Variation of 1800 MHz mobile licences

A consultation on requests for an increase of 3 dB in the maximum permissible base station power

Consultation

Publication date:	31/03/14
Closing Date for Responses:	30/05/14

Contents

Section 1

Executive summary

1.1 This consultation sets out our proposal to increase the maximum permissible base station transmit power (e.i.r.p.) in the 1800 MHz Public Wireless Network licences by 3 dB to 65 dBm per carrier for Universal Mobile Telecommunications System (UMTS) and 65 dBm per 5 MHz for Long Term Evolution (LTE) and Worldwide Interoperability for Microwave Access (WiMAX). EE Limited ("EE"), Hutchison 3G UK Limited ("H3G"), Telefónica UK Limited ("Telefónica") and Vodafone Limited ("Vodafone") have all requested that their 1800 MHz licences be varied to implement this power increase.

1.2 This document assesses these requests and in doing so:

- provides background information on the 1800 MHz bands and licences;
- sets out Ofcom's statutory and policy framework;
- considers the implications for competition and the implications for other users in, and adjacent, to the 1800 MHz Public Wireless Network licence bands;
- considers the request in the light of Ofcom's statutory duties.

1.3 Having considered the relevant factors in relation to each request and subject to responses to this consultation, Ofcom's preliminary view is it is appropriate and proportionate to agree to the variation of EE, H3G, Telefónica and Vodafone's Public Wireless Network licences, to increase the maximum permissible base station transmit power in the 1800 MHz band by 3 dB for UMTS, LTE and WiMAX technologies.

1.4 We will carefully consider any representations made in response to this consultation before reaching a final decision.

Section 2

Introduction

Scope of this document

2.1 This section sets out the relevant factual background, the applicable legal framework and the analytical framework we have applied in reaching the proposals set out in this document.

2.2 Section 3 considers the impact on competition before going on to consider the impact on spectrum management in relation to potential impact on affected spectrum users of increasing the maximum permissible base station transmit power in the 1800 MHz frequency band.

Background to licence variation requests

2.3 Licences for use of the 1800 MHz band are held by:

- Telefónica: 1805.1 to 1810.9 MHz
- Vodafone: 1810.9 to 1816.7 MHz
- H3G: 1816.7 to 1831.7 MHz
- EE: 1831.7 to 1876.7 MHz

2.4 Spectrum in the 1800 MHz band was first licensed for GSM1800 (2G) to mobile network operators in the early 1990s. Following consultation[1] on a licence variation request, Ofcom published its Decision[2] on 21 August 2012 to grant a variation to EE to allow the use of LTE and WiMAX (4G) technology. Following that variation, EE traded some of its 1800 MHz spectrum to H3G.

2.5 In February 2013, Ofcom consulted[3] on the liberalisation of mobile spectrum in the 900 MHz, 1800 MHz and 2100 MHz frequency bands to allow the use of 4G technology. This consultation also included a proposal to increase the power limit of the 900 MHz licences by 3 dB for UMTS and 4G technology.

2.6 In their responses to this consultation, EE and H3G requested that their 1800 MHz licences also be varied so as to increase the maximum permissible base station transmit power of their 1800 MHz Public Wireless Network licences, by 3 dB to 65 dBm per carrier for UMTS and 65 dBm per 5 MHz for LTE and WiMAX.

[1] http://stakeholders.ofcom.org.uk/consultations/variation-1800mhz-lte-wimax/summary

[2] http://stakeholders.ofcom.org.uk/consultations/variation-1800 MHz-lte-wimax/statement

[3] http://stakeholders.ofcom.org.uk/consultations/variation-900-1800-2100/

2.7 On 9 July 2013, Ofcom published its Decision[4] to permit the use of 4G technology in the 900 MHz, 1800 MHz and 2100 MHz frequency bands and to increase the maximum permitted power in the 900 MHz licences by 3 dB for UMTS and 4G technology. We explained in the same statement that we would consider the requests from EE and H3G to increase the maximum permitted power of their 1800 MHz licences by 3 dB as part of a subsequent consultation.

2.8 Having received formal requests from EE and H3G, we asked Telefónica and Vodafone if they wished to request the same variation in respect of their licensed 1800 MHz spectrum licences. They have both confirmed that they are requesting this same variation.

Legal Framework

2.9 The applicable legal framework derives from our duties under both European and domestic legislation, specifically from:

- the Common Regulatory Framework[5] for electronic communications networks and services, in particular, the Framework Directive and the Authorisation Directive – together with a number of Decisions that apply to these specific spectrum bands; and

- the Communications Act 2003 (the "2003 Act") and the Wireless Telegraphy Act 2006 (the "2006 Act") which transpose the provisions of those directives into national law.

European Law

2.10 There are a number of European Directives and Decisions that relate specifically to the 1800 MHz frequency band.

2.11 Article 14 of the Authorisation Directive requires that rights of use (in this case a wireless telegraphy licence) "*may only be amended in objectively justified cases and in a proportionate manner, taking into consideration, where appropriate, the specific conditions applicable to transferable rights of use for radio frequencies*".

2.12 More generally, in carrying out our regulatory tasks, including considering the case for amending rights of use, we are required to take all reasonable measures which are aimed at achieving the objectives set out in Article 8 of the Framework Directive. Article 8 requires national regulatory authorities:

- to promote competition in the provision of electronic communications networks and services by, amongst other things by ensuring that there is no distortion or restriction of competition in the electronic communications sector and by

[4] http://stakeholders.ofcom.org.uk/binaries/consultations/variation-900-1800-2100/statement/statement.pdf

[5] The Common Regulatory Framework comprises the Framework Directive (Directive 2002/21/EC), the Authorisation Directive (Directive 2002/20/EC), the Access Directive (Directive 2002/19/EC), the Universal Service Directive (Directive 2002/22/EC) and the Directive on privacy and electronic communications (Directive 2002/58/EC), as amended by the Better Regulation Directive (Directive 2009/140/EC).

encouraging efficient use and ensuring the effective management of radio frequencies; and

- to contribute to the development of the internal market by, amongst other things, removing obstacles to the provision of electronic communications networks and services at a European level and encouraging the interoperability of pan-European services.

The 2003 Act and the 2006 Act

Duties

2.13 The requirements of Article 8 of the Framework Directive are given effect to by our duties under the 2003 Act (in particular section 3 and 4) and the 2006 Act (in particular section 3).

2.14 Our principal duty under the 2003 Act is to further the interests of citizens in communications matters, and the interests of consumers in relevant markets, where appropriate by promoting competition.

2.15 By virtue of our principal duty, we are required to secure (amongst other things) the optimal use for wireless telegraphy of the electro-magnetic spectrum, and the wide availability throughout the UK of a wide range of electronic communications services.

2.16 In performing those duties, we are also required to have regard to various matters where they appear to us to be relevant in the circumstances, including the desirability of promoting competition in relevant markets, the desirability of encouraging investment and innovation in relevant markets, and the desirability of encouraging the availability and use of high speed data transfer services throughout the UK.

2.17 In furthering the interests of consumers, we must have regard in particular to the interests of those consumers in respect of choice, price, quality of service and value for money.

2.18 In performing our principal duty, we must have regard in all cases to the principles under which regulatory activities must be transparent, proportionate, consistent and targeted only at cases in which action is needed.

2.19 The 2006 Act requires us, amongst other things, to have regard to the desirability of promoting the efficient management and use of the part of the electromagnetic spectrum available for wireless telegraphy. It also requires us to ensure that wireless telegraphy licence conditions are objectively justified in relation to the networks and services to which they relate, non-discriminatory, proportionate and transparent.

Powers

2.20 Section 9 of the 2006 Act gives Ofcom the power to grant wireless telegraphy licences subject to such terms as Ofcom thinks fit.

2.21 Schedule 1(6) of the 2006 Act gives Ofcom a general discretion to vary wireless telegraphy licences and sets out the process that Ofcom must follow.

2.22 Ofcom has a broad discretion under Schedule 1(6) of the 2006 Act to agree to vary licences but there are some limitations on that discretion. These include the following:

- UK obligations under EU law or international agreements where use of spectrum has been harmonised: Ofcom will not agree to remove restrictions from licences or other changes that would conflict with the UK's obligations under international law;

- Ofcom must comply with any direction from the Secretary of State under section 5 of the 2003 Act or section 5 of the 2006 Act;

- Ofcom must act in accordance with its statutory duties, including the duty to ensure optimal use of the spectrum;

- General legal principles, which include the duties to act reasonably and rationally when making decisions and to take account of any legitimate expectations;

- Any restrictions on variation contained in the relevant licences themselves, subject Schedule 1(8)(5)of the 2006 Act.

Process for considering a licence variation request

2.23 In terms of process, Article 14 of the Authorisation Directive requires that Member States must ensure that, except where proposed amendments are minor and have been agreed with the licensee:

- notice of the proposed change is given in an appropriate manner; and

- interested parties, including users and consumers, are allowed a sufficient period of time to express their views on the proposed amendments (such time to be no less than four weeks except in exceptional cases).

2.24 Section 7 of the 2003 Act provides that where we are proposing to do anything for the purposes of or in connection with the carrying out of our functions, and it appears to us that the proposal is important, then we are required to carry out and publish an assessment of the likely impact of implementing the proposal, or a statement setting out our reasons for thinking that it is unnecessary to carry out such an assessment. Where we publish such an assessment, stakeholders must have an opportunity to make representations to us about the proposal to which the assessment relates.

2.25 The 2006 Act sets out in Schedule 1 a process for the variation of wireless telegraphy licences. In the case where a variation is proposed by the licensee, we are under no obligation (under the 2006 Act) to consult on the proposal.

2.26 The variation of licences in the 1800 MHz bands to allow an increase in the maximum permissible base station transmit power may not be considered to be a minor variation by interested third parties. On that basis, we are publishing for consultation our proposal to vary these licences to give interested third parties an opportunity to make representations, and our assessment of the likely impact of doing so.

Framework for analysis of licence variation requests

2.27 In section 3, the analytical framework we have applied in considering these variation requests reflects our relevant regulatory objectives and our statutory duties, as set out above. Of particular relevance to our assessment are our principal duties, which are to further the interests of citizens in relation to communications matters; to further

the interests of consumers in relevant markets, where appropriate, by promoting competition; and to promote optimal use of spectrum.

2.28 In considering whether to grant the variation requests, we have considered both the likely impact on competition of granting those variations and the likely impact on spectrum management, in particular the impact on existing licensed use of adjacent spectrum.

Impact on competition

2.29 In deciding whether to vary the relevant licences as requested, we have considered the extent to which varying those licences would:

- further the interests of consumers by, for example, encouraging innovation, investment and the availability and use of mobile services throughout the UK; and result in better choice, price, quality of service and value for money; and/or

- give rise to a material risk of a distortion of competition to the detriment of consumers such that any benefits to consumers resulting from varying those licences without delay would be outweighed by the detriment to consumers resulting from such a distortion of competition.

Impact on spectrum management

2.30 Ofcom's general policy is to set technical restrictions that are the minimum necessary to provide adequate protection against harmful interference. This is because optimal use of the radio spectrum is more likely to be secured if users decide, rather than Ofcom dictates, the way in which technology is used or a service is provided in a particular frequency band. Imposing the minimum necessary constraints will increase users' flexibility and freedom to respond to changing conditions and to make best use of the valuable spectrum resource. Following on from this, we have considered whether varying the relevant licences would be consistent with the minimum necessary to provide adequate protection against harmful interference.

2.31 Section 3 and Annex 6 set out our consideration of the proposed variation and the detailed technical assessment.

Section 3

Assessment of increase in 1800 MHz maximum permissible base station transmit power

Introduction

3.1 This section deals with the impact of the proposed variation on competition and spectrum management and, together with detailed technical assessment in Annex 6, forms Ofcom's impact assessment of the 1800 MHz licence variation request.

Impact on consumers and competition

3.2 As explained in section 2 above, we have considered whether the likely benefits to consumers from varying the 1800 MHz licences to increase the maximum permitted base station transmit power are likely to be outweighed by any negative effects on consumers as a result of a reduction in competition. For the reasons explained below, we do not consider that allowing a higher maximum permitted base station transmit power will result in any detriment to competition or other spectrum use. Accordingly, we do not consider that the proposed variation should result in any consumer detriment.

Potential impact for consumers

3.3 There are a number of potential benefits that an increase in maximum power could bring for an operator in providing service to consumers, including:

- improving coverage and/or capacity;
- improving the ability to penetrate deeper into buildings; and
- providing flexibility to coverage and traffic management, load balancing and efficient handovers between different network layers.

3.4 We understand that base stations, for the most part, operate at lower power than the maximum transmit powers contained in the licences. This reflects the fact that the base stations' transmit power is one of the key parameters used when optimising network performance. Its optimal level will vary from site to site dependant on a number of factors including cell size, site distribution and traffic loading. Allowing a higher maximum permitted base station transmit power will give operators greater flexibility to organise their networks to meet customer demands and expectations.

3.5 To the extent that the additional flexibility provided by the increase may enable operators to provide improved quality of service and / or reduce the cost of providing a given level of service, we consider that this may benefit consumers over time.

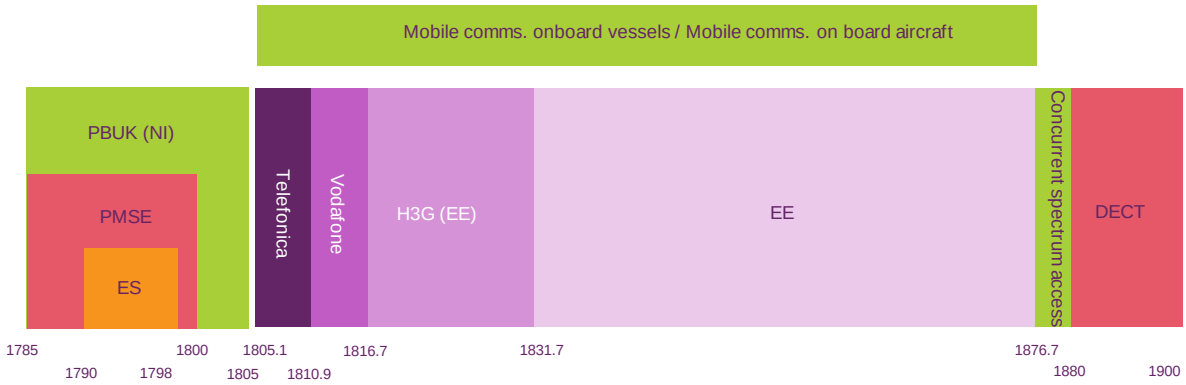
Competition considerations

3.6 The 1800 MHz band is one of a number of frequency bands used by operators to provide mobile services to customers. We have previously granted similar licence variation requests to increase the maximum permitted power in the 900 MHz and 2100 MHz bands from 62 dBm per 5 MHz (or carrier) to 65 dBm per 5 MHz (or carrier). The effect of the change proposed here would be to increase the maximum permitted power in the 1800 MHz licence to the same level as that which already applies to the 900 MHz and 2100 MHz licences. Accordingly, we consider that the increase at 1800 MHz is unlikely to distort competition in a way that harms consumers, noting also that, whether or not they are currently deploying (or intending to deploy) 4G services in this particular band, all of the current national wholesale operators also have access to 3G/4G capable spectrum in several bands. Moreover, all four current national wholesale operators hold 1800 MHz licences and all four have requested that their licences be varied to increase the maximum permitted power.

Impact on spectrum management and use/users

3.7 We have considered the impact on spectrum management; in particular whether varying the licence would be consistent with setting the technical conditions at the minimum necessary to provide adequate protection to potentially affected spectrum users (outlined in Figure 1) in, and adjacent to, the 1800 MHz base station downlink band against harmful interference. We set out below our analysis of the potential impact on these spectrum users.

Figure 1: Spectrum users in 1785 - 1900 MHz



Impact below 1800 MHz mobile downlink band

Northern Ireland licensee in 1785 – 1805 MHz

3.8 The band 1785 – 1805 MHz was awarded under a coordinated auction in Northern Ireland and Ireland in May 2007 to Personal Broadband UK (“PBUK”) on an unpaired and technology neutral basis.

3.9 Our current assessment is that the minimal PBUK network deployment to date will not be impacted by the proposed 3 dB e.i.r.p. increase and our expectation is that current coordination arrangements would continue for future sites.

Programme Making and Special Events (PMSE) at 1785 – 1800 MHz

3.10 The band 1785 – 1800 MHz is used by PMSE, primarily for wireless microphones. Currently, there is very limited PMSE assignment in this band. However, CEPT has recently approved Report 50[6] which deals with the technical conditions for the use of the bands 821 - 832 MHz and 1785 - 1805 MHz for wireless radio microphones, including the technical conditions to facilitate the use of PMSE equipment for EU-wide operations.

3.11 This may increase uptake of wireless microphones in the 1785 -1800 MHz band in the future notwithstanding additional studies required to determine which wireless audio applications are appropriate, and to what extent these bands will provide additional capacity for wireless audio applications.

3.12 To assess the impact of 3 dB e.i.r.p. increase on wireless microphone receivers, we have conducted minimum coupling loss (MCL) analysis as detailed in Annex 6 to understand the required separation distance between macro base station and PMSE receiver for satisfactory operations both indoors and outdoors.

3.13 We have also assessed the extent to which these separation distances would increase with a 3 dB higher e.i.r.p. compared with the separation distances that are required for base stations operating at current maximum permissible e.i.r.p. limit. The assessment covers both rural and urban environments to capture the two extremes of radio wave propagation conditions.

3.14 The results of our analysis for the first adjacent PMSE channel (Table A5 in Annex 6) suggest that:

- for urban deployment scenarios , the required separation distance when e.i.r.p. increases by 3 dB compared to current limits remains small i.e. from ~100 m to ~115 m (~15%) for indoor PMSE receivers and from ~185 m to ~225 m (~ 22%) for outdoor PMSE receivers;

- for rural deployment scenarios, the required separation distance is large compared with urban cases even with current limit without a 3 dB power increase. The required separation distance increases from ~1510 m to ~1835 m (~22%) with a 3 dB higher e.i.r.p. in the outdoor case. However, the required separation distance is small compared to cell range in rural environment which is typically 10-20 km[7]. Moreover, the probability of PMSE systems operating at its noise floor below its sensitivity level and in close proximity to macro base station would be very small.

3.15 We also note that there are mitigation measures that could be implemented by PMSE to minimise interference from macro base stations such as employing PMSE channels other than the first adjacent channel to mobile base station band. Finally, as

[6] CEPT Report 50, "Technical conditions for the use of the bands 821-832 MHz and 1785-1805 MHz for wireless radio microphones in the EU, March 2013": http://www.erodocdb.dk/Docs/doc98/official/pdf/CEPTREP050.PDF

[7] H. Holma, A. Toskala, John Wiley & Sons Ltd., 2009, "LTE for UMTS: OFDMA and SC-FDMA based radio access"

indicated in CEPT ECC Report 191[8], the dominant interference mechanism is not the macro base stations but indoor pico-cells which have the potential to operate in close proximity to indoor wireless microphones. The proposed increase in permitted maximum power is only relevant for macro-cells and not to pico-cells.

3.16 Our provisional conclusion is that there is no significant impact to current and future PMSE use in 1800 MHz band if we allow a 3 dB increase in maximum e.i.r.p. of mobile base stations.

Emergency services at 1790 – 1798 MHz

3.17 The Home Office is currently using the 1790 – 1798 MHz band for emergency services. Our discussions with the Home Office indicate that any potential impact of the 3 dB e.i.r.p. increase will be managed by bilateral discussion between Home Office and the relevant 1800 MHz licensees.

Impact above 1800 MHz mobile downlink band

Concurrent spectrum access (CSA) licensees at 1876.7 – 1880 MHz

3.18 The paired 1781.7 – 1785 MHz (uplink) and 1876.7 - 1880 MHz bands (downlink) (also referred to as "the DECT Guard band") were awarded to 12 licensees for CSA in April 2006 on a technology neutral basis.

3.19 The technical licence conditions were set based on GSM spectrum emission mask and are feasible for low power (pico-cells) deployments. We understand that current deployments in the 1876.7 - 1880 MHz are based on GSM technology.

3.20 As the coexistence between different cellular network technologies is dealt with by the relevant technology standard organisation[9], the impact to CSA downlink at 1876.7 - 1880 MHz due to 1800 MHz base station e.i.r.p. increase will not be any greater than the impact to 1800 MHz base stations downlink operating adjacent to another 1800 MHz licensee (and implementing a power increase) when both are operating on an uncoordinated basis.

3.21 Therefore, our provisional conclusion is that there will be no significant additional impact to CSA licensees in 1876.7 - 1880 MHz band if we allow a 3 dB increase in maximum e.i.r.p. of 1800 MHz base stations.

Digitally Enhanced Cordless Telephones (DECT) at 1880 – 1900 MHz band

3.22 The band 1880 – 1900 MHz is authorised on a licensed exempt basis for DECT for private self provided communication implementing Commission Decision of 9th July 1997 on a common technical regulation for DECT.

[8] ECC Report 191, "Adjacent band compatibility between MFCN and PMSE audio applications in the 1785-1805 MHz frequency range, September 2013": http://www.erodocdb.dk/Docs/doc98/official/pdf/ECCREP191.PDF

[9] http://www.3gpp.org/

3.23 We have conducted minimum coupling loss analysis as outlined in Annex 6 to compare the increase in required separation distance between macro base station and DECT receivers operating both indoors and outdoors with a 3 dB e.i.r.p. increase as compared to existing limit.

3.24 The results of our analysis for the first adjacent DECT carrier (Table A7 of Annex 6) suggest that:

- for urban deployment scenarios with a 3 dB higher e.i.r.p., the worst case separation distance remains small i.e. increases by ~15% (from ~100 m to ~115 m) for DECT outdoor use;

- for rural deployment scenarios, the worst case separation distance increases by ~22% (from ~800 m to ~975 m) with a 3 dB higher e.i.r.p. for DECT outdoor use. This suggests that DECT outdoor use could be impacted with the current as well as the requested higher e.i.r.p. (although the separation distance of ~975 m is still very small compared to cell range in a rural environment which is typically 10-20 km^7 and the probability of macro base station and DECT systems operating in such close proximity would be small). In practice, the impact is likely to be minimal for the reasons below.

3.25 The typical use of DECT is indoors and the ability to use DECT outdoors is primarily governed by the coverage of the DECT transmitters inside the house. The worst case separation distance for the first one or two adjacent DECT carriers may suggest a reduction in DECT reception range on these carriers. In such occurrences, the dynamic channel allocation feature of DECT enables detection of interference on these carriers and should shift the DECT operation to any of the eight distant carriers, thereby operating at its maximum range and without loss in capacity. Moreover, as indicated in CEPT Report 41, the potential for interference is likely to exist from indoor pico-cells which have the potential to operate in close proximity to indoor DECT operating in the adjacent channel.

3.26 It should also be noted that the assumptions we have used for DECT receiver selectivity err on the conservative side and that actual systems are likely to have better selectivity than used in our analysis as highlighted in literature review (see Annex 6).

3.27 Our provisional conclusion is that a 3 dB increase in maximum e.i.r.p. of base stations has no additional significant impact on the operation of DECT as compared to the current limit.

Impact on services in 1800 MHz mobile downlink band

Mobile communication services on-board vessels (MCV) and aircraft (MCA)

3.28 MCV and MCA services are currently authorised to operate on a licence exempt basis in the 1800 MHz band to provide mobile communication on-board ships and aircrafts.

3.29 MCV provides mobile connectivity from vessel based base station where coverage from land based base stations end. Similarly, MCA provides mobile connectivity on-board aircrafts at altitudes above 3000 meters.

3.30 Due to the nature of operation and separation distances between these services and terrestrial mobile base stations, there is unlikely to be any impact of the proposed 3 dB e.i.r.p. increase on MCV and MCA.

Emissions from cellular base stations

3.31 Emissions near to mobile base stations[10] have been consistently found to be only a small fraction of the safety levels for exposure published by Public Health England[11] (formerly the UK Health Protection Agency) which refer to levels set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). No installation tested by us has exceeded 0.5% of the specified emission safety level (i.e. the highest measurement was still a factor of 200 times smaller than the ICNIRP limit) and in recent years, the results[12] have been consistently found to be significantly less than this.

3.32 In our Statement[4] on the requests for the variation of 900, 1800, 2100 MHz mobile licences published on 9 July 2013 (para 4.5 and footnote 17), we considered that the power flux density that could be created by a site with multiple antennas operating simultaneously at different frequencies with the maximum permissible power levels increased by 3 dB at all frequencies represented a very small proportion of the ICNIRP limit.

Provisional conclusions

3.33 Based on the above, our provisional conclusion is that there is unlikely to be a significant change in the existing interference environment experienced by current radio services operating in the same band or adjacent to the 1800 MHz licensees if we allow a 3 dB increase in the maximum ei.r.p. of base stations.

3.34 In addition, the following points are also of relevance to our provisional conclusion:

- the primary use of PMSE (wireless microphone) and DECT is mainly indoors and the associated building penetration losses provide adequate protection from outdoor macro base station located in close proximity;
- the 3 dB higher e.i.r.p. is only relevant for macro base stations and it is unlikely that these higher powers will be used on all base stations and at all times (in fact, we note that the majority of macro base stations operate at significantly less than the current, maximum permissible power level);
- the assumptions that we have used for DECT receiver characteristics are quite conservative and the actual systems are likely to have better selectivity than used in our analysis as highlighted by literature review.

[10] http://stakeholders.ofcom.org.uk/sitefinder/audit-info

[11] http://www.hpa.org.uk/

[12] http://stakeholders.ofcom.org.uk/sitefinder/mobile-base-station-audits/

- additional factors such as minimal use and availability of multiple PMSE channels in 1800 MHz band and DECT's inherent interference avoidance feature (*by channel switching*) further minimises wider compatibility and coexistence issues.

3.35 In light of the considerations set out in this section and subject to considering responses to this consultation, we propose to vary the 1800 MHz Public Wireless Network licences of EE, H3G, Telefónica and Vodafone to increase the maximum permissible base station transmit power from 62 dBm per carrier to 65 dBm per carrier for UMTS and from 62 dBm per 5 MHz to 65 dBm per 5 MHz for LTE and WiMAX in the 1800 MHz band.

Question 1 : Do you agree with the proposal to vary the 1800 MHz Public Wireless Network licences to increase the maximum permissible downlink transmit power (e.i.r.p.) by 3 dB from 62 dBm per carrier to 65 dBm per carrier for UMTS and from 62 dBm per 5 MHz to 65 dBm per 5 MHz for LTE and WiMAX technologies?

Section 4

Next steps

4.1 Following consideration of comments from stakeholders, we plan to publish our decision on the proposed variation of the 1800 MHz Public Wireless Network licence for all the licensees.

4.2 Our provisional timetable is

- Publication of consultation — 31 March 2014
- Consultation closes — 30 May 2014
- Publication of statement of our decision — Summer 2014

Annex 1

Responding to this consultation

How to respond

A1.1 Ofcom invites written views and comments on the issues raised in this document, to be made **by 5pm on 30 May 2014**.

A1.2 Ofcom strongly prefers to receive responses using the online web form at http://stakeholders.ofcom.org.uk/consultations/variation-1800mhz/ , as this helps us to process the responses quickly and efficiently. We would also be grateful if you could assist us by completing a response cover sheet (see Annex 3), to indicate whether or not there are confidentiality issues. This response coversheet is incorporated into the online web form questionnaire.

A1.3 For larger consultation responses - particularly those with supporting charts, tables or other data - please email cliff.mason@ofcom.org.uk attaching your response in Microsoft Word format, together with a consultation response coversheet.

A1.4 Responses may alternatively be posted or faxed to the address below, marked with the title of the consultation.

Cliff Mason
Floor 3
Spectrum Policy Group
Riverside House
2A Southwark Bridge Road
London SE1 9HA

Fax: 020 7981 3333

A1.5 Note that we do not need a hard copy in addition to an electronic version. Ofcom will acknowledge receipt of responses if they are submitted using the online web form but not otherwise.

A1.6 It would be helpful if your response could include direct answers to the questions asked in this document, which are listed together at Annex 4. It would also help if you can explain why you hold your views and how Ofcom's proposals would impact on you.

Further information

A1.7 If you want to discuss the issues and questions raised in this consultation, or need advice on the appropriate form of response, please contact Cliff Mason on 020 7783 4353.

Confidentiality

A1.8 We believe it is important for everyone interested in an issue to see the views expressed by consultation respondents. We will therefore usually publish all responses on our website, www.ofcom.org.uk, ideally on receipt. If you think your response should be kept confidential, can you please specify what part or whether

all of your response should be kept confidential, and specify why. Please also place such parts in a separate annex.

A1.9 If someone asks us to keep part or all of a response confidential, we will treat this request seriously and will try to respect this. But sometimes we will need to publish all responses, including those that are marked as confidential, in order to meet legal obligations.

A1.10 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to Ofcom to use. Ofcom's approach on intellectual property rights is explained further on its website at http://www.ofcom.org.uk/about/accoun/disclaimer/

Next steps

A1.11 Following the end of the consultation period, Ofcom intends to publish a statement in summer 2014.

A1.12 Please note that you can register to receive free mail Updates alerting you to the publications of relevant Ofcom documents. For more details please see: http://www.ofcom.org.uk/static/subscribe/select_list.htm

Ofcom's consultation processes

A1.13 Ofcom seeks to ensure that responding to a consultation is easy as possible. For more information please see our consultation principles in Annex 2.

A1.14 If you have any comments or suggestions on how Ofcom conducts its consultations, please call our consultation helpdesk on 020 7981 3003 or e-mail us at consult@ofcom.org.uk . We would particularly welcome thoughts on how Ofcom could more effectively seek the views of those groups or individuals, such as small businesses or particular types of residential consumers, who are less likely to give their opinions through a formal consultation.

A1.15 If you would like to discuss these issues or Ofcom's consultation processes more generally you can alternatively contact Graham Howell, Secretary to the Corporation, who is Ofcom's consultation champion:

A1.16 Graham Howell
Ofcom
Riverside House
2a Southwark Bridge Road
London SE1 9HA

Tel: 020 7981 3601

Email Graham.Howell@ofcom.org.uk

Annex 2

Ofcom's consultation principles

A2.1 Ofcom has published the following seven principles that it will follow for each public written consultation:

Before the consultation

A2.2 Where possible, we will hold informal talks with people and organisations before announcing a big consultation to find out whether we are thinking in the right direction. If we do not have enough time to do this, we will hold an open meeting to explain our proposals shortly after announcing the consultation.

During the consultation

A2.3 We will be clear about who we are consulting, why, on what questions and for how long.

A2.4 We will make the consultation document as short and simple as possible with a summary of no more than two pages. We will try to make it as easy as possible to give us a written response. If the consultation is complicated, we may provide a shortened Plain English Guide for smaller organisations or individuals who would otherwise not be able to spare the time to share their views.

A2.5 We will consult for up to 10 weeks depending on the potential impact of our proposals.

A2.6 A person within Ofcom will be in charge of making sure we follow our own guidelines and reach out to the largest number of people and organisations interested in the outcome of our decisions. Ofcom's 'Consultation Champion' will also be the main person to contact with views on the way we run our consultations.

A2.7 If we are not able to follow one of these principles, we will explain why.

After the consultation

A2.8 We think it is important for everyone interested in an issue to see the views of others during a consultation. We would usually publish all the responses we have received on our website. In our statement, we will give reasons for our decisions and will give an account of how the views of those concerned helped shape those decisions.

Annex 3

Consultation response cover sheet

A3.1 In the interests of transparency and good regulatory practice, we will publish all consultation responses in full on our website, www.ofcom.org.uk.

A3.2 We have produced a coversheet for responses (see below) and would be very grateful if you could send one with your response (this is incorporated into the online web form if you respond in this way). This will speed up our processing of responses, and help to maintain confidentiality where appropriate.

A3.3 The quality of consultation can be enhanced by publishing responses before the consultation period closes. In particular, this can help those individuals and organisations with limited resources or familiarity with the issues to respond in a more informed way. Therefore Ofcom would encourage respondents to complete their coversheet in a way that allows Ofcom to publish their responses upon receipt, rather than waiting until the consultation period has ended.

A3.4 We strongly prefer to receive responses via the online web form which incorporates the coversheet. If you are responding via email, post or fax you can download an electronic copy of this coversheet in Word or RTF format from the 'Consultations' section of our website at www.ofcom.org.uk/consult/.

A3.5 Please put any parts of your response you consider should be kept confidential in a separate annex to your response and include your reasons why this part of your response should not be published. This can include information such as your personal background and experience. If you want your name, address, other contact details, or job title to remain confidential, please provide them in your cover sheet only, so that we don't have to edit your response.

Cover sheet for response to an Ofcom consultation

BASIC DETAILS

Consultation title: **Variation of 1800 MHz mobile licences (March 2014)**

To (Ofcom contact): **Cliff Mason**

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

CONFIDENTIALITY

Please tick below what part of your response you consider is confidential, giving your reasons why

Nothing ☐

Whole response ☐

Part of the response ☐

Name/contact details/job title ☐

Organisation ☐

If there is no separate annex, which parts?

If you want part of your response, your name or your organisation not to be published, can Ofcom still publish a reference to the contents of your response (including, for any confidential parts, a general summary that does not disclose the specific information or enable you to be identified)?

DECLARATION

I confirm that the correspondence supplied with this cover sheet is a formal consultation response that Ofcom can publish. However, in supplying this response, I understand that Ofcom may need to publish all responses, including those which are marked as confidential, in order to meet legal obligations. If I have sent my response by email, Ofcom can disregard any standard e-mail text about not disclosing email contents and attachments.

Ofcom seeks to publish responses on receipt. If your response is non-confidential (in whole or in part), and you would prefer us to publish your response only once the consultation has ended, please tick here. ☐

Name

Signed (if hard copy)

Annex 4

Consultation question

Question 1 : Do you agree with the proposal to vary the 1800 MHz Public Wireless Network licences to increase the maximum permissible downlink transmit power (e.i.r.p.) by 3 dB from 62 dBm per carrier to 65 dBm per carrier for UMTS and from 62 dBm per 5 MHz to 65 dBm per 5 MHz for LTE and WiMAX technologies?

Annex 5

Proposed change to 1800 MHz licence

A5.1 Subject to consultation responses, we intend to change paragraph 10 in Schedule 1 of EE, H3G, Telefónica and Vodafone's Public Wireless Network Licence.

A5.2 The proposed amendment is shown below:

Maximum Permissible Downlink Transmit Power

10. The power transmitted (in e.i.r.p.) in any direction on the downlink frequencies of the Permitted Frequency Blocks by the Radio Equipment shall not exceed:

Technology	**900 MHz spectrum**	**1800 MHz spectrum**
for GSM	62 dBm per carrier	62 dBm per carrier
for UMTS	65 dBm per carrier	65~~2~~ dBm per carrier
for LTE	65 dBm per 5 MHz	65~~2~~ dBm per 5 MHz
for WiMAX	65 dBm per 5 MHz	65~~2~~ dBm per 5 MHz

Annex 6

Detailed technical assessment

Introduction

A6.1 This annex presents the technical assessment relating to the impact of a 3 dB increase in e.i.r.p. of 1800 MHz mobile base stations on PMSE and DECT systems operating adjacent to the 1800 MHz band.

A6.2 The maximum permissible e.i.r.p. currently allowed in the 1800 MHz licences for UMTS is 62 dBm per carrier and 62 dBm per 5 MHz for LTE and WiMAX systems.

A6.3 In our assessment, the following two mechanisms[13] have been considered that may be used to achieve a 3 dB increase in e.i.r.p.:

- higher gain antennas; or
- higher transmission power.

A6.4 We first reviewed the previous relevant compatibility studies carried out in CEPT on this subject and noted that the results of these studies may not be directly applicable to our technical analysis. The main differences being the assumed maximum e.i.r.p. of mobile base stations and frequency offsets between base stations and PMSE/ DECT systems.

A6.5 We have conducted further analysis with revised assumptions that are in line with UK's deployment scenarios. Also, some of the key parameters such as ACS of victim systems (PMSE and DECT) and ACLR of mobile base stations are modified to reflect practical values and frequency offsets applicable to UK spectrum allocation.

A6.6 This annex is structured as follows:

- Review of previous CEPT studies
- System modelling and technical parameters
- Methodology and results
- Provisional conclusion

[13] This will have impact on the out of band emissions of base stations and therefore the resulting ACLR. This is further explained in A6.25.

Review of previous CEPT studies

A6.7 In this section, we revisit the findings of relevant previous compatibility studies carried out in CEPT between mobile base station and PMSE/DECT systems, particularly for the scenario of outdoor macro base stations where a 3 dB increase in e.i.r.p. would be applicable.

PMSE

A6.8 The most recent and relevant study on the adjacent band compatibility between mobile base station and PMSE systems (wireless microphones) is ECC Report 191[8]. All possible deployment scenarios between wireless microphones in 1785 - 1805 MHz and LTE/GSM base stations operating in adjacent 1805 - 1880 MHz band are studied.

A6.9 For PMSE outdoor operations in the presence of outdoor base stations, the report concludes that:

- a separation distance of 100 m is sufficient to ensure that PMSE has the possibility to find an operational channel;
- the impact of base stations is negligible for frequency offsets larger than 1 MHz and 100 m separation distance.

A6.10 For PMSE indoor operations, the probability of interference is considerably low due to building/wall penetration losses.

DECT

A6.11 We have reviewed ERC Report 100[14], ECC Report 96[15] and CEPT Report 41[16] that present the compatibility evaluation of GSM, UMTS, LTE/WiMAX technologies and DECT systems, respectively.

A6.12 ERC Report 100 deals with the interference of GSM1800 base stations to DECT systems operating in the adjacent band. Interference scenarios evaluated include macro base station to indoor and outdoor (below roof-top installations) DECT systems. The report concludes that:

- in most cases, the base station interference to DECT systems only affect one or two of the available ten DECT carriers. However, dynamic channel allocation

[14] ERC Report 100, "Evaluation of DECT/GSM1800 compatibility, February 2000": http://www.erodocdb.dk/Docs/doc98/official/pdf/REP100.PDF

[15] ECC Report 96, "Compatibility between UMTS 900/1800 and systems operating in adjacent bands, April 2007": http://www.erodocdb.dk/Docs/doc98/official/pdf/ECCREP096.PDF

[16] CEPT Report 41, "Compatibility between LTE and WiMAX operating within the bands 880-915 MHz / 925-960 MHz and 1710-1785 MHz / 1805-1880 MHz (900/1800 MHz bands) and systems operating in adjacent bands, November 2010": http://www.erodocdb.dk/docs/doc98/official/pdf/CEPTRep041.pdf

mechanism allows DECT to avoid this interference with negligible impact on capacity;

- the report also notes that actual DECT receivers may have a 6-10 dB better blocking performance than the minimum specifications in ETSI standards.

A6.13 ECC Report 96 extends the findings of ERC Report 100 to UMTS systems by using a statistical modelling approach. It also notes that actual GSM1800 MHz deployment required no additional measures for protection of DECT systems. The report concludes that:

- for DECT indoor operations, in the presence of outdoor UMTS base stations, separation distance of 700 m is required for the interference probability to be within acceptable limits (≤ 5 %).

A6.14 CEPT Report 41 extends the compatibility study to LTE and WiMAX technologies and notes compatibility issues to be similar with GSM and UMTS technologies. It concludes that:

- results presented in ERC Report 100 and ECC Report 96 are also valid for LTE and WiMAX technologies;

- dynamic channel allocation mechanism enables DECT to detect interference on closest carrier(s) and escape to more distant carrier(s) hence, no guard band is required between LTE/WiMAX and DECT allocations.

Summary of review

A6.15 Review of recent literature suggests that PMSE and DECT systems have in general a good compatibility with mobile base stations. However, we also note that the results of these studies may not be directly applicable to our technical analysis. The main differences are:

- assumed maximum e.i.r.p. of base stations is less than the 65 dBm per 5 MHz that is relevant to our assessment;

- assumed frequency offsets between base stations and PMSE/ DECT systems are less than those actually deployed in the UK;

- assumed base station heights are much greater than average cellular network deployment in the UK.

A6.16 Therefore, we have revised the above assumptions and conducted minimum coupling loss analysis to assess the impact with a 3 dB increase in e.i.r.p. of macro base stations. We have also revised the ACS of PMSE/ DECT receivers and ACLR of mobile base stations to reflect practical values and frequency offsets applicable to UK.

System modelling and technical parameters

A6.17 In this section, we provide the relevant band plans, system parameters and key assumptions used in our technical analysis.

Band plan

A6.18 PMSE and DECT band plans with their respective adjacency to mobile base stations downlink allocation are illustrated in Figure A1 and A2, respectively.

Figure A1: PMSE band plan

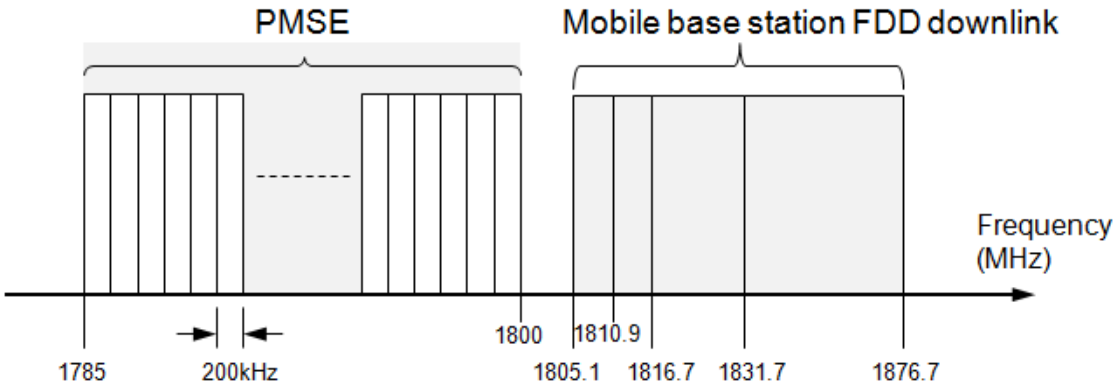
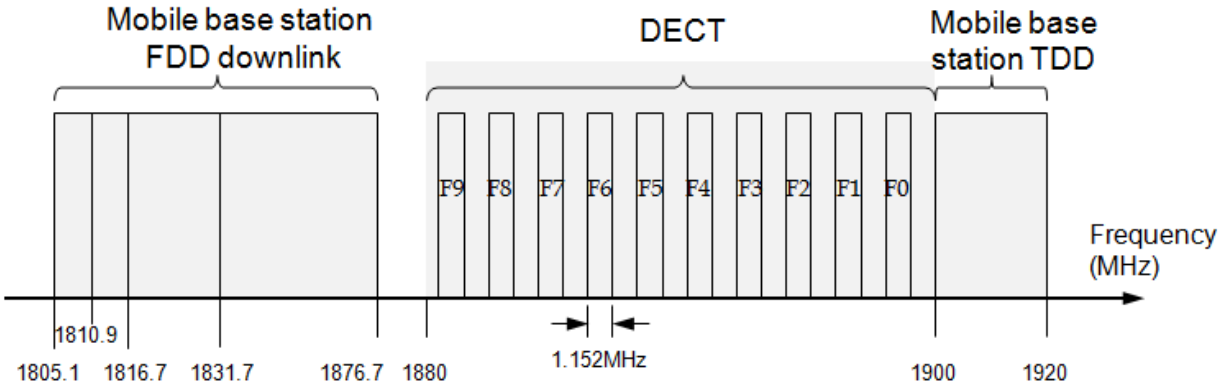


Figure A2: DECT band plan



PMSE and DECT receiver parameters

A6.19 The primary use of PMSE in 1785 - 1800 MHz is wireless microphones. These are either handheld or body worn PMSE wireless microphones with integrated or body worn transmitters.

A6.20 DECT is mainly used for providing local cordless phone coverage in both home and corporate environments. DECT base stations are normally located indoors however few that are installed outdoors are typically positioned below rooftops.

A6.21 PMSE and DECT parameters used in our technical assessment are listed in Table A1. For PMSE, these have been extracted from ECC Report 191 while ETSI TR 103 089[17] has been used for DECT parameters.

Table A1: PMSE (wireless microphone) and DECT receiver parameters

Parameter	PMSE		DECT	
Receive Bandwidth	0.2 MHz		1.152 (~1) MHz	
Reference sensitivity	-90 dBm		-93 dBm	
Thermal noise level	-121 dBm		-114 dBm	
Noise figure	6 dB		11 dB	
Noise floor	-115 dBm		-103 dBm	
Interference protection level	-115 dBm		-103 dBm	
Antenna height	3 m		1.5 m	
Antenna gain	0 dBi		0 dBi	
ACS (edge-to-edge frequency offset)	=1 MHz	> 5MHz	= 3.3 MHz (F9)	>3.3 MHz (F8-F0)
	60 dB	70 dB[18]	63 dB[19]	64 dB[19]

Base stations parameters

A6.22 The mobile base station out of band (OOB) emission limits are defined in the relevant technology standards. For LTE, WiMAX and UMTS technologies, these limits are set in 3GPP TS36.104[20], IEEE 802.16[21] and 3GPP TS25.104[22], respectively. For the commonly deployed channel bandwidths of 5, 10, 15 and 20

[17] ETSI TR 103 089 v1.1.1, "Digital Enhanced Cordless Telecommunications (DECT); DECT properties and radio parameters relevant for studies on compatibility with cellular technologies operating on frequency blocks adjacent to the DECT frequency band. January 2013": http://www.etsi.org/deliver/etsi_tr/103000_103099/103089/01.01.01_60/tr_103089v010101p.pdf

[18] Table A5.6 in Ofcom Technical Report, "TV white spaces: approach to coexistence, September 2013": http://stakeholders.ofcom.org.uk/binaries/consultations/white-space-coexistence/annexes/technical-report.pdf

[19] We have used the improved blocking performance of 6 dB as compared to the value derived from ETSI standard and used in CEPT Report 41. This is based on the practical tests results in ERC Report 100 which indicated that measured DECT device has blocking performance 6 to 17 dB better than the values in the ETSI standard.

[20] 3GPP TS 36.104 v.12.2.0, "Technical Specification Group Radio Access Network; E-UTRA; Base station (BS) radio transmission and reception (Release 12), January 2014": http://www.3gpp.org/DynaReport/36104.htm

[21] IEEE 802.16, "IEEE Standard for Air Interface for Broadband Wireless Access Systems, 2012": http://standards.ieee.org/about/get/802/802.16.html

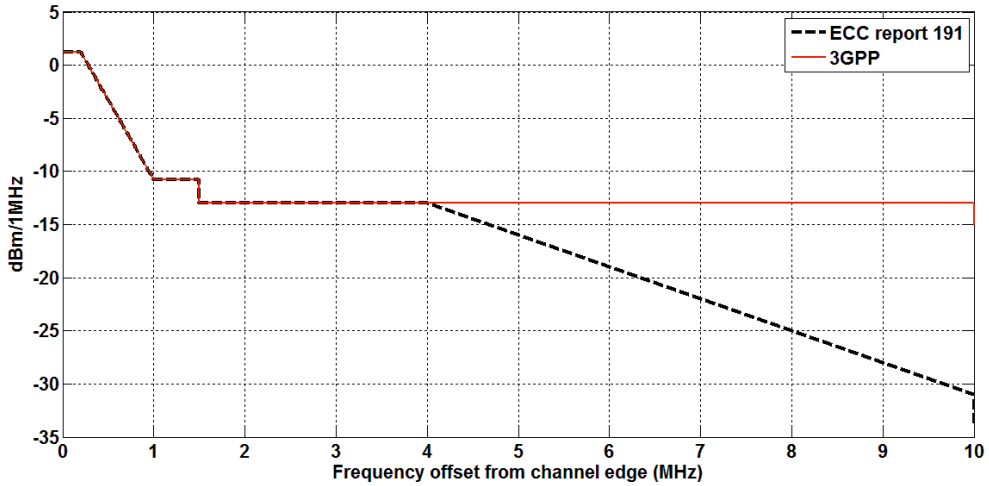
[22] 3GPP TS 25.104 v12.2.0 (2013-12), "Technical Specification Group Radio Access Network; Base station (BS) radio transmission and reception (FDD) (Release 12), December 2013": http://www.3gpp.org/DynaReport/25104.htm

MHz, these limits are identical, thereby making the technical analysis presented in this annex equally applicable to LTE, WiMAX and UMTS technologies.

A6.23 The base stations OOB emission limits used in ECC Report 191 which deals with PMSE compatibility also takes into account the improved attenuation due to duplex filters at a frequency offset more than 4 MHz from channel edge. Considering the natural/realistic decay of OOB emission[23], we have used the same attenuation in our technical analysis when deriving the ACLR for both PMSE and DECT receiver bandwidths.

A6.24 A comparison of OOB emission limits based on 3GPP standard and ECC Report 191 is shown in Figure A3.

Figure A3: Comparison of spectrum emission mask for macro base stations



A6.25 As indicated earlier, we have modelled the impact of 3 dB increase in e.i.r.p. that could be implemented using two mechanisms (higher gain antennas or higher transmission power). These have different impacts on the resulting ACLR:

- **higher gain antennas -** deployment of antennas with higher gain results in higher in-band and out-of-band e.i.r.p. Hence, antennas with 3 dB higher gain than currently used will increase both the in-band and out-of-band e.i.r.p. by 3 dB. Therefore, the ACLR remains the same as with the current limits;

- **higher transmission power -** the in-band e.i.r.p. can be increased by providing higher transmission power at the antenna port. Contrary to higher gain antennas, this method does not affect the absolute out-of-band power limits specified in the 3GPP standard and therefore maximum out-of-band e.i.r.p. remains the same. This results in a 3dB increase in ACLR.

A6.26 Table A2 lists the LTE macro base station parameters that have been used in our technical assessment.

[23] Para 5.21 in Ofcom Technical Report, "Technical analysis of interference from mobile network base stations in the 800 MHz band to digital terrestrial television - Further modelling, 23 February 2012": http://stakeholders.ofcom.org.uk/binaries/consultations/949731/annexes/DTTCo-existence.pdf

Table A2: LTE macro base station parameters

Parameter	Current limits	3 dB e.i.r.p. increase	
		Higher gain antennas	Higher transmission power
Maximum transmit power	47 dBm	47 dBm	50 dBm
Antenna gain include losses	15 dBi	18 dBi	15 dBi
Antenna height	20 m[24]		
Bandwidth	5 MHz		

Methodology and Results

A6.27 We have used Minimum Coupling Loss (MCL) approach for the technical assessment. MCL is the required isolation (in dB) between a mobile base station (interferer) and DECT/PMSE (victim) receiver to meet the required interference threshold.

A6.28 The required isolation is then converted to a minimum separation distance for the interfering base station to victim receiver link by using appropriate propagation models. In our analysis, we have used Extended Hata[25] urban and rural propagation model. MCL approach can be summarised as:

$$\boldsymbol{isolation}\ (\boldsymbol{dB}) = \boldsymbol{P_{INT}} + \boldsymbol{G_{VICT}} + \boldsymbol{G_{INT}} - \boldsymbol{I_{VICT}} - \boldsymbol{ACIR}$$

where:

$\boldsymbol{P_{INT}}$ is the maximum transmit power of the interferer;

$\boldsymbol{G_{VICT}}$ and $\boldsymbol{G_{INT}}$ are the net antenna gain (including feeder loss) of victim and interferer, respectively;

$\boldsymbol{I_{VICT}}$ is the interference protection level at the victim receiver;

$\boldsymbol{ACIR}$ is given by $\boldsymbol{ACIR^{-1}} = \boldsymbol{ACLR^{-1}} + \boldsymbol{ACS^{-1}}$ (linear).

A6.29 In our analysis, three cases relating to the maximum e.i.r.p. of macro base station are considered and listed in Table A3 below. These cases apply to both PMSE and DECT results.

Table A3: Considered cases for macro base station maximum e.i.r.p.

Case	Description	Maximum e.i.r.p. (dBm / 5MHz) (transmit power + antenna gain)
A	Current licence e.i.r.p. limit	47 dBm+15 dBi
B	e.i.r.p.increase via higher gain antennas	47 dBm+**18 dBi**
C	e.i.r.p. increase via higher transmit power	**50 dBm**+15 dBi

[24] UK contribution to ITU-R WP5D, "Base station antenna heights for IMT-Advanced systems, July 2013": http://www.itu.int/md/R12-WP5D.AR-C-0274/en

[25] European Radiocommunication Office (ERO), "The COST231-Hata SE21 model, SEAMCAT implementation of Extended Hata and Extended Hata-SRD models": http://tractool.seamcat.org/raw-attachment/wiki/Manual/PropagationModels/ExtendedHata/Hata-and-Hata-SRD-implementation_v1.pdf

A6.30 The predominant use of PMSE and DECT is indoors. However, for completeness, both indoor and outdoor deployment scenarios have been considered. For each case listed in Table A3, results are produced for rural and urban environments to model the two extremes of propagation conditions:

- urban: outdoor base station and indoor PMSE/DECT receiver (**urban indoor**);
- urban: outdoor base station and outdoor PMSE/DECT receiver (**urban outdoor**);
- rural: outdoor base station and indoor PMSE/DECT receiver (**rural indoor**);
- rural: outdoor base station and outdoor PMSE/DECT receiver (**rural outdoor**).

A6.31 A 10 dB building attenuation[26] is assumed when the victim receiver is indoors and interfering transmitter is outdoors.

Results

PMSE

A6.32 Table A4 and A5 show the required isolation and separation distances for the three cases of macro base station e.i.r.p. limits, respectively.

A6.33 The frequency separation (MHz) refers to the gap between the PMSE channel edge and the band edge of the mobile base station. To illustrate the most critical case, we have considered the first PMSE adjacent channel that is centred at 1879.9 MHz; resulting in a 5.1 MHz of edge-to-edge frequency separation.

Table A4: Required isolation between PMSE and macro base station

Frequency separation (MHz)	Case	ACS (dB)	ACLR (dB)	ACIR (dB)	Required isolation (dB)	
					Indoor	Outdoor
5.1	A	70	70.3	67.1	99.9	109.9
5.1	B	70	70.3	67.1	102.9	112.9
5.1	C	70	73.3	68.3	101.7	111.7

Table A5: Separation distance for PMSE channel closest to mobile base station band

Frequency separation (MHz)	Case	Urban (m)		Rural (m)	
		Indoor	Outdoor	Indoor	Outdoor
5.1	A	~100	~185	~785	~1510
5.1	B	~115	~225	~955	~1835
5.1	C	~100	~210	~880	~1700

[26] Based on value used in ECC Report 191. This value is within the range of the building penetration loss value considered in Ofcom Technical Report, "Assessment of future mobile competition and award of 800 MHz and 2.6 GHz, Annex 7-12, 24 July 2012": http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/statement/Annexes7-12.pdf

A6.34 For the urban cases, it can be seen that there is a small increase in required separation distances when e.i.r.p. increases by 3 dB compared to current limits. The distance increases by ~15 m and ~40 m for urban indoor and outdoor, respectively.

A6.35 For the rural cases, the increase in separation distances is relatively large as compared to urban cases. The distance increases by ~170 m and ~325 m for rural indoors and outdoors, respectively. This is in line with the much larger cell ranges in rural environments due to better propagation conditions than urban environments (i.e.10-20 km in rural as compared to 1-2 km in urban[7]).

DECT

A6.36 DECT supports ten carriers each about 1 MHz as illustrated in Figure A2. The ACLR of mobile base station and ACS of DECT receiver for all carriers (F9-F0) is given in Table A6. These have been calculated by using the spectrum emission mask of Figure A3 for both 5 MHz and 20 MHz channel bandwidths.

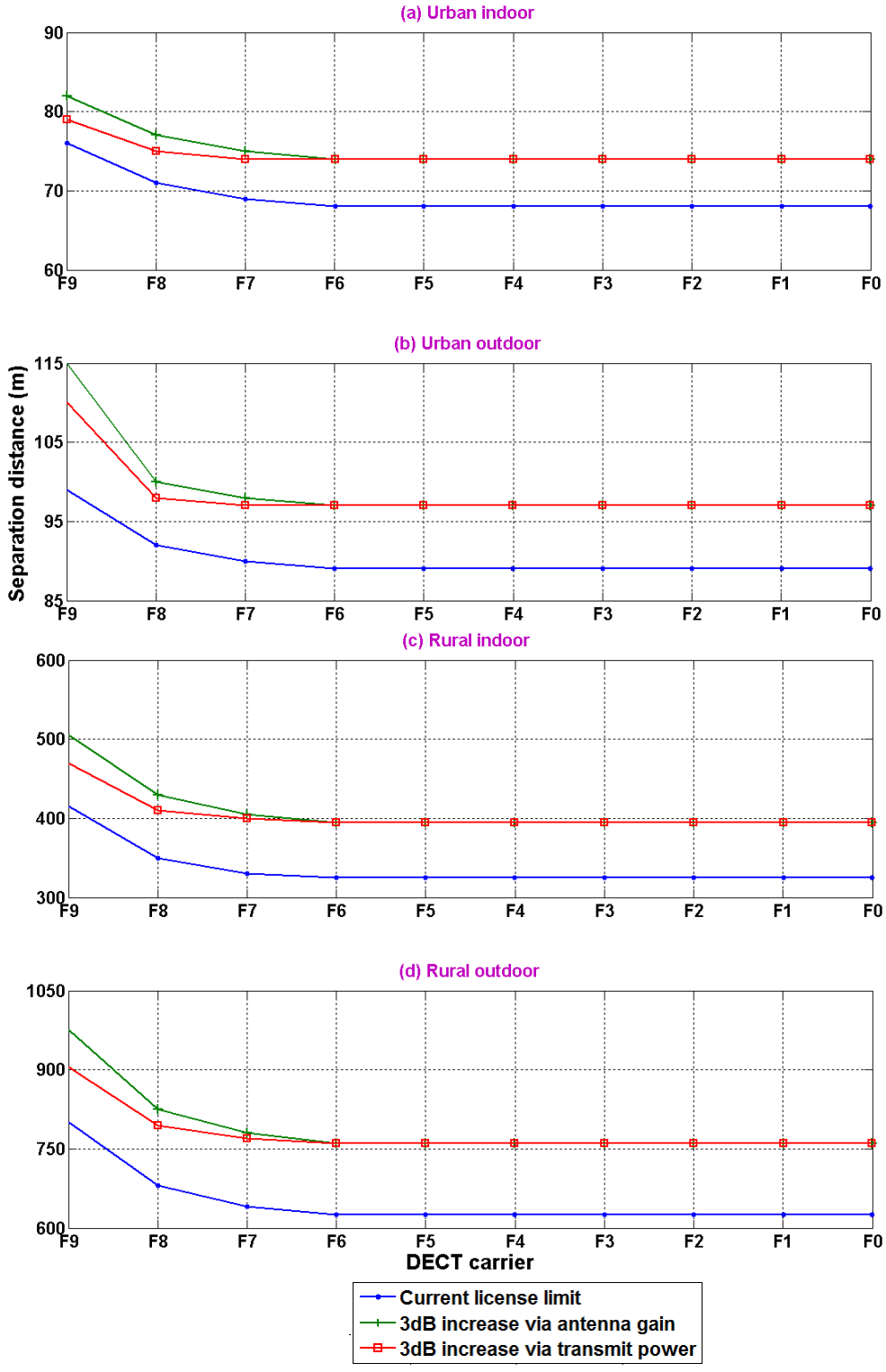
Table A6: ACS (DECT) and ACLR (mobile base station) for all DECT carriers

DECT carrier index	DECT carrier frequency (MHz)	ACS (dB)	ACLR (dB) Case A		ACLR (dB) Case B		ACLR (dB) Case C	
			5 MHz	20 MHz	5 MHz	20 MHz	5 MHz	20 MHz
F9	1881.792	63	63.3	69.3	63.3	69.3	66.3	72.3
F8	1883.52	64	68.5	74.5	68.5	74.5	71.5	77.5
F7	1885.248	64	73.6	79.6	73.6	79.6	76.6	82.6
F6	1886.976	64	81.8	87.8	81.8	87.8	84.8	90.8
F5	1888.704	64	86.8	92.8	86.8	92.8	89.8	95.8
F4	1890.432	64	91.81	97.81	91.81	97.81	94.81	100.81
F3	1892.16	64	96.8	102.8	96.8	102.8	99.8	105.8
F2	1893.888	64	101.8	107.8	101.8	107.8	104.8	110.8
F1	1895.616	64	106.9	112.9	106.9	112.9	109.9	115.9
F0	1897.344	64	134	140	134	140	137	143

MCL results for mobile base stations with 5 MHz channel bandwidth

A6.37 The minimum separation distances required between macro base station (5 MHz bandwidth) and DECT receiver using extended Hata propagation model for all DECT carriers are shown in Figure A4. The three cases of maximum macro base station emission limits of Table A3 have been examined for four deployment scenarios (urban indoor, urban outdoor, rural indoor and rural outdoor).

Figure A4: Separation distances for DECT carriers



A6.38 Similar to PMSE results, the MCL analysis for DECT shows that in general, the separation distances marginally increase for all DECT carriers as compared to current e.i.r.p. limits. Another clearly visible trend is that for carriers F7-F0, there is very small difference in required separation distance when power increase is implemented through increase in antenna gain or increase in transmit power. Interference is dominated by ACS of DECT receivers.

A6.39 More specifically, for urban outdoor scenario with a 3 dB increase, a separation distance of ~115 m is required between the interferer transmitter and the victim receiver for the first adjacent carrier F9 and this further reduces to ~100 m from carrier F6 onwards.

A6.40 As expected, the separation distances for rural environment with a 3 dB e.i.r.p. increase are relatively large as compared to urban cases with the first adjacent DECT carrier F9 requiring ~505 m and ~975 m of separation for indoors and outdoors deployments, respectively.

A6.41 Table A7 summarises the percentage increase in separation distances from current licence limit as compared to a 3 dB power increase via antenna gain for the DECT carrier F9, which is closest to the mobile base station band and most vulnerable compared to other carriers. This worst case increase in separation distance is around ~15% and ~22% for urban and rural cases, respectively.

Table A7: Increase in separation distance (%) current vs. 3 dB increase for carrier F9

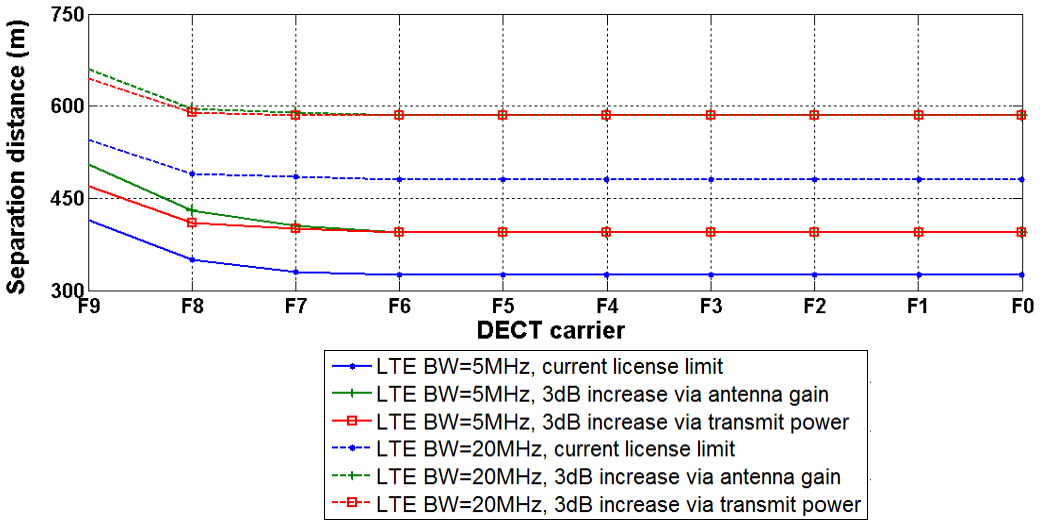
Deployment scenarios	Increase in separation distance
Urban indoor	from ~75 m to ~80 m (~7%)
Urban outdoor	from ~100 m to ~115 m (~15%)
Rural indoor	from ~415 m to ~505 m (~22%)
Rural outdoor	from ~800 m to ~975 m (~22%)

MCL results for mobile base stations with 20 MHz channel bandwidth

A6.42 We have extended the MCL analysis to mobile base station employing 20 MHz of channel bandwidth noting the fact that the first adjacent 1800 MHz licensee has 45 MHz of downlink spectrum and may deploy channel bandwidths wider than 5 MHz.

A6.43 Figure A5 compares the minimum separation distance between DECT receiver with 5 MHz and 20 MHz mobile base station interferer in a rural indoor environment. A 3 dB e.i.r.p. increase for 20 MHz macro base station increases the separation distance by around ~21% (~545 m - ~660 m) for carrier F9 in a rural indoor scenario compared to current limit.

Figure A5: Comparison between 5 and 20 MHz bandwidths in rural indoor scenario



A6.44 The above MCL results for mobile base station employing 5 or 20 MHz channel bandwidths may suggest that DECT may be impacted with the current as well as the requested higher e.i.r.p. in the rural environment. Again, the required separation distance is very small compared to cell range in rural environment which is typically 10-20 km[7]. The probability of macro base station and DECT systems operating in such close proximity would be small.

A6.45 The worst case separation distance for the first one or two adjacent DECT carriers may suggest a reduction in DECT reception range on these carriers. In such occurrences, DECT dynamic channel allocation mechanism enables to detect interference on these carriers and shift to any of the distant carriers (F7-F0), thereby operating at its maximum range and without loss in capacity.

Provisional conclusion

A6.46 Results of impact assessment presented in this annex in conjunction with the extensive studies conducted in CEPT show that a 3 dB increase in e.i.r.p. of base stations would have no material impact on the operation of DECT and PMSE systems.

A6.47 The interference environment these systems are currently experiencing will change marginally with the 3 dB increase in e.i.r.p. but not to an extent where it will be difficult for these systems to co-exist with mobile networks in adjacent bands. The following points are also of relevance to our provisional conclusion:

- the primary use of PMSE (wireless microphone) and DECT is mainly indoors and the associated building penetration losses provide adequate protection from outdoor macro base station located in close proximity;
- the 3 dB higher e.i.r.p is only valid for macro base stations and it is unlikely that these higher powers will be used on all base stations and even if these were to be used, not all base station will operate at maximum power at all times;
- the assumptions that we have used for DECT receiver characteristics are quite conservative and the actual systems is likely to have better selectivity than used in our analysis as highlighted by literature review;
- additional factors such as minimal use and availability of multiple PMSE channels in 1800 MHz band and DECT's inherent interference avoidance (*by channel switching*) feature further minimises wider compatibility and coexistence issues.