Industry response to Ofcom's Consultation on WSD Requirements

9th January 2013

This response represents the shared views of the companies named below[1],which include major players in Internet and wireless access innovation.

We see the growing importance of wireless connectivity in supporting multi-device access to a wealth of online services. We understand the importance of Wi-Fi technology in enabling this access[2] and are acutely aware of its need for additional spectrum, such as the TV white spaces, which can be harmonised globally, to secure enhancements in both coverage and capacity. We also have in mind the unprecedented connectivity requirements to enable a thriving *Internet of Things*.

We welcome the opportunity to respond to this consultation, which is an important milestone towards enabling the many benefits we see flowing from TV white space spectrum - and more generally from the underlying dynamic spectrum access technology. Since these benefits do not come at any cost to existing services, we encourage Ofcom to proceed as quickly as possible with finalising and enacting the regulations.

We commend Ofcom on the thoroughness and transparency of its technical work on the draft regulations, to date. We also recognise its pioneering work in Europe, helping establish harmonised conditions and standards, which will enable essential economies of scale.

We believe that Ofcom's commitment to open the TV white spaces on a licence-exempt and technology neutral basis provides the best chance of extracting the full economic and social benefits from underused spectrum capacity. Licence exemption has enabled the 2.4GHz band, once discounted as junk spectrum, to become a vibrant generator of economic value and cradle of wireless innovation.

- In February 2012, In-Stat forecast that revenues from Wi-Fi chipsets alone would reach US $ 6.1 Billion, by 2015.
- Independent economist, Richard Thanki, has estimated[3] that Wi-Fi adds between US $52 and $ 99 billion, annually, to the value of fixed consumer broadband access services, supporting the increasing population of tetherless devices. This seems likely to represent only a small fraction of the total value generated by Wi-Fi – both directly and indirectly.

White space applications have already demonstrated their value

[*2.5 (P5)*] TV white space (TVWS) applications have already demonstrated their value and the underlying dynamic spectrum access has great potential to enable innovation in technology, services and applications.

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[1] Adaptrum, Broadcom, CSR, Google, Jaguar Land Rover, Microsoft, Neul, Sky and Spectrum Bridge

[2] A recent Wireless Broadband Alliance industry report, illustrates the growing role played by Wi-Fi. http://www.wballiance.com/wba/wp-content/uploads/downloads/2012/11/WBA_Wi-Fi_Industry_Report_Nov2012-2.pdf

[3] The Economic Significance of Licence-Exempt Spectrum to the Future of the Internet, June 2012 (link)

- Commercial white space applications began in the US, early in 2012, with a number of radios and databases having been certified by the FCC:
  - Adaptrum has significant commercial deployments of TVWS radios scheduled for 2013 and Spectrum Bridge has been operating a commercial database service since early 2012
  - In the city of Wilmington, North Carolina, white space networks are assisting urban and rural connectivity requirements. For example, as well as providing more comprehensive broadband Internet coverage, white spaces networks are enabling public premises to be protected more efficiently and Environment quality to be monitored more comprehensively.
- [*2.7 (p6)*]Applications have already gone well beyond the 'suggested' stage, with major trials of broadband, machine-to-machine and other applications:
  - In Bute, Cambridge and Singapore, white spaces networks have been used to provide broadband access in rural as well as urban areas
  - Mine safety and efficiency is being enhanced by communication systems that benefit from the greater propagation offered by TV white spaces (compared with the higher frequency bands traditionally available for licence-exempt deployments)
  - A trial has recently started in the Western Cape, South Africa, bringing broadband access to ten schools. This provides an excellent example of the greater flexibility and cost-efficiency of white spaces technology, compared to existing solutions
  - UK white spaces technology pioneer, Neul, has demonstrated the efficacy of the TV white spaces for both broadband connectivity and machine to machine applications, in significant deployments.

As yet unknown applications may enable even greater value from this underused spectrum capacity.

The regulatory framework needs to be flexible – to encourage innovation

We agree with Ofcom, that, as with any emerging technology, the regulatory framework should be flexible, to accommodate different approaches, given this early stage in the evolution of TV white spaces (TVWS) technology. *[4.7.3 (p17)]*.

We also believe that, to ensure greatest value for consumers, it is necessary to keep regulatory requirements to the minimum needed and to harmonise the approach as much as possible with that of other regulators. Since the US was the first to establish a framework for TVWS, the US requirements (laid down by the FCC) have become the industry's benchmark. It would help economies of scale for Ofcom's proposals to enable devices compliant with the FCC requirements to be allowed to operate in the UK with as little modification as possible – in conjunction with databases approved by Ofcom.

Minimising the constraints on innovation

We believe that Ofcom has worked hard to satisfy the concerns expressed by diverse stakeholders, within its technical working group (TWG). However, it is our view that some of the measures proposed are in danger of going beyond what is strictly required to protect against interference to the licensed services. The risk is that they would add unnecessary costs and could constrain industry's scope for innovation. In this regard, the features which concern us most are:

- The *Kill switch*
- Real-time channel usage feedback from device to database.

We understand Ofcom's desire to leave 'hooks' that could be useful in assisting coexistence of white space applications. However, since these features seem to belong more to network operation than regulation, we suggest that the detailed device-to-database service behaviour associated with these features be left to industry, to define. In this way, innovation coupled with market demand can determine which approaches are most efficient in meeting consumer requirements.

Kill Switch - pushing frequency availability updates, from database to device

We understand that the '*kill switch*', which might be better labelled 'update from the database' is intended to inform white space devices of any changes to the available frequency data they have obtained (which is still within its validity period). Such short notice changes are most likely to arise from PMSE applications, rather than from DTT services. Whilst pushing available frequency data from database to device seems like a good idea, in principle, it raises practical difficulties, which are not encountered when devices request information from the database.

This proposed mechanism would require database services to keep track of potentially large numbers of devices, and their addresses, raising challenges of scale. Reaching white space devices could be difficult, given that they might be located behind firewalls, which are common features of domestic and commercial networks. Opening the possibility of reaching devices in this way also raises security concerns – whether for the correct operation of the white space devices or the safety of other devices and data present on end-user networks.

We suggest that the '*kill switch*' be left optional, such that white space devices in which the feature cannot be implemented could instead be given a shorter validity time (e.g. 60 minutes), for a subset of channels (e.g. 2) in locations where short notice changes are reasonably likely (e.g. near a public venue). By setting a shorter validity time, the relevant white space devices would then automatically re-consult the database with the required frequency.

Another suggested application for the '*kill switch*' is to assist in detecting and addressing interference problems. However:

- It is not clear how such an event would be triggered. The detection of any problem could take some time, such that it may be sufficient to either use the validity time supplied to devices by the database or to request the site operator (e.g. service provider/ property owner) to disable its device or devices
- If a device has only intermittent contact with the database, as might be the case in a remote rural application, for example, then pushing data to the device might not be possible. Nor is there much risk of any significant harm from failing to deliver an update, in such a location.

Related issues on time validity of frequency availability data

- [*6.16.4 (p39)*] Specifying the same validity time-limit for all devices might lead to overload of database services (WSDB), since it would force all white space devices to re-consult at the same time. A possible alternative would be to specify a duration, within which a further request to the WSDB must be made, if the device is to continue transmissions in the white spaces.
- [*6.19 (p39)*] Setting a longer time validity in rural areas, reflecting lower risk of interference with short-notice PMSE applications, might make life easier for rural workers – who would benefit from longer intervals between requiring Internet access (to connect to a database service).

Real-time notification of channel usage

Ofcom's proposals [*5.35.5 (p24)*] require white space devices to notify their choice of frequency (or frequencies) to the geolocation database and receive confirmation back from the database, before they can start communicating in the band. We think that this notification/confirmation mechanism should be left optional, at least for devices in the consumer personal/portable category.

We understand that Ofcom intends this real time feedback of frequency usage by white space devices to optimise coexistence of multiple white space applications – particularly assisting service providers using white spaces for wide area networks (such as for rural broadband access). Whilst it seems clear why operators of such wide area networks might want to avoid conflicts in use of the available white space frequencies, we believe that requiring all white space devices to provide the proposed feedback is disproportionate. Devices in the consumer personal/portable category (likely to be the most numerous type) are expected to be operating at much lower power, lower height and indoors, in many cases. Such devices present little risk to wide area networks using white space frequencies and, therefore, should be allowed to move freely between all available channels.

Rapid frequency movement could be used as a means of mitigating interference and driving greater value from white spaces applications (much as Bluetooth technology uses the 2.4 GHz spectrum, to deliver a number of valuable applications). In our view, requiring all white space devices to provide real time channel usage feedback, and await confirmation from the database, would put an unnecessary burden on devices and geolocation databases and result in a waste of communication capacity.

Although we strongly advise against mandating all white space devices to report their channel use in real time, we see little objection to retrospective reporting of channel usage by white space devices, which might assist investigations of interference complaints or be used to research how efficiently spectrum is being used, for example.

If Ofcom deems that certain applications need to be protected against other white space users, in a given area (as is already proposed for PMSE), then this could be handled by reserving frequencies in the geolocation databases, rather than through imposing constraints on white space devices.

In short, we recommend that the real time reporting of channel use be left optional.

Relating to Geolocation Database Services

[*3.14 (p11)*] We support Ofcom's proposal to allow both open and closed database services. This enables the greatest scope for business model innovation and competition.

- We would recommend that Ofcom encourages there to be more than one affordable public (open) database, to ensure that spectrum access remains affordable to all comers. This might arise naturally, but could also be achieved, for example, by requiring major database service providers to offer at least an affordable basic public interface, as well as any closed (private) access mode(s)
- We presume the non-discriminatory requirement [*3.14 bullet 9 (p11)*] applies to open databases, rather than closed.

[*5.28 (p22)*] We note that white space databases (WSDBs) would be required to keep records of WSD use. We recommend careful consideration of the period for which records need to be kept, to avoid discouraging emerging database service providers.

In summary

We commend Ofcom for its careful work in laying the foundations for dynamic access to the TV white spaces, opening the door to more efficient use of spectrum across all bands and a new era in wireless innovation. Already, commercial and trial applications using TV white spaces, including broadband and machine-to-machine, are demonstrating the value that this approach can deliver.

To ensure that UK consumer/citizens and industry can derive the greatest benefits from this underused spectrum, we urge Ofcom to minimise the regulatory constraints on white space devices. In particular, we recommend that that the '*kill switch*' and *real-time notification/confirmation of channel use* be left optional.

Apart from the details addressed in our comments, above, we fully support Ofcom's proposals for enabling licence-exempt white space devices operation and we encourage it to move ahead as quickly as possible with implementing the regulation, with appropriate Government support where needed. This will help to ensure that the UK reaps the benefits of the considerable regulator and industry investment already made in securing a lead in this exciting new market.

Questions and Answers

A number of the companies whose shared views are represented in this document have provided detailed answers to Ofcom's questions, separately, in their own responses. We seek only to address the broader issues here.

Question 1: Do you agree with our approach to defining the various categories of WSDs?

> Yes, we believe that recognising different categories is helpful to ensuring greater efficiency and value from spectrum use. It is clear, for example, that fixed rural broadband access applications need quite different sharing assumptions than personal/portable devices do. By differentiating between these, each category should be allowed to enjoy the flexibility to use spectrum commensurate with assumptions which are appropriate to that type of device. For example, professionally installed rural base-stations should enjoy higher power limits than would be appropriate for personal /portable devices.

Question 2: Do you agree with our proposed sequence of operations for WSDs

> We agree with the proposed sequence, in general, with the exception of mandating feedback of selected channel and the need to wait for confirmation from the database.

Question 3: Do you agree with our proposed additional operational requirements for master WSDs?

> [No comment.]

Question 4: Do you agree with our proposed additional operational requirements for Slave WSDs?

- Paragraph 5.76 states that a slave WSD must cease transmission if it loses communication with the master WSD for more than **5 seconds**.
    - There are a number of use cases that would be precluded by this constraint. Checking communications every 5 seconds would pose an extreme burden on many device types, especially those which are battery powered.
    - In general, the protection limits for a given location (pixel) are static. It is highly unlikely that a slave WSD would move into a different protection zone in the time span of a few seconds (100 meters (per pixel) in 5 second implies a speed of the order of 45 mph or 72 kph). Since many slave WSD use cases (being managed by a master WSD) are likely to involve stationary devices, we suggest that the requirements of a likely minority of rapidly moving slave devices be handled separately – for example using a separate technology identifier (or set thereof).
    - This requirement potentially creates denial of service vulnerabilities for WSDs. If one (or many) WSD disrupts the communication of another for 5 seconds or more, it would cause the victim WSD to cease operation. This could lead to wasteful congestion of the white space spectrum as slave WSDs struggle to establish and maintain a connection with master WSDs.

- Paragraph 5.4 implies that all slave devices within the master WSD's coverage area will receive a set of generic, default, cautious operational parameters.
    - If the slave device has a geo-location capability, we think it would be better for it to receive more accurate (non-default) operating parameters for its exact location. This seems to be possible, given the language in paragraph 5.33, but paragraph 5.4 sub-paragraph (b) does not make that clear.

Question 5: Do you agree with the proposed device parameters, operational parameters and channel usage parameters

Yes, in general. However, we would like to note the following points.

- It is important to maintain as close an alignment with IETF PAWS, to maximise the harmonisation benefits. It will also be necessary to accommodate other bands in future.
- Paragraph 5.12 states that vertical geo-location capability is optional for both master and slave WSDs, but only mentions height above sea level.
    - Some geo-location technologies might not use mean sea level as a vertical reference point. We think it would be beneficial to allow height data to be specified using other common formats, for example, above ground level.
- Paragraph 5.53 states that device parameters must be determined automatically
    - This eliminates the possibility for having manually entered information, even for "professionally installed" equipment.
    - We are concerned that this would preclude a number of valuable applications where automatic location determination is challenging or impossible, for example, in underground locations. The places where automatic geo-location is difficult also tend to be places where WSDs are less likely to cause interference.

Question 6: Do you agree with our approach of implementing the requirements in the example SI and the draft IR and VNS

[No comment.]