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White Space Devices (WSDs)

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Preface

Radio Standard Specification RSS-222, Issue 2, *White Space Devices* replaces RSS-222, Issue 1, dated February 2015.

List of Changes:

- (1) The sections on RSS-102 (for radio frequency exposure) and RSP-100 (requirements for the certification of radio apparatus) have been removed since these documents are normative references in RSS-Gen.
- (2) White space frequency bands have been revised based on the [*Decision on the Technical and Policy Framework for White Space Devices*](#).
- (3) Additional e.i.r.p. and associated conducted power limits, power spectral densities and conducted adjacent channel emission limits have been included for fixed white space devices.
- (4) New sections have been included to address certification and licensing requirements.
- (5) Channel bonding requirements have been clarified and additional requirements prescribed.
- (6) Definition for ***less congested areas*** has been added.
- (7) A transition period has been included for the certification of WSDs(White Space Devices).
- (8) The measurement section on multiple antennas has been removed since the measurement method is defined in ANSI C63.10, *American National Standard for Testing Unlicensed Wireless Devices* (referenced in RSS-Gen, *General Requirements for Compliance of Radio Apparatus*)
- (9) A confidence level associated with the uncertainty of the geo-location accuracy has been prescribed.
- (10) The description of alternate geo-location determination (other than GPS) must be included in the test report.
- (11) A dependency requirement for the power level of a mode I personal/portable device has been added when the controlling device is limited to 40 mW.
- (12) Additional editorial changes and clarifications have been made, as appropriate.

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List of Acronyms

AGL	above ground level
AMSL	above mean sea level
DUT	device under test
GPS	Global Positioning System
HAAT	height above average terrain
ISED ID	ISED Certification Number
RBW	Resolution Bandwidth
PSD	power spectral density
WSD	white space device
WSDB	white space database

1. Scope

Radio Standards Specification RSS-222, Issue 2, White Space Devices (WSDs), sets out the certification requirements for licence-exempt, radio apparatus operating in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 657-663 MHz, known as white space devices (WSDs).

2. Coming into force and transition period

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

Effective six (6) months from the date of publication, ISED will no longer accept applications for the certification of new WSDs complying with RSS-222, issue 1 (available upon request by email). After this period, applications for the certification of new WSDs demonstrating compliance with issue 2 of RSS-222 shall be accepted.

3. General requirements

3.1. Purpose and application

WSDs are licence-exempt radio apparatus that operate on frequencies within white space, which refers to spectrum that is not being used by incumbent radio services in the VHF, UHF frequency bands at a particular time and in certain geographical area. WSDs operate on a no-interference, no-protection basis. WSDs may provide a variety of services such as wireless broadband.

RSS-222 does not apply to radio apparatus intended for general public broadcasting services. Such equipment is regulated by ISED's Broadcasting Equipment Procedures (BPRs) and Broadcasting Equipment Standards (BETS).

3.2. Certification requirements

Equipment covered by this standard is classified as Category I equipment. Either a technical acceptance certificate (TAC) issued by ISED's Certification and Engineering Bureau or a certificate issued by a recognized certification body (CB) is required.

3.3. Licensing requirements

Equipment covered by this standard is exempt from licensing requirements pursuant to 15section15 of the [*Radiocommunication Regulations*](#).

3.4. RSS-Gen compliance

RSS-222 shall be used in conjunction with RSS-Gen, [*General Requirements for Compliance of Radio Apparatus – Limits and Methods of Measurement*](#), for general specifications and information relevant to the equipment for which this standard applies.

3.5. Reference publications

ISED documents are available on the [official publications](#) section of Spectrum Management and Telecommunications website.

DBS-01, White Space Database Specifications

[Decision on the Technical and Policy Framework for White Space Devices.](#)

4. Definitions

Available channel: a range of frequencies (typically a 6 MHz wide channel) available for use by a white space device (WSD).

Contact Verification Signal: an encoded signal broadcasted by a fixed or mode II personal/portable device for reception by mode I personal/portable devices. The purpose of this signal is to determine whether the mode I personal/portable device is still within the reception range of the fixed or mode II personal/portable device to which they had provided list of available channels.

Duplex gap (600MHz): an 11 MHz frequency range in the 652-663-MHz that separates the uplink and downlink frequencies of the 600 MHz services.

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.

Fixed white space device (WSD): a WSD that transmits and/or receives radiocommunication signals at a specified fixed location. The fixed device selects radio frequency channels for operation from a list of available channels provided by a white space database.

Geo-location capability: the ability of a WSD to determine its geographic coordinates within a required level of accuracy.

Innovation, Science and Economic Development Identification Number (ISED ID): ISED's certification number of a WSD.

Less congested area: Geographical area where at least half of the TV channels are not being used for broadcast and other protected services, and could be available for use by a WSD.

Maximum conducted output power: the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented (e.g. alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any

mode.

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

Mode I personal/portable white space device (WSD): a personal/portable WSD that does not use an internal geo-location capability and does not directly access a white space database 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 from either a fixed device or a mode II personal/portable device. A mode I personal/portable device does not initiate a network of WSDs or provide a list of available radio frequency channels to another mode I device.

Mode II personal/portable white space device: a personal/portable WSD that uses an internal geo-location capability and accesses a white space database (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 device or another mode II WSD. A mode II device may provide its lists of available radio frequency channels to another personal/portable device.

Network initiation: a process by which a fixed or mode II WSD sends control signals to one or more fixed WSDs or personal/portable WSDs which allows them to begin communications.

Operating channel: an available channel used by a WSD for transmission and/or reception.

Sleep mode: the inactive, but not powered-off state of the WSD.

White space (WS): the part of the spectrum that is available for radiocommunication by a radio system, at a specific time and in a given geographical area.

White space database (WSDB): an ISED-designated third party database that maintains records of all licensed services and systems approved to operate within white space frequency bands. The white space database determines available channels at a specific time and geographic location, and provides lists of available channels to WSDs.

White space device (WSD): a radio apparatus that operates in the white space frequency bands using dynamic spectrum access techniques.

5. Technical requirements

This section establishes technical requirements for the compliance of a WSD, in addition to the test mode, radiofrequency and access to the database requirements further prescribed in this standard.

5.1 Display of available channels

A WSD shall incorporate the capability to provide a list of identified available channels and its selected operating channel(s) for display purposes either through direct means (e.g. display on device) or indirectly (e.g. through auxiliary equipment).

5.2 WSD transmit power control

WSDs shall incorporate a transmit power control feature to limit their operating power. A description of the device's transmit power control feature shall be included in the test report.

5.3 Antenna requirements for personal/portable WSDs

All transmit and receive antenna(s) of personal/portable WSDs shall be permanently attached.

5.4 Antenna requirements for fixed WSDs

The maximum gain of the transmitting antenna used with a fixed WSD must be declared by the manufacturer in the certification application.

If the fixed WSD is designed for use in less congested areas, a statement shall be included in the test report that it is designed for such areas.

5.5 Power control for fixed WSDs

A description of the power level control mechanism and ongoing compliance to the limits shall be included in the test report for fixed WSDs with antenna gain higher than 6 dBi and a 36 dBm e.i.r.p. or for fixed WSDs with antenna gain higher than 10 dBi and a 40 dBm e.i.r.p. (i.e. intended for operation in less congested areas).

6. WSD test mode requirements

A WSD test mode shall be made available to testing personnel (but not end-users) in order to perform the certification compliance tests. This section establishes the requirements for the WSD test mode.

6.1 Radio frequency test mode requirements

The WSD test mode shall provide, the ability:

- 1) to configure the device under test (DUT) to operate on a selectable frequency band;
- 2) to vary the output power from the minimum to the maximum levels and to set the output power at the desired level; and
- 3) to continuously transmit a modulated signal (i.e. with no time bursting or signal gating applied).

6.2 White Space Database (WSDB) interface

Radio management software shall be provided, in order to perform the WSDB interface certification tests on the WSD. The software shall provide the following, the ability:

- 1) to view all information sent to and provided by the device;
- 2) to provide a list of available channels to the WSD;
- 3) to manually select an available channel;
- 4) to block a channel from the list of available channels; and
- 5) to instruct a personal/portable WSD to apply its lower-power limit (see sections 7.2.2. and 7.3.2).

7. Radio frequency requirements, measurement method and limits

This section prescribes the radio frequency requirements, measurement procedures and limits that shall be applied to WSDs. The requirements and measurement procedures can be performed without requiring access to a WSDB. section

7.1. White space frequency bands

7.1.1. Operation on unauthorized frequency bands

For operation in Canada, verify that the device under test (DUT) cannot be tuned to operate on unauthorized frequency bands, based upon the type of WSD (fixed or personal/portable), as prescribed in section 7.1.2.

The lockout of unauthorized channels may not be implemented in the DUT, but must be reliant upon limitations provided to the DUT by the database.

7.1.2. Permissible channels of operation

All WSDs can operate on available channels in the frequency bands 470-608 MHz.

Only fixed WSDs shall operate on available channels in the frequency bands 54-72 MHz, 76-88 MHz, and 174-216 MHz. These bands shall only be used for communication between fixed WSDs.

Low power personal/portable WSDs can operate in the 657-663 MHz frequency band with a maximum e.i.r.p. of 40 mW.

All WSDs shall operate only on available channels and power levels as specified above and as established by a WSDB.

7.1.3. Channel bonding

All WSDs can operate on a single 6 MHz channel, multiple non-contiguous 6 MHz channels, a group of contiguous 6 MHz channels or a mixture of contiguous and non-contiguous 6 MHz wide channels. Operation on a channel bonding basis shall only be performed on available channels as determined by the WSDB.

WSDs operating on a channel bonding fashion (i.e. multiple contiguous or non-contiguous channels) shall maintain compliance with all the requirements prescribed herein. In particular, WSDs operating on

a contiguous channel bonding shall maintain compliance to: the transmitter power limit prescribed applicable to 6 MHz (i.e. white space channel's width), the power spectral density over the prescribed RBW, the channel edge requirement and the adjacent channel requirements. In the case of a group of contiguous channels, the channel edge and adjacent channel requirements apply at the edge and adjacent to the out-of-band emissions of the group of channels.

To demonstrate compliance to the requirements, for channel bonding operation, the worst case measurements shall be included in the test report. A description of the channel bonding shall be included in the test report.

7.2. Transmitter power, power spectral density (PSD) for fixed WSDs

7.2.1. Measurement method

The following measurement method shall be used to measure the conducted power and conducted PSD of a fixed WSD.

1. Connect a patch cable of known attenuation (at the specific frequencies under consideration) between the antenna port of the DUT and a spectrum analyzer. It may be necessary to insert an external attenuator in the signal path to prevent overload damage to the analyzer.
2. Select the analyzer's power averaging (root-mean-square (RMS)) detector, a span of 10 MHz, a resolution bandwidth (RBW) of 100 kHz, a video bandwidth of 300 kHz and a sweep speed that provides one millisecond per trace point integration time.
3. Activate the DUT test mode that provides continuous transmission of the output signal (no time bursting or signal gating) on the operating channel under investigation (low, middle and high channels within each intended DUT tuning range must be examined).
4. Employ trace averaging over a minimum of 10 traces.
5. Use the integrated band/channel power analyzer function to determine the average power within the 6 MHz bandwidth.
6. Use the peak marker function to determine the maximum power in any 100 kHz band.
7. Make the necessary corrections to the measured amplitude levels to account for peripherals (e.g. signal attenuation in the patch cable and/or external attenuator). Record the adjusted amplitude levels as the power levels measured in the 6 MHz bandwidth and in a 100 kHz band respectively.
8. If the device has multiple antenna ports, the power must be summed across all antennas and antenna elements.
9. Compare the total conducted power levels and PSDs to the applicable conducted power and PSD limits of Table 1, in section 7.2.2, to assess compliance.
10. Repeat until data is accumulated for the low, middle and high channels in each intended DUT tuning range.

7.2.2. Power and power spectral density (PSD) limits

The conducted power level and the conducted PSD of a fixed WSD shall not exceed the limits in Table 1 during any time of continuous transmission.

Table 1: Fixed WSD Power and PSD Limits

Channel e.i.r.p. (dBm per 6 MHz)	Channel Conducted power limit (dBm per 6MHz)	Channel Conducted power spectral density (dBm/100kHz)
16	10	-7.4
20	14	-3.4
24	18	0.6
28	22	4.6
32	26	8.6
36	30	12.6
40	30	12.6

A fixed WSD can operate between the e.i.r.p. levels prescribed in Table 1. If the WSD operates at a level equal to or less than 36 dBm e.i.r.p., then the conducted power and conducted power spectral density (PSD) limits shall be linearly interpolated proportionally to the e.i.r.p. level between the values in table 1.

If the fixed WSD operates at e.i.r.p. levels above 36 dBm, then the applicable conducted power limit and conducted power spectral density limits are those prescribed for the 40 dBm e.i.r.p. level.

If a fixed WSD with a transmitting antenna of directional gain greater than 6 dBi is used, then both the channel conducted output power and conducted channel PSD shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

If a fixed WSD designed for operation in less congested areas with a transmitting antenna of directional gain greater than 10 dBi is used, both the conducted channel power and conducted PSD shall be reduced by the amount in dB that the directional gain of the antenna exceeds 10 dBi.

7.3. Transmitter power, power spectral density (PSD) for personal/portable WSDs (mode I and mode II)

7.3.1. Measurement method

The following radiated measurement method shall be used to measure the radiated power and radiated PSD.

1. Connect a patch cable of known attenuation (in the specific frequency range under consideration) between a measurement antenna of known receive gain and a spectrum analyzer.
2. Activate the DUT test mode that provides continuous transmission of the output signal (no time bursting or signal gating) on the operating channel under investigation (low, middle and high channels within each intended DUT tuning range must be examined).
3. Determine the azimuth and elevation associated with the maximum emission, as per RSS-Gen.

4. Select the analyzer's power averaging (RMS) detector, a span of 10 MHz, a resolution bandwidth (RBW) of 100 kHz, a video bandwidth of 300 kHz and a sweep speed that provides one millisecond per trace point integration time.
5. Employ trace averaging over a minimum of 10 traces.
6. Use the integrated band/channel power analyzer function to determine the average amplitude over the 6 MHz channel bandwidth.
7. Use the peak marker function to determine the maximum amplitude in any 100 kHz band segment.
8. Make the necessary corrections to the measured amplitude levels to account for externalities inserted into the signal path (e.g. signal attenuation in the patch cable(s) and the measurement antenna gain). Record the adjusted amplitude levels as the power measured in the 6 MHz bandwidth and a 100 kHz band respectively.
9. Determine the associated e.i.r.p. levels using guidance provided in RSS-Gen.
10. Compare the power and PSD levels to the applicable limits in Table 2 of Section 7.3.2 to assess compliance.
11. Repeat until data is accumulated for the low, middle and high channels in each intended DUT tuning range.

7.3.2. Power and PSD limits

The conducted power level and the conducted PSD of a personal/portable WSD shall not exceed the limits in Table 2 during any time of continuous transmission.

Table 2: Personal/Portable WSD Power and PSD Limits

Parameter	Limit	Low-Power Limit*
Channel e.i.r.p. (dBm/6MHz)	20	16
PSD (dBm/100 kHz)	2.6	-1.4

* When testing a personal/portable WSD, the radio management software shall be used to apply the low-power limit.

7.4. Transmitter emissions for band edge and adjacent channels for all WSDs

7.4.1. Measurement method

As with power measurements, the preferred methodology for determining the maximum band edge and adjacent channel emission power is to use a conducted measurement procedure. In cases where there is no accessible antenna port for performing conducted measurements (e.g. personal/portable WSDs), a radiated measurement procedure can be used (see RSS-Gen).

Out-of-band emission measurements are to be made with the DUT activated in the test mode that provides continuous transmission of the output signal (no time bursting or signal gating) on the operating channel being investigated. For band edge, adjacent channel, and beyond adjacent channel measurements, the low, middle and high channels of the intended tuning range must be tested.

7.4.1.1. Channel edge measurement

The band edge measurement must be performed relative to both the lower (f_L) and upper (f_U) channel edge frequencies. The PSD is to be measured within a 100 kHz band segment relative to the channel edge (i.e. $f_L - 100$ kHz). Note that the operating channel may consist of a group of contiguous white space channels, in which case, the channel edge limit applies to the 100 kHz frequency band relative to the group of contiguous white space channels.

The following steps provide the settings and procedures to follow to perform the band edge measurements.

1. Select the power averaging (RMS) detector, a start frequency of $f_L - 100$ kHz and a stop frequency of f_L (where f_L is the lower edge frequency of the operating channel), a resolution bandwidth (RBW) of 10 kHz, a minimum video bandwidth of 30 kHz and a sweep speed that provides one millisecond per trace point integration time.
2. Employ trace averaging over a minimum of 10 traces.
3. Use the integrated band/channel power function of the analyzer to determine the maximum average PSD over the 100 kHz frequency span.
4. Adjust the measured amplitude level to account for externalities in the signal path (e.g. It may be necessary to insert an external attenuator in the signal path to prevent overload damage to the analyzer for conducted measurements and the measurement antenna gain for radiated tests).
5. Repeat procedure with the analyzer start frequency set to f_U and the stop frequency set to $f_U + 100$ kHz.
6. Repeat the entire procedure until data is accumulated for the lower, middle and upper channels in each intended DUT tuning range.

7.4.1.2. Adjacent channel measurement

The adjacent channel emission limit applies in any 100 kHz band segment within either the lower or upper 6 MHz frequency band relative to the operating channel ($N \pm 1$, where N represents the channel of operation). Note that the operating channel may consist of a group of contiguous white space channels, in which case, the adjacent channel emission limit applies to the 6 MHz frequency band relative to the group of contiguous white space channels.

The following spectrum analyzer settings and procedures are recommended for this measurement:

1. Select the power averaging (RMS) detector, a start frequency of $f_L - 6$ MHz and a stop frequency of $f_L - 100$ kHz (where f_L is the lower edge frequency of the operating channel), a resolution bandwidth (RBW) of 100 kHz, a minimum video bandwidth of 300 kHz and a sweep speed that provides one millisecond per trace point integration time.
2. Employ trace averaging over a minimum of 10 traces.
3. Use the peak marker function of the analyzer to determine the maximum PSD in any 100 kHz segment within the frequency span.
4. Adjust the measured amplitude level to account for externalities in the signal path (e.g. It

may be necessary to insert an external attenuator in the signal path to prevent overload damage to the analyzer conducted measurements and the measurement antenna gain for radiated tests).

5. Repeat the procedure with the analyzer start frequency set to $f_U + 100$ kHz and the stop frequency set to $f_U + 6$ MHz.
6. Repeat the entire procedure until data is accumulated for the lower, middle and upper channels in each intended DUT tuning range.

7.4.2. Transmitter band edge and adjacent channel power limits

The band edge and adjacent channel power levels of WSDs shall not exceed the limits established in Table 3 and Table 4 during any time of continuous transmission.

Table 3: Fixed WSD Band Edge and Adjacent Channel Power Limits

Channel (dBm per 6 MHz) e.i.r.p level	Band edge and adjacent channel conducted power limit (dBm/100 kHz)
16	-62.8
20	-58.8
24	-54.8
28	-50.8
32	-46.8
36	-42.8
40	-42.8

Table 4: Personal/Portable WSD Band Edge and Adjacent Channel Power Limits

Parameter	Limit (dBm/100 kHz)	Low-power Limit* (dBm/100 kHz)
Band Edge	-52.8	-56.8
Adjacent Channel Power Level	-52.8	-56.8

* When testing a personal/portable WSD, the radio management software shall be used to apply its low-power limit.

These limits apply for both outside a single 6 MHz channel or outside a group of contiguous 6 MHz channels. For non-contiguous aggregation, the requirements of a single 6 MHz channel apply to each channel in that aggregation of channels.

If a fixed WSD operates at e.i.r.p levels between the values prescribed in Table 3 and its e.i.r.p. is equal to or less than 36 dBm (4 000mW), its conducted band edge and adjacent channel power levels shall comply with the higher applicable limit prescribed in Table 3.

If a fixed WSD operates at e.i.r.p. levels above 36 dBm (4 000 mW), its applicable conducted band edge and adjacent channel power limits are those prescribed for the 40 dBm (10 000 mW) e.i.r.p. level.

A fixed WSD with a transmitting antenna of directional gain greater than 6 dBi shall comply with the limits applicable to the 40 dBm e.i.r.p. level. Its maximum conducted band edge power and adjacent channel power levels shall be reduced by the same amount (in decibels) that the directional gain of the antenna exceeds 6 dBi.

7.4.3. Unwanted emissions measurements and limits

Beyond the immediate adjacent channel of the WSD's channel or group of contiguous channels, the WSD's unwanted emissions shall comply to the general field strengths prescribed in RSS-Gen. The unwanted emissions shall be measured according to the RSS-Gen requirements.

7.5. Unwanted Field Strength Emissions in the Band 602-620 MHz

7.5.1. Unwanted Field Strength Emissions Measurements

Field strength for unwanted emissions that fall within the frequency band 602-620 MHz shall not exceed the limits specified in table 5. The emission levels within these channels should be measured on a radiated basis. When performing these measurements, the DUT shall be tuned to the center frequency of the frequency band 596-602 MHz.

7.5.2. Field Strength Emissions Limits

Transmitter field strength emissions must comply with the following field strength limits at a distance of one metre.

Table 5: Field Strength Emission Limits for the Band 602-620 MHz

Frequency (MHz)	Field Strength dB μ V/metre /120 kHz at 1 m
602-607	$120 - 5 (F(\text{MHz}) - 602)$
607-608	95
608-614	30
614-615	95
615-620	$120 - 5 (620 - F(\text{MHz}))$

In the above table, F is the frequency in MHz in the prescribed frequency range.

8. Geo-location requirements for fixed and mode II personal/portable WSD

The WSD shall determine its location in accordance with the requirements of this section and provide both the location and its uncertainty to the WSDB.

8.1. Reference datum

A fixed WSD and mode II personal/portable white space geographical coordinates shall be based on the North American Datum of 1983 (NAD 83).

8.2. Geo-location accuracy

A fixed and mode II personal/portable WSD's location and geo-location uncertainty, in meters, shall be determined with a confidence level of 95 %.

A description demonstrating the uncertainty and confidence level of the geo-location method used shall be provided by the applicant in the test report.

8.3. Alternate geo-location technology

If a technology other than GPS is used, a description of a fixed WSD or mode II personal/portable WSD's location device technology shall be provided in the test report.

8.4. Internal geo-location capability and external geo-location source for fixed WSDs

A fixed WSD shall incorporate a geo-location capability to determine its geographic coordinates to the accuracy level specified in section 8.2.

A fixed WSD can obtain its geographic coordinates through an external geo-location source when it is used at a location where its internal geo-location capability does not function. An external geo-location source may be connected to a fixed device through either a wired or a wireless connection, and a single geo-location source may provide location information to multiple fixed devices. An external geo-location source must be connected to a fixed device using a secure connection that ensures that only an external geo-location source that has been approved with a particular fixed device can provide geographic coordinates to that device. The geographic coordinates must be provided automatically by the external geo-location source to the fixed device; users may not manually enter them. Alternatively, an extender cable may be used to connect a remote receive antenna to a geo-location receiver within a fixed device.

The geographic coordinates of the fixed WSD shall be determined from the first activation from a power-off condition. This information may be stored internally in the fixed WSD.

8.5. Geo-location capability mode II personal/portable WSDs

A mode II personal/portable WSD shall incorporate a geo-location capability to determine its geographical coordinates to the accuracy level specified in section 8.2. The mode II personal/portable WSD shall re-establish its position each time it is activated from a power-off condition or extended sleep mode period (i.e. sleep mode period lasting 60 seconds or more). The mode II personal/portable WSD shall verify its location at least once every 60 seconds while in operation, except when it is in extended sleep mode.

A mode II personal/portable device shall contain a declaration of conformity statement in the test report for the specified accuracy.

9. Access requirements for WSDs to the White space database (WSDB)

This section addresses the WSD database access requirements. See *Annex A – WSD Certification Procedure for Access to White Space Database (WSDB)* for WSDs' database access test procedures.

9.1. Fixed WSDs

9.1.1. Fixed WSD initialization

Fixed WSDs shall access a white space database (WSDB) over the Internet to determine the available channels and the corresponding maximum permitted power for each available channel, based on their geographical coordinates, taking into consideration the fixed WSD's antenna height and geo-location uncertainty, prior to their initial service transmission at a given location.

A fixed WSD shall be capable of providing the following information to a WSDB:

1. ISED ID;
2. manufacturer's serial number of the device;
3. geographic coordinates (latitude and longitude (NAD 83));
4. geographic coordinates' uncertainty with 95% accuracy; and
5. antenna height above ground level (AGL) or above mean sea level (AMSL).

9.1.2. Fixed WSD WSDB update

Fixed WSDs shall access the white space database at least once a day (i.e. at least once every 24 hours) to verify that the operating channels remain available. If the database indicates that the channel is no longer available at the current operating level, the fixed WSD shall immediately stop operating on the channel or reduce its power to a permissible level, as indicated by the WSDB. Fixed WSDs shall update their use of channels in accordance with the channel availability schedule information provided by their database. The channel availability schedule shall be updated daily and shall cover a period of 48 hours from the time that the device last accessed the WSDB.

9.1.3. Fixed WSD failure to contact the WSDB

If a fixed WSD fails to successfully contact a WSDB during any given day, it may continue to operate until 11:59 p.m. (local time) of the following day, at which time it shall cease operating. The fixed WSD shall only begin operating again once it re-establishes contact with an approved WSDB, and re-verifies the list of available channels.

9.1.4. Fixed WSD without a direct connection to the internet

If a fixed WSD does not have a direct connection to the Internet, it can relay its initialization and registration request via another fixed WSD. In this case, the fixed WSD can transmit on a channel that the relaying fixed WSD has previously transmitted on or on a channel which the relaying WSD indicates is available for use to access the database. Once registered with a WSDB, the newly registered fixed WSD shall only use the available channels indicated by the WSDB and cannot use the list of channels

intended for another WSD.

9.1.5. Fixed WSD power loss

Should a fixed WSD lose its power, it shall re-verify and re-establish contact with a fixed WSD or mode II personal/portable WSD or a white space database to obtain a list of available channels. Additionally, should a fixed WSD lose its power and obtain a new list of available channels, it shall signal all mode I WSDs that it is serving to acquire and use a new available channel list.

9.2. Mode II personal/portable WSDs

9.2.1. Mode II personal/portable WSD initialization

Mode II personal/portable WSDs shall access a WSDB over the Internet to determine the available channels and their corresponding maximum permitted power at their geographic coordinates, taking into consideration the device's geo-location uncertainty, and prior to their initial service transmission at that location. Operation is permitted only on channels and at power levels that are indicated by the WSDB as being available for personal/portable WSDs.

A mode II personal/portable WSD shall be capable of providing the database with the following information:

1. ISED ID;
2. manufacturer's serial number of the device; and
3. geographical coordinates (latitude and longitude (NAD 83)).
4. Geographical coordinates' uncertainty with 95 % accuracy.

A mode II personal/portable WSD shall access the database for a list of available channels each time it is activated from a power-off condition.

9.2.2. Mode II personal/portable WSD location change

If a mode II personal/portable WSD changes location during operation by more than the geo-location's uncertainty from the location at which it last accessed the database, the mode II personal/portable WSD shall re-verify its location and the database for its available channels, except as provided in Section 9.2.4.

9.2.3. Mode II personal/portable WSD database update

A mode II personal/portable WSD shall re-verify its location and shall access a WSDB at least once a day (i.e. at least once every 24 hours) to verify that the operating channel(s) and corresponding power levels remain available. Mode II personal/portable WSDs shall update their operating channels and corresponding power levels in accordance with the channel availability schedule information provided by their database. The channel availability schedule shall be updated daily and shall cover a period of 48 hours beginning at the time that the device last accessed the WSDB.

9.2.4. Mode II personal/portable WSD multiple location channel list

A mode II personal/portable WSD may load channel availability information for multiple locations around its current location and use that information to define a geographic area within which it can operate on the same available channels at all locations. For example, a mode II personal/portable WSD could calculate a bounded area in which a channel or channels are available at all locations within the area and operate on a mobile basis within the area. In this case, the mode II personal/portable WSD shall re-contact a WSDB if/when it moves beyond the boundary of the area where the channel availability data is valid. The mode II personal/portable WSD shall access a WSDB daily, to verify that the operating channel(s) continue to be available, even if it has not moved beyond that boundary.

9.2.5. Mode II personal/portable WSD failure to contact the database

If a mode II personal/portable WSD fails to successfully contact a WSDB during any given day, it can continue to operate until 11:59 p.m. (local time) of the following day, at which time it shall cease operations until it re-establishes contact with a WSDB and re-verifies its list of available channels.

9.2.6. Mode II personal/portable WSD power loss

Should a mode II personal/portable WSD lose its power, it shall re-verify and re-establish contact with a fixed WSD or mode II personal/portable WSD, or a WSDB to obtain a list of available channels. Additionally, should a mode II WSD lose its power and obtain a new list of available channels, it shall signal all mode I WSDs that it is serving to acquire and use a new available channel list.

9.2.7. Mode II personal/portable WSD without a direct connection to the internet

If a mode II WSD does not have a direct connection to the Internet, it can relay its initialization and registration request via another fixed or mode II WSD. In this case, the mode II WSD can transmit on a channel that the relaying WSD (fixed or mode II) has previously transmitted on, or on a channel which the relaying WSD indicates is available for use to access the database. Once registered with a WSDB, the newly registered mode II WSD shall only use the available channels indicated by the WSDB and cannot use the list of channels intended for another WSD.

9.3. Mode I personal/portable WSDs

A mode I personal/portable WSD shall only transmit upon receiving a list of available channels from a fixed or mode II personal/portable WSD that has contacted a WSDB. The list of available channels can only be provided by a fixed WSD or mode II personal/portable WSD after it has contacted and provided the database with the ISED ID of the mode I personal/portable device and has received confirmation of the validity of the ISED ID. WSD operation is permitted only on channels that are indicated in the database as being available for personal/portable WSDs.

9.3.1. List of channels provided by a mode II personal/portable WSD or fixed WSD to a mode I personal/portable WSD

A mode II personal/portable WSD shall provide a list of channels to a mode I personal/portable WSD

that is the same as the list of available channels of the mode II WSD.

A fixed WSD shall provide a list of channels to a mode I personal/portable WSD that is the same as the list of channels available to the fixed WSD. However, a mode I personal/portable WSD shall only operate on the channels that are indicated in the database as being available for personal/portable WSDs. Alternatively, a fixed WSD shall obtain from a WSDB a list of available channels that includes adjacent channels available to a Mode I personal/portable white space device, but not a fixed white space device.

9.3.2. Mode I personal/portable WSD contact with a fixed WSD or mode II personal/portable WSD

To initiate contact with a fixed WSD or mode II personal/portable WSD, a mode I personal/portable WSD can transmit:

- (a) on an available channel used by the fixed WSD or mode II personal/portable WSD, or
- (b) on a channel that a fixed or mode II personal/portable WSD indicates is available for use by a mode I device for this purpose.

At least once every 60 seconds, except when in sleep mode, a mode I personal/portable WSD must either:

- i. receive a contact verification signal from the mode II WSD or fixed WSD that has previously provided its current list of available channels, or
- ii. contact a mode II personal/portable or fixed WSD to re-verify and/or re-establish channel availability.

A mode I personal/portable WSD shall immediately cease operation if a contact cannot be established as described in (i) or (ii) within the specified time interval (i.e. once every 60 seconds).

9.3.3. Mode I power limitation dependency

Mode I personal/portable WSD shall limit their power to 40 mW, if the WSD that controls it is itself limited to 40 mW.

9.4. Identification of database operability

At the time of certification, a formal letter or agreement identifying that the WSD is able to operate with at least one WSDB shall be provided by the applicant.

10. Test report

In additiona to the reporting requirements set forth in in RSS-Gen, the test report shall include:

- a. The type of WSD (fixed, mode I or mode II).
- b. A description of the transmit power control feature.

- c. The screenshots of the WSDB interface's response with respect to the applicable test.
- d. A statement that the fixed WSD is designed for use in less congested areas (if applicable).
- e. The maximum gain of the transmitting antenna(s) used with a fixed WSD.
- f. A description of the power level control mechanism and ongoing compliance to the limits for fixed WSDs operating above a 6 dBi gain for devices operating at 36 dBm e.i.r.p. or above 10 dBi gain for devices operating at 40 dBm e.i.r.p.
- g. A description demonstrating the uncertainty and confidence level of the geo-location method.
- h. The description of alternate geo-location determination (if applicable).
- i. A declaration of conformity statement for a mode II personal/portable device with geo-location capability.

Annex A – WSD certification procedure for access to white space database (WSDB)**A1.1 Fixed WSD initialization**

The fixed WSD shall provide the following information to a white space database (WSDB):

- 1) ISED ID;
- 2) manufacturer's serial number of the device;
- 3) geographic coordinates (latitude and longitude (NAD 83));
- 4) geographic coordinates' uncertainty with 95% confidence level; and
- 5) antenna height above ground level (AGL) or above mean sea level (AMSL).

For a fixed WSD without direct connection to the Internet, it must confirm its own WSDB registration through an Internet-connected fixed or mode II personal/portable WSD. Separate channel availability data will be provided to the requesting WSD available to that registered WSD.

A fixed WSD shall access the database for a list of available channels each time it is activated from a power-off condition.

A1.2 Mode II personal/portable WSD initialization

The mode II WSD shall provide the following information to a WSDB:

- 1) ISED ID;
- 2) manufacturer's serial number of the device; and
- 3) geographic coordinates (latitude and longitude (NAD 83)).
- 4) geographic coordinates' uncertainty with 95% confidence level;

For a mode II personal/portable WSD without a direct connection to the Internet, confirm that registration through a registered WSD takes place only on a channel available to that registered WSD.

A1.3 Mode I personal/portable WSD initialization

Through the use of the WSDB interface, trigger the mode I WSD to provide its IC ID. Again, through the use of the WSDB interface, confirm that the information being sent by the mode I WSD includes its ISED ID.

A1.4 Fixed WSD and mode II personal/portable WSD failure to contact the database

Block access to the WSDB from the WSD. All other device functions, including Internet connectivity, should be maintained. Confirm that the WSD shuts down by 11:59 p.m. (local time) on the following day.

A1.5 Mode II personal/portable white space position verification

Using the system management software provided with the device, validate that the WSD executes position verification and WSDB access, as required. The WSD should display the available channel list to allow confirmation.

A1.6 Mode II personal/portable white space power loss

Disconnect the power source from operating mode II personal/portable WSD. Reconnect power and use the system management software to confirm the receipt of a new available channel list from a WSDB.

A1.7 Mode I personal/portable white space signal verification

Use the system management software to confirm that a mode I personal/portable WSD does not operate unless it receives an available channel verification signal on power-up, and every 60 seconds thereafter.

A1.8 Mode II personal/portable white space channel list update

Disconnect the power source and/or relocate a mode II personal/portable WSD and confirm that an updated available channel list is pushed to the connected mode I personal/portable WSD.

A1.9 WSD database update

Use the radio management software to provide an available channel list to the DUT and select a channel from the list. This channel is the DUT's operating channel. Using the radio management software, block the DUT's operating channel from the channel availability list. Confirm that the DUT updates its channel availability list within 24 hours (i.e. a day) from the time that it received the list. Using the system management software, also confirm that the WSD changes to an alternate available channel at the scheduled time.

A1.10 White space channel availability

Using the radio management software to specify an available channel or list of channels, confirm that the WSD is operating on an available channel from the list, at its authorized power and cannot be made to operate on an unauthorized channel.

A1.11 First adjacent power reduction for personal/portable WSD

Using the radio management software, specify that the channels available to the device are subject to the low-power limit. Use the applicable test procedures provided in Section 7 for personal/portable WSDs to confirm that the output power, power spectral density (PSD), band edge and adjacent channel power do not exceed the low-power e.i.r.p. limit values specified in Table 2 of Section 7.3.2. and Table 4 of Section 7.4.2



Innovation, Science and
Economic Development Canada

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Développement économique Canada

DBS-01

Issue 2 Draft1 External
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Spectrum Management and Telecommunications

Database Specifications

White Space Database Specifications

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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DRAFT

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
$EHAAT \leq 3$	2.5	3.2	0.4	0.5	0.1	0.1
$3 < EHAAT \leq 10$	4.6	5.8	0.8	1	0.2	0.3
$10 < EHAAT \leq 30$	8	10	1.3	1.7	0.4	0.5
$30 < EHAAT \leq 50$	10.3	12.9	1.7	2.1	0.5	0.6
$50 < EHAAT \leq 75$	12.6	16.3	2.1	2.6	0.6	0.7
$75 < EHAAT \leq 100$	15.1	18.9	2.4	3	0.7	0.8
$100 < EHAAT \leq 150$	18.5	23.3	3	3.7	0.8	1
$150 < EHAAT \leq 200$	21.2	26.8	3.4	4.3	0.9	1.2
$200 < EHAAT \leq 250$	23.7	29.8	3.8	4.8	1	1.3
$250 < EHAAT \leq 700$	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, WSDBA 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 (dBμV/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 dBμV/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 dBμ, 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.

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 WSDDB 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

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* N±1	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.