Innovation, Science and Economic Development Canada
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Spectrum Management and Telecommunications

Standard Radio System Plan

Technical Requirements for Fixed Radio Systems Operating in the Bands 1700-1710 MHz and 1780-1850 MHz

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Preface

This Standard Radio System Plan (SRSP) replaces SRSP-301.7, issue 4. Issue 5 of SRSP-301.7 has been released to amend the technical requirements for fixed radio systems used for the management of the electricity supply.

The following are the main changes:

1. Redundant requirements already covered by SRSP-300-Gen were removed.
2. Radio frequency (RF) channel centre frequencies for the band 1800-1830 MHz (section 4.2.1) were modified to be based on a 100 kHz grid instead of 125 kHz.
3. Other editorial updates and improvements have been made throughout the document.

Issued under the authority of
the Minister of Industry

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Wen Kwan
Director General
Engineering, Planning and Standards Branch

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1. Intent

This Standard Radio System Plan (SRSP) states the minimum technical requirements for the efficient use of the frequency bands 1700-1710 MHz and 1780-1850 MHz by radio systems in the fixed service, namely:

a. fixed point-to-point line-of-sight digital radio systems in the frequency bands 1700-1710 MHz, 1780-1800 MHz and 1830-1850 MHz;

b. analog and digital radio systems, in the frequency band 1700-1710 MHz, used for aural broadcasting studio-to-transmitter link (STL) services; and

c. fixed point-to-point and point-to-multipoint digital radio systems, in the frequency band 1800-1830 MHz, used for the management of the electricity supply.

In this standard, the phrase "fixed radio systems used for the management of the electricity supply" refers to radio systems carrying traffic solely for the management, operation and maintenance of the electricity supply.

This SRSP is intended to be used in the design and specification of radio systems and equipment, as well as in the technical evaluation of applications for new radio facilities or for modifications to radio systems submitted in accordance with the current issue of Radio Standards Procedure RSP-113, *Application Procedures for Planned Radio Stations Above 960 MHz in the Fixed Service*.

This SRSP must be used in conjunction with SRSP-300-Gen, *General Technical Requirements for Fixed Radio Systems Operating in Frequency Bands above 960 MHz*, to assess compliance with Innovation, Science and Economic Development Canada (ISED) requirements. Certain technical requirements which were found in the previous issue of SRSP-301.7 are now addressed in SRSP-300-Gen. Except where otherwise specified in this SRSP, fixed radio systems in the frequency bands 1700-1710 MHz and 1780-1850 MHz shall comply with both the requirements of this SRSP as well as those prescribed in SRSP-300-Gen.

Where requirements in SRSP-300-Gen are different from those in this SRSP, the requirements in this SRSP shall take precedence.

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

2. General

This Standard replaces SRSP-301.7, Issue 4. Further revision of this SRSP will be made as required. Existing radio systems that were licensed as standard prior to the issuance of this SRSP may continue to operate as standard. Extension, expansion, or modification of these systems will be considered by ISED on a case-by-case basis. New systems shall conform to the requirements of this standard.

Analog and digital radio systems used for aural broadcasting STL services will be permitted in the band 1700-1710 MHz and, on a case-by-case basis, in the bands 1780-1800 MHz and 1830-1850 MHz. All

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STL systems shall conform to the applicable provisions for point-to-point digital radio systems in the bands 1700-1710 MHz, 1780-1800 MHz and 1830-1850 MHz in this SRSP and in SRSP-300-Gen.

It should be noted that the fixed service shares the bands 1700-1710 MHz and 1780-1850 MHz with other services in accordance with the Canadian Table of Frequency Allocations. It may be necessary to coordinate with meteorological satellite (METSAT) earth stations operating in the band 1700-1710 MHz. For fixed systems operating near 1710 MHz and near 1850 MHz, coordination may be required with Advanced Wireless Services (AWS) and Personal Communications Services (PCS) systems, respectively, operating in the adjacent bands.

3. Related documents

The current issues of the following documents are applicable and available on ISED's Spectrum Management and Telecommunications website, under Official publications:

Arrangement D	*Arrangement Between the Department of Transport and the Interdepartment Radio Advisory Committee for the Exchange of Frequency Assignment Information and Engineering Comments on Proposed Assignments Along the Canada-United States Borders in Certain Frequency Bands Above 30 Mc/s*
CPC-2-0-03	*Radiocommunications and Broadcasting Antenna Systems*
CTFA	*Canadian Table of Frequency Allocations*
DGRB-011-07	*Licensing Framework for the Auction for Spectrum Licences for Advanced Wireless Services and other Spectrum in the 2 GHz Range*
RSP-113	*Application Procedures for Planned Radio Stations Above 960 MHz in the Fixed Service*
SRSP-300-Gen	*General Technical Requirements for Fixed Radio Systems Operating in Frequency Bands above 960 MHz*
SP 1-20 GHz	*Revisions to Microwave Spectrum Utilization Policies in the Range of 1-20 GHz*
SP 1-3 GHz	*Amendments to the Microwave Spectrum Utilization Policies in the 1-3 GHz Frequency Range*
SP Gen	*General Information Related to Spectrum Utilization and Radio Systems Policies*
TRC-43	*Designation of Emissions, Class of Station and Nature of Service*

CPC – Client Procedures Circular

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DGRB – Radiocommunication and Broadcasting Regulatory Branch
RSP – Radio Standards Procedure
SP – Spectrum Utilization Policy
SRSP – Standard Radio System Plan
TRC – Telecommunications Regulation Circular

4. Radio frequency channel arrangement description

This section describes the radio frequency (RF) channel arrangements for radio systems.

4.1 RF channel arrangements for point-to-point radio systems in the frequency bands 1700-1710 MHz, 1780-1800 MHz and 1830-1850 MHz

To facilitate assignment of a range of frequencies and bandwidths in the available spectrum, centre frequencies may be assigned on a 125 kHz grid. Channel bandwidths of 1 to 10 MHz, in 250 kHz increments, may be assigned as needed in the bands 1700-1710 MHz, 1780-1800 MHz or 1830-1850 MHz, with the exception of the channel bandwidths of STL systems, to be assigned on 125 kHz grid and shall not exceed 1 MHz. The centre frequency shall be chosen such that the occupied bandwidth of the emission is contained within the bands.

4.1.1 RF channel centre frequencies for the band 1700-1710 MHz

Centre frequencies shall be selected from a 125 kHz grid, starting at 1700.5 MHz and ending at 1709.5 MHz, as expressed by the following relationship:

$$A_n = 1700.375 + 0.125n \qquad \text{for } n = 1 \text{ to } 73$$

where n is an integer, and A_n is the centre frequency (in MHz) of the RF channel. The lowest available frequency shall be assigned first.

Unidirectional radio systems used for aural broadcasting STL services shall be licensed first in this band. If no frequencies are available in this band, new STL systems may be licensed in the bands 1780-1800 MHz and 1830-1850 MHz, in accordance with section 2.

4.1.2 RF channel centre frequencies for the bands 1780-1800 MHz and 1830-1850 MHz

Equipment employing frequency division duplexing or time division duplexing is permitted in these bands. The minimum transmit/receive (T/R) spacing will be determined by the limitations of the equipment and the ability to coordinate.

Centre frequencies shall be selected from a 125 kHz grid, starting at 1780.5 MHz and ending at 1849.5 MHz, as expressed by the following relationship:

$$B_n = 1780.375 + 0.125n \qquad \text{for } n = 1 \text{ to } 553$$

where n is an integer, and B_n is the centre frequency (in MHz) of the RF channel.

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Frequencies in the bands 1780-1800 MHz and 1830-1850 MHz shall be used first. Where there are no available frequencies in these bands, frequencies anywhere in the band 1780-1850 MHz can be used; a point-to-point system operating in the band 1800-1830 MHz through this provision shall follow the technical requirements specified in sections 5.1 and 6.1 below.

4.2 RF channel arrangements for fixed radio systems used for the management of the electricity supply in the frequency band 1800-1830 MHz

Fixed point-to-point and point-to-multipoint radio systems used for the management, operation and maintenance of the electricity supply shall use robust modulation schemes tolerant of interference, and the radio system design shall include link budget margins for self-interference impairments. Network planning techniques shall be used to maximize frequency reuse. To increase spectrum utilization, the centre frequencies shall be reassigned to use the same frequencies to the maximum extent possible. Normally, the total bandwidth assigned to a given licensee should not exceed 20 MHz. At the discretion of ISED's regional offices, requests for additional bandwidth may be considered if technical justification is provided.

In order to facilitate assignment of a range of frequencies and bandwidths in the available spectrum, centre frequencies may be assigned on a 100 kHz grid. The centre frequency shall be chosen such that the occupied bandwidth of the emission is contained within the frequency band 1800-1830 MHz.

4.2.1 RF channel centre frequencies for the band 1800-1830 MHz

Centre frequencies shall be selected from a 100 kHz grid, starting at 1800 MHz and ending at 1830 MHz, as expressed by the following relationship:

$$C_n = 1799.9 + 0.1n \qquad \text{for } n = 1 \text{ to } 301$$

where n is an integer, and C_n is the centre frequency (in MHz) of the RF channel.

In the case of extension, expansion, or modification of existing radio systems that were licensed as standard prior to the issuance of this SRSP, centre frequencies may be selected based on a 125 kHz grid established in the previous issue of this SRSP, as expressed by the following relationship:

$$C_n = 1799.875 + 0.125n \qquad \text{for } n = 1 \text{ to } 241$$

However, existing radio systems are encouraged to adopt the centre frequency plan based on a 100 kHz grid. In future revisions of this SRSP, ISED may remove the frequency plan based on a 125 kHz grid.

4.2.2 RF channel selection for the band 1800-1830 MHz

In the case of radio systems employing frequency division duplexing (FDD), the transmit channel of the terminal station shall be selected from the frequency band 1800-1810 MHz and the transmit channel of the base station shall be selected from the frequency band 1820-1830 MHz. The pair of channels shall be selected such that the frequency separation between them is either 20 MHz or 25 MHz.

In the case of radio systems employing time division duplexing (TDD), the frequency channel shall be selected from the frequency band 1810-1820 MHz.

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At the discretion of ISED's regional offices, a different frequency selection may be permitted on a case-by-case basis if suitable technical justification is provided.

4.3 Protection channels

Protection channels are not permitted in the bands 1700-1710 MHz, 1780-1800 MHz and 1830-1850 MHz. However, quad-path diversity applications will be considered on a hop-by-hop basis to solve special propagation problems. Quad-path diversity refers to the use of frequency diversity and space diversity on the same path.

5. Transmitter characteristics

This section describes the transmitter characteristics for radio systems.

5.1 Transmitter characteristics for radio systems in the frequency bands 1700-1710 MHz, 1780-1800 MHz and 1830-1850 MHz

The transmitter power delivered to the antenna input shall not exceed the limits for each authorized bandwidth shown in table 1.

Table 1: Power limits for radio systems in the frequency bands 1700-1710 MHz, 1780-1800 MHz and 1830-1850 MHz

Authorized bandwidth (MHz)	Power limit	
	Watts (W)	Decibel-watts (dBW)
10	10	+10
9	10	+10
8	10	+10
7	10	+10
6	10	+10
5	5	+7
4	5	+7
3	5	+7
2	2	+3
1	2	+3

An increase in transmitter power over the above specified limit may be permitted if technical justification is provided. The power delivered to the antenna input shall not exceed 20 W (+13 dBW) per channel.

The centre frequency of the emission shall be maintained within ±0.001% of the assigned frequency.

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5.1.1 Spectral efficiency

Digital systems shall have a minimum spectral efficiency of 1 bit/s/Hz on a single polarization.

5.2 Transmitter characteristics for fixed radio systems used for the management of the electricity supply in the frequency band 1800-1830 MHz

The transmitter power delivered to the antenna input shall not exceed 2 W in any 1 MHz segment within the channel bandwidth.

An increase in transmitter power over the above specified limit may be permitted if technical justification is provided. However, the power delivered to the antenna input shall not exceed 20 W (+13 dBW) per channel.

In the case of radio systems employing antenna systems consisting of multiple antenna elements, the above transmitter power limits apply to the aggregate power delivered across all antenna elements.

The centre frequency of the emission shall be maintained within ±0.001% of the assigned frequency.

5.2.1 Spectral efficiency

Digital systems shall normally have a minimum spectral efficiency of 1 bit/s/Hz on a single polarization. At the discretion of ISED's regional offices, digital systems with a lower spectral efficiency may be permitted on a case-by-case basis if suitable technical justification is provided.

5.2.2 Emission limits

In the 1 MHz bands immediately adjacent to the upper and lower limits of the authorized bandwidth, the mean power of emission in any band equal to 1% of the authorized bandwidth shall be attenuated by at least $43 + 10 \log_{10}$ (mean output power in watts) dB.

Beyond the first 1 MHz bands immediately adjacent to the upper and lower limits of the authorized bandwidth, the mean power of emission in a bandwidth that is equal to 1 MHz shall be attenuated by at least $43 + 10 \log_{10}$ (mean output power in watts) dB.

6. Antenna characteristics

This section describes the antenna characteristics for radio systems.

6.1 Antenna characteristics for radio systems in the frequency bands 1700-1710 MHz, 1780-1800 MHz and 1830-1850 MHz

For radio systems in the frequency bands 1700-1710 MHz, 1780-1800 MHz and 1830-1850 MHz, the co-polarized radiation pattern envelope in the horizontal plane of the antenna shall remain within envelope B, shown in figure 1 and table 2, for both vertical and horizontal polarizations.

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Figure 1: Minimum antenna characteristics for radio systems in the frequency bands 1700-1710 MHz, 1780-1800 MHz and 1830-1850 MHz

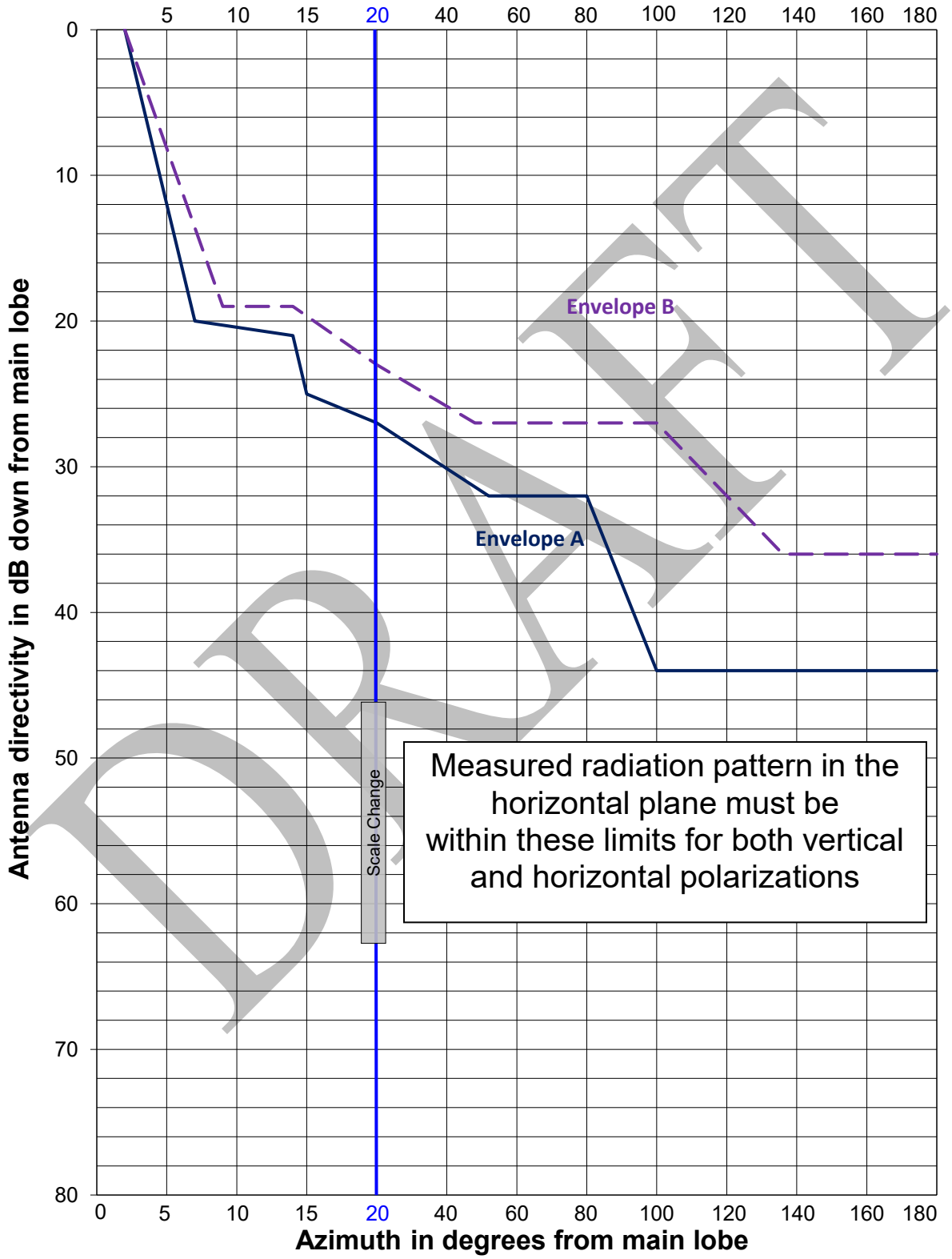

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Table 2: Minimum antenna characteristics for radio systems in the frequency bands 1700-1710 MHz, 1780-1800 MHz and 1830-1850 MHz

Envelope A		Envelope B	
Azimuth (in degrees from main lobe)	**Antenna directivity (in dB down from main lobe)**	**Azimuth (in degrees from main lobe)**	**Antenna directivity (in dB down from main lobe)**
2	**0**	**2**	**0**
7	**20**	**9**	**19**
14	**21**	**14**	**19**
15	**25**	**20**	**23**
20	**27**	**48**	**27**
52	**32**	**100**	**27**
80	**32**	**136**	**36**
100	**44**	**180**	**36**
180	**44**		

6.2 Antenna characteristics for fixed radio systems used for the management of the electricity supply in the frequency band 1800-1830 MHz

The use of directional antennas is encouraged to reduce interference and facilitate network planning; however, omnidirectional antennas are permitted in some cases, as outlined below.

If a point-to-multipoint radio system makes use of relay or repeater stations to improve or extend the coverage of a base station, these stations shall be treated as terminal stations for the purpose of antenna characteristics.

6.2.1 Antenna characteristics for base stations in point-to-multipoint links

The gain of base station antennas for point-to-multipoint systems shall be greater than or equal to 7 dBi. Omnidirectional antennas are permitted if they respect this minimum gain.

6.2.2 Antenna characteristics for terminal stations in point-to-multipoint links

If the transmitter power density at the antenna input is greater than or equal to 0.25 W/MHz, a terminal station shall make use of a directional antenna, and the antenna gain shall be greater than or equal to 12 dBi. In addition, the 3 dB beam width shall not exceed 30° in vertical and horizontal polarizations, and the front-to-back ratio shall be at least 20 dB.

If the transmitter power density at the antenna input is less than 0.25 W/MHz, omnidirectional and directional antennas are permitted.

6.2.3 Antenna characteristics for point-to-point links

Point-to-point systems shall make use of a directional antenna, and the antenna gain shall be greater than or equal to 12 dBi. In addition, the 3 dB beam width shall not exceed 30° in vertical and horizontal polarizations, and the front-to-back ratio shall be greater than or equal to 20 dB.

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7. Maximum equivalent isotropically radiated power

The maximum equivalent isotropically radiated power (e.i.r.p.) from the antenna shall not, in any case, exceed +55 dBW per RF channel.

8. Avoidance of the geostationary satellite orbit

As far as is practicable, sites for transmitting terrestrial stations operating in the fixed service should be selected so that the direction of maximum radiation of the antenna will be pointed at least 2° away from the geostationary satellite orbit, taking into account the effect of atmospheric refraction.

9. Enhanced technical requirements for moderately congested and highly congested areas

The technical requirements in this section apply only to radio systems operating in moderately congested and highly congested areas, as defined in the Geographical Differences Policy guideline in part B, section 1.6, of SP 1-20 GHz. The requirements apply only to radio systems in the frequency bands 1700-1710 MHz, 1780-1800 MHz and 1830-1850 MHz, excluding fixed radio systems used for the management, operation and maintenance of the electricity supply in the band 1800-1830 MHz.

The co-polarized radiation pattern envelope in the horizontal plane of the antenna shall remain within envelope A, shown in figure 1 and table 2, for both vertical and horizontal polarizations.

Digital systems shall have a minimum spectral efficiency of 2.4 bits/s/Hz on a single polarization.

10. International coordination

Stations operating in the band 1780-1850 MHz near the Canada-United States (U.S.) border are subject to the provisions of Arrangement D.

Canada does not currently have a formal arrangement with the U.S. government for the sharing of the 1700-1710 MHz band in the border regions. Licensees will be subject to any future agreements between Canada and the U.S. regarding use of these systems in the border regions, which may result in modifications of previously authorized stations.

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