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Spectrum Management and Telecommunications

Database Specifications

White Space Database Specifications

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Preface

Database Specification DBS-01, issue 4, *White Space Database Specifications*, replaces *White Space Database Specifications,* issue 3.

The following are the main changes:

1. Added a new class of white space devices (WSDs) with less stringent first-adjacent channel unwanted emission limits.
2. Added new minimum separation distances associated with the new class of WSDs.
3. Included additional guidance related to the operation of mobile WSDs to clarify specific scenarios where simplified calculations of channel availability can be permitted.
4. Added provisions to clarify that proxy devices are permitted to be used for database access.
5. Made editorial changes and clarifications, as appropriate.

Issued under the authority of
the Minister of Innovation, Science and Industry

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Martin Proulx
Director General
Engineering, Planning and Standards Branch

Contents

List of acronyms

AGL	Above ground level
AMSL	Above mean sea level
dirHAAT	Height above average terrain in the direction of the affected TV station
EHAAT	Effective height above average terrain
ERP	Effective radiated power
e.i.r.p.	Equivalent isotropically radiated power
HAAT	Height above average terrain
ISED	Innovation, Science and Economic Development Canada
LP	Low-power
LPA	Low-power apparatus
RRBS	Remote rural broadband systems
UHF	Ultra high frequency
VHF	Very high frequency
VLP	Very low-power
WSD	White space device
WSDB	White space database
WSDBA	White space database administrator

1. Scope

Database Specification DBS-01, issue 4, *White Space Database Specifications*, sets out the technical requirements for the designation of a database capable of identifying available channels for use by white space devices (WSDs) in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 657-663 MHz.

2. Coming into force

This document will come into force upon its publication on Innovation, Science and Economic Development Canada's (ISED) Spectrum Management and Telecommunications website. White space database administrator (WSDBA) applications for designation based on the current issue may be submitted at any time once the document has come into force. Existing WSDBAs which have been designated by ISED under the previous issue of DBS-01 can retain their designation and may continue to operate as previously approved. See section 5 for additional details.

3. Definitions

The following terms are used in this document:

Adjacent channel: A channel that is immediately adjacent to the protected channel of a licensed service or system.

Available channels: A range of frequencies that are deemed by a white space database (WSDB) as available for use by white space devices (WSDs) at a specific time and geographic location.

Class A white space device (WSD): A fixed, mobile or narrowband personal/portable WSD that adheres at all times to the specified Class A conducted power limits outlined in RSS-222, *White Space Devices (WSDs)*, for band edge and adjacent channel emissions.

Class B white space device (WSD): A fixed, mobile or narrowband personal/portable WSD that adheres at all times to the specified Class B conducted power limits outlined in RSS-222, *White Space Devices (WSDs)*, for band edge and adjacent channel emissions.

Dynamic spectrum access (DSA): A technique by which a radio system dynamically adapts to the local radio spectrum environment in order to determine, and then access, available spectrum at specific locations and at a specific time.

Effective height above average terrain (EHAAT): The average of the height above average terrain (HAAT) values determined for 8 radials spaced every 45 degrees of azimuth, starting from true north.

Fixed white space device (WSD): A WSD that transmits and receives radiocommunication signals at a specified fixed location. A fixed WSD selects potential operational frequencies from a list of available channels, as provided by a WSDB.

Geo-fenced area: A geographic area, defined by a boundary, over which certain channels are available; the list of available channels is determined and provided by a WSDB.

Geolocation capability: The ability of a WSD to determine its geographic coordinates and geolocation uncertainty (in metres), with a confidence level of 95%.

Height above average terrain (HAAT): The height of the centre of radiation of an antenna above the average terrain elevation profile (see its definition below) within these specified distance segments along a particular radial:

- For WSDs, RRBS and TV station antennas, the specified distance segment for calculation shall be from 3 to 16 km.
- For low-power (LP) TV station antennas, the specified distance segment for calculation shall be from 0 to 5 km.

Determination of the HAAT does not stop at the Canadian border or over bodies of water, i.e. each HAAT determination shall incorporate the full radial segment and shall not be truncated at the border or over bodies of water.

Height above average terrain in the direction of the affected station (dirHAAT): The largest of the HAAT values determined for radials spaced every 5 degrees of azimuth within an arc of ±22.5 degrees from a line between a WSD location and the closest point on the protected contour of the affected station

Height above ground level (AGL): The height of the radiating centre of an antenna above the ground directly below the antenna.

Innovation, Science and Economic Development Canada (ISED) certification number (IC number): The ISED certification number of a WSD.

Less congested area: A geographic area where at least half of the TV channels within a specific TV band are not being used for broadcast and other protected services and could be made available for use by a WSD.

Low-power apparatus (LPA): A wireless microphone device certified under Radio Standards Specification RSS-210, *Licence-Exempt Radio Apparatus: Category I Equipment*, with a voluntary licence issued under Client Procedures Circular CPC-2-1-28, *Voluntary Licensing of Licence-Exempt Wireless Microphones in the TV Bands*.

Mobile white space device (WSD): A WSD that transmits and/or receives radiocommunication signals on available channels while stationary or in motion within a defined geo-fenced area. The mobile WSD selects potential operational frequencies from a

list of available channels, as provided by a WSDB. A mobile WSD uses an incorporated geolocation capability to determine its location with respect to the boundaries of the defined geo-fenced area.

Mode I personal/portable white space device (WSD): 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 channels. A mode I personal/portable WSD shall obtain, from either a fixed, a mobile or a mode II personal/portable WSD, a list of available channels on which it may operate. A mode I personal/portable WSD does not initiate a network of WSDs or provide a list of available channels to another mode I personal/portable WSD for use by such a device.

Mode II personal/portable white space device (WSD): A personal/portable WSD that uses internal geolocation and accesses a WSDB for a list of available channels. Access to the WSDB may be through a direct connection to the Internet or through an indirect connection that uses a fixed, a mobile or other mode II personal/portable WSD. A mode II personal/portable WSD may provide its lists of available channels to another personal/portable WSD for use by that device.

Narrowband white space device (WSD): A fixed, mode I personal/portable or mode II personal/portable WSD that transmits and/or receives radiocommunication signals with a bandwidth no greater than 100 kHz. A narrowband WSD can operate as a client device or an access point.

Network element device: A network entity communicating with a WSDB as a proxy for one WSD or multiple WSDs operating on the same network.

Personal/portable white space device (WSD): A WSD that transmits and/or receives radiocommunication signals while stationary or in motion at unspecified fixed points.

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

Remote rural broadband systems (RRBS): Fixed systems that provide wireless Internet access for subscriber-based broadband Internet applications that are authorized by a licence to operate on the same frequency bands as WSDs.

Separation distance: The minimum distance that shall exist between a WSD and a station’s protected contour (for broadcasting, RRBS, etc.) in order for a WSD to be permitted to operate.

Terrain elevation profile: Terrain elevations along a particular radial, calculated at intervals of 100 m or less. The terrain elevation is calculated based on the following datasets:

- **in Canada:** the Canadian Digital Elevation Model (CDEM), 1945-2011, or equivalent, at the highest available resolution
- **in the United States:** the United States Geological Survey 3D Elevation Program (USGS 3DEP), or equivalent, using 1 arc-second data for the contiguous U.S. and 2 arc-second data for Alaska, or the highest available resolution

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 headends, outside the edge of the protected contours of a TV station. TV receive sites include those where signals are received over the air, e.g. full power TV stations, TV broadcasters or LP TV stations (i.e. LP or very low-power (VLP) transmitters, translators or booster transmitters).

White space: The part of the spectrum that is, or has become, available to WSD for radiocommunication by radio systems at a specific time period and in a given geographic area.

White space device (WSD): A type of radio apparatus that operates in the white space frequency bands using DSA techniques.
White space database (WSDB): An ISED-designated database that maintains records of protected licensed services and systems operating within the white space frequency bands. The WSDB determines available channels for use by WSDs at a specific time and geographic location.

White space database administrator (WSDBA): A service provider designated by ISED to administer a WSDB within Canada.

4. Related documents

All spectrum-related documents referred to in this paper are available on ISED's Spectrum Management and Telecommunications website. Refer to the following documents as needed:

BPR-4	*Application Procedures and Rules for Television Broadcasting Undertakings*BPR-10 *Application Procedures and Rules for Digital Television (DTV) Undertakings*
CPC-2-1-28	*Voluntary Licensing for Licence-Exempt Wireless Microphones in the TV Bands*
CPC-4-1-01	*Application Procedures for White Space Database Administrators (WSDBAs)*
RSS-210	*Licence-Exempt Radio Apparatus: Category I Equipment*
RSS-222	*White Space Devices (WSDs)*
SMSE-012-12	*Framework for the Use of Certain Non-broadcasting Applications in the Television Broadcasting Bands Below 698 MHz*

SMSE-003-19	*Decision on the Technical and Policy Framework for White Space Devices*
SPB-001-24	*Decision on New Access Licensing Framework, Changes to Subordinate Licensing and White Space to Support Rural and Remote Deployment*
SRSP-300.512	*Technical Requirements for Remote Rural Broadband Systems (RRBS) Operating in the Bands 512-608 MHz (TV Channels 21 to 36)*

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BPR: Broadcasting Procedures and Rules
CPC: Client Procedures Circular
RSS: Radio Standards Specification
SMSE: Spectrum Management Spectrum Engineering
SPB: Spectrum Policy Branch
SRSP: Standard Radio System Plan

5. WSDBA designation

New WSDBA applicants seeking an ISED designation shall be required to comply with the requirements of the current issue of this standard. Upon reception of a WSDBA designation application, ISED will review and assess compliance with the current issue of this standard in accordance with the procedures set out in Client Procedures Circular CPC-4-1-01, *Application Procedures for White Space Database Administrators (WSDBAs)*.

Existing WSDBAs which have been designated by ISED under the previous issue of DBS-01 are not required to meet the additional provisions introduced in the current issue of this document. However, if such a WSDBA would like to make any subsequent changes to its WSDB, it shall obtain approval from ISED and may be required to a submit an application for retaining its designation status, as set out in CPC-4-1-01, and will be assessed for compliance with the current issue of this document.

In order to maintain its designation, a WSDBA shall comply at all times with the terms and conditions of its designation agreement with ISED. In the event of any non-compliance, ISED may take action as laid out under the terms of this agreement, up to and including revoking the WSDBA's designation status. Inactive and revoked WSDBs are prohibited from providing any available channels and corresponding maximum power levels in response to queries from WSDs.

The application and approval status of WSDBAs are shown on ISED's online list of designated WSDBAs, available on ISED's Dynamic Spectrum Access (DSA) website.

6. Purpose and application

A WSDB is a database system designated by ISED that provides WSDs with lists of available channels and the corresponding maximum permitted power for each available

channel, while ensuring protection of all licensed services and systems operating in the white space frequency bands. WSDs are licence-exempt wireless devices that operate on a no-protection, no-interference basis with licensees operating in the same white space frequency bands. A WSDB uses information provided by a WSD, such as geolocation data, to dynamically manage its access to spectrum and provide it with available channels at a specific time and geographic location.

7. Alternative methodologies

This technical standard provides a specific methodology through which a WSDB calculates the list of channels and corresponding maximum power levels available to WSDs. In order to provide maximum flexibility for WSDB implementation, ISED may, on a case-by-case basis and at its discretion, allow a WSDB to implement an alternative calculation methodology different from the one described in this technical standard. This alternative method can be used as long as the WSDBA can demonstrate to ISED that this methodology ensures the level of protection to licensed services specified by the protection criterion established in this document. Regardless of the methodology implemented, a WSDB shall apply the same methodology to all WSDs for which it is providing a list of available channels.

For example, a WSDB could be permitted to use:

- Alternate terrain elevation datasets and/or an alternative methodology for calculating terrain elevation profiles, different than those specified in this document, which results in a greater level of protection to licensed services.
- An alternative methodology which results in larger protected contours than those calculated with the specifications contained in this document.
- An alternative methodology which results in larger minimum separation distances than those specified inthis document.
- An alternative methodology which addresses only a portion of the Canadian geography and/or a portion of the permitted frequency range, provided that the WSDB returns a result of no available channels for operation outside this area and/or frequency range.

If a designated WSDBA would like to make any subsequent changes to its calculation methodology for its WSDB, it shall first obtain written approval from ISED and may be required to submit a new application for retaining its designation status, as set out in CPC-4-1-01, that uses the updated calculation methodology.

8. Optional provisions

In order to provide maximum flexibility and allow for incremental WSDB implementations, some provisions covered in this technical standard are optional.

When determining available channels and corresponding maximum power levels, the following provisions are optional for WSDBs:

- The determination of less congested areas in the case where the WSDB does not provide any available channels for scenarios limited to less congested areas (see section 14.1)
- The implementation of a maximum EHAAT of 700 m in the case where the WSDB implements a maximum EHAAT of 500 m instead (see section 14.4)
- The use of dirHAAT instead of EHAAT when determining separation distances (see section 14.5)

A WSDB may choose whether or not to implement the capability of communicating with and providing available channels to Class A WSDs, narrowband WSDs and/or mobile WSDs. If a WSDB chooses not to implement the requirements associated with these WSD types, it shall not provide any available channels to any WSD of that type.

If a designated WSDBA would like to make any subsequent changes to its WSDB to include optional provisions which were not previously implemented, it shall first obtain written approval from ISED and may be required to submit a new application for retaining its designation status, as set out in CPC-4-1-01, that uses the newly included provisions.

9. White space frequency bands and channels

The frequency bands and channels authorized for use by WSDs are shown in table 1. A WSDB shall provide to a WSD only available channels from among those listed in table 1 and as per the requirements of this standard.

Table 1: Overview of authorized white space frequency bands/channels

Frequency bands (MHz)	Channel name	Incumbent services	Personal/ portable WSD	Fixed WSD	Mobile WSD
54-60	TV Channel 2	TV Broadcasting, LPA	Not permitted	✓ **	✓
60-72	TV Channels 3-4	TV Broadcasting, LPA	Not permitted	✓ **	✓
76-88	TV Channels 5-6	TV Broadcasting, LPA	Not permitted	✓ **	✓
174-216	TV Channels 7-13	TV Broadcasting, LPA	Not permitted	✓ **	✓
470-512	TV Channels 14-20	TV Broadcasting, LPA	✓ **	✓ **	✓

512-602	TV Channels 21-35	TV Broadcasting, LPA, RRBS	✓ **	✓ **	✓
602-608	TV Channel 36***	TV Broadcasting, LPA, RRBS	✓	✓	Not permitted
608-614	TV Channel 37*	Medical telemetry and radio astronomy	Not permitted	Not permitted	Not permitted
614-617	600 MHz guard band	LPA	Not permitted	Not permitted	Not permitted
617-652	600 MHz mobile downlink	Mobile services	Not permitted	Not permitted	Not permitted
652-657	600 MHz duplex gap	LPA	Not permitted	Not permitted	Not permitted
657-663	600 MHz duplex gap	LPA	✓	Not permitted	Not permitted
663-698	600 MHz mobile uplink	Mobile services	Not permitted	Not permitted	Not permitted

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

**Narrowband WSDs are permitted to operate only in available channels below 602 MHz that are allowed for the specific type of narrowband WSD (fixed, mode II personal/portable or mode I personal/portable) and shall be self-restricted to operate within that spectrum irrespective of the WSDB's calculation of channel availability.

***On channel 36, a WSDB shall limit fixed Class B WSDs to an e.i.r.p. level of 625 mW or less. A WSDB shall not permit fixed Class A WSDs to operate on channel 36.

10. WSDB access to ISED's SMS database

A WSDB shall access the publicly available data extract from ISED's Spectrum Management System (SMS) database in the "White Space Data Extract" section of the Spectrum Management System Data web page.

10.1. WSDB information update from ISED's SMS database

A WSDB shall retrieve, at least once every 24 hours, the most up to date White Space Data Extract from the ISED SMS database.

10.2. WSDB failure to access ISED's SMS database

Should the White Space Data Extract not be accessible, additional attempts to retrieve it from the ISED SMS database shall be made at least once every 4 hours. If more than 12 hours has elapsed without the WSDB being able to retrieve this data extract, the WSDBA shall contact ISED regarding the unsuccessful access to the ISED SMS database.

Thereafter, a WSDB may continue to operate for seven days from the last successful access, unless otherwise indicated by ISED. After those seven days, the WSDB shall operate only in accordance with instructions provided by ISED.

Following unsuccessful attempts to access the ISED SMS database, and thereafter obtaining a successful connection, the WSDBA shall notify ISED of the successful access.

10.3. Information provided in the White Space Data Extract

The White Space Data Extract contains the following information:

- Station data for active over the air TV broadcasting stations
- Station data for protected stations such as RRBS
- Licence information for licensed LPAs
- Horizontal antenna pattern data for active over the air TV broadcasting stations
- Certificate information for certified WSDs

The specifics of the information fields in the White Space Data Extract are provided in the associated glossary. The White Space Data Extract may also include information of other radio systems not protected from WSDs, such as radio systems operating under a developmental licence, which are provided for information purposes only.

10.3.1. Geographic reference datum

If the geographic reference datum for coordinates of stations provided in the White Space Data Extract differs from the datum used by a WSDB's internal calculations and/or the datum used to obtain the geographic coordinates of WSDs, the WSDB shall ensure that the appropriate conversion calculations are incorporated.

11. Registration of TV receive sites and licensed LPAs

A WSDB shall have a registration process for TV receive sites and licensed LPAs, according to the criteria set out in this section and its subsections. A WSDB shall incorporate a publicly available and easily accessible method for viewing the registered TV receive site and licensed LPA information.

11.1. Registration of TV receive sites

A WSDB shall incorporate a publicly available and easily accessible registration process for TV receive site users to obtain protection from WSDs. A WSDB shall only provide protection to TV receive sites that are registered with the WSDB under this process, or that are registered with another designated WSDB and obtained via synchronization (see section 15).

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

- name of the contact individual or business responsible for the TV receive site
- mailing address for the contact
- email address for the contact
- phone number for the contact
- geographic coordinates of the location of the TV receive site
- call sign of the TV receive site
- call sign of the TV transmitter associated with the TV receive site

A WSDB shall validate the obtained information from TV receive site users by:

- Confirming that the obtained call sign of the TV transmitter associated with the TV receive site is a valid ISED-authorized call sign included in the White Space Data Extract.
- Confirming that the TV receive site geographic coordinates reside no farther than 80 km outside the nearest edge of the protected contour of the TV transmitter associated with the TV receive site (see section 15).

If the obtained information cannot be validated, the WSDB shall reject the registration and return a message to the user to contact ISED for authorization.

11.2. Registration of licensed LPAs

A WSDB shall incorporate a publicly available and easily accessible registration process for licensed LPA users to log information about their scheduling and location(s) of operation to obtain protection from WSDs. A WSDB shall provide protection to licensed LPAs at times and locations that are registered with the WSDB under this process, or that are registered with another designated WSDB and obtained via synchronization (see section 17).

A WSDB shall obtain and register the following information from licensed LPA users wishing to be protected from WSDs:

- name of the contact individual or business responsible for the licensed LPA
- mailing address for the contact
- email address for the contact
- phone number for the contact
- area of operation, as outlined in section 11.2.1, where the licensed LPA will be used
- centre frequency (MHz) or channel number of the channel(s) used by the licensed LPA at the area of operation being registered
- period of operation of the channels, i.e. specific hours, days, weeks and/or months, when the licensed LPA will be used at the area of operation being registered

- licensed LPA's authorization number (i.e. licence number)

A WSDB shall validate the obtained information from licensed LPA users by:

- Confirming that the obtained licensed LPA's authorization number reflects a valid ISED license included in the White Space Data Extract.
- Confirming that the licensed LPA is authorized, as specified on the license information in the White Space Data Extract, to operate on frequencies which overlap with the channel(s) being registered.
- Confirming that the licensed LPA is authorized, as outlined in section 11.2.1, to operate in the area of operation being registered.

If the obtained information cannot be validated, the WSDB shall reject the registration and return a message to the user to contact ISED for a licence, as detailed in CPC-2-1-28.

A WSDB shall limit the period of operation being registered to less than one year. A WSDB shall allow a licensed LPA user to register a period of operation as a recurring event. For the protection of the future occurrences of the event, the WSDB shall ensure that the registered licensed LPA information remains valid at that time.

11.2.1. Area of operation for licensed LPA registration

To register the area of operation of a licensed LPA, a WSDB shall first obtain from the White Space Data Extract the location (i.e. geographic coordinates) and the authorized radius of operation of the licensed LPA, and use this information as outlined below to validate the area of operation being registered by the licensed LPA user.

If no authorized radius of operation is provided in the license or if the authorized radius of operation is less than or equal to 500 m, the area of operation being registered with the WSDB shall be defined by the user using a radius around the location of the licensed LPA, and the maximum radius registered by the user shall be 500 m.

If the authorized radius of operation is larger than 500 m, the area of operation being registered with the WSDB shall be defined by the user using a point and radius or a quadrilateral option, as chosen by the user and as prescribed below. The WSDB shall ensure that the area of operation registered by the user lies completely within the area defined by the licensed LPA's location and authorized radius of operation.

- Point and radius option: The area(s) of operation shall be defined using a maximum of 25 geographic points at any one time. Each geographic point shall have a maximum radius of operation of 500 m around the particular point.
- Quadrilateral option: The area(s) of operation shall be defined based on the edges of straight lines connecting the vertices (geographic points) of a quadrilateral. Up to four quadrilaterals may be registered. Each quadrilateral shall be specified with four geographic points and the distance between any two adjacent points shall be limited to 3 km.

ISED may consider allowing a WSDBA to use other options for licensed LPA users to define the area of operation for the licensed LPA on a case-by-case basis, at the request of the WSDBA.

12. Obtaining and validating WSD device information

A WSDB shall securely obtain and validate device information prior to initiating service and whenever providing available channels and corresponding maximum power levels to a WSD, according to the criteria outlined in this section and its subsections.

A WSDB may obtain device information directly from WSDs, indirectly from WSDs communicating with the WSDB through other WSDs, or indirectly through a network element device communicating with the WSDB as a proxy for one or multiple WSDs operating on the same network.

12.1. Obtaining WSD device information

A WSDB shall obtain the following device information from fixed WSDs:

- Geographic coordinates (latitude and longitude) that lie in Canada
- Location uncertainty in meters with a confidence level of 95% or greater
- Antenna height above ground level (AGL) or above mean sea level (AMSL) in meters
- ISED certification number
- Manufacturer's serial number

A WSDB shall obtain the following device information from mobile WSDs:

- Geographic coordinates defining a geo-fenced area that lies entirely in Canada
- Antenna height AGL in meters
- ISED certification number
- Manufacturer's serial number

A WSDB shall obtain the following device information from mode II personal/portable WSDs:

- Geographic coordinates that lie in Canada
- Location uncertainty in meters with a confidence level of 95% or greater
- ISED certification number
- Manufacturer's serial number

A WSDB shall obtain the following device information from any intermediate WSD communicating with the WSDB on behalf of a mode I personal/portable WSD:

- Device information of the intermediate device, as outlined above based on its device type
- ISED certification number of the mode I personal/portable WSD
- Manufacturer's serial number of the mode I personal/portable WSD

12.2. Validating WSD device information

A WSDB shall only provide available channels and corresponding maximum power levels to WSDs whose information has been validated by the WSDB.

For all WSD types, a WSDB shall validate that the obtained ISED certification numbers reflect valid certifications and corresponding device type labels under Radio Standards Specification RSS-222, *White Space Devices (WSDs)*. A list of certified devices with ISED certification numbers and device type labels is provided in the White Space Data Extract.

For fixed and mobile WSDs, a WSDB shall additionally validate that the fixed or mobile WSD is registered with the WSDB and associated with a registered point of contact (see section 13.2). The registration of fixed and mobile WSDs is required regardless of the type of application for which the WSD is put into use, i.e. regardless of whether the WSD operates as a base station, a subscriber module or customer premise equipment (CPE), etc.

13. Registration of fixed and mobile WSDs and points of contact

A WSDB shall have a registration process for fixed and mobile WSDs and a registration process for points of contact responsible for resolving interference issues related to the operation of registered fixed and mobile WSDs. A WSDB shall only provide available channels and corresponding maximum power levels to fixed and mobile WSDs that have been registered with the WSDB and that have been associated with a registered point of contact.

13.1. Registration of fixed and mobile WSDs

A WSDB shall securely register the device information obtained from fixed and mobile WSDs. The WSDB shall ensure that the registered fixed or mobile WSD device information is accurate, complete and kept-up-to date (e.g. the WSDB shall ensure that the registration is updated when new device information is obtained).

13.2. Registration of points of contact

A WSDB shall securely register the following information of the point of contact responsible for resolving interference issues related to the operation of specific fixed and/or mobile WSDs registered with the WSDB:

- Name of the contact individual, department or business
- Mailing address for the contact
- Phone number for the contact
- Verified email address for the contact

A WSDB shall have a method of associating a registered point of contact with the specific registered fixed and/or mobile WSDs they are responsible for (e.g. using a combination of the ISED certification numbers and the manufacturer's serial numbers).

13.3. Storing and disclosing registered information

A WSDB shall store registered fixed and mobile WSD device information and the associated point of contact information in a secure database for the duration of at least 60 calendar days after the device's last contact with the WSDB.

A WSDB shall incorporate a publicly available and easily accessible method for viewing the registered device information of fixed and mobile WSDs.

A WSDBA shall disclose fixed and mobile WSD device information and associated point of contact information registered with its WSDB to ISED upon request.

14. WSDB determination of available frequencies and corresponding maximum power levels

When a WSD contacts a WSDB to obtain a list of available channels, the WSDB shall provide to the WSD a list of available channels and corresponding maximum power levels according to the criteria set out in this section and its subsections. The WSDB shall provide to each WSD it communicates its own separate list of available channels, even if the WSD communicates with the WSDB indirectly though an intermediate WSD or through a network element device (for example; a mode I personal/portable WSD communicating though another WSD, or a fixed WSD operating as a subscriber module in a broadband deployment communicating through another fixed WSD operating as a base station radio).

A WSDB shall be capable of determining available channels for a given WSD based on:

- The protected licensed services' information retrieved from ISED's White Space Data Extract (see section 10)
- The registered TV receive site and licensed LPA information (see section 11)
- The device information obtained from the WSD and the WSD device type (see section 12)
- The required protection criteria (see sections 15 to 18)
- The provisions for supporting mobile WSDs, if implemented (see section 19)
- The provisions for supporting narrowband WSDs, if implemented (see section 20)

When providing channel availability to a WSD, a WSDB shall include any scheduled changes in channel availability within the coming 48 hours.

A WSDB may provide available channel information to mode II personal/portable WSDs for locations beyond their current position. The mode II personal/portable WSDs can use that

information to define a geographic area within which it could operate on the same available channels at all locations.

14.1. Determination of less congested areas

A WSDB shall be able to determine if a geographic point or area falls within a less congested area by validating if at least half of the TV channels are not being used by protected services and could be made available for use by a WSD. Less congested areas shall be determined separately for each of the three TV bands; 54-72 MHz along with 76-88 MHz for the low VHF band; 174-216 MHz for the high VHF band; and 470-608 MHz for the UHF band.

When determining less congested areas, a “channel” is considered available for WSD use if it is available for use by a fixed WSD operating with 40 mW e.i.r.p. at 3 m EHAAT with an antenna height AGL below 10 m.

The implementation of provisions for less congested areas is optional for WSDBs. A WSDB may avoid the need to calculate less congested areas if it limits all WSDs to an e.i.r.p. level of less than or equal to 4 W (36 dBm) and does not provide any available channels to mobile WSDs.

14.2. WSD power limits

In less congested areas, a WSDB shall not provide any available channels to a fixed WSD with a corresponding e.i.r.p. level greater than 16 W (42 dBm) per 6 MHz channel. In areas which are not less congested, a WSDB shall not provide any available channels to a fixed WSD with a corresponding e.i.r.p. level greater than 4 W (36 dBm) per 6 MHz channel.

On channel 36, a WSDB shall limit fixed Class B WSDs to an e.i.r.p. level of 625 mW (28 dBm). A WSDB shall not permit fixed Class A WSDs to operate on channel 36.

In less congested areas, a WSDB shall not provide any available channels to a mobile WSD with a corresponding e.i.r.p. level greater than 16 W (42 dBm) per 6 MHz channel. In areas which are not less congested, a WSDB shall not provide any available channels to a mobile WSD.

A WSDB shall not provide any available channels to a mode I or mode II personal/portable WSD with a corresponding e.i.r.p. level greater than 100 mW (20 dBm) per 6 MHz channel.

14.3. Treatment of antenna height

If a fixed or mobile WSD reported its antenna height as a height AMSL, the WSDB shall convert the height AMSL to a height AGL. To perform the conversion, the WSDB shall determine the ground elevation at the device’s geographic coordinates and subtract its value from the reported height AMSL to produce the equivalent antenna height AGL.

If the antenna height AGL of the fixed or mobile WSD is less than 1.5 meters, the WSDB shall set it to a value of 1.5 meters for the purpose of determining channel availability.

14.4. Height limits

A WSDB may choose to implement a maximum EHAAT limit of 500 m or optionally 700 m. A WSDB shall not provide any channels to a fixed or mobile WSD if its EHAAT exceeds the limit implemented (e.g. 500 m or 700 m).

In the case of an intermediate fixed or mobile WSD requesting available channels for a mode I personal/portable WSD, a WSDB shall not provide any available channels for the mode I personal/portable WSD if the EHAAT of the intermediate WSD exceeds 106 m.

14.5. Use of dirHAAT instead of EHAAT

For the protection of TV broadcasting and RRBS stations, and where a WSDB is capable of calculating the dirHAAT of each affected station, the WSDB may optionally use dirHAAT instead of the EHAAT when determining appropriate separation distances.

14.6. Treatment of location uncertainty

When providing channel availability and corresponding maximum power levels to a WSD with reported location accuracy uncertainty, a WSDB shall increase the required separation distances by the amount that the location accuracy uncertainty of the WSD exceeds 50 m.

15. Protection criteria for TV broadcasting stations and registered TV receive sites

A WSDB shall protect active over-the-air TV broadcasting stations and registered TV receive sites, and return a list of available channels and corresponding maximum power levels to WSDs according to the protection criteria set out in this section and its subsections.

15.1. Protection contours for TV broadcasting stations

A WSDB shall calculate protected contours for TV broadcasting stations based on the propagation models and electromagnetic field strength levels specified in table 2 and in accordance with the methodology described in Annex B.

Table 2: Thresholds for the protected contours of TV broadcasting stations

Type of TV station	TV channel	Thresholds for TV broadcasting station-protected contour (dBµV/m)	Propagation curve*
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)	64-20log(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)	41-20log(615/F**)	F(50,90)
***See BPR-10, annex F. ****F is the centre frequency of the TV channel in MHz.			

15.1.1. Protection of registered TV receive sites

A WSDB shall protect TV receive sites outside the protected contour, where signals are received for retransmission or monitoring. These sites include TV studio and transmitter locations, relay points and broadcasting distribution undertaking headends, 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 from WSDs, a TV receive site shall be registered with a WSDB as described in section 11.1.

A WSDB shall ensure that WSDs protect a registered TV receive site by not operating on a co-channel or adjacent-channel basis over the area encompassing an arc of ±30 degrees from a line extending from the registered TV receive site towards its associated TV transmitter station. This protection area shall extend to a radius of 80 km for co-channel protection and 20 km for adjacent-channel protection, or to the edge of the associated TV station's protected contour, whichever distance is less.

Outside of the ±30-degree arc area, a WSDB shall ensure WSDs protect a registered TV receive site by operating at least at the minimum co-channel and adjacent channel separation distances from the TV receive site coordinates specified in Tables 3 and 4.

Table 3: Minimum co-channel separation distance (km) from the TV receive site coordinates outside of the 30-degree arc area

WSD e.i.r.p. (W)	Fixed, mobile or mode II personal/portable WSD
e.i.r.p. ≤ 4	8
4 < e.i.r.p. ≤ 10	10.2
e.i.r.p. > 10	16.6

Table 4: Minimum adjacent-channel separation distance (km) from the TV receive site coordinates outside of the 30-degree arc area

WSD e.i.r.p. (W)	Fixed cClass A or mobile cClass A WSD	Fixed Class B, mobile Class B or personal/portable mode II WSD
e.i.r.p. ≤ 4	6.2	2
4 < e.i.r.p. ≤ 10	7.8	2.5
e.i.r.p. > 10	11.1	3.5

For the protection of registered TV receive sites, there is no need to increase the separation distances above when a fixed, mobile or mode II personal/portable WSD communicates with a mode I personal/portable WSD.

15.2. Protection of TV broadcasting stations

A WSDB shall ensure that fixed and mobile WSDs protect both digital and analog TV broadcasting station by operating at least at the minimum co-channel and adjacent channel separation distances from the TV protected contours indicated in the tables in Annex B:

- table B1 applies to all co-channel cases in the UHF frequency band;
- table B2 applies to all adjacent channel cases in the UHF frequency band for Class A WSDs;
- table B3 applies to all adjacent channel cases in the UHF frequency band for Class B WSDs;
- table B6 applies to all co-channel cases in the low and high VHF frequency band;
- table B7 applies to all adjacent channel cases in the low and high VHF frequency bands for Class A WSDs; and
- table B8 applies to all adjacent channel cases in the low and high VHF frequency bands for Class B WSDs.

The adjacent channel case separation distances are required to be implemented only for channels within the same TV band (i.e. low VHF, high VHF, or UHF) in which the TV station is operating. If a fixed Class B or mobile Class B WSD is operating with an e.i.r.p. level of 40 mW or less, as well as with an antenna height AGL not exceeding 10 m, a WSDB shall not apply the adjacent channel separation distances in tables B3 and B8 and shall list all adjacent channels as available within the broadcast TV protected contours. Adjacent channel separation distances in tables B2 and B7 for fixed Class A and mobile Class A WSDs shall be applied regardless of e.i.r.p. level or antenna height AGL.

A WSDB shall also apply the minimum separation distances provided in tables B4 and B5 of Annex B for personal/portable WSDs from the near side of the protected contours for both digital and analog TV stations. If a personal/portable WSD is operating with an e.i.r.p. level of 40 mW or less, a WSDB shall not apply the adjacent channel separation distances in table B5 and shall list all adjacent channels as available within the broadcast TV-protected contours.

16. Protection criteria for RRBS

A WSDB shall protect the RRBS base station (downstream) transmitted protected contour, which corresponds to a field strength of 30.8 dBµV/m at a receive antenna height of 9 m. The RRBS-protected contour shall be calculated using the licensed base station power following the method outlined in Annex B. The RRBS downstream operation is protected with a minimum separation distance from the protected contour, as specified in sections 16.1 and 16.3 below.

A WSDB shall also protect the RRBS base station (upstream) received signal at the RRBS base station location. The RRBS upstream operation is protected with a minimum separation distance from the base station location, as specified in sections 16.2 and 16.4 below.

When the WSD's power level falls in between any two power levels referenced in tables 5 and 6 below, the higher power level requirements shall apply.

16.1. Fixed and mobile WSD minimum separation distance from the RRBS base station protected contour on the RRBS base station transmit channel (downstream)

A WSDB shall ensure that fixed and mobile WSDs protect the RRBS base station transmit channel by operating at least at the minimum co-channel separation distances from the RRBS base station protected contour specified in table 5.

Table 5: Fixed and mobile WSD minimum separation distance from the RRBS base station protected contour on the RRBS base station transmit channel (downstream)

EHAAT (m) of fixed or mobile WSD	Minimum separation distance (km) from the protected contour of the RRBS transmit channel base station		
	Co-channel to RRBS base station transmit frequency		
	WSD e.i.r.p. (both Class A and B)		
	4 W	10 W	16 W
EHAAT ≤ 3	2.5	3.2	3.6
3 < EHAAT ≤ 10	4.6	5.8	6.5
10 < EHAAT ≤ 30	8.0	10.0	11.3
30 < EHAAT ≤ 50	10.3	12.9	14.5
50 < EHAAT ≤ 75	12.6	16.3	18.3
75 < EHAAT ≤ 100	15.1	18.9	21.3
100 < EHAAT ≤ 150	18.5	23.3	26.1
150 < EHAAT ≤ 200	21.2	26.8	30.1
200 < EHAAT ≤ 250	23.7	29.8	32.7
250 < EHAAT ≤ 300	25.9	32.0	35.1

300 < EHAAT ≤ 350	27.9	34.1	37.5
350 < EHAAT ≤ 400	29.9	36.1	39.8
400 < EHAAT ≤ 450	31.4	38.0	41.7
450 < EHAAT ≤ 500	32.8	39.8	43.5
500 < EHAAT ≤ 700 (optional)	37.5	45.4	49.9

16.2. Fixed and mobile WSD minimum separation distance from the RRBS base station on the RRBS base station receive channel (upstream)

A WSDB shall ensure that fixed and mobile WSDs protect the RRBS base station receive channel by operating at least at the minimum co-channel separation distances from the RRBS base station coordinates specified in table 6.

Table 6: Fixed and mobile WSD minimum separation distance from the RRBS base station coordinates on the RRBS base station receive channel (upstream)

EHAAT (m) of fixed or mobile WSD	Minimum separation distance (km) from the RRBS base station coordinates		
	Co-channel to RRBS base station receive frequency		
	WSD e.i.r.p. (both Class A and B)		
	4 W	10 W	16 W
EHAAT ≤ 3	11.4	14.3	16.1
3 < EHAAT ≤ 10	20.7	26.1	29.3
10 < EHAAT ≤ 30	39.8	51.2	58.0
30 < EHAAT ≤ 50	47.3	57.8	64.2
50 < EHAAT ≤ 75	53.8	64.1	70.3
75 < EHAAT ≤ 100	58.9	69.3	75.5
100 < EHAAT ≤ 150	66.0	76.3	82.8
150 < EHAAT ≤ 200	70.8	82.0	89.3
200 < EHAAT ≤ 250	76.3	89.0	96.9
250 < EHAAT ≤ 300	81.2	94.9	102.9
300 < EHAAT ≤ 350	86.5	101.0	109.5
350 < EHAAT ≤ 400	91.3	106.5	115.7
400 < EHAAT ≤ 450	95.6	111.8	121.2
450 < EHAAT ≤ 500	99.7	116.5	126.2
500 < EHAAT ≤ 700 (optional)	113.4	132.8	143.7

16.3. Mode II personal/portable WSD minimum separation distance from the RRBS base station protected contour on the RRBS base station transmit channel (downstream) for co-channel operation

A WSDB shall ensure that mode II personal/portable WSDs operate at least at the minimum separation distance of 8.2 km from the transmit RRBS base station protected contour.

16.4. Mode II personal/portable WSD minimum separation distance from the RRBS base station coordinates on the RRBS base station receive channel (upstream) for co-channel operation

A WSDB shall ensure that mode II personal/portable WSDs operate at least at the minimum separation distance of 37.8 km from the RRBS receive channel's base station coordinates.

16.5. Communication with mode I personal/portable WSDs and protection criteria for RRBS

A WSDB shall ensure that when a WSD communicates with a mode I personal/portable WSD, the minimum separation distances outlined in sections 15.1 to 15.4 above are increased by:

- 1.3 km when the mode I personal/portable device operates at an e.i.r.p. less than or equal to 40 mW
- 1.7 km when the mode I personal/portable device operates at an e.i.r.p. greater than 40 mW

17. Protection criteria for registered licensed LPA

A WSDB shall protect licensed LPA according to the licensed LPA areas of operation and scheduling information registered within the WSDB. A WSDB shall provide channels only to WSDs located at least at the minimum separation distance from the edge of the registered area of operation of the protected licensed LPA. For fixed and mobile WSDs, the minimum separation distance shall be 1 km if the device e.i.r.p. is less than or equal to 10 W, and 1.3 km if the device e.i.r.p. is greater than 10 W. For personal/portable WSDs, the minimum separation distance shall be 0.4 km.

For the protection of registered licensed LPA, there is no need to increase the distances above when a fixed, mobile, or mode II personal/portable WSD communicates with a mode I personal/portable WSD.

18. Protection criteria for radio astronomy observatories

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

- Dominion Radio Astrophysical Observatory, located near Penticton, British Colombia (latitude 49° 19´ 12¨ N, longitude 119° 37´ 12¨ W)
- Algonquin Provincial Park, located in Ontario (latitude 45° 57´ 19.8¨ N, longitude 78° 4´ 22.95¨ W)

For the protection of radio astronomy observatories, there is no need to increase the distance above when a fixed, mobile, or mode II personal/portable WSD communicates with a mode I personal/portable WSD.

19. WSDB requirements for mobile WSDs operating in geo-fenced areas

A WSDB may choose whether or not to implement the capability of providing available channels to mobile WSDs. If it does choose to implement this capability, the requirements described in this section shall be met. A WSDB shall not provide any available channels to a mobile WSD if these requirements are not implemented.

19.1. Available channels over a geo-fenced area

A WSDB shall provide a list of available channels and the corresponding maximum permitted power levels to a mobile WSD for operation within a defined geo-fenced area. A WSDB shall not provide any list of available channels to a mobile WSD operating outside of a less congested area.

The WSDB shall take into consideration the mobile device's antenna height AGL in determining the list of available channels. The WSDB shall take into consideration any variation in mobile device EHAAT throughout the geo-fenced area and shall limit the channel availability provided to the mobile WSD to only channels available in every point within the area.

19.2. Mobile WSD minimum separation distance

A WSDB shall ensure that mobile WSDs operate at least at the minimum separation distances from protected services that apply for fixed WSDs, as specified in sections 15, 16, 17 and , at all points within the geo-fenced area in which the mobile WSD intends to operate.

To simplify the calculations performed by the WSDB, certain scenarios could only necessitate determining channel availability at the center point of the geo-fenced area in which the mobile WSD intends to operate instead of assessing all points. For example, this simplification would be appropriate:

- If the geo-fenced area can be enclosed within a circle of radius equal to or less than 100 meters;
- If the boundary of geo-fenced area is located at a distance greater than the largest minimum separation distances from protected services that apply for fixed WSDs, as specified in sections 15, 16, 17 and 18.

19.3. Boundaries of geo-fenced areas

A WSDB shall obtain from a mobile WSD the boundaries that define the geo-fenced area in which the mobile WSD intends to operate. Alternatively, the WSDB may provide the mobile

WSD with the boundaries of a geo-fenced area in which it can operate. The area boundaries used by the WSDB to determine channel availability shall be the same as the boundaries stored within the mobile WSD.

20. WSDB requirements for supporting narrowband WSDs

A WSDB may choose whether or not to implement the capability of providing available channels to narrowband WSDs. If it does choose to implement this capability, the requirements described in this section shall be met. A WSDB shall not provide any available channels to a narrowband WSD if these requirements are not implemented.

A WSDB shall obtain and validate device information from narrowband fixed WSDs, narrowband mode II personal/portable WSDs and narrowband mode I personal/portable WSDs as outlined in section 12.2, in the same way as for the respective device type. A WSDB shall register narrowband fixed WSDs as outlined in section 13.1, in the same way as for fixed WSDs.
A WSDB shall determine available channels and corresponding maximum power levels for narrowband WSDs by limiting the maximum power level to 4 W (36 dBm) per 6 MHz channel and by:

- applying the separation distances for a fixed WSD to narrowband fixed WSDs;
- applying the separation distances for a fixed WSD to narrowband mode II personal/portable WSDs and assuming an antenna height AGL of 3 m;

When a WSD communicates with a mode I personal/portable WSD, various parts of this technical standard include provisions to increase the minimum separation distance applied to protect incumbent services by some prescribed amount. A WSDB shall apply the same increase in minimum separation distances when a WSD communicates with a narrowband mode I personal/portable WSD as those prescribed when a WSD communicates with a non-narrowband mode I personal/portable WSD.

21. Security

A WSDB shall incorporate reasonable and reliable communication and information security measures. A WSDB shall employ both of 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 ensure that all communications between the WSDB and WSDs are accurate and secure, and to prevent corruption or unauthorized modification of data during communication
- Implementation of reasonable information security standards to protect the data in the WSDB from unauthorized access, input, manipulation or the deliberate extraction of operational and/or client data

Furthermore, the WSDB security protocols for communication and information security shall be updated in a timely manner to ensure protection against any new and emerging security

threats. ISED reserves the right to review and request information on the security features implemented by a WSDB and may, at its discretion, direct the WSDBA to make adjustments.

22. Synchronization

A WSDB shall ensure that the registration information of fixed and mobile WSDs, of TV receive sites, and of the areas of operation and scheduling of licensed LPA sites is synchronized at least every 15 minutes with all other designated Canadian WSDBs.

Any designated WSDBA and a new entrant WSDBA seeking designation shall develop a successful synchronization process within two months of the application date of the new entrant WSDB. If the process is unsuccessful, ISED will specify the synchronization process that both WSDBAs shall implement as well as the time frame under which it shall be completed. To the extent possible, new entrant WSDBAs are expected to adopt any existing de facto standards for synchronization established between designated WSDBAs.

23. Operation near the Canada-U.S. border

Operating U.S. broadcasting stations are to be protected according to the same criteria specified for Canadian stations above; however, protected contours will be assumed to stop at the Canada-U.S. border. The required separation distances extend within Canada.

24. Interference response

Interference cases resulting from incorrect licence information will be the sole responsibility of the licensee, which is responsible for providing accurate and current data under the terms of their license.

Other interference cases stemming from the operation of WSDs remain ISED's responsibility and WSDBAs shall provide requested information to ISED following a formal request. In order to facilitate the request and for the purposes of resolving cases of potentially harmful interference, a WSDBA shall implement capabilities according to the criteria set out in this section and its subsections.

Anyone with interference concerns or issues is encouraged to contact their closest ISED district office.

24.1. Detailed log files

A WSDBA shall retain detailed logs of all mobile and fixed WSD registrations and authentications with its WSDB.

A WSDBA shall retain detailed logs of all WSD communications, i.e. queries and responses, with its WSDB. These logs shall include a reference to the registered information of the associated device in the case of mobile and fixed WSDs.

A WSDBA shall retain all detailed logs for a duration of at least 60 calendar days after a device's last contact with its WSDB and shall make all such information available to ISED upon request.

24.2. Spectrum availability check

A WSDB shall incorporate a publicly available and easily accessible method of viewing general channel availability at a given location.

Following a request from ISED, a WSDBA shall be able to provide ISED with a method of querying its WSDB for available frequencies and associated maximum power levels at a given location and for a given set of WSD parameters. The WSDB shall be able to return a response to such a query as if it were being queried by a WSD.

25. Enforcement instructions from ISED

Even if a WSDB meets the requirements of this document, ISED may impose corrective measures and provide enforcement instructions to WSDBAs whenever harmful interference to protected licensed systems is caused by the operation of WSDs. A WSDBA shall abide by any corrective measures and comply with enforcement instructions from ISED.

25.1. List of denied devices

Following a request from ISED, a WSDB shall deny the provision of available channels to particular WSDs that are no longer authorized by ISED to operate under the control of the WSDB. These denied devices may be identified by ISED using the device ISED certification number or using a combination of the device ISED certification number and the manufacturer's serial number. If a WSDBA uses additional parameters to identify devices registered with its WSDB, ISED may also use these additional parameters to identify denied devices. Devices shall only be added to or removed from the list of denied devices after receiving formal direction from ISED.

25.2. List of denied geographic areas

Following a request from ISED, a WSDB shall deny the provision of specific channels to all WSDs located in particular geographic areas. These denied geographic areas, along with the associated denied channels, may be identified by ISED using a geographic point and radius or using a quadrilateral area defined by four geographic points connected with lines of longitude and latitude. Geographic areas shall only be added to or removed from the list of denied geographic areas after receiving formal direction from ISED.

26. Contact information

All enquiries concerning the technical requirements for the designation of a WSDBA and for the operation of a WSDB should be directed to the following address:

Directorate of Coordination and Terrestrial Engineering (DCTE)
Innovation, Science and Economic Development Canada
235 Queen Street
Ottawa ON K1A 0H5
Email: dynamicspectrumaccess-accesdynamiqueauspectre@ised-isde.gc.ca

Annex A: Determination of the TV- and RRBS-protected contours

The following is the procedure for determining TV- and RRBS-protected contours:

a. The height above average terrain (HAAT) value of the TV broadcast or RRBS station on each of 360 equally spaced radials, starting from true north and moving clockwise, is calculated.

   In calculating the HAAT value, the ground elevation above mean sea level (AMSL) at the station location provided in the ISED database shall be used instead of the ground elevation predicted by the terrain elevation dataset.

b. The effective radiated power (ERP) is determined in the direction of each radial by subtracting the station's antenna pattern attenuation in that direction (i.e. dB attenuation below the maximum antenna gain) from the station's maximum ERP value.

   Since the HAAT values are to be computed for 1-degree intervals and the antenna pattern tabulation may be at much larger intervals, the white space database (WSDB) shall, in such cases, interpolate dB units between provided antenna pattern attenuation data points using linear interpolation.

   Where the station antenna pattern data is not provided, the WSDB shall assume an omnidirectional antenna pattern, i.e. the maximum ERP value is applied in all directions.

c. The ERP and HAAT, in conjunction with the criteria in section 15.2, are used to calculate the distance from the TV broadcast station to the TV-protected contour along each radial.

   Similarly, the distance from the RRBS base station to the protected contour of the RRBS base station transmit channel is calculated along each radial using the determined ERP and HAAT values and the F(50,90) propagation curves, until a 30.8 dBµV/m field strength level is reached at a 9 m receive antenna height.

   For interpolating a value between available data points on the F propagation curves, interpolation shall be used and all units shall be converted to the decibel scale during the interpolation process (i.e. field strength remains in dBu, height is converted to dB referenced to 1 m, and distance is converted to dB referenced to 1 km). As a minimum, linear interpolation shall be implemented, but more accurate interpolation techniques may also be permitted.

   Data tables for the F propagation curves are available on ISED's website under the figure descriptions for the curves provided in annex F of BPR-10. The use of these data tables is recommended, but other sources of data tables may be accepted by ISED if they accurately cover the same propagation curves. The F propagation curves have a limited range of data points for input and output parameters for which to provide

propagation results. If a terrain profile or station antenna height leads to a height value above or below the curve limits, the value at the limit should be used (i.e. 30 m and 1600 m for lower and upper limits respectively). If the transmitter power is sufficiently low that a distance below the curve limits is obtained, the free space propagation model should be used as an alternate.

Annex B: Minimum separation distances

This annex prescribes the minimum separation distance required between the TV-protected contour and white space devices (WSDs) operating at a given height (i.e. effective height above average terrain (EHAAT)), channel range and power level. The white space database (WSDB) shall provide the list of available channels based on the prescribed minimum separation distances and the WSD's location, in accordance with the requirements of section 14.3.1. For the cases when the WSD's power level falls in between any of the two power levels referenced in tables B1 to B6 below, the higher power level requirements shall apply.

Table B1: Minimum separation distance (in km) of fixed (Ch. 14 to 36) and mobile (Ch. 14 to 35) WSDs[1] operating at UHF frequency from the digital and analog TV-protected contour for co-channel operation

EHAAT (m) of fixed or mobile WSD	Fixed or mobile WSD equivalent isotropically radiated power (e.i.r.p.)							
	40 mW	100 mW	250 mW	625 mW	1.6 W	4 W	10 W	16 W
EHAAT ≤ 3	1.3	1.7	2.1	2.7	3.3	4.0	4.5	5.0
3 < EHAAT ≤ 10	2.4	3.1	3.8	4.8	6.1	7.3	8.5	9.4
10 < EHAAT ≤ 30	4.2	5.1	6.0	7.1	8.9	11.1	13.9	15.3
30 < EHAAT ≤ 50	5.4	6.5	7.7	9.2	11.5	14.3	19.1	20.9
50 < EHAAT ≤ 75	6.6	7.9	9.4	11.1	13.9	18.0	23.8	26.2
75 < EHAAT ≤ 100	7.7	9.2	10.9	12.8	17.2	21.1	27.2	30.1
100 < EHAAT ≤ 150	9.4	11.1	13.2	16.5	21.4	25.3	32.3	35.5
150 < EHAAT ≤ 200	10.9	12.7	15.8	19.5	24.7	28.5	36.4	39.5
200 < EHAAT ≤ 250	12.1	14.3	18.2	22.0	27.3	31.2	39.5	42.5
250 < EHAAT ≤ 300	13.9	16.4	20.0	23.9	29.4	35.4	42.1	45.9
300 < EHAAT ≤ 350	15.3	17.9	21.7	25.7	31.4	37.6	44.5	48.4
350 < EHAAT ≤ 400	16.6	19.3	23.2	27.3	33.3	39.7	46.9	51.0
400 < EHAAT ≤ 450	17.6	20.4	24.4	28.7	35.1	41.9	49.4	53.8
450 < EHAAT ≤ 500	18.3	21.4	25.5	30.1	36.7	43.7	51.4	55.9

[1] Operating on channel 36 is not permitted for Class A WSDs.

500 < EHAAT ≤ 550 (optional)	18.9	21.8	26.3	31.0	37.9	45.3	53.3	57.5
550 < EHAAT ≤ 700 (optional)	21.1	23.3	29.9	37.4	46.1	55.3	64.4	69.5

When a fixed or mobile WSD communicates with a mode I personal/portable WSD operating at an e.i.r.p. less than or equal to 40 mW, the minimum separation distances in table B1 shall be increased by 1.3 km. When a fixed or mobile WSD communicates with a mode I personal/portable WSD operating at an e.i.r.p. greater than 40 mW, the minimum separation distances in table B1 shall be increased by 1.7 km. When a fixed or mobile WSD communicates with a narrowband mode I personal/portable WSD, the minimum separation distances in table B1 shall be increased by 1.3 km.

Table B2: Minimum separation distance (in km) of fixed (Ch. 14 to 35) and mobile (Ch. 14 to 35) Class A WSDs operating at UHF frequency from the digital and analog TV-protected contour for adjacent channel operation

EHAAT (m) of fixed or mobile WSD	Fixed or mobile WSD e.i.r.p.						
	100 mW	250 mW	625 mW	1.6 W	4 W	10 W	16 W
EHAAT ≤ 3	0.2	0.3	0.3	0.4	0.5	0.6	0.7
3 < EHAAT ≤ 10	0.4	0.5	0.6	0.7	0.9	1.2	1.3
10 < EHAAT ≤ 30	0.6	0.8	1.0	1.3	1.6	2.0	2.2
30 < EHAAT ≤ 50	0.8	1.0	1.2	1.6	2.0	2.6	2.9
50 < EHAAT ≤ 75	1.0	1.3	1.6	2.0	2.5	3.2	3.6
75 < EHAAT ≤ 100	1.2	1.5	1.8	2.3	2.9	3.6	4.1
100 < EHAAT ≤ 150	1.4	1.8	2.2	2.8	3.6	4.5	5.0
150 < EHAAT ≤ 200	1.6	2.0	2.6	3.3	4.1	5.2	5.8
200 < EHAAT ≤ 250	1.8	2.3	2.9	3.6	4.6	5.8	6.5
250 < EHAAT ≤ 300	2.0	2.5	3.2	4.0	5.0	6.3	7.1
300 < EHAAT ≤ 350	2.2	2.7	3.4	4.3	5.4	6.8	7.7
350 < EHAAT ≤ 400	2.3	2.9	3.6	4.6	5.8	7.3	8.2
400 < EHAAT ≤ 450	2.4	3.1	3.9	4.9	6.2	7.7	8.7
450 < EHAAT ≤ 500	2.6	3.2	4.1	5.2	6.5	8.2	9.2

500 < EHAAT ≤ 550(optional)	2.7	3.4	4.3	5.4	6.8	8.6	9.6
550 < EHAAT ≤ 700 (optional)	3.1	3.8	4.8	6.1	7.7	9.7	10.9

Table B3: Minimum separation distance (in km) of fixed (Ch. 14 to 36) and mobile (Ch. 14 to 35) Class B WSDs operating at UHF frequency from the digital and analog TV-protected contour for adjacent channel operation

EHAAT (m) of fixed or mobile WSD	Fixed or mobile WSD e.i.r.p.						
	100 mW	250 mW	625 mW	1.6 W	4 W	10 W	16 W
EHAAT ≤ 3	0.1	0.1	0.1	0.1	0.2	0.2	0.3
3 < EHAAT ≤ 10	0.1	0.2	0.2	0.2	0.3	0.4	0.5
10 < EHAAT ≤ 30	0.2	0.3	0.3	0.4	0.5	0.6	0.7
30 < EHAAT ≤ 50	0.3	0.3	0.4	0.5	0.7	0.8	1.0
50 < EHAAT ≤ 75	0.3	0.4	0.5	0.7	0.8	0.9	1.0
75 < EHAAT ≤ 100	0.4	0.5	0.6	0.8	1.0	1.1	1.3
100 < EHAAT ≤ 150	0.5	0.6	0.8	0.9	1.2	1.3	1.5
150 < EHAAT ≤ 200	0.5	0.7	0.9	1.1	1.4	1.5	1.7
200 < EHAAT ≤ 250	0.6	0.8	1.0	1.2	1.5	1.7	1.9
250 < EHAAT ≤ 300	0.7	0.8	1.0	1.3	1.6	2.1	2.3
300 < EHAAT ≤ 350	0.7	0.9	1.1	1.4	1.8	2.2	2.4
350 < EHAAT ≤ 400	0.8	1.0	1.2	1.5	1.9	2.4	2.7
400 < EHAAT ≤ 450	0.8	1.0	1.3	1.6	2.1	2.6	2.9
450 < EHAAT ≤ 500	0.8	1.1	1.4	1.7	2.1	2.7	2.9
500 < EHAAT ≤ 550(optional)	0.9	1.2	1.5	1.8	2.2	2.8	3.0
550 < EHAAT ≤ 700 (optional)	1.0	1.2	1.6	2.0	2.4	3.1	3.4

When a fixed or mobile WSD communicate with a mode I personal/portable WSD operating at an e.i.r.p. greater than 40 mW, the minimum separation distances in tables B2 and B3 shall be increased by 0.1 km. When a fixed or mobile WSD communicates with a narrowband mode I personal/portable WSD, the minimum separation distances in table B1 shall be increased by 0.1 km.

Table B4: Minimum separation distance (in km) of mode II personal/portable WSD from the digital and analog TV-protected contour for co-channel operation

Type of WSD being communicated with	Mode II personal/portable WSD e.i.r.p.	
	40 mW	100 mW
Mode II personal/portable or fixed WSD	1.3	1.7
Mode I personal/portable WSD	2.6	3.4

Table B5: Minimum separation distance (in km) of mode II personal/portable WSD from the digital and analog TV-protected contour for adjacent channel operation

Type of WSD being communicated with	Mode II personal/portable WSD e.i.r.p. of 100 mW*
Mode II personal/portable or fixed WSD	0.1
Mode I personal/portable WSD	0.2
*Adjacent channel operation is permitted for personal/portable WSDs operating below 40 mW, i.e. all adjacent channels are listed as available within the TV-protected contour.	

Table B6: Minimum separation distance (in km) of fixed (Ch. 2 to 13) and mobile (Ch. 2 and Ch. 5 to 13) WSDs operating at VHF frequency from the digital and analog TV-protected contour for co-channel operation

EHAAT (m) of fixed or mobile WSD	VHF channel range	Fixed or mobile WSD e.i.r.p.							
		40 mW	100 mW	250 mW	625 mW	1.6 W	4 W	10 W	16 W
	2 to 6	3.4	4.2	5.3	6.6	8.4	10.5	13.2	14.9
EHAAT ≤ 3	7 to 13	1.9	2.4	3	3.8	4.7	5.9	7.5	8.4
3 < EHAAT ≤ 10	2 to 6	6.1	7.7	9.6	12.1	15.3	19.2	24.1	27.1

	7 to 13	3.5	4.3	5.4	6.8	8.6	10.8	13.6	15.3
	2 to 6	10.5	13.2	16.6	21.7	28.2	37	50.6	59.9
10 < EHAAT ≤ 30	7 to 13	5.9	7.5	9.4	11.8	18.2	23.4	30.1	34.4
	2 to 6	13.6	17.4	21.9	28.1	36.5	47.9	62.7	71.1
30 < EHAAT ≤ 50	7 to 13	7.7	9.6	12.1	18.6	23.7	30.2	38.8	44.3
	2 to 6	17	21.5	27.4	35	44.9	57.5	71.2	79.2
50 < EHAAT ≤ 75	7 to 13	9.4	11.8	18.3	23.1	29.3	37.2	47.2	53.1
	2 to 6	19.8	25.3	32	40.6	51.5	63.6	77.3	85
75 < EHAAT ≤ 100	7 to 13	10.8	16.9	21.3	26.9	34.2	42.9	53.6	59.5
	2 to 6	24.6	31.3	39.3	49.1	60.8	73.1	86.9	94.3
100 < EHAAT ≤ 150	7 to 13	13.2	20.6	26.1	32.8	41.5	51.7	62.7	68.6
	2 to 6	28.7	36.2	45	55.9	67.8	80.3	94.2	101.6
150 < EHAAT ≤ 200	7 to 13	18.7	23.6	29.8	37.6	47.3	58.3	69.2	74.7
	2 to 6	32.2	40.4	50.2	61.7	74	87	100.7	108.4
200 < EHAAT ≤ 250	7 to 13	20.9	26.5	33.5	42.1	52.7	63.5	74.3	79.9
	2 to 6	35.3	44.2	54.8	67.3	79.0	92.2	105.9	113.5
250 < EHAAT ≤ 300	7 to 13	23.0	29.1	36.8	46.1	57.3	67.9	78.7	83.9
300 < EHAAT ≤ 350	2 to 6	38.3	48.0	59.4	71.6	84.5	98.0	112.5	120.3
	7 to 13	25.2	32.5	40.8	50.6	61.7	72.5	83.3	89.0
350 < EHAAT ≤ 400	2 to 6	41.2	51.7	63.5	75.8	89.6	103.3	118.5	127.1
	7 to 13	27.7	35.7	44.4	54.8	66.0	76.7	87.7	93.7
400 < EHAAT ≤ 450	2 to 6	44.3	55.8	67.7	80.4	94.5	109.1	125.1	133.9
	7 to 13	30.1	38.7	48.3	59.1	70.3	81.2	92.9	99.5
450 < EHAAT ≤ 500	2 to 6	47.3	59.2	71.4	84.7	99.5	114.6	130.8	140.1
	7 to 13	32.8	41.9	52.1	62.9	74.1	85.4	98.2	105.0
500 < EHAAT ≤ 700 (optional)	2 to 6	57.0	69.6	83.1	97.4	112.8	128.7	145.2	153.3
	7 to 13	40.5	51.6	63	75.2	88.6	101.4	114.9	122.0

Table B7: Minimum separation distance (in km) of fixed (Ch. 2 to 13) and mobile (Ch. 2 and Ch. 5 to13) Class A WSDs operating at VHF frequency from the digital and analog TV-protected contour for adjacent channel operation

EHAAT (m) of fixed or mobile WSD	VHF channel range	Fixed or mobile WSD e.i.r.p.						
		100 mW	250 mW	625 mW	1.6 W	4 W	10 W	16 W
EHAAT ≤ 3	2 to 6	0.4	0.5	0.7	0.8	1.0	1.3	1.5
	7 to 13	0.2	0.3	0.4	0.5	0.7	0.8	0.9
3 < EHAAT ≤ 10	2 to 6	0.8	1.0	1.2	1.5	1.9	2.4	2.7
	7 to 13	0.5	0.6	0.8	1.0	1.2	1.5	1.7
10 < EHAAT ≤ 30	2 to 6	1.3	1.7	2.1	2.7	3.4	4.2	4.8
	7 to 13	0.8	1.1	1.3	1.7	2.1	2.7	3.0
30 < EHAAT ≤ 50	2 to 6	1.7	2.2	2.7	3.4	4.3	5.5	6.1
	7 to 13	1.1	1.4	1.7	2.2	2.7	3.4	3.9
50 < EHAAT ≤ 75	2 to 6	2.1	2.6	3.3	4.2	5.3	6.7	7.5
	7 to 13	1.3	1.7	2.1	2.7	3.4	4.2	4.7
75 < EHAAT ≤ 100	2 to 6	2.4	3.0	3.9	4.9	6.1	7.7	8.7
	7 to 13	1.5	1.9	2.4	3.0	3.9	4.9	5.5
100 < EHAAT ≤ 150	2 to 6	3.0	6.8	4.7	6.0	7.5	9.4	10.6
	7 to 13	1.9	2.4	3.0	3.8	4.7	6.0	6.7
150 < EHAAT ≤ 200	2 to 6	3.4	4.3	5.5	6.9	8.7	10.9	12.3
	7 to 13	2.2	2.7	3.4	4.4	5.5	6.9	7.7
200 < EHAAT ≤ 250	2 to 6	3.9	4.8	6.1	7.7	9.7	12.2	13.7
	7 to 13	2.4	3.1	3.8	4.9	6.1	7.7	8.7
250 < EHAAT ≤ 300	2 to 6	4.2	5.3	6.7	8.5	10.6	13.4	15.0
	7 to 13	2.7	3.4	4.2	5.3	6.7	8.4	9.5
300 < EHAAT ≤ 350	2 to 6	4.6	5.7	7.2	9.7	11.5	14.4	16.2
	7 to 13	2.9	3.6	4.5	5.8	7.2	9.1	10.2
350 < EHAAT ≤ 400	2 to 6	4.9	6.1	7.7	9.8	12.3	15.4	17.3
	7 to 13	3.1	3.9	4.9	6.2	7.7	9.7	11.0

400 < EHAAT ≤ 450	2 to 6	5.2	6.5	8.2	10.3	13.0	16.4	18.4
	7 to 13	3.3	4.1	5.2	6.5	8.2	10.3	11.6
450 < EHAAT ≤ 500	2 to 6	5.5	6.9	8.6	10.9	13.7	17.2	19.4
	7 to 13	3.4	4.3	5.4	6.9	8.7	10.9	12.2
550 < EHAAT ≤ 700 (optional)	2 to 6	6.5	8.1	10.2	12.9	16.2	20.4	22.9
	7 to 13	4.1	5.1	6.4	8.1	10.2	12.9	14.5

Table B8: Minimum separation distance (in km) of fixed (Ch. 2 to 13) and mobile (Ch. 2 and Ch. 5 to13) Class B WSDs operating at VHF frequency from the digital and analog TV-protected contour for adjacent channel operation

EHAAT (m) of fixed or mobile WSD	VHF channel range	Fixed or mobile WSD e.i.r.p.						
		100 mW	250 mW	625 mW	1.6 W	4 W	10 W	16 W
EHAAT ≤ 3	2 to 6	0.2	0.3	0.3	0.4	0.5	0.6	0.6
	7 to 13	0.1	0.2	0.2	0.2	0.3	0.3	0.4
3 < EHAAT ≤ 10	2 to 6	0.4	0.4	0.5	0.7	0.8	1.0	1.1
	7 to 13	0.2	0.3	0.3	0.4	0.5	0.6	0.7
10 < EHAAT ≤ 30	2 to 6	0.6	0.7	0.9	1.1	1.4	1.7	1.9
	7 to 13	0.3	0.4	0.5	0.6	0.8	1.0	1.1
30 < EHAAT ≤ 50	2 to 6	0.7	0.9	1.1	1.4	1.8	2.2	2.5
	7 to 13	0.4	0.5	0.7	0.8	1.0	1.3	1.4
50 < EHAAT ≤ 75	2 to 6	0.9	1.1	1.4	1.7	2.1	2.7	3.0
	7 to 13	0.5	0.6	0.8	1.0	1.2	1.5	1.7
75 < EHAAT ≤ 100	2 to 6	1.0	1.3	1.6	2.0	2.5	3.1	3.5
	7 to 13	0.6	0.7	0.9	1.1	1.4	1.8	2.0
100 < EHAAT ≤ 150	2 to 6	1.2	1.5	1.9	2.4	3.0	3.8	4.2
	7 to 13	0.7	0.9	1.1	1.4	1.7	2.1	2.4
150 < EHAAT ≤ 200	2 to 6	1.4	1.8	2.2	2.8	3.5	4.3	4.9
	7 to 13	0.8	1.0	1.3	1.6	2.0	2.5	2.8

200 < EHAAT ≤ 250	2 to 6	1.6	2.0	2.4	3.1	3.9	4.8	5.4
	7 to 13	0.9	1.1	1.4	1.8	2.2	2.7	3.1
250 < EHAAT ≤ 300	2 to 6	1.7	2.1	2.7	3.4	4.2	5.3	6.0
	7 to 13	1.0	1.2	1.5	1.9	2.4	3.0	3.4
300 < EHAAT ≤ 350	2 to 6	1.8	2.3	2.9	3.6	4.6	5.7	6.4
	7 to 13	1.1	1.3	1.6	2.1	2.6	3.2	3.6
350 < EHAAT ≤ 400	2 to 6	2.0	2.5	3.1	3.9	4.9	6.1	6.9
	7 to 13	1.1	1.4	1.8	2.2	2.8	3.5	3.9
400 < EHAAT ≤ 450	2 to 6	2.1	2.6	3.3	4.1	5.2	6.5	7.3
	7 to 13	1.2	1.5	1.9	2.3	2.9	3.7	4.1
450 < EHAAT ≤ 500	2 to 6	2.2	2.7	3.4	4.3	5.4	6.8	7.7
	7 to 13	1.3	1.6	2.0	2.5	3.1	3.9	4.3
500 < EHAAT ≤ 700 (optional)	2 to 6	2.6	3.2	4.1	5.1	6.4	8.1	9.1
	7 to 13	1.5	1.8	2.3	2.9	3.6	4.6	5.1