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BBC

Submission to Ofcom on TV white space devices consultation

1. Introduction

The BBC welcomes the opportunity to respond to Ofcom's consultation on TV white spaces (TVWS), published on 22 November 2012. In particular, we are keen to be fully involved in the development of a concept which could lead to the introduction of innovative new ways of delivering multi-media content and, more generally, lead to enhanced spectrum efficiency. However, it is critical that any proposals to introduce new licence-exempt uses in UHF interleaved spectrum do not lead to an increase in the risk of harmful interference to existing services. With that in mind, we welcome Ofcom's continued commitment to maintaining robust protection to Digital Terrestrial Television (DTT), programme making and special events (PMSE) and local TV use in its ongoing policy and technical work

Ofcom is aware that both UHF spectrum at 470-790 MHz and broadband internet platforms remain vital to delivery of UK broadcasting services. In its November 2012 UHF Strategy statement, Ofcom affirmed its long term commitment to the DTT platform, emphasising the crucial role it plays in providing low cost universal access to the public service TV channels and in sustaining viewer choice. Similarly, Ofcom has long accepted the importance of continued PMSE access to interleaved spectrum and the sector's contribution to the social and cultural well-being of the UK.

As a result of this, any proposals which have the potential to jeopardise the integrity of the DTT platform, increasing the risk of harmful interference to existing economically and socially valuable services, need to be approached with some caution.

A number of detailed questions on the level of protection to DTT services will need to be addressed in future consultations and, clearly, the need to provide sufficient protection to TV services and PMSE will need to underpin the development of new services using TVWS.

However, assuming that the geolocation services and databases as set out in this consultation prove reliable, the proposed framework is generally acceptable to the BBC. We realise the potential benefits to UK consumers that new and innovative services could bring. We are, therefore, committed to working constructively with Ofcom and other stakeholders as these technologies develop – as we did in the recent trials at Cambridge and Scotland.

With specific reference to this consultation, our broad observations are that:

- The framework provides a useful starting point for facilitating access to TV white space spectrum by licence-exempt devices using a geolocation database;

- Future consultations that define the technical parameters used to protect DTT should recognise the economic and social value of the services currently deployed in the DTT spectrum band;

- Given that all geolocation databases should use the same Ofcom-mandated algorithm and the same coverage predictions to give the same information, the BBC believes that Ofcom should be responsible for calculating a single "Master Database" used to protect DTT and PMSE. This would provide basic white-space availability information but would still leave opportunities for additional providers to deliver further value-added information on a competitive basis, whilst obtaining the basic information from the 'Master Database'.

- The proposals to open up unused white space spectrum using a database could be equally appropriate for other licensed bands which are not fully utilized (e.g. IMT or Military bands) and we urge Ofcom to explore these possibilities as part of its wider duty to promote optimal use of radio spectrum; and

- The VNS will require further development to ensure the proposed tests are realisable and practical, although we suggest that Ofcom should provide further clarity on the actual status of this VNS bearing in mind the ongoing work at ETSI BRAN.

2. Responses to questions

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

The approach appears sensible and the chosen WSD categories are appropriate.

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

The sequence of events defined to access TVWS spectrum appear logical and appropriate

Some security issues remain regarding the Ofcom list of approved databases (§5.35.1). It is important to ensure that WSDs cannot be directed via a rogue list to a trojan database. Some form of security certificate would appear necessary to address this and Ofcom should take advice on best practice from IT professionals. Although the approach of HTTPS suggested in §5.68 would prevent snooping of the data from master to WSDB, it would not be sufficient to prevent a trojan WSDB from operating.

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

The proposed operational requirements are satisfactory and we support the proposal for the master to report its operating parameters back to the database. This potentially would allow coordination of WSD spectrum use; could lead to more intelligent allocation of frequencies, and could be used in any future interference investigations.

With regard to the permitted mobility of 50m (§5.58), before re-consulting the database we note that this potentially allows a device to wander outside of the UKPM planning pixel used to determine its permitted EIRP. This is a potential issue in some areas of the country, particularly towards the edge of service of a transmitter. This issue could be addressed by calculating the availability over a cluster of pixels (e.g. 9, or more, depending upon the position uncertainty of the location service) and using the most restrictive set of values or by the WSDB defining the permitted mobility of the device before re-consulting the database.

With regard to multi-channel operation (§5.61-5.63) the approach is acceptable for contiguous channel aggregation. It should be noted, however, that the justification developed in Appendix 6 does not take account of any receiver non-linearity (intermodulation) and it may be necessary to further limit channel aggregation if measurements on actual receivers indicate a potential risk. It is known, for example, that

the protection ratios for N+2/N+4 operation are substantially higher (typ. 10dB) than for N+2 operation as a consequence of 3rd order intermodulation in the TV tuner. Further studies are required, but it is felt that non-contiguous channel aggregation is potentially more of a problem than contiguous channel aggregation.

With regard to the table of out of block emissions defined in §5.64, it is unclear if the number of device classes will be necessary. A new database will be required for each device class and this should be reviewed as devices emerge.

We note the proposal to set a permitted out of block power level of -84dBm/100kHz (defined in §5.66; equivalent to -65dBm/8MHz) and this would be an appropriate value to protect DTT and PMSE reception at the edge of service. Unfortunately it would appear that in many situations this limit would never apply; e.g. class 2 devices operating at 20dBm are permitted to radiate -54dBm/100kHz in all TV channels. This is a particular issue for PMSE as aggregation of OOB interference from multiple WSDs could adversely affect radio microphone reception. It would be desirable to specify a mechanism to ensure that the power amplifiers of WSDs are completely disabled whenever WSD operation is not permitted (e.g. in theatres).

With regard to security (§5.68-5.70), there is a clear regulatory requirement to ensure that WSDs can only consult with authorised databases and that appropriate mechanisms are put in place to prevent unauthorised databases from operating. The adoption of HTTPS for the communication between WSD and WSDB is a useful start, as this prevents snooping of the communication between WSD and WSDB. However, further measures would appear to be necessary to prevent trojan databases from operating and compromising the entire protection framework.

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

The approach developed for slave operation, where the slave is not geolocated, uses the coverage area of the master device as a proxy for the position of the slave. This allows generic operational parameters for the slave to be determined.

It is noted that that the slave antenna gain is an important parameter and the proposal to limit the maximum antenna gain is a sensible approach (§5.85). The range will also be a function of the modulation mode for the communication between master and slave and it will be necessary to use the most robust mode (i.e. that providing communication at the lowest C/N ratio) for the initial determination of the master coverage area. It should be noted that timing data (e.g. ping times) and knowledge of the actual slave antenna gain

and the chosen operating mode (i.e. not necessarily the most robust mode) could be used to refine the generic slave operating parameters once communication has been established.

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

The defined parameters are in general appropriate and sensible.

The device height is a particularly important parameter and it is unfortunate that this cannot be automatically determined using current geolocation technology. It is proposed (§6.7.8, §6.12.8) that this should be an optional parameter which would need to be entered manually (if used). It is felt that manually entered data should only be used if the WSD is operated by a professional communications provider. In other cases, the device height should be inferred from the x/y coordinates using the clutter height (for urban/ suburban areas) or a conservative assumption on mast height (e.g. 20m) for rural areas.

With regard to multi-channel operation, it is felt that non-contiguous channel aggregation may be more harmful than contiguous channel aggregation as a consequence of intermodulation in the victim receiver. As such, it may be necessary to limit the former and allow the latter. The proposals in §6.16.3 and §6.21.3 do not appear to be flexible enough to control both contiguous and non-contiguous channel aggregation. Some technologies, e.g. the Weightless standard, support fast channel hopping over multiple TV channels and the interference impact on DTTT receivers is potentially quite severe. It may be necessary to limit such behaviour and this is not covered by the proposals.

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

This approach is satisfactory and the decision to support regulatory requirements with compulsory tests in the VNS is welcomed. The draft nature of the VNS is noted and there appear to be a number of potential issues that will require further clarification and development of the VNS.

The device classes listed in Table 2 of §5.39 may require further refinement; class 2 devices, which permit AFLR values of 74dB at all frequency offsets are potentially more interfering than class 3 devices.

The out of block emission floor of -84dBm/100kHz defined in §5.39 would be appropriate to protect some set-top TV reception, however it is unclear why the limits defined in Table 2 of §5.44 have been relaxed by 30dB in the VHF radio bands (87.5-118MHz and 174-230MHz) to -54dBm. Such levels of unwanted emissions are likely to cause

unacceptable interference to FM and DAB radio services, particularly when interference aggregation from multiple WSDs is considered.

We note that no conformance test has been defined to prohibit slave to slave communications in the event of the master device losing communication with the WSDB (§5.102 – §5.104). It would be appropriate to develop a conformance test to protect against this risk.

We also note that no antenna tests are defined and the actual antenna gain of a WSD is not checked (§6.47).

It would be useful to define the format of the device shutdown message (§6.130) to assess compliance of the "kill switch" functionality (§6.128-6.141). This would appear to require the master WSDB to listen on a TCP port for such a message from the WSDB which would use a "push" technology. This may be an issue for WSD master devices connected to the internet behind a firewall or NAT router, where polling may be the only option.

It is unclear to what extent the proposed tests have been validated using real RF test equipment. Some spectrum analyser measurements require the use of a peak detector (e.g. occupied bandwidth (§6.65, §6.77), unwanted emissions outside 470-790MHz (§6.163, §6.168), receiver spurious emissions (§6.180)), whilst other tests specify RMS detection (in-block EIRP spectral density (§6.108), unwanted emissions 470-790MHz (§6.149)), Since the calibration of a peak detector on most spectrum analysers is only valid for CW signals, RMS detection would be appropriate for WSD measurements which are noise like signals with peak to mean ratios which are a function of the device TDD parameters.

The test for unwanted emissions within the band 470-790MHz requires a measurement of the "*UUT maximum average power level*" (§6.149) and this requires further clarification.

The main consultation document assumes that the AFLR of a WSD will be constant, and the level of out of block emissions will decrease pro-rata with the power of the wanted emissions subject to a noise floor limit of -84dBm/100kHz. This is set out in §5.66 and is necessary to ensure that the protection ratios used to construct the WSDB are not a function of the EIRP and operating point of the WSD. It is anticipated that practical WSDs may not behave in this way and the AFLR is likely to decrease at lower powers as the output signal sinks into the noise floor of the RF modulator and power amplifier. This is particularly likely if power control is implemented in the digital domain, as the signal will be degraded by the quantisation noise of the DAC at lower EIRP. It would therefore be appropriate to measure AFLR over a range of EIRP level. The proposed tests in the

VNS are specified only at maximum EIRP (§6.144) and a set of measurement frequencies and EIRPs needs to be specified.

The tests to assess the behaviour of mobile WSDs to ensure they consult the database should they move by a distance greater than 50m (§6.228) appear to be somewhat impractical. A test harness to emulate the geolocation service (typically GPS) would be required for a practical laboratory test.

The location uncertainty of a WSD is an important parameter, as the WSDB must account for this when determining the appropriate EIRP for the device. Where the uncertainty is high, all potential locations must be considered and the most restrictive EIRP must be used. It is noted that a WSD is permitted to report “no horizontal geo-location uncertainty” to the WSDB (§5.111 and Table 4), but it is unclear how the EIRP would be determined for such a case. A nominal uncertainty could be assumed, based on the device class, but this may prove unsatisfactory and requires further clarification.