Application for a variation to 3G licences (and consequent proposal to vary draft 2GHz MSS/CGC Base station licences)

This document sets out Ofcom's decision on the request to vary 3G and MSS/CGC Wireless Telegraphy licences

Statement

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Section 1

Executive summary

1.1 This statement sets out Ofcom's decision to permit an increase of the maximum in-band power limit for the five existing 3G licences and, consequently, future 2 GHz MSS/CGC licences[1] to 65 dBm e.i.r.p. per carrier. This increase would only apply to the base transmit power in the Frequency Division Duplex (FDD) portion of the 3G spectrum.

1.2 We consider that this has the potential to provide benefits for customers through improved voice capacity, data throughput and in-building signal availability by making more effective use of currently available base station technology. We believe that in practice this will have no adverse effect on the operation of services in adjacent spectrum bands.

1.3 Our consultation2 was triggered by a variation request from Vodafone Ltd (subsequently supported by the four other 3G network operators Telefónica O2, Orange, T-Mobile and Three) to increase the maximum in-band power from the current level of 62 dBm e.i.r.p. per carrier to 65 dBm e.i.r.p. per carrier. We proposed an increase to 68 dBm e.i.r.p. per carrier in order to provide headroom for likely developments in 3G base station technology and noting that in other countries there is no specific e.i.r.p. per cell carrier. However, responses received did not support the higher level and we have therefore decided to limit the increase to 65 dBm e.i.r.p. per carrier.

1.4 The consultation also drew a number of responses from individuals and groups concerned about the potential impact of base station transmissions on health and the environment. In its the response, the Health Protection Agency noted that the levels of emissions measured in the vicinity of base stations are generally several orders of magnitude below the level set and recognised internationally as a safe limit for human exposure and the increase in permitted maximum power by 3 dB (a doubling) will not significantly change that position.

Matters covered in this document

1.5 This document is structured as follows:

- Section 2 summarises the main features of the 3G licences, the proposed variation request and our assessment of the responses to the consultation;
- Section 3 considers the major issues that different parties raised in responses to the consultation. In relation to each issue we summarise the responses and set out our analysis and conclusion;
- Section 4 sets out our decision on the proposed variation.

[1] For the purposes of this statement the 2 GHz bands specifically refers to the band 2110 – 2170 MHz used for 3G base station transmissions and to the band 2170 – 2200 MHz assigned to MSS/CGC. It does not include the bands 1900 – 1920 MHz and 2010 – 2025 MHz assigned for 3G TDD transmissions.

[2] http://www.ofcom.org.uk/consult/condocs/3Glicences/

Section 2

Background to this statement

2.1 This section summarises the main features of the proposed variation and the responses to the consultation.

Consultation on the licence variation proposal

2.2 Five licences under the Wireless Telegraphy Act to provide 3G cellular services in the UK were awarded following a spectrum auction in 2000. The technical parameters set in those licences reflected the state of technology development at that time. However the technical standards for 3G (and other radio services) continue to evolve over time and variations to the licensed conditions may become necessary in order to accommodate new technology or engineering configurations.

2.3 Vodafone Limited first approached Ofcom in late 2008 to request a variation to their 3G licence and, consulting other 3G operators, all appeared to be supportive of their proposal and wished to associate with it. The request noted that:

- base station equipment manufacturers are increasingly offering systems that are capable of operating at power levels in excess of the current maximum power in the UK 3G licences;
- many European countries (eg Germany, France and Sweden) do not have a specific e.i.r.p. per carrier limit stated in their 3G licences; they only place limits on emissions into adjacent channels, referring to the relevant 3GPP ("3G Partnership Project") standards for guidance on out of band emissions;
- the use as above in Europe does not appear to have given rise to any adjacent channel interference issues;
- improved coverage for a small power increase might mean a reduction in the number of additional sites needed for coverage and consequently a reduction in environmental impact;
- potential benefits for consumers include improved voice capacity, data throughput and in-building signal availability.

2.4 Although industry had requested only a 3 dB rise (to 65 dBm e.i.r.p. per carrier, representing a doubling of the maximum permitted power) to make more effective use of currently available base station technology, our consultation proposed a 6 dB rise (to 68 dBm e.i.r.p. per carrier) in the maximum permitted power would give additional flexibility for the likely development of base station technology in the near future. It should be noted that this increase was only considered for base transmit power in the Frequency Division Duplex (FDD) portion of the 3G spectrum.

2.5 Limits for out-of-band and spurious emissions for 3G bases stations would not be allowed to increase and would be capped at their current levels

2.6 Considering the adjacency of 3G to services for Programme Making and Special Events (PMSE) and existing impacts on the usability of the immediately adjacent PMSE channels, Ofcom undertook initial studies to assess the impact of the proposal.

2.7 These studies indicated that, while there would be a measurable rise in the blocking of PMSE equipment in the first two adjacent channels, the practical consequences would be little or no different to the situation at present. The first adjacent channel is currently impacted to an extent that its use is very limited; the use of the second channel is currently dependent on channel filters being fitted to PMSE receivers. Such channel filters would provide sufficient immunity to maintain that level of use even with an increase (whether 2 times or 4 times) in adjacent 3G power.

2.8 We noted also that a 2009 consultation on the implementation of a Complementary Ground Component to the Mobile Satellite Service in the 2 GHz band ("2 GHz MSS/CGC" or "CGC"), adjacent to 3G frequency bands, had also considered operation of terrestrial stations at increased powers and concluded that these should remain comparable with 3G levels for coordination and co-existence reasons.

2.9 We therefore proposed that if a variation was granted we should incorporate the higher power limit in future 2 GHz MSS/CGC base station licences.

2.10 Considering the citizen / consumer interest, we believe that the increase will be of benefit to consumers because it has the potential to facilitate the provision of better in-building penetration, wider coverage in rural areas and reduced impact on the environment and visual amenity for a reduced requirement for new masts.

2.11 We asked stakeholders to consider the following questions when responding to the consultation:

Are there any reasonable grounds why Ofcom should not grant the request to vary the five Wireless Telegraphy Third Generation Mobile Licences by increasing the permitted maximum in-band EIRP to 68 dBm as soon as practicable? If so, please explain your reasoning for this.

Are there any reasonable grounds why Ofcom should not also apply the increased permitted maximum in-band EIRP to future 2 GHz MSS/CGC licences? If so, please explain your reasoning for this.

Responses to the consultation

2.12 We received 127 responses, some submitted on a confidential basis or including confidential sections or including information (such as details or circumstances of named individuals) that could not be published for data protection reasons. Non-confidential responses were published on our website3.

2.13 The majority of responses were from private individuals, many of whom opted to withhold their names. For data protection reasons, personal e-mail addresses or contact phone numbers for private enquirers were also withheld from publication. Contact details for company / organisation responses were published, except where indicated otherwise in those responses.

2.14 Some of these responses appeared to assume that a power increase across all installed stations would be applied. As discussed in section 3 of this document, this is very unlikely in practice for engineering reasons. Many cited concerns of about the safety of base station emissions. Base station compliance with public exposure guidelines is discussed in this document.

[3] http://stakeholders.ofcom.org.uk/consultations/3Glicences/?showResponses=true

Ofcom's decision

2.15 We have carefully considered all responses received. The main conclusions of our consideration are that:

- technology has changed and developed since the initial setting of a maximum licensed power and there is new equipment on the market that is capable of using increased powers more effectively;
- operators wish to deploy the latest available technology to deliver services as efficiently as possible to their customers;
- any increase in detrimental impacts on spectrum quality experienced by Programme Making and Special Events (PMSE) users in neighbouring bands, are unlikely in practice to change those effects already being experienced by them;
- there is therefore no spectrum management reason for not increasing the FDD base transmit power levels in 3G and 2 GHz MSS/CGC licences to 68 dBm e.i.r.p. per carrier;
- not all operators support the level of 68 dBm e.i.r.p. per carrier at present, having considered engineering and coordination impacts only at 65 dBm e.i.r.p. per carrier;
- the proposed rise in the maximum power limit should not lead to a risk of the field strengths in the vicinity of base stations exceeding the ICNIRP recommended safety levels. Results from the Ofcom audit of cellular base stations [http://stakeholders.ofcom.org.uk/sitefinder/audit-info] show that the field strengths measured are typically a tiny fraction of the ICNIRP recommendations and the proposed rise (either 2x or 4x), if applied to any of the base station audits conducted so far, would not result in any of them exceeding the safety levels. Additionally, an increase in the maximum power limit would not absolve the mobile operators from compliance with the relevant safety legislation which will continue to apply.

2.16 We consider that it is justified to allow an increase in the maximum in-band FDD base transmit power limits for the existing 3G licences and consequently future 2 GHz MSS/CGC licences from 62 dBm e.i.r.p. per carrier (58 dBm e.i.r.p. per MHz) to 65 dBm e.i.r.p. per carrier (61 dBm e.i.r.p. per MHz).

2.17 Our decision does not set a precedent for the maximum in-band power limits applicable to future UMTS use in other bands (e.g. at 900 MHz or 1800 MHz) as those bands will be subject to other adjacencies and coordination conditions, requiring separate consideration.

Section 3

Assessment of the licence variation and responses to the consultation

3.1 In this section, we consider the major points that were raised in responses to the consultation. Non-confidential responses are available on our website.

3.2 The headings under which we consider issues raised in responses are:

- Effects of the proposed variation on other spectrum users;
- Other comments on technical issues
- Size of increase in maximum power limit
- Application of increased power limit to 2 GHz MSS
- Power limits in other mobile spectrum licences
- Consultation responses about environmental and health effects

Effects of the proposed variation on other spectrum users

3.3 Ofcom received four responses from programme making and special events (PMSE) users. Two of these responses stated that there is considerable interference into the 2105 MHz PMSE channel in areas where there is 3G coverage and that current operational practice is to avoid the adjacent channel wherever possible.

3.4 It was discussed in Annex 7 of the consultation that there may be an increased effect to PMSE users in the first two adjacent channels, but that the practical effect of the interference experienced by users with or without filtering applied to their equipment should have minimal impact on the potential usability of the spectrum, either before or after the application of a power increase.

3.5 One PMSE response commented on one of the propagation models that we used in the technical analysis in the consultation. It suggested that the “pedestrian” model for propagation would underestimate the interference because it is designed to model handheld reception at 1.5m height, rather than a wireless camera receiver at 10m height. However, this response did not recognise that we examined three separate propagation models in our technical analysis: the pedestrian model; a COST-Hata propagation model for a 10m high receiving antenna; and a free space propagation model. We derived individual separation distances for each of these propagation models and presented these in the consultation. Our conclusions took account of the results from all three propagation models.

3.6 All four responses from PMSE users commented on the existing 3G out of band limits, which were not proposed for change in this consultation. PMSE users considered the existing limits to be very relaxed, and believed that current base station emissions fall well below the licence limits. As such, they were concerned

that an increase in in-band base station power would result in the out of band emissions rising closer to the licence limits.

3.7 Two responses drew a comparison between the existing out of band limits in the 3G licences and a previous Ofcom consultation on out of band limits for the spectrum award at 2010 to 2025 MHz. In that consultation, Ofcom had proposed that licences in the award should include out of band limits of -38 dBm/MHz above the 2025 MHz boundary and an in band e.i.r.p. of 61 dBm/5 MHz. These responses then proposed that base station out of band emission limits at the 2110 MHz boundary should be reduced to -38 dBm/MHz e.i.r.p. The current out of band emission limits are specified as power into the antenna and the permitted values in the 3G licences are -13 dBm/MHz across the 2105 MHz channel and -30 dBm/MHz in the 2095 MHz channel. Taking into account antenna gain, which our calculations assumed to be 18 dBi, imposing such a change would imply 26 to 43 dB reduction in the current emission limits in the 3G licences.

3.8 However as stated above, this consultation did not include any consideration of potential changes to the out of band limits in connection with the increase in the upper permitted limit for in-band e.i.r.p. Out of band limits were to be capped at the levels currently permitted in the 3G licences. The discussion of proposals to modify the out-of-band limits is therefore not considered to be within the scope of this decision and Statement which concerns only the in-band power limit. There are already a large number of installed 3G base stations using the current out of band limits, installed over the past decade. We anticipate that many of these would continue in use regardless of any change in maximum permitted in-band power. As such it would be impractical to impose major retrospective changes to their out of band emissions. Our objective in performing the analysis on the proposals for changes to the 3G licences has been to determine the impact of the proposed change. In doing this we have to consider the context in which the change is being proposed, which is the environment in which 3G and PMSE currently use this spectrum. Having reviewed the above comments, we consider the analysis that we presented in the consultation document remains valid.

3.9 Some PMSE users also expressed concern about the impact of an increase in CGC power on their use of PMSE channels at 2205 MHz and 2215 MHz. The MOD also sought clarification about the impact of this increase on its use of spectrum above 2200 MHz. As with the proposals regarding the maximum in-band power in 3G spectrum, the proposal is to increase only the maximum permitted in-band power for CGC base stations and we have clarified that the out-of-band emission mask remains unchanged for CGC base stations.

Other comments on technical issues

3.10 One response queried the rationale for the proposed increase. In particular, it suggested that increasing base-station (BS) power would only help downstream data; upstream data from the handset to the BS would not be helped at all. This is correct and it reflects the asymmetric nature of data services, which are usually arranged to provide greater download data rates than upload data rates. The power increase would therefore benefit high speed download data rates, without affecting maximum upload data rates.

3.11 The response also suggested that picocells and femtocells were better ways to provide in-building coverage. We agree that picocells and femtocells may be a more effective approach in some circumstances and operators do, of course, deploy them for this purpose. But in other circumstances it may be more appropriate to rely on

macro base stations to provide in-building coverage. Allowing a greater range of base station power levels gives increased flexibility for networks to implement the most effective solution for each particular scenario.

3.12 Finally, the response drew a comparison between typical powers of base stations operating on different 3G networks in the UK, based on a sample it took from the public Sitefinder website, and the current maximum e.i.r.p. in the licences. The figures quoted are not surprising and we would expect to see a range of power in any sample; 3G base stations operate at different output powers dictated by considerations such as cell size, capacity planning and local propagation, and individual operators use different network planning assumptions.

Size of increase in maximum power limit

3.13 In our consultation we proposed an increase to 68 dBm e.i.r.p. per carrier even though the request had been only to 65 dBm e.i.r.p. per carrier. The reason for floating this proposal was to test the desirability of providing headroom for likely developments in 3G technical standards.

3.14 In their responses Vodafone and Telefónica O2 supported the proposal to increase the maximum permitted power to 68 dBm e.i.r.p. per carrier and agreed with Ofcom's analysis of the potential impact on adjacent PMSE spectrum.

3.15 In contrast, 3UK supported an increase to 65 dBm e.i.r.p. per carrier but raised concern that the further increase to 68 dBm e.i.r.p. per carrier has not been assessed and could lead to an increased burden for inter-operator coordination, in particular with regard to ICNIRP compliance. Ofcom notes this concern, although measured exposure limits in publicly accessible areas are very significantly below the ICNIRP guideline levels.

3.16 In further discussions with the 3G licensees it was clear that there was support only for the additional increase and that concerns remained about permitting this additional increase without the licensees themselves having done their own analysis of the technical implications for coordination and potential interference.

3.17 Accordingly, we have decided not to proceed with the 6 dB increase and to limit our consideration to the 3 dB increase that was originally requested. Licensees would therefore need to make a new licence variation request if they wanted Ofcom to consider a further power increase in this frequency band in future.

Application of increased power limit to 2GHz MSS

3.18 The proposal to extend the increase also to future 2 GHz MSS/CGC base stations was supported by Inmarsat, who noted that this is consistent with Ofcom's earlier statement on the licensing of MSS/CGC networks. Inmarsat felt that this would help to maximise the opportunity for innovation in the spectrum awarded to them under the EC Decision 2009/449/EC.

3.19 3UK suggested that the additional power should not be offered to satellite operators for the provision of mobile services, referring to competition grounds. Ofcom notes that the allocation and assignment of 2 GHz MSS spectrum, which includes the right to deploy a complementary ground component, was made under The EC decision which is legally binding on the UK. We do not agree that a decision to permit the same increase in base station power for CGCs as we are approving for 3G licensees raises competition concerns. It is desirable for the maximum powers in the two

adjacent services (3G and CGC) to be of a comparable order of magnitude for reasons of technical compatibility of adjacent users.

Power limits in other mobile spectrum licences

3.20 3UK also referred to a possible application of these power levels to future spectrum allocations including 800 MHz and 2.6 GHz awards. Ofcom confirms that the proposed increase in maximum power level in this consultation applies only to the FDD 2.1 GHz spectrum allocated to 3G licensees and to the adjacent 2 GHz MSS/CGC allocation. In any other spectrum bands, any limits to power levels will be considered with reference to the engineering and coordination requirements of that spectrum, as appropriate. Nothing in this statement should therefore be taken as an indicator of likely power levels for any other spectrum band or service.

Consultation responses about environmental and health effects

3.21 Many of the responses from individuals raised concerns about potential environmental and health impacts of radiation. Of these, most were unspecific and expressed general concern about a perception that emissions from phones and masts posed a potential hazard to health. Some detailed instances of ill-health which they felt could be attributed to the presence of masts.

3.22 A number of these appeared to assume that the proposal was to increase the power of all existing base stations by up to four times the current level of emissions. For reasons of engineering and coordination, the majority of existing cellular base stations operate at less than the current licensed maximum power. An increase in the licensed maximum power will therefore have little, if any, effect on the majority of base stations whose output is already optimised for their current deployment.

3.23 However, the effect of an increase in the permitted maximum power will, of course, lead to an increase in power at some base stations. In considering the responses on potential health and environmental effects, it is important to note that responsibility for health issues rests with the Health Protection Agency, although Ofcom carries out measurement of representative samples of cellular base stations in publicly accessible areas[4] so as to allow those with an interest to assess compliance with public exposure guidelines.

3.24 The Department for Communities and Local Government (DCLG) code of practice[5] that was agreed between industry and government in 2002 states that “All sites must be designed to comply with national health and safety legislation and compliance with the International Commission on Non-Ionizing Radiation Protection (ICNIRP) public exposure guidelines as expressed in the EU Council Recommendation of 12 July 1999.” It is further stated in para 83 that “All applications for planning permission or prior approval should be accompanied by a signed declaration that the equipment and installation has been designed to be in full compliance with the requirements of the radio frequency (RF) public exposure guidelines of the International Commission on Non-Ionizing Radiation Protection (ICNIRP)”.

3.25 In 2006, the World Health Organisation published an advice sheet[6] covering base stations which concluded that “Considering the very low exposure levels and research results collected to date, there is no convincing scientific evidence that the

[4] http://stakeholders.ofcom.org.uk/sitefinder/mobile-base-station-audits/
[5] http://www.communities.gov.uk/documents/planningandbuilding/pdf/codemobilenetwork.pdf
[6] http://www.who.int/entity/mediacentre/factsheets/fs304/en/index.html

weak RF signals from base stations and wireless networks cause adverse health effects". WHO also published a further advice sheet[7] in May 2010 covering mobile phones themselves which concluded "To date, no adverse health effects have been established for mobile phone use."

3.26 In the UK, advice relating to the use of mobile phone technology has been published by the UK Health and Safety Executive (HSE)[8], one of a number of public bodies which regulate work that causes or could cause EMF exposure of workers or the public, and by the UK Health Protection Agency[9]. Further information is also available from the Mobile Operators' Association[10].

3.27 In its response to our consultation, the Health Protection Agency observed that this "…increase in maximum emitted power is likely to cause some heightened concern about exposures…" The response concludes: "HPA agrees that this small increase in maximum licensed power should not alter the fact that exposures at locations to which the public normally have access near base stations are well within the ICNIRP guidelines. HPA also considers that the Audit offers an appropriate vehicle to respond to concerns about exposures at these higher power sites and recommends that Ofcom prioritises any requests for measurements at such sites."

3.28 Ofcom notes the conclusion of the Health Protection Agency that the levels of exposure are very small in relation to the ICNIRP guidance and accepts that the audit process provides a mechanism to verify that future installations remain well within compliance. All installations will continue to be subject to meeting the ICNIRP guideline limits and Ofcom's audit programme indicates that, even in the vicinity of cellular masts, measurements are consistently found to be very significantly below these levels (by at least two orders of magnitude).

3.29 Some responses raised concerns about the potential effect of wireless transmissions on the population numbers of bees, including their ability to navigate and return to their hives. We note that these responses were concerned with the existence of radiation per se, which is a wider question than one associated with the incremental effect of a 6 dB increase in permitted power levels proposed in the consultation (or of a 3 dB increase which we are now approving). We have forwarded the relevant responses to the Department for Environment, Food and Rural Affairs.

[7] http://www.who.int/mediacentre/factsheets/fs193/en/index.html
[8] http://www.hse.gov.uk/radiation/nonionising/index.htm
[9] http://www.hpa.org.uk/Topics/Radiation/UnderstandingRadiation/UnderstandingRadiationTopics/ElectromagneticFields/MobilePhones/
[10] http://www.mobilemastinfo.com/information/intro.htm

Section 4

Decision

4.1 We have broad discretion to vary licences, subject to acting in accordance with our statutory duties and general legal principles. The duties relevant to this decision are to:

- further the interests of citizens and consumers;
- secure optimal use of the spectrum;
- have regard to the desirability of promoting:
    - efficient management and use of spectrum
    - economic and other benefits arising from the use of wireless telegraphy
    - development of innovative services
    - competition in provision of electronic communications services;
- ensure licence conditions are objectively justified, non-discriminatory, proportionate and transparent.

  General legal principles include duties to act reasonably and rationally when making decisions and to take account of legitimate expectations.

4.2 We also have a duty not to preserve wireless telegraphy licence conditions that are no longer objectively justifiable or proportionate, unless there are compelling reasons to maintain them.

4.3 Following consideration of the responses to our consultation, as set out in section 3 above, we have decided to grant the request to vary the 3G licences to permit a maximum base transmit power in the FDD portion of the 3G spectrum of 65 dBm e.i.r.p. per carrier, an increase of 3 dB over the current limit. Equivalently, we have decided that any CGC licences that we issue in the 2 GHz frequency range will include a maximum power limit of 65 dBm e.i.r.p. per carrier.