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Ofcom's decision to update the technical conditions of mobile licences in the 800 MHz band

Statement

Publication Date: 27 October 2021

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Annex

1. Overview

1.1 This document confirms our view, after consultation, that it is appropriate to amend the technical conditions of the Spectrum Access 800 MHz licences. Our decision will allow licensees to transmit at higher powers and closer align the out-of-band and out-of-block technical conditions with the Spectrum Access 700 MHz licences. The licence amendment is available to all holders of Spectrum Access 800 MHz licences on request.

1.2 These changes should help increase network capacity, facilitate the rollout of new antenna designs and improve geographic and in-building coverage capabilities of mobile networks. Closer alignment of the technical conditions between the 700 MHz and 800 MHz bands should also assist manufacturers to build equipment that covers both bands. This would make it easier for operators to roll out in these bands as they would not need to deploy different base station equipment. A condition of the licence change is that the use of these higher powers is subject to the operator having in place a mitigation scheme to protect Digital Terrestrial Television (DTT) viewers from undue interference should it occur.

What we have decided on - in brief

We have decided that it is appropriate to make a number of technical changes to the Spectrum Access 800 MHz licences to enable mobile network operators to improve their network coverage and increase capacity. These changes include:

Aligning the in-block transmit power limit with the recently awarded 700 MHz band. We have decided to allow an increase in the permitted base station transmit power from 61 dBm/(5 MHz) EIRP to 64 dBm/(5 MHz) EIRP. This is accompanied by a change to the way in which the power limit is referenced, moving from per radio equipment to per antenna. As part of this change, femtocells must implement power controls to minimise interference to adjacent channels. The use of these higher powers is subject to the operator having in place a mitigation scheme to protect Digital Terrestrial Television (DTT) viewers should interference arise.

To help facilitate equipment manufacturers make equipment that is capable of using both the 700 MHz and 800 MHz bands we have changed some of the out-of-band and out-of-block limits. This is to closer align the power limits with the technical conditions set out in the Spectrum Access 700 MHz licences and the European Conference of Postal and Telecommunications Administrations (CEPT) recommendation for the 800 MHz band.

1.3 Our decision follows a consultation on the proposals initiated in July 2021.[1] The consultation closed on 7 September and we received six responses.

1.4 Licensees that wish to take advantage of these changes can apply to Ofcom for a variation of their licence. Although the likelihood of interference is low, operators will not be able to transmit at the new higher power limits until they have in place a scheme to help and

[1] Ofcom's proposals to update the technical conditions of mobile licences in the 800 MHz band published 13 July 2021 https://www.ofcom.org.uk/__data/assets/pdf_file/0026/221948/800-mhz-variation-condoc.pdf

assist DTT viewers to resolve any undue interference should it occur. Licensees will have to provide Ofcom details of their proposed scheme which we will need to be satisfied with before they can begin transmitting above the power limits currently set out in their licence. Licensees that do not wish to transmit above their current in-block power parameters will not be required to put in place this mitigation scheme.

2. Background

2.1 After receiving requests from two network operators (Hutchison 3G and BT) asking for a variation to their Spectrum Access 800 MHz licences we undertook a wider review of the technical conditions contained in them.

2.1 The aim of the review was to ensure that any technical restrictions in the licences were the minimum necessary whilst ensuring adequate protection to other users from interference. The review considered the advances in technology since the licences were awarded back in 2013 and the change of use of the adjacent 700 MHz band from DTT to another mobile service. The review focused on the following three areas:

- the in-block power limit;
- the out-of-block power limits; and
- the out-of-band power limits.

2.1 The two operators outlined a number of benefits that increasing the power would bring. It had also been highlighted to us from some manufacturers, that the current out-of-band emission mask below 790 MHz made it difficult to build base station equipment that could transmit in both the 700 MHz and 800 MHz bands. This is despite the proximity of the downlink frequency bands being next to each other. There is a desire from equipment manufacturers to build a single base station that can be used for the 700 MHz and 800 MHz band together.

Proposed changes

2.2 The findings of our licence review identified a number of areas where an amendment to the technical conditions would be beneficial to the Spectrum Access 800 MHz licensees. We therefore proposed the following changes to the Spectrum Access 800 MHz licence in our consultation.

- Align the in-block power limit with the recently awarded 700 MHz band. This would increase the permitted power from 61 dBm/(5 MHz) EIRP to 64 dBm/(5 MHz) EIRP. The power limit would be defined by reference to the antenna rather than the whole radio system. This increase was conditional on those mobile network operators that wish to use the increased power having in place a mitigation scheme to protect DTT viewers should interference arise;
- Relax the out-of-band limits in 733 to 790 MHz; and
- Introduce limits to align the out-of-band and out-of-block limits between 790 to 791, 821 to 832 MHz and 791 to 821 MHz with the 800 MHz mask set out in CEPT Report 30.[2]

[2] CEPT Report 30 "The identification of common and minimal (least restrictive) technical conditions for 790 - 862 MHz for the digital dividend in the European Union", published 30 October 2009

2.3 The changes that we proposed to the out-of-band and out-of-block limits are set out in Table 1 below.

Table 1: Existing and proposed 800 MHz out-of-block and out-of-band emissions limits

Frequency Range	Existing 800 MHz licences maximum mean EIRP limit	Our proposed 800 MHz maximum mean EIRP limit
470 – 694 MHz	0* dBm /(8 MHz) relates to a specific piece of equipment irrespective of the number of transmit antennas.	0* dBm / (8 MHz) relates to a specific piece of equipment irrespective of the number of transmit antennas.
694 - 703 MHz		
703 – 733 MHz		
733 – 788 MHz		16 dBm /(5 MHz) per antenna
788 – 790 MHz		12 dBm /(2 MHz) per antenna
790 – 791 MHz	N/A	17.4 dBm /(1 MHz) per antenna
791 – 821 MHz	N/A	11 dBm /(1 MHz) per antenna baseline limit
821 – 832 MHz	N/A	15 dBm /(1 MHz) per antenna
832 – 862 MHz	-49.5 dBm /(5 MHz) relates to a specific piece of equipment irrespective of the number of transmit antennas.	-49.5 dBm /(5 MHz) relates to a specific piece of equipment irrespective of the number of transmit antennas.

**This assumes the base station is transmitting at the maximum in-block power limit. Lower limits apply if the in-block power is lower.*

2.4 To manage the small risk of interference to DTT equipment in some circumstances, we proposed that a requirement for using the increased in-block power would be that any operator, that wishes to take advantage of this, must set up a scheme to help and assist DTT viewers to resolve any undue interference should it occur. We proposed that licensees would have to provide Ofcom details of their scheme which we would need to be satisfied with before they can begin transmitting above the current 61 dBm/(5 MHz) EIRP per radio equipment in-block power limit, as set out in their licence. We did consider that some operators may not wish to take up these proposed changes and, in this case, they would not be required to put in place a mitigation scheme.

2.5 We also pointed out that licensees would still be required to comply with the internationally recognised guidelines on electromagnetic fields (EMF) for the protection of the general public. These guidelines are set by the International Commission for Non-Ionising Radiation Protection (ICNIRP) and ensure that sites are operated in a way that does not adversely affect people's health. We require that, even if operators increase power, the emission limits should remain well within the guidelines that we have set.

Our provisional assessment of the proposed changes

2.6 We considered the requested licence variation and our further proposals in light of our relevant licensing functions and statutory duties.

2.7 As the radio spectrum is a finite national resource of considerable economic and social value, when considering the variation we must take into account the statutory duties placed on us. In light of those duties, the factors that we take into account include:

- securing optimal spectrum use;
- the impact on spectrum users in the same and adjacent bands;
- promoting competition;
- encouraging innovation and investment; and
- benefits for consumers and citizens.

2.8 In reaching our provisional conclusion, we had to balance the advantages and disadvantages of updating the licences, in light of the relevant factors and evidence, in order to reach an outcome that most appropriately meets our relevant statutory duties.

2.9 We considered both the likely impact on competition of making these changes and the likely impact on spectrum management, in particular the impact on existing licensed or exempted users of the adjacent spectrum bands.

2.10 We provisionally concluded that it is appropriate to update the technical conditions contained in the Spectrum Access 800 MHz licences as we had proposed. We advised that these proposed changes would be available to all Spectrum Access 800 MHz licensees.

Consultation

2.11 Affected licensees and any other interested parties had until 5pm on 7 September 2021 to respond to the consultation. In the consultation we asked the following six questions.

Question 1) Do you agree with our proposals to change the in-band power limits contained in the Spectrum Access 800 MHz licence and Ofcom's assessment of the risk of interference? If you disagree, please provide details.

Question 2) Do you agree with our proposals to require licensees to have in place a mitigation scheme to resolve any DTT issues should they occur? If not, please provide details.

Question 3) Do you agree with the proposals to relax the out-of-band emission limits? If you disagree, please provide details.

Question 4) Do you agree with the proposals to add the transitional out-of-band and out-of-block emission limits? If you disagree, please provide details.

Question 5) Do you have any further comments on the technical assessment carried out by Ofcom in Annex 1 of this document.

Question 6) Do you agree with Ofcom's assessment on whether to change the emissions limits of the Spectrum Access 800 MHz licences? If you disagree, please provide further information.

2.12 We received six non-confidential responses. A summary of the comments made and our response to these is set out in Section 3.

3. Responses to the consultation

3.1 We received six non-confidential responses to the consultation. We have grouped the responses around the following three themes:

- the in-block power limit;
- the out-of-block and out-of-band power limits; and
- interference to PMSE.

In-block power increase

3.2 Vodafone, Telefonica, Hutchinson 3G (3UK), Digital Mobile Spectrum Limited (DMSL) and BT agreed with all of the proposed changes to the in-block power limits.

3.3 3UK stated that due to the change of use to the adjacent 700 MHz band it is no longer necessary to retain restrictions that were imposed to protect DTT use in 700 MHz. Telefonica supported the proposals as it would bring the 800MHz band in line with the 700MHz and 900MHz bands.

3.4 The British Entertainment Industry Radio Group (BEIRG) highlighted some concerns in our proposals to change the in-block emission levels. These are explored further in paragraphs 3.11 to 3.34 below where we discuss PMSE.

DTT Mitigation scheme

3.5 All four mobile operators and DMSL, that runs the current DTT mitigation scheme, agreed with the proposals to require that operators have a scheme in place to provide advice and assistance to DTT viewers in the event they suffer undue interference as a result of the proposed increase in power.

3.6 Telefonica noted that not all providers may take up the power increase. They agreed with the approach we set out in paragraph 3.34 of the consultation, that the mitigation scheme requirement would only apply to those who chose to transmit above the current limit of 61 dBm/ (5 MHz) EIRP per radio equipment.

3.7 DMSL, who run the current mitigation scheme, confirmed that it intends to provide mitigation to resolve any DTT issues that occur as a result of the change to in-band power limits. Vodafone stated that they are committed to minimise interference to DTT viewers and would continue work with DMSL to educate viewers and deal with interference issues that may arise. They advised that DMSL has a proven track record in providing mitigation services to the satisfaction of both Government and Ofcom.

Out-of-block and out-of-band power limits

3.8 All four mobile operators agreed with the proposed changes to the emission limits. DMSL agreed with the relaxation of the emission limits in the band 733 to 790 MHz but did not have any comments on the proposals to add the transitional out-of-band and out-of-block

emission limits. Telefonica did raise a point relating to the proposed transitional out-of-band and out-of-block limits.

3.9 Telefonica said that they did not anticipate there being a problem with the proposed introduction of the transitional out-of-band and out-of-block limits, however, they wished that where new limits imposed additional restrictions that these only apply to new equipment. They did not want these limits to cover equipment which had been deployed during the time period when the transitional limits did not exist.

3.10 We agree that we do not expect there to be an issue, as the emission limits will align with the harmonised mask from CEPT Report 30[2] (with the restriction of one to four antennas being removed). We would expect that equipment built by manufacturers would already comply with these emission requirements to satisfy licences in European countries. However, we will make provision in the licence for the transitional out-of-band and out-of-block emission limits to apply only to equipment deployed from the point of the licence variation where these limits are more stringent than the existing requirements.

Impact on PMSE in 821 to 832 MHz

3.11 BEIRG raised a number of comments concerning coexistence issues with PMSE use in the band 821 to 832 MHz. There were no other comments on our coexistence assessments for the 694 to 703 MHz band.

3.12 BEIRG raised the following points regarding the impact on PMSE from the proposed licence variation:

- extending the range of coverage for mobile services in 800 MHz would change the interference risk in fringe coverage areas, principally from mobile handsets;
- they objected to the proposal not to restrict the number of base station antennas;
- the variation poses a risk to utility of the 823 to 832 MHz duplex gap for PMSE users and, consequently, some would elect to migrate to comparatively more expensive licence products in the 470 to 694 MHz band; and
- there should be a mitigation scheme in place for PMSE users affected by the changes, similar to the scheme we proposed for operators to resolve any problems with DTT receivers.

3.13 They also questioned the statement from Ofcom that we did not believe there is a risk of undue interference to other services in adjacent bands including PMSE. BEIRG advised that they would like to examine the research undertaken by Ofcom that led to this conclusion as they remained deeply concerned about the impact on their ability to operate interference-free.

Impact of extended mobile coverage

3.14 BEIRG stated that the increase in permitted transmit power potentially extends the range of a base station and could increase the risk of interference from mobile terminals. They

said that this is because increasing the in-block power limit would result in areas which currently have no 800 MHz coverage becoming areas of low levels of coverage. BEIRG refers to these areas as "fringe areas" and believe that in these areas mobile terminals will tend to operate at increased uplink power levels. This, they said, can result in high numbers of uncontrolled intermodulation products in locations where there are large numbers of mobile terminals, thus increasing the interference risk to any nearby PMSE device. They went on to state that allowing the maximum power to be defined per-antenna further increases the potential range and the areas of fringe reception.

3.15 In response to the comments from BEIRG we have expanded on the qualitative analysis we outlined for the consultation document[3] to address the points they have raised. The main difference between the analysis below and the analysis in the consultation document is the additional emphasis on the potential risk of interference from mobile handsets. We do not believe that this licence variation warrants any further detailed technical analysis. To respond to the concerns raised by BEIRG, we have broken down the issue into two parts:

- the in-block power increase (the factor which BEIRG is concerned about causing "fringe" coverage); and
- the risk of interference from mobile handsets (the outcome BEIRG is concerned about).

In-block power increase and risk of interference from mobile handsets

3.16 There already exists areas of fringe coverage caused by the current deployment of mobile services in the 800 MHz band. The scenario which BEIRG raised regarding extending 800 MHz coverage could happen today without the proposed power increase. It is unclear how the proposed licence variation would be different to operators extending coverage through the deployment of more 800 MHz base stations. This is something that the mobile networks are currently doing under their existing 800 MHz licence conditions due to the Shared Rural Network (SRN) agreement they entered into with Government.

3.17 Telefonica highlighted in their consultation response that a range of factors influence the optimal maximum power used by mobile network operators, and that they will often select a power below the maximum permitted to optimise network performance. This is because the power used by a mobile base station is determined by several factors including network planning and traffic management. We discussed some of these factors further in paragraph A1.20 of Annex 1 to the consultation document. For example, when designing a network an operator needs to consider the balance of a good signal being available from a serving base station and the interfering signals from other nearby base stations. Additionally, network optimisation, the process of adjusting a mobile network to optimise it for a set of performance requirements, is becoming a more frequent activity. Networks have become more automated and more complex[4], which means that the power level at a location may vary over time.

[3] Annex 1 of our consultation.
[4] https://www.ericsson.com/en/managed-services/network-optimization , date accessed 11/10/2021

3.18 Our proposals would not alter the maximum allowable mobile handset power level which remains at 23 dBm. Uplink power in any mobile band is determined by several factors including network resource scheduling and base station sensitivity. For example, we expect that 4T4R antenna systems would improve the sensitivity of base stations, so typical mobile uplink power may not necessarily need to increase.

3.19 It is not conclusive that, due to this proposed licence variation, mobile handsets will necessarily increase their transmit powers (within the allowable ranges) and adversely change the interference environment when there are multiple mobile devices around a PMSE device. Therefore, we do not consider that the impact of this licence variation would be any different than what could occur today.

Restriction on number of base station antennas

3.20 BEIRG said that the lack of a maximum number of antennas could, theoretically, allow for unlimited power to be radiated by mobile base stations. They also stated that this was contrary to CEPT proposals. Although we stated in the consultation that the use of more than 4T4R is unlikely, they pointed out that it remains possible that this could be exceeded. For this reason, they would like a hard limit placed on the number of antennas. They suggested that if an operator does have a case in the future where more than four antennas are required, then this could and should be dealt with on a case-by-case basis by reference to the regulator. They went on to state that since Ofcom believed this situation is unlikely it should not create an onerous regulatory workload.

3.21 Regarding the in-block power limits[5], CEPT Report 30 does not require an in-block EIRP limit, although it suggests an administration may apply one. In cases where a limit is specified, an administration is able to authorise higher limits in particular locations, e.g. in rural areas. There is also no limit on the number of antennas for the in-block EIRP. Table 11 within the CEPT Report 30, covering transition requirements for Base Station out-of-block emissions did note a per antenna limit of one to four as that was at the time what the studies were based on. There are no restrictions on the number of antennas for the 700 MHz band use and one of the objectives of this variation was to more closely align the technical conditions in the 700 and 800 MHz licences.

3.22 In the consultation[6] we explained that there are fewer incentives to use high order multiple-input and multiple-output (MIMO) systems in lower frequency bands and that there are practical challenges when using very large antenna arrays in lower frequency bands. We explained that we do not expect antenna systems in 800 MHz to exceed four transmit antennas in the short to medium term and the use of antenna systems using more than four transmit antennas remains uncertain in the longer term. We also said that if widespread deployment of more than four antennas were to occur, and had the potential to cause interference, then we would need to reassess our coexistence studies. If

[5] Note that in the 800 MHz European Commission Decision there were no obligations regarding the in-block EIRP limits that Member States could apply to the band.
[6] Paragraphs A1.16 to A1.19 of our consultation document.

a problem were to arise then this may require further changes to be placed on licensees in order to protect other users. Although we note the that the licences already contain a requirement not to cause interference.

3.23 The power used by a mobile base station is determined by a number of factors including network planning and traffic management. We do not believe that in making this change we would, in practice, allow network operators to transmit at unlimited EIRP level. Although, in theory, operators could deploy an unlimited number of antennas and hence unlimited power, there are practical reasons why this would not be the case including physical space on masts, network planning constraints, EMF requirements, etc.

3.24 Given our assessment, we do not believe it is necessary to restrict the licences to only one to four antennas. Our policy approach has been to keep the 800 MHz licences aligned with the 700 MHz band and not impose additional restrictions where there is no clear evidence that these are needed. We will continue to monitor the situation and, if in the unlikely event this were to be a problem, we would look again at the technical conditions for both bands.

Utility, financial impact and mitigation scheme for PMSE

Utility

3.25 BEIRG stated that although there is still some scepticism within much of the UK's PMSE community regarding the utility of the 800 MHz duplex gap, it is very useable spectrum and unlike channel 38, this band is available across Europe. BEIRG argued that any decrease in the actual utility of the 800 MHz duplex gap will decrease confidence in its use, which in turn would cause PMSE users to migrate to other PMSE spectrum, notably the 470 to 694 MHz band.

3.26 For the reasons we explain above, we do not consider that the proposed changes represent an increased risk of interference to PMSE users of spectrum in the 800 MHz duplex gap. We also disagree with the assumption that, were users to be adversely affected, they would move to coordinated licence spectrum in the 470 to 694 MHz band.

3.27 PMSE access to 823 to 832 MHz is granted via the UK Wireless Microphone Licence (UHF) , which also authorises licensees to use other frequencies, for example in channel 38 (606 to 614 MHz) and 1785 to 1805 MHz. While providing PMSE licensees flexibility in deployment the shared nature of that licence means that interference from other PMSE users operating in the same location remains possible. In the unlikely event that users were to experience reduced utility in the 800 MHz duplex gap attributable to the changes we have proposed, we believe it is just as likely that they would elect to use one of the other spectrum options included in their existing licence.

Financial impact

3.28 BEIRG also argued that PMSE users would face higher licence fees if forced to move to the 470 to 694 MHz band. This is because PMSE access to spectrum in the 470 to 694 MHz

band is licensed on a coordinated basis and will be more expensive to license for some PMSE users compared to the licence product of which 823 MHz to 832 MHz forms part.

3.29 BEIRG also contend that reduced utility of spectrum in the 800 MHz duplex gap might render some PMSE equipment obsolete and force some users to invest in new equipment that is appropriate for use below 694 MHz.

3.30 As we explain above, this position rests on two assumptions with which we disagree. We do not believe our proposals constitute an increased risk of interference to PMSE users in the 800 MHz duplex gap, nor do we believe that users would migrate to the 470 to 694 MHz band.

Mitigation scheme

3.31 BEIRG commented that Ofcom should put in place a scheme to mitigate any potential losses should interference be caused to PMSE users. They stated that if, as Ofcom believes, there is no interference as a result of increased mobile base station radiated power then the requirement will not be onerous. If interference to PMSE does occur, the consequences for the users could be financially very damaging. In addition, the investigation and rectification of interference is a specialist job which can be very expensive. They point to the requirements that Ofcom propose to place on mobile providers to mitigate interference to DTT receivers should they occur. In order to create a level playing field for all spectrum users, BEIRG advised that all parties must be afforded the same treatment by Ofcom.

3.32 As we explained above, CEPT Report 30 does not require an in-block EIRP limit and there is no limit on the number of antennas for the in-block EIRP. Noting the European harmonisation of these bands, we are aware that not all European countries state a limit of the in-band EIRP in their 800 MHz licensees. We do not consider that there is a significant increase in the risk of interference to PMSE within 821 to 832 MHz.

3.33 The DTT mitigation scheme is required to resolve issues arising from older equipment being impacted by the deployment of the newer mobile systems, this is not the case for PMSE in the 823 to 832 MHz band. Receivers for PMSE within 821 to 832 MHz have to be fit for purpose and should be built to take into account the spectrum environment it operates in (which is adjacent to higher power mobile services). Our proposals included introducing out of band limits in the 823 to 832 MHz band where there is currently none. These limits are aligned with those set out in CEPT Report 30. The changes we are making do not materially change this spectrum environment, equipment already built to take account of this should continue to operate without issue. Therefore, we do not agree that a mitigation scheme for PMSE users is required.

3.34 Our position remains that utility in 821 to 832 MHz will not be degraded for PMSE use by this licence variation and that no further measures are required.

4. Decision

4.1 In this section we set out our final assessment of the licence variation requests and our further proposed changes to the licences. For the reasons explained below, our decision is that it is appropriate to grant the changes, upon request from a licensee. We consider that consumers are likely to benefit from the variations.

Legal framework

4.2 Ofcom is responsible for authorising use of the radio spectrum. We permit the use of the radio spectrum either by granting wireless telegraphy licences under the Wireless Telegraphy Act 2006 (the "2006 Act") or by making regulations exempting the use of particular equipment from the requirement to hold such a licence. It is unlawful and an offence to install or use wireless telegraphy apparatus without holding a licence granted by Ofcom, unless the use of such equipment is exempted. In Annex 2 we set out in more detail the relevant legal framework, which we have taken into account in making the decision set out in this document. This annex should be treated as part of this document.

Assessment

Securing optimal use of spectrum

4.3 In securing our principal duty to further the interests of citizens in relation to communications matters and consumers in relevant markets, we are further required to secure the optimal use for wireless telegraphy of the electro-magnetic spectrum.

4.4 Ofcom's general policy is to set technical restrictions that are the minimum necessary to provide adequate protection against undue 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.

4.5 In order to expand capacity operators can add more spectrum to their existing network, increase the number of transmission sites or improve how efficiently they use their existing spectrum. One way of improving efficiency is to increase the number of antennas on a site. The proposed in-block power increase has been requested by one operator specifically to enable them to move from a system using two transmit antennas and two receive antennas (2T2R); to a system that will use four transmit antennas and four receive antennas (4T4R). The use of more antennas reduces the need for an operator to require additional spectrum and is an efficient use of their existing spectrum resources.

4.6 Licensees are able to increase the number of antennas under their current in-power limits however, this would have the effect of reducing the existing coverage of a cell. This is due to the power limit being set for the total transmission of all the radio equipment

irrespective of the number of antennas, meaning that in order to double the number of antennas the power supplied to each would need to be halved (e.g. 4 x 10 Watts for the four antennas instead of 2 x 20 Watts for the 2 antenna). These changes should provide better coverage and in-building penetration for existing equipment, as the higher power is able to overcome some of the building entry losses caused by the building.

Impact of licence changes on other users of the radio spectrum

4.7 Our technical analysis has shown that, other than DTT, no other users should be adversely affected by the changes to the Spectrum Access 800 MHz licence. However, we believe that the increased risk of undue interference to some DTT users can be mitigated by requiring those companies that wish to transmit at the higher permitted powers to resolve any problems should they arise. This approach has been adopted in respect to the rollout of 700 MHz and 800 MHz services. In their responses to the consultation all four mobile operators agreed with this condition.

4.8 As discussed above, our position is that utility in 821 to 832 MHz will not be degraded for PMSE use and that no further measures are required to be taken in relation to PMSE users.

Promote competition

4.9 We have a principal duty to further the interests of citizens in relation to communications matters and to further the interests of consumers in relevant markets, where appropriate by promoting competition. We believe the UK market for mobile services is generally operating well with continuing innovation and relatively low prices compared to other markets internationally.

4.10 The changes would align the in-block power, out-of-block and out-of-band limits where appropriate with the licences granted as part of the 700 MHz award.

4.11 As part of our work on the 700 MHz award we considered the potential competition concerns relating to the asymmetries in low frequency spectrum.[7] In that work we showed that the coverage potential for 800 MHz is currently less than that of other low frequency spectrum. The increase in the in-block power limit may make it easier for 800 MHz licensees to match the coverage of other low frequency bands such as 700, 900 and 1400 MHz.

4.12 These changes are available to all four mobile operators that hold these licences. Therefore, we do not consider that they would have an adverse impact on competition between mobile network operators or any other licensees in the 700, 800, 900 or 1400 MHz bands.

4.13 Finally, we considered whether the changes would have an adverse competitive impact on other spectrum users, and have concluded that they would not. The changes to technical

[7] Annex 6

conditions should not impact the spectrum quality of existing deployments in or adjacent to the 800 MHz band.

Encouraging innovation and investment

4.14 We have also had regard to the economic and other benefits that may arise from the use of this spectrum, and the need to encourage the development of innovative services. The variation to the permitted in-block power level from 61 dBm to 64 dBm has been requested to enable the deployment of advanced technologies such as LTE-advanced and potential 5G in the future.

4.15 In addition to increasing capacity and coverage to meet demand for services delivered via existing mobile networks, there is the potential for this spectrum to be used for 5G services in the future.[8] Further deployment of LTE-advanced or 5G services has the potential to deliver benefits for UK consumers and businesses, including superfast broadband, greatly expanded capacity and innovative new services.

4.16 The 800 MHz band has properties and characteristics that make them particularly suitable for mobile broadband use, including latest technologies. We consider it important that operators are able to take advantage of changes in technology or the operating environment so that they can meet consumer demand, particularly for increasing capacity for mobile broadband services, improve coverage, and enable the industry to take advantage of innovation opportunities.

4.17 In addition, our further decision to harmonise the technical conditions with the 700 MHz bands would mean that licensees would have the same in-block power limits apply to all the spectrum they hold in 700 MHz and 800 MHz. It has been highlighted to us, that the current out of band emission mask below 790 MHz can make it difficult to build base station equipment which transmits in both the 700 MHz and 800 MHz bands. There is a desire from equipment suppliers to build a single base station that can be used for the 700 MHz and 800 MHz band together due to the proximity of the downlink frequency bands. Our proposed changes may make it easier and potential cheaper for operators to roll out in both bands.

Benefit to citizens and consumers

4.18 Spectrum is a scarce and valuable resource. These licences are of direct public benefit because they ensure that citizens, consumers and businesses can all realise the greatest available value from use of the frequencies.

4.19 Consumers should benefit from the changes, as they are likely to lead to higher quality enhanced mobile broadband services being available.

4.20 The move to more efficient antenna technologies will enable deployment of LTE-advanced and other technologies. Even without the antenna upgrades the increased power to

[8] 800 MHz band is designated by the 5G New Radio (NR) standard as band n20

existing equipment would still help increase indoor and deep indoor geographic coverage over the UK.

4.21 As the variation is available to all Spectrum Access 800 MHz licensees, we would expect to see these benefits apply to customers of all networks that decide to take advantage of the power increase.

EMF and health concerns

4.22 In October 2020, we published a statement setting out our decision to formally incorporate the relevant limits in the International Commission for Non-Ionising Radiation Protection (ICNIRP) guidelines on limiting exposure to electromagnetic fields (EMF) (the "ICNIRP Guidelines") into our spectrum licences, following a public consultation process.[9]

4.23 This requirement applies to all 2006 Act licence classes which authorise equipment to transmit at powers above 10 Watts EIRP. We received a significant number of comments in response to our proposals in relation to health concerns which we addressed during that consultation process.[10] Whilst we have seen no evidence that spectrum users are operating radio equipment in breach of the ICNIRP general public limits, the licence condition we have imposed sets out a clear requirement on licensees to ensure services operate in a way which will not adversely affect peoples' health. It also puts Ofcom in a position where we can take appropriate enforcement action in the event the ICNIRP general public limits are breached.

4.24 Ofcom has been carrying out radio frequency EMF measurements near mobile phone base stations for many years.[11] These measurements have consistently shown these are well within the internationally agreed levels published in the ICNIRP Guidelines. In March 2021 we published the latest update to our summary of results from measurements taken near 5G base stations.[12] These results show that, at all locations where we have conducted measurements, the EMF levels are at small fractions of the maximum levels identified in the ICNIRP Guidelines. We continue to monitor the EMF levels and publish the results regularly.[13]

4.25 We expect that, as a result of these changes, the emission levels will remain well within the levels that we have set. Licensees will continue to not be allowed to exceed the internationally agreed exposure levels for the protection of the general public and there should therefore be no EMF implications for public health.

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[9] See our Statement on "Measures to require compliance with international guidelines for limiting exposure to electromagnetic fields (EMF)" dated 5 October 2020 ("EMF Statement") and "Update on implementation of measures to require compliance with international guidelines for limiting exposure to electromagnetic fields (EMF)" dated 1 March 2021 ("EMF Update").

[10] See section 3 of both our EMF Statement and our EMF Update.

[11] Ofcom inherited a programme of EMF measurements started by its predecessor, the Radiocommunications Agency (one of the five regulators whose duties were subsumed by Ofcom when it was created).

[12] Electromagnetic Field (EMF) measurements near 5G mobile phone base stations Summary of results, updated 1 March 2021

[13] Mobile phone base station audit results

Decision

4.26 We have considered the requested licence variation and our further proposals in light of our relevant licensing functions and statutory duties. Our conclusion is that it is appropriate to update the technical conditions contained in the Spectrum Access 800 MHz licences as we have proposed in our consultation, and that we would grant a licence variation reflecting these changes upon request from a licensee. The changes are shown in a marked-up version of a Spectrum Access 800 licence, attached as Annex 3.

4.27 Our assessment is based on operators deploying existing 2T2R or 4T4R antenna technologies. If, in future, systems with a larger number of transmit antennas are widely deployed, and have the potential to cause interference, we will need to review the technical conditions for the 700 MHz and 800 MHz licences. If deemed necessary, we would consider amending the technical conditions set out in these licences.

4.28 We do note the risk of undue interference to some existing DTT equipment in certain scenarios. However, we do not believe that this should be a barrier to making these changes providing that appropriate mitigation schemes are put in place by licensees to resolve any issues should they arise. Our decision to allow increased in-band power is subject to licensees establishing and operating a scheme to provide advice and assistance to DTT viewers suffering undue interference.

4.29 Our requirement for the DTT mitigation scheme is not a result of our additional decision to align the in-band power limit to *per antenna*, instead of being specified *irrespective of the number of antennas*. As shown by our technical analysis[14] we would have mandated this requirement in relation to the original requested 3 dBm power increase from the two operators.

4.30 The licence variation would be accompanied by a notice under Schedule 1 paragraph 4 of the licence. A draft notice is attached as Annex 4. This notice would require licensees to have in place a DTT mitigation scheme before transmitting at the increased in-band power level. We are not prescribing in detail how the licensees should set up and run their schemes. However, we would need to be satisfied that the scheme meets the objective that 800 MHz band mobile services have in place a process a robust process to handle any reports of undue interference to DTT viewers – and, if they do cause interference, that the licensee takes appropriate and proportionate measures to address this.

4.31 An indication of what we expect to see in a plan is provided in the form of guidance, set out in Annex 3 of the 700 MHz award Information Memorandum.[15] This sets out that a plan must make provisions in at least the following areas.

- Engaging with consumers – Licensees need to make appropriate provision for informing consumers at risk of being affected by interference. We expect licensees to provide an advice line and to advertise that help is available.

[14] The analysis can be found in Annex 1 of the 800 MHz consultation.
[15] Award of the 700 MHz and 3.6-3.8 GHz spectrum bands Information Memorandum, published 13 March 2020

- Assisting consumers who experience problems – Licensees need to assist consumers who experience interference resulting from mobile in the 800 MHz band.
- Helping vulnerable consumers – Licensees need to take account of the needs of vulnerable consumers.
- Operational functions – Licensees have to take account of the operational side of supporting DTT viewers. This includes how the costs of viewer support is funded and how performance is tracked.

4.32 Overall, we believe that consumers are likely to benefit from the licence variations from higher quality of innovative mobile services being available and through the optimal spectrum use on the part of licensees. Consumers may also benefit from these services providing faster download speeds and improved coverage.

4.33 In our view, these changes to the Spectrum Access 800 MHz licences are:

- **objectively justified** in that they would enable optimal use of spectrum and encourage investment and innovation in the services that can be deployed in the 800 MHz band, whilst also addressing the risks of undue interference that might otherwise arise from the proposed permitted increase in power;
- **not unduly discriminatory** against particular persons or against a particular description of persons, in that these changes would be available to all holders of Spectrum Access 800 MHz licences;
- **proportionate** to what they are intended to achieve, in that several conditions are updated to make them less restrictive to take account of changes in market conditions since the licences were issued, and to impose mitigation requirements which are the minimum necessary to provide adequate protection against undue interference; and
- **transparent in relation to what they are intended to achieve**, in that our decision, and our underlying objectives and reasoning, are described and explained in this document.

4.34 We consider that our decision would further the performance of our general duties in section 3 of the 2003 Act, as citizens and consumers will likely benefit from better mobile coverage, higher quality enhanced mobile broadband services and optimal use of spectrum. We describe above the factors we have taken into account in reaching our conclusion, which reflect the matters set out in section 3 of the 2006 Act and (insofar as they are relevant) in section 3 of the 2003 Act, and the requirements of section 4 of the 2003 Act.

A1. Respondents

Digital Mobile Spectrum Limited (DMSL)

British Entertainment Industry Radio Group (BEIRG)

Hutchinson 3G UK Ltd

Telefonica UK Ltd

Vodafone

BT/EE

A2. Legal Framework

A2.1 This section provides an overview of the main legislative provisions relevant to wireless telegraphy licensing and the proposed variations. It is not a full statement of all the legal provisions which may be relevant to Ofcom's functions and to wireless telegraphy licensing.

A2.2 The applicable legal framework derives from our duties and powers under both the Communications Act 2003 (the 2003 Act) and the Wireless Telegraphy Act 2006 (the 2006 Act).

Licence variation

Ofcom's powers to vary a spectrum licence

A2.3 Our powers to carry out our spectrum functions are set out in the 2006 Act. Such powers include, under sections 9 and 10, the general power to revoke or vary any wireless telegraphy licences. Schedule 1 of the 2006 Act sets out a process for the variation of wireless telegraphy licences.

A2.4 We have a duty set out in section 9(7) of the 2006 Act to ensure that wireless telegraphy licence conditions are objectively justified in relation to networks and services to which they relate, non-discriminatory, proportionate and transparent. We consider that this obligation is ongoing and must be assessed against market circumstances and the state of technology development at the time.

A2.5 We have a broad discretion under paragraph 6 of Schedule 1 of the 2006 Act to vary licences, subject to certain limitations:

- pursuant to paragraph 6A of Schedule 1 of the 2006 Act, any variation of a wireless telegraphy licence must be objectively justifiable;
- UK obligations under international agreements where use of spectrum has been harmonised: we will not agree to remove restrictions from licences or other changes that would conflict with the UK's obligations under international law;
- section 5 of the 2003 Act and section 5 of the 2006 Act enable the Secretary of State to give us directions in respect of the carrying out of our spectrum functions;
- we must act in accordance with our statutory duties, including our duty to secure optimal use of the spectrum and our duties under section 3 of the 2006 Act; and
- general legal principles, which include the duties to act reasonably and rationally when making decisions and to take account of any legitimate expectations.

The licence variation process

A2.6 Paragraph 7 of Schedule 1 of the 2006 Act sets out a process for the variation of wireless telegraphy licences.

A2.7 Where we propose to vary a wireless telegraphy licence, we must:

- give the licensee a notice which sets out the reasons for the proposed variation and specifies the period within which the licensee may make representations about the proposal.

A2.8 We must then within 1 month of the end of that period:

- decide whether or not to vary the licence in accordance with our proposal or with modifications; and
- notify the licensee of our decision and the reasons for it.

A2.9 However, this process does not apply to a proposed licence variation that is made at the request or with the consent of the licensee.

Ofcom's duties when carrying out spectrum functions

A2.10 In carrying out our spectrum functions we have a duty under section 3 of the 2006 Act to have regard, in particular, to:

- the extent to which the spectrum is available for use, or further use, for wireless telegraphy;
- the demand for use of that spectrum for wireless telegraphy; and
- the demand that is likely to arise in future for such use.

A2.11 We also have a duty to have regard, in particular, to the desirability of promoting:

- the efficient management and use of the spectrum for wireless telegraphy;
- the economic and other benefits that may arise from the use of wireless telegraphy;
- the development of innovative services; and
- competition in the provision of electronic communications services.

Ofcom's general duties

A2.12 Our principal duty under section 3(1) of the 2003 Act, when carrying out our functions, is:

- to further the interests of citizens in relation to communications matters; and
- to further the interests of consumers in relevant markets, where appropriate by promoting competition.

A2.13 In doing so, we are also required by section 3(2) to secure (among other things):

- the optimal use of spectrum, and
- the availability throughout the United Kingdom of a wide range of electronic communications services.

A2.14 Section 3(4) also requires us to have regard to the following matters (amongst others):

- the desirability of promoting competition in relevant markets;
- the desirability of encouraging investment and innovation in relevant markets;
- the different needs and interests, so far as the use of the electro-magnetic spectrum for wireless telegraphy is concerned, of all persons who may wish to make use of it; and
- the different interests of persons in the different parts of the United Kingdom, of the different ethnic communities within the United Kingdom and of persons living in rural and in urban areas.

A2.15 Section 4 of the 2003 Act requires us, when carrying out our spectrum management functions, to act in accordance with additional requirements, including:

- the requirement to promote competition; and
- the requirement to promote the interests of all members of the public in the UK.

A2.16 Where it appears to us that any of our duties in section 3 of the 2006 Act conflict with one or more of our general duties under sections 3 to 6 of the 2003 Act, we must give priority be our duties under the 2003 Act.

Impact assessment

A2.17 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.

A2.18 The consultation (including its annexes) constituted our impact assessment for the purposes of section 7 of the Act.

Equality Impact Assessment

A2.19 Section 149 of the Equality Act 2010 (the 2010 Act) imposes a duty on us, when carrying out our functions, to have due regard to the need to eliminate discrimination, harassment, victimisation and other prohibited conduct related to the following protected characteristics: age; disability; gender reassignment; marriage and civil partnership; pregnancy and maternity; race; religion or belief; sex and sexual orientation. The 2010 Act also requires us to have due regard to the need to advance equality of opportunity and foster good relations between persons who share specified protected characteristics and persons who do not.

A2.20 Section 75 of the Northern Ireland Act 1998 (the 1998 Act) also imposes a duty on us, when carrying out our functions relating to Northern Ireland, to have due regard to the need to promote equality of opportunity and regard to the desirability of promoting good relations across a range of categories outlined in the 1998 Act. Ofcom's Revised Northern

Ireland Equality Scheme explains how we comply with our statutory duties under the 1998 Act.

A2.21 To help us comply with our duties under the 2010 Act and the 1998 Act, we assess the impact of our proposals on persons sharing protected characteristics and in particular whether they may discriminate against such persons or impact on equality of opportunity or good relations.

A2.22 In the consultation we said that we did not consider our proposals had any equality implications under the 2010 Act or the 1998 Act. We did not receive any comments in response to this and we remain of this view.

A3. Changes to Spectrum Access 800 MHz licence document

The changes to the licence are tracked in this section. Black text is the original licence provisions, Blue text the changes proposed in the consultation and Red text amendments made in response to comments received.

SCHEDULE 1 TO LICENCE NUMBER: xxxxxxx

Schedule Date: **xx xxxx 2021**

Licence category: **Spectrum Access Licence (790 – 862 MHz)**

Description of Radio Equipment

1. References in this schedule to the Radio Equipment are references to any wireless telegraphy station or wireless telegraphy apparatus that is established, installed and/or used under this schedule.

Interface Requirements for the Radio Equipment

2. Use of the Radio Equipment shall be in accordance with the following Interface Requirement:

   IR 2090: Terrestrial systems capable of providing electronic communications services in the 800 MHz band

Special conditions relating to the Radio Equipment

3.

   (a) Subject to paragraph 3(b) of this schedule, during the period that this Licence remains in force, unless consent has otherwise been given by Ofcom, the Licensee shall compile and maintain accurate written records of the following details relating to the Radio Equipment:

      i) postal address (including post code);

      ii) National Grid Reference, to at least 1 metre resolution;

      iii) antenna height (above ground level), type, and boresight bearing east of true north (if applicable); and

      iv) radio frequencies which the Radio Equipment uses

   and the Licensee must produce these records if requested by any person authorised by Ofcom.

(b) The conditions relating to the keeping of records contained in sub-paragraphs 3(a)(ii) and (iii) of this schedule shall not apply in respect of femtocell equipment and smart/intelligent low power repeater equipment.

(c) The Licensee shall submit to Ofcom copies of the records detailed in sub-paragraph 3(a) above at such intervals as Ofcom may notify to the Licensee.

(d) The Licensee shall provide to:

i) Ofcom;

ii) the entity established in accordance with paragraphs 2.1 – 2.2 of the "*Notice of DTT interference mitigation procedures required under spectrum access licences for the 800 MHz band"* notified to it by Ofcom in accordance with paragraph 4 of this schedule; and/or

iii) the Oversight Board

in such manner and at such times as they may reasonably require, such documents or other information as they may require for the purposes of taking steps to mitigate interference to users of the electromagnetic spectrum in the 470-790 MHz band, or to make recommendations to Ofcom or Government with respect to such steps being taken.

Co-ordination at frequency and geographical boundaries and compliance with other procedures relating to interference

4. The Licensee shall ensure that the Radio Equipment is operated in compliance with such co-ordination procedures as may be notified to the Licensee by Ofcom from time to time. The Licensee shall also ensure that it complies with any other procedures relating to the mitigation of interference as may be notified to the Licensee by Ofcom from time to time.

International cross-border co-ordination

5. The Licensee shall ensure that the Radio Equipment is operated in compliance with such cross-border co-ordination and sharing procedures as may be notified to the Licensee by Ofcom from time to time.

Permitted Frequency Blocks

6. Subject to the emissions permitted under paragraph 10 of this schedule, the Radio Equipment may only transmit within the following frequency bands (the "Permitted Frequency Blocks"):

Downlink frequencies	Uplink frequencies
xxx – xxx MHz	**xxx – xxx** MHz

Maximum power within the Permitted Frequency Blocks

7. The power transmitted in the Permitted Frequency Blocks shall not exceed:

(a) Downlink Frequencies

	Maximum mean power dBm / (5 MHz) EIRP per antenna
Radio Equipment*	64 ~~61~~

* For femtocell base stations, power control must be applied to minimise interference to adjacent channels.

~~The maximum EIRP relates to the EIRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas~~

(b) Uplink Frequencies[16]

Radio Equipment	**Maximum mean power**
Fixed or installed Radio Equipment	23dBm EIRP*
Mobile or nomadic Radio Equipment	23dBm TRP*

* The maximum mean power relates to the EIRP or TRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas.

Maximum power of base stations outside the Permitted Frequency Blocks

8. For transmissions on the downlink frequencies, the EIRP emanating from the Radio Equipment transmissions at any frequency outside the downlink frequencies of the Permitted Frequency Blocks, ~~shall not exceed the higher (least stringent) of (a) the baseline requirements and (b) the transition requirements for that frequency~~ but within 791 – 821 MHz, shall not exceed:

Frequency range	**Maximum mean EIRP per antenna**	**Measurement bandwidth**
-5 to 0 MHz offset from lower block edge 0 to 5 MHz offset from upper block edge	22 dBm*	5 MHz
-10 to -5 MHz offset from lower block edge 5 to 10 MHz offset from upper block edge	18 dBm*	5 MHz
Out of block baseline power limit (BS) < -10 MHz offset from lower block edge > 10 MHz offset from upper block edge	11 dBm*	1 MHz

* These limits apply to all Radio Equipment installed after [licence variation date].

9. In addition, the EIRP emanating from the Radio Equipment transmissions at any frequency outside the downlink frequencies of the Permitted Frequency Blocks shall not exceed the

[16] Consumer user equipment will be authorised by means of a licence exemption under section 8 of the Wireless Telegraphy Act 2006

higher (least stringent) of (a) the baseline requirements and (b) the transitional requirements for that frequency

(a) Baseline requirements

Frequency range	In-block EIRP, P, dBm/(10 MHz)**	Maximum mean EIRP in frequency range	Measurement bandwidth
470 to 733 MHz ~~790 MHz~~	P ≥ 59	0 dBm*	8 MHz
	36 ≤ P < 59	(P−59) dBm*	8 MHz
	P < 36	−23 dBm*	8 MHz

* The maximum EIRP relates to the EIRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas.
**This is the in-block EIRP measured in a bandwidth of 10 MHz.

Frequency range	**Maximum mean EIRP**	**Measurement bandwidth**
733 to 788 MHz	16 dBm per antenna	5 MHz
788 to 790 MHz	12 dBm per antenna	2 MHz
790 to 791 MHz	17.4 dBm per antenna**	1 MHz
821 to 832 MHz	15 dBm per antenna**	1 MHz
832 to 862 MHz	−49.5 dBm*	5 MHz

* The maximum EIRP relates to the EIRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas.
** Subject to the further limits set out in paragraph 9(b), these limits apply to all Radio Equipment installed after [licence variation date].

(b) Transitional requirements

For a block with a lower edge of 791 MHz

Frequency range	**Maximum mean EIRP per antenna**	**Measurement bandwidth**
778 – 783 MHz	17 dBm	5 MHz
783 – 788 MHz	19 dBm	5 MHz
788 – 790 MHz	19.2 dBm	2 MHz
790 – 791 MHz	16.2 dBm*	1 MHz

For a block with a lower edge of 796 MHz

Frequency range	Maximum mean EIRP per antenna	Measurement bandwidth
783 – 788 MHz	17 dBm	5 MHz
788 – 790 MHz	14.2 dBm	2 MHz
790 – 791 MHz	11.2 dBm*	1 MHz

* Subject to the further limits set out in paragraph 9(a), these limits apply to all Radio Equipment installed after [licence variation date].

Interpretation of terms in this schedule

10. In this schedule:

(a) "dBm" means the power level in decibels (logarithmic scale) referenced against 1 milliwatt (i.e. a value of 0 dBm is 1 milliwatt);

(b) "EIRP" means the equivalent isotropically radiated power. This is the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain);

(c) "femtocell" means Radio Equipment transmitting on the downlink frequencies, which operates at a power not exceeding 24 dBm EIRP per carrier, and which is or will be used only by and under the control of the Licensee, following the establishment of a telecommunications link between the femtocell and a network of the Licensee;

(d) "Fixed or installed" means used or installed at specific fixed points;

(e) "IR" means a United Kingdom Radio Interface Requirement published by Ofcom ~~in accordance with Article 4.1 of Directive 1995/5/EC of the European Parliament and of the Council on radio equipment and telecommunications terminal equipment (RTTE) and the mutual recognition of their conformity;~~

(f) "lower block edge" means, in relation to each Permitted Frequency Block, the lowest frequency in that Permitted Frequency Block;

(g) "measurement bandwidth" means the size of an individual spectrum segment within the specified frequency range that is used to measure compliance with the specified power limit;

(h) "mobile or nomadic" means intended to be used while in motion or during halts at unspecified points;

(i) "Oversight Board" has the meaning given to it in the "Notice of DTT interference mitigation procedures required under spectrum access licences for the 800 MHz band" notified to the Licensee under paragraph 4 of this schedule;

(j) "Permitted Frequency Blocks" has the meaning given to it in paragraph 8 of this schedule;

(k) "smart/intelligent low power repeater" means a repeater which operates with power not exceeding 24 dBm EIRP per carrier, which may be established by customers of the Licensee who have written agreements with the Licensee and:

- The Licensee has ultimate control of the repeater, i.e. each individual repeater can be disabled remotely by the Licensee;
- The repeater operates only on the Licensee's frequencies and with their valid Public Land Mobile Network Identifier;
- Must not cause undue interference to other spectrum users; and
- The repeater only transmits on the uplink frequencies when actively carrying a call (voice, video or data) or signalling from serviced handsets;

(l) "TRP" means the total radiated power. This is the integral of the power transmitted in different directions over the entire radiation sphere;

(m) "upper block edge" means, in relation to each Permitted Frequency Block, the highest frequency in that Permitted Frequency Block.

A4. DTT mitigation scheme notice

Introduction

A4.1 This Notice is given to each Licensee under its respective Spectrum Access 800 MHz licence.

A4.2 This Notice sets out the procedures relating to the mitigation of interference that the Licensee must comply with if it wishes to operate the Radio Equipment at a power level exceeding the Power Threshold.

A4.3 In this Notice:

a) **'DTT Coexistence Scheme'** means a scheme for the purpose of providing information and advice to DTT Viewers and assisting DTT Viewers to resolve undue interference suffered by them as a result of the Licensee's use of the Radio Equipment at power levels exceeding the Power Threshold;

b) **'DTT Viewers'** means viewers of digital terrestrial television services operating at frequencies below 694 MHz who suffer or may be likely to suffer undue interference from mobile services;

c) '**Licensee'** means the licensee under a Varied 800 MHz Licence;

d) **'Power Threshold'** means a mean power exceeding 61 dBm / (5MHz) EIRP per radio equipment in the downlink frequencies in the Licensee's Permitted Frequency Blocks;

e) **'Scheme Plan'** means a plan for a DTT Coexistence Scheme which Ofcom has confirmed in accordance with paragraph A4.7 of this Notice;

f) **'Varied 800 MHz Licence'** means a licence authorising the use in the United Kingdom of spectrum in the frequency bands 791 to 821 MHz and 832 MHz to 862 MHz and which permits the Radio Equipment to transmit at power levels exceeding the Power Threshold;

A4.4 Any other defined term used in this Notice has the same meaning as in the relevant Varied 800 MHz Licence

A4.5 The terms "interference" and "undue interference" in this Notice should be construed in accordance with section 115 of the Wireless Telegraphy Act 2006.

Procedures

A4.6 Before operating the Radio Equipment at a power level exceeding the Power Threshold, the Licensee must submit a plan to Ofcom for establishing and operating a DTT Coexistence Scheme.

A4.7 Ofcom will confirm to the Licensee if it considers a submitted plan meets the policy objective set out in "*Ofcom's decision to update the technical conditions of mobile licences in the 800 MHz band*", dated 27 October 2021.

A4.8 During any period when the power transmitted by the Radio Equipment exceeds the Power Threshold, unless consent has otherwise been given in writing by Ofcom, the Licensee must operate the DTT Coexistence Scheme as described in the Scheme Plan and otherwise act in accordance with the Scheme Plan.

A4.9 A Scheme Plan may be amended from time to time:

g) by the Licensee submitting a revised plan to Ofcom for consideration under paragraph A4.7; or

h) by Ofcom on reasonable notice to the Licensee.

A4.10 The Licensee shall provide to Ofcom and any entity established or operating as part of the DTT Coexistence Scheme, in such manner and at such times as they may reasonably require, such documents or other information as they may require for the purposes of the scheme's operation, monitoring that operation and assessing its appropriateness and effectiveness.