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Spectrum Management and Telecommunications

Broadcasting Procedures and Rules

Part 9: Application Procedures and Rules for Terrestrial S-DARS Undertakings (Satellite Digital Audio Radio Service)

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Canada

Contents

1. General

1.1 Spectrum Accommodation

Since the 1992 ITU World Administrative Radio Conference, through the adoption of an in-country footnote, a few countries including the United States, allocated the band 2310-2360 MHz to the broadcasting-satellite service and complementary terrestrial broadcasting service on a primary basis. Furthermore, the United States saw to designate the band 2320-2345 MHz for the establishment of two satellite digital audio radio services (S-DARS), including the installation of terrestrial S-DARS transmitters in urban areas to augment the satellite radio coverage.

More recently, Industry Canada, through its spectrum utilization policies, made the band 2320-2345 MHz available to accommodate similar satellite radio services in Canada based on using the American satellites, should the CRTC grant broadcasting licences to Canadian digital satellite subscription radio service undertakings, and the government amend its satellite-use policy regarding broadcasting undertakings for this exceptional circumstance. Subsequently, the CRTC granted broadcasting licences to Canadian Satellite Radio Inc. (CSR) and SIRIUS Canada, and the government modified its satellite-use policy to permit these licensees to use the U.S. S-DARS satellite facilities of XM Radio and SIRIUS Radio respectively, for the transmission of Canadian digital satellite subscription radio services in Canada.

It should be noted that the bands (2305-2320 MHz and 2345-2360 MHz) adjacent to the S-DARS operations are designated for Wireless Communication Services (WCS) applications under the fixed and mobile service allocations and the spectrum has been auctioned to various licensees. Use of these bands for WCS is governed by the applicable Industry Canada policy and licensing procedures[1] and there are provisions in the policy to manage the potential interference of out-of-band emissions by terrestrial S-DARS transmitters into the WCS receivers.

1.2 Bilateral Coordination with the United States (S-DARS to S-DARS)

Noting that Canadian digital satellite subscription radio service undertakings are associated with U.S. partners through commercial agreements and that close spectrum coordination for the terrestrial S-DARS transmitters is expected to be carried out between the Canadian and U.S. licensees, bilateral coordination between Canada and the United States is not required. Figure 1 below describes the frequency sub-bands to be used for the satellite and terrestrial S-DARS transmitters by CSR and SIRIUS Canada respectively.

[1] See Industry Canada document entitled *Policy and Licensing Procedures for the Auction of Spectrum Licences in the 2300 MHz and 3500 MHz Bands.*

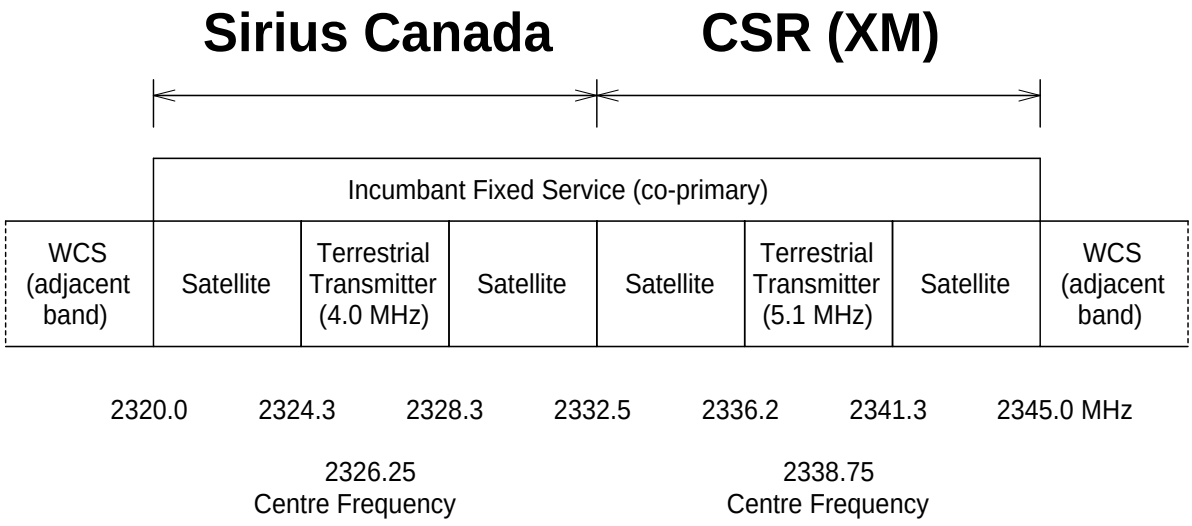
1.3 Coordination within Canada

As the band 2310-2345 MHz is co-allocated to the fixed service, the Canadian satellite radio licensees are expected to reach a mutually acceptable arrangement with the existing fixed service licensees[2] for fixed stations that are within 150 km of any terrestrial S-DARS transmitter. Furthermore, due to the WCS operations in bands adjacent to the satellite radio services, satellite radio licensees will be required to cooperate, or at times reach an arrangement, with the WCS operators depending on the location of the terrestrial S-DARS transmitters, in particular in non-urban areas.[3] Sections 3.5 and 3.6 describe these requirements.

1.4 Radiated Out-of-Band Emissions

Radiated out-of-band emissions of the terrestrial S-DARS transmitter shall be -75 dBW or less, relative to an isotropic radiator, when measured with a resolution bandwidth of 1 MHz. The limit applies to all bands outside the band occupied by the terrestrial and satellite components of the S-DARS service.

Figure 1: Satellite and Terrestrial Spectrum Utilization



[2] In 2000, Industry Canada placed a moratorium on the licensing of any new fixed and mobile systems in the band 2285-2360 MHz. See *Canada Gazette* Notice DGTP-003-00.

[3] See Section 5.3.2 of the Industry Canada document entitled *Policy and Licensing Procedures for the Auction of Spectrum Licences in the 2300 MHz and 3500 MHz Bands.*

2. Terrestrial S-DARS - General

2.1 Definitions

2.1.1 Effective Isotropic Radiated Power (e.i.r.p.)

The effective isotropic radiated power (e.i.r.p.) is the product of the transmitter output power, the transmission line (and combiner) efficiency and the maximum power gain of the antenna relative to an isotropic radiator.

2.1.2 Effective Radiated Power (e.r.p.)

The effective radiated power (e.r.p.) is the product of the transmitter output power, the transmission line (and combiner) efficiency and the maximum power gain of the antenna relative to a dipole radiator.

e.i.r.p. = e.r.p. + 2.15 dB when expressed in dBW
e.i.r.p. = e.r.p. x 1.64 when expressed in W

2.1.3 Urban vs. Non-Urban

To assist in determining if the transmitter is in an urban area, the applicant should refer to the MapInfo file, which outlines the urban and rural areas of Canada, available on Industry Canada's website at http://spectrumgeo.ic.gc.ca/txt/download-eng.html#congestion_zones.

2.2 Maximum Permissible Operating Power

The maximum permissible operating power is 12.5 kW e.i.r.p. This is calculated using the maximum value of radiation from the antenna in the plane of maximum radiation and in the direction of maximum radiation for directional antennas.

3. Preparation of Technical Submissions Supporting Applications for Terrestrial S-DARS Transmitters

3.1 Application Requirements

3.1.1 Application

An application is required for:

(a) the construction of a new terrestrial S-DARS transmitter/facility;

(b) modification to an existing terrestrial S-DARS transmitter which impacts on its coverage such as the addition of transmitters, changes to e.i.r.p., antenna height, antenna pattern, or location.

A summary table of requirements is listed in Section 3.8.

3.1.2 Forms and Documents

All necessary forms can be obtained from the departmental website at http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf01700.html.

3.1.2.1 General

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

Include is the following documentation:

- the appropriate application forms, which can be obtained from the Department's website at http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf01700.html

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

- maps (MapInfo format: *.DAT/*.ID/*.MAP/*.TAB or GIS format: *.MIF,*.MID) (see section 3.2.7)

- form (in PDF format) IC-3052A, *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) one copy of the departmental form IC-3052A, *Commitment Form*[4] (refer to BPR-1, Section 1.2);

(b) an engineering brief preferably in PDF format, including all the detailed technical information as outlined in Section 3.2.

[4] All Industry Canada forms referred in this document can be found on its website at http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf01700.html.

3.1.2.2 Site Selection Requirements

All proposed antenna structures whether new or modified, low or full power, must comply with the requirements of Client Procedures Circular CPC-2-0-03, Issue 4, *Radiocommunication and Broadcasting Antenna Systems* (effective January 1, 2008), and Section 2 of BPR-1. In addition to meeting the requirements regarding 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.

3.2 Engineering Brief

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

3.2.1 Title Page

The title page shall include the submission title, project or reference number, date, name and address of the applicant, as well as the name of the consultant.

3.2.2 Table of Contents

The table of contents shall cross-reference pages and sections of the brief.

3.2.3 Summary Sheet

A summary sheet, as per Appendix A, shall be prepared for each proposed transmitter site and each antenna on that site. Note that the antenna location coordinates are to be given to the nearest hundredth of a second, referenced to the NAD-83 system.

3.2.4 Main Section of Brief

Introduction - A general statement shall address the purpose of the brief.

Sources of Information - List sources of information used in compiling the engineering brief.

Transmitters - Specify make, type and output power.

Description of Antenna System - The following details are required:

- antenna - manufacturer, type, number of sections (if applicable), power gain, vertical and horizontal radiation patterns; and

- polarization - only vertical polarization shall be employed.

3.2.5 Diagrams

An elevation diagram of each structure and transmitting antenna as per Figure A1 of Appendix A and a block diagram of major components of the transmitting system are to be included in the engineering brief.

3.2.6 Radiation Patterns

Radiation Patterns - Horizontal and vertical radiation patterns shall be submitted for each antenna. For installations comprised of more than one antenna, the composite pattern shall be provided.

Radiation Pattern Data - For each antenna, the applicant shall provide vertical and horizontal pattern data.

Beam Tilt - Beam tilt shall be indicated in degrees below (positive) or above (negative) the horizontal plane.

3.2.7 Maps

When the e.i.r.p. is greater than 50 W, the applicant shall provide a site map, showing each proposed antenna site with geographical coordinates (latitude and longitude).

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

Refer to Sections 3.1.2.2 and 3.7 and to CPC-2-0-03 for the requirements regarding these issues.

3.4 On-air Testing Procedures

Note: These procedures only apply to terrestrial S-DARS facilities that exceed 50 W e.i.r.p.

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

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 District Office Manager soon after the issuance of the letter of authority.

Following successful on-air tests, including compliance with out-of-band emission limits outlined in Section 1.4, the applicant’s consultant shall certify to the Department that the facility is ready to commence operation in accordance with the approved technical brief and request permission to commence a normal broadcasting schedule.

3.5 WCS - Wireless Communication Services

Note: This section only applies to terrestrial S-DARS facilities that exceed 50 W e.i.r.p.

The Department has indicated that the approach to the technical certification of digital satellite subscription radio service undertakings will focus primarily on the use of the spectrum in accordance with current policy provisions and on coordination with other radiocommunication services. Furthermore, the authorization of terrestrial transmitters for the two satellite radio applications would be subject to the existing procedures, limits and conditions set out in the policy document for the WCS systems auction process.

The WCS policy document[5] made the following statements and provisions:

> "...In view of the potential of satellite radio services being implemented, it is important that applicants bidding for WCS spectrum licences take into account the potential operation of satellite radio terrestrial repeaters in the band 2320-2345 MHz..."
>
> "Canadian WCS licensees are advised to consider employing base station receivers with adequate front-end RF filtering to facilitate compatibility with potential S-DARS terrestrial repeater operation in the adjacent band..."
>
> "...Due to this anticipated environment, potential satellite radio and WCS licensees will be required to exchange information on their system deployments and to cooperate to ensure reasonable placement of their respective stations in urban areas. In the initial stages, as information becomes available on the potential location of the respective systems, the Department will make this information available."

Therefore, terrestrial S-DARS transmitters to be implemented for the purpose of augmenting the satellite coverage within urban areas, and which meet the requirements for technical certification, will need to be located in cooperation with those WCS operators, licensed and operating, within the urban area to maximize co-existence of both services. If the licensed Wireless Communication Service is not in operation, information on the current and future terrestrial S-DARS locations needs to be provided to the WCS licensees in a timely manner, in order to facilitate the current and long-term plans of both the WCS and S-DARS licensees.

The Department expects S-DARS licensees to optimize their locations in urban centres in order that the actual number of terrestrial S-DARS transmitters are kept to the minimum number required to achieve the quality of service objectives of S-DARS.

For terrestrial S-DARS transmitters located outside urban centres or for transmitters intended to improve coverage outside those urban centres, greater than 50 W e.i.r.p. (17 dBW), the S-DARS licensee will need to seek an arrangement with any WCS licensee within the coverage area of the terrestrial S-DARS transmitter. Written confirmation shall be provided to the Department. Upon request, the Department will provide a list of the existing WCS licensees.

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5 Ibid (see footnote 1)

The respective licensees must work in collaboration to develop a suitable arrangement before the deployment of facilities. It is expected that the time frame to develop such an arrangement will not exceed 30 calendar days. In the event that a mutually acceptable arrangement cannot be concluded between licensees, either licensee may ask the Department to facilitate resolution of the case.

3.6 Fixed Service Coordination

For each terrestrial S-DARS transmitter, the licensee is expected to reach a mutually acceptable arrangement with the licensee of any existing fixed service within a 150-km radius, if the bandwidth of the fixed service overlaps the bandwidth of the terrestrial S-DARS. The respective licensees must work in collaboration to develop a suitable arrangement before the deployment of the facilities. Written confirmation shall be provided to the Department. In the event that a mutually acceptable arrangement cannot be concluded within 30 calendar days of the initial contact, either licensee may ask the Department to intervene to resolve the issue.

3.7 RF Interference and Immunity of Receivers/Equipment

3.7.1 Requirements

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

3.7.2 Resolving Issues

The broadcasters will be responsible for solving immunity-type interference when applicable, i.e., for valid complaints (see Section 3.7.4).

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

3.7.3 Method for Calculating High Field Strength Contours

In predicting high field strength contours, the e.r.p. should be based on the appropriate antenna vertical plane radiation pattern for the azimuthal direction concerned.

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

$$F = 137 + 10 \log (\text{e.r.p.}) - 20 \log (d)$$

where:

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

e.r.p.: 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.

3.7.4 Complaints Judged Not Valid by the Department

The following list identifies the types of complaints judged not valid by the Department and for which terrestrial S-DARS operators are not responsible for remedial action:

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

- 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 130 dBμV/m;

- any other complaint which, in the judgement of the Department, is considered not valid.

3.8 Summary of Requirements

Table 1 represents a checklist of the items that need to be addressed by the applicant. These items may be related to information and analysis that needs to be provided, coordination with other users of the spectrum and consultation with municipalities.

Table 1 - Characteristics of the Terrestrial S-DARS Transmitters

	50 W e.i.r.p. or less		Greater than 50 W e.i.r.p.	
	Existing tower with no changes	**New tower or changes**	**Existing tower with no changes**	**New tower or changes**
TX and Antenna Parameters	y	y	y	y
Geo Coordinates	y	y	y	y
WCS Coordination	n	n	y (Note 1)	y (Note 1)
Fixed Services Coordination	y	y	y	y
RF Exposure Analysis	y	y	y	y
EMCAB-2 Analysis	Refer to Section 3.7			
Public/Municipal/ Land-use Authority Consultation, RF Exposure, etc.	Refer to Sections 3.1.2.2 and 3.3			

Note 1: refer to Section 3.5

Appendix A - Summary Sheet

APPLICANT:_____

Terrestrial S-DARS Transmitter: **NEW** ☐ **CHANGE** ☐

LOCATION:_____

SITE COORDINATES (NAD-83 system) **N. LAT.** ____ ° ____ ' _____._____" **(seconds: 2 decimal points)**

W. LONG. _____ ° ____ ' _____._____" **(seconds: 2 decimal points)**

ANTENNA TYPE **DIRECTIONAL** ☐ **OMNIDIRECTIONAL** ☐

e.i.r.p.: _____ **W (Vertical Polarization) at** **BEAM TILT** _____ **Degrees below Horizontal**

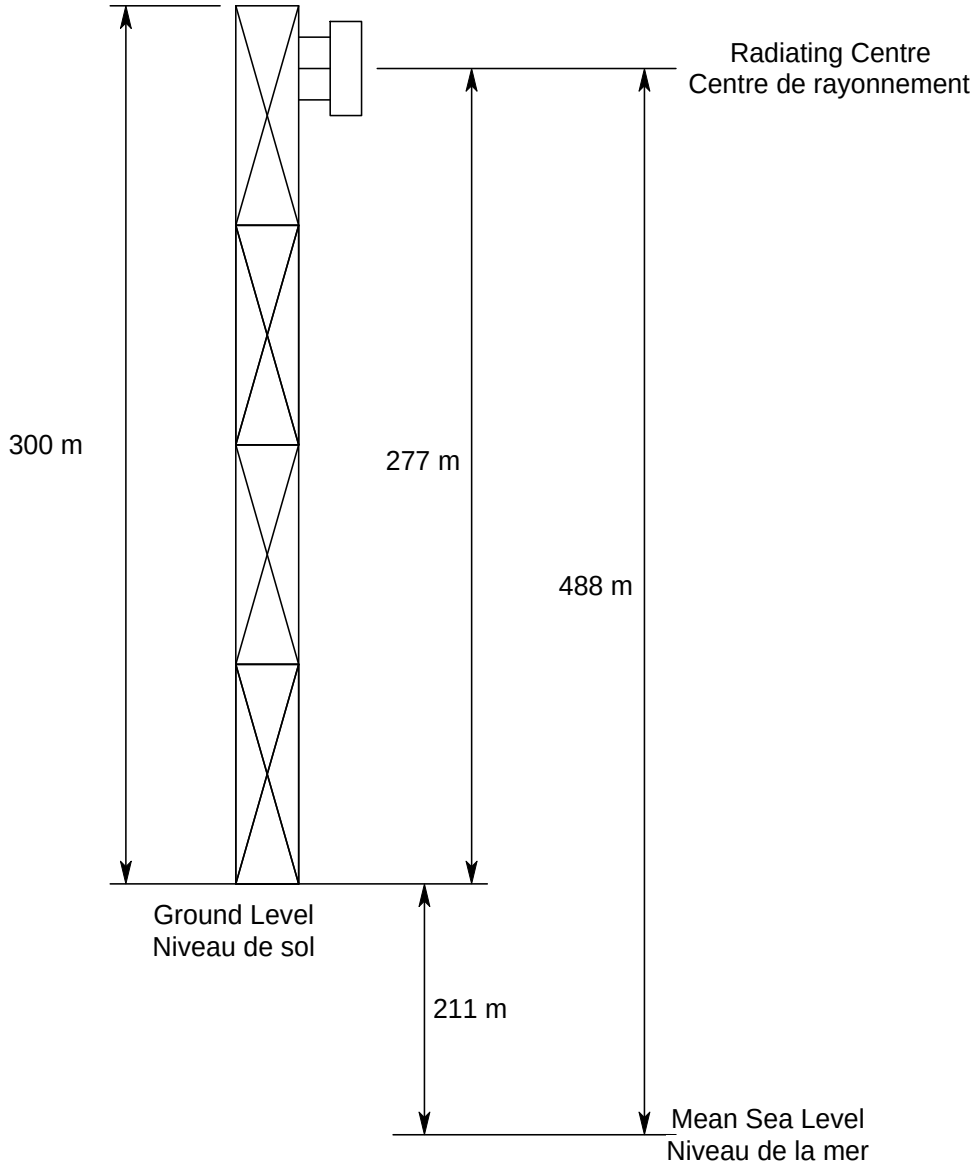
MAXIMUM ANTENNA GAIN :_____ **dBi** **AZIMUTH of BORESIGHT:** _____ **Degrees**

RCAG: _____ **Metres**

RCAMSL: _____ **Metres**

GROUND LEVEL: _____ **Metres**

Figure A1 - Elevation Diagram of Typical Tower and Transmitting Antenna



Appendix B - Antenna Radiation Pattern Data

Format of the Antenna Radiation Pattern

For the vertical and horizontal patterns, data shall be taken relative to maximum gain (boresight = 0^o). For the vertical and horizontal pattern, a sufficient number of points shall be selected to provide an accuracy of ±0.5 dB in the main beam of the antenna (0 to -10 dB range from maximum) and an accuracy of 1 dB in all other directions.

An electronic file must be prepared for the composite antenna pattern. The file shall contain two sections. The first specifies the horizontal pattern. The second section specifies the vertical pattern. The first line of each section gives the number of data pairs (azimuth, gain) describing the pattern. The elevation angle relative to the boresight must cover the range from 0^o to 90^o (assuming a symmetrical pattern in the 0^o to -90^o range). The gain for each antenna is specified in dB relative to maximum gain. An example of antenna pattern file is presented in Table B1.

Although in the example degree increments are evenly spaced, this need not be the case. Both the degree and dB values can be up to four decimals.

Table B1: Example of Antenna Pattern File

Horizontal

18
0,0
20,0
40,0
60, -0.5
80, -4
100, -15
120, -20
140, -35
160, -35
180,-35
200, -35
220, -35
240, -35
260, -15
280, -4
300, 0.5
320, 0
340,0

Vertical

10
0,0
10, -2
20, -2
30, -2
40, -3
50, -5
60, -15
70, -15
80, -15
90, -15