Manually configurable white space devices

Consultation on the licensing of manually configurable white space devices operating in the UHF TV band

Consultation

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About this document

This document sets out Ofcom's consultation proposals for authorising certain types of white space devices (WSD) on a licensed basis.

'White spaces' are gaps in the radio spectrum in frequency bands, which can be used to offer wireless applications. These can bring benefits to citizens and consumers. While we expect most WSDs will operate on a licence exempt basis in the future, many do not currently meet our requirements for licence exemption and require manual configuration by the user.

Ofcom is therefore considering whether these manually configured devices should be licensed on a transitional basis, while equipment is developed that meets our licence exemption regulations. We would propose to review whether authorisation is still required after around three years.

This follows a recently published statement allowing white spaces devices that are able to operate automatically and without any manual configuration to operate in the UHF TV band on a licence exempt basis.

The consultation closes on 24 April 2015.

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Section 1

Summary

1.1 Ofcom has a duty to ensure that the radio spectrum is used in the most efficient way. On 12 February 2015 Ofcom published its TVWS Framework Statement[1] on implementing dynamic spectrum access in the UHF TV band (470 to 790 MHz). The Statement explained how we will allow white space devices (WSDs) to operate in those frequencies, subject to control by databases that are designated by Ofcom.

1.2 As set out in our TVWS Framework Statement, our approach is to authorise the deployment of WSDs under a licence exemption if they meet certain technical and operational requirements to ensure there is a low probability of harmful interference to other spectrum users. One key technical characteristic in order to qualify as licence exempt is that a device must not allow any manual configuration of the device parameters by the user or anyone else. This is to reduce the risk that a user could incorrectly configure the device, increasing the probability of harmful interference.

1.3 This consultation explores whether we should authorise devices that do not operate automatically and instead require an element of manually configuration by an installer to operate in the UHF TV band under a licensing regime. We refer to these devices as manually configurable white space devices (MCWSDs).

1.4 The background to this consultation is that we ran a pilot of the TVWS framework over the course of 2014 and 2015 and none of the devices tested during the pilot were able to demonstrate that they could determine their location automatically. As such, they would not be authorised for operation under our licence exemption. We therefore wish to explore if there is a need for a complementary licensing regime as a transitional arrangement to allow devices to operate in TVWS while equipment is developed that is capable of meeting our licence exemption regulations.

1.5 Having had regard to our statutory duties and having considered the costs and benefits of authorising MCWSDs under a licensing regime, we propose to authorise such devices on a transitional basis with a review of whether authorisation is still required after around three years. Our initial view is that allowing this would enable the deployment of WSDs to begin sooner in the UK and would therefore bring benefits to citizens and consumers earlier than would otherwise be the case. If equipment that complies with the terms of our licence exemption is developed sooner than we anticipate, we envisage that licence exempt equipment and MCWSDs operating under a licence would be able to operate alongside one another.

1.6 However, we also recognise the need to mitigate the increased probability of MCWSDs causing interference to incumbent users of the band. We propose to do this by introducing licence conditions, both technical and non-technical, which we consider would be appropriate in order to ensure a low probability of MCWSDs causing harmful interference to DTT and PMSE services. Our proposals for these licence conditions are set out in detail in section 5 of this consultation.

1.7 Our current expectation based upon our research and evidence from the trials and pilot remains that most WSDs should be capable of meeting the technical

[1] Implementing TV white spaces: Statement, 12 February 2015, http://stakeholders.ofcom.org.uk/consultations/white-space-coexistence/statement

requirements for licence exemption in future and we would therefore propose to review whether licences are still required after around three years. We believe it is less clear whether there is a case for authorising MCWSDs on a longer term basis. However, we also wish to explore whether there are specific use cases of TVWS that might warrant a licensing regime on a longer term basis and we invite stakeholders to comment on this possibility.

Section 2

Introduction

2.1 On 12 February 2015 Ofcom published its TVWS Framework Statement[2] on implementing dynamic spectrum access in the UHF TV band. This sets out how we will allow white space devices (WSDs) to operate in those frequencies, subject to control by databases that are designated by Ofcom.

2.2 In the TVWS Framework Statement and accompanying example licence exemption regulations we explained the requirements that WSDs will have to meet in order to be able to operate as licence exempt equipment. This consultation explores whether we should put in place a complementary regime to allow a different category of white space devices, referred to as manually configurable white space devices (MCWSDs), to also operate in the UHF TV band. Under our proposal MCWSDs would also receive the powers and frequencies for operation from white space databases designated by Ofcom, calculated in accordance with the same rules for co-existence as set out in our TVWS Framework Statement, and would be subject to the same operational and technical requirements for use as the licence exempt devices, except in relation to specific requirements connected with their manual configuration.

Impact assessment

2.3 The analysis presented in section 4 of this consultation represents an impact assessment, as defined in section 7 of the Communications Act 2003. Impact assessments provide a valuable way of assessing different options for regulation and showing why the preferred option was chosen. They form part of best-practice policy-making. This is reflected in section 7 of the Communications Act 2003, which means that generally we have to carry out impact assessments where our proposals would be likely to have a significant effect on businesses or the general public or when there is a major change in our activities. However, as a matter of policy, we are committed to carrying out and publishing impact assessments in relation to the great majority of our policy decisions. For further information about our approach to impact assessments, see the guidelines "Better policy-making: Ofcom's approach to impact assessment".

Equality impact assessment

2.4 In carrying out our functions, Ofcom is required under the Equality Act 2010 to have due regard to the need to:

- Eliminate unlawful discrimination, harassment and victimisation;
- Advance equality of opportunity between different groups; and
- Foster good relations between different groups, in relation to the following protected characteristics: age; disability; gender re-assignment; pregnancy and maternity; race; religion or belief; sex and sexual orientation.

[2] Implementing TV white spaces: Statement, 12 February 2015, http://stakeholders.ofcom.org.uk/consultations/white-space-coexistence/statement

2.5 Equality Impact Assessments (EIAs) assist us in making sure that we are meeting our principal duty of furthering the interests of citizens and consumers regardless of their background or identity.

2.6 We do not expect that the outcome of our proposed approach for the licensing of MCWSDs using the UHF TV band is likely to have any particular impact on race, disability or gender equality or those with any of the other characteristics protected by the Equality Act 2010. Specifically, we do not envisage the impact of any outcome to be to the detriment of any group of society. We have not seen the need to carry out separate EIAs in relation to the additional equality groups in Northern Ireland: religious belief, political opinion and dependants. This is because we anticipate that our proposals will not have a differential impact in Northern Ireland compared to consumers in general.

Remainder of this document

2.7 In the remainder of this consultation we:

- outline the legal framework for authorising spectrum use, the framework for white space device operation and the state of white space device technology today, which are the context for this consultation, in section 3;
- describe and analyse options for authorisation of MCWSDs in section 4;
- set out our proposed licence conditions for the licence in section 5;
- discuss the long term evolution of the licensing regime in section 6 and
- outline our timetable for the remaining steps in our process in section 7.

2.8 This consultation also contains a number of annexes, which are structured as follows:

- Annex 1 includes details on how to respond to this consultation;
- Annex 2 sets out Ofcom's consultation principles, under which this consultation is being conducted;
- Annex 3 contains a template coversheet for responses to this consultation;
- Annex 4 lists the consultation questions;
- Annex 5 contains a draft copy of the proposed licence; and
- Annex 6 provides a glossary of terms used in this consultation.

Section 3

Context

Legal framework

3.1 Ofcom is responsible for authorising civil use of the radio spectrum. We achieve this by granting wireless telegraphy licences under the Wireless Telegraphy Act 2006 (the WT Act) and by making regulations exempting users of particular equipment from the requirement to hold such a licence.

3.2 Under section 8(1) of the WT Act, it is an offence to establish, install or use wireless telegraphy (WT) equipment in the UK except where such use is authorised either by the issue of an appropriate wireless telegraphy licence or where the use of such equipment is exempted from the need to hold such a licence by regulations (i.e. a statutory instrument) made under section 8(3) of the WT Act.

3.3 Under section 8(4) of the WT Act, we are required to make regulations to exempt equipment if the conditions in section 8(5) are met, namely if its installation or use is not likely to:

- involve undue interference with wireless telegraphy;
- have an adverse effect on technical quality of service;
- lead to inefficient use of the part of the electromagnetic spectrum available for wireless telegraphy;
- endanger safety of life;
- prejudice the promotion of social, regional or territorial cohesion; or
- prejudice the promotion of cultural and linguistic diversity and media pluralism.

3.4 Section 9(1) of the WT Act gives us the power to grant wireless telegraphy licences subject to such terms as we think fit. This broad discretion is, however, subject to the following requirements:

- we must impose only those terms that we are satisfied are objectively justifiable in relation to the networks and services to which they relate, not unduly discriminatory and proportionate and transparent as to what they are intended to achieve (section 9(7));
- in relation to a licence for the establishment, installation or use of wireless telegraphy apparatus or stations for the provision of an electronic communications network or service , the terms of a licence must be of a kind falling within Part B of the Authorisation Directive (section 9(1A)); and
- we can only impose a limitation on the nature of wireless telegraphy equipment or wireless telegraphy apparatus which can be established, installed or used if it is necessary for one of the following purposes:
  - avoiding undue interference with wireless telegraphy;

- the protection of public health against electromagnetic fields;
- ensuring technical quality of service;
- ensuring maximisation of frequency sharing;
- safeguarding the efficient management and use of the part of the electromagnetic spectrum available for wireless telegraphy; or
- ensuring the fulfilment of a general interest objective[3] (section 9ZA).

3.5 Section 12 of the WT Act permits Ofcom to charge fees for wireless telegraphy licences, subject to certain specified exemptions relating to licences granted in accordance with auction regulations made under section 14 of the WT Act. Under Article 13 of the Authorisation Directive, any fees imposed for rights of use of radio frequencies must reflect the need to ensure the optimal use of the resources. Such fees must be objectively justifiable, transparent, non-discriminatory and proportionate in relation to their intended purpose and take into account the objectives set out in Article 8 of the Framework Directive.

3.6 Ofcom's principal duty under section 3 of the Communications Act 2003 is to further the interests of citizens in relation to communications matters and of consumers in relevant markets, where appropriate by promoting competition. Ofcom takes account of the impact of its decisions upon both citizen and consumer interests in the markets we regulate. In carrying out these duties, we are required, among other things, to secure a number of objectives such as the desirability of promoting competition, investment and innovation. Moreover, in carrying out our general duties, Ofcom is required to secure the optimal use of spectrum for wireless telegraphy and to have regard to the principle under which all regulatory activities should be targeted only at cases in which action is needed.

UK's dynamic spectrum access framework in the UHF TV band

3.7 The TVWS Framework Statement describes in detail Ofcom's approach for allowing the deployment of WSDs in the UHF TV band under a licence exempt regime. The key features of that framework are:

- The operation of WSDs in the spectrum band will be controlled by white space databases that have been designated by Ofcom.
- Ofcom will list all designated databases in the licence exemption regulations. We will also list the databases in a machine-readable file published on a website controlled by Ofcom so they can be selected by a WSD.
- Our regulations will require that devices only operate according to parameters provided by a database that is in our list of designated databases. We identify two categories of devices: master WSDs and slave WSDs. A master WSD is able to communicate with a database to obtain the parameters. A slave WSD gets its parameters through a master WSD. Once a master WSD has selected a

[3] These are: safety of life, the promotion of social, regional or territorial cohesion, avoidance of inefficient use of frequencies, the promotion of cultural and linguistic diversity and media pluralism and the fulfilment of a requirement under the ITU Radio Regulations.

particular database it will report information to the database about its location and its technical characteristics, known as its device parameters.

- The database will use those device parameters, together with other information it has about the existing users of the band, to determine, following rules set by Ofcom, what, if any, frequencies are available for that particular device and what power it is able to transmit at in those frequencies. This information is known as the operational parameters and is communicated to the device. These operational parameters are only valid for a short period of time so devices will have to query the database on a regular basis to transmit.

- The device is then able to use the operational parameters communicated by the database to select which frequencies to operate on and its transmit power, and it reports that information back to the database. These are known as the channel usage parameters.

- Databases are able to instruct a device to stop transmitting, for example in response to an instruction from Ofcom following an interference investigation.

3.8 The details of the framework are set out in more detail in section 3 of the TVWS Framework Statement.

3.9 The TVWS Framework Statement sets out our intention to authorise WSDs by licence exemption. We consider that licence exempt access to the UHF TV band for WSDs will promote efficient use of spectrum, bring economic benefits and allow the emergence of innovative services. We intend to put in place a set of technical requirements that WSDs must comply with to ensure a low probability of harmful interference.

3.10 An important part of the TVWS framework is that the device parameters that the database receives must be accurate. Without accurate information on the WSD's location and technical characteristics, there is an increased probability that interference could occur as the database would provide erroneous operational parameters to the device.

3.11 One key requirement to ensure that accurate device parameters are provided to the database is that these parameters are determined by the device itself. This means that the device determines its location automatically, and the rest of the device parameters are determined without user interaction. This would mitigate the possibility of a user incorrectly inputting the WSD's device parameters. We intend to introduce requirements in our licence exemption to this effect, requiring in particular that WSDs must not allow anyone to input or modify the parameters of the device. This is what we mean when we describe a WSD as not being manually configurable.

White space device technology

3.12 Over the course of 2014 and 2015, Ofcom ran a pilot of the TVWS framework. A number of companies, including 6Harmonics, Adaptrum, Carlson Wireless Technologies, Eurecom, KTS Wireless, Mediatek, MELD Technology, Neul, NICT and Sinecom, deployed equipment in our pilot.

3.13 None of the WSDs tested during the pilot were able to demonstrate that they were capable of operating without some degree of manual configuration. This was the case for both fixed and portable devices. Manually configuring a WSD typically involves determining some or all of the device's location, its type, class of emissions

and antenna gain. This can be done by either entering the information into the firmware of the device or communicating it to the database by some other means, for example through a network management system. We classify such devices as manually configurable white space devices (MCWSDs).

3.14 We recognise that some of the MCWSDs deployed during the pilot are prototypes and are in many cases designed for the US market where the framework operates differently to the one being put in place in the UK. We expect these devices to evolve and future releases to be fully compliant with the licence exemption regulations. However, as they stand these types of devices would not comply with the licence exemption regulations. Given that none of the devices deployed in the pilot were able to demonstrate that they were capable of automatically obtaining their device parameters for communication to a database, we believe we need to explore whether use of such devices should nevertheless be authorised.

3.15 Through this consultation we wish to explore if there is a need to license MCWSDs on a transitional basis to allow devices to operate in TVWS while equipment is developed that is capable of meeting our licence exemption regulations. We anticipate that equipment that meets the terms of the licence exemption might be available within three years of the introduction of the regulatory framework. Consequently, we propose that any licensing regime for MCWSDs should be reviewed within three years of the licences becoming available to assess whether it is still required or should be withdrawn. If equipment that is capable of meeting the terms of our licence exemption is developed sooner, we envisage that it could be deployed alongside MCWSDs that are operating under a licence.

3.16 In the light of the applications we have seen in the pilot, we also wish to consider whether there are specific use cases of TVWS that might warrant a licensing regime on a longer term basis. This would be for equipment not intended for installation by consumers but rather for deployment by businesses with professional expertise in installing radio equipment. For example, manual configuration would make it possible for a master device to access TVWS in circumstances where it may not always be possible for the equipment itself to know its location, such as some indoor locations. Stakeholders expressed interest in this type of professionally installed equipment in their responses to our 2012 Device Requirements consultation.[4] We would not expect this to be mass market equipment suitable for consumers, and our current expectation based upon our research and evidence from the trials is that in the majority of cases WSDs should, in future, be capable of meeting the technical requirements to operate under our licence exemption regulations.

3.17 Any longer term licensing regime would have different objectives and be aiming to meet different needs. We therefore are not certain that the proposed licence terms and conditions for a transitional licensing arrangement set out in this consultation document would be appropriate for a longer term licensing regime. We would expect to consider these issues at the three year review point and consult further if appropriate. We discuss the possibility of licensing MCWSDs on a longer term basis in section 6 of this consultation.

[4] TV white spaces: a consultation on white space device requirements, 22 November 2012, http://stakeholders.ofcom.org.uk/binaries/consultations/whitespaces/summary/condoc.pdf

Licence exemption not appropriate for MCWSDs

3.18 As explained above, an important requirement of our licence exemption is that devices must not allow a user to input or modify the device parameters or affect the operation of the device in accordance with operational parameters provided by a white space database.

3.19 While in some cases Ofcom has authorised certain equipment that allows some significant element of configuration or installation by the user on a licence exempt basis, we do not consider that it is appropriate, in the case of WSDs, to authorise manually configurable equipment on a licence exempt basis.

3.20 This is because we consider that there is an increased risk that MCWSDs may cause harmful interference compared to WSDs that automatically determine their device parameters. The user or installer (who may not have the expertise needed to accurately configure a device) could enter incorrect device parameters in the device, by mistake or deliberately. This could happen when the device is first installed and also in the event that it is moved to a different location. If the WSD reports inaccurate device parameters to a database (in particular location, for example), the database may provide operational parameters that could result in interference to other spectrum users in the proximity of that WSD. We therefore consider that there is an increased risk that manually configured devices could result in harmful interference to other spectrum users operating in or adjacent to the UHF TV band.

Section 4

Option assessment for manually configurable white space devices

4.1 In this section we consider whether Ofcom should allow MCWSDs to operate under the dynamic spectrum access framework it is introducing in the UHF TV band. We consider two options:

- Option 1: allow MCWSDs to operate under a licensing regime; or
- Option 2: do not allow MCWSDs to operate.

4.2 We have decided to allow access to TVWS for devices that cannot be manually configured in the TVWS Framework Statement. We believe this will bring significant benefits. The TVWS Framework Statement implements earlier decisions which were taken to further both our general and our spectrum duties. Our assessment of the impact of our proposals for device authorisation was set out in our consultation on white space device requirements published in 2012[5] and our assessment of the impact of our coexistence proposals was set out in our consultation on co-existence published in 2013[6].

4.3 Our assessment of the costs and benefits of the TVWS framework in general is set out in the impact assessments referred to above. The option assessment in this section therefore considers the costs and benefits of the two options set out in paragraph 4.1 on the basis that the TVWS framework is implemented. Consequently, in our analysis we are interested in the costs and benefits that each option for MCWSDs is likely to add incrementally to our decision to introduce the TVWS framework.

4.4 As noted in section 3, we do not consider licence exemption to be suitable for authorising MCWSDs as our view is that manual configuration increases the probability of harmful interference compared to WSDs that are capable of automatically determining their device parameters. This is because it is possible that the device is incorrectly configured and reports incorrect device parameters to the database, which would result in the database issuing erroneous operational parameters, increasing the probability of harmful interference. Therefore, this option assessment does not consider authorising MCWSDs under licence exemption in more detail.

4.5 This consultation, and the analysis below, considers the costs and benefits of licensing MCWSDs as a transitional arrangement until the use of TVWS is more established and in anticipation of the development of equipment that meets our licence exemption regulations. We do not consider the costs and benefits of licensing MCWSDs in the longer term in this section as we are not clear whether there is a need for this. We discuss the possibility of licensing MCWSDs on a longer term basis in section 6 of this consultation.

[5] TV white spaces: a consultation on white space device requirements, Consultation, 22 November 2012, http://stakeholders.ofcom.org.uk/consultations/whitespaces/
[6] TV white spaces: approach to coexistence, Consultation, 4 September 2013, http://stakeholders.ofcom.org.uk/consultations/white-space-coexistence/

Option 1: allow MCWSDs to operate under a licensed regime

4.6 Under Option 1, Ofcom would allow MCWSDs to operate in the UK on a transitional basis while equipment is being developed that is capable of meeting our licence exemption regulations. This would mean that there would be two different categories of WSDs that could be deployed, under two different regulatory regimes: devices that do not allow manual configuration could be operated under the licence exemption, and devices that allow manual configuration would require a licence. We consider that these two different categories of WSDs could operate alongside one another, if equipment capable of meeting the terms of our licence exemption were developed sooner than we anticipate. Consequently, the development of the opportunities brought about by the implementation of the TVWS framework could be exploited through a broader range of devices.

Potential benefits

4.7 As explained in section 3, most devices available at present are manually configurable and it may be some time before non-configurable devices are widely available. On installation of these devices, the device parameters are entered directly into the management console of the device or possibly into a network management interface that sits between the device and the database. It should be emphasised that the framework for TVWS access that we have set out in the TVWS Framework Statement is based around geolocation and licence exemption. This is what we expect to be the dominant use of TVWS. In common with our proposed licence exemption regulations, the ETSI harmonised standard does not allow for manual configuration. This consultation essentially addresses a proposal for a transitional measure as the market in WSDs develops.

4.8 We consider that our decision, as set out in our TVWS Framework Statement, to implement the TVWS framework in general is likely to bring benefits to citizens and consumers, which, although uncertain, could potentially be very substantial relative to the costs. The main benefit of allowing MCWSDs access to TVWS on a transitional basis is that the benefits associated with implementing the TVWS framework could be realised more quickly. Current equipment needs manual configuration and manufacturers may take some time to upgrade their products to comply with our licence exemption rules, given that demand may be low until the TVWS framework becomes more established. If MCWSDs are allowed, they could be deployed as soon as the TVWS framework is implemented and the benefits would be realised at an earlier date. Licensing MCWSDs could be a useful measure over the next few years to allow access to TVWS while manufacturers are developing equipment that is capable of meeting our licence exemption regulations.

4.9 Although MCWSDs are different from licence exempt WSDs in that they are unable to automatically determine their location and communicate it to a database, their operation would be controlled by databases, depending on their location, under the same framework and rules as applied to licence exempt WSDs. As a result, authorising MCWSDs would benefit Ofcom as it would allow use of a geolocation database approach to spectrum management at an earlier stage while manufacturers are developing devices that are capable of meeting the technical requirements of our licence exemption. If we were to decide not to authorise MCWSDs, we would have to wait until equipment was developed that was capable of meeting our licence exemption before we could demonstrate that the geolocation database approach could work in practice.

4.10 In addition, MCWSDs give the person deploying WSDs an additional tool for dealing with the challenges posed by imbalance between the transmit powers of master and slave WSDs that can arise under the TVWS framework. For example, it is possible that in some situations the Generic Operational Parameters (GOPs) provided to a slave are insufficient to get a network operational because they only allow the slave to hear the master's broadcast of GOPs but do not allow sufficient transmit power for the slave to respond to the master.[7] If the master and slave can be manually configured then it may be possible for the installer to mitigate this problem by manual geolocation of both master and slave devices and so allow the slave to transmit using specific operational parameters, which will generally allow high transmit powers. We recognised in the TVWS Framework Statement that GOPs can be quite restrictive in some cases and we noted that we intend to work with industry to discuss how to improve this part of the framework. However, licensing MCWSDs should allow access to TVWS in these circumstances over the next few years until the framework can be developed.

Potential costs

4.11 There are three sources of possible costs associated with this option:

- Costs incurred by existing users of the UHF TV band or adjacent bands from interference caused by MCWSDs;
- Costs incurred by Ofcom from putting in place a licence regime for MCWSDs and managing interference investigations; and
- Costs incurred by companies wishing to deploy MCWSDs when obtaining a licence.

Interference costs

4.12 The TVWS framework is designed to ensure that there is a low probability of harmful interference to existing users of the UHF TV band and adjacent bands from the deployment of WSDs. This objective is a key consideration in the calculation and communication of the operational parameters that devices are allowed to use. The operational parameters are limited in such a way that we consider there is a low probability of any interference costs arising from the deployment of WSDs in general.

4.13 MCWSDs, if authorised, would also be part of the TVWS framework, which is designed to minimise the probability of interference to DTT and PMSE. As such, their operational parameters would be determined by the same set of rules as for WSDs that are not manually configurable. As noted in section 3, use of MCWSDs may give rise to an increased risk of harmful interference, stemming from the possibility that incorrect device parameters could be entered by the user. However, we think that this risk can be mitigated through the licensing regime and the associated licence conditions. We would therefore expect that in practice the interference costs to industry from deployment of MCWSDs would be unlikely to be materially greater than for licence exempt use of WSDs, provided the appropriate licence conditions are put in place for MCWSDs.

4.14 Furthermore, we do not expect we will need to issue many licences to deploy MCWSDs as we expect that equipment that meets our licence exemption regulations

[7] See section 3 of the TVWS Framework Statement for brief explanation of this issue.

will be developed shortly. We do not expect MCWSDs to be mass market devices for use by consumers. Our expectation is that, as deployment of MCWSDs will be limited, the risk of harmful interference is likewise limited.

Ofcom's licensing and interference management costs

4.15 If Ofcom decides to authorise MCWSDs it will do so through a licence and will have to create a new licence product. There are a number of costs associated with this process for Ofcom. These would include the training and allocation of staff to administer licences on an ongoing basis and ensure data on licensees are kept up-to-date.

4.16 As noted above, we consider that special licence conditions are required to mitigate the increased risk that MCWSDs will cause harmful interference through incorrect configuration of their device parameters. Our proposed licence conditions, set out in detail in section 5, include a requirement for licensees to have a Quality Assurance (QA) process in place to ensure MCWSDs deployed under the licence are correctly configured and a requirement for licensees to send Ofcom a record of the installation of every MCWSD they make under the licence. Ofcom will incur extra administration costs as a result of these licence conditions, for example, by assessing licensees' QA processes and inspecting records of installation. The costs of licensing MCWSDs will therefore be greater than those associated with our licence exemption. However, given the licensing regime proposed in section 5, we do not expect the costs of creating and maintaining a new licence product to be overly burdensome for Ofcom.

4.17 Although the TVWS framework has been formulated in such a way as to ensure there is a low probability of harmful interference, we cannot ensure that no interference will ever be experienced. As such, introducing the TVWS framework in general is likely to increase Ofcom's costs associated with spectrum management and interference management activities to some extent, such as investigation of harmful interference, enforcement and prosecution costs. The proposed licensing regime for MCWSDs would involve some additional interference management activities for Ofcom. For example, we may also wish to carry out physical inspections of licensees' deployments of MCWSDs. However, we anticipate that the incremental costs of Ofcom's interference management activities for the proposed licensing regime will be limited as we expect that in general we could use the same systems and processes to manage the potential for interference to be caused by MCWSDs as can be used for other WSDs.

4.18 If authorised, we intend MCWSDs to operate on a non-interference non-protection basis (see section 5). This means that the equipment must not cause harmful interference to any other authorised services and that no protection will be given from harmful interference received from other authorised services. Therefore, Ofcom would expect there to be only minimal costs in addressing interference experienced by MCWSDs.

Costs of compliance for industry

4.19 The requirement to obtain a licence to enable deployment of MCWSDs will impose some costs on the operators of such equipment in that they will have to spend time on obtaining the licence and complying with its terms, and pay a fee. Licensees will also likely incur some costs related to setting up and complying with the proposed licence conditions, in particular the QA process and the record-keeping for each installation of a MCWSD (as set out in section 5). However, we consider that the proposals set out in this consultation would not represent a disproportionate burden

on industry in terms of obtaining the licence or ongoing compliance costs. We would expect installers of MCWSDs to keep records of installation as part of best business practice regardless of our proposed licence conditions and therefore do not consider our proposed record-keeping requirements to represent a significant additional cost for industry.

Option 2: do not allow MCWSDs to operate

4.20 Option 2 would mean that MCWSDs would not be authorised to operate in the UK. The only WSDs that would be authorised to operate would be those that complied with the licence exemption. Accordingly, the development of the opportunities brought about by the implementation of the TVWS framework could only be exploited through WSDs that complied with the licence exemption.

Potential benefits

4.21 If we were to implement Option 2, the only way to access TVWS would be through the licence exemption. This would remove the risk that operators might be disincentivised to invest and develop equipment capable of automatically determining its device parameters if a licensing regime was put in place for MCWSDs.

4.22 Furthermore, under Option 2 Ofcom would avoid incurring the costs associated with introducing a new licence product.

4.23 These benefits are explained above in the discussion of the potential costs of Option 1.

Potential costs

4.24 As noted in section 3, none of the WSDs deployed in the pilot were able to demonstrate that they were capable of operating without manual configuration and, as such, would not comply with the licence exemption. If we were to implement Option 2 and not authorise the use of MCWSDs in the UK, it is likely that most, if not all, of the companies involved in the pilot would need to take time to develop WSDs that are capable of automatically determining and reporting their device parameters. As a result, the principal costs of Option 2 – not allowing MCWSDs to operate – are that it is likely to delay and possibly reduce the benefits that are likely to result from the introduction of the TVWS framework. We expect devices that comply with the licence exemption to be developed within the next three years and we are therefore initially proposing this transitional licensing regime will be reviewed after three years.

4.25 These benefits are explained above in the discussion of the potential benefits of Option 1. If we adopt Option 2, these benefits would be lost.

Ofcom's proposal

4.26 We currently continue to expect that most WSDs will be capable of meeting the technical requirements to operate under our licence exemption regulations in the future. We continue to consider that licence exemption as set out in the TVWS Framework Statement remains the best approach for authorising access to TVWS in the long term and maximises the benefits of access to TVWS.

4.27 However, we consider that we should allow the deployment of MCWSDs as a transitional arrangement. Allowing such devices alongside WSDs that comply with the licence exemption regulations increases the likelihood that the benefits from the

introduction of the TVWS framework will be realised over the next few years while manufacturers develop equipment that is capable of meeting our licence exemption regulations. While allowing MCWSDs to operate does create some additional implementation costs and could increase the risk of interference to existing users, we consider the risk could be mitigated by imposing appropriate licence conditions (see section 5), the costs are likely to be minimal and to be significantly less than the benefits.

4.28 We set out our proposed licence conditions in section 5 of this consultation and in the draft licence in Annex 5. Our initial view is that these licence conditions are likely to be appropriate for reducing the probability of harmful interference and would be proportionate and suitable for licensing MCWSDs as a transitional measure until the TVWS framework becomes more established.

4.29 We anticipate that equipment that meets the terms of the licence exemption regulations might be available within three years of the introduction of the TVWS framework and we would expect the majority to use licence exempt equipment when it becomes available. We are unsure as to whether there will be an ongoing need to license MCWSDs, and we therefore propose to review the licensing regime for MCWSDs after around three years.

4.30 If, after a review, we decide there is a need to license MCWSDs on an ongoing basis, we will review the licence terms and conditions with a view to assessing if they would remain appropriate, as it is likely our objectives for a longer term licensing regime would be different to our objectives for licensing MCWSDs as a transitional arrangement. We discuss the possibility of licensing MCWSDs on a longer term basis in section 6.

Question 1: Do you agree with our assessment of the likely costs and benefits of our proposal to license MCWSDs as a transitional arrangement? Please provide any available evidence to support your response.

Question 2: If you agree that Ofcom should allow MCWSDs to operate in the UHF TV band within the TVWS framework, how long do you believe that the licensing regime would need to be in place?

Question 3: If you agree that Ofcom should allow MCWSDs to operate in the UHF TV band within the TVWS framework, when do you believe it would be appropriate to conduct a review to assess whether there is an ongoing need to license MCWSDs?

Section 5

Proposed licence conditions

5.1 This section describes the proposed licence conditions that Ofcom would expect the deployment of MCWSDs within its TVWS framework to follow, if Ofcom decides to authorise the operation of MCWSDs. The proposed licence conditions set out in this section were formulated considering licensing MCWSDs on a transitional basis.

5.2 A draft licence is set out in Annex 5. Again, the draft licence conditions are proposals for a transitional arrangement and may not be suitable to license MCWSDs on a longer term basis.

5.3 If we decide to license MCWSDs on a longer term basis, we would need to consider what changes we would need to make to the licensing regime to ensure it remained appropriate. Any licensing regime for MCWSDs in the longer term may look different to the licence proposals set out below and in the draft licence in Annex 5 and we would expect to consult on the detail before introducing such a regime.

Question 4: Do you agree with the proposed terms of the draft licence as set out in Annex 5 and as discussed below?

Overview of licensing approach

5.4 Ofcom's objective in designing a licensing approach for MCWSDs is to find one that minimises the costs to Ofcom and the industry while providing adequate safeguards to ensure a low probability of harmful interference to existing users of the UHF TV band. The powers and frequencies at which an MCWSD may transmit would be controlled at a detailed level by the databases designated by Ofcom and there is no need to impose licence conditions that duplicate those controls.

5.5 Rather, the purpose of the licence would be to mitigate the increased risk of interference created by MCWSDs and to set out the necessary technical and operational conditions that specify how the devices must operate in conjunction with the databases. Our view is that we need a licensing approach with particular obligations in the licence in relation to the determination of device parameters.

Non-interference non-protection

5.6 We propose that MCWSDs would have to comply with the same rules as other WSDs regarding coexistence with the existing users of the band. Furthermore, we propose that MCWSDs would receive no protection from interference from other WSDs of any type. Any co-ordination between WSDs will be a matter for the industry, as envisaged under the TVWS framework.

5.7 Therefore, we propose to issue licences on a non-protection, non-interference basis. Users of MCWSDs may not cause interference to other users and they will have no protection against interference from other authorised users of the radio spectrum.

5.8 In summary, their status would be the same as that of users of WSDs under the licence exemption.

Scope of the licence regarding master and slave WSDs

5.9 Under the TVWS framework there are two categories of WSD, a master and a slave. A master is a device that is able to communicate with and obtains operational parameters from a designated database, and a slave is a WSD that is only able to operate in TVWS when under the control of a master WSD.

5.10 We propose to set up the licensing regime to give industry flexibility in how they deploy MCWSDs. Therefore, we propose to allow both masters and slaves to be MCWSDs. Whether a single licence can cover a network of masters and slaves will depend on the details of the deployment. The person in control of the device would need to hold the licence.

5.11 The proposed licensing regime is intended to be complementary to the licence exemption approach and so it would be possible, for example, for a deployment to be authorised so that a master MCWSD is covered by a licence but the slaves would comply with the exemption and so would not need a licence.

Question 5: Do you think it would be beneficial for the licensing regime for MCWDs to cover both masters and slaves?

Type A and Type B devices

5.12 In our TVWS Framework Statement we defined two types of WSDs: type A and type B. A type A WSD is a device that is intended for fixed use only[8]. This type of equipment can have integral[9], dedicated[10] or external[11] antennas. A type B WSD is a device that is not intended for fixed use and which has an integral antenna or a dedicated antenna. Databases will allocate different operational parameters to type A and type B devices as one type might be more likely to cause harmful interference than another in certain situations.

5.13 We have considered whether we should authorise both type A and type B MCWSDs under our licensing regime.

5.14 We consider that manual configuration of type B devices is impractical. Under our proposed licence conditions, as set out below, users would be required to manually reconfigure the device every time it moved, make a record of what the device parameters were and how they were determined and send a copy of this record to Ofcom. Furthermore, we consider this situation would increase the risk of harmful interference, as it is more likely that the location of the device would be incorrectly determined if the device was in motion.

5.15 As such, we propose that our licensing regime for MCWSDs would only apply to type A, or fixed, devices and would not apply to type B devices. MCWSDs would need to be fixed while in use to be licensed. We would expect devices that are mobile to be

[8] Fixed use in this context means that the device does not move while being used
[9] Integral antenna: antenna designed as a part of the equipment, without the use of an external connector, which cannot be disconnected from the equipment by a user with the intent to connect another antenna
[10] Dedicated Antenna: a removable antenna supplied and assessed with a white space device and which has been designed for use with that device.
[11] External antenna: a removable antenna which is designed for use with a broad range of radio equipment and has not been designed specifically for use with a specific product.

able to automatically geolocate and communicate with a designated database. We note that as set out in the TVWS Framework Statement, Type B slaves may not be geolocated but those devices would have to rely on generic operational parameters for slaves served by their serving masters.

Question 6: Do you agree that our licensing regime should only apply to type A devices?

Is a licence required for each MCWSD?

5.16 If we were to adopt an individual approach to licensing, each MCWSD would require a licence. This approach would mean that Ofcom's licensing system would hold accurate information on the location of all licensed MCWSDs. This would help to identify MCWSDs if they caused interference to other spectrum users. We consider that the alternative option is a licence that authorises the licence holder to deploy any number of MCWSDs under a single licence, subject to the conditions of that licence. Under that approach, a single licence could be used for a number of MCWSDs provided that the licensee was the person who is ultimately in control of, and responsible for, all of the equipment deployed under the licence.[12]

5.17 We consider that requiring a licence for each individual MCWSD would be more burdensome and costly for both Ofcom and the industry in terms of administrative costs.[13] Such an approach could be detrimental to innovation by increasing the barriers to spectrum access and would take some time for Ofcom to set up. We consider that this would be contrary to our principal objective in proposing to license MCWSDs, namely to allow access to TVWS while equipment is developed that meets the conditions of our licence exemption. We are also proposing that information on the location of each device would be captured by as part of information that licensees would be required to record and would be available to Ofcom for the purpose of our interference management functions.

5.18 For these reasons, we propose to adopt the option of permitting a licensee to deploy any number of MCWSDs under the terms of their licence, provided that such equipment remained under the ultimate control of the licensee.

Question 7: Do you agree with our approach to allow a number of MCWSDs under the control of a single licensee to be subject to a single licence?

Limitations on the number of licences

5.19 We do not propose to place any limits on the number of licences we are able to issue, subject to those that may result our proposed special licence conditions relating to a licensee being able to demonstrate that it has processes in place that will ensure the device parameters for MCWSDs are correctly determined and communicated to a designated database. These are set out in detail in the paragraphs below. However, it is our expectation that equipment that meets the

[12] We note that the licensee would be able to authorise in writing other people acting on behalf of the licensee, such as installers, to establish, install or use the equipment on the licensee's behalf, provided that such people are made aware of, and of the requirement to comply with, the terms of the licence.

[13] Note that Ofcom aims to recover its costs when authorising WT Act licences. See http://stakeholders.ofcom.org.uk/consultations/cbfframework/statement

conditions for licence exemption will be available shortly and that therefore relatively few of these licences need to be issued.

Possible non-technical licence conditions to mitigate the risk of incorrect device parameters

5.20 As discussed in section 3, our view is that use of MCWSDs, if they are to be allowed, must be subject to mitigation of the risk of inaccurate device parameters being used. We consider that we can apply this through authorising their use through a licence and applying appropriate conditions. This is in contrast to WSDs that are able to automatically determine their device parameters, which will operate under a licence exemption.

5.21 Given the increased risk of harmful interference that may arise from the use of MCWSDs, we consider that a licence with specific non-technical conditions would need to be put in place in order to mitigate the risks. The increased probability of harmful interference comes from the greater possibility that incorrect device parameters may be entered by the installer of the MCWSD, both when it is first installed and subsequently if it is moved and installed in a different location. We have identified possible options for licence requirements which we consider would be necessary and proportionate to mitigate the increased risk of harmful interference, which we set out below. These are also set out in schedule 1 of the draft licence in Annex 5.

Quality Assurance for accurate determination of device parameters

5.22 We consider there is a need to place an ongoing obligation on licensees to ensure that MCWSDs covered by the licence are installed correctly, and to allow Ofcom a means of checking compliance with this.

5.23 We are proposing to introduce a number of obligations for this:

- An obligation that MCWSDs must be installed correctly, requiring the installer to ensure that the device parameters are accurately determined and communicated successfully to a designated database.

- An obligation on the licensees to have a Quality Assurance (QA) process in place to ensure MCWSDs are installed correctly. We discuss this in more detail from paragraph 5.24 below.

- An obligation requiring licensees to keep an accurate record of each configuration or reconfiguration of every MCWSD that it establishes, installs or uses under the licence in a way that sets out what the device parameters entered on each configuration or reconfiguration were and explains how the device parameters were accurately determined and communicated to a designated database. The record would also contain details of the QA process used to ensure correct installation or establishment. The licensee would not be required to make a record every time the device parameters were input into the MCWSD (for example, if the device parameters needed to be re-entered after a power-off but are not altered, e.g. if the MCWSD had not moved). Rather, the licensee would be required to make a new record every time the device parameters are initially input following installation of a MCWSD or are changed, for example if the MCWSD was moved and installed in a different location, or, where devices report antenna height, if the antenna height changes.

- An obligation requiring licensees to send Ofcom the records it makes as set out above following every installation or establishment of a MCWSD that it makes under the licence, or every time a change is made to the configuration of the device. We would intend to explore with industry the format for these records and the manner in which they could be provided to Ofcom which would minimise the burden and would be most efficient for both Ofcom and industry. This might be as simple as a spread sheet that is added to as installations take place and could be sent to Ofcom either monthly or as and when a MCWSD is newly installed or established.

5.24 Our initial view is that appropriate QA processes should be developed by licensees and others interested in allowing deployment of MCWSDs. We envisage that an effective QA process should set down procedures for installers on the following points:

- Processes for the installer on how to determine the MCWSD's location;
- Information on what equipment is to be used to determine the MCWSD's location;
- Processes that constitute a 'check process' to allow installers to ensure a MCWSD has been installed correctly, in that its device parameters have been accurately determined and communicated to a designated database;
- Appropriate procedures to ensure the ongoing maintenance of a MCWSD, in particular to ensure that its device parameters remain as first determined and that location data is kept up-to-date; and
- Information on administrative processes to ensure accurate records of installation, including the parameters determined and communicated to the database are made and stored in an appropriate way.

5.25 The Federation of Communication Services (FCS) publishes a Code of Practice for Business Radio Site Engineering.[14] The Code of Practice sets out appropriate procedures and techniques for the installation of radio transmitters, associated receivers and their ancillary equipment in base station sites for use in the Business Radio Sector. Our initial view is that industry might be able to use the FCS Code of Practice as an exemplar in the development of a QA process for the correct installation of MCWSDs.

5.26 Our initial view is that the development of a QA process and appropriate procedures for the installation of MCWSDs should be industry-led. However, we recognise it might be helpful for Ofcom to provide further guidance as to what an appropriate QA process might cover. We may consider providing such guidance in the future.

5.27 We note it is likely that for business reasons, licensees might wish to keep a record of installations of MCWSDs and to ensure installations are accurate in any event. We also consider it to be likely that licensees would want to monitor installations on an ongoing basis and to have oversight of installers, regardless of our special licence conditions. We therefore would expect the QA process to create limited additional regulatory burden for licensees.

[14] Federation of Communication Services Code of Practice for Business Radio Site Engineering, June 2013: http://www.fcs.org.uk/image_upload/pdf/13-06-13-fcs1331-bs-cop-revision-2013-final-endorsed.pdf

5.28 While we would expect licensees to meet their obligations, we consider it important that Ofcom has the right to inspect these records. We therefore propose to include in the licence an obligation on the licensee to send a copy of the record of installation or establishment for every MCWSD deployed under the licence to Ofcom.

5.29 We propose that, in particular at the outset of the deployment of MCWSDs, we would inspect copies of these records to ensure that the device parameters of MCWSDs are accurately determined and communicated to a designated white space database. This would allow us to confirm that MCWSDs are being installed correctly and licensees are complying with their licence.

Question 8: Do you agree that the proposal for specific licence terms will mitigate the risks posed by the use of MCWSDs?

Question 9: Do you consider the proposed licence terms are appropriate and proportionate?

Application for licences

5.30 In accordance with our standard licensing practice, Ofcom requests certain information from potential licensees on application for licences to operate radio equipment. As well as the standard information required of applicants, we propose to ask applicants for licences to operate MCWSDs to provide Ofcom with details of their QA process on application. This would ensure that potential licensees have appropriate QA processes in place and would allow Ofcom to assess whether the applicant's proposed QA process sufficiently mitigates the risk of installers entering incorrect device parameters and so ensures a low probability of harmful interference.

Question 10: Do you have any comments on our proposal to require applicants for licences to deploy MCWSDs to supply details of their QA process on application?

Technical licence conditions

5.31 As explained above, we envisage that MCWSDS will be part of the TVWS framework set out in our TVWS framework Statement. Therefore, the licence will stipulate that the frequencies and powers at which MCWSDs transmit will be as specified by a database designated by Ofcom.

5.32 The details of the proposed technical conditions are set out in schedule 2 of the draft licence in Annex 5. In many respects the proposed licence conditions are the same as those set out in the licence exemption for WSDs. The key areas of difference relate to how device parameters would be determined and reported to a database. We explain these below.

User access restrictions and determination of device parameters

5.33 The technical requirements under the licence exemption impose restrictions on a user's access to the hardware or software settings in a WSD. In particular, they require that the user shall not be able to alter the settings include the determination of device parameters. Under the proposed licensed regime, we propose that this requirement will not apply for MCWSDs and that the licensee could determine the device parameters. This would be relevant to all device parameters, with the exception of the UniqueID, which is the device parameter that allows a database to

uniquely identify a device. We would expect the UniqueID of a MCWSD to be specified by the manufacturer.

5.34 We also propose that the licensee should be able to manually modify other configuration parameters – that are not defined as device parameters as such – but could still have an impact on the radio behaviour of the device. One such parameter is the antenna gain.

Provision of device parameters to the database

5.35 Master WSDs operating under the licence exemption are required to be capable of accurately reporting their device parameters to a database automatically. Slave WSDs are required to report their device parameters, where they know them, to a master WSD following the same rules.

5.36 We propose that the requirement to provide parameters accurately will remain under the licensed regime for MCWSDs.

5.37 However, under our proposals the device parameters for MCWSDs could be provided to the database in two ways:

- The licensee could enter the device parameters, and any other configuration parameter, directly in the device – via a management console for instance. The device will then communicate the parameters to the database.

- The licensee could provide the device parameters to the database directly – for instance via a webform provided by the database operator or via the licensee's own Operations and Management Centre. The database could then use the UniqueID, which the device always has to provide, to link the device parameters to a specific device. There will be a requirement on the licensee to report the device parameters to the database before the device can begin operating

5.38 Both approaches have been suggested by stakeholders and our understanding is that both are possible in the US. We do not currently think there are reasons to preclude either approach hence we propose that neither the WT licence nor the database contract will not put constraints on this.

Question 11: Do you agree with the proposed technical conditions of the draft licence?

Other non-technical licence conditions

Geographical extent of the licence

5.39 The geographical extent of the licence must match the geographical scope of the white space availability data that a database is able to calculate. We expect that the database will be able to provide operational parameters for all areas of the UK. Therefore, we propose that the licence should authorise the licensee to establish, install and use the radio equipment in the whole of the UK.

Designated Databases

5.40 We propose that the licence would require that the MCWSDs deployed under the licence operate in accordance with operational parameters provided by one of the databases listed in the licence exemption regulations.

Licence duration, fee and revocation notice period

5.41 We propose to create a new licence product for MCWSDs. We propose that this licence product has no end date and it will be subject to an annual payment interval.

5.42 In line with the principles defined in the strategic review of spectrum pricing[15] we propose that this licence product should be subject to cost based fees (CBF). We recently consulted on our cost allocation methodology for setting CBFs and published our statement[16] setting out our approach in 2014 (the 2014 CBF Statement).

5.43 Since this would be a new licence product, in the absence of information on actual administration costs, we have estimated the likely costs based on our experience in creating new licence products, issuing licences and managing interference.

5.44 Adopting our cost allocation methodology, we have identified four relevant cost categories for the purposes of setting the proposed MCWSD licence fee[17]:

- Spectrum policy programmes and projects;
- Spectrum engineering and enforcement;
- ICT; and
- Property and other common costs.

5.45 We have estimated the number of full time equivalent (FTE) days per year we expect would be required to manage each MCWSD licence.

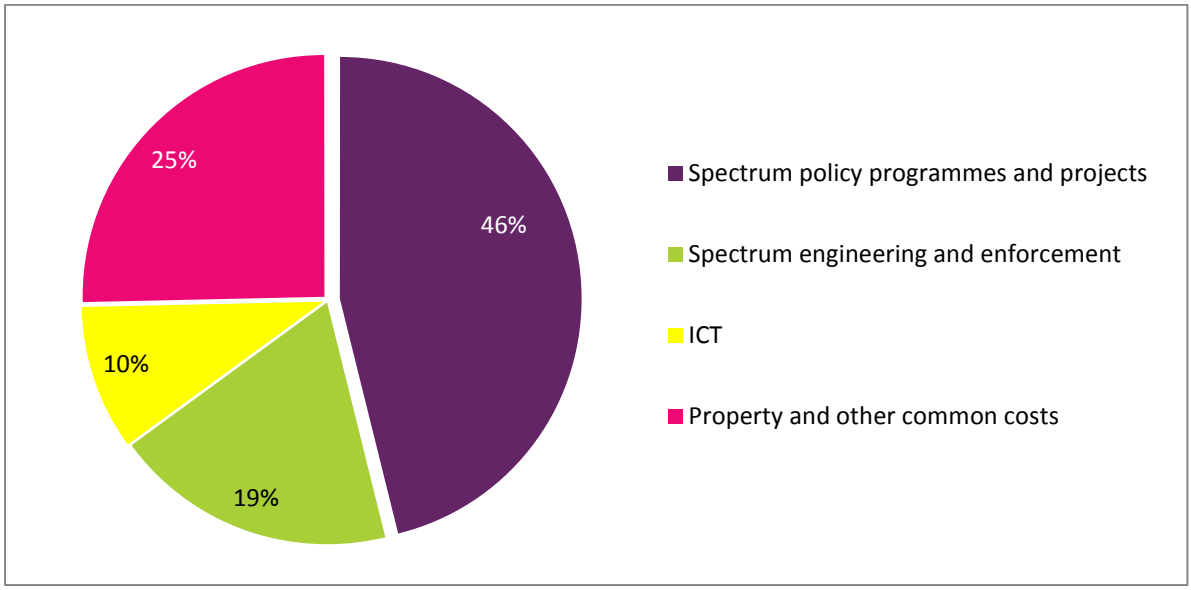
- With regard to spectrum policy programme and project costs, which include issuing and managing the licence and licence product[18] - we expect this would require two FTE days per year.
- For spectrum engineering and enforcement costs, which include managing and addressing interference issues - we expect this would require one FTE day per year.

5.46 In addition to the direct staff costs identified above there are also indirect costs relating to ICT, property and other common costs associated with managing the licence product. Accordingly we have apportioned these costs to the licence product on the basis of their direct costs.

5.47 A breakdown of our estimated spectrum management costs for MCWSDs across the four cost categories is set out in Figure 5.1 below.

[15] SRSP: The revised Framework for Spectrum Pricing, Statement, 17 December 2010, http://stakeholders.ofcom.org.uk/binaries/consultations/srsp/statement/srsp-statement.pdf
[16] Spectrum Pricing: A framework for setting cost based fees, Statement, 17 March 2014, http://stakeholders.ofcom.org.uk/binaries/consultations/cbfframework/statement/CBFstatement.pdf
[17] As this licence product is a secondary user of spectrum, we do not consider there are any associated international costs with this licence product.
[18] As we expect to manage the issuing of licences by our spectrum team directly, there are currently no separate licensing costs as identified in the cost allocation methodology, though these may occur in the future if the licensing process changes.

Figure 5.1 Breakdown of spectrum management costs for MCWSDs



5.48 Based on these estimates, we propose to charge a licence fee of £1,500 per licence, per year. We have sought to estimate and attribute costs according to the likely spectrum management needs of the sector and we would expect to review this fee if, following implementation, we considered there was a significant misalignment with costs in the future. However, we would only be able to consider this once the licensing regime for MCWSDs has been operational for at least one full financial year.

5.49 Assuming we decide to implement a transitional licensing regime, it is possible that after a review in a few years we may decide that we no longer need to license MCWSDs and would seek to phase out this licence product. However, we would wish to give stakeholders who are already licensed to operate MCWSDs some certainty and we therefore propose that licences issued under this transitional arrangement would be subject to a five year minimum notice period for revocation for spectrum management reasons. We consider that five years should give sufficient certainty to the industry while allowing Ofcom the ability to remove this licence product in the future if, following a review, it was shown not to be needed.

Question 12: Do you have any comments on the proposed duration for this licence?

Question 13: Do you have any comments on our proposed licence fee of £1,500?

Question 14: Do you have any comments on our proposed five year minimum notice period for revocation for spectrum management reasons?

Other licence requirements

5.50 The general terms and conditions of the licence will closely follow that of our other licences set out in the Wireless Telegraphy General Licence Conditions Booklet[19] published February 2006. A copy of the draft licence can be found in Annex 5 of this document. It sets out the following conditions:

[19] http://licensing.ofcom.org.uk/binaries/spectrum/regulations-technical-reference/General_Licence_Conditions.pdf

- licence term, variation and revocation process;
- how changes to the licence will be managed;
- licence fees and their payment;
- the ability of Ofcom employees to access and inspect equipment; and
- power for Ofcom to require the modification, restriction and closedown of equipment.

Section 6

Longer term evolution of licensing regime

Long-term licensing of MCWSDs

6.1 When formulating the proposed licence conditions for licensing MCWSDs above, we have considered the licensing regime as a transitional arrangement that will allow the benefits of the TVWS framework to be realised while equipment is developed that is capable of meeting our licence exemption regulations. Licence exemption remains our preferred approach to implementing the TVWS framework.

6.2 However, we recognise that there may be circumstances under which MCWSDs might need to be licensed on a longer term basis. For example, it may not be possible for WSDs to report their location in all cases, for example in some indoor locations, or it may be that businesses with a professional interest in radio installation have other ongoing needs for MCWSDs. It is not our expectation that MCWSDs would be mass market devices.

6.3 In these circumstances, we recognise that it might be appropriate for Ofcom to license MCWSDs on an ongoing basis. Our objectives for a longer term licensing regime for MCWSDs would likely be different to our objectives when authorising MCWSDs as a transitional measure and consequently we anticipate that the licence conditions for an ongoing licensing regime may need be different to those set out above for the transitional licensing arrangement. For example, we may need to reconsider whether the licence fee of £1,500 remains appropriate in the longer term. If the numbers of MCWSDs were to increase in a longer term licensing arrangement, we would need to consider what process would need to be put in place for interference management purposes, for example, relating to holding more detailed information of individual installations of MCWSDs. However, we would expect to consult on the detail of any such licensing regime.

6.4 We would be interested in views on whether there is likely to be a case for allowing manual configuration on an ongoing basis and, if so, what the likely use cases are and why it would not be possible for them to operate under the licence-exemption.

Question 15: Do you believe there is likely to be an ongoing need for white space devices that allow some level of manual configuration? Please give reasons for your answer.

Enhanced mode

6.5 Stakeholders have previously spoken to Ofcom about the possibility that some WSDs could be allowed greater availability to white space than currently allowed, dependent on their technical characteristics. Some fixed WSDs may have technical characteristics that would allow them to benefit from better TVWS availability without increasing the probability of harmful interference, than would currently be allowed by a database on the basis of their device parameters alone. These additional technical characteristics could be antenna directionality, polarisation, and position (such as whether the device is fixed indoor or outdoor). For instance, if the antenna has high directivity and points in a suitable direction, it may cause less interference and hence could be allowed to transmit at higher power. If the database had knowledge of

additional information for WSDs, it would be able to provide better availability for fixed WSDs. We refer to this as 'enhanced mode'.

6.6 Our main concern to date with allowing fixed WSDs to operate in enhanced mode was the suitability of licence exemption for such an operation. The arguments against allowing enhanced mode under a licence exemption are similar to those arguments against allowing MCWSDs to operate under a licence exemption, as discussed in section 3. Namely, enhanced mode requires a qualified operator to communicate the device parameters and additional information about the WSD's technical characteristics to a database to avoid increasing the probability of harmful interference, and for this reason should not be available to unidentified users.

6.7 The licensing regime proposed to authorise the deployment of MCWSDs could be an important foundation for allowing WSDs of certain technical characteristics to operate in enhanced mode. A licensing regime would mitigate our concerns that technical characteristics about the device could be provided incorrectly, as it would require licensed users to provide the additional device characteristics to the databases.

6.8 Ofcom would need to specify the calculations that take advantage of the additional characteristics prior to this type of operation and do so in a way that was consistent with our objective that WSDs should only create a low probability of harmful interference to existing users of, and adjacent to, the UHF TV band. We would consider this at a later date if there was evidence that there would be a benefit from allowing devices operating in enhanced mode.

Question 16: Do you believe there is merit in exploring allowing enhanced operation through a licensing regime in the future and if so what additional capabilities should be allowed?

Section 7

Next steps

7.1 We are inviting views and comments on the proposals in this document by 24 April 2015. Thereafter we propose to publish a statement in summer 2015. If we decide to proceed with the proposals in this document, we expect to notify and publish an Interface Requirement alongside the statement.

7.2 In parallel with this consultation, we will be implementing the framework for dynamic spectrum sharing in the UHF TV band as explained in our TVWS framework Statement. One of the key next steps is to designate databases. We are targeting the completion of that process by around summer 2015, subject to further discussions with the databases concerned.

7.3 If we decide to proceed with the proposals set out in this consultation then we anticipate that those wishing to deploy MCWSDs could apply for licences shortly after the implementation of the licence exemption, which we anticipate will come into effect towards the end of 2015.

Annex 1

Responding to this consultation

How to respond

A1.1 Ofcom invites written views and comments on the issues raised in this document, to be made **by 5pm on 24 April 2015**.

A1.2 Ofcom strongly prefers to receive responses using the online web form at http://stakeholders.ofcom.org.uk/consultations/manually-configurable-wsds/howtorespond/form, as this helps us to process the responses quickly and efficiently. We would also be grateful if you could assist us by completing a response cover sheet (see Annex 3), to indicate whether or not there are confidentiality issues. This response coversheet is incorporated into the online web form questionnaire.

A1.3 For larger consultation responses - particularly those with supporting charts, tables or other data - please email TV.WhiteSpaces@ofcom.org.uk attaching your response in Microsoft Word format, together with a consultation response coversheet.

A1.4 Responses may alternatively be posted to the address below, marked with the title of the consultation.

Rachael Morris
Spectrum Policy Group
Floor 3
Ofcom
Riverside House
2A Southwark Bridge Road
London SE1 9HA

A1.5 Note that we do not need a hard copy in addition to an electronic version. Ofcom will acknowledge receipt of responses if they are submitted using the online web form but not otherwise.

A1.6 It would be helpful if your response could include direct answers to the questions asked in this document, which are listed together at Annex 4. It would also help if you can explain why you hold your views and how Ofcom's proposals would impact on you.

Further information

A1.7 If you want to discuss the issues and questions raised in this consultation, or need advice on the appropriate form of response, please contact Rachael Morris on 020 7981 3685.

Confidentiality

A1.8 We believe it is important for everyone interested in an issue to see the views expressed by consultation respondents. We will therefore usually publish all responses on our website, www.ofcom.org.uk, ideally on receipt. If you think your

response should be kept confidential, can you please specify what part or whether all of your response should be kept confidential, and specify why. Please also place such parts in a separate annex.

A1.9 If someone asks us to keep part or all of a response confidential, we will treat this request seriously and will try to respect this. But sometimes we will need to publish all responses, including those that are marked as confidential, in order to meet legal obligations.

A1.10 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to Ofcom to use. Ofcom's approach on intellectual property rights is explained further on its website at http://www.ofcom.org.uk/terms-of-use/

Next steps

A1.11 Following the end of the consultation period, Ofcom intends to publish a statement in summer 2015.

A1.12 Please note that you can register to receive free mail Updates alerting you to the publications of relevant Ofcom documents. For more details please see: http://www.ofcom.org.uk/email-updates/

Ofcom's consultation processes

A1.13 Ofcom seeks to ensure that responding to a consultation is easy as possible. For more information please see our consultation principles in Annex 2.

A1.14 If you have any comments or suggestions on how Ofcom conducts its consultations, please call our consultation helpdesk on 020 7981 3003 or e-mail us at consult@ofcom.org.uk . We would particularly welcome thoughts on how Ofcom could more effectively seek the views of those groups or individuals, such as small businesses or particular types of residential consumers, who are less likely to give their opinions through a formal consultation.

A1.15 If you would like to discuss these issues or Ofcom's consultation processes more generally you can alternatively contact Graham Howell, Secretary to the Corporation, who is Ofcom's consultation champion:

Graham Howell
Ofcom
Riverside House
2a Southwark Bridge Road
London SE1 9HA

Tel: 020 7981 3601

Email: Graham.Howell@ofcom.org.uk

Annex 2

Ofcom's consultation principles

A2.1 Ofcom has published the following seven principles that it will follow for each public written consultation:

Before the consultation

A2.2 Where possible, we will hold informal talks with people and organisations before announcing a big consultation to find out whether we are thinking in the right direction. If we do not have enough time to do this, we will hold an open meeting to explain our proposals shortly after announcing the consultation.

During the consultation

A2.3 We will be clear about who we are consulting, why, on what questions and for how long.

A2.4 We will make the consultation document as short and simple as possible with a summary of no more than two pages. We will try to make it as easy as possible to give us a written response. If the consultation is complicated, we may provide a shortened Plain English Guide for smaller organisations or individuals who would otherwise not be able to spare the time to share their views.

A2.5 We will consult for up to 10 weeks depending on the potential impact of our proposals.

A2.6 A person within Ofcom will be in charge of making sure we follow our own guidelines and reach out to the largest number of people and organisations interested in the outcome of our decisions. Ofcom's 'Consultation Champion' will also be the main person to contact with views on the way we run our consultations.

A2.7 If we are not able to follow one of these principles, we will explain why.

After the consultation

A2.8 We think it is important for everyone interested in an issue to see the views of others during a consultation. We would usually publish all the responses we have received on our website. In our statement, we will give reasons for our decisions and will give an account of how the views of those concerned helped shape those decisions.

Annex 3

Consultation response cover sheet

A3.1 In the interests of transparency and good regulatory practice, we will publish all consultation responses in full on our website, www.ofcom.org.uk.

A3.2 We have produced a coversheet for responses (see below) and would be very grateful if you could send one with your response (this is incorporated into the online web form if you respond in this way). This will speed up our processing of responses, and help to maintain confidentiality where appropriate.

A3.3 The quality of consultation can be enhanced by publishing responses before the consultation period closes. In particular, this can help those individuals and organisations with limited resources or familiarity with the issues to respond in a more informed way. Therefore Ofcom would encourage respondents to complete their coversheet in a way that allows Ofcom to publish their responses upon receipt, rather than waiting until the consultation period has ended.

A3.4 We strongly prefer to receive responses via the online web form which incorporates the coversheet. If you are responding via email, post or fax you can download an electronic copy of this coversheet in Word or RTF format from the 'Consultations' section of our website at http://stakeholders.ofcom.org.uk/consultations/consultation-response-coversheet/.

A3.5 Please put any parts of your response you consider should be kept confidential in a separate annex to your response and include your reasons why this part of your response should not be published. This can include information such as your personal background and experience. If you want your name, address, other contact details, or job title to remain confidential, please provide them in your cover sheet only, so that we don't have to edit your response.

Cover sheet for response to an Ofcom consultation

BASIC DETAILS

Consultation title:

To (Ofcom contact):

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

CONFIDENTIALITY

Please tick below what part of your response you consider is confidential, giving your reasons why

Nothing ☐

Whole response ☐

Part of the response ☐

Name/contact details/job title ☐

Organisation ☐

If there is no separate annex, which parts?

If you want part of your response, your name or your organisation not to be published, can Ofcom still publish a reference to the contents of your response (including, for any confidential parts, a general summary that does not disclose the specific information or enable you to be identified)?

DECLARATION

I confirm that the correspondence supplied with this cover sheet is a formal consultation response that Ofcom can publish. However, in supplying this response, I understand that Ofcom may need to publish all responses, including those which are marked as confidential, in order to meet legal obligations. If I have sent my response by email, Ofcom can disregard any standard e-mail text about not disclosing email contents and attachments.

Ofcom seeks to publish responses on receipt. If your response is non-confidential (in whole or in part), and you would prefer us to publish your response only once the consultation has ended, please tick here. ☐

Name

Signed (if hard copy)

Annex 4

Consultation questions

A4.1 The following is a list of consultation questions raised in this document.

Question 1: Do you agree with our assessment of the likely costs and benefits of our proposal to license MCWSDs as a transitional arrangement? Please provide any available evidence to support your response.

Question 2: If you agree that Ofcom should allow MCWSDs to operate in the UHF TV band within the TVWS framework, how long do you believe that the licensing regime would need to be in place?

Question 3: If you agree that Ofcom should allow MCWSDs to operate in the UHF TV band within the TVWS framework, when do you believe it would be appropriate to conduct a review to assess whether there is an ongoing need to license MCWSDs?

Question 4: Do you agree with the proposed terms of the draft licence as set out in Annex 5 and as discussed below?

Question 5: Do you think it would be beneficial for the licensing regime for MCWDs to cover both masters and slaves?

Question 6: Do you agree that our licensing regime should only apply to type A devices?

Question 7: Do you agree with our approach to allow a number of MCWSDs under the control of a single licensee to be subject to a single licence?

Question 8: Do you agree that the proposal for specific licence terms will mitigate the risks posed by the use of MCWSDs?

Question 9: Do you consider the proposed licence terms are appropriate and proportionate?

Question 10: Do you have any comments on our proposal to require applicants for licences to deploy MCWSDs to supply details of their QA process on application?

Question 11: Do you agree with the proposed technical conditions of the draft licence?

Question 12: Do you have any comments on the proposed duration for this licence ?

Question 13: Do you have any comments on our proposed licence fee of £1,500?

Question 14: Do you have any comments on our proposed five year minimum notice period for revocation for spectrum management reasons?

Question 15: Do you believe there is likely to be an ongoing need for white space devices that allow some level of manual configuration? Please give reasons for your answer.

Question 16: Do you believe there is merit in exploring allowing enhanced operation through a licensing regime in the future and if so what additional capabilities should be allowed?

Annex 5

Draft licence for manually configurable white space devices

Wireless Telegraphy Act 2006

Licence for manually configurable white space devices

Licence number	
Licensee	
Licensee address	
Licence first issue date	
Licence version date	
Payment interval	

1. This Licence is issued by the Office of Communications ("Ofcom") on <date> and replaces any previous authority granted in respect of the service subject to this Licence by Ofcom or the Secretary of State.

2. This Licence authorises <name> (the "Licensee") to establish, install and/or use radio equipment transmitting and/or receiving stations and/or radio apparatus as described in the schedule (the "Radio Equipment") subject to the terms set out below.

3. Licence term

This Licence shall continue in force until revoked by Ofcom in accordance with paragraph 4 below or surrendered by the Licensee.

4. Licence variation and revocation

Pursuant to schedule 1, paragraph 8 of the Wireless Telegraphy Act 2006 (the "Act"), Ofcom may not vary or revoke this Licence under schedule 1, paragraph 6 of the Act except:

a) at the request of, or with the consent of, the Licensee;

b) if there has been a breach of a term of this Licence;

c) if, in connection with the transfer or proposed transfer of rights and obligations arising by virtue of the Licence, there has been a breach of any provision of regulations made by Ofcom under powers conferred by section 30 (1) and (3) of the Act[20];

d) in accordance with schedule 1, paragraph 8(5) of the Act;

e) if it appears to Ofcom to be necessary or expedient for the purposes of complying with a direction by the Secretary of State given to Ofcom under section 5 of the Act or section 5 of the Communications Act 2003; or

f) for reasons related to the management of the radio spectrum, provided that in such a case the power to revoke may only be exercised after at least five years' notice is given in writing.

Where Ofcom exercise their power to revoke or vary this Licence in accordance with schedule 1, paragraph 6 of the Act, the Licensee shall be notified in writing or by a general notice. Any general notice will be posted on the Ofcom website.

5. Transfer

This Licence may not be transferred. The transfer of rights and obligations arising by virtue of this Licence may however be authorised in accordance with regulations made by Ofcom under powers conferred by section 30 of the Act[21].

6. Changes

The Licensee must give Ofcom prior notice in writing of any proposed change to the Licensee's name and address from that recorded in the Licence.

7. Fees

The Licensee shall pay Ofcom the relevant sums as provided in section 12 of the 2006 Act and the Regulations made there under:

a) on or before the date of issue of the Licence; and

b) on or before the payment date shown on the Licence for subsequent payments or such other dates as shall be notified in writing to the Licensee, in accordance with those regulations and any relevant terms, provisions and limitations of the Licence.

8. Radio Equipment use

The Licensee must ensure that the Radio Equipment is established, installed and operated in accordance with the provisions of this Licence including the schedules to the Licence. Any proposal to amend any detail specified in the schedules to this Licence must be agreed with Ofcom in advance and implemented only after this Licence has been varied or reissued accordingly.

[20] These are regulations on spectrum trading.
[21] See Ofcom's website for the latest position on spectrum trading and the types of trade which are permitted.

The Licensee must ensure that the Radio Equipment is operated in compliance with the terms of this Licence and is used only by persons who have been authorised in writing by the Licensee to do so on behalf of the Licensee and that such persons are made aware of, and of the requirement to comply with, the terms of this Licence.

9. Access and inspection

The Licensee shall permit a person authorised by Ofcom:

a) to have access to the Radio Equipment; and

b) to inspect this Licence and to inspect, examine and test the Radio Equipment at any and all reasonable times or, when in the opinion of that person an urgent situation exists, at any time to ensure the Radio Equipment is being used in accordance with the terms of this Licence.

10. Modification, restriction and closedown

A person authorised by Ofcom may require any of the radio stations or radio apparatus that comprise the Radio Equipment to be modified or restricted in use or temporarily or permanently close down immediately if in the opinion of the person authorised by Ofcom:

a) a breach of a term of this Licence has occurred; and/or

b) the use of the Radio Equipment is causing or contributing to undue interference to the use of other authorised radio equipment.

Ofcom may require any of the radio stations or radio apparatus that comprise the Radio Equipment to be modified or restricted in use or temporarily closed down either immediately or on the expiry of such period as may be specified in the event of a national or local state of emergency being declared. Ofcom may only exercise this power after a written notice is served on the Licensee or a general notice applicable to holders of a named class of Licence is published.

11. Interpretation

In this Licence:

a) The “Act” means the Wireless Telegraphy Act 2006;

b) the establishment, installation and use of the Radio Equipment shall be interpreted as establishment or use of wireless telegraphy stations and installation or use of wireless telegraphy apparatus as specified in section 8 of the Act;

c) “inspect” includes examine and test;

d) the expression "interference" shall have the meaning given by section 115 of the Act; and

e) the expressions “wireless telegraphy apparatus” and “wireless telegraphy station” shall have the meanings given by section 117 of the Act.

The schedules to this Licence form part of this Licence together with any subsequent schedules that Ofcom may issue as a variation to this Licence at a later date.

The Interpretation Act 1978 shall apply to this Licence as it applies to an Act of Parliament.

ISSUED BY OFCOM

SCHEDULE 1 TO LICENCE NUMBER: [licence number]

1. Description of Radio Equipment licensed

The Radio Equipment means any wireless telegraphy stations or apparatus which is able to operate on frequencies within the band 470 to 790 MHz which have been determined by a designated white space database as being available for use in accordance with the requirements set out in Schedule 2 (“white space devices”). The Radio Equipment must be a Type A device.

2. Use of the Radio Equipment

Use of the Radio Equipment shall be in accordance with schedule 2 of this Licence.

The Radio Equipment shall at all times be installed, maintained and used in such a way that its use does not cause or contribute to any undue interference with the authorised use of any other radio equipment.

3. Quality assurance, record-keeping and provision of information

a) During the period that this Licence remains in force, the Licensee shall have in place a written quality assurance process to ensure the correct configuration of the Radio Equipment [in accordance with paragraph 5 of Schedule 2],

b) The Licensee shall submit to Ofcom information regarding the quality assurance process it has in place in accordance with paragraph 3(a) above in such manner and at such times as Ofcom may request.

c) During the period that this Licence remains in force and for six [6] months thereafter, the Licensee shall compile and maintain an accurate record of the each configuration or reconfiguration of:

   i) the Device Parameters of the Radio Equipment established, installed or used under this Licence; and

   ii) any other parameter reported by the Radio Equipment to a Designated White Space Database,

   in a way that sets out what the Device Parameters entered on each configuration or reconfiguration were, and explains how the Device Parameters were determined and communicated to a Designated White Space Database.

d) The Licensee shall submit to Ofcom in such format and in such manner as Ofcom may request copies of the records detailed in paragraph 3(c) above:

   i) following every establishment or installation of the Radio Equipment under this Licence; and

   ii) every time a change is made to the configuration of the Device Parameters or any other parameters reported by the Radio Equipment to a Designated White Space Database.

e) The Licensee shall give Ofcom access to the place where the records detailed in paragraph 3(c) above are kept.

f) The Licensee must also submit to Ofcom in such manner and at such times as Ofcom may request, all information relating to the establishment, installation or use of the Radio Equipment, whether stored in hard copy or electronic form, as reasonably requested for the purposes of verifying compliance with this Licence or for statistical or interference management purposes.

4. Geographical boundaries

The Licence authorises the Licensee to establish, install and use the Radio Equipment in the United Kingdom (which, for the avoidance of doubt, does not include the Channel Islands or Isle of Man).

5. Interpretation

In this Schedule:

a) "Designated White Space Database" means a database which [will be] listed in Schedule [1] of the [proposed] Wireless Telegraphy (White Space Devices) (Exemption) Regulations [2015];

b) "Device Parameters" means the following information:

i) information specifying that the device is a master device or a slave device;

ii) the white space device's unique identifier;

iii) information specifying that the white space device is Type A equipment;

iv) the location of the white space device expressed as its antenna latitude and longitude coordinates; and

v) the level of uncertainty in the accuracy of the white space device's antenna latitude and longitude coordinates, specified as $\pm\Delta x$ and $\pm\Delta y$ metres respectively (corresponding to a ninety-five per cent confidence level);

c) "Type A equipment" means a white space device which is intended for fixed use only and which has an integral, dedicated or external antenna, where:

i) Integral antenna means an antenna designed as a part of the Radio Equipment, without the use of an external connector, which cannot be disconnected from the equipment by a user with the intent to connect another antenna;

ii) Dedicated antenna means a removable antenna supplied and assessed with the Radio Equipment and which has been designed for use with that device; and

iii) External antenna means a removable antenna which has not been designed specifically for use with a specific product.

SCHEDULE [2] TO LICENCE NUMBER: [licence number]

Conditions for the use of the Radio Equipment

1. The Radio Equipment authorised under this Licence must be used in accordance with the conditions set out in this schedule.

General requirements

2. The Radio Equipment must not be used airborne.

3. The Licensee shall operate the Radio Equipment on a 'non-interference, non-protected' basis.

Master devices and slave devices

4. The Radio Equipment must be:

    a) a white space device that is able to communicate directly or indirectly with and obtain operational parameters from a Designated White Space Database ("a master device"); or

    b) a white space device that is only able to transmit when under the direction of a master device ("a slave device").

Accurate configuration

5. The Licensee must ensure that the Radio Equipment is configured correctly, so that on establishment, installation or use of the Radio Equipment the Device Parameters of the Radio Equipment, as well as any other parameters to be reported by the Radio Equipment to a Designated White Space Database, are accurately communicated to a Designated White Space Database.

Permitted Frequencies

6. The Radio Equipment must:

    a) transmit within the frequency band 470 to 790 MHz; and

    b) transmit on frequencies which have been determined by a Designated White Space Database as being available for use.

Maximum permissible e.i.r.p.

7. The maximum permitted E.I.R.P. for the Radio Equipment is 36 dBm/(8 MHz).

Master device requirements

8. If the Radio Equipment is a master device, it must:

    a) provide its Device Parameters to a Designated White Space Database when requesting master operational parameters and when requesting generic operational parameters for use by slave devices;

b) after having received master operational parameters from a Designated White Space Database, provide to the Designated White Space Database its Channel Usage Parameters;

c) only transmit in accordance with:

i) the master operational parameters that it has received from a Designated White Space Database; and

ii) the Channel Usage Parameters that it has reported to the Designated White Space Database;

d) only provide slave operational parameters to a slave device if those slave operational parameters have been provided to the master device by a Designated White Space Database;

e) provide to the Designated White Space Database from which it has received operational parameters:

i) when requesting specific operational parameters for use by a slave device, all Device Parameters, any other parameters which are reported to it by the slave device, and the master device's unique identifier;

ii) all Device Parameters and any other parameters which are reported to it by any slave devices which transmit using generic operational parameters which it has broadcast, as well as the master device's unique identifier; and

iii) the Channel Usage Parameters of any slave devices to which it has provided Slave Operational Parameters;

f) undertake an update process in respect of the operational parameters which a master device has received from a Designated White Space Database, under which:

i) a master device must verify with a Designated White Space Database if the operational parameters which it has received remain valid or are not valid; and

ii) a master device must undertake this update process within the time period specified in the operational parameter (T_{Update}), as described in paragraph 14(m)(vii); and

g) cease all transmissions, and instruct all slave devices to which it has provided slave operational parameters to cease all transmissions, if:

i) it is unable to verify that the operational parameters it is using are still valid in accordance with paragraph 8(f); or

ii) if a Designated White Space Database sends an instruction to the master device that the operational parameters it is using are not valid.

Reporting of parameters for a master device

9. Provision of information to a Designated White Space Database by a master device as required by paragraph 8(a) and 8(e)(i) may be communicated by the device itself or by the installer or operator of the device.

10. Provision of information to a Designated White Space Database by a master device as required by paragraph 8(b) and 8(e)(ii) must be communicated by the device itself and not by the installer or operator of the device.

Slave white space device requirements

11. If the Radio Equipment is a slave device, it must:

    a) in order to transmit using generic operational parameters, provide the information specified in paragraph 14(d)(i) and (ii) to a master device;

    b) in order to obtain and transmit using specific operational parameters, provide all its device parameters to a master device;

    c) after having received slave operational parameters from a master device, provide its Channel Usage Parameters to that master device, unless the Channel Usage Parameters have been determined by the master device;

    d) only transmit in accordance with:

        i) slave operational parameters which it has received from a master device; and

        ii) Channel Usage Parameters that have been determined by the slave device and reported to a master device or Channel Usage Parameters that have been determined by a master device for the slave device;

    e) cease all transmissions if:

        i) the slave device loses communications for more than five seconds with the master device that controls it; or

        ii) the slave device receives an instruction to cease transmissions from the master device that controls it.

Reporting of parameters for a slave device

12. Provision of information to a master device by a slave device as required by paragraph 11(a) and (b) may be communicated by the device itself or by the installer or operator of the device.

13. Provision of information to a master device by a slave device as required by paragraph 11(d)(ii) must be communicated by the device itself and not by the installer or operator of the device.

Interpretation

14. In this Schedule:

a) “Channel Usage Parameters” means the following information:

i) the lower and upper frequency boundaries within which the white space device will transmit; and

ii) the maximum in-block EIRP spectral density at which the white space device will transmit between each lower frequency boundary and its corresponding upper frequency boundary.;

b) “dBm” means decibels of power referenced to one milliWatt;

c) “dedicated antenna” means a removable antenna supplied and assessed with the Radio Equipment and which has been designed as an indispensable part of that device

d) “Device Parameters” means the following information;

i) information specifying that the device is a master device or a slave device;

ii) the white space device’s unique identifier;

iii) information specifying that the white space device is Type A equipment or Type B equipment;

iv) the location of the white space device expressed as its antenna latitude and longitude coordinates; and

v) the level of uncertainty in the accuracy of the white space device’s antenna latitude and longitude coordinates, specified as ±Δx and ±Δy metres respectively (corresponding to a ninety-five per cent confidence level);

e) “Designated White Space Database” means a database which [will be] listed in Schedule [1] of the [proposed] Wireless Telegraphy (White Space Devices) (Exemption) Regulations [2015];

f) “DTT channel” is an 8 MHz frequency channel in accordance with the European harmonised DTT channel raster;

g) “EIRP” means equivalent isotropic radiated power;

h) “external antenna” means a removable antenna which has not been designed specifically for use with a specific product;

i) “generic operational parameters” means slave operational parameters that can be used by all slave devices operating in the area in which transmissions from the master device can be received;

j) “in-block EIRP spectral density” means the EIRP specified in dBm over a bandwidth of 0.1 MHz and the EIRP specified in dBm over a bandwidth of 8 MHz where both EIRPs are measured within the DTT channels used by a white space device;

k) “integral antenna” means an antenna designed as a part of the Radio Equipment, without the use of an external connector, which cannot be disconnected from the device by a user in order to connect another antenna;

l) “kHz” means kilohertz;

m) “master operational parameters” means the following information:

i) the lower and upper frequency boundaries within which a master device may transmit;

ii) the maximum permitted in-block EIRP spectral density, in dBm over a bandwidth of 0.1 MHz, for each DTT channel within which a master device may transmit;

iii) the maximum permitted in-block EIRP, in dBm, for each DTT channel within which a master device may transmit;

iv) limits on the maximum total number of DTT channels that may be used at any given time and the maximum number of contiguous DTT channels that may be used at any given time;

v) the time period during which the operational parameters are valid;

vi) the geographic area within which the operational parameters are valid;

vii) the time period (T_{Update}) indicating how often (in seconds) a master device must check with a Designated White Space Database that the operational parameters it has received from that database are still valid; and

viii) information indicating if the simultaneous channel operation power restriction applies as specified in Schedule 3.

n) “MHz” means megahertz;

o) "non-interference, non-protected" means that the Radio Equipment must not cause undue interference to any other authorised wireless telegraphy stations or apparatus and no claim may be made for protection from undue interference originating from other authorised wireless telegraphy stations or apparatus;

p) “operational parameters” means master operational parameters or slave operational parameters;

q) “slave operational parameters” means the following information which may take the form of generic operational parameters or specific operational parameters:

i) the lower and upper frequency boundaries within which a slave device may transmit;

ii) the maximum permitted in-block EIRP spectral density, in dBm over a bandwidth of 0.1 MHz, for each DTT channel within which a slave device may transmit;

iii) the maximum permitted in-block EIRP, in dBm, for each DTT channel within which a slave device may transmit;

iv) limits on the maximum total number of DTT channels that may be used at any given time and the maximum number of contiguous DTT channels that may be used at any given time;

v) the time period during which the operational parameters are valid;

vi) the geographic area within which the operational parameters are valid; and

vii) information indicating if the simultaneous channel operation power restriction applies as specified in Schedule 3.

r) "specific operational parameters" means slave operational parameters that are specific to a particular slave device;

s) "Type A equipment" means a white space device which is intended for fixed use only and which has an integral, dedicated or external antenna;

t) "Type B equipment" means a white space device which is not intended for fixed use and which has a dedicated or integral antenna;

u) "unique identifier" means a set of characters comprising the unique serial number of a white space device, a white space device's model number or other identifier of the product family to which the white space device belongs and the unique identifier of the manufacturer of the white space device.

SCHEDULE [3] TO LICENCE NUMBER: [licence number]

Simultaneous channel operation

The simultaneous channel operation power restriction can take a value of 0 or 1.
A value of 1 indicates that, in case of simultaneous operation in multiple DTT channels, a white space device must restrict its maximum total EIRP to {P1,i} dBm, where P1,i is the in-block EIRP provided by the Designated White Space Database in the operational parameters for DTT channel i specified by the frequency pair fl,i, fu,i and where fl,i, is the frequency at the lower edge of the ith channel and fu,i is the frequency at the upper edge of the ith channel.
A value of 0 indicates that this restriction does not apply.

Annex 6

Glossary

Channel Usage Parameters means the information that a white space device reports back to a qualifying database regarding what specific channels and power levels it has decided to use to transmit at. The Channel Usage Parameters are selected by the white space device from the Operational Parameters provided by the database.

Communications Act 2003 is an Act of the Parliament of the United Kingdom. It consolidated the telecommunication and broadcasting regulators in the UK, introducing the Office of Communications (Ofcom) as the new industry regulator and its duties. http://www.legislation.gov.uk/ukpga/2003/21/contents

Device Parameters means the technical characteristics and the location of an individual white space device and includes Master Device Parameters and Slave Device Parameters.

DTT refers to Digital Terrestrial Television, the terrestrial platform for the delivery of TV content via broadcasting in the UHF TV band (DTT Channels 21 – 60 (470 to 790 MHz)).

Dynamic Spectrum Access (DSA) is a technology for a variety of reconfigurable radio equipment allowing it to select the frequency on which it will operate at a given location and over a given period of time to optimise the use of available spectrum and avoid interference with other radios or other systems.

EIRP refers to Equivalent Isotropically Radiated Power, the product of the power supplied to the antenna and the antenna gain relative to an isotropic antenna.

Enhanced mode is when a white space device is permitted greater availability to white space than it would otherwise be, based on its additional technical characteristics, such as antenna directionality, polarisation, and position.

ETSI is the European Telecommunications Standards Institute. They produce standards for information and communications technologies (ICT), including fixed, mobile, radio, converged, broadcast and internet technologies (http://www.etsi.org/).

Geolocation is a term used to describe the process of finding, determining and providing the exact location of an object. It enables device location based on geographical coordinates and measurements. Geolocation commonly uses Global Positioning System (GPS) and other related technologies to assess and specify geographical locations.

Generic Operational Parameters (GOPs) means the Operational Parameters generated by a database that any slave white space device within the coverage area of a given master white space device may use for its transmissions in the TV White Spaces.

GNSS (Global Navigation Satellite System) is a satellite system that is used to pinpoint the geographic location of a user anywhere in the world.

GPS (Global Positioning System) is a satellite based radio navigation system that allows users to determine their exact location, velocity, and time 24 hours a day, in all weather conditions, anywhere in the world (subject to there being an unobstructed line of sight to four or more GPS satellites).

Licence Exemption Regulation refers to the UK Statutory Instrument (SI) required for enabling TV White Space equipment to be used without the requirement of applying for a licence to operate in the UK. http://www.parliament.uk/business/bills-and-legislation/secondary-legislation/statutory-instruments/

Master Device Parameters means the Device Parameters for a master white space device.

Master Operational Parameters means the Operational Parameters that a specific master white space device shall use for its transmissions in the TV white spaces.

Master WSD means a white space device that is able to communicate with a database and with other white space devices.

Manually configurable white space device (MCWSD) means an item of wireless telegraphy equipment which operates in TV White Spaces and requires the user to configure its Device Parameters, including its location, on installation.

MHz means Megahertz. A unit of frequency, representing one million cycles per second. 1 Hz (Hertz) is one cycle per second. 1 Megahertz (1 MHz) = 1,000,000 Hertz (or 1000 kHz).

Operational Parameters means the technical parameters generated by a database that contains the characteristics, such as frequencies and powers that a specific white space device shall use for its transmissions in the TV White Spaces. The term is also used as an umbrella to cover the Master Operational Parameters, the Generic Operational parameters and the Specific Operational Parameters

Pilot means the TV White Spaces conceptual framework designed by Ofcom in consultation with Industry to:

- test the proposed framework for the use of TV White Spaces by white space devices and Ofcom's co-existence proposals;
- provide stakeholders with the opportunity to conduct their own trials; and
- enable the Operator and All Other Operators to consider TV White Space availability and evaluate their internal business case

PMSE (Programme Making and Special Events) is a class of radio application that supports a wide range of activities in entertainment, broadcasting, news gathering and community events.

Slave Device Parameters means the Device Parameters for a slave white space device.

Slave WSD means a white space device that is only able to communicate with other white space devices and not with a database.

TV White Space Device (TVWSD) or **White Space Device (WSD)** means an item of wireless telegraphy equipment which operates in TV White Spaces.

TV White Space Database (TVWSDB) or **White Space Database (WSDB)** means a database system which can communicate with white space devices and provide information on TV White Space availability.

Wi-Fi is a facility allowing computers, smartphones, or other devices to connect to the Internet or communicate with one another wirelessly within a particular area.

Wireless Telegraphy Act 2006 is an Act of the Parliament of the United Kingdom. This Act repealed the Wireless Telegraphy Act 1949 and consolidated enactments about wireless telegraphy. http://www.legislation.gov.uk/ukpga/2006/36/contents.

Wireless Telegraphy Register provides information about who is licensed to operate services in specific frequencies or geographical areas.