Spectrum Management and Telecommunications

Standard Radio System Plan

Technical Requirements for Fixed Radio Systems Operating in the Bands 1427-1452 MHz and 1492-1518 MHz

Aussi disponible en français – PNRH-301,4
Preface

Issue 5 of SRSP-301.4 has been released to reflect policy changes in Canada Gazette notice DGTP-006-09, Spectrum Allocation and Utilization Policy Regarding the Use of Certain Frequency Bands Below 1.7 GHz for a Range of Radio Applications (SP-1.7 GHz), released in June 2009.

Changes include the following:

• N-MCS sub-band 1429.5-1430.5 MHz has been extended to 1429.5-1432 MHz, adding six frequency blocks. Consequential changes have been made through the rest of this document;

• frequency coordination of new and modified N-MCS or SRS stations located in the band 1427-1432 MHz is required with systems deployed in the United States, subject to the provisions of Arrangement K between Canada and the United States (Section 8); and

• numerous additional updates and editorial corrections have been made.

This Standard Radio System Plan (SRSP) replaces SRSP-301.4, Issue 4.

Issued under the authority of
the Minister of Industry

____________________________________
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1. **Intent**

1.1 This SRSP sets out the minimum technical requirements for the efficient use of:

- the frequency bands 1427-1452 MHz and 1492-1518 MHz by fixed, line-of-sight subscriber radio systems (SRS). These systems are characterized as two-way, point-to-multipoint.

- the frequency bands 1429.5-1432 MHz and 1493.5-1496.5 MHz, designated for fixed narrowband multipoint communication systems (N-MCS), including utility telemetry systems. Mobile N-MCS may also be deployed on a secondary basis.¹

This SRSP does not cover Wireless Medical Telemetry Services (WMTS) operating in the frequency band 1427-1429.5 MHz.

1.2 This SRSP is intended to be employed 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. Applications and modifications should be 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*, for SRS and the current issue of Client Procedures Circular CPC-2-1-23, *Licensing Procedure for Spectrum Licences for Terrestrial Services*, for N-MCS.

1.3 This SRSP specifies equipment 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 standard replaces SRSP-301.4, Issue 4. Further revision of this SRSP will be made as required.

2.2 Pursuant to document DGTP-010-09 entitled *Consultation on the Spectrum Allocations and Spectrum Utilization Policies for the Frequency Range 1435-1525 MHz (L-Band)*, a moratorium on all new licensing in the band 1435-1535 MHz is in effect.

2.3 Existing SRS, licensed as standard prior to the issuance of this SRSP, may continue to operate as standard. Extension and/or expansion of these existing systems using channels S1, S1’, S2 and S2’ will be considered by Industry Canada on a case-by-case basis. For new SRS, channels S1, S1’, S2 and S2’ are not available, and licensing on other SRS channels (see Section 4.1) must conform to the requirements of this standard.

2.4 Existing N-MCS, licensed as standard prior to the issuance of this SRSP, may continue to operate as standard.

¹ N-MCS licensees may also deploy mobile N-MCS on a secondary basis within their assigned frequency block and licence area. Any such mobile systems will operate on a no interference, no protection basis with regard to other users of these bands.
2.5 Radio systems conforming to these technical requirements will be given priority in licensing over non-standard radio systems operating in these bands.

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

2.7 Fixed radio systems operating in the bands 1452-1492 MHz and 1515-1525 MHz share this spectrum with other radiocommunication services as outlined in Spectrum Utilization Policy SP 1-3 GHz.

2.8 Point-to-point remote repeater systems and radio entrance links in the band 1427-1525 MHz used to implement SRS are considered part of SRS.

2.9 Although a radio system may conform to the requirements of this SRSP, modifications may be required to the system whenever harmful interference\(^2\) is caused.

2.10 When potential interference between radio systems cannot be resolved by the parties concerned, Industry Canada should be advised. After consultation with these parties, the Department will determine the necessary modifications and schedule of modifications to address the conflict.

2.11 Industry Canada may require licensees and/or applicants to use receiver selectivity characteristics that provide rejection of harmful interference.

2.12 N-MCS equipment will need to be type-approved (certified) in accordance with Radio Standards Specification RSS-142.

2.13 It should be noted that the radio astronomy service operates in the adjacent band, 1400-1427 MHz. Applicants for channels in the sub-band 1427-1432 MHz, proposing to operate within a 50-km radius of the Dominion Radio Astrophysical Observatory (DRAO) near Penticton, British Columbia (49° 19' 18" N and 119° 37' 08" W), must first coordinate their proposed frequency assignment with DRAO by contacting the Director of the Observatory, by telephone at 250-497-2361, or facsimile at 250-497-2355.

2.14 It should be further noted that the Digital Radio Broadcasting (DRB) service operates in the adjacent band, 1452-1492 MHz. The future use of the band 1452-1492 MHz for DRB has been under review for some time. If SRS channels S5, S6, S7, S1', S2' and S3' or N-MCS channels D, E and F are being considered for use, special frequency coordination considerations may be necessary according to the procedures outlined in annexes A and B respectively.

2.15 Licensees are advised that the United States uses the band 1435-1525 MHz for aeronautical mobile (telemetry) operations. The development of SRS and N-MCS stations in this band near the Canada-United States border could be affected by this aeronautical mobile (telemetry) use.

\(^2\) For the purpose of this SRSP, “harmful interference” means interference that endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance with regulations and technical requirements laid down by Industry Canada under the *Radiocommunication Act*. 
2.16 It should be noted that the fixed service shares this band with other services in accordance with the Canadian Table of Frequency Allocations.


3. Related Documents

The current issues of the following documents are applicable. They are available on Industry Canada’s Spectrum Management and Telecommunications website at [http://www.ic.gc.ca/spectrum](http://www.ic.gc.ca/spectrum).

- **SP 1-3 GHz**: Amendments to the Microwave Spectrum Utilization Policies in the 1-3 GHz Frequency Range
- **SP 1-20 GHz**: Revisions to Microwave Spectrum Utilization Policies in the Range of 1-20 GHz
- **SP-1.7 GHz**: Spectrum Allocation and Utilization Policy Regarding the Use of Certain Frequency Bands Below 1.7 GHz for a Range of Radio Applications
- **SP Gen**: General Information Related to Spectrum Utilization and Radio Systems Policies
- **---**: Canadian Table of Frequency Allocations 9 kHz to 275 GHz
- **RSP-113**: Application Procedures for Planned Radio Stations Above 960 MHz in the Fixed Service
- **RSS-142**: Narrowband Multipoint Communication Systems in the Bands 1429.5-1432 MHz and 1493.5-1496.5 MHz
- **TRC-43**: Designation of Emissions (Including Necessary Bandwidth and Classification), Class of Station and Nature of Service
- **CPC-2-1-22**: Licensing Procedure for Automatic Meter Reading Equipment in the 1.4 GHz Band
- **CPC-2-1-23**: Licensing Procedure for Spectrum Licences for Terrestrial Services
- **CPC-2-0-03**: Radiocommunication and Broadcasting Antenna Systems
- **Allotment Plan**: Allotment Plan for Digital Radio Broadcasting (DRB), Issue 2, November 1998
- **Arrangement K**: 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 Band 1427-1432 MHz By Telemetry Systems and Subscriber Radio Systems in the Fixed Service near the Canada-United States Border

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CPC - Client Procedures Circular  
RSP - Radio Standards Procedure  
RSS - Radio Standards Specification  
SP - Spectrum Utilization Policy  
TRC - Telecommunications Regulation Circular
4. **Radio Frequency (RF) Channel Arrangement Description**

4.1 **Subscriber Radio Systems (SRS)**

4.1.1 **RF Channel Arrangements**

The RF arrangements defined in this standard provide for an RF channel bandwidth of 3.5 MHz. Channel pairs are provided with a common transmit/receive separation of 66.5 MHz.

4.1.2 **RF Channel Centre Frequencies**

4.1.2.1 There are seven paired channels for which the centre frequencies are expressed by the following relationships and shown in Figure 1:

\[
\begin{align*}
\text{Lower half of the band} & \quad S_n = 1425.25 + 3.5n & \text{for } n = 1 \text{ to } 7 \\
\text{Upper half of the band} & \quad S_n' = 1491.75 + 3.5n & \text{for } n = 1 \text{ to } 7 \\
\end{align*}
\]

where \( n \) is the channel number, and \( S_n \) and \( S_n' \) are the centre frequencies, in MHz, of the paired channels.

![Figure 1](image-url)

4.1.2.2 Channels S1, S1', S2 and S2' are not available for licensing of new SRS (see Section 2.2).

4.1.3 **Assignment of Frequencies**

4.1.3.1 Normally, the lower sub-band channels are assigned to the central (hub) station transmitters and the upper sub-band channels are assigned to outstation (remote) transmitters. If repeater stations are used, the inbound and outbound repeater transmitter frequencies are assigned in one sub-band and receiver frequencies in the other sub-band. New radio systems in this band should use the highest available frequency channel that can be successfully coordinated starting at channels S6/S6'. Channels S7/S7' should be used only when none of the channels S3/S3' to S6/S6' are available for assignment. In each case, the channels assigned will be determined by the regional office in consultation with the applicant.
4.1.3.2 Applicants are advised that systems using frequency assignment S7 may be subject to adjacent band sharing with the mobile-satellite service (MSS). The implementation of MSS in Canada is subject to the *International Table of Frequency Allocations*, the *Canadian Table of Frequency Allocations* and domestic spectrum policies.

4.1.4 Spectral Efficiency/Channel Loading

4.1.4.1 Digital systems submitted for licensing shall have a minimum spectral efficiency of 1.0 bit/s/Hz of the RF channel bandwidth on a single polarization.

4.1.4.2 SRS employing analogue modulation shall have a minimum channel loading of 15 full duplex trunks.

4.2 Narrowband Multipoint Communication Systems (N-MCS)

4.2.1 RF Channel Arrangements

The sub-bands 1429.5-1432 MHz and 1493.5-1496.5 MHz, assigned for N-MCS, are divided into 10 frequency blocks of 250 kHz each and three frequency blocks of 1 MHz each, as follows. These blocks are not paired.

- **Block A1**: 1429.50-1429.75 MHz
- **Block A2**: 1429.75-1430.00 MHz
- **Block A3**: 1430.00-1430.25 MHz
- **Block A4**: 1430.25-1430.50 MHz
- **Block A5**: 1430.50-1430.75 MHz
- **Block A6**: 1430.75-1431.00 MHz
- **Block A7**: 1431.00-1431.25 MHz
- **Block A8**: 1431.25-1431.50 MHz
- **Block A9**: 1431.50-1431.75 MHz
- **Block A10**: 1431.75-1432.00 MHz

**1 MHz Blocks:**

- **Block D**: 1493.5-1494.5 MHz
- **Block E**: 1494.5-1495.5 MHz
- **Block F**: 1495.5-1496.5 MHz

Where justified by the capacity requirements of the N-MCS, more than one frequency block may be assigned in a given area.

Assignment of frequencies in these sub-bands should take into consideration the sharing and possible coordination with other services, as indicated in SP 1-3 GHz and SP 1.7 GHz.
5. **Transmitter Characteristics**

5.1 **SRS**

5.1.1 The transmitter power delivered to the antenna input shall not exceed 10 watts (+10 dBW) per RF channel.

5.1.2 The centre frequency of the emission shall be maintained within ± 0.003% of the assigned frequency.

5.2 **N-MCS**

The transmitter power delivered to the antenna input shall not exceed the levels specified in Radio Standards Specification RSS-142.

6. **Antenna Characteristics**

6.1 **SRS**

This standard does not specify minimum antenna characteristics for SRS. However, the Department may, on a case-by-case basis, specify minimum antenna discrimination characteristics to address coordination problems.

6.2 **N-MCS**

N-MCS antennas will normally not exceed +8 dBi gain. Higher gain antennas may be used when needed to facilitate frequency reuse, mitigate interference or deal with propagation problems in difficult terrain. If an antenna with greater than +8 dBi gain is to be used, the transmitter power delivered to the antenna may need to be reduced in order to comply with the maximum equivalent isotropically radiated power (e.i.r.p.) limitation of Section 7.2.

7. **Maximum Equivalent Isotropically Radiated Power (e.i.r.p.)**

7.1 **SRS**

The e.i.r.p. from the antenna shall not exceed +45 dBW per RF channel.

7.2 **N-MCS**

The e.i.r.p. from the antenna shall not exceed +18 dBW. Protection of SRS and other N-MCS must be assured when higher gain antennas are used.
8. Coexistence with Systems Deployed in the United States

8.1 Arrangement K: 1427-1432 MHz

Under the provisions of Arrangement K between Canada and the United States, a new or modified NMCS or SRS station located in the band 1427-1432 MHz is subject to frequency coordination requirements with systems deployed in the United States under the following conditions:

(a) the station is located at a distance less than 90 km from the Canada-United States border; and

(b) the station would produce, at ground level in the territory of the other country, a power flux density (pfd) level greater than -116 dBW/m² in any 1 MHz bandwidth.

Notwithstanding the above, a system licensed prior to the entry into force of Arrangement K may continue to operate in the frequency range 1427-1432 MHz using its currently authorized parameters.

Additional details regarding the coordination process are contained in Arrangement K.

8.2 Coordination in Bands Not Covered by an Arrangement

For the bands 1432-1452 MHz and 1492-1518 MHz, there is currently no coordination agreement with the United States. As a result, coordination of stations in the Canada-United States border area is not required at this time. Licensees should however be aware that, as neither Canadian nor U.S. licensees are required to coordinate their use of these bands in the border area, the possibility of harmful interference exists either to or from Canadian stations in these bands. Each instance of harmful interference will be dealt with on a case-by-case basis and may result in the requirement for licensees to modify the operating parameters of their stations in order to eliminate the interference.

Furthermore, licensees should also be aware that they will be subject to the provisions of any future agreements or arrangements between Canada and the United States for use of these frequency bands in the Canada-United States border area.

A.1 This coordination process identifies coordination requirements for DRB systems and SRS in adjacent bands. The procedure applies to: DRB systems on channels 1, 2 and 3; SRS on channels S5, S6 and S7 (adjacent to 1452 MHz); DRB systems on channels 21, 22 and 23; and to SRS on channels S1', S2' and S3' (adjacent to 1492 MHz).

A.2 It should be noted that the DRB Allotment Plan avoids the allotment of channels adjacent to SRS channels to the extent possible, thus reducing the number of potential interference cases. Therefore, a fixed service applicant of new SRS should take into consideration the existence of DRB allotments in order to minimize the possibility of SRS receivers experiencing unacceptable interference from high DRB transmission levels.

A.3 When a new fixed SRS station is being planned, the SRS applicant must identify whether the proposed receiving site is located within the trigger distance of a DRB transmitting station or DRB allotment. When a new DRB (including gap-fillers) station is being planned, the DRB applicant will identify whether any existing SRS receiving sites are located within the trigger distance of the DRB transmitting station. These trigger distances are provided by a series of graphs found in Figure 1.

A.4 For stations located within the trigger distance, a detailed interference analysis should be performed by the applicant using, where possible, the relevant terrain elevation data, the actual SRS parameters, as well as DRB system operating parameters that are consistent with the digital service area (DSA) shown in the DRB Allotment Plan.

A.5 If the detailed analysis shows the possibility of interference, mitigation techniques should be investigated by the applicant to facilitate the operation of both systems. These techniques may include, but are not limited to, improved filtering in receivers, use of cross-polarization, as well as modification of DRB and SRS parameters such as power, location and channel.
Figure 1

<table>
<thead>
<tr>
<th>DRB/SRS Channel Combination</th>
<th>Ch1/S7</th>
<th>Ch2/S7</th>
<th>Ch1/S6</th>
<th>Ch2/S6</th>
<th>Ch1/S5</th>
<th>Ch2/S5</th>
<th>Ch3/S5</th>
<th>Ch23/S3'</th>
<th>Ch21/S3'</th>
<th>Ch22/S1'</th>
<th>Ch21/S1'</th>
<th>Ch22/S2'</th>
<th>Ch21/S2'</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRB Power</td>
<td>Series 1</td>
<td>Series 2</td>
<td>Series 3</td>
<td>Series 4</td>
<td>Series 5</td>
<td>Series 6</td>
<td>Series 7</td>
<td>Series 8</td>
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<td></td>
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<tr>
<td>dBW</td>
<td>kW</td>
<td>Coordination Trigger Distance in Kilometres</td>
<td></td>
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<tr>
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<td>108</td>
<td>95</td>
<td>86</td>
<td>81</td>
<td>76</td>
<td>70</td>
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<td>57</td>
<td></td>
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<td>37</td>
<td>30</td>
<td></td>
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<td>64</td>
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<td>46</td>
<td>37</td>
<td>29</td>
<td>21</td>
<td>12</td>
<td>6</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Coordination Trigger Distance

- Series 1
- Series 2
- Series 3
- Series 4
- Series 5
- Series 6
- Series 7
- Series 8

h(DRB) = 100 m, h(SRS) = 150 m

B.1 This coordination process identifies coordination requirements for DRB systems and N-MCS in adjacent bands. The procedure applies to DRB channel 23 (1491.184 MHz) and N-MCS channel blocks D, E and F. Approximately 1.5 MHz separates the band edges of the two systems.

B.2 When a new N-MCS is being planned, the N-MCS applicant should determine if the proposed N-MCS is within the frequency reuse contour (FRC) of the DRB system. If a new DRB system is planned, the DRB applicant should determine if the FRC of the proposed DRB overlaps the area authorized for the N-MCS.

B.3 For proposed stations within these FRC ranges, a detailed interference analysis should be conducted by the applicant using, where possible, the relevant terrain elevation data, the actual N-MCS parameters, as well as DRB system operating parameters that are consistent with the digital service area (DSA) shown in the DRB Allotment Plan.

B.4 If the detailed engineering analysis shows the possibility of interference, mitigation techniques should be investigated to facilitate operation of both systems. These techniques may include, but not be limited to, improved filtering in the receivers, use of cross-polarization techniques, as well as modification of DRB and N-MCS parameters such as power, location and channel.

B.5 The assignment of channel blocks for N-MCS will take into account the existence of DRB allotments in order to minimize the possibility of N-MCS receivers experiencing unacceptable interference from high DRB transmission levels. New N-MCS should not constrain the implementation of DRB by using adjacent channels in close proximity to DRB allotments. Depending on equipment configurations, it is possible that N-MCS channel blocks D, E and F may not be able to operate in the same geographic area as DRB channel 23.

C.1 Conditions for Coordination with Other Canadian Licensees

C.1.1 This coordination process identifies requirements for SRS and N-MCS that have a co-channel relationship. The procedure applies between:

- N-MCS operating in the same block;
- N-MCS operating in blocks A1-A10 and SRS channels S1 and S2; and
- SRS channel S1' and N-MCS operating in blocks D, E or F.

C.1.2 Coordination is only required with incumbent licensees located within 90 km of the proposed station.

C.1.3 An SRS applicant is required to coordinate with the incumbent N-MCS licensee if the power flux density (pfd) level of any proposed SRS station exceeds -116 dBW/m²/MHz at or within the boundary of the N-MCS operator’s licence area.

C.1.4 An N-MCS applicant is required to coordinate with all incumbent SRS licensees where the pfd level of a proposed N-MCS station exceeds -116 dBW/m²/MHz at the SRS hub or remote station.

C.1.5 An N-MCS applicant is required to coordinate with incumbent N-MCS licensees operating in the same frequency block if the pfd level of any proposed N-MCS station exceeds -116 dBW/m²/MHz within the incumbent operator’s licence area.

C.2 Coordination Process

The following coordination procedures are intended to be used between two licensees in the absence of another mutually agreed upon standard to govern coordination of any proposed transmitter.

C.2.1 Where coordination is required, as identified above, the SRS or N-MCS applicant is required to contact all incumbent licensees\(^3\) with a licence area within 90 km of the proposed SRS or N-MCS station whose assigned frequency channels overlap those of the proposed station to request coordination. This contact shall be through registered mail (or other mutually acceptable method). It is suggested that the data elements given in Section C.4 be provided.

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C.2.2 A recipient of a coordination request must respond by registered mail⁴ (or other mutually acceptable method) within 45 days of receipt to state any objection to deployment of the proposed system. If no objection is raised within that time frame, the licensee initiating the coordination request may proceed with deployment.

C.2.3 If an objection is raised, licensees shall collaborate to develop a mutually acceptable solution to the potential interference problem. It is recommended that a detailed interference analysis be performed using actual SRS and N-MCS parameters and terrain elevation data.

C.2.4 If the detailed analysis shows the possibility of interference, mitigation techniques should be investigated by the applicant to facilitate the operation of both systems. These techniques may include, but are not limited to, improved filtering in receivers, use of cross-polarization or smart antennas and modification of system parameters such as power, location and channel.

C.2.5 In the event that potential interference cannot be resolved between licensees, Industry Canada should be advised. After consultation with these parties, the Department will determine the necessary modifications and schedule of modifications to address the conflict. A station that requires coordination shall not be placed in operation until an understanding has been reached.

C.2.6 Proposed facilities must be deployed within 180 calendar days of the conclusion of coordination, otherwise coordination must be reinitiated.

C.2.7 Coordination must be reinitiated in the case of modifications that would result in an increase of pfd or a change in polarization.

C.2.8 All results of analysis on pfd and agreements made between licensees must be retained by the licensees and made available to the Department upon request.

⁴ The date of postmark will be taken as the date of response.
C.3 Sample pfd Calculation

The following examples, provided for information, illustrate how the pfd level may be determined.\(^5\)

Proposed station parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Example 1</th>
<th>Example 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Type</td>
<td></td>
<td>SRS</td>
<td>N-MCS</td>
</tr>
<tr>
<td>Station transmitter power into the antenna PT</td>
<td>(P_T)</td>
<td>10 dBW</td>
<td>7 dBW</td>
</tr>
<tr>
<td>Channel bandwidth B</td>
<td>(B)</td>
<td>3.5 MHz</td>
<td>50 kHz</td>
</tr>
<tr>
<td>Transmitter antenna height above ground (H_T)</td>
<td>(H_T)</td>
<td>30 metres</td>
<td>10 metres</td>
</tr>
<tr>
<td>Transmitter antenna gain (G_T)</td>
<td>(G_T)</td>
<td>18 dBi</td>
<td>8 dBi</td>
</tr>
<tr>
<td>Channel centre frequency (F_{MHz})</td>
<td>(F_{MHz})</td>
<td>1428.75 MHz</td>
<td>1429.525 MHz</td>
</tr>
<tr>
<td>Distance from the transmitter to the incumbent station or licence area (D_{km})</td>
<td>(D_{km})</td>
<td>70 km</td>
<td>40 km</td>
</tr>
</tbody>
</table>

C.3.1 Example 1: SRS

Under free-space propagation conditions, the spectral power density in dBW/MHz may be calculated as follows:

\[
\begin{align*}
    P_{\text{boundary}} &= P_T' + G_T - (20 \log F_{MHz} + 20 \log D_{km} + 32.4) \\
    &= (4.6 + 18 - 20 \log (1428.75) - 20 \log (70) - 32.4) \text{ dBW/MHz} \\
    &= (4.6 + 18 - 63.1 - 36.9 - 32.4) \text{ dBW/MHz} \\
    &= -109.8 \text{ dBW/MHz}
\end{align*}
\]

where: \(P_T' = P_T - 10 \log B_{MHz}\)

\[
\begin{align*}
    &= 10 - 10 \log (3.5) \\
    &= 4.6 \text{ dBW/MHz}
\end{align*}
\]

Then, the power flux density in dBW/m\(^2\) in 1 MHz (pfd) may be calculated as follows:

\[
\begin{align*}
    \text{pf}d &= P_{\text{boundary}} - 10 \log A_r \\
    &= (-109.8 - 10 \log (3.508 \times 10^{-3})) \text{ dBW/m}^2/\text{MHz} \\
    &= (-109.8 - (-24.5)) \text{ dBW/m}^2/\text{MHz} \\
    &= -85.3 \text{ dBW/m}^2/\text{MHz}
\end{align*}
\]

where: \(A_r = \frac{\lambda^2}{(4\pi)}\)

\[
\begin{align*}
    &= \frac{c^2}{(4\pi F_{Hz}^2)} \\
    &= \frac{(3 \times 10^8)^2}{(4\pi \times (1428.75 \times 10^6)^2)} \\
    &= 3.508 \times 10^{-3} \text{ m}^2
\end{align*}
\]

\(^5\) It should be noted that the example calculation assumes line-of-sight conditions. Where line-of-sight does not exist, an appropriate propagation model that takes into account the non-line-of-sight situation should be used. If the propagation loss calculated using an alternative propagation model is known, this value in decibels can be substituted for the function \((20 \log F_{MHz} + 20 \log D_{km} + 32.4)\) in the following examples.
C.3.2 Example 2: N-MCS

Under free-space propagation conditions, the spectral power density in dB(W/MHz) for N-MCS using bandwidths of less than 1 MHz may be calculated as follows:

\[
P_{\text{boundary}} = P_T + G_T - (20 \log F_{\text{MHz}} + 20 \log D_{\text{km}} + 32.4)
\]
\[
= (7 + 8 - 20 \log (1429.525) - 20 \log (40) - 32.4) \text{ dBW/MHz}
\]
\[
= (7 + 8 - 63.1 - 32.0 - 32.4) \text{ dBW/MHz}
\]
\[
= -112.5 \text{ dBW/MHz}
\]

Then, the power flux density in dBW/m² in 1 MHz (pfD) may be calculated as follows:

\[
pfD = P_{\text{boundary}} - 10 \log A_r
\]
\[
= (-112.5 - 10 \log (3.505 \times 10^{-3})) \text{ dBW/m²/MHz}
\]
\[
= (-112.5 - (-24.6)) \text{ dBW/m²/MHz}
\]
\[
= -87.9 \text{ dBW/m²/MHz}
\]

where:

\[
A_r = \frac{\lambda^2}{(4\pi)}
\]
\[
= \frac{c^2}{(4\pi F_{\text{Hz}})^2}
\]
\[
= \frac{(3 \times 10^8)^2}{(4\pi x (1429.525 \times 10^6))^2}
\]
\[
= 3.505 \times 10^{-3} \text{ m}^2
\]

C.4 Parameters for Coordination

When coordination is required, it is suggested that the following parameters be provided:

Licensee information (Corporate name/Mailing address/Telephone/Fax/E-mail)
Location of transmitter (Community/Province)
Geographical coordinates of transmitting antenna
e.i.r.p. (dBW)
Ground elevation and antenna height above ground (m)
Centre frequency (MHz)
Polarization
Maximum antenna gain (dBi)
Antenna pattern/tabulation of the pattern
Azimuth of the maximum antenna gain
Bandwidth and emission designation(s)