INTRODUCTION TO STAKEHOLDER

TTP is Europe's leading independent technology and product development company providing technology innovation, intellectual property generation and product development to a worldwide base of clients from major blue chip corporations to technology start-ups. TTP brings 25 years of heritage in communications innovation, disruptive product development, game changing service platform creation and a broad and deep level of industry intelligence. TTP operates in global markets and industry sectors including communications, energy, industrial, medical, healthcare, consumer, printing, automotive and aerospace.

TTP are very active in the White Spaces initiative and are a key contributor to the Cambridge TV White Spaces trial, responsible for the implementation of one of the world's first Rural Broadband radio links using TV White Space spectrum, as a demonstration platform showing the potential for this new and disruptive technology area.

For more information on TTP's involvement and to download TTP's trial report, please visit: http://www.ttp.com/technology/communications/white_space_technology/ which is a report investigating the radio link parameters anticipated to deploy 'UK style' broadband links – putting into context the RF power levels that TTP believe are required.

TTP's interests range from M2M to fixed wireless radio links, with a specific interest in the development of rural broadband technology using TV White Space spectrum. As a product development company, TTP aim to build expertise in the development of products across these range of markets, offering professional design services, intellectual property and solutions for products designed to meeting demanding specifications, whilst also matching the required price point for successful commercial deployment.

Rural broadband provision is seen as one of the key applications for TV White Space spectrum, assisting in serving people with little or no current broadband access over ADSL or fibre networks. The UK economic benefit of such provision in un-served areas is extremely significant, meaning that appropriate regulation of TV White Space spectrum is critical.

STAKEHOLDER RESPONSE

DEVICE CATEGORIES

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

TTP believe that this is a reasonable approach to prescribing fair spectrum use for White Space Devices. However, for WSD's to be commercially successful it will be necessary to have further categories of device types to allow flexibility of deployment leading to a greater chance of commercial success. This is particularly relevant to the rural broadband application, as radiated power levels are critical to the success of the service.

TTP suggest that the use of directional antennas with higher gain have a fundamental influence in the definition of device types, due to the potential benefits to DTT/PMSE protection and WSD performance that these can offer. For example; this may be a type 'A' professionally installed WSD with a high gain yagi pointing in a known direction – clearly this should be given merit when spectrum resource and output power levels are allocated to such a device, so as to give maximum performance benefits while ensuring that risk to DTT is low.

We suggest Ofcom create a further type of device for ***professionally installed*** WSDs, thereby giving these WSDs further opportunity for increased spectrum usage and power levels. A distinction between consumer installed and professionally installed WSD will prove beneficial because extra parameters can be declared, **which assist in the protection of primary users.**

- A ***professionally installed*** WSD is defined as a fixed unit which has been installed by service technicians, including the appropriate mounting of the antenna at the premises, with device parameters programmed into the WSD which can be passed to the WSDB upon authentication and application for spectrum. These parameters may be: antenna height, antenna directionality and antenna bore sight heading. This applies for both master and slave WSDs.

From work done during the Cambridge trial (which has also been found in the trial at Bute), it has been seen that the broadband application will need radiated power levels at the top of end of the anticipated EIRP limits, as discussed during the technical working groups and trials.

TTP's report on rural broadband service concludes that the **path losses** for such radio links are expected to be **in excess of 140dB**. For new broadband services to be successful, the inclusion of the 'professionally installed' type **may be the best way to achieve an acceptable level of performance and service without harming existing services.**

SEQUENCE OF OPERATIONS

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

TTP agree with the proposals set out in this section. In addition, TTP feel it necessary that the WSDB has further information on antenna characteristics (as indicated above and discussed later in this document). We anticipate that extra functionality will evolve during the development of these operations.

ADDITIONAL OPERATIONAL REQUIREMENTS: MASTER WSD

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

TTP agree with the proposals set out in this section, with the following additional comments:

[5.49] Agreed. Measures should be taken to ensure that in the situation where only one WSDB is applicable, down times are not so excessive as to damage service provision reputations.

[5.53] Agreed. A simple level of protection should be expected however, to encompass the possibility of low cost devices.

[5.54 & 5.55] TTP believe that at this stage 60 seconds is a reasonable initial figure. However it should be seen as a number which is likely to require changes throughout the development of WSDs as more in-field experience is obtained.

[5.69 & 5.70]Since the implication of malicious corruption or unauthorised modifications of the data potentially have national DTT/PMSE protection implications, a base level of low cost security should perhaps be expected or specified by Ofcom? Is it important to ensure that the cost of such security does not compromise the ability to produce low cost consumer WSDs.

ADDITIONAL OPERATIONAL FEATURES: SLAVE WSD

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

TTP agree with the proposals set out in this section, with the following additional comments:

[5.72]A pragmatic level of parameter security must be expected commensurate with the overall WSD cost and market.

[5.85]Whilst appreciating the reasoning behind the concern regarding calculation of expected coverage areas, TTP believe that specifying a limit on slave WSD antenna gain is **counter productive to the protection of primary users**, for the following reasons:

- The use of directional antennas for the WSD transmitter means that the transmitter power can be directed at a particular heading. As a result of this, the **risk of DTT/PMSE interference is lower**. In addition, this leads to lower power consumption and many other benefits such as device cost, heat and transmitter mask cleanliness – again **with a resultant lower risk to primary users.**

- In order to maximise signal-to-noise ratio of the radio link, best receiver performance can be obtained using directional antennas. In turn this allows lower radiated power of the corresponding transmitter to achieve the required link budget. **Lower radiated power obviously has a benefit for DTT and PMSE protection**.

- Optimising the performance of a WSD receiver using directional antennas also assists in the rejection of in-band interference coming from distant sources at off bore sight heading angles. This is particularly applicable when considering rural broadband fixed radio links (increasing signal-to-interference ratio). The consequence of improving this rejection is a reduction of the interference floor which in turn results in lower corresponding WSD transmitter power to achieve the same link budget, **with the associated risk benefits to primary users.**

Overall, TTP believe that (especially for rural broadband applications/fixed point to point links) **the use of highly directional antennas should be actively encouraged, rather than limited**. This approach seeks to maximise the radio performance while minimising the transmitter output powers, thus avoiding un-necessary omni-directional signal patterns.

A suggestion may be to introduce a subset of device types (as described in the above response to question 1), which are professional installations with certain directionality classifications and heading angle of antenna. Such device types would have more freedom in terms of spectrum allowances and power limits, knowing that these devices are well controlled by their nature, allowing greater opportunity for fixed WSD radio links, with a resulting lower risk to DTT/PMSE.

In addition, from our work in the Cambridge trial and our knowledge of the anticipated EIRPs from the ongoing technical studies and experimentation, TTP believe that **limiting the slave WSD antenna gain/directionality will seriously degrade the performance of White Space broadband opportunities to the extent that the performance may not be acceptable for commercial deployment.** Initially at least, the rural broadband case may only be achieved by a 'professionally installed' type – which is also applicable to base station installations.

Note also, that in the scenario deployed during the Cambridge trial, with a 3 metre DTT to WSD antenna separation and ~1.2W EIRP (headings: 270 degrees and 150 degrees respectively), **no DTT interference was observed.** To achieve the performance obtained for the trial service, which is commensurate with the general public expectations of 'broadband' within the Cambridge trial test license conditions, **direction antennas had to be used.**

PARAMETERS

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

TTP agree with the proposals set out in this section.

In addition, TTP believe that device parameters should be technology agnostic to allow for maximum opportunity.

TTP believe, as noted above, that the WSDB should incorporate the ability to include antenna directionality and beam angle into the protection ratio calculation. This allows greater potential for DTT/PMSE protection along with opportunity for WSDs.

DRAFT REGULATORY AND TECHNICAL DELIVERABLES

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

TTP agree with the proposals set out in this section. As a general comment however, it is important to maintain pace on TVWS developments as delays in regulatory matters will cause inevitable problems with the timely design and release of products. It is important for the UK to take a leading stance in TVWS development and maintaining a competitive edge.