

Project	IEEE P802.16 Broadband Wireless Access Working Group		
Title	Technical Requirements for Fixed Radio Systems Operating in the Bands 24.25 - 24.45 and 25.05 - 25.25 GHz		
Date Submitted	7 September, 1999		
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Re:	Call for Contribution on the Coexistence Practice Document		
	Specifically, this document deals with inter-system coordination process and parameters in the 24 GHz band.		
Abstract	This document is the draft Standard Radio System Plan (SRSP) for broadband wireless system operating in the bands 24.25 – 24.45 and 25.05 – 25.25 GHz		
Purpose	To assist in the determination of appropriate co-existence criteria for broadband wireless access systems.		
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Release	The contributor acknowledges and accepts that this contribution may be made publicly available by 802.16.		

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Note: This draft has not been adopted by Industry Canada.

Spectrum Management and Telecommunications Policy

Standard Radio System Plan

Technical Requirements for Fixed Radio Systems Operating in the Bands 24.25 - 24.45 and 25.05 - 25.25 GHz

Technical Requirements for Fixed Radio Systems Operating in the Bands 24.25 - 24.45 and 25.05 - 25.25 GHz

1. Intent

- 1.1 This Standard Radio System Plan (SRSP) states the minimum technical requirements for the efficient use of the frequency bands 24.25 - 24.45 GHz and 25.05 - 25.25 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.
- 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 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 SP-GEN, *General Information Related to Spectrum Utilization and Radio System Policies*.
- 2.4 Although a radio system conforms to the requirements of this SRSP, modifications may be required to the system whenever harmful interference¹ is caused to other radio stations or systems.
- 2.5 When potential conflict between radio systems cannot be resolved by the parties concerned, Industry Canada should be advised, and after consultation with the parties concerned, 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

¹¹ For the purpose of this SRSP, harmful interference means interference which 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*.

in accordance with the *Canadian Table of Frequency Allocations*.

- 2.8 Licensees will be expected to respect the International Telecommunication Union (ITU) *Radio Regulations* pertaining to the 24 GHz bands and abide by any future arrangements/agreements established with other countries.
- 2.9 Industry Canada 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 Licensees are permitted to deploy point-to-point or point-to-multipoint systems within their service areas.
- 2.11 Point-to-point and point-to-multipoint implementations will require the equipment to be type approved in accordance with RSS-191.
- 2.12 Licensees are required to make available to Industry Canada, upon request, information on certain technical parameters of their hub and point-to-point stations.

3 Related Documents

- 3.1 The current issues of the following documents are applicable:
 - 3.1.1 **Spectrum Utilization Policy GEN (SP-GEN)** - *General Information Related to Spectrum Utilization and Radio System Policies*
 - 3.1.2 *Policy and Licensing Procedures for the Auction of the 24 and 38 GHz Frequency Bands*
 - 3.1.3 **Telecommunications Regulation Circular (TRC) 43** - *Notes Regarding Designation of Emission (Including Necessary Bandwidth and Classification), Class of Station and Nature of Service*
 - 3.1.4 **Radio Standards Specification (RSS) 191** - *Local Multipoint Communication Systems at 28 GHz, and Point-to-Point and Point-to-Multipoint Systems at 24 and 38 GHz*
 - 3.1.5 **Client Procedures Circular (CPC) 2-0-03** – *Environmental Process, Radiofrequency Fields and Land-Use Consultation*
 - 3.1.6 **Safety Code 6** - *Limits of Exposure to Radiofrequency Fields at Frequencies from 10 kHz - 300 GHz*, available on the Internet at the Health Canada web site: <http://www.hc-sc.gc.ca>
 - 3.1.7 *Canadian Table of Frequency Allocations*

- 3.1.8 Associated documents addressing coordination process for broadband fixed wireless systems in the 24 GHz, 28 GHz, and 38 GHz bands are available on the Radio Advisory Board of Canada (RABC) website:
<http://www.rabc.ottawa.on.ca>

- 3.2 Unless otherwise stated, the above documents are available electronically on the Internet at Industry Canada's web site: <http://strategis.ic.gc.ca/spectrum>.

4 Radio Frequency Block Arrangement Description

- 4.1 The bands 24.25 - 24.45 GHz and 25.05 - 25.25 GHz are divided into five (40 MHz+40 MHz) paired frequency blocks², as follows:

Paired Block	Lower Frequency Block (MHz)	Upper Frequency Block (MHz)
A / A'	24250 - 24290	25050 - 25090
B / B'	24290 - 24330	25090 - 25130
C / C'	24330 - 24370	25130 - 25170
D / D'	24370 - 24410	25170 - 25210
E / E'	24410 - 24450	25210 - 25250

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

5 Technical Requirements

- 5.1 The transmitter power into the antenna must not exceed +10 dBW per carrier.
- 5.2 The effective isotropically radiated power (e.i.r.p.) density shall not exceed +30 dBW/MHz for subscriber stations, and +14 dBW/MHz for hubs. The maximum e.i.r.p. of a transmit station must not exceed +55 dBW per carrier.

6 Inter-System Coordination

6.1 International Coordination

²² 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 which carries a specific radio signal.

- 6.1.1 Usage of the band 24.25 - 25.25 GHz near the Canada/U.S. 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 GHz, 25.05 - 25.25 GHz, and 38.6 - 40.0 GHz*, which is included as Appendix A of this document.

6.2 Domestic Coordination

- 6.2.1 Domestic coordination is required between licensed service areas³ where the shortest distance between the respective service area boundaries is less than⁴ 60 km. The operators are encouraged to arrive at mutually acceptable sharing agreements that would allow for the provision of service of each licensee within its service area to the maximum extent possible.
- 6.2.2 In circumstances where a sharing agreement between operators does not exist or has not been concluded, and whose service areas are less than 60 km apart, the following coordination process shall be employed:
- 6.2.2.1 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 area 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 Appendix D for a sample calculation of a pfd level.)
- 6.2.2.2 Deployment of facilities which generate a pfd less than or equal to -114 dBW/m² in any 1 MHz (pfd A) at the other service area boundaries are not subject to any coordination requirements.
- 6.2.2.3 Deployment of facilities which generate a pfd greater than pfd A (-114 dBW/m² in any 1 MHz), but less than or equal to -94 dBW/m² in any 1 MHz (pfd B) at the other service area boundaries, are subject to successful coordination between the affected licensees in accordance with the following coordination process:

³³ Appendix B is provided as a guide to determine which service areas should be considered for coordination.

⁴⁴ In the event an operator uses 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).

- 6.2.2.3.1 The operator must notify the respective licensee(s) of its intention to deploy the facility(ies) along with the appropriate information necessary to conduct an interference analysis.
- 6.2.2.3.2 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 systems⁵ only.
- 6.2.2.3.3 If there is no objection raised, then the deployment may proceed.
- 6.2.2.3.4 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. It is expected that the time frame to develop such an agreement should not exceed 30 calendar days.
- 6.2.2.3.5 Proposed facilities must be deployed within 120 calendar days from the conclusion of coordination, otherwise coordination must be reinitiated as per section 6.2.2.
- 6.2.2.4 Deployment of facilities which generate a pfd greater than -94 dBW/m² in any 1 MHz (pfd B) at the other service area boundaries are subject to successful coordination between the affected licensees.
- 6.2.2.5 The above process is described graphically in Appendix C of this document for illustration purposes.
- 6.2.3 In any event, 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.
- 6.2.4 All results of analysis on pfd, or agreements made between licensees, must be retained by the licensees and be made available to the Department upon request.
- 6.2.5 If a licence is transferred, the sharing agreement(s) developed between the former licensees shall remain in effect until superseded by a new agreement

⁵⁵ Existing systems include systems that are operational prior to the receipt of the notification, or systems that have been coordinated previously.

between the licensees.

- 6.2.6 In the event a satisfactory agreement or a successful coordination between the licensees is not reached, the Department should be informed. In these cases, the Department may impose appropriate technical limitations to facilitate reasonable implementation of systems.
- 6.2.7 Licensees shall ensure that the pfd at the boundary of the neighbouring service areas that have not been licensed does not exceed pfd B.
- 6.2.8 While coordination between adjacent block licensees operating in the same vicinity may not be required in most cases, licensees may agree to coordinate certain installations to avoid interference.

Appendix A

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 GHz, 25.05 - 25.25 GHz and 38.6 - 40.0 GHz

[to be provided by Industry Canada]

Appendix B Co-Frequency Block Coordination

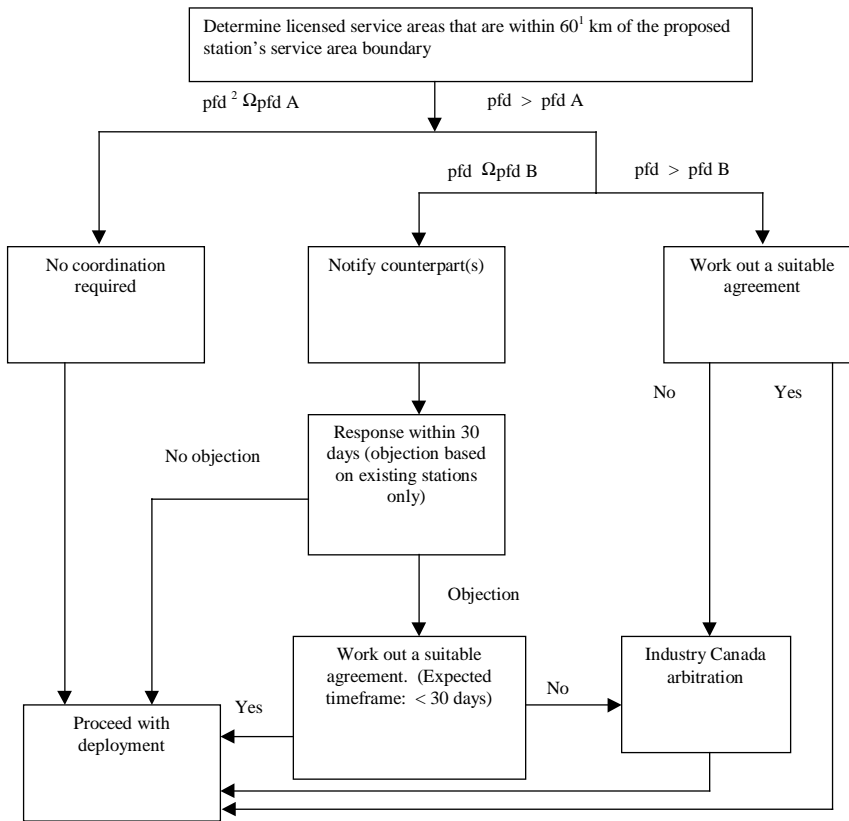
(Definition of Tier 3 areas can be found on the Industry Canada website:
<http://strategis.ic.gc.ca/spectrum>)

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.
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.

Appendix 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).

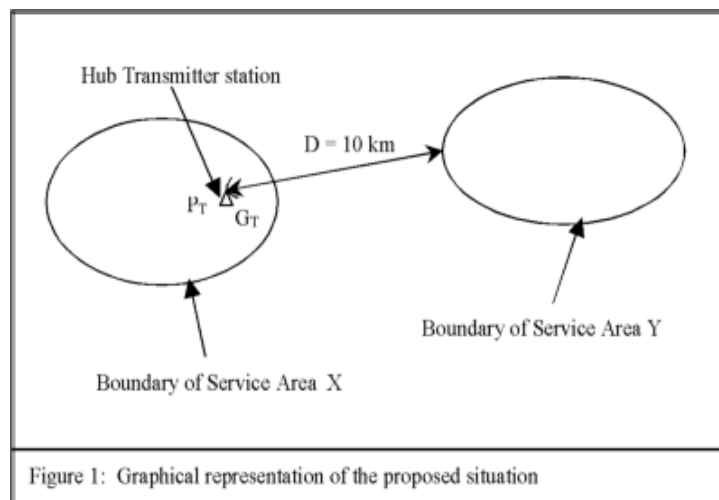
Appendix D

Sample calculation

The following example is provided to illustrate how the pfd level at the service area boundary can be determined⁶:

Proposed station parameters:

Parameter	Symbol	Value
Hub transmitter power into the antenna	P_T	-12 dBW
Channel bandwidth	B	40 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	21 dBi
Centre frequency of channel	F	24270 MHz
Distance from hub transmitter to the boundary of service area Y	D	10 km



The spectral power density in dBW/MHz at the boundary of service area Y

⁶ It should be noted that the example calculation assumes line-of-sight conditions due to the short path length and the height of the transmitting antenna. In other cases, where the distance is larger and/or the transmitting antenna height is small, line-of-sight conditions may not exist. In these cases, an appropriate propagation model that takes the non-line-of-sight situation into account should be used.

($P_{\text{at the boundary of Service Area Y}}$) may be calculated using free space propagation, and taking into account such factors as atmospheric losses, as follows:

$$\begin{aligned}
 P_{\text{at the boundary of Service Area Y}} &= P_T' + G_T - 20 \log F_{\text{MHz}} - 20 \log D_{\text{km}} - 32.4 - L_a \\
 &= (-28 + 21 - 20 \log (24270) - 20 \log (10) - 32.4 - \\
 &\quad 0.1 \times 10) \text{ dBW/MHz} \\
 &= (-28 + 21 - 87.7 - 20 - 32.4 - 1) \text{ dBW/MHz} \\
 &= -148.1 \text{ dBW/MHz}
 \end{aligned}$$

$$\begin{aligned}
 \text{where: } P_T' &= P_T - 10 \log B_{\text{MHz}} \\
 &= -12 - 10 \log (40) \\
 &= -28 \text{ dBW/MHz} \\
 G_T &= 21 \text{ dBi} \\
 F_{\text{MHz}} &= 24270 \\
 D_{\text{km}} &= 10 \\
 L_a &= \text{atmospheric losses} \\
 &= 0.1 \text{ dB/km}
 \end{aligned}$$

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

$$\begin{aligned}
 \text{pfd} &= P_{\text{at the boundary of Service Area Y}} - 10 \log A_r \\
 &= (-148.1 - 10 \log (1.216 \times 10^{-5})) \text{ dBW/m}^2 \text{ in 1 MHz} \\
 &= (-148.1 - (-49.15)) \text{ dBW/m}^2 \text{ in 1 MHz} \\
 &= -99 \text{ dBW/m}^2 \text{ in 1 MHz}
 \end{aligned}$$

$$\begin{aligned}
 \text{where: } A_r &= \lambda^2 / (4\pi) \\
 &= c^2 / (4\pi F_{\text{Hz}}^2) \\
 &= (3 \times 10^8)^2 / (4\pi \times (24.27 \times 10^9)^2) \\
 &= 1.216 \times 10^{-5} \text{ m}^2
 \end{aligned}$$