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Standard Radio System Plan

Technical Requirements for Fixed Radio Systems Operating in the Band 38.6-40.0 GHz

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Canada

Preface

Issue 3 of SRSP-338.6 has been developed to reflect modifications made to RSS-191, Issue 2. The certification requirements for point-to-point broadband communication systems in the band 38.6-40.0 GHz have been removed from RSS-191, Issue 2 and transferred to SRSP-338.6, Issue 3.

Issued under the authority
of the Minister of Industry

Robert W. McCaughern
Director General
Spectrum Engineering Branch

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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 frequency band 38.6-40.0 GHz for digital systems in the fixed service for broadband wireless applications, including point-to-point and point-to-multipoint systems.
- 1.2 This SRSP is intended to be employed in the design and specification of radio systems and equipment, and 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, *Application Procedures for Planned Radio Stations Above 960 MHz in the Fixed Service* (RSP-113).
- 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 SRSP replaces SRSP-338.6, Issue 2. Further revision of this SRSP will be made as required.
- 2.2 Radio systems conforming to these technical requirements will be given priority in licensing over non-standard radio systems operating in this band.
- 2.3 The arrangements for non-standard systems are outlined in *General Information Related to Spectrum Utilization and Radio Systems Policies* (SP-Gen).
- 2.4 Although a radio system may conform to the requirements of this SRSP, modifications may be required to the system whenever harmful interference¹ is caused.
- 2.5 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 resolve the conflict.
- 2.6 Industry Canada may require licensees and/or applicants to use receiver selectivity characteristics that provide rejection of harmful interference.
- 2.7 It should be noted that the fixed terrestrial service shares this band with other services in accordance with the *Canadian Table of Frequency Allocations* and spectrum utilization policies.

¹ 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*.

- 2.8 It should be noted that an arrangement exists between Canada and the United States regarding power flux density levels produced by the fixed-satellite service (FSS) to protect the fixed service. See excerpt from *Arrangement Between Canada and the United States on Principles to Govern the Use of the 37.5-42.5 GHz Band by the Fixed and Fixed-Satellite Services* (Annex E).
- 2.9 The Department will require applicants and/or licensees to cooperate in the selection and use of the assigned frequencies in order to minimize interference, thereby obtaining the most effective use of the authorized spectrum.
- 2.10 For point-to-multipoint implementations operating in the band 38.6-40.0 GHz, the equipment must be type-approved in accordance with Radio Standards Specification, *Local Multipoint Communication Systems in the Band 25.35-28.35 GHz; Point-to-Point and Point-to-Multipoint Broadband Communication Systems in the Bands 24.25-24.45 GHz and 25.05-25.25 GHz and Point-to-Multipoint Broadband Communications in the Band 38.6-40.0 GHz* (RSS-191).
- 2.11 Licensees are required upon request to make available to Industry Canada information on certain technical parameters of their hub and point-to-point stations.

3. Related Documents

The current issues of the following documents are applicable and available on the [Spectrum Management and Telecommunications website](http://ic.gc.ca/spectrum) at <http://ic.gc.ca/spectrum>.

Canadian Table of Frequency Allocations

Policy and Licensing Procedures for the Auction of the 24 and 38 GHz Frequency Bands

SP-Gen *General Information Related to Spectrum Utilization and Radio Systems Policies*

RSS-191 *Local Multipoint Communication Systems in the Band 25.35-28.35 GHz; Point-to-Point and Point-to-Multipoint Broadband Communication Systems in the Bands 24.25-24.45 GHz and 25.05-25.25 GHz and Point-to-Multipoint Broadband Communications in the Band 38.6-40.0 GHz*

TRC-43 *Notes Regarding Designation of Emission (Including Necessary Bandwidth and Classification), Class of Station and Nature of Service*

CPC-2-1-17 *38 GHz Licensing Process and Application Procedure*

CPC-2-0-03 *Radiocommunication and Broadcasting Antenna Systems*

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

Interim Arrangement Concerning the Sharing Between Canada and the United States of America on Broadband Wireless Systems in the Frequency Bands 24.25-24.45, 25.05-25.25 GHz, and 38.6-40.0 GHz

Arrangement Between Canada and the United States on Principles to Govern the Use of the 37.5-42.5 GHz Band by the Fixed and Fixed-Satellite Services

CPC – Client Procedures Circular

RSS – Radio Standards Specification

SRSP – Standard Radio System Plan

TRAA – Terrestrial Radiocommunication Agreements and Arrangements

TRC – Telecommunications Regulation Circular

4. Radio Frequency Block Arrangement Description

4.1 The band 38.6-40.0 GHz is divided into 14 (50 MHz + 50 MHz) paired frequency blocks², as shown in Table 1.

4.2 The frequency blocks available for licensing are symmetrically paired to facilitate frequency division duplex (FDD) systems. For these systems in Blocks C/C' to J/J', the base station to subscriber links are preferred in the upper frequency block, and the subscriber to base station links are preferred in the lower frequency block. Time division duplex (TDD) systems may operate in either sub-band.

Table 1: 38 GHz Band Plan and Associated Usage

Block	Lower Frequency Block (MHz)	Upper Frequency Block (MHz)	Usage
A/A'	38600 – 38650	39300 – 39350	P-P
B/B'	38650 – 38700	39350 – 39400	P-P
C/C'	38700 – 38750	39400 – 39450	P-P, P-MP
D/D'	38750 – 38800	39450 – 39500	P-P, P-MP
E/E'	38800 – 38850	39500 – 39550	P-P, P-MP
F/F'	38850 – 38900	39550 – 39600	P-P, P-MP
G/G'	38900 – 38950	39600 – 39650	P-P, P-MP
H/H'	38950 – 39000	39650 – 39700	P-P, P-MP
I/I'	39000 – 39050	39700 – 39750	P-P, P-MP
J/J'	39050 – 39100	39750 – 39800	P-P, P-MP
K/K'	39100 – 39150	39800 – 39850	P-P
L/L'	39150 – 39200	39850 – 39900	P-P
M/M'	39200 – 39250	39900 – 39950	P-P
N/N'	39250 – 39300	39950 – 40000	P-P

² For the purpose of this SRSP, a frequency block is defined as a contiguous portion of spectrum within a frequency band, typically assigned to a single operator. A frequency block may accommodate one or more channels. A channel is defined as a specified portion of the radio frequency spectrum that carries a specific radio signal.

- 4.3 The frequency blocks A/A', B/B', and K/K' to N/N' are licensed on a shared basis among several operators. Operators may deploy point-to-point systems in accordance with their spectrum licences.
- 4.4 The frequency blocks C/C' to J/J' are licensed on an area-exclusive basis. Operators may deploy point-to-point and/or point-to-multipoint systems within their spectrum licensed service areas.

5. General Coordination Requirements for Frequency Blocks A/A' to N/N'

- 5.1 Licensees are expected to take full advantage of interference mitigation techniques such as antenna discrimination, polarization, frequency offset, shielding, site selection, and/or power control to facilitate the coordination of systems.
- 5.2 If a licence is transferred, the sharing agreement(s) developed between the former licensees shall remain in effect until superseded by a new agreement between the licensees.
- 5.3 In the event that a satisfactory agreement or successful coordination between the licensees is not reached, the installing licensee should inform Industry Canada. In these cases, the Department may impose appropriate technical limitations to facilitate reasonable implementation of systems.

6. International Inter-System Coordination

Use of the band 38.6-40.0 GHz near the Canada/United States border is subject to the provisions of the *Interim Arrangement Concerning the Sharing Between Canada and the United States of America on Broadband Wireless Systems in the Frequency Bands 24.25-24.45, 25.05-25.25 GHz, and 38.6-40.0 GHz*.

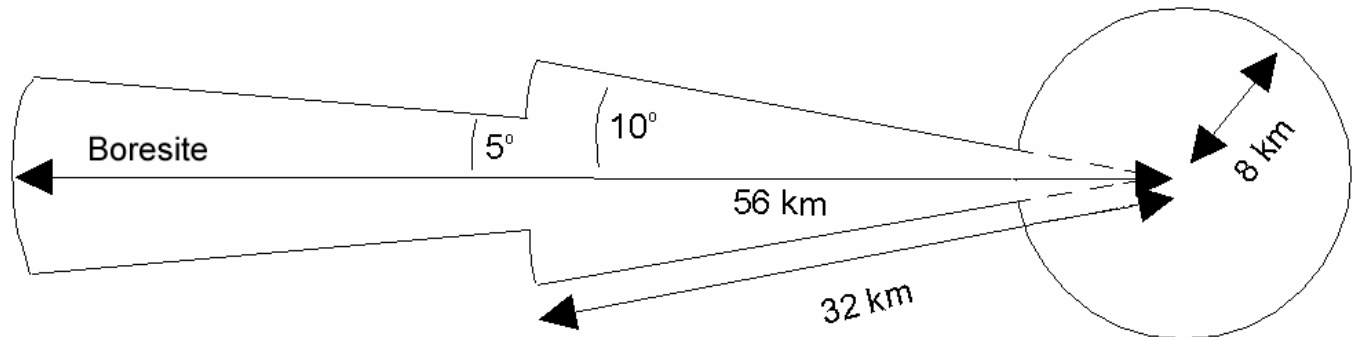
7. Domestic Inter-System Coordination for Point-to-Point Frequency Blocks A/A', B/B', and K/K' to N/N'

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 38 GHz transmitter. Licensees who propose transmitters that would normally trigger the present procedure, but who can mutually agree to an alternate coordination procedure, are not bound by this process.

7.1 38 GHz Co-Channel³, Frequency Coordination

7.1.1 General Coordination Trigger Criteria

Whenever a licensee seeks to install facilities, successful completion of applicable coordination is required prior to activation. Coordination will be required whenever a proposed transmitting station coordination footprint encompasses existing or previously notified receiving stations of another licensee. The coordination footprint extends to the following distances:



7.1.2 Notification and Response Process

7.1.2.1 General

If a proposed station triggers the coordination process, the installing licensee will be obligated to notify all licensees concerned. The said notice shall include the applicant's interference analysis and all data required for the recipients to perform an interference analysis (see Annex A for suggested parameters).

It is recommended that prior to commencement of operation of a 38 GHz system, field tests be performed to determine whether interference caused by building reflections or unknown frequency sources, which was not anticipated during the interference calculations⁴, is detected at the proposed site while looking along the proposed azimuth.

7.1.2.2 Response Time

Upon receipt of a coordination notice, a recipient shall have a maximum of 10 business days to submit an interference objection. This objection shall include the calculation details of all potential cases of unacceptable interference into and from facilities proposed in the notice. Failure of a recipient to respond to a coordination notice within the 10 business day time frame will indicate that the recipient has no interference objection(s) to the facilities proposed in the notice.

³ For this coordination procedure, radio system "B" requires coordination with radio system "A" if there is any significant overlap of the interior spectrum skirts (i.e., both co-channel and adjacent channel, regardless of their occupied bandwidth).

⁴ Calculations can be made with the help of Bulletin TSB10-F, *Interference Criteria for Microwave Systems*, available from the Telecommunications Industry Association (TIA), or other recognized coordination methodology and criteria.

7.1.2.3 Expedited Notification and Response Process

At times, it may become necessary for licensees to deploy systems even more rapidly than provided for in the notice and response procedure contained in this recommendation. To do so, licensees shall be allowed to activate systems immediately upon confirmation of receipt of the coordination notice, provided that the notice clearly identifies a licensee's intent to do so, and includes the activation date, the time, and a 24-hour contact telephone number for notification, should an interference case occur.

Licensees activating facilities under this expedited procedure will be held wholly responsible for avoiding and/or resolving any cases of interference created by such activation, and will be required to cease transmission immediately upon receiving verbal and/or written notice from another licensee that interference has occurred. This requirement will remain in effect until the standard 10-day coordination period has expired.

7.1.2.4 Time to Construct/Commencement of Operation

Upon successful resolution of all interference objections, the licensee shall so inform Industry Canada and have 90 days to construct and commence operation.

7.1.2.5 Notice of Operation/Notice of Decommission

Within two (2) business days of completion of construction and initiation of operation of coordinated facilities, a licensee will notify all licensees who received a coordination notice that facilities contained in that notice are in permanent operation.

Upon decommission of previously operational facilities, a licensee shall notify all other affected parties that a particular facility has been permanently taken out of service within two (2) business days of decommission. Affected parties are defined as those who would have received a coordination notice under this recommendation had this been a proposed activation.

7.2 38 GHz Adjacent Block, Frequency Coordination

Although coordination between adjacent block licensees operating in the same vicinity is not required in most cases, licensees may agree to coordinate certain installations to avoid interference.

8. Domestic Inter-System Coordination for Point-to-Point and Point-to-Multipoint Frequency Blocks C/C' to J/J'

8.1 Domestic coordination is required between licensed service areas⁵ where the shortest distance between the respective service area boundaries is less than 60 km⁶. Operators are encouraged

⁵ Annex B is provided as a guide to determine which service areas should be considered for coordination.

⁶ In the event that an operator uses sites of very high elevations relative to local terrain that could produce interference to service areas beyond 60 km, the operator shall coordinate with the affected licensee(s).

to arrive at mutually acceptable sharing agreements that would allow for the provision of service of each licensee within their service area to the maximum extent possible.

- 8.2 In circumstances where a sharing agreement does not exist or has not been concluded between operators whose service areas are less than 60 km apart, the following coordination process shall be employed:
 - 8.2.1 Operators are required to calculate the power flux density (pfd) at the service area boundary of the neighbouring service area(s) for the transmitting facilities. Power flux density is calculated using accepted engineering practices, taking into account such factors as propagation loss, atmospheric loss, antenna directivity toward the service boundary, and curvature of the Earth. The pfd level at the service area boundary shall be the maximum value for elevation points up to 500 m above local terrain elevation. (See Annex D for a sample calculation of a pfd level.)
 - 8.2.2 Deployment of facilities that generate a pfd less than or equal to -125 dBW/m^2 in any 1 MHz (pfd A) at the other service area boundaries is not subject to any coordination requirements.
 - 8.2.3 Deployment of facilities that generate a pfd greater than pfd A (-125 dBW/m^2 in any 1 MHz), but less than or equal to pfd B (-105 dBW/m^2 in any 1 MHz) at the other service area boundaries, is subject to successful coordination between the affected licensees in accordance with the following coordination process:
 - 8.2.3.1 The operator must notify the respective licensee(s) of its intention to deploy the facility(ies), and submit the information necessary to conduct an interference analysis.
 - 8.2.3.2 The recipient of the notification must respond within 30 calendar days to indicate any objection to the deployment. Objection may be based on harmful interference to existing systems⁷ only.
 - 8.2.3.3 If there is no objection raised, the deployment may proceed.
 - 8.2.3.4 If an objection is raised, the respective licensees must work in collaboration to develop a suitable agreement between the licensees before the deployment of facilities. The time frame to develop such an agreement should not exceed 30 calendar days.
 - 8.2.3.5 Proposed facilities must be deployed within 120 calendar days of the conclusion of coordination, otherwise, coordination must be re-initiated as per section 8.2.
 - 8.2.4 Deployment of facilities that generate a pfd greater than pfd B (-105 dBW/m^2 in any 1 MHz) at the other service area boundaries is subject to successful coordination between the affected licensees.
 - 8.2.5 The above process is described graphically in Annex C of this document.

⁷ Existing systems include systems that are operational prior to the receipt of notification, or systems that have previously been successfully coordinated.

- 8.3 Licensees shall ensure that the pfd at the boundary of the neighbouring service areas that have not been licensed does not exceed pfd B.
- 8.4 All results of analysis on pfd and agreements made between licensees must be retained by the licensees and made available to Industry Canada upon request.
- 8.5 Although coordination between adjacent block licensees operating in the same vicinity is not required in most cases, licensees may agree to coordinate certain installations to avoid interference.

9. Technical Requirements for Point-to-Point Usage in Frequency Blocks A/A' to N/N'

9.1 Frequency Stability

The centre frequency of the emission shall be maintained within $\pm 0.001\%$ of the assigned frequency.

9.2 Transmitter Output Power

The transmitter power into the antenna must not exceed +10 dBW per carrier.

9.3 Equivalent Isotropically Radiated Power (e.i.r.p.)

The maximum e.i.r.p. of a transmit station must not exceed +55 dBW per carrier.

9.4 Transmitter Unwanted Emissions

9.4.1 Single-Carrier Transmitter

Unwanted emissions shall be attenuated by at least A (dB) below the total mean output power, P_{mean} , as follows:

- (a) In any 1.0 MHz band, outside and removed from the virtual block edge⁸ frequency by up to and including $\pm 200\%$ of the occupied bandwidth:
- (i) $A = 11 + 10 \log_{10}(B_{\text{occ}}) + 40(f_{\text{offset}}/B_{\text{occ}})$ dB, for emissions in which the occupied bandwidth is equal or greater than 1 MHz; or
 - (ii) $A = 11 + 40(f_{\text{offset}}/B_{\text{occ}})$ dB, for emissions in which the occupied bandwidth is less than 1 MHz.

Attenuation greater than $56 + 10 \log_{10}(B_{\text{occ}})$ dB, or to an absolute level lower than -43 dBW/MHz, whichever is less stringent, is not required.

⁸ Virtual block edge is a reference frequency used as a block edge frequency for testing of unwanted emissions to avoid effects of radio frequency (RF) block filters. See RSS-191, Section 4.5 for more details.

Where:

B_{occ} : occupied bandwidth in MHz

f_{offset} : frequency offset from the virtual block edge in MHz.

- (b) In any 1.0 MHz band which is removed from the virtual block edge frequency by more than $\pm 200\%$ of the occupied bandwidth:

$A = 43 + 10\log_{10}(P_{mean})$ in dB, or 80 dB below P_{mean} , whichever is less stringent. P_{mean} is the mean output power of the transmitter in watts.

9.4.2 Multi-carrier Transmitter or Multi-Transmitters Sharing a common final stage amplifier

For a multi-carrier transmitter or multi-transmitters sharing a common final stage amplifier, the emission mask is to be the same as for single-carrier transmitters, but using the occupied bandwidth that is defined for multi-carrier transmitters. The total mean power shall be the sum of the individual carrier/transmitter powers. Guard bands, if used in the equipment design, shall also be used in testing the spectrum mask.

When several transmitters share a passive antenna, each transmitter should satisfy the individual mask; the multi-carrier mask should not be applied in this case.

9.5 Antenna Characteristics

For point-to-point blocks A/A', B/B', and K/K' to N/N', the co-polarized radiation pattern envelope in the horizontal plane of the antenna must remain within the envelope shown in Figure 1 for both vertical and horizontal polarizations.

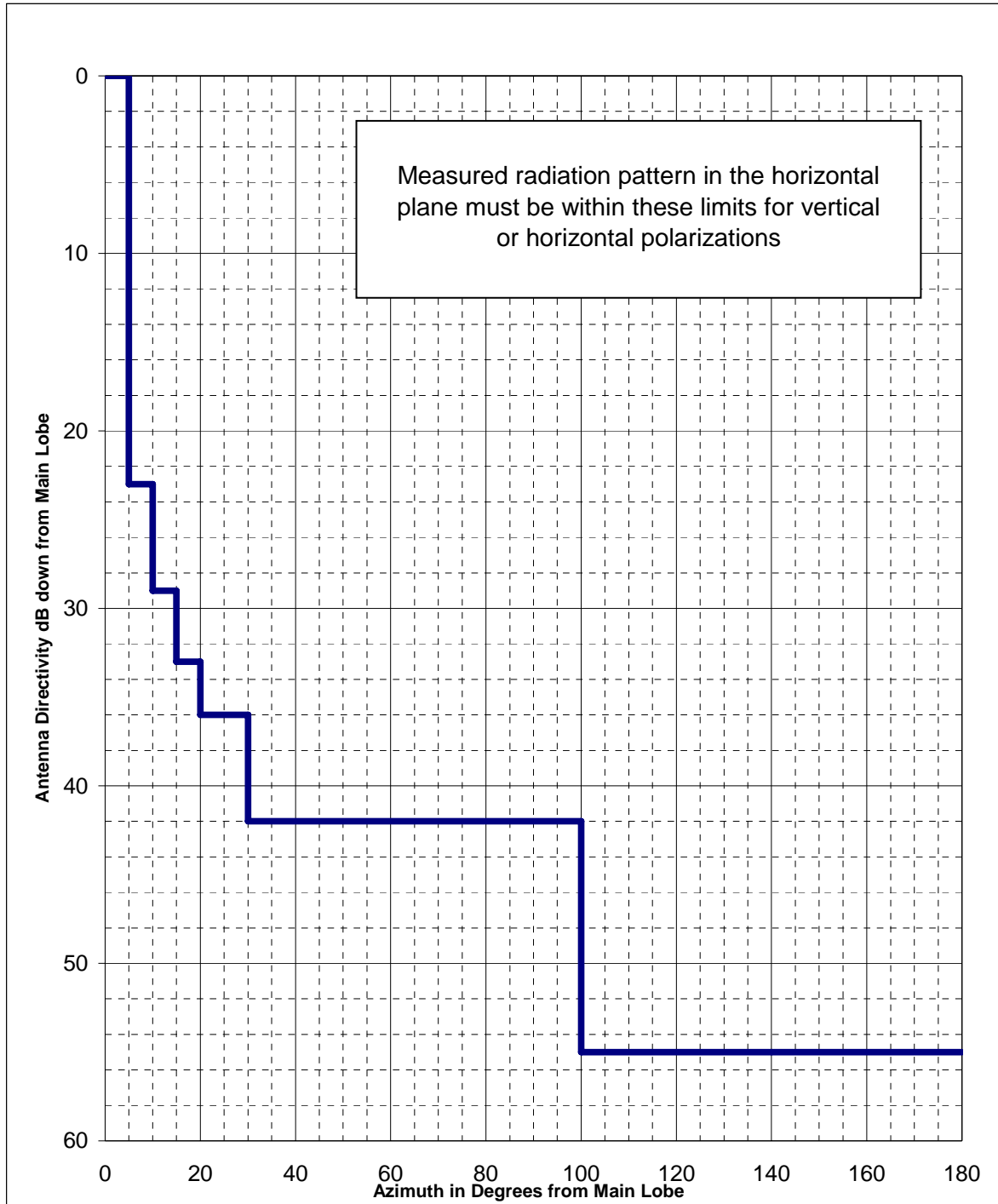
10. Technical Requirements for Point-to-Multipoint Usage in Frequency Blocks C/C' to J/J'⁹

10.1 Transmitter Output Power

For point-to-multipoint systems, the e.i.r.p. density shall not exceed +30 dBW/MHz for subscriber stations, and +14 dBW/MHz for hubs.

⁹ Technical requirements related to the certification of point-to-multipoint frequency blocks C/C' to J/J' are specified in RSS-191.

Figure 1: Minimum Antenna Characteristics, Frequency Band 38.6-40.0 GHz



Annex A – Parameters for Coordination

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

- contact 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
- antenna pattern/ tabulation of the pattern
- azimuth of the maximum antenna gain
- maximum antenna gain (dBi)
- bandwidth and emission designation

Note: More parameters can be provided if needed for the coordination process.

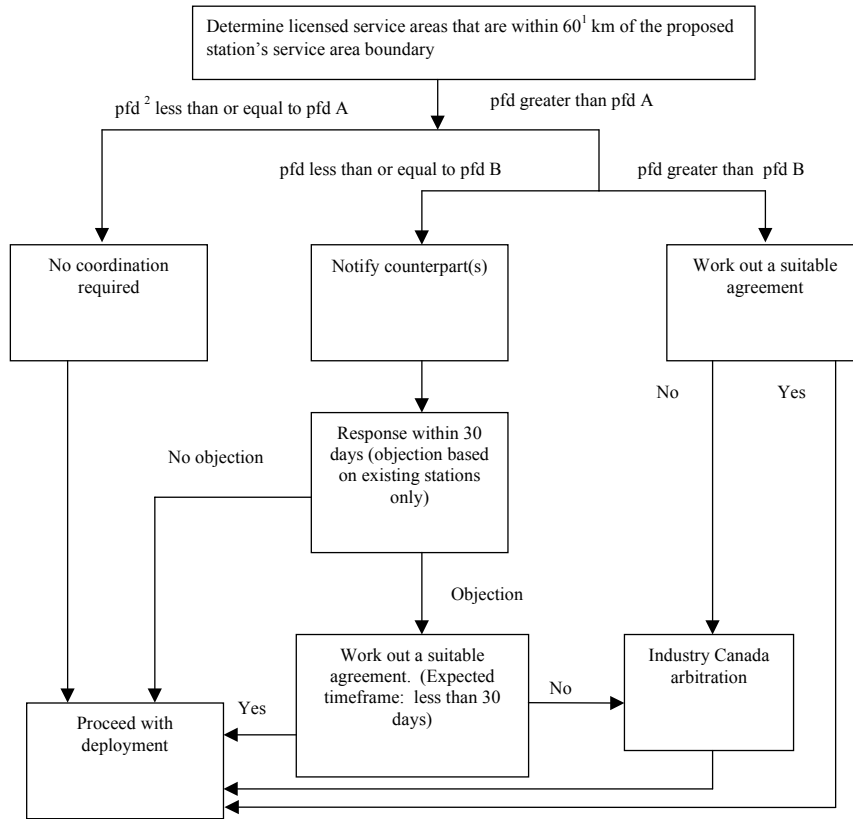
Annex B – Service Areas within 60 km

Definition of Tier 3 areas can be found on Industry Canada’s [Spectrum Management and Telecommunications website](http://ic.gc.ca/spectrum) at <http://ic.gc.ca/spectrum>.

Tier 3 Area	Tier 3 Areas that Should be Considered for Coordination
3-01	3-10, 3-17.
3-02	3-03, 3-04, 3-07.
3-03	3-02, 3-04, 3-05, 3-07.
3-04	3-02, 3-03.
3-05	3-03, 3-06, 3-07.
3-06	3-05, 3-07, 3-08, 3-09.
3-07	3-02, 3-03, 3-05, 3-06, 3-08.
3-08	3-06, 3-07, 3-09, 3-10.
3-09	3-06, 3-08, 3-10, 3-11, 3-12.
3-10	3-01, 3-08, 3-09, 3-12, 3-17.
3-11	3-09, 3-12, 3-13.
3-12	3-09, 3-10, 3-11, 3-13, 3-14, 3-15, 3-16, 3-17.
3-13	3-11, 3-12, 3-14, 3-15, 3-18, 3-19.
3-14	3-12, 3-13, 3-15, 3-16, 3-17, 3-18.
3-15	3-12, 3-13, 3-14, 3-16, 3-18, 3-19, 3-20, 3-21.
3-16	3-12, 3-14, 3-15, 3-17, 3-20, 3-21, 3-23, 3-24, 3-34.
3-17	3-01, 3-10, 3-12, 3-14, 3-16, 3-34, 3-36, 3-37, 3-59.
3-18	3-13, 3-14, 3-15, 3-19.
3-19	3-13, 3-15, 3-18, 3-20, 3-21.
3-20	3-15, 3-16, 3-19, 3-21, 3-22, 3-23, 3-24, 3-34.
3-21	3-15, 3-16, 3-19, 3-20, 3-22, 3-23, 3-24, 3-25, 3-34.
3-22	3-21, 3-23, 3-25.
3-23	3-16, 3-20, 3-21, 3-22, 3-24, 3-25, 3-26, 3-34.
3-24	3-16, 3-20, 3-21, 3-23, 3-25, 3-26, 3-34.
3-25	3-21, 3-22, 3-23, 3-24, 3-26, 3-27, 3-28, 3-29, 3-30.
3-26	3-23, 3-24, 3-25, 3-27, 3-28, 3-30, 3-34, 3-35.
3-27	3-25, 3-26, 3-28, 3-30, 3-33.
3-28	3-25, 3-26, 3-27, 3-30, 3-33.
3-29	3-25, 3-30.
3-30	3-25, 3-26, 3-27, 3-28, 3-29, 3-31, 3-33.
3-31	3-30, 3-32, 3-33.
3-32	3-31, 3-33.
3-33	3-27, 3-28, 3-30, 3-31, 3-32.
3-34	3-16, 3-17, 3-20, 3-21, 3-23, 3-24, 3-26, 3-34, 3-35, 3-36, 3-37.
3-35	3-26, 3-34, 3-36, 3-37, 3-38.
3-36	3-17, 3-34, 3-35, 3-37.
3-37	3-17, 3-34, 3-35, 3-36, 3-38.
3-38	3-35, 3-37, 3-39, 3-59.

Tier 3 Area	Tier 3 Areas that Should be Considered for Coordination
3-39	3-38, 3-40, 3-41, 3-43, 3-59.
3-40	3-39, 3-41, 3-43.
3-41	3-39, 3-40, 3-42, 3-43.
3-42	3-41, 3-43, 3-45.
3-43	3-39, 3-40, 3-41, 3-42, 3-44, 3-45, 3-59.
3-44	3-43, 3-45, 3-47, 3-48, 3-49, 3-51, 3-56, 3-57, 3-58, 3-59.
3-45	3-42, 3-43, 3-44, 3-45, 3-46, 3-47, 3-48.
3-46	3-45, 3-47, 3-50.
3-47	3-44, 3-45, 3-46, 3-48, 3-50, 3-51.
3-48	3-44, 3-45, 3-47, 3-50, 3-51.
3-49	3-44, 3-57, 3-58, 3-59.
3-50	3-46, 3-47, 3-48, 3-51.
3-51	3-44, 3-47, 3-48, 3-50, 3-52, 3-56, 3-57.
3-52	3-51, 3-53, 3-54, 3-55, 3-56, 3-57.
3-53	3-52, 3-54, 3-55.
3-54	3-52, 3-53, 3-55.
3-55	3-52, 3-53, 3-54.
3-56	3-44, 3-51, 3-52, 3-57.
3-57	3-44, 3-49, 3-51, 3-52, 3-56, 3-58, 3-59.
3-58	3-44, 3-49, 3-57, 3-59.
3-59	3-17, 3-38, 3-39, 3-43, 3-44, 3-49, 3-57, 3-58.

Annex C – Process to Determine Whether Coordination is Required for Cases Where a Sharing Agreement Between the Licensees has not been Concluded



¹In the event an operator using sites of very high elevations relative to local terrain that could produce interference to service areas beyond 60 km, this operator shall coordinate with the affected licensee(s).

²Pfd is calculated at the service area boundary of the respective counterpart(s).

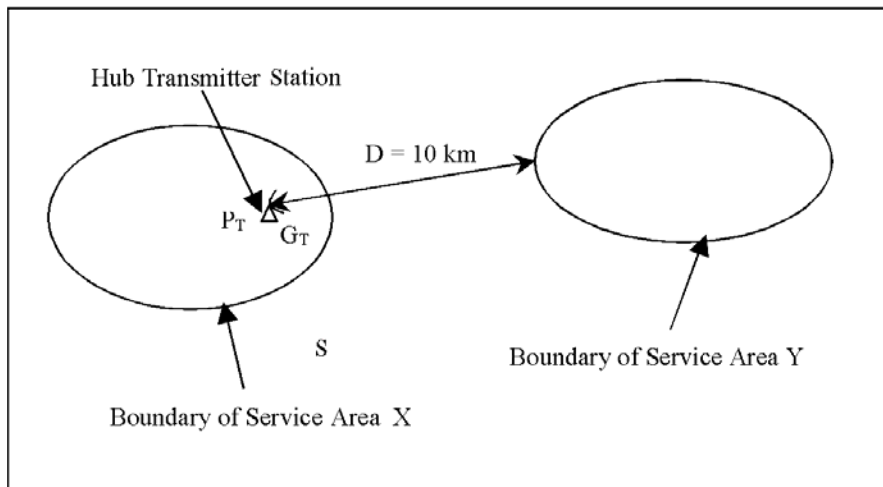
Annex D – Sample Calculation

The following example is provided to illustrate how the pfd level at the service area boundary can be determined¹⁰:

Proposed station parameters:

Parameter	Symbol	Value
Hub transmitter power into the antenna	P_T	0 dBW
Channel bandwidth	B	50 MHz
Transmitter antenna height above ground	H_T	100 metres
Transmitter antenna gain (maximum gain toward the service area boundary at any elevation point 0-500 m above average terrain)	G_T	16 dBi
Centre frequency of channel	F	38750 MHz
Distance from hub transmitter to the boundary of service area Y	D	10 km

Figure 1 – Graphical representation of the proposed situation



¹⁰ 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 the non-line-of-sight situation into account should be used.

The spectral power density in dBW/MHz at the boundary of Service Area Y ($P_{\text{at the boundary of Service Area Y}}$) may be calculated using free space propagation, taking into account such factors as atmospheric losses, as follows:

$$\begin{aligned}
 P_{\text{at the boundary of Service Area Y}} &= P_T' + G_T - 20 \log F_{\text{MHz}} - 20 \log D_{\text{km}} - 32.4 - L_a \\
 &= (-17 + 16 - 20 \log (38750) - 20 \log (10) - 32.4 - 0.1 \times 10) \\
 &\quad \text{dBW/MHz} \\
 &= (-17 + 16 - 91.8 - 20 - 32.4 - 1) \text{ dBW/MHz} \\
 &= -146.2 \text{ dBW/MHz}
 \end{aligned}$$

where:

$$\begin{aligned}
 P_T' &= P_T - 10 \log B_{\text{MHz}} \\
 &= 0 - 10 \log (50) \\
 &= -17 \text{ dBW/MHz} \\
 G_T &= 16 \text{ dBi} \\
 F_{\text{MHz}} &= 38750 \\
 D_{\text{km}} &= 10 \\
 L_a &= \text{atmospheric losses} \\
 &= 0.1 \text{ dB/km}
 \end{aligned}$$

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

$$\begin{aligned}
 \text{pfd} &= P_{\text{at the boundary of Service Area Y}} - 10 \log A_r \\
 &= (-146.2 - 10 \log (4.770 \times 10^{-6})) \text{ dBW/m}^2 \text{ in 1 MHz} \\
 &= (-146.2 - (-53.2)) \text{ dBW/m}^2 \text{ in 1 MHz} \\
 &= -93 \text{ dBW/m}^2 \text{ in 1 MHz}
 \end{aligned}$$

where:

$$\begin{aligned}
 A_r &= \lambda^2 / (4\pi) \\
 &= c^2 / (4\pi F_{\text{Hz}}^2) \\
 &= (3 \times 10^8)^2 / (4\pi \times (38.75 \times 10^9)^2) \\
 &= 4.770 \times 10^{-6} \text{ m}^2
 \end{aligned}$$

Annex E – Arrangement Between Canada and the United States on Principles to Govern the Use of the 37.5-42.5 GHz Band

The parties to this arrangement:

- (1) support retention of the pfd values contained in Table 21-4 of the *Radio Regulations* applicable to the bands within the 37.5-42.5 GHz range;
- (2) will obtain concurrence of other administrations party to this arrangement before authorizing a frequency assignment for an FSS network in the 37.5-40 GHz band if such an FSS network would produce a power flux density in excess of the values in Table 21-4 minus 12 dB in the other country's territory, noting that the -12 dB value is subject to review as per item (3) below;
- (3) will consider the results of technical studies with regard to the appropriate value of downlink power control and adjust the criteria in item (2) above if warranted and agreed upon by each of the parties;
- (4) will propose the suppression of Resolution 84 (WRC-2000) in national and international fora, e.g., CITEL, ITU etc., with a view towards addressing the fade compensation requirements within Region 2;
- (5) will take steps to reflect these principles in their respective domestic policies to ensure that operators of satellite systems wishing to implement services will be aware of their responsibilities and requirements;
- (6) recognize that each administration is free to declare in a global context that it is under no obligation to accept the provision of FSS within its territory if it believes that emissions from satellites providing services in its territory would cause unacceptable interference to its terrestrial services in the 37.5-40 GHz and 42-42.5 GHz bands;
- (7) recognize that these principles are subject to review at any time at the request of administrations party to this arrangement.

Note: For the band 38.6-40.0 GHz, the Table 21-4 power flux density values at the Earth's surface, produced by space stations in the fixed-satellite service under assumed free-space propagation conditions, are as follows:

Type of FSS	Limit in dB (W/m ²) for angle of arrival (δ) above the horizontal plane			Reference bandwidth
	0° - 5°	5° - 25°	25° - 90°	
Non-geostationary	-120	$-120 + 0.75(\delta - 5)$	-105	1 MHz
Geostationary	-127	5° - 20°	20° - 25°	-105
		$-127 + (4/3)(\delta - 5)$	$-107 + 0.4(\delta - 20)$	