BASIC DETAILS

Consultation title: Digital Dividend: Geolocation for Cognitive Access

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Name Mark Waddell Signed (if hard copy)

Q1: Should we suggest only high level parameters, leaving further work to industry, or should we seek to set out full details of parameters to be exchanged?

There is a trade-off between an overly prescriptive approach that might prevent useful utilisation of the white space and a less prescriptive approach that potentially leaves the primary licensed services vulnerable to interference. Given the high value of the DTT network, as the nation's most important TV delivery platform, protection of the primary services should continue to be Ofcom's priority.

From the research and studies carried out to date, the following parameters need to be addressed:

1) Device EIRP limits for a given location. This will be a function of:
    a) The class of device and its C/I characteristic to the primary service. Different white space technologies will use different coding and modulation schemes and will require different protection ratios for the primary service. Ofcom have commissioned extensive C/I studies in the past to investigate the compatibility of DTT and PMSE with candidate technologies for the digital dividend and must continue this commitment to understand the interference characteristics of emerging white space technologies.
    b) The location of the device and including its height and the clutter characteristics in the surrounding environment. This is required to determine the propagation model to victim primary service receivers.
2) The database update interval, necessary to protect dynamic PMSE assignments.
3) Logging of the location, UHF channel and EIRP of white space assignments in order to provide an audit trail for interference investigations.

Q2: Should both closed and open approaches be allowed? Should there be any additional requirements on the providers of closed databases?

Whichever approach is adopted, the regulator requires a mechanism to verify that the database provides the required protection to the primary services. A single open approach would greatly simplify such checks, allowing Ofcom to execute its duties with the minimum effort. If a closed approach is to be permitted, the database provider must provide appropriate mechanisms for automated verification of the database to ensure the protection of the primary services is not compromised.

Q3: What information should be provided to the database? Are our assumptions about fields and default values appropriate?

The position and class of device should be provided as a minimum set of parameters. Using a clutter database and information on the interference characteristic for the particular class of device, a list of candidate channels and permitted EIRP levels can then be calculated and returned to the device.

Q4: Should the translation from transmitter location to frequency availability be performed in the database or in the device?

The translation from DTT transmitter location and PMSE assignments to a table of frequency availability will be computationally intensive and is best performed in the database.

Q5: Have we outlined an appropriate information set for the database to provide to the device? Can industry be expected to develop the detailed protocols?

The information set outlined seems appropriate and the definition of the exact protocols should be left as a standardization task for bodies such as the IEEE or ETSI.

Q6: Is a two-hourly update frequency an appropriate balance between the needs of licence holders and of cognitive device users?

A two hourly check would be a minimum requirement to protect PMSE. Frequency assignments for PMSE events tend to be booked a day in advance, but unlicensed use of the pre-booked channels sometimes necessitates a short notice change. The update frequency is thus linked to unlicensed radio microphone activity. Unfortunately, this may increase with the appointment of a commercial band manager charging higher fees. Under such circumstances, more frequent updates may prove desirable, perhaps half-hourly.

Q7: Is there benefit to devices receiving a time validity along with any database request and to act accordingly?

This would be beneficial – a short time-validity period could be applied in locations where PMSE assignments are frequently required, with longer periods for areas with little PMSE activity, e.g. rural areas. The addition of a time validity period would also permit short notice changes to PMSE assignments, required to cope with unlicensed PMSE use, as discussed above.

Q8: What role could push technology play?

Push technology does not appear to offer any benefits in protecting the primary services.

Q9: Do you have any comments on the suggested approach to implementing the database for DTT?

The approach discussed, whereby the cognitive interference is limited at a ratio to the wanted DTT signal of -33dB for co-channel interference and -17dB for adjacent channel interference, has some merit, but it is unclear which level of received DTT signal strength should be used in the calculations. If the wanted signal strength is based on the mean received signal level at 10m above ground level on a 12dBi antenna, this would result in WSD EIRP levels that could cause significant interference to lower quality installations, including loft and portable receivers. Furthermore, the mean level does not take account of the location variation in a DTT coverage area. Although the DTT network is not planned for portable reception, significant parts of the UK enjoy a significant coverage margin for fixed reception, which enables portable reception in many areas, particularly after completion of DSO. Basing permitted C/I levels on fixed reception parameters would tend to severely compromise reception on portable and loft mounted antennas, which are often used for second sets, which would be unfortunate.

An alternative approach, used In CEPT SE42 and SE43, is to limit the permitted WSD EIRP to a level based on a given degradation to the DTT receiver sensitivity. For co-channel interference an I/N ratio of -10dB is typically used, whereby the device EIRP is limited to a level 10dB below the noise floor of the receiver, resulting in a 0.4dB degradation in DTT sensitivity. For adjacent channel interference, the EIRP limit can be increased by the difference in protection ratios for co-channel and adjacent channel interference[1]. Assuming a co-channel C/I of 20dB and -30dB for the adjacent channel, the interference in the adjacent channel can be increased by 50dB relative to the co-channel case. Permitted offsets for other channels can be derived using the appropriate C/I figures for typical DTT receivers. The DTG D-book C/I targets provide a useful baseline for receiver performance.

In practice, additional allowances have to be made for multiple WSDs working at different offsets, the out of band characteristics of the WSDs and device aggregation effects. The precise details of these calculations are currently under detailed consideration within CEPT SE43.

Q10: Do you have any comments on the suggested approach to implementing the database for PMSE?

For protection of the PMSE receiver, the suggested building penetration loss of 20dB between indoor PMSE antenna and outdoor WSD would tend to over-estimate the isolation between WSD and the PMSE victim. TV planning measurements suggest a building penetration loss of 7dB with a standard deviation of 6dB[2]. For outdoor PMSE, building penetration losses will not apply, and LOS propagation models will be appropriate for calculating the level of WSD interference.

The analysis presented in the discussion document makes assumptions about the PMSE received signal level which may not be appropriate. A preferred analysis would be based on a permitted I/N budget, as discussed earlier, limiting the maximum degradation to PMSE receiver sensitivity. We are aware that Ofcom have recently undertaken an extensive programme of PMSE receiver C/I measurements (as yet unpublished) and these will be important in assessing the interference effects at different frequency offsets.

Q11: Do you believe it is practical to implement such a database?

The computation of the database is practical, but the choice of propagation model needs further research and verification. The approach discussed suggests a low-height to low-height propagation model is used to determine the isolation between the WSD and the

[1] The difference in protection ratio between the co-channel and adjacent channels is known as the adjacent channel interference ratio (ACIR).

[2] For further details, see "The Chester 1997 Multilateral Coordination Agreement relating to Technical Criteria, Coordination Principles and Procedures for the introduction of Terrestrial Digital Video Broadcasting (DVB-T)", European Conference of Postal and Telecommunications Administrations, Chester, 25 July 1997
(http://www.ero.dk/132D67A4-8815-48CB-B482-903844887DE3)

victim primary service. This will not be appropriate in all circumstances and it is felt that a clutter database will be required to determine the correct propagation model at a given location. It has been assumed that the WSD will be at street level in most use case scenarios, however a WLAN type application with the WSD located indoors is emerging, potentially at elevated height (e.g. in a block of flats). Under such cases, a LOS model may be appropriate to prevent interference to the primary service.

Q12: Is it appropriate for third parties to host the database? If so should there be any constraints? If not, who should host the database instead?

Protection of the primary licensed services is imperative and it feels inappropriate to delegate this responsibility to proponents of cognitive devices. Ofcom needs to retain tight control of the design and verification of the database if it is to fulfil its obligations to spectrum license holders. It may be appropriate to subcontract the operation and maintenance of the database to a not-for-profit, trade-body funded by white space device manufacturers and supplemented by a tax on white space devices. This needs to be closely regulated by Ofcom using automated verification of the database contents.

Q13: How can any costs best be met?

The costs could be met initially through spectrum award revenues, and subsequently by a tax on devices.

Q14: What are the difficulties and expected costs to licence holders in providing the necessary information to the database? Could this information be provided in any other way?

Information on TV transmitters and PMSE assignments are held by the current PMSE band manager, JFMG whose parent company Arqiva also operates the DTT network. Ofcom should approach Arqiva to fully understand the cost implications of operating a geolocation database. Ofcom may be able to address some of these issues in its planned beauty contest for a replacement PMSE band manager.