



Spectrum Management and Telecommunications

Radio Standards Specification

White Space Devices (WSDs)

DRAFT

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

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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.

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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