

Cognitive Radio: Ofcom consultation response

Question 1. The executive summary sets out our proposals for licence-exempting cognitive devices using interleaved spectrum. Do you agree with these proposals?

Nokia¹ supports the the further study of Cognitive Radio, which in general has the potential to increase the efficient use of spectrum. As we said in a previous consultation UK should take an active, and early, interest in the developments in the USA in order to avoid sub-optimal outcomes. The situation in Europe is different from the US in a number of respects, so it is important that the issues are brought to the fore before mass market deployment is taking place.

We believe that in the same way that Wifi has enabled some mobile operators, as well as new players, to increase traffic capacity without the constraints of existing networks, cognitive radio in UHF will do the same. It will bring more competition, but equally may provide a wider choice in cost effective solutions for the traditional telecommunications operators.

We particularly welcome recent moves to harmonise the use of this band in Europe as far as possible, and any commonality in regulations for White Space Devices internationally is also clearly important. Even if there are differences in the detail, regulations should not be so prescriptive as to rule out products which are competitive on an international scale.

Comparing the USA and Europe, there are important differences in the regulatory framework. We prefer the self-certification that is enabled in Europe with the RTTE Directive. Perhaps even more important the 'New Approach' enables manufacturers to make their own choice on methods of avoiding interference and achieving spectrum efficiency.

With an objective of increasing spectrum use, cognitive radio will have a significant role to play in some bands. But it is important to remember that Cognitive Radio is still a long way from being a panacea. Although development is to be welcomed, subject to the avoidance of interference, it cannot create spectrum capacity - only improve efficient use. For business, it will be an economic issue as to whether it is more cost-effective to use cognitive radio, or to use existing licence-exempt spectrum. The regulator, in addition will need to ascertain the cost of sharing, including the long term opportunity cost, if for example new services such as mobile TV are prevented from access later. In our answers we propose that Ofcom consider restricting Cognitive Devices to frequencies below 698MHz, as in USA.

Therefore the cost of equipment is particularly important in this area. It will be a long process to develop cognitive radio to be fully flexible. Until that time spectrum harmonisation will remain a useful and necessary tool, while further research and development of cognitive radio is welcomed.

¹ **About Nokia**

Nokia is a world leader in mobile communications, driving the growth and sustainability of the broader internet and communications industries. Nokia connects people to each other and the information that matters to them with easy-to-use and innovative products like mobile phones, devices and solutions for imaging, games, media and businesses. Nokia provides equipment, solutions and services for network operators and corporations.

Detection

Question 2. Do you agree that the sensitivity level for DTT should be -72 dBm?

Yes

Question 3. Do you agree with an additional margin of 35 dB resulting in a sensitivity requirement for cognitive devices of -114 dBm?

We note that Ofcom have assumed an antenna gain for portable and mobile devices (TVs and CD – Cognitive Devices) of 0dBi. In fact we have found that -7dBi would be a more accurate value.

See

http://www.dvb-h.org/PDF/01566629_DVB-H.pdf

We agree with the FCC that the sensitivity requirement will need adjusting for antenna gain.

Question 4. Do you agree with a maximum transmit power level of 13 dBm EIRP on adjacent channels and 20 dBm on non-adjacent channels?

The calculations Ofcom have presented here have not taken in to account indoor antennas – in particular those associated with portable and mobile receivers.

Question 5. Would it be appropriate to expect DTT equipment manufacturers to improve their receiver specifications over time? If so, what is the best mechanism to influence this?

In the long term this could be advantageous, but for mobile receivers improvements may be particularly difficult. As Ofcom has said it would also be unreasonable to expect viewers to change receivers to avoid interference.

Question 6. Do you agree that the reference receive level for wireless microphones should be -67 dBm?

Question 7. Do you agree with an additional margin of 59 dB for wireless microphones?

Question 8. Do you agree with a sensitivity requirement for -126 dB (in a 200 kHz channel) for wireless microphones?

Question 9. Do you agree with a maximum transmit power level in line with that for DTT? Are there likely to be any issues associated with front end overload?

Question 10. Do you agree that the sensitivity level for mobile television receivers should be -86.5 dBm?

We assume that the sensitivity is measured at the antenna port.

The -86.5dBm Ofcom has used is on the low side.

Referring to IEC62002-1 (DVB-H Mobile Interface specification) the noise figure will be typically 6dB and noise floor -99.2dBm. C/N (table 20) would be typically 7 or 13dB (assuming 3/4 MPE-FEC and QPSK 1/2 or 16-QAM.) We recommend assuming a C/N of 10dB and a sensitivity therefore of -89dBm.

Question 11. Do you agree with an additional margin of 20 dB for mobile television?

Yes

Question 12. Is it likely that mobile television will be deployed in the interleaved spectrum? If so, would it be proportionate to provide full protection from cognitive access?

It is quite possible that interleaved spectrum will be used for mobile TV (which could be DTT or MBMS as well as DVB-H), especially if the outcome of the awards for cleared spectrum is that no mobile broadcast bidders are successful. DVB-H can share multiplexes with DTT, which provides for a flexibility that could lead to mobile TV in the future even if it is not envisaged when interleaved spectrum is first awarded.

See page 206 of:

http://www.dvb-h.org/PDF/01566629_DVB-H.pdf

If mobile TV were not to be afforded protection, in addition to increased interference it would increase the risk to any new mobile TV service, and jeopardise the business case. In the longer term some additional filtering might be possible for mobile TV, but this (the band for cognitive radio) would have to be agreed internationally. The issue of legacy mobile TV devices would also remain.

One partial solution would be to restrict CD to frequencies below 698 MHz (in fact this is the case in USA.) This would at least keep higher channels available for mobile TV, or indeed other services, which could if necessary incorporate high pass filtering to avoid blocking problems.

The same interference issue (from non-adjacent CD) applies also to mobile TV deployed in cleared spectrum, even though it may be several channels away. (This would also apply to technologies other than DVB-H such as portable DTT and MBMS.) Ofcom does not appear to have considered this.

Question 13. Should we take cooperative detection into account now, or await further developments and consult further as the means for its deployment become clearer?

Geolocation databases

Question 14. How could the database approach accommodate ENG and other similar applications?

It would put a considerable burden for cognitive devices - and the network between the devices and database - to necessitate the devices to check the database for updates every hour. It would be perhaps better if unpredictable (ENG) applications that may require use at short notice be limited to only a portion of the spectrum allowed for cognitive devices. There could be a further requirement that cognitive devices about to use that part of spectrum

should also deploy sensing, whereas database access alone would be sufficient on the part of spectrum with slower database update frequency.

If operationally possible certain channels, where PMSE is not given protection, should be set aside for CD with infrequent database update. In exchange other channels would exclude CD use, and provide even greater protection to PMSE.

Question 15. What positional accuracy should be specified?

The accuracy does not need to be specified, but devices with more accurate positioning would be able to operate in more places.

Question 16. How rapidly should the database be updated? What should its minimum availability be? What protocols should be used for database enquiries?

The frequency of updates would need to depend on the service. The master database could be updated by PMSE licencees themselves.

With regards to the minimum availability, the requirement will be high, at least for channels used by PMSE. The reliability of access can be boosted by the duplicates of the database, and will be market driven.

When considering international harmonisation, internet based, open protocols and standard enquiry languages are clearly a preferable way forward for database access. As a device manufacturer addressing global markets we see clear benefits in that.

Question 17. Is funding likely to be needed to enable the database approach to work? If so, where should this funding come from?

Since Ofcom already hold the licensee information they are the natural candidates to hold the master database, notwithstanding the possibility of duplicating the information (or subsets thereof) elsewhere. However if users were required to pay to access the information this could remove much of the attractiveness of cognitive radio, which would in general be competing with licence-exempt access (noting, however, that 'free' and 'licence-exempt' are not synonymous.)

For CR to be attractive it needs to be free from recurring costs, similar to licence-exempt devices. Ofcom (or at least one database holder) should make available the data free of charge. Other databases may be able to charge, if they provide added value or can bundle the data with an internet or other service.

Question 18. Should the capability to use the database for spectrum management purposes be retained? Under what circumstances might its use be appropriate?

This could be useful if it were to enable, for example, future deployment of a mobile TV service, but this does not imply that device registration should be required.

Question 19. Should any special measures be taken to facilitate the deployment of cognitive base stations?

Cognitive base stations could enable new 'paid' services eg in rural areas but if they are sharing spectrum with services with a higher priority there may be cases where the 'low priority' service itself needs extra protection from repeated or unforeseen difficulties in access. There are also consumer protection issues to consider, if CDs purchased do not live up to expectations, because of difficulties in accessing spectrum at a later date.

Beacon reception

Question 20. Where might the funding come from to cover the cost of provision of a beacon frequency?

Such a solution could be funded by a service provider or manufacturer.

Question 21. Is a reliability of 99.99% in any one location appropriate? Does reliability need to be specified in any further detail?

Comparing the different options

Question 22. Do you agree with our proposal to enable both detection and geolocation as alternative approaches to cognitive access?

Geolocation should be mandatory, but the database need not be checked frequently if only channels that are not used by PMSE are used. Mandatory sensing would only be required for channels used by ENG, and thus need not be required in all CD.

Other important parameters

Question 23. Should we restrict cognitive use of the interleaved spectrum at the edge of these bands? If so, what form should these restrictions take?

On the assumption that Channel 61 is awarded on a national basis and used as a mobile receiver band it would seem sensible to exclude Channel 60 from cognitive use. However this and similar issues (such as whether channels adjacent to PMSE are available for use) need to be decided against agreed criteria and included in the database.

Question 24. Do you agree that there should be no limits on bandwidth?

Yes

Question 25. Do you agree that a maximum time between checks for channel availability should be 1s?

This figure appears burdensome for the the CD, while not removing the possibility of interference to PMSE. It would seem better to separate at least some of the CD channels from PMSE channels, as mentioned above.

If it is not possible to segregate the PMSE channels in this way it may be better to give the option of less frequent checks in exchange for restrictions on the mobility of the CD (eg for those not used in cars or trains, or those used only indoors.)

Question 26. Do you agree that the out-of-band performance should be -44 dBm?

Question 27. Is a maximum transmission time of 400ms and a minimum silence time of 100ms appropriate?

While we agree there is merit in encouraging sharing of spectrum between the licence-exempt users these proposals seem unduly prescriptive, and more so than for example the sharing used in 2.4GHz. We also note that the FCC did not in fact adopt these proposals.

Silence times of 100mS would render some fast applications/services difficult if not impossible. Spectrum access would also become rather 'hit and miss', especially if more than two devices are trying to access at the same time.

For CD to be able to usefully share a channel a more rapid protocol would be better. This could be developed later by industry if there is a need.

Question 28. Is it appropriate to allow “slave” operation where a “master” device has used a geolocation database to verify spectrum availability?

Yes

Impact assessment

A5.1 The analysis presented in this annex represents an impact assessment, as defined in section 7 of the Communications Act 2003.

A5.2 You should send any comments on this impact assessment to us by 1 May 2009. We will consider all comments before deciding whether to implement our proposals.

The opportunity costs of CR eg the potential value of future mobile TV deployment needs to be estimated. Even if mobile TV services have not been shown to be highly profitable so far, in some countries the take up has been high (18 million subscribers in Japan) and the fact that consumers are often willing to pay a monthly fee indicates an economic value that needs to be considered.