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Database Requirements

# White Space Database Specifications

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## List of Acronyms

AET	Average Elevation of Terrain
AGL	Above Ground Level
AMSL	Above Mean Sea Level
BDU	Broadcasting Distribution Undertaking (such as a cable or satellite TV business)
CPE	Customer Premises Equipment
DUT	Device Under Test
ENG	Electronic News Gathering
ERP	Effective Radiated Power (dipole)
e.i.r.p.	Equivalent Isotropically Radiated Power
HAAT	Height Above Average Terrain
IC	Industry Canada
IC ID	Industry Canada Identification Number
ISP	Internet Service Provider
LP/LPA	Low-power or Low-power Apparatus (such as wireless microphones)
maxHAAT	Maximum Height Above Average Terrain
REL	<i>Radio Equipment List</i>
RRBS	Remote Rural Broadband Systems
TVWS	TV White Space
TVWSDB	TV White Space Database
VLP	Very Low-power
WS	White Space
WSDB	White Space Database
WSDBA	White Space Database Administrator
WSD	White Space Device

## 1. Intent

DBS-01, Issue 1, *White Space Database Specifications*, sets out the minimum technical requirements for the designation of a database capable of indicating available channels for use by white space devices in the white space frequency bands (i.e. 54-60 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-698 MHz).

## 2. General Scope and Application

A white space database (WSDB) is a database system recognized by Industry Canada that provides lists of available channels to white space devices (WSDs), while ensuring protection of all licensed services and systems operating in the white space frequency bands. WSDs are licence-exempt, low-power wireless devices that operate on a no-protection, no-interference basis with respect to licensees operating in the same white space frequency bands. A WSDB uses geolocation data provided by WSDs to dynamically manage their access to spectrum.

Television white spaces (TVWS) are the unused portions of the TV broadcast spectrum in the VHF and UHF bands that remain vacant to prevent interference between broadcast stations or because there is limited demand for over-the-air TV stations in certain geographic locations. For the purposes of this document, TVWS will be referred to as white space (WS) where applicable.

Notwithstanding the fact that a WSDB satisfies the requirements of this document, Industry Canada may impose corrective measures whenever harmful interference to licensed services or systems is caused by the operation of WSDs.

## 3. White Space Contact Information

In case of interference or concerns regarding calculations performed by authorized WSDBs, Industry Canada encourages the parties involved to contact the Department directly, in order to resolve the issue and address the disagreement. Please contact Industry Canada directly at: [whitespaceblanc@ic.gc.ca](mailto:whitespaceblanc@ic.gc.ca).

## 4. Definitions

**Available Channels:** A range of frequencies available for use by WSDs.

**Device Type Identifier:** An identifier that can be associated with certification of a WSD by IC.

**Dynamic Spectrum Access:** A technique by which a radio system dynamically adapts to the local radio spectrum environment in order to determine — and then access — available channels at specific locations.

***Far Side of a Protected Contour:*** The far-side of a protected contour is the point on a TV protected contour that is 180 degrees opposite to the direction from the TV transmitter towards a WSD.

***Fixed WSD:*** A device that transmits and/or receives radiocommunication signals at a specified fixed location. The fixed device selects potential operational frequencies from a list of available channels, as provided by a WSDB.

***Geolocation Capability:*** The ability of a WSD to determine its geographic coordinates within a required level of accuracy.

***Height Above Average Terrain (HAAT):*** The height of the centre of radiation of the antenna above the average elevation of the terrain (AET) between 3 km and 16 km at 100 m intervals<sup>1</sup> from the antenna along a particular radial. AET is calculated based on Geobase 50K Canadian Digital Elevation Data (CDED) 1 arc-second data for Canada, the United States Geological Survey National Elevation Dataset (USGS NED) 1 arc-second data for the continental U.S., and the NED 2 arc-second for Alaska. Determination of HAAT does not stop at the border or over bodies of water. Each HAAT determination shall incorporate the full 3-to-16 km radial segment and shall not be truncated at the border nor over bodies of water.

***Maximum Height Above Average Terrain (maxHAAT):*** The largest of the HAAT values determined for eight standard radials spaced every 45 degrees of azimuth starting from true north.

***HAAT in the Direction of the Affected TV Station:*** The largest of the HAAT values determined for standard radials spaced every 5 degrees of azimuth within an arc of  $\pm 22.5$  degrees from a line between the WSD location and the closest point on the contour in the direction of the affected TV transmitter.

***Industry Canada Identification (IC ID):*** The IC certification number of a WSD.

***Low-power apparatus (LPA):*** Examples of low-power apparatus (LPA) include wireless microphones and wireless cameras, systems for cue and control communications, as well as synchronization of video camera signals. Low-power FM transmitters may also be included in this category, but their use is restricted and is only authorized for operation under specific conditions. LPA may be limited to a particular location (fixed) or used on a Canada-wide or province-wide basis (Electronic News Gathering (ENG) type), depending on its licence.

***Personal/Portable WSD:*** A personal/portable WSD is a device that transmits and/or receives radiocommunication signals while stationary or in motion at unspecified fixed points.

***Mode I Personal/Portable Device:*** A personal/portable WSD that does not use an internal geolocation capability and does not directly access a WSDB to obtain a list of available radio frequency channels.

A mode I personal/portable device must obtain a list of available channels on which it may operate through an indirect connection via either a fixed device or a mode II personal/portable device. A mode I

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<sup>1</sup> In the case of low-power TV, distances from 0 to 5 km should be used instead.

personal/portable device does not initiate a network of WSDs nor provide a list of available radio frequency channels to another mode I device for use by such a device.

**Mode II Personal/Portable Device:** A personal/portable WSD that uses internal geolocation and accesses a WSDB for a list of available radio frequency channels.

Access to the database may be through a direct connection to the Internet or through an indirect connection via a fixed or other mode II WSD. A mode II device may provide its lists of available radio frequency channels to another mobile device for use by that device.

**Operating Channel:** An available channel used by a WSD for transmission and/or reception.

**Protected Contour:** A contour within which a station and its associated receivers or remote stations have protection from other devices operating in the same frequency bands and which might interfere with the station.

**Remote Rural Broadband Systems (RRBS):** Fixed systems that provide wireless Internet access for subscriber-based broadband Internet applications, using TVWS spectrum, on a licensed basis.

**Separation Contour:** A contour resulting from the sum of the protected contour and the separation distance which together define a new and larger contour.

**Separation Distance:** The minimum distance between a WSD and a station's protected contour (for broadcasting, RRBS, etc.) at which a WSD may operate.

**TV Receive Site:** A location where signals are received for retransmission or monitoring, including TV studio and transmitter locations, relay points and broadcasting distribution undertaking (BDU) head-ends outside the edge of the protected contours of a TV station. This includes receive sites for a full power TV station, a TV broadcaster or a low-power TV station (i.e. an LP or a very low-power (VLP) transmitter, translator or booster transmitter) where signals are received over the air.

**White Space (WS):** Part of the spectrum that is, or has become, available for radiocommunication by radio systems at a specific time period and in a given geographical area.

**White Space Database (WSDB):** An Industry Canada-recognized third party database that maintains records of all licensed services and systems approved to operate within WS frequency bands. The WSDB determines available channels at a specific time and geographic location, and provides lists of available channels to WSDs.

**White Space Database Administrator (WSDBA):** A third party service provider designated by Industry Canada to administer a WSDB within Canada.

**White Space Device (WSD):** A radio apparatus that operates in the WS frequency bands using dynamic spectrum access techniques.

## 5. Related Documents

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

<b>CPC-4-1-01</b>	<i>Application Procedures for TV White Space Database Administrators (TVWS Database Administrators)</i>
<b>RSS-222</b>	<i>White Space Devices (WSDs)</i>
<b>SMSE-12-11</b>	<i>Consultation on a Policy and Technical Framework for the Use of Non-Broadcasting Applications in the Television Broadcasting Bands Below 698 MHz</i>
<b>SMSE-12-12</b>	<i>Framework for the use of Certain Non-broadcasting Applications in the Television Broadcasting Bands Below 698 MHz</i>
<b>SRSP-300.512</b>	<i>Technical Requirements for Remote Rural Broadband Systems (RRBS) Operating in the Bands 512-608 MHz and 614-698 MHz (TV Channels 21 to 51)</i>
<b>RSS-196</b>	<i>Point-to-Multipoint Broadband Equipment Operating in the Bands 512-608 MHz and 614-698 MHz for Rural Remote Broadband Systems (RRBS) (TV Channels 21 to 51)</i>
<b>CPC-2-1-11</b>	<i>Low-power Licensed Radio Apparatus</i>
<b>CPC-2-1-28</b>	<i>Voluntary Licensing for Licence-exempt Low-power Radio Apparatus in the TV Bands</i>
<b>RSS-210</b>	<i>Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment</i>
<b>BPR-4</b>	<i>Application Procedures and Rules for Television Broadcasting Undertakings</i>
<b>BPR-10</b>	<i>Application Procedures and Rules for Digital Television (DTV) Undertakings</i>

[Access to Information Act](#)

[Personal Information Protection and Electronic Documents Act \(PIPEDA\)](#)

## 6. White Space Frequency Bands

The frequency bands/channels authorized for use by WSDs are shown in Table 1.



**Table 1: Available Channels by Type of WSD**

<b>Frequency Bands (MHz)</b>	<b>TV Channels</b>	<b>Personal/ Portable WSD</b>	<b>Fixed WSD</b>
<b>54-60</b>	2	Not permitted	✓
<b>60-72</b>	3-4*	Not permitted	
<b>76-88</b>	5-6	Not permitted	✓
<b>174-216</b>	7-13	Not permitted	✓
<b>470-512</b>	14-20	Not permitted	✓
<b>512-608</b>	21-36	✓	✓
<b>608-614</b>	37**	Not permitted	
<b>614-698</b>	38-51	✓	✓

\*Channels 3 and 4 (60-72 MHz) have been excluded from the list due to the use of these channels by consumer electronic devices in North America.

\*\*Channel 37 (608-614 MHz) has been excluded to protect the operation of radio astronomy and wireless medical telemetry.

A WSDB shall only provide available channels, depending on the type of WSD (fixed or personal/portable) under discussion, from among those listed above. The availability of channels will be subject to the constraints related to the location and use of active TV broadcast stations and remote rural broadband systems.

## **7. Database Information**

### **7.1 Industry Canada Database Information**

Information on licensed systems and services is available in Industry Canada's licensing, certification and broadcasting databases. The WSDBs shall retrieve updated Industry Canada licensing information at least every 24 hours. For information on interfacing with these databases and interpretation of data fields, please refer to Industry Canada's [Spectrum Management and Telecommunications website](http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf10498.html) at: [http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h\\_sf10498.html](http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf10498.html).

This site includes links to all of Industry Canada's relevant databases as well as detailed information on how to access and interpret this data.

### **7.1.1 Information Required for TV Broadcasting Stations**

A WSDB shall obtain the following information from Industry Canada's database for broadcasting stations to be protected from WSDs:

- (i) Transmitter coordinates (latitude/longitude);
- (ii) Maximum ERP;
- (iii) Height AGL of the radiating centre of the transmitting antenna;
- (iv) Ground elevation AMSL
- (v) Horizontal transmit antenna pattern (if antenna is directional);
- (vi) Channel numbers;
- (vii) Station call sign; and
- (viii) Station status.

### **7.1.2 Information Required for RRBS Base Stations**

A WSDB shall obtain the following information from Industry Canada's database to help protect RRBS stations from WSDs:

- (i) Transmitter coordinates (latitude/longitude);
- (ii) Maximum ERP;
- (iii) Height AGL of the radiating centre of the transmitting antenna;
- (iv) Site elevation AMSL;
- (v) Transmit antenna pattern (horizontal/vertical);
- (vi) Channel numbers (both downstream (transmit) and upstream (receive) channels); and
- (vii) Station call sign.

### **7.1.3 Information Required for Low Power Apparatus**

In cases where Industry Canada's WSDB has accepted registration and scheduling information from LPA stations, a WSDB shall obtain the following information:

- (i) Coordinates (latitude/longitude);
- (ii) Whether it is fixed or ENG-type;
- (iii) Radius of operation (if ENG-type); and
- (iv) Frequency of operation (if fixed-type).

## **7.2 Registration Facilities**

A WSDB shall provide a facility in which to collect the following information for those systems and services which are not included in the Industry Canada databases, and shall be included as part of the WSDB: fixed WSD registrations, TV receive-site registrations and LPA geographic location, service area and time-of-use scheduling information.

### **7.2.1 Fixed WSD Registration**

A WSDB shall provide a registration facility for fixed WSD users served by the WSDB. This information is to be collected from the users to facilitate investigations in the event that harmful interference occurs.

A WSDB shall collect the following information from fixed WSD users:

- (i) Name of the individual or business that owns the device (e.g. the Internet Service Provider (ISP) providing the service not the ISP's customers);
- (ii) Name of a contact person responsible for resolving interference issues related to the device's operation;
- (iii) Mailing address for the contact person;
- (iv) Valid email address for the contact person; and
- (v) Phone number for the contact person.

The registration information shall be considered public.

Prior to registering a WSD for the first time, a WSDB shall verify that the above-mentioned information for the registration is complete and that a verified email address has been provided by the fixed WSD user.

### **7.2.2 TV Receive Site Registration and Cable TV Head-ends**

A WSDB shall provide a registration process for TV receive sites that qualify for protection under Section 7.2.1.

A WSDB shall obtain the following registration information from TV receive-site users wishing to be protected from WSDs:

- (i) Names of the individuals or businesses responsible for each TV receive site;
- (ii) Contact addresses;
- (iii) Valid email addresses for contact persons;
- (iv) Phone numbers for contact persons;
- (v) Coordinates of the location of the TV receive site;
- (vi) Channels received at the TV receive site and their call signs; and
- (vii) Call sign of the transmitter associated with the receive site or the cable operation number for cable TV head-ends.

The registrations shall be considered public.

A WSDB shall confirm that the TV receive site being registered is associated with an Industry Canada-authorized call sign.

A WSDB shall confirm that the TV receive site or cable TV head-end being registered resides no farther than 80 km outside the nearest edge of an associated protected contour.

If the information cannot be validated, the WSDB shall reject the registration of the TV receive site or the cable TV head-end, and return a message to contact Industry Canada for authorization.

### **7.2.3 LPA Scheduling Information**

A WSDB shall provide a facility for users of LPA to register scheduling and location information.

(a) A WSDB shall obtain the following time-of-use scheduling information from any licensed LPA wishing to be protected from WSDs:

- (i) Name of the individual or business responsible for an LPA;
- (ii) Contact address;
- (iii) Valid email address for contact person;
- (iv) Phone number for contact person;
- (v) Geographical coordinates (see NAD83) of the location or area(s) of operation where the LPA will be used;
- (vi) TV channels used by the LPA at the indicated site(s)<sup>2</sup>;
- (vii) Specific hours, days, weeks and/or months when the LPA will be used (Note that on dates when an LPA is not in use, the site will not be offered protection from WSDs); and
- (viii) The LPA's licence number.

(b) With regard to item (a)(v) above, the following parameters should be noted:

- (i) The area of operation for an LPA may be defined as a point and radius area or as a quadrilateral. Multiple registrations that specify more than one point in the facility may be entered for very large sites.
- (ii) Under the point and radius option, the operational location(s) of the LPA can be defined using up to 25 geographical points at any one time, with a maximum radius of operation of 500 metres around any point; or
- (iii) Under the quadrilateral option, the operational location(s) of the LPA can be defined based on the edges of straight lines connecting the vertices (geographic points) of the quadrilateral.
  - 1. Each quadrilateral must be specified with four geographic points and the distance between any two adjacent points must be limited to 3 km.
  - 2. In cases where an LPA occupies a larger area, up to four non-contiguous quadrilaterals may be registered.

Online registration of LPA can be facilitated by directly accessing designated WSDBs as indicated on the following Industry Canada website:

[http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h\\_sf10498.html](http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf10498.html).

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<sup>2</sup> For an LPA that is used on a fixed basis, the WSDB shall only allow the registration of the frequency or frequencies specified on the licence. For ENG-type LPA it is not necessary to perform this check.

(c) A WSDB shall confirm that an LPA that wishes to register its time-of-use scheduling information in the database has a valid licence according to the Industry Canada database. If none exists, the WSDB shall reject the registration of the LPA, and return a message to contact Industry Canada for a licence.

(d) All registrations shall be considered public.

#### **7.2.4 Developmental Licences**

A WSDB shall provide a facility for users of developmental licences to register their scheduling and location information. The data to be collected and validation requirements are as specified for LPA in Section 7.2.3 above.

### **8. Denied List**

A WSDB shall include the capability to maintain a list of devices which are not authorized to operate with WSDBs and which shall not be permitted to gain access to channels. Devices on the denied list may be identified by device type identifier and/or manufacturer's serial number. Devices will be added to or removed from the denied list only upon formal direction from Industry Canada. It is anticipated that this capability will be used rarely and there is no requirement for an external interface or automated update of this list.

### **9. Protection Criteria for TV Broadcasting Stations**

A WSDB shall only return available channels according to certain protection criteria, as discussed in the remainder of this document.

#### **9.1 Protection Criteria for Over-the-Air TV Broadcasting Stations**

A WSDB shall protect active, over-the-air TV broadcasting stations. TV broadcasting stations with the following status are active: operational (OP), authorized (AU) or temporary operation (TO).

A WSDB shall protect all types of TV broadcasting stations, including active analog and digital TV stations (i.e. including full service TV stations, TV re-broadcasters and low-power TV stations (i.e. including LP TV translator and VLP TV translators and booster stations).

#### **9.2 Protected Contours of TV Broadcasting Stations**

For the purposes of protecting fixed TV services from white space devices, a WSDB shall calculate protected contours for TV broadcasting stations based on the propagation models and electromagnetic field strength levels specified in Table 2 below.

**Table 2 -- Thresholds for the Protected Contours of TV Broadcasting Stations**

<b>Type of TV Station *</b>	<b>TV Channel</b>	<b>Thresholds for TV Broadcasting Station-Protected Contour (dB<math>\mu</math>V/m)</b>	<b>Propagation Curve **</b>
Analog (full and low-power)	Low VHF (Ch. 2-6)	47	F(50,50)
	High VHF (Ch. 7-13)	56	F(50,50)
	UHF (Ch. 14-51)	$64-20\log(615/F)$	F(50,50)
Digital (full and low-power)	Low VHF (Ch. 2-6)	28	F(50,90)
	High VHF (Ch. 7-13)	36	F(50,90)
	UHF (Ch. 14-51)	$41-20\log(615/F)$	F(50,90)

\*See BPR-10, *Application Procedures and Rules for Digital Television (DTV) Undertakings*, Annex F.

\*\*F is the centre frequency of the TV channel in MHz.

### 9.2.1 Protection of TV Receive Sites

A WSDB shall protect TV receive-sites outside the protected contour, where signals are received for retransmission or monitoring, including TV studio and transmitter locations, relay points and broadcasting distribution undertaking (BDU) head-ends, provided that such sites are no farther than 80 km outside the nearest edge of the protected contours of the station. In order to receive protection, a TV receive-site must have registered with a WSDB as described in Section 7.2.2 above.

The protection area of the receive-sites from WSDs shall encompass an arc of  $\pm 30$  degrees from a line between a registered receive-site and the contour of the TV station being received, in the direction of the station's transmitter at a distance of up to 80 km from the nearest edge of the protected contour of the received TV station for co-channel operation and up to 20 km from the registered receive-site for adjacent channel operation except that the protection distance shall not exceed the distance from the receive site to the protected contour. Outside of this  $\pm 30$ -degree arc, WSDs may not operate within 8 km from the receive site for co-channel operation and within 2 km from the receive site for adjacent channel operation.

For purposes of this section, a TV station being received may include a full power TV station, a TV rebroadcaster or a low-power TV station (i.e. LP or VLP transmitter, translator or booster transmitter) where signals are received over the air.

The distance of the TV transmitter to its protected contour shall be determined using the calculation procedure detailed in Annex B.

### 9.3 WSD Separation Distance from Broadcast TV Protected Contour

#### 9.3.1 Maximum Height for Fixed WSDs

- (i) WSDB shall not provide any channel on the list of available channels to a fixed WSD if its maxHAAT exceeds 250 m or its (AGL) exceeds 30 m.
- (ii) If the fixed WSD reports height as AMSL, the WSDB shall convert AMSL to AGL as follows:
  - Determine the site elevation for the reported fixed WSD geographic coordinates, using the same method used to determine elevation for HAAT calculations; and
  - Subtract the site elevation from the reported AMSL, which will produce an AGL value, and if the resulting AGL is less than 1.5 m, set AGL to 1.5 m.
- (iii) When applying Tables 3, 4 and 4bis below, where a database is capable of calculating the HAAT in the direction of the affected TV station, this value may be used instead of the maxHAAT.

#### 9.3.2 Separation Distance from WSD to Protected Contour of TV Broadcasting Station

- (i) When a fixed or mode II personal/portable WSD contacts a WSDB and provides its geographic coordinates, the WSDB will provide a list of available channels to the WSD based upon the criteria below:
  - (a) In the case of a fixed or mode II personal/portable WSD operating with a power level greater than 40 mW (16 dBm), a WSDB's list shall be based on the minimum separation distances outside the broadcast TV-protected contours of both co-channel and adjacent channel digital television (DTV) stations, as specified in Table 3 and Table 4, respectively;
  - (b) Notwithstanding (a), for TV stations operating on co-channel frequencies, if a fixed WSD operates with a power level greater than 40 mW (16 dBm), a WSDB shall list the available channels based on the larger separation distance indicated in Section 9.3.2 (i)(a) and the minimum separation distances away from the far side of the broadcast DTV-protected contours, as specified in Table 3bis;
  - (c) Notwithstanding (a), if a mode II personal/portable WSD operates with a power level greater than 40 mW (16 dBm), a WSDB shall list the available channels based on the larger separation distance indicated in Section 9.3.2 (i)(a) and the minimum separation distances away from the far side of the DTV broadcast-protected contours, as specified in Table 4bis;
  - (d) If a fixed WSD or mode II personal/portable WSD operates with a power level greater than 40 mW (16 dBm), a WSDB shall list the available channels based on the minimum separation distances outside the broadcast analog TV-protected contours of the co-channel, adjacent channel and taboo channels,<sup>3</sup> as specified in Table 3 and Table 3bis, respectively.

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<sup>3</sup> If N is the broadcast channel, then the taboo channels are N±2, N±3, N±4, N±7, N±8, N+14, and N+15.

- (e) Notwithstanding (d), if a fixed WSD operates with a power level greater than 40 mW (16 dBm), a WSDB shall list the available channels based on the larger separation distance of 9.3.2 (i)(a) and the minimum separation distances away from the far side of the broadcast analog TV-protected contours of the co-channel, adjacent channel and taboo channels, as specified in Table 3bis.
  - (f) Notwithstanding (d), if a mode II personal/portable WSD operates with a power level greater than 40 mW (16 dBm), a WSDB shall list the available channels based on the larger separation distance of Section 9.3.2 (i)(a) and the minimum separation distances from the far side of the broadcast analog TV-protected contours of the co-channel, adjacent channel and taboo channels, as specified in Table 4bis.
  - (g) If a personal/portable WSD operates with power levels of 40 mW (16 dBm) or less, a WSDB may list the available channels within the broadcast TV-protected contours of all adjacent channels and beyond.
- (ii) In determining these required separations, the WSDB shall, by default, include a margin of error of  $\pm 50$  m in the WSD location, unless more specific information on the location accuracy of the WSD is available.



**Table 3 -- Required Separation Distance of Fixed WSD From the Broadcast TV-Protected Contour**

Fixed WSD		DTV (Full and Low-power) (km)			Analog TV (Full and Low-power) (km)	
maxHAAT (m)	Channel Range	Co-channel	1st Adjacent Channel	Taboo Channels N±2, N±3, N±4	Co-channel	1st Adjacent and Taboo Channels
<b>Below 3</b>	2-6	37.0	2.0	0.0	28.1	2.2
	7-13	23.4	1.7	0.0	19.4	2.0
	14-51	14.4	1.4	0.0	11.4	1.0
<b>4-10</b>	2-6	37.0	2.0	0.0	28.1	2.2
	7-13	23.4	1.7	0.0	19.4	2.0
	14-51	14.4	1.4	0.0	11.4	1.0
<b>11-30</b>	2-6	37.0	2.0	0.0	28.1	2.2
	7-13	23.4	1.7	0.0	19.4	2.0
	14-51	14.4	1.4	0.0	11.4	1.0
<b>31-50</b>	2-6	47.9	2.5	0.0	36.5	2.2
	7-13	30.2	1.7	0.0	25.1	2.0
	14-51	18.7	1.4	0.0	14.7	1.0
<b>51-75</b>	2-6	57.5	3.1	0.0	44.8	2.6
	7-13	37.2	1.9	0.0	31.1	1.7
	14-51	23.2	1.4	0.0	18.5	1.0
<b>76-100</b>	2-6	63.6	3.5	0.0	51.5	2.9
	7-13	42.9	2.0	0.0	36.2	1.7
	14-51	27.0	1.4	0.0	21.4	1.0
<b>101-150</b>	2-6	73.1	4.2	0.0	60.7	3.4
	7-13	51.7	2.1	0.0	43.9	1.8
	14-51	33.1	1.4	0.0	26.3	1.0
<b>151-200</b>	2-6	80.4	4.7	0.0	67.8	3.8
	7-13	58.3	2.1	0.0	49.9	1.8
	14-51	37.1	1.4	0.0	30.3	1.0
<b>201-250</b>	2-6	87.0	5.1	0.0	74.0	4.0
	7-13	63.5	2.2	0.0	55.6	1.8
	14-51	40.3	1.4	0.0	33.7	1.0

**Table 3bis -- Minimum Separation Distance Between Fixed WSD and the Far Side of the Broadcast TV-Protected Contour**

Fixed WSD		DTV (Full & Low-power) (km)		Analog TV (Full & Low-power) (km)	
maxHAAT (m)	Channel Range	Co- channel	1st Adjacent Channel	Co-channel	1st Adjacent and Taboo Channels
<b>Below 3</b>	2-6	82.1	3.5	43.0	2.3
	7-13	53.4	2.6	28.2	2.2
	14-51	35.1	1.9	21.1	1.8
<b>4-10</b>	2-6	82.1	3.5	43.0	2.3
	7-13	53.4	2.6	28.2	2.2
	14-51	35.1	1.9	21.1	1.8
<b>11-30</b>	2-6	82.1	3.5	43.0	2.3
	7-13	53.4	2.6	28.2	2.2
	14-51	35.1	1.9	21.1	1.8
<b>31-50</b>	2-6	90.3	4.5	55.4	3.0
	7-13	63.3	3.4	36.3	2.2
	14-51	42.2	2.5	21.1	1.8
<b>51-75</b>	2-6	96	5.6	64.0	3.7
	7-13	71.4	4.1	44.5	2.5
	14-51	48.3	3.0	26.1	1.8
<b>76-100</b>	2-6	101.3	6.4	70.1	4.2
	7-13	77.2	4.5	50.7	2.6
	14-51	53.0	3.4	30.3	1.8
<b>101-150</b>	2-6	110.5	7.9	79.8	5.1
	7-13	85.3	5.3	59.9	2.8
	14-51	59.8	3.9	36.2	1.8
<b>151-200</b>	2-6	117.9	9.0	87.2	5.8
	7-13	91.1	5.9	66.5	3.0
	14-51	64.2	4.4	40.5	1.8
<b>201-250</b>	2-6	124.1	10.1	93.7	6.4
	7-13	96.5	6.2	71.6	3.1
	14-51	69.0	4.7	44.0	1.8

**Table 4 -- Required Separation Distance Between Personal/Portable Mode II WSD (100 mW) and the Broadcast TV-Protected Contour**

Personal/Portable Mode II WSD	Distance (km)				
	DTV (Full and Low-power)			Analog TV (Full and Low-power)	
Channel Range	Co-channel	1st Adjacent Channel*	Taboo Channels N±2, N±3, N±4	Co-channel	1st Adjacent and Taboo Channels*
21-36, 38-51	14.4	1.1	0.0	11.4	1.0

\*Adjacent and taboo channel operation is permitted for personal/portable WSDs operating below 40 mW.

**Table 4bis -- Required Separation Distance Between Personal/Portable Mode II WSD (100 mW) and the Far Side of the Broadcast TV-Protected Contour**

Personal/Portable Mode II WSD	Distance (km)				
	DTV (Full and Low-power)			Analog TV (Full and Low-power)	
Channel Range	Co-channel	1st Adjacent Channel*	Taboo Channels N±2, N±3, N±4	Co-channel	1st Adjacent and Taboo Channels*
21-36, 38-51	35.1	1.9	0.0	21.1	1.8

\*Adjacent and taboo channel operation is permitted for personal/portable WSDs operating below 40 mW.

## 10. Protection Criteria of Remote Rural Broadband Systems (RRBSs)

A WSDB shall protect the RRBS base station (downstream) transmitted protected contour, which corresponds to a field strength of 37.8 dB $\mu$ V/m at a receive antenna height of 10 m. The RRBS nominal service contour is calculated using the licensed base station power and minimum HAAT of 30 m in all directions as described in Annex C.

A WSDB shall also protect the RRBS base station (upstream) received signal at the RRBS base station from the CPE. The separation distances for the receive channel shall be calculated using the protection criteria as specified in Table C2 in Annex C.

The WSD separation distance from RRBS scenarios are outlined below.

**10.1 Fixed Separation Distance From a Fixed WSD to an RRBS Base Station-protected Contour (Downstream)**

A WSDB shall ensure that fixed WSDs shall protect the transmit channel of the RRBS base station by operating outside the protected contours of the transmit co-channel, and outside the first adjacent and second adjacent transmit channel RRBS stations, at the minimum separation distances specified in Table 5a.

**Table 5a -- Required Separation Between Fixed WSD and the Protected Contour (Downstream) of the RRBS Transmit Channel Base Station**

maxHAAT of Fixed WSD	Required Separation (km) of Fixed WSD from the Protected Contour of the RRBS Transmit Channel Base Station		
	Co-channel	1 <sup>st</sup> Adjacent Channel	2 <sup>nd</sup> Adjacent Channel
Less than 3 m	8.1	1.3	0.4
3 m to less than 10 m	8.1	1.3	
10 m to less than 30 m	8.1	1.3	
30 m to less than 50m	10.2	1.6	
50 m to less than 75 m	12.1	1.8	
75 m to less than 100 m	14.2	2.0	
100 m to less than 150 m	17.1	2.3	
150 m to less than 200 m	20.3	2.7	
from 200 m to 250 m	22.8	2.9	

**10.2 Fixed WSD Separation Distance to the RRBS Base Station Receive Channel (Upstream)**

A WSDB shall ensure that fixed WSDs shall protect the co-channel receive channel of the RRBS licensee by operating at the minimum separation distances from the RRBS base station coordinates specified in Table 5b. Note that, unlike the distances in Table 5a, these distances do not include the RRBS nominal service contour.

**Table 5b -- Fixed WSD Separation from RRBS Base Station (Upstream)**

maxHAAT of Fixed WSD	Required Separation from RRBS Receive Channel Base Station Coordinates (km)		
	Co-channel	1 <sup>st</sup> Adjacent Channel	2 <sup>nd</sup> Adjacent Channel
Less than 3 m	31.0	7.3	1.6
3 m to less than 10 m	31.0	7.3	1.6
10 m to less than 30 m	31.0	7.3	1.6
30 m to less than 50 m	38.3	9.1	1.9
50 m to less than 75 m	44.6	10.8	2.2
75 m to less than 100 m	50.1	12.7	2.5
100 m to less than 150 m	57.8	15.3	2.9
150 m to less than 200 m	64.6	18.0	3.3
200 m to 250 m	69.9	20.7	3.6

### 10.3 Mode II Personal/Portable WSD Separation Distance to RRBS Base Transmit Channel Protected Contour

A WSDB shall ensure that mode II personal/portable WSDs operating with power levels less than or equal to 100 mW (20 dBm) shall operate at the separation distance to the transmit RRBS base station contours as specified in Table 6a.

**Table 6a -- Mode II Personal/Portable Separation Distance to RRBS Base Transmit Channel Protected Contour**

maxHAAT of Mode II WSD	Required Separation from RRBS Base Transmit Protected Contour (km)	
	Co-channel	1 <sup>st</sup> Adjacent Channel*
Less than 250 m	8.2	0.7

\*First and second adjacent channel operation is permitted for personal/portable WSDs operating below 40 mW.

**10.4 Mode II Personal/Portable WSD Separation Distance to the Receive RRBS Base Station Coordinates**

A WSDB shall ensure that Mode II personal/portable WSDs operating with power levels less than or equal to 100 mW (20 dBm) shall operate at the separation distance, as specified in Table 6b, to the receive channel’s base station-protected contour.

**Table 6b -- Mode II Personal/Portable Separation Distance to RRBS Receive Channel-Protected Contour**

maxHAAT of Mode II WSD	Required Separation from Receive RRBS Base Station Coordinates (km)	
	Co-channel	1 <sup>st</sup> Adjacent Channel*
Less than 250 m	37.8	6.5

\*First and second adjacent channel operation is permitted for personal/portable WSDs operating below 40 mW.

In determining the required separations, the WSDB shall by default include a margin of error of ±50 metres in the WSD location, unless more specific information on the location accuracy of the WSD is available.

**11. Protection Criteria to Licensed LPA and Developmental Stations**

- (i) Registered licensed LPA and developmental licence scheduling information will be included within the WSDB and a WSDB shall not provide channels within the following distances of the registered licence during their indicated time of operation according to the protection criteria outlined in Table 7.

**Table 7 -- WSD Separation Distances From Protected LPA and Developmental Stations**

White Space Device Characteristics	Required Co-channel Separation From Protected LPA and Developmental Stations (km)
Personal/portable	400 m
Fixed	1 km

## 12. Protection of Radio Astronomy

In order to protect radio astronomy observatories, a WSDB shall not permit the use of WSDs on any channel within a distance of 2.4 km from the following coordinates:

- The Dominion Radio Astrophysical Observatory, located near Penticton, British Columbia (latitude 49° 19' 12" N, longitude 119° 37' 12" W); and
- Algonquin Provincial Park in Ontario (latitude 45° 57' 19.8" N, longitude 78°4' 22.95" W).

## 13. Security

- (i) A WSDB shall incorporate reasonable and reliable security measures to ensure that WSD will not operate on occupied channels or cause interference to licensed services or systems.
- (ii) A WSDB shall employ the following measures to protect the security of operational and/or client data:
  - Implementation of reasonably secure methods for data transmission and authentication that are designed to prevent corruption or unauthorized modification of data when communicated between the WSDB and WSDs; and
  - Implementation of reasonable controls designed to protect data from unauthorized access, input, manipulation or the deliberate extraction of operational and/or client data.

## 14. Database Access Initialization and Reverification Procedures

- (i) A WSDB shall provide fixed and mode II personal/portable WSDs with channel availability information and shall include any scheduled changes in channel availability within the coming 48 hours, upon initialization and reverification of WSD contact.
- (ii) A WSDB may provide available channel information to mode II personal/portable WSDs for locations beyond their current position and use that information to define a geographic area within which they could operate on the same available channels at all locations.

## 15. Synchronization

- (i) A WSDB shall ensure it synchronizes its data with Industry Canada licensing information at least every 24 hours;

- (ii) A WSDB shall ensure that the registration information of the fixed WSD sites, TV receive sites, cable TV head-ends, and scheduling information of licensed LPA sites is synchronized with the other designated Canadian WSDBs, as well as with any U.S. WSDBs identified by Industry Canada<sup>4</sup> at least every 15 minutes.
- (iii) Industry Canada may specify particular channels and locations where WSDBs must ensure protection to services that change in operation faster than usual. The WSDB must take appropriate steps to ensure WSDs operating at the specified locations clear the protected channel within 15 minutes after a reservation is made by any such service with any of the certified, authorized WSDBs.

## 16. Detailed Log Files

For the purposes of resolving potentially harmful radio interference, WSDBAs must maintain a log of all active WS device registration, client contact and related operational information, for a minimum period of sixty (60) calendar days, and must make all such information available to Industry Canada upon request.

A WSDBA shall also provide Industry Canada with access to the detailed log files of WSD queries and responses (including those that are personally identifiable) contained in its database, for the purposes of evaluation and enforcement.

## 17. Operation Near the Canada-U.S. Border

### 17.1 Background

The bands 54-60 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-698 MHz are currently covered by the [Agreement Between the Government of Canada and the Government of the United States of America Related to the TV Broadcasting Service and the Associated Working Arrangement \(the Agreement\)](#), the [Letter of Understanding \(LOU\)](#),<sup>5</sup> which covers areas within 400 km of the border, and the [Interim Agreement Between Canada and the United States Concerning Digital Television \(DTV\) \(the Interim Agreement\)](#).

These three agreements and working arrangements deal with the sharing and use of the bands by broadcasting services operating in the United States and in Canada. In addition, the LOU specifies that new (non-broadcasting) services shall not claim protection from DTV stations or analog TV stations in either country.

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<sup>4</sup> This provision will depend on the outcome of cross-border negotiations with the U.S. During those negotiations, Industry Canada will consider and minimize any resulting burden on Canadian databases.

<sup>5</sup> The full title of the LOU is: [Letter of Understanding Between the Federal Communications Commission of the United States of America and Industry Canada Related to the Use of the 54-72 MHz, 76-88 MHz, 174-216 MHz and 470-806 MHz Bands for the Digital Television Broadcasting Service Along the Common Border](#).



The LOU does not deal with non-broadcasting versus non-broadcasting operations in the border area. Therefore, until such time as a new Agreement can be reached between Canada and the United States, any authorization issued for non-broadcasting use in Canada within 400 km of the border area must be on a no-interference, no-protection basis with respect to broadcasting services in the United States.

## **17.2 Protection Criteria for U.S. Stations**

Operating U.S. broadcasting stations, protected receive sites and LPA are to be protected according to the same criteria specified for Canadian stations above, with the exception that protected contours and/or operational areas will be assumed to stop at the Canada/U.S. border. The required separation distances extend within Canada.

## **18. Interference Response**

Interference response remains Industry Canada's responsibility. In order to facilitate this, a WSDB shall:

- (a) Retain logs of WSD queries and responses for sixty (60) days to allow for audits in the case of interference reports. This information shall be provided to Industry Canada following a formal request by the Department; and
- (b) Be capable of indicating, upon request by Industry Canada, that no channels are available when queried by a specific WSD or mode of WSDs. This capability is to be implemented such that a mode of a WSD, or all WSDs, can also be denied to channels on the basis of a geographic area defined by a point and radius, or by a quadrilateral defined by straight lines connecting four geographic points.

Issued under the authority of  
the Minister of Industry

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Daniel Duguay  
Director General  
Engineering, Planning and Spectrum Branch

## **Annex A – WSDB Interface Evaluation Tests**

### **A1.1 WSDB Interface Test to Connect with a Fixed WSD**

A WSDB shall perform the following validations on the information provided by a fixed WSD before initializing it:

- a. Device is certified under RSS-222 as a fixed WSD. This may require the WSD to provide a device-type identifier (e.g. an Industry Canada Identification Number (IC ID)) to the WSDB;
- b. Manufacturer's serial number for the device is not on the denied list;
- c. Geographic coordinates are within Canada; and
- d. Antenna height AMSL or AGL is provided and the height AGL is  $\leq 30$  m.

### **A1.2 WSDB Interface with a Mode II Personal/Portable WSD Initialization**

A WSDB shall perform the following validations on the information provided by a mode II personal/portable WSD before initializing it:

- (a) Device is certified under RSS-222 as a Mode II Personal/Portable device. This may require the WSD to provide a device-type identifier (e.g. an Industry Canada Identification Number (IC ID)) to the WSDB;
- (b) Manufacturer's serial number for the device is not on the denied list; and
- (c) Geographic coordinates are within Canada.

### **A1.3 WSDB Mode I Personal/Portable WSD Validation**

A WSDB shall perform the following checks on the information provided by a mode I personal/portable WSD before initializing it:

- (a) That the device is certified under RSS-222 as a Mode I Personal/Portable device. This may require the WSD to provide a device-type identifier (e.g. an Industry Canada Identification Number (IC ID)) to the WSDB;
- (b) If the validation request comes from a fixed WSD, that the fixed WSD has a maxHAAT of less than or equal to 106 m.

### **A1.4 White Space Channel Availability**

A WSDB shall confirm which available channels are available to the type of WSD (fixed or personal/portable) under test.

### **A1.5 First Adjacent Power Reduction**

A WSDB shall only provide available channels to a WSD located within the protected contour of a station on the first adjacent or any taboo channel when it is a personal/portable WSD that has an output power limited to 40 mW e.i.r.p or less.

## **Annex B – Determination of the TV Broadcast Protected Contour**

- (i) The position of the protected contour of each TV station is determined using the height above average terrain (HAAT, as defined in Section 4) measurement on each of 360 equally-spaced radials, starting from True North and moving clockwise.
- (ii) The ERP is determined in the direction of each radial, using the directional antenna tabulations for the broadcast station. Individual relative field values are then squared and multiplied by the maximum ERP, which will derive the ERP along the specific radial. Since the HAAT values are to be computed for 1 degree intervals and the antenna tabulation will typically be at much larger intervals, the WSDB should interpolate dB units between provided antenna data points using linear interpolation. Where the broadcast antenna pattern data does not exist for a directional station, the maximum ERP value is applied in all directions.
- (iii) The ERP and HAAT, in conjunction with the criteria in Section 9.2, are used to calculate the distance from the broadcast station to the protected contour along the radial.

## **Annex C – Methodology on the Derivation of the Required Separation Distance to the TV Broadcast and RRBS Contours**

This section is for information only. It describes how the separation distances in tables 3 to 6 were obtained.

### **C1. Methodology Used to Derive the Required Separation Distances From TV Broadcast Contours**

1. Compute the maximum allowable WSD field strengths ( $\text{dB}\mu\text{V/m}$ ) at the protected contours of the TV stations:

$$U_{ws} = D - D/U + FB$$

where FB is the front-to-back ratio of the TV receive antenna in dB, given in Table C1(b) below, D/U in dB is the protection ratio given in Table C1(a), and D is the threshold of the protected TV contours in  $\text{dB}\mu\text{V/m}$  as given in Table 2.

2. Once the maximum allowable WSD field strength values are computed ( $U_{ws}$ ), one can then use the WSD's ERP and maxHAAT, together with the F(50,10) propagation curves, to extract the intermediate distance. Note that due to the limitation of the F(50,10) curves, the minimum HAAT that can be used is 30 m.
3. In order to calculate the actual minimum distances required ( $D_{req}$ ) between the WSD and the protected contours of the TV stations in each band, the intermediate distance is multiplied by a compensation factor of 1.12, which will produce the separation distance to the TV broadcast protected contours. The 1.12 is used to adjust the front-to-back ratio, as shown in Table C1(b), of the TV receiving station when it is not at the maximum value.

Table C1(a): TV Protection Ratios

Type of TV Station	Interfering Channel Offset Relative to Channel N	TV Protection Ratios (Desired/Undesired) (dB)
Analog (full and low-power)*	N-1	-14
	N	34
	N+1	-17
Analog (full and low-power)** UHF only	N-2	-24
	N+2	-28
	N-3	-30
	N+3	-34
	N-4	-34
	N+4	-25
	N-7	-35
	N+7	-43
	N-8	-32
	N+8	-43
	N+14	-33
	N+15	-31
Digital (full and low-power)***	N-4	-52
	N-3	-48
	N-2	-44
	N-1	-33
	N	23
	N+1	-33
	N+2	-44
	N+3	-48
N+4	-52	
* Analog TV protection values have been taken from Industry Canada's Broadcasting Procedures and Rules BPR-10, <a href="#">Part 10: Application Procedures and Rules for Digital Television (DTV) Undertakings</a> .		
** Analog TV protection values have been taken from Industry Canada's Broadcasting Procedures and Rules BPR-10, <a href="#">Part 10: Application Procedures and Rules for Digital Television (DTV) Undertakings</a>		
*** Digital TV protection values have been taken from ATSC <i>Recommended Practice: Receiver Performance Guidelines</i> , <a href="#">Document A/74:2010, 7 April 2010</a> .		

**Table C1(b): Front-to-Back Ratio (dB)**

Channels	Analog Station	DTV Station	Far Side of Contour
2-6	6	10	0
7-13	6	12	0
14-51	6	14	0

**C2. Methodology for the Derivation of the Required Separation Distance to RRBS**

The methodology for the derivation of the required separation distance to RRBS has been adopted from Appendix B in SRSP 300.512, [\*Technical Requirements for Remote Rural Broadcast Systems \(RRBS\) Operating in the Bands 512-608 and 614-698 MHz \(TV Channels 21 to 51\)\*](#).

1. The distance to the Service Contour of the RRBS Base Station Transmit Channel is derived by using the F(50,90) curves, its ERP and its calculated HAAT for each degree starting at 0 degrees; until the 37.8 dB $\mu$ V/m field strength level is reached.
2. The protection criteria in the RRBS Base Station Transmit (Downstream) Channel in Table C2 are used to calculate the separation distances from the WSDs to the RRBS protected contour as defined in Section 10 under tables 5a and 6b. The separation distances have been calculated assuming WSDs are active on multiple channels.
3. The protection criteria in the RRBS Base Station Receive (Upstream) Channel in Table C2, along with a 1.2 multiplier (to take into account multiple WSDs) are used to calculate the separation distances from WSDs to the RRBS base station coordinates, as shown in Section 10 under tables 5b and 6b. The separation distances have been calculated assuming WSDs are active on multiple channels.

**Table C2: RRBS Station Protection Criteria**

<b>Channel</b>	<b>RRBS CPE (Downstream) Protection Criteria (dB<math>\mu</math>V/m)</b>	<b>RRBS Base Station (Upstream) Protection Criteria* (dB<math>\mu</math>V/m)</b>
Co-channel	37.8	14.8
1 <sup>st</sup> Adjacent	69.0	46.1
2 <sup>nd</sup> Adjacent	91.6	68.6

\*SRSP 300.512, sections 9.2.3 and 9.2.25.