



Implementing Geolocation

Summary of consultation responses and next steps

Statement

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Section 1

Executive Summary

White space devices and implementation of geolocation databases

- 1.1 The term white space (or interleaved) spectrum describes a range of frequencies that are not in use by the licensee all of the time at all locations. A white space device (WSD or devices) can make use of those frequencies provided interference is not caused to the licensed users of the spectrum.
- 1.2 Location-aware wireless devices coupled with a central database of spectrum usage in different locations offer the promise of being able to access, in an opportunistic way, underutilised frequency bands around the United Kingdom for innovative and useful services.
- 1.3 This document summarises our approach to implementing the geolocation method to allow licence exempt wireless devices to access TV white space (TVWS) spectrum¹, based on the responses to our consultation of November 2010 (the “November 2010 Consultation”).
- 1.4 In our November 2010 Consultation we said that, subject to the responses, Ofcom would need to:
 - Consult on and later publish a Statutory Instrument (SI) exempting appropriate devices from the need to be covered by a Wireless Telegraphy Act licence;
 - Make arrangements to enable information about licensed services in the relevant spectrum to be made available to a database; and
 - Specify requirements to be met by geolocation database(s) and their providers that wish to be accredited by Ofcom and listed on our website.
- 1.5 We have now considered responses to the November 2010 Consultation carefully and have decided that these are the appropriate next steps. This statement presents our considerations in reaching these decisions and conveys further detail on how we will work to achieve them.

Protection of existing licensees

- 1.6 We will allow WSDs to access the TV white space providing that no harmful interference is caused to existing services, including: Digital Terrestrial Television (DTT) services, Programme Making and Special Events (PMSE) users or other future licensed users. The responses to the November 2010 Consultation and our work to date leads us to believe that this is achievable for a number of reasons, including:
 - The further work undertaken by Ofcom and others in defining the geolocation database approach; and

¹ Including frequencies between 470 and 790MHz.

- The ultimate ability of the regulator to control the emission levels allowed by databases and to prevent WSDs from transmitting if necessary, so that any harmful interference is avoided.

1.7 In line with some of the respondents to the November 2010 Consultation, we believe practical trials and demonstrations are necessary to validate that using the geolocation approach effectively prevents harmful interference. We welcome the first trials that are now underway in the UK, in Bute and Cambridge. We will monitor these trials and consider, where possible, any findings relevant to the prevention of harmful interference.

Appropriate conditions for exempting WSDs

1.8 Overall, we concluded that while the market for WSDs is far from certain, there is substantial interest and a potential for significant value to be generated if some of these applications are successful. Equally, there is a wide range of potential applications and technologies, implying that a high degree of flexibility should be provided in our implementation approach. We believe that the extent of WSDs in circulation is not relevant as their use is subject to causing no undue interference. We further believe that practical testing of WSDs will be beneficial in addressing the remaining uncertainty around future applications and likely market.

1.9 In summary, we will continue on the principle that WSDs will operate on a licence exempt basis and in our view the draft structure of the SI remains the correct way forward subject to further investigating a number of suggestions proposed by the respondents to the November 2010 Consultation.

Enabling timely access to TVWS spectrum and harmonised device standards

1.10 We believe that enabling a harmonised approach to WSDs across is the best way to ensure the maximum value is obtained from the spectrum for UK citizens and consumers. Therefore our objective will be to help progress the European harmonised standards for WSDs in a timely manner in line with Ofcom and UK objectives. Our proactive work within Europe to date is testament to this. The majority of respondents supported this approach. We have previously worked closely with the relevant European bodies and see our continued involvement as critical.

1.11 However, we acknowledge that work within Europe is still at an early stage and the development of the relevant standards could take several years to complete, potentially delaying the deployment of innovative new services. We do not wish the emergence of European harmonised standards to be an impediment in the meantime. This leads us to the position of continuing to drive work forward within Europe towards European harmonisation and enacting national regulations for the UK. We have decided to enable deployment of WSDs in the UK by preparing and consulting on exemption regulations through an SI, which may make reference to a published Interface Requirement (IR) document referencing a voluntary national specification (VNS). Once the European standards are complete, they will supersede the relevant national regulations.

1.12 If a Harmonised Standard was not available within a suitable timeframe then we would expect manufacturers and other industry parties to work closely to achieve appropriate proposals for a VNS to cover this area. We will work closely with them to ensure these are appropriate and, in particular, will not cause harmful interference.

Requirements of databases and database providers

- 1.13 Responses to consultations and workshops held with key stakeholders have led us to conclude that many different database ownership options might emerge. We have decided at this stage that our approach should favour neither closed nor open database approaches, but that it should be flexible and enable the appropriate solutions to be decided by the market which emerges, not the regulator.
- 1.14 There was general agreement on the high-level approach contained in the November 2010 Consultation. Our decision is to continue with the high-level approach, to take account of some of the responses and to further refine our approach in the coming months. In particular:
- We will undertake further work to determine whether it is appropriate to remove the requirement for a database to respond to a request from a WSD within 10 seconds. At this stage we have insufficient evidence to conclude whether our requirement for database providers to update their algorithms within one week is too stringent; and
 - We acknowledge there are a range of issues around securing data held in the databases and the interactions with WSDs. We will discuss these matters with potential database providers in the coming months. This may be an area where we seek to consult again on the detailed requirements for database providers in due course.
- 1.15 Respondents were broadly supportive of the proposed responsibilities of database providers. Therefore we will use these as the principles when making contractual or regulatory arrangements with third party database providers. Those third parties interested in running a database will need to apply to Ofcom for a listing on a website hosted by Ofcom (or a trusted party) from which WSDs can then select their preferred database. Ofcom will need to consider applications against certain minimum requirements and may require entry into a contract and payment for the listing of the database.
- 1.16 We will now work to further define appropriate minimum requirements that third parties providing the database functionality would need to meet in their applications for a listing. We also expect this work to provide additional clarity on the legal responsibilities of database providers. If necessary, we will consult on these more detailed requirements in due course.
- 1.17 We will also work to define and create an appropriate website or database hosted by Ofcom (or a trusted party) with listings of third party geolocation databases which WSDs can use to select their preferred database.

Next steps

- 1.18 Ofcom will now:
- Investigate arrangements, in co-operation with industry partners, to enable information about licensed services in the relevant spectrum to be made available to a database;
 - Specify requirements to be met by geolocation database(s) and their providers that wish to be accredited by Ofcom and listed on our website; and

- Prepare and consult on a draft IR document and VNS as the basis for licence exemption of TVWS devices in the UK.

1.19 We will do this by:

- Continuing to engage closely with all relevant parties on both UK-specific issues and on the steps required to achieve a harmonised European regulatory approach. Relevant parties include incumbent stakeholders (such as the DTT and PMSE communities), WSD manufacturers and potential database providers;
- Working closely with any white space trials and their participants to monitor the ability of the technology to manage harmful interference; and
- Establishing likely costs and issues with ongoing provision of the data required by the geolocation database, and clarifying any necessary commercial arrangements.

1.20 We believe with this statement we have set out our next steps to establish a regulatory framework to enable WSDs and geolocation databases to emerge in the UK. We recognise there are a number of issues that remain where further detail is required, and there may be the need for more decisions on behalf of the regulator which could require consultation.

1.21 In this statement we have considered WSDs operating in TV white spaces. We note that the technology has the possibility of being usefully applied elsewhere in the radio spectrum to ensure it is used to maximum benefit. For example, it may have potential in making spectrum available for new uses following any switch to digital radio services. Alternatively it may be helpful in exploiting some of the public sector spectrum holdings. We will continue to consider other areas of the radio spectrum where WSDs may be of benefit.

Section 2

Background

- 2.1 Since its launch in 2005, our Digital Dividend Review (DDR) has considered how to make the spectrum freed up by digital switchover (DSO) available for new uses². This includes the capacity available within the spectrum that will be retained to carry the six DTT multiplexes after DSO, and lies between 470 and 790MHz. This is known as interleaved spectrum because not all this spectrum in any particular location will be used for DTT and so is available for other services as long as they can interleave their usage around the primary users.
- 2.2 While it is not clear what applications will emerge in the white spaces, suggestions have included rural broadband, Wi-Fi routers with increased range, city-wide broadband data networks, increased wireless device interconnectivity, hospital data networks and much more.
- 2.3 Enabling devices that could use this spectrum, termed cognitive or WSDs, aligns with many of our duties both in furthering the interests of citizens and consumers and those duties related to spectrum. WSDs might enable competition in communications services benefitting consumers as well as, for example, better rural broadband providing citizen benefits. They will increase the efficiency of use of the spectrum retained for broadcasting, are likely to bring economic benefits and many expect they will be a fertile area for the emergence of innovative services and applications.

Previous consultations on cognitive devices

- 2.4 We issued a statement on 13 December 2007 entitled “Digital Dividend Review: A statement on our approach”, (the “December 2007 Statement”) where we considered our approach to awarding the digital dividend³. Specifically, we considered the use of interleaved spectrum by licence-exempt devices (i.e. those exempted from the need to be licensed under the Wireless Telegraphy Act 2006⁴). We concluded that we should allow access by licence-exempt devices to interleaved spectrum as long as we were satisfied that it would not cause harmful interference to licensed uses, including DTT and PMSE. This is because the applications that such devices might enable could potentially bring substantial benefits to citizens and consumers.
- 2.5 We published a consultation entitled “Digital dividend: cognitive access. Consultation on licence-exempting cognitive devices using interleaved spectrum”⁵ on 16 February 2009. This predominately consulted on the sensing threshold levels that would be needed for licence-exempt devices making use of sensing alone.
- 2.6 In a subsequent statement entitled “Digital dividend: cognitive access. Statement on licence-exempting cognitive WSDs using interleaved spectrum” published on 1 July 2009⁶ (the “July 2009 Statement”), we noted that there were three mechanisms that could be used by a licence-exempt device operating in these bands to determine which frequencies it could use to make transmissions.

² See <http://stakeholders.ofcom.org.uk/spectrum/project-pages/ddr/> for more information about the DDR, including previous publications.

³ www.ofcom.gov.uk/consult/condocs/ddr/statement/statement.pdf

⁴ www.opsi.gov.uk/acts/acts2006/pdf/ukpga_20060036_en.pdf.

⁵ <http://stakeholders.ofcom.org.uk/consultations/cognitive/>

⁶ <http://stakeholders.ofcom.org.uk/binaries/consultations/cognitive/statement/statement.pdf>

2.7 These were:

- Sensing (also known as detection): where devices monitor frequencies for any radio transmissions and if they do not detect any, assume that the channel is free and can be used;
- Geolocation: where devices determine their location and query a “geolocation” database which returns the frequencies they can use at their current location. The devices are prohibited from transmitting until they have successfully determined from the database which frequencies, if any, they are able to transmit on in their location. In this case parameters such as location accuracy and frequency of database enquiry are important; and
- Beacon transmission: where a network of fixed transmitters or base stations are established around the country and broadcast signals informing devices as to which channels are free in the vicinity⁷.

2.8 We concluded that beacon transmission was inferior to the other two approaches and that we would not consider it further. This is because it required the establishment of a costly infrastructure and because it was inherently inefficient in that beacon transmissions needed to be restricted to smaller areas than the available white space in order to avoid the risk of interference occurring due to unexpected propagation of the beacon signal. However, we will reassess this conclusion if new proposals for beacons are put forwards.

2.9 We noted that there were advantages and disadvantages to both sensing and geolocation. While sensing does not require any form of infrastructure, and hence devices could be autonomous, sensing to very low signal levels is costly and possibly not achievable. Geolocation does not have the inconveniences of sensing but requires a database to be established and kept up to date.

2.10 At this stage in the development we concluded that it was appropriate to proceed with regulation enabling both sensing and geolocation in order to enable device developers to select their preferred approach.

2.11 In the July 2009 statement we set out the device parameters needed for sensing although we did not issue an SI, preferring to delay this until such time as there was a clear need.

Geolocation

2.12 On 17 November 2009, we published a discussion document⁸ entitled “Digital Dividend: Geolocation for Cognitive Access. A discussion on using geolocation to enable licence-exempt access to the interleaved spectrum” (the “November 2009 Consultation”).

⁷ Note we only considered beacon transmission in general and not specific cases such as the use of beacons to protect wireless microphones (which is generally not needed in the UK).

⁸ See <http://www.ofcom.org.uk/consult/condocs/cogaccess/>

- 2.13 The responses to the November 2009 Consultation⁹ were predominantly supportive to our proposed way ahead with some useful suggestions for improvement or for additional flexibility.
- 2.14 Our conclusions from these responses were that:
- Our approach of setting out the key parameters we would expect to see transferred to and from the database is appropriate. We should let industry and standards bodies determine the detailed protocols.
 - We should be flexible with regards to the number and form of databases. However, each database would need to be registered and there must be a mechanism to verify its correctness.
 - An implication of this is that there will need to be an agreed process whereby all database owners can download the parameters of licensed operation from single databases likely owned by the PMSE band manager and the broadcasters.
 - At present we should require translation within the database, not the device. Licence holders find this preferable and there is little call for device translation. However, we might review this decision in the future.
 - Providing a time-validity stamp to the data is a better solution than setting a minimum update time. The default might be two hours initially.
 - Database providers can use push technology as well if they wish but it is not something we need to incorporate into any regulations at this point.
 - Further discussion was needed with licence holders and other stakeholders to set the parameter values used in the propagation modelling.
 - There does not appear to be any reason to prevent bodies other than Ofcom hosting any databases as long as they are appropriately regulated.
 - There is little consensus on what any costs might be and where they should fall. However, it is not clear that this issue needs to be addressed immediately and might best be revisited as the market structure becomes clearer.
- 2.15 Based on the responses that we received, workshops held with key stakeholders and further analysis and thinking, we concluded in our consultation “Implementing geolocation”¹⁰ published in November 2010 (the “November 2010 Consultation”) that:
- The device would be licence exempt.
 - In order that Ofcom can manage the databases the device would initially consult an Ofcom list of databases and select from this its preferred database.
 - The device would contact this preferred database and provide as a minimum its location, the accuracy of that location (unless better than 100m¹¹), its model

⁹ See <http://stakeholders.ofcom.org.uk/consultations/cognitive/?showResponses=true>

¹⁰ <http://stakeholders.ofcom.org.uk/binaries/consultations/geolocation/summary/geolocation.pdf>

¹¹ Since we are assuming 100m pixels for coverage modelling, any greater accuracy than 100m for location will probably not bring benefits and hence we assume a default value of 100m.

identifier¹² and height above ground level if mounted on a mast or similar. It might also provide further information including the amount of data it wished to receive in response.

- The database would return an information set which must include start and end frequencies for available bands, associated maximum power levels, a time validity for the information and a notification of any requirement for sensing to be used in addition.
- Many different database ownership options might emerge and we should be as flexible as possible in allowing one or more databases and providing mechanisms for future changes.

2.16 We further set out the following consultation questions:

Q1: What are your views on the likely use and take-up of WSDs? Do you intend to participate in this area, for example by hosting a pilot or developing equipment?

Q2: Are these appropriate conditions for licence exempting the WSDs?

Q3: Is the lack of European harmonised standards problematic for development of WSDs?

Q4: Do you have any comments on these requirements? Are there any other requirements that should be placed on the database?

Q5: Do you have any comments on these responsibilities?

Q6: Might you be interested in becoming a database provider? If so, can you provide more details on the extent and timing of likely provision?

Q7: Is our approach of working with Europe where possible but moving ahead alone if no European approach appears forthcoming appropriate or should we await European harmonisation regardless of how long this might take?

2.17 We stated that subject to responses to the November 2010 Consultation, we would then need to:

- Consult on and later publish a SI exempting appropriate devices from the need for a licence;
- Make arrangements to enable information about licensed services in the relevant spectrum to be made available to a database; and
- Specify requirements to be met by geolocation database(s) that wish to be listed on the Ofcom website.

2.18 This statement sets out the responses to the November 2010 Consultation and Ofcom's consideration as well as next steps.

¹² This will be a unique text string set by the manufacturer at the time of placing the device on the market and communicated to the database provider. For example, it might have a form such as "MOT-WSD-M635". The information can be used to tailor responses according to the devices out-of-band emissions, if known, or to apply different regulation to particular classes of device as appropriate

Section 3

Implementing geolocation

Introduction

- 3.1 A key element in enabling WSDs in the TV bands¹³ is the definition and provision of a database which, given a device's location, can tell the device which frequency channels and power levels it is able to use without causing harmful interference to other licensed users in the vicinity. We expect that such a database may need to service millions of requests per day and that servicing each request may require a material amount of data processing.
- 3.2 We consulted on the requirements that should be placed on the database, the responsibilities that should be met by the database providers, as well as canvassing interest from those who may wish to be database providers.

Responses and Ofcom's consideration

- 3.3 The closing date for responses was 7 December 2010. Ofcom received 40 responses to the November 2010 Consultation, from a range of industry stakeholders, organisations, community groups and individuals. The responses were broadly supportive of our approach to implementing geolocation databases. However, we acknowledge some stakeholders' concerns about protecting existing services, in particular DTT and PMSE, from harmful interference.
- 3.4 We have published those responses which are not confidential¹⁴ and a list of those respondents who did not request their details to be kept confidential is in Annex 1.

General consideration: Harmful interference

- 3.5 Existing licensees in the bands concerned want to ensure that WSDs do not cause harmful interference to their services. We take this concern very seriously. It is our duty to secure an optimal use of the spectrum. This means ensuring that it is used as efficiently as possible without harmful interference being caused.

Our general duties

- 3.6 Under section 3(1) of the Communications Act, it is our principal duty in carrying out our functions:
- To further the interests of citizens in relation to communications matters; and
 - To further the interests of consumers in relevant markets, where appropriate by promoting competition.
- 3.7 In carrying out this principal duty, we are required to secure a number of objectives such as the desirability of promoting competition, investment and innovation.

¹³ In white space between 470 and 790MHz.

¹⁴<http://stakeholders.ofcom.org.uk/consultations/geolocation/?showResponses=true>

Our spectrum duties

3.8 In carrying out our general duties, we are required to secure in particular the optimal use of the electromagnetic spectrum for wireless telegraphy and to have regard to the different needs and interests of all persons who may wish to make use of the spectrum for wireless telegraphy.

3.9 In addition, in carrying out our spectrum functions, we are specifically required to have regard in particular to:

- The extent to which the spectrum is available for use or further use for wireless telegraphy;
- The demand for use of that spectrum for wireless telegraphy;
- Band emissions, if known, or to apply different regulation to particular classes of device as appropriate; and
- The demand that is likely to arise in future for the use of that spectrum for wireless telegraphy;

and to have particular regard to the desirability of promoting:

- The efficient management and use of the spectrum for wireless telegraphy;
- The economic and other benefits that may arise from the use of wireless telegraphy;
- The development of innovative services; and
- Competition in the provision of electronic communications services.

Our duties in relation to the proposed licence exempt access

3.10 We believe that, in particular, licence-exempt access to these bands will promote efficient use of spectrum, bring economic benefits, allow the emergence of innovative services and may lead to increased competition. We set out why we believe this in detail in the November 2010 Consultation. Our reasoning continues to apply to this statement.

Conclusion

3.11 We will allow WSDs to access the TV white space providing that no harmful interference is caused to existing services, including: DTT services, PMSE users or other future licensed users. The responses to the November 2010 Consultation and our work to date leads us to believe that this is achievable for a number of reasons, including:

- The further work undertaken by Ofcom and others in defining the geolocation database approach; and
- The ultimate ability of the regulator to control the emission levels allowed by databases and to prevent WSDs from transmitting if necessary, so that any harmful interference is avoided.

- 3.12 In line with many of the respondents to the November 2010 Consultation, we believe practical trials and demonstrations are necessary to validate that using the geolocation approach effectively prevents harmful interference. We welcome the first trials that are now underway in the UK, in Bute and Cambridge. We will monitor these trials closely and work with licensees and the participants in these and any future trials to ensure that the database approach is demonstrated as a way to successfully prevent harmful interference. If appropriate and necessary, we will explore the possibility of undertaking trials ourselves.
- 3.13 In summary, we believe the regulator's ability to control interference in a direct manner through use of the database and other safeguards that are discussed in this document to react to any unforeseen circumstances, mean we can proceed with little risk of harmful interference being caused to existing licensees. We also acknowledge that there remain details and practical issues to be finalised with respect to demonstrating compliance in order to place WSDs on the market.

Question 1: What are your views on the likely use and take-up of WSDs? Do you intend to participate in this area, for example by hosting a pilot or developing equipment?

- 3.14 A range of views were expressed with a majority indicating a strong expectation for a large growth in this area. Other respondents felt that it was too early to predict future market growth, as supporting technology and the regulatory framework are currently at a relatively early stage.
- 3.15 There were mixed views on timing with some agreeing with our estimate that it would take until around 2014 for a mass market to develop, while others said that the timing would be faster than we predicted.
- 3.16 One respondent noted that the amount of white space spectrum might reduce over time and that inefficient protocols might also reduce usefulness, dampening demand. They, and several others, recommended trials to resolve some of these issues as well as enabling interference concerns to be tested.
- 3.17 Ideas for use of WSDs range from wide area applications, such as the provision of rural broadband, to enhanced local area networking. A number of respondents suggested machine-to-machine communications would be a major growth area. Specific examples included telemedicine or smart grid applications, in which energy consumption can be remotely measured and controlled.
- 3.18 We asked about stakeholders' involvement in developing WSDs or in undertaking or monitoring trials of related technology. Approximately half of the respondents indicated that they are either currently engaged in such activities, or would be interested in doing so.

Conclusion

- 3.19 Overall, we conclude that while the market for WSDs is far from certain, there is substantial interest and a potential for significant value to be generated if some of these applications are successful. Equally, there is a wide range of potential applications and technologies, implying that a high degree of flexibility should be provided in our implementation approach. We believe that the extent of WSDs in circulation is not relevant as their use is subject to no undue interference. We further believe that practical testing of WSDs will be beneficial in addressing the remaining uncertainty around future applications and likely market.

Question 2: Are these appropriate conditions for licence exempting the WSDs?

- 3.20 In our November 2010 Consultation we proposed a regulatory package which aimed to implement regulations for the use of WSDs through an SI. This question asked whether the structure of the SI and associated conditions were appropriate for licensing exempting WSDs.
- 3.21 The majority of respondents agreed that the conditions are appropriate, either as they stand or with suggested modifications. Some respondents, however, felt that the SI does not adequately offer sufficient assurance that interference will not be caused to licensed services. They suggest testing of prototype WSD is required to improve understanding of how devices will operate in practice, which we support. The PMSE community, in particular, emphasised the potential impact of interference caused to their services. We acknowledge the concerns of the PMSE community and will continue to work with them to maintain a current and detailed understanding of their use of the spectrum.
- 3.22 A number of the suggested modifications were common across multiple respondents and are described in the following paragraphs.
- 3.23 *PMSE receiver height.* In our November 2010 Consultation, we suggested that PMSE receivers would be at a height of around 1.5m, implying that a particular “low height” propagation model should be used. Three respondents told us that receivers were often mounted on scaffolding, or gantries above ground level, and as a result were more typically at a height of 6-10m. We accept this and will undertake some further work to determine whether and how to make appropriate changes. We will discuss this further with the PMSE community over the coming months.
- 3.24 *International database lookup.* Some respondents noted that WSDs are likely to move from country to country and hence will need a mechanism whereby they know how to find the appropriate geolocation database list for each country. We agree with this and would encourage international bodies such as the European Conference of Postal and Telecommunications Administrations (CEPT) or the European Telecommunications Standards Institute (ETSI) to design an appropriate approach.
- 3.25 *Slave-to-slave communications.* In our November 2010 Consultation, we suggested that master devices be allowed to communicate with slave devices but that one slave device would not be allowed to directly communicate with another. The reason for this was that if unlimited slave-to-slave communications occurred there might be transmissions some unknown distance from the master device, but using the frequency assignment provided to the master. This could invalidate the database assignment which is made based on an understanding of where the transmissions could occur.
- 3.26 A large number of respondents suggested this was unnecessarily restrictive and could prevent mesh-like applications. Most acknowledged that unlimited slave-to-slave communications might be problematic but suggested there might be circumstances when they could be allowed. One respondent felt this could be where the user group could be trusted to a greater degree and cited public safety users as an example. However, some respondents were concerned the slave-to-slave communications could increase the possibility of causing interference to licensed users.
- 3.27 In principle we see no harm in slave-to-slave communications where both slaves are under the control of the same master since, by definition, their distance from the

master will have been taken into account in gaining the channel assignment. We therefore propose to undertake some further work to investigate allowing slave-to-slave communications where both slaves are under the control of the same master, provided harmful is not caused to licensed services. At this stage, we believe that additional protocols would need to be developed to enable slaves to determine that they are controlled by the same master. We do not currently see how the database concept could be reliably extended to slaves outside the control of the master and are not minded to allow this, but remain open to proposals showing how it could be done.

- 3.28 *Use of lower power levels than authorised.* Some argued that WSDs might opt to use lower power levels than those returned by the database in return for a larger geographical area of validity. This is clearly possible, but would complicate the database protocol which might require additional exchanges between the WSD and database. We see no problem with such exchanges but there is a question as to whether they need to form part of the core protocol between WSDs and the database. Instead, they could become part of a “value added” service from the database provider.
- 3.29 *Security issues.* Some noted that adequate security would be needed to prevent various attacks such as spoofing the Ofcom list of databases. Another concern was the potential for WSDs to be “hacked” and loaded with unauthorised software, which could cause them to operate at different frequencies or power levels to those assigned by the database. We agree that there are a number of security related issues to consider. It is our intention to work closely with stakeholders and industry partners to better understand the likely threats and potential solutions.
- 3.30 *Restrictions to power levels.* Following on from the above security concerns, some argued that if devices had an upper power limit of, for example 100mW, this would limit the potential for problems if the software of WSDs is hacked. At this stage, our preference is not to impose an upper power limit or otherwise place restrictions on the efficiency with which spectrum can be used, but to deal with such illegal behaviour through the enforcement tools that we have at our disposal. As mentioned above, we intend to work with industry partners to assess the likely security threats to WSD operation and may review our position on limiting power levels in the future if strong supporting evidence emerges.
- 3.31 *Compliance with the R&TTE¹⁵ Directive and related issues.* One respondent commented on our approach towards the emissions mask where there are no “hard” values set in the specification. Instead, manufacturers are required to supply, or otherwise refer to, typical masks for each device type which are then taken into account by the database algorithms. The respondent felt this would not work because manufacturers cannot be obliged to provide such a mask and there is no way to check that what they provide is accurate.
- 3.32 We have considered this point and agree that we cannot oblige manufacturers to provide a mask. However, we do not believe that such action will be necessary. It is our belief that manufacturers will be incentivised to provide accurate device masks on a voluntary basis as the most efficient way to ensure that their devices have access white space spectrum.

¹⁵ The Radio and Telecommunications Terminal Equipment (R&TTE) Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity

- 3.33 We recognise the novelty of our approach, which seeks to provide important flexibility to device manufacturers. Given the uncertainty as to the applications that may develop in white space spectrum, we think such flexibility is of great value at this point.
- 3.34 *Differing interference potential across technologies.* A number of respondents noted that different technologies (e.g. OFDM and CDMA¹⁶) had differing interference potential, particularly to digital terrestrial television, for the same power levels. In particular it has been previously noticed that LTE¹⁷ may be especially problematic to some TV receivers. They urged us to take this into account.
- 3.35 We believe that it would be possible to do this by using the model number provided by the device and having previously established the relative interference potential of the technology at the time that the device type is placed onto the market. We plan to investigate the practicalities of this approach further, in particular to determine how to support devices that support more than one technology.
- 3.36 *Licensing model.* One respondent questioned whether a licence exempt approach should be adopted. They suggested that greater value might be derived from the white space if it were made available for mobile broadband, potentially as an extension of the networks that mobile operators might operate at 800MHz. The question of licensed versus licence exempt usage was not something that we were considering as a part of this November 2010 Consultation, having concluded in earlier consultations that licence exempt access was more appropriate. However, the respondent suggested that, since that analysis, the concept of “mobile broadband extension” had been developed and changed the analysis by substantially increasing the value of the white space spectrum.
- 3.37 Estimating the potential value that might be derived from the white space under different models is clearly difficult given the uncertainties involved in this area. However, we are disinclined to move to a licensed model at this stage because:
- a) Only one respondent was clearly in favour of this approach (although another supported a somewhat analogous method, see paragraph 3.38);
 - b) While the respondent showed how the value from licensed use might be higher than we have predicted, equally other respondents have suggested that the value under licence-exempt use might also be higher; and
 - c) Our duties to encourage innovation incline us towards enabling licence-exempt access in a range of spectrum bands.
- 3.38 *Channel reservation.* A few respondents thought that some form of channel reservation might be valuable, enabling some applications to have guaranteed access. For example, this might be provided to rural broadband applications. In an extreme mode it could be extended to change to a licensed model.
- 3.39 We had considered this in Annex 7 of our November 2010 Consultation and concluded that we did not have sufficient evidence at present to include it and that it would complicate the access and database provision. However, we believe it could be subsequently introduced if needed. Hence, we remain of the opinion that reserved

¹⁶ Orthogonal Frequency Division Multiplexing (OFDM) and Code Division Multiple Access (CDMA)

¹⁷ Long Term Evolution (LTE) is a set of technical standards which describe an emerging mobile radio system, considered to be one of the candidate technologies for 4G systems

access might have a role to play in the future and our approach is sufficiently flexible to allow it to be introduced at a later date if it transpires it is worthwhile.

- 3.40 *Height information for mobiles.* One respondent noted that the height of a mobile might be important, for example when it was in a tall building, and that this should be taken into account. We have discussed and debated this issue with stakeholders in the past and while we agree that scenarios could be envisaged when a mobile in an elevated position could cause increased interference over one at ground level, there does not appear to be any practical way to establish the height of such a mobile. If a way of establishing height were to emerge we would consider including this in the approach set out but we feel it disproportionate to prevent all white space access because of the risk of an elevated height mobile. Instead, we suggest that if this proves to be problematic, that in areas with tall buildings the allowed power levels provided by the database are adjusted to accommodate this risk.
- 3.41 *Limiting the likelihood and impact of interference.* A number of respondents emphasised the need for robust mechanisms to reduce the likelihood of harmful interference caused to licensed users. These included a so-called “kill switch”, to immediately disable WSDs if they cause interference. It is clearly important to protect licensed services from interference and there are a number of approaches, both proactive and reactive, to achieve this. The main thrust of our approach to interference management is proactive; by using a geolocation database, WSDs can be assigned operating frequencies and transmit power levels that have been calculated not to cause interference.
- 3.42 Ofcom retains control over the performance of the algorithms used in the databases and will update them if required to manage interference. A kill switch is a useful reactive tool and we believe that it should form a core part of the protocol which describes the information exchange between WSDs and the database.
- 3.43 *Real-life testing.* In relation to the previous point, a number of stakeholders emphasised the need for rigorous, real-life testing of WSDs to better understand the potential for interference into licensed services.
- 3.44 We have undertaken a detailed analysis of our algorithms for calculating available channels and appropriate transmit powers and are confident that our approach is both robust and flexible. At the time of preparing the November 2010 Consultation, real-life testing had not been undertaken in the UK, as WSDs are based on emerging technologies that had hitherto been unavailable. This will change in the coming 1-2 years; indeed, industry stakeholders are beginning to undertake testing with WSD prototype equipment. We are interested in following these trials and, wherever possible and appropriate, would call on trial organisers to make methodologies and results available to the wider community. We believe there is significant benefit in such trials involving all stakeholders with an interest in the development of WSDs, including representatives of DTT and PMSE licensees. In the event that additional evidence is required to satisfy ourselves that licensed services are protected from harmful interference, it may become necessary for us to commission our own studies or trials.

Conclusion

- 3.45 In summary, we will continue on the principle that WSDs will operate on a licence exempt basis and in our view the draft structure of the SI remains the correct way forward subject to further investigating a number of suggestions proposed by the respondents to the November 2010 Consultation. These are:

- a) Reviewing our proposed approach to modelling interference to reflect the operation of PMSE receivers mounted in scaffolding, or gantries, above ground level;
- b) Investigate allowing communication between slaves under the control of a single master;
- c) Incorporating a kill switch in the protocol that describes communication between WSDs and the database. This is a useful reactive tool, which can be used to remotely disable devices in the event that interference is detected; and
- d) Monitoring of manufacturers' developments with regards to possible "hacking" of WSDs, with the potential for malicious operation and increased likelihood of interference and, where appropriate, encourage the adoption of rigorous security standards. We note, however, that the threat of hacking is relevant to a number of communications devices and is not specific to WSDs.

Question 3: Is the lack of European harmonised standards problematic for development of WSDs?

- 3.46 Manufacturers or others are legally obliged to only place on the market radio devices that avoid harmful interference. This is a mandatory requirement of the R&TTE Directive.
- 3.47 European harmonised standards, developed by the ETSI and referenced in the Official Journal of the European Union, are the preferred way for manufacturers to demonstrate that their radio equipment conforms to the requirements of the R&TTE Directive.
- 3.48 The majority of respondents commented that the lack of European harmonised standards was a problem for the development of WSDs.
- 3.49 Others suggested that European harmonised standards are desirable, but not absolutely necessary at this stage. Only three respondents felt that the lack of European harmonised standards was not a barrier to the development of WSDs.
- 3.50 Some respondents suggested that WSDs would not be produced without a harmonised standard. However, other responses, including from manufacturers, disagreed. Others noted that the standards bodies were unable to move ahead without some regulatory guidance and that, unless some regulators made the first steps, a harmonised standard would not emerge.
- 3.51 Particular comments of note are detailed in the following paragraphs.
- 3.52 *Preventing non-compatible devices being used in the UK.* If devices were not harmonised and a device conforming to a different standard were brought into the UK it might cause interference and hence should not function. We believe the current database approach would recognise that the model identifier of the device was not one supported and it would not provide it with operating parameters.
- 3.53 *Moving ahead in lieu of a harmonised standard.* One respondent suggested that, while European harmonised standards are important for the success of WSDs, the lack of harmonisation should not act as a barrier to their deployment. The respondent proposed an approach in which WSDs will be authorised for use in the UK only, an

approach which would be modified once European harmonised standards become available.

Conclusion

- 3.54 We believe that enabling a harmonised approach to WSDs across Europe as outlined in the Radio Spectrum Policy Group's (RSPG) opinion on cognitive technologies¹⁸ is the best way to ensure the maximum value is obtained from the spectrum for UK citizens and consumers. The RSPG opinion indicated that the main harmonisation activities for WSDs would be expected to take place through standards bodies, such as the ETSI. The RSPG also recognised that the approaches by regulators to the rollout of WSDs in Europe may move forward at different speeds due to resources and the nature of the different national broadcast and PMSE deployments. Therefore our objective will be to help progress the European harmonised standards for WSDs in a timely manner in line with Ofcom and UK objectives.
- 3.55 We do not wish the emergence of European harmonised standards to be an impediment in the meantime. Deployment and development of WSD and geolocation databases is likely to inform and facilitate the development of robust European harmonised standards and to further de-risk any possibility of interference. Therefore, similar to the process that was followed previously in relation to enabling early adoption of Broadband Fixed Wireless Access services in the 5.8GHz band in the UK, we have decided to enable deployment of WSDs in the UK by preparing and consulting on exemption regulations through a SI, which may make reference to a published IR document referencing a VNS. We believe that further proof of concept testing and the monitoring of current and future trials will inform and facilitate the development of more robust European harmonised standards and further de-risk any possibility of interference.
- 3.56 If a Harmonised Standard was not available within a suitable timeframe then we would expect manufacturers and other industry parties to work closely to achieve appropriate proposals for a VNS to cover this area. We will work closely with them to ensure these are appropriate and, in particular, will not cause harmful interference.
- 3.57 This would allow early WSDs to be deployed and for prototype services to emerge in the UK. This approach also facilitates a phased introduction of WSDs, providing us, the device manufacturers and incumbent service providers and licensees with the opportunity to monitor and validate the performance of real-world deployments. Crucially it could enable European standards to be developed with the benefit of practical experience and be a useful interim measure to ensure the timely development of a harmonised approach.
- 3.58 We might have to amend any SI that we issue, for example to refer to the resultant European harmonised standards once they emerge. There is therefore some risk of the early UK equipment standards being different from the European harmonised standards that emerge. We believe this risk is significantly mitigated by us developing our national standard in parallel to the harmonised standard, and both the white space community and Ofcom working closely with European regulatory groups towards developing such standards.

¹⁸http://rspg.groups.eu.int/documents/documents/meeting/rspg24/rspg_10_348_ct_opinion_final.pdf, February 2011

- 3.59 Were European harmonised standards not to emerge or white space access not to gain traction in the market and lead to valuable services of benefit to UK citizen-consumers, or if more valuable services emerged, then we would reserve the ability to suspend the operation of databases and thus ensure the spectrum was available for other uses. At present, we do not see evidence to suggest this is likely. However we note it is a benefit of this technology that the regulator can move forward with exemption of WSD without the usual risk of the value of spectrum bands being sterilised.
- 3.60 While we are not currently aware of any activities to harmonise spectrum bands specifically for WSD access and we note that harmonised spectrum is not necessary for this technology, should any work arise in this area in Europe we will actively participate in this.

Question 4: Do you have any comments on these requirements? Are there any other requirements that should be placed on the database?

- 3.61 We asked stakeholders their views on our requirements for geolocation databases. There was general agreement on our fundamental approach, but were a number of requirements that stimulated particular comment from stakeholders. They are detailed as follows.
- 3.62 *Testing and trials.* Three respondents emphasised the need for thorough in-the-field trials of databases and devices ahead of widespread deployment of WSDs. The purpose would be to verify that the information provided to WSDs by the database(s) meets expectations and does not cause harmful interference to licensed users.
- 3.63 We acknowledge the benefits of trials and we welcome the first trials that are now underway in the UK, in Bute and Cambridge. We will monitor these trials closely and work with licensees and the participants in the trials to ensure that the database approach is shown to successfully prevent harmful interference.
- 3.64 *Database response requirements.* Many said that our requirement for databases to respond within 10 seconds may be too stringent and that no timing requirement was needed, especially for closed databases. We will undertake some further work to determine whether it is appropriate to remove this requirement.
- 3.65 *Security.* A number of respondents stressed the need to secure the interactions between WSDs and databases. This may involve authentication of both ends of the connection to prevent spoofing and encryption of data sent between them. In addition, the data held within the databases will need to be secured to prevent malicious tampering.
- 3.66 We agree that such measures are necessary, but believe that detailed implementation details are best left to database providers, who have the necessary skills and experience to secure such a service. We will take this further in any future discussions with potential database providers.
- 3.67 *Slave emissions mask.* It was noted that we currently do not take the emissions mask of slave devices into account and that the master device may not know these when it performs its database enquiry. If the slave had a worse emission mask (i.e. increased out-of-band emissions) than the master then the database calculations might be inaccurate as a result.

- 3.68 We agree that this is a valid point and suggest that we require the master to report the model type of slave devices to the database in subsequent messages. If the master attached a slave device with a different model number from itself then it should report this to the database and receive a modified set of channels. If subsequent slave devices that were attached were of the same model number no further action would be needed, but the process would need to be repeated for each different model number. Master devices that habitually attached the same slaves could report this in their initial contact message.
- 3.69 *Duration to update algorithms.* One respondent noted that updating algorithms in the database may take longer than one week, especially where complexity has increased and the software needs testing. We will discuss this matter with potential database providers in the coming months. We may seek to consult again on the detailed requirements for database providers in due course.
- 3.70 *Protecting special events.* One respondent said that we should be able to put special constraints around particular events such as music festivals – e.g. a larger protection distance where it is known that receivers are exposed or at high level. We believe that this can be readily incorporated into our database proposals, by the PMSE database owner either indicating a “protected area” or entering a number of transmitter sites around the area.
- 3.71 *Confidentiality of licensing data.* Some entities were concerned that the licensing data (DTT coverage and locations of PMSE equipment) was commercially sensitive and needed to be protected by appropriate mechanisms. One suggested that “ghost” databases might be set up purely to allow entities to gain access to the licensing data. Some thought that the best solution to this was a single database, perhaps run by a not-for-profit entity.
- 3.72 At present, we believe that data confidentiality is best managed through a contract with each database provider setting out their responsibilities with licensing data, backed up with penalty clauses as appropriate.
- 3.73 In a related issue, a few respondents suggested that multiple databases might be inefficient and it was not clear what benefit they would bring, given that all databases had to provide the same responses. This was an issue dealt with in a previous consultation and no new evidence has been presented to suggest to us that it needs be revisited.
- 3.74 We are of the opinion that databases can differentiate themselves in terms of providing services of additional value or tailoring their responses, for example, for fixed links rather than devices with circular coverage zones. Any inefficiencies would be for industry to bear and are normal as part of a competitive environment.
- 3.75 *Cross-border issues.* One respondent correctly pointed out that there will be cases where white space usage could cause interference across a border, e.g. from Northern Ireland into the Republic of Ireland. This is correct, although the UK is fortunate in that these issues will be restricted to a few relatively small areas.
- 3.76 For simplicity in this early stage of white space we suggest that the database prevent usage in border areas but we hope that in due course other administrations will develop their own database and cross-border database coordination will be possible, enabling operation in these regions.

- 3.77 *Sensing.* Several respondents felt that a geolocation database approach alone is insufficient to prevent harmful interference to existing licensed services. Some suggested that WSDs should use a sensing approach, in which devices listen on one or more channels to determine whether they are being used by licensed services. A comparison of the various approaches to determining whether spectrum is free and available to use by a WSD was covered in a previous consultation and statement¹⁹.
- 3.78 We concluded at the time that there were advantages and disadvantages to both sensing and geolocation approaches, and that we should proceed with regulation to enable both. However, in the short- to medium-term, we concluded that geolocation would be the most important mechanism, given the expected cost and complexity of making WSDs that are sufficiently sensitive to sense the very low level signals of licensed users. The ability of WSDs to sense such signals is likely to improve in the medium- to long-term and our geolocation approach is sufficiently flexible to accommodate sensing if it is subsequently required. Therefore at this time we do not propose to accommodate sensing within the VNS which we will draft. We note this could be accommodated if and when it was thought necessary, including in European harmonised standards.

Conclusion

- 3.79 There was general agreement on the high-level approach contained in the November 2010 Consultation. However there were a number of requirements that stimulated particular comment from stakeholders. These included:
- Testing of database functionality;
 - Requirements for the database response time;
 - Security between WSDs and databases (for example, the authentication of valid databases);
 - Requirements on the duration with which database algorithms should be updated; and
 - Confidentiality of licensing data.
- 3.80 Our decision is to continue with the high-level approach, to take account of some of these responses and to further refine our approach in the coming months. In particular:
- We will undertake further work to determine whether it is appropriate to remove the requirement for a database to respond to a request from a WSD within 10 seconds. At this stage we have insufficient evidence to conclude whether our requirement for database providers to update their algorithms within one week is too stringent;
 - We acknowledge there are a range of issues around securing data held in the databases and the interactions with WSDs. We will discuss these matters with potential database providers in the coming months. This may be an area where we seek to consult again on the detailed requirements for database providers in due course.

¹⁹ Digital Dividend: Cognitive Access, July 2009, <http://stakeholders.ofcom.org.uk/binaries/consultations/cognitive/statement/statement.pdf>

Question 5: Do you have any comments on these responsibilities?

- 3.81 We asked stakeholders their views on the high level responsibilities for potential database providers. In the November 2010 Consultation we proposed that database providers would be responsible for interference caused and potentially liable to pay compensation (for example, to viewers or affected licensees) in the cases that:
- They incorrectly implemented the algorithms provided by Ofcom;
 - They failed to update the database with the latest information on licensed services within the timescales required; or
 - They failed to change the algorithms within a week, in the case that Ofcom decided changes were needed.
- 3.82 Database providers would not be responsible for interference that occurred to licence holders if this was a result of:
- Incorrect information within the DTT or PMSE databases;
 - Inaccuracies of the propagation algorithm provided; or
 - Inaccurate information provided by the WSDs.
- 3.83 There were a number of comments, many of which can be interpreted as more general comments on our overall approach, and have been covered by the November 2010 Consultation's other questions. Specific comments on responsibilities for database providers are detailed in the following paragraphs.
- 3.84 *Spectrum management responsibilities.* One respondent expressed concerns that our approach effectively shifts responsibility for spectrum management to database providers who have no incentive to protect PMSE or other licensed users.
- 3.85 We acknowledge the concerns about interference and emphasise that Ofcom remains responsible for investigating and resolving complaints about interference to wireless services. We also note that Ofcom already delegates responsibility for spectrum management and licensing for a limited set of frequencies to JFMG. This continues to be a successful arrangement that provides both licensing and protection from interference for PMSE users.
- 3.86 *Database test cases.* One respondent asked that we provide test cases in the event of changes to database algorithms. This would enable database providers to check their implementation against a common reference. We think this is a sensible suggestion and will explore this at the appropriate time.
- 3.87 *Liabilities.* One respondent asked for more detail on possible liabilities and recommended that we give full consideration to how potential disputes are dealt with. We expect to develop further guidance on these matters as we commence discussions with potential database providers.

Conclusion

- 3.88 In summary, respondents were broadly supportive of the proposed responsibilities. Therefore we will use these as the principles when making contractual or regulatory arrangements with third party database providers. Those third parties interested in

running a database will need to apply to Ofcom for a listing on a website hosted by Ofcom (or a trusted party) from which WSDs can then select their preferred database. Ofcom will need to consider applications against certain minimum requirements and may require entry into a contract and payment for the listing of the database.

- 3.89 We will now work to further define appropriate minimum requirements that third parties providing the database functionality would need to meet in their applications for a listing. We also expect this work to provide additional clarity on the legal responsibilities of database providers. If necessary, we will consult on these more detailed requirements in due course.
- 3.90 We will also work to define and create an appropriate website or database hosted by Ofcom (or a trusted party) with listings of third party geolocation databases which WSDs can use to select their preferred database.

Question 6: Might you be interested in becoming a database provider? If so, can you provide more details on the extent and timing of likely provision?

- 3.91 Six respondents indicated that they might be interested to varying degrees and timescales. Some of these respondents suggested that they would be in a position to move quickly to develop a prototype database, leveraging existing, similar work for other administrations.
- 3.92 Several respondents stated the view that any costs incurred in developing and running a database should not be borne by owners or operators of incumbent services, such as DTT and PMSE. The subject of cost of database provision was not explicitly covered in the November 2010 Consultation. The subject was previously covered in the consultation "Digital Dividend: Cognitive Access"²⁰, published in February 2009. However, responses at the time suggested that it was too early to assess potential business models for providing geolocation databases. With technologies beginning to mature, we believe that there is now an opportunity to revisit these issues and will discuss further with potential database providers in the coming months.

Conclusion

- 3.93 Responses to consultations and workshops held with key stakeholders have led us to conclude that many different database ownership options might emerge. We have decided at this stage that our approach should favour neither closed nor open database approaches, but that it should be flexible and enable the appropriate solutions to be decided by the market which emerges not the regulator.
- 3.94 Our decision is therefore to adopt a flexible approach, allowing multiple third-party database providers to emerge and which, as far as is possible, is able to accommodate future change.
- 3.95 We expect third parties in a competitive marketplace to be incentivised to provide the best database service to consumers and to enable the overlay of useful innovative functions and services to the minimum database functionality we will specify.

²⁰<http://stakeholders.ofcom.org.uk/binaries/consultations/cognitive/summary/cognitive.pdf>

Question 7: Is our approach of working with Europe where possible, but moving ahead alone if no European approach appears forthcoming, appropriate or should we await European harmonisation regardless of how long this might take?

- 3.96 The majority of respondents indicated their view that we should continue with our approach of working with Europe. A smaller number of respondents felt that we should either wait for harmonisation before moving ahead, or that we should move ahead alone. Particular comments are detailed in the paragraphs below.
- 3.97 *Someone needs to take a lead.* Some noted the “chicken and egg” problem that standards cannot move ahead without regulation and that international regulatory initiatives often required a lead from one or more regulators. They felt that we are well placed to continue to take the lead and move the work forwards.
- 3.98 *Multiple work streams.* One respondent noted that not all aspects of the geolocation approach needed to be harmonised, e.g. the database algorithms. We can therefore continue to work on some aspects alone whilst maintaining alignment with Europe in other areas.
- 3.99 *Ofcom rules likely to be adopted by others.* There was a feeling from many that others would adopt the same rules as us and therefore there was little risk in us moving ahead.

Conclusion

- 3.100 In summary, we strongly believe that a harmonised approach to WSDs is desirable and our proactive work within Europe to date is testament to this. The majority of respondents supported this approach. We have been and continue to see it as critical to continue to work closely with the European bodies.
- 3.101 We also note the comments of some respondents that Ofcom is well-placed to drive the work forward. However, we acknowledge that work within Europe is still at an early stage and the development of the relevant standards could take several years to complete, potentially delaying the deployment of innovative new services. As we have stated already, this leads us to the position of continuing to drive work forward within Europe towards European harmonisation and enacting national regulations for the UK. Once the European standards are complete, they will supersede the relevant national regulations.

Conclusion

- 3.102 We have considered all the responses to the November 2010 Consultation carefully and have decided that the next steps outlined in paragraph 2.17 are appropriate.

Section 5

Next steps

4.1 We have stated that we will now:

- Consult on and subsequently publish a SI exempting appropriate devices from the need for a licence;
- Investigate arrangements, in co-operation with industry partners, to enable information about licensed services in the relevant spectrum to be made available to a database; and
- Specify requirements to be met by geolocation database(s) and their providers that wish to be accredited by Ofcom and listed on our website.

4.2 To support these activities Ofcom will now:

- Continue to engage closely with European regulatory and standards groups to facilitate the development of a harmonised approach to WSDs. We see achieving harmonised standards within Europe, and more widely, as a critical outcome for WSDs. We are currently participating in European harmonisation activities around WSDs and are actively involved in technical working groups, such as CEPT working group SE43²¹. We will continue to play a part, seeking to achieve European harmonisation around the concepts and ideas set out in this document. If it becomes clear that harmonisation will result in different concepts than those set out here then we believe it will be relatively simple to modify our proposals. We will also work with other countries, such as the US, to seek global alignment of technical standards as far as is possible. We will work with the relevant industry parties over the next months to ensure the VNS contains the relevant information.
- Ofcom will take a very close interest in early deployments of WSDs and databases to ensure harmful interference is not caused. Ofcom believes that the geolocation database approach affords a significant degree of flexibility for device operation, while serving as an effective means to manage interference. We will work with our enforcement team to ensure they are alert to the possibility of any interference that could emerge and are actively monitoring this.
- Work with stakeholders to finalise the critical activities that are necessary for setting up a suitable regulatory framework to manage and update the flow of information to and from a geolocation database. Ofcom intends to set up further workshops and direct engagement with those interested parties to facilitate definition of the key areas of detail.
- Undertake further work to establish how access to the licensing information for DTT and PMSE would be facilitated. The geolocation database will only function if it has access to up-to-date DTT and PMSE licensing information, and it is important to note in this context that the PMSE data may change constantly. We have not yet agreed conditions of access to the DTT coverage plan and the

²¹ The working group is defining technical and operational requirements for the operation of cognitive radio systems in TV white spaces. See <http://www.cept.org/ecc/groups/ecc/wg-se/se-43>

PMSE usage with the relevant parties. This will be a key next step and we will work with stakeholders to achieve this.

- 4.3 As we move ahead through this process and understand in more detail the associated costs, such as those of providing licensing data to the geolocation database operators it is possible that we will conclude that the costs are such that we are unable to proceed directly with our proposals. In this case, we may investigate alternative approaches or alternative routes for funding. If these are not successful it is possible that we might not move ahead with these proposals on cost grounds.

Additional considerations

- 4.4 We intend to proceed on the basis that WSDs are able to opportunistically access TV white spaces from 470MHz to 790MHz. In April 2011, we published a discussion paper on the long-term future of UHF spectrum bands IV and V. We are seeking to develop a better understanding of the future demands for UHF spectrum, including the TV white space spectrum identified for use by WSDs. Responses to the discussion paper, along with subsequent analysis, will enable us to establish a framework for ensuring that future decisions relating to UHF spectrum support citizen and consumer benefits in the longer term. Given the requirement for a strategic approach to UHF spectrum, it is not possible to guarantee the amount of spectrum likely to be available to WSDs at a particular location in the long term.

Annex 1

Non-confidential respondents

Association of Professional Wireless Production Technologies (APWPT)

Arqiva

BBC

British Entertainment Industry Radio Group (BEIRG)

Brian Copsey

BT

Confederation of Aerial Industries (CAI)

Cambridge Consultants

Chris Woolf

Churches Legislation Advisory Service

Coalition

Colin Macnab

Comsearch

Concerned PMSE User

Digital UK

ElectroSensitivity UK

Ericsson

Everything Everywhere

Freeview

Google

Highfield Church

Institute of Broadcast Sound

Intellect

JFMG Ltd

NetTek

Neul

Nicholas Wilcock

Spectrum for Programme Makers Forum

QoS MOS

Samsung

Shure

Silver Spring Networks

Spectrum Bridge

Telcordia and InterConnect

TTP

Virgin Media

Vodafone

VON Europe

XG

Annex 2

Glossary

CDMA	Code Division Multiple Access
CEPT	European Conference of Postal and Telecommunications Administrations
DDR	Digital Dividend Review
DTT	Digital Terrestrial Television
ETSI	European Telecommunications Standards Institute
OFDM	Orthogonal Frequency Division Multiplexing
PMSE	Programme Making and Special Events
R&TTE	Radio and Telecommunications Terminal Equipment
TVWS	TV White Space
WSD	White Space Device