Use of Short Range Devices alongside mobile broadband services operating in the 800MHz band

Information Update

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Section 1

Summary

The purpose of this information update

1.1 This document sets out our current view on the operation of next-generation mobile technology alongside certain types of wireless equipment known as Short Range Devices (SRDs).

1.2 A wide range of devices fall into the SRD category. They include domestic audio equipment like wireless headphones; wireless microphones used in non-commercial situations (such as church services or for school fetes etc.); certain types of wireless alarms including call pendants worn by elderly and vulnerable people; and devices for tracking supermarket stock.

1.3 SRDs are allowed to operate at particular radio frequencies without the need for a licence - unlike many other kinds of wireless equipment which use licensed radio spectrum (such as mobile phone networks; television and radio services; and professional entertainment equipment like stage microphones). Licence-exempt operation for SRDs is permitted on the basis that devices do not cause interference to other users and that they can expect no protection from interference caused by properly licensed users operating in nearby frequencies.

1.4 The environment in which SRDs operate at present will change after the roll-out of the next generation of mobile broadband networks – known as 4G or Long-Term Evolution (LTE) – after 2012. Although LTE devices are expected to deliver significant value to consumers and society in future, they have the potential to affect other kinds of equipment operating in nearby frequencies.

1.5 This information update explains why we think SRDs will not be unduly impaired in the changed circumstances – although we expect manufacturers and service providers may wish to consider design enhancements or changes to operating practices ahead of the roll-out of the new LTE networks.

Background and context

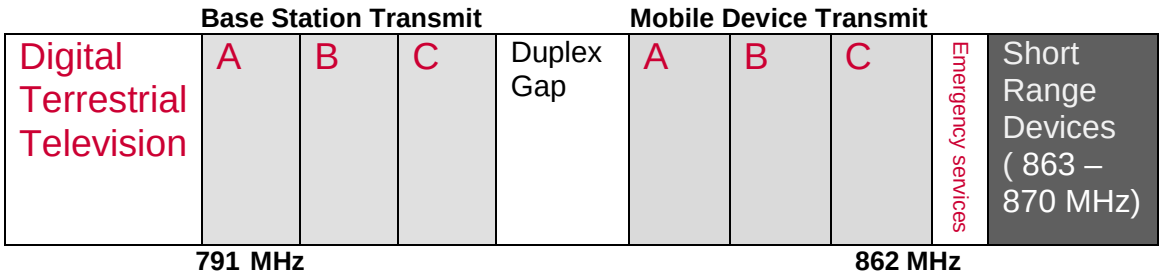
1.6 Short Range Devices operate across Europe in the radio frequency band between 863 and 870 MHz (known as the SRD band). The future deployment of mobile broadband services will make use of the neighbouring spectrum between 791 and 862 MHz (known as the 800 MHz band). The relationship between the bands is illustrated in the diagram below.

1.7 Licences to use the 800 MHz band for mobile services will be auctioned by Ofcom next year. On 2 June 2011, we published proposals for the technical licence conditions we intend to apply to the 800 MHz (and 2.6GHz) spectrum[1]. That

[1] Consultation and information on technical licence conditions for 800 MHz and 2.6 GHz spectrum and related matters published by Ofcom on 2 June 2011

document considered how interference from new broadband services operating in those bands might affect a wide range of products and services, not limited to SRDs.

Illustration of 800 MHz Band (791 to 862 MHz) in relation to Short Range Devices Band (863 to 870 MHz)



1.8 We stated that we did not anticipate it would be necessary to impose technical licence conditions to protect SRDs from interference from mobile broadband services operating in the 800 MHz and 2.6 GHz bands. However, we said we were planning to conduct some further research into possible interference to social alarms - one of the many different types of SRD – because of the implications for personal safety. To date, we are the only European regulatory body to carry out this type of study – despite the roll-out of 4G technology happening in the same way right across the Continent.

1.9 Even though SRDs – including social alarms - operate without any expectation of protection against interference, we were keen to find out whether LTE devices operating alongside would cause problems for users. We wanted to make sure that manufacturers and users had as much information as possible in case they needed to adapt their devices or how they were operated.

1.10 The circumstances in which interference might occur are limited – but could include, for example, the user of a 4G handset or dongle sending a large amount of data (such as a movie or computer game) to another user while in close proximity to an SRD device. We carried out a range of technical tests to see how this might affect the operation of SRDs – especially social alarms. We have also reviewed stakeholder comments and the output of further research on wireless microphones.

1.11 We will reach final decisions on all of the matters relating to the award of the 800MHz and 2.6GHz spectrum when we publish the Information Memorandum for the award next year (2012). Our interim conclusion is that future 4G mobile services are unlikely to cause undue interference to SRDs – although makers and manufacturers will certainly need to be aware of the new circumstances in which their SRD devices might operate. There are a number of approaches they might choose to take in adjusting to the new environment, which are set out in this document below.

How the SRD frequency band is used

1.12 Different types of devices use (or could use) different parts of the SRD band:

- The frequencies between 863 and 865 MHz are used mainly by audio devices including wireless headphones; assistive listening devices, such as amplified sound for the hard of hearing; and wireless microphones used in mainly non commercial situations such as schools and church halls (professional use of such equipment is usually licensed and deployed in other frequency bands).

- The frequencies between 865 and 868 MHz are used mainly by so-called RFID devices i.e. the tracking and monitoring of cargo or stock in manufacturing or distribution industries.

- The frequencies between 868 and 870 MHz are used mainly for telemetry devices (alarm and monitoring systems). These include commercial fire alarms, domestic intruder alarms, smart meters (for utilities), routine medical monitoring, and social alarms for the vulnerable (e.g. push button pendants worn by the elderly and vulnerable).

Nature of potential interference

1.13 The potential for interference to SRDs stems from the mobile transmit portion of the 800 MHz band - 832 to 862 MHz, which is closest to the SRD band (as illustrated above). These frequencies will be used to provide the uplink from consumer devices such as phones and data dongles to mobile network base-stations. The greatest risk of interference therefore derives from data upload via consumer devices, such as LTE phones, tablets, dongles etc.

1.14 Although the power levels transmitted by network base stations themselves are likely to exceed by a great deal those transmitted by consumer devices, the frequencies they use to downlink data to consumers (791 to 821 MHz) are sufficiently far away from the SRD band to present little or no risk of interference. It is also the case that LTE base stations are fixed (and the impact of their emissions, therefore, more predictable), and will be far fewer in number than LTE handsets and dongles.

1.15 Our research (summarised in more detail in Section 2 below) indicates that where there is potential for interference, the impact is most likely to be seen as a reduction in the maximum operating range of the SRD device, rather than a complete failure of the device.

Regulatory considerations

1.16 Use of the SRD band is harmonised throughout Europe and is licence exempt. This means devices are deployed on a non-interference/non-protected basis, as defined by the European Commission[2]. That is to say, SRDs may use the band, provided that

[2] Commission Decision of 9 November 2006 on harmonisation of the radio spectrum for use by short-range devices (2006/771/EC) as amended (Article 3(1)). Recital 3 to the Commission Decision also provides "…*radio-communications services…… have priority over short-range devices and are not required to ensure protection of particular types of short-range devices against interference.*

they comply with specified technical constraints, but they are not guaranteed protection from other lawful use of this or any other band, including from other SRDs.

1.17 The definition is reflected in the long standing "Short range devices information sheet"[3] published on the Ofcom website which states: "*If you receive interference from an authorised service that is operating within the terms of an appropriate licence or under licence exemption conditions, we cannot provide any protection; you or your SRD manufacturer must find a solution."*

1.18 We have not yet determined the precise technical conditions which are to apply to the use of the 800MHz band, although we note that these will need to be compliant with the provisions of the Annex to Commission Decision 2010/267/EU. This sets out certain technical parameters in relation to use of the 800 MHz band for networks, including LTE, other than high-power broadcasting networks.

1.19 Notwithstanding the general non-interference/non-protected nature of SRDs, in taking proposals on the award of the 800 MHz band forward, Ofcom has undertaken detailed technical analysis to understand the potential for interference and the likely impact. At the same time we have engaged extensively with manufacturers and with groups representing users of SRDs in order to consider with them the most appropriate ways to address potential problems.

Our current position

1.20 Having reviewed stakeholders' responses to our proposals and after considering the further research, we currently remain of the view (as set out in our consultation) that it is not appropriate to apply technical licence conditions to the 800MHz licences to protect SRDs. We set out in this document our reasons for continuing to take this view. However, this remains a provisional view and we will make final decisions in this regard when we are in a position to make decisions on the entirety of the award of the 800MHz and 2.6GHz bands. We will take account of any further evidence that is available at that time, including evidence arising out of the further work we are undertaking on wireless audio equipment (discussed later in this document). We are publishing this update now to provide further transparency to stakeholders in advance of taking final decisions in the context of the award.

1.21 We are also announcing that we have decided to make available test facilities at Ofcom's Technical Measurement Centre, which will enable SRD manufacturers to assess their own equipment in an environment which simulates an operational LTE (4G) mobile network. There are currently no operational LTE networks in the UK and those elsewhere in Europe are small-scale and not generally representative of a fully commercial network. The test facilities we are making available will give manufacturers an opportunity to explore the impact, if any, of LTE networks on their proprietary equipment before operational networks have been rolled out in this country. We will try to ensure that the test facilities closely reflect the emerging understanding of how LTE network operators will design and manage their networks in the UK.

[3] http://stakeholders.ofcom.org.uk/spectrum/spectrum-management/licence-exempt-radio-use/licence-exempt-devices/short-range-devices-information

1.22 We also intend to continue working closely with other regulators and equipment suppliers in Europe to ensure that European technical standards remain appropriate in the light of LTE rollout.

Section 2

Technical Analysis

Introduction

2.1 Ofcom has undertaken a range of technical studies to assess the potential effect of the 800 MHz award on SRDs operating in the 863 to 870 MHz band.

2.2 A detailed initial study of potential interference issues ("Aegis/ERA lab research") was published in June 2011 alongside the consultation on technical licence conditions for the 800 MHz award[4]. On the basis of this work, we did not propose the imposition of any additional conditions on the deployment of LTE devices in order to protect SRDs. However, we indicated that further analysis would be undertaken in order to consider more specifically the potential impact on social alarm systems used by the old and vulnerable, and on amateur wireless microphones.

2.3 The further analysis of social alarms[5] ("ERA social alarm study") emulated LTE transmissions alongside social alarm systems in the real-life scenario of a flat in a sheltered housing complex. The results, published in September 2011, concluded that alarms will in fact be more robust alongside LTE devices than was suggested in the original study. On the basis of this new evidence we currently see no reason to change our overall view that additional technical licence conditions are not justified. We have also considered the responses of key stakeholders (users and manufacturers). The responses are discussed in detail in Section 3 below.

2.4 Further technical research was also conducted on potential interference to audio equipment in the 863 to 865 MHz frequencies. Full details will be published early next year (2012) but our current view is that additional technical licence conditions, as with social alarms, cannot be justified to protect SRDs in this licence exempt band.

Background to testing

2.5 At the time of the initial ERA research, no LTE networks had been rolled out in the UK, and deployments in other European countries (notably Germany and Sweden) were at a very early stage. For this reason, it was not possible to conduct tests in 'real-life' network environments. Instead, research was commissioned using equipment to simulate or emulate the signals of an LTE consumer device.

2.6 The results we gained were very dependent on the assumptions made about the characteristics of devices and networks – in particular: the amount of data being transmitted and thus the volume of resource blocks (amount of spectrum) they will use when uploading data; and the power levels at which handsets and dongles are likely to operate.

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[4]Aegis and ERA: Investigation on the receiver characteristics of SRD equipment in the 863-870 MHz band

[5]ERA Technology: Investigation of LTE UE interference into social alarms

2.7 The operators of LTE networks will control the bandwidth available to a consumer on a continuous basis, reflecting both the amount of data which the user is attempting to upload and the competing demand for bandwidth from other customers served by the cell site.

2.8 The resource block allocation algorithms will determine both the unwanted out-of-block (OOB) emissions from the LTE handset or dongle and also how long the device will need to transmit at this power in order to upload data. This in turn influences the probability of any potentially interfering signal being transmitted at the same time that a nearby SRD device is attempting to receive an SRD signal.

2.9 Prospective suppliers and operators of LTE networks have not yet determined the resource block allocation algorithms which will decide this balance between the number of resource blocks allocated and the duration of call. In any event, the algorithms – which are unique to an individual LTE supplier - are likely to evolve over time as loading increases both on the LTE network and in individual cells. They may also vary between urban and rural locations.

2.10 Another dimension which introduces a degree of uncertainty is the power allocated to the user. Related to the decision on how many resource blocks should be allocated to a given call; LTE suppliers will need to determine whether to use relatively high bursts of power or more sustained outputs. The proximity of an LTE device to the associated base station is also a consideration as higher transmit powers are required to overcome increased path losses at greater distances. The level of overall transmit power will also influence the probability that the uploading of a given block of data may cause interference to nearby SRDs.

2.11 The amount of interference suffered by an SRD (usually manifested as a reduction in range) is caused in most cases by the presence of OOB emissions from an LTE device that falls within the receive band of the SRD. Whilst the OOB emissions are related to the number, duration and power of the resource blocks allocated, the amount of received power is also related to the proximity of the LTE device to the SRD receiver. The greater the physical separation of the two devices, the greater the attenuation of the LTE interference signal and the lower the impact on the SRD.

Summary of initial test programme

2.12 The initial analysis which we commissioned (the Aegis/ERA lab research) was based both on anticipated worst-case scenarios using LTE test signals and a User Equipment (UE) emulator from a vendor's test network. This was intended to set the boundary of this worst case and to inform minimum protection distances where LTE devices would have little or no impact on neighbouring SRDs.

2.13 ETSI/EC standards[6] set out the maximum (mean) permitted in-band signal levels for LTE devices as 23dBm, coupled with a mask describing the permitted unwanted emissions. This was used as a base-line assumption for an initial interference risk. In general, it is expected that the OOB emissions from the device will fall off more quickly than is specified in the standard. Previous analysis[7] of 3G devices indicates that equipment suppliers built devices that bettered the minimum standard by

[6] Ref Euro standards for LTE kit ECC/Dec/(09)03?
[7] ERA Technology: Measurements of UTRA FDD User Equipment Characteristics in the 2.1GHz Band

approximately 5 to 10dB. It is therefore likely that 4G equipment will achieve lower out of band emissions.

2.14 Subsequent testing included scenarios where the LTE consumer device variously meets the EC standards; betters it by -5dB; or betters it by -10dB.

2.15 As indicated above, the level of anticipated interference was very dependent on what assumptions were made about the actual operation of LTE handsets and dongles and the type of SRD. The Aegis/ERA lab research included the worst case scenario i.e. handsets or dongles operating relatively close to a victim device, at near to maximum power and utilising a large number of resource blocks. This was supplemented by tests using a variety of less extreme assumptions.

2.16 In Ofcom's view, it is highly unlikely that the maximum volume of resource blocks will be allocated to one call as this would exhaust the capacity of the cell site and deny any other customers the ability to upload data. It is also Ofcom's view that it is highly unlikely that a handset or dongle will transmit at full power while using a large number of resource blocks, since high device power indicates that a user is close to the cell edge. In this case the network must manage interference between cells, with one such solution being the effective sharing of resource blocks between neighbouring cells in cell edge locations.

2.17 The Aegis/ERA lab research indicated that, using worst case assumptions, LTE handsets and dongles could be a source of potentially high levels of interference, Aegis/ERA tests under more likely circumstances, e.g. operating at lower power and using only a limited number of resource blocks, indicated that undue interference from LTE devices was unlikely.

2.18 The possible exception was wireless audio equipment operating in the nearby 863 to 865 MHz band and social alarms operating at or around 869 MHz.

Summary of further testing of social alarms

2.19 Users of social alarms may – on occasion – rely on these types of devices to call for emergency assistance. For this reason, we were particularly concerned to understand the potential impact of LTE services could have on these specific devices.

2.20 As a result, we asked ERA to carry out a more detailed assessment of the potential for these devices to suffer interference in the real-life environment of a sheltered housing complex. We refer to this as the ERA social alarm study.[8] In addition, we carried out further lab-based tests on a range of related devices.

2.21 In the ERA social alarm study the alarm unit was subjected to discontinuous (time varying) LTE 800 MHz device emissions captured from an emulator developed by a leading LTE equipment vendor. The device emulator was configured for 20 Mbits/s and 10 Mbits/s data throughput, with out-of-block (OOB) spectral emissions adjusted to match, as closely as practicable, with the out-of-block requirements for FDD terminal stations (LTE devices) defined in ECC/DEC/(09)03. The tests were then repeated with the OOB emissions adjusted to be 5 dB and 10 dB better than the ECC requirement.

[8] See footnote 5 above

2.22 The results show that, under worst case assumptions, with the LTE device located 2m from the social alarm hub unit and operating at the maximum permitted EIRP of 23 dBm, there is the potential for some range reduction to the social alarm system. However, when the OOB emissions were reduced to 10 dB below the ECC requirement, as may be considered more representative of a real device, the alarm was successfully triggered from all locations inside the test flat, and all locations except the very furthest point in the complex's communal garden.

2.23 When the LTE device was placed at other locations in the flat and garden, with OOB emissions 10 dB below the ECC requirement, the alarm was successfully triggered from all locations. This is most likely due to a combination of the lower OOB emissions and reduced interfering signal strength received at the social alarm hub unit.

Interpretation of test results

2.24 We have discussed above that the level of interference to which an SRD is subject to is related to; 1) the OOB emissions from the LTE device; 2) the application throughput of the user in the uplink (this affects the number of resource blocks used), 3) the proximity in path loss terms of the LTE user to their base station (this affects the power control level of the LTE terminal) and 4) the proximity of the LTE user (or users) to the SRD (this affects the level of the interfering signal received at the SRD).

2.25 The results of technical tests could be reported in a number of different ways. The test programme which formed the basis of the initial Aegis/ERA lab research was reported on the basis of the minimum separation distance required between an LTE consumer device and an SRD receiver to guarantee no blocking or desensitising of the SRD receiver (based on a variety of assumptions about the strength of the signal from the SRD transmitter - for example a pendant alarm or wireless microphone).

2.26 The subsequent supporting ERA social alarm study was reported on the basis of reductions, if any, in the maximum operating distance between an SRD transmitter and receiver, when the receiver was in the proximity of signals from an LTE device.

2.27 While both approaches rely on the same underlying data, we believe the latter approach is more useful when assessing the impact of LTE on equipment such as SRD receivers which, typically, are designed to be used at variable distances from the transmitter.

2.28 Alongside this research, we have also considered carefully the views of stakeholders. These are discussed in Section 3 below.

Section 3

Responses to the consultation on 800 MHz technical licence conditions

3.1 We received responses relating to SRDs from approximately 15 different organisations or individuals. There were a number of common themes brought out in the responses. Some of these themes have been addressed in the further work we have undertaken. A brief summary of the responses and our current thinking on these is provided below.

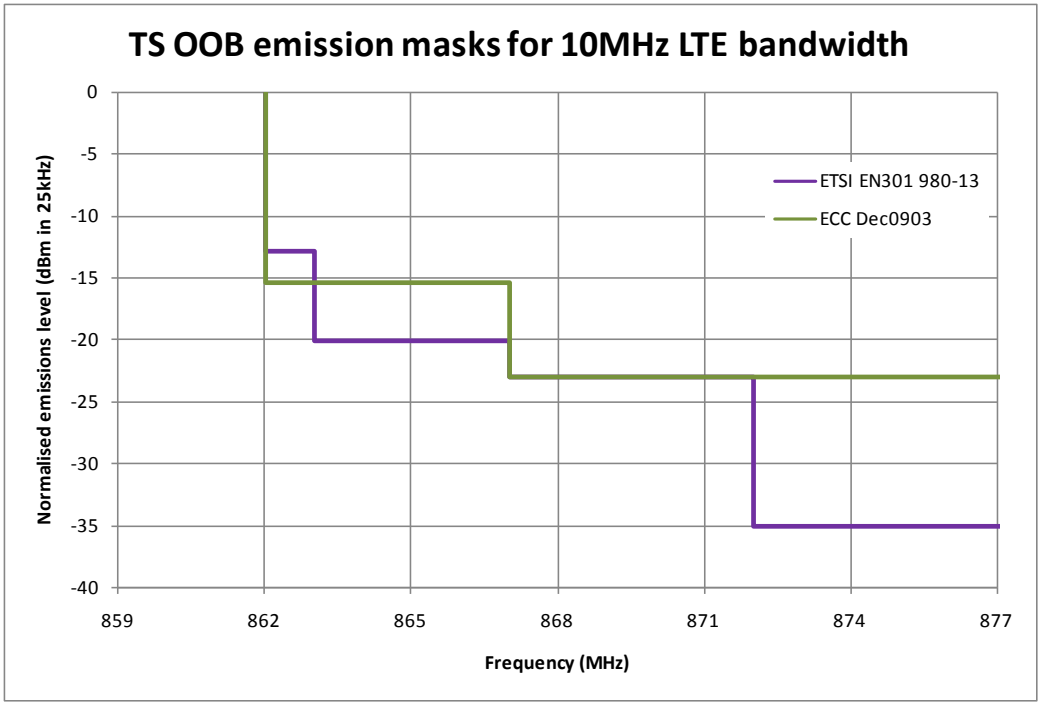
The nature of the emission masks

3.2 A number of respondents (including Continental Compliance, Great Circle Design and one confidential respondent) highlighted differences between the emissions masks presented in the report on the Aegis/ERA lab research and those specified in EN 301 908-13 and those based on the ECC/Dec/(09)03 along with the difference in mask levels compared to the levels of interference used in the initial technical work.

3.3 Whilst the ECC/Dec/(09)03 is not specified for frequencies above 862MHz, we have assumed these OOB levels would be applicable over the SRD band in our studies and we have based our emissions studies on the 10MHz LTE channel. We agree that the OOB emissions masks presented in the initial Aegis/ERA lab research report were misleading due to signal level normalisation and in one case an error. This error related to the graphs only and did not affect any measurement results. This has now been corrected and the emission masks presented without normalisation in a re-issued version of that report[9].

3.4 Our analysis concludes that EN 301 908-13 allows for a 1.5dB measurement uncertainty on the OOB emissions within the quoted values as is common for similar ETSI measurement-based levels for UE terminals. When normalising to common measurement bandwidths and taking account of the measurement uncertainty, the actual permitted OOB emissions for ECC/Dec/(09)03 are greater than the ETSI standard in part of the SRD band and identical in the part allocated to social alarms. A comparison graph is shown below, normalised for a 25kHz measurement bandwidth. It would be unwise for an equipment manufacturer to design a device in the hope that measurement uncertainty will be lower than the allowance or will work in his favour. We therefore consider that the limits used in the initial and subsequent studies are appropriate.

[9] Issue 2 can be found on the Ofcom website, see footnote 4



3.5 In our studies, we have used the emissions from emulated signals based on recordings of LTE devices. The OOB emissions therefore reduce significantly below the relevant masks as the distance from the LTE block increases. Whilst we acknowledge that there is a possibility that spurious emissions may occur anywhere within the bounds of the mask, we also recognise that these are highly likely to be transient and exist for only short periods of time. We therefore consider that it is more realistic to test with as-close-to real transmissions as can be achieved. Assuming emissions at the mask limit is not realistic, especially in the top end of the SRD band.

3.6 Continental Compliance Ltd noted that some published FCC test reports show LTE device emissions 10dB below levels permitted in EN 301 908-13 suggesting that we should maintain our worst case assumptions for OOB emissions from the LTE emulator. However this also adds support to our assumption that OOB emissions from devices may be between 5 and 10dB better than the relevant standards.

Equipment standards

3.7 A number of respondents, including: Telecare Service Association, Ei Electronics, Mr. B Copsey, Great Circle Design and one confidential respondent, raised concerns about the standards for both LTE and SRDs and their respective OOB emission parameters along with the difficulty for certain devices to identify the presence of interference and then subsequently mitigate it.

3.8 We agree that some improvement in co-existence may be achievable via improvements and changes to relevant standards for both LTE and SRDs in order to provide long term improved protection. We have therefore engaged within the relevant standardisation bodies as highlighted below in Section 4 “Pan-European consideration of LTE interference issues”. One area of ongoing work in EU standardisation is a project to ensure high reliability as required by EN54-25 without the need for such sensitive receivers. We also agree with Great Circle Design that improvements in SRD standards and signalling may yield only a few dB improvement against a raised noise floor caused by LTE OOB emissions

Concern about the impact of multiple LTE users at a location

3.9 BEIRG and Continental Compliance commented about the number of LTE users likely to be within the vicinity of the SRD receiver and raised concerns about this increased risk. We agree that the number of LTE users within an audience scenario may be considerable; however we believe that the number of users likely to impact on the range of a device may be less than suggested by some respondents. As LTE resources are shared between users on a time and resource block basis, multiple users will share the available resources. Our current analysis shows that a single user with a large allocation of resource blocks will produce a greater degree of OOB emissions than several users with a lower allocation of resource blocks. Therefore multiple users may be modelled as a single user with a higher resource block allocation.

Traffic assumptions

3.10 Comments were also received from Continental Compliance, Great Circle Design and a confidential respondent about the traffic assumptions made in our initial technical analysis. We agree that overall 800MHz LTE networks are likely to be relatively heavily loaded, however the interference mechanism for SRDs is caused by individual (or multiple) user device. In this scenario the relevant traffic assumption is that of an individual user. We expect that there will be common demand for high throughput applications eventually. We also recognise that the commercial model for deployment of LTE is unlikely to favour the use of all cell resources by a very limited number of users on a long term basis.

Other potential reasons why interference may be worse than modelled

3.11 There was a general suggestion from many respondents that the impact of LTE interference would be worse than we suggested in the consultation and our initial technical work. Examples were cited to suggest that the impact of SRD to SRD interference is currently mitigated by: geographical separation of radio microphones and the use of 10mW SRDs, whereas LTE powers will be higher power and could be in any location. They also suggested that: spurious LTE emissions will raise the noise floor in the band, making the cost of SRDs in the band more expensive due to increased requirements; 1-way communications are unaware of interference and with LTE being likely to cause blocking for several seconds this could adversely affect SRDs with latency requirements, which will be unaware that transmissions have not been successfully received. Careful band segregation within the SRD standard allows different types of SRDs to co-exist harmoniously with one another whereas LTE OOB emissions will be indiscriminate across the entire band.

3.12 Ei Electronics pointed out that existing “fade margins” allowed for in installation of wireless alarm systems could not be used to combat additional interference from LTE and that additional margins may need to be allowed for in new system installations. We agree with this approach but note that the existing margins will provide some protection to current systems in some circumstances, thus reducing the likelihood that there will be any impact of LTE interference.

3.13 We acknowledge that the majority of SRDs coexist in the same or adjacent bands with the use of low duty cycles; listen before talk; or segregation by sub-band allocation or geography. However, as highlighted in our initial work, the use of

wireless audio devices that do not have a duty cycle requirement do have the potential to cause interference to other SRDs operating within the band.

3.14 We also agree that there was a risk that we might have underestimated the levels of interference in our initial study. In order to inform our understanding further we have therefore undertaken further work as detailed above and initial findings suggest that with likely LTE usage the impact of LTE interference will be a small reduction in range.

3.15 Ei Electronics and Mr B Copsey indicated that they expect LTE terminals to operate at near full power, at least in the start up phase. Whilst we acknowledge that this is possible, we also draw a distinction between the low resource usage of the initial signalling and the higher throughput requirements of ongoing application uploads, which may not be at such a high power. We also note that initial LTE deployments will be coverage limited rather than capacity limited, leading to use of high device transmit powers. There will be a low number of data dongles at this stage of rollout and these will have low upload requirements being used as a mobile broadband configuration and therefore the likelihood of interference will also be low.

Proposals that LTE terminals should be individually licensed

3.16 Several responses (including BEIRG and APWPT) proposed that in order to protect SRDs, mobile terminals should not be licence exempt. Other respondents (including Ei Electronics, Mr B Copsey, Great Circle Design and a confidential respondent) raised concerns regarding the proposed power of the mobile terminal. Some suggested that the TRP should be reduced by 3dB to +20dBm. In either case, no evidence was supplied to quantify the reduction in the number of SRD devices that would be affected. We also note that the proposed power is part of a pan-European harmonised standard.

3.17 Some respondents raised specific concerns regarding higher power fixed terminals and suggested that these, in particular, should not be licence exempt. However we are proposing +23dBm EIRP for this classification of terminal within the 800MHz allocation. JFMG supported the plans for making terminals licence exempt provided that they do not cause interference to PMSE users. We do not expect any significant interference from LTE terminals to PMSE users operating below 790 MHz.

Concern about the impact of LTE base station emissions

3.18 A number of respondents (including APWPT, BEIRG, Mr. B Copsey, Ei Electronics and Great Circle Design) suggested that the proposed EIRP of the LTE base stations should be reduced by 3dB or more to avoid interference to PMSE, wireless microphones and other SRDs. The edge of a Block C base station is at 821MHz which is separated by a minimum of 42MHz from the start of the SRD band allocation. According to ECC/Dec/(09)03, the out of band emissions from a base station must be below -49.5dBm / 5MHz within 832 to 862MHz to protect from base-to-base interference. We expect that at 862MHz the OOB emissions will be considerably less than this level and that this reduced level will continue throughout the SRD Band. We therefore consider that the main risk of interference to SRDs is caused by the LTE mobile device operating in block C (ending at 862MHz).

Potential impacts on channel 69 users and other users of wireless audio systems

3.19 APWPT, BEIRG, Mr B Copsey and JFMG suggested that a number of channel 69 wireless microphone users will have moved to the SRD band and interference may adversely affect them. They also cited other wireless audio users such as tour guides and alarm systems with audio monitoring. Our analysis indicates that around 500 channel 69 licensees have not registered to surrender their equipment, including around 200 of whom we were unable to contact. Taking account of those companies that have ceased using channel 69 equipment and those who did not own equipment (hiring it when needed) we expect that there are significantly less than 500 users that are likely to have switched to the SRD band. JFMG suggested that some users will use antennas located higher than 1.5m and may include gain in the receive systems and that protection distances could be increased. Whilst this is possible, our discussions with some wireless microphone equipment makers suggest that this is an uncommon configuration for users in the unlicensed SRD band.

3.20 APWPT and Mr B Copsey suggested that additional licence exempt spectrum should be made available for wireless microphones around 1800MHz or another band. The LPRA also requested additional spectrum for SRDs. Other emergency services usage at 1800MHz prevents this band from being used. However we are working within the relevant harmonisation and standardisation bodies and should there be a strong case for additional SRD spectrum allocations through EU harmonisation in the future then this will be considered.

Questions about receiver sensitivity

3.21 Several respondents (including Continental Compliance, Great Circle Design, and Telecare Services Association) suggested that many alarm systems have sensitivities that are at least 5dB better than the value measured in our initial technical work and in one case a sensitivity of -120dBm was quoted. We have undertaken additional work on social alarms and our measurements of one example of three different makes of equipment show similar minimum sensitivities to those originally recorded. We also note that measured noise floor during our trial in a sheltered housing facility in Lambeth was just above -98dBm and therefore increased sensitivity would be of no benefit in this environment.

3.22 It was also suggested by some of these respondents that assuming the system was operating 3dB above the minimum sensitivity was a more realistic scenario (as defined by various manufacturers) than 10dB (one of the options reviewed in our initial lab research). Clofield Communications cited an example of a distant user at 25m, with body blocking causing a received signal in the region of -105dBm. Honeywell stated that system range should not be permanently decreased due to interference from LTE with devices greater than 1m from the alarm.

3.23 In our further work on social alarms, we have presented the interference impact as a possible reduction in range and demonstrated how this varies with different assumptions around LTE device usage and the impact of body blocking on the alarm system. We have also stated that we think the impact on range is likely to be low. LTE usage assumptions and the transient nature of LTE users and throughputs mean that any reduction in range will not be permanent. We believe that whilst this study was specifically on social alarms it should give an indication as to the impact of any interference on wireless alarm and telemetry systems operating in similar parts of the spectrum.

Other issues

3.24 Two respondents, Continental Compliance and a respondent who wished to remain anonymous, were concerned about the impact on the ability of alarm repeaters, amplifiers or external antennas to extend the range of alarm systems. We believe that if the repeater is treated in the same way as the main alarm receiver then all assumptions regarding range reduction or protection distances should be applied to both the receiver and the repeater locations.

3.25 A number of respondents (including LPRA, and subsequent verbal responses from several organisations) commented that they would like to see a greater understanding of the emissions from base stations and user devices. We entirely agree with this approach and subsequent to the consultation we have progressed with additional technical work to evaluate further the impact of interference on social alarms and wireless microphones. We are also gaining further knowledge around the likely transmit power levels and resource block usage from commercial and trial networks. LPRA hoped that the MNOs will use the available information to inform their policy and processes around resource scheduling, although this is not something that we propose to require.

3.26 These same respondents plus APWPT also asked for us to work with the SRD industry to support communications into the market. Mr B Copsey also asked if 863-865MHz wireless microphones would be included with part of the DTT co-existence process. Due to the non-protection status of the SRD band, where the installation and use of SRDs are un-structured, co-existence coordination will not be consistent with DTT co-existence. However we agree that clear communication to users and makers of SRDs is important to ensure that confidence in new and legacy products is maintained. As such we are continuing discussions with interested parties and will continue this dialogue both in the lead up to our final decisions and as LTE licenses are issued and deployments commence.

3.27 We note the LPRA request to increase the power limit from 10mW to 25mW in the 433-434MHz band for low duty cycle operation. We will need to undertake further work on this but we intend to take this forward with the relevant authorities.

3.28 APWPT, BEIRG, Mr B Copsey, EI Electronics and some confidential responses all requested that Ofcom should reopen funding for channel 69 PMSE users who had moved to channel 70 or to fund improvements to equipment or new units in order to help mitigate the risk of interference. Consistent with the status of SRD users as summarised in the “Short range devices information sheet”, as already discussed in Section 1 Summary above, Ofcom will not be providing additional funding to mitigate the risk of interference as this is a matter for users and manufacturers.

Section 4

Pan-European consideration of LTE interference issues

4.1 Use of both the 800 MHz band and the licence-exempt SRD band are harmonised throughout Europe. Additionally, it would be unrealistic, impractical and costly to expect 800 MHz network operators and equipment manufacturers to have systems and devices made to specifications applying only to the UK market and nowhere else in Europe.

4.2 The R&TTE Directive 1999/05/EC places responsibility on manufacturers to ensure that apparatus placed on the market is fit for its intended purpose. Until now, some SRD applications have been able to achieve high levels of reliability by operating in relatively benign spectrum within the 863 to 870 MHz band - possibly with an almost exclusive allocation - even though the harmonised standards used to place the apparatus on the market are the most generic (EN 300 220).

4.3 Against this background, the European Commission has indicated[10] a preference for less application-specific SRD allocations in future. To that end, there may need to be European wide activity to ensure equipment standards remain fit for purpose as spectrum allocations become less application specific. In particular the reliance on particularly sensitive receivers, to achieve the desired reliability of communication, may no longer be seen as the first choice method as standards develop in the future.

4.4 To date, no other European country has proposed that technical licence conditions (beyond those set out in Commission Decision 2010/267/EU) should be applied on a national basis to protect SRDs from interference from LTE – even though some countries have completed 800 MHz spectrum auctions, and some LTE networks are beginning to roll-out. As we understand the position, the predominant basis for this approach elsewhere has been to rely on the non-interference/non-protection principle for SRDs which places all responsibility for mitigating interference from authorised sources on manufacturers and users. More recently, however, a number of European initiatives have begun with the aim of further raising equipment standards for certain types of device – namely those devices that are deemed to have personal safety implications.

4.5 Given there is both a) a European Commission Decision harmonising the use of the 800 MHz band (2010/267/EU) coupled with a harmonised standard for LTE (EN 301 908) and b) a European Commission Decision harmonising the use of SRDs (2006/771/EC) coupled with harmonised standards for SRDs (EN 300 220, EN302 208, EN 300 422, EN 301 357) the issue of potential interference to SRDs is clearly an issue shared by all European member states.

4.6 Recent activity in ETSI and CEPT recognises that equipment standards lie at the heart of the issue, both from the perspective of SRD susceptibility and LTE device unwanted emissions. Moves are already underway to establish more robust pan-European technical standards for safety-critical devices (ETSI TR 103 056 (draft)). In this Systems Reference Document, alternative methods of operation to ensure the

[10] RECOM (11)28 Guidance to CEPT on the 5th update of EC Decision 2006/771/EC

continued reliability of safety systems are discussed. These could include for example, a requirement for fail-safe technology such as duplex operation (i.e. systems that transmit until an acknowledgement signal is received).

4.7 Given the guidance to CEPT from the European Commission on removing, where possible, application specific constraints, and the drive to make SRD communication robust in the face of interference, there is an arguable case that improvements to SRD equipment standards will occur for social and other alarms systems with or without LTE roll-out.

4.8 Ofcom is supportive of efforts to bring about these kinds of improvements. We are engaging with key European bodies in ETSI and CEPT. We have highlighted the research we have completed to these forums. CEPT has now started studies (SE24 Work Items 41 and 42) to investigate whether the SRD and LTU device equipment standards have been developed in a way that ensures technical mutual compatibility. We are also aware of internal ETSI communications discussing this same issue of the compatibility of both equipment standards.

Section 5

Our current position

5.1 Following careful consideration of consultation responses and in light of our extensive engagement with key stakeholders (notably with manufacturers, trade associations and users' representatives) we currently see no reason to change our view that it is inappropriate to impose constraints on the 800 MHz award in order to protect SRDs. However, this remains a provisional view and we will taken a final decision on this when we make decisions on the entirety of the award of the 800 MHz and 2.6 GHz bands.

5.2 We are mindful that in the UK devices have operated in the SRD band for some time in a relatively benign environment free from interference. However, it has always been made clear that this unlicensed band is available for use on the principle of non-interference/non-protection. Further, it has also been made clear that a current benign environment offers no guarantee against future interference from licensed services in neighbouring frequencies.

5.3 However, recognising the benefit to society of these technologies, we have been mindful to consider very carefully the possible effect of LTE devices on existing users of the SRD band. In almost every case, the potential interference results in a reduction in the range over which an SRD may transmit rather than the failure of the equipment per se. However, we were particularly concerned where potential interference to social and other alarms might have implications for the personal safety of users. In those cases, we have weighed up various elements including:

- the actual likelihood of equipment failure, and the potential consequences should that happen;
- the range of mitigations available other than imposing technical licence conditions on use of the 800 MHz spectrum;
- the practicality and cost of imposing UK-only requirements on LTE equipment makers and network operators that will not apply elsewhere;
- the relevant applicable European legislation;
- the responsibilities under the R&TTE Directive for those placing apparatus on the market in Europe to ensure that their equipment is fit for its intended purpose as deployed;
- the value to society that will derive from the 800 MHz auction and the deployment of next generation mobile technology;

5.4 Our current position remains that the likelihood and extent of interference from LTE will be low and the imposition of licence conditions on users of 800 MHz spectrum is not likely to be justified. If a user or manufacturer is still concerned, there is a wide range of alternative approaches available for current users of the SRD band, including social and other alarms. The alternatives for manufacturers and users include migration to other frequency bands; changing the characteristics of signal transmission (such as ensuring social alarms send repeated signals until the call is acknowledged); alternative technologies; or providing advice or information (in the case of leisure or entertainment equipment).

5.5 In many cases, SRD users are likely to have some control over the interference e.g. they may choose to switch off mobile devices in close proximity or – at least – not upload data at the same time as using SRD equipment. In any event, interference is likely to be an issue over only very short periods when large amounts of data are being uploaded in close proximity to an SRD at the precise moment a signal is being sent to its receiver.

Continuing engagement with stakeholders

5.6 In the case of all types of SRD, there is a range of approaches to mitigate potential interference that could be adopted if manufacturers and/or users are concerned.

5.7 We have noted the various responses to our recent consultation that request additional investigation and information into the market and we are therefore undertaking the additional pieces of research as outlined below.

5.8 In our initial study we concluded that social alarms and wireless audio equipment were of greatest concern with regard to the impact of LTE interference on their operation. Having now published further work on the social alarms, we are in the process of undertaking additional testing around radio microphones operating in the 863-865MHz band. This research – for publication in early 2012 - will demonstrate the practical impact of the presence of LTE interference on radio microphone receivers from different manufacturers.

5.9 We have also agreed to undertake further research into the likely usage of LTE and we propose to make our assumptions and information available to SRD stakeholders. This work will include analysis of: measurements of OOB emissions from commercially available LTE devices and base stations; information on the distribution of actual transmit power levels within commercial and non-commercial 800MHz networks; information on the number of resource blocks that are being allocated in real user scenarios within these networks; and how this affects the OOB emissions.

5.10 Ofcom also intends to provide a test bed where we will make facilities available for SRD manufacturers to assess their own devices in the presence of LTE emissions from handsets with a range of different parameters. This facility will allow equipment makers to understand the impact of any interference and will enable them to provide guidance to consumers and make improvements to their devices.

5.11 We are also willing to work with the SRD sector to keep it informed of the emerging picture for LTE rollout and how this may vary geographically. We welcome continued information exchange across the industry and any suggestions on practical approaches that would provide value to the sector.

5.12 Before auctioning the 800 MHz band, Ofcom intends to publish a Statement and Information Memorandum (IM) setting out information relevant to those considering participating in the auction. We will set out our final decisions in relation to SRDs in those documents, taking account of any further evidence that is available at that time, including additional technical work referred to above.