 For a domestic allotment, the maximum permissible interfering signal at the protected contour of another co-channel VHF or UHF domestic allotment, shall not exceed that shown in the following table using F(50,10) curves:

	Interference Signal Level (in dBu)		
Channels	**No Freq. Offset**	**Freq. Offset**	**Precise Freq. Offset**
VHF 2-6	15	32	39
VHF 7-13	24	41	48
UHF 14-69	29	46	53

[3] The applicant should send the letter and the copy of the brief early enough so that the affected licensee can reply at the latest 10 days before the start of the Public Hearing. Should the 30-day response time fall beyond this deadline, the Department will not send technical comments to the CRTC. It is to be noted that, in this case, the applicant is taking the risk of having the application withdrawn and assumes the responsibility for it.

C-1.4.2 An interfering signal exceeding the values of the above table may be permitted by mutual agreement. In addition, any limitation to the service area of the channel applied for, shall not extend into areas where service is intended.

For separation requirements to U.S.A. allotments and assignments, refer to Section C-1.8.

C-1.5 Separation Requirements for Adjacent Channel VHF Allotments in Canada

For unlimited allotments, the minimum distance to an adjacent channel unlimited allotment is 96 km. For domestic limited allotments, the minimum distance to either a limited or unlimited adjacent channel allotment, shall be such that the permissible interfering signal at the adjacent channel's protected contour does not exceed the limits established in Table 2 in Appendix 8. However, an interfering signal exceeding the values in Table 2 may be permitted by mutual agreement. In addition, any limitation to the service area of the channel applied for, shall not extend into areas where service is intended.

For separation requirements to U.S.A. allotments and assignments, refer to C-1.8.

C-1.6 Separation Requirements for UHF Allotments in Canada

The protection afforded domestic UHF allotments is based on the standard separation distances to other co-channel and technically related channel allotments. The standard separation distances are shown in Table 3 in Appendix 8 for class A, B and C stations taken at maximum parameters using a nominal zero and 10 or 20 kHz frequency offset. UHF channel allotments normally shall not be made at separation distances less than those shown in the table. However, a limited class A, B or C channel may be allotted at less than the standard separations providing that the desired to undesired field strength ratios, as shown in Table 3, are not exceeded. In addition, any limitation to the service area of the channel applied for, shall not extend into areas where service is intended.

For separation requirements to U.S.A. allotments and assignments, refer to Section C-1.8.

C-1.7 Maximum Permissible Parameters for UHF Class C Allotments (Super Parameter Stations)

C-1.7.1 Class C allotments may have operating parameters in excess of the maximum parameters, i.e. 1000 kW ERP at 300 m EHAAT, providing the ERP does not exceed 5000 kW and the maximum level of the co-channel interfering signal, at the protected Grade B contour of another co-channel allotment, does not exceed the applicable values listed in Section C-1.4. In addition, the protection requirements listed in Table 1 of the Appendix 8 shall be met. For EHAATs greater than 600 m refer to Section C-1.1.9.

Super parameter stations are not protected beyond a radial distance of 70 km.

C-1.8 Separation Requirements between Canada and U.S.A. Allotments

C-1.8.1 **No VHF** allotment in Canada may normally be made with respect to a U.S.A. allotment, at separation distances less than those shown in the table below using a nominal visual carrier frequency offset of 10 or 20 kHz:

Frequency Relationship	Zone in Canada	Separation
Co-channel	1 or 2	275 km to allotments in USA Zone 1
Co-channel	2	305 km to allotments in USA Zone 2
Co-channel	1	275 km to allotments in USA Zone 2
First Adjacent Channel	1 or 2	95 km to allotments in USA Zone 1 or 2

The Zones for Canada and the U.S.A. are shown in Appendix 10.

The maximum permitted interfering signal to the protected contour of VHF allotments in the U.S.A. is contained in the Canada-U.S.A. Working Arrangement.

C-1.8.2 **No UHF** allotment in Canada may normally be made with respect to a U.S.A. allotment, at separation distances less than those shown in the table below using a nominal visual carrier frequency offset of 10 or 20 kHz. These separation distances are based on a maximum ERP of 1000 kW and EHAAT of 300 metres.

Frequency Relationship	Zone in Canada	Separation
Co-channel	1 or 2	250 km to allotments in USA Zone 1
Co-channel	2	280 km to allotments in USA Zone 2
Co-channel	1	250 km to allotments in USA Zone 2
First Adjacent (N=±1)	1 or 2	90 km to allotments in USA Zone 1 or 2
Intermod. (N=±2,3,4,5)	1 or 2	30 km to allotments in USA Zone 1 or 2
Local Oscillator (N=±7)	1 or 2	95 km to allotments in USA Zone 1 or 2
Intermed. Freq. Beat (N=±8)	1 or 2	30 km to allotments in USA Zone 1 or 2
Sound Image (N=±14)	1 or 2	95 km to allotments in USA Zone 1 or 2
Picture Image (N=±15)	1 or 2	120 km to allotments in USA Zone 1 or 2

Where “N” is the number of the reference channel.

The maximum permitted interfering signal to the protected contour of UHF allotments in the USA is contained in the Canada-U.S.A. Working Arrangement.

C-2. Changes to the Table of Allotments

When a television service is being contemplated for a particular area and the Canadian Television Channel Allotment Plan does not contain a suitable unoccupied allotment, changes to the allotment plan 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 upgrading of allotments:

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

(b) adding or changing an allotment at the expense of limiting an existing allotment or assignment. Where an assignment is concerned, the licensee's comments on the proposed limitation shall be sought, as required in C-2.4.3. The proposed limitation shall not be greater than that permissible under Section C-2.3.1 for VHF and under Section C-2.3.2 for UHF. For existing allotments refer to Section C-2.3.3;

(c) adding or changing a UHF allotment at the expense of reclassifying an existing allotment or assignment. This will occur when the parameters of the existing assignment are less than the maximum equivalent with the next lower class. Where reclassification of an assignment is proposed, the licensee's comments on the proposed reclassification shall be sought as required in Section C-2.4.3;

(d) adding or changing an allotment at the expense of changing the channel of an allotment or an assignment. In the latter case, the licensee's agreement shall be obtained (refer to Section C-2.4.3);

(e) adding or changing an allotment at the expense of changing the offset of an assignment or requiring the use of precision frequency control (refer to Section C-2.4);

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

(g) adding or changing an allotment at the expense of deleting an existing allotment.

C-2.2 Impact on the Plan

It is noted that some of the changes in C-2.1 may have a positive impact on the allotment plan 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 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.

C-2.3 Proposals to Limit VHF and UHF Channels

C-2.3.1 Proposals to Limit VHF Assignments

A proposal to add a channel which is predicated on limiting an **unlimited** assignment shall be supported by a technical submission, and the licensee shall be informed as required in Section C-2.4.3. The proposal shall protect the station's Grade B contour which shall be determined using the station's operating ERP and an EHAAT of 150 metres. However, where the station's EHAAT exceeds 150 metres, the protected contour shall be the Grade B contour as calculated using the operating parameters but not exceeding the distances designated in Section C-1.1.19. Proposals to add a channel which will further limit a **limited** assignment shall be supported by a technical submission and the licensee shall be informed as required in Section C-2.4.3. The proposal shall protect the station's Grade B contour as calculated using the station's operating parameters.

C-2.3.2 Proposals to Limit UHF Assignments

A proposal to add a channel which is predicated on limiting an **unlimited** assignment shall be supported by a technical submission and the licensee shall be informed as required in Section C-2.4.3 The proposal shall protect the station's Grade B contour which shall be determined using the station's operating ERP and using an EHAAT of 100, 150 or 300 metres respectively for the class A, B or C stations. When the station's EHAAT exceeds that for the class the protected contour shall be the Grade B contour as calculated using its operating parameters but not exceeding the distances in C-1.1.19. Proposals to add a channel which will further limit a **limited** assignment shall be supported by a technical submission and the licensee shall be informed as required in Section C-2.4.3. The proposal shall protect the station's Grade B contour as calculated using the station's operating parameters.

C-2.3.3 Proposals to Limit VHF or UHF Allotments

A proposal to limit an unoccupied unlimited allotment to a limited allotment or to reduce further an unoccupied limited allotment shall be supported by technical submission demonstrating that the change would provide an improved channel utilization.

C-2.4 Application Requirement

C-2.4.1 When an application for a new television undertaking requires modifications to the Plan, the applicant may consult with the Department regarding these modifications prior to the formal filing of the 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-2.4.2 Any application proposing to change the channel of an assignment will be found to be incomplete unless it is accompanied by proof that the station affected agrees to the change.

C-2.4.3 Applicants proposing to limit, reclassify, change the offset or implement precision frequency control of 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, preferably at the date of filing

the application or immediately after the CRTC has issued a Notice of Public Hearing[4]. 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 change 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. Applicants proposing changes involving the offset or precision frequency control which result in additional capital and operating cost for existing stations, will be expected to cover these expenses. Both parties shall agree to maintain the offset or precision frequency control.

C-2.4.4 An applicant may accept interference within its Grade B 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 Appendix 6 and shall be shown as a hatched area on the proposed station's coverage map.

C-2.5 Incompatibilities

In all of the cases described in C-2.1, 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 cooperate 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 incompatibility known to each of the applicants involved, urging their resolution prior to consideration of the applications by the CRTC.

C-2.6 Allotment Planning

C-2.6.1 Applications for the addition or for modifications to the Canadian Television Channel Allotment Plan may be made with, or independently from an application for an assignment. In either case, documentation in respect of the allotment change(s) shall be submitted.

C-2.6.2 A UHF 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.

[4] The applicant should send the letter and the copy of the brief early enough so that the affected licensee can reply at the latest 10 days before the start of the Public Hearing. Should the 30-day response time fall beyond this deadline, the Department will not send technical comments to the CRTC. It is to be noted that, in this case, the applicant is taking the risk of having the application withdrawn and assumes the responsibility for it.

C-2.6.3 The Department may make changes to the Canadian Television Channel Allotment Plan which are independent of any application received. It will also take independent decisions, based on technical considerations, 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 Grade A and Grade B contours which indicate the approximate extent of coverage over average terrain in the absence of interference from other television 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 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, detailed analysis with profile data should be included;

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

Radial No.	Azimuth (deg.)	Depression angle	ERP (kW)	HAAT (metres)	Distance to Grade A Contour (kW)	Distance to Grade B Contour (km)
1	0	0.38°	20	190	24	37
2	45	0.40°	19	207	23	37
3	90	0.42°	18	232	25	38
4	135	0.51°	17	335	30	43
5	180	0.47°	17	281	28	40
6	225	0.39°	20	200	24	37
7	270	0.49°	17	311	29	42
8	315	0.49°	17	296	29	41

Note: Depression angle values shall only be provided for UHF transmitting antennas.

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 coordinate 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.

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 using a planimeter, by obtaining 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.

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 radials,

(d) HAAT for the radial.

C-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). To use the curves for other powers, the sliding scale associated with the curves should be used as the ordinate scale. This sliding scale is placed on the curves with the appropriate gradation for power on the horizontal 40 dB line. The right edge of this scale is placed in line with the appropriate antenna height gradations, the curves then become direct reading (in μV/m and in dB above 1 uV/m) for the selected ERP and HAAT. Where the intersecting point falls between the curves of equidistant points, linear interpolation shall be used.

C-3.3 Location of Service Contours

C-3.3.1 Depression Angle

The depression angle is based on the difference in elevation of the antenna centre of radiation above the average terrain (HAAT) and the radio horizon. Assuming a smooth spherical earth with a radius of 8500 km, this depression angle can be determined by the following equation:

$$A = 0.0278 \sqrt{H}$$

where: A is the depression angle in degrees;

H is the height in metres of the transmitting antenna radiation centre above average terrain of the 3 to 16 km sector of the pertinent radial (HAAT).

C-3.3.2 Beam Tilt

High elevation antennas may be designed with beam tilt of the vertical radiation pattern, to ensure the coverage for the major communities near the antennas.

C-3.3.3 Grade A and Grade B Contours

The distances to the Grade A and Grade B 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 value in the direction of the eight standard radials should be used. The antenna vertical plane radiation pattern shall include the beam tilt.

For UHF transmitting antenna systems, the ERP at the depression angle (radio horizon) shall be used. However, in cases where the relative vertical pattern radiation value at the depression angle determined by the above formula in C-3.3.1 exceeds 90% of the maximum value of the radiation pattern in the vertical plane containing the pertinent radial, the maximum radiation shall be used.

C-4. Computation of Distance and Azimuth

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

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;

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

(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 km. 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),

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

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 Maximum Field Strength of TV Broadcasting Stations

C-5.1 Introduction

Service requirements and constraints related to the siting of TV broadcasting stations may result in high signal strength levels in populated areas. Under these conditions, TV receivers are susceptible to interference from strong adjacent TV signals. Also, broadcast receivers are susceptible to immunity-type interference, and non-radio frequency equipment (radio-sensitive equipment) may be affected as well. To avoid or to minimize such problems, applicants are encouraged to locate their transmitters away from populated areas. Where this is unavoidable, it is necessary to assess the potential for interference.

C-5.2 Purpose

The purpose of this subsection is to:

- identify the analysis required from applicants in determining interference potential,

- define the responsibilities of broadcasters in response to interference complaints,

- identify non-valid complaints of interference.

The requirements of this subsection apply to all applications for the issue or amendment of broadcasting certificates for TV 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, C-5.3.2. C-5.3.3 and C-5.3.4 are required. In specific cases, the Department may accept a common assessment for co-located stations, multiplexed or otherwise.

C-5.3.1 Assessment of Close-in Field Strength Levels and Population Estimates

For strong adjacent TV signal interference, applicants for a new station or for changes to an existing station shall submit an estimate of the population within the 120 dBu contour for channels 2 to 6 inclusive, or the 115 dBu contour for channels 7 to 69 inclusive.

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 above 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 field strength contours.

C-5.3.2 If there is any population within the high field strength contours in C-5.3.1 above, determine if any part of the above contours would be located between the Grade A and Grade B contours of any Canadian stations, assigned or allotted, on the first and second adjacent channels for the VHF band, or on the first through fifth adjacent channels for the UHF band. For allotted but unassigned channels, maximum permissible parameters are to be assumed.

C-5.3.3 If there is any population within the overlap areas identified in C-5.3.2 above, then the possibility of interference exists and a list of the Canadian assignments and allotments identified in C-5.3.2 above shall be submitted to Industry Canada:

C-5.3.4 Immunity-Type Interference

Broadcast receivers and their associated equipment, as well as non-radio equipment (radio-sensitive devices), are expected to operate properly within field strengths lower that those indicated in the Department's Electromagnetic Compatibility Advisory Bulletin 2 (EMCAB-2). The Department uses EMCAB-2 to make determinations on interference or immunity cases.

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 dBu (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 Close-in 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 $\Theta_i + A \leq 10^0$:

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

This general relationship is plotted for various antenna heights as shown in Figure 3 of Appendix 1.

C-5.5 Resolving Issues

C-5.5.1 Responsibilities

The broadcaster will accept responsibility to:

(A) In the case of strong adjacent channel interference

- remedy valid complaints of interference to TV receivers within the 120 dBu contour (channels 2-6 inclusive) or the 115 dBu contour (channels 7-69 inclusive) of the station (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 120 dBu contour (channels 2-6 inclusive) or the 115 dBu contour (channels 7-69 inclusive) 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.

(B) In the case of immunity-type interference

The broadcasters will be responsible of solving immunity-type interference when applicable, i.e. for valid complaints.

The guidelines on resolving immunity issues relating to radio-sensitive equipment, are outlined in Industry Canada's Client Procedures Circular 3-14-01, *Determinations of Harmful Interference with respect to Radio-Sensitive Equipment*. This CPC can also be used as a guide for resolving immunity related interference to broadcast receivers and associated equipment.

C-5.6 List of Complaints Judged Not Valid by Industry Canada

The following is the list 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 is attributed to the desired signal being received at a location outside the coverage area of the station;

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

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

(e) 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;

(f) where the complaint is attributed to the reception of a first-adjacent TV channel station which, under normal allotment criteria, is not fully protected from interference;

(g) where the complaint is attributed to the reception of a second-adjacent TV channel station which has less than Grade A signal strength, providing the applicant's site has been chosen to minimize this problem (typical receivers cannot reject a strong local signal when tuned to receive a weak adjacent channel station);

(h) where the complaint is attributed to immunity-type interference to broadcast receivers and associated equipment located in an area where the measured field strength does not exceed the 125 dBμV/m;

(i) where the complaint is attributed to immunity-type interference to radio sensitive equipment (RSE) that is located in an area where the measured field strength does not exceed the 130 dBμV/m;

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

C-6. Radio Frequency (RF) Exposure, Land-Use and Public Consultations, Immunity-Related Interference, Environmental Assessment and Transport/NAVCANADA Safety-Related Issues

Refer to Sections B-1.1.3 and C-9 and to CPC-2-0-03 for the requirements on these issues.

C-7. Other Types of Interference

C-7.1 Harmonic Interference

C-7.1.1 The assignment of a frequency that is harmonically related to the frequency of an existing station in the same area, is very involved from the standpoint of protecting the station on the higher frequency, particularly where different powers and radiation patterns have to be taken into account. Another complicating factor relating to the adequacy of protection of the higher frequency station is the possibility of the internal generation of this type of interference within receivers.

C-7.1.2 Where possible, assignments of harmonically related frequencies in the protected coverage area of an existing station should be avoided. However, if such assignments are required, an analysis shall be submitted in the engineering brief showing that a particular operation is feasible.

C-8. Television Ghosting Interference

C-8.1 Introduction

The transmitter site for a TV station shall be selected to provide an adequate signal to the immediate and surrounding areas. This often results in a site located in close proximity to other antenna towers and metallic structures. As part of the site selection process, a prediction of the degree of impairment of the television signal due to ghost images resulting from such structures shall be made. In addition, where an antenna tower is proposed in close proximity to an existing TV station, a prediction of the degree of impairment to that existing station is also required.

C-8.2 Purpose

The purpose of this section is to establish acceptable picture grades (minimum standard of picture quality) in the presence of ghosts for the various types of TV services. These standards were developed from a study on subjective impairment of television signals due to ghosting interference.

C-8.3 Television Ghost Prediction Method

A report entitled *Report on Predicting Television Ghosting Interference and Picture Quality* (TB-5), has been prepared by Industry Canada.

The method has been developed for both triangular and square section towers and is valid for specific frequency ranges and delay ranges. Use of the method of computation developed by the Department is recommended. The use by consultants of another method may be accepted by the Department, but justification for its choice shall be provided.

C-8.4 Television Ghost Analysis Procedure

This procedure shall apply to primary and secondary television stations.

C-8.4.1 Requirements

A station shall provide the required grade of service in all directions where there are populated areas including the areas where there may be imminent urban development. Exceptions may be made for stations where the ghosting occurs in mountainous terrain or over water.

C-8.4.2 Ghost Interference Analysis

All antenna towers and other metallic structures, situated within a radius of 500 metres from the proposed transmitter site, from which ghosting interference to the service area could result, should be analyzed. If the reflecting structure is substantially higher than the antenna's radiation centre and the separation distance is greater than 500 metres, it is advisable that a study be carried out. When a non-directional antenna is used by a station, worst case reflecting structures are those that are located directly in line with the principal service area and behind the transmitting antenna; accordingly, locations for the analysis should be selected in that direction.

The above-mentioned 500 metres separation distance is only a guideline and should be applied logically according to the actual situation.

In a case where the consultants for a proposed and for an existing station disagree over the level of potential ghost interference in a common service area, they will be asked to submit their calculations to Industry Canada. If this question has not been resolved, the Department will not approve the incoming station without a commitment, in writing, that the construction of the tower would be monitored jointly by the Department and the applicant and, if objectionable ghosting is created, the tower height will be reduced to permit the existing stations to maintain the picture grade required in Section C-7.6 below.

C-8.5 Relationship Between Ghost Delay and Ghost Level

The Figure of Appendix 7 shows the relationship of ghost delay to ghost level for given picture impairment grades based on a 'typical' sample of TV viewers.

The subjective effects of very short time delayed ghosts appear to be more severe than the curves would indicate in the range 0-500 nano-seconds. Brief tests and theoretical calculations indicate that significant colour saturation and hue changes can be anticipated where the ghost delay is approximately one half period, plus an integer number of periods of the colour subcarrier frequency. Delays in this range result in phase and amplitude modulation of the colour burst and chrominance signal. This aspect of ghost impairment is not covered under this procedure.

C-8.6 Minimum Standard

The 5-point scale system used in CCIR Recommendation 500-1 is selected as the basic scale to provide an adequate assessment of picture quality.

C-8.6.1 Television Stations on Allotted Channels

Minimum Standard: - Grade 4.0 or better for population within the service contours.

C-8.6.2 Low-Power Television Stations

Recommended Minimum Standard: - Grade 3.5 or better for population within the service contour.

C-9. Transmitting Antennas

C-9.1 Polarization

It shall be the standard to employ horizontal polarization. However, circular or elliptical polarization may be employed if desired, in which case clockwise (right hand) rotation, as defined in the IEEE Standard Definition 42A65-3E2, and transmission of the horizontal and vertical components in time and space quadrature shall be used. For either non-directional or directional antennas, the licensed effective radiated power of the vertically polarized component may not exceed the licensed effective radiated power of the horizontally polarized component. For directional antennas, the maximum effective radiated power of the vertically polarized component shall not exceed the maximum effective radiated power of the horizontally polarized component in any specified horizontal or vertical direction. Slant polarization may not be used.

C-9.2 Directional Antennas

C-9.2.1 Directional antennas may be used by stations operating on unlimited allotments, but their use shall not prevent future increases up to the maximum parameters for VHF and UHF channels. 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-9.2.2 For protection purposes, the ratio of maximum to minimum fields of 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 a 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.

C-9.2.3 Antennas designed with beam tilt of the vertical radiation characteristic, for the purpose of meeting protection requirements, will not be approved. However, the Department would be prepared to consider as special cases, proposals involving beam tilt designed to improve television service close to the antenna, provided that such proposals are supported in the engineering brief by a technical justification.

C-9.2.4 For stations using high gain UHF-TV antennas, it should be noted that the physical rigidity of the antenna and supporting structure becomes a factor in maintaining a reliable signal to the service areas. For antennas with a vertical power gain in excess of 25, particular attention shall be given to the mechanical stability of the antenna installation, and to the location of the vertical pattern minima in relation to the service area.

C-10. Off-Air Pick-Up Reception for TV Rebroadcasting Stations

C-10.1 The signal analysis for a television rebroadcasting station using off-air pick-up or a combination of off-air pick-up and microwave link is to include the following:

(a) detailed information on the expected field strength of the master station at the proposed receiving location for the rebroadcasting station. This should consist of the measurement data, including copies of charts of actual field strengths recorded over a period of at least thirty days. However, if such measurements are not practicable, the adequacy of the received signal at the point of reception shall be established by calculation. The method used in the analysis shall be outlined in detail;

(b) results of measurements (which shall be conducted at the proposed receiving location) to determine the presence and levels of extraneous noise, such as interference from electrical equipment, power lines, etc. In this connection, an interference-free condition should not be assumed on the basis of the remoteness of the pick-up station from the usual interference sources. Moreover, the possibility of co-channel interference at the pick-up antenna site shall be considered in the analysis; and

(c) an undertaking that, in the event the off-air received signal proves to be inadequate in practice, the applicant would provide for microwave, or appropriate alternate facilities, at the applicant's own expense, to overcome the deficiency.

C-10.2 In some cases, the new channel assignment is technically related to the channel used for the off-air reception program feed of an existing rebroadcasting station. When such an assignment precludes the continued use of the off-air reception program feed, an alternate

method of program feed shall be provided. The costs of any change that is required to accomplish this objective shall be borne by the licensee of the existing rebroadcasting station that has in the previous years benefited from the direct off-air reception.

C-11. Siting and Service

C-11.1 TV station transmitters shall be so located to serve the principal centre to which the channel is assigned and to ensure the overall effectiveness of the Allotment Plan. A minimum field strength that corresponds to the Grade A contour is required for satisfactory service to principal target centres[5]. In secondary target centres, where the reception is achieved by an outdoor receiving antenna, a minimum field strength corresponding to the Grade B contour shall be provided.

C-12. Television/Land Mobile Adjacent Band Interference (Provisional)

Frequency bands 150-174 MHz, 450-470 MHz and 806-890 MHz are allocated to land mobile (LM) services. These are adjacent to VHF and UHF channels 7 (174-180 MHz), 14 (470-476 MHz) and 69 (800-806 MHz). Television assignments with relatively high power on the above channels may cause interference[6] to land mobile (LM) base receivers which operate on frequencies near the edge of the television allocations. Conversely, land mobile transmitters on assigned frequencies near the edge of the channel and within the service contour of the television undertaking may cause interference to TV reception.

Consequently, any application proposing the use of TV Channels 7, 14, or 69 may require special analysis and negotiations as part of the technical submission. Appendix 11 provides guidelines outlining the technical criteria that should be applied to minimize or eliminate mutual interference between television and adjacent-band land-mobile services.

The data on LM assignments is available from Industry Canada on a case-by-case basis.

Case of certain Channel 14 Allotments

Concerning the protection of LM base stations operating in the bands adjacent to TV channel 14, when the allotments at Ottawa, Ontario and Sherbrooke, Quebec are assigned, these allotments necessitate the use of the extra filtering of spurious television emissions. Conversely, these two allotments must be protected by the LM base stations.

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5 Any populated area defined as city, town, locality etc. as per Natural Resources Canada maps.

6 It is expected that technologies utilizing digital modulation techniques will be implemented in the future in the land mobile bands to increase the spectrum utilization efficiency. These technologies may increase immunity to interference between television and adjacent band land mobile services.

Section D: Preparation of Technical Submissions Supporting Applications for Low-Power Television (LPTV) 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 television stations using standard television channels on an unprotected non-interfering basis (such a low power television 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-3051A, *Application for LP or VLP Undertaking or for Auxiliary Transmitter*. 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 CRTC. The two applications should be filed simultaneously.

D-1.2.2 All necessary forms may be obtained from any departmental regional office (Vancouver, Winnipeg, Toronto, Montréal, Moncton) or departmental headquarters in Ottawa.

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

(a) one copy of departmental Form IC-3051A should be submitted when applying for a new station or a change of technical facilities for an existing station. Form IC-3051A also contains an abbreviated technical submission which should be presented as the engineering brief if the minimum separation distances of Appendix 9 are complied with. Otherwise, a complete engineering brief (five copies) should be submitted in accordance with Section D-2;

(b) one copy of departmental Form IC-3052B, *Commitment Form*, 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).

D-1.2.4 Antenna Siting Considerations

See Section B-1.1.3 on this matter. The applicant must indicate that the antenna system complies with the requirements of BPR-1, Section 2 and CPC-2-0-03.

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 television assignments and allotted channels under the Canadian Television Channel Allotment Plan. 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 protect 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 a television 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) in accordance with *Broadcasting Equipment Technical Standard 4* (BETS-4) 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-2.6.5 Scrambling Equipment - A description of the encoder/decoder system should be included with block diagrams showing the interface requirements in the transmitting and receiving systems. Scrambled TV systems shall meet the technical requirements of *Telecommunications Regulation Circular 59* (TRC-59).

D-2.7 Coverage Prediction and Service Contour Map

Coverage prediction and a service 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 Television Stations on Unprotected Channels

E-1. Technical Criteria

E-1.1 Conditions

E-1.1.1 Definitions

A low-power TV (LPTV) station is a secondary assignment operating on an unprotected channel.

E-1.1.2 Antenna Height

The transmitting antenna height (HAAT) is the height of the radiation centre of the antenna above the arithmetic average of the elevation of the terrain in the coverage area. The HAAT may be determined using the average elevation of the terrain measured in metres from zero to five kilometres along four standard radials at 0, 90, 180 and 270 degrees from true north.

E-1.1.3 Transmitter

The output power of the transmitting equipment shall not exceed a maximum peak visual output of 50 Watts on VHF and 500 Watts on UHF band channels. The transmitter power is the peak power output during the transmission of a synchronizing pulse.

Equipment meeting the requirements of **BETS-4** for low power category A or B equipment without sufficient margin with respect to the frequency stability parameter may be precluded from use under certain demanding conditions such as:

(a) multiple transmitter chain systems;

(b) stations which propose the use of frequency offsets to minimize co-channel separation;

(c) equipment exposed to wide temperature variations.

E-1.1.4 Service and Coverage

An LPTV station may provide service within its Grade A contour or within its Grade B contour.

As a guide, a Grade A signal is considered to be the signal strength desirable to provide satisfactory service in an urban area. For a low noise environment or where an outdoor antenna is used, a Grade B signal may provide satisfactory service to a rural or a low density population residential area.

The effective radiated power (ERP) in any direction shall not exceed the value required to establish the Grade B contour at 12 km when the HAAT is 30 metres, i.e. 100 W for channels 2-6, 400 W for channels 7-13 and 5000 W for channels 14-69. The ERP is equal to the transmitter power supplied to the antenna multiplied by the gain (relative to a dipole) of the antenna in a given direction.

The Grade B contour shall not normally extend beyond a distance of 12 km in any direction from the antenna site.

E-1.1.5 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 Sections E-1.1.2 and E-1.1.3. In such cases, a broadcast consultant should be retained to demonstrate that the existing stations and allotments shall be protected from interference. The analysis shall be based on the protection ratios specified in Section E-1.3.2. The protected contour of television undertakings in these cases is the Grade B contour.

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

E-1.2.1 LPTV stations will be considered as secondary assignments. In other words, the operation of the station shall be established on an unprotected basis. Should the operation of a station established in accordance with this section cause interference to stations operating on allotted channels, whether established before or after the low-power station, or to other radio

services, remedial measures would have to be taken even to the extent of closing down the station if another suitable channel cannot be used. Conversely, an LPTV station is not entitled to protection from interference from stations on allotted channels. LPTV stations are only entitled to protection from other low-power stations, authorized at a later date and from Very Low-Power Television stations (refer to Section F).

E-1.2.2 Interference to and from existing stations and allotments is not deemed to exist if the technical criteria for protection set forth in Section E-1.3 are met. The desired-to-undesired (D/U) 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 acceptable engineering method.

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

E-1.2.4 Where a new primary station or one which has changed parameters, causes interference to an LPTV station but does not receive any, the latter may either accept the interference or make application to change its operation to alleviate the interference.

E-1.2.5 LPTV stations are not required to provide protection to Very Low-Power Television stations.

E-1.3 Choice of Channel

E-1.3.1 Channels for TV broadcasting are assigned as per Section C-1.1.8. The protection ratio for co-channel is the ratio of the desired Grade B signal calculated using F(50,50) curves and the undesired interfering signal calculated using F(50,10) curves (D/U).

E-1.3.2 Channels shall be chosen to satisfy the following technical criteria for protection to all other channels allotted or assigned in the area;

VHF co-channel:	with no nominal offset the protection ratio is 35 dB; with offset the protection ratio is 25 dB.
VHF 1st adjacent channel:	the protection ratio is −16 dB, except that both LPTV stations could be co-located with similar parameters.
UHF co-channel:	with no nominal offset the protection ratio is 28 dB; with offset the protection ratio is 18 dB.

UHF 1st adjacent channel:	the protection ratio is −16 dB, except that two LPTV stations could be co-located with similar parameters.
UHF ± 2, ± 3, ± 4 adjacent channel:	there is to be no overlap of the 100 dBu F(50,50) contours, except that both LPTV stations could be co-located with similar parameters.
UHF ± 7th adjacent channel:	there is to be no overlap of the 74 dBu F(50,50) contours.
UHF ± 14th adjacent channel:	the protection ratio is −28 dB.
UHF ± 15th adjacent channel:	the protection ratio is −10 dB.

E-1.3.3 Proposals predicated on operation with a normal frequency offset of ± 10 kHz shall use transmitters with a frequency stability of ± 1000 Hz or better.

E-1.3.4 The application of the above technical criteria results in the minimum distance separations given in Tables 1 and 3 in Appendix 9 for the types of stations operating with the noted parameters. Proposals which would not provide these minimum distance separations to other broadcasting transmitting undertakings may be given special case consideration. However, applicants shall support their case for such reduced separations based on accepted engineering practices and giving such reasons as the use of actual rather than maximum allowable station parameters and local terrain factors or geographical conditions and also demonstrate that no interference to existing stations would result.

E-1.3.5 Although not mandatory, an applicant may choose to apply the technical criteria for protection to the proposed channels of the system. To assure minimum interference within the Grade B service area, the separation distances given in Table 2 or 4 in Appendix 9 are required between low power and other classes of stations operating with the parameters noted.

E-1.3.6 The transmitting system shall be co-sited for multichannel low power TV broadcast operations, i.e. either a single, broadband, multichannel antenna system shall be used for the transmission of all signals to be distributed in the community or, if more than one antenna is used for the transmission of the signals, then these antennas shall be located within a circle having a radius of 40 metres.

E-1.3.7 For a low-power UHF or VHF rebroadcasting station proposing to use a block of UHF or VHF television assignments, the channels selected should satisfy the technical criteria for protection as stated in Section E-1.3.2.

E-2. Quality of Rebroadcast Signal

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

E-2.2 In order to provide an adequate signal to the service area, a prediction of the degree of impairment of the signal due to ghost images resulting from nearby structures shall be made in accordance with the requirements of Section C-7.

E-2.3 If the program material is to be provided by a microwave link or satellite feed, an estimate of the signal-to-noise ratio is required. For microwave program links, application should be made to the appropriate Regional Office.

E-2.4 If more than one rebroadcasting station is involved in a chain of stations, the signal-to-noise ratios at each 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 1, 2 and 3 in Appendix 4 shall be used to determine the distance to the Grade B contour as follows:

(a) in areas of relatively smooth terrain, the distance to the 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 the Grade B 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.

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) where 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 Grade B contour labelled. The map referred to in D-1.2.4 would be suitable, supplemented by a map of the adjacent area if necessary.

Section F: Preparation of Technical Submissions Supporting Applications for Very Low-Power Television (VLPTV) Stations in Small Remote Communities

Very low-power television stations shall only be established in those communities which are both outside 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 TV channels on an unprotected non-interfering basis.

F-1. Application Procedure

F-1.1 Application Form

An application for a broadcasting certificate shall be made on departmental Form IC-3051A, *Application for a LP or VLP Undertaking or for Auxiliary Transmitter*. Two copies of this form should be submitted. An application form for a broadcasting licence can be obtained from the CRTC. The two applications shall be filed simultaneously.

F-1.2 Antenna Siting Considerations

See Section B-1.1.3 on this matter. The applicant must indicate that the antenna system complies with the requirements of BPR-1, Section 2 and CPC-2-0-03.

Section G: Technical Requirements for the Establishment of Very Low-Power Television (VLPTV) Stations in Small Remote Communities

G-1. Technical Criteria

G-1.1 Conditions

G-1.1.1 Power

The transmitter power shall not exceed 2 Watts for VHF channels and 10 Watts for UHF channels.

G-1.1.2 Antenna Parameters

The maximum antenna height above ground shall not exceed 30 metres. The maximum gain of the antenna shall not exceed 12 dB.

G-1.1.3 Equipment

Recommended minimum technical standards for the transmitter are outlined in *Broadcasting Equipment Technical Standard 9* (BETS-9).

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.

G-1.2 Selection of Frequency (Refer to Section C-1.1.8)

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. The separations are based on providing protection to other TV stations and allotments.

The frequency of the transmitted signal shall correspond to the carrier frequency specified for allotted channels.

Table	Frequencies Relationship	Separation between Stations (km)		
		VLPTV to VLPTV	VLPTV to LPTV	VLPTV to PTV[7]
2-6 (VHF)	Co-channel	75	80	157
	Adjacent	10[8]	15	92
7-13 (VHF)	Co-Channel	52	59	129
	Adjacent	710	14	84
14-69 (UHF)	Co-channel	24	32	90
	1st Adjacent	610	14	72
	± 2, ± 3, ± 4	110	2	18
	± 7th Adjacent	4	9	55
	± 14th Adjacent	410	13	71
	± 15th Adjacent	6	14	72

Table G-1: Separations required to assure protection to other allotments and assignments.

[7] Primary television stations and allotments.

[8] These distances may be eliminated if stations are co-sited.

G-1.3 Interference

G-1.3.1 Interference to and from Other Stations

Very Low-Power TV (VLPTV) stations are not protected from interference caused by primary stations nor from LPTV stations. VLPTV stations shall not cause interference to any new or existing stations, and such stations are only entitled to protection from other VLPTV stations established in accordance with this section.

G-1.3.2 Remedial Measures

Should the operation of a VLPTV 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 allotment plans.

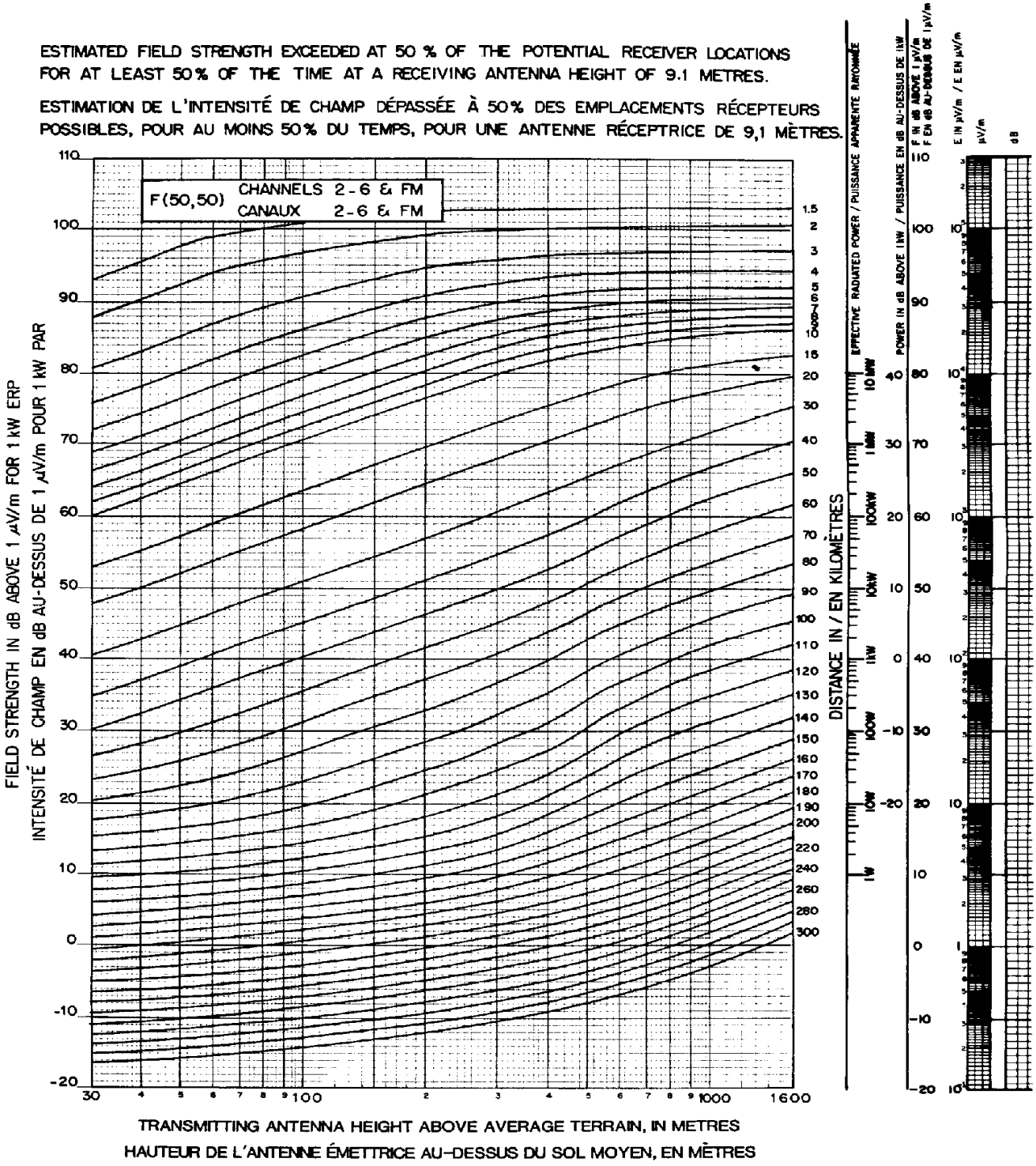
G-1.4 Service and Coverage Guidelines

The signal strength normally required to provide a satisfactory service to low density population areas is the Grade B contour. As a guideline, for a 2 Watt transmitter on VHF channels and a 10 Watt transmitter for UHF channels using a specified antenna at a height of 30 metres above ground, the distances from the transmitter to the Grade B contour are estimated as follows:

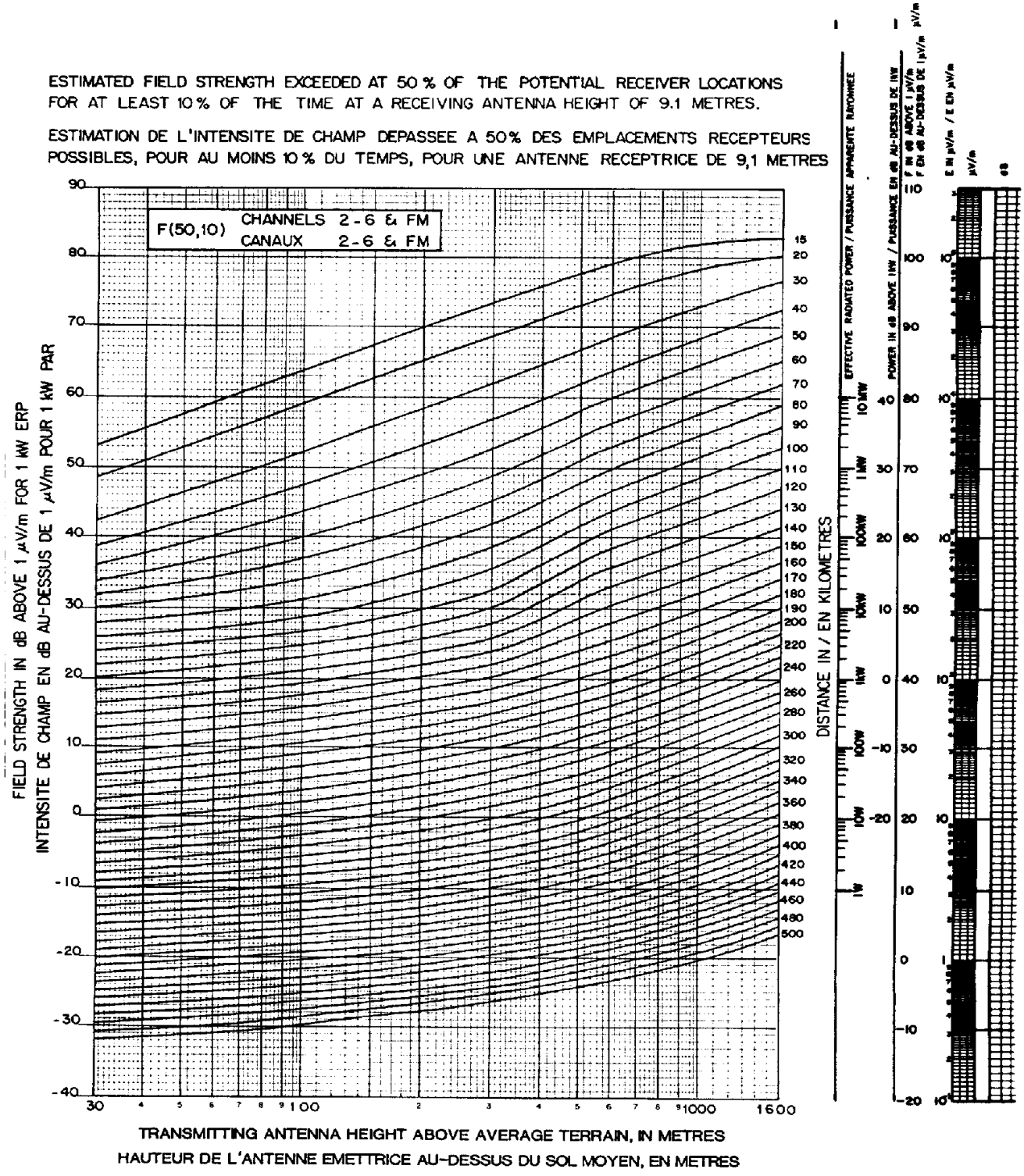
Service		Distance (km) to the Grade B contour
TV Channels 2-6:	Directional Antenna (7.6 dB Gain) Non-directional Antenna (0 dB Gain)	6.5 maximum 4.0 radius
TV Channels 7-13:	Directional Antenna (8.4 dB Gain) Non-directional Antenna (0 dB Gain)	5.0 maximum 3.0 radius
TV Channels 14-69:	Directional Antenna (8.5 dB Gain) Non-directional Antenna (0 dB Gain)	3.8 maximum 2.5 radius

Table G-2: Distance to the Grade B contour for Very Low-Power Television Stations

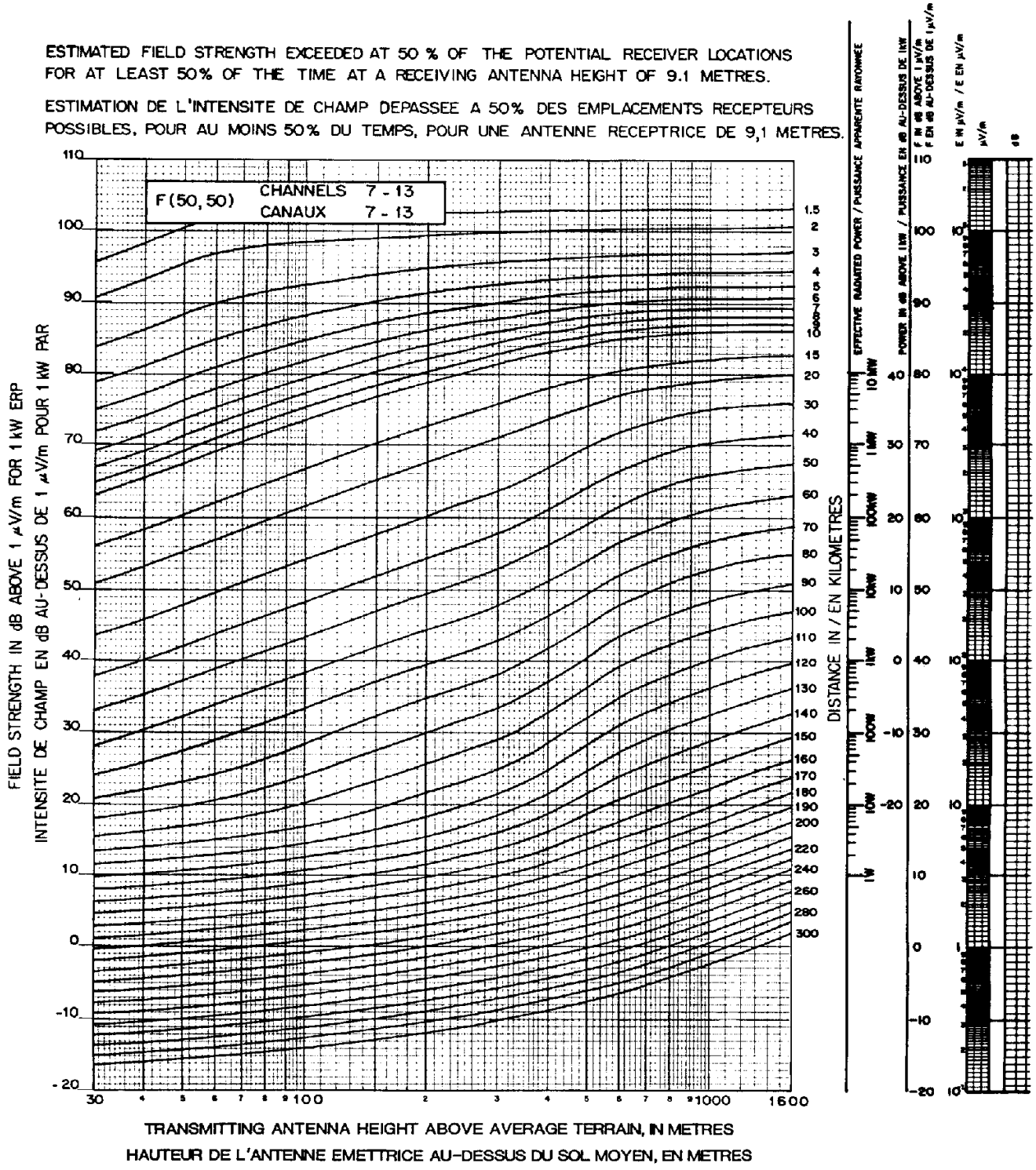
Appendix 1 - Figure 1: Propagation Curves F(50,50) for Channels 2-6



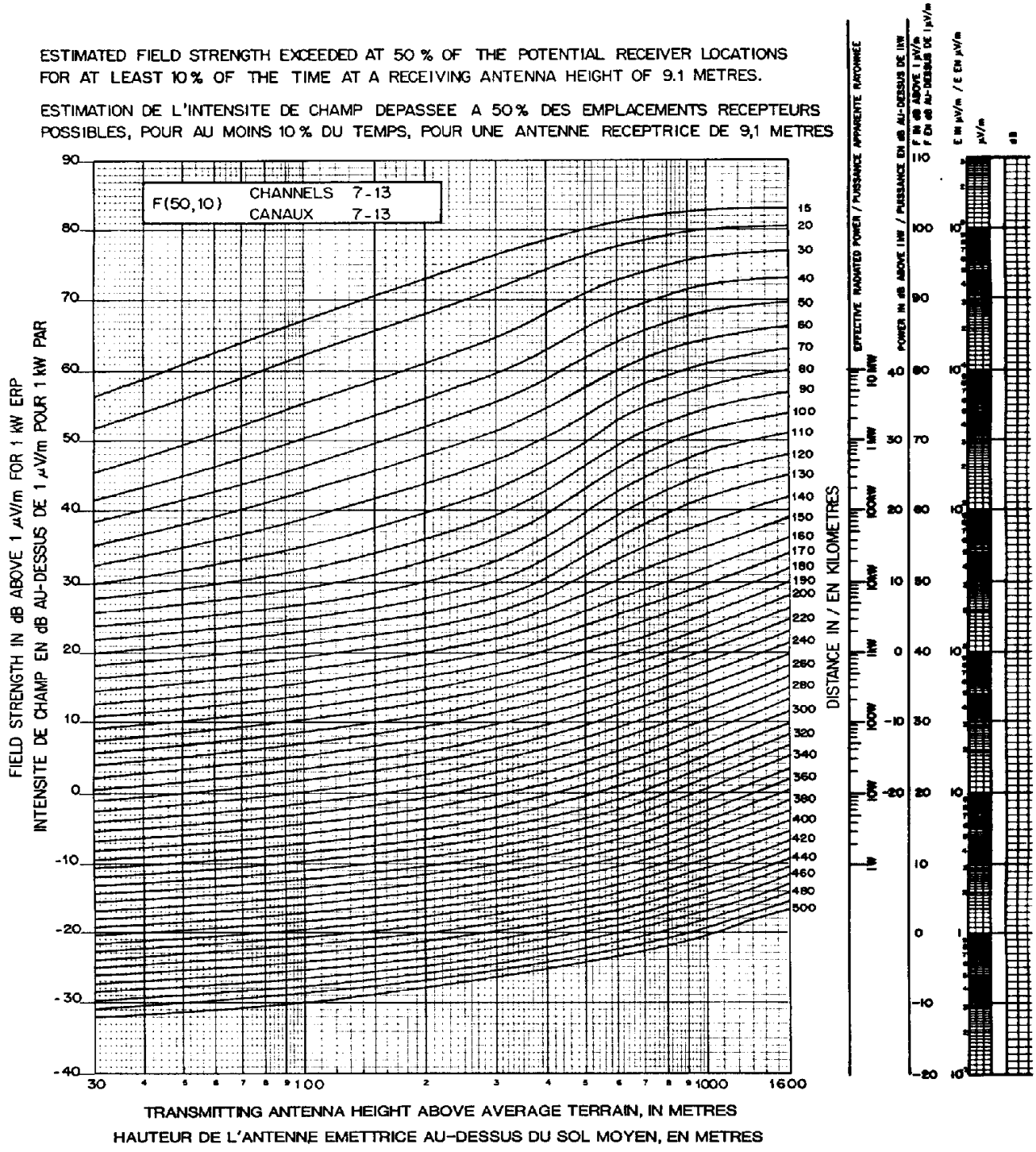
Appendix 1 - Figure 2: Propagation Curves F(50,10) for Channels 2-6



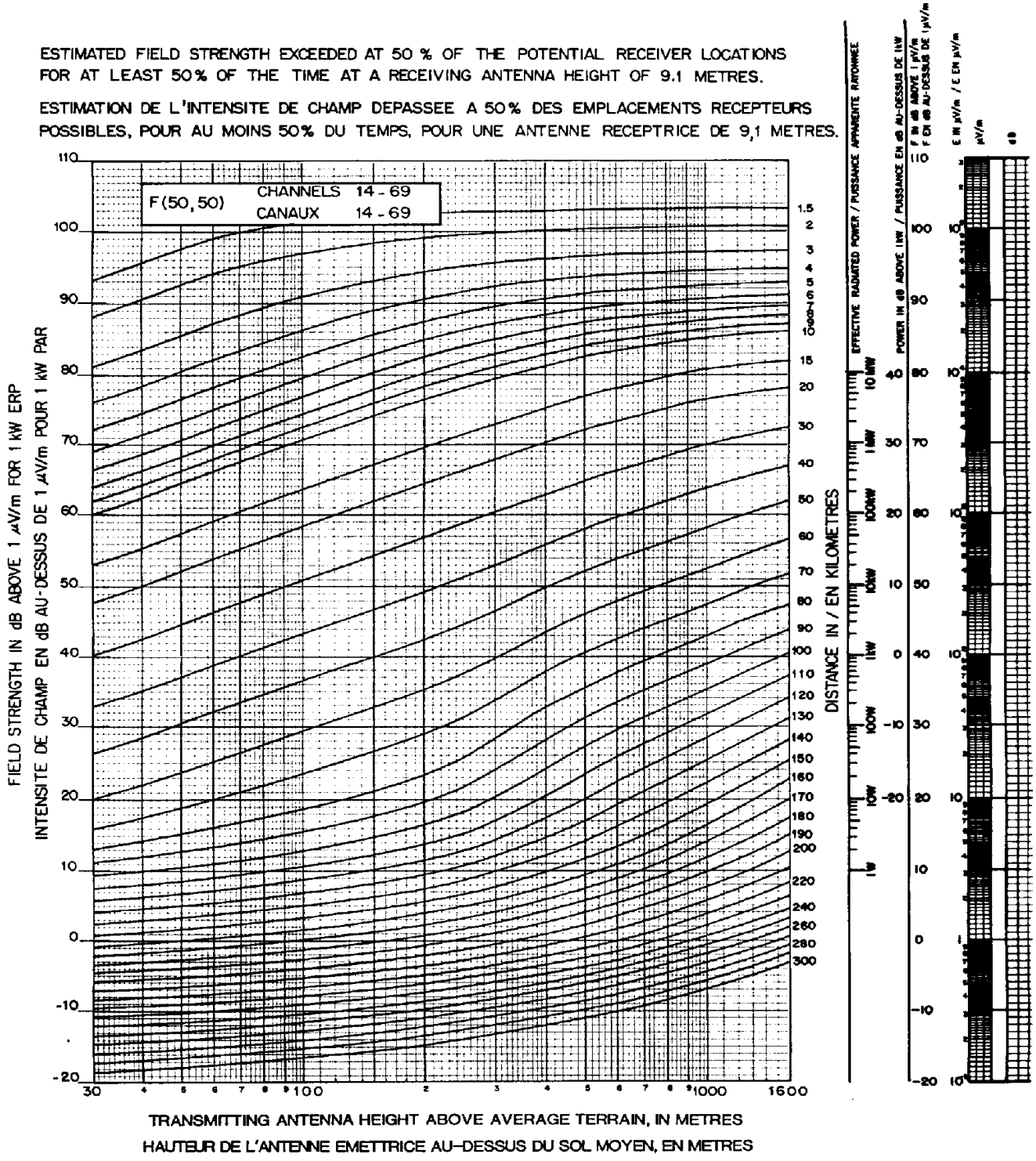
Appendix 1 - Figure 3: Propagation Curves F(50,50) for Channels 7-13



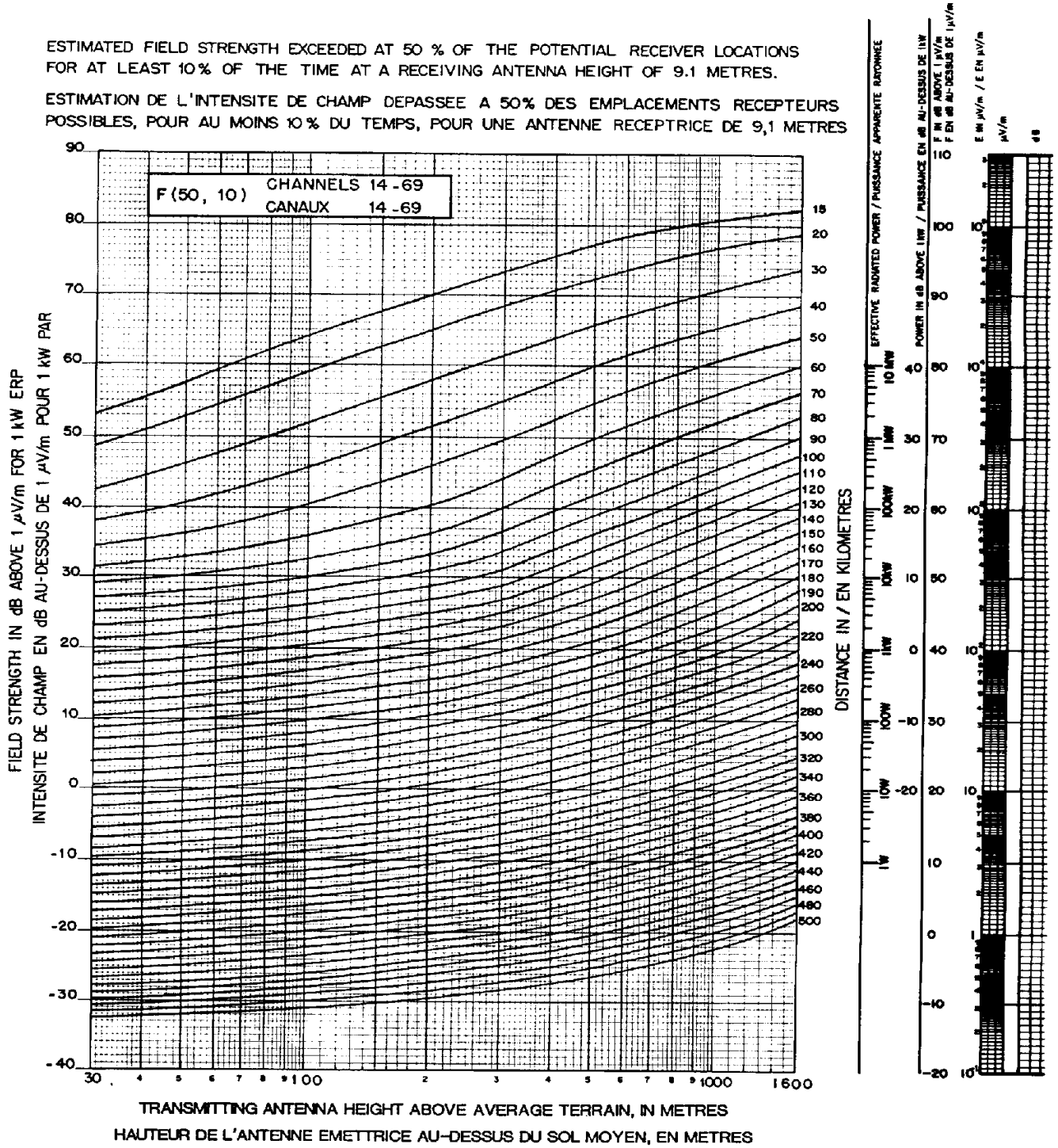
Appendix 1 - Figure 4: Propagation Curves F(50,10) for Channels 7-13



Appendix 1 - Figure 5: Propagation Curves F(50,50) for Channels 14-69



Appendix 1 - Figure 6: Propagation Curves F(50,10) for Channels 14-69



Appendix 2 - Summary Sheet

APPLICANT: **STATION: NEW CHANGE**
STATION LOCATION:
STATION CALL SIGN:
ANTENNA CO-ORDINATES:
N. LAT. ° ' "
W. LONG. ° ' "

TRANSMITTER VISUAL POWER: **kW**
TRANSMITTER AURAL POWER: **kW**
LINE EFFICIENCY: %

ANTENNA TYPE:__ DIRECTIONAL,__ NON-DIRECTIONAL
ANTENNA POWER GAIN: MAXIMUM__ AT HORIZONTAL,__ AT BEAM TILT
AVERAGE__ AT HORIZONTAL,__ AT BEAM TILT

ERP: MAXIMUM __ kW (Horizontal Polarization)
AVERAGE __ kW (Horizontal Polarization)

AT BEAM TILT __ kW Maximum
AT BEAM TILT __ kW Average

TILT VALUE:___ DEGREES
MAXIMUM VERTICAL POLARIZED COMPONENT:___ kW
EHAAT: __ METRES

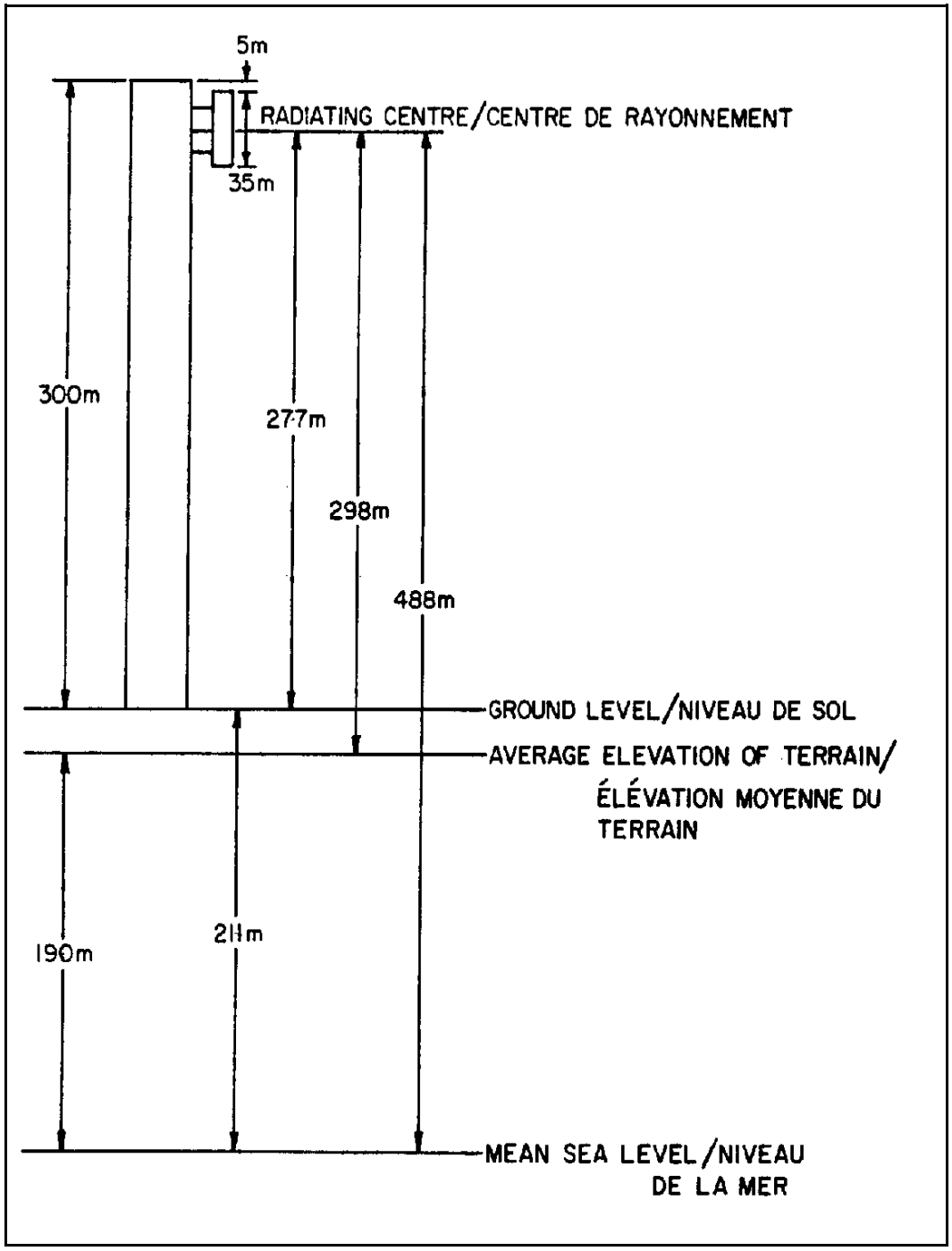
RCAMSL: __ METRES

CHANNEL NUMBER (OFFSET):

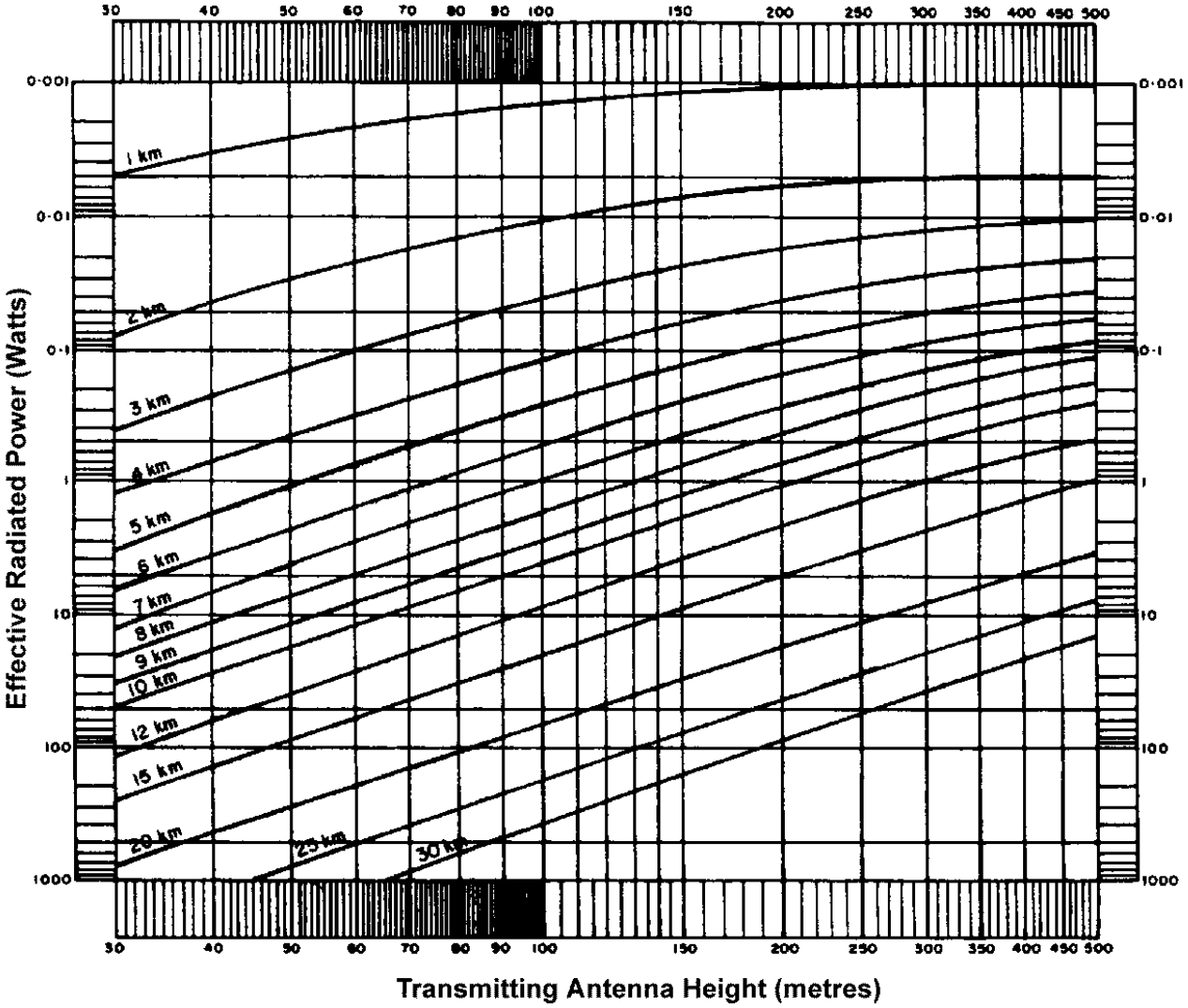
CLASS OF STATION:

MODES: MONO ( ), STEREO ( ), UNATTENDED ( ).

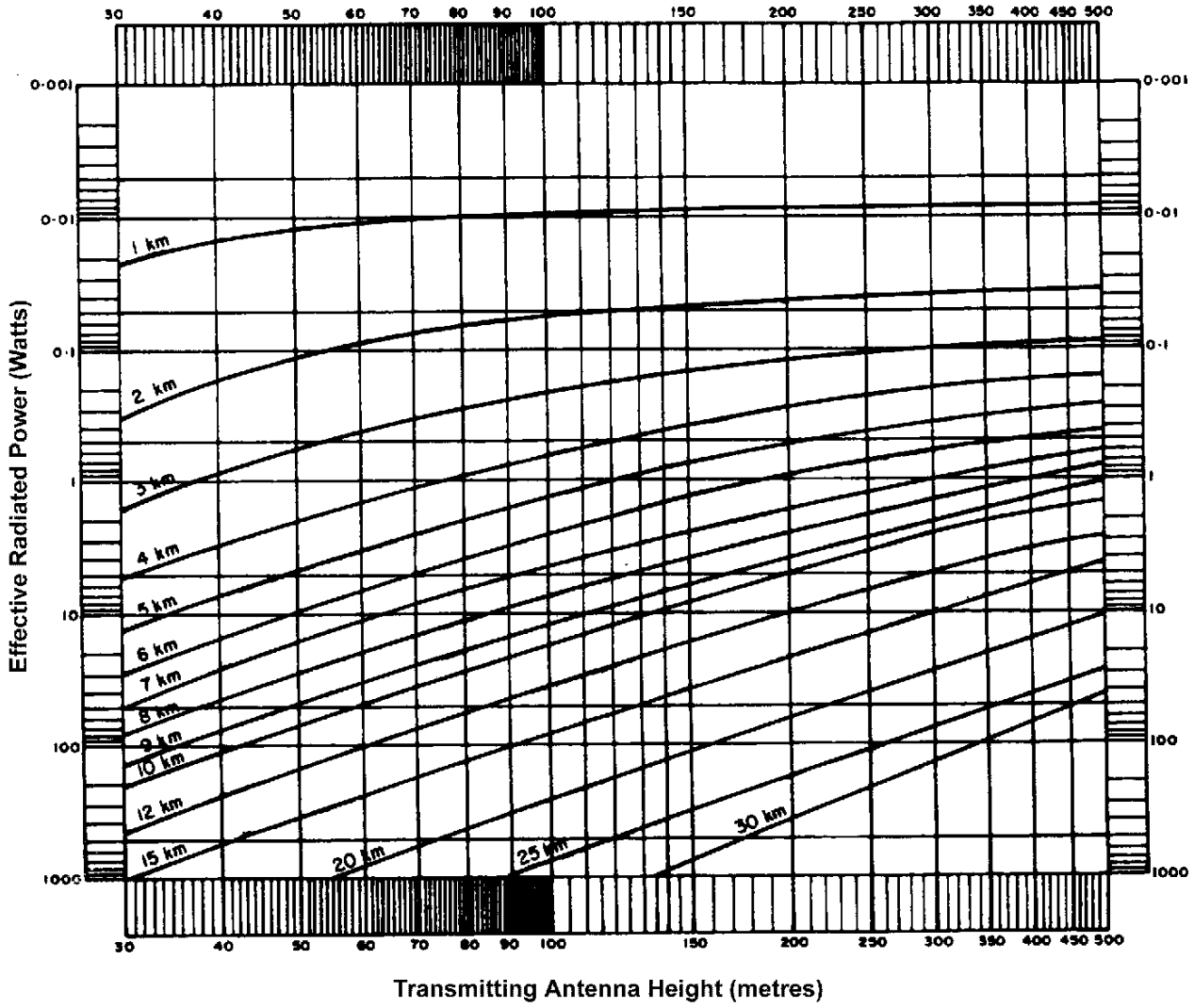
Appendix 3 - Elevation Diagram of Typical Tower and Transmitting Antenna



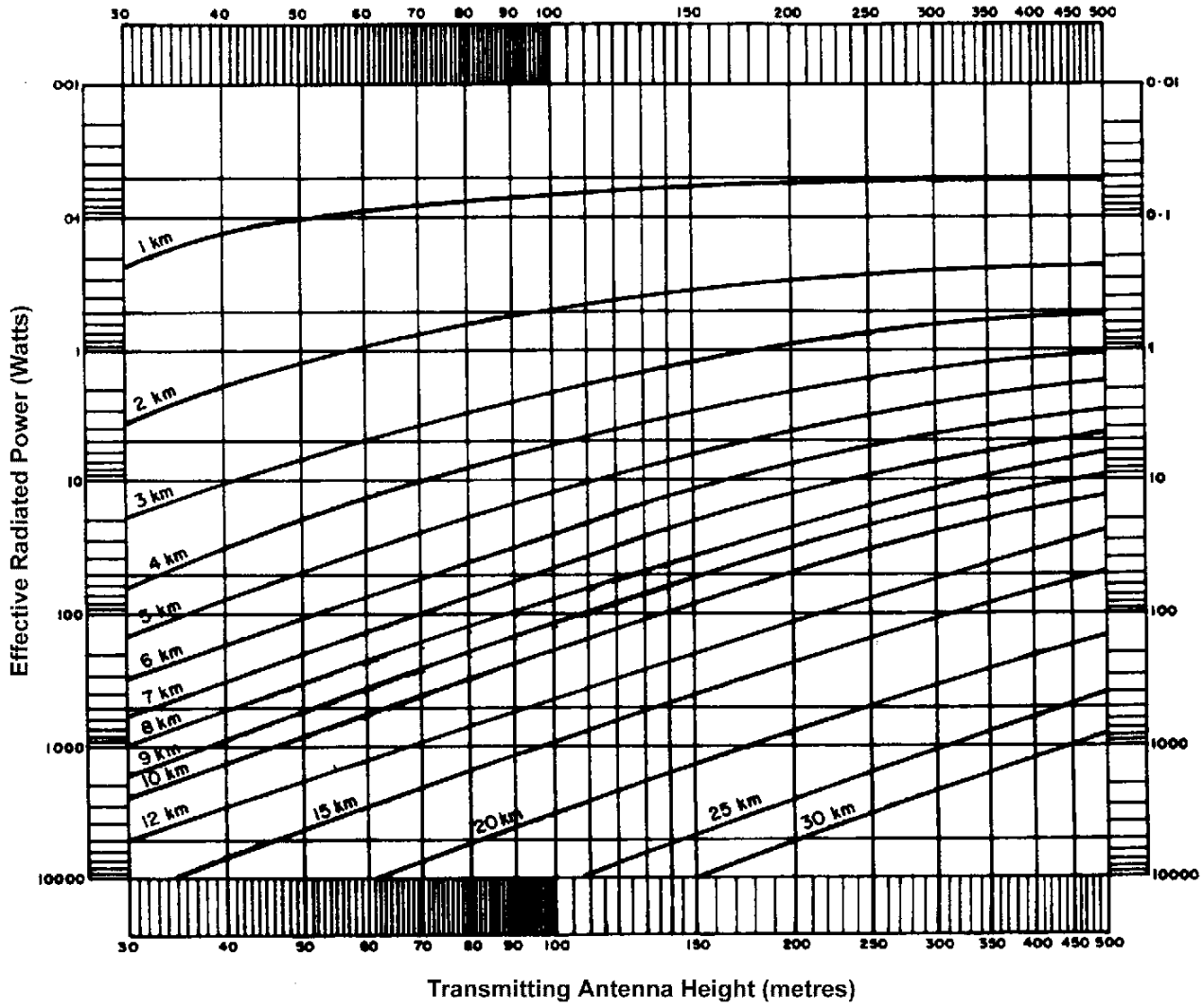
Appendix 4 - Figure 1: 47 dB above 1 Microvolt per Metre Contour Channels 2-6



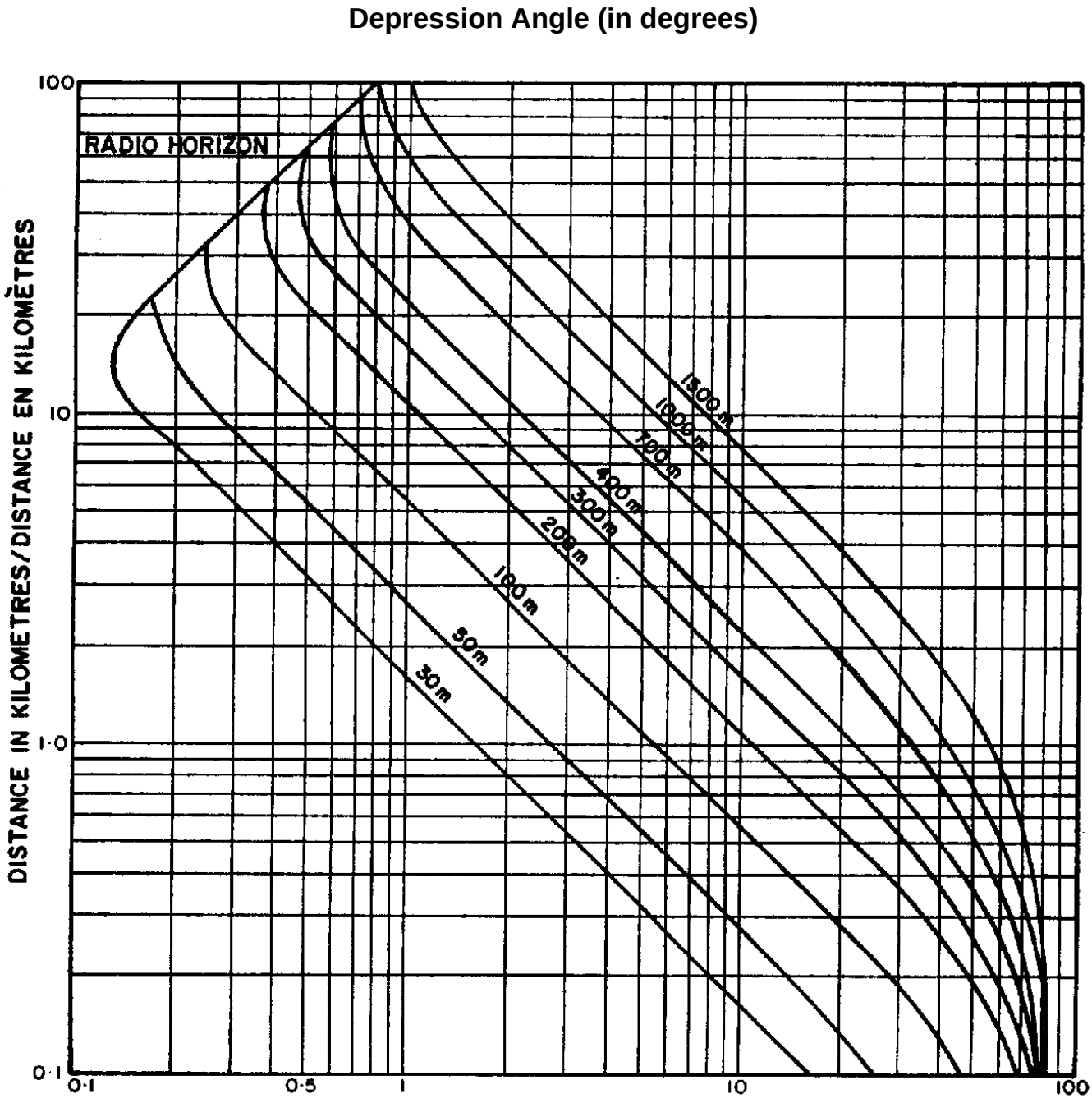
Appendix 4 - Figure 2: 56 dB above 1 Microvolt per Metre Contour Channels 7-13



Appendix 4 - Figure 3: 64 dB above 1 Microvolt per Metre Contour Channels 14-69



Appendix 5 - Distance Versus Depression Angle
(For various antenna heights)



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-1.4.

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 UHF Class B station and a proposed Class A station which are short-spaced and on co-channels.

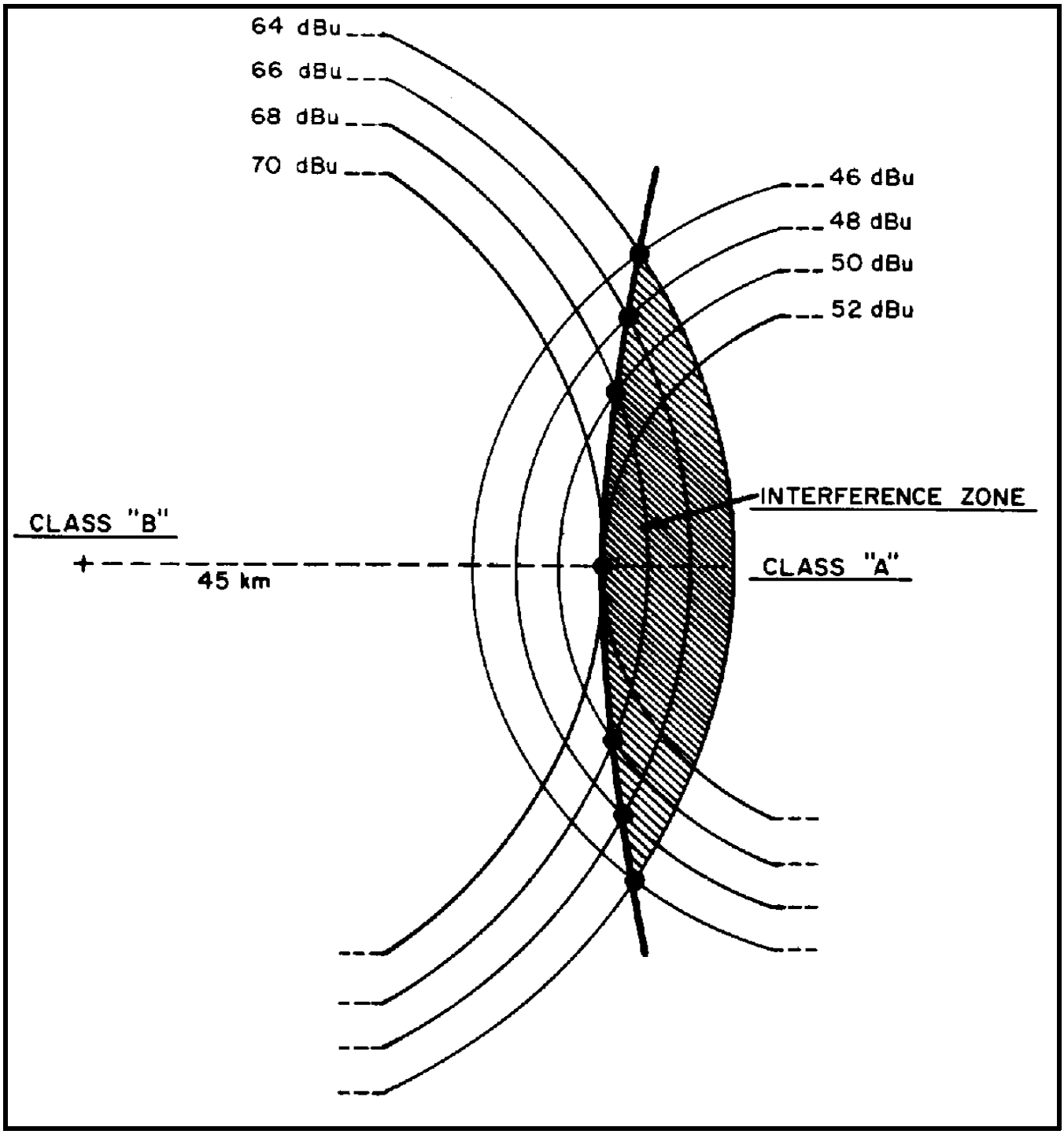
1. The protected service contour from Section C-1.2 is 64 dBu which extends to 45 km.

2. The interfering contour from Section C-1.4 is 46 dBu (the extent of this contour will vary depending on the proposed operating facilities).

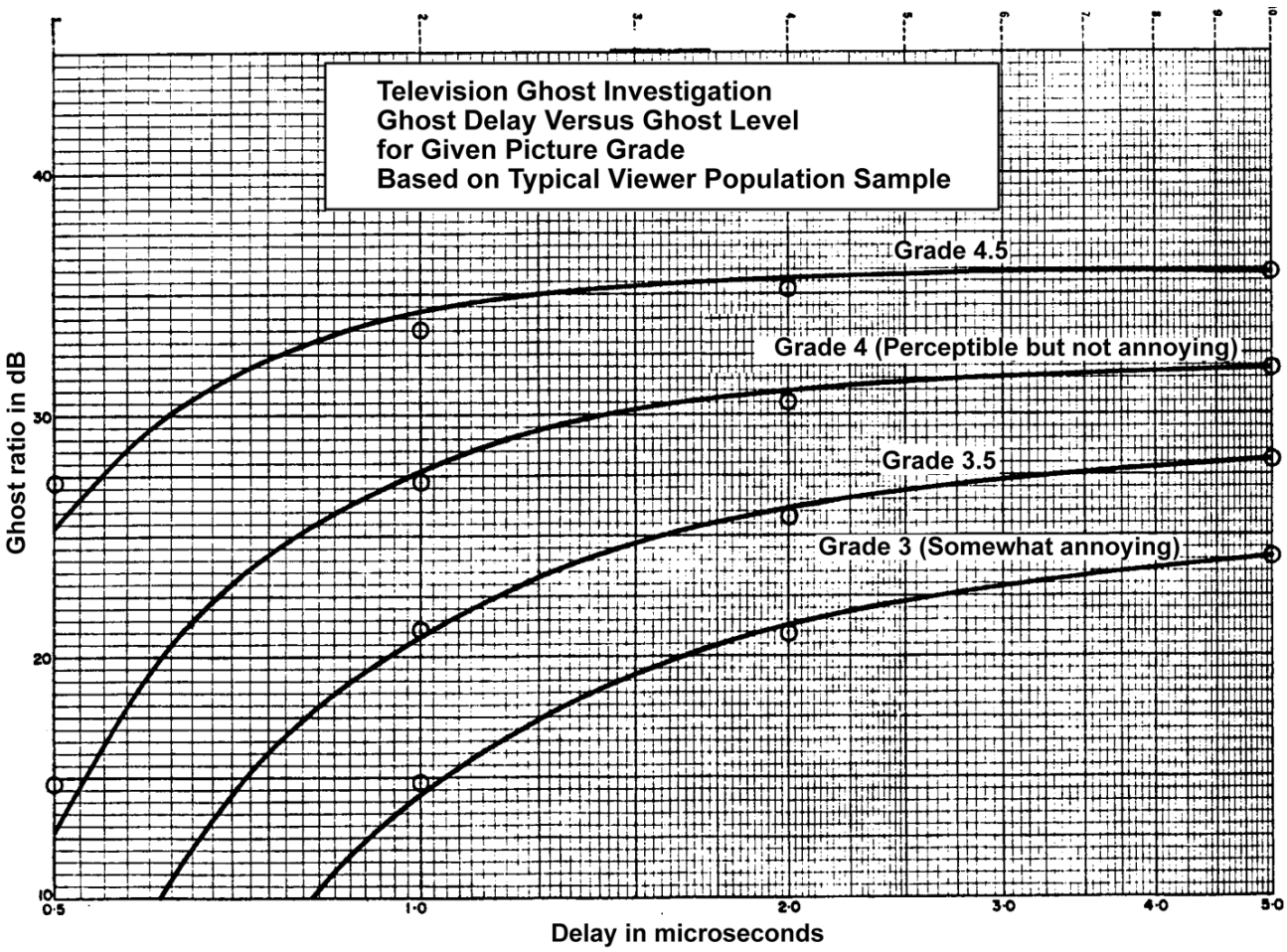
3. Mark the two points where the contours intersect.

4. Plot the 66 dBu service contour and the 48 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.


64 dBu
66 dBu
68 dBu
70 dBu
46 dBu
48 dBu
50 dBu
52 dBu
INTERFERENCE ZONE
CLASS "B"
CLASS "A"
45 km

Appendix 7 - Ghost Delay Versus Ghost Level for a Given Picture Grade



Appendix 8 - Table 1: UHF Protection Criteria for Assignments with Operating Parameters

Greater than 1000 kW ERP and/or 300 Metres EHAAT

Channel Separations	Protection Criteria
± 1	The maximum permissible F(50,10) signal at the protected Grade B contour is equal to 100 dBu
± 2, ± 3	No overlap of 100 dBu contours calculated with F(50,50) curves
± 4	Protected site outside of proposed 74 dBu F(50,50) contours
± 7	No overlap of 74 dBu contours calculated with F(50,50) curves
± 14	The maximum permissible F(50,10) signal at the protected Grade B contour is equal to 110 dBu
± 15	The maximum permissible F(50,10) signal at the protected Grade B contour is equal to 92 dBu

For international protection criteria, refer to the International Agreement.

Appendix 8 - Table 2: Adjacent Channel VHF Separations

For VHF allotments or assignments, where the separation is less than 96 km, the maximum permissible interfering signal at the adjacent channel's protected Grade B signal contour of a domestic assignment shall not exceed that shown in the table below using F(50,50) propagation curves:

Channels 2-6

Separation between TX Sites (km)	Interfering Signal (dBu)	D/U Protection Ratio (dB)
Between 95 and less than 96	96	-49
Between 93 and less than 95	84	-37
Between 92 and less than 93	77	-30
Less than 92	72	-25

Channels 7-13

Separation between TX Sites (km)	Interfering Signal (dBu)	D/U Protection Ratio (dB)
Between 95 and less than 96	93	-37
Between 93 and less than 95	89	-33
Between 90 and less than 93	87	-31
Between 87 and less than 90	84	-28
Between 84 and less than 87	82	-26
Less than 84	81	-25

Appendix 8 - Table 3a: Standard Separation Distances in Kilometres Required Between Canadian Classes of UHF Television Allotments and Assignments

Class of Allotment/ Assignment		Channel separation r, number of channels above (+) or below (-) the reference channel n					
		0 Co-channel		± 1 Adjacent D/U = −16 dB at D = 74 dBu F(50,50) or D/U = −36 dB at D = 64 dBu F(50,50)	± 2, ± 3 IM No overlap of D = 100 dBu F(50, 50) U = 100 dBu F(50,50)	+ 4 Adjacent Locate Outside D = 74 dBu F(50,50)	− 4 Adjacent Locate Outside D = 74 dBu F(50,50)
Channel Accorded Protection n Desired (D)	Potential Interfering Channel n + r Undesired (U)	Non-offset	Offset				
		D/U = 35 dB D = 64 dBu F(50,50) U = 29 dBu F(50,10)	D/U = 18 dB D = 64 dBu F(50,50) U = 46 dBu F(50,10)				
C	C	353	250	88	36	53	53
C	B	328*	225*	77	25	53	30
C	A	308*	205*	73	21	53	15
B	C	328	225	77*	25	30	53
B	B	248	153	52	14	30	30
B	A	228*	133*	48	10	30	15
A	C	308	205	73*	21	15	53
A	B	228*	133	48	10	15	30
A	A	163	85	28	6	15	15

* Protection Provided at Potential Interfering Channel 64 or 74 dBu Contour.

Appendix 8 - Table 3b: Standard Separation Distances in Kilometres Required Between Canadian Classes of UHF Television Allotments and Assignments

Class of Allotment/ Assignment		**Channel separation r, number of channels above (+) or below (-) the reference channel n**				
Channel Accorded Protection n Desired (D)	Potential Interfering Channel n + r Undesired (U)	± 7 Oscillator No overlap of D = 74 dBu F(50,50) U = 74 dBu F(50,50)	+ 14 Sound image D/U = −46 dB at D = 64 dBu F(50,50) U = 110 dBu F(50,50)	+ 15 Picture image D/U = −28 dB at D = 64 dBu F(50,50) U = 92 dBu F(50,50)	− 14 Sound image* D/U = −46 dB at D = 64 dBu F(50,50) U = 110 dBu F(50,50)	− 15 Picture image* D/U = −28 dB at D = 64 dBu F(50,50) U = 92 dBu F(50,50)
C	C	106	80	99	80	99
C	B	83	74	82	55	74
C	A	68	72	75	35	54
B	C	83	55	74	74	82
B	B	60	49	57	49	57
B	A	45	47	50	29	37
A	C	68	35	54	72	75
A	B	45	29	37	47	50
A	A	30	27	30	27	30

* Protection Provided at Potential Interfering Channel 64 or 74 dBu Contour.

Appendix 9 - Table 1: Minimum Distance Separations in Kilometres Required Between Low-Power (LP) VHF and Other VHF Television Allotments and Assignments

Class of Station/System		Channels 2-6			Channels 7-13		
		Channel separation r, number of channels above (+) or below (−) the reference channel (n)					
		0 Co-channel		± 1 Adjacent	0 Co-channel		± 1 Adjacent
Channel accorded protection (n) Desired (D)	Channel applied for (n + r) Undesired (U)	Non-offset	Offset	D/U = −16 dB D = 47 dBu F(50,50) U = 63 dBu F(50,10)	Non-offset	Offset	D/U = −16 dB D = 56 dBu F(50,50) U = 72 dBu F(50,10)
		D/U = 35 dB D = 47 dBu F(50,50) U = 12 dBu F(50,10)	D/U = 25 dB D = 47 dBu F(50,50) U = 22 dBu F(50,10)		D/U = 35 dB D = 56 dBu F(50,50) U = 21 dBu F(50,10)	D/U = 25 dB D = 56 dBu F(50,50) U = 31 dBu F(50,10)	
Regular	LP	209	159	94	158	123	85
LP	LP	132	82	17*	88	53	11*

Note 1: Distances are based on VHF low-power operations having 100 watts ERP and 30 m EHAAT and regular stations operating with the maximum values given in C-1.1.9. For other low-power parameters, the desired-to-undesired (D/U) ratios in the Table must be satisfied.

Note 2: The Grade B contour is 12 kilometres and and 8 kilometres respectively for channel 2-6 and 7-13.

Note 3: In principle, those distances marked with as asterisk (*) may be eliminated if stations are co-sited.

Note 4: Offset operations require a frequency stability of ± 1000 Hz.

Appendix 9 - Table 2: Distance Separations in Kilometres Required to Assure Minimum Interference Within the Grade B Service Area of Low-Power VHF Television Broadcasting Stations from Other Classes of VHF Television Allotments or Assignments

Class of Station/System		Channels 2-6			Channels 7-13		
		Channel separation r, number of channels above (+) or below (−) the reference channel (n)					
		0 Co-channel		± 1 Adjacent	0 Co-channel		± 1 Adjacent
Channel accorded protection (n) Desired (D)	Channel applied for (n + r) Undesired (U)	Non-offset	Offset	D/U = −16 dB D = 47 dBu F(50,50) U = 63 dBu F(50,10)	Non-offset	Offset	D/U = −16 dB D = 56 dBu F(50,50) U = 72 dBu F(50,10)
		D/U = 35 dB D = 47 dBu F(50,50) U = 12 dBu F(50,10)	D/U = 25 dB D = 47 dBu F(50,50) U = 22 dBu F(50,10)		D/U = 35 dB D = 56 dBu F(50,50) U = 21 dBu F(50,10)	D/U = 25 dB D = 56 dBu F(50,50) U = 31 dBu F(50,10)	
LP	Regular	367	290	90	323	258	78
LP	LP	132	82	17*	88	53	11*

Note 1: Distances are based on VHF low-power operations having 100 watts ERP and 30 m EHAAT and regular stations operating with the maximum values given in C-1.1.9. For other low-power parameters, the desired-to-undesired (D/U) ratios in the Table must be satisfied.

Note 2: The Grade B contour is 12 kilometres and and 8 kilometres respectively for channel 2-6 and 7-13.

Note 3: In principle, those distances marked with as asterisk (*) may be eliminated if stations are co-sited.

Note 4: Offset operations require a frequency stability of ± 1000 Hz.

Appendix 9 - Table 3: Minimum Distance Separations in Kilometres Required Between a Low-Power UHF Television Station and Other Classes of UHF Television Allotments or Assignments

Class of Station/System		**Channel separation r, number of channels above (+) or below (−) the reference channel n**						
		0 Co-channel		± 1 Adjacent	± 2, ± 3, ± 4 Intermodulation	− 7 Oscillator Radiation	+ 14 Sound Image	+ 15 Picture Image
Channel accorded protection (n) Desired (D)	Channel applied for (n + r) Undesired (U)	**Non-offset**	**Offset**	D/U = − 16 dB D = 64 dBu F(50,50) U = 80 dBu F(50,10)	D/U = 0 dB D = 100 dBu F(50,50) U = 100 dBu F(50,50)	D/U = 0 dB D = 74 dBu F(50,50) U = 74 dBu F(50,50)	D/U = − 28 dB D = 64 dBu F(50,50) U = 92 dBu F(50,10)	D/U = − 10 dB D = 64 dBu F(50,50) U = 74 dBu F(50,10)
		D/U = 28 dB D = 64 dBu F(50,50) U = 36 dBu F(50,10)	D/U = 18 dB D = 64 dBu F(50,50) U = 46 dBu F(50,10)					
C	LP	140	107	75	20	60	72	77
B	LP	115	82	50	9	37	47	52
A	LP	95	62	30	5	22	27	32
LP	LP	82	49	17*	3*	14	14*	19

Note 1: Distances are based on a UHF low-power operating at 5 kW ERP and 30 metres EHAAT (with a Grade B contour of 12 kilometres) and other UHF stations operating with parameters according to the class designations shown in Section C-1.1.9. For other low-power parameters the desired-to-undesired (D/U) ratios in the Table must be satisfied at the desired contour.

Note 2: In principle, those distances marked with an asterisk (*) may be eliminated if stations are co-sited.

Note 3: Offset operations require a frequency stability of ± 1000 Hz.

Appendix 9 - Table 4: Distance Separations in Kilometres Required to Assure Minimum Interference Within the Grade B (64 dBu) Service Area of Low-Power UHF Television Broadcasting Stations from Other Classes of UHF Television Allotments and Assignments

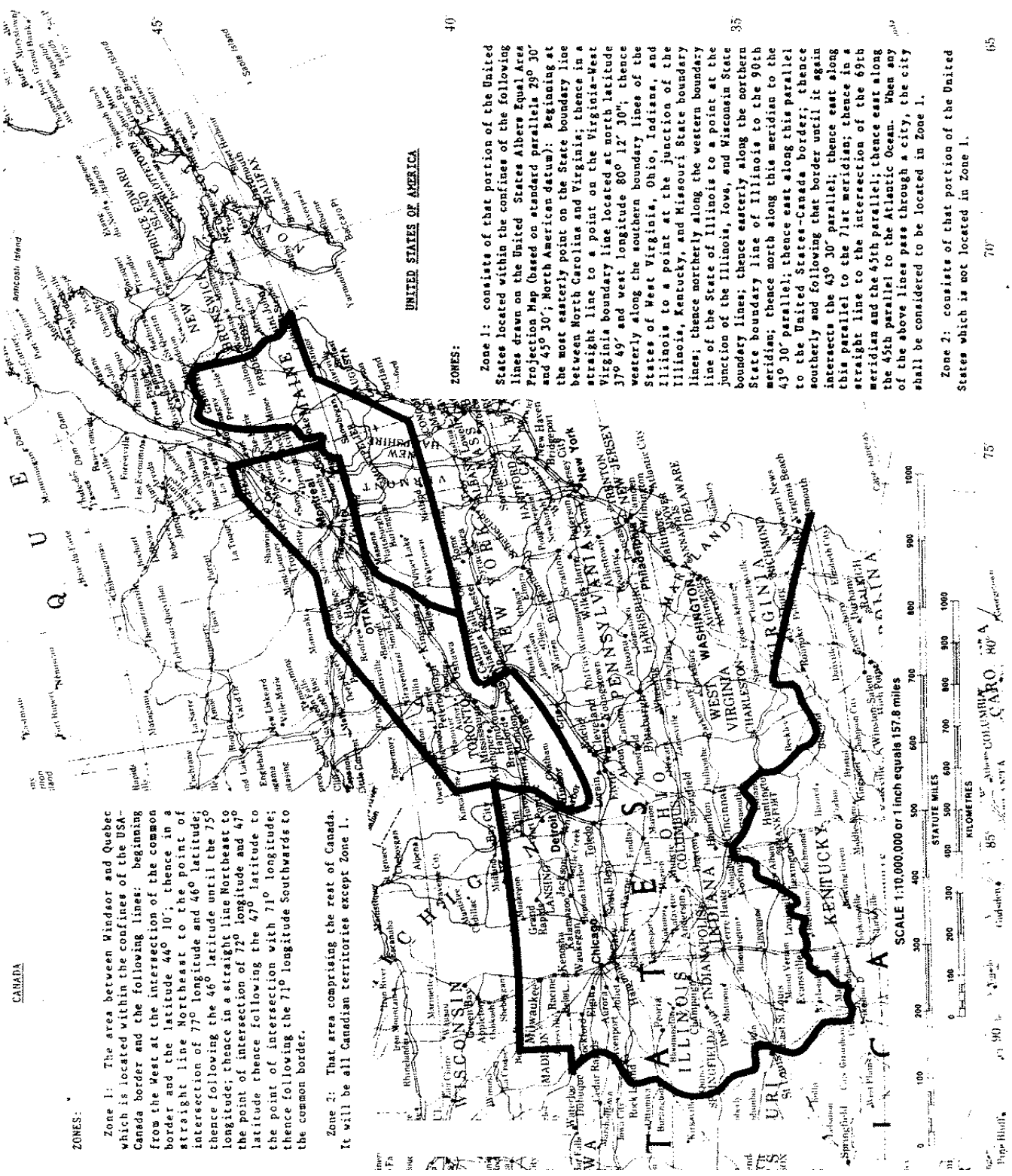
Class of Station/System		Channel separation r, number of channels above (+) or below (−) the reference channel n						
		0 Co-channel		± 1 Adjacent D/U = − 16 dB D = 64 dBu F(50,50) U = 80 dBu F(50,10)	± 2, ± 3, ± 4 Intermodulation D/U = 0 dB D = 100 dBu F(50,50) U = 100 dBu F(50,50)	− 7 Oscillator Radiation D/U = 0 dB D = 74 dBu F(50,50) U = 74 dBu F(50,50)	+ 14 Sound Image D/U = − 28 dB D = 64 dBu F(50,50) U = 92 dBu F(50,10)	+ 15 Picture Image D/U = − 10 dB D = 64 dBu F(50,50) U = 74 dBu F(50,10)
Channel accorded protection (n) Desired (D)	Channel applied for (n + r) Undesired (U)	Non-offset	Offset					
		D/U = 28 dB D = 64 dBu F(50,50) U = 36 dBu F(50,10)	D/U = 18 dB D = 64 dBu F(50,50) U = 46 dBu F(50,10)					
LP	C	252	192	62	20	60	41	72
LP	B	175	122	35	9	37	24	44
LP	A	114	72	22	5	22	17	27
LP	LP	82	49	17*	3*	14	14*	19

Note 1: Distances are based on a UHF low-power operating at 5 kW ERP and 30 metres EHAAT (with a Grade B contour of 12 kilometres) and other UHF stations operating with parameters according to the class designations shown in Section C-1.1.9. For other low-power parameters the desired-to-undesired (D/U) ratios in the Table must be satisfied at the desired contour.

Note 2: In principle, those distances marked with an asterisk (*) may be eliminated if stations are co-sited.

Note 3: Offset operations require a frequency stability of ± 1000 Hz.

Appendix 10 - Zones One and Two Canada and U.S.A.



Appendix 11 - Television/Land Mobile Mutual Interference Analysis (Provisional)

Purpose

The purpose of this appendix is to define the factors and to provide a method for evaluating mutual interference between land mobile services and TV services on channel 7, 14 and 69 operating in adjacent frequency bands. It is to be noted that the present analysis does not deal with interference from multiple sources.

A. Interference to Land Mobile

Interference to land mobile base station receivers may occur when they operate near the site of a TV transmitter and on frequencies close to the TV channel (within 4 MHz). Such interference may be eliminated or reduced by increasing the physical separation of the stations.

The following are the types of interferences and possible remedies:

(a) **Out-of-channel radiation from the television undertaking**. This type of interference is produced intrinsically and with respect to the ambient "noise floor":

(i) out-of-channel radiation by the television transmitter which can intrinsically create interference to LM. Normal operation usually results in video components[1] up to −60 dB in the adjacent channel, reference level being the peak envelope visual power.

(ii) LM usable sensitivity at VHF and UHF frequencies which is determined by internal noise and man-made noise. The sensitivity of a typical receiver is such that an input signal of 0.5 μV (−114 dBm, assuming a receiver input impedance of 50 Ω) would result in a 12 dB SINAD ratio at the output. To minimize the potential for interference to land mobile receivers, out-of-channel television emissions at the specific LM carrier frequency and at the input of land mobile should ideally not exceed −120 dBm (assuming a signal to interference ratio of 6 dB at that level).

While the above numbers apparently prohibit co-existence of LM and adjacent band television services except at great distances, statistical, technical and subjective factors have, in reality, proven that separation distances much lower than those implied by the theoretical numbers above can

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1 In the worst case, components as high as the below figures can exist for a few seconds at a time:
−40 dB @ f_v − 4.5 MHz (aural image, 3.25 ± 0.01 MHz below channel edge)
−40 dB @ f_v + 9.0 MHz (visual image, 4.25 ± 0.01 MHz above channel edge)
−60 dB @ f_v − 3.58 MHz (chroma image, 2.33 ± 0.01 MHz below channel edge)
−37 dB (worst case sporadic video components) down to 3 MHz below and up to 4 MHz above channel edge.
Emissions at a specific frequency could, from a particular contributor, be reduced by a further 20 to 30 dB at the television transmitter by the use of special filters.

provide satisfactory results. In fact, a minimum separation distance[2] of 35 km is deemed to be sufficient for full power television undertakings. The minimum separation distance may be decreased by 3 km per dB of reduced ERP value to a minimum separation distance of 15 km. In real interference situations, the actual values that could be attributed to the above factors and in the footnote no. 2 may differ from those assumptions. Additional factors such as TV antenna pattern, the degree of additional TV transmitter filtering and/or other rejections in the LM system may provide shorter separation distances. The ambivalent nature of all these factors does not provide a sound foundation on which distance separation requirements could be based. The Department will therefore consider individual agreements between the TV applicant and the affected LM operators as an alternatives to minimum separation distances.

(b) **Desensitization of the base station receiver**. Interference can be minimized by installing cavity filters at the LM receiver to provide some rejection of the adjacent visual or aural carriers except where the frequency is too close.

(c) **Intermodulation products**. Intermodulation products result from the mixing of two or more undesired signals at the input of the receiver. This may be eliminated by employing appropriate filters at the land mobile receiver to reduce the magnitude of the TV signal contributing to the intermodulation product. If the intermodulation products are caused by mixing inside the receiver, upgrading the receiving equipment or better shielding may also alleviate the problem.

B. Interference to Television

Figures 1 to 3 reflect measured values of protection ratio versus frequency separation for various channels.

In the case of channels 7 and 14, if a land mobile transmitter of relatively high power is operating on a frequency near 2.33 MHz below the edge of the channels, a mixing process takes place producing severe color interference. For other frequencies in the lower 4 MHz adjacent band of channels 7 and 14 or in the entire upper adjacent 4 MHz band of channel 69, interference to television generally takes the form of distortion of the luminance information.

The potential for interference in the second, third and fourth adjacent TV channel is negligible.

LM assignments in the frequency band beyond 4 MHz from the edge of television channels can operate within the television service contour and provide the required protection. Within 4 MHz, however, **full protection** to television service from LM base station operations may be provided either through co-siting the TV transmitting antenna with the related adjacent channel LM base station transmitter, or by selecting the television site in such a way to keep the LM base station outside the proposed service contour (Grade B) where the protection ratios are met. These options may prove to be impractical in some cases due to location.

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[2] The separation distance is based on out-of-channel (within 4 MHz from the edge of channel) TV emissions that are suppressed by 60 dB (referenced to peak envelope visual power), a receive LM antenna gain of 5 dB (10 dB for UHF) and a cross-polarization discrimination of 20 dB.

Co-siting TV and LM transmitters will result in a uniform signal differential inside the service contour of the television undertaking. The best approach to co-siting is to locate both the TV and LM transmitting antennas on the same tower or supporting structure. In such cases, similar antenna patterns are not needed as long as the TV/LM effective radiated power (ERP) ratio meets or exceeds that implied in Table 1. For best results, the LM receiver(s) should be kept at some distance rather than at the transmitting antenna site.

When not co-located, LM base station transmitters inside a television service contour will establish pockets of interference the size of which varies depending on the frequency separation and the strength of the television signal. As the separation distance between the two stations increases, the field strength of the TV signal decreases enlarging progressively the size of the area of interference. For all such cases, the applicant shall indicate the presence of interference zones from the related LM assignments on the coverage map. The interfering field strength of the land mobile station may be calculated using the propagation curves of Figure 4.

Viewing tests were conducted in 1989 (refer to report BTRB-7 entitled *Protection to Television from Land Mobile Stations Operating Adjacent to Television Channels 7, 13, 14 and 69*) to determine the susceptibility of television receivers to adjacent band LM interference. LM signals in the frequency bands adjacent to channels 7, 14 and 69 were applied to the receiver terminals and the levels were adjusted for "Just Perceptible" interference. The viewing conditions for the assessment of picture quality were in accordance with the CCIR Recommendation 500-3. The TV signal at the receiver terminal was adjusted to −25, −35 and −55 dBm (dB above 1 mW).

The average protection or rejection ratios obtained at the laboratory are based on non-varying desired and undesired input voltages at the receiver. In practice, it is necessary to define the percentage of time as well as the percentage of locations for which the desired quality of service is met.

The picture quality for coverage inside the Grade A (or Grade B) contour is defined as a picture of acceptable quality for at least 70% (50% for the Grade B) of receiver locations and 90% of the time. If F(50,50) propagation curves are used inside these contours, a time probability factor (T) and a location probability factor (L) have to be used to account for signal fading and terrain irregularities respectively. Consequently, protection to television reception from LM base station transmitters is derived from the following formula:

$$F_u = F_d - PR + AD - H(L) - H(T) \quad (1)$$

where: F_u and F_d are the undesired LM and desired TV signal levels respectively. F_u is calculated by the free space propagation model out to 1 km. The "Egli propagation model" for 50% of locations is to be used for distances of in excess of 2 km (refer to Figures 4 of this appendix). Interpolation is used to join the curves for distances of between 1 and 2 km. F_d is calculated by using the F(50,50) propagation curves. Figure 4 indicates the field strength for typical land mobile stations with an ERP of 125 W (VHF) and 250 W (UHF). The appropriate field strengths for other ERP values can be obtained by shifting the curves ± 6 dB vertically for each multiplication/division of the ERP by a factor of 2. Field strengths are expressed in dBu.

PR is the average protection ratio in dB obtained from the receiver measurements (see Figures 1 to 3 in this appendix);

AD is the combined cross-polarization and directional discrimination of the TV receiving antenna against LM signals in dB (AD ≈ 15 dB when LM base station outside the Grade B, otherwise, AD = 0 dB);

H(L) is the adjustment made in dB with respect to the percentage of locations where the desired field strength level will be above the calculated value;

H(T) is the adjustment made in dB with respect to the percentage of time when the desired field strength level will be above the calculated value.

At VHF frequencies (channel 7)

Inside	H(L) (in dB)	H(T) (in dB)	Total (in dB)
Grade A	4	3	7
Grade B	0	5	5

At UHF frequencies (channels 14 and 69)

Inside	H(L) (in dB)	H(T) (in dB)	Total (in dB)
Grade A	6	3	9
Grade B	0	4	4

Near the Grade B Contour

The protection ratios of Figures 1 to 3 are average values obtained at a TV receiver input level of −55 dBm. This level of signal represents viewing conditions close to the edge of the protected contour.

Co-located (same tower) TV and LM Transmitters

For TV receiving locations near the transmitting site, the television signal levels will be very high and therefore outdoor receiving antennas are not normally used. The reduced antenna size (rabbit ears) and its reduced height above ground limit the actual level. Measurements have indicated that the TV signal into the receiver using an indoor antenna inside the Grade A contour is usually between −25 and −35 dBm. In addition, it is assumed that the indoor TV receiving antenna provides no cross-polarization discrimination and indeed very little directional discrimination against vertically polarized LM transmissions, hence:

$$AD = 0 \text{ dB}$$

Table 1 gives the average values of the protection ratio for television. These are based on a receiver input level of −35 dBm (inside the Grade A contour). The ratios for −25 dBm are somewhat similar since they do not exhibit significant dependence on the level of the desired television signal.

TV Channels	Frequency Separation (in MHz) of LM Base Station from the edge of the TV Channel	Protection Ratio (dB) at the Input of the Television Receiver
7 and 14	2 - 3	+12
	> 3	0
69	> 2	+3

Table 1: Average Desired (TV) to Undesired (LM) protection ratios for TV receiver input level of between −25 and −35 dBm.

Fig. 1: Desired (TV) to undesired (LM) protection ratio curves for Ch. 7

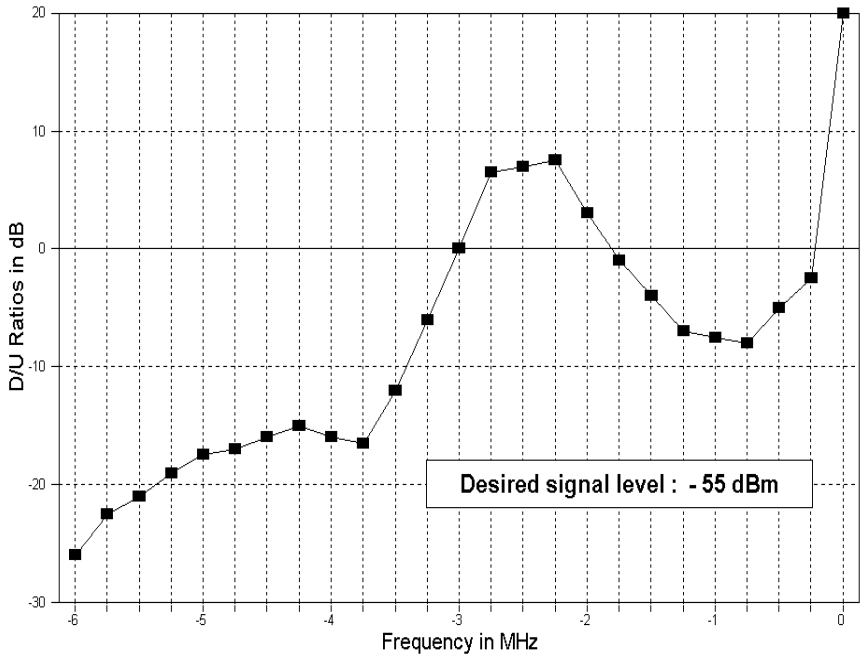

Fig. 2: Desired (TV) to undesired (LM)
protection ratio curves for Ch. 14

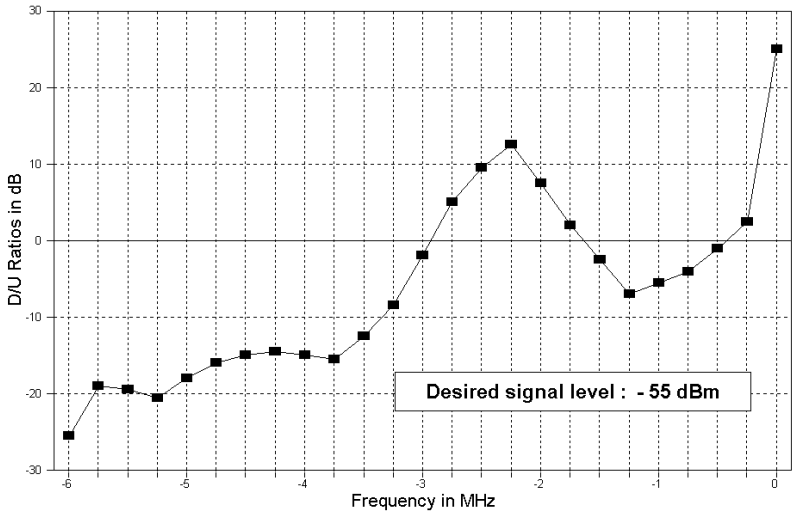

Fig. 3: Desired (TV) to undesired (LM)
protection ratio curves for Ch. 69

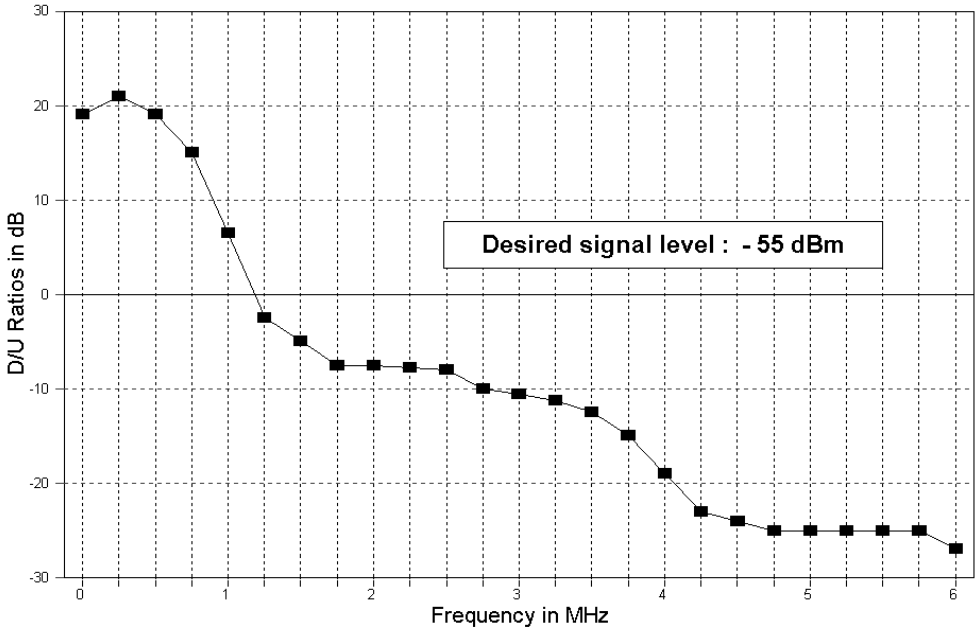

Fig. 4: Field Strength of Land Mobile Stations