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Spectrum Management and Telecommunications

Standard Radio System Plan

General Technical Requirements for Fixed Radio Systems Operating in Frequency Bands above 960 MHz

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Canada

Preface

SRSP-300-Gen, issue 2, *General Technical Requirements for Fixed Radio Systems Operating in Frequency Bands above 960 MHz* sets out general technical requirements for the efficient use of frequency bands above 960 MHz by radio systems in the fixed service which are licensed 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 Standard replaces SRSP-300-Gen, Issue 1. Further revision of this SRSP will be made as required.

The following are the main changes:

1. The scope of SRSP-300-Gen has been expanded from covering only fixed point-to-point radio systems to include all types of fixed radio systems operating above 960 MHz.
2. The scope of each requirement has been clarified to specify which requirements are applicable only to certain types of fixed radio systems.
3. Definitions of types of fixed radio system have been added in section 2.
4. Other editorial changes and clarifications 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

Contents

1. Scope

This Standard Radio System Plan (SRSP) sets out general technical requirements for the efficient use of frequency bands above 960 MHz by licensed radio systems in the fixed service. These systems include:

- Point-to-point radio systems;
- Point-to-multipoint radio systems;
- Unidirectional point-to-point radio systems used for the distribution of television video or audio broadcasting signals (such as studio-to-transmitter links used to relay television or radio program material between a media studio and the site of broadcasting station); and
- Point-to-transportable radio systems used for the distribution of media and program material from a temporary location to a studio (such as TV pick-up systems used for media to provide coverage of special events).

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 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 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.

This SRSP shall be used in conjunction with other SRSPs, as prescribed in the SRSP-300-Gen applicability list. Except where otherwise specified in the applicable SRSP for a specific frequency band, fixed service radio systems shall comply with the technical specifications prescribed in this document.

2. Definitions

The following is a list of terms and associated definitions commonly used in SRSP documents.

Adaptive error correction coding
Adaptive error correction coding is a technology which can automatically change the forward error correction of a link to compensate for changes in link conditions.

Adaptive modulation
Adaptive modulation is a technique used to modify the modulation of a signal based on the characteristics of the channel between the transmitter and receiver.

Authorized bandwidth
Authorized bandwidth refers to the bandwidth of frequency spectrum which is licensed by Innovation, Science and Economic Development Canada (ISED) to be used by a user of a radio system.

Automatic transmit power control
Automatic transmit power control (ATPC) is a technology used to improve the availability performance of a radio system by automatically increasing the transmit power during “fading” conditions which cause radio propagation impairments, such as heavy rainfall.

Availability objective
Availability objective is the percentage of time that a radio system is functioning at the designated minimum bit rate capacity.

Branching or spur routes
A branching or spur route refers to a link which branches off the main set of links used to interconnect two distinct locations. The branching or spur route enables an additional location to become interconnected with the two locations already connected by the main route.

Branch-off angle
A branch-off angle refers to the angle in the horizontal plane between a link in the main route of a radio system and an adjoining link of a branching or spur route in the same radio system.

Co-channel dual polarization
Co-channel dual polarization (CCDP) refers to a radio link using two different polarizations and the same frequency to simultaneously transmit separate information.

Duplex frequency block
A duplex frequency block refers to a contiguous range of spectrum which contains one set of radio frequency channels which are paired with channels from another duplex frequency block to form together a channel plan for a frequency division duplex system.

Equivalent isotropically radiated power
The product of the power supplied to the antenna and its gain relative to an isotropic antenna in a given direction.

Hop length
Hop length refers to the distance between the two end points of a direct radiocommunication link (i.e. distance from the transmitter antenna to the receiver antenna). For hops making use of passive reflectors or passive repeaters, the hop length refers to the sum of both path segments (i.e. transmitter to reflector/repeater plus reflector/repeater to receiver). In the case of active repeaters, a hop length refers to each individual path segment (e.g. transmitter to repeater).

Multi-band radio systems
A multi-band radio system is a radio system with capability to transmit on multiple frequency bands simultaneously.

Occupied bandwidth
The width of a frequency band, such that below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5% of the emitted power. This is also known as the 99% emission bandwidth. For transmitters in which there are multiple carriers, contiguous or non-contiguous in frequency, the occupied bandwidth is to be the sum of the occupied bandwidths of the individual carriers.

Point-to-point radio system
A fixed radiocommunication system used to relay information directly between two stations located at specified fixed points.

Point-to-multipoint radio system
A fixed radiocommunication system used to relay information between a single station (main or primary) located at a specified fixed point and a number of remote stations located at fixed points.

Point-to-transportable radio systems used for the distribution of media and program material from a temporary location to a studio
A fixed radiocommunication system used to relay television video or audio broadcasting signals related to coverage of temporary events. This includes TV pick-up systems consisting of links between a camera and a temporary studio or links between a temporary studio and a main studio.

Protection channels
In a radio system actively using one or more radio frequency channels, a protection channel refers to an additional radio frequency channel which is available to be used if one of the main channels cease functioning because of an impairment.

Quad-path diversity
Quad-path diversity refers to the simultaneous use of both frequency diversity and space diversity in a single radio link hop between two sites.

Spectral efficiency
Spectral efficiency refers to the measure of how much bit rate capacity a radio system provides per unit of a prescribed reference bandwidth.

Studio-to-transmitter links (STL)
A fixed radiocommunication system used to relay television or radio program material and related communications from the studio to the transmitter site of a television broadcast station.

TV pick-up system
A fixed radiocommunication system used for short-term per event operations between a remote television camera location and the studio. A TV pick-up may consist of a camera to transportable studio link and a transportable studio to TV broadcast studio link.

Two-frequency plan
A two-frequency plan refers to a frequency reuse plan for a bidirectional radio system composed of multiple point-to-point links, which is designed to operate with the reuse of the same pair of frequencies following successful coordination with other radio systems.

Unidirectional point-to-point radio systems used for the distribution of television video or audio broadcasting signals
A fixed radiocommunication system used to relay television video or audio broadcasting signals. This includes TV studio-to-transmitter links, studio-to-transmitter links for aural broadcasting, links between an off-air end point of a TV pick-up site and a broadcast transmitter site or distribution site (such as a cable TV headend), links between a remote studio and the principal studio of a television broadcasting or cable TV station.

3. General

This section includes information and technical requirements on general aspects, such as licensing, resolution of interference conflicts and spectrum sharing.

3.1 Purpose and application

SRSP-300-Gen must be used in conjunction with other SRSPs, as applicable to the specific frequency band and type of fixed radio system, for assessing its compliance with ISED requirements.

3.2 Licensing process

Existing radio systems that were licensed as standard prior to the issuance of issue 2 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.

3.3 Compliance of radio systems

Radio systems conforming to the technical requirements in this standard will be given priority in licensing over non-standard radio systems operating in the frequency band associated with an SRSP.

The Geographical Differences Policy (GDP) guideline applies to this SRSP. The GDP incorporates some technical requirements that are applied in areas having certain levels of congestion, which are further described in part B, section 1.6 of Spectrum Utilization Policy SP 1-20 GHz, *Revisions to Microwave Spectrum Utilization Policies in the Range of 1-20 GHz*.

The arrangements for non-standard systems are outlined in SP GEN, *General Information Related to Spectrum Utilization and Radio System Policies*.

Even if a radio system complies with the requirements of this SRSP and any other applicable SRSP, modifications may be required to that system by the operator whenever harmful interference is caused, as described in the *Radiocommunication Act* and *Radiocommunication Regulations*.

3.4 Resolution of interference conflicts between radio systems

When potential interference between radio systems cannot be resolved by the parties concerned, ISED must be advised. After consultation with these parties, ISED will determine the necessary modifications and schedule of modifications to resolve the conflict. Amongst other possible necessary modifications, ISED may require licensees and/or applicants to use a receiver with improved selectivity characteristics.

3.5 Spectrum sharing

It should be noted that the fixed service shares many frequency bands with other services in accordance with the *Canadian Table of Frequency Allocations*.

Information on the stations of other services operating in the different frequency bands is available on

ISED's Spectrum Management System website, ~~ISED's Spectrum Management System website~~ under Spectrum Management System Data.

Licensees and applicants for the deployment of fixed service shall coordinate their installations with licensees and applicants for other services.

4. Related documents

All Innovation, Science and Economic Development Canada publications related to spectrum management and telecommunications are available on the Spectrum Management and Telecommunications website. Refer to the following documents as needed:

- CPC-2-0-03, *Radiocommunications and Broadcasting Antenna Systems*
- CTFA, *Canadian Table of Frequency Allocations*
- RSP-113, *Application Procedures for Planned Radio Stations Above 960 MHz in the Fixed Service*
- SP Gen, *General Information Related to Spectrum Utilization and Radio Systems Policies*
- SP 1-20 GHz, *Revisions to Microwave Spectrum Utilization Policies in the Range of 1-20 GHz*
- TRC-43, *Designation of Emissions, Class of Station and Nature of Service*
- RIC-66, *Addresses and Telephone Numbers of District Offices*

Acronyms

CPC: Client Procedures Circular
CTFA: Canadian Table of Frequency Allocations
RIC: Radiocom Information Circular
RSP: Radio Standards Procedure
SP: Spectrum Utilization Policy
TRC: Telecommunications Regulation Circular

5. General technical requirements applicable to all fixed radio systems

This section describes technical requirements applicable to all fixed radio system types.

5.1 Bandwidth requirements

The occupied bandwidth of fixed radio systems must be fully contained within the permitted channel bandwidths specified in the radio frequency channel arrangements of the SRSP for the applicable frequency band under use. The aggregation or bonding of channels to create a single emission having a wider bandwidth than the limits specified in the SRSP of the applicable frequency band is not permitted. In the case of fixed radio systems having separate emissions on multiple channels, the emissions on each channel shall comply with all requirements set out in this SRSP as well as the SRSP of the applicable frequency band.

5.2 Transmitter power limits

In the case of systems using automatic transmit power control (ATPC) to maintain link availability

during deep fading conditions, the transmitter power at the antenna port may be temporarily increased by a value corresponding to the ATPC range, up to the maximum power specified in the applicable SRSP for the frequency band in which the transmitter operates. In addition, the maximum equivalent isotropically radiated power (e.i.r.p.) limits indicated in the corresponding SRSP shall be met at all times.

5.3 Spectral efficiency

Digital systems shall meet the minimum spectral efficiency specified in the applicable SRSP.

For the purposes of assessing compliance with the limits specified in the applicable SRSP, the spectrum efficiency (b/s/Hz) is calculated by dividing the maximum bit rate (payload + overhead) (Mb/s) by the channel spacing of the frequency plan used (MHz).

For radio systems employing co-channel dual polarization (CCDP), spectral efficiency is based on the maximum bit rate on a single polarization.

In the case of systems using adaptive modulation or adaptive error correction coding to maintain link availability during deep fading conditions, the spectral efficiency level may be temporarily lowered for a short period of time, provided that the link is designed to meet the minimum spectral efficiency requirements specified in the applicable SRSP.

6. General technical requirements applicable to fixed point-to-point radio systems and permanent unidirectional fixed radio systems used for the distribution of television video or audio broadcasting signals

This section describes technical requirements applicable to fixed point-to-point radio systems and permanent unidirectional fixed radio systems used for the distribution of television video or audio broadcasting signals.

6.1 Frequency planning

Fixed radio systems are normally required to be designed reusing the same frequency (or pair of frequencies in the case of systems employing frequency division duplex) on each hop. If the radio system is designed as a closed loop, it shall consist of an even number of hops. Frequency reuse is also required for additional frequencies added for capacity reasons. Where reasonable justification is provided (e.g. where siting prevents adequate antenna discrimination), other frequencies beyond the standard frequency pair may be used to resolve the issue, at the discretion of ISED's district offices.

6.2 High-low frequency block conformity

The proposed transmit frequency shall be in the same duplex frequency block as any nearby site within 100 meters having an existing transmit frequency in the same band (licensed or pending authorization). The same applies to the proposed receive frequency.

6.3 Branching or spur route channels

The frequencies assigned to a main route system should be reused on the branching or spur routes where

possible. The siting of repeater stations should be planned with this requirement in mind to ensure sufficient antenna discrimination at the branch-off angle.

6.4 Protection channels

a. One paired protection channel may be permitted for systems with more than one paired working channel in normal congestion and uncongested areas.
b. Protection channels for radio systems operating in moderately congested and highly congested areas are not permitted.
c. Quad-path diversity applications will be considered on a hop-by-hop basis to solve rare propagation problems which can't feasibly be resolved by other means.

Note: The levels of congestion (i.e. normal, moderate, high, and uncongested) are defined in SP 1-20 GHz.

6.5 Availability

The radio link availability objective for fixed point-to-point radio systems should not exceed 99.999% for a single hop. The availability parameter is validated by ISED using the Vigants-Barnett and Crane availability models. ISED will require additional technical justification if this availability objective is exceeded. Availability improvement factors provided by the use of diversity techniques are not taken into consideration for this criteria.

In the case of systems using ATPC, the availability requirement is evaluated based on the nominal transmit power (i.e. the power transmitted during normal propagation conditions).

6.6 Minimum hop length

The distance between end points of a fixed point-to-point link should meet or exceed the hop length values specified in Table 1 below. The applicant shall provide additional technical justification if the hop length of the fixed link is below the minimum value specified in Table 1. ISED's district offices will consider, at their discretion, the justification provided as part of their evaluation of the licence application.

Table 1: Minimum hop length for fixed point-to-point radio systems

Frequency range (MHz)	Minimum hop length for radio systems not using CCDP (km)	Minimum hop length for radio systems using CCDP (km)
960-6930	24	20
6930-8500	15	13
8500-11700	9	8
11700-13250	8	7
13250-15350	7	4
15350-19700	4	3
19700-23600	2	1
23600 and above	-	-

6.7 Unwanted Emission Limits

Depending on the operating frequency, transmitter emissions beyond the authorized bandwidth of a radio system shall be attenuated in accordance with the corresponding specifications.

6.7.1 For operating frequencies equal to or below 15.35 GHz

In any 4 kHz band, where the centre frequency is removed from the assigned frequency by more than 50% up to and including 250% of the authorized bandwidth, the mean power of emission shall be attenuated below the mean output power of the transmitter in accordance with the following equation:

$$A = 35 + 0.8\ (P - 50) + 10 \log_{10} B\ (dB)$$

where:

A = attenuation (in dB) below the mean output power level
P = percent removed from the centre frequency of the assigned RF channel
B = authorized bandwidth (in MHz)

Notes:
1. In no case shall the attenuation be less than 50 dB.
2. Attenuation greater than 80 dB or to an absolute power of less than −13 dBm/MHz is not necessary.

In any 1 MHz band, where the centre frequency is removed from the assigned frequency by more than 250% of the authorized bandwidth, the mean power of emission shall be attenuated by $43 + 10 \log_{10}$ (mean output power in watts) dB or 80 dB, whichever is the lesser attenuation.

6.7.2 For operating frequencies above 15.35 GHz

In any 1 MHz band, where the centre frequency is removed from the assigned frequency by more than 50% up to and including 250% of the authorized bandwidth, the mean power of emission shall be attenuated as specified by the following equation:

$$A = 11 + 0.4\ (P - 50) + 10 \log_{10} B\ (dB)$$

where:

A = attenuation (in dB) below the mean output power level
P = percent removed from the centre frequency of the assigned RF channel
B = authorized bandwidth in MHz

Notes:
1. In no case shall the attenuation be less than 11 dB.
2. Attenuation greater than 56 dB or to an absolute power of less than −13 dBm/MHz is not necessary.

In any 1 MHz band, where the centre frequency is removed from the assigned frequency by more than 250% of the authorized bandwidth, the mean power of emission shall be attenuated by $43 + 10 \log_{10}$ (mean output power in watts) dB or 80 dB, whichever is the lesser attenuation.

7. General technical requirements applicable to fixed point-to-point radio systems

This section describes technical requirements applicable only to fixed point-to-point radio systems.

7.1 Use of multi-band radio systems

The use of multiband radio systems is generally allowed for fixed point-to-point links, provided that each transmitted signal satisfies the requirements specified in this SRSP, as well as all requirements specified in the corresponding SRSPs of the frequency bands in which it operates.

7.2 Use of multiple input multiple output (MIMO) and co-channel dual polarization (CCDP) technology

In the specific case of point-to-point fixed service systems, a MIMO link consists of a link between two fixed antenna structures where each antenna structure has multiple physically separated antennas, and the system simultaneously transmits and receives multiple independent data streams on the same frequency. Co-channel dual polarization (CCDP) refers to a radio link using two orthogonal polarizations and the same frequency to simultaneously transmit separate information streams. The use of MIMO and CCDP is permitted as measures to increase capacity while minimizing the need for additional spectrum.

For the purpose of planning, coordination, and assessment of compliance with ISED's technical requirements, fixed point-to-point radio systems employing MIMO will be assessed as multiple single input single output (SISO) links, where each SISO link consists of one pair of the system's antennas. Each SISO link must satisfy the requirements specified in this SRSP, as well as all requirements specified in the corresponding SRSP of the frequency band in which the radio system operates.

Similarly, for fixed point-to-point radio systems employing CCDP, the use of each polarization must satisfy the requirements specified in this SRSP, as well as all requirements specified in the corresponding SRSP of the frequency band in which the radio system operates.

8. Antenna characteristics requirements applicable for all fixed radio systems

The antenna shall meet the radiation pattern envelope requirements as specified in the corresponding SRSP of the frequency band in which the radio system operates. Prior to the release of issue 1 of this SRSP in March 2023, ISED had a practice of considering a 3dB tolerance when evaluating the conformity of an antenna's radiation pattern to the applicable SRSP antenna mask. This means that the antenna's radiation pattern could exceed the mask by up to 3 dBs before the antenna was considered by ISED to be non-compliant. As of March 2023, this tolerance is no longer considered for new antenna systems. At any angle, the radiation pattern shall not exceed the radiation pattern envelope by any margin.

However, ISED will not require the removal or replacement of antenna systems licensed as standard prior to March 2023. As a result, modifications of such radio systems will be permitted by ISED to remain as standard if the antenna was previously considered standard due to the past application of the 3 dB tolerance.