OfW570: Guidance for manually configurable white space devices

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Section 1

Introduction

1.1 This document provides general guidance on the use of manually configurable white space devices (MCWSDs) and high level guidance on the types of procedures and practices Ofcom expects a Quality Assurance (QA) scheme to cover for the installation and use of MCWSDs. It does not specify in detail what a MCWSD licensee's written QA procedure should include. Holders of licences to operate MCWSDs must read the licence conditions themselves and, if necessary, take their own legal advice.

1.2 White Space Devices (WSDs) are radio equipment which can transmit in unused frequencies in the UHF TV band (470 to 790 MHz) in accordance with powers and frequencies communicated by a White Space Database (WSDB).

1.3 It is unlawful to use a wireless telegraphy station or apparatus – such as a WSD – except under and in accordance with a licence granted by Ofcom under the Wireless Telegraphy Act 2006 ("WT Act"), or in accordance with licence exemption regulations made by Ofcom under section 8(3) of the WT Act. Compliance with the terms of the Licence Exemption regulations or with the terms of the licence for manually configurable WSDs remains the responsibility of the user / licensee.

1.4 A WSD may be automatically configurable or manually configurable:

- An **automatically configurable** WSD must not allow a user to modify the settings of the device in a way which would affect the parameters that the device communicates to a white space database, or which would cause it to operate other than in accordance with the operational parameters provided by the WSDB.

- A **manually configurable** WSD (MCWSD) allows a user to modify the settings of the device in a way which would alter the parameters communicated by the device to the database, or a way which may cause it to fail to operate in accordance with operational parameters from the WSDB. A MCWSD may, for instance, require that the user configures the device location or the antenna gain in the device before operation.

1.5 An automatically configurable WSD may be operated without a licence, provided that it complies with the terms of the Licence Exemption regulations[1] for WSDs. A manually configurable WSD cannot be operated without a Wireless Telegraphy licence issued by Ofcom under the WT Act, and only if the device conforms to the requirements of the licence.

1.6 The MCWSD Licence imposes a number of obligations on the licensee for the purposes of mitigating and dealing with interference. These include the following:

[1] The Wireless Telegraphy (White Space Devices) (Exemption) Regulations 2015
http://www.legislation.gov.uk/id/uksi/2015/2066

- **Accurate configuration**
  The licensee must ensure that any device is configured correctly, so that any parameter that the device communicates to a WSDB is accurate.

- **Quality assurance (QA) procedure**
  The licensee must have in place a written quality assurance procedure, which must be followed by the licensee and the installers, to ensure the correct configuration of the devices. Ofcom may request the licensee to provide the details of the QA procedure.

- **Installation Records**
  The licensee must hold records of the current configuration of each MCWSD that it operates under the licence. The records must include the parameters listed in the licence under the definition of an "Installation Record".
  The licensee must submit the Installation Record of each device to the WSDBs that the device may connect to. This must be done before the device starts operations. If the information about a device changes – for example, if a device is re-located – then the licensee must update its own records and provide a new Installation Record to the WSDBs.

- **Provision of information**
  Ofcom may request that the licensee provides Ofcom with information about the establishment, installation or use of devices and in particular the Installation Records for the purposes of verifying compliance with the licence or for statistical or interference management purposes. Ofcom may also request the Installation Records from the WSDBs.

- **Access and inspection**
  The licensee must allow persons authorised by Ofcom to have access to the devices, and to inspect and test the devices, to ensure they are being used in accordance with the terms of the licence.

- **Modification, restriction and closedown**
  A person authorised by Ofcom may require that a device is modified or restricted, temporarily or permanently, or closed down immediately if that person thinks that a breach of the licence terms has occurred or that the device is causing or contributing to undue interference to other authorised spectrum users.

- **Contact details**
  Licensees must give Ofcom prior notice in writing of any proposed change to the licensee's name and address from that recorded in the licence.

1.7 The rest of this document provides guidance for the written Quality Assurance procedure and general guidance on key requirements of operating MCWSDs. This guidance only covers compliance with the requirements imposed by a MCWSD Licence in respect of the accurate installation and operation of a manually configurable white space device.

Section 2

Guidance on quality assurance scheme

2.1 Ofcom's high level guidance in the MCWSD Statement[2] is that the Quality Assurance (QA) scheme should ensure:

- That the device behaves in accordance with the licence conditions at all times. In particular, that the information provided to WSDBs for the purposes of calculation of Operational Parameters for a device is correct over the operating life of the equipment, and that the device radiates in accordance with the Operational Parameters provided by the WSDB over the operating life of the equipment; and

- That the records retained by the licensee and provided to the WSDB about the configuration of each MCWSD operating under the licence (the installation records) are correct at all times.

2.2 The sections below provide high level guidance about the types of processes and procedures that Ofcom expects a Quality Assurance Scheme to cover in order to fulfil these objectives. Therefore this document does not set out in any comprehensive detail what a licensee's written QA procedure should include.

Installation and normal operation and maintenance

2.3 The QA process should include appropriate procedures for ensuring that the Device Parameters provided to the database for the purpose of obtaining operational parameters have been configured correctly at installation and accurately communicated to a designated database. The procedure should ensure that the Installation Record for a MCWSD is completed upon initial installation, or on any reconfiguration, and provided to the WSDB before the device is put into operation (i.e. before a MCWSD starts requesting operational parameters from a database). The values for the Device Parameters in an Installation Record must match the values for those parameters that a device provides to the WSDB

2.4 Appropriate procedures to ensure the ongoing maintenance of a MCWSD should be in place, in particular to ensure that device parameters remain as first determined and that location data is kept up-to-date.

2.5 The QA process should include appropriate procedures for ensuring information on administrative processes to ensure the Installation Record is accurate, stored appropriately and has been supplied to a database before the MCWSD starts operation.

2.6 In addition to the Installation Record a QA Record should also be maintained for each MCWSD installation. These records contain the Installation Records for each device, and additional installation information. An example QA Record is provided in Annex 1.

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[2] Licensing manually configurable white space devices, 25 September 2015
http://stakeholders.ofcom.org.uk/consultations/manually-configurable-wsds/

Adverse events

2.7 The QA process should include appropriate procedures to deal with inadvertent or unauthorised modification of the device configuration that could result in non-compliance with the licence terms, or in the Installation Records being inaccurate. In particular, the process should cover monitoring for accidental damage or unauthorised alterations.

Modification

2.8 The QA process should include appropriate procedures to ensure that any changes to the installation of a device (e.g. a change in location) which require a change in the configuration of the device are captured in a new Installation Record, and that the device parameters reported to the database are amended if affected by the changes.

2.9 An appropriate change control process should be in place to capture and amend all records relating to a MCWSD installation should the device configuration or installation change. This process should include a communications process to inform the WSDBs that the old Installation Record is no longer valid and communicate to the WSDBs the new Installation Record. These steps must happen before device operation is restored.

Decommissioning

2.10 The QA process should include appropriate procedures for taking a device out of service and ensure that decommissioning is captured in the licensee's own records. The procedure should also ensure that the Installation Record is removed from the WSDB.

Section 3

General guidance

3.1 A master device requires an internet connection to obtain the list of qualified WSDBs from Ofcom and to communicate with a WSDB. The installer should verify that the master device's internet connection is active before it is set to operate.

Requirements with regards to location

3.2 Devices may only transmit from locations falling within the UK or Isle of Man and their territorial sea limits, so installers must ensure that the location of a device is within these boundaries[3].

3.3 The MCWSD Licence requirements for the location of master and slave devices are as follows:

- Master devices must provide their location to a WSDB in order to obtain operational parameters.
- Slave devices may or may not provide their location in order to obtain operational parameters. Slave devices that do not provide their locations will be subject to generic operational parameters (GOP), whereas slave devices that do provide locations located will be subject to specific operational parameters[4] (SOP). These parameter sets are described in Annex 2.

3.4 With regard to how location is determined, the MCWSD Licence allows that:

- A master or a slave device may have automatic geo-location. This is the ability of a device to determine its location automatically without user configuration.
- The location may be entered manually in the device. However this option is not allowed for Type B devices[5] – either master or slave – which transmit while in motion.

3.5 In order to mitigate errors in the operation of MCWSDs, the following guidelines should be observed when configuring a device's location:

- The device must report location to the WSDB as longitude and latitude according to WGS84[6]. It must also report location uncertainty[7] with two values: longitude uncertainty and latitude uncertainty, both in metres.

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[3] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/447200/UK_TS_2015_A4.pdf

[4] Specific operational parameters will normally provide better channel and power availability than generic operational parameters.

[5] A device that is not intended for fixed use and which has an integral antenna or a dedicated antenna.

- If a device has automatic geolocation capability, the installer must ensure that the location mechanism is configured according to the guidance of the manufacturer so that it produces the most accurate location fix. For example, if the device uses GPS then the installer must ensure that the GPS antenna is located in open air and as close as possible to the WS antenna.

- If the location is configured manually, then the installer should use a location device that conforms to the requirements, i.e. it provides horizontal location and uncertainty in the location with the required confidence (see footnote 7), and whose accuracy has been tested. In addition, the installer may double check the location reported by the device against another location method.

- If the device used in the location process reports the position with reference to a coordinate system that is not WGS84, then a well know conversion system should be used. The Ordnance Survey converter should be used for NGR locations[8].

- Antenna height is an optional Device Parameter but it is recommended that it is configured and provided to the WSDB. Note that if height information is not provided then the WSDB will apply a conservative default value. If height information is provided by the WSD to the WSDB then it must include height uncertainty and the reference level, which can be either ground level (AGL, above ground level) or sea level (ASL, above sea level). The height may be determined automatically by the device or manually by the installer. If manually configured, height above ground level is normally easier to determine accurately than height above sea level and is therefore recommended.

Requirements with regards to other Device Parameters

3.6 Device type (Type A or Type B – see further below) and device category (master or slave – see further below) are mandatory Device Parameters. Technology identifier and device emission class are optional parameters.

3.7 If any of these parameters is configured manually in the device, the values declared by the manufacturer in the product information sheet should be used for the purposes of the device configuration.

Other aspects

3.8 The installer should ensure that the antenna gain and cable losses are accurately configured. The WSDB will communicate to the device an EIRP limit per channel, hence the device must be correctly configured to account for the gains and losses occurring after its antenna port.

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[6] NIMA Technical Report TR8350.2 (1984, including amendment 1 of 03 January 2000 and amendment 2 of 23 June 2004): "Department of Defense World Geodetic System 1984. Its Definition and Relationships with Local Geodetic Systems". http://earth-info.nga.mil/GandG/publications/tr8350.2/wgs84fin.pdf.

[7] Uncertainty must be provided with at least a 95% confidence level. This means that the locating device or method must provide a confidence of 95% or better that the actual location is within the uncertainty area.

[8] http://www.ordnancesurvey.co.uk/gps/transformation

3.9 In addition to the information required to be kept as part of the Installation Records, the licensee may also decide to keep additional site information as part of the QA process. This additional information could cover:

- The date and time of the first installation of the device, as well as the name and contact details of the installer.
- Additional details about the installation site, including its NGR coordinates and address, and contact details for the person responsible for access to the site.
- Details about the ancillary equipment at the site, such as: antenna gain, feeder and cable losses, antenna pointing direction.
- An event and change log describing the date and time of any changes to the device configuration or installation, as well as details of the person making the changes.
- Details of the date and time of decommission of the site, as well as of the installer responsible for decommission.

Operations

3.10 The licensee should ensure that the installation is properly maintained. In particular, the device must always communicate the correct Device Parameters to the WSDB. The licensee should ensure that the device has an adequate power connection, is appropriately sheltered and there are security measures to protect against unauthorised access.

3.11 The device may need to be re-configured as a result of an adverse event, such as a power cut, or the licensee may deliberately modify the configuration of the device after it has been put into service (for example due to re-location or a change in the antenna characteristics). In such cases, the licensee should ensure that the installer responsible follows the procedures for modification as set out in its written QA procedure.

Installation records

3.12 An Installation Record includes the Device Parameters as well as additional information about a MCWSD. The licensee must ensure that the Installation Record for a MCWSD is completed upon initial installation or on any reconfiguration, and provided to the WSDB before the device is put into operation. The values for the Device Parameters in an Installation Record must match the values for those parameters that a device provides to the WSDB when making a request for Operational Parameters. This will be verified by the WSDB each time the device makes a request and, if the verification fails, the device will not be given Operational Parameters. The contents of an Installation Record are listed in the MCWSD Licence.

3.13 An Installation Record must be provided to the WSDBs before a device starts operations and they must be kept up to date. If a device configuration or installation is modified and the content of the Installation Record changes as a result, then the licensee must inform the WSDBs and provide a new Record before the device restarts transmissions.

3.14 If a device is taken out of service then the licensee must inform the WSDBs that maintained an Installation Record. The Record will then be removed by the WSDB. There is no requirement for the licensee or the WSDB to maintain copies of Installation Records for installations that have been decommissioned

Section 4

Glossary

Dedicated Antenna	Removable antenna which has been designed for use and supplied with a specific type of device.
Device Parameters	The technical characteristics and the location of an individual WSD.
EIRP	Equivalent Isotropically Radiated Power.
External Antenna	Removable antenna which is designed for use with a broad range of radio equipment.
Generic Operational Parameters (Generic Slave Operational Parameters)	Operational parameters that may be used by any slave device located within the coverage area of the master device that broadcasts those Generic Operational Parameters.
Installation Record	A record of information about a specific installation of a MCWSD as required under the terms of the MCWSD Licence.
Integral antenna	Antenna designed as a fixed part of the equipment and cannot be disconnected from the equipment by a user with the intent to connect another antenna.
Licence Exemption Regulations for WSDs	The Wireless Telegraphy (White Space Devices) (Exemption) Regulations 2015.
Manually Configurable WSD (MCWSD)	A WSD that allows a user to input, configure, reconfigure or alter any technical or operational settings or features of the device in a way which would affect the Device Parameters, or its operation in accordance with Operational Parameters.
Master Device	A WSD capable of communicating with and obtaining Operational Parameters from a White Space Database.
MCWSD Licence	Licence under the WT Act issued by Ofcom relating to use of MCWSDs.
Operational Parameters	Transmission parameters communicated by a WSDB to a WSD containing the channels, power levels and other spectrum usage information that the WSD must comply with when transmitting.

Slave Device	A WSD capable of transmitting after receiving Slave Operational Parameters from a Master Device.
Specific Operational Parameters (Specific Slave Operational Parameters)	Operational Parameters that are calculated for a specific slave device.
Type A WSD	A WSD which is intended for fixed use only and which has an integral antenna, a dedicated antenna or an external antenna.
Type B WSD	A WSD which is not intended for fixed use and which has a dedicated antenna or an integral antenna.
White Space Database	A database service provided by an organisation which is qualified by Ofcom to support operation of Automatically Configurable WSDs or Manually Configurable WSDs.
White Space Device (WSD)	A wireless telegraphy station or apparatus capable of transmitting within the frequency band 470 MHz to 790 MHz after receiving operation parameters calculated by a WSDB.

Annex 1

Example quality assurance record

A1.1 The table below provides an example QA Record which should be maintained for each MCWSD installation. These Records contain the Installation Records for each device and additional installation information.

QA Parameter	Description	Device Parameter	Installation Record parameter
Licence details			
Licence number	As provided by Ofcom		Y
Licensee Name	As appears in the Licence		
Licensee address	As appears in the Licence		
Licensee contact details	Name, telephone and email of the person at the licensee responsible for managing the licence		
First installation			
Date / time	Date and time when the first installation was completed		
Installer contact details	Name, telephone and email of the person responsible for the installation		
Installer company	Name and details of the installer's company (if different from the licensee)		
Site details			
Mobility	Fixed or mobile		Y
NGR coordinates	Site eastings and northings		
Location address	Full address of the location if available, must include postcode		
Mobility description	If mobile, description of the locations or the area of operation		
Indoor location	Whether the device antenna is located indoors or outdoors		
Contact details for access to site	Name, telephone and email of the person that has access to the installation site		
Company responsible for access to site	If different from the licensee		

Device Parameters *Provided by the device to the WSDB when requesting Operational Parameters*			
Unique ID	Unique device identifier including the manufacturer identifier, model identifier and serial number	Y	Y
Antenna horizontal location	Longitude and latitude coordinates, and longitude uncertainty and latitude uncertainty in metres	Y	Y
Antenna height	Antenna height and height uncertainty are in metres, and height reference	Y	Y
Device type	Type A or Type B	Y	Y
Device category	Master or slave	Y	Y
Technology identifier	A set of characters representing the technology	Y	Y
Device Emission class	Class 1, Class 2, Class 3, Class 4 or Class 5	Y	Y
Additional installation characteristics			
Manufacturer name	Full name of the manufacturer		Y
Model name	Full model name		Y
Feeder and cable losses	This must include all losses and gains between the antenna and the antenna port of the device		
Antenna gain	in dBi		
Maximum output power capability	Maximum power in dBm that the device can output at its antenna port		
Maximum EIRP	in dBm (This must be the sum of the feeder/cable losses, the antenna gain and the maximum power capability)		Y
Antenna type	Integral, dedicated, external		Y
Antenna pointing direction	If the antenna is not omnidirectional		
WSDBs	Names of the WSDBs that the device may contact to get Operational Parameters		
Location determination method	Method of determining the longitude/latitude, including the device used if relevant		Y
Application description	Text description of the intended use of the device, in particular the operating times		Y
Event and Change log *an entry with the following parameters must be created for each event or change*			

Date / time	Date and time when the event took place or the installation was modified
Description	A description of the event and/or how the device installation has been modified
Installer contact details	Name, telephone and email of the person responsible for the dealing with the event or the modification
Installer company	Name and details of the installer's company (if different from the licensee)
Decommission	
Date / time	Date and time when the installation is taken out of service
Reason for decommission	Description of the reason
Installer contact details	Name, telephone and email of the person responsible for the decommissioning
Installer company	Name and details of the decommission company (if different from the licensee)

Annex 2

Generic and specific operating parameters for slave WSDs

A2.1 A slave device may operate according to generic operational parameters (GOPs) or according to specific operational parameters (SOPs).

A2.2 The GOPs are calculated by the WSDB using the location of the serving master device and its technical and operational characteristics. The GOPs can be used by any slave device that can listen to the broadcasts of the master device, i.e. any slave device that is in the master's coverage area. A slave device does not need to provide any information about itself to a master device (location or technical characteristics) to obtain the GOPs (it only needs to provide details of its unique identifier and the fact that it is a slave device to a master device if it will transmit using GOPs).

A2.3 The SOPs are calculated by the WSDB using the location and technical characteristics of a specific slave device. Therefore this information must be communicated to the WSDB through a master device in order to obtain the parameters.

A2.4 Depending on its device capabilities, a slave device may be able to operate using GOPs or using SOPs. Due to the nature of the calculations by the WSDB, SOPs will normally provide better channel and power availability than GOPs. It is therefore recommended that a slave device which has the capability to operate with SOPs is configured to do so.