Cover sheet for response to an Ofcom discussion

BASIC DETAILS

Document title :	Digital Dividend: Geolocation for Cognitive Access
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Name of respondent :	Arqiva Limited
Representing (self or organisation/s) :	Organisation
Address (if not received by email) :	

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Name Peter Couch Signed (if hard copy)

Head of Strategy Development, for and on behalf of Arqiva Limited

About Arqiva

Arqiva has its headquarters in Hampshire, with other major UK offices in Warwick, London, Buckinghamshire and Yorkshire. It now has 9 international satellite teleports, over 70 other manned locations, and around 9000 shared radio sites throughout the UK and Ireland including masts, towers and rooftops from under 30 to over 300 metres tall.

The company is owned by a consortium of long-term investors led by Canadian Pension Plan Investment Board (CPPIB) and has 3 operating divisions: Terrestrial Broadcast, Satellite & Media and Wireless Access.

Arqiva is technology- and service-neutral and operates at the heart of the broadcast and mobile communications industry. We are at the forefront of network solutions and services in an increasingly digital world. The company provides much of the infrastructure behind television, radio and wireless communications in the UK and has a growing presence in Ireland, mainland Europe and the USA.

Arqiva is a founder member of Freeview (Arqiva broadcasts all 6 Freeview multiplexes and is the licensed operator of 2 of them) and was a key launch technology partner for Freesat. Arqiva is also the licensed operator of the Digital One national commercial DAB multiplex.

Alongside the BBC, Arqiva's Spectrum Planning Group plays a critical role in planning Digital Switch Over (DSO).

In addition, for broadcasters, media companies and corporate enterprises Arqiva provides end-to-end capability ranging from;

- outside broadcasts (10 trucks including HD, used for such popular programmes as Antiques Roadshow, Question Time, Proms in the Park, a wide range of sporting events and the IIFA Awards 2007 "BollyWood Oscars" with a huge worldwide audience);
- satellite newsgathering (30 international broadcast SNG trucks);
- spectrum management for Programme-Making & Special Events (PMSE) through subsidiary JFMG;
- 10 TV studios;
- playout (capacity to play out over 70 channels including HD);
- digital signage, including managing the output for CBS Outdoor's digital escalators and cross track projection on the London Underground; to
- satellite distribution (over 1200 services delivered).

In the communications sector the company supports cellular, wireless broadband, video, voice and data solutions for the mobile phone, public safety, public sector, public space and transport markets.

Major customers include the BBC, ITV, Channel 4, Five, BSkyB, Classic FM, the five UK mobile operators, Viacom, Turner Broadcasting, Metropolitan Police and RNLI.

Digital Dividend: Geolocation for Cognitive Access

Summary of Response

Arqiva appreciates the opportunity to respond to this discussion document.

Arqiva supports Ofcom in the development of innovative ways to deploy wireless based services and welcomes Ofcom's ongoing work programme to protect existing licensed users whilst optimising the potential for the deployment of cognitive access based services through the utilisation of the geolocation database approach. As noted in our response to Ofcom's recent consultation, "Digital Dividend – cognitive access," we consider ourselves ideally placed to facilitate such a solution, given our responsibilities for the planning of the High Power Digital Terrestrial Television (DTT) networks and through our ownership of the PMSE spectrum manager JFMG – clearly two of the key data sources that would need to be referenced are administered by Arqiva.

With reference to the geolocation database approach we have responded directly to the questions in the body of this document, whilst here we emphasise those aspects of particular importance.

- Licensed users of spectrum should be protected from harmful interference caused by the introduction of geolocation based cognitive access devices and Ofcom should ensure that the appropriate systems and processes are introduced to ensure that this principle is upheld.
- Considerable activity is underway both in the US and Europe to optimise the introduction of cognitive devices into interleaved spectrum. We urge Ofcom to consider a harmonised approach to define a minimum standard for the operation of devices to minimise the risk of inappropriate equipment being used in the UK market.
- We wish to highlight concerns over the accuracy of location based systems, particularly indoors, and the risk of false positive results leading to reference locations being incorrect. Without a robust and reliable approach to device location confirmation a heightened risk of harmful interference will result.
- Due to the developmental nature of cognitive access systems and the control regime that is being considered we would encourage Ofcom to undertake extensive trials to prove the viability of the approach.
- We urge Ofcom to consider appropriate controls to ensure that only devices compliant with defined standards of operation and performance can be used within the UK.

In summary, Arqiva welcome the opportunity to contribute and be involved in the ongoing development of cognitive access systems in the UK market, but urge Ofcom to protect licensed users from harmful interference.

Response to specific questions

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?

Ofcom will need to specify sufficient high-level information to ensure that cognitive devices are able to provide the required degree of protection to licensed services, but full details of the parameters required to achieve this can be decided by industry.

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

A single database will be much easier to police and update and will ensure consistency, and we would agree that multiple identical databases offer no advantage. Furthermore, every effort should be taken to ensure harmonisation across international boundaries through the definition of minimum standards to minimise the risk of inappropriate equipment being used in the UK market.

Rather than having separate closed databases for the third option, users could access the same information via a third party (such as a manufacturer who processes it to suit particular devices). It could therefore appear that there are many sources, but in reality all information should come from a single source.

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

The overall approach outlined by Ofcom appears reasonable; however, the assumptions about fields and default values are not clear as some information (including Q3 itself) appears to be missing from the Ofcom document's main text.

The device will need to signal its type and location, and how it obtained its location if multiple methods are available, so as to allow the database to estimate the accuracy based on the device type and method used. Speed information, and possibly direction, will also be necessary as this will determine the period for which information will be valid. Furthermore, device initiated location updates may have to be implemented to account for location changes due to mobility. In defining location it is important to ensure appropriate reliability of the system being used to guarantee the accuracy of the location as defined. We understand that some systems can generate false positive results, particularly indoors, which if used to approve spectrum availability for cognitive access devices may lead to a heightened risk of harmful interference. We encourage Ofcom to consider in greater detail the reliability of location based systems and define standards for their use with geolocation based cognitive access devices.

In the absence of sufficient data, the database must assume a worst case condition and impose appropriate limits.

The case will need to be considered where data are sent based on the device being stationary, but subsequently starting to move. Either the device will need to recognise this and signal for a new request, or it must know how to deal with this situation. If when standing still it is proposed to send limited information, there may not then be enough information to deal with a device on the move. The proposed course of action is covered to an extent in the footnote 9 on page 6 of the discussion document.

Whatever system is used must be fail-safe, to protect the rights of licensed spectrum users.

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

The translation should be performed in the database to allow for enhancements over time. In this way, any changes to the algorithm, etc, which might be implemented, will all be centrally located and easier to apply. If placed in a remote device, it would be difficult

to guarantee that the device would be able to cope with, for example, an updated calculation method.

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?

Ofcom's approach to the data set to be provided appears appropriate. As well as the database indicating which channels can be used and the appropriate power levels, it could also specify how far from the current position operation on a particular frequency is valid and the rate at which power must be reduced as the device changes position. If the device's location were to change, it could then calculate if a channel is still available, and use an appropriate algorithm to reduce power. However, it should be noted that it may not be possible to update such an algorithm in the device, should this be needed at a later date.

It should be left for industry to decide how to implement the detail of what is required.

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

The requirement will depend on how much data are stored in a device and whether it is moving. If the device only stores data for its immediate vicinity then it will need to request an update whenever it moves. As a general rule for a mobile device, the update frequency should be based on how close it gets to the data boundary and on its velocity (see response to Q5 above). Such intelligence within the device would limit the amount of data needing to be transferred. Automatic two-hourly updates as indicated for PMSE appear reasonable subject to the dynamic nature of the use, and we would agree that changes to DTT services are much less frequent and always planned well ahead.

In the case of moving devices, see our response to Question 3, we encourage Ofcom to consider the accuracy of location sensing tools and the need for standards of operation in the case of geolocation based cognitive access devices to protect licensed users from harmful interference.

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

As noted, PMSE and DTT updates will be required even if the device is stationary. Data for PMSE could be valid for short or long periods of time depending on particular circumstances. Hence, when longer periods apply, the use of time stamps through consultation with the PMSE Band Manager could enable specific frequency allocations to require less frequent updates.

Q8: What role could push technology play?

The use of push technology for the database to update the device would introduce complication and has the disadvantage of needing a permanent connection. The device would have to take appropriate action (ceasing operation) should this connection fail. However, push technology might still be required should there be a need for a facility to remotely switch off cognitive devices which were determined to be causing interference.

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

The general approach outlined by Ofcom is not unreasonable. However, limiting devices so that co-channel interference is 33 dB below the wanted signal (and 17 dB above for adjacent channels) is based on median values and takes no account of the distribution of signals for both the wanted DTT and the interfering device(s) across the pixel.

Furthermore, the protection as discussed is based on a nominal 64QAM 2/3 DTT system. It is quite possible that other modes could be used which would affect the level

at which interference occurs. For example, the use of 64QAM 3/4 will result in about 1.5 dB greater susceptibility to interference.

Unfortunately, the level of protection Ofcom is expecting to provide, and to what percentage of the population interference will be allowable are still unclear and will need to be defined. We emphasise our primary concern that it would still be possible for cognitive devices to cause interference when using the above assumptions. See also the response to Q11.

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

Arqiva does not have a view on the protection levels required for PMSE other than to note international arrangements for PMSE use should also be considered.

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

We encourage Ofcom that every effort should be taken to ensure that the approach adopted to facilitate the deployment of cognitive access based services should be such that licensed users are protected from harmful interference.

The propagation model proposed was derived for calculating loss between two devices at street level. Strictly speaking, propagation from a street level device to a rooftop aerial is outside the range the model was designed for. However, as Ofcom proposes using a line-of-sight element up to a distance of 2.1 km based on what appears to be a 0.1% probability that the level will be exceeded, the proposal appears reasonable as long as due account is taken of the variability of DTT signals (see response to Q9 above).

In calculating interference, the location variability of the DTT signal should be taken into account at least down to the minimum level required to decode a signal. In other words, the prediction for the wanted DTT signal needs to be reduced to take into account location variability to a level that limits loss to the agreed level, such as 0.1%.

There is a need to engage with broadcasters to discuss how modelling should be carried out; when the database would need updating and how it would be updated. The scope of a full assessment for this subject area is far greater than warranted by the simple question included in this discussion document. Furthermore, the approach appears to rely on assumption on top of assumption. As it is early days in the development of cognitive access systems we urge Ofcom to undertake extensive trialling before such systems can be deployed commercially in order to ensure that all possible protection is afforded to licensed users.

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?

Third party hosting of the database would be appropriate providing that sufficient controls are put in place regarding access to, and the use of, the data. This data (for example, detailed coverage information of the DTT network) has commercial value and it must be ensured that it can be used only to facilitate the operation of cognitive devices and not for other commercial purposes. Perhaps the third party host should operate independent of those parties directly generating income from the services delivered over the spectrum, in the same way that. JFMG administers the spectrum independently of the broadcasters and theatres that generate income from the use of the spectrum.

Q13: How can any costs best be met?

The key requirement is that the costs of this system should be borne by those benefiting from the use of cognitive devices, and not by licensed spectrum users seeking protection from any interference which might be caused. Any unwarranted costs incurred by licensed users would need to be passed on to those parties responsible for the interference, as there is no provision in the costs of designing and deploying the High

Power DTT networks for protection against, and mitigation of, secondary interference from cognitive access systems.

If the use of cognitive devices is seen as a benefit to the nation as a whole, since ultimately everyone will benefit directly or indirectly, then the cost could be borne by the State, arguably funded by tax revenue from the device sales. The alternative of charging cognitive device beneficiaries directly (either suppliers or end users) is more complex and problematic, especially if in the case of end users the devices are used as part of a mesh network and communicate with each other directly, rather than through a third party who could otherwise manage the charging.

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?

For DTT, the data will need to come from a source that is representative of DTT coverage and one to which the broadcasters subscribe. This effectively means output from the UK Planning Model, which could be provided by the BBC or Arqiva. This model is proprietary to the parties involved and hence subject to confidentiality arrangements.

The data that would need to be supplied are transmitting station position and channel, and for each pixel location files detailing the sum of the wanted signal, the sum of interfering signals, the standard deviation associated with both and the station service area data. Population and clutter data could also be supplied depending on the sophistication of the algorithm used to calculate channel availability for cognitive devices. In total, this represents around 50 gigabytes of data. The data have commercial value as noted in the response to Q12 above, and some restrictions on its use will be necessary in order to protect the DTT platform.

The cost of providing information to the database should not be borne by the licence holders using the spectrum.

The discussion document refers to stakeholders notifying the Regulator of interference where it is possible the database might be incorrect, it is not clear how this would work for the average TV viewer. This implies a cost to the broadcasters and multiplex operators, as stakeholders, in maintaining resources and technical services for the co-ordination and investigation of problems that were not envisaged at the time the networks were designed and deployed. These are likely to require a significant investment and the stakeholders should not be required to finance this work, as broadcasters and multiplex operators do not benefit from other services sharing the licensed spectrum. A process will also need to be put in place to allow feedback as a result of interference investigations to be fed back into the database.

Ofcom refers to ‘the modelling tool’ to analyse problems, and it needs to be clarified what tool will be used and who will carry out the modelling and bear the cost.

Supplemental Observations

Policing the database

A single database would be easier to police than multiple databases, as noted in the response to Q2. It is stated that the database may potentially be required to handle millions of requests per hour and it must be ensured that it has the capacity to cope with this level of activity. Should the database be unable to reply to a request then the default condition that a device is not allowed to transmit must be maintained. It is noted that Ofcom would act in a manner appropriate to any problem that might arise, but it is not clear what this means, or what sanctions the Regulator would have in cases of non-compliance by the operator.

Policing of devices

Policing of devices in many ways is of greater concern than policing of the database.

Given that devices will be unlicensed it will be necessary to prevent cheap, non-compliant devices (possibly imported from other markets) being used. It must be assumed that such devices could cause interference and thus will detract from the quality of service DTT viewers receive, or could be damaging to PMSE operations. Identifying the cause of interference from such devices is likely to be difficult if not impossible. One end result of this would be that over a period of time DTT viewers who can no longer receive a reliable service are likely to abandon the terrestrial platform.

If rules are applied as to how unlicensed devices should behave, it will therefore be necessary to police the sale of devices to ensure that only compliant models are used.

It will also be necessary for devices to be tested to ensure compliance. It has been suggested that almost every electronic device will ultimately be allowed to form part of a mesh network, and central testing of all devices will therefore become impractical. Device standards will drive device behaviour, so setting and policing of the standard will become the only method by which devices can be made compliant.

Although standards can determine how a device should behave they will not directly control its radio frequency (RF) performance. The primary function of a device is to pass data to and from another device, and the RF parameters and control of these is secondary. So, even with strictly set standards it will be difficult to police them as there is no driver to compel manufacturers to comply fully. Whereas major manufacturers will comply, smaller unknown brands may not. Unless the user suffers interference directly as a result he will not care about the secondary function of protecting other services, so without sufficient controls in place it would be left for others to identify and mitigate interference problems that might arise.