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Spectrum Management and Telecommunications

Radio Standards Specification

# White Space Devices (WSDs)



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Canada

## Preface

Industry Canada Radio Standard Specifications (RSS) describe the various technical requirements and processes to be followed when demonstrating compliance of radio apparatus that is used for radiocommunication other than broadcasting.

This document will be in force as of the publication date of Notice No. SMSE-XXX-XX in Canada Gazette, Part I. Upon publication, the public has 120 days to submit comments. Comments received will be taken into account in the preparation of the next version of the document.



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All Spectrum Management and Telecommunications publications are available on the following website
http://www.ic.gc.ca/spectrum

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the Minister of Industry

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## List of acronyms

AGL Above Ground Level
DUT Device Under Test
HAAT Height Above Average Terrain
IC ID Industry Canada Identification Number
PSD Power Spectral Density
WSD White Space Device
WSDB White Space Database

## 1. Scope

Radio Standards Specification 222 (RSS-222), Issue 1, *White Space Devices (WSD)* sets out the requirements for the technical compliance of license-exempt, category I radio apparatus operating in the frequency bands 54-60MHz, 76-88MHz, 174-216MHz, 470-608MHz and 614-698MHz, known as White Space Devices (WSDs). This document shall be used in conjunction with other Radio Standards Specifications (RSS) for compliance with Industry Canada requirements.

## 2. General Requirements

### 2.1 Purpose and Application

White space devices (WSD) are licence-exempt radio apparatus that operate on frequencies within white space which is a part of the spectrum available for radiocommunication by radio systems at a specific time and in a given geographical area. WSD operate on a no-protection, no-interference basis. White-space devices may provide a variety of services such as wireless broadband, amongst others.

RSS-222 does not apply to radio apparatus intended for general public broadcasting services. Such equipment is regulated by the Department's broadcasting equipment procedures (BPR) and broadcasting equipment standards (BETS).

### 2.2 RSS-Gen Compliance

In addition to RSS-222, the requirements in RSS-Gen, *General Requirements for Compliance of Radio Apparatus - Limits and methods of measurement*, shall be met.

### 2.3 Radio Frequency Exposure (RSS-102)

The requirements in Radio Standards Specification RSS-102, *Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)*, shall be met.

### 2.4 Test Report

A test report shall be compiled providing a record of the tests and results demonstrating compliance with the technical requirements in this standard and with RSS-Gen. The test report shall indicate the date the tests were completed. Additionally, the test report shall clearly state the white space device's type (fixed, mode I or mode II)

### 2.5 Certification of Radio Apparatus

The application for equipment certification shall be submitted in accordance with Industry Canada's Radio Standards Procedure RSP-100, *Certification of Radio Apparatus*, which sets out the requirements for certification of radio apparatus. RSP-100 shall be used in conjunction with RSS-Gen and other Radio Standards Specifications (RSSs) specifically applicable to the type of radio apparatus for which certification is sought.

## 2.6 Related Documents

All Spectrum Management and Telecommunications publications are available on the following website: http://www.ic.gc.ca/spectrum, under *Official Publications*.

In addition to the related documents specified in RSS-Gen, *General Requirements and Information for the Certification of Radio Apparatus,* the following documents should be consulted.

ANSI C63.10 *Testing Unlicensed Wireless Devices*

ANSI C63.4 *American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz*

## 3. Definitions

***Available channel*** is a range of frequencies which is not being used and is available for use by a white space device.

***Contact Verification Signal*** is an encoded signal broadcasted by a fixed or mode II personal/portable device for reception by mode I personal/portable devices to which the fixed or mode II personal/portable device has provided a list of available channels for operation. The purpose of this signal is to determine whether or not the mode I personal/portable device is still within the reception range of the fixed or mode II personal/portable device for purposes of validating the list of available channels used by the mode I personal/portable device.

***Dynamic Spectrum Access*** is a technique by which a radio system dynamically adapts to the local radio spectrum environment in order to determine available channels at specific locations.

***Fixed white space device*** is a white space device 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*** is the ability of a white space device to determine its geographic coordinates within a required level of accuracy.

***Industry Canada Identification Number (IC ID)*** is Industry Canada's certification number of a white space device.

***Maximum conducted output power*** is 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** is a white space device that transmits and/or receives radiocommunication signals while in motion, i.e. at non-vehicular speeds, or at unspecified fixed points.

**Mode I personal/portable white space device** is a personal/portable white space device 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 white space devices or provide a list of available radio frequency channels to another Mode I device for use by such a device.

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

**Network initiation** is a process by which a fixed or mode II white space device sends control signals to one or more fixed white space device or personal/portable white space device which allows them to begin communications.

***Operating channel*** is an available channel used by a white space device for transmission and/or reception.

***Protected contour*** is a contour within which a station (for broadcasting, RRBS, etc.) and its associated receivers or remote stations have protection from other devices operating in the same frequency bands and which may potentially interfere with the station.

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

***Separation Distance*** is the minimum distance between a white space device and a station's protection contour (for broadcasting, RRBS, etc.) at which a white space device may operate.

***Sleep mode*** is the inactive, but not powered-off state of the white space device.

**White space (WS)** – Part of the spectrum available for radiocommunication by radio systems at a specific time and in a given geographical area, on a no-protection, non-interference basis to other authorized radio services.

***White space database*** is an Industry Canada recognized 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 white space devices.

***White space device*** is a radio apparatus that operates in the white space frequency bands using dynamic

spectrum access techniques.

## 4. Technical Requirements

### 4.1 Display of available channels

A WSD shall incorporate the capability to display a list of identified available channels and its selected operating channel(s).

### 4.2 WSD Transmit Power Control

WSDs shall incorporate transmit power control to limit their operating power to the minimum necessary for successful communication. A description of the device's transmit power control feature mechanism shall be included in the test report.

### 4.3 Antenna requirements for personal/portable WSD

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

### 4.4 Antenna requirements for fixed WSD

The maximum gain of the transmitting antenna used with a fixed WSD must be declared by the manufacturer in the certification application. If the transmitting antenna gain exceeds 6 dBi, the conducted output power, power spectral density, band edge emissions and adjacent channel emissions limits shall all be reduced by the amount in dB by which the gain exceeds 6 dBi.

### 4.5 Equipment with Multiple Antennas

#### 4.5.1 Correlated Transmission

When multiple antennas are used to:

(a) transmit the same digital data in a given symbol period (even with different coding or phase shifts) for transmission diversity; or
(b) steer signal energy towards a particular direction for enhanced directional gain (i.e. beamforming); or

(c) device any other transmission mode,

and where signals from different antennas are correlated, the e.i.r.p. shall be calculated based on the aggregate power (conducted across all antennas) and resulting directional gain dBi, $G_{max} + 10 \log_{10} N$, where $N$ is the number of antennas and $G_{\max}$ is the highest gain in dBi among all antennas.

#### 4.5.2 Uncorrelated transmission

When multiple transmitted antennas are used and each antenna:

(a) transmits different digital data during any given symbol period (i.e. Space-Time Block Codes or Space-Time Codes); or

(b) transmits independent parallel data stream over the same frequency bandwidth in order to increase data rates (i.e. spatial multiplexing); or

(c) forms any other transmission mode,

and where signals from different antennas are completely uncorrelated, the e.i.r.p. shall be calculated based on the aggregate power (conducted across all antennas) and maximum antenna gain $G_{max}$.

## 5. White Space Device (WSD) Test Mode Requirements

### 5.1 Radio Frequency Test Mode Requirements

A test mode shall be accessible and made available for a WSD submitted for evaluation in order to perform the certification compliance tests (but not by end-use users) described in section 6.

The WSD test mode shall provide as a minimum:

1) The ability to compel the device-under-test (DUT) to operate on a frequency band selectable by the test personnel.
2) The ability to vary the output power from the minimum to the maximum realizable levels and set it to a desired level.
3) The ability to continuously transmit a modulated signal (i.e., with no time bursting or signal gating applied).

### 5.2 White Space Database (WSDB) Interface

Radio management software shall be provided, in order to perform the WSDB interface certification tests. The software shall provide, as a minimum, the following:

1) The ability to view all information sent to and provided by the device.
2) The ability to provide a list of available channels to the DUT.
3) The ability to manually select an available channel.
4) The ability to block a channel from the list of available channels.
5) The ability to instruct a personal/portable white space device to apply its lower-power limit (see Sections 6.2.2.2 and 6.3.2).

## 6. Measurement Method and Limits

This section establishes the radio frequency measurement procedures that shall be applied to WSD. These measurement procedures can be performed without requiring access to a WSDB.

## 6.1 White Space Frequency Bands

### 6.1.1 Measurement Method

For operation in Canada, verify that the DUT cannot be tuned to operate on unauthorized frequency bands, based upon WSD type: fixed, Mode I personal/portable or Mode II personal/portable. Also, verify that the DUT cannot be tuned to operate on frequencies outside of the authorized frequency band(s).

Note that the lockout of unauthorized channels may not be totally implemented in the DUT but rather, must be reliant upon limitations provided to the DUT by the database (e.g., channel 37).

### 6.1.2 Permissible Channels of Operation

All WSDs may operate in available channels in the frequency bands 512-608MHz and 614-698MHz. Note that the frequency band 608-614 MHz is prohibited from WSD use.

Only fixed WSDs shall operate on available channels in the frequency bands 54-60 MHz, 76-88MHz, 174-216MHz and 470-512MHz. These bands shall only be used for communication between fixed WSDs.

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

## 6.2 Transmitter Power, Power Spectral Density (PSD), and Transmit Power Control

### 6.2.1 Fixed WSD

#### 6.2.1.1 Measurement Method

The following paragraphs provide the settings and procedures for using a spectrum analyzer (with signal-processing capability) to perform the conducted power measurement. This measurement procedure shall be used to measure the conducted power and conducted power spectral density 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. For a fixed WSD, 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 (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 with 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 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. Check that the reported DUT transmit antenna gain complies with section 6.2.1.2 of this document. If required, reduce the maximum power and PSD limits by the amount in dB that the transmit antenna exceeds 6 dBi.
9. Compare the recorded power and power spectral density levels to the applicable limits in Table 1 of section 6.2.1.2 to assess compliance.
10. Repeat until data is accumulated for the low, middle and high channels in the DUT tuning range.

#### 6.2.1.2 Fixed WSD Power and Power Spectral Density Limits

Fixed WSD conducted power level per 6 MHz of bandwidth on which the devices operate and the power spectral density per 100 kHz band within a 6 MHz wide channel shall not exceed the levels in the table below during any time of continuous transmission.

**Table 1: Fixed WSD Power and Power Spectral Density Limits**

| Parameter | Conducted Limit |
|---|---|
| Power | 1 W (30dBm) |
| Power spectral density | 12.6 dBm/100kHz |

Fixed WSD with a transmitting antenna of directional gain greater than 6 dBi shall reduce the maximum conducted output power and power spectral density by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 6.2.2 Mode I and Mode II Personal/portable WSD

#### 6.2.2.1 Measurement method

The power limits for personal/portable WSD are specified using e.i.r.p. The following paragraphs provide the settings and procedures to perform radiated power measurements.

Refer to ANSI C63.10-2009 for general guidance on performing radiated measurements on unlicensed devices.

Once the azimuth and elevation associated with the maximum emission has been determined, use the following analyzer settings and procedures for final measurements.

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. 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.
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 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 amplitude over the 6 MHz channel bandwidth.
6. Use the peak marker function to determine the maximum amplitude in any 100 kHz band segment.
7. Make the necessary corrections to the measured amplitude levels to account for externalities inserted into the signal path (e.g. signal attenuation in patch cable 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.
8. Determine the associated e.i.r.p. levels using guidance provided in RSS-Gen.
9. Compare the power and power spectral density levels to the applicable limits in Table 2 of section 6.2.2.2 to assess compliance.
10. Repeat until data is accumulated for the low, middle and high channels in the DUT tuning range.

#### 6.2.2.2 Personal/portable WSD Power and Power Spectral Density Limits

Personal/portable WSD' e.i.r.p. power level per 6 MHz of bandwidth on which the devices operate and power spectral density per 100 kHz band segment within a 6 MHz wide channel shall not exceed the levels in the table below during any time interval of continuous transmission.

**Table 2: Personal/portable WSD Power and Power Spectral Density Limits**

| Parameter | e.i.r.p. Limit | Low-power e.i.r.p. limit* |
|---|---|---|
| Power | 100 mW (20dBm) | 40mW (16dBm) |
| Power Spectral Density | 2.6 dBm/100kHz | -1.4 dBm/100kHz |

* When testing Personal/portable WSDs, use the radio management software to apply its low-power limit when performing this test.

### 6.3 Transmitter Emissions

#### 6.3.1 Measurement Method

As with the power measurements, the preferred methodology for determining the maximum band-edge and adjacent-channel emission power is to utilize a conducted measurement procedure. However, in

those cases where there is no accessible antenna port for accommodating conducted measurements (e.g. personal/portable WSDs), a radiated measurement procedure can be used (see ANSI C63.10 as referenced in 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 to be investigated. For band-edge, adjacent channel, and beyond adjacent channel measurements, the low, middle and high channels of the tuning range must be tested.

#### 6.3.1.1 Band-edge Measurement

The band-edge measurement must be performed relative to both the low ($f_L$) and upper ($f_U$) channel edge frequencies. The power spectral density (PSD) PSD is to be measured within a 100 kHz band segment relative to the channel edge (i.e., $f_L$-100 kHz). The following paragraphs 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 power spectral density over the 100 kHz frequency span.
4. Adjust the measured amplitude level to account for externalities in the signal path (e.g., attenuation in the patch cable for conducted measurements; to include 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 the DUT range.

#### 6.3.1.2 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±1, where N represents the channel of operation).

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 power spectral density 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. attenuation in the patch cable for 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 the DUT tuning range.

### 6.3.2 Transmitter Band Edge and Adjacent Channel Power Limits

WSDs band edge and adjacent channel power shall not exceed the levels established in Table 3 and Table 4 per 100 kHz band for fixed WSDs and personal/portable WSDs, respectively.

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

| Parameter | Conducted Limit |
|---|---|
| Band Edge | -42.8 dBm / 100 kHz |
| Adjacent Channel Power Level | -42.8 dBm / 100 kHz |

Fixed WSD with a transmitting antenna of directional gain greater than 6 dBi shall reduce the maximum conducted band edge power and adjacent channel power levels by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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

| Parameter | e.i.r.p. Limit | Low-power e.i.r.p Limit* |
|---|---|---|
| Band Edge | -52.8 dBm / 100 kHz | -56.8 dBm / 100 kHz |
| Adjacent Channel Power Level | -52.8 dBm / 100 kHz | -56.8 dBm / 100 kHz |

* When testing Personal/portable WSDs, use the radio management software to apply its low-power limit when performing this test.

### 6.3.3 Spurious Emissions Measurements and Limits

Beyond the adjacent-channel emissions, the emission limits of RSS-Gen apply. See RSS-Gen and ANSI C.63.10-2009 for guidance on performing those measurements.

## 6.4 Field Strength Emissions in the 602-620 MHz Frequency Band

### 6.4.1 Field Strength Emissions Measurements

Section 6.4.2 provides a table of field strength limits applicable to emissions from WSD that fall within the frequency band 602-620 MHz. The emission levels within these channels should be measured on a radiated basis following the guidance provided in ANSI C63.10 – 2009. When performing these measurements, the DUT shall be tuned to the frequency bands 596-602 MHz and 620-626 MHz.

### 6.4.2 Field Strength Emissions Limits

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

**Table 5: Field strength emission limits for the 602-620 MHz Frequency Band**

| Frequency (MHz) | Field Strength dBµV/meter /120kHz at 1 m |
|---|---|
| 602-607 | 120-5[F(MHz)-602] |
| 607-608 | 95 |
| 608-614 | 30 |
| 614-615 | 95 |
| 615-620 | 120-5[620-F(MHz)] |

## 6.5 Transmitter Frequency Stability

The transmitter frequency stability limit shall be determined as follows:

(a) The frequency offset shall be measured according to the procedure described in RSS-Gen and recorded;

(b) Using a resolution bandwidth of 1% of the occupied bandwidth, a reference point at the unwanted emission level which complies with the attenuation of $43+ 10 \log_{10} p$ (watts) on the emission mask of the lowest and highest channel shall be selected, and the frequency at these points shall be recorded as $f_L$ and $f_H$ respectively.

The applicant shall ensure frequency stability by showing that $f_L$ minus the frequency offset and $f_H$ plus the frequency offset shall be within the frequency range in which the equipment is designed to operate.

## 7. Geo-location Requirements

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

### 7.1. Fixed WSD

A fixed WSD with geo-location capability shall determine its geographic coordinates to an accuracy of 50 meters (i.e. ± 50m).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.

A fixed WSD with geo-location capability shall include a declaration of conformity statement in the test report for the specified accuracy in this section.

In addition to the labelling requirements of RSS-Gen, the fixed WSD user manual shall also include the following statements or equivalent:

*If the fixed WSD is moved to another location or if the stored coordinates become altered, the operator shall re-establish the device's:*

1. *Geographic location and store this information in the WSD either by means of the device's incorporated geo-location capability or through the services of a professional installer;*
2. *Registration with the white space database based on the device's new coordinates.*

The user manual of a fixed WSD without an integrated geo-location capability shall also include the following statement or equivalent in the user manual:

*The fixed WSD's geo-location shall be determined to an accuracy of 50 meters (i.e. ± 50m) by a professional installer. Its geographic coordinates shall be determined and provided prior to beginning any transmissions.*

### 7.2. Mode II Personal/Portable WSD

A mode II personal/portable WSD shall incorporate a geo-location capability to determine its geographic coordinates to an accuracy of 50 meters (i.e. ± 50m). The mode II personal/portable WSD shall re-establish its position each time it is activated from a power-off condition. The mode II personal/portable WSD shall verify its location at least once every 60 seconds while in operation, except when it is in sleep mode.

A mode II personal/portable device with geo-location capability shall contain a declaration of conformity statement in the test report for the specified accuracy in this section.

## 8. WSD Database Access Requirements

This section addresses the WSD database access requirements. See *Annex 1 – WSD Database Access Certification Procedure* for WSD database access test procedures.

### 8.1. Fixed WSD

#### 8.1.1 Fixed WSD Initialization

Fixed WSD shall access a white space database over the Internet to determine the available channels at their geographic coordinates, taking into consideration the fixed WSD's antenna height, prior to their initial service transmission at a given location.

A fixed WSD shall be capable of providing the following information to a white space database:

1. Industry Canada Identification Number (IC ID)
2. Manufacturer's serial number of the device
3. Geographic coordinates (latitude and longitude (NAD 83))
4. Antenna height above ground level (AGL)

#### 8.1.2 Fixed WSD Database 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, the fixed WSD shall immediately stop operating on the channel. 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 at the time of the device last accessed the database.

### 8.1.3 Fixed WSD Failure to Contact the Database

If a fixed WSD fails to successfully contact a white space database during any given day, it may continue to operate until 11:59 p.m. 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 white space database, and re-verifies its list of available channels.

### 8.1.4 Fixed WSD without a Direct Connection to the Internet

If a fixed WSD does not have a direct connection to the Internet, it may relay its initialization and registration request via another fixed WSD. In this case, the fixed WSD may 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 white space database and may not use the list of channels intended for another WSD.

## 8.2. Mode II Personal/portable WSD

### 8.2.1 Mode II Personal/Portable WSD Initialization

Mode II personal/portable WSD shall access a white space database over the Internet to determine the available channels at their geographic coordinates prior to their initial service transmission at that location. Operation is permitted only on channels that are indicated in the database as being available for personal/portable WSD.

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

1. Industry Canada Identification Number (IC ID)
2. Manufacturer's serial number of the device
3. Geographic coordinates (latitude and longitude (NAD 83))

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.

### 8.2.2 Mode II Personal/Portable WSD Location Change

If a mode II personal/portable WSD changes location during operation by more than 100 metres 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 8.2.4.

### 8.2.3 Mode II Personal/Portable WSD Database Update

A mode II personal/portable WSD that has been in a powered state shall re-verify its location and shall access a white space database daily to verify that the operating channel(s) remain available. Mode II personal/portable WSD shall update their operating 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 beginning at the time of the device last accessed the database.

### 8.2.4 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 personal/portable basis within the area. In this case, the mode II personal/portable WSD shall re-contact a white space database 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 white space database daily, to verify that the operating channel(s) continue to be available, even if it has not moved beyond that boundary.

### 8.2.5 Mode II Personal/Portable WSD Failure to Contact the Database

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

### 8.2.6 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 white space database 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 it is serving to acquire and use a new available channel list.

## 8.3. Mode I Personal/Portable WSD

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 white space database. The list of available channels may only be provided by a fixed WSD or mode II personal/portable WSD after it has contacted and provided the database with the IC ID of the mode I personal/portable device and has received confirmation of the validity of the IC ID. WSD operation is permitted only on channels that are indicated in the database as being available for personal/portable WSD.

### 8.3.1 List of channels provided by a Mode II 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 available channels to a mode I personal/portable WSD only if the fixed WSD height above average terrain (HAAT) as verified by the white space database does not exceed 106 meters. The fixed WSD shall provide a list of available channels to the mode I personal/portable WSD that is the same as the list of channels made available to the fixed WSD, with the exception that a Mode I personal/portable device shall only operate on those channels permissible for use as established in section 6.1.2 of this document.]

### 8.3.2 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 may transmit:

(a) on an available channel used by the fixed WSD or mode II personal/portable WSD
(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:

(c) receive a contact verification signal from the mode II WSD or fixed WSD that has previously provided its current list of available channels, or;
(d) 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 (c) or (d) within the specified time interval (i.e. once every 60 seconds).

## 8.4. 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.

# Annex 1 – WSD Database Access Certification Procedure

## A1.1 Fixed WSD Database Interface Tests

The fixed WSD shall provide the following information to a WSDB:

1) Industry Canada Identification Number (IC ID)
2) Manufacturer's serial number of the device
3) Geographic coordinates (latitude and longitude (NAD 83)
4) Antenna height above ground level (AGL)

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.

## A1.2 Mode II Personal/portable WSD Initialization

Mode II WSD shall provide the following information to a WSDB:

1) Industry Canada Identification Number (IC ID)
2) Manufacturer's serial number of the device
3) Geographic coordinates (latitude and longitude (NAD 83))

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 Validation

Through a fixed WSD or a mode II personal/portable WSD, the mode I personal/portable WSD shall provide its Industry Canada ID to the database. Confirm that the white space database does not validate a mode I personal/portable WSD without receiving this validation.

Confirm that validation only takes place on a channel available to the fixed WSD / mode II personal/portable WSD.

## A1.4 Fixed WSD and Mode II Personal/Portable WSD Failure to Contact the Database

Block access to the white space database from the WSD. All other device functions, including Internet connectivity, should be maintained. Confirm that the WSD shuts down by 11:59 p.m. 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 white space database 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 white space database.

### A1.7 Mode I Personal/portable White Space Signal Verification

Use the system management software to confirm that a mode I personal/portable WSD receives an available channel verification channel 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 it received the list. Using the system management software, also confirm that the WSD changes to an alternate available channel at the scheduled time.

### A1.11 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.

### A1.12 1st – Adjacent Power Reduction

Using the radio management software, specify that the channels available to the device are subject to the low-power limit for use within the protected contour of a 1$^{st}$-adjacent station. Use the applicable test procedures provided in Section 6 for personal/portable WSDs to confirm that the output power, PSD, band edge and adjacent channel power don't exceed the *Low power limit* values specified in Table 2 of section 6.2.2.2 and Table 4 of section 6.3.2.