

Spectrum Management

Broadcasting Circular

Low Power FM and TV Processing in the Regions: Provision of Regional Assistance to the Special Applicant in Remote Areas and the Processing of this Application

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Preamble

In the spring of 1992, the Spectrum Management Operations Committee (SMOC) approved the report of the Spectrum Management Broadcasting Operations (SMBO) sub-committee on regionalization of certain broadcasting activities. This aspect of regionalization concerning the assistance to specific applicants in remote areas and the processing of their low power FM and TV applications is reflected in this Broadcasting Circular.

Purpose

This Circular describes the procedure to be followed in the provision of services to an applicant who requests assistance in the completion of an application for a low power or very low power FM or TV undertaking, and in the processing of the completed application form. This procedure only applies to those undertakings proposed for remote, non spectrum-congested areas.

Procedure

The details of the procedure are provided in the following pages.

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1. Introduction

The broadcast regulation program in Industry Canada has been characterized for many years by a dependence on private sector broadcast engineering consultants to lead applicants through the broadcast certification process. This specialized consultant industry still exists and is used by mainstream broadcasters proposing regular facilities and others for low power facilities.

There is now a new class of applicant for low power broadcasting facilities in remote areas: the applicant does not normally make use of the specialized private sector consultants or technical staff of existing broadcasters. The Department (in concert with the CRTC) has responded to this new class of applicant by simplifying application requirements and procedures to the extent that the compulsory use of an engineering consultant is no longer required. In addition, the Department responded to these applicants by providing a local point of contact and in-depth service such as pre-application consultation, assistance in channel selection, advice with respect to equipment availability, site evaluation, area of service, etc.

This Circular describes the procedure to be followed by regional/district staff in the provision of services to this new class of applicant.

2. Pre-Application Consultation

2.1 Criteria re "Special Applicant"

- 2.1.1 This applicant requests detailed assistance from the regional/district staff in the preparation of low power (LP) and very low power (VLP) FM and TV applications for remote, non spectrum-congested areas.
- 2.1.2 FM applications short spaced by more than 8 km from minimum required separation distances stated in Broadcast Procedures and Rules, (BPR) Part III, *Application Procedures and Rules for FM Broadcasting undertakings*, require a consultant.
- 2.1.3 A broadcasting consultant is not mandatory for multi-channel TV applications but is strongly recommended due to the complexity of the installation.

2.2 Class Definitions

- 2.2.1 Low power FM is defined as 50 watt maximum effective radiated power (ERP) in any direction associated with 60 metres transmitting antenna height above average terrain (HAAT). When the HAAT is greater than 60 metres, equivalent parameters are utilized, i.e. the ERP is derated in accordance with BPR, Part III, Figure 1 in Appendix 4.

In mountainous terrain locations, where the transmitting antenna height is more than 300 metres above the elevation of the community to be served, the Department will consider proposals with the following limiting conditions:

- the effective radiated power shall not exceed 50 watts in any direction;
- the 3 mV/m service contour shall not extend beyond a distance of 8 km from the transmitting site.

A broadcast engineering consultant should be retained to demonstrate that the existing stations and allotments would be protected from interference.

2.2.2 Very low power FM is defined as 10 watts maximum ERP in any direction with 30 metre maximum antenna height above ground. (Beware of mountain top sites, where the class may be exceeded. Normally, the 3 mV/m service contour extends slightly over 2 km.)

2.2.3 In both classes, service goes out to the 3 mV/m contour.

2.2.4 Low power TV has a maximum transmitter power of 50 watts for channels 2-13 and 500 watts for channels 14-69. The Grade B contour does not normally extend beyond 12 km.

2.2.5 Very low power TV has a maximum transmitter power of 2 watts for channels 2-13 and 10 watts for channels 14-69, using an antenna with a maximum gain of 12 dB and a 30 metre maximum antenna height above ground. (Beware of mountain top sites, where the class may be exceeded. The normal distance to the Grade B contour is indicated in Section G-1.4 of BPR, Part IV, *Broadcast Procedures and Rules for TV Broadcasting Undertakings*.)

2.3 Site Considerations

2.3.1 Determine the area which the applicant wishes to cover with his proposed operation. For LPFM, the 3 mV/m service contour extends slightly over 4 km. For LPTV, the Grade B contour extends to 12 km.

2.3.2 Site choice is made taking into account the following factors:

- distance from area to be covered;
- availability of services, e.g. hydro, roads;
- existing antenna structures and availability;
- distance to airport (for FM, spurious on radio navigation and communications channels generally);
- TV ghost producing structures in the vicinity, e.g. water tower (BC-9);
- vicinity of population regarding RF exposure (BC-8) and overload signals (BC-5);

- environmental assessment (EA) analysis (BC-4);
- air clearance consideration (BC-13).

2.3.3 The same considerations apply to VLPFM and VLPTV.

2.4 FM Channel Analysis and Selection

- 2.4.1 The LAN software SS_PROG accesses the FM short spacing program. See software manual for more details on its use.
- 2.4.2 If no specific channel has been requested by applicant and channel usage in the area is unknown, a scan of channels with SS_PROG will be necessary.
- 2.4.3 The separations utilized in the program are found in BPR, Part III, Tables E-1 and E-2 for LPFM, and Table G-1 for VLPFM. Intermediate Frequency (10.6/10.8 MHz) separations in the program are based on separations in Table C-1 (generally no overlap of 96 dBu contours).
- 2.4.4 Channels 299 and 300 are not acceptable due to FM/NAV/COM compatibility.
- 2.4.5 Avoid channels 201-220 in areas where TV channel 6 is received.
- 2.4.6 There is no taboo with regard to the second harmonic relationship to TV channels 7-13. However, avoid second harmonic relationships to local or received VHF-TV channels in the general area.
- 2.4.7 Fourth adjacencies may be acceptable if no other channels are available.
- 2.4.8 Short spacings up to 8 km from those separations indicated in the Tables are permitted. A short spacing greater than 8 km requires that the technical submission be prepared by a consultant.
- 2.4.9 LPFM may be assigned an allotted channel, provided a commitment is given in writing to change channel, where required. VLPFMs are not normally assigned in centres with allotted channels.
- 2.4.10 Interference to other frequency-related regular undertakings in the area is normally not permitted. (Note: Under exceptional circumstances, the LP applicant may seek approval in writing from the related undertaking.)
- 2.4.11 Channel selection must be approved by HQ before the application is completed. HQ will check against U.S. exclusivities internationally and against mutual exclusivities domestically. Upon HQ approval of the channel selection, the channels are only **suggested** and the applicant makes the choice of channels, with regional advice where requested.

- 2.4.12 HQ will run FM/NAV/COM compatibility analysis and advise the region/district of Transport Canada's (TC) reply.
- 2.4.13 **No guarantee is given** with regard to protection or interference-free operation.

2.5 TV Channel Analysis and Selection

- 2.5.1 The LAN software SS_PROG accesses the TV short spacing program. See software manual for more details on its use.
- 2.5.2 If no specific channel has been requested by the applicant and channel usage in the area is unknown, a scan of channels with SS_PROG will be necessary.
- 2.5.3 The separations utilized in the program are found in BPR, Part IV, Appendix 9, Tables 1 to 4 for LPTV, and BPR, Part IV, Table G-1 for VLPTV.
- 2.5.4 Avoid the use of channel 6 if FM channels 201-220 are operating in the area. Channel 37 cannot be used as it is reserved exclusively for radio astronomy.
- 2.5.5 Channels 7, 14 and 69 should be avoided due to possible land mobile (LM) conflicts.
- 2.5.6 LPTV and VLPTV may NOT be assigned an allotted channel, even if the applicant offers to provide a commitment in writing to change channel. Allotments **MUST** be protected.
- 2.5.7 Depending on location, UHF channels are preferable for LP and VLP multi-channel operation. However, because of equipment and complexities of multi-channel operation, a broadcasting consultant is strongly recommended.
- 2.5.8 A short spacing from the required separations in the Tables requires an analysis considering antenna pattern, ERP and HAAT in pertinent directions. The short spacing analysis uses the protection ratios in the Tables. Pertinent interfering contours should not overlap protected contours of other undertakings and allotments. F50M software or curves may be used to determine the interfering contour. Refer to Section 2.8.
- 2.5.9 Interference to other frequency-related regular undertakings in the area is normally not permitted. (Note: Under exceptional circumstances, LP applicant may seek approval in writing from related undertaking.)
- 2.5.10 Determine if there is any interference to proposed LP undertaking.
- 2.5.11 Channel selection must be approved by HQ before the application is completed. HQ will check against U.S. exclusivities internationally, and against mutual exclusivities domestically.

2.5.12 Upon HQ approval of the channel selection, the channels are only **suggested** and the applicant makes the choice of channels, with regional advice where requested.

2.5.13 **No guarantee is given** with regard to protection or interference-free operation.

2.6 ERP Determination

2.6.1 Use of an omni-directional or directional antenna depends on site location, transmitter power, and coverage desired.

2.6.2 Use scales in application form (or scientific calculator) to determine transmission line efficiency and maximum power gain of antenna (reference to dipole).

2.6.3 For LPFM, the maximum ERP is 50 watts in any direction, based on 60 metres HAAT. Refer to Section 2.2.1 when the HAAT is greater than 60 metres.

2.6.4 For VLPFM, the maximum ERP is 10 watts. Refer to Section 2.2.2 for other limitations.

2.6.5 For LPTV, the maximum transmitter power is 50 watts for VHF channels and 500 watts for UHF channels. With a 30 metre HAAT, this results in the following maximum ERP, based on a Grade B contour distance of 12 km:

- 100 watts for channels 2-6
- 400 watts for channels 7-13
- 5000 watts for channels 14-69

Refer to Section 2.2.4 for other limitations.

2.6.6 For VLPTV, the maximum transmitter power is 2 watts for VHF channels and 10 watts for UHF channels. Refer to Section 2.2.5 for other limitations.

2.7 Coverage Determination

2.7.1 Information on the derivation of the VHF/UHF F(50,50) and F(50,10) propagation curves is contained in Appendix A.

2.7.2 Refer to Section E-3.1 of BPR, Part III, for details on LPFM coverage predictions. The F(50,50) field strength curves in Figures 2 and 3 of BPR, Part III, Appendix 4, are used to determine 3 mV/m and 0.5 mV/m coverage respectively at 0, 90, 180, and 270 degrees azimuth. F50M software may also be used.

2.7.3 Refer to Section E-3.1 of BPR, Part IV, for details on LPTV coverage predictions. The F(50,50) field strength curves in Figures 1, 2 or 3 of BPR, Part IV, Appendix 4, are used to determine Grade B coverage at 0, 90, 180,

and 270 degrees azimuth. The Grade B contour should ***normally not exceed 12 km***. F50M software may also be used.

- 2.7.4 Use the height of antenna above ground as an approximation of HAAT to determine approximate coverage, unless site is on a mountain top, hill, etc.
- 2.7.5 The coverage map should show realistic contours when required, due to hilly terrain. The PREDICT software can be used for this purpose.
- 2.7.6 Plot coverage on a suitable map with co-ordinate (degrees) and distance (km) scales shown.
- 2.7.7 Any interference to the LP coverage should be shown on the map (use method in Section 2.8).

2.8 Interference Analysis

- 2.8.1 Short spacings to related allotments, assignments and other low power undertakings have been determined using the SS_PROG software.
- 2.8.2 The coverage of existing stations can be determined from the coverage map in the technical brief. For an allotment, the protected coverage is related to its Class.
- 2.8.3 Interfering contours are normally determined from the F(50,10) propagation curves. F50M software can be used.
- 2.8.4 Please note that the closest interfering contour extension is 15 km for the F(50,10) curves for low and high band VHF and UHF. For closer extensions, one has to revert to the F(50,50) curves. This can be justified on the basis that as you get very close to the transmitting site, there is practically no difference in the time factor (i.e. 50 and 10).
- 2.8.5 Use procedure in Appendix 6 of BPR, Parts III and IV, to determine interference zones. Another method is to use the FTGI software.

2.9 Equipment Type Approval

- 2.9.1 Extreme care must be exercised when the applicant requests a recommendation on equipment. The applicant should normally be referred to the Department's list of type-approved equipment.
- 2.9.2 For FM, where the use of a heterodyne translator (a device which receives on one frequency and transmits on another without demodulation) is appropriate, and until such time as a specification may be issued for the type-approval of such equipment, a submission shall be made under Broadcasting Standards Procedure 100 (BSP-100), *Certification of Broadcasting Equipment*, to establish its technical acceptability.

2.10 Off-Air Reception of Signal to be Broadcast

- 2.10.1 If the applicant proposes to rebroadcast the off-air signal of an existing station, an estimate of available signal strength is sufficient.
- 2.10.2 In some cases, a subjective assessment may be the only means to address this aspect. Consequently, the calculations required within the LPFM application form may be disregarded for **remote** areas. They are there essentially for LPFM rebroadcasters in populated areas.
- 2.10.3 Off-air feeds are not protected from interference caused by incoming stations on related frequencies, however every effort should be made to avoid interfering with the off-air receiving systems of neighbouring broadcasting undertakings.

3. Application Processing

- 3.1 All of the items under Section 2.3, Site Considerations, should have been satisfactorily addressed during the consultation process.
- 3.2 Make sure the application form is completed pertinently and adequately, and signed by the applicant.
- 3.3 Ensure that the applicant submits site clearance form (if required) to TC (Refer to BC-13) and municipal notification letter to the municipality, or other appropriate authority (e.g. park authority, band council).
- 3.4 Ensure that copies of the application forms (for HQ and CRTC) are sent to HQ for acknowledgement, together with copies of the site clearance form (if required) and the municipal notification letter.
- 3.5 Indicate to HQ that you helped with the application and will be providing technical evaluation comments.

4. Technical Evaluation Comments

- 4.1 Since you have assisted the applicant in filling the application form, the processing has already been done.
- 4.2 The evaluation comments should reflect:
 - (a) a short sentence on coverage adequacy;
 - (b) frequency aspects;
 - (c) environmental assessment aspects, if any;
 - (d) scrambling for TV;

- (e) interference consideration and zones in coverage;
- (f) FM/NAV/COM conditions (standard paragraph to be found in specimen).

Refer to examples on next pages for guidance.

- 4.3 These technical evaluation comments and regional comments (see BC-7) should be submitted by the Regional Broadcast Engineer to the pertinent group at HQ as soon as possible, keeping in mind any deadline imposed by CRTC Hearings. They should be received at HQ no later than 20 days before the Hearing date. Refer to BC-1.

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EVALUATION COMMENTS ON BROADCAST APPLICATION
OBSERVATIONS SUR L'ÉVALUATION DE DEMANDES EN RADIODIFFUSION

LOCATION / EMPLACEMENT

APPLICANT / DEMANDEUR

PARTICULARS / DÉTAILS

For authority to establish and operate a new low power FM rebroadcasting undertaking at _____.

PROPOSED

Channel:

Frequency: _____ MHz

ERP: _____ watts

HAAT: _____ m.

Antenna Site: _____ (co-ordinates)

Mode of Operation: _____ Omni-directional (Directional), monophonic

COMMENTS / OBSERVATIONS

CONDITIONALLY TECHNICALLY ACCEPTABLE - An analysis of the FM/NAV/COM compatibility in the area has been submitted to Transport Canada (TC) for comments. Technical acceptability is conditional upon TC's approval and the proposal is subject to any conditions that are agreed to between the two departments. The Commission will be advised upon receipt of TC's reply.

The proposed FM broadcasting undertaking should provide adequate service to _____ and the surrounding area.

The proposed operation is predicated on the use of channel ____ LP. The undertaking would qualify as class LPFM, which is permitted maximum operating parameters of 50 watts at a HAAT of 60 metres under Broadcast Procedures and Rules, Part III, Section E. ____ other channel(s) is (are) available for assignment in the area under the present FM Allotment Plan.

It is proposed to rebroadcast programs of _____ via satellite.

Since _____ is located more than 32 km from the common Canada-U.S.A. border, this proposal need not be notified to the FCC.

A commitment with respect to understanding and accepting the limitations of this service has been signed by the applicant.

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EVALUATION COMMENTS ON BROADCAST APPLICATION
OBSERVATIONS SUR L'ÉVALUATION DE DEMANDES EN RADIODIFFUSION

LOCATION / EMPLACEMENT

APPLICANT / DEMANDEUR

PARTICULARS / DÉTAILS

For authority to establish and operate a new very low power FM rebroadcasting undertaking at _____.

PROPOSED

Channel:
Frequency: _____ MHz
ERP: _____ watts
HAAT: _____ m.
Antenna Site: _____ (co-ordinates)
Mode of Operation: _____ Omni-directional (Directional), monophonic

COMMENTS / OBSERVATIONS

CONDITIONALLY TECHNICALLY ACCEPTABLE - Since the Department's analysis has indicated a potential for interference to aeronautical NAV/COM services in the area, technical acceptability is conditional upon satisfactory resolution of any interference to these services revealed by monitoring during on-air trials. The applicant will be apprised of on-air testing conditions following a favourable decision by the CRTC.

The proposed FM broadcasting undertaking should provide adequate service to _____ and the surrounding area.

The proposed operation is predicated on the use of channel ____ VLP. The undertaking would qualify as class VLPM, which is permitted maximum operating parameters of 10 watts at an antenna height of 30 metres under Broadcast Procedures and Rules, Part III, Section G. ____ other channel(s) is (are) available for assignment in the area under the present FM Allotment Plan.

It is proposed to rebroadcast programs of _____ via satellite.

Since _____ is located more than 32 km from the common Canada-U.S.A. border, this proposal need not be notified to the FCC.

A commitment with respect to understanding and accepting the limitations of this service has been signed by the applicant.

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EVALUATION COMMENTS ON BROADCAST APPLICATION
OBSERVATIONS SUR L'ÉVALUATION DE DEMANDES EN RADIODIFFUSION

LOCATION / EMPLACEMENT

APPLICANT / DEMANDEUR

PARTICULARS / DÉTAILS

For authority to establish and operate two new low power television broadcasting undertakings at _____.

PROPOSED

Transmit Channels:
 Transmitter Power: _____ watts
 Antenna Site: _____ (co-ordinates)
 Mode of Operation: _____ Omni-directional (Directional)

COMMENTS / OBSERVATIONS

Technically Acceptable: The proposed operations are in compliance with the requirements of Broadcast Procedures and Rules, Part IV, for TV Broadcasting Undertakings.

A Grade B service should be provided to _____ and surrounding area.

It is proposed to transmit the following programming as received via satellite:

Channel	Programming
_____	_____
_____	_____

Scrambling will (not) be utilized.

Since _____ is located more than 32 km from the common Canada-U.S.A. border, this proposal need not be notified to the FCC.

The proposed operations would be constrained by the conditions set forth in Section E-1.2 of BPR, Part IV.

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EVALUATION COMMENTS ON BROADCAST APPLICATION
OBSERVATIONS SUR L'ÉVALUATION DE DEMANDES EN RADIODIFFUSION

LOCATION / EMPLACEMENT

APPLICANT / DEMANDEUR

PARTICULARS / DÉTAILS

For authority to establish and operate a new very low power television broadcasting undertaking at

_____.

PROPOSED

Transmit Channel:

Transmitter Power: _____ watts

Antenna Site: _____ (co-ordinates)

Mode of Operation: _____ Omni-directional (Directional)

COMMENTS / OBSERVATIONS

Technically Acceptable: The proposed operation is in compliance with the requirements of Broadcast Procedures and Rules, Part IV, for TV Broadcasting Undertakings.

A Grade B service should be provided to the _____ area.

It is proposed to transmit the programming of _____ as received via satellite.

Scrambling will (not) be utilized.

Since _____ is located more than 32 km from the common Canada-U.S.A. border, this proposal need not be notified to the FCC.

The proposed operation would be constrained by the conditions set forth in Section G-1.3 of BPR, Part IV.

Appendix A

VHF/UHF F(50,50) and F(50,10) Propagation Curves

The original VHF and UHF propagation curves were developed in the late 1940's by the USA. Since then, additional field strength data became available to the FCC. Moreover, additional measurement information was made available by the Association of Federal Communications Consulting Engineers (AFCCE). A Working Group consisting of representatives of AFCCE, FCC, other government agencies and the industry was formed. This group made extensive studies of all information available and developed the currently used VHF and UHF propagation curves.

The curves are based on data from VHF and UHF surveys involving 118 radials, with path-lengths ranging from about 10 to 90 miles. This data was examined with respect to field strength variations with terrain roughness, path-length, distances beyond the horizon, and antenna heights, as well as fading ratios. By correlating these variable relationships in several different ways, maximum utilization of the data was possible, and natural trends in distance, antenna height, terrain roughness, time and fading were in reasonable coherence when these factors were applied to the data. The new curves were designed for use with average terrain conditions. The CCIR terrain roughness factor was used and the curves have been adjusted to H=50 metres, which is considered average terrain roughness in the United States.

Predictions from the curves are an estimate of the median field strengths over areas where the general character of the terrain is fairly uniform i.e. no abrupt change in terrain roughness. Useful predictions are possible when medians are required in describing the distribution of field strength over areas of appreciable extent. The standard error of estimate for median values will increase when area size is reduced. Moreover, considerations such as obstruction by hills, trees, etc., antenna heights, local structural environment, inclination of the land, weather conditions over the propagation path will all contribute toward variations of field strength.

In summary, the new curves may be used for general assignment purposes (i.e. developing an allotment plan) or for providing a rough estimate of the probable field strength distribution for a proposed or existing undertaking. They cannot be used to predict with any accuracy the field which would be established by any specific operation over a particular path to any equally specific area, even when a terrain correction factor is employed.

In predicting the distance to the field intensity contours the F(50,50) and F(50,10) field strength curves should be used. 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 mile of about 103 dB above one microvolt per meter (137.6 millivolts per meter). To use the curves for other powers, the sliding scale (attached at the edge of the curves) should be trimmed and 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, and the curves then become direct reading (in uV/m and in dB above 1 uV/m) for this power and antenna height.

Where the antenna height is not one of those for which a scale is provided, the signal strength or distance is determined by interpolation between the curves connecting the equidistant points. Dividers may be used in lieu of the sliding scale. In predicting the distances to the field intensity contours, the effective radiated power to be used is that in the horizontal plane in the pertinent direction. In predicting other field intensities over areas not in the horizontal plane, the effective radiated power to be used is the power in the direction of such areas; the appropriate vertical plane radiation pattern must, of course, be considered in determining this power.