Discussion document

# Draft regulatory requirements for white space devices in the UHF TV band



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Section 1

# Introduction

1.1 This draft document contains the proposed regulatory requirements that white space devices (WSDs) will have to meet in order to operate within the UHF TV band.

1.2 These requirements will form the basis for the drafting of regulatory instruments to enable the legal use of WSDs in the UK. These include the Statutory Instrument (SI), the Interface Regulation (IR), and the Voluntary National Specification (VNS).

## Section 2

# Terminology

2.1 UHF TV band – For the purposes of this document, this is defined as the frequency band 470 – 790 MHz (channels 21-60), but excluding 606 – 614MHz[1] (channel 38) and 550 – 606 MHz[2] (channels 31-37).

2.2 White space device (WSD) – A radio equipment that operates in the white spaces of the UHF TV band.

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2.3 White space – Part of the spectrum, which is available for a radio-communication application (service, system) at a given time in a given geographical area on a non-interfering and non-protected basis with regard to other services with a higher priority on a national basis.

2.4 TV white space database (WSDB) – A database system that maintains records of incumbent licensed users and is capable of determining and returning information to WSDs on the available frequencies and permitted power levels at specific geographic locations, based on technical algorithms specified by Ofcom.

2.5 Geo-location capability – Capability of a WSD to determine its geographic latitude and longitude coordinates.

2.6 Master WSD – A WSD which directly communicates with a WSDB (through an internet connection) to obtain operating parameters specific to its geographic location.

2.7 Fixed WSD – A WSD whose antennas are permanently mounted on a non-moving platform (e.g., base station, home router[3]). A fixed WSD can be a master or a slave device.

2.8 Portable/mobile WSD – A WSD whose antennas are mounted on a portable/mobile platform (e.g., mobile terminal, laptop). A portable/mobile WSD can be a master or a slave device.

2.9 Indoor WSD – A WSD whose antennas are located within a building.

2.10 Outdoor WSD – A WSD whose antennas are not located within a building.

2.11 Slave WSD – A WSD which does not directly communicate with a WSDB, and which can only obtain operating parameters specific to its geographic location from its serving master WSD.

[1] This channel is used for uncoordinated (shared licence) wireless microphones in the UK.
[2] These channels have been cleared in the UK.
[3] A home router may not be strictly a fixed device; i.e., the antenna(s) of a home router may or may not be permanently mounted on a non-moving platform. However, it is unlikely that the movements of a home router within the home will be significant in the context of interference to licensed services (small separations between victim and interferer are handled via reference geometries). For this reason, a home router will be treated as a fixed device in the context of regulations for white space devices.

2.12 Electronic communications network[4] (ECN) – 1) a transmission system for the conveyance, by the use of electrical, magnetic or electro-magnetic energy, of signals of any description; and 2) such of the following as are used, by the person providing the system and in association with it, for the conveyance of signals: a) apparatus comprised in the system, b) apparatus used for the switching and routing of the signals; and c) software and stored data.

2.13 Electronic communications service[5] (ECS) – A service consisting in, or having as its principal feature, the conveyance by means of an ECN of signals except insofar as it is a content service.

2.14 Communications provider (CP) – These are defined[6] as Providers of ECSs and ECNs and therefore would not include members of the public."

2.15 Base station (BS) – A station that forms part of an ECN, providing bidirectional services to user stations within its area of operation.

2.16 User station/equipment (UE) – A station that, in relation to an ECN, provides services directly to a user.

2.17 Consumer premises equipment (CPE) – A UE which is located at a user's premises and, in relation to an ECN, provides services directly to a user.

2.18 In-block emissions – Emissions corresponding to those segments of a radiated signal's frequency spectrum which carry information intended for a receiver. The width of the in-block segment of the frequency spectrum is the nominal bandwidth of the signal.

2.19 Out-of-block emissions – Emissions corresponding to those segments of a radiated signal's frequency spectrum (outside the in-block segment) which correspond to unintended radiations.

2.20 Active mode – Mode in which there is active transmission by the WSD.



[4] As defined in Section 32(1) of the Communications Act.
[5] As defined in Section 32(2) of the Communications Act.
[6] As defined in Section 23(4) of the Communications Act.

## Section 3

# Requirements for master WSDs

3.1 In order to be authorised to radiate within the UHF TV band, a master WSD **must**

a) discover one or more approved WSDBs,

b) communicate specific information to one or more approved WSDBs,

c) receive specific information from one or more approved WSDBs,

d) operate subject to the specific instructions and parameters received from an approved WSDB, and

e) communicate appropriate information to its associated slave WSDs so that the slave WSDs are able to operate subject to the specific instructions and parameters received by the master WSD from an approved WSDB.

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3.2 All communication between a master WSD and a WSDB **must** be performed electronically.

3.3 Communication between a master WSD and a WSDB **must** not occur within the UHF TV band, unless the master WSD has already been authorised by the WSDB to radiate within the UHF TV band.

## Database discovery

3.4 [When operating in the territories of the United Kingdom, a master WSD **must** discover approved WSDBs by consulting a website maintained by (or on behalf of) Ofcom which holds a list of approved WSDBs. This requirement applies unless the master WSD has consulted the website within the last 24 hours.

or

3.5 When operating in the territories of the United Kingdom, a master WSD **must** discover WSDBs that are approved by Ofcom. This requirement applies unless the master WSD has discovered Ofcom-approved WSDBs within the last 24 hours.]

## Information communicated from a master WSD to a WSDB

Master WSD antenna location

3.6 A master WSD **must** communicate the latitude and longitude coordinates (in WGS84 format) of its transmitting antennas to a WSDB. Specifically, the following requirements apply:

3.6.1 A master WSD **must** have the capability to automatically determine the latitude and longitude coordinates of its antennas, unless the device falls under the category of master WSDs described in 3.6.2.

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3.6.2 Where a fixed master WSD is installed by (or on behalf of) a communications provider, and where the master WSD is a base station of an ECN, the master WSD **may** have the capability to automatically determine the latitude and longitude coordinates of its antennas. Alternatively, the antenna latitude and longitude coordinates of the fixed master WSD **must** be determined by the installer.

3.6.3 Where the antenna latitude and longitude coordinates of a fixed master WSD are determined by the installer, it is the sole responsibility of the communications provider to ensure that the antenna coordinates provided are accurate.

3.6.4 The accuracy of the determined latitude and longitude coordinates of an antenna **must** be specified as ±x and ±y metres respectively, corresponding to a 95% confidence level. If x or y is greater than [50] metres, then a master WSD **must** communicate the values of x and y to a WSDB .

3.7 A master WSD **may**[7] communicate its antenna height(s) above ground level to a WSDB.

3.8 Where the antenna latitude and longitude coordinates are determined by the installer, a fixed master WSD **must** also communicate its antenna height(s) above ground level to a WSDB.

Other fixed master WSD antenna characteristics

3.9 A fixed master WSD **may**[7] additionally communicate the following information to a WSDB:

3.9.1 Antenna angular discrimination (directionality and orientation) – This **must** be specified[8] as relative gain (in dB) at intervals of [10] degrees in absolute[9] azimuth and elevation. Where multiple antennas are involved, the angular discrimination **must** apply to the combined emissions from the antennas.

3.9.2 Antenna polarisation – This **must** be specified as either horizontal polarisation, vertical polarisation, or slant (±45 degrees) polarisation.

3.10 Where a fixed master WSD wishes to communicate any of the antenna characteristics outlined in 3.9, the following requirements apply:

3.10.1 A fixed master WSD **must** have the capability to automatically determine these characteristics, unless the device falls under the category of fixed master WSDs described in 3.10.2.

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[7] If this information is not communicated, then default values will be used by the WSDB.
[8] We are also considering an alternative approach. Here the angular discrimination will be specified via a horizontal radiation "pattern identifier", a vertical radiation "pattern identifier", an absolute azimuth pointing angle (0° to 360°, with a resolution of 10°), and an absolute elevation pointing angle (-90° to +90°, with a resolution of 10°). The pattern identifiers would relate to angular discrimination *templates* maintained by Ofcom and provided to WSDBs. This approach would significantly reduce the amount of information that needs to be communicated to the WSDB.
[9] Azimuth values are between 0° and 360°, where 0° points East, and 90° points north. Elevation values are between -90° and +90°, where 0° points to the horizon, and +90° points vertically up.

3.10.2 Where a fixed master WSD is installed by (or on behalf of) a communications provider, and where the master WSD is a base station of an ECN, the master WSD **may** have the capability to automatically determine these characteristics. Alternatively, the antenna characteristics of the fixed master WSD **must** be determined by the installer.

3.10.3 Where the antenna characteristics outlined in 3.9 are determined by the installer, it is the sole responsibility of the communications provider to ensure that the antenna characteristics provided are accurate.

Other parameters

3.11 A master WSD **must** communicate its technology identifier[10] to a WSDB.

3.12 A master WSD **must** communicate to a WSDB the technology identifiers of its associated slave WSDs[11].

3.13 [A master WSD **must** communicate its unique device identifier[12] to a WSDB.]

3.14 [A master WSD **must** communicate to a WSDB the unique device identifiers[12] of its associated slave WSDs.]

3.15 A master WSD **must** communicate to a WSDB whether it, and its associated slave WSDs, are fixed devices or portable/mobile devices.

3.16 A fixed master WSD **may**[7] communicate to a WSDB whether it, and its associated fixed slave WSDs, are indoor devices or outdoor devices.

3.17 Where such information is available, a master WSD **must** communicate to the WSDB the locations and antenna characteristics (see 4.4 and 4.5) of its associated slave WSDs.

3.18 After receiving instructions from a WSDB in relation to the maximum permitted EIRPs over the DTT channels, and prior to initiating transmissions within the UHF TV band, a master WSD **must** communicate to the WSDB the following information:

3.18.1 The lower and upper frequency boundaries[13] of the in-block emissions of the master WSD, and those of the in-block emissions of its associated

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[10] The technology identifier would enable the WSDB to use technology-specific protection ratios, and would also be helpful in informing the WSDB with regards to the broad time-frequency structure of the WSD signals. This latter information could be used in the context of 3.18; i.e., feedback from WSDs to WSDBs with regards to the used radio resource. For this latter reason, the reporting of the technology identifier is mandatory. It would be advantageous for industry if the technology identifier was internationally harmonised.

[11] This accounts for the unlikely cases where the master and slave use different technologies (e.g., where the slave is involved in slave-to-slave communications, and communicates with the master WSD via a non-whitespace technology). The reporting of the technology identifier is mandatory (see footnote 10).

[12] The unique device identifier would enable the WSDB to instruct the master WSD and its associated slaves to cease transmission in the context of 3.19.7. The device identifier would need to be internationally harmonised. We are considering whether to mandate this requirement in the regulations or to rely on an industry led harmonised solution.

slaves. A lower frequency will be specified as (470 + 8k + 0.2n) MHz, with the corresponding upper frequency specified as (470 + 8k + 0.2m) MHz, where 0 ≤ k ≤ 39, 0 ≤ n ≤ 39, 1 ≤ m ≤ 40, and n < m.

3.18.2 The maximum in-block EIRP spectral densities (in dBm/(0.2 MHz)) that the master WSD, and its associated slaves, actually radiate between each reported lower frequency boundary and its corresponding upper frequency boundary.

## Information received by a master WSD from a WSDB

3.19 A master WSD **must** be able to receive the following information[14] from a WSDB:

3.19.1 A list of lower and upper frequency boundaries[15] within which the master WSD and its associated slave WSDs are authorised to operate. A lower frequency will be specified as (470 + 8k + 0.2n) MHz, with the corresponding upper frequency specified as (470 + 8k + 0.2m) MHz, where 0 ≤ k ≤ 39, 0 ≤ n ≤ 39, 1 ≤ m ≤ 40, and n < m.

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3.19.2 A maximum permitted master WSD EIRP spectral density, specified in units of dBm/(0.2 MHz), between each lower frequency boundary and its corresponding upper frequency boundary as described in 3.19.1.

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3.19.3 A maximum permitted slave WSD EIRP spectral density, specified in units of dBm/(0.2 MHz), between each lower frequency boundary and its corresponding upper frequency boundary as described in 3.19.1.

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3.19.4 A sensing level[16] for the detection of DTT use of spectrum, specified in units of dBm/(8 MHz).

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3.19.5 A sensing level[16] (optional) for the detection of PMSE use of spectrum, specified in units of dBm/(0.2 MHz).

3.19.6 A single time validity for the parameters communicated by the WSDB as described in 3.19.1 to 3.19.5.

3.19.7 [Instruction for the master WSD and its associated slave WSDs to cease[17] transmission within [x] seconds when instructed by the WSDB.]

[13] The use of upper and lower frequency boundaries (defined over a 200 kHz raster) allows a WSDB to collect more granular information with regards to the usage of the frequency resource by narrowband WSD technologies. The upper and lower frequencies of a boundary pair do not straddle a DTT channel boundary. Note that a WSD may transmit over multiple, non-contiguous, whole DTT channels or fractions of DTT channels.

[14] While the communication of some of this information from a WSDB to a master WSD is optional, maser WSDs must be able to receive and interpret these.

[15] The upper and lower frequencies of a boundary pair do not straddle a DTT channel boundary. Note that a WSD may transmit over multiple, non-contiguous, whole DTT channels or fractions of DTT channels.

[16] The sensing function itself is not mandatory for the WSDs.

[17] This requirement implements a so-called WSDB "kill switch" to disable WSDs in the event of interference to licensees. We are assessing if the time validity parameter as described in 3.19.6 would be a sufficient tool to disable the WSDs without the need to mandate a kill switch.

3.19.8 [An acknowledgement from the WSDB, in the context of 3.18, that the reported information on the DTT channels and EIRP spectral densities actually used by the master and slave WSDs were received successfully by the WSDB[18]].

## Operation of a master WSD

3.20 A master WSD **must** only transmit within the UHF TV band in accordance with the relevant instructions and parameters in 3.19 provided by an approved WSDB, and for a time period which does not exceed the time validity of those instructions and parameters.

3.21 A master WSD that is associated with slave WSDs **must** ensure that it communicates appropriate information to those slave WSDs, so that the slave WSDs are able to transmit within the UHF TV band in accordance with the relevant instructions and parameters in 3.19 provided by an approved WSDB, and for a time period which does not exceed the time validity of those instructions and parameters.

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3.22 A portable/mobile master WSD **must** ensure that it has access to valid instructions and parameters from a WSDB whenever the determined latitude or longitude coordinates of its antennas change by more than 50 metres with respect to those determined at the time of its previous consultation with a WSDB.

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## Additional requirements for master WSDs

3.23 A master WSD **must** meet the minimum adjacent channel leakage ratio[19] (ACLR) values outlined in the table below.

Table 1. Master WSD adjacent channel leakage ratios for n±1 to n±10 DTT channel adjacencies.

| $\pm n^{th}$ adjacent DTT channel | Base station | User station |
|---|---|---|
| | ACLR (dBc/(8 MHz)) | |
| n = 1 | | |
| n = 2 | | |
| n = 3 | | |
| n = 4 | | |
| n = 5 | | |
| n = 6 | | |
| n = 7 | | |
| n = 8 | | |
| n = 9 | | |
| n ≥ 10 | | |

[18] This forms part of a handshake protocol and may be an area where industry could harmonise without the need for an explicit requirement in the regulations.
[19] Here, the ACLR is defined as the ratio of mean in-block EIRP over mean out-of-block EIRP, both measured over a bandwidth of 8 MHz.

3.24 [The maximum contiguous bandwidth of a master WSD must not exceed [x] MHz.]

3.25 [The maximum non-contiguous bandwidth of a master WSD must not exceed [x] MHz.]

## Security requirements

3.26 Communications between a master WSD and a WSDB **must** be performed using secure protocols[20] that avoid malicious corruption or unauthorized modification of the data.

3.27 Communications between a master WSD and a slave WSD for purposes of relaying WSDB-related instructions and parameters **must** employ secure protocols[21] that avoid malicious corruption or unauthorized modification of the data.



[20] We expect these security protocols to be internationally standardised by bodies such as the IETF.
[21] We expect these security protocols to be specified within technology standards.

## Section 4

# Requirements for slave WSDs

4.1 In order to be authorised to radiate within the UHF TV band, a slave WSD **must**

a) communicate specific information to its serving master WSD,

b) receive specific information from its serving master WSD, and

c) operate subject to the specific instructions and parameters received from its serving master WSD.

4.2 Communication between a slave WSD and a master WSD for the purposes of establishing the operating parameters of the slave WSD within the UHF TV band **may** be performed electronically or otherwise[22].

4.3 Communication between a slave WSD and a master WSD **must** not occur within the UHF TV band, unless the WSDs have already been authorised by a WSDB to radiate within the UHF TV band.

## Information communicated from a slave WSD to a master WSD

### Slave WSD antenna location

4.4 A slave WSD **may**[7] communicate the latitude and longitude coordinates of its transmitting antennas to its serving master WSD. Where the slave WSD wishes to perform such communication, the following requirements apply:

4.4.1

4.4.2 A slave WSD, **must** have the capability to automatically determine the latitude and longitude coordinates of its antennas, unless the device falls under the category of master WSDs described in 4.4.3.

4.4.3 Where a fixed slave WSD is installed by (or on behalf of) a communications provider, and where the slave WSD is a base station of an ECN, the slave WSD **may** have the capability to automatically determine the latitude and longitude coordinates of its antennas. Alternatively, the antenna latitude and longitude coordinates of the fixed slave WSD **must** be determined by the installer.

4.4.4 Where the antenna latitude and longitude coordinates of a fixed slave WSD are determined by the installer, it is the sole responsibility of the communications provider to ensure that the antenna coordinates provided are accurate.

[22] This accounts for cases where, for example, the master and slave are operated by the same communications provider.

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4.4.5 The accuracy of the determined latitude and longitude coordinates of an antenna **must** be specified as ±x and ±y metres respectively, corresponding to a 95% confidence level. If x or y is greater than [50] metres, then a slave WSD **must** communicate the values of x and y to its serving master WSD.

4.4.6 A slave WSD **may**[7] communicate its antenna height(s) above ground level to its serving master WSD.

4.4.7 Where the antenna latitude and longitude coordinates are determined by the installer, a fixed slave WSD **must** also communicate its antenna height(s) above ground level to its serving master WSD.

Other slave WSD antenna characteristics

4.5 A fixed slave device which communicates its latitude and longitude coordinates **may**[7] additionally communicate the following information to its serving master WSD:

4.5.1 Antenna angular discrimination (directionality and orientation) – This **must** be specified[23] as relative gain (in dB) at intervals of [10] degrees in absolute[24] azimuth and elevation. Where multiple antennas are involved, the angular discrimination **must** apply to the combined emissions from the antennas.

4.5.2 Antenna polarisation – This **must** be specified as either horizontal polarisation, vertical polarisation, or slant (±45 degrees) polarisation.

4.6 Where a fixed slave WSD wishes to communicate any of the antenna characteristics outlined in 4.5, the following requirements apply:

4.6.1 A fixed slave WSD **must** have the capability to automatically determine these characteristics, unless the device falls under the category of master WSDs described in 4.6.2.

4.6.2 Where a fixed slave WSD is installed by (or on behalf of) a communications provider, and where the slave WSD is a base station of an ECN, the slave WSD **may** have the capability to automatically determine these characteristics. Alternatively, the antenna characteristics of the fixed slave WSD **must** be determined by the installer.

4.7 Where the antenna characteristics outlined in 4.5 are determined by the installer, it is the sole responsibility of the communications provider to ensure that the antenna characteristics provided are accurate.

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[23] We are also considering an alternative approach. Here the angular discrimination will be specified via a horizontal radiation "pattern identifier", a vertical radiation "pattern identifier", an absolute azimuth pointing angle (0° to 360°, with a resolution of 10°), and an absolute elevation pointing angle (-90° to +90°, with a resolution of 10°). The pattern identifiers would relate to angular discrimination *templates* maintained by Ofcom and provided to WSDBs. This approach would significantly reduce the amount of information that needs to be communicated to the WSDB.

[24] Azimuth values are between 0° and 360°, where 0° points East, and 90° points north. Elevation values are between -90° and +90°, where 0° points to the horizon, and +90° points vertically up.

Other parameters

4.8 A slave WSD **must** communicate its technology identifier[25,26] to its serving master WSD.

4.9 [A slave WSD **must** communicate a unique device identifier[27] to its serving master WSD.]

4.10 [A slave WSD **must** communicate to its serving master WSD whether it is a fixed device or a portable/mobile device.]

## Information received by a slave WSD from a master WSD

4.11 A slave WSD **must** be able to receive the following information[28] from its serving master WSD:

4.11.1 An indication of the lower and upper frequency boundaries[15] within which the slave WSD is authorised to operate.

4.11.2 A maximum permitted slave WSD EIRP spectral density, specified in units of dBm/(0.2 MHz), between each lower frequency boundary and its corresponding upper frequency boundary as described in 4.11.1.

4.11.3 A sensing level[16] for the detection of DTT use of spectrum specified in units of dBm/(8 MHz).

4.11.4 A sensing level[16] for the detection of PMSE use of spectrum, specified in units of dBm/(0.2 MHz).

4.11.5 A single time validity for the parameters communicated by the serving master WSD as described in 4.11.1 to 4.11.4.

4.11.6 [Instruction for the slave WSD to cease[29] transmission within [x] seconds when instructed by a master WSD.]

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[25] The technology identifier would enable the WSDB to use technology-specific protection ratios, and would also be helpful in informing the WSDB with regards to the broad time-frequency structure of the WSD signals. This latter information could be used in the context of 3.18; i.e., feedback from WSDs to WSDBs with regards to the used radio resource. For this latter reason, the reporting of the technology identifier is mandatory. It would be advantageous for industry if the technology identifier was internationally harmonised.

[26] This accounts for the unlikely cases where the master and slave use different technologies (e.g., where the slave is involved in slave-to-slave communications, and communicates with the master WSD via a non-whitespace technology). The reporting of the technology identifier is mandatory (see footnote 25).

[27] The device identifier would enable the WSDB to instruct the master WSD and its associated slaves to cease transmission in the context of 4.11.6. The device identifier would need to be internationally harmonised. We are considering whether to mandate this requirement in the regulations or to rely on an industry led harmonised solution.

[28] While the communication of some of this information from a master WSD to its slave WSDs is optional, slave WSDs must be able to receive and interpret these.

## Operation of a slave WSD

4.12 A slave WSD **must** only transmit within the UHF TV band in accordance with the instructions and parameters in 4.11 provided by its serving master WSD, and for a time period which does not exceed the time validity of those instructions and parameters.

4.13 A slave WSD **must** cease transmission immediately when instructed so by its serving master WSD, or within [5] seconds of not receiving communications[30] from its serving master WSD.

4.14 A slave WSD **may** communicate with another slave WSD provided that each is controlled via communication over the UHF TV band[31] by its serving master WSD.

## Additional requirements for slave WSDs

4.15 A slave WSD **must** meet the minimum adjacent channel leakage ratio[32] (ACLR) values outlined in the table below.

Table 2. Slave WSD adjacent channel leakage ratios for n±1 to n±10 DTT channel adjacencies.

| ±n$^{th}$ adjacent DTT channel | Base station | User station |
|---|---|---|
| | ACLR (dBc/(8 MHz)) | |
| n = 1 | | |
| n = 2 | | |
| n = 3 | | |
| n = 4 | | |
| n = 5 | | |
| n = 6 | | |
| n = 7 | | |
| n = 8 | | |
| n = 9 | | |
| n ≥ 10 | | |

4.16 [The maximum contiguous bandwidth of a slave WSD must not exceed [x] MHz.]

4.17 Portable/mobile slave WSDs, and non-geolocated fixed slave WSDs, **must** have antennas with gain not exceeding 2.15dBi[33].

[29] This requirement implements a so-called WSDB "kill switch" to disable WSDs in the event of interference to licensees. We are assessing if the time validity parameter as described in 4.11.5 would be a sufficient tool to disable the WSDs without the need to mandate a kill switch.
[30] This is to mitigate circumstances where the slave moves outside the coverage area of its associated master.
[31] This is to ensure that the slave WSDs are within the expected UHF coverage areas of their respective master WSDs.
[32] Here, the ACLR is defined as the ratio of mean in-block EIRP over mean out-of-block EIRP, both measured over a bandwidth of 8 MHz.

**Section 5**

# Summary of exchanged information

*[Editor's note: Tables need to be updated.]*

## Information communicated from a master WSD to a WSDB

| **Mandatory** |
|---|
| Master WSD antenna latitude and longitude coordinates (in WSG84 format). |
| Master WSD antenna latitude and longitude coordinate accuracies, x and y metres (defined at a 95% confidence level), where x or y is greater than [50] metres. |
| Technology identifier of the master WSD and its associated slave WSDs. |
| [Unique device identifier of the master WSD and its associated slave WSDs.] |
| Fixed or portable/mobile nature of the master WSD and its associated slave WSDs. |
| Lower and upper frequency boundaries of the in-block emissions of the master WSD and its associated slave WSDs. |
| In-block EIRP spectral densities (in dBm/(0.2 MHz)) actually radiated by the master WSD and its associated slave WSDs between each reported lower frequency boundary and it associated upper frequency boundary. |

| **Mandatory (only where such data is available at the master WSD)**[34] |
|---|
| Slave WSD antenna latitude and longitude coordinates (in WSG84 format). |
| Slave WSD antenna latitude and longitude coordinate accuracies, x and y metres (defined at a 95% confidence level), where x or y is greater than [50] metres. |
| Slave WSD antenna height(s) above ground level (in metres). |
| Slave WSD antenna angular discrimination (in dB). |

[33] A WSDB needs to estimate the possible locations of a portable/mobile slave WSD (or a non-geolocated fixed slave WSD) based on the expected coverage areas of its associated master WSD. To do so, the WSDB will assume a 2.15 dBi slave antenna gain, corresponding to an integral dipole.
[34] Note that, a master WSD must communicate to a WSDB any information (mandatory or optional) that is communicated to the master WSD by its associated slave WSDs.

| |
|---|
| Slave WSD antenna position(s) (indoor or outdoor). |
| Slave WSD antenna polarisation(s) (vertical, horizontal, or slant). |

| **Optional** |
|---|
| Master WSD antenna height(s)[35] above ground level (in metres). |
| Master WSD antenna angular discrimination (in dB). |
| |
| Master WSD antenna polarisation(s) (vertical, horizontal, or slant). |
| Indoor or outdoor nature of the fixed master WSD and its associated fixed slave WSDs. |

**Deleted:** Master WSD antenna position(s) (indoor or outdoor).



[35] Unless where the master WSD antenna latitude and longitude coordinates are determined by the installer, in which case the reporting of the antenna height is mandatory.

**Deleted:** user/

## Information communicated from a WSDB to a master WSD

| **Mandatory** |
|---|
| A list of frequency boundary pairs. |
| A list maximum permitted master WSD EIRP spectral densities (in dBm/(0.2 MHz)) applicable within each frequency boundary pair. |
| A list maximum permitted slave WSD EIRP spectral densities (in (dBm/0.2 MHz)) applicable within each frequency boundary pair. |
| Time validity of parameters (in minutes). |
| Acknowledgement of receipt of information from master WSDs on used channels and EIRPs. |
| [Instruction for a master WSD and associated slaves WSD to cease transmission]. |

| **Optional** |
|---|
| Sensing level for detection of DTT use of spectrum (in dBm/(8 MHz)). |
| Sensing level for detection of PMSE use of spectrum (in dBm/(0.2 MHz)). |

**Deleted:** forty DTT channel identifiers (indexed as 21 to 60)

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## Information communicated from a slave WSD to a master WSD

| **Mandatory** |
|---|
| Technology identifier of the slave WSD. |
| [Unique device identifier of the slave WSD.] |
| Fixed or portable/mobile nature of the slave WSD. |

| **Optional** |
|---|
| Indoor or outdoor nature of the fixed slave WSD. |
| Slave WSD antenna latitude and longitude coordinates (in WSG84 format). |
| Slave WSD antenna latitude and longitude coordinate accuracies, x and y metres (defined at a 95% confidence level), where x or y are greater than [50] metres. |
| Slave WSD antenna height(s)[36] above ground level (in metres). |
| Slave WSD antenna angular discrimination (in dB). |
| Slave WSD antenna position(s) (indoor or outdoor). |
| Slave WSD antenna polarisation(s) (vertical, horizontal, or slant). |

[36] Unless where the slave WSD antenna latitude and longitude coordinates are determined by the installer, in which case the reporting of the antenna height is mandatory.

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## Information communicated from a master WSD to a slave WSD

| **Mandatory** |
|---|
| An indication of frequency boundary pairs. |
| A list of maximum permitted slave WSD EIRP spectral densities (in dBm/(0.2 MHz)) applicable within each frequency boundary pair.. |
| Time validity of parameters (in minutes). |
| [Instruction for a slave WSD to cease transmission.] |

| **Optional** |
|---|
| Sensing level for detection of DTT use of spectrum (in dBm/(8 MHz)). |
| Sensing level for detection of PMSE use of spectrum (in dBm/(0.2 MHz)). |

**Deleted:** list of forty DTT channel identifiers (indexed as 21 to 60)

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