Aligning licence terms in the 3.4-3.8 GHz band

STATEMENT:

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Section

Annex

1. Overview

Currently, spectrum licences in the 3.4-3.6 GHz and 3.6-3.8 GHz bands (collectively the 3.4-3.8 GHz band) are subject to different terms from one another. We consider that removing the disparity between terms in these bands could potentially reduce barriers to efficient trades, such as transaction costs and complexity.

In our May 2022 Consultation, we proposed to align the terms of UK Broadband's licences with other licences in the same band. Following that Consultation, we have decided to align licences in the 3.4-3.8 GHz band as we proposed. This is consistent with our statutory duties, including our duty to secure optimal use for wireless telegraphy of the electro-magnetic spectrum. In this document we present our approach to dealing with this issue, and address responses to our Consultation.

What we have decided – in brief

To help reduce barriers to potential trading, we have decided to:

- Change the notice periods for revocation in UK Broadband's licences in the 3.4-3.6 GHz and 3.6-3.8 GHz bands and include new start dates for payment of annual licence fees in those licences, so that the terms of those licences align with those in the licences we auctioned in the same respective bands.
- Make fee regulations which will require UK Broadband to pay lump-sum amounts for its 3.4 GHz and 3.6 GHz licences based on the auction prices in the recent 3.4 GHz auction and 3.6 GHz auction respectively.

This proposal does not affect UK Broadband's 3.9 GHz spectrum.

2. Introduction and legal framework

2.1 In May 2022, we consulted on proposals to align the terms of the UK Broadband 3.4 GHz and 3.6 GHz licences with the terms of auctioned licences in the same bands (the 'Consultation'). We included copies of the draft amended licences and the draft fee regulations that would be needed to give effect to our proposals.

2.2 This statement sets out our decision on this subject in light of our legal duties described below, taking account of responses to the Consultation.

Legal framework

Power to grant licences

2.3 Section 8(1) of the Wireless Telegraphy Act 2006 (the "WTA") provides Ofcom with the power to grant wireless telegraphy licences.

2.4 Section 9(1) of the WTA provides that wireless telegraphy licences may be granted subject to such terms, provisions and limitations as Ofcom think fit. Section 9(7) of the WTA provides that Ofcom may only impose terms that they are satisfied are:

a) objectively justifiable in relation to the networks and services to which they relate;

b) not such as to discriminate unduly against particular persons or against a particular description of persons;

c) proportionate to what they are intended to achieve; and

d) in relation to what they are intended to achieve, transparent.

Power to amend licences

2.5 Paragraph 6 of Schedule 1 to the WTA provides that Ofcom may revoke a wireless telegraphy licence or vary its terms, provisions or limitations by a notice in writing given to the holder of the licence; or by a general notice applicable to licences of the class to which the licence belongs, published in such way as may be specified in the licence.

2.6 Paragraph 6A of Schedule 1 to the WTA provides that Ofcom may not revoke or vary a wireless telegraphy licence unless the proposed revocation or variation is objectively justifiable.

2.7 Paragraph 7 of Schedule 1 to the WTA sets out the procedure that applies where Ofcom proposes to vary a licence, including notice requirements, the provision of an opportunity for the licence holder to make representations and, where the result of the variation is that the term of the licence is extended, the requirement to publish the decision and the reasons for it.

2.8 Where a variation is made with the consent of the licence holder, the procedural requirements relevant to the variation of a licence set out in paragraph 7 of Schedule 1 to

the WTA do not apply. However, if the result of the variation is that the term of the licence is extended, the decision and the reasons for it must be published. Paragraph 6A of Schedule 1 to the WTA requiring the variation to be objectively justifiable would also continue to apply in cases where the variation is made with consent.

Power to set and vary fees

2.9 Under section 12(1) of the WTA Ofcom have the power to require licensees to pay fees to Ofcom on the grant of a licence, and subsequently during its term and in respect of its variation or revocation. The timing of the fee payment must be set out in the regulations, and the amount of the fee can be prescribed in the regulations, or alternatively the regulations may provide for the amount to be determined by Ofcom in accordance with the regulations.[1] Where the licence was granted following an auction the circumstances in which the fee can be changed are limited.[2]

2.10 Section 13 of the WTA provides for Ofcom to set fees at an amount that is higher than the cost to Ofcom of carrying out our radio spectrum functions. This power may be exercised if we think fit in the light (in particular) of the matters to which we must have regard under section 3 of the WTA.

Ofcom's duties

2.11 When exercising its functions Ofcom must act in accordance with its statutory duties. Section 3 of the WTA imposes a number of duties relating to spectrum management. Amongst other things, in carrying out its spectrum functions Ofcom is required to have regard to the extent to which spectrum is available for use, and the demand (both current and future) for the use of spectrum. Section 3 of the WTA also requires Ofcom to have regard to the desirability of promoting the development of innovative services and competition in the provision of electronic communications services.

2.12 Section 3 of the Communications Act 2003 sets out Ofcom's general duties including its principal duty:

a) to further the interests of citizens in relation to communications matters; and

b) to further the interests of consumers in relevant markets, where appropriate by promoting competition.

2.13 In carrying out its functions, section 3(2) provides that Ofcom is required, amongst other things, to secure the optimal use for wireless telegraphy of the electro-magnetic spectrum,

[1] Section 12(3) WTA.

[2] Under section 12(6) WTA where a licence was granted following an auction the fee can only be changed (a) where a provision included in the licence with the consent of the holder of the licence provides for the regulations to apply; (b) where the licence includes terms restricting the exercise by Ofcom of their power to revoke the licence before the end of a period and that period has expired; (c) where the licence would, but for a variation, have ceased to have effect at the end of a period and that period has expired; or (d) where the licence is a surrendered-spectrum licence. In the case of (c) or (d) the consent of the Secretary of State is required.

the availability throughout the UK of a wide range of electronic communication services and the availability throughout the UK of a wide range of television and radio services.

2.14 Ofcom is also required to to act in accordance with the six requirements set out in section 4 of the Communications Act 2003. Under section 2B, Ofcom is also required to have regard to the statement of strategic priorities prepared by the Secretary of State and designated for the purposes of section 2A.

2.15 In making the decision set out in this statement, we have had regard to these statutory duties. We place particular weight in this context on our duty to secure optimal use for wireless telegraphy of the electro-magnetic spectrum. We interpret our obligation to secure optimal use of spectrum to mean that the spectrum is used in a way that maximises the value that citizens and consumers derive from it, including the wider social value of spectrum use, and taking into account the specific consumer and citizen interests, including the interests of particular groups within society. Ofcom has also had regard to the statement of strategic priorities. In particular, our objective of removing barriers to potential future trades is consistent with the Government's belief that there should be greater liquidity in the spectrum market and barriers to spectrum trading should be removed.[3]

Making statutory instruments to implement our policy decisions

2.16 Before making any regulations by statutory instrument, we are required by section 122(4) of the WTA to give statutory notice of our proposal to do so to. Under section 122(5), such notice must state that we propose to make the regulations in question, set out their general effect, specify an address from which a copy of the proposed regulations or order may be obtained, and specify a time period of at least one month during which any representations with respect to the proposal must be made to us. The Consultation published on 24 May 2022 served as this notice and included a copy of the draft regulations we proposed to make at annex 2.

[3] Statement of Strategic Priorities for telecommunications, the management of radio spectrum, and postal services, 29 October 2019, paragraph 40.

3. Aligning terms of licences in the 3.4-3.8 GHz band

Our Consultation proposals

3.1 In our Consultation, we noted that there was general consensus that optimal deployment of 5G is best achieved with large contiguous blocks of spectrum. We set out our view that there was scope for commercial negotiations to result in rearrangements of the 3.4-3.8 GHz band which increase efficiency relative to the current position.[4]

3.2 However, we explained that at present there are differences in the terms of the UK Broadband (UKB) licences held by H3G, and the other licences[5] in the band. We noted that these differences could potentially act as a barrier to spectrum trading, by leading to a complex and protracted negotiation and unnecessary transaction costs.[6] H3G and at least one other MNO told us that they have had difficulties in agreeing trades in the band due to the disparity between the terms of auctioned licences and the terms of the UKB Licences.[7]

3.3 We explained that we proposed to align the licence terms and fees of UKB licences in the band with the terms and fees of auctioned licences in the band, by varying the terms of the UKB Licences as follows:

- For the 3.4 GHz UKB licence:
  - Change the notice period for revocation from five years' notice to no earlier than 11 April 2038; and
  - Include a new start date for fee payments so that UKB will start to pay annual licence fees ("ALFs") from 12 April 2038
- For the 3.6 GHz UKB licence:
  - Change the notice period for revocation from five years' notice to no earlier than 26 April 2041;
  - Include a new start date for fee payments so that UKB will start to pay ALFs from 27 April 2041; and
  - Remove the licence term which permits spectrum leasing.

3.4 Under our proposals, UKB would no longer be subject to ALFs for these licences until 2038 and 2041 respectively, so, to align the fees across licences, we proposed to require UKB to pay lump-sum amounts for its licences based on the auction prices of spectrum in the 2018 3.4 GHz auction (for its 3.4 GHz licence) and in the 2021 3.6 GHz auction (for its 3.6 GHz licence), offset by the ALFs which UKB had paid for the licences to date.

[4] Consultation, paragraphs 3.1 to 3.7.
[5] Licences awarded in the 2018 3.4 GHz auction and the 2021 3.6 GHz auction.
[6] Consultation, paragraph 3.14.
[7] Consultation, paragraph 3.8.

3.5 In our Consultation we explained that we did not consider that there were any significant costs to MNOs or consumers from the proposed changes. However, we noted that there are potential benefits to society if the changes assist efficient spectrum trades and as a consequence, result in more efficient use of spectrum.

3.6 We received three responses to our Consultation. H3G and Vodafone agreed with our proposals, although Vodafone suggested some changes to the detail of our proposed calculation of the lump sum amounts for UKB's 3.4 and 3.6 GHz licences. VMO2 made an initial response to our Consultation and a follow-up response. In both responses it disagreed with our proposals.

3.7 In the remainder of this section we set out:

a) Our objective in aligning the licences.

b) Our approach to aligning the licences.

c) Our calculation of the lump-sum amounts.

3.8 Under each of these headings we set out our decision, summarise stakeholders' views received in response to the Consultation and provide our response to stakeholders' views.

Our objective in aligning the licences

Our decision

3.9 Our objective in aligning UKB's licence terms and fees with auctioned licence terms and fees is to remove barriers to future trades which could potentially reduce fragmentation in the band, and in doing so to allow for a more efficient use of the band.

3.10 Optimal deployment of 5G is best achieved through the use of large contiguous blocks of spectrum.[8] Currently, the 3.4-3.8 GHz band is fully assigned to four mobile network operators (MNOs) but not all assignments in the band are contiguous – rather, a degree of fragmentation of spectrum holdings remains in the band.[9]

3.11 Our view is that spectrum trading could help to reduce this fragmentation. Licensees have the ability to trade spectrum in order to achieve contiguous allocations of spectrum. However, trading can be hindered when transaction costs are high and the negotiations between parties are complex. In the case of the 3.4-3.8 GHz band, some operators have reported difficulties in agreeing trades in the band due to the disparity between the terms of auctioned licences and the terms of the UKB Licences.[10]

3.12 We have therefore decided to remove this disparity so that all licensees within each of the 3.4 and the 3.6 GHz bands are in the same position with respect to their licence terms and fees.[11]

[8] Consultation, paragraph 3.2.
[9] Consultation, paragraph 3.7.
[10] Consultation, paragraph 3.8.
[11] Consultation, paragraph 3.16.

Stakeholder views

3.13 In its initial response to our Consultation, VMO2 said that we had not clearly articulated the problem we were seeking to solve, stating: "*It is unclear whether the complaints of Three [H3G] and another MNO relate to: a specific issue to do with defragmentation of the 3.4-3.8 GHz band; or an issue to do with spectrum trading more generally: either the negative impact of ALFs per se; or that (sic) the level of ALFs generally being too high and justifying the application of a discount on current spectrum pricing to remove this barrier to trading*".

3.14 In its follow up response, VMO2 said that *"It is obvious from [Consultation, Table 3.1] that Ofcom is concerned about the structure of prices, rather than the actual prices paid for spectrum. Otherwise, it would have explicitly stated that the difference in licence fees paid by UKB for 3.4 versus 3.6 GHz spectrum is also an issue."* VMO2 added that *"After the 3.6 GHz award primary round, O2 and Vodafone agreed to trade spectrum between the 3.4 and 3.6 GHz bands, spectrum that has the same price structure but was sold for markedly different fixed prices."* VMO2 said this demonstrated that the level of prices does not prohibit trading.

3.15 VMO2 noted that Three's consultation response referred to the disparity between what Three pays in ALFs for UKB licences and the price of auctioned licences in the band, as well as the barriers to trade from differences in the licence terms.

Our response

3.16 We disagree with VMO2 that our proposed objectives did not articulate the problem we are seeking to solve.

3.17 Our Consultation stated that:

a) "*Spectrum trading can lead to an efficient allocation of spectrum but can be hindered when transaction costs are high and the negotiations between parties are complex.*

b) *The differences between UKB licences and the auctioned licences [described above] could potentially lead to a complex and protracted negotiation and unnecessary transaction costs. This could act as a potential barrier to trading.*

c) *For these reasons, and consistent with our legal duties, we are proposing to align the licence terms and fees of the UKB licences with the terms and fees of auctioned licences.*

d) *The purpose of such an alignment would be to remove the disparity between the UKB licences and auctioned licences such that all licensees within each of the 3.4 and the 3.6 GHz bands are in the same position with respect to their licence terms and fees, removing the potential barriers to trading. We consider that this could as a consequence lead to more efficient use of spectrum, consistent with our duty to secure the optimal use for wireless telegraphy of the electro-magnetic spectrum*". [12]

[12] Consultation, paragraphs 3.13 to 3.16.

3.18 We consider this to be a clear articulation of the problem we are seeking to solve and of our proposed solution. We have not suggested that there is a negative impact of ALFs *per se* on spectrum trading, nor is our proposal concerned with the level of ALFs generally being too high.

3.19 We agree with VMO2 that differences in the historical prices paid for spectrum at auction, as in the example they describe, are unlikely in themselves to act as a barrier to trading.

3.20 As stated above, our objective is to remove potential barriers to trading arising from differences between the UKB and auctioned licences. While H3G has commented in its response that our proposal "*…puts operators on a fair, level-playing field in relation to fees paid for equivalent spectrum*", H3G's comments regarding the level of fees in its response do not alter the stated objective of our approach.

Our approach to aligning the licences

Our decision

3.21 We have decided to implement our decision to place all licensees within each of the 3.4 and the 3.6 GHz bands in the same position with respect to their licence terms and fees by:

a) varying UKB's licence terms so as to align them with the terms of the auctioned licences in the band; and[13]

b) making new fee regulations to require UKB to pay lump-sum amounts for its 3.4 GHz and 3.6 GHz licences based on the auction prices in the recent 3.4 GHz auction and 3.6 GHz auction respectively.[14,15]

3.22 As we describe above, our objective is to remove barriers to trading of spectrum in these bands, consistent with our duty to secure the optimal use of spectrum. We consider that aligning the terms of the licences in each of the UKB 3.4 GHz and 3.6 GHz licences, and in the case of the 3.6 GHz licence by also removing the licence term which prevents spectrum leasing, achieves our objective. Specifically, we have therefore decided to:

- For the 3.4 GHz UKB licence:
  - Change the notice period for revocation from five years' notice to no earlier than 11 April 2038; and
  - Include a new start date for fee payments so that UKB will start to pay annual licence fees ("ALFs") from 12 April 2038.
- For the 3.6 GHz UKB licence:

[13] Consultation, paragraph 3.15.
[14] Consultation, paragraph 3.20.
[15] We intend to make the Wireless Telegraphy (Licence Charges for the 3.4 GHz Frequency Band and the 3.6 GHz Frequency Band) Regulations 2022 which will revoke the Wireless Telegraphy (Licence Charges for the 3.4 GHz Frequency Band and the 3.6 GHz Frequency Band) Regulations 2019.

- Change the notice period for revocation from five years' notice to no earlier than 26 April 2041;
- Include a new start date for fee payments so that UKB will start to pay ALFs from 27 April 2041; and
- Remove the licence term which permits spectrum leasing.[16]

3.23 We also consider that it is appropriate to require UKB to pay lump-sum amounts for its 3.4 GHz and 3.6 GHz spectrum to align its fees with the auction prices paid by successful bidders in the 2018 and 2021 auctions.[17] We consider that:

a) The effectiveness of our approach in removing a potential barrier to trading and securing the efficient use of spectrum depends on the alignment of the licence terms (the notice period for revocation, the start date for ALF payments, and leasing permission).

b) In addition, we consider it appropriate that the licence variation should be conditional on a lump-sum payment, and that this lump sum payment should put UKB in a broadly equivalent position to other licensees in these bands.

c) We are therefore requiring UKB to pay, for the 3.4 GHz licence, a lump-sum amount based on the auction price of spectrum in the 2018 3.4 GHz auction, and for the 3.6 GHz licence, a lump-sum amount based on the auction price of spectrum in the 2021 3.6 GHz auction, in each case offset by ALFs paid by UKB for each licence since the respective auction dates.

3.24 We consider that these decisions are proportionate to the issue we are trying to address. In reaching this decision we are satisfied that:

a) our approach is effective to achieve our aim of removing the current potential barriers to trade;

b) our approach is no more onerous than is required to achieve that aim;

c) our approach is the least onerous option which achieves that aim;

d) our approach does not produce adverse effects which are disproportionate to our aim.

3.25 Our decision will address the issues (different licence terms and fees) which we have identified as causing barriers to trading, and no stakeholders have provided evidence that they would not be effective in doing so.[18] We do not consider that there are any significant costs to MNOs or consumers from these changes, or any negative consequences for the wider market. For this reason we do not consider that our approach will be more onerous than is required to achieve our aim. We also consider that it is the least onerous option

[16] For the avoidance of doubt, revocation of either or both licences will continue to be subject to a five-year notice period.
[17] VMO2 response, page 17.
[18] Although, as noted above, VMO2 said that we had not clearly articulated the problem we were seeking to solve. VMO2 said that "The lack of clarity about the rationale for [the] proposal makes it hard for us to engage on what the right solution is."

which achieves our aim. In addition, we do not consider that our approach will produce any adverse effects which would be disproportionate to our aim.

Stakeholder views

3.26 VMO2's views broadly fall into three categories: regulatory certainty, cost benefit analysis, and alternative valuations.

Regulatory certainty

3.27 VMO2 described the proposed licence change as a "selective rewriting of history" which would make it difficult for VMO2 to rely on current and future regulatory contracts. It said that this change "*signals that Ofcom would be willing to intervene in a way that radically changes the regulatory contract that MNOs believe they acted under (and would act against going forward). This would reduce the confidence that MNOs would have in their regulator being cautious to depart from its past regulatory decisions, and only doing so if it could justify that its proposal would deliver substantial benefits to consumers and competition in regulated markets, or in the face of a demonstrable change in circumstances*."

3.28 VMO2 said that we disregarded whether parity would be achieved between H3G and other MNOs. In particular VMO2 commented that "*Through its proposal, Ofcom would not expose H3G to the full cost of the risk profile it chose by keeping its ALF-bearing 3.x GHz on distinct licence terms rather than surrendering some or all of this spectrum before participating in the 3.4 and 3.6 GHz auctions. … [H3G] could, for the next 20 years, reduce its exposure to these ALFs if fees proved too costly and no trading partner could be found, by surrendering its ALF-bearing spectrum, without the risk of writing off sunk capital. This option was not available to MNOs that purchased 3.4 GHz spectrum at a fixed price*".

Cost benefit analysis

3.29 VMO2 said that we had not conducted a proper cost-benefit analysis, in particular taking account of the loss of ALF receipts by Her Majesty's Treasury ('HMT'). VMO2 said that the proposals would reduce the ALF revenues received by HMT and that "*Ofcom must account for this impact on HMT – and by extension on UK tax payers – as part of its assessment of a possible intervention*".

Alternative valuations

3.30 VMO2 suggested a number of alternative measures to our proposals, based on its interpretation of our objectives.

3.31 VMO2's first option involves making ALFs fungible, which it said would help to reduce fragmentation. This proposal is designed to defragment the 3.4-3.8 GHz band by making it possible to transfer ALFs payable to a different specific frequency in the same band as part of a trade. In its follow up response, VMO2 said that this was the most proportionate solution because 'it delivers the benefits of fragmentation with 100% certainty'.

3.32 VMO2's other options relate to the approach used to calculate the lump sum payment. VMO2's options are:

a) *Net present value ('NPV') approach*: VMO2 presented an option of setting the lump sum amount equal to the net present value of the discounted payments that H3G would make for its ALF-bearing 3.x GHz spectrum, absent the proposed licence change. This involves making assumptions about the appropriate discount rate and rate of inflation. VMO2 said that "*Three would be indifferent between paying a lump-sum at [net present value of future ALF payments] and continued ALF payments in line with the 3.x ALF Statement*".[19]

b) *Adjusted net present value.* In this approach, VMO2 suggests that Ofcom could revise the ALFs which are currently in place as a result of our previous 3.4 GHz and 3.6 GHz ALF decisions, and set a lump sum value based on the resulting ALFs.

c) *Ofcom's proposal but with market value determined on the 3.4 GHz auction price only.* In this option, the value of both the 3.4 GHz and 3.6 GHz licences would be based on the 3.4 GHz auction price.

d) VMO2's final proposed approach ('*counterfactual auction approach*') is designed, in its view, to achieve parity between the risks and amounts paid by all MNOs holding 3.x GHz spectrum. VMO2's view is that this can be achieved by establishing "*the price that MNOs would have paid for their spectrum in the counterfactual auction in which the full 190 MHz was sold and that resulted in the same allocation of spectrum as after the actual*".[20] It proposes to do this by: (a) assuming that H3G surrendered its 3.4 GHz spectrum prior to the 3.4 GHz auction and this spectrum was added to the lots of spectrum auctioned, and (b) using auction prices during bidding rounds from the 3.4 GHz auction and H3G's revealed demand when bidding in the auction.

Our response

Regulatory certainty

3.33 We recognise the importance of providing regulatory stability to stakeholders, noting however that this must be balanced against our wider functions and duties. We do not consider VMO2's characterisation of our proposals to be accurate in this regard. Rather, our proposals are a solution to the problem we have identified in these particular circumstances. The only stakeholder directly affected is H3G, which owns UKB and which has agreed to the proposed changes to UKB's licences, although other MNOs may benefit if the proposals facilitate trading leading to a more efficient use of spectrum.

3.34 We consider that our objective is appropriate in the market circumstances we observe and that the changes we are making are appropriate and proportionate to achieve that objective. In particular, we consider that removing barriers to trading of spectrum in this band has the potential to deliver substantial benefits; and the emergence of evidence that

[19] VMO2 response, page 17.
[20] VMO2 response, page 20.

the non-alignment of licence terms has acted as a barrier to trading in this band justifies our approach.

3.35 As regards VMO2's comments that H3G will not be exposed to the full cost of the risk profile it chose by not surrendering its licences prior to the 3.4 GHz and 3.6 GHz, we note that while VMO2 comments on the benefit to H3G of being able to surrender its ALF spectrum without incurring a sunk cost, H3G will in fact lose that option following the licence realignment. We expect any benefit H3G will have had to date from this option will be limited.

3.36 As noted above, our Consultation did not suggest that ALFs create a barrier to trade or that reduced ALFs would improve the ability to trade. Following our changes to UKB's licence terms, those licences will not be liable for ALFs before 2038 at the earliest. This is not the same as applying a discount on ongoing ALFs.

Cost benefit analysis

3.37 In reaching our decision, we have considered the impact of our proposals. Our Consultation represented an impact assessment as defined in section 7 of the Communications Act 2003. In preparing the Consultation document, we considered the costs and benefits of the changes we were proposing. In reaching our decision, we have also taken account of stakeholder comments received in response to our Consultation on the impact of our proposals.[21]

3.38 We do not consider that there are any significant costs to MNOs or consumers from the proposed changes. However, there are potential benefits to society if the changes assist efficient spectrum trades.[22]

3.39 We therefore consider that our decision is appropriate and proportionate to achieve our objective of improving the efficiency of spectrum allocation by facilitating trading in the context of our duties and functions.

3.40 It is also not Ofcom's objective or duty to raise revenue for HMT. Given our statutory duties, this is not a consideration we can take into account when making policy decisions.[23] Nor is revenue-raising our purpose in setting ALFs.

Alternative valuations

3.41 In our view, the alternative measures identified by VMO2 have disadvantages which make them less appropriate or less likely to be effective than the course we have decided to pursue.

[21] Consultation, paragraph 2.21.
[22] Consultation, paragraph 3.22.
[23] See, for example, paragraph 1.22 of Ofcom, Digital Dividend Review consultation, December 2006. https://www.ofcom.org.uk/__data/assets/pdf_file/0032/28796/ddrmain.pdf

3.42 With respect to the suggestion of making ALFs fungible across the relevant band,[24] we consider that this would be unlikely to achieve our objective of removing barriers to future trades.

a) Prior to entering negotiations, the parties to a trade would prefer certainty from Ofcom about the decision it would make to facilitate the trade, including with respect to the licence terms and fees.

b) Ofcom would therefore need to provide certainty in respect of the future action we would take without knowing the details of the outcome of negotiations.

3.43 However, any future decision would depend on the specific circumstances at the time, as Ofcom is unable to fetter its future discretion. Consequently, even where Ofcom gave guidance, the parties to any trade would not have have any certainty as to the decision Ofcom might take. Therefore, this approach would not significantly reduce uncertainty or complexity. These would remain as barriers to future trades and therefore would be unlikely to achieve our objective.[25]

3.44 We do not consider VMO2's options of setting the lump sum as the NPV of existing ALFs, or revising ALFs and then setting a lump sum on this basis (the 'adjusted net present value' approach) to be appropriate. This is because:

a) ALFs are a policy tool which Ofcom uses to ensure the ongoing efficient use of spectrum.

b) The existing ALFs were based on annualising the lump sum payments made in the 3.4 GHz auction. At present, UKB pays ALFs for these licences and has the option of avoiding future ALF payments by surrendering its licence.

c) Under our proposals, UKB would no longer be subject to ALFs for these licences until the revised start dates for fee payments.

d) As a result we do not consider that an assumed value of future ALFs, over a time period when ALFs will now not in fact apply, is a relevant or appropriate basis for setting the lump sum payment.

3.45 As regards VMO2's option of setting the lump sum payment based on prices in the auction for 3.4 GHz alone, as we explained above, we consider it appropriate that the lump sum payment should put UKB in a broadly equivalent position to other licensees in these bands. Setting the lump sum payment based on prices in the auction for 3.4 GHz alone would not

[24] VMO2 submitted that a precedent was created in the 2018 auction, where the facility existed for H3G to enter the assignment stage of the 3.4 GHz auction with its pre-existing 40 MHz spectrum holding. VMO2 concluded that: "*It follows that to write the regulations to undertake the 3.4 GHz auction in this way, primary legislation already allows Ofcom to make spectrum fees fungible between specific frequency licences."* However, as acknowledged by VMO2, these regulations were made in the context of an auction, under section 14 of the WTA that relates to the procedure for granting licences by auction. In this case section 14 of the WTA is not relevant.

[25] We disagree with VMO2 that this option would deliver the benefits of fragmentation with certainty, as this would only occur if parties agreed to trade.

achieve this. We therefore consider it more appropriate to base the lump sum payment on prices in the auctions for 3.4 GHz and 3.6 GHz as we proposed in our Consultation.

3.46 With respect to the 'counterfactual auction' proposal, we consider that if the UKB spectrum had been available to other bidders in the 3.4 GHz auction, this could have altered some or all bidders' optimal bidding strategies during some or all bidding rounds, and certainly we cannot rule out that possibility. However, it is not possible for Ofcom to retrospectively establish how operators would have bid in a counterfactual scenario and we consider VMO2's approach to be speculative. In addition, we do not consider that revising auction payments in this way is necessary or appropriate to achieve our objective.

Calculation of the lump-sum amounts for the UKB 3.4 and UKB 3.6 GHz licences

Our decision

3.47 We set out above our decision to require UKB to pay, for the 3.4 GHz licence, a lump-sum amount based on the auction price of spectrum in the 2018 3.4 GHz auction, and for the 3.6 GHz licence, a lump-sum amount based on the auction price of spectrum in the 2021 3.6 GHz auction, in each case offset by ALFs paid by UKB for each licence since the respective auction dates. We calculate these lump sum amounts for UKB's licences as follows:

- We calculate a gross lump-sum value for each of the 3.4 and 3.6 GHz bands, by multiplying UKB's spectrum holding for each of the bands by the auction price of each band.
- We calculate the ALF amounts paid by UKB since the relevant auction date, for each of the 3.4 and 3.6 GHz bands.
- We then subtract the total of ALF payments to be offset in each band from the gross lump-sum value of that band to give the net lump sum value for each band. The results are then added together to arrive at the net lump-sum total.
- All figures in our calculation are converted to current prices using CPI.

3.48 For illustrative purposes, we present the updated calculations of the lump-sum amounts, expressed in **July 2022 prices**, in the table below:

Table 3.1: Lump-sum values for the UKB 3.4 and UKB 3.6 GHz spectrum

	Band		3.4 GHz	3.6 GHz
A	Amount of spectrum held by	MHz	40	80
B	Auction price	£ per MHz	8,792,106	4,673,025
C	Gross lump-sum value	£m	351.7	373.8
D	ALF payments to be offset*	£m	(80.9)	(67.4)
E	Net lump-sum value	£m	270.8	306.4
F	Net lump-sum total	£m	**577.2**	

** This includes payments up to and including 31 August 2022; future ALF payments becoming liable before the new fee regulations come into force are also to be offset but are not included in this calculation.*

3.49 The calculations above assume a **lump-sum payment date** of 31 August 2022. These calculations will need to be updated once the lump-sum payment date is confirmed. Any **future payments of ALFs** becoming liable after 31 August 2022 and before the new fee regulations come into force would also **need to be offset** against the net lump-sum total. We note the next such payment is the 31 December 2022 payment of £40.4m (in July 2022 prices).

3.50 In addition, values are expressed in July 2022 prices for convenience. Depending on when the lump-sum payment is made, the lump-sum amounts set out above would need to be **indexed by CPI** to account for changes in price levels between July 2022 and the **lump-sum payment date**.

Stakeholder views

3.51 Vodafone commented on our use of CPI indexation as follows: "*[I]t is questionable whether the value of spectrum is inflating in-line with CPI, particularly in the current tumultuous macro-environment. In the context of ALFs, Ofcom cannot evade the issue that such fee increases must make their way to consumer pricing, and hence spectrum policy in this area is both intensifying the cost-of-living crisis and further driving inflationary pressures. Double-digit inflation was not envisaged when ALF policy was devised, and Ofcom should seriously consider whether it would be appropriate to apply a guard rail to ALF indexation (e.g. private sector pensions typically cap indexation at 5%; such an approach could be applied to ALFs)*".

3.52 Vodafone also commented that "*We understand that UKBB first approached Ofcom about the variation in May 2021- had the calculation been carried out at the time with the prevailing rate of inflation, then the fee faced by UKBB to effect the change would be some £30m less. We do not suggest that Ofcom should reduce the fee – UKBB has had the benefit of having the money in its bank in the meantime and this is clearly a complex policy question to which Ofcom had to apply due diligence – but we believe that so long as UKBB accepts and funds the licence change expeditiously after the final statement is issued,*

Ofcom should not further index the calculation based on inflation between March 2022 and the date of variation."

3.53 Vodafone added: "*We note that an alternative approach might have avoided this issue – Ofcom could have used the auction fee as a debt outstanding on UKBB and applied interest at the cost of capital assumed in the ALF consultation (there would still have been an increasing bill until the date of licence variation, but not at the extreme level of current CPI rates)*".

3.54 Vodafone also said that we had failed to account for the value of spectrum contiguity in calculating the lump sum value. It said that licensees in the band have paid considerable sums to achieve spectrum contiguity or proximity. Vodafone said it could not be correct that UKB be able to hold a substantial contiguous spectrum block in the 3.6 GHz band while facing no such costs.

Our response

3.55 In our view, the lump sum payment should be made in current prices, rather than historical prices, and CPI indexation is an appropriate and well-established means of achieving this, and is consistent with our use of CPI indexation in setting ALFs.[26] We do not consider it necessary or appropriate to adopt the novel approach suggested by Vodafone, of treating the auction fee as a debt outstanding on UKB.

3.56 We do not agree with Vodafone's proposal of stopping the indexation at March 2022. We note that Vodafone accepts that between May 2021 and March 2022 UKB had the benefit of not yet having made the payment, and Ofcom had a requirement to apply due diligence (as Vodafone puts it). This is also true of the time from March 2022 and the date of variation of the licences.

3.57 As regards Vodafone's comment on spectrum contiguity, we note that Vodafone made a similar point in commenting on ALFs for 3.6 GHz in response to our December 2018 consultation. We stated that we did not consider Vodafone's argument that H3G's value for the spectrum may be higher (for example for reasons of contiguity) to be relevant as an indicator of market value. We noted that our framework for setting ALFs focuses on the forward-looking marginal opportunity cost of the spectrum, rather than H3G's value for its UKB spectrum holdings.[27] In the present case, we consider that, as UKB will be making the lump sum payment in lieu of paying a future stream of ALFs, and as those ALFs did not reflect a contiguity premium, it would not be appropriate to introduce such a contiguity premium into the calculation of the lump-sum payment.

[26] For example, see Ofcom, Annual Licence Fees for 900 MHz and 1800 MHz spectrum, December 2018; https://www.ofcom.org.uk/__data/assets/pdf_file/0020/130547/Statement-Annual-licence-fees-900-MHz-and-1800-MHz.pdf , and as a more recent example, Ofcom, Annual Licence Fees for 2100 MHz spectrum, December 2021; https://www.ofcom.org.uk/__data/assets/pdf_file/0027/229428/1900_2100-mhz-statement.pdf

[27] Paragraph 4.20, Annual Licence Fees for UK Broadband's 3.4 GHz and 3.6 GHz spectrum, Statement, June 2019. https://www.ofcom.org.uk/__data/assets/pdf_file/0013/151231/statement-annual-licence-fees-uk-3.4-ghz-and-3.6-ghz-spectrum.pdf

Next steps

3.58 To implement our decision, we will now proceed to vary the UKB 3.4 and 3.6 GHz licences in substantively the same way as set out in annex 1. As explained in our consultation, we will also move the 3.9 GHz spectrum out of UKB's 3.6 GHz licence and into a new, separate licence called "Spectrum Access 3.9 GHz". H3G has confirmed that it would consent to the proposed changes and we will therefore vary these licences by consent.

3.59 Once the licences are varied, we will then make the fee regulations in substantively the same form as set out in annex 2. The fee regulations will confirm the fee payment date and the lump-sum payment amount for each of the licences.

A1. UKB 3.4 GHz and UKB 3.6 GHz licences

Draft UKB 3.4 GHz licence

Starts from next page

Office of Communications (Ofcom)
Wireless Telegraphy Act 2006

SPECTRUM ACCESS 3.~~54~~ 4 GHz

This licence document replaces the version of the Licence issued by Ofcom on 25 June 2019 to UK Broadband

Licence no.: ~~1197663~~ TBC
Date of issue: 18 May 2021
Fee Payment Date: ~~31 July~~12 April (annually from 12 April 2038)

1. The Office of Communications (Ofcom) grants this wireless telegraphy licence ("the Licence") to

UK Broadband Limited
(Company Registration number: 04713634)
("the Licensee")
Great Brighams Mead
Vastern Road
Reading
Berkshire
RG1 8DJ

to establish, install and use wireless telegraphy stations and/or wireless telegraphy apparatus as described in the schedule to this Licence (together "the Radio Equipment") subject to the terms set out below.

Licence term

2. This Licence shall continue in force until revoked by Ofcom or surrendered by the Licensee.

Licence variation and revocation

3. Pursuant to schedule 1, paragraph 8 of the Wireless Telegraphy Act 2006 (the "Act"), Ofcom may not revoke this Licence under schedule 1, paragraph 6 of the Act except:

(a) at the request, or with the consent, of the Licensee;

(b) if there has been a breach of any of the terms of this Licence;

(c) in accordance with schedule 1 paragraph 8(5) of the Act;

(d) if it appears to Ofcom to be necessary or expedient to revoke the Licence for the purpose of complying with a direction by the Secretary of State given to Ofcom under section 5 of the Act or section 5 of the Communications Act 2003;

(e) if, in connection with the transfer or proposed transfer of rights and obligations arising by virtue of the Licence, there has been a breach of any provision of regulations made by Ofcom under the powers conferred by section 30 of the Act[28];

(f) for reasons related to the management of the radio spectrum, provided that in such case the power to revoke may only be exercised after at least five years' notice is given in writing (such notice period must not expire before 11 April 2038); or

[28] These are regulations on spectrum trading.

(g) if the Licensee has been found to the reasonable satisfaction of Ofcom to have been involved in any act, or omission of any act, constituting a breach of any award regulations associated with the frequencies permitted in this licence ("the Regulations").

4. Ofcom may only revoke or vary this Licence by notification in writing to the Licensee and in accordance with schedule 1, paragraphs 6, 6A and 7 of the Act.

Transfer

5. This Licence may not be transferred. The transfer of rights and obligations arising by virtue of this Licence may however be authorised in accordance with regulations made by Ofcom under powers conferred by section 30 of the Act[29].

Changes to the Licensee Details

6. The Licensee shall give prior notice to Ofcom in writing of any proposed change to the Licensee's name and address as recorded in paragraph 1 of this Licence.

Fees

7. From 12 April 2038 ~~T~~the Licensee shall each year pay to Ofcom the relevant fee as provided under section 12 of the Act and regulations made thereunder on or before the fee payment date shown above, or on or before such dates as shall be notified in writing to the Licensee.

8. The Licensee shall also pay interest to Ofcom on any amount which is due to Ofcom under the terms of this Licence or provided for in any regulations made by Ofcom under sections 12 or 13(2) of the Act from the date such amount falls due until the date of payment, at the then applicable Bank of England base rate. In accordance with section 15 of the Act any such amount and any such interest is recoverable by Ofcom.

9. If the Licence is surrendered, revoked or varied, no refund, whether in whole or in part, of any amount which is due under the terms of this Licence, payable in accordance with the Regulations, or provided for in any regulations made by Ofcom under sections 12 and 13(2) of the Act will be made, except at the absolute discretion of Ofcom.

Radio equipment use

10. The Licensee shall ensure that the Radio Equipment is established, installed and used only in accordance with the provisions specified in the schedules to this Licence. Any proposal to amend any detail specified in any of the schedules to this Licence must be agreed with Ofcom in advance and implemented only after this Licence has been varied or reissued accordingly.

11. The Licensee shall ensure that the Radio Equipment is operated in compliance with the terms of this Licence and is used only by persons who have been authorised in writing by the Licensee to do so and that such persons are made aware of, and of the requirement to comply with, the terms of this Licence.

12. The Licensee must ensure that all Radio Equipment is established, installed, modified and used only in accordance with the provisions specified in schedule 2 (EMF Licence Condition) of this Licence.

[29] See Ofcom's website for the latest position on spectrum trading and the types of trade which are permitted.

Access and inspection

13. The Licensee shall permit a person authorised by Ofcom:

    (a) to have access to the Radio Equipment; and

    (b) to inspect this Licence and to inspect, examine and test the Radio Equipment,

    at any and all reasonable times or, when in the opinion of that person an urgent situation exists, at any time, to ensure the Radio Equipment is being used in accordance with the terms of this Licence.

Modification, restriction and closedown

14. Any person authorised by Ofcom may require the Radio Equipment or any part thereof, to be modified or restricted in use, or temporarily or permanently closed down immediately if in the opinion of the person authorised by Ofcom:

    (a) a breach of a term of the Licence has occurred; and/or

    (b) the use of the Radio Equipment is, or may be, causing or contributing to undue interference to the use of other authorised radio equipment.

15. Ofcom may require any of Radio Equipment to be modified or restricted in use, or temporarily closed down either immediately or on the expiry of such period as may be specified in the event of a national or local state of emergency being declared. Ofcom may only exercise this power after a written notice has been served on the Licensee or a general notice applicable to holders of a named class of licence has been published.

Geographical boundaries

16. Subject to the requirements of any coordination procedures notified to the Licensee pursuant to schedule 1 to this Licence, and excluding the areas set out in paragraph 17 of this Licence, the Licensee is authorised to establish, install and use the Radio Equipment in the United Kingdom. (The Licensee is not authorised to establish, install and use the Radio Equipment in the Channel Islands or the Isle of Man).

17. The areas excluded from this licence are the territorial sea and any inland waters adjacent to the territorial sea, but in the case of streams, rivers or other watercourses which form part of such inland waters they are only excluded where such stream, river or watercourse is more than 2km wide.

Interpretation

18. In this Licence:

(a) the establishment, installation and use of the Radio Equipment shall be interpreted as establishment and use of wireless telegraphy stations and installation and use of wireless telegraphy apparatus as specified in section 8(1) of the Act;

(b) the expression “interference” shall have the meaning given by section 115 of the Act;

(c) the expressions “wireless telegraphy station” and “wireless telegraphy apparatus” shall have the meanings given by section 117 of the Act;

(d) the expression “territorial sea” shall be determined in accordance with the Territorial Sea Act 1987;

(e) the expression “inland waters” shall have the meaning given by section 221(1) of the Water Resources Act 1991;

(f) the schedules form part of this Licence together with any subsequent schedule(s) which Ofcom may issue as a variation to this Licence at a later date; and

(g) the Interpretation Act 1978 shall apply to this Licence as it applies to an Act of Parliament.

Issued by Ofcom

Office of Communications

SCHEDULE 1 TO LICENCE NUMBER: ~~1197663~~ TBC

Schedule Date: 18 May 2021

Licence Category: Spectrum Access 3.~~5~~4 GHz

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 2097: Terrestrial systems capable of providing electronic communications services in the 3.4 to 3.8 GHz 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 10m resolution;

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

iv) radio frequencies which the Radio Equipment uses; and

v) Transmitted power expressed in dBm / 5 MHz EIRP per cell for non-AAS Radio Equipment; and

vi) Transmitted power expressed in dBm / 5 MHz TRP per cell for AAS Radio Equipment.

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)(i), (ii) and (iii) of this schedule shall not apply in respect of femtocell equipment and smart/intelligent low power repeater equipment.

(c) The conditions relating to the keeping of records contained in paragraph 3(a) of this schedule shall not apply in respect of licence exempt radio equipment.

(d) 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.

(e) The Licensee shall submit to Ofcom in such manner and within such period as specified by Ofcom, such other information in relation to the Radio Equipment, or any wireless telegraphy station or wireless telegraphy apparatus which the Licensee is planning to use, as Ofcom may from time to time request. Such information may include, but is not limited to, information in relation to the radio frequency, transmitted power and date of first use for wireless telegraphy stations or wireless telegraphy apparatus to be established, installed or used within such timeframe and in such areas as Ofcom may reasonably request.

Coordination at frequency and geographical boundaries

4. The Licensee shall ensure that the Radio Equipment is operated in compliance with such coordination procedures as may be notified to the Licensee by Ofcom from time to time.

International cross-border coordination

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

Cooperation between Licensees

6. In addition to complying with the specific transmission terms, conditions and limitations set out in this Licence, the Licensee must liaise and co-operate with other holders of licences in the 3410 MHz – 3800 MHz band (if necessary adjusting transmission power and other technical parameters of transmission) in such a way that harmful interference is not caused by one network deployment to that of another Licensee within the band.

Permitted Frequency Blocks

7. The Radio Equipment may only transmit within the following frequency bands (the "Permitted Frequency Blocks"):

3480 - 3500 MHz
3580 - 3600 MHz

Maximum power within the Permitted Frequency Blocks

8. Subject to any more restrictive limitations imposed by the coordination requirements notified by Ofcom in accordance with paragraphs 4 and 5 of this schedule, the power transmitted in the Permitted Frequency Blocks shall not exceed:

Radio Equipment	Maximum mean power
non-AAS base station[a]	65 dBm / 5 MHz EIRP per cell
AAS base station[a]	44 dBm / 5 MHz TRP per cell
Mobile or nomadic terminal station[b]	28 dBm TRP
Fixed or installed terminal station[b]	35 dBm / 5 MHz EIRP

[a] For femtocell base stations, power control must be applied to minimise interference to adjacent channels.
[b] 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

9. When transmitting, the Licensee must either transmit in accordance with the condition in paragraph (a) or in accordance with the condition in paragraph (b) –

(a) The condition referred to is that the Licensee must transmit within the limits of the Permissive Transmission Mask and, if doing so, the Licensee must also transmit within the limits of transmission Frame Structure A.

(b) The condition referred to is that the Licensee must transmit within the limits of the Restrictive Transmission Mask, and, if doing so, it must also transmit and within the limits of transmission Frame Structure B.

10. The Permissive Transmission Mask means that –

for transmissions on the downlink frequencies, the maximum mean EIRP or TRP emanating from the Radio Equipment transmissions at any frequency outside the Permitted Frequency Blocks, but within 3410 – 3800 MHz, shall not exceed the following transitional and baseline requirements:

	Non-AAS dBm / 5 MHz EIRP per antenna	AAS dBm / 5 MHz TRP per cell	
-5 to 0 MHz offset from lower block edge 0 to 5 MHz offset from upper block edge	Min(PMax – 40, 21)	Min(PMax’ – 40, 16)	
-10 to -5 MHz offset from lower block edge 5 to 10 MHz offset from upper block edge	Min(PMax – 43, 15)	Min(PMax’ – 43, 12)	
Out of block baseline power limit (BS) < -10 MHz offset from lower block edge > 10 MHz offset from upper block edge	Min(PMax – 43, 13)	Min(PMax’ – 43, 1)	

11. The Restrictive Transmission Mask means that –

for transmissions on the downlink frequencies, the EIRP emanating from the Radio Equipment transmissions at any frequency outside the Permitted Frequency Blocks, but within 3410 – 3800 MHz, shall not exceed the following baseline:

	non-AAS dBm / 5 MHz EIRP per cell*	AAS dBm / 5 MHz TRP per cell
Out of block baseline power limit (BS)	- 34	-43

12. Frame Structure A (also known as the “Preferred Frame Structure”) means that:

(a) transmissions from the Licensee’s base stations have a frame structure as shown in Figure 1. Timeslots (or subframes) 0, 2 to 5 and 7 to 9 must be allocated to Downlink (D) or Uplink (U) transmissions as indicated or may be left with no transmissions;

(b) the Licensee must ensure that the special subframe (S) in timeslots 1 and 6 have a structure that is compatible with TD-LTE special subframe configuration 6, also known as 9:3:2 (DwPTS: GP: UpPTS). For the avoidance of doubt, a special subframe structure is compatible where there are no uplink transmissions within the downlink pilot timeslot (DwPTS) or guard period (GP) and no downlink transmissions within the uplink pilot timeslot (UpPTS) or guard period (GP);

(c) timeslots must have a duration of 1 millisecond;

(d) the Licensee shall ensure that frames start at a common reference time so that all licensees’ frames are aligned and transmissions synchronised;

Note: TD-LTE frame configuration 2 (3:1) is compatible with this frame structure, as are some 5G NR frame configurations. Other technologies are permitted provided that the requirements of 12(a) to 12(d) are met.

13. Frame Structure B (also known as the “Compatible Frame Structure”) means that:

(a) transmissions from the Licensee’s base stations must have a frame structure as shown in Figure 2. Timeslots (or subframes) 0 and 2 must be allocated to Downlink (D), or Uplink (U) transmissions as indicated;

(b) the Licensee must ensure that the special subframe (S) in timeslot 1 has a structure that is compatible with TD-LTE special subframe configuration 6, also known as 9:3:2 (DwPTS: GP: UpPTS). For the avoidance of doubt, a special subframe structure is compatible where there are no uplink transmissions within the downlink pilot timeslot (DwPTS) or guard period (GP) and no downlink transmissions within the uplink pilot timeslot (UpPTS) or guard period (GP);

(c) timeslots must have a duration of 1 millisecond;

(d) the Licensee shall ensure that frames start at a common reference time so that all licensees’ frames are aligned and transmissions synchronised;

(e) timeslots with no transmission indicated may have no transmission or must be determined as a Downlink, Uplink or Special subframe as necessary in order to ensure compliance with paragraph 13(c) and 13(f);

(f) the Licensee must cooperate to minimise harmful sub-frame overlaps if different technologies are used. On rare occasions this may require the frame alignment or guard period to be slightly offset;

(g) for the avoidance of doubt all-downlink frame structures such as Supplementary Downlink (SDL) are not permitted.

Note: all current TD-LTE frame configurations are compatible with this frame structure, as are some 5G NR frame configurations. Other technologies are permitted provided that the requirements of 13(a) to 13(d) are met.

Figure 1: Frame Structure A

DL/UL ratio	Subframe number									
	0	1	2	3	4	5	6	7	8	9
3:1	D	S	U	D	D	D	S	U	D	D

Figure 2: Frame Structure B

DL/UL ratio	Subframe number									
	0	1	2	3	4	5	6	7	8	9
Any	D	S	U							

14. Irrespective of whether the Restrictive Transmission Mask or the Permissive Transmission Mask is being used, the EIRP or TRP emanating from the Radio Equipment transmissions at any frequency outside the Permitted Frequency Blocks shall not exceed the following additional band edge requirements:

	Non-AAS *dBm / MHz*[a] *EIRP per antenna*	AAS *dBm / MHz*[a] *TRP per cell*
Below 3390 MHz	-50	-52

[a] We note this level is defined in the Commission Decision 2019/235/EC as per MHz rather than per 5 MHz

	Non-AAS *dBm / 5 MHz EIRP per antenna*	AAS *dBm / 5 MHz TRP per cell*
3390 – 3400 MHz	Min(PMax – 43, 13)	Min(PMax' – 43, 1)
3400 – 3405 MHz	Min(PMax – 43, 15)	Min(PMax' – 43, 12)
3405 – 3410 MHz	Min(PMax – 40, 21)	Min(PMax' – 40, 16)
3800 – 3805 MHz	Min(PMax – 40, 21)	Min(PMax' – 40, 16)
3805 – 3810 MHz	Min(PMax – 43, 15)	Min(PMax' – 43, 12)
3810 – 3840 MHz	Min(PMax – 43, 13)	Min(PMax' – 43, 1)
Above 3840 MHz	-2	-14

Small Cells

15. The Licensee is required to comply with the Permissive Transmission Mask as set out in paragraph 10 of this schedule but is not required to comply with the frame structure requirements set out in paragraphs 12 or 13 above, for:

(a) Indoor Domestic Small Cells; or

(b) Indoor Non-domestic Small Cells, except where another licensee demonstrates that they are suffering harmful interference as a result.

If another licensee demonstrates that they are suffering harmful interference as a result of an Indoor Non-domestic Small Cell, the Indoor Non-domestic Small Cell must comply with the requirements set out in paragraphs 9 and 12 above, where Frame Structure A is used or those requirements set out in both paragraphs 9 and 13 above where Frame Structure B is used.

Interpretation of terms in this schedule

16. In this schedule:

(a) “5G NR” means 5G New Radio and refers to the air interface that has been developed by 3GPP for fifth generation (5G) mobile radio networks. This air interface defines how 5G base stations and user devices both transmit and receive radio signals using spectrum;

(b) “AAS” means active antenna system. An AAS is a base station and antenna system where the amplitude and / or phase between antenna elements is continually adjusted resulting in an antenna pattern that varies in response to short term changes in the radio environment. This is not intended to include long term beam shaping such as fixed electrical down tilt. In AAS base stations the antenna system is integrated as part of the base station system or product;

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

(d) “Downlink” means transmissions from a base station to a terminal station (handset);

(e) “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), measured during the “on” part of the transmission;

(f) “femtocell” means a base station 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;

(g) “Fixed or installed” means used or installed at specific fixed points;

(h) Indoor” means a location inside a building or place in which the shielding will typically provide the necessary attenuation to protect wireless telegraphy against harmful interference;

(i) “Indoor Domestic Small Cell” means a base station with an EIRP of less than or equal to 24dBm per 20 MHz carrier that is located within a residential property;

(j) “Indoor Non-domestic Small Cell” means a base station with an EIRP of less than or equal to 24dBm per 20 MHz carrier that is located indoors but not within a residential property;

(k) "IR" means a United Kingdom Radio Interface Requirement notified by Ofcom in accordance with Article 8 of Directive 2014/53/EU of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment (known as the Radio Equipment Directive);

(l) “lower block edge” means, in relation to each Permitted Frequency Block, the lowest frequency in that Permitted Frequency Block;

(m) “mobile or nomadic” means intended to be used while in motion or during halts at unspecified points;

(n) “non-AAS” means a piece of Radio Equipment which is not an AAS;

(o) “per antenna” means per radiating unit/component (irrespective of the number of radiating elements that make up that unit/component);

(p) “per cell” means per specific piece of Radio Equipment. For a multi-sector base station, per cell refers to each one of the individual sectors irrespective of the number of transmit antennas;

(q) “Permitted Frequency Blocks” has the meaning given to it in paragraph 7 of this schedule;

(r) “PMax” is the maximum mean power for the base station in question if it is using a non-AAS. This is measured as EIRP per carrier and determined on a per antenna basis;

(s) “PMax’” is the maximum mean power for the base station in question if it is using an AAS. This is measured as TRP per carrier and determined on a per cell basis;

(t) “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 timeslot when actively carrying a call (voice, video or data) or signalling from serviced handsets.

(u) “TDD” means the application of time-division multiplexing to separate uplink and downlink signals;

(v) “TD-LTE” means the TDD variant of LTE (Long Term Evolution or 4G technology);

(w) “TRP” means the total radiated power. This is the integral of the power transmitted in different directions over the entire radiation sphere, measured during the on part of the transmission;

(x) “Uplink” means transmissions from a terminal station (handset) to a base station; and

(y) “upper block edge” means, in relation to each Permitted Frequency Block, the highest frequency in that Permitted Frequency Block.

SCHEDULE 2 TO LICENCE NUMBER: ~~1197663~~ TBC

EMF Licence Condition

Schedule Date: **18 May 2021**

Licence category: **Spectrum Access 3.~~5~~4 GHz**

Sites which are not shared with another licensee

1. The Licensee shall only establish, install, modify or use Relevant Radio Equipment if the total electromagnetic field exposure levels produced by the Licensee's On-Site Radio Equipment do not exceed the basic restrictions[30] in the relevant tables for general public exposure identified in the ICNIRP Guidelines[31] in any area where a member of the general public is or can be expected to be present when transmissions are taking place.

Sites which are shared with another licensee

2. In the case of a shared site where the Shared Site Exemption applies to the Licensee, the Licensee shall comply with paragraph 1 above.

3. In the case of a shared site where the Shared Site Exemption does not apply to the Licensee, the Licensee shall only establish, install, modify or use the Relevant Radio Equipment if:

   (a) the total electromagnetic field exposure levels produced by the Licensee's On-Site Radio Equipment, together with

   (b) the total electromagnetic field exposure levels produced by all other wireless telegraphy stations and wireless telegraphy apparatus operated by another licensee on the same site for which the Licensee can reasonably assume that a Shared Site Exemption does not apply,

   do not exceed the basic restrictions[32] in the relevant tables for general public exposure identified in the ICNIRP Guidelines[33] in any area where a member of the general public is or can be expected to be present when transmissions are taking place.

Emergency Situations

4. The obligations in paragraphs 1, 2 and 3 above will not apply if the Relevant Radio Equipment is being used for the purpose of seeking emergency assistance or reporting and responding to an emergency situation (in the vicinity of that situation) including for search and rescue activities and maritime emergency communications[34].

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[30] Compliance with the reference levels for general public exposure identified in the ICNIRP Guidelines will ensure compliance with the basic restrictions.
[31] The relevant tables for general public exposure are identified in Ofcom's "Guidance on EMF Compliance and Enforcement".
[32] Compliance with the reference levels for general public exposure identified in the ICNIRP Guidelines will ensure compliance with the basic restrictions.
[33] The relevant tables for general public exposure are identified in Ofcom's "Guidance on EMF Compliance and Enforcement".
[34] Further information on emergency situations in set out in Ofcom's "Guidance on EMF Compliance and Enforcement".

Relationship with authorised transmission levels

5. The Licensee shall comply with paragraphs 1, 2 and 3 above notwithstanding the maximum transmission levels authorised in the Licence.

Records

6. The Licensee shall keep, or shall procure that a third party shall keep, and shall make available to Ofcom on request, records (including the type of records identified in Ofcom's "Guidance on EMF Compliance and Enforcement") that demonstrate how it has complied with paragraphs 1, 2 and 3 above when Relevant Radio Equipment is established, installed, modified or used.

Ofcom's "Guidance on EMF Compliance and Enforcement"

7. When evaluating its compliance with paragraphs 1, 2 and 3 above, the Licensee shall take into account Ofcom's "Guidance on EMF Compliance and Enforcement" that is in force at the relevant time.

Interpretation

8. In this schedule:

(a) **"dBi"** means the ratio in dB (decibel) when comparing the gain of the antenna to the gain of an isotropic antenna. An isotropic antenna is a theoretical antenna which radiates power uniformly in all directions;

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

(c) **"ERP"** means effective radiated power which is the product of the power supplied to an antenna and its gain in a given direction relative to a half-wave dipole;

(d) "**general public**" means any person who is not: (a) the Licensee, owner, operator or installer of the Relevant Radio Equipment; or (b) acting under a contract of employment or otherwise acting for purposes connected with their trade, business or profession or the performance by them of a public function;[35]

(e) **"ICNIRP Guidelines"** means the version of the Guidelines published by the International Commission on Non-Ionizing Radiation Protection for limiting exposure to electromagnetic fields which are identified in Ofcom's "Guidance on EMF Compliance and Enforcement" that is in force at the relevant time.[36]

(f) **"Licensee's On-Site Radio Equipment"** means the Relevant Radio Equipment and any other wireless telegraphy station(s) and wireless telegraphy apparatus on the same site which transmits at powers higher than 10 Watts EIRP or 6.1 Watts ERP.[37]

(g) **"Relevant Radio Equipment"** means all the Radio Equipment that is authorised by this Licence to transmit at powers higher than 10 Watts EIRP or 6.1 Watts ERP.

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[35] There is pre-existing health and safety legislation which already requires employers to protect workers from exposure to electromagnetic fields ("EMF") including the following legislation specifically relating to EMF (as amended from time to time): The Control of Electromagnetic Fields at Work Regulations 2016, The Control of Electromagnetic Fields at Work Regulations (Northern Ireland) 2016 and The Merchant Shipping and Fishing Vessels (Health and Safety at Work) (Electromagnetic Fields) Regulations 2016.

[36] Ofcom's "Guidance on EMF Compliance and Enforcement" will initially require the Licensee to comply with the ICNIRP Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz), published in: Health Physics 74(4):494-522, dated April 1998 and available at: https://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf ("1998 Guidelines") or the ICNIRP Guidelines for limiting exposure to electromagnetic fields (100 KHz to 300 GHz), published in: Health Physics 118(5): 483–524; 2020 and available at: https://www.icnirp.org/cms/upload/publications/ICNIRPrfgdl2020.pdf ("2020 Guidelines"). However, once work on the relevant standards explaining the methodology for assessing compliance with the 2020 Guidelines has progressed sufficiently, Ofcom will publish a public consultation on updating its "Guidance on EMF Compliance and Enforcement" to explain that going forward Ofcom will be requiring the Licensee to comply with the 2020 Guidelines only. Following this public consultation, Ofcom will publish an updated version of Ofcom's "Guidance on EMF Compliance and Enforcement" on its website. Ofcom will follow the same process for any subsequent versions of the ICNIRP Guidelines.

[37] 10 Watts EIRP is equivalent to 6.1 Watts ERP. In linear units EIRP (W) = 1.64 x ERP (W); in decibels EIRP (dB) = ERP (dB) + 2.15. Ofcom's "Guidance on EMF Compliance and Enforcement" explains how the Licensee can determine if wireless telegraphy station(s) or wireless telegraphy apparatus "transmits at powers higher than 10 Watts EIRP or 6.1 Watts ERP".

(h) **"Shared Site Exemption"** means any of the following three situations apply on a shared site in relation to the Licensee's or another licensee's wireless telegraphy station(s) or wireless telegraphy apparatus that is authorised to transmit at powers higher than 10 Watts EIRP or 6.1 Watts ERP:

- The first situation is that all of the licensee's wireless telegraphy station(s) or wireless telegraphy apparatus on a shared site do not transmit at a combined total radiated power in any particular direction[38] that is higher than 100 Watts EIRP or 61 Watts ERP;[39]
- The second situation is that the total electromagnetic field exposure levels produced by the licensee's wireless telegraphy station(s) or wireless telegraphy apparatus in any area where a member of the general public is or can be expected to be present when transmissions are taking place is no more than 5% of the basic restrictions or 5% of the reference levels in the relevant tables for general public exposure identified in the ICNIRP Guidelines;[40]
- The third situation is where the licensee's wireless telegraphy station or wireless telegraphy apparatus has an antenna gain that is equal to or higher than 29 dBi and has a fixed beam;

(i) **"shared site"** means a site that is shared by the Licensee and at least one other licensee for the purposes of establishing, installing, modifying or using wireless telegraphy stations or wireless telegraphy apparatus;

(j) **"site"** means a physical structure, building, vehicle or moving platform;

(k) **"wireless telegraphy apparatus"** has the meaning given to it in section 117 of the Wireless Telegraphy Act 2006; and

(l) **"wireless telegraphy station"** has the meaning given to it in section 117 of the Wireless Telegraphy Act 2006.

Ofcom

[38] For the purpose of this situation, the combined total radiated power is a simple sum of the radiated powers (in EIRP or ERP) of all of the licensee's wireless telegraphy station(s) or wireless telegraphy apparatus on the shared site that transmits signals covering the same or overlapping areas.

[39] 100 Watts EIRP is equivalent to 61 Watts ERP.

[40] The relevant tables for general public exposure are identified in Ofcom's "Guidance on EMF Compliance and Enforcement".

Draft UKB 3.6 GHz licence

Starts on next page

Office of Communications (Ofcom)
Wireless Telegraphy Act 2006

SPECTRUM ACCESS 3.6 GHz

This licence document replaces the version of the Licence issued by Ofcom on 25 June 2019 to UK Broadband Limited.

Licence no.: ~~**0823615**~~ **TBC**
Date of issue: **18 May 2021**
Fee Payment Date: ~~**31 December**~~ **27 April** (annually from 2041)

1. The Office of Communications (Ofcom) grants this wireless telegraphy licence ("the Licence") to

UK Broadband Limited
(Company Reg No: 4713634)
("the Licensee")
Great Brighams Mead
Vastern Road
Reading
Berkshire
RG1 8DJ

to establish, install and use wireless telegraphy stations and/or wireless telegraphy apparatus as described in the schedule to this Licence (together "the Radio Equipment") subject to the terms set out below.

Licence term

2. This Licence shall continue in force until revoked by Ofcom or surrendered by the Licensee.

Licence variation and revocation

3. Pursuant to schedule 1, paragraph 8 of the Wireless Telegraphy Act 2006 (the "Act"), Ofcom may not revoke this Licence under schedule 1, paragraph 6 of the Act except:

(a) at the request, or with the consent, of the Licensee;

(b) if there has been a breach of any of the terms of this Licence;

(c) in accordance with schedule 1 paragraph 8(5) of the Act;

(d) if it appears to Ofcom to be necessary or expedient to revoke the Licence for the purpose of complying with a direction by the Secretary of State given to Ofcom under section 5 of the Act or section 5 of the Communications Act 2003;

(e) if, in connection with the transfer or proposed transfer of rights and obligations arising by virtue of the Licence, there has been a breach of any provision of

regulations made by Ofcom under the powers conferred by section 30 of the Act[41];

(f) for reasons related to the management of the radio spectrum, provided that in such case the power to revoke may only be exercised after at least five years' notice is given in writing (such notice period must not expire before 26 April 2041).

4. Ofcom may only revoke or vary this Licence by notification in writing to the Licensee and in accordance with schedule 1, paragraphs 6, 6A and 7 of the Act.

Transfer

5. This Licence may not be transferred. The transfer of rights and obligations arising by virtue of this Licence may however be authorised in accordance with regulations made by Ofcom under powers conferred by section 30 of the Act[42].

Changes to the Licensee Details

6. The Licensee shall give prior notice to Ofcom in writing of any proposed change to the Licensee's name and address as recorded in paragraph 1 of this Licence.

~~Spectrum Leasing~~

~~The Licensee may:~~

~~confer the benefit of the Licence (which is hereinafter referred to as a "lease") on another person (referred to as the "leaseholder") in respect of any wireless telegraphy station or wireless telegraphy apparatus to which the Licence relates;~~

~~in his contract with the leaseholder permit the leaseholder to confer the benefit of the Licence (hereinafter referred to as "sub-lease") on any other person ("sub-leaseholder"),~~

~~provided that the conditions set out in schedule 3 to this Licence are met.~~

Fees

7. From 27 April 2041 ~~T~~the Licensee shall each year pay to Ofcom the relevant fee as provided under section 12 of the Act and regulations made thereunder on or before the fee payment date shown above, or on or before such dates as shall be notified in writing to the Licensee.

8. The Licensee shall also pay interest to Ofcom on any amount which is due to Ofcom under the terms of this Licence or provided for in any regulations made by Ofcom under sections 12 or 13(2) of the Act from the date such amount falls due until the date of payment, at the then applicable Bank of England base rate. In accordance

[41] These are regulations on spectrum trading.
[42] See Ofcom's website for the latest position on spectrum trading and the types of trade which are permitted.

with section 15 of the Act any such amount and any such interest is recoverable by Ofcom.

9. If the Licence is surrendered, revoked or varied, no refund, whether in whole or in part, of any amount which is due under the terms of this Licence, payable in accordance with the Regulations, or provided for in any regulations made by Ofcom under sections 12 and 13(2) of the Act will be made, except at the absolute discretion of Ofcom.

Radio equipment use

10. The Licensee shall ensure that the Radio Equipment is established, installed and used only in accordance with the provisions specified in the schedules to this Licence. Any proposal to amend any detail specified in any of the schedules to this Licence must be agreed with Ofcom in advance and implemented only after this Licence has been varied or reissued accordingly.

11. The Licensee shall ensure that the Radio Equipment is operated in compliance with the terms of this Licence and is used only by persons who have been authorised in writing by the Licensee to do so and that such persons are made aware of, and of the requirement to comply with, the terms of this Licence.

12. The Licensee must ensure that all Radio Equipment is established, installed, modified and used only in accordance with the provisions specified in schedule 4 (EMF Licence Condition) of this Licence.

Access and inspection

13. The Licensee shall permit a person authorised by Ofcom:

    (a) to have access to the Radio Equipment; and

    (b) to inspect this Licence and to inspect, examine and test the Radio Equipment,

    at any and all reasonable times or, when in the opinion of that person an urgent situation exists, at any time, to ensure the Radio Equipment is being used in accordance with the terms of this Licence.

Modification, restriction and closedown

14. Any person authorised by Ofcom may require the Radio Equipment or any part thereof, to be modified or restricted in use, or temporarily or permanently closed down immediately if in the opinion of the person authorised by Ofcom:

    (a) a breach of a term of the Licence has occurred; and/or

    (b) the use of the Radio Equipment is, or may be, causing or contributing to undue interference to the use of other authorised radio equipment.

15. Ofcom may require any of Radio Equipment to be modified or restricted in use, or temporarily closed down either immediately or on the expiry of such period as may

be specified in the event of a national or local state of emergency being declared. Ofcom may only exercise this power after a written notice has been served on the Licensee or a general notice applicable to holders of a named class of licence has been published.

Geographical boundaries

16. Subject to the requirements of any coordination procedures notified to the Licensee pursuant to schedule 1 to this Licence, and excluding the areas set out in paragraph 17 of this Licence, the Licensee is authorised to establish, install and use the Radio Equipment in the United Kingdom. (The Licensee is not authorised to establish, install and use the Radio Equipment in the Channel Islands or the Isle of Man).

17. The areas excluded from this licence are the territorial sea and any inland waters adjacent to the territorial sea, but in the case of streams, rivers or other watercourses which form part of such inland waters they are only excluded where such stream, river or watercourse is more than 2km wide.

Interpretation

18. In this Licence:

(a) the establishment, installation and use of the Radio Equipment shall be interpreted as establishment and use of wireless telegraphy stations and installation and use of wireless telegraphy apparatus as specified in section 8(1) of the Act;

(b) the expression “interference” shall have the meaning given by section 115 of the Act;

(c) the expressions “wireless telegraphy station” and “wireless telegraphy apparatus” shall have the meanings given by section 117 of the Act;

(d) the expression “territorial sea” shall be determined in accordance with the Territorial Sea Act 1987;

(e) the expression “inland waters” shall have the meaning given by section 221(1) of the Water Resources Act 1991;

(f) the schedules form part of this Licence together with any subsequent schedule(s) which Ofcom may issue as a variation to this Licence at a later date; and

(g) the Interpretation Act 1978 shall apply to this Licence as it applies to an Act of Parliament.

Issued by Ofcom

Office of Communications

SCHEDULE 1 TO LICENCE NUMBER: ~~0823615~~ TBC

Schedule Date: 18 May 2021

Licence Category: Spectrum Access 3.6 GHz

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 2097: Terrestrial systems capable of providing electronic communications services in the 3.4 to 3.8 GHz 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 10m resolution;

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

iv) radio frequencies which the Radio Equipment uses; and

v) Transmitted power expressed in dBm / 5 MHz EIRP per cell for non-AAS Radio Equipment; and

vi) Transmitted power expressed in dBm / 5 MHz TRP per cell for AAS Radio Equipment.

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)(i), (ii) and (iii) of this schedule shall not apply in respect of femtocell equipment and smart/intelligent low power repeater equipment.

(c) The conditions relating to the keeping of records contained in paragraph 3(a) of this schedule shall not apply in respect of licence exempt radio equipment.

(d) 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.

(e) The Licensee shall submit to Ofcom in such manner and within such period as specified by Ofcom, such other information in relation to the Radio Equipment, or any wireless telegraphy station or wireless telegraphy apparatus which the Licensee is planning to use, as Ofcom may from time to time request. Such information may include, but is not limited to, information in relation to the radio frequency, transmitted power and date of first use for wireless telegraphy stations or wireless telegraphy apparatus to be established, installed or used within such timeframe and in such areas as Ofcom may reasonably request.

Coordination at frequency and geographical boundaries

4. The Licensee shall ensure that the Radio Equipment is operated in compliance with such coordination procedures as may be notified to the Licensee by Ofcom from time to time.

International cross-border coordination

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

Cooperation between Licensees

6. In addition to complying with the specific transmission terms, conditions and limitations set out in this Licence, the Licensee must liaise and co-operate with other holders of licences in the 3410 MHz – 3800 MHz band (if necessary adjusting transmission power and other technical parameters of transmission) in such a way that harmful interference is not caused by one network deployment to that of another Licensee within the band.

Permitted Frequency Blocks

7. The Radio Equipment may only transmit within the following frequency bands (the "Permitted Frequency Blocks"):

3600 - 3680 MHz

Maximum power within the Permitted Frequency Blocks

8. Subject to any more restrictive limitations imposed by the coordination requirements notified by Ofcom in accordance with paragraphs 4 and 5 of this schedule, the power transmitted in the Permitted Frequency Blocks shall not exceed:

Radio Equipment	Maximum mean power
non-AAS base station[a]	65 dBm / 5 MHz EIRP per cell
AAS base station[a]	44 dBm / 5 MHz TRP per cell
Mobile or nomadic terminal station[b]	28 dBm TRP
Fixed or installed terminal station[b]	35 dBm / 5 MHz EIRP

[a] For femtocell base stations, power control must be applied to minimise interference to adjacent channels.
[b] 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

9. When transmitting, the Licensee must either transmit in accordance with the condition in paragraph (a) or in accordance with the condition in paragraph (b) –

(a) The condition referred to is that the Licensee must transmit within the limits of the Permissive Transmission Mask and, if doing so, the Licensee must also transmit within the limits of transmission Frame Structure A.

(b) The condition referred to is that the Licensee must transmit within the limits of the Restrictive Transmission Mask, and, if doing so, it must also transmit and within the limits of transmission Frame Structure B.

10. The Permissive Transmission Mask means that –

for transmissions on the downlink frequencies, the maximum mean EIRP or TRP emanating from the Radio Equipment transmissions at any frequency outside the Permitted Frequency Blocks, but within 3410 – 3800 MHz, shall not exceed the following transitional and baseline requirements:

	Non-AAS dBm / 5 MHz EIRP per antenna	AAS dBm / 5 MHz TRP per cell	
-5 to 0 MHz offset from lower block edge 0 to 5 MHz offset from upper block edge	Min(PMax – 40, 21)	Min(PMax' – 40, 16)	
-10 to -5 MHz offset from lower block edge 5 to 10 MHz offset from upper block edge	Min(PMax – 43, 15)	Min(PMax' – 43, 12)	
Out of block baseline power limit (BS) < -10 MHz offset from lower block edge	Min(PMax – 43, 13)	Min(PMax' – 43, 1)	

> 10 MHz offset from upper block edge			

11. The Restrictive Transmission Mask means that –

for transmissions on the downlink frequencies, the EIRP emanating from the Radio Equipment transmissions at any frequency outside the Permitted Frequency Blocks, but within 3410 – 3800 MHz, shall not exceed the following baseline:

	non-AAS dBm / 5 MHz EIRP per cell*	AAS dBm / 5 MHz TRP per cell
Out of block baseline power limit (BS)	- 34	-43

12. Frame Structure A (also known as the “Preferred Frame Structure”) means that:

(a) transmissions from the Licensee’s base stations have a frame structure as shown in Figure 1. Timeslots (or subframes) 0, 2 to 5 and 7 to 9 must be allocated to Downlink (D) or Uplink (U) transmissions as indicated or may be left with no transmissions;

(b) the Licensee must ensure that the special subframe (S) in timeslots 1 and 6 have a structure that is compatible with TD-LTE special subframe configuration 6, also known as 9:3:2 (DwPTS: GP: UpPTS). For the avoidance of doubt, a special subframe structure is compatible where there are no uplink transmissions within the downlink pilot timeslot (DwPTS) or guard period (GP) and no downlink transmissions within the uplink pilot timeslot (UpPTS) or guard period (GP);

(c) timeslots must have a duration of 1 millisecond;

(d) the Licensee shall ensure that frames start at a common reference time so that all licensees’ frames are aligned and transmissions synchronised;

Note: TD-LTE frame configuration 2 (3:1) is compatible with this frame structure, as are some 5G NR frame configurations. Other technologies are permitted provided that the requirements of 12(a) to 12(d) are met.

13. Frame Structure B (also known as the “Compatible Frame Structure”) means that:

(a) transmissions from the Licensee’s base stations must have a frame structure as shown in Figure 2. Timeslots (or subframes) 0 and 2 must be allocated to Downlink (D), or Uplink (U) transmissions as indicated;

(b) the Licensee must ensure that the special subframe (S) in timeslot 1 has a structure that is compatible with TD-LTE special subframe configuration 6, also known as 9:3:2 (DwPTS: GP: UpPTS). For the avoidance of doubt, a special subframe structure is compatible where there are no uplink transmissions within the downlink pilot timeslot (DwPTS) or guard period (GP)

and no downlink transmissions within the uplink pilot timeslot (UpPTS) or guard period (GP);

(c) timeslots must have a duration of 1 millisecond;

(d) the Licensee shall ensure that frames start at a common reference time so that all licensees' frames are aligned and transmissions synchronised;

(e) timeslots with no transmission indicated may have no transmission or must be determined as a Downlink, Uplink or Special subframe as necessary in order to ensure compliance with paragraph 13(c) and 13(f);

(f) the Licensee must cooperate to minimise harmful sub-frame overlaps if different technologies are used. On rare occasions this may require the frame alignment or guard period to be slightly offset;

(g) for the avoidance of doubt all-downlink frame structures such as Supplementary Downlink (SDL) are not permitted.

Note: all current TD-LTE frame configurations are compatible with this frame structure, as are some 5G NR frame configurations. Other technologies are permitted provided that the requirements of 13(a) to 13(d) are met.

Figure 3: Frame Structure A

DL/UL ratio	Subframe number									
	0	1	2	3	4	5	6	7	8	9
3:1	D	S	U	D	D	D	S	U	D	D

Figure 4: Frame Structure B

DL/UL ratio	Subframe number									
	0	1	2	3	4	5	6	7	8	9
Any	D	S	U							

14. Irrespective of whether the Restrictive Transmission Mask or the Permissive Transmission Mask is being used, the EIRP or TRP emanating from the Radio Equipment transmissions at any frequency outside the Permitted Frequency Blocks shall not exceed the following additional band edge requirements:

	Non-AAS *dBm / MHz*[a] *EIRP per antenna*	AAS *dBm / MHz*[a] *TRP per cell*
Below 3390 MHz	-50	-52

[a] We note this level is defined in the Commission Decision 2019/235/EC as per MHz rather than per 5 MHz

Non-AAS *dBm / 5 MHz EIRP per antenna*	AAS *dBm / 5 MHz TRP per cell*

3390 – 3400 MHz	Min(PMax – 43, 13)	Min(PMax' – 43, 1)
3400 – 3405 MHz	Min(PMax – 43, 15)	Min(PMax' – 43, 12)
3405 – 3410 MHz	Min(PMax – 40, 21)	Min(PMax' – 40, 16)
3800 – 3805 MHz	Min(PMax – 40, 21)	Min(PMax' – 40, 16)
3805 – 3810 MHz	Min(PMax – 43, 15)	Min(PMax' – 43, 12)
3810 – 3840 MHz	Min(PMax – 43, 13)	Min(PMax' – 43, 1)
Above 3840 MHz	-2	-14

Small Cells

15. The Licensee is required to comply with the Permissive Transmission Mask as set out in paragraph 10 of this schedule but is not required to comply with the frame structure requirements set out in paragraphs 12 or 13 above, for:

(a) Indoor Domestic Small Cells; or

(b) Indoor Non-domestic Small Cells, except where another licensee demonstrates that they are suffering harmful interference as a result.

If another licensee demonstrates that they are suffering harmful interference as a result of an Indoor Non-domestic Small Cell, the Indoor Non-domestic Small Cell must comply with the requirements set out in paragraphs 9 and 12 above, where Frame Structure A is used or those requirements set out in both paragraphs 9 and 13 above where Frame Structure B is used.

Interpretation of terms in this schedule

16. In this schedule:

(a) "5G NR" means 5G New Radio and refers to the air interface that has been developed by 3GPP for fifth generation (5G) mobile radio networks. This air interface defines how 5G base stations and user devices both transmit and receive radio signals using spectrum;

(b) "AAS" means active antenna system. An AAS is a base station and antenna system where the amplitude and / or phase between antenna elements is continually adjusted resulting in an antenna pattern that varies in response to short term changes in the radio environment. This is not intended to include long term beam shaping such as fixed electrical down tilt. In AAS base stations the antenna system is integrated as part of the base station system or product;

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

(d) "Downlink" means transmissions from a base station to a terminal station (handset);

(e) “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), measured during the “on” part of the transmission;

(f) “femtocell” means a base station 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;

(g) “Fixed or installed” means used or installed at specific fixed points;

(h) Indoor” means a location inside a building or place in which the shielding will typically provide the necessary attenuation to protect wireless telegraphy against harmful interference;

(i) “Indoor Domestic Small Cell” means a base station with an EIRP of less than or equal to 24dBm per 20 MHz carrier that is located within a residential property;

(j) “Indoor Non-domestic Small Cell” means a base station with an EIRP of less than or equal to 24dBm per 20 MHz carrier that is located indoors but not within a residential property;

(k) "IR" means a United Kingdom Radio Interface Requirement notified by Ofcom in accordance with Article 8 of Directive 2014/53/EU of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment (known as the Radio Equipment Directive);

(l) “lower block edge” means, in relation to each Permitted Frequency Block, the lowest frequency in that Permitted Frequency Block;

(m) “mobile or nomadic” means intended to be used while in motion or during halts at unspecified points;

(n) “non-AAS” means a piece of Radio Equipment which is not an AAS;

(o) “per antenna” means per radiating unit/component (irrespective of the number of radiating elements that make up that unit/component);

(p) “per cell” means per specific piece of Radio Equipment. For a multi-sector base station, per cell refers to each one of the individual sectors irrespective of the number of transmit antennas;

(q) “Permitted Frequency Blocks” has the meaning given to it in paragraph 7 of this schedule;

(r) “PMax” is the maximum mean power for the base station in question if it is using a non-AAS. This is measured as EIRP per carrier and determined on a per antenna basis;

(s) “PMax’” is the maximum mean power for the base station in question if it is using an AAS. This is measured as TRP per carrier and determined on a per cell basis;

(t) “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 timeslot when actively carrying a call (voice, video or data) or signalling from serviced handsets.

(u) “TDD” means the application of time-division multiplexing to separate uplink and downlink signals;

(v) “TD-LTE” means the TDD variant of LTE (Long Term Evolution or 4G technology);

(w) “TRP” means the total radiated power. This is the integral of the power transmitted in different directions over the entire radiation sphere, measured during the on part of the transmission;

(x) “Uplink” means transmissions from a terminal station (handset) to a base station; and

(y) “upper block edge” means, in relation to each Permitted Frequency Block, the highest frequency in that Permitted Frequency Block.

SCHEDULE 2 TO LICENCE NUMBER: 0823615

Schedule Date: 18 May 2021

Licence Category: Spectrum Access 3.6 GHz

Description of Radio Equipment

In this Licence, the Radio Equipment means any station apparatus that transmits in accordance with the requirements of paragraphs 6 and 7 of this schedule.

Interface Requirements for the Radio Equipment use

Use of the Radio Equipment shall comply with the following Interface Requirements:

IR 2015.1 to IR 2015.3: Spectrum Access in the 3400 MHz to 4009 MHz band.

Special conditions relating to the operation of the Radio Equipment

During the period that this Licence remains in force, the Licensee shall compile and maintain accurate written records of:

the following details relating to the Radio Equipment where the Radio Equipment spectral density exceeds 25 dBm/MHz or total e.i.r.p. exceeds 30 dBm:

postal address;

National Grid reference (to 100 metres resolution);

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

radio frequencies used by the Radio Equipment; and

a statement of the number of subscribing customers,

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

The Licensee shall inform Ofcom of the address of the premises at which this Licence and the information detailed at sub-paragraph 3(a) of this schedule shall be kept.

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

The Licensee must also submit to Ofcom in such manner and at such times as Ofcom requests all information relating to the establishment, installation or

use of the Radio Equipment as is reasonably requested for the purpose of verifying compliance with this Licence or for statistical purposes.

The Licensee must ensure that the Radio Equipment is established and installed only for terrestrial use.

Co-ordination

The Licensee must operate the Radio Equipment in accordance with any co-ordination procedure notified by Ofcom.

Permitted frequency band

The Radio Equipment may only transmit within the following frequency band:

3925 - 4009 MHz

Maximum permissible e.i.r.p.

The Licensee shall ensure that the Radio Equipment conforms to the following e.i.r.p. limits:

Maximum e.i.r.p. +53 dBm/MHz

Except for mobile terminals, which shall conform to the following e.i.r.p. limit:

Maximum e.i.r.p. 25 dBm/MHz

In addition to this, the Licensee may be required to take additional measures to ensure that the establishment, installation and use of the Radio Equipment does not cause undue interference to receiving stations and/or radio apparatus operated by a neighbouring licensee.

Permissible Out of Block Emissions

For Radio Equipment operating at powers above 25dBm/MHz deployed before 1st January 2010 the Licensee shall ensure that Out of Block shall conform to the following:

Frequency offset measured from the edges of the frequency bands specified in section 5	Maximum radiated spectral power density EIRP (dBm/MHz)
0	53
0	44
0 < Δf < 0.6	44 – 41.67*Δf
0.6	19
1	19

1 < Δf < 2	19 - 20*(Δf - 1)
≥ 2	-1

For Radio Equipment operating at powers above 25dBm/MHz deployed after 1st January 2012 the Licensee shall ensure that Out of Block shall conform to the following:

Frequency offset measured from the edges of the frequency bands specified in section 5	Maximum radiated spectral power density EIRP (dBm/MHz)
0	53
0	44
0 < Δf < 0.6	44 – 41.67*Δf
0.6	19
1	19
1 < Δf < 2	19 - 20*(Δf - 1)
2	-1
5	-1
5	-15.6
5 < Δf < 6.5	-15.6 – 10.27*(Δf - 5)
6.5	-31
6.5 < Δf < 9.5	-31 – 4*(Δf - 6.5)
≥ 9.5	-43

The Licensee shall ensure that Out of Block Emission from the Radio Equipment operating at powers up to 25dBm/MHz shall conform to the following:

Frequency offset measured from the edges of the frequency bands specified in section 5	Maximum radiated spectral power density EIRP (dBm/MHz)
0	13.7
0 < Δf < 1	13.7 - 15*Δf
1	-1.3
1 < Δf < 2.5	-1.3 - 1.27*(Δf - 1)
2.5	-3.2
2.5 < Δf < 7.5	-3.2 - 0.46*(Δf - 2.5)
7.5	-5.5
7.5 < Δf < 9.5	-5.5 - 5*(Δf - 7.5)
≥ 9.5	-15.5

Interpretation

In this schedule:

"dBm" means the power level in decibels (logarithmic scale) referenced against 1 milliwatt (i.e. a value of 0 dBm is 0.001 W);

"e.i.r.p." 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);

"IR" means a United Kingdom Radio Interface Requirement notified by Ofcom in accordance with Directive 2014/53/EU of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment (known as the Radio Equipment Directive);

"Out of Block Emission" means radio frequency emissions generated by the Radio Equipment and radiated into the frequency bands adjacent (in terms of frequency) to the Licensee's Permitted Frequency Bands;

"Maximum radiated spectral power density" (of Out of Block Emissions) is the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna that is outside the Licensee's Frequency Block;

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SCHEDULE 3 TO LICENCE NUMBER: 0823615

Schedule Date: 18 May 2021

Licence Category: Spectrum Access 3.6 GHz

Spectrum Leasing

Grant of lease

The Licensee may confer the benefit of the Licence (which is hereinafter referred to as a "lease") on another person (referred to as the "leaseholder) in respect of any wireless telegraphy station or wireless telegraphy apparatus to which the Licence relates, provided that the conditions in this schedule are met.

Conditions

The conditions are –

L1. The Licensee may only confer the benefit of the Licence on one or more than one leaseholder for –

any geographical area forming part of the geographical area in which the Licensee is authorised to establish, install or use wireless telegraphy stations or apparatus under this Licence; and

for any frequency range forming part of the frequency band which the Licensee is authorised to use.

L2. The Licensee shall remain responsible for all obligations under the Licence (including without limitation the obligations to pay licence fees in accordance with clause 8 of this Licence).

L3. If the Licensee –

transfers his rights and obligations under the Licence by way of spectrum trade; or

receives a notice of revocation from Ofcom revoking his Licence, the lease (and any sub-lease) shall automatically extinguish.

L4. If Ofcom varies this licence in such a way that the provisions in condition 1 are no longer satisfied in respect of a lease which has been granted (or any sub-lease made by the leaseholder), that lease (or sub-lease) shall automatically extinguish.

L5. The licensee must inform the leaseholder and any sub-leaseholder immediately when his Licence terminates (regardless of the reason for such termination).

L6. The Licensee must inform the leaseholder (and any sub-leaseholder) that it proposes to apply for a spectrum trade, prior to any such application being made to Ofcom.

~~L7. The Licensee must ensure that the use of Radio Equipment by the leaseholder (and any sub-leaseholder) complies with the terms, provisions and limitations of this licence.~~

~~L8. The Licensee must inform the leaseholder in writing of the following matters before use of the radio equipment commences:~~

~~the terms, provision and limitations of the Licence that governs the establishment, installation and use of the Radio Equipment;~~

~~that failure to meet the terms, provisions and limitations of this licence may be a criminal offence;~~

~~that failure to meet the terms, provisions and limitations of this Licence may also result in close down of the Radio Equipment.~~

~~L9. The Licensee must have a written contract with the leaseholder containing the terms of the lease and must make this available to Ofcom immediately on request.~~

~~L10. The Licensee must maintain records at all times of the persons to whom he has granted a lease and any persons who have been granted a sub-lease under this Licence.~~

~~L11. The Licensee must make these records (and any other relevant information) immediately available to Ofcom on request.~~

~~L12. The Licensee must ensure that one of the terms of the written contract is that both parties are bound by a dispute resolution procedure that provides for the prompt and satisfactory resolution of disputes with or between the holders of leases or any sub-leases under this Licence, including any relating to interference management.~~

~~L13. If Ofcom investigates interference management issues which arise as a result of a complaint to Ofcom, and if both the person which is the subject of any undue interference caused and the source of any undue interference caused are the leaseholder, sub-leaseholders or the Licensee himself, Ofcom will charge the Licensee (and the Licensee shall pay) Ofcom's costs which relate to the investigation.~~

~~L14. The Licensee must comply with all instructions given by Ofcom (whether verbal or in writing) which relate to the Licence or the use of the frequency band, and ensure that any leaseholder any sub-leaseholder are immediately informed and also comply with these instructions.~~

Grant of sub-lease

The Licensee may in his contract with the leaseholder permit the leaseholder to confer the benefit of the Licence (hereinafter referred to as "sub-lease") on any other person ("sub-leaseholder") provided that the conditions in this schedule are met.

L15. The Licensee must –

prohibit the sub-leaseholder from further conferring the benefit of the Licence on any other third party; and

ensure that the sub-leaseholder is made aware of that prohibition.

L16. The Licensee must procure that the terms of any such permission are contained in his contract with his leaseholder.

L17. The Licensee must procure that the written contract between the leaseholder and the sub-leaseholder containing the terms of the lease is made available to Ofcom immediately on request.

L18. The Licensee must require in his contract that the leaseholder informs him immediately of any sub-lease which has taken place.

L19. The sub-lease may only confer the benefit of the Licence on one or more than one such person for –

any geographical area forming part of the geographical area in which the Licensee is authorised to establish, install or use wireless telegraphy stations or apparatus under this Licence; and

for any frequency range forming part of the frequency band which the Licensee is authorised to use.

L20. The Licensee shall remain responsible for all obligations under the Licence (including without limitation the obligations to pay licence fees in accordance with clause 8 of this Licence).

L21. The Licensee shall procure that the sub-leaseholder is informed of the following matters in writing before use of the radio equipment commences:

the terms, provision and limitations of the Licence that governs the establishment, installation and use of the Radio Equipment;

that failure to meet the terms, provisions and limitations of this Licence may be a criminal offence;

that failure to meet the terms, provisions and limitations of this Licence may also result in close down of the Radio Equipment.

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SCHEDULE ~~4~~ 2 TO LICENCE NUMBER: ~~0823615~~ TBC

EMF Licence Condition

Schedule Date: **18 May 2021**

Licence category: **Spectrum Access 3.6 GHz**

Sites which are not shared with another licensee

1. The Licensee shall only establish, install, modify or use Relevant Radio Equipment if the total electromagnetic field exposure levels produced by the Licensee's On-Site Radio Equipment do not exceed the basic restrictions[43] in the relevant tables for general public exposure identified in the ICNIRP Guidelines[44] in any area where a member of the general public is or can be expected to be present when transmissions are taking place.

Sites which are shared with another licensee

2. In the case of a shared site where the Shared Site Exemption applies to the Licensee, the Licensee shall comply with paragraph 1 above.

3. In the case of a shared site where the Shared Site Exemption does not apply to the Licensee, the Licensee shall only establish, install, modify or use the Relevant Radio Equipment if:

   (a) the total electromagnetic field exposure levels produced by the Licensee's On-Site Radio Equipment, together with

   (b) the total electromagnetic field exposure levels produced by all other wireless telegraphy stations and wireless telegraphy apparatus operated by another licensee on the same site for which the Licensee can reasonably assume that a Shared Site Exemption does not apply,

   do not exceed the basic restrictions[45] in the relevant tables for general public exposure identified in the ICNIRP Guidelines[46] in any area where a member of the

[43] Compliance with the reference levels for general public exposure identified in the ICNIRP Guidelines will ensure compliance with the basic restrictions.
[44] The relevant tables for general public exposure are identified in Ofcom's "Guidance on EMF Compliance and Enforcement".
[45] Compliance with the reference levels for general public exposure identified in the ICNIRP Guidelines will ensure compliance with the basic restrictions.
[46] The relevant tables for general public exposure are identified in Ofcom's "Guidance on EMF Compliance and Enforcement".

general public is or can be expected to be present when transmissions are taking place.

Emergency Situations

4. The obligations in paragraphs 1, 2 and 3 above will not apply if the Relevant Radio Equipment is being used for the purpose of seeking emergency assistance or reporting and responding to an emergency situation (in the vicinity of that situation) including for search and rescue activities and maritime emergency communications[47].

Relationship with authorised transmission levels

5. The Licensee shall comply with paragraphs 1, 2 and 3 above notwithstanding the maximum transmission levels authorised in the Licence.

Records

6. The Licensee shall keep, or shall procure that a third party shall keep, and shall make available to Ofcom on request, records (including the type of records identified in Ofcom's "Guidance on EMF Compliance and Enforcement") that demonstrate how it has complied with paragraphs 1, 2 and 3 above when Relevant Radio Equipment is established, installed, modified or used.

Ofcom's "Guidance on EMF Compliance and Enforcement"

7. When evaluating its compliance with paragraphs 1, 2 and 3 above, the Licensee shall take into account Ofcom's "Guidance on EMF Compliance and Enforcement" that is in force at the relevant time.

[47] Further information on emergency situations in set out in Ofcom's "Guidance on EMF Compliance and Enforcement".

Interpretation

8. In this schedule:

(a) **"dBi"** means the ratio in dB (decibel) when comparing the gain of the antenna to the gain of an isotropic antenna. An isotropic antenna is a theoretical antenna which radiates power uniformly in all directions;

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

(c) **"ERP"** means effective radiated power which is the product of the power supplied to an antenna and its gain in a given direction relative to a half-wave dipole;

(d) "**general public**" means any person who is not: (a) the Licensee, owner, operator or installer of the Relevant Radio Equipment; or (b) acting under a contract of employment or otherwise acting for purposes connected with their trade, business or profession or the performance by them of a public function;[48]

(e) **"ICNIRP Guidelines"** means the version of the Guidelines published by the International Commission on Non-Ionizing Radiation Protection for limiting exposure to electromagnetic fields which are identified in Ofcom's "Guidance on EMF Compliance and Enforcement" that is in force at the relevant time.[49]

(f) **"Licensee's On-Site Radio Equipment"** means the Relevant Radio Equipment and any other wireless telegraphy station(s) and wireless

[48] There is pre-existing health and safety legislation which already requires employers to protect workers from exposure to electromagnetic fields ("EMF") including the following legislation specifically relating to EMF (as amended from time to time): The Control of Electromagnetic Fields at Work Regulations 2016, The Control of Electromagnetic Fields at Work Regulations (Northern Ireland) 2016 and The Merchant Shipping and Fishing Vessels (Health and Safety at Work) (Electromagnetic Fields) Regulations 2016.

[49] Ofcom's "Guidance on EMF Compliance and Enforcement" will initially require the Licensee to comply with the ICNIRP Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz), published in: Health Physics 74(4):494-522, dated April 1998 and available at: https://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf ("1998 Guidelines") or the ICNIRP Guidelines for limiting exposure to electromagnetic fields (100 KHz to 300 GHz), published in: Health Physics 118(5): 483–524; 2020 and available at: https://www.icnirp.org/cms/upload/publications/ICNIRPrfgdl2020.pdf ("2020 Guidelines"). However, once work on the relevant standards explaining the methodology for assessing compliance with the 2020 Guidelines has progressed sufficiently, Ofcom will publish a public consultation on updating its "Guidance on EMF Compliance and Enforcement" to explain that going forward Ofcom will be requiring the Licensee to comply with the 2020 Guidelines only. Following this public consultation, Ofcom will publish an updated version of Ofcom's "Guidance on EMF Compliance and Enforcement" on its website. Ofcom will follow the same process for any subsequent versions of the ICNIRP Guidelines.

telegraphy apparatus on the same site which transmits at powers higher than 10 Watts EIRP or 6.1 Watts ERP.[50]

(g) **"Relevant Radio Equipment"** means all the Radio Equipment that is authorised by this Licence to transmit at powers higher than 10 Watts EIRP or 6.1 Watts ERP.

(h) **"Shared Site Exemption"** means any of the following three situations apply on a shared site in relation to the Licensee's or another licensee's wireless telegraphy station(s) or wireless telegraphy apparatus that is authorised to transmit at powers higher than 10 Watts EIRP or 6.1 Watts ERP:

- The first situation is that all of the licensee's wireless telegraphy station(s) or wireless telegraphy apparatus on a shared site do not transmit at a combined total radiated power in any particular direction[51] that is higher than 100 Watts EIRP or 61 Watts ERP;[52]
- The second situation is that the total electromagnetic field exposure levels produced by the licensee's wireless telegraphy station(s) or wireless telegraphy apparatus in any area where a member of the general public is or can be expected to be present when transmissions are taking place is no more than 5% of the basic restrictions or 5% of the reference levels in the relevant tables for general public exposure identified in the ICNIRP Guidelines;[53]
- The third situation is where the licensee's wireless telegraphy station or wireless telegraphy apparatus has an antenna gain that is equal to or higher than 29 dBi and has a fixed beam;

(i) **"shared site"** means a site that is shared by the Licensee and at least one other licensee for the purposes of establishing, installing, modifying or using wireless telegraphy stations or wireless telegraphy apparatus;

(j) **"site"** means a physical structure, building, vehicle or moving platform;

(k) **"wireless telegraphy apparatus"** has the meaning given to it in section 117 of the Wireless Telegraphy Act 2006; and

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[50] 10 Watts EIRP is equivalent to 6.1 Watts ERP. In linear units EIRP (W) = 1.64 x ERP (W); in decibels EIRP (dB) = ERP (dB) + 2.15. Ofcom's "Guidance on EMF Compliance and Enforcement" explains how the Licensee can determine if wireless telegraphy station(s) or wireless telegraphy apparatus "transmits at powers higher than 10 Watts EIRP or 6.1 Watts ERP".
[51] For the purpose of this situation, the combined total radiated power is a simple sum of the radiated powers (in EIRP or ERP) of all of the licensee's wireless telegraphy station(s) or wireless telegraphy apparatus on the shared site that transmits signals covering the same or overlapping areas.
[52] 100 Watts EIRP is equivalent to 61 Watts ERP.
[53] The relevant tables for general public exposure are identified in Ofcom's "Guidance on EMF Compliance and Enforcement".

(l) **"wireless telegraphy station"** has the meaning given to it in section 117 of the Wireless Telegraphy Act 2006.

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A2. Draft fee regulations

STATUTORY INSTRUMENTS

2022 No.

ELECTRONIC COMMUNICATIONS

The Wireless Telegraphy (Licence Charges for the 3.4 GHz Frequency Band and the 3.6 GHz Frequency Band) Regulations 2022

Made - - - - ***

Coming into force ***

The Office of Communications ("OFCOM") make the following Regulations in exercise of the powers conferred by sections 12, 13(2) and 122(7) of the Wireless Telegraphy Act 2006 ([54a]) ("the Act").

Before making these Regulations OFCOM have given notice of their proposal to do so in accordance with section 122(4)(a) of the Act, published notice of their proposal in accordance with section 122(4)(b) of the Act, and have considered the representations made to them before the time specified in the notice in accordance with section 122(4)(c) of the Act.

Citation and commencement

The Regulations may be cited as the Wireless Telegraphy (Licence Charges for the 3.4 GHz Frequency Band and the 3.6 GHz Frequency Band) Regulations 2022 and entered into force on [DATE].

Interpretation

In these Regulations—

"MHz" means megahertz;

"OFCOM" means the Office of Communications;

"3.4 GHz frequency bands" means the frequencies from 3480.0 MHz to 3500.00 MHz and 3580.0 to 3600 MHz; and

"3.6 GHz frequency band" means the frequencies from 3600.0 MHz to 3680.0 MHz.

([a]) 2006 c. 36

Revocation

The Wireless Telegraphy (Licence Charges for the 3.4 GHz Frequency Bands and the 3.6 GHz Frequency Band) Regulations 2019([55b]) are hereby revoked.

Licence charges payable for the 3.4 GHz frequency bands

—a) On [**date to be specified in final regulations**] the holder of a wireless telegraphy licence of the Spectrum Access 3.4 GHz licence class authorising the use of any frequencies in the 3.4 GHz bands shall pay to OFCOM the amount calculated in accordance with paragraph (2) and (3)

The formula to calculate the total sum mention in paragraph (1) is—

$S = [\textbf{£270,792,410, updated figure to be specified in the final regulations}] \times (CPI_t \div CPI_0)$;

Where—

"S" means the total sum;

"CPI_t" means the most recent CPI value that is available for [**the payment date specified in regulation 4(1)**];

"CPI_0" means the CPI value that is available on 31 July 2022;

"CPI value" means the number given in respect of that month in the monthly all items consumer prices index published by the Statistics Board.

If the total sum calculated in accordance with paragraph (2) is a fraction of a whole number, it shall be rounded down to the nearest whole number.

Licence charges payable for the 3.6 GHz frequency band

—b) On [**date to be specified in the final regulations**] the holder of a wireless telegraphy licence of the Spectrum Access 3.6 GHz class authorising the use of frequencies in the 3.6 GHz band shall pay to OFCOM the amount calculated in accordance with paragraph (2) and (3).

The formula to calculate the total sum mention in paragraph (1) is—

$S = [\textbf{£306,432,095, updated figure to be specified in the final regulations}] \times (CPI_t \div CPI_0)$;

Where—

"S" means the total sum;

"CPI_t" means the most recent CPI value that is available for [**the payment date specified in regulation 5(1)**];

"CPI_0" means the CPI value that is available on 31 July 2022;

"CPI value" means the number given in respect of that month in the monthly all items consumer prices index published by the Statistics Board.

If the total sum calculated in accordance with paragraph (2) is a fraction of a whole number, it shall be rounded down to the nearest whole number.

[Name]
Group Director, Spectrum Group
Office of Communications

[Date]

[b] S.I. 2019/1004

EXPLANATORY NOTE

(This note is not part of the Regulations)

These Regulations set the level of charges payable to OFCOM in respect of the licences of Spectrum Access 3.4 GHz licence class granted under section 8 of the Wireless Telegraphy Act 2006 (c.36) for the use of the frequencies in the bands 3480-3500.0 MHz and 3580.0-3600.0 MHz.

These Regulations also set the level of charges payable to OFCOM in respect of the licences of Spectrum Access 3.6 GHz licence class granted under section 8 of the Wireless Telegraphy Act 2006 (c.36) for the use of the frequencies in the band 3600.0-3680.0 MHz.

Regulation 3 removes the charges payable by holders of a Spectrum Access 3.5 GHz licence for the use of the frequencies in the bands 3480-3500.0 MHz and 3580.0-3600.0 MHz, and the charges payable by holders of a Spectrum Access 3.6 GHz licence for the use of the frequencies in the band 3600.0-3680.0 MHz prescribed by the Wireless Telegraphy (Licence Charges for the 3.4 GHz Frequency Band and the 3.6 Ghz Frequency Band) Regulations 2019.

Regulation 4 imposes a fee for the use of the frequencies in the bands 3480-3500.0 MHz and 3580.0-3600.0 MHz.

Regulation 5 imposes a fee for the use of the frequencies in the band 3600.0-3680.0 MHz.

A regulatory impact assessment of the effect of these Regulations has been prepared. Copies of this assessment have been placed in the library of the Houses of Parliament.