Additional comments:

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

This stakeholder has a number of objections to these proposals, some of which are summarised below. The objections are explained in more detail in the following questions.

Ofcom has agreed that it will only allow cognitive access to interleaved spectrum on a licence exempt basis if it does ?not cause harmful interference to existing users? [1.2]. So long as Ofcom adheres to this commitment there is no reason to reject the other proposals in this consultation. Ofcom reiterate this commitment just three times [2.6, 2.9, and 5.1].

Ofcom states that ?Cognitive devices can detect spectrum that is otherwise unused and transmit without causing harmful interference? [1.3] but does not provide the relevant and extremely important proof of this. This consultation regularly admits, especially in Annex A, that there will be a small amount of interference to some licensed users, which is in contradiction of the statement in paragraph [1.3]. More example of this mistake are 2.8, 2.11, 2.14, 4.4, 4.7, 5.13, 5.22, 11.1, A5.17, A5.20, A5.21, A5.22, A5.24, A5.25 and A5.31.

Given Ofcom?s historic inability to prosecute unlawful use of the spectrum (especially by some of the PMSE community), which causes interference on licensed users, this stakeholder does not have much faith that Ofcom will be able to effectively regulate to prevent harmful interference from cognitive devices.

Ofcom claims that the interleaved spectrum is ?unused? in 2.4 (and figure 2) - this needs amending to reflect existing users of the spectrum.

Please define ?sufficiently? in 1.5. According to the statement in 1.2 the ?certainty? in 1.5 should be 100%.

In 1.8 Ofcom acknowledges that it can not allow cognitive access to interleaved spectrum, given the commitment in 1.2, stating that ?it is not possible to set parameters such that harmful interference will never occur? [1.8].

The period of access to the database [table 2] has yet to be determined. Such an important detail should be included as part of the consultation.

With its current proposal, Ofcom has not bettered the US? system (in fact Ofcom is less strict in some areas) which, according to reports, has resulted in destructive interference to radio microphones. For example, the US has a detection and geo-location based system, which is not preventing interference by cognitive systems. These two methods, despite their apparent appeal, as demonstrated in this consultation, are not working in the US.

Ofcom claims that the economic benefit of allowing licence exempt access is between

£85m and £135m over ten years [A5.12]. Ofcom also admits that if its projections are correct a maximum of £20m of existing total benefits would be lost. This is a massive 25% or 12.5% of the forecasted economic benefit of licence-exempt access. This calculation is based solely on Ofcom?s own projections, which this stakeholder believes, and has demonstrated, are too optimistic. The percentage of affected users would only have to reach 0.16% (of existing DTT viewers and PMSE users) for the economic benefit of licence-exempt access to be wiped out.

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

The sensitivity level should be at the lowest possible level that will allow the maximum number of people (who are existing users of the spectrum and should therefore be protected in whatever way possible by Ofcom) to have interference free DTT: it should be -84dBm.

Section 5 of the consultation claims to ?ensure that a cognitive device that relied on sensing alone did not cause harmful interference to licensed spectrum users? whereas the section is actually attempting to ensure that this was unlikely rather than impossible.

Has Ofcom considered the effect of the weather on its proposed value? Has Ofcom considered the effect of a cognitive device without a 0dBi antenna in its proposed value?

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

There is some significant information missing from Ofcom?s calculation for the additional margin and therefore the sensitivity requirement of the cognitive device:

Ofcom has made calculations based on typical DTT antenna gains and losses rather than the extreme values. Ofcom?s estimate of the percentage of people affected by this proposal therefore needs adjusting to accommodate the antennas which fall short of the stated values, or the values need changing to cover all 99% of the population receiving DTT .

5.13 assumes that there is no correlation between DTT signal level and the actual hidden node margin in any given location ? further work is required to prove that this is the case.

5.16 makes dangerous assumptions about the variation in signal level from building to building and admits that it ?is not possible to characterise comprehensively?, instead deciding to pick figures from the flawed US model. Given the reports harmful interference from cognitive devices in the US Ofcom needs to isolate its research from any data gathered for the US decision, by choosing to perform its own research.

5.16 also makes a dangerous assumption about viewers? ability to isolate the reason for poor signal on their DTT receivers. Though it would be possible to control cognitive devices in their own homes, they would not necessarily know that was the

solution to their problem. Furthermore, Ofcom should not expect viewers to make these changes because of the flaws in this proposal.

This stakeholder has yet to receive information regarding the ?further work? mentioned by Ofcom in 5.20. Please can Ofcom also provide the citation for the measurements of the difference in the signal level seen by the cognitive device depending on polarity [5.21]?

Has Ofcom considered the effect of the weather on its proposed value? Has Ofcom considered the effect of a cognitive device without a 0dBi antenna in its proposed value?

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 figures quoted in 5.24 assume free-space propagation in a scenario where there is a high likelihood that nearby walls will reflect the omni-directional signal of the cognitive device towards the antenna, thus reducing the quoted path loss.

Ofcom doesn?t yet know the technology generating the interference when calculating the carrier-to-interference ratio so the worst possible case should be used. Please note that two of the DTT receivers under test had a C/I ratio of above -30dB in the adjacent channel and, given that Ofcom has a responsibility to protect existing users of the spectrum, these receivers should be taken into account when determining the maximum transmit power of the cognitive device.

Ofcom admits that quantifying the risk of interference is very difficult but still chooses an apparently arbitrary figure of 20dBm for the power. Please provide the evidence to suggest this figure is appropriate.

Has Ofcom considered the effect of the weather on its proposed value? Has Ofcom considered the effect of a cognitive device without a 0dBi antenna in its proposed value?

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?:

Advancements in technology which improve the efficiency of spectrum are applauded but Ofcom should not be expecting DTT equipment manufacturers to improve their receiver specifications to compensate ?interference caused? [5.24] by this consultation.

Ofcom suggests that the older inferior units could be phase out but provides no research into the life of the current units or the funding needed to compensate affected viewers for having to replace their units.

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

Ofcom claims that the figure of -67dBm was calculated for receive level after visits to a range of venues where ERA noticed that there was a need to ensure a high-quality link. It would appear that the figure of -67dBm actually arose through an addition of a figure from a European paper to the average sensitivity (-91.5dBm) of radio microphones rather than on-site research. Genuine research is required in order to determine what the reference receive level for wireless microphones is. Given the reported problems in the US with cognitive devices creating interference over radio microphone signals, it is extremely important that all the stages of this consultation are undertaken properly.
Has Ofcom performed measurements to check that its figures are applicable to all models of analogue radio microphone?

Ofcom admits that it has not actually bothered to quantify the levels for sensing for PMSE [A5.20]. This is a massive omission and needs rectifying immediately.

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

Ofcom claims in 5.32 that the additional margin would be below 39dB in all cases. This is not true and needs amending. Actually the hidden node margin was below 39dB for 99% of all locations simulated rather than for ?all cases?.

Further work is being done into the effect of body-loss on the signal from a wireless microphone. This work is likely to prove that the body loss is above the quoted figure of 20dB. Therefore Ofcom should hold this consultation until all the facts are ready to be presented.

Has Ofcom considered the effect of the weather on its proposed value? Has Ofcom considered the effect of a cognitive device without a 0dBi antenna in its proposed value?

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

The sensitivity requirement needs re-calculating once the issues raised in questions 2 to 7 have been addressed.

Has Ofcom considered the effect of the weather on its proposed value? Has Ofcom considered the effect of a cognitive device without a 0dBi antenna in its proposed value?

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?:

Has Ofcom performed measurements to check that it?s C/I figures [5.37] are applicable to all models of analogue radio microphone?

Ofcom should have already obtained advice from wireless microphone manufacturers with regard to front-end overload [5.38], rather than consulting stakeholders without the necessary information available.

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

Has Ofcom considered the effect of the weather on its proposed value? Has Ofcom considered the effect of a cognitive device without a 0dBi antenna in its proposed value?

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

Is there any data to support Ofcom?s suggestion that values for building shielding are ?in the region of 15dB?? Measurements should be taken rather than relying on values ?often quoted? in the past.

Has Ofcom considered the effect of the weather on its proposed value? Has Ofcom considered the effect of a cognitive device without a 0dBi antenna in its proposed value?

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?:

Has Ofcom taken appropriate measurements for the scenario that a single handset contains both cognitive and mobile television services? This scenario, which this stakeholder considers extremely likely, needs further research, to determine the effect such close proximity will have on the two services and any possible external effects, such as interference on licensed users of interleaved spectrum which may be caused by this close proximity. There doesn?t appear to be any consideration of this scenario in 5.43 and 5.44.

5.45 needs clarification because it currently implies that cognitive devices could transmit at -11.5dBm when they detect a signal in the channel they wish to use. This stakeholder suggests: "When determining whether it is safe to transmit, cognitive devices which are able to detect signals in the channel they intend to use and also in the channels adjacent could have their maximum transmission power level set to -1.5dBm. The transmission power should be restricted to - 11.5dBm if the device is only capable of detecting signals in its chosen channel and not the adjacent channels."

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?:

Ofcom should wait further developments before taking cooperative detection into account, but it should consider the frequency on which the cognitive devices might communicate as part of the DDR.

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

Ofcom should implement all of the options mentioned in the consultation in order to ensure that ENG does not suffer from destructive interference. This is, of course, subject to the guarantee that there will not be any interference to licensed users of the interleaved spectrum. Ofcom needs to implement measures which are more strict than the flawed US system. With its current proposal, Ofcom has not bettered the US? system (in fact Ofcom is less strict in some areas) which, according to reports, has resulted in destructive interference to radio microphones. For example, the US has a detection and geo-location based system, which is not preventing interference by cognitive systems. These two methods, despite their apparent appeal demonstrated in this consultation, are not working in the US.

Question 15: What positional accuracy should be specified?:

Ofcom has chosen to reduce the accuracy of the geo-location system to 100m, when compared with an accuracy of 50m in the US. Since the US system has proved unsuccessful, adopting a less-accurate and more lenient system is unlikely to result in interference-free spectrum use by licensed users.

Ofcom has not considered how cognitive devices will determine their position when indoors, and therefore without access to global positioning satellites (this consideration only earns one line in the annex [A5.10]). The method of geo-location without the GPS service or even a WiFi service should be considered and consulted on. Simply using the last known coordinates would be unacceptable. Ofcom claims that existing technology will allow successful geo-location but hasn?t considered locations indoors with no wireless access to the database of any kind.

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

Ofcom needs to think carefully about the point at which information regarding a new licence is updated onto the geo-location database [6.11]. It is common that radio-microphone licences are taken up at short notice before the frequencies are used. At what point does this information make it onto the system? Ofcom needs to decide whether the database will be updated (and by who) at the point of application, the point of issue or the point of invoice, and also consider the possibility of an application being retracted half-way through the process but after the database has been updated. It will be difficult to provide CORRECT information to the database in a short period of time.

The rapidity of the update to the database depends on the options chosen in 6.4, since the most affected licensed users of the interleaved spectrum are those that have to use

it at short notice.

The database needs to be accessible at ALL times. It needs to have backups at every stage, including the frequency upon which it is transmitted. Therefore, if any part of the system fails on the main equipment, the backup equipment will be able to support all enquiries until the master system is fixed. The cognitive device could be programmed to use the backup frequency if it has no response from the master system. The database needs to be of sufficient power to field enquiries from every single cognitive device at one time without overloading the wireless or wired network. .

The database should be designed to allow access, but not alteration, by other parties ? perhaps like the database on JFMG?s website. It would be useful when planning the use of frequencies for PMSE applications, increasing spectrum efficiency as a result.

The suggestion that the update to a cognitive device be the same rate as the update of the database [6.14] misses the important detail that the cognitive device will not always be switched on and may move location while off. An update must take place as soon as the device is switched on (and before any transmission, irrespective of whether the database has been updated. Similarly, the suggestion that a cognitive device makes an enquiry every time it needs to transmit, perhaps by radio channel [6.15], misses the important fact that a cognitive device may not be in range because it is inside a densely-constructed building and therefore would be unable to retrieve the required information. Likewise, it would be unable to ascertain its location. Relying on a nearby cognitive device to provide the required information is too unreliable to be acceptable [6.16].

Ofcom suggests that older cognitive devices which have a potential for harmful interference (despite Ofcom?s commitment to prevent it) will ?over time? be phased out [9.24]. This is not an acceptable approach, since the five-year life of the equipment estimated by Ofcom would be a period in which there would be harmful interference to existing licensed users of interleaved spectrum. Management of the database could (as suggested by Ofcom) lock out old models if they were causing interference to 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?:

This funding should come from Ofcom, generated by the DDR auction, or from the cognitive device manufacturers.

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

This stakeholder applauds the capability to use the database for spectrum management purposes, since it will allow an easy solution to the harmful interference likely to be caused by cognitive devices if the current proposals in this consultation are not amended. However, this stakeholder is concerned that, despite a database existing in

the US from which cognitive devices download the frequencies available, there are still reports of interference on radio microphones which have not been prevented by the regulatory body, by using the database to protect the affected frequencies in the affected locations. Ofcom could use the database to create the same ?safe-harbours? the US had to create from cognitive devices, to protect from the interference caused [3.5].
Ofcom?s suggestions for harmonisation with the US are of concern, since cognitive devices over there, which are reportedly already causing harmful interference, could end up being used in the UK (once manufacturers make models capable of working in many countries) causing interference to licensed users of the interleaved spectrum in the UK [10.5]. This stakeholder applauds Ofcom?s commitment not to support harmonisation unless it does ?not result in harmful interference to licensed users of the interleaved spectrum in the UK? [10.8]. Ofcom needs to respect this commitment rather than claiming that the interference is negligible or sufficiently low to be acceptable.

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

There should be the same requirements for detection on a cognitive fixed base station, high up off the ground, as there are for handheld cognitive devices. The high power base station should be able to detect radio microphones operating in densely constructed buildings within its transmission range in order to be sure that no interference will be caused. High power cognitive base stations should NOT rely on geo-location databases alone.

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

This funding should come from Ofcom, generated by the DDR auction, or from the cognitive device manufacturers.

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

The beacon network needs to be 100% reliable in order to satisfy Ofcom's commitment not to cause harmful interference on existing licence holders in the interleaved spectrum. The database needs to be accessible at ALL times. Therefore, he beacon network needs to have backups at every stage, including the frequency upon which it is transmitted. Therefore, if any part of the system fails on the main equipment, the backup equipment will be able to support all transmissions until the master system is fixed. The cognitive device could be programmed to use the backup frequency if it has no signal from the master system. [7.5 & 7.6]

Ofcom has not considered how such a beacon network would ensure there was no destructive interference to ENG, not has Ofcom given any indication of the regularity of update to the beacons from the database.

The proposal to reduce the beacon power in order to prevent a cognitive device

receiving a signal outside of the covered area, and therefore prevent a transmission in inaccurate spectrum, is likely to cause problems within the covered area instead. With reduced power, the beacon will not reach some areas within the covered area resulting in cognitive devices in those pockets not knowing the protected frequencies.

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

Ofcom acknowledges that detection alone would not work [3.7]. The minimum requirement should be both geo-location and detection. This is the system currently used in the US, with already flawed results. Other amendments, many of which are mentioned in this response, need making to the proposal to ensure Ofcom upholds its commitment to ensure existing licence holders of interleaved spectrum are not subject to any interference.

Ofcom admits that detection in the cognitive devices may not be accurate ?if they detected noise or spurious emissions within the spectrum and could not distinguish this from an intentional signal? [8.4]. The level to which the devices are required to detect to be sure not to cause harmful interference are already below the noise floor in some locations. This is a major problem which needs to be addressed by Ofcom.

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?:

If the cognitive devices are designed properly and Ofcom?s proposal for their non-harmful use is comprehensive and effective rather than flawed, there should be no need for cognitive devices to be restricted at the edge of the bands of interleaved spectrum. If such restrictions are necessary, assumptions can be made about the likelihood of interference from cognitive devices to licensed existing users in any part interleaved spectrum.

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

If there were no limit on bandwidth, Ofcom?s ?politeness of use? objective - to ensure that the available resource is shared fairly between all those attempting to use it - would be affected: fewer devices would be able to find available spectrum.

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

Yes.

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

Ofcom claims that the figure of -67dBm [9.13] was calculated for receive level after visits to a range of venues where ERA noticed that there was a need to ensure a high-

quality link. It would appear that the figure of -67dBm actually arose through an addition of a figure from a European paper to the average sensitivity (-91.5dBm) of radio microphones rather than on-site research. Genuine research is required in order to determine what the reference receive level for wireless microphones is. Given the reported problems in the US with cognitive devices creating interference over radio microphone signals, it is extremely important that all the stages of this consultation are undertaken properly.
Has Ofcom performed measurements to check that its figures are applicable to all models of analogue radio microphone? If not, the figure of -44dBm for out-of-band performance needs further research.
Ofcom admits that it is not possible to design a cognitive device to be able to detect future technologies [2.11]. Has Ofcom conducted research into the effect cognitive devices will have on known future technologies such as digital radio microphones? Respondents to previous consultations have already recommended that Ofcom to contact manufacturers for details of new designs [2.14]. Though digital radio microphones are currently far inferior to analogue radio microphones for use in PMSE applications, advancements in technology will hopefully - at some stage in the next decade - make digital technologies usable in most PMSE applications. Ofcom should consider this technology in its ?future-proofing? chapter instead of suggesting that there are no known future technologies that may be used in the interleaved spectrum.

Has Ofcom considered the effect of the weather on its proposed value? Has Ofcom considered the effect of a cognitive device without a 0dBi antenna in its proposed value?

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

The inclusion of a silence time in order for other devices to gain access to the spectrum [9.17] will only work if devices are capable of scanning the spectrum to ascertain that a gap has become available. Therefore, this method presumes that detection is part of the cognitive proposal. The detection technology needs to be extremely well designed in order to avoid any interference to licensed users of interleaved spectrum.

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

This approach would be permissible: if the database from which the master gets its information is working properly, is continuously available, and has up to date information; if the scan by the master correctly reveals that the spectrum is unused; and if interference is not going to be caused to licensed users of interleaved spectrum.