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Spectrum Management and Telecommunications

Database Specifications

White Space Database Specifications

DRAFT

Preface

Database Specifications DBS-01, Issue 2, *White Space Database Specifications*, replaces *White Space Database Specifications*, Issue 1.

List of Changes:

- (1) White space frequency bands have been revised based on the Decision on the Technical and Policy Framework for White Space Devices.
- (2) In addition to the list of available channels, the WSDB will also provide the associated maximum power levels on which a WSD may operate.
- (3) Editorial changes and clarifications have been made to improve the standard.
- (4) Definition for less congested areas has been added.
- (5) The use of the terms “Television White Space (TVWS)” has been revised to “White Space (WS)”. This reflects the expanded and more general use of spectrum beyond the former TV spectrum.
- (6) Updated the tables of separation distances between WSDs and TV protected contours to facilitate the operation of WSDs’ power levels up to 10 Watts Equivalent Isotropic Radiated Power (e.i.r.p.), and for various power levels below 4 Watts e.i.r.p. The separation distances have also been revised to address separation distances for antenna height below 30 m (outside the F curve range).
- (7) Allow a higher effective height above average terrain (EHAAT), directional height above average terrain (dirHAAT) and antenna height above ground level (AGL). The separation distances have been revised in light of those changes.
- (8) A transition period has been defined to facilitate the transition from DBS-01 issue 1 requirements to DBS-01, issue 2 requirements.
- (9) The separation distances must now include the difference of geo-location’s uncertainty if above the reference ± 50 m uncertainty.

Issued under the authority of
the Minister of Innovation, Science and Economic Development Canada

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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
ISED	Innovation, Science and Economic Development Canada
ISP	Internet Service Provider
LP/LPA	Low-power or Low-power Apparatus (such as wireless microphones)
EHAAT	Effective Height Above Average Terrain
REL	<i>Radio Equipment List</i>
RRBS	Remote Rural Broadband Systems
VLP	Very Low-power
WS	White Space
WSDB	White Space Database
WSDBA	White Space Database Administrator
WSD	White Space Device

1. Scope

DBS-01, Issue 2 *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 in the white space frequency bands (i.e. 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 657-663 MHz).

2. Transition period

2.1 Coming into force

This document will come into force upon its publication on the Innovation, Science and Economic Development Canada's (ISED) Spectrum Management and Telecommunications website.

2.2 New WSDB designations

New WSDBs submitted to ISED for WSDB designation shall be required to comply with the requirements of DBS-01, issue 2. Upon reception of an application for designation, ISED will review and assess compliance to the current issue of this standard.

2.3 Existing designations under DBS-01

Within six months from the date of publication of this standard, a WSDBA having an existing WSDB designation from ISED shall submit an application to ISED demonstrating compliance with the current issue of this standard. Upon reception of the application, ISED will review and assess compliance with the current issue of this standard. In order to maintain its designation, the WSDBA shall be required to take satisfactory corrective measures, as identified and within the timeline set out by ISED.

3. Purpose and application

A white space database (WSDB) is a database system recognized by Innovation, Science and Economic Development Canada (ISED, formerly Industry Canada (IC)) that provides lists of available channels and the corresponding maximum permitted power for each available channel 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 information provided by a WSD, such as geolocation data to dynamically manage their access to spectrum.

White spaces (WS) are the unused portions of the spectrum in the VHF and UHF bands that are available for radiocommunication systems, at a specific time and in a given geographic area.

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

4. White space contact information

In case of interference or concerns regarding calculations performed by authorized WSDBs, ISED encourages the parties involved to contact the Department directly, in order to resolve the issue and address the disagreement. Please contact ISED directly at: ic.whitespace-espaceblanc.ic@canada.ca

5. Definitions

Adjacent Channel: A channel that is immediately adjacent to the protected channel.

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 ISED.

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.

Effective Height Above Average Terrain (EHAAT): The average of the HAAT values determined for eight standard radials spaced every 45 degrees of azimuth starting from true north.

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 and confidence level.

Height Above Ground Level (AGL): The height of the centre of radiation of the antenna above the ground directly below the antenna.

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 intervals¹ from the antenna along a particular radial. AET is calculated based on Geobase Canadian Digital Elevation Model² (CDEM) or 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.

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

² <https://open.canada.ca/data/en/dataset/7f245e4d-76c2-4caa-951a-45d1d2051333>

HAAT in the Direction of the Affected TV Station (*dirHAAT*): The largest of the HAAT values determined for standard radials spaced every 5 degrees of azimuth within an arc of ± 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 ISED certification number of a WSD.

Less congested areas: Geographic areas where at least half of the TV channels are unused for broadcast and other protected services and available for white space device use.

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.

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 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.

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.

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, authorised to operate on a licensed basis on the same frequency bands as WSDs.

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.

Taboo Channel: A channel that is not immediately adjacent to the protected channel and is separated by a defined channel separation from the protected channel. For analog TV, these channels include $N\pm 2$, $N\pm 3$, $N\pm 4$, $N\pm 7$, $N\pm 8$, $N+14$, $N+15$. For digital TV, these channels include $N\pm 2$, $N\pm 3$, $N\pm 4$.

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 ISED-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 ISED 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.

6. 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>.

<u>BPR-4</u>	<i>Application Procedures and Rules for Television Broadcasting Undertakings</i>
<u>BPR-10</u>	<i>Application Procedures and Rules for Digital Television (DTV) Undertakings</i>
<u>BPR-11</u>	<i>Broadcasting Television Application Procedures During the 600 MHz Transition</i>
<u>CPC-2-1-11</u>	<i>Low-power Licensed Wireless Microphones</i>
<u>CPC-2-1-28</u>	<i>Voluntary Licensing for Licence-exempt Wireless Microphones in the TV Bands</i>
<u>CPC-4-1-01</u>	<i>Application Procedures for TV White Space Database Administrators (TVWS Database Administrators)</i>

<u>RSS-196</u>	<i>Point-to-Multipoint Broadband Equipment Operating in the Bands 512-608 MHz for Rural Remote Broadband Systems (RRBS) (TV Channels 21 to 36)</i>
<u>RSS-210</u>	<i>Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment</i>
<u>RSS-222</u>	<i>White Space Devices (WSDs)</i>
<u>SMSE-12-12</u>	<i>Framework for the use of Certain Non-broadcasting Applications in the Television Broadcasting Bands Below 698 MHz</i>
<u>SMSE-003-19</u>	<i>Decision on the Technical and Policy Framework for White Space Devices</i>
<u>SRSP-300.512</u>	<i>Technical Requirements for Remote Rural Broadband Systems (RRBS) Operating in the Bands 512-608 MHz (TV Channels 21 to 36)</i>

[**Digital Television \(DTV\) Allotment Plan**](#)

[**Digital Television \(DTV\) Transition Schedule**](#)

7. White space frequency bands

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

Table 1 -- Overview of authorized white space frequency bands

Frequency bands (MHz)	Channel name	Incumbent services	Personal/ Portable WSD	Fixed 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 g	✓	✓
512-608	TV Channels 21-36	TV Broadcasting, LPA, RRBS	✓	✓
608-614	TV Channel 37**	Medical telemetry and radio astronomy	Not permitted	
614-617	600 MHz guard band	LPA	Not permitted	
617-652	600 MHz mobile downlink	Mobile services	Not permitted	
652-657	600 MHz duplex gap	LPA	Not permitted	
657-663	600 MHz duplex gap	LPA	✓	Not permitted
663-698	600 MHz mobile uplink	Mobile services	Not permitted	

**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 to a WSD from among those listed above and as per the requirements of this standard.

8. Database information

8.1. ISED database information

Information on licensed systems and services is available in ISED's licensing, certification and broadcasting databases.

The ISED Database information may be accessed from the Spectrum Management System Data webpage, available at: http://sms-sgs.ic.gc.ca/eic/site/sms-sgs-prod.nsf/eng/h_00010.html. In particular, the information is available under the white space data extract section of the page. [CPC-4-1-01](#) provides additional information on access to and interpretation of ISED's database information.

8.1.1. WSDB update from ISED database

The WSDBs shall retrieve updated ISED licensing information once every 24 hours at minimum.

8.1.2. WSDB failure to access ISED database

Should the ISED database not be available, additional attempts to retrieve information from the ISED database shall be made at least once every 4 hours. If more than 12 hours have elapsed without the WSDBA being able to retrieve this information, the WSDBA shall contact ISED regarding the unsuccessful access to the ISED database. Thereafter, a WSDB may continue to operate for 7 days, from the last successful access, unless indicated otherwise by ISED. After those 7 days, the WSDBA shall only operate in accordance with instructions provided by ISED. It is anticipated that the latter approach (i.e. contacting ISED for further instructions) would only occur in rare circumstances.

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

8.1.3. Information required for TV broadcasting stations

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

- (i) Transmitter coordinates – latitude;
- (ii) Transmitter coordinates – longitude;
- (iii) Effective radiated power (ERP);
- (iv) Height AGL of the radiating centre of the transmitting antenna;
- (v) Ground elevation AMSL;
- (vi) Horizontal transmit antenna pattern (if antenna is directional);
- (vii) Centre frequency;
- (viii) Station call sign; and
- (ix) Nature of the station (i.e. analog station or digital station).

8.1.4. Information required for RRBS base stations

A WSDB shall obtain the following information from ISED's database for RRBS stations to be protected from WSDs:

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

8.1.5. Information required for licenced low power apparatus and developmental licences

A WSDB shall obtain the following information from ISED's database for low power apparatus and developmental licences to be protected from WSDs:

- (i) Transmitter coordinates – latitude;
- (ii) Transmitter coordinates – longitude ;
- (iii) License Number ;
- (iv) Radius of operation; and
- (v) Licence type (LPA or developmental).

8.2. Registration facilities

A WSDB shall provide a facility in which to collect the information for systems and services which are not included in the ISED databases.

Online registration can be facilitated by directly accessing designated WSDBs as indicated on the following ISED website: http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf10498.html.

8.2.1. Fixed WSD registration

A WSDB shall provide a registration facility for fixed WSD users served by the WSDB. This information is collected from 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;
- (v) Phone number for the contact person; and
- (vi) Height AGL of the antenna.

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.

8.2.2. 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 11.2.1.

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 ISED-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 ISED for authorization.

8.2.3. Licenced LPA registration information

A WSDB shall provide a registration facility for users of licenced LPA to register scheduling and location information to obtain protection from WSDs.

(a) A WSDB shall obtain the following 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 of the location or area(s) of operation where the LPA will be used;
- (vi) Centre frequency (MHz) of the channel(s) used by the LPA at the indicated site;
- (vii) Period of operation (i.e. period of use) of the channels: 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) 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 ISED database. If none exists, the WSDB shall reject the registration of the LPA, and return a message to contact ISED for a licence.

(c) A WSDB shall only allow the registration of LPA operations within geographical areas and frequencies specified on the licence. The period of registration shall be limited to less than 1 year.

(d) A WSDB shall allow a registration to establish a recurring event that reflects the same time period as provided in the period of operation of licensed LPA.

(e) All registrations shall be considered public.

8.2.3.1. Area of operation of LPA

As per the geographical area of operation (i.e. item (a)(v) of section 8.2.3), the maximum area of operation of a licenced LPA consists of a radius of 500 m for a fixed location. However, where large areas of operation and coverage are required and supported by the licence, an LPA's area of operation shall be defined as a point and radius area or as a quadrilateral area, as chosen by the user. As part of

one registration, and in cases where the event is over a large geographical area, the registration shall allow up to the maximum number of points prescribed below, as applicable for the given option. Additional registrations may be required to ensure the protection of the full geographical area.

- (i) Point and radius option: The operational location(s) of the LPA shall be defined using a maximum of 25 geographical points at any one time. Each geographical points shall have a maximum radius of operation of 500 metres around the particular point; or
- (ii) Quadrilateral option: the operational location(s) of the LPA shall 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 shall be limited to 3 km.
 2. In cases where an LPA occupies a larger area, up to four non-contiguous quadrilaterals may be registered.

8.2.4. 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 8.2.3 above.

9. 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 WS channels. A WSDB shall enable devices on the denied list to be identified by any of the following parameters: Hardware Version Identification Number (HVIN), Firmware Version Identification Number (FVIN), product marketing name or certification number. Devices will be added to or removed from the denied list only upon formal direction from ISED. 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.

10. WSD power limits

A WSDB shall not provide any available channels to a fixed WSD operating with an e.i.r.p. level greater than 10 W (40 dBm). Furthermore, in areas other than less congested areas, a WSDB shall not provide any available channels to a fixed WSD operating with an e.i.r.p. level greater than 4 W (36 dBm). A WSDB shall not provide a list of available channels to a personal/portable WSD operating with an e.i.r.p. level greater than 100 mW (20 dBm).

11. Protection criteria for TV broadcasting stations

A WSDB shall only return available channels according to the protection criteria prescribed in the remainder of this document.

11.1. Protection criteria for over-the-air TV broadcasting stations

A WSDB shall protect active, over-the-air TV broadcasting stations, as indicated by the ISED database.

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)).

11.2. 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

Type of TV station	TV channel	Thresholds for TV broadcasting station-protected contour (dB μ V/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- $20\log(615/F^{**})$	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.

11.2.1. 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, 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 8.2.2 above.

The protection area of the receive-sites from WSDs shall encompass an arc of ± 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 ± 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 re-broadcaster 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.

11.3. WSD separation distance from broadcast TV protected contour

11.3.1. Maximum height for fixed WSDs

- (i) A WSDB shall not provide any channel on the list of available channels to a fixed WSD if its EHAAT exceeds 700 m or its AGL exceeds 100 m. Furthermore, in areas other than less congested areas, a WSDB shall not provide any available channels to a fixed WSD if its AGL exceeds 30 m.
- (ii) In the case of a fixed WSD requesting available channels for a mode I personal/portable WSD, a WSDB shall not provide any available channels for the mode I device if the fixed WSD's EHAAT exceeds 106 m.
- (iii) 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 the AGL value to 1.5 m.
- (iv) When applying Tables D1 and D2 of Annex D, where a database is capable of calculating the HAAT in the direction of the affected TV station (dirHAAT), this value may be used instead of the EHAAT.

11.3.2. 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. These criteria provide separation distances from the protected contours of the TV stations based upon the e.i.r.p. level of the WSD, the type of WSD (fixed or personal/portable), and the

type of TV station. The separation distances are provided in tables of Annex D: Tables D1 and D2 provide the separation distances for fixed WSDs from the near side of the protected contours for digital and analog TV stations respectively; Table D3 provide the separation distances for personal/portable WSDs from the near side of the protected contours for both digital and analog TV stations.

- (a) For a fixed WSD operating with an e.i.r.p. level greater than 40 mW (16 dBm), a WSDB shall list the available channels based upon the e.i.r.p. level of the WSD and on the required separation distances outside of the broadcast TV-protected contours indicated in Tables D1 and D2 of Annex D, for all co-channel, adjacent channel, and taboo channels cases.
 - (b) For a fixed WSD operating with an e.i.r.p. level of 40 mW (16 dBm) or less and an antenna height exceeding 10 meters above ground level, a WSDB shall list the available channels for a fixed WSD operating with an e.i.r.p. of 40 mW based upon the required separation distances outside of the broadcast TV-protected contours indicated in Tables D1 and D2 of Annex D, for all co-channel, adjacent channel, and taboo channels cases.
 - (c) For a fixed WSD operating with an e.i.r.p. level of 40 mW (16 dBm) or less and an antenna height not exceeding 10 meters above ground level, a WSDB shall list all adjacent channels and beyond as available within the broadcast TV-protected contours.
 - (d) For a mode II personal/portable WSD operating with an e.i.r.p. level greater than 40 mW (16 dBm), a WSDB shall list the available channels based on the required separation distances outside of the broadcast TV-protected contours indicated in Table D3 of Annex D, for all co-channel, adjacent channel, and taboo channels cases.
 - (e) For a mode II personal/portable WSD operating with an e.i.r.p. level of 40 mW (16 dBm) or less, a WSDB shall list the available channels for a mode II personal/portable WSD operating with an e.i.r.p. of 40 mW based on the required separation distances outside of the broadcast TV-protected contours indicated in Table D3 of Annex D only for the co-channel case; a WSDB shall list all adjacent channels and beyond as available within the broadcast TV protected contours.
- (ii) In determining these required separations, the WSDB shall increase the required separation distances by the amount that the location accuracy uncertainty of a white space device exceeds ± 50 meters.

12. 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 μ V/m at a receive antenna height of 10 m. The RRBS protected 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.

12.1. 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 3, based upon the WSD e.i.r.p. level.

Table 3 -- Required separation between Fixed WSD and the protected contour of the RRBS transmit channel base station (Downstream)

EHAAT of Fixed WSD (or dirHAAT, if applicable), m	Required separation (km) of Fixed WSD from the protected contour of the RRBS transmit channel base station					
	Co-channel		1 st Adjacent channel		2 nd Adjacent channel	
	Fixed WSD e.i.r.p.		Fixed WSD e.i.r.p.		Fixed WSD e.i.r.p.	
	≤ 4 W	> 4 W	≤ 4 W	> 4 W	≤ 4 W	> 4 W
EHAAT ≤ 3	2.5	3.2	0.4	0.5	0.1	0.1
3 < EHAAT ≤ 10	4.6	5.8	0.8	1	0.2	0.3
10 < EHAAT ≤ 30	8	10	1.3	1.7	0.4	0.5
30 < EHAAT ≤ 50	10.3	12.9	1.7	2.1	0.5	0.6
50 < EHAAT ≤ 75	12.6	16.3	2.1	2.6	0.6	0.7
75 < EHAAT ≤ 100	15.1	18.9	2.4	3	0.7	0.8
100 < EHAAT ≤ 150	18.5	23.3	3	3.7	0.8	1
150 < EHAAT ≤ 200	21.2	26.8	3.4	4.3	0.9	1.2
200 < EHAAT ≤ 250	23.7	29.8	3.8	4.8	1	1.3
250 < EHAAT ≤ 700	37.5	45.4	6.4	8	1.7	2.2

In determining these required separations, the WSDB shall increase the required separation distances by the amount that the location accuracy uncertainty of a white space device exceeds ±50 meters.

12.2. 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 4. Note that, unlike the distances in Table 3, these distances do not include the RRBS nominal service contour.

Table 4 -- Fixed WSD separation from RRBS base station (Upstream)

EHAAT of Fixed WSD (or dirHAAT, if applicable), m	Required separation (km) from RRBS receive channel base station coordinates					
	Co-channel		1 st Adjacent channel		2 nd Adjacent channel	
	Fixed WSD e.i.r.p.		Fixed WSD e.i.r.p.		Fixed WSD e.i.r.p.	
	≤ 4 W	> 4 W	≤ 4 W	> 4 W	≤ 4 W	> 4 W
EHAAT ≤ 3	11.4	14.3	1.9	2.4	0.5	0.6
3 < EHAAT ≤ 10	20.7	26.1	3.4	4.3	0.9	1.2
10 < EHAAT ≤ 30	39.8	51.2	5.9	7.5	1.6	2
30 < EHAAT ≤ 50	47.3	57.8	7.7	9.6	2.1	2.6
50 < EHAAT ≤ 75	53.8	64.1	9.4	11.8	2.6	3.2
75 < EHAAT ≤ 100	58.9	69.3	10.8	13.6	3	3.7
100 < EHAAT ≤ 150	66	76.3	13.3	16.7	3.6	4.6
150 < EHAAT ≤ 200	70.8	82	15.3	19.9	4.2	5.3
200 < EHAAT ≤ 250	76.3	89	17.1	22.1	4.7	5.9
250 < EHAAT ≤ 700	113.4	132.8	28.1	36	7.8	9.9

In determining these required separations, the WSDB shall increase the required separation distances by the amount that the location accuracy uncertainty of a white space device exceeds ±50 meters.

12.3. 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 5.

Table 5 -- Mode II personal/portable separation distance to RRBS base transmit channel protected contour

EHAAT of Mode II WSD	Required separation from RRBS base transmit protected contour (km)	
	Co-channel	1 st Adjacent channel*
≤ 250 m	8.2	0.7

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

In determining these required separations, the WSDB shall increase the required separation distances by the amount that the location accuracy uncertainty of a white space device exceeds ±50 meters.

12.4. 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 6, to the receive channel's base station coordinates.

Table 6 -- Mode II personal/portable separation distance to RRBS receive channel-protected contour

EHAAT of Mode II WSD	Required separation from receive RRBS base station coordinates (km)	
	Co-channel	1 st Adjacent channel*
≤ 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 increase the required separation distances by the amount that the location accuracy uncertainty of a white space device exceeds ±50 meters.

13. Protection criteria to licensed LPA and developmental stations

Registered licensed LPA and developmental licence scheduling information will be included within the WSDB. A WSDB shall only provide channels to WSDs located at least at the minimum separation distance prescribed in Table 7 from the registered area of operation of the protected LPA and developmental stations.

Table 7 -- WSD separation distances from protected LPA and Developmental stations

White space device characteristics	Required co-channel separation distance from registered area of operation of protected LPA and Developmental stations (km)	
	WSD e.i.r.p. ≤ 4 W	WSD e.i.r.p. > 4 W
Personal/portable	0.4	0.6
Fixed	1	1.6

14. 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).

15. Security

- 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.
- 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.

16. Database access initialization and reverification procedures

- 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.
- 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.

17. Synchronization

- 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 ISED³ at least every 15 minutes.
- ISED may specify particular channels and locations where WSDBs must ensure protection to services that change in operation faster than usual. The WSDB should take appropriate steps to

³ This provision will depend on the outcome of cross-border negotiations with the U.S. During those negotiations, ISED will consider and minimize any resulting burden on Canadian databases.

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.

18. 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 ISED upon request.

A WSDBA shall also provide ISED 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.

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

19.1 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 \(LOU\)](#),⁴ 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.

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.

Additionally, the UHF band (i.e. 470-608 MHz) are subject to the [Statement of Intent Between the Federal Communications Commission of the United States of America and the Department of Industry of Canada Related to the Reconfiguration of Spectrum Use in the UHF Band for Over-The-Air Television Broadcasting and Mobile Broadband Services](#). This SOI pertains to the reconfiguration of UHF band to facilitate the use of over-the-air television broadcasting and mobile broadband services.

⁴ 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](#).

19.2 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.

20. Interference response

Interference response remains ISED'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 ISED following a formal request by the Department; and
- (b) Be capable of indicating, upon request by ISED, 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.

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 (i.e. ISED ID).
- 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 ≤ 30 m, for areas other than congested areas.
- e. geographic coordinates' uncertainty with 95% confidence level.

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.
- (b) Manufacturer's serial number for the device is not on the denied list; and
- (c) Geographic coordinates are within Canada.
- (d) geographic coordinates' uncertainty with 95% confidence level.

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 through an intermediate fixed WSD or mode II WSD before initializing it:

- (a) That the device is certified under RSS-222 as a Mode I Personal/Portable device.
- (b) If the validation request comes from a fixed WSD, that the fixed WSD has a EHAAT 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 WSD that has an e.i.r.p. of 40 mW or less, and in the case of a fixed WSD, operates also with an antenna height above ground level of 10 m 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. In calculating the HAAT value, the ground elevation and station height above sea level provided in the ISED database should be used instead of the ground elevation predicted by the terrain elevation data files. For interpolating a value between available data points on the F propagation curves, linear interpolation should be used with all units 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). 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 and 1600 metres for lower/upper limits respectively). If the transmitter power is sufficiently low such that a distance below the curve limits is obtained, the free space propagation model should be used as an alternate.

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 (dB μ 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 dB μ 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 EHAAT, together with the F(50,10) propagation curves, to extract the intermediate distance. For interpolating a value between available data points on the F(50,10) propagation curves, linear interpolation should be used with all units converted to the decibel scale during the interpolation process (i.e. field strength remains in dB μ , height is converted to dB referenced to 1 m, and distance is converted to dB referenced to 1 km). The F(50,10) propagation curves have a limited range of data points for input and output parameters for which to provide propagation results. If a station antenna height is below 30 m and/or the distance is below the minimum F(50,10) propagation curves distance limit of 15 km, the Egli⁵ propagation model should be used to calculate the intermediate distance.
3. In order to calculate the actual minimum distances required 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.

⁵ Egli propagation model equation:

$$PL = 88 + 40 \log(d) + 20 \log(f) - 20 \log(h_t * h_r)$$

Where PL is the path loss in dB, d is the distance in kilometers, f is the frequency in MHz, h_t and h_r are the transmitter and receiver antenna heights in meters.

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 ISED's Broadcasting Procedures and Rules BPR-10, Part 10: Application Procedures and Rules for Digital Television (DTV) Undertakings .		
** Analog TV protection values have been taken from ISED's Broadcasting Procedures and Rules BPR-10, Part 10: Application Procedures and Rules for Digital Television (DTV) Undertakings .		
*** Digital TV protection values have been taken from ATSC <i>Recommended Practice: Receiver Performance Guidelines</i> , Document A/74:2010, 7 April 2010 .		

Table C1(b): Front-to-back ratio (dB)

Channels	Analog station	DTV station
2-6	6	10
7-13	6	12
14-51	6	14

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, [SRSP-300.512 — Technical Requirements for Remote Rural Broadband Systems \(RRBS\) Operating in the Bands 512–608 MHz \(TV Channels 21 to 36\)](#)

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 μ V/m field strength level is reached. For interpolating a value between available data points on the F(50,90) propagation curves, linear interpolation should be used with all units 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). The F(50,90) propagation curves have a limited range of data points for input and output parameters for which to provide propagation results. If a station antenna height is below 30 m and/or the distance is below the minimum F(50,90) propagation curves distance limit of 1.5 km, the Egli propagation model should be used to calculate the separation distance.
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 12 under tables 3 and 4. The separation distances have been calculated assuming WSDs are active on multiple channels.

Table C2: RRBS station protection criteria

Channel	RRBS CPE (Downstream) protection criteria (dBμV/m)	RRBS base station (Upstream) protection criteria* (dBμV/m)
Co-channel	37.8	14.8
1 st Adjacent	69.0	46.1
2 nd Adjacent	91.6	68.6

*SRSP 300.512, sections 9.2.3 and 9.2.25.

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ANNEX D – Separation distances

This Annex prescribes the required separation distance of WSDs operating at a given height (i.e. EHAAT), channel range, and power level. The WSDB shall provide the list of available channels based on the prescribed separation distances and the WSDs location, in accordance with the requirements of section 11.3.2 (Separation distance from WSD to protected contour). As indicated in section 11.3.1, the directional HAAT can be used instead of EHAAT.

Table D1 -- Required separation distance of Fixed WSD from the broadcast DTV-protected contour

		Separation distance in kilometers (km) of the Fixed WSD from the broadcast DTV-protected contour										
		Co-channel							Adjacent channel N±1		Taboo channels N±2, N±3, N±4	
		Fixed WSD e.i.r.p.							Fixed WSD e.i.r.p.		Fixed WSD e.i.r.p.	
EHAAT of Fixed WSD (or dirHAAT, if applicable), m	Channel range	40 mW	100 mW	250 mW	625 mW	1.6 W	4 W	10 W	≤ 4 W	10 W	≤ 4 W	10 W
EHAAT ≤ 3	2 to 6	3.4	4.2	5.3	6.6	8.4	10.5	13.2	2	3.2	0	0
	7 to 13	1.9	2.4	3	3.8	4.7	5.9	7.5	1.7	2.7	0	0
	14 to 51	1.5	1.8	2.3	2.9	3.6	4.5	5.7	1.4	2.2	0	0
3 < EHAAT ≤ 10	2 to 6	6.1	7.7	9.6	12.1	15.3	19.2	24.1	2	3.2	0	0
	7 to 13	3.5	4.3	5.4	6.8	8.6	10.8	13.6	1.7	2.7	0	0
	14 to 51	2.6	3.3	4.2	5.2	6.6	8.3	10.4	1.4	2.2	0	0
10 < EHAAT ≤ 30	2 to 6	10.5	13.2	16.6	21.7	28.2	37	50.6	2	3.2	0	0
	7 to 13	5.9	7.5	9.4	11.8	18.2	23.4	30.1	1.7	2.7	0	0
	14 to 51	4.5	5.7	7.2	9	11.3	14.3	18.2	1.4	2.2	0	0
30 < EHAAT ≤ 50	2 to 6	13.6	17.4	21.9	28.1	36.5	47.9	62.7	2.5	4	0	0
	7 to 13	7.7	9.6	12.1	18.6	23.7	30.2	38.8	1.7	2.7	0	0
	14 to 51	5.8	7.3	9.2	11.6	14.6	18.6	23.8	1.4	2.2	0	0
50 < EHAAT ≤ 75	2 to 6	17	21.5	27.4	35	44.9	57.5	71.2	3.1	4.9	0	0
	7 to 13	9.4	11.8	18.3	23.1	29.3	37.2	47.2	1.9	3	0	0
	14 to 51	7.2	9	11.3	14.2	18.4	23.2	29.3	1.4	2.2	0	0

75 < EHAAT ≤ 100	2 to 6	19.8	25.3	32	40.6	51.5	63.6	77.3	3.5	5.5	0	0
	7 to 13	10.8	16.9	21.3	26.9	34.2	42.9	53.6	2	3.2	0	0
	14 to 51	8.3	10.4	13	17	21.4	26.9	33.9	1.4	2.2	0	0
100 < EHAAT ≤ 150	2 to 6	24.6	31.3	39.3	49.1	60.8	73.1	86.9	4.2	6.6	0	0
	7 to 13	13.2	20.6	26.1	32.8	41.5	51.7	62.7	2.1	3.3	0	0
	14 to 51	10.1	12.7	15.9	20.8	26.3	33	39.6	1.4	2.2	0	0
150 < EHAAT ≤ 200	2 to 6	28.7	36.2	45	55.9	67.8	80.3	94.2	4.7	7.4	0	0
	7 to 13	18.7	23.6	29.8	37.6	47.3	58.3	69.2	2.1	3.3	0	0
	14 to 51	11.6	14.6	19	23.8	30.2	37	44.1	1.4	2.2	0	0
200 < EHAAT ≤ 250	2 to 6	32.2	40.4	50.2	61.7	74	87	100.7	5.1	8.1	0	0
	7 to 13	20.9	26.5	33.5	42.1	52.7	63.5	74.3	2.2	3.5	0	0
	14 to 51	13	16.4	21.1	26.6	33.7	40.2	47.8	1.4	2.2	0	0
250 < EHAAT ≤ 700	2 to 6	57	69.6	83.1	97.4	112.8	128.7	145.2	5.1	8.1	0	0
	7 to 13	40.5	51.6	63	75.2	88.6	101.4	114.9	2.2	3.5	0	0
	14 to 51	20.9	26.9	34.3	42.1	51.2	60.4	70.2	1.4	2.2	0	0

DRAFT

Table D2 -- Required separation distance of Fixed WSD from the broadcast analog TV-protected contour

		Separation distance in kilometers (km) of the Fixed WSD from the broadcast analog TV-protected contour								
		Co-channel							Adjacent channel N±1 and Taboo channels N±2, N±3, N±4, N±7, N±8, N+14, N+15	
		Fixed WSD e.i.r.p.							Fixed WSD e.i.r.p.	
EHAAT of Fixed WSD (or dirHAAT, if applicable), m	Channel range	40 mW	100 mW	250 mW	625 mW	1.6 W	4 W	10 W	≤ 4 W	10 W
EHAAT ≤ 3	2 to 6	2.7	3.4	4.2	5.3	6.7	8.4	10.5	2.2	3.5
	7 to 13	1.6	2	2.5	3.2	4	5	6.3	2	3.2
	14 to 51	1.2	1.5	1.8	2.3	2.9	3.6	4.5	1	1.6
3 < EHAAT ≤ 10	2 to 6	4.9	6.1	7.7	9.6	12.1	15.3	19.2	2.2	3.5
	7 to 13	2.9	3.7	4.6	5.7	7.3	9.1	11.4	2	3.2
	14 to 51	2.1	2.6	3.3	4.1	5.2	6.6	8.2	1	1.6
10 < EHAAT ≤ 30	2 to 6	8.4	10.5	13.2	16.6	21.8	28.1	36.9	2.2	3.5
	7 to 13	5	6.3	7.9	9.9	12.5	19.4	24.9	2	3.2
	14 to 51	3.6	4.5	5.7	7.1	9	11.3	14.2	1	1.6
30 < EHAAT ≤ 50	2 to 6	10.8	13.6	17.3	21.9	28.3	36.5	47.8	2.2	3.5
	7 to 13	6.5	8.1	10.2	12.8	19.8	25.2	32.1	2	3.2
	14 to 51	4.7	5.8	7.3	9.2	11.6	14.6	18.6	1	1.6
50 < EHAAT ≤ 75	2 to 6	13.2	16.9	21.5	27.4	35.1	44.8	57.4	2.6	4.1
	7 to 13	7.9	9.9	12.4	19.4	24.6	31.1	39.4	1.7	2.7
	14 to 51	5.7	7.1	9	11.3	14.2	18.4	23.2	1	1.6
75 < EHAAT ≤ 100	2 to 6	15.3	19.8	25.3	32	40.8	51.5	63.5	2.9	4.6
	7 to 13	9.1	11.4	17.9	22.5	28.7	36.2	45.4	1.7	2.7
	14 to 51	6.6	8.2	10.4	13	17.1	21.4	26.9	1	1.6
100 < EHAAT ≤ 150	2 to 6	19.3	24.6	31.3	39.3	49.3	60.7	73	3.4	5.4
	7 to 13	11.1	17.3	21.9	27.6	34.9	43.9	54.6	1.8	2.8

	14 to 51	8	10.1	12.7	15.9	20.9	26.3	33	1	1.6
150 < EHAAT ≤ 200	2 to 6	22.5	28.6	36.1	45	56.2	67.7	80.3	3.8	6
	7 to 13	12.9	19.8	25	31.6	40	49.9	60.9	1.8	2.8
	14 to 51	9.3	11.6	14.6	19	23.9	30.2	37	1	1.6
200 < EHAAT ≤ 250	2 to 6	25.3	32.2	40.3	50.2	61.9	73.9	86.9	4	6.3
	7 to 13	17.6	22.2	28.1	35.5	44.8	55.6	66.3	1.8	2.8
	14 to 51	10.4	13	16.3	21.1	26.7	33.6	40.2	1	1.6
250 < EHAAT ≤ 700	2 to 6	44.9	56.9	69.5	83	97.7	112.7	128.6	4	6.3
	7 to 13	33.3	43.1	54.7	65.9	78.7	91.7	104.6	1.8	2.8
	14 to 51	17.3	20.9	26.8	34.2	42.3	51.1	60.4	1	1.6

Table D3 -- Required separation distance between Personal/Portable Mode II WSD (100 mW) and the broadcast TV-protected contour

Personal/Portable Mode II WSD	Separation distance (km)				
	DTV (Full and Low-power)			Analog TV (Full and Low-power)	
		Adjacent channel*	Taboo channels* N±2, N±3, N±4		Adjacent channel* N±1 and Taboo channels* N±2, N±3, N±4, N±7, N±8, N±14, N±15
Channel range	Co-channel			Co-channel	
14-36, 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.