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Standard Radio System Plan

# **Technical Requirements for Public Safety Broadband Systems in the Bands 758-768 MHz and 788-798 MHz**

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**Canada**

## Preface

Standard Radio System Plan SRSP-540, issue 1, *Technical Requirements for Public Safety Broadband Systems in the Bands 758 768 MHz and 788-798 MHz*, sets out the minimum technical requirements for the efficient use of the bands 758-768 MHz and 788-798 MHz by public safety broadband (PSB) systems.

Issued under the authority of  
the Minister of Innovation, Science and Economic Development

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## 1. Intent

This Standard Radio System Plan (SRSP) sets out the minimum technical requirements for the efficient use of the bands 758-768 MHz and 788-798 MHz by public safety broadband (PSB) systems.

This SRSP specifies the technical characteristics relating only to efficient spectrum usage, and is not to be regarded as a comprehensive specification for equipment design and/or selection.

## 2. General

This SRSP is based on current and planned technologies being considered by service provider(s) for implementing PSB systems in Canada. Revisions to this SRSP will be made as required.

While a system may satisfy the requirements of this SRSP, Innovation, Science and Economic Development Canada (ISED or the Department) may require adjustments to radio and auxiliary equipment in radio stations whenever harmful interference<sup>1</sup> is caused to other radio stations or systems.

The arrangements for non-standard systems are outlined in the document entitled Spectrum Utilization Policies SP-Gen, [\*General Information Related to Spectrum Utilization and Radio Systems Policies\*](#).

ISED should be advised when a potential conflict between radio systems cannot be resolved by the parties concerned. After consulting with these parties, the Department will determine what modifications need to be made and establish an implementation schedule for these modifications in order to resolve the conflict.

ISED may require licensees<sup>2</sup> to use receiver selectivity characteristics that provide improved rejection of harmful interference.

Equipment operating in the PSB bands 758-768 MHz and 788-798 MHz must be certified in accordance with Radio Standards Specification RSS-140, *Equipment Operating in the Public Safety Broadband Frequency Bands 758-768 MHz and 788-798 MHz*.

Licensees are required to make available to the Department, upon request, information on certain technical parameters of their radio systems.

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<sup>1</sup> As defined in the [\*Radiocommunication Act\*](#), **harmful interference** means an adverse effect of electromagnetic energy from any emission, radiation or induction that (a) endangers the use or functioning of a safety-related radiocommunication system; or (b) significantly degrades or obstructs, or repeatedly interrupts, the use or functioning of radio apparatus or radio-sensitive equipment.

<sup>2</sup> In the absence of a licensing framework for spectrum in the bands 758-768 MHz and 788-798 MHz, the term **licensees** refers to authorized users of these bands.

### 3. Related documents

All Spectrum Management and Telecommunications publications are available online under [Official Publications](#).

The current issues of the following documents should be consulted in conjunction with this SRSP:

|             |  |
|-------------|--|
| TRAA        | <a href="#"><i>Treaty Series 1962 No. 15 — Coordination and Use of Radio Frequencies — Exchange of Notes between Canada and the United States of America</i></a><br><br><i>Statement of Intent between the Federal Communications Commission of the United States of America and the Department of Innovation, Science and Economic Development Canada Related to the Sharing and Use of the Frequency Bands 758-768 and 788-798 MHz by the [Public Safety] Mobile Service along the Canada-United States Border (forthcoming)</i> |
| CTFA        | <a href="#"><i>Canadian Table of Frequency Allocations</i></a>   |
| SP-Gen      | <a href="#"><i>General Information Related to Spectrum Utilization and Radio Systems Policies</i></a>  |
| SMSE-014-17 | <a href="#"><i>Decisions on Policy, Technical and Licensing Framework for Use of the Public Safety Broadband Spectrum in the Bands 758-763 MHz and 788-793 MHz (D Block) and 763-768 MHz and 793-798 MHz (PSBB Block)</i></a>  |
| SP-746      | <a href="#"><i>Mobile Service Allocation Decision and Designation of Spectrum for Public Safety in the Frequency Band 746-806 MHz</i></a>  |
| RSS-140     | <i>Equipment Operating in the Public Safety Broadband Frequency Bands 758-768 MHz and 788-798 MHz</i>  |
| CPC-2-0-03  | <a href="#"><i>Radiocommunication and Broadcasting Antenna Systems</i></a>   |
| CPC-2-1-23  | <a href="#"><i>Licensing Procedure for Spectrum Licences for Terrestrial Services</i></a>  |
| RP-25       | <a href="#"><i>Policy Principles for Public Safety Radio Interoperability</i></a>  |

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TRAA – Terrestrial Radiocommunication Agreements and Arrangements

CTFA – Canadian Table of Frequency Allocations

SP – Spectrum Utilization Policy

SMSE – Canada Gazette Notice

RSS – Radio Standards Specification

RSP – Radio Standards Procedure

CPC – Client Procedures Circular

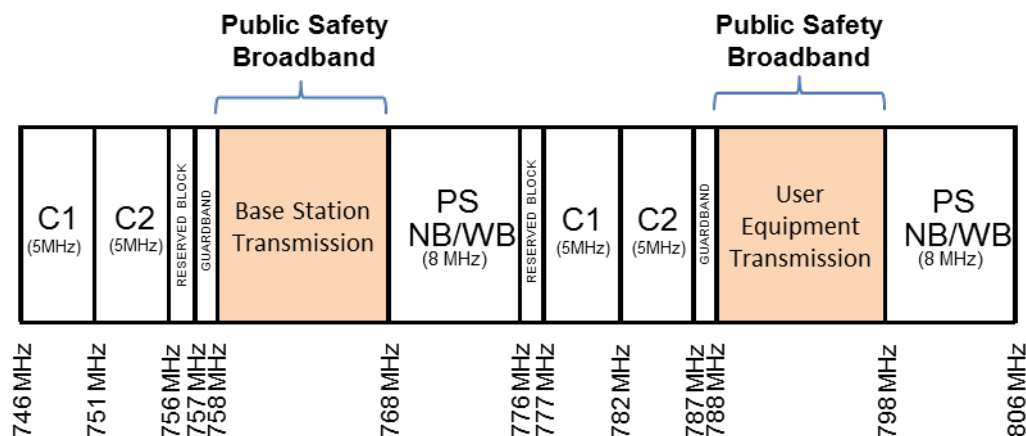
SRSP – Standard Radio System Plan

RP – Radio Systems Policies

#### 4. Spectrum availability and band plan

The block structure for PSB systems at 700 MHz is shown in figure 1 and table 1.

**Figure 1: 700 MHz band plan**



**Table 1: 700 MHz band frequency blocks**

| Total spectrum | Lower band  | Upper band  |
|----------------|-------------|-------------|
| 20 MHz         | 758-768 MHz | 788-798 MHz |

Base station transmissions occur in the frequency range 758-768 MHz. Transmissions from mobile and portable<sup>3</sup> occur in the frequency range 788-798 MHz.

Spectrum in the bands 758-768 MHz and 788-798 MHz is designated for PSB use. Commercial use of unused capacity will be authorized provided that public safety users have priority and pre-emptive rights over any form of commercial use. Eligibility for licensing as well as pre-emption conditions will be specified in a forthcoming licensing framework.

Any technology used in the designated PSB spectrum must be capable of interoperability with other systems in the bands 758-768 MHz and 788-798 MHz both nationally and cross-border, consistent with “standards-based shared systems” as defined in RP-25.

<sup>3</sup> Refer to RSS-140 for the definitions of mobile and portable equipment.

## 5. Technical criteria

### 5.1 Radiated power and antenna height limits

#### 5.1.1 Fixed and base stations

For fixed and base stations transmitting in accordance with section 4 within the frequency range 758-768 MHz with a channel bandwidth equal to or less than 1 MHz, the maximum permissible equivalent radiated power (e.r.p.) is 1000 W with an antenna height above average terrain (HAAT)<sup>4</sup> of up to 305 m.

For fixed and base stations transmitting in accordance with section 4 within the frequency range 758-768 MHz with a channel bandwidth greater than 1 MHz, the maximum permissible e.r.p. is 1000 W/MHz (i.e. no more than 1000 W e.r.p. in any 1 MHz band segment) with an antenna HAAT of up to 305 m.

Fixed and base stations located in geographical areas at a distance greater than 26 km from large or medium population centres<sup>5</sup> and transmitting in accordance with section 4 within the frequency range 758-768 MHz may increase their e.r.p. up to a maximum of 2000 W/MHz (i.e. no more than 2000 W e.r.p. in any 1 MHz band segment), with an antenna HAAT of up to 305 m.

Within 26 km of any large or medium population centre, fixed and base stations may operate at increased e.r.p. if more than 50% of the population within a particular sector's coverage is located outside these large and medium population centres.

Fixed and base stations with increased e.r.p. must not be used to provide coverage to large and medium population centres. However, some incidental coverage of these large and medium population centres by stations with increased e.r.p. is permitted.

This provision also applies to fixed and base stations with a channel bandwidth equal to or less than 1 MHz (i.e. e.r.p. may be increased up to a maximum of 2000 W).

For all installations with an antenna HAAT of more than 305 m, a corresponding reduction in e.r.p. according to the following formula shall be applied:

$$\text{e.r.p.}_{\text{reduction}} = 20\log_{10}(\text{HAAT} / 305) \text{ dB}$$

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<sup>4</sup> The antenna height above average terrain (HAAT) is the height of the centre of radiation of the antenna above the average elevation of the terrain between 3 and 16 km from the antenna, for an individual radial. The final antenna HAAT (also known as the effective height of the antenna above average terrain (EHAAT)) is the average of the antenna HAATs for 8 radials spaced every 45 degrees of azimuth starting with true north.

<sup>5</sup> Population centres are defined in Statistics Canada [Census Dictionary](#). A large urban population centre is defined as an area with a population of 100,000 or more and a population density of 400 persons or more per square kilometre. A medium population centre is defined as an area with a population between 30,000 and 99,999, and a population density of 400 persons or more per square kilometre.

MapInfo files describing boundaries of these centres are available [online](#).

### **5.1.2 Mobile and portable equipment**

A wide array of equipment is expected to be supported by PSB systems. Mobile equipment, including mobile stations and portable repeaters that transmit in the band 788-798 MHz, is limited to an e.r.p. of 30 W. Portable equipment in this band, including handheld devices, is allowed to transmit with a maximum e.r.p. of 3 W. The equipment should employ automatic transmit power control such that stations operate on the minimum required power.

## **5.2 Other criteria**

### **5.2.1 Power measurement settings**

The specified e.r.p. values in section 5.1 shall be measured during any continuous transmission time with a measurement instrument calibrated in terms of root-mean-square (rms) equivalent voltage.

### **5.2.2 Stations with multiple antennas using multiple-input, multiple-output (MIMO) technology**

If a fixed or base station is equipped with multiple antennas, the following rules regarding e.r.p. and antenna height shall apply.

#### **5.2.2.1 e.r.p. for correlated transmission**

When multiple antennas are used at a station to transmit the same digital data in a given symbol period (even with different coding or phase shifts) for transmit diversity, or to steer signal energy towards a particular direction for enhanced directional gain (i.e. beamforming) or to devise any other transmission mode where signals from different antennas are correlated, the e.r.p. shall be calculated based on the aggregate power conducted across all antennas and resulting directional gain  $10 \log_{10}(N) + G_{\max}$  dBd. Here,  $N$  is the number of antennas and  $G_{\max}$  is the highest gain in dBd among all antennas.

#### **5.2.2.2 e.r.p. for uncorrelated transmission**

When multiple antennas are used at a station in which each antenna transmits different digital data during any given symbol period (i.e. space-time block codes) or independent parallel data stream over the same frequency bandwidth in order to increase data rates (i.e. spatial multiplexing), or from any other transmission mode where signals from different antennas are completely uncorrelated, the e.r.p. shall be calculated based on the aggregate power conducted across all antennas and maximum antenna gain  $G_{\max}$ .

#### **5.2.2.3 Antenna height**

The antenna HAAT of a fixed or a base station with multiple antennas shall be calculated with reference to the highest antenna.



### **5.2.3 Transmitter unwanted emissions**

Transmitter unwanted emissions are specified in RSS-140, *Equipment Operating in the Public Safety Broadband Frequency Bands 758-768 MHz and 788-798 MHz*.

## **6. General guidelines for the coexistence of systems operating in the same frequency blocks and in adjacent service areas**

In the event that different licensees are authorized for a PSB system using the same frequency block in adjacent geographic service areas, coordination of any transmitter installations that are close to the boundary shall be required to eliminate any harmful interference that might exist and ensure continuance of equal access to the frequency block by both licensees.

Fixed or base stations must not generate a power flux density (pfd) outside the licensed service area that exceeds  $-116 \text{ dBW/m}^2$  in any 1 MHz, unless agreed otherwise by the affected licensee.

Possible interference conflicts resulting from the operation of two PSB systems in adjacent geographic service areas may occur. The resolution of those conflicts should be arrived at through mutual arrangements between the affected parties following consultation and coordination. When potential conflicts between systems cannot be resolved in a timely fashion, ISSED shall be so advised, whereupon, following consultations with the parties concerned, the Department will determine the necessary course of action.

System expansion measures, such as addition of cells, cell splitting and sectorization, must not force major changes in the system of the licensee in the adjacent geographic service area, except by mutual agreement between the affected parties. Changes that would have potential impacts on the other licensee, including cell site locations, cell sectorization and cell splitting, require consultation with the other licensee.

## **7. International coordination**

Specific coordination rules and procedures for the sharing of the bands 758-768 MHz and 788-798 MHz between Canadian and U.S. licensees are under negotiation between ISSED and the Federal Communications Commission (FCC). In the interim, the coordination requirements below should be applied.

Coordination of a new or modified station shall be required if the following conditions apply:

- (a) the station is located at a distance less than 120 km from Canada–United States border
- (b) the ground level pfd produced by the station in the other country's territory exceeds  $-116 \text{ dBW/m}^2$  in any 1 MHz of the spectrum

The coordination process is outlined in Annex A.

The ground level pfd across the border shall not exceed  $-96 \text{ dBW/m}^2$  in any 1 MHz bandwidth unless otherwise accepted by the U.S. licensee and by ISED.

If a licence is transferred, assigned or reissued, ISED requires any existing agreement forming the basis for coordination to continue to apply with respect to the new licensee unless a new agreement is reached.

Canadian licensees are encouraged to enter into agreement(s) with the U.S. licensee to facilitate coordination. The Agreements should:

- (a) allow reasonable and timely development of the licensees' respective systems
- (b) allow for the provision of services by licensees within their service areas on either side of the border to the maximum extent possible
- (c) utilize all available interference mitigation techniques, including antenna directivity, polarization, frequency offset, shielding, site selection and/or power control
- (d) continue to apply to any subordinate licensees or transferees

Licensees must retain all data and calculations related to the coordination of stations and/or Agreements and must provide the Department with such data and calculations, along with other supporting documentation, upon request.

## **Annex A — Coordination procedure near the Canada–United States border**

When coordination with the U.S. licensee is required, Canadian licensees must complete the process outlined below.

The licensee seeking coordination shall determine the maximum power flux density (pfd) value at and beyond the border that could be produced by any single transmitting station. In making this determination (calculation), the licensee shall use sound engineering practices and generally accepted terrain-sensitive propagation models.

The licensee must communicate with the affected U.S. licensee and either enter into an agreement as defined in the SRSP or provide the U.S. licensee with a coordination request.

The coordination request shall set out the following information and parameters:

- licensee information (corporate name, mailing address, telephone number, email address)
- licensed service areas
- point of contact
- location of transmitter (community, province/territory)
- geographic coordinates of transmitting antenna
- effective radiated power (e.r.p.) (dBW)
- ground elevation and antenna height above ground (m)
- centre frequency (MHz)
- antenna polarization
- antenna pattern / tabulation of the pattern
- azimuth of the maximum antenna gain
- bandwidth and emission designation

The coordination request shall be sent by registered mail (or a mutually acceptable method) and shall provide notification that the recipient may respond by registered mail (or a mutually acceptable method) within 30 days of its receipt to state any objection to deployment of the proposed facilities. It should be noted that the date of postmark shall be taken as the date of response. If no objection is raised by the U.S. licensee within this time period, then the coordination process may be considered complete.

If the recipient of a coordination request raises an objection within 30 days of receipt of that request, the licensee shall collaborate to develop a mutually acceptable solution to the potential interference problem (an Agreement).

In the event that the Canadian licensee and the U.S. licensee cannot reach an Agreement within 30 days of receipt of an objection, the Canadian licensee may request that ISED facilitate resolution of the case with the Federal Communications Commission (FCC) of the United States.

A station that requires coordination shall not be placed in operation until an Agreement has been reached between the relevant licensees or until ISED and the FCC have agreed on sharing terms.

In cases where there is no licensee within 120 km on the U.S. side of the border, no station of the proposed system in Canada shall produce a pfd at or beyond the border that exceeds  $-106 \text{ dBW/m}^2$  in any 1 MHz bandwidth, unless otherwise agreed upon by both ISED and the FCC.

If the licensees cannot reach a mutually acceptable solution within 90 days of the start of the process, the Canadian licensee shall ensure that the transmit power of the relevant stations is reduced to meet  $-116 \text{ dBW/m}^2$  within any 1 MHz pfd limit. Subsequently, the Canadian licensee may request that ISED facilitate a resolution of the case with the FCC.