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What do you want Ofcom to keep confidential?:

Keep name confidential

If you want part of your response kept confidential, which parts?:

Ofcom may publish a response summary:

Yes

I confirm that I have read the declaration:

Yes

Ofcom should only publish this response after the consultation has ended:

You may publish my response on receipt

Additional comments:

Question 1: 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?:

It is sufficient to only suggest high level parameters and leave the details to the industry to work out in standards organizations. Industry is able to come up with globally agreed parameters much more quickly than would happen through coordination between different regulatory entities.

Question 2: Should both closed and open approaches be allowed? Should there be any additional requirements on the providers of closed databases?:

From a technical perspective, as long as there are open databases that are based on open, interoperable standards, closed databases can coexist with them. However, closed databases by definition introduce ?walled gardens?, and caution must be used to prevent the locking of CR users to them. It has to be possible for a device to access also an open database and not be limited to a closed one.

Closed database may also complicate cognitive device roaming if in some country/region, no open database (based on standardized protocols) is deployed. Only open, interoperable databases give good enough guarantee to device vendors that their devices may access the database regardless of where those devices operate.

Furthermore, multiple, open databases encourage a high level of competition (e.g., low pricing), innovation, and reliability in database services. Innovation in the rapidly developing field of database services will thrive, and consumers will be able to enjoy those services at the lowest possible market-determined prices with multiple database providers.

Question 3: What information should be provided to the database? Are our assumptions about fields and default values appropriate?:

We very much concur with Ofcom thinking on the device providing the accuracy of its location. Regardless of the locationing method used (GPS, A-GPS, something else), the cognitive device can never be 100% certain of its location. For example, the device could be very close to the edge of a 100m x 100m pixel, in which case even some inaccuracy in GPS measurement could actually report its location in a wrong pixel.

It should be noted, that the accuracy of spatial resolution depends mostly on the technology used to determine location, and not on the vendor implementing location determination methods. If GPS signal is available, then location can be determined usually with greater than 10m accuracy, but if GPS is not available, then the accuracy of location determination is much worse (eg 50-300m for 2G/3G, 50-100m for wifi, etc.).

The accuracy of spatial resolution may be implementation and device specific, and the database should take that into account when replying to channel availability queries. For example, if the accuracy reported by the device is poor, the database would need to limit the available channels it reports to only those that are available over the uncertainty area of the device?s spatial location. It must be noted that such uncertainty in the device?s location by no means threatens the protected areas of the primary

service users; it mainly limits the spectrum potentially available to the device.

Our recommendation is that location accuracy should be imposed only to the database as pixel granularity, rather than requiring the cognitive device to determine its location with 100m x 100m accuracy. The device should instead send its location and the accuracy it thinks it was able to determine (whatever that is), which then would be considered as the area of operation of the device

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Enforcing the 100m x 100m locationing granularity on cognitive devices and expecting them to know exactly where they are located will not guarantee less harmful interference but may only result in higher likelihood of interference to primary users due to the reasons outlined above.

Furthermore, we understand from the section 3.11 of the discussion document that the device could request frequency availability for multiple pixel locations with one database request. This means that the device could report an area for which it wants the list of available channels for each pixel (as opposed to a list of available channels across all the pixels which is the case for location inaccurary radius). If this is indeed possible, in addition to a default radius, the device could opt to provide an area for which it wants to download frequency information. This area could be defined as a polygon instead of only a circle with a default radius.

We also agree with Ofcom thinking on the device providing information on its type. Out-of-band emission characteristics are one example of additional information, but there may be other parameters that would help the database in formulating its response.

Question 4: Should the translation from transmitter location to frequency availability be performed in the database or in the device?:

We understand the challenges brought about if the translation calculations were to be done in the cognitive device. Database would appear to be the correct place to perform the translation.

Question 5: Have we outlined an appropriate information set for the database to provide to the device? Can industry be expected to develop the detailed protocols?:

We agree with Ofcom thinking that pre-defined frequency bandwidths would unnecessarily limit the flexibility of frequency use for cognitive devices. Start and end frequencies on each available frequency band in each reported pixel location would be a very good approach.

One aspect to consider with regards to reporting the list of frequencies in each pixel is what pixels are considered in the report to the cognitive device. In the simplest form the database only returns the information for the pixel that the cognitive device is located in. As we elaborated in the answer to Q3, it is generally not possible to limit the information to only one pixel due to the inaccuracies in the cognitive device?s locationing. From the locationing inaccuracy point of view, the inaccuracy radius

would be seen as an ?inflated pixel?, for which the database would still report only one list of available channels. However, for future flexibility, particularly in light of moving devices, the database could have option of reporting a number of pixels with their respective lists of available channels. In line with the discussion in Q3, these pixels could constitute an area defined by the device and provided to the database in its query.

Flexibility in the definition of the area would be particularly useful for a moving device. A large circle defined around the device could make the database report channel availability on pixels that may have no relevance to the device due to its direction of movement. A polygon directed to the direction that the device is moving would allow the database to return much more relevant channel information to a device in motion.

Question 6: Is a two-hourly update frequency an appropriate balance between the needs of licence holders and of cognitive device users?:

From regulatory point of view, it should be sufficient that the cognitive device only uses information that is up to date. In other words, rather than require the cognitive device to check the database at least two-hourly, the device is required to have updated channel information within two hours from changes taking place in the database. How the device goes about ensuring that should be left to the industry to agree on and define. Devices that have no other means than direct query to the database by default would be required to check the database two-hourly, but this should not be a blanket requirement to all the cognitive devices.

Question 7: Is there benefit to devices receiving a time validity along with any database request and to act accordingly?:

Yes, we agree that such a time stamp would bring benefits. It would in particular provide for flexibility in the cognitive device [database] re-checking frequency if the updates from PMSE users turn out to be less common than expected.

Question 8: What role could push technology play?:

We agree that continuous http connection between the cognitive device and database does not bring clear advantage over perioding re-checking. However, push via the Internet is by no means the only possibility for the database and cognitive device to interact. There are already existing radio technologies such as cellular radio that may be implemented in some cognitive devices. Using existing cellular connections is not too far-fetched a solution to provide cost effective and reliable push functionality between the database and some cognitive devices.

Question 9: Do you have any comments on the suggested approach to implementing the database for DTT?:

No comment.

Question 10: Do you have any comments on the suggested approach to implementing the database for PMSE?:

No comment.

Question 11: Do you believe it is practical to implement such a database?:

We believe that populating the database in line with the design principles that Ofcom is outlining is practical.

Question 12: 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?:

Database hosting should be open to all competent parties interested in providing it. This paves the way for innovation and provides the opportunity to provision both bare-bones databases and more full-fledged databases catering to additional, novel needs. The existence of multiple databases in parallel and open to market forces is critical. Multiple databases may be identical in terms of providing spectrum availability information. But different voluntary premium services could be provided on top of those databases and thus this provides business motivation for the interested party to host the database.

The constraint we prefer to see is that hosting of the database must be based on neutrality, with no favoritism towards any stakeholders. The purpose of database neutrality is to ensure fair competition. In order to ensure database neutrality, interfaces, protocols and data formats should be standardized, and based on open standards. International harmonization on these standards is preferred, because the use of databases in spectrum management is already being considered in many regions.

As far as database neutrality is ensured, we do not see any reason why third parties (or even interested parties) could not host the database(s).

Question 13: How can any costs best be met?:

Setting up a database needs funding, and it is envisioned that the database administrator needs to charge fees to support its operations. There can be several funding scenarios:

1) Funded by the government, as the database(s) serve public interest (e.g. to protect the public TV transmissions)
2) Industry forms a non-profit organization for administering the database
3) Funded by primary users of TV spectrum, as they get protection to their services from database(s)
4) Retail model
4.1 End-user is charged for the use of database(s)
4.2 Each WSD device is charged per query basis or through a levy at the time of purchase

5) Wholesale model
5.1 Service provider contracts through fixed pricing for access to database as a function of queries or number of active customers
5.2 A WSD manufacturer contracts with a DB administrator to pay a one-time fixed fee for each WSD that accesses the database

The operational costs of running a database may be covered by the database administrator by any suitable means to support its business case. However, for the initial capital expenses of setting up a database administrator service there may not yet be enough cognitive devices and users out to provide funding. In principle, database funding does not require regulatory oversight, but any fees should be preferably usage based and not implicitly levied on the devices. That is, we would not want to see a fee levied on a device able to access a database if that functionality is never used. The fee should preferably reflect the actual usage of the device.

Question 14: 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?:

No comment.