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Spectrum Management and Telecommunications

Radio Standards Specification

White Space Devices (WSDs)

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Preface

Radio Standards Specification RSS-222, issue 4, *White Space Devices (WSDs)*, replaces RSS-222, issue 3, dated October 2021.

The main changes are listed below:

1. Added a new class of white space devices (WSDs) with less stringent first-adjacent channel unwanted emission limits in section 11.
2. Permitted the operation of mobile WSDs on channels 3 and 4 in section 11 based on the [Decision on New Access Licensing Framework, Changes to Subordinate Licensing and White Space to Support Rural and Remote Deployment](#).
3. Added provisions to clarify that proxy devices are permitted to be used for database access in section 14.
4. Added diagrams showing the different types of white space devices allowed to indirectly connect to the database in Annex B.
5. Made editorial changes and clarifications, as appropriate.

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Contents

1. Scope	1
2. Purpose and application	1
3. Coming into force and transition period	1
4. Certification	1
5. Licensing	2
6. RSS-Gen compliance	2
7. Related documents	2
8. Definitions	2
9. WSD technical requirements	5
9.1 Display of available channels	5
9.2 Transmit power control.....	5
9.3 Antenna requirements for personal/portable WSDs	5
9.4 Antenna requirements for mobile WSDs	5
9.5 User manual text for the antennas of fixed WSDs.....	5
9.6 User manual text for the antennas of mobile WSDs	6
9.7 Narrowband operation.....	6
10. Test mode requirements	6
10.1 WSDB interface	7
11. Radio frequency requirements, measurement method and limits	7
11.1 White space frequency bands.....	7
11.2 Measurement method.....	9
11.3 Measurement requirements.....	9
11.4 Transmitter power and PSD for fixed and mobile WSDs.....	9
11.5 Transmitter power and PSD for personal/portable WSDs (mode I and mode II).....	10
11.6 Transmitter power and PSD for narrowband WSDs.....	10
11.7 Transmitter emissions for band edge and adjacent channels for all WSDs	11
12. Geolocation requirements for fixed, mobile and mode II personal/portable WSDs ..	13
12.1 Geolocation accuracy	13
12.2 Alternate geolocation technology	14
12.3 Requirements for internal geolocation capability and external geolocation source for both fixed and mobile WSDs	14
12.4 Additional geolocation requirements for fixed WSDs	14
12.5 Additional geolocation requirements for mobile WSDs.....	14
12.6 Geolocation capability mode II personal/portable WSDs	15
13. Access requirements for WSDs to the WSDB	15
13.1 WSD certification procedure for access to WSDB.....	15
13.2 Fixed WSDs	15

13.3 Mobile WSDs 16

13.4 Mode II personal/portable WSDs..... 18

13.5 Mode I personal/portable WSDs..... 20

13.6 Identification of database operability..... 21

14. Test report..... 21

Annex A (normative): White space device (WSD) certification procedure for access to white space database (WSDB) 22

Annex B: White space device (WSD) types and connection to database 25

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1. Scope

Radio Standards Specification RSS-222, issue 4, *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 WSDs.

2. Purpose and application

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

WSDs can operate on a fixed or non-stationary configuration (i.e. personal/portable and mobile) on available channels identified by a white space database. Under special circumstances (i.e. less congested areas), WSDs can operate in a mobile configuration in a geo-fenced area, thus enabling services such as wireless broadband onboard vehicles (e.g. bus, tractor, crane, bucket truck). WSDs can operate either on 6 MHz wide channels or on 100 kHz channels, known as narrowband.

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

RSS-222 does not apply to WSDs operating on satellites and aircraft, including unmanned aerial vehicles. These types of operation are prohibited for WSDs.

3. Coming into force and transition period

This document will be in force as of its publication on [ISED's website](#). However, a transition period of six months following its publication will be provided, within which compliance with RSS-222, issue 3, or RSS-222, issue 4, will be accepted. After this period, only applications for the certification of equipment under RSS-222, issue 4, will be accepted. Furthermore, after this transition period, equipment that is manufactured, imported, distributed, leased, offered for sale or sold in Canada shall comply with RSS-222, issue 4.

4. Certification

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

5. Licensing

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

6. RSS-Gen compliance

Equipment being covered by this standard shall also comply with the general requirements set out in Radio Standards Specification RSS-Gen, [General Requirements for Compliance of Radio Apparatus](#).

7. Related documents

All Spectrum Management and Telecommunications publications are available on the [Official publications](#) section of ISED's website. The following documents should be consulted in conjunction with this RSS:

DBS-01	White Space Database Specifications
SMSE-012-12	Framework for the Use of Certain Non-broadcasting Applications in the Television Broadcasting Bands Below 698 MHz
SMSE-003-19	Decision on the Technical and Policy Framework for White Space Devices
SPB-001-24	Decision on New Access Licensing Framework, Changes to Subordinate Licensing and White Space to Support Rural and Remote Deployment

DBS: Database specification
SMSE: Spectrum Management Spectrum Engineering
SPB: Spectrum Policy Branch

8. Definitions

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

Class A white space device (WSD): A fixed, mobile or narrowband personal/portable WSD that adheres at all times to the specified Class A conducted power limits outlined in this document for band edge and adjacent channel emissions.

Class B white space device (WSD): A fixed, mobile or narrowband personal/portable WSD that adheres at all times to the specified Class B conducted power limits outlined in this document for band edge and adjacent channel emissions.

Contact verifications signal: An encoded signal broadcast by a fixed, mobile 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, mobile or mode II personal/portable device, which had provided a list of available channels to the mode I device.

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

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

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

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

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

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

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 shall be summed across all antennas and antenna elements. The average shall 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.

Mobile white space device (WSD): A WSD that transmits and receives radiocommunication signals on available channels while stationary or in motion within a defined geo-fenced area. The mobile WSD selects potential operational frequencies from a list of available channels, as provided by a WSDB. A mobile WSD uses an incorporated geolocation capability to determine its location with respect to the boundaries of the defined geo-fenced area.

Mode I personal/portable white space device (WSD): A personal/portable WSD that

does not use an internal geolocation capability and does not directly access a WSDB to obtain a list of available channels. A mode I personal/portable WSD shall obtain, from either a fixed, a mobile or a mode II personal/portable WSD, a list of available channels on which it may operate. A mode I personal/portable WSD does not initiate a network of WSDs or provide a list of available channels to another mode I personal/portable WSD for use by such a device.

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

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

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

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

Operating channel: An available channel used by a WSD for transmission and reception.

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

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

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

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

White space database (WSDB): An ISED-designated database that maintains records of protected licensed services and systems operating within the white space frequency bands. The WSDB determines available channels for use by WSDs at a specific time and geographic location.

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

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

9. WSD technical requirements

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

9.1 Display of available channels

A WSD shall incorporate the capability of providing a list of the device's identified available channels and its selected operating channel(s) either directly (e.g. through display on device) or indirectly (e.g. through auxiliary equipment).

9.2 Transmit power control

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

In the case of fixed or mobile WSDs, this description shall also include how to maintain, in relation to the antenna gain of the WSD, ongoing compliance with the transmitter's power, power spectral density (PSD), band edge, adjacent channel and unwanted emissions limits specified in section 11.

9.3 Antenna requirements for personal/portable WSDs

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

9.4 Antenna requirements for mobile WSDs

Mobile WSDs may use electrically steerable directional antennas. The maximum e.i.r.p. used by the WSD in any direction shall be used in determining channel availability.

9.5 User manual text for the antennas of fixed WSDs

In addition to the user manual requirements of RSS-Gen, a fixed WSD shall include the following text in the user manual:

The antenna height above ground shall be determined by the installer or operator of the fixed device, or by automatic means. This information shall be stored internally in the white space device. If the fixed device is moved, the operator shall re-establish the device's antenna height above ground level and also

update the device's registration with the white space database.

9.6 User manual text for the antennas of mobile WSDs

In addition to the user manual requirements of RSS-Gen, a mobile WSD shall include the following text in the user manual:

The antenna height above ground shall be determined by the operator of the mobile device, or by automatic means. If the antenna height is changed, the operator shall re-establish the device's antenna height above ground level and also update the device's registration with the white space database.

9.7 Narrowband operation

Narrowband operation is restricted to fixed or personal/portable WSDs.

Narrowband WSDs shall operate on 100 kHz sub-channel(s) within the central 5.5 MHz portion of a 6 MHz channel. The sub-channel(s) shall be on integral multiples of 100 kHz starting at an offset of 250 kHz from the 6 MHz channel edge.

The remaining 250 kHz portions of the lower and upper edges of the 6 MHz channel may be used by narrowband WSDs if the WSDB indicates that two adjacent 6 MHz channels are available. In this case, a combined 500 kHz (i.e. two 250 kHz portions) of spectrum from two adjacent 6 MHz channels may be used for a total of five sub-channels. These five sub-channels shall be located on integral multiples of 100 kHz, with the third channel centred at the channel edge between the two adjacent 6 MHz channels.

Narrowband WSDs shall operate with a 1% maximum duty cycle. The total transmission time shall not exceed 36 seconds in an hour. The maximum duty cycle applies to each 100 kHz sub-channel being used by a narrowband WSD.

Narrowband WSDs are not authorized to operate in the frequency bands 602-608 MHz and 657-663 MHz and are permitted to operate only in available channels below 602 MHz that are allowed for the specific type of narrowband WSD (i.e. fixed or personal/portable). WSDBs will treat a narrowband WSD as a fixed WSD for the purpose of calculating channel availability, however, narrowband WSDs shall be self-restricted to operate below 602 MHz and only in permitted channels irrespective of the WSDB calculation of channel availability above 602 MHz. A description of the mechanism used by the narrowband WSD to self-restrict its operation to permitted spectrum below 602 MHz and only in permitted channels shall be included in the test report.

10. Test mode requirements

This section establishes the requirements for the WSD's test mode.

10.1 WSDB interface

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

- display all information sent to and provided by the WSD
- provide a list of available channels to the WSD
- manually select an available channel
- block a channel from the list of available channels
- instruct a personal/portable WSD to apply its lower-power limit (see sections 11.5.1 and 11.7.1)

11. Radio frequency requirements, measurement method and limits

This section prescribes the radio frequency requirements, measurement method and limits that shall be applied to WSDs.

11.1 White space frequency bands

This section prescribes the requirements related to white space frequency bands.

11.1.1 Permissible channels of operation

WSDs shall operate only on available channels as permitted for specific types of WSDs (see table 1 below). The WSDB establishes the available channels and power levels for WSDs.

Table 1: Overview of permissible white space frequency bands and channels

Frequency bands (MHz)	Channel name	Personal/portable WSD	Fixed WSD	Mobile WSD
54-60	TV channel 2	Not permitted	✓	✓
60-72	TV channels 3-4	Not permitted	✓	✓
76-88	TV channels 5-6	Not permitted	✓	✓
174-216	TV channels 7-13	Not permitted	✓	✓
470-512	TV channels 14-20	✓	✓	✓
512-602	TV channels 21-35	✓	✓	✓
602-608	TV channel 36	✓ *	✓ *, **	Not permitted
608-614	TV channel 37	Not permitted	Not permitted	Not permitted

614-617	600 MHz guard band	Not permitted	Not permitted	Not permitted
617-652	600 MHz mobile downlink	Not permitted	Not permitted	Not permitted
652-657	600 MHz duplex gap	Not permitted	Not permitted	Not permitted
657-663	600 MHz duplex gap	✓ *, ***	Not permitted	Not permitted
663-698	600 MHz mobile uplink	Not permitted	Not permitted	Not permitted

* Narrowband WSDs are not authorized to operate in the frequency bands 602-608 MHz and 657-663 MHz.

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

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

11.1.2 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 that uses channel bonding shall be performed only on available channels as determined by the WSDB.

Narrowband WSDs are also permitted to operate on multiple contiguous or non-contiguous 100 kHz sub-channels as long as the 1% duty cycle limit is met for each 100 kHz sub-channel, including all other technical requirements.

WSDs that operate using channel bonding (i.e. multiple contiguous or non-contiguous channels) shall maintain compliance with all requirements prescribed herein. In particular, WSDs that operate using contiguous channel bonding shall maintain compliance to:

- the transmitter power limit prescribed applicable to 6 MHz (i.e. the white space channel's width) or 100 kHz in the case of narrowband WSDs
- the PSD over the prescribed resolution bandwidth
- 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 of and adjacent to the group.

A description of the channel bonding shall be included in the test report. To demonstrate compliance with the requirements for channel bonding operation, the test report shall include measurements based on the maximum number of channels supported by the

device.

11.2 Measurement method

The applicable measurement methods are described in the following American National Standards Institute (ANSI) standard: ANSI C63.10.

11.3 Measurement requirements

To demonstrate compliance with the power limits established in this standard (i.e. wanted emissions, as well as band edge, adjacent channel emissions and other unwanted emissions), measurements shall be required for the minimum and maximum discrete e.i.r.p. levels that the WSD supports in response to WSDB commands. The discrete e.i.r.p. levels shall be identified in the test report.

Measurements for the minimum discrete e.i.r.p. level are required to be made only for a WSD configured with the maximum bandwidth it can support (i.e. a single 6 MHz channel for a device that does not support channel bonding, and the maximum number of contiguous 6 MHz channels for a device that does support channel bonding).

11.4 Transmitter power and PSD for fixed and mobile WSDs

This section prescribes the power and PSD requirements applicable to fixed and mobile WSDs.

11.4.1 Power limits for fixed and mobile WSDs

Fixed and mobile WSDs shall operate only at e.i.r.p. power levels at or below the levels established by a WSDB for each specific channel indicated as being available at the WSD's location. For a discrete e.i.r.p. level established by the WSDB, the conducted power and conducted PSD of the fixed or mobile WSD's channel shall not exceed the prescribed limits of table 2. If a fixed or mobile WSD is operating at an e.i.r.p. below the discrete level established by a WSDB, it is required to meet only the limits in table 2 that are prescribed for the e.i.r.p. level identified by the WSDB.

The maximum conducted power of a fixed or mobile WSD shall not exceed 30 dBm per 6 MHz channel. The conducted PSD of a fixed or mobile WSD shall not exceed 12.6 dBm per 100 kHz.

The e.i.r.p. of a fixed or mobile WSD shall not exceed 42 dBm per 6 MHz channel in less congested areas (as determined by a WSDB), and shall not exceed 36 dBm per 6 MHz channel in areas not considered "less congested".

The power limits in table 2 for a channel e.i.r.p. of 36 dBm or less are based on a maximum antenna gain of 6 dBi; if the antenna gain exceeds 6 dBi, then both the channel conducted power and channel conducted PSD limits shall be reduced by the

amount in dB that the directional gain of the antenna exceeds 6 dBi.

The power limits in table 2 for a channel e.i.r.p. above 36 dBm are based on a maximum antenna gain of 12 dBi; if the antenna gain exceeds 12 dBi, then both the channel conducted power and channel conducted PSD limits shall be reduced by the amount in dB that the directional gain of the antenna exceeds 12 dBi.

Table 2: Power and PSD limits for fixed and mobile WSDs

Channel e.i.r.p. limit (dBm/6 MHz)	Channel conducted power limit * (dBm/ 6 MHz)	Conducted PSD limit (dBm/100 kHz)
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
42	30	12.6

* The values of the channel conducted power limits are based on a uniform distribution of the PSD over 5.5 MHz.

11.5 Transmitter power and PSD for personal/portable WSDs (mode I and mode II)

This section prescribes the power and PSD requirements applicable to personal/portable WSDs.

11.5.1 Power and PSD limits

The power level and the PSD of a personal/portable WSD shall not exceed the limits in table 3.

Table 3: Personal/portable WSD power and PSD limits

Parameter	Limit	Low-power limit*
Channel e.i.r.p. (dBm/6 MHz)	20	16
e.i.r.p. 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.

11.6 Transmitter power and PSD for narrowband WSDs

Narrowband WSDs shall operate only at e.i.r.p. power levels at or below levels established by a WSDB for each specific channel indicated as being available at the

narrowband WSD's location. For a discrete e.i.r.p. level established by the WSDB, the narrowband WSD's channel conducted PSD shall not exceed the prescribed limits of table 4. If a narrowband WSD is operating at an e.i.r.p. below the discrete level established by a WSDB, it is required to meet only the limits in table 4 that are prescribed for the e.i.r.p. level identified by the WSDB.

The narrowband WSD shall determine its e.i.r.p. level by scaling down the e.i.r.p. power level established by the WSDB for a 6 MHz channel into the equivalent level within a 100 kHz bandwidth as outlined in table 4.

Table 4: Power and PSD limits for narrowband fixed and narrowband personal/portable WSDs

e.i.r.p. power level established by the WSDB (dBm/6 MHz)	Narrowband WSD e.i.r.p. limit (dBm/100kHz)	Narrowband WSD Conducted PSD limit (dBm/100 kHz)
16	-1.4	-7.4
20	2.6	-3.4
24	6.6	0.6
28	10.6	4.6
32	14.6	8.6
36	18.6	12.6

The maximum conducted power of a narrowband WSD shall not exceed 12.6 dBm per 100 kHz sub-channel. Furthermore, when using channel bonding to operate on multiple 100 kHz sub-channels, the maximum conducted PSD of a narrowband WSD shall not exceed 12.6 dBm in any 100 kHz bandwidth. The maximum e.i.r.p. of a narrowband WSD shall not exceed 18.6 dBm per 100 kHz sub-channel. If the directional gain of the transmitting antenna of a narrowband WSD is greater than 6 dBi, both the maximum conducted output power and PSD limits shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The 100 kHz sub-channel plan that narrowband WSDs shall follow is defined in section 9.7.

11.7 Transmitter emissions for band edge and adjacent channels for all WSDs

This section prescribes the band edge and adjacent channel emission requirements applicable to all WSDs.

11.7.1 Transmitter band edge and adjacent channel power limits

A WSD shall operate only at e.i.r.p. power levels at or below the levels established by a WSDB for each specific channel indicated as being available at the WSD's location. For a discrete e.i.r.p. level established by the WSDB, the WSD's band edge and adjacent channel conducted power shall not exceed the limits prescribed in table 5 and table 6 during any time of transmission. If a WSD is operating at an e.i.r.p. below the level

established by a WSDB, it is required to meet only the limits that are prescribed for the e.i.r.p. level established by the WSDB.

The power limits in table 5 for a channel e.i.r.p. of 36 dBm or less are based on a maximum antenna gain of 6 dBi; if the antenna gain exceeds 6 dBi, then the band edge and adjacent channel conducted power limit shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The power limits in table 5 for a channel e.i.r.p. above 36 dBm are based on a maximum antenna gain of 12 dBi; if the antenna gain exceeds 12 dBi, then the band edge and adjacent channel conducted power limit shall be reduced by the amount in dB that the directional gain of the antenna exceeds 12 dBi.

Table 5: Fixed and mobile WSD band edge and adjacent channel conducted power limits

Channel e.i.r.p. limit (dBm/6 MHz)	Class A band edge and adjacent channel WSD conducted power limit (dBm/100 kHz)	Class B band edge and adjacent channel WSD conducted power limit (dBm/100 kHz)
16	-42.8	-62.8
20	-38.8	-58.8
24	-34.8	-54.8
28	-30.8	-50.8
32	-26.8	-46.8
36	-22.8	-42.8
40	-22.8	-42.8
42	-22.8	-42.8

Table 6: Personal/portable WSD band edge and adjacent channel power limits

Parameter	e.i.r.p. limit (dBm/100 kHz)	e.i.r.p. 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 being aggregated for channel bonding. For non-contiguous aggregation, the requirements of a single 6 MHz channel apply to each channel in that aggregation of channels.

For narrowband WSDs, the first adjacent channel conducted power shall be limited

to -the power levels in table 7 starting at the edges of the 6 MHz channel within which the narrowband WSD is operating. No adjacent channel power limit shall apply between the edge of a narrowband channel and the edge of the 6 MHz channel containing it. In cases where two adjacent 6 MHz channels are indicated as available by a WSDB and the WSD is operating on the adjoining 250 kHz edges of these 6 MHz channels, the first adjacent channel conducted power limit shall apply only at the upper and lower edges of these two combined 6 MHz channels.

Table 7: Fixed narrowband and personal/portable narrowband WSD band edge and adjacent channel power limits

Narrowband WSD EIRP limit (dBm/100kHz)	Class A band edge and adjacent channel WSD conducted power limit (dBm/100 kHz)	Class B band edge and adjacent channel WSD conducted power limit (dBm/100 kHz)
-1.4	-42.8	-62.8
2.6	-38.8	-58.8
6.6	-34.8	-54.8
10.6	-30.8	-50.8
14.6	-26.8	-46.8
18.6	-22.8	-42.8

11.7.2 Unwanted emissions measurements and limits

For frequencies separated by more than 6 MHz from the edge of a WSD's channel of operation, the WSD's unwanted emissions shall comply with the general field strengths prescribed in RSS-Gen. The unwanted emissions shall be measured according to the RSS-Gen requirements. For WSDs using channel bonding to operate on multiple contiguous 6 MHz channels, this limit shall apply for frequencies separated by more than 6 MHz from the edge of the group of contiguous channels.

12. Geolocation requirements for fixed, mobile and mode II personal/portable WSDs

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.

12.1 Geolocation accuracy

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

For fixed and mobile WSDs using an external geolocation capability, the geolocation uncertainty shall account for both the accuracy of the geolocation source and the separation distance between such a source and the WSD.

A description demonstrating the uncertainty and confidence level of the geolocation method used shall be provided by the applicant in an attestation letter.

12.2 Alternate geolocation technology

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

12.3 Requirements for internal geolocation capability and external geolocation source for both fixed and mobile WSDs

Fixed and mobile WSDs shall determine their geographic coordinates through an internal geolocation capability incorporated into the device. However, a fixed or mobile WSD can also obtain its geographic coordinates through an external geolocation source when it is used at a location where its internal geolocation capability does not function.

An external geolocation source may be connected to a fixed device through either a wired or a wireless connection, and a single geolocation source may provide location information to multiple fixed devices. A secure connection shall be used to ensure that only an external geolocation source that has been approved with a particular fixed device can provide geographic coordinates to that device.

The geographic coordinates shall be provided automatically by the external geolocation source to the fixed device; users shall not manually enter them. Alternatively, an extender cable may be used to connect a remote receive antenna to a geolocation receiver within a fixed device.

12.4 Additional geolocation requirements for fixed WSDs

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

12.5 Additional geolocation requirements for mobile WSDs

A mobile WSD shall verify its location coordinates at least once every 60 seconds while in operation, except while in sleep mode (i.e. a mode in which the device is inactive but not powered off). A mobile WSD shall re-establish its position each time it is activated from a power-off condition or sleep mode period.

A mobile WSD shall have the capability to internally store the geographic coordinates that define the geo-fenced area in which it can operate. The area boundaries stored within the mobile WSD shall be the same as those used by the WSDB to determine channel availability.

A mobile WSD shall be capable of determining its location with respect to the stored boundaries of the geo-fenced area in which it can operate.

12.6 Geolocation capability mode II personal/portable WSDs

Mode II personal/portable WSDs shall determine their geographic coordinates through an internal geolocation capability incorporated into the device. 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. 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 WSD shall contain a declaration of conformity statement in the test report for the specified accuracy.

13. Access requirements for WSDs to the WSDB

This section addresses the WSDB access requirements for all WSDs.

13.1 WSD certification procedure for access to WSDB

The procedure prescribed in Annex A shall be performed to verify the WSD's access to the WSDB. The different WSD types and the associated permissible methods of connecting to the database are illustrated in the diagrams provided in Annex B.

13.2 Fixed WSDs

This section addresses the WSDB access requirements for fixed WSDs.

13.2.1 Fixed WSDs: Initialization

Fixed WSDs shall access a WSDB over the Internet to determine the available channels and the corresponding maximum permitted power for each available channel. This data is based on the WSD's geographic coordinates, taking into consideration the fixed WSD's antenna height and geolocation 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:

- ISED certification number (IC number)
- manufacturer's serial number
- geographic coordinates (latitude and longitude)
- geographic coordinates' uncertainty with 95% confidence, in metres
- antenna height AGL or above mean sea level (AMSL).

13.2.2 Fixed WSDs: WSDB update

Fixed WSDs shall access the WSDB at least once every 24 hours to verify that the operating channels remain available. If the WSDB 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 determined by the WSDB. Fixed WSDs shall update their use of channels in accordance with the channel availability schedule provided by their WSDB. The channel availability schedule shall be updated daily and shall cover a period of 48 hours from the time that the WSD last accessed the WSDB.

13.2.3 Fixed WSDs: 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 operations until it re-establishes contact with an approved WSDB and re-verifies the list of available channels.

13.2.4 Fixed WSDs: No direct connection to the Internet

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

13.2.5 Fixed WSDs: Power loss

Should a fixed WSD lose its power, it shall re-verify and re-establish contact with a WSDB directly or through a fixed WSD, mobile WSD or mode II personal/portable WSD 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 to all mode I WSDs it is serving that they need to acquire and use a new available channel list.

13.3 Mobile WSDs

This section addresses the WSDB access requirements for mobile WSDs.

13.3.1 Mobile WSDs: Initialization

Mobile WSDs shall access a WSDB over the Internet to determine the available channels and the maximum permitted power for each available channel within the geofenced area in which it intends to operate. This data is based on the geographic

coordinates of the geo-fenced area, taking into consideration the mobile WSD's antenna height and geolocation uncertainty.

A mobile WSD shall be capable of providing the following information to a WSDB when it requests a list of available channels for the geo-fenced area in which it intends to operate:

- ISED certification number (IC number) manufacturer's serial number
- the boundaries of the geo-fenced area in which the WSD intends to operate *
- antenna height AGL

* A mobile WSD shall provide the WSDB with the boundaries of the geo-fenced area in which it intends to operate. Alternatively, the boundaries of the geo-fenced area may be loaded from the WSDB into the mobile WSD.

13.3.2 Mobile WSDs: WSDB update

A mobile WSD shall access a WSDB at least once every 24 hours to verify that the operating channels within the geo-fenced area and the corresponding power levels continue to remain available. Mobile WSDs shall update their operating channels and corresponding power levels in accordance with the channel availability schedule provided by their WSDB. The channel availability schedule shall be updated daily and shall cover a period of 48 hours beginning at the time the WSD last accessed the WSDB.

13.3.3 Mobile WSDs: Operation within geo-fenced area

A mobile WSD shall operate only within geo-fenced areas over which the WSDB has determined channel availability. WSD operation is permitted only on channels that are indicated in the WSDB as being available at the same power level throughout the entire geo-fenced area in which the mobile WSD intends to operate.

A mobile WSD shall cease operations if its location (including the impact of location uncertainty) is outside of the boundary of the geo-fenced area over which the WSDB has determined the list of available channels.

Mobile WSDs shall operate only in less congested areas as determined by the WSDB.

13.3.4 Mobile WSDs: Failure to contact the WSDB

If a mobile 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 operations until it re-establishes contact with an approved WSDB and re-verifies the list of available channels.

13.3.5 Mobile WSDs: No direct connection to the Internet

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

13.3.6 Mobile WSDs: Power loss

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

13.4 Mode II personal/portable WSDs

This section addresses the WSDB access requirements for mode II personal/portable WSDs.

13.4.1 Mode II personal/portable WSDs: 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 prior to their initial service transmission at that location. These WSDs shall take into consideration the WSD's geolocation uncertainty. WSD operation is permitted only on channels and at power levels that are indicated in the WSDB as being available for personal/portable WSDs.

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

- ISED certification number (IC number) manufacturer's serial number
- geographic coordinates (latitude and longitude)
- geographic coordinates' uncertainty with 95% confidence, in metres

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

13.4.2 Mode II personal/portable WSDs: Location change

If a mode II personal/portable WSD changes location during operation by more than the geolocation's uncertainty from the location at which it last accessed the WSDB, the mode II personal/portable WSD shall re-verify its location and the WSDB for its available channels, except as provided in section 13.4.4.

13.4.3 Mode II personal/portable WSDs: WSDB update

A mode II personal/portable WSD shall re-verify its location and shall access a WSDB 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 provided by their WSDB. The channel availability schedule shall be updated daily and shall cover a period of 48 hours beginning at the time that the WSD last accessed the WSDB.

13.4.4 Mode II personal/portable WSDs: 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 (including the impact of location uncertainty) where the channel availability data is valid. The mode II personal/portable WSD shall access a WSDB every 24 hours, to verify that the operating channel(s) continue to be available, even if it has not moved beyond that boundary.

13.4.5 Mode II personal/portable WSDs: Failure to contact the WSDB

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.

13.4.6 Mode II personal/portable WSDs: No direct connection to the Internet

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

13.4.7 Mode II personal/portable WSDs: Power loss

Should a mode II personal/portable WSD lose its power, it shall re-verify and re-establish contact with a WSDB directly or through a fixed WSD, mobile WSD or mode II

personal/portable WSD to obtain a list of available channels. Additionally, should a mode II personal/portable WSD lose its power and obtain a new list of available channels, it shall signal to all mode I WSDs it is serving that they need to acquire and use a new available channel list.

13.5 Mode I personal/portable WSDs

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

13.5.1 Mode I personal/portable WSDs: List of channels provided by a mode II personal/portable WSD, a fixed WSD, or a mobile WSD

If a fixed, mobile or mode II WSD is requesting available channels for a mode I personal/portable WSD, the WSDB shall provide a separate list of channels intended specifically for the mode I WSD. The fixed, mobile or mode II WSD shall provide this list of channels to the mode I personal/portable WSD.

13.5.2 Mode I personal/portable WSDs: Contact with a fixed WSD, mobile WSD or mode II personal/portable WSD

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

- on an available channel used by the fixed WSD, mobile WSD or mode II personal/portable WSD; or
- on a channel that a fixed, mobile 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 shall either:

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

13.5.3 Mode I personal/portable WSDs: Power limitation dependency

A mode I personal/portable WSD shall limit its power to 40 mW e.i.r.p. if the WSD that controls the mode I personal/portable device is itself limited to 40 mW e.i.r.p.

13.6 Identification of database operability

At the time of certification, the applicant shall provide a formal letter for each WSDB with which the WSD operates. The letter shall be from a WSDBA that operates an ISED-designated WSDB, as shown on the list of [designated databases](#) provided on ISED's website.

14. Test report

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

- the class of WSD (Class A, Class B)
- the type of WSD (fixed, mobile, mode I or mode II) an identification whether the device is narrowband
- a description of the transmit power control feature
- screenshots of the WSDB interface's response to the applicable test
- the maximum gain of the transmitting antenna(s) used with a fixed or mobile WSD
- a description of the power level control mechanism and ongoing compliance to the limits for fixed WSDs, with a gain above 6 dBi for devices operating at 36 dBm e.i.r.p. or a gain above 12 dBi for devices operating at 42 dBm e.i.r.p.
- a description of the power level control mechanism and ongoing compliance to the limits for mobile WSDs operating above a 12 dBi gain
- a description demonstrating the uncertainty and confidence level of the geolocation method
- a description of alternate geolocation determination (if applicable)
- a declaration of conformity statement for a fixed, mobile, or mode II personal/portable device with geolocation capability

Additionally, in the case of a WSD that requires or has the option to be managed with a network element device representing one or multiple WSDs operating on the same network, the test report shall include details demonstrating compliance to this RSS when the WSD communicates with the WSDB through the network element device. A detailed description of the communication network and protocol used between the network element device, the WSD and the WSDB shall also be provided and include a security statement guaranteeing that the WSD can only be authorized by the network element device to radiate emissions in the TV white space bands as permitted by the WSDB.

Annex A (normative): White space device (WSD) certification procedure for access to white space database (WSDB)

A1. Fixed WSD initialization

Confirm that the initialization requirements for fixed WSDs, listed below, have been met.

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

- ISED certification number (IC number) manufacturer's serial number
- geographic coordinates (latitude and longitude)
- geographic coordinates' uncertainty with 95% confidence level
- antenna height AGL or above mean sea level (AMSL)

A fixed WSD without direct connection to the Internet shall confirm its own WSDB registration through an Internet-connected fixed or mode II personal/portable WSD and it shall be provided with separate channel availability data.

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

A2. Mobile WSD initialization

Confirm that the initialization requirements for mobile WSDs, listed below, have been met.

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

- ISED certification number (IC number) manufacturer's serial number
- geographic coordinates
- geographic coordinates defining the boundaries of the geo-fenced area in which the WSD intends to operate
- geographic coordinates' uncertainty with a 95% confidence level
- antenna height AGL

For a mobile 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.

A3. Mode II personal/portable WSD initialization

Confirm that the initialization requirements for mode II personal/portable WSDs, listed below, have been met.

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

- ISED certification number (IC number) manufacturer's serial number

- geographic coordinates (latitude and longitude)
- 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.

A4. Mode I personal/portable WSD initialization

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

A5. Fixed WSD, mobile WSD and mode II personal/portable WSD failure to contact the WSDB

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.

A6. Mode II personal/portable and mobile WSD position verification

Using the system management software provided with the WSD, validate that the mode II personal/portable or mobile WSD executes position verification and WSDB access, as required. The WSD should display the available channel list to allow confirmation.

A7. Mode II personal/portable WSD 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.

A8. Mode I personal/portable WSD 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.

A9. Mode II personal/portable WSD 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.

A10. WSD database update

Use the radio management software to provide an available channel list to the device under test (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 of receiving the list. Using the system management software, also confirm that the WSD changes to an alternate available channel at the scheduled time.

A11. White space channel availability

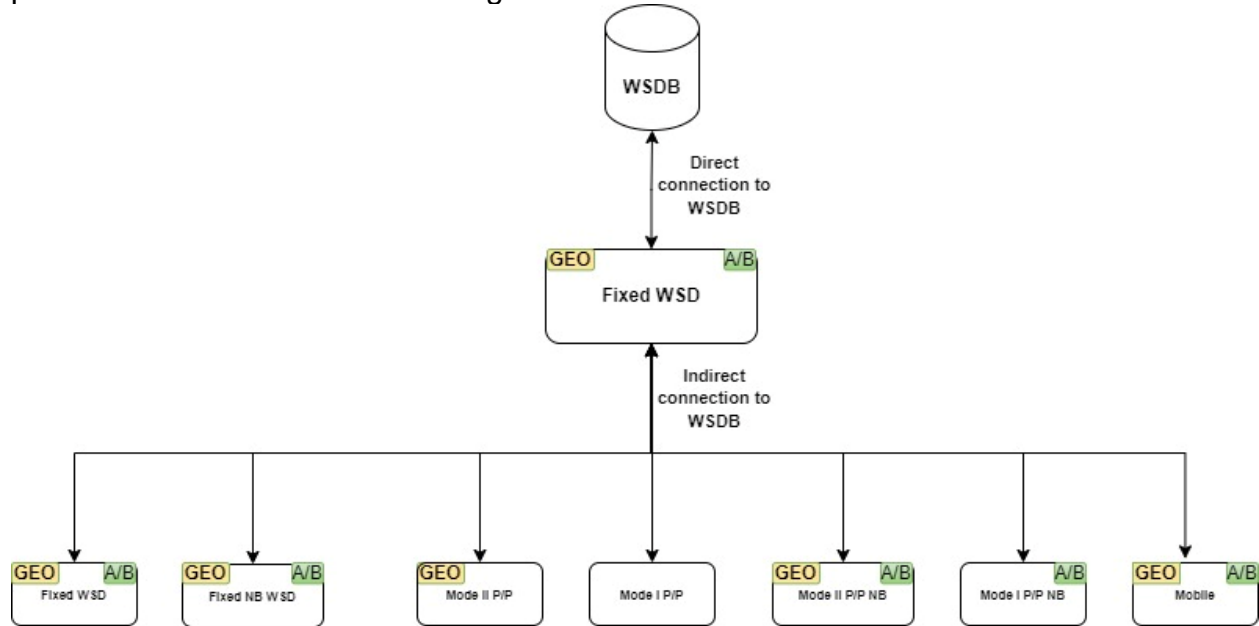
Using the radio management software to specify an available channel or list of channels, confirm that the WSD is operating on an available channel from the list at its authorized power, and cannot be made to operate on an unauthorized channel or at an unauthorized power level.

A12. First adjacent power reduction for personal/portable WSD

Using the radio management software, specify that the channels available to the WSD are subject to the low-power limit. Use the applicable test procedures provided in section 11 for personal/portable WSDs to confirm that the output power, power spectral density, band edge and adjacent channel power do not exceed the low-power e.i.r.p. limit values specified in table 3 of section 11.5.1 and table 6 of section 11.7.1.

Annex B: White space device (WSD) types and connection to database

The following diagrams illustrate the different WSDs types and the associated permissible methods of connecting to the database.



GEO: Geo-location capability

A/B: Classes A and B allowed

Figure B.1 – Types of white space devices allowed to indirectly connect to the database through a fixed white space device

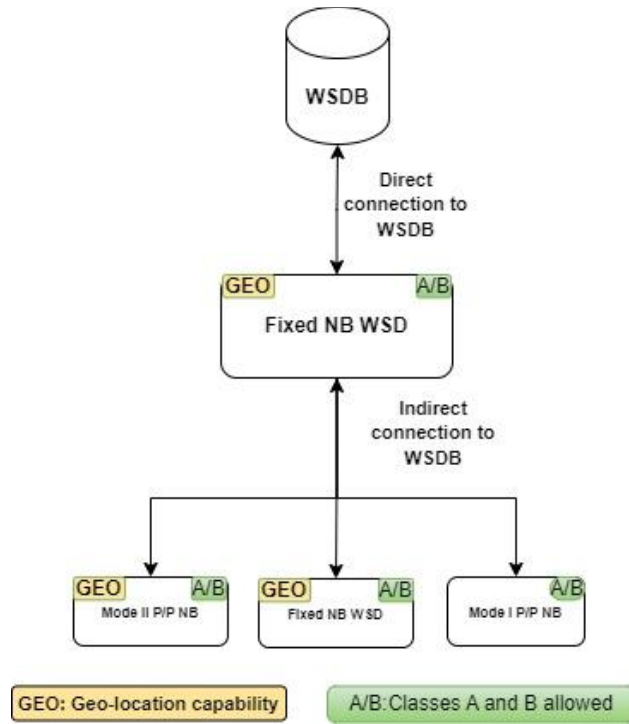


Figure B.2 – Types of white space devices allowed to indirectly connect to the database through a narrowband fixed white space device

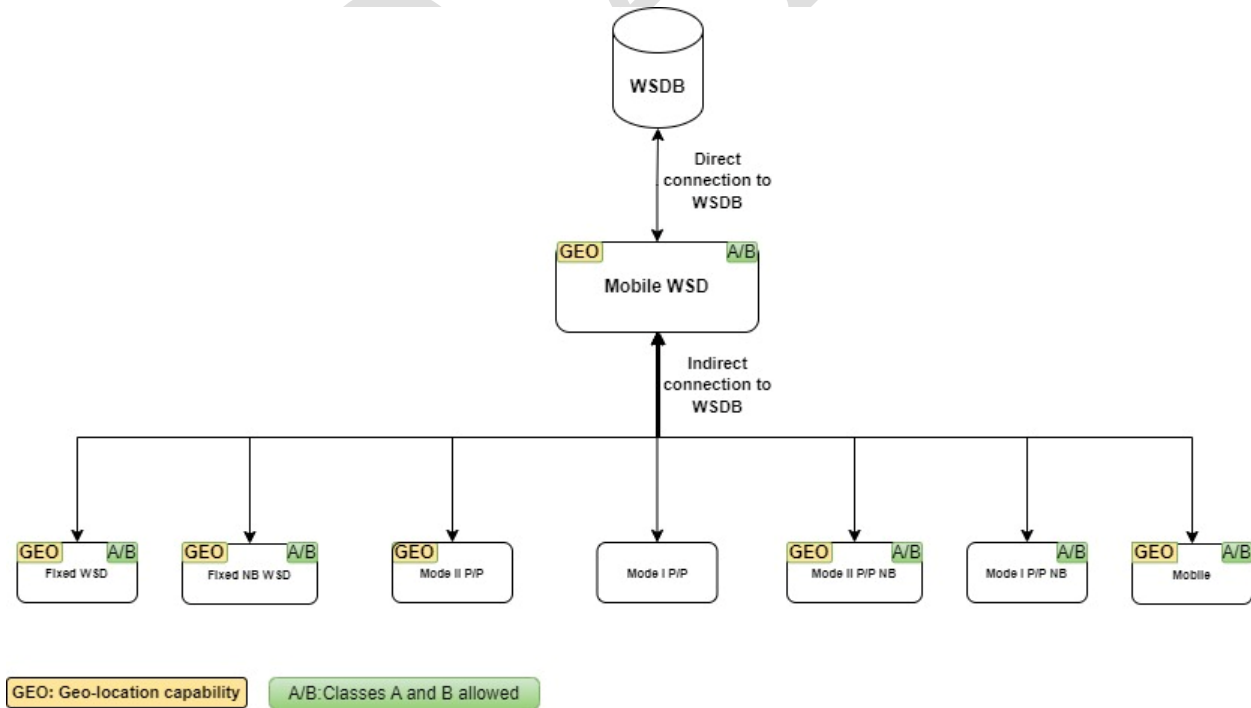


Figure B.3 – Types of white space devices allowed to indirectly connect to the database through a mobile white space device

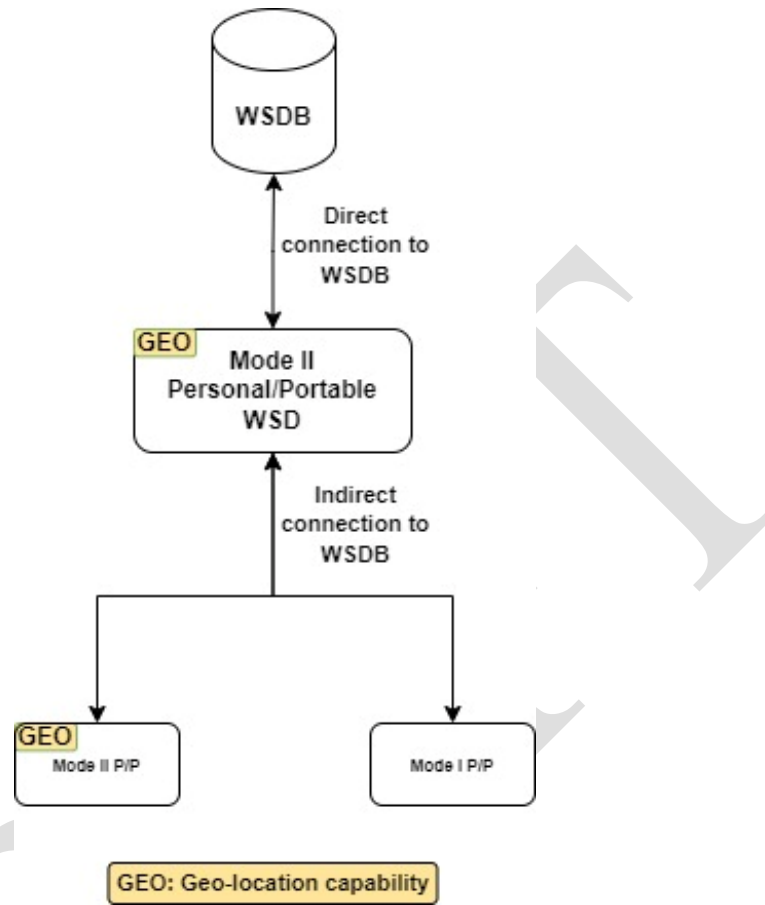


Figure B.4 – Types of white space devices allowed to indirectly connect to the database through a Mode II personal/portable white space device

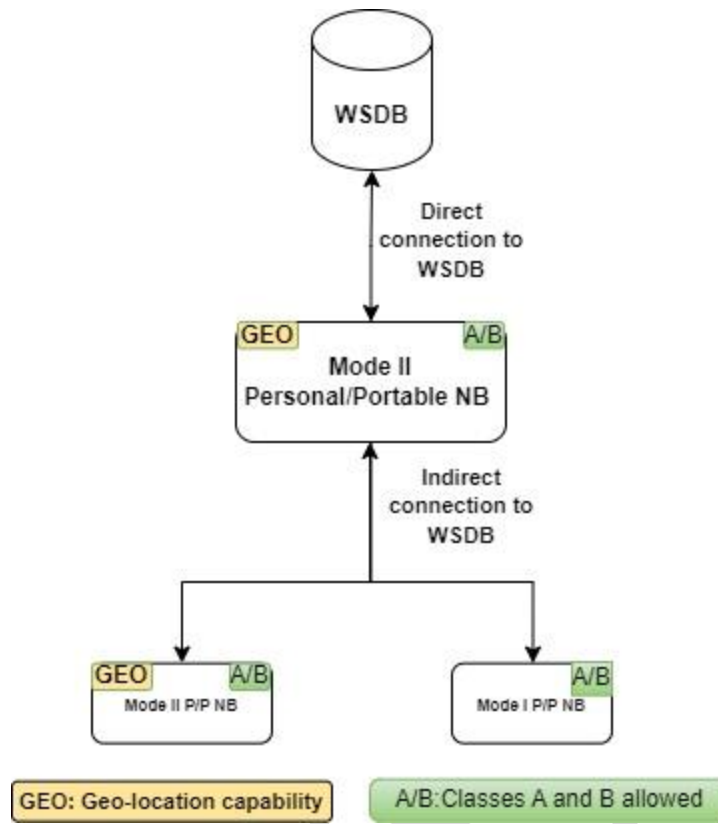


Figure B.5 – Types of white space devices allowed to indirectly connect to the database through a Mode II personal/portable narrowband white space device