Technical Requirements for Mobile Broadband Services (MBS) in the Bands 698-756 MHz and 777-787 MHz
Preface

This Standard Radio System Plan (SRSP) outlines the technical requirements for the operation of Mobile Broadband Services (MBS) in the bands 698-756 MHz and 777-787 MHz.

Issued under the authority of
the Minister of Industry

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1. **Intent**

1.1 This Standard Radio System Plan (SRSP) sets out the minimum technical requirements for the efficient use of the bands 698-756 MHz and 777-787 MHz (known as the 700 MHz band) by Mobile Broadband Services (MBS).

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

2. **General**

2.1 This SRSP is based on the current or planned technologies being considered by the service providers to implement MBS in Canada. Revisions to this SRSP will be made as required.

2.2 Notwithstanding the fact that a system satisfies the requirements of this SRSP, Industry Canada may require adjustment to radio and auxiliary equipment in radio stations whenever harmful interference\(^1\) is caused to other radio stations or systems.


2.4 Industry Canada should be advised when potential conflict between radio systems cannot be resolved by the parties concerned. After consultation with these parties, Industry Canada will determine what modifications need to be made and establish a schedule for these modifications in order to resolve the conflict.

2.5 Industry Canada may require licensees to use receiver selectivity characteristics that provide improved rejection of harmful interference. For example, television broadcasting transmissions in adjacent bands may result in the generation of intermodulation and other interference products within MBS receivers located in areas where television signals are strong.

2.6 MBS equipment must be certified in accordance with Radio Standards Specification RSS-130, *Mobile Broadband Services (MBS) Equipment Operating in the Frequency Bands 698-756 MHz and 777-787 MHz*.

2.7 Licensees are required to make available to Industry Canada, upon request, information on certain technical parameters of their radio systems.

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\(^1\) 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.
3. Related Documents

The current issues of the following documents are applicable and are available on the Spectrum Management and Telecommunications website at http://www.ic.gc.ca/spectrum.

TRAA

*Treaty Series 1962 No. 15 — Coordination and Use of Radio Frequencies, Exchange of Notes between Canada and the United States of America*

*Arrangement O: Sharing Arrangement Between the Department of Industry of Canada and the Federal Communications Commission of the United States of America Concerning the Use of the Frequency Bands 698-758 MHz and 776-788 MHz for the Fixed and Mobile (Except Aeronautical Mobile) Services Along the Canada-United States Border*

*Letters of Exchange for Arrangement O*

CTFA

*Canadian Table of Frequency Allocations 9 kHz to 275 GHz*

SP-Gen

*General Information Related to Spectrum Utilization and Radio Systems Policies*

SMSE-002-12

*Policy and Technical Framework: Mobile Broadband Services (MBS) — 700 MHz Band — Broadband Radio Service (BRS) — 2500 MHz Band*

DGSA-001-13

*Licensing Framework for Mobile Broadband Services (MBS) — 700 MHz Band*

SP-746

*Mobile Service Allocation Decision and Designation of Spectrum for Public Safety in the Frequency Band 746-806 MHz*

SP-768

*Narrowband and Wideband Public Safety Radiocommunication Systems in the Bands 768-776 MHz and 798-806 MHz*

RSS-Gen

*General Requirements and Information for the Certification of Radiocommunication Apparatus*

RSS-102

*Radio Frequency (CRF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)*

RSS-130

*Mobile Broadband Services (MBS) Equipment Operating in the Frequency Bands 698-756 MHz and 777-787 MHz*

RSP-100

*Radio Equipment Certification Procedure*

CPC-2-0-03

*Radiocommunication and Broadcasting Antenna Systems*

CPC-2-1-23

*Licensing Procedure for Spectrum Licences for Terrestrial Services*
SRSP-511  
*Technical Requirements for Land Mobile Radio Services Operating in the Bands 768-776 MHz and 798-806 MHz*

SAB-001-10  
*Low-power Licensed Radiocommunication Devices, Including Wireless Microphones, in the Band 698-806 MHz*

SAB-001-12  
*Low-power Licensed Radiocommunication Devices, Including Wireless Microphones, in the Band 698-806 MHz*

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TRAA – Terrestrial Radiocommunication Agreements and Arrangements  
SP – Spectrum Utilization Policy  
SMSE – Canada Gazette Notice  
DGSA – Canada Gazette Notice  
RSS – Radio Standards Specification  
RSP – Radio Standards Procedure  
CPC – Client Procedures Circular  
SRSP – Standard Radio System Plan  
SAB – Spectrum Advisory Bulletin

4. **Band Plan**

4.1 The block structure for MBS at 700 MHz is shown in Figure 1 and Table 1.

![Figure 1: 700 MHz Band Plan](image-url)
Table 1: 700 MHz Band Frequency Blocks

<table>
<thead>
<tr>
<th>Block</th>
<th>Total Spectrum</th>
<th>Lower Sub-band</th>
<th>Upper Sub-band</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paired Block A</td>
<td>12 MHz</td>
<td>698-704 MHz</td>
<td>728-734 MHz</td>
</tr>
<tr>
<td>Paired Block B</td>
<td>12 MHz</td>
<td>704-710 MHz</td>
<td>734-740 MHz</td>
</tr>
<tr>
<td>Paired Block C</td>
<td>12 MHz</td>
<td>710-716 MHz</td>
<td>740-746 MHz</td>
</tr>
<tr>
<td>Unpaired Block D</td>
<td>6 MHz</td>
<td>716-722 MHz</td>
<td>-</td>
</tr>
<tr>
<td>Unpaired Block E</td>
<td>6 MHz</td>
<td>722-728 MHz</td>
<td>-</td>
</tr>
<tr>
<td>Paired Block C1</td>
<td>10 MHz</td>
<td>746-751 MHz</td>
<td>777-782 MHz</td>
</tr>
<tr>
<td>Paired Block C2</td>
<td>10 MHz</td>
<td>751-756 MHz</td>
<td>782-787 MHz</td>
</tr>
</tbody>
</table>

4.1.1 For the paired blocks A, B and C, base station transmission is in the frequency range 728-746 MHz, with the parameters specified in Section 5.1.1. Transmissions from mobile, portable and fixed subscriber equipment\(^2\) are in the frequency range 698-716 MHz with parameters specified in Section 5.1.2.

4.1.2 For the paired blocks C1 and C2, base station transmission is in the frequency range 746-756 MHz with the parameters specified in Section 5.1.1. Transmissions from mobile, portable and fixed subscriber equipment are in the frequency range 777-787 MHz with parameters specified in Section 5.1.2.

4.1.3 For the unpaired blocks D and E, base station transmission is preferred in the frequency range 716-728 MHz with the parameters specified in Section 5.1.1.

4.1.4 Systems using duplexing schemes different than those outlined in sections 4.1.1 to 4.1.3 may be deployed. Such systems shall not interfere with, nor claim protection from, systems deployed in accordance with sections 4.1.1 to 4.1.3. Furthermore, any possible guardband requirements for systems in the unpaired blocks using different duplexing schemes than the preferred (specified in Section 4.1.3) shall be taken from the unpaired D and E blocks.

5. Technical Criteria

5.1 Radiated Power and Antenna Height Limits

5.1.1 Fixed and base stations

5.1.1.1 For fixed and base stations transmitting in accordance with sections 4.1.1 to 4.1.3 within the frequency range 716-756 MHz with a channel bandwidth equal to or less than 1 MHz, the maximum permissible equivalent isotropically radiated power (e.i.r.p.) is 1640 watts with an

\(^2\) Refer to RSS-130 for the definitions of mobile, portable and fixed subscriber equipment.
antenna height above average terrain (HAAT)\(^3\) up to 305 metres. The same e.i.r.p. limit also applies to fixed and base stations operating at any frequency in the 700 MHz band in accordance with Section 4.1.4.

5.1.1.2 For fixed and base stations transmitting in accordance with sections 4.1.1 to 4.1.3 within the frequency range 716-756 MHz with a channel bandwidth greater than 1 MHz, the maximum permissible e.i.r.p. is 1640 watts/MHz (i.e. no more than 1640 watts e.i.r.p. in any 1 MHz band segment) with a HAAT up to 305 metres. The same e.i.r.p. limit also applies to fixed and base stations operating at any frequency in the 700 MHz band in accordance with Section 4.1.4.

5.1.1.3 Fixed and base stations located in geographical areas at a distance greater than 26 km from large or medium population centres\(^4\) and transmitting in accordance with sections 4.1.1 to 4.1.3 within the frequency range 716-756 MHz, may increase their e.i.r.p. up to a maximum of 3280 watts/MHz (i.e. no more than 3280 watts e.i.r.p. in any 1 MHz band segment), with an antenna HAAT up to 305 metres.

Within 26 km of any large or medium population centre, fixed and base stations may operate at increased e.i.r.p. if more than 50% of the population within a particular sector’s coverage\(^5\) is located outside these large and medium population centres.

Fixed and base stations with increased e.i.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.i.r.p. is permitted.

This provision also applies for fixed and base stations with a channel bandwidth equal to or less than 1 MHz (i.e. e.i.r.p. may be increased up to a maximum of 3280 watts).

5.1.1.4 For all installations with an antenna HAAT in excess of 305 metres, a corresponding reduction in e.i.r.p. according to the following formula shall be applied:

\[
\text{EIRP}_{\text{reduction}} = 20 \log_{10} \left( \frac{\text{HAAT}}{305} \right) \text{ dB}
\]

\(^3\) 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 and 16 km from the antenna, for an individual radial. The final HAAT (also known as the effective height of the antenna above average terrain (EHAAT)) is the average of the antenna heights above the average terrain (HAAT) for 8 radials spaced every 45 degrees of azimuth starting with true north.

\(^4\) 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 at: http://spectrumgeo.ic.gc.ca/txt/download-eng.html.

\(^5\) Population within the sector’s coverage may be determined from the MapInfo spectrum grid cell data available at http://spectrumgeo.ic.gc.ca/txt/download-eng.html#spectrum_grid; see “Table 3: The Spectrum Grid Map Layers”.
5.1.2 **Mobile and portable stations and fixed subscriber equipment**

Mobile stations and outdoor fixed subscriber equipment, which transmit in the bands 698-716 MHz and 777-787 MHz, are limited to an e.i.r.p. of 50 watts. Portable stations and indoor fixed subscriber equipment in these bands are allowed to transmit with a maximum e.i.r.p. of 5 watts. These stations 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 power 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.i.r.p. and antenna height shall apply.

5.2.2.1 **E.i.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.i.r.p. shall be calculated based on the aggregate power conducted across all antennas and resulting directional gain $10 \log_{10} \left( N \right) + G_{\text{max}} \text{ dBi}$. Here, $N$ is the number of antennas and $G_{\text{max}}$ is the highest gain in dBi among all antennas.

5.2.2.2 **E.i.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 forms any other transmission mode where signals from different antennas are completely uncorrelated, the e.i.r.p. shall be calculated based on the aggregate power conducted across all antennas and maximum antenna gain $G_{\text{max}}$. 


5.2.2.3 Antenna height

The 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-130, *Mobile Broadband Services (MBS) Equipment Operating in the Frequency Bands 698-756 MHz and 777-787 MHz*.

6. General Guidelines for Coexistence of Systems Operating in the Same Frequency Blocks and in Adjacent Service Areas

6.1 In the event that an MBS system using the same frequency block is authorized to different licensees 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 otherwise exist and ensure continuance of equal access to the frequency block by both licensees.

6.2 Fixed or base stations operating in accordance with sections 4.1.1 to 4.1.3 in the frequency range 716-756 MHz must not generate outside the licensed service area a power flux density (pfd) that exceeds $-116\,\text{dBW/m}^2$ in any 1 MHz unless agreed otherwise by the affected licensee.

6.3 Possible interference conflicts resulting from the operation of two MBS 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, Industry Canada shall be so advised, whereupon, following consultations with the parties concerned, the Department will determine the necessary course of action.

6.4 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. General Guidelines for Coexistence of Systems Operating in Adjacent Frequency Blocks

7.1 Possible interference conflicts resulting from the operation of two MBS systems operating in adjacent blocks may occur even though the technical specifications of both this SRSP and RSS-130 are being met. The resolution of those conflicts should be arrived at through mutual arrangements between the affected parties following consultation and coordination.
7.2 When potential conflicts between systems cannot be resolved, Industry Canada shall be so advised, whereupon, following consultations with the parties concerned, the Department will determine the necessary modifications and/or schedule of modifications.

8. Coexistence of Systems Operating in Adjacent Bands

8.1 Coordination may be required with licensees in adjacent bands. In this context, coordination involves consultation between licensees to ensure the coexistence between systems in adjacent bands. Licensees should consult Industry Canada for the most up-to-date list of licensees in the area.

8.2 Possible interference conflicts resulting from the operation of systems in the bands illustrated in Section 4 and radio systems in adjacent bands may occur. The resolution of those conflicts should be through mutual arrangements between the affected parties following consultation and coordination.

8.3 When potential conflicts between systems cannot be resolved in a timely fashion, Industry Canada shall be so advised, whereupon, following consultations with the parties concerned, Industry Canada will determine the necessary course of action.

8.4 Television broadcasting transmissions on channel 51 (692-698 MHz) in Winnipeg, Manitoba, and London, Ontario, may produce adjacent-channel interference for MBS receivers employing Block A spectrum in areas where the TV signals are strong, particularly within the 115 dBu F(50,90) contour of the channel 51 television broadcasting station.

8.5 Any MBS fixed or base station transmitting immediately above channel 51 needs to be coordinated with TV stations operating on channel 51 in the same area.

9. International Coordination

9.1 Licensees in the frequency bands 698-756 MHz and 777-787 MHz operating stations near the Canada-United States border are required to coordinate with U.S. licensees according to Arrangement O: Sharing Arrangement Between the Department of Industry of Canada and the Federal Communications Commission of the United States of America Concerning the Use of the Frequency Bands 698-758 MHz and 776-788 MHz for the Fixed and Mobile (Except Aeronautical Mobile) Services Along the Canada-United States Border. The current coordination requirements are stated below. These requirements are subject to change from time to time in accordance with international agreements and arrangements.

9.2 Coordination of a new or modified station shall be required if:

(a) the station is located at a distance less than 120 km from Canada-United States border; and

(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.

9.3 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 Industry Canada.

9.4 If a licence is transferred, assigned or reissued, Industry Canada 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.

9.5 Canadian licensees are encouraged to enter into agreements with U.S. licensees (Agreements) to facilitate coordination which should:

(a) allow reasonable and timely development of the respective systems of the licensees;

(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; and

(d) continue to apply to any subordinate licensees or transferees.

9.6 Licensees must retain all data and calculations related to coordination of stations and/or Agreements and must provide Industry Canada with such data and calculations, along with other supporting documentation, upon request.
Annex A — Coordination Procedure Near the Canada-United States Border

A.1 When coordination with U.S. licensees is required, Canadian licensees must complete the process outlined below.

A.2 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.

A.3 The licensee must communicate with any 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.

A.4 A Coordination Request shall set out the following information and parameters:
- Licensee information (corporate name/mailing address/telephone/email)
- Licensed service areas
- Point of contact
- Location of transmitter (community/province/territory)
- Geographic coordinates of transmitting antenna
- Effective isotropic radiated power (e.i.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

A.5 The Coordination Request shall be sent by registered mail (or mutually acceptable method) and shall provide notification that the recipient may respond by registered mail (or 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.

A.6 If a recipient of a Coordination Request raises an objection within 30 days of receipt of that request, licensees shall collaborate to develop a mutually acceptable solution to the potential interference problem (an Agreement).

A.7 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 Industry Canada facilitate resolution of the case with the Federal Communications Commission (FCC) in the United States.
A.8 A station that requires coordination shall not be placed in operation until an Agreement has been reached between the relevant licensees or until Industry Canada and the FCC have agreed on sharing terms.

A.9 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 Industry Canada and the FCC.

A.10 If a licensee in Canada operating in accordance with Section A.9 above is notified by a new licensee on the U.S. side of the border of the issuance of a new licence, the operational licensee in Canada shall seek coordination with the U.S. licensee within 30 days, using the process outlined in sections A.2 to A.8.

A.11 In regard to Section A.10, if the licensees cannot reach a mutually acceptable solution within 90 days of receipt of the notification from the U.S. licensee, 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 power flux density (pfd) limit. Subsequently, the Canadian licensee may request that Industry Canada facilitate a resolution of the case with the FCC.