Response to Ofcom Consultation 'Cognitive Access to Licence-Exempt Interleaved Spectrum' (due date: 1st May 2009).

1. General observations

Intellect UK commends Ofcom on the thorough and considered nature of the '*Digital Dividend: cognitive access'* – Consultation on *'license-exempting cognitive devices using interleaved spectrum'*. We believe that innovative use of spectrum has the potential to benefit both UK citizen-consumers and the UK telecommunications industry.

While the unused channels between terrestrial television channels at any given geographic location – 'white spaces' – exist in order to prevent co-channel interference, Intellect believes that the extent of the use of these white spaces by Cognitive Radio devices – in addition to the existing PMSE users – will depend on the technical and operational requirements which will be defined to avoid interference to protected services. Devices operating in these white spaces could help to provide access to the Internet that is one of the Digital Britain goals. However, Intellect believes that the viable provision of ubiquitous BB coverage using CRDs stands to be proven, given the severe limitations needed upon it to adequately protect existing licensed broadcast services. In this context, it is worth noting that the United States already allows personal/portable devices to use the white spaces on an unlicensed basis.

However, placing Cognitive Radio Devices in the "white space" presents the possibility of direct (not only via the antenna) interference to existing Digital Television Receivers since they have not been specifically designed to withstand in-band transmitters in near to medium proximity. The effect referred to here may not be directly related to the selectivity performance but by electromagnetic disturbance directly to the electronics of the TV. If this happens, then major interference problems may be experienced in deploying CRD into homes. It is suggested that the magnitude of this risk be determined before committing to any scheme related to this consultation, recognising that although this issue of EMC currently falls outside Ofcom's *direct* responsibility, Ofcom should consult with the body that does have that responsibility.

It is important, however, that any such CRD devices operate within parameters that afford appropriate protection to the licensed users of the same spectrum. It is only on such a non-interference basis that the access these devices will provide can be made broadly available to consumers. So whilst white space technology can potentially increase broadband competition, it nonetheless must do so within limits that protect licensed services, and this remains to be demonstrated through trials and further technical analysis.

Finally, it should be recognised that the license exempt use of CRDs is no substitute for licensed broadband/BB services operating in this and other bands.

Cognitive Radio

A Cognitive Radio Device (CRD) is often portrayed as "listen before transmit" operation. This mechanism works with a degree of usefulness when all devices on the channel are effectively the same and are time-sharing with each other.

When the CRD is to avoid the frequencies or channels used by another system but communicate with devices of its own kind, then the CRD must not just simply avoid an occupied channel, but must reliably identify the other "user".

2. Answers to Questions (with Ofcom's sub-titles retained)

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

If a viable and tested method of protecting the licensed users of the spectrum can be resolved, there is no reason to withhold spectrum from other applications.

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

We are not in a position to comment. The correct figure should come out of a trial.

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

We are not in a position to comment. The correct figure should come out of a trial.

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?

We are not in a position to comment. The correct figure should come out of a trial, which should include the use of a variety of indoor as well as outdoor TV aerials. The policy conclusions should also come out of the trial. There is a reduced probability of interference to PMSE/ENG if the CRD operates at a lower power level than the PSME/ENG device.

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?

Intellect agrees that poor receiver filtering and intermod performance could significantly reduce the economic benefit that is achievable from the introduction of new services. Therefore, we agree that some form of action is necessary to encourage the necessary changes. Noting the complex nature of the licensing issues in this regard, it seems that a spectrum pricing approach could be difficult to introduce in an effective way and so it would appear that a standardisation route might be more effective. This would have the further advantage that the solution could be eventually applied at an international level, thus recovering the economies of scale.

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

No. Some representative wireless microphones, both analogue and digital, should also be included in the trial.

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

See answer to Q6.

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

See answer to Q6.

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?

Need to undertake a trial to ascertain this.

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

No comment.

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

No comment.

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?

If it is licensed, it should have full protection. Not so if license exempt.

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?

Need to await further developments on cooperative detection.

Geolocation databases

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

At a cost.

Question 15. What positional accuracy should be specified?

It is merely necessary to avoid licensed users.

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

It is merely necessary to avoid licensed users.

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

It is not obvious where this common good cost should be taken, nor where liability should be placed if problems do arise.   Also, it would be a difficult situation were the UK to find itself in a position whereby the incumbent organisation having control of the spectrum could effectively control access, yet not be charged administratively for the spectrum it denies to others.

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

It is not clear what "spectrum management purposes" are in mind. Suggest further consultation on any specific applications and therefore assume that spectrum management purposes are outside the scope of this current consultation.

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

If base stations are a necessary part of the deployment of the CRD's then the "base station" may be required to be connected to the Internet for management purposes and for data content. Reserving a single channel on which the "base station" conveys the local operating frequencies would then be sufficient to set-up the CRDs.

Beacon reception

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

Answer is not obvious, as L.E. users would not be expecting to pay. Licensed users would see it as an unfair imposition.

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

Is this overall reliability of the system, or just the reliability of the beacon transmitter? If just the transmitter, then there will be a lesser reliability of the system. What system reliability would be acceptable?

Comparing the different options

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

Yes. The regulation should provide clarity on the objectives.

Ofcom should bring into existence a database suitable for geo-location cognitive approaches that is to be utilised and maintained in a manner that permits the introduction of new services.

Furthermore, the regulation should also permit detection under defined technical parameters.

Solution providers would then be able to innovate to meet the objectives of the regulation using either strategy or in combination, as they see fit.

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?

At area edges, cognitive recognition of DTT stations may be unreliable so geolocation with a spectrum database would seem to provide an answer. A trial would provide the answer here. However, if geolocation works in parallel with cognitive recognition, the system is more robust as the CRD will not transmit upon the channels in use in the area but will also avoid anything else that it hears that is not recognised as a partner device.

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

It all depends on the number of contiguous white space channels available. Where only 1 such channel is available, the bandwidth must obviously be restricted to the bandwidth of the white space available.

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

No, this is too restrictive. The database checksum / release number should be checked regularly. 1 second intervals may be too frequent unless limited in the amount of data downloaded. Given the requirements for PMSE / ENG, periods of five or ten minutes may be acceptable, thus allowing slower data-rate transmissions to be used – potentially aligning the data-rate with existing RDS / TMC /TeleText systems.

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

Let a trial determine this with a range of TV receivers.

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

No, this would make some services impossible. Any sharing mechanisms can be developed by standards bodies.   The 400mS/100mS proposal has already been rejected in the USA. This issue is probably inappropriate for Ofcom to trial since it relates to CRDs working together.

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

No comment.

------------------------end of Intellect's 6-page response--------------------------