Annual licence fees for 2100 MHz spectrum

Annexes 1-5

STATEMENT:

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Annex

A1. Legal framework

Ofcom's power to set fees

A1.1 Under Section 12 of the Wireless Telegraphy Act 2006 (the "**Wireless Telegraphy Act**"), Ofcom has the power to require licensees to pay fees to Ofcom on the grant of a licence and subsequently. The requirement to pay fees at times after the grant of a licence must be imposed by way of regulations made by Ofcom. 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.

A1.2 Section 12(5) of the Wireless Telegraphy Act provides that, where a licence has been awarded as part of an auction process, fees cannot ordinarily be charged for that licence. This is however subject to section 12(6) of the Wireless Telegraphy Act which provides that fees may be payable, even in respect of auctioned spectrum, in specific cases. This includes where provision has been included in the licence with the consent of the holder of that licence for fees to apply. Paragraph 8 of each of the 2100 MHz mobile licences states that, on or after 1 January 2022, annual licence fees will become payable in respect of those licences.

A1.3 Section 13 of the Wireless Telegraphy Act provides for Ofcom to set fees at an amount that is higher than the cost to us 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 Wireless Telegraphy Act.

A1.4 Section 122 of the Wireless Telegraphy Act is a general provision about matters relating to Ofcom's powers to make statutory instruments (including fees regulations under section 12 of that Act). It includes a requirement that where we are proposing to make regulations we must publish a notice setting out the general effect of the regulations and give a period of at least one month within which representations on the proposed regulations may be made to us.

A1.5 The legal framework for the setting of fees derives from the Communications Act 2003 (the "**Communications Act**") and the Wireless Telegraphy Act. However, in the case of licences for frequencies in the 2100 MHz band, the *Wireless Telegraphy Act 2006 (Directions to OFCOM) Order 2010* (the "**Direction**") is also relevant. We discuss this below before setting out our statutory duties under the Communications Act and the Wireless Telegraphy Act.

The Direction

A1.6 Under Section 5 of the Wireless Telegraphy Act, the Secretary of State may by order direct Ofcom to exercise its powers in such cases, in such manner, subject to such restrictions and constraints, and with a view to achieving such purposes as may be specified in, or determined by the Secretary of State in accordance with, the order.

A1.7 In December 2010, as part of a package of reforms of spectrum management, the Government directed Ofcom to vary the 2100 MHz licences (subject to the MNOs' consent) so as:

- to include a mobile coverage obligation[1];
- to make the licences continue in force indefinitely (unless and until revoked by Ofcom); and
- to require the licensees to pay an annual charge for their licences (in respect of periods following 31 December 2021) which is set by Ofcom and which reflects the full market value of the frequencies in the 2100 MHz band.

A1.8 In June 2011[2], the 2100 MHz licences were varied to give effect to the Direction. The mobile coverage obligation was stated to apply in respect of the paired 2100 MHz spectrum. Paragraph 8 of each licence included a new provision requiring the payment of annual licence fees from 1 January 2022.

The duties imposed by the Communications Act

A1.9 Sections 2A - 2C of the Communications Act[3] set out the legislative framework for the Government's Statement of Strategic Priorities for telecommunications, management of radio spectrum, and postal services (the "**SSP**").[4]

A1.10 Under section 2B(2) of the Act, Ofcom must have regard to the SSP when exercising its regulatory functions relating to telecoms, management of radio spectrum and postal services. The SSP was designated on 29 October 2019, having been laid in draft before Parliament on 18 July 2019.

A1.11 Section 3 of the Communications Act sets out Ofcom's general duties including its principal duty:

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

A1.12 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, 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.

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[1] In particular, that by 30th June 2013, the licensee must provide an electronic communications network that is capable of providing mobile telecommunications services to an area within which at least 90% of the population of the United Kingdom lives and with a 90% probability that users in outdoor locations within that area can receive the service with a sustained downlink speed of not less than 768kbps in a lightly loaded cell.

[2] Ofcom, *Statement on variation of 2100 MHz Third Generation Mobile Wireless Telegraphy Act Licences*, July 2011, https://www.ofcom.org.uk/__data/assets/pdf_file/0027/73854/statement.pdf.

[3] Inserted by The Digital Economy Act 2017.

[4] DCMS, *Statement of Strategic Priorities for telecommunications, the management of radio spectrum and postal services*, 18 July 2019, https://www.gov.uk/government/publications/statement-of-strategic-priorities.

A1.13 Section 3(3) of the Communications Act provides that in performing its duties, Ofcom must in all cases have regard to the principles of transparency, accountability, proportionality and consistency, as well as ensuring that its actions are targeted only at cases in which action is needed.

A1.14 Section 3(4) of the Communications Act requires Ofcom, in performing its duties, to have regard to a number of factors as appropriate, including the desirability of promoting competition, encouraging investment and innovation in relevant markets, encouraging the availability and use of high speed data transfer services throughout the UK, the different interests of persons living in rural and in urban areas and the different needs and interests of everyone who may wish to use the spectrum for wireless telegraphy.

A1.15 In performing our duty under Section 3 of furthering the interests of consumers, we must have regard, in particular, to the interests of those consumers in respect of choice, price, quality of service and value for money.

A1.16 Section 4 of the Communications Act requires Ofcom to act in accordance with six requirements when carrying out certain specified functions, including our functions under the Wireless Telegraphy Act 2006. These include a requirement to promote competition in relation to the provision of electronic communications networks and electronic communications services, and to take account of the desirability of carrying out its functions in a manner which, so far as practicable, does not favour one form of electronic communications network, electronic communications service or associated facility, or one means of providing these, over another.

A1.17 Section 7 of the Communications Act requires Ofcom to carry out an impact assessment where it is proposing to do anything for the purposes of, or in connection with, the carrying out of their functions. This was set out in Section 5 of the July 2021 consultation.

The duties imposed by the Wireless Telegraphy Act

A1.18 Section 3 of the Wireless Telegraphy Act imposes a number of further 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, or further use, for wireless telegraphy;
- the demand for use of the spectrum for wireless telegraphy; and
- the demand that is likely to arise in future for the use of the spectrum for wireless telegraphy.

A1.19 Section 3 of the Wireless Telegraphy Act also requires Ofcom to have regard to the desirability of promoting:

- the efficient management and use of the part of the electromagnetic spectrum available for wireless telegraphy;
- the economic and other benefits that may arise from the use of wireless telegraphy;
- the development of innovative services; and

- competition in the provision of electronic communications services.

Equality Impact Assessment

A1.20 Section 149 of the Equality Act 2010 (the "2010 Act") imposes a duty on Ofcom, when carrying out its functions, to have due regard to the need to eliminate discrimination, harassment, victimisation and other prohibited conduct related to the following protected characteristics: age; disability; gender reassignment; marriage and civil partnership; pregnancy and maternity; race; religion or belief; sex and sexual orientation. The 2010 Act also requires Ofcom to have due regard to the need to advance equality of opportunity and foster good relations between persons who share specified protected characteristics and persons who do not.

A1.21 Section 75 of the Northern Ireland Act 1998 (the "1998 Act") also imposes a duty on Ofcom, when carrying out its functions relating to Northern Ireland, to have due regard to the need to promote equality of opportunity and regard to the desirability of promoting good relations across a range of categories outlined in the 1998 Act. Ofcom's Revised Northern Ireland Equality Scheme explains how we comply with our statutory duties under the 1998 Act.

A1.22 To help us comply with our duties under the 2010 Act and the 1998 Act, we assess the impact of our proposals on persons sharing protected characteristics and in particular whether they may discriminate against such persons or impact on equality of opportunity or good relations. We fulfil these obligations by carrying out an Equality Impact Assessment ('**EIA**'), which examines the impact our policy is likely to have on people, depending on their personal circumstances. EIAs also assist us in making sure that we are meeting our principal duty of furthering the interests of citizens and consumers, regardless of their background and identity.

A1.23 In our July 2021 consultation, we did not consider the impact of our proposals to be to the detriment of any protected group within society. We therefore did not carry out separate EIAs in relation to race or gender equality, or equality schemes under the Northern Ireland and Disability Equality Schemes. We maintain this view in reaching the decisions set out in this statement.

A2. Paired 2100 MHz spectrum – Approach to international benchmarking

Introduction

A2.1 In this annex, we set out the methodology of the international benchmarking analysis that underpins our decision which further to consideration of stakeholder responses is as set out in our July 2021 consultation. The methodology is consistent with those adopted in previous ALF decisions.

A2.2 First, we provide an overview of the methodology employed in:

a) the derivation of the relative value benchmarks for European auctions; and

b) the approach to tiering these benchmarks based on the quality of the evidence.

A2.3 Next, we highlight changes in our model, in particular:

a) the exclusion of assignment fee from the Slovenian (2021) auction prices;

b) updates to PPP and population data; and

c) updates to discount rate inputs.

A2.4 Our assessment of the informational value of individual European auctions is provided in Annex A3.

Overview

A2.5 We first identify European auctions for the 700 MHz, 800 MHz, 2100 MHz, 2.3 GHz, 2.6 GHz, and 3.4-3.8 GHz bands that have taken place since 2010. We consider European awards to be the most relevant in informing the value of UK paired 2100 MHz spectrum because we consider that European countries are more likely to share similar regulatory and other characteristics that affect the value of the paired 2100 MHz band in the UK. We consider that this approach gives us a sufficient and appropriate set of comparators.

A2.6 Annex A3 lists all the auctions we have included in our sample. Where possible, we have used prices from these awards to derive relative value benchmarks to inform our assessment of the market value of UK paired 2100 MHz spectrum.

A2.7 As in the July 2021 Consultation we express all UK-equivalent values in April 2021 prices.

A2.8 Paragraphs A2.10 to A2.37 lay out these steps in greater detail and address stakeholder comments on our general approach.

A2.9 Paragraphs A2.38 to A2.42 explain where the detailed calculations differ from our July 2021 Consultation.

Derivation of benchmarks

A2.10 To derive our relative value benchmarks, we first take the individual results of European auctions which have been held since 2010 in the 700 MHz, 800 MHz, 2100 MHz, 2.3 GHz, 2.6 GHz, and 3.4-3.8 GHz spectrum bands. We then convert these into UK-equivalent absolute values. This means that, for a given country, when looking at the relative values of the different bands, we are doing so on a consistent basis, having taken account of factors such as different licence durations or auctions that happened at different times.

A2.11 We then use these UK-equivalent absolute values to derive our relative value benchmarks.

UK-equivalent absolute values

A2.12 In constructing the UK-equivalent absolute values for the European auctions, we make a series of adjustments to account for country-specific factors which have the potential to affect auction values in comparator countries relative to the UK.

a) All payments associated with an auction are summed to get a final award value. Any payments not paid at the date of award, such as ALFs, are discounted from the date of initial payment to derive the present value of the award using the pre-tax nominal cost of debt[5] for the respective country.[6]

b) Where there was a substantial delay between the auction and the date the spectrum became available to winning bidders, we calculate an adjustment to allow for the fact that observed auction prices likely reflect the value of the licence at the date the spectrum becomes available for use, discounted back to the date of the auction.[7] The discount rate used here is a post-tax real weighted average cost of capital (WACC)[8] for the respective country.[9]

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[5] The adjustment to incorporate the present value of annual fees into a lump sum for licences is essentially the reverse adjustment we make in annualising the lump sums into annual fees if there were no likelihood of review. Generally, annual fees in the benchmark countries do not appear to be adjusted annually for inflation in the same way we are adopting for ALFs in the UK. We therefore discount future fee payments using a nominal discount rate. We previously set out that the implications of using a pre-tax approach are broadly similar to using a post-tax approach with a separate adjustment for the differential tax treatment of ALFs. We therefore considered it a reasonable proxy to apply the pre-tax discount rate. See Ofcom, *Annual Licence Fees for 900 MHz and 1800 MHz frequency bands*, December 2018, Annex 1, paragraph A1.44, https://www.ofcom.org.uk/__data/assets/pdf_file/0021/130548/Annexes-1-6.pdf. In the remainder of this Annex we refer to this as the **2018 Statement.** We also apply a liquidity risk premium adjustment of 30bp, consistent with our approach to annualisation in the lower polar case, as set out in Annex 4.

[6] BEREC Report on Regulatory Accounting in Practice 2020, Chapter 5, Section 5.2.4; BEREC Report on Regulatory Accounting in Practice 2019, Chapter 5, Section 5.2.4; BEREC Report on Regulatory Accounting in Practice 2018, Chapter 5, Section 5.2.4; earlier values as used in the 2018 Statement.

[7] For this analysis, we consider a delay longer than a year between the auction date and the date at which spectrum becomes available to the winning bidders as likely to be factored into the auction prices.

[8] In estimating an adjustment to an auction price for licence duration or delayed access to spectrum, we are adjusting for the difference in value an operator would place on having access to spectrum for a shorter (or longer) period. This will reflect the difference in cash flows they expect to earn. The risk of these expected cash flows should be reflected in this adjustment, and so we consider it appropriate to use the WACC in adjusting for licence duration and delayed access to spectrum. The appropriate WACC to use will reflect expectations at the time of the auction.

[9] BEREC Report on Regulatory Accounting in Practice 2020, Chapter 5; BEREC Report on Regulatory Accounting in Practice 2019, Chapter 5; BEREC Report on Regulatory Accounting in Practice 2018, Chapter 5; European Central Bank: HICP inflation forecasts; earlier values as used in the 2018 Statement.

c) The present value of any award is scaled by differences in licence duration between that award and the 20-year duration of the UK spectrum awards using the post-tax real WACC for the respective country.

d) All awards are converted from the domestic currency in which they were awarded to £ sterling using PPP exchange rate conversions in the year of the award.[10]

e) All awards are converted to today's prices by applying the UK CPI.[11]

f) All awards are scaled from the size of the respective country's population to the UK population.[12]

g) A single absolute per MHz value for each spectrum band in an auction is generally derived by averaging the values of all relevant lots sold, weighted by the size of a given lot, or a specific lot where it is more reflective of market value.

A2.13 Despite making these adjustments, country-specific factors have the potential to affect auction prices in comparator countries relative to the UK. Absolute auction prices may therefore not provide reliable indicators of the value of spectrum in the UK. Some country-specific factors, such as general price levels, will be reflected in the PPP estimates which we have used to derive absolute value benchmarks. However, other differences in auction values are more difficult to address in a robust way – for example, the greater propagation characteristics of lower-frequency bands may be more or less important depending on the level of urbanisation and population density in a country.

A2.14 In general, we expect that relative values are less likely to be affected by country-specific factors than absolute values.

Relative value benchmarks

A2.15 To calculate the relative values of 2100 MHz we identify European countries in which the 2100 MHz spectrum band, either of the 700 MHz and 800 MHz bands (the "low frequency bands") and preferably also any of the 2.3 GHz, 2.6 GHz and 3.4-3.8 GHz bands (the "high frequency bands") have been auctioned since 2010.

A2.16 We adopt the distance method as our preferred method for deriving benchmark values of 2100 MHz spectrum. Benchmark values of 2100 MHz generated by the distance method reflect the UK auction values of both a low frequency band (either 700 MHz or 800 MHz) and a high frequency band (either of 2.3 GHz, 2.6 GHz, and 3.4-3.8 GHz). We consider that, in principle, this is an advantage over a paired ratio[13] which reflects the UK auction value of only one other frequency band.

[10] The World Bank, DataBank, Purchasing power parity (PPP) conversion factor, GDP, https://data.worldbank.org/indicator/pa.nus.ppp.
[11] Office for National Statistics, Consumer price inflation, https://www.ons.gov.uk/economy/inflationandpriceindices/timeseries/d7bt/mm23.
[12] The World Bank, DataBank, Population, https://data.worldbank.org/indicator/sp.pop.totl.
[13] By paired ratio we mean the relative value of one spectrum band to another. For example, in our 2018 Statement we used the paired ratio of 900 MHz to 800 MHz to estimate our market value of 900 MHz.

A2.17 The distance method is applied by:

a) calculating the "Y/X" ratio as the difference in value between 2100 MHz and the high frequency band ("Y"), divided by the difference in value between the low frequency band and the high frequency band ("X"), which is referred to as the "Y/X ratio" and expressed as a percentage; and

b) relating this to the corresponding values of the low frequency band and the high frequency band in the UK.

A2.18 Expressed formulaically, the distance method takes the following expression, where the terms "L" and "H" and the number 2100 represent the value of the low frequency band, high frequency band and 2100 MHz band for a given benchmark country or the UK denoted by the subscripts "BC" and "UK", respectively.

$$2100_{UK} = \frac{2100_{BC} - H_{BC}}{L_{BC} - H_{BC}} \cdot (L_{UK} - H_{UK}) + H_{UK}$$

Proxies for the value of high frequency bands

A2.19 In countries where auction prices are available for a low frequency band and the 2100 MHz band but not a high frequency band, we derive a high frequency band proxy which we then use alongside the low frequency band and the 2100 MHz price to calculate relative value benchmarks.

A2.20 Our principal approach starts by considering auction evidence from other countries and calculating a ratio between the price of a high frequency band and the price of a second band in those countries. We then apply this ratio to the price of the second band in the country where a proxy is needed. For example, to derive a proxy value of the 3.4-3.8 GHz band in a country where the price of this band is not available, we start by calculating the ratio of the 3.4-3.8 GHz band price relative to the 700 MHz band price in countries where both these prices are available; we then multiply the 700 MHz band price from the first mentioned country by the calculated ratio to arrive at a proxy value of the 3.4-3.8 GHz band in that country. This approach can be similarly applied to other combinations of bands for which prices are available in relevant countries.

The Netherlands and Norway

A2.21 Auction prices in the Netherlands and Norway are available for the 700 MHz and 2100 MHz spectrum bands. In principle, either of these two bands could be used as the 'second band' in deriving a proxy for a high frequency band.

A2.22 Auction evidence from other countries is available to calculate ratios for the following combinations of high frequency bands and 'second bands':

Table A2.1: Combinations of spectrum bands to derive a high frequency band proxy ratio for the Netherlands and Norway

Band combination	Number of ratios	Countries	Values	Comments
2.3 GHz / 700 MHz	3	Slovenia, Sweden, UK	Min: 0.06 Avg: 0.25 Max: 0.38	A relatively wide range of values generated by a sample of three benchmarks. The highest value is more than five times larger than the lowest value.
2.6 GHz / 700 MHz	3	Austria, Germany, UK	Min: 0.11 Avg: 0.22 Max: 0.44	A relatively wide range of values generated by a sample of three benchmarks. The highest value is approximately four times larger than the lowest value.
3.4-3.8 GHz / 700 MHz	7	Austria, Germany, Hungary, Slovenia, Sweden, UK (x2)	Min: 0.08 Avg: 0.31 Max: 0.67	A relatively wide range of values generated by a sample of seven benchmarks. The highest value is more than eight times larger than the lowest value. Ratios from Germany (0.67) and the UK (0.56) imply value of 3.4-3.8 GHz in the Netherlands is higher than 2100 MHz (0.52); ratio from Germany implies value of 3.4-3.8 GHz in Norway is higher than 2100 MHz (0.59).
2.3 GHz / 2100 MHz	1	Slovenia	0.28	A single data point for this combination of bands.
2.6 GHz / 2100 MHz	2	Austria, Germany	Min: 0.12 Avg: 0.16 Max: 0.20	A small sample based on two data points only.
3.4-3.8 GHz / 2100 MHz	4	Austria, Germany, Hungary, Slovenia	Min: 0.21 Avg: 0.39 Max: 0.66	A relatively wide range of values generated by a sample of four benchmarks. The highest value is more than three times larger than the lowest value. Consistent with auction evidence about relative values.

Source: Ofcom analysis

A2.23 Based on available evidence, we do not consider any of the band combinations to be clearly more informative of the relative market values in the Netherlands or Norway than the other band combinations. Consequently, we derive a range of relative value benchmarks based on the available proxies for the Netherlands[14] and Norway[15], which we then interpret in the context of all other international benchmarks.

Croatia

A2.24 Auction prices in Croatia are available for the 800 MHz and 2100 MHz spectrum bands. In principle, either of these two bands could be used as the 'second band' in deriving a proxy for a high frequency band.

A2.25 In our 2018 Statement, we used a 2.6 GHz proxy for Croatia.[16] We consider this remains appropriate in our current analysis.

Interpretation of benchmarks

Quality of evidence: tiers

A2.26 We categorise the available relative value benchmarks into three tiers, which reflect how informative of UK market values we consider them to be. Our criteria for placing a relative benchmark in **Tier 1** (highest quality) are that:

a) the auction prices appear likely to have been primarily determined by a market-driven process of bidding in the auctions (generally this means the prices were not set by reserve prices);

b) based on the evidence available to us, the relative prices in the auction are at least as likely to be based on bidders' intrinsic valuations of spectrum as on strategic bidding; and

c) the outcome appears likely to be informative of forward-looking relative spectrum values in the UK, having regard to country-specific circumstances and auction dates.

A2.27 Our criteria for placing a benchmark in **Tier 2** are that one or more of the criteria for Tier 1 are not met; but

a) there is some evidence that the relative auction prices reflect bidders' relative intrinsic valuations of different bands; and

b) while there is a clear, evidence-based reason for considering that the outcome is less informative of forward-looking relative spectrum values in the UK, the outcome is not obviously uninformative of forward-looking relative spectrum values in the UK.

A2.28 Our criterion for placing a benchmark in **Tier 3** is that it does not meet the criteria for Tier 1 or Tier 2.

[14] See Annex A3, paragraph A3.82, Table A3.15 and Table A3.16.
[15] See Annex A3, paragraph A3.132 and Table A3.20.
[16] Ofcom 2018 Statement, Annex A2, paragraph A2.37.

Risk of understatement or overstatement

A2.29 In addition to our assessment of which tier a benchmark is in we have assessed whether there is a risk that each benchmark is an understated or overstated estimate of the UK value of the relevant band.

A2.30 We characterise the nature of the risks according to the:

a) **Likelihood** of understatement or overstatement: we consider whether this can be categorised as a larger risk or a smaller risk, but in some cases, we cannot be sure of the likelihood of possible understatement or overstatement.

b) **Scale** of the potential understatement or overstatement: we consider whether this can be categorised as larger or a smaller understatement or overstatement, but in some cases, we cannot be sure of the scale of possible understatement or overstatement.

c) **Direction** of potential effect: whether the risk is of an understatement or overstatement, or both. In some cases, there may be some reasons for considering the benchmark may be an understatement, and other reasons for considering it may be an overstatement. In these cases, we reach a view as to whether the effects tend to balance out, or one is likely to be stronger than the other.

A2.31 In assessing the risks, we consider both whether the auction outcomes are likely to reflect market value in the country concerned, and also whether there are other factors, such as country-specific factors or the date of the award, that might inform our interpretation of what the benchmark says about market value in the UK.

Benchmarks where the Y/X ratio is greater than 1

A2.32 Four distance method benchmarks in our analysis produce a Y/X ratio greater than 1. This happens when the 2100 MHz price is higher than the lower band price. In our analysis this is the case with German and Slovenian benchmarks using the 700 MHz and 2100 MHz combination.

Consultation responses

A2.33 All respondents argued against using distance method benchmarks that produce a Y/X ratio greater than 1:

a) BT argued that these benchmarks should be excluded or their Y/X ratio truncated to 1 because they lead to an incorrect application of the distance method. It pointed out that Ofcom previously in its September 2015 900 MHz and 1800 MHz ALF Statement disregarded a distance method benchmark with a Y/X ratio of below zero because the negative lump-sum value produced by this benchmark was not sensible.[17]

[17] BT consultation response, pp. 9-11.

b) Three argued that any distance method benchmarks using the German and Slovenian 700 MHz prices should be disregarded, because the 2100 MHz spectrum sold for more than the 700 MHz spectrum in these countries, which it considers "non-sensical" as it would imply that the UK value of 2100 MHz paired spectrum is higher than the UK value of 700 MHz spectrum.[18]

c) VMO2 argued that these benchmarks should be excluded because the higher valuation of the 2100 MHz spectrum relative to the 700 MHz spectrum is "counterintuitive" and "inconsistent with the common understanding of below 1 GHz spectrum being more valued per MHz than higher bandwidth spectrum."[19]

d) Vodafone argued that the higher pricing of 2100 MHz spectrum relative to 700 MHz spectrum is at odds with the latter having superior propagation characteristics.[20]

Our decision

A2.34 Consistent with our position in the 2015 ALF Statement, we do not consider that we should downgrade either benchmark purely on the basis that the observed pricing ratio is out of line with other countries.[21]

A2.35 In the example mentioned by BT with reference to the 2015 ALF Statement, we did not include a distance method benchmark from Denmark because its application would lead to a negative value for the UK 1800 MHz spectrum, which we did not consider to be a sensible indication of market value of that spectrum.[22] However, in the present case, the application of the relevant German and Slovenian benchmarks leads to positive values for the UK 2100 MHz spectrum. Also, in relation to 1800 MHz information from Denmark, we noted in our October 2013 consultation that 1800 MHz spectrum sold at a UK-equivalent price which was lower than 2.6 GHz. We also noted that 900 MHz spectrum sold at a very low price and said that "neither of these outcomes is surprising given that the three largest operators were not allowed to bid".[23] On this basis, we concluded that both 900 MHz and 1800 MHz provided less important evidence. Our assessment was therefore based on the exclusion from the auction of the three largest operators, not relative band prices on their own.[24] Similar circumstances of incumbents being excluded did not apply in the Germany 2015 auction or the Slovenia 2021 auction.

A2.36 We recognise that the pricing ratio in the relevant German and Slovenian benchmarks implies a market value of the 2100 MHz higher than that of the 700 MHz spectrum. The ratio is consistent with our interpretation of the auction evidence for those bands, having

[18] Three consultation response, paragraphs 3.2, 3.6 and 3.8-3.9.
[19] VMO2 consultation response, p. 3.
[20] Vodafone consultation response, p. 6.
[21] Ofcom, *Annual Licence Fees for 900 MHz and 1800 MHz spectrum,* September 2015, Annex 8, paragraph A8.482, https://www.ofcom.org.uk/__data/assets/pdf_file/0032/78629/annex_8.pdf In the remainder of this Annex we refer to this as the **2015 Statement**.
[22] Ofcom 2015 Statement, Annex 8, paragraph A8.285.
[23] Ofcom, *Annual licence fees for 900 MHz and 1800 MHz spectrum*, October 2013, Annex 7, p. 90, https://www.ofcom.org.uk/__data/assets/pdf_file/0023/57326/900-1800-fees.pdf.
[24] Ofcom 2015 Statement, Annex 8, paragraph A8.484.

regard to the relative risks of understatement or overstatement. We have reflected these risks in our interpretation of the relevant benchmarks and take account of these risks in our assessment of the lump-sum value of the UK 2100 MHz spectrum.[25]

A2.37 Some respondents to our July 2021 Consultation raised specific points about the tiering of the German and Slovenian benchmarks, which we address in Annex 3.

Updates to the model compared to the July 2021 Consultation

Slovenian (2021) auction prices

A2.38 In its response to our July 2021 Consultation, BT pointed out that our calculations of the Slovenian benchmarks are based on auction prices inclusive of assignment fee, whereas our previous approach was to not include assignment fee in the calculation.[26]

A2.39 We have updated the Slovenian (2021) auction prices in our model by excluding the assignment fee.

PPP and population data

A2.40 In its response to our July 2021 Consultation, BT pointed out that our calculations are based on PPP and population data up to 2019, whereas the latest data at the time of its response were for 2020.[27]

A2.41 We have updated the PPP and population data in our model by adding the 2020 data.

Discount rate inputs

A2.42 In accordance with our analysis in Annex A4, we have updated the liquidity risk premium, cost of debt and WACC inputs in our model.

[25] See Annex A3, paragraphs A3.44 and A3.103 and Section 4.
[26] BT consultation response, p. 12.
[27] BT consultation response, p. 11.

A3. Paired 2100 MHz spectrum – Relevant spectrum awards

Introduction

A3.1 In this annex we discuss the results of mobile spectrum awards in Europe since the beginning of 2010 relevant to informing our relative value benchmarks for the 2100 MHz spectrum band in the UK. We focus on countries where the 2100 MHz band, at least one of the low frequency bands (700 MHz and 800 MHz) and, preferably, at least one of the high frequency bands (2.3 GHz, 2.6 GHz, and 3.4-3.8 GHz) have been auctioned in this period.

A3.2 This annex contains separate sections for each of the countries considered. We begin with the countries (organised in alphabetical order) for which we can derive Tier 1 distance method benchmarks. We received specific comments in response to the July 2021 consultation about auction evidence from Germany and Slovenia which we address in the respective country specific sections below. For other countries where no comments were received on the analysis set out in our consultation, we have decided to adopt our consultation position and reproduce our assessment here for completeness, having updated the numbers as set out in Annex A2 paragraphs A2.38-A2.42.

A3.3 The structure of our assessment for each country is as follows:

a) A summary of our assessment of those auctions we have analysed in previous ALF Statements.[28]

b) Information on the circumstances and outcome of the auction or auctions that we have not analysed in previous ALF Statements. This includes a table summarising the amount of spectrum awarded to each winning bidder and the prices paid. Where relevant, we also report the final price mark-up over the reserve price. It also includes a table setting out the principal rules and features of the auction design.

c) Where relevant, a summary of our estimation of band-specific prices in CCA awards or other auction formats where band-specific prices were not fully disclosed.

d) Our assessment of whether the values derived from each auction are likely to reflect the market value in the country concerned, and whether the relative market values of different bands in the country concerned are likely to reflect the UK relative market values.[29]

[28] That is (i) Ofcom, 2015 Statement; and (ii) Ofcom 2018 Statement.

[29] We take into account the implications of coverage obligations on the auctioned spectrum in our assessment and discuss these in the circumstances where we consider that the coverage obligations require deployment significantly in excess of commercial levels, and as a result the auction price could risk understating the value of that band.

e) A summary of the relative value benchmarks and our assessment. This includes the tier of evidence to which the relative value benchmarks belong, and our interpretation of the benchmarks in terms of the likelihood, scale, and direction of any understatement or overstatement of the UK market value.

A3.4 We then set out our position for the auction evidence from the countries for which we are not able to derive Tier 1 distance method benchmarks. We received no comments on these countries.

A3.5 Table A3.1 presents an overview of our relative value benchmarks for each relevant combination of spectrum bands in countries where we have been able to derive them.

Table A3.1: Overview of relative value benchmarks

Country	Low frequency award year	2100 MHz award year	High frequency award year	Risk of understatement or overstatement	Tiering
	700 MHz-2.3 GHz				
United Kingdom	2021		2018		
Slovenia	2021	2021	2021	Risk of overstatement	1
	700 MHz-2.6 GHz				
United Kingdom	2021		2013		
Austria	2020	2020	2010	Risk of under- or overstatement	1
Germany	2015	2019	2010	Larger risk of overstatement	1
Greece	2020	2020	2014	Risk of under- or overstatement	3
Iceland	2017	2017	2017	Risk of under- or overstatement	3
	700 MHz-3.4-3.8 GHz				
United Kingdom	2021		2018		
United Kingdom	2021		2021		
Austria	2020	2020	2019	Risk of under- or overstatement	1
Germany	2015	2019	2019	Risk of overstatement	1

Greece	2020	2020	2020	Risk of under- or overstatement	3
Hungary	2020	2020	2020	Risk of under- or overstatement	1
Slovenia	2021	2021	2021	Risk of overstatement	1
	700 MHz-proxies				
Netherlands	2020	2020	proxies	Risk of under- or overstatement	1
	800 MHz-2.6 GHz				
United Kingdom	2013		2013		
Austria	2013	2020	2010	Risk of understatement	1
Germany	2010	2019	2010	Larger risk of understatement	1
Greece	2014	2020	2014	Risk of under- or overstatement	3
Iceland	2017	2017	2017	Risk of under- or overstatement	3
	800 MHz-2.6 GHz proxy				
Croatia	2013	2019	proxy	Risk of under- or overstatement	3
	800 MHz-3.4-3.8 GHz				
United Kingdom	2013		2018		
United Kingdom	2013		2021		
Austria	2013	2020	2019	Risk of understatement	1
Germany	2010	2019	2019	Larger risk of larger understatement	1
Greece	2014	2020	2020	Risk of under- or overstatement	3

Source: Ofcom analysis

Austria

A3.6 As we received no responses to the consultation in relation to our assessment of Austrian auctions, our assessment in this section is as set out in the July 2021 consultation and is reproduced here for completeness.

A3.7 We are able to derive four distance method benchmarks for Austria, namely:

a) 700-2100-2600;

b) 700-2100-3400/3600;

c) 800-2100-2600; and

d) 800-2100-3400/3600.

A3.8 These are based on the following auction awards:

a) 2.6 GHz was auctioned in October 2010;

b) 800 MHz was auctioned as part of May 2013 multiband auction;

c) 3.4-3.8 GHz were auctioned in March 2019; and

d) 700 MHz and 2100 MHz were auctioned as part of the September 2020 multiband auction.

Awards considered in previous ALF Statements

A3.9 In our 2015 Statement we considered the October 2010 2.6 GHz auction, and the May 2013 multiband auction.

A3.10 While the May 2013 multiband auction was a CCA format we were able to derive band-specific prices.[30]

A3.11 Overall, our view was that:

a) there were no specific risks identified to suggest the 2.6 GHz spectrum auction price over or understated market value in Austria;[31]

b) the linear reference price (LRP) results for the 800 MHz band showed that all lots sold well above reserve price to the three incumbent bidders and that the Austrian results were around twice as high as the UK LRP for the 800 MHz band. We discussed the potential for strategic bidding in all bands offered in the October 2013 multiband auction. We concluded that the 800 MHz price carried a risk of overstating the 800 MHz market value in Austria, the likelihood and scale of which are unknown;[32] and

[30] Ofcom 2015 Statement, Annex 8, pp. 12-62, https://www.ofcom.org.uk/__data/assets/pdf_file/0032/78629/annex_8.pdf,.
[31] Ofcom 2015 Statement, Annex 8, paragraph A8.62.
[32] Ofcom 2015 Statement, Annex 8, paragraph A8.61.

c) the 1800 MHz distance method benchmark which used these 800 MHz and 2.6 GHz results met the Tier 1 criteria.[33]

A3.12 We derived the distance method benchmark using the revenue constrained LRP for the 800 MHz and 1800 MHz bands. Although we considered the unconstrained LRP to be more representative of the market value, we decided to use the revenue constrained LRP to take a conservative approach that resulted in a lower estimated value of the UK 1800 MHz band. In the present valuation of the 2100 MHz band, we use the unconstrained LRP for the 800 MHz band. Alongside being more representative of the market value of the 800 MHz band, is also produces a more conservative estimate of the UK 2100 MHz band.

March 2019 3.4-3.8 GHz auction

A3.13 In March 2019, regional licences in the 3.4-3.8 GHz spectrum band were auctioned in Austria using a clock auction format.

A3.14 The award information is set out in Table A3.2 and the auction features summarised in Table A3.3.

Table A3.2: March 2019 3.4-3.8 GHz auction results[34]

	3.4 – 3.8 GHz (TDD) in all 12 regions (MHz)	3.4 – 3.8 GHz (TDD) in fewer than 12 regions (MHz)	Price Paid (EUR m)
Total available	**390 in each region**		
A1 Telekom Austria	100	20-40 (7 of 12 regions)	64.3
Hutchison Drei Austria	100	-	51.9
T-Mobile Austria	110	-	56.9
Regional bidders	-	30-80 (7 of 12 regions)	14.5
Unsold	-	10-60 (7 of 21 regions)	

Source: RTR

[33] Ofcom 2015 Statement, Annex 8, paragraphs A8.138-A8.139 and A8.220.

[34] The Austrian Regulatory Authority for Broadcasting and Telecommunications (RTR), *Award result: a successful step towards 5G*, March 2019, https://www.rtr.at/TKP/presse/pressemitteilungen/pressemitteilungen/PI07032019TK.en.html, and https://www.rtr.at/TKP/was_wir_tun/telekommunikation/spectrum/procedures/5G_Frequenzvergabe_3_4-3_8GHz/5G-Auction-Outcome.en.html.

Table A3.3: March 2019 3.4-3.8 GHz auction features[35]

	Description	Comments
Number of bidders, number of lots, lot sizes	7 bidders, including 3 incumbent MNOs. 39 lots of spectrum in total, auctioned in lots of 10 MHz.	The overall number of lots in each region exceeded the number of potential bidders.
Spectrum caps / restrictions	A1 and T-Mobile: 150 MHz in all regions. All other bidders: 170 MHz in all regions.[36]	The caps were not binding on any of the bidders.
Reserve prices	Reserve prices varied by region; from €19,700 (per 10 MHz) in rural Salzburg region to €311,400 (per 10 MHz) in urban Vienna/St Pölten region.[37]	All spectrum sold above reserve prices.
Obligations	Three levels: Level 1 all spectrum holders; level 2 holders of at least 50 MHz in one region (additional to level 1); level 3 for holders of at least 90 MHz in one region (additional to level 1 and 2). Each coverage obligation is associated with a minimum number of locations the licence holder must operate.	

Source: RTR

A3.15 Hutchison Drei Austria and T-Mobile Austria acquired each of their spectrum bands in all 12 regions. A1 Telekom Austria acquired most, but not all its spectrum bands in all 12 regions. To derive auction prices corresponding to a national licence, we used the prices paid by Hutchison Drei Austria and T-Mobile Austria.

[35] RTR, *Tender Document - Procedure for Spectrum Award in the 3410 to 3800 MHz Range*, September 2018, NON-BINDING TRANSLATION, https://www.rtr.at/TKP/was_wir_tun/telekommunikation/spectrum/procedures/5G_Frequenzvergabe_3_4-3_8GHz/Tender_Documents_3_4_-_3_8_GHz_EN.pdf.

[36] In case of an additional bidding round, the NRA had set alternative spectrum caps: 160 MHz in all regions for A1 and 170 MHz in all regions for all other bidders. RTR, *Tender Document - Procedure for Spectrum Award in the 3410 to 3800 MHz Range*, September 2018, NON-BINDING TRANSLATION, https://www.rtr.at/TKP/was_wir_tun/telekommunikation/spectrum/procedures/5G_Frequenzvergabe_3_4-3_8GHz/Tender_Documents_3_4_-_3_8_GHz_EN.pdf, p. 25.

[37] RTR, *Tender Document - Procedure for Spectrum Award in the 3410 to 3800 MHz Range*, September 2018, NON-BINDING TRANSLATION, https://www.rtr.at/TKP/was_wir_tun/telekommunikation/spectrum/procedures/5G_Frequenzvergabe_3_4-3_8GHz/Tender_Documents_3_4_-_3_8_GHz_EN.pdf, pp. 24-25.

September 2020 multiband auction

A3.16 In September 2020, 700 MHz, 1500 MHz, and 2100 MHz spectrum bands were auctioned in Austria using an SMRA clock hybrid format.

A3.17 The award information is set out in Table A3.4 and the auction features summarised in Table A3.5.

Table A3.4: September 2020 multiband auction results[38]

	700 MHz (TDD) (MHz)	1500 MHz (SDL) (MHz)	2100 MHz (TDD) (MHz)	Extended coverage obligation (cadastral municipalities)	Price Paid (EUR m)
Total available	**2 x 30**	**80 + 10***	**2 x 60**	**1,702**	
A1 Telekom Austria	-	30	2 x 25	349	65.6
Hutchison Drei Austria	2 x 10	30	2 x 20	738	49.6
T-Mobile Austria	2 x 20	20 + 10*	2 x 15	615	86.7
Unsold	-	-	-	-	

** One lot of 10 MHz (B01) is subject to power restrictions and was assigned to the winner of lot B02 (10 MHz).*

Source: RTR

Table A3.5: September 2020 multiband auction features[39]

	Description	Comments
Number of bidders, number of lots, lot sizes	Three incumbent MNOs 700 MHz: six lots of 2 x 5 MHz 1500 MHz: 18 lots of 5 MHz 2100 MHz: 12 lots of 2 x 5 MHz	The overall number of lots exceeded the number of potential bidders.
Spectrum caps	700 MHz: 2 x 20 MHz (2 x 10 MHz for A1 Telekom) 1500 MHz: 60 MHz	None of the caps were binding. The 1500 MHz cap excludes the power restricted lot of 10 MHz (B01).

[38] RTR, *Auction results*, September 2020, https://www.rtr.at/TKP/was_wir_tun/telekommunikation/spectrum/procedures/Multibandauktion_700-1500-2100MHz_2020/FRQ5G_2020_Outcome.en.html.

[39] RTR, *Tender Document - in the procedure for awarding spectrum in the 700, 1500 and 2100 MHz ranges*, December 2019, NON-BINDING TRANSLATION, https://www.rtr.at/TKP/was_wir_tun/telekommunikation/spectrum/procedures/Multibandauktion_700-1500-2100MHz_2020/TenderDocument-700_1500_2100_MHz-F_1_16_EN-non-binding-trans.pdf.

	2100 MHz: 2 x 40 MHz (2 x 30 MHz for A1 Telekom)	
Reserve prices	700 MHz: four lots €9.5m, one lot €7.125m and one lot €2.375m (per 2 x 5 MHz). 1500 MHz: €3.125m (per 5 MHz) 2100 MHz: €13.9m (per 2 x 5 MHz)	Spectrum sold above reserve prices.
Obligations	A mix of coverage obligations applicable for 700 MHz and 2100 MHz spectrum staggered over time; basic coverage obligations which do not need to be met using 700 MHz or 2100 MHz[40] frequencies specifically, and extended coverage obligations for 700 MHz in exchange for a discount on spectrum fees.[41]	

Source: RTR

A3.18 The auction proceeded in four stages:[42]

a) In the **first stage**, the 700 MHz and 2100 MHz bands were auctioned as abstract 2x5 MHz spectrum blocks, with extended coverage obligation of 150 underserved cadastral municipalities associated with each block in the 700 MHz band. The total price achieved in the first stage was €231,400,00 across both bands.

b) In the **second stage**, the 1500 MHz band was auctioned as abstract 10 MHz spectrum blocks. The total price achieved in the second stage was €55,706,000.

c) In the **third stage**, specific frequencies within each band were assigned to the winning bidders from the first and the second stage. The total price achieved in the third stage was €2,543,420.

d) In the **fourth stage**, additional extended coverage obligations not attached to specific frequencies were auctioned, comprising 802 underserved cadastral municipalities. The total discount achieved in the fourth stage was €87,800,000.

[40] A company assigned at least 2 x 15 MHz of 2100 MHz spectrum is expected to achieve specific population coverage and download/upload speeds by end of 2023 with higher coverage obligations expected by end of 2025. Companies assigned 2 x 10 MHz or less in the 2100 MHz must fulfil the coverage obligations at half of the stated data transmission rates for downloads and uploads.

[41] In the tender document, the NRA stipulates that given the 700 MHz band may be the last coverage spectrum to be awarded for mobile services for some time it considers it appropriate to set ambitious coverage obligations as part of the spectrum award. To reflect this, we have considered the impact of 700 MHz coverage obligations in our estimates. RTR, *Tender Document - in the procedure for awarding spectrum in the 700, 1500 and 2100 MHz ranges*, December 2019, NON-BINDING TRANSLATION, https://www.rtr.at/TKP/was_wir_tun/telekommunikation/spectrum/procedures/Multibandauktion_700-1500-2100MHz_2020/TenderDocument-700_1500_2100_MHz-F_1_16_EN-non-binding-trans.pdf, p. 4.

[42] RTR, *Award Decision No. F 1/16-394*, October 2020, https://www.rtr.at/TKP/was_wir_tun/telekommunikation/spectrum/procedures/Multibandauktion_700-1500-2100MHz_2020/F_1_16_Zuteilungsbescheid.pdf, section II.2 (in German).

A3.19 We used the published data about the outcome of the auction stages to infer band-specific prices and the value of extended coverage obligation attached to the 700 MHz band as follows:

a) We estimated the average price of the 1500 MHz band based on the overall results of the second stage and a pro-rata share of the total price achieved in the third stage. This resulted in an estimated average price of €702,494 per MHz of the 1500 MHz band.

b) We estimated the average price of the 2100 MHz band using the estimated average price of 1500 MHz and the results of the first three stages for A1 Telekom Austria who acquired spectrum only in the 1500 MHz and 2100 MHz bands. This resulted in an estimated average price of €1,541,624 per MHz of the 2100 MHz band.

c) We estimated the auction price of the 700 MHz band using the estimated average prices of the 1500 MHz and 2100 MHz bands and the results of the first three stages for Hutchison Drei Austria and T-Mobile Austria who acquired spectrum in the 700 MHz band. This resulted in an estimated auction price of €48,455,071 per 60 MHz of spectrum in the 700 MHz band.

d) To account for the extended coverage obligation attached to the 700 MHz band, we estimated the average value of extended coverage obligation based on the results of the fourth stage for Hutchison Drei Austria and T-Mobile Austria. This resulted in an estimated average value of extended coverage obligation of €121,623 per municipality covered for Hutchison Drei Austria and €129,545 per municipality covered for T-Mobile Austria.

e) We adjusted the auction price of the 700 MHz band by adding the estimated value of the extended coverage obligation attached to that band, expressed as the number of municipalities to be covered multiplied by the estimated average value of extended coverage for Hutchison Drei Austria and T-Mobile Austria, respectively. This resulted in an adjusted price of €162,669,056 per 60 MHz of spectrum in the 700 MHz band (that is, €2,711,151 per MHz).

Whether award outcomes are likely to reflect market value in Austria

3.4-3.8 GHz spectrum award in March 2019

A3.20 For the 3.4-3.8 GHz band, we note that it sold above the reserve price, with all three national MNOs competing as well as bidders looking for regional licences. The spectrum caps were not binding on any of the bidders.

A3.21 We note that there were coverage obligations on 3.4-3.8 GHz linked to the amount of spectrum secured in the auction and varying by location, but we do not consider these to be overly onerous on operators.[43] Therefore we consider it unlikely that the additional coverage obligations attached to this band could lead to a risk of understatement for the

[43] In the tender document, RTR note that the coverage obligations were intended to ensure effective use of spectrum and prevent any hoarding of it, while also encouraging rapid roll-out of 5G infrastructure.

spectrum acquired above those thresholds. Overall, we have not identified any specific risks that we consider could risk under- or overstating the 3.4-3.8 GHz award.

700 MHz and 2100 MHz spectrum award in September 2020

A3.22 Both the 700 MHz and 2100 MHz bands sold above the reserve price, and the spectrum caps were not binding on any of the bidders.

A3.23 The 700 MHz band price with the extended coverage obligation carries a larger risk of larger understatement of the unencumbered market value of the 700 MHz band.

A3.24 We have sought to address this risk by adjusting the 700 MHz band price by estimating the value of the extended coverage obligation attached to that band and adjusting the price accordingly.[44]

A3.25 The resulting 700 MHz band price excluding the extended coverage obligation carries a risk of under- or overstatement the likelihood or size of which we are unable to quantify.

A3.26 We have not identified any specific risks of under- or overstatement for the 2100 MHz band although we note that the award is subject to basic and 2100 MHz specific coverage obligations.[45]

Likelihood of reflecting relative market values in the UK

A3.27 We have not identified and country-specific factors that would mean the Austrian relative values of 700 MHz, 2100 MHz or 3.4-3.8 GHz are not reflective of the UK relative values.

Assessment of the benchmarks

Risk of understatement or overstatement

A3.28 We are combining auction prices from different auctions in different years. There is a risk that this gap in time affects the risk of understatement or overstatement, although we have not identified a clear direction or magnitude of the possible effects.

A3.29 Based on the above, we consider that:

a) The relative value benchmarks using 700 MHz (removing the effects of the extended coverage obligation), and 2100 MHz in combination with and either of 2.6 GHz or 3.4-3.8 GHz carry a risk of under- or overstatement, the likelihood or size of which we are unable to quantify.

b) The relative value benchmarks using 800 MHz, 2100 MHz and either of 2.6 GHz or 3.4-3.8 GHz carry a risk of understatement. This is due to the 800 MHz price carrying a risk of overstating the 800 MHz market value in Austria.

[44] See paragraph A3.17.
[45] We do not consider these to be overly onerous and do not expect them to understate the award.

Tiering

A3.30 Considering the criteria for inclusion in Tier 1:

a) The auction prices of 700 MHz, 800 MHz, 2100 MHz, 2.6 GHz, and 3.4-3.8 GHz were all above reserve. This would suggest that the auction prices were primarily determined by a market-driven process of bidding.

b) Based on the evidence available to us, we consider that the relative prices in the auction are at least as likely to be based on bidders' intrinsic valuation of spectrum as on strategic bidding; and

c) The auction outcome appears likely to be informative of forward-looking relative spectrum values in the UK, having considered country-specific circumstance and the timing of these awards.

A3.31 Considering the factors above, our view is that the Tier 1 criteria are satisfied for the relative value benchmarks from Austria.

Summary

Table A3.6: Summary of evidence points from Austria

	UK-equivalent absolute value (£m/MHz)				Relative value benchmark
Band combination	**700 MHz**	**2100 MHz**	**2.6 GHz**	**"Y/X" ratio**	**UK 2100 MHz (£m/MHz)**
Value	21	11.7	2.3	0.50	10.1
Risk assessment; Tier	Risk of under- or overstatement	No specific risk identified	No specific risk identified	Risk of under- or overstatement Tier 1	
Band combination	**700 MHz**	**2100 MHz**	**3.4-3.8 MHz**	**"Y/X" ratio**	**UK 2100 MHz (£m/MHz)**
Value	21	11.7	4.4	0.44	10.6 (UK 3.4 GHz) 8.6 (UK 3.6 GHz)
Risk assessment; Tier	Risk of under- or overstatement	No specific risk identified	Risk of under- or overstatement	Risk of under- or overstatement Tier 1	
Band combination	**800 MHz**	**2100 MHz**	**2.6 GHz**	**"Y/X" ratio**	**UK 2100 MHz (£m/MHz)**
Value	86.9	11.7	2.3	0.11	9.6

Risk assessment; Tier	Risk of overstatement	No specific risk identified	No specific risk identified	Risk of understatement Tier 1	
Band combination	**800 MHz**	**2100 MHz**	**3.4-3.8 GHz**	**"Y/X" ratio**	**UK 2100 MHz (£m/MHz)**
Value	86.9	11.7	4.4	0.09	10.5 (UK 3.4 GHz) 7.1 (UK 3.6 GHz)
Risk assessment; Tier	Risk of overstatement	No specific risk identified	Risk of under- or overstatement	Risk of understatement Tier 1	

Source: Ofcom analysis

Germany

A3.32 We received two responses[46] to the July 2021 consultation in relation to our assessment of German auctions which we consider below.

A3.33 We are able to derive four distance method benchmarks for Germany, namely:

a) 700-2100-2600;

b) 700-2100-3600;

c) 800-2100-2600; and

d) 800-2100-3600.

A3.34 These are based on the following auction awards:

a) 800 MHz and 2.6 GHz were auctioned as part of May 2010 multiband auction;[47]

b) 700 MHz was auctioned as part of the June 2015 multiband auction; and

c) 2100 MHz and 3.6 GHz[48] were auctioned in June 2019.

Awards considered in previous ALF Statements

A3.35 In our 2015 Statement we considered the May 2010 and June 2015 multiband auctions.

[46] BT consultation response, pp. 9-10 and 12-15; Vodafone consultation response, pp. 2-3 and pp. 6-7.
[47] 2100 MHz spectrum was also auctioned in the May 2010 multiband auction. In deriving the benchmarks for Germany we have used the more recent June 2019 auction data on 2100 MHz.
[48] 3420 MHz – 3690 MHz - in our analysis, we refer to this band as '3.6 GHz'.

A3.36 Overall, our view was that:

a) that the price of 800 MHz was likely to reflect market value in Germany but that there was a larger risk that the market value of 800 MHz at the time of the auction was a larger overstatement of the forward-looking market value of 800 MHz;[49]

b) the price of 2.6 GHz may understate market value in Germany although we said we could not be sure of the likelihood and scale of this understatement;[50]

c) the auction prices in the 800 MHz and 2.6 GHz bands were significantly above reserve, and as such appeared likely to have been primarily determined by a market-driven process of bidding;[51] and

d) the 700 MHz band sold significantly above reserve, although there was a possibility of strategic demand reduction in the band which suggested that 700 MHz prices could understate market value.[52]

June 2019 2100 MHz and 3.6 GHz auction

A3.37 In June 2019, 2100 MHz and 3.6 GHz spectrum bands were awarded in Germany through an SMRA.

A3.38 The award information is set out in Table A3.7 below and the auction features summarised in Table A3.8 below.

Table A3.7: June 2019 2100 MHz and 3.6 GHz award results[53]

	2100 MHz (FDD) (MHz)	3.6 GHz (TDD) (MHz)	Price Paid (EUR m)
Total available	**2 x 60**	**300**	**6,549.7**
Telekom Deutschland	2 x20	90	2,174.9
Telefónica	2 x10	70	1,424.8
Vodafone	2 x 20	90	1,879.7
Drillisch Netz	2 x 10	50	1,070.2
Unsold	-	-	-
Total reserve price for band (EUR m)	**57.5**	**49.6**	
Total auction revenue (EUR m)	**2,374.1**	**4,175.5**	
% mark-up	**4029%**	**8318%**	

Source: BNetzA

[49] Ofcom 2015 Statement, Annex 8, paragraph A8.346 and A8.361(a), Table A8.4.4.
[50] Ofcom 2015 Statement, Annex 8, paragraphs A8.315-8.316, and A8.347.
[51] Ofcom 2015 Statement, Annex 8, paragraph A8.490.
[52] Ofcom 2015 Statement, Annex 8, paragraph A8.472(b).
[53] Bundesnetzagentur (BNetzA), *Auction results*, June 2019, https://www.bundesnetzagentur.de/SharedDocs/Downloads/EN/BNetzA/PressSection/PressReleases/2019/20190612_auction.pdf?__blob=publicationFile&v=4, and https://www.bundesnetzagentur.de/_tools/FrequenzXml/Auktion2019_XML/497.html.

Table A3.8: June 2019 2100 MHz and 3.6 GHz award features[54]

	Description	
Licence duration	20 years (except for some 2100 MHz lots which are available from 2026, not 2021).	
No of bidders; no. of lots; lot sizes	Four bidders. 2100 MHz (FDD): 12 lots of 2 x 5 MHz 3.6 GHz (TDD): one lot of 20 MHz[55], 28 of 10 MHz[56]	
Spectrum caps/restrictions	No spectrum caps or other restrictions	
Reserve prices	2100 MHz: €3.75m (15 years) and €5m (20 years), per 2 x 5 MHz. 3.6 GHz: €2m for the 20 MHz lot; €1.7m for each 10 MHz lot.	All spectrum sold above reserve prices.
Obligations	All successful bidders were subject to coverage requirements including covering 98% of households, and coverage of roads, railways and waterways as well as operating a minimum number of base stations by end of 2022 or 2024 depending on the requirement. Less onerous obligations were in place for new entrants.	

Source: BNetzA

Our provisional view

Whether award outcomes are likely to reflect market value in Germany

A3.39 We said that both the 2100 MHz and 3.6 GHz spectrum sold well above the reserve price, with all incumbents able to participate. Drillisch Netz (an MVNO) also participated and won spectrum. There were no spectrum caps.

A3.40 Consistent with our approach in previous ALF Statements, we considered the implications of the coverage obligations qualitatively. In principle, if such obligations were likely to require deployments significantly in excess of commercial levels then we considered that the auction price could risk understating the value of that band (without coverage obligation) in the UK in our assessment. We did not consider that the obligations in this auction were likely to require deployments significantly in excess of commercial levels.

A3.41 Overall, this would suggest that the auction is likely to have been competitive and reflective of market values in Germany. Based on the information available to us, we did not identify a risk associated with these awards.

[54] BNetzA, *5G award – decisions III & IV (English translation)*, November 2018, https://www.bundesnetzagentur.de/SharedDocs/Downloads/EN/Areas/Telecommunications/Companies/TelecomRegulation/FrequencyManagement/ElectronicCommunicationsServices/FrequencyAward2018/20181214_Decision_III_IV.pdf?__blob=publicationFile&v=3, Table 3 and paragraphs 632-636 for minimum price and licence duration.
[55] 3400 MHz – 3420 MHz.
[56] 3420 MHz – 3700 MHz.

Likelihood of reflecting relative market values in the UK

A3.42 We said that we were not aware of any country-specific factors that would mean the German 2019 2100 MHz or 3.6 GHz auctions were not reflective of the value in the UK.

Risk of understatement or overstatement of the benchmarks

A3.43 We recognised that we are combining auction prices from different auctions in different years. We said there is a risk that this gap in time affects the risk of understatement or overstatement, although we did not identify a clear direction or magnitude of the possible effects.

A3.44 Based on the above, we considered that:

a) The relative value benchmarks using 700 MHz, and 2100 MHz in combination with

   i) 2.6 GHz: carry a larger risk of overstatement; or

   ii) 3.6 GHz: carry a risk of overstatement.

   iii) This is due to the 700 MHz and 2.6 GHz prices both carrying a risk of understatement. We are not able to quantify the size of these risks.

b) The relative value benchmarks using 800 MHz, and 2100 MHz in combination with

   i) 2.6 GHz: carry a larger risk of understatement; or

   ii) 3.6 GHz: carry a larger risk of larger understatement.

   iii) This is due to the 800 MHz price carrying a larger risk of larger overstatement of the 800 MHz market value in Germany.

Tiering of the benchmarks

A3.45 We considered the criteria for inclusion in Tier 1:

a) The auction prices of 700 MHz, 800 MHz, 2100 MHz, 2.6 GHz, and 3.6 GHz were all above reserve. This would suggest that the auction prices were primarily determined by a market-driven process of bidding.

b) As there is evidence that the price of 700 MHz in the 2015 auction might have been affected by strategic bidding, this could indicate that the second criterion for inclusion in Tier 1 is not met for benchmarks including the 700 MHz auction. However, we noted that we cannot be sure of the scale of any such effect on relative prices; and

c) The auction outcomes appear likely to be informative of forward-looking relative spectrum values in the UK, having considered country-specific circumstance and the timing of these awards.

A3.46 We recognised that there are possible reasons why benchmarks using the 700 MHz price might not meet the second criterion from inclusion in Tier 1. Consistent with our approach in our 2015 ALF Statement, our provisional conclusion was to include these benchmarks in Tier 1 given they are market based information determined by bidding in the auctions in

question.[57] We took account of the risk of strategic bidding through the risks of overstatement and understatement outlined above.

A3.47 Considering the factors above, our provisional view was that the Tier 1 criteria are satisfied for all the relative value benchmarks from Germany.

Consultation responses

A3.48 BT and Vodafone raised concerns with the 700 MHz auction price, arguing that benchmarks using this price should not be considered as Tier 1:

a) BT, Vodafone and Frontier (commissioned by Vodafone) argued that the pricing of the German 700 MHz band relative to other bands – and its lower pricing relative to the German 2100 MHz band – was due to specific local circumstances, pointing out that the German 700 MHz (2015) auction was held at a time when only three active players were present in the market, whereas auctions of the other bands used in our analysis were held at times of four players in the market and consequently more competition for spectrum.[58]

b) BT also argued that the German 700 MHz auction price from 2015 was the result of strategic bidding, pointing to a "strange" progress of the bidding in this auction.[59]

A3.49 Vodafone and Frontier also argued that competition in the German 2100 MHz (2019) auction was intensified by specific local circumstances: a new entrant who particularly needed that spectrum; the spectrum having been previously awarded and thus incumbents having intrinsic values to protect their sunk network investment; and the set aside of spectrum in the 3.6 GHz band for industrial use, which constrained supply and led to abnormally high pricing in the German 2019 auction. They pointed out that the German 2019 auction raised almost double the amount anticipated by analysts.[60]

A3.50 We address these comments in our decision below.

Our decision

Possibility of changes in market structure affecting the relative prices of 700 MHz and 2100 MHz

A3.51 In our 2015 Statement, we considered the potential impact of market concentration between 2010 and 2015 on the 2015 auction outcome. We noted that we did not have reliable evidence on how operators' spectrum valuations would be affected by changes in market structure. We concluded that, to the extent the change in market structure had lowered competition for spectrum in the auction, we had considered this as part of our assessment of the possibility of signalling and strategic demand reduction.[61]

[57] Ofcom 2015 Statement, paragraphs 3.63-3.67 and 3.75-3.76.
[58] BT consultation response, p. 13; Vodafone consultation response, p. 6 and Frontier Economics report, pp. 17-21.
[59] BT consultation response, pp. 12-13.
[60] Vodafone consultation response, p. 6. Frontier Economics report, pp. 19-20.
[61] Ofcom 2015 Statement, Annex 8, paragraph A8.466(a).

A3.52 We consider this approach remains appropriate for the present analysis of the relative prices of 700 MHz and 2100 MHz spectrum. Although the market structure changed in the opposite direction between the 2015 and 2019 auctions, this time with an additional player (Drillisch) coming into the market and bidding in the 2019 auction, there is again no clear evidence on how this may have affected operators' spectrum valuations.

Possibility of signalling and strategic demand reduction in the 700 MHz band

A3.53 In our 2015 Statement, we identified the possibility of strategic demand reduction in the 700 MHz band, according to the obvious focal point of 2x10 MHz each. We also noted that Vodafone's bids for additional 700 MHz lots in Rounds 155, 169 and 172 – amounting to bids for the entire band in the latter two stages – were consistent with an interpretation of the auction in which bidders were using the 700 MHz band to signal a strategic demand reduction outcome in the 900 MHz and 1800 MHz bands.[62] We concluded that bidding activity on 700 MHz and 900 MHz from rounds 169 to 173 was unlikely to be consistent with intrinsic value bidding. We considered that signalling and strategic demand reduction was a more likely explanation of bidding in these rounds of the auction than intrinsic value bidding.[63]

A3.54 On the above basis, we considered there to be a risk that the price of 900 MHz in the 2015 auction understates market value in Germany.[64] We also noted there was evidence that the price of 900 MHz (and 1800 MHz) spectrum in the 2015 auction might have been affected by strategic demand reduction, which could indicate that the second criterion for inclusion in Tier 1 was not met. However, we noted that we could not be sure of the scale of any such effect on relative prices.[65] We considered whether such evidence was sufficient for us to classify these benchmarks as Tier 2, or whether they should be included in Tier 1. We noted that the auction prices are market-based information determined by bidding in the auction. In contrast, the Portugal and Spain benchmarks that we classified as Tier 2 did not reflect auction bids by operators but instead the reserve prices set by the regulator, which we would generally expect to be less informative about market value. We considered this to be an important distinction, relating to our first criterion for inclusion in Tier 1. On this basis, we decided to include the German benchmarks in Tier 1, while taking account of the possibility of strategic demand reduction through the risks of overstatement or understatement.[66]

A3.55 We consider this approach is also appropriate for benchmarks using the German 700 MHz price. Whilst the initial bidding rounds appear consistent with strategic demand reduction in the 700 MHz band, with each of the three MNOs being the standing-high bidder on two lots at or close to the reserve price between rounds 1 to 154, the subsequent rounds appear to reflect more competitive bidding which, despite its apparent use for signalling

[62] Ofcom 2015 Statement, Annex 8, paragraph A8.423.
[63] Ofcom 2015 Statement, Annex 8, paragraphs A8.431 and A8.431.
[64] Ofcom 2015 Statement, Annex 8, paragraph A8.448.
[65] Ofcom 2015 Statement, Annex 8, paragraph A8.490(b).
[66] Ofcom 2015 Statement, paragraphs 3.66 and 3.67.

purposes, has ultimately driven the auction price significantly above the reserve price towards the intrinsic value. Consistent with our approach to benchmarks using the German 900 MHz band in our previous ALF determinations, we consider that benchmarks using the German 700 MHz should also be included in Tier 1, whilst we take account of the possibility of strategic demand reduction through the risks of overstatement or understatement.

Possibility of specific local circumstances affecting the 2100 MHz and 3.6 GHz auction prices

A3.56 The circumstances mentioned by Vodafone support our view that the auction is likely to have been competitive and reflective of market values in Germany, while none of them is indicative of operators bidding above their intrinsic values.[67]

A3.57 On this basis, we remain of the view that we cannot identify any risk associated with these awards.

Risk of understatement or overstatement

A3.58 In the light of the consultation responses, we consider that our assessment of the risk of understatement or overstatement for the distance method benchmarks from Germany as presented in our July 2021 Consultation remains appropriate.

Tiering

A3.59 Having considered the consultation responses as outlined above, we remain of the view that it is appropriate to consider all the distance method benchmarks from Germany as Tier 1.

Summary

Table A3.9: Summary of evidence points from Germany

	UK-equivalent absolute value (£m/MHz)			Relative value benchmark	
Band combination	**700 MHz**	**2100 MHz**	**2.6 GHz**	**"Y/X" ratio**	**UK 2100 MHz (£m/MHz)**
Value	16.5	16.6	2	1.01	14.1
Risk assessment; Tier	Risk of understatement	No specific risk identified	Risk of understatement	Larger risk of overstatement Tier 1	
Band combination	**700 MHz**	**2100 MHz**	**3.4-3.8 MHz**	**"Y/X" ratio**	**UK 2100 MHz (£m/MHz)**

[67] And Vodafone does not seem to suggest this.

Value	16.5	16.6	11	1.02	14.2 (UK 3.4 GHz) 14.3 (UK 3.6 GHz)
Risk assessment; Tier	Risk of understatement	No specific risk identified	No specific risk identified	Risk of overstatement Tier 1	
Band combination	**800 MHz**	**2100 MHz**	**2.6 GHz**	**"Y/X" ratio**	**UK 2100 MHz (£m/MHz)**
Value	63.4	16.6	2	0.24	13.5
Risk assessment; Tier	Larger risk of larger overstatement	No specific risk identified	Risk of understatement	Larger risk of understatement Tier 1	
Band combination	**800 MHz**	**2100 MHz**	**3.4-3.8 GHz**	**"Y/X" ratio**	**UK 2100 MHz (£m/MHz)**
Value	63.4	16.6	11	0.11	11 (UK 3.4 GHz) 7.7 (UK 3.6 GHz)
Risk assessment; Tier	Larger risk of larger overstatement	No specific risk identified	No specific risk identified	Larger risk of larger understatement Tier 1	

Source: Ofcom analysis

Hungary

A3.60 As we received no responses to the consultation in relation to our assessment of Hungarian auctions, our assessment in this section is as set out in the July 2021 consultation and reproduced for completeness.

A3.61 We are able to derive a distance method benchmark for Hungary based on 700 MHz, 2100 MHz and 3.6 GHz.

A3.62 This is based on the March 2020 multiband auction.

March 2020 700 MHz, 2100 MHz, 2.6 GHz and 3.6 GHz award

A3.63 In March 2020, 700 MHz, 2100 MHz, 2.6 GHz and 3.6 GHz spectrum bands were awarded in Hungary through an ascending clock auction format. We understand that the bidding was conducted sequentially by band as follows: 1) 2.6 GHz, 2) 3.6 GHz, 3) 700 MHz, and 4) 2100 MHz.

A3.64 The award information is set out in Table A3.10 below and the auction features summarised in Table A3.11 below.

Table A3.10: March 2020 700 MHz, 2100 MHz, 2.6 GHz and 3.6 GHz award results[68, 69]

	700 MHz (FDD) (MHz)	2100 MHz (FDD) (MHz)	2.6 GHz (TDD) (MHz)	3.6 GHz (TDD) (MHz)	Price Paid (HUF m)
Total available	**2 x 25**	**2 x 15**	**15**	**310**	**128,490**
Hungarian Telekom	2 x 10	2 x 10	-	120	54,240
Vodafone	2 x 10	2 x 5	-	50	38,650
Telenor	2 x 5	-	-	140	35,600
Unsold	-	-	15	-	
Total reserve price for band (HUF m)	**25,000**	**12,000**	**1,000**	**46,500**	
Total auction revenue (HUF m)	**64,500**	**12,840**	**-**	**51,150**	
% mark-up	**158%**	**7%**	**-**	**10%**	

Source: NMHH and Commsupdate

[68] Nemzeti Media- es Hirkozlesi Hatosag [Hungary's National Media & Infocommunications Authority] (NMHH), *Auction results,* March 2020, https://english.nmhh.hu/article/211179/Three_operators_to_pay_a_total_of_HUF_1285_bn_at_an_auction_of_the_NMHH_for_the_spectrum_open_for_5G; and https://english.nmhh.hu/article/211267/UF191801972019_szamu_hatarozat_arveresi_eljaras_eredmenyenek_megallapitasa_az_5G_bevezeteset_tamogato_es_tovabbi_vezetek_nelkuli_szelessavu_szolgaltatasokhoz_kapcsolodo_frekvenciahasznalati_jogosultsagok_targyaban.

[69] Commsupdate, *Article on auction results,* March 2020, https://www.commsupdate.com/articles/2020/03/27/hungarian-trio-awarded-700mhz-2100mhz-3600mhz-spectrum-in-5g-auction/.

Table A3.11: March 2020 700 MHz, 2100 MHz, 2.6 GHz and 3.6 GHz award features[70]

	Description	Comment
Licence duration	15 years with a five-year extension option. [71]	
No of bidders; no. of lots; lot sizes	Three bidders. 700 MHz: five lots of 2 x 5 MHz 2100 MHz: three lots of 2 x 5 MHz 2.6 GHz: one lot of 15 MHz 3.6 GHz: 31 lots of 10 MHz	
Spectrum caps/restrictions	700 MHz: 2 x 10 MHz 2100 MHz: 2 x 15 MHz (2 x 30 MHz including existing spectrum holdings) 2.6 GHz: 15 MHz 3.6 GHz: 140 MHz (including existing spectrum holdings); minimum bid of 20 MHz	700 MHz and 3.6 GHz spectrum caps were binding on Hungarian Telekom and Vodafone, and Telenor respectively.
Reserve prices	700 MHz: HUF 5.0bn (per 2 x 5 MHz) 2100 MHz: HUF 4.0bn (per 2 x 5 MHz) 2.6 GHz: HUF 1.0bn (per 15 MHz) 3.6 GHz: HUF 1.5bn (per 10 MHz)	Spectrum sold above reserve except for unpaired 2.6 GHz which did not sell.
Obligations	-	

Source: NMHH

A3.65 Additionally, bidders were entitled to a 50% annual licence fee discount for 10 years on the 700 MHz and 3.6 GHz bands, subject to meeting the 5G deployment requirements.[72] We understand that all three bidders claimed this discount.[73] The fees appear to be based on a fixed fee per MHz in each of the bands.[74]

Whether award outcomes are likely to reflect market value in Hungary

A3.66 The 2100 MHz spectrum sold slightly above reserve price. We consider that the price is likely to be reflective of market value in Hungary.

A3.67 The 700 MHz spectrum sold well above reserve price. We note that the spectrum cap was binding for both Hungarian Telekom and Vodafone which could create a risk that the

[70] NMHH, *Documentation of the auction procedure*, June 2019, https://english.nmhh.hu/document/205102/MFCN_draft_documentation_20190621_final_EN.pdf.
[71] The relative value benchmarks for Hungary are based on the extended licence duration. Using the initial licence duration would not have a material impact on the relative value benchmarks.
[72] NMHH, *Documentation of the auction procedure*, June 2019, Table 1 in Annex 2, https://english.nmhh.hu/document/205102/MFCN_draft_documentation_20190621_final_EN.pdf.
[73] NMHH, *Decision on the auction outcome*, April 2020, https://english.nmhh.hu/article/211267/UF191801972019_szamu_hatarozat_arveresi_eljaras_eredmenyenek_megallapitasa_az_5G_bevezeteset_tamogato_es_tovabbi_vezetek_nelkuli_szelessavu_szolgaltatasokhoz_kapcsolodo_frekvenciahasznalati_jogosultsagok_targyaban.
[74] NMHH, *Decision on the auction outcome*, April 2020, section 7 on frequency fees, https://nmhh.hu/cikk/211267/UF191801972019_szamu_hatarozat_arveresi_eljaras_eredmenyenek_megallapitasa_az_5G_bevezeteset_tamogato_es_tovabbi_vezetek_nelkuli_szelessavu_szolgaltatasokhoz_kapcsolodo_frekvenciahasznalati_jogosultsagok_targyaban.

auction price understates market value in Hungary. This may be mitigated in part by the presence of a third bidder (Telenor) for whom the cap was not binding.

A3.68 The 3.6 GHz spectrum also sold slightly above reserve price. We note that the spectrum cap was binding on Telenor which could create a risk that the auction price understates market value in Hungary. This may be mitigated in part by the presence of two other bidders for whom the cap was not binding.

A3.69 The prices we use in the model for 700 MHz and 3.6 GHz do not take into account the potential discount on annual licence fees available subject to meeting the 5G deployment criteria. As a result, there is a risk that these overstate market value.

A3.70 On balance, we consider that these two risks offset each other to some extent, such that overall we consider the 700 MHz and 3.6 GHz prices to be at risk of under or overstatement, the likelihood and scale of which we are unable to determine.

Likelihood of reflecting relative market values in the UK

A3.71 We are not aware of any country-specific factors that would cause the Hungarian 2020 auction results to not be reflective of the relative values of the spectrum bands in the UK.

Assessment of the benchmarks

Risk of understatement or overstatement

A3.72 Based on the above, we consider that the relative value benchmark using 700 MHz, 2100 MHz and 3.6 GHz carries a risk of under- or overstatement the likelihood and scale of which we are unable to determine.

A3.73 This is due to both the 700 MHz and 3.6 GHz prices carrying a risk of understatement due to binding spectrum caps on one or more bidders and a risk of overstatement due to the net impact of the potential discount on annual licence fees.

Tiering

A3.74 Considering the criteria for inclusion in Tier 1:

a) The auction prices of 700 MHz, 2100 MHz, 3.4-3.8 GHz were all above reserve. This would suggest that the auction prices were primarily determined by a market-driven process of bidding.

b) Based on the evidence available to us, we consider that the relative prices in the auction are at least as likely to be based on bidders' intrinsic valuations of spectrum as on strategic bidding; and

c) The auction outcomes appear likely to be informative of forward-looking relative spectrum values in the UK, having considered country-specific circumstance and the timing of these awards.

A3.75 Considering the factors above, our view is that the Tier 1 criteria are satisfied for the relative value benchmarks from Hungary.

Summary

Table A3.12: Summary of evidence points from Hungary

	UK-equivalent absolute value (£m/MHz)			Relative value benchmark	
Band combination	700 MHz	2100 MHz	3.4-3.8 MHz	"Y/X" ratio	UK 2100 MHz (£m/MHz)
Value	77.7	31.7	9.7	0.32	9.9 (UK 3.4 GHz) 7.4 (UK 3.6 GHz)
Risk assessment; Tier	Risk of under- or overstatement	No specific risk identified	Risk of under- or overstatement	Risk of under- or overstatement Tier 1	

Source: Ofcom analysis

The Netherlands

A3.76 As we received no responses to the consultation in relation to our assessment of Dutch auctions, our assessment of Dutch auctions in this section is as set out in the July 2021 consultation and reproduced for completeness.

A3.77 The July 2020 Dutch multiband auction included 700 MHz and 2100 MHz spectrum.[75]

A3.78 In April 2010 there was an award of 2.6 GHz spectrum using a CCA auction format. As set out in our 2015 Statement, due to limits placed on the amount of spectrum that the three existing operators could win we do not consider that the auction prices reflected market value in the Netherlands.[76]

A3.79 As a result, in order to derive distance method benchmarks for the Netherlands we have estimated proxy values for the high frequency bands, as discussed in Annex 2, paragraphs A2.19-A2.23.

[75] A 2 x 10 MHz of 2100 MHz spectrum was also auctioned in the Netherlands in December 2012 as part of the multiband auction using a CCA format. As discussed in 2015 Statement, Annex 8, paragraphs A8.648-A8.657 we were unable to derive band specific prices from that award.

[76] Ofcom 2015 Statement, , Annex 8, p. 175, , https://www.ofcom.org.uk/__data/assets/pdf_file/0032/78629/annex_8.pdf.

July 2020 700 MHz, 1400 MHz and 2100 MHz award

A3.80 In July 2020, 700 MHz, 1400 MHz and 2100 MHz spectrum bands were awarded in the Netherlands through an SMRA-Clock hybrid auction format.[77]

A3.81 The award information is set out in Table A3.13 below and the auction features summarised in Table A3.14 below.

Table A3.13: July 2020 700 MHz, 1400 MHz and 2100 MHz award results[78,79]

	700 MHz (FDD) (MHz)	1400 MHz (SDL) (MHz)	2100 MHz (FDD) (MHz)	Price Paid (EUR m)
Total available	**2 x 30**	**40**	**2 x 60**	**1,219.7**
KPN	2 x10	15	2 x 20	415.8
Vodafone	2 x 10	15	2 x 20	415.8
T-Mobile	2 x 10	10	2 x 20	388.3
Unsold	-	-	-	
Total reserve price for band (EUR m)	**451.1**	**40.2**	**423.3**	
Total auction revenue (EUR m)	**473.9**	**251.9**	**493.9**	
% mark-up	**5%**	**526%**	**17%**	

Source: Deutsche Telekom, Dutch Government Gazette

[77] DotEcon, *Recommended auction model for the award of 700, 1400 and 2100 MHz spectrum*, March 2020, https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2020/03/06/bijlagen-veiling-mobiele-communicatie/DotEcon+-+Final+recommendations+including+assessment+of+responses.pdf.
[78] Deutsche Telekom article, *T-Mobile, KPN play 5G catch-up with VodafoneZiggo*, July 2020, https://www.telcotitans.com/deutsche-telekomwatch/t-mobile-kpn-play-5g-catch-up-with-vodafoneziggo/1948.article.
[79] Government Gazette of the Kingdom of the Netherlands, *Granting of multiband auction licenses by the Telecom Agency*, July 2020, https://zoek.officielebekendmakingen.nl/stcrt-2020-41318.html#d17e52, and https://www.agentschaptelecom.nl/onderwerpen/multibandveiling/documenten/publicaties/2020/07/27/biedingen-en-data-multibandveiling-2020.

Table A3.14: July 2020 700 MHz, 1400 MHz and 2100 MHz award features[80,81,82]

	Description	Comment
Licence duration	20 years; 700 MHz and 1400 MHz after the auction until end of 2040. 2100 MHz: from end of January 2021, until end of 2040.	
No of bidders; no. of lots; lot sizes	Three bidders 700 MHz: six lots of 2 x 5 MHz 1400 MHz: eight lots of 5 MHz 2100 MHz: 12 lots of 2 x 5 MHz	
Spectrum caps/restrictions	700 MHz: 40 MHz for KPN, 40 MHz for Vodafone, and 30 MHz for T-Mobile Auction[83]: 140 MHz for KPN, 120 MHz for Vodafone, and 80 MHz for T-Mobile.	Spectrum caps not binding
Reserve prices	700 MHz: €75.18m (per 2 x 5 MHz) 1400 MHz: €5.03m (per 5 MHz) 2100 MHz: €35.279m (per 2 x 5 MHz)	Spectrum sold above reserve.
Obligations	700 MHz: winners of 2 x 10 MHz (or more spectrum) are required to provide 98% of outdoor coverage with a minimum speed of 8Mbps after two years increasing to 10Mbps after six years.[84]	

Source: State Secretary for Economic Affairs and Climate Policy, DotEcon, and Dutch Government Gazette

Proxies for the value of high frequency bands

A3.82 We have derived proxies for the value of high frequency bands in the Netherlands using evidence about the relative prices from other countries. The range of proxy values for the available band combinations is summarised in Table A3.15.[85]

[80] The Dutch State Secretary for Economic Affairs and Climate Policy, *The application and auction procedure*, March 2020, https://www.government.nl/binaries/government/documents/publications/2020/03/06/non-binding-translation-auction-regulation-and-explanatory-notes-2020/Non-binding+translation+auction+regulation+and+explanatory+notes+2020.pdf.
[81] DotEcon, *Recommended auction model for the award of 700, 1400 and 2100 MHz spectrum*, March 2020, https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2020/03/06/bijlagen-veiling-mobiele-communicatie/DotEcon+-+Final+recommendations+including+assessment+of+responses.pdf.
[82] Government Gazette of the Kingdom of the Netherlands, *Granting of multiband auction licenses by the Telecom Agency*, July 2020, https://zoek.officielebekendmakingen.nl/stcrt-2020-41318.html#d17e52.
[83] The total auction cap reflects participants' existing spectrum holdings and lot sizes of auctioned spectrum.
[84] The coverage and speed requirement will only apply to parties that hold licences in the 800 and 900 MHz frequency bands and will be limited in time until 2030. The [Dutch] State Secretary for Economic Affairs and Climate Policy, *The application and auction procedure*, March 2020, https://www.government.nl/binaries/government/documents/publications/2020/03/06/non-binding-translation-auction-regulation-and-explanatory-notes-2020/Non-binding+translation+auction+regulation+and+explanatory+notes+2020.pdf.
[85] For the 2.6 GHz band, the range of proxy values derived using international benchmarks is significantly higher than the auction price achieved in the April 2010 2.6 GHz auction in the Netherlands with a UK-equivalent absolute value of £0.3m per MHz.

Table A3.15: Proxies for the value of high frequency bands in the Netherlands

High frequency band	Band combination used to derive proxy	Relative value ratio based on international benchmarks	UK-equivalent absolute value of proxy (£m per MHz)
2.3 GHz	700 MHz-2.3 GHz	0.25	7.0
	2100 MHz-2.3 GHz	0.28	4.0
	Mid-point	-	5.5
2.6 GHz	700 MHz-2.6 GHz	0.22	6.2
	2100 MHz-2.6 GHz	0.16	2.3
	Mid-point	-	4.2
3.4-3.8 GHz	700 MHz-3.4/3.8 GHz	0.31	8.6
	2100 MHz-3.4/3.8 GHz	0.39	5.6
	Mid-point	-	7.1

Source: Ofcom analysis

Whether award outcomes are likely to reflect market value in the Netherlands

A3.83 Both the 700 MHz and 2100 MHz spectrum sold slightly above reserve price, and the spectrum caps were not binding.

A3.84 Consistent with our approach in previous ALF Statements, we have considered the implications of the coverage obligations on the 700 MHz spectrum qualitatively. In principle, if such obligations were likely to require deployments significantly in excess of commercial levels then we considered that the auction price could risk understating the value of that band (without coverage obligation) in the UK in our assessment. We do not consider that the obligations in this auction were likely to require deployments significantly in excess of commercial levels.

A3.85 We note that in both the 700 MHz and 2100 MHz spectrum bands the auction outcome was an equal split of the spectrum between the three MNOs. Given the price was just above reserve this could be consistent with bidders tacitly colluding to obtain lower prices (market division) with the equal split of the spectrum in both bands being a focal point for this strategic demand reduction. While we cannot rule out the possibility of strategic demand reduction, we do not have clear evidence that it took place. Based on the information available to us, we consider that the auction is likely to have been competitive. We have not identified any specific risks associated with the 700 MHz and 2100 MHz awards, and this would suggest that they reflect market values in the Netherlands.

A3.86 As noted earlier, we do not consider that the 2.6 GHz auction prices reflected market value in the Netherlands. To derive a distance method benchmark, we use a proxy for the high frequency band. In the 2015 Statement, we discuss how using a proxy value carries a risk of under/overstatement to the distance method benchmark.[86,87]

Likelihood of reflecting relative market values in the UK

A3.87 We are not aware of any country-specific factors that would cause the Dutch 2020 auction results to not be reflective of the relative values of the spectrum bands in the UK.

Assessment of the benchmarks

Risk of understatement or overstatement

A3.88 Based on the above, we consider that the relative value benchmarks using 700 MHz, 2100 MHz and a high frequency proxy carry a risk of under/overstatement to the distance method benchmark, the likelihood or size of which we are unable to quantify.

Tiering

A3.89 Considering the criteria for inclusion in Tier 1:

a) The auction prices of 700 MHz and 2100 MHz were above reserve. This would suggest that the auction prices were primarily determined by a market-driven process of bidding.

b) Based on the evidence available to us, we consider that the relative prices in the auction are at least as likely to be based on bidders' intrinsic valuations of spectrum as on strategic bidding; and

c) The auction outcomes appear likely to be informative of forward-looking relative spectrum values in the UK, having considered country-specific circumstance and the timing of these awards.

A3.90 Considering the factors above, our view is that the Tier 1 criteria are satisfied for the relative value benchmarks from the Netherlands which use a proxy for the high frequency band.

[86] Ofcom 2015 Statement, Annex 8, paragraph A8.910 in relation to the Swedish distance method benchmark.
[87] There is a risk that the average ratio of 2.6 GHz to the low frequency spectrum, 700 MHz in this case may not reflect closely the relative value of these bands in the Netherlands.

Summary

Table A3.16: Summary of evidence points from the Netherlands

UK-equivalent absolute value (£m/MHz)				Relative value benchmark	
Band combination	**700 MHz**	**2100 MHz**	**2.3 GHz proxy**	**"Y/X" ratio**	**UK 2100 MHz (£m/MHz)**
Value	27.8	14.5	4-7	0.36-0.44	8.5-9.2
Band combination	**700 MHz**	**2100 MHz**	**2.6 GHz proxy**	**"Y/X" ratio**	**UK 2100 MHz (£m/MHz)**
Value	27.8	14.5	2.3-6.2	0.38-0.48	9.2-10
Band combination	**700 MHz**	**2100 MHz**	**3.4-3.8 GHz proxy**	**"Y/X" ratio**	**UK 2100 MHz (£m/MHz)**
Value	27.8	14.5	5.6-8.6	0.31-0.40	9.8-10.4 (UK 3.4 GHz) 7.2-8.2 (UK 3.6 GHz)
Risk assessment; Tier	No specific risk identified	No specific risk identified	Risk of under- or overstatement	Risk of under- or overstatement Tier 1	

Source: Ofcom analysis

Slovenia

A3.91 We received two responses[88] in relation to our assessment of Slovenian auctions which we consider below.

A3.92 We can derive two distance method benchmarks for Slovenia, namely 700-2100-2300 and 700-2100-3400/3600.

A3.93 These are based on the results of the April 2021 multiband auction.

A3.94 We note that a single lot of 2x5 MHz 2100 MHz spectrum was auctioned with a five year licence duration in September 2016 alongside a 2x10 MHz lot of 1800 MHz spectrum.[89] In

[88] BT consultation response, pp. 10-11 and pp. 14-15; Vodafone consultation response, pp. 6-7.
[89] We considered this award in 2018 Statement, Annex 2, paragraphs A2.259-A2.268.

light of the short licence duration and the limited amount of spectrum available we do not consider this auction to be informative of the market value of 2100 MHz spectrum in Slovenia. As a result, we use the results from the April 2021 multiband auction in deriving distance method benchmarks for Slovenia.

April 2021 700 MHz, 1500 MHz, 2100 MHz, 2.3 GHz, 3.6 GHz and 26 GHz award

A3.95 In April 2021, 700 MHz, 1500 MHz, 2100 MHz, 2.3 GHz, 3.6 GHz and 26 GHz spectrum bands were awarded in Slovenia. The auction was an enhanced SMRA (or eSMRA) format.[90,91]

A3.96 The award information is set out in Table A3.17 below and the auction features summarised in Table A3.18 below.

Table A3.17: April 2021 700 MHz, 1500 MHz, 2100 MHz, 2.3 GHz, 3.6 GHz and 26 GHz award results[92]

	700 MHz (FDD) (MHz)	700 MHz (SDL) (MHz)	1500 MHz (SDL) (MHz)	2100 MHz (FDD) (MHz)	2.3 GHz (TDD) (MHz)	3.6 GHz (TDD) (MHz)	26 GHz (TDD) (MHz)	Price Paid (EUR m)
Total available	**2 x 30**	**15**	**90**	**2 x 60**	**70**	**380**	**1000**	**164.2**
A1 Slovenija	2 x 10	-	45	2 x 15	-	100	400	42.4
T-2				2 x 10	40			18.2
Telekom Slovenije	2 x 10	15	25	2 x 20		140	400	52.1
Telemach	2 x 10		20	2 x 15	30	140	200	51.6
Unsold	-	-	-	-	-	-	-	
Total reserve price for band (EUR m)	**17.4**	**0.02**	**0.16**	**30.0**	**3.2**	**17.1**	**1.3**	
Total auction revenue (EUR m)	**31.4**	**0.035**	**2.81**	**70.6**	**11.2**	**46.5**	**1.7**	
% mark-up	**80%**	**75%**	**1655%**	**135%**	**255%**	**172%**	**38%**	

Source: AKOS

[90] AKOS [Slovenian NRA], *Public Tender with public auction for the award of radio frequencies for the provision of public communications services in the 700 MHz, 1500 MHz, 2100 MHz, 2300 MHz, 3600 MHz and 26 GHz radio frequency bands*, December 2020, https://www.akos-rs.si/fileadmin/user_upload/Tender_documentation_multiband.pdf.

[91] DotEcon advised AKOS on the auction design and characterised the auction as a "Combinatorial Clock Auction (CCA) with a relative cap activity rule". DotEcon, *AKOS announces results of spectrum auction*, April 2014, https://www.dotecon.com/news/akos-announces-results-of-spectrum-auction/.

[92] AKOS, *Auction results,* April 2021, https://www.akos-rs.si/en/akos-for-media/press-releases/news/results-of-multiband-auction.

Table A3.18: April 2021 700 MHz, 1500 MHz, 2100 MHz, 2.3 GHz, 3.6 GHz and 26 GHz award features[93]

	Description	Implications
Licence duration	15 years	
No of bidders; no. of lots; lot sizes	Four bidders 700 MHz (FDD): six lots of 2 x 5 MHz 700 MHZ (SDL): one lot of 10 MHz (+5 MHz[94]) 1500 MHz (SDL): six lots of 10 MHz and 2 lots of 10 MHz (+5 MHz[95]) 2100 MHz (FDD): 12 lots of 2 x 5 MHz[96] 2.3 GHz (TDD): seven lots of 10 MHz 3.6 GHz (TDD): 38 lots of 10 MHz 26 GHz (TDD): five lots of 200 MHz	
Spectrum caps/restrictions	700/800/900 MHz (FDD): 2 x 35 MHz 3.6 GHz (TDD): 160 MHz 26 GHz: 800 MHz Auction cap (excl. SDL): 425 MHz.	A1 and Telekom acquired spectrum up to the sub-1 GHz cap; none of the other caps were binding
Reserve prices	700 MHz (FDD): €2.9m (per 2 x 5 MHz) 700 MHZ (SDL): €20,000 (per 10 MHz) 1500 MHz (SDL): €20,000 (per 10 MHz) 2100 MHz (FDD): €2.5m (per 2 x 5 MHz) 2.3 GHz (TDD): €450,000 (per 10 MHz) 3.6 GHz (TDD): €450,000 (per 10 MHz) 26 GHz (TDD): €250,000 (per 200 MHz)	All spectrum sold above reserve.
Obligations	General coverage obligations apply to all but the 700 MHz SDL, 1500 MHz SDL and 26 GHz bands. In addition, winners of 700 MHz FDD are subject to additional coverage obligations (including a requirement to cover 99% of motorways, highways and population by end of 2025 with less stringent requirement on providers with no existing sub-1 GHz spectrum holdings).	

Source: AKOS

Our provisional view

Whether award outcomes are likely to reflect market value in Slovenia

A3.97 In our July 2021 Consultation we noted that the 700 MHz spectrum sold above reserve price although the spectrum cap was binding on two of the bidders. We recognised that this could create a risk that the auction price understates market value in Slovenia, which may be mitigated in part by the presence of a third bidder (Telemach) for whom the cap

[93] AKOS, *Public Tender with public auction for the award of radio frequencies for the provision of public communications services in the 700 MHz, 1500 MHz, 2100 MHz, 2300 MHz, 3600 MHz and 26 GHz radio frequency bands*, December 2020, https://www.akos-rs.si/fileadmin/user_upload/Tender_documentation_multiband.pdf.
[94] An additional 5 MHz is included in the licence with restrictions applied.
[95] 5 MHz is added to the lots at the lower and upper end of the band to protect the licences in the adjacent bands.
[96] One lot is available from April 2023, rather than from September 2021 like the other 11 lots.

was not binding and a fourth bidder (T-2) who did not secure any spectrum in the 700 MHz band.[97]

A3.98 Consistent with our approach in previous ALF Statements, we considered the implications of the coverage obligations on the 700 MHz spectrum qualitatively.

A3.99 We noted that general coverage obligations apply to most frequencies included in the 2021 auction.[98] In addition, there were additional coverage obligations on 700 MHz, which operators are able to meet using any spectrum holdings, and operators with no sub-1 GHz spectrum ahead of the auction have a longer timeframe for achieving these. Overall, we did not consider that the coverage obligations are likely to be over and above commercial levels.

A3.100 On balance, we considered that there is a risk that the 700 MHz price understates market value in Slovenia, but the scale of this understatement is unknown.

A3.101 We noted that the 2100 MHz, 2.3 GHz and 3.6 GHz spectrum all sold above reserve price, and there were no binding spectrum caps. Based on the information available to us, we did not identify any risks associated with these awards.

Likelihood of reflecting relative market values in the UK

A3.102 We said that we were not aware of any country-specific factors that would cause the Slovenian 2021 auction results to not be reflective of the relative values of the spectrum bands in the UK.

Risk of understatement or overstatement

A3.103 Based on the above, we considered that the relative value benchmarks using 700 MHz, 2100 MHz and either of 2300 MHz or 3.6 GHz carry a risk of overstatement to the distance method benchmark. However, we were unable to determine the likelihood or scale of this overstatement.

Tiering

A3.104 We considered the criteria for inclusion in Tier 1:

a) The auction prices of 700 MHz, 2100 MHz, 2.3 GHz and 3.6 GHz were above reserve. This would suggest that the auction prices were primarily determined by a market-driven process of bidding.

b) Based on the evidence available to us, we consider that the relative prices in the auction are at least as likely to be based on bidders' intrinsic valuations of spectrum as on strategic bidding; and

[97] Based on the available information we do not know whether T-2 sought to acquire any spectrum in the 700 MHz band.
[98] Excluding the 700 MHz SDL, 1500 MHz SDL and 26 GHz bands.

c) The auction outcomes appear likely to be informative of forward-looking relative spectrum values in the UK, having considered country-specific circumstance and the timing of these awards.

A3.105 Considering the factors above, our provisional view was that the Tier 1 criteria are satisfied for the relative value benchmarks from Slovenia.

Consultation responses

A3.106 BT, Vodafone and Frontier (commissioned by Vodafone) raised concerns with the 700 MHz and 2100 MHz auction prices used in the Slovenian benchmarks, arguing that these should not be considered as Tier 1:

a) BT, Vodafone and Frontier argued that caps applied to sub-1 GHz spectrum in the Slovenian 2021 auction, which were binding on two of the bidders (Telekom Slovenije and A2 Slovenija), had the effect of constraining demand in the 700 MHz band.[99]

b) BT, Vodafone and Frontier argued that the Slovenian 700 MHz spectrum was accompanied by onerous coverage obligations, which were difficult to achieve for the smallest operator (T-2) who could therefore only bid weakly in that band and focused its demand on the 2100 MHz band.[100]

c) BT suggested that the Slovenian 2100 MHz price was the result of strategic price driving because one of the bidders (T-2) only held spectrum in this band prior to the auction and it was therefore imperative for it to secure spectrum in this band to operate its network beyond September 2021, which gave the other bidders a strong incentive to bid strategically.[101]

d) Vodafone argued that the relative prices of the Slovenian 2100 MHz and 700 MHz spectrum are at odds with what the Slovenian regulator believed when it set the eligibility point requirement for 700 MHz spectrum well above that for 2100 MHz spectrum in the auction rules. Vodafone and Frontier suggested that the outcome arose because of the auction rules around switching demand between these two bands, which led to bidders becoming inadvertently stranded on 2100 MHz when its price outstripped that of 700 MHz.[102]

A3.107 We address these comments in our decision below.

[99] BT consultation response, p. 14; Vodafone consultation response, p. 7 and Frontier Economics report, p. 22-23.
[100] BT consultation response, p. 14; Vodafone consultation response, pp. 6-7 and Frontier Economics report, p. 17 and 21-23.
[101] BT consultation response, p. 14.
[102] Vodafone consultation response, p. 6 and Frontier Economics report, p. 17 and 22-23.

Our decision

Spectrum caps in the 700 MHz band

A3.108 We recognise the existence of spectrum caps in the 700 MHz band which were binding on two of the bidders. This has already been reflected in our assessment of risks.

Coverage obligations in the 700 MHz band

A3.109 We recognise that the coverage obligations attached to the 700 MHz band might have been more challenging to achieve for the smallest operator (T-2). We note that this might have been mitigated by the fact that operators with no sub-1 GHz spectrum ahead of the auction had a longer timeframe for achieving these, as noted above. On the balance, we do not consider this presents a significant risk in addition to that already identified as a result of the binding spectrum caps.

Possibility of strategic price driving in the 2100 MHz band

A3.110 Whilst we recognise that T-2 only held spectrum in the 2100 MHz band prior to the auction and might therefore have placed intrinsic value on acquiring spectrum in the same band, we note that all other operators also held 2100 MHz spectrum prior to the auction and ended up acquiring spectrum in that band equal or close to their pre-auction holdings.[103] We do not consider this to be indicative of operators bidding above their intrinsic values. Such behaviour would reduce their own ability to compete for other bands by spending an unnecessary amount from their budget on 2100 MHz while providing no clear benefits in terms of reducing competition from T-2: who was able to bid strongly in the 2.3 GHz band and secured most of the spectrum in that band alongside the spectrum it acquired in the 2100 MHz band.

Possibility of bidders becoming inadvertently stranded on 2100 MHz spectrum

A3.111 Activity rules of the auction placed restrictions on bidders' switching demand between different lot categories that can be summarised as follows:

a) Each lot category eligible for switching[104] was associated with a lot rating. For example, a 2x5 MHz lot of 700 MHz FDD carried a rating of 6, a 2x5 MHz lot of 2100 MHz carried a rating of 4, and a 1x10 MHz lot of 2300 MHz or 3.6 GHz carried a rating of 2.

b) A bidder's overall activity was measured in points, by multiplying the number of lots in each category by the lot rating in that category and summing across lot categories.

c) Bidders could switch demand between different lot categories subject to not exceeding their current level of activity. For example, a bidder wishing to switch to an extra lot of 700 MHz FDD would need to reduce their demand in other lot categories by 6 points.

[103] AKOS, *Results of Multiband Auction,* April 2021, https://www.akos-rs.si/en/akos-for-media/press-releases/news/results-of-multiband-auction.
[104] All lot categories except 26 GHz.

d) Also, the reduction of demand in a particular lot category was only possible subject to the aggregate demand in that lot category not falling below supply.[105]

A3.112 The above activity rules meant that switching demand from a single lot of 700 MHz FDD to a single lot of 2100 MHz would result in a loss of two activity points, while a similar switch in the opposite direction would not be possible.

A3.113 However, bidders could still switch demand between 700 MHz FDD and 2100 MHz without the loss of activity points, provided they switch three lots of 2100 MHz for every two lots of 700 MHz FDD. This would be possible in both directions.

A3.114 Also, bidders could switch demand between 700 MHz FDD and two other lot categories. For example, they could switch between one lot of 700 MHz FDD and the combination of one lot of 2100 MHz and one lot of 3.6 GHz. Again, this would work in both directions.

A3.115 We recognise that switching demand as outlined above would not be possible under some scenarios. For example, switching to 700 MHz FDD would not be possible if the excess demand across all other lot categories was less than six points. However, even in this case bidders would still be able to switch between 2100 MHz and the other lot categories such as 2300 MHz or 3.6 GHz if the latter presented a better value for money. Also, such a low level of excess demand, corresponding to no more than one lot of 2100 MHz, would likely imply the bidding was drawing to a close, which means a significant price increase would be unlikely at that point.

A3.116 Based on the above, it appears unlikely that bidding in the 2100 MHz led to a significant price increase due to bidders' inability to switch demand to other bands.

Risk of understatement or overstatement

A3.117 In the light of the consultation responses, we consider that our assessment of the risk of understatement or overstatement for the distance method benchmarks from Slovenia as presented in our July 2021 consultation remains appropriate.

Tiering

A3.118 Having considered the consultation responses as outlined above, we remain of the view that it is appropriate to consider the distance method benchmarks from Slovenia as Tier 1.

[105] AKOS, *Public Tender with public auction for the award of radio frequencies for the provision of public communications services in the 700 MHz, 1500 MHz, 2100 MHz, 2300 MHz, 3600 MHz and 26 GHz radio frequency bands*, December 2020, https://www.akos-rs.si/fileadmin/user_upload/Tender_documentation_multiband.pdf.

Summary

Table A3.19: Summary of evidence points from Slovenia

	UK-equivalent absolute value (£m/MHz)			Relative value benchmark	
Band combination	**700 MHz**	**2100 MHz**	**2.3 GHz**	**"Y/X" ratio**	**UK 2100 MHz (£m/MHz)**
Value	26.9	29.4	8.2	1.13	15.3
Risk assessment; Tier	Risk of understatement	No specific risk identified	No specific risk identified	Risk of overstatement Tier 1	
Band combination	**700 MHz**	**2100 MHz**	**3.4-3.8 MHz**	**"Y/X" ratio**	**UK 2100 MHz (£m/MHz)**
Value	26.9	29.4	6.3	1.12	14.8 (UK 3.4 GHz) 15.3 (UK 3.6 GHz)
Risk assessment; Tier	Risk of understatement	No specific risk identified	No specific risk identified	Risk of overstatement Tier 1	

Source: Ofcom analysis

Auction evidence from other countries

A3.119 In addition to the five countries outlined above, there are eight other European countries that have auctioned paired 2100 MHz spectrum since 2010.

A3.120 In the following section, we briefly summarise the results from the countries for which we can derive Tier 2 and Tier 3 distance method benchmarks.

A3.121 In addition, we note:

a) **Denmark** auctioned 2100 MHz spectrum in April 2021 as part of CMRA auction.[106] Given the format of the auction we are not able to derive band specific prices.

[106] Danish Energy Agency, *Danish press release on Auction results*, April 2021, https://ens.dk/presse/danskerne-faar-bedre-daekning-og-hurtigere-adgang-til-5g and Dotecon, *Completion of the 1500 MHz, 2100 MHz, 2300 MHz, 3.5 GHz and 26 GHz spectrum auction in Denmark,* April 2021, https://www.dotecon.com/news/completion-of-the-1500-mhz-2100-mhz-2300-mhz-3-5-ghz-and-26-ghz-spectrum-auction-in-denmark/.

b) **Switzerland** auctioned 2100 MHz spectrum in February 2012 as part of a CCA auction. As set out in our 2015 Statement we were unable to derive band specific prices.[107]

c) **Turkey** auctioned 2100 MHz spectrum in August 2015 as part of a multiband auction. Consistent with our approach in previous ALF Statements we have not included Turkey in our benchmarking exercise. We briefly discuss the auction in our 2018 Statement.[108]

A3.122 We note that additional auction evidence has become available since our July 2021 consultation for relevant spectrum bands in Croatia (700 MHz and 3.4-3.8 GHz), Norway (2600 MHz and 3.4-3.8 GHz) and the main bidding phase of the Portugal auction. However, given the quality of evidence that is already available from these countries, we do not consider that any of the resulting band combinations would allow us to produce a relative value benchmark likely to qualify higher than Tier 3. Consequently, we consider it would be disproportionate to perform a full analysis of this additional evidence at this stage.

Tier 2 benchmarks

A3.123 We have not identified any Tier 2 distance method benchmarks.[109]

Tier 3 benchmarks

Croatia

A3.124 We are able to derive a distance method benchmark for Croatia using the November 2013 800 MHz auction[110], the January 2019 2100 MHz auction[111] and the 2.6 GHz proxy we used for Croatia for our 2018 ALF Statement.[112]

A3.125 We consider this benchmark to be Tier 3 evidence given that the primary determinant of the 800 MHz auction result was the level of the reserve price and the 2100 MHz award was a first price sealed bid auction[113] for spectrum with a licence duration of only five years.

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[107] Ofcom 2015 Statement, Annex 8, paragraphs A8.294-A8.940.
[108] Ofcom 2018 Statement, Annex 2, paragraphs A2.269-A2.279.
[109] We note that in its response, Vodafone said that as Tier 2 is supposed to be used to provide a cross-check on the results from Tier 1 benchmarks and to ensure a conservative outcome, the absence of Tier 2 benchmarks was a significant gap. While Tier 2 and Tier 3 benchmarks (where available) are used as a cross-check on the results of the Tier 1 benchmarks, we disagree that the absence of any Tier 2 benchmarks is a significant gap. The benchmark evidence is objectively tiered against the tiering criteria. We do not consider it would be appropriate to downgrade Tier 1 or upgrade Tier 3 benchmarks in order to ensure that we had some Tier 2 benchmarks. See Vodafone's consultation response page 7; and Frontier's report, page 23.
[110] Ofcom 2018 Statement, Annex 2, paragraphs A2.11-A2.46.
[111] Hrvatska regulatorna agencija za mrežne djelatnosti [Croatian NRA] (HAKOM), *Press release on bids received*, January 2019, https://www.hakom.hr/hr/otvorene-su-ponude-zaprimljene-u-postupku-javne-drazbe-radiofrekvencijskog-spektra-434/434.
[112] Ofcom 2018 Statement, Annex 2, paragraphs A2.37.
[113] In a single-round sealed-bid first price auction, bidders are highly likely to consider how others might bid. When determining what to bid, bidders will typically trade off the amount paid in the event of winning (which they would want to minimise) with the chance of having a higher bid than those of their rivals. In having these considerations, bidders will decide what share of their valuation they will bid. Making bids below valuation is referred to as "bid shading".

Greece

A3.126 We are able to derive four distance method benchmarks for Greece, namely:

a) 700-2100-2600;

b) 700-2100-3400/3600;

c) 800-2100-2600; and

d) 800-2100-3400/3600.

A3.127 The 800 MHz and 2.6 GHz spectrum bands were auctioned in October 2014 and were discussed in our 2015 Statement.[114] The 700 MHz, 2100 MHz and 3.6 GHz bands were auctioned in December 2020.[115]

A3.128 We consider these benchmarks to be Tier 3 evidence. The 800 MHz and 2.6 GHz bands both sold at or very close to reserve price in 2014 as did the 700 MHz and 2100 MHz in 2020. As a result, we consider that the benchmarks largely reflect the relative value of reserve prices set by the regulator rather than market value or bidders' relative intrinsic valuations of different bands, and as such do not satisfy the first criteria for either Tier 1 or Tier 2.

Iceland

A3.129 We are able to derive two distance method benchmarks for Iceland, namely 700-2100-2600 and 800-2100-2600 as all four of those bands were auctioned in the May 2017 multiband auction.[116]

A3.130 We consider these benchmarks to be Tier 3 evidence. The 700 MHz, 800 MHz and 2100 MHz bands all sold at reserve price. As a result, we consider that the benchmarks largely reflect the relative value of reserve prices set by the regulator rather than market value or bidders' relative intrinsic valuations of different bands, and as such do not satisfy the first criteria for either Tier 1 or Tier 2.

[114] Ofcom 2015 Statement, Annex 8, paragraphs A8.493-A8.536.
[115] CommsUpdate, *Greece: lightning 5G sale – article on auction results*, December 2020, https://www.commsupdate.com/articles/2020/12/17/greece-lightning-5g-sale/, and The Hellenic Telecommunications and Post Commission (EETT), *Press release on auction results [in Greek]*, December 2020, https://www.eett.gr/opencms/opencms/admin/News_new/news_1353.html.
[116] Electronic Communications Office of Iceland (ECOI), *Press release on auction results [in Icelandic]*, May 2017, https://www.pfs.is/fjarskipti/tidnir-og-taekni/upplysingar-vegna-tidniuppbods-22.-mai-2017 and CommsUpdate, *Iceland concludes auction for LTE spectrum in four bands – article on auction results*, June 2017, https://www.commsupdate.com/articles/2017/06/02/iceland-concludes-auction-for-lte-spectrum-in-four-bands/.

Norway

A3.131 There have been two awards of 2100 MHz in Norway in recent years. The first in November 2012[117] and the second in June 2019[118] when 2100 MHz was auctioned alongside 700 MHz.

A3.132 We are able to derive distance method benchmarks using the 700 MHz and the 2100 MHz from the June 2019 auction and a proxy value for the high frequency band.[119] We could also derive distance method benchmarks using the 2100 MHz from the November 2012 auction.

A3.133 We note that on both occasions when 2100 MHz has been auctioned it has sold at the reserve price. As a result, we consider that the benchmarks largely reflect the relative value of the reserve prices set by the regulator for 2100 MHz relative to different bands rather than market value or bidders' relative intrinsic valuations of different bands, and as such do not satisfy the first criteria for either Tier 1 or Tier 2. We therefore consider these benchmarks to be Tier 3 evidence.

Summary of Tier 3 benchmarks

A3.134 Table A3.20 below summarises the distance method benchmarks for the Tier 3 benchmarks discussed above.

Table A3.20: Summary of Tier 3 benchmarks

	UK-equivalent absolute value (£m/MHz)			Relative value benchmark	
	700 MHz	**2100 MHz**	**2.6 GHz**	**"Y/X" ratio**	**UK 2100 MHz (£m/MHz)**
Greece	24.4	8.5	4.1	0.22	7.9
Iceland	5.5	5.2	3.7	0.82	14.1
	700 MHz	**2100 MHz**	**3.4-3.8 MHz**	**"Y/X" ratio**	**UK 2100 MHz (£m/MHz)**
Greece	24.4	8.5	2.4	0.28	9.6 (UK 3.4 GHz) 7 (UK 3.6 GHz)
	700 MHz	**2100 MHz**	**proxies**	**"Y/X" ratio**	**UK 2100 MHz (£m/MHz)**

[117] CommsUpdate, *NPT confirms conclusion of 2GHz auction after one round – article on auction results*, November 2012, https://www.commsupdate.com/articles/2012/11/20/npt-confirms-conclusion-of-2ghz-auction-after-one-round/.
[118] CommsUpdate, *Nkom announces results of 700MHz, 2100MHz spectrum auction - article on auction results*, June 2019, https://www.commsupdate.com/articles/2019/06/06/nkom-announces-results-of-700mhz-2100mhz-spectrum-auction/
[119] 800 MHz was auctioned in Norway in December 2013 but due to the auction format we were unable to derive band-specific prices. Ofcom 2015 Statement, Annex 8, pp. 179-181.

Norway	19	11.2	3.1-4.8 (2.3 GHz) 1.8-4.2 (2.6 GHz) 4.4-5.9 (3.4-3.8 GHz)	0.46-0.51 (2.3 GHz) 0.48-0.55 (2.6 GHz) 0.41-0.47 (3.4-3.8 GHz)	8.3-10.8
	800 MHz	**2100 MHz**	**2.6 GHz**	**"Y/X" ratio**	**UK 2100 MHz (£m/MHz)**
Greece	44.7	8.5	4.1	0.11	9.2
Iceland	5.5	5.2	3.7	0.82	31.6
	800 MHz	**2100 MHz**	**2.6 GHz proxy**	**"Y/X" ratio**	**UK 2100 MHz (£m/MHz)**
Croatia	86.5	34.9	9.3	0.33	15.3
	800 MHz	**2100 MHz**	**3.4-3.8 GHz**	**"Y/X" ratio**	**UK 2100 MHz (£m/MHz)**
Greece	44.7	8.5	2.4	0.14	11.6 (UK 3.4 GHz) 8.5 (UK 3.6 GHz)

Source: Ofcom analysis

A4. Annualisation

Our approach

A4.1 In Section 4 we set out our revised annualisation rate and the annual licence fees for the paired 2100 MHz spectrum derived from this annualisation rate.

A4.2 In this section we set out the detail behind our approach to deriving the annualisation rate. We adopt the same approach to annualisation that we used in the 2018 Statement and in the 2019 3.4 – 3.6 GHz ALF Statement.[120] This section also addresses the comments we received in response to the July 2021 consultation.

A4.3 We calculate the ALFs by spreading the lump-sum value of spectrum over 20 years, using an ALF profile that is flat in real terms (i.e. adjusted for inflation). The annualisation rate used to calculate the annual payment depends on three key parameters: the discount rate (which we explain below); the time period for annualisation (20 years); and the tax adjustment factor (TAF), which is used to adjust the annual fees to reflect the more favourable tax treatment of annual fees compared to a lump-sum payment.

A4.4 Specifically, the value of ALF in year t is derived from the lump sum value (LSV) in 2021, annualisation rate and inflation as follows:

$$ALF_t = LSV * TAF * \underbrace{\left[\frac{r}{1-(1+r)^{-t*}}\right] * \left[\frac{1}{(1+r)}\right]}_{\text{Annualisation rate}} * \left[\frac{CPI_t}{CPI_{t0}}\right]$$

A4.5 Where:

- ALF_t is the value of ALF in year t;
- LSV is the lump-sum value of spectrum;
- TAF is an adjustment factor that reflects the tax advantages of ALF over lump-sum payments;
- r is the real post-tax discount rate;
- t* is the length of period over which we spread the LSV for the purposes of calculating ALF, i.e. 20 years; and
- CPI_{t0} is the level of the CPI (all items) index in April 2021 and CPI_t is the latest available figure for the same index published in the Consumer Price Inflation Reference Tables by the Office for National Statistics.

[120] Ofcom, *Annual Licence Fees for UK Broadband's 3.4 GHz and 3.6 GHz spectrum,* 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.

Discount rate for annualisation

A4.6 In spreading the lump sum over a 20-year period, we use a discount rate at which the present value of the resulting payment stream equals the lump-sum value if it had been paid today.

A4.7 The discount rate depends on, among other things, the uncertainty associated with this future ALF payment stream. One uncertainty relates to whether changes in the market value of the spectrum over time affect future ALFs. The discount rate which will leave MNOs indifferent between paying ALFs and paying a lump-sum amount depends on the extent to which changes in the market value over time affect the level of ALF and, therefore, it is an important consideration in determining an appropriate discount rate.

A4.8 As in previous ALF decisions, we consider that the appropriate discount rate would sit somewhere between a lower polar case of the cost of debt (as an approximation of the case where the ALFs are fixed for 20 years and do not vary with market value) and an upper polar case of the weighted average cost of capital (WACC, as an approximation of the case where the ALFs vary with the market value of the spectrum). We use a risk-sharing adjustment to determine where between these two polar cases the appropriate discount rate would lie.

A4.9 Consistent with the approach described above, in our July 2021 consultation, we proposed a real post-tax discount rate of 0.2%. This was based on a lower polar case of -1.0%, an upper polar case of 3.6%, and a 25% risk-sharing adjustment.[121]

A4.10 We discuss our proposals, the stakeholder comments, and our decision on each component of the discount rate below.

Lower polar case

Our provisional view

A4.11 Consistent with our established methodology, we proposed to use an estimate of the pre-tax nominal cost of debt for UK MNOs as our starting point for the discount rate in the lower polar case. Specifically, we proposed to use market rates for BBB-rated 10-year corporate bonds.[122]

A4.12 We then proposed to reduce the current market rate (calculated as a 12-month average yield) for our estimate of the inflation risk premium and the liquidity risk premium. Finally, we converted the adjusted cost of debt into a real post-tax figure, using our long-term inflation and tax rates assumptions. For the purposes of the consultation, we used a lower

[121] In other words, the discount rate is calculated as: [lower polar case + (upper polar case – lower polar case) * risk-sharing adjustment], rounded to one decimal point.
[122] Based on Bloomberg's BVCSGU10 Index.

polar case of -1.0%, using data up to 31 October 2020.[123] We noted that we would update the cost of debt for the latest market evidence in the Statement.

Consultation responses

A4.13 BT, Three and VMO2 thought we overstated the cost of debt by using a BBB bond index.

a) BT suggested that ALFs are paid to the government (via Ofcom) ahead of any payments to debt holders, and as such represent a more 'senior' claim on MNO cash flows. BT suggested that rating agencies assign a one notch difference in credit rating between senior and subordinated debt.[124]

b) BT also suggested that ALFs are more like a bond secured against an asset, since in the event of non-payment, the government can revoke the licence, re-sell to another MNO and recoup some of the loss. BT claimed this would warrant a further one notch uplift to the assumed credit rating.

c) Overall, BT considered that we should estimate the cost of debt with reference to an 'A-' rating, and estimated that this would reduce our cost of debt by 26bps.[125]

d) VMO2 and Three made similar arguments to BT. Three referenced previous work by NERA (on behalf of Telefonica) which estimated that an adjustment for security could be worth around 10-12bps.[126]

A4.14 Vodafone did not comment on the methodology but stated that cost of debt estimates using more recent market data would lead to a lower cost of debt estimate.[127]

Our decision

A4.15 Further to consideration of responses to consultation, we have decided to use the same methodology for the lower polar case as in the July 2021 consultation. The latest market evidence produces a lower polar case of -1.0%, unchanged from the consultation. While corporate bond yields have declined, this has been offset by a reduction in the debt premium, resulting in a smaller adjustment for liquidity risk. We expand on our reasoning and address key consultation responses below.

Benchmark index

A4.16 We continue to use the BBB 10-year bond index to derive the pre-tax nominal cost of debt.

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[123] This is the cut-off date we used for estimating various cost of capital parameters in our recent charge control decisions in telecoms; Ofcom, *Promoting competition and investment in fibre networks: Wholesale Fixed Telecoms Market Review 2021-26*, March 2021, Annex 20, https://www.ofcom.org.uk/__data/assets/pdf_file/0021/216084/wftmr-statement-annexes-1-26.pdf.In the remainder of this Annex we refer to this as **WFTMR 2021**.Ofcom, *Wholesale Voice Markets Review 2021-26*, March 2021, Annex 2, https://www.ofcom.org.uk/__data/assets/pdf_file/0026/216791/annexes-1-4-2021-26-wholesale-voice-markets-review.pdf. In the remainder of this Annex we refer to this as **MCT 2021**.

[124] BT consultation response, pp. 20-22; Three consultation response, pp. 13-17; VMO2 (additional) consultation response; and Vodafone consultation response, pp. 8-10.

[125] BT consultation response, pp. 22-24; Three consultation response, pp. 13-17; VMO2 (additional) consultation response and Vodafone consultation response, pp. 8-10.

[126] Three consultation response, pp. 14-15 andVMO2 (additional) consultation response.

[127] Vodafone consultation response, p. 8.

A4.17 In previous ALF decisions, we discussed extensively whether using the MNO corporate cost of debt, with a BBB rating, is appropriate. While the ALF payments are not identical to repaying interest on a corporate bond, we were not persuaded that there was evidence of the ALF payment stream being sufficiently less risky, such that it would afford an explicit ratings uplift. The latest responses from some of the MNOs repeat many of the arguments we have previously discussed.

A4.18 With respect to security, we considered that the rating agency guidance was clear that any ratings uplift would depend on a range of structural features of the debt in question, most of which did not apply to ALF payments. We also noted that there was uncertainty about the remaining value of spectrum that could be realised in the event of an MNO 'defaulting' on the ALFs.[128] We therefore disagree that we should adjust the cost of debt for security.

A4.19 With respect to subordination, it is similarly clear from the rating agency guidance (cited by BT in its response) that the debt would need to be contractually senior in ranking, and that there are several other factors which are used to make a distinction between senior and subordinated debt, which do not apply to ALFs.[129] We also previously discussed that it was not clear that the MNOs would always prioritise paying ALFs ahead of interest payments on debt, since the repercussions of defaulting on corporate debt could be greater than the repercussions of 'defaulting' on ALFs.[130] We therefore disagree that we should adjust the cost of debt for subordination.

Latest market evidence

A4.20 The 12-month average yield on the BBB 10-year bond index was 1.7% as at 29 October 2021. This is slightly lower than the 12-month average yield of 1.9% used in the July 2021 consultation. We then apply several adjustments to this latest yield as set out below.

Inflation risk premium

A4.21 We require an estimate of the real discount rate since we index the base level of ALF to outturn inflation. In deriving the real discount rate from data on nominal bond yields, we assume a constant rate of CPI inflation of 2% (consistent with our long-term view of inflation, discussed below). However, the actual annual ALF payments will be indexed to outturn inflation. This provides the government with protection against outturn inflation being different to forecast.

A4.22 Understanding how capital markets price in this type of inflation protection is not straightforward because there is no market for traded CPI-linked debt which can be used

[128] Ofcom 2018 Statement, Annex 5, paragraphs A5.31-38, https://www.ofcom.org.uk/__data/assets/pdf_file/0021/130548/Annexes-1-6.pdf.

[129] For example, S&P's methodology involves six distinct steps to assess whether to apply a notch differential, with ALF payments not fitting the description of securities which might attract a different rating to the issuer's main rating. S&P (2018), Reflecting Subordination Risk in Corporate Issue Ratings, pp. 3-5. Moody's methodology considers whether the difference in expected loss rate is sufficiently significant for any difference in rating to be applied. Moody's, *Updated Summary Guidance for Notching bonds, Preferred Stocks and Hybrid Securities of Corporate Issuers,* February 2007, p. 2, https://www.moodys.com/sites/products/aboutmoodysratingsattachments/2006400000430106.pdf.

[130] Ofcom, *Annual licence fees for 900 MHz and 1800 MHz spectrum*, February 2015, paragraph 4.48. https://www.ofcom.org.uk/__data/assets/pdf_file/0022/83146/annual-licence-fees-900MHz-1800-further-consultation.pdf.

to infer the potential CPI inflation risk premium. In previous decisions, we acknowledged that there was some empirical evidence of a positive RPI inflation risk premium. With RPI more volatile than CPI and given that there is no explicit official inflation target for RPI (unlike CPI), we concluded that if there was any CPI inflation risk premium in nominal bond yields, it was not likely to be significant. To reflect the possibility of a positive inflation risk premium, we reduced the observed nominal yield by 10 basis points. We continue to apply this adjustment in this decision.

Liquidity risk premium

A4.23 Liquidity risk refers to the difficulties that a creditor may encounter when trying to sell an asset on the secondary market. This can restrict the creditor's ability to manage risk exposure, and so creditors may require a premium for bearing liquidity risk. In our case, there is no realistic prospect of the creditor (the government) wanting to resell the ALF payment stream. To the extent that our measure of the discount rate includes some compensation for liquidity risk, it might therefore be appropriate to remove it.

A4.24 As discussed in the 2018 Statement, there is empirical evidence that nominal bond yields include compensation for liquidity risk (i.e. the inability to easily trade the asset). However, we noted that this is an area of ongoing empirical research and estimates of the liquidity risk premium need to be treated with caution. In that decision, we applied a 30% adjustment to the debt premium to adjust for liquidity risk. [131]

A4.25 The average debt premium for the BBB index is 1.1%[132], compared to 1.4% in the consultation. After applying a 30% adjustment to this debt premium for liquidity risk, this translates into a 30bp reduction to our cost of debt estimate, rather than the 50bp we used in the July 2021 consultation.

Converting into a real post-tax figure

A4.26 After adjusting for inflation and liquidity risk, the pre-tax nominal cost of debt is 1.3%. We then derive a post-tax nominal discount rate, using our estimate of the average corporate tax rate which will prevail over the 20-year period (24.9%).[133] This gives a post-tax nominal rate of 1.0%. The equivalent post-tax real rate is then -1.0%, using our CPI inflation forecast of 2%.

Table A4.1: Discount rate in the lower polar case

Parameter	Value	Source or derivation
Pre-tax nominal cost of debt	**1.7%**	**Ofcom estimate**
Debt premium	**1.1%**	**Ofcom estimate**
Adjustment for inflation risk	**0.1%**	**Ofcom estimate**

[131] Ofcom 2018 Statement, Annex 5, paragraph A5.53, https://www.ofcom.org.uk/__data/assets/pdf_file/0021/130548/Annexes-1-6.pdf.
[132] Based on a 12-month average to 29 October 2021, consistent with our assumption for the cost of debt.
[133] The tax rate is 24.9%, based on our estimate of the average tax rate over the 20-year period from the TAF calculation.

Adjustment for liquidity risk	**0.3%**	**= 30% * debt premium**
Adjusted pre-tax nominal cost of debt	**1.3%**	**= pre-tax nominal cost of debt – adjustment for inflation risk – adjustment for liquidity risk**
Tax rate	**24.9%**	**Ofcom estimate**
Adjusted post-tax nominal cost of debt	**1.0%**	**= adjusted pre-tax nominal cost of debt * (1 – tax rate)**
CPI inflation forecast	**2.0%**	**Ofcom estimate**
Adjusted post-tax real cost of debt **(lower polar case)**	-1.0%	**= (1+ adjusted post-tax nominal cost of debt) / (1 + CPI inflation forecast) - 1**

Source: Ofcom.

Upper polar case

Our provisional view

A4.27 Consistent with previous ALF decisions, we proposed to base our estimate of the upper polar case on the forward-looking WACC which reflected the riskiness of a UK MNO. This is consistent with how we define the upper polar case, which is that, hypothetically, if the ALF payments were set up in such a way that they varied in line with the future after-tax cash flows of the licensee (e.g. through some form of net revenue sharing arrangement between the licensees and the government) the government would be fully exposed to the underlying systematic risk.

A4.28 We proposed a real post-tax WACC of 3.6%, which was largely based on input parameters underpinning our most recent price control decision in mobile (MCT 2021). A key difference between the WACC in MCT 2021 and our upper polar case WACC is that for the purposes of setting ALFs, we use a forward-looking cost of debt in the WACC, consistent with the lower polar case.

Consultation responses

A4.29 BT, Three and VMO2 considered the discount rate should be based solely on the lower polar case, i.e. that our risk-sharing adjustment should be zero.[134] This would remove the need for us to estimate a discount rate for the upper polar case. We discuss the rationale and our decision to retain the risk-sharing adjustment further below.

A4.30 However, if we continue to place some weight on the upper polar case, BT, Three and VMO2 considered that we had overstated the upper polar case by not adjusting the cost of capital for inflation and liquidity risk premia.[135]

[134] BT consultation response, pp. 18-20. Three consultation response, p. 16. VMO2 additional consultation response.
[135] BT consultation response, pp. 22-23; Three consultation response, pp. 15-16; VMO2 additional consultation response and Vodafone consultation response, pp. 8-10.

- BT, Three and VMO2 all stated that by fixing the ALF payments in real terms, the government would not be exposed to inflation risk in the upper polar case. We should therefore reduce the cost of capital by 0.1%, in the same way as we reduce the nominal cost of debt to remove the inflation risk premium associated with nominal corporate bonds in the lower polar case.
- BT, Three and VMO2 also all stated that the government would not need compensation for liquidity risk in the upper polar case, as there is no realistic prospect of the government wanting to resell the ALF payment stream. BT suggested applying the same adjustment to both the costs of debt and the costs of equity in the WACC. Using the consultation estimate of the liquidity risk premium in the lower polar case, BT asserted that the WACC should be reduced by 0.5%.

A4.31 Vodafone considered that we had overstated the asset beta by relying on BT's asset beta. Instead, it presented alternative beta estimates for mobile companies compiled by BEREC. Vodafone also noted that it would be unfairly penalised if an asset beta significantly above Vodafone's own asset beta of 0.52 was used.[136]

Our decision

A4.32 We have decided to use the same methodology for the upper polar case as in the July 2021 consultation. We considered, in light of consultation responses, whether the latest market evidence warrants a change in our cost of capital assumption. Based on our review, the discount rate in the upper polar case is unchanged at 3.6%, derived from the following inputs.

- A pre-tax nominal cost of debt consistent with the lower polar case, i.e. 1.7%.
- A nominal risk-free rate consistent with our cost of debt. Given the latest average debt premium of 1.1%, this implies a nominal RFR of 0.6%.
- A total expected market return (EMR) of 6.7%, consistent with our most recent cost of capital decisions in telecoms (WFTMR 2021 and MCT 2021).[137] A real EMR of 6.7% combined with a CPI inflation forecast of 2.0% produces a nominal EMR of 8.8%.[138]
- A forward-looking gearing of 45%, consistent with WFTMR 2021 and MCT 2021.
- A forward-looking asset beta of 0.62 and a debt beta of 0.10, consistent with WFTMR 2021 and MCT 2021. Combined with our gearing assumption, this implies an equity beta of 1.05.

Table A4.2: WACC for UK MNO, upper polar case

WACC component	Estimate	Source or derivation
Nominal RFR	**0.6%**	**Ofcom estimate**
Nominal EMR	**8.8%**	**Ofcom estimate**

[136] Vodafone consultation response, pp. 8-9.
[137] Ofcom WFTMR 2021 Statement, Annex 20, Table A20.1.
[138] Using the Fisher equation. Nominal EMR = (1 + real EMR) * (1 + CPI inflation) - 1

Nominal ERP	**8.2%**	**= Nominal EMR – Nominal RFR**
Debt beta (βd)	**0.10**	**Ofcom estimate**
Asset beta (βa)	**0.62**	**Ofcom estimate**
Gearing (g)	**45%**	**Ofcom estimate**
Equity Beta (βe)	**1.05**	**= (βa - βd*g) / (1-g)**
Pre-tax nominal cost of equity (Ke)	**12.3%**	**= (RFR + ERP *βe) / (1-t)**
Pre-tax nominal cost of debt (Kd)	**1.7%**	**Ofcom estimate**
Corporate tax rate (t)	**24.9%**	**Ofcom estimate**
Pre-tax nominal WACC	**7.5%**	**= Ke*(1-g) + Kd*g**
CPI inflation forecast	**2.0%**	**Ofcom estimate**
Post-tax nominal WACC	**5.6%**	**= pre-tax nominal WACC * (1-t)**
Post-tax real WACC	**3.6%**	**= (1+ post-tax nominal WACC) / (1+CPI inflation) -1**

Source: Ofcom. All real values are with respect to CPI.

A4.33 Regarding our assumption for the EMR, we typically assume that the EMR is relatively stable over time. Our assessment of the appropriate estimate in WFTMR 2021 and MCT 2021 drew on a range of evidence, most of which is long-term in nature, and ultimately reflected regulatory judgement. We consider that our assessment of the EMR in WFTMR 2021 and MCT 2021 remains appropriate for the purposes of setting ALFs in this decision, which comes only nine months after concluding these market reviews.

A4.34 Regarding our assumption for the asset beta, we also do not mechanistically adjust for short-term market movements in the beta. We consider all the evidence in the round before deciding on a point estimate. To arrive at the asset beta of 0.62 in MCT 2021, which was equivalent to the asset beta for the 'Other UK Telecoms' (OUKT) part of BT Group, as estimated in WFMTR 2021,[139] we used the following reasoning:

- Within our disaggregation of the BT asset beta, the OUKT category captures its mobile activities and a range of fixed telecoms services.[140]
- We had previously concluded that there was no statistically significant difference in the asset betas of mobile and fixed providers, and that as a result the OUKT asset beta is a relevant reference point for the asset beta of a UK MNO.[141]
- We reviewed the asset betas for a wide range of telecoms comparators, including the European parent companies of UK MNOs, in reaching our view on the appropriate

[139] For the purposes of setting charge controls in fixed access markets, we disaggregate the BT asset beta three-ways.
[140] Apart from lower risk fixed access services, which are captured in 'Openreach' within our disaggregation.
[141] Ofcom 2018 Statement, paragraph A5.78.

OUKT asset beta in WFTMR 2021.[142] We settled on a point estimate of 0.62 (lower than 0.65 used in previous decisions) reflecting the longer-term downward trend in the betas.[143]

A4.35 Given the extensive beta analysis undertaken as part of WFTMR 2021 and MCT 2021, our latest price control decisions on the asset beta continue to be a reasonable reference point for the systematic risk of a UK MNO, given the overall uncertainty in estimating betas.[144]

A4.36 Furthermore, we disagree with Vodafone's characterisation that our estimate is based solely on BT's data. As discussed above, we used a range of evidence, including beta evidence for the parent groups of UK MNOs.

A4.37 We also note that Vodafone did not raise concerns about our methodology or the level of the asset beta for UK mobile when we consulted on our MCT 2021 proposals.

A4.38 Finally, we note that the combination of our asset beta, debt beta and forward-looking gearing assumption produces an overall equity beta of 1.05 which is within the 95% confidence interval for Vodafone's equity beta (both at the time of the MCT 2021 analysis and more recently).[145] This is a helpful cross-check on the overall reasonableness of our assumptions, and, therefore, we do not agree that they penalise Vodafone.

Adjusting the upper polar case for inflation and liquidity risk

A4.39 The inflation and liquidity risk premia adjustments applied in the lower polar case arise because of our use of nominal corporate bond yields as a starting point for proxying the risk of ALF payments when they are fixed in real terms over the full 20 year period. The adjustments recognise that there is some empirical evidence that nominal bond yields may be an imperfect proxy for the risks we are trying to estimate (specifically, the default risk of the licensee).

A4.40 In the upper polar case, such adjustments are not necessary. In the upper polar case, the government is fully sharing in the risk of the operating cash flows of the licensee, and hence requires compensation for the full risk associated with these cash flows. The cost of capital for a typical licensee is the relevant benchmark to capture this compensation. In the capital asset pricing model (CAPM), which we use to estimate the cost of capital, the risk premium above the risk-free rate reflects the compensation required by investors for bearing systematic risk.[146]

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[142] Ofcom WFTMR 2021 Statement, Annex 21, paragraphs A21.102-106.
[143] The overall range for the asset betas of telecoms companies was quite wide: 0.41 to 0.81 against the home index, and 0.38 to 0.75 against the global index. Ofcom WFTMR 2021 Statement, Annex 21, Table A21.6.
[144] As a sense check, we considered recent trends in the market betas for BT Group and Vodafone, the two UK listed telecoms which own UK mobile networks. The 5-year equity betas for BT and Vodafone have remained broadly unchanged since our analysis for WFTMR 2021 / MCT 2021. The 5-year asset betas have declined slightly, reflecting the increase in average gearing, however, we note that measured asset betas can be unduly affected by short-term changes in market capitalisation affecting gearing. Overall, the recent evidence is broadly in line with the wider benchmarking of telecoms betas done for WFTMR 2021 / MCT 2021.
[145] Vodafone's equity beta at the time of WFMTR 2021 / MCT 2021 analysis was 0.96, with a 95% confidence interval of 0.84 to 1.09. Vodafone's updated 5-year equity beta (as at 29/10/21) was 0.98, with a 95% confidence interval of 0.91 to 1.06. Ofcom WFTMR 2021 Statement, Annex 21, Table A21.5. Ofcom analysis of Bloomberg data.
[146] Systematic risk is cash flow risk which cannot be diversified away by holding a portfolio of assets.

A4.41 We consider that, in the upper polar case, the government is in a position akin to any other investor fully participating in the cash flow risk of the licensee. We do not see compelling reasons why the systematic risk exposure (and hence the required compensation for risk) would differ between the government and another investor fully participating in the cash flow risk of the business. To illustrate this, it is helpful to consider the cost of capital for an all-equity financed firm.[147] The cost of capital would then be measured by the risk-free rate plus the equity beta multiplied by the equity risk premium. In the CAPM, the beta measures the covariance of company returns with the market.

A4.42 With respect to liquidity risk, there is no explicit consideration of liquidity within the CAPM framework. In fact, implicitly, the required return is the same for liquid and illiquid assets with similar market risk exposure.[148]

A4.43 With respect to inflation risk, outturn ALF payments would have the same market risk as MNO cash flows. ALF payments would only be fixed in real terms (i.e. provide protection against outturn inflation being different to our forecast of 2%) if the underlying MNO cash flows go up or down with outturn inflation. To the extent that investing in MNO cash flows provides some inflation protection that is valued by investors (i.e. it provides protection against a particular market risk which cannot be diversified away), this would be captured in our beta estimate.

Risk-sharing adjustment

Our provisional view

A4.44 We proposed to make an adjustment for the degree of risk sharing between licence holders and the government – which arises due to the possibility of future fee reviews that could increase or decrease the ALF payments (subject to the completion of any such review). The possibility of a review of ALFs exposes the government to a degree of systematic risk of the cash flows from the operation of the licences. Therefore, we considered that a risk-sharing adjustment was appropriate.

A4.45 In line with our previous ALF decisions, we proposed to allow for a 25% risk sharing adjustment between the lower polar case and upper polar case to estimate the final discount rate.

[147] We could have used an all-equity WACC in the upper polar case. We are interested in estimating the government's exposure to systematic risk, which is a function of business risk and is independent of capital structure. We assume some debt financing in the WACC simply to reflect that in practice MNOs have some debt in their capital structure. The all-equity WACC is also 3.6% (to one decimal point).

[148] See, for example, A. Damodaran, *Marketability and Value: Measuring the Illiquidity Discount,* July 2005, p. 19, https://people.stern.nyu.edu/adamodar/pdfiles/papers/liquidity.pdf. "In conventional asset pricing models, the required rate of return for an asset is a function of its exposure to market risk. Thus, in the CAPM, the cost of equity is a function of the beta of an asset […] Consequently, the required rate of return will be the same for liquid and illiquid assets with similar market risk exposure."

Consultation responses

A4.46 BT considered that the proposed risk-sharing adjustment of 25% was inappropriate and that the discount factor should instead be based on the lower polar case. BT argued that, unlike with previous ALF decisions, there are no planned spectrum auctions in the next 20 years that are of obvious relevance to the 2100 MHz ALF and that there would therefore be no market reference point to justify a change to the ALF during the licence period. Similarly, it also suggested that a future international auction was unlikely to trigger a fee review. [149]

A4.47 BT also stated that if Ofcom continues to believe that a risk-sharing adjustment is appropriate, it should at a minimum revise the risk-sharing adjustment to 10%.[150]

A4.48 Three and VMO2 made similar arguments to BT.[151]

Our decision

A4.49 Further to consideration of responses to consultation, we have decided that a risk-sharing adjustment of 25% remains appropriate.

A4.50 The risk-sharing adjustment determines where the final discount rate sits between the lower and the upper polar cases. A non-zero risk-sharing adjustment means there is a likelihood of future fee reviews that could increase or decrease the ALFs.

A4.51 In both our 2015 and 2018 Statement, we did not think it sensible to try to assign specific probabilities to when a review (or reviews) might take place. We considered some stylised examples to gain insight into the question but acknowledged that ultimately we needed to exercise judgement. Taking a conservative approach to interpreting the evidence, we decided a risk-sharing adjustment of 25% was appropriate.[152]

A4.52 Whilst in these decisions we noted that the upcoming 700 MHz and 3.6-3.8 GHz auction could potentially trigger a review of ALFs if this provided evidence of a material misalignment, it is not the case that this was the only factor which could trigger such a review and we noted that we could not predict at what point a fee review might occur.[153] Spectrum holders are able to hand back their spectrum, which implies a degree of risk transfer, and there might be other circumstances which provide evidence of a material misalignment.

A4.53 Given that material misalignment could occur regardless of whether or not additional auctions occur in future, a non-zero risk sharing adjustment remains appropriate. We remain of the view that while it is possible to create many different scenarios of how and

[149] BT consultation response, pp. 18-20.

[150] BT consultation response, pp. 18-20.

[151] Three consultation response, p. 16 and VMO2 additional consultation response.

[152] Ofcom 2018 Statement, paragraph A5.100.

[153] Ofcom, *Annual licence fees for 900 MHz and 1800 MHz spectrum*, February 2015, paragraph 7.41, https://www.ofcom.org.uk/__data/assets/pdf_file/0022/83146/annual-licence-fees-900MHz-1800-further-consultation.pdf.

when any review might occur, there is no certainty as to whether and when any review would be undertaken. The risk-sharing adjustment ultimately reflects our regulatory judgement, and we have therefore decided to retain the 25% risk-sharing adjustment, consistent with previous ALF decisions.

Discount rate for annualisation

A4.54 To calculate the final discount rate, we need to combine our discount rates in the lower and upper polar cases together with the 25% risk-sharing adjustment. Some stakeholders have queried our approach to rounding the intermediate calculations, and the final answer, and suggested that it disadvantages the MNOs.[154]

A4.55 As most of the inputs into our discount rate calculations reflect judgement, rather than precise values, there is not necessarily one right approach to rounding. We still prefer rounding the overall discount rate to one decimal point, to reflect that this final number is ultimately also a judgement.

A4.56 In the July 2021 consultation, we used the unrounded values for the discount rates in the upper and lower polar cases (which result from our choice of individual parameters) to arrive at our final discount rate of 0.2%.[155] Applying the same approach for the statement, the final discount rate to two decimal points is 0.14%, which rounds to 0.1% to one decimal point. The slight differences in the final answer arise due to the specific changes to some of the inputs discussed earlier.

A4.57 Therefore, our overall post-tax real discount rate in this decision is 0.1%.

Tax adjustment

A4.58 We calculate a tax adjustment from the difference in tax benefits from ALF payments compared to the tax deductions available from amortisation of a lump-sum payment, converted to present values using the post-tax discount rate. The tax adjustment factor (TAF) is calculated as:

$$TAF = 1 + \left[\frac{(PV\ of\ tax\ benefits\ of\ ALF - PV\ of\ tax\ benefits\ of\ the\ amortisation\ of\ LSV)}{LSV}\right]$$

A4.59 We estimate a tax adjustment factor of 1.058, which equates to an average tax rate of 24.9% over the 20-year period.

Annualisation rate

A4.60 As summarised in Table A4.3 below, the resulting annualisation rate is 5.34%.

[154] BT consultation response, p. 24 and Three consultation response, pp. 13-14.
[155] The final discount rate to two decimal points was 0.16%. If we simply used rounded estimates of -1.0% and 3.6%, the final discount rate to two decimal points was 0.15%. In both cases, the final answer rounded to one decimal point was 0.2%.

Table A4.3: Summary of input values into formula for calculating base level of ALF

	Our decision
Length of period over which we spread the LSV for the purposes of calculating ALF (t*)	20 years
Real post-tax discount rate (r)	0.1%
Adjustment factor that reflects tax advantages over lump-sum payments (TAF)	1.058
Annualisation rate	5.34%

Source: Ofcom

A5. Copy of Regulations

This is a copy of the Regulations made by the Office of Communication on 13th December 2021 as submitted for registration and publication. The final version of these Regulations will be published on legislation.gov.uk in due course.

STATUTORY INSTRUMENTS

2021 No. 0000

ELECTRONIC COMMUNICATIONS

The Wireless Telegraphy (Licence Charges for the 2100 MHz Frequency Band) Regulations 2021

Made - - - -	*13th December 2021*
Coming into force - -	*27th December 2021*

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

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, commencement, and extension

1.—(1) These Regulations may be cited as the Wireless Telegraphy (Licence Charges for the 2100 MHz Frequency Band) Regulations 2021 and shall come into force on 27th December 2021.

(2) These Regulations do not extend to the Channel Islands and Isle of Man.

Interpretation

2. In these Regulations—

"concurrent licence" means a licence held by two or more persons;

"licence" means a wireless telegraphy licence of the Spectrum Access 2100 MHz licence class;

"licensee" means a person who is the holder of a wireless telegraphy licence of the Spectrum Access 2100 MHz licence class;

"OFCOM" means the Office of Communications; and

(**a**) 2006 c.36

"2100 MHz paired frequency band" means the frequencies from 1920.0 megahertz to 1979.7 megahertz and 2110.3 megahertz to 2169.7 megahertz.

Licence charges payable for the 2100 MHz paired frequency band

3.—(1) On 4th January 2022, and on each anniversary of that date, a licensee shall pay to OFCOM the total sum specified in paragraph (2).

(2) The total sum to be paid in accordance with paragraph (1) shall be determined having regard to the following formula—

$S = £56{,}100 \times N \times [CPI_t \div CPI_0]$

where—

(a) "S" means the total sum;

(b) "N" means the total number of kilohertz within the 2100 MHz paired frequency band (the use of which is authorised under a licence, across the United Kingdom) divided by one hundred;

(c) "CPI" means the number given in respect of that month in the monthly all items consumer prices index published by the Office for National Statistics;

(d) "CPI_t" means the most recent CPI value that is available on 4th January of the year in which charges are due; and

(e) "CPI_0" means the CPI value for April 2021.

(3) 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.

Payment by instalments

4.—(1) This regulation applies in respect of a licensee where —

(a) the total sum payable by that licensee in accordance with regulation 3 is in excess of £100,000; and

(b) OFCOM receive notice from that licensee of that licensee's intention to make payment in ten equal instalments of that total sum.

(2) Where this regulation applies in respect of a licensee, that licensee—

(a) shall not be required to make payment of the total sum prescribed by regulation 3 at the prescribed time other than in accordance with this paragraph; and instead

(b) shall make payment of the total sum in ten equal instalments with the first instalment to be paid to OFCOM on the day which shall be the same day as the total sum was due to be paid to OFCOM and each subsequent instalment to be paid on the same day in each of the nine consecutive months thereafter.

(3) Where at any time, the licensee fails to make payment in accordance with paragraph (2)(b), all of the outstanding payments, if any, shall become immediately due for payment.

Concurrent licence

5. In the case of a concurrent licence, the "licensee" in these Regulations shall refer to all the concurrent holders of that licence.

Philip Marnick
Group Director of Spectrum
Office of Communications

13th December 2021

EXPLANATORY NOTE

(This note is not part of the Regulations)

These Regulations set the level of charges payable to the Office of Communications ("OFCOM") in respect of the Spectrum Access 2100 MHz licence class, for wireless telegraphy licences granted under section 8 of the Wireless Telegraphy Act 2006 which authorise the use of the frequencies 1920.0 megahertz to 1979.7 megahertz paired with the frequencies 2110.3 megahertz to 2169.7 megahertz.

Regulation 3 prescribes the charges payable after these Regulations commence. Such charges equate to an amount of £561,000 per megahertz.

A regulatory impact assessment of the effect of these Regulations has been prepared and is available to the public from the OFCOM Library at Riverside House, 2a Southwark Bridge, London SE1 9HA (Tel: 020 7981 3000) and on OFCOM's website at www.ofcom.org.uk. Copies of the regulatory impact assessment have been placed in the libraries of both Houses of Parliament.