18 September 2024

BT INFORMATION TO ASSIST OFCOM IN ITS REVIEW OF ANNUAL LICENCE FEES FOR MOBILE SPECTRUM IN THE 900MHz, 1800 MHz and 2100 MHz BANDS

1. This submission responds to questions Ofcom asked BT Group in the context of its current work to review ALFs in the 900 MHz, 1800 MHz and 2100 MHz bands. It builds on points discussed in our original letter to Ofcom requesting a review of the 1800 MHz band ALFs. Subsequent to Ofcom announcing its review of fees for all the above bands it offered to meet with BT Group. During that meeting BT Group agreed to revert to Ofcom expanding on our preference for (i) a simple linear interpolation method to determine spectrum Lump Sum Values (LSVs) instead of re-using the "distance method"; (ii) as well as how Ofcom should treat the annualization rate used to convert LSVs into on-going annual payments. We also agreed to share the international auction benchmarks we considered when thinking about how Ofcom might set LSVs that reduce complexity (and the number of regulatory judgement calls required in setting them).

Our proposal and its benefits in a nutshell

2. To reduce complexity (for Ofcom and operators) and the degree of judgement required in setting LSVs aligned with value, Ofcom should estimate UK LSVs for bands subject to ALFs using linear interpolation between the most recent low and high band auction results (700 / 3600 MHz in 2021) to mitigate material misalignment of ALF spectrum values.

3. Ofcom should not make further adjustment to LSVs for unusual recent price inflation and should consider some further discount to ensure these would remain a conservative estimate, if spectrum values were to fall in the coming years. This would minimise risks of further misalignment given historic trends. The mobile sector has seen declining revenue and declining marginal efficiencies in recent years, producing lower margins, and telecoms sectoral deflators have been amended to reflect quality adjusted prices (which have fallen significantly over time i.e. up to 96% since 2010). This contrasts with deflators used for the general economy such as the consumer price index (CPI).

4. If Ofcom acts on the potential consequences of misaligned fees and chooses to update LSVs in line with our proposals, Ofcom may not need to revisit annualisation rates used to convert lump sum values to an annual fee based on current parameter inputs. To do so risks setting an annualisation rate that may justifiably need further review as macro-economic conditions stabilise given we are currently at the tail-end of a still highly volatile time.

5. If the annualisation rate is revisited as part of Ofcom's review, Ofcom will need to mitigate two challenges. Firstly, those set out above regarding the long-term average cost of debt; and secondly, related to the inconsistency between forecast and actual CPI in the formula Ofcom uses to set annualization rates so that they annual payment reflects the time value of money (and associated tax implications).

6. Turning to the still unusually high current cost of debt, for illustration, were Ofcom to use current 10-year BBB bond yields this would generate an annualisation rate of 6.2% today, which would raise ALFs for BTEE by £11m pa across 1800 MHz and 2100 MHz combined assuming no change in LSV.

7. The challenges regarding the long-term average cost of debt could be mitigated in different ways by considering longer-term averages e.g. for the last 10-15 years (which are similar to 2018 rates with minimal increase in overall ALFs) or blended rates between today's forward looking rates and those used in Ofcom's initial fee determinations (raising fees, all other things equal by c £6m pa). Most importantly a current snapshot of the forward-looking cost of debt today is unlikely to be representative of the forward looking long run average cost of debt. There may be other options including combining independent forecasts of gilt rates and adjusting them for the risk of corporate bonds but we don't see how this adds robustness or meets our suggestion for reduced complexity.

8. Secondly, a distortion that compounds over time arises in the formula used to calculate the annualization rate due to material differences between forecast (the Bank of England's 2% target rate) and outturn inflation. This affects the initial determination and future escalation of ALFs. This leads to compounding distortion in the constant real £ value of future fees. This concern could be addressed by pegging annual ALFs increases at, say, 2%. Alternatively, Ofcom could revise its long run forecast CPI from 2% to 3% to reflect potentially higher forward-looking CPI (i.e. there may be even greater tolerance than in the past for the BoE to diverge from its 2% inflation target).

9. In Part A below we address the Lump Sum Value topic and in Part B we address matters related to the annualisation of this Lump Sum to set recurring annual fees. The Annexes contain additional supporting evidence.

A. ESTIMATION OF CURRENT UK LUMP SUM SPECTRUM VALUES

10. We previously set out how new UK auction benchmarks (LSVs) are a trigger for a misalignment review.[1] BT's request to review the 1800 MHz ALFs also explained that the "distance method" is no longer a reliable method to determine the estimated UK market value of spectrum. This is for several reasons, principally because:

    (i) some of the UK auctions used for low and high band reference prices (i.e. 800/2600 MHz) are now very old (i.e.12 years ago) and these do not reflect how spectrum values have fallen over time;

    (ii) this is compounded by the fact that in the current distance method these low and high band reference prices from old auctions are inflated to present day using CPI, which in recent years has been abnormally high, exacerbating the disconnect between fees and spectrum value over time;[2]

    (iii) there is now a much larger number of international auction results than when the method was first proposed. In principle, this could give information on where, according to international auctions, the price of a band of interest sits relative to the price of reference low and high band prices. Unfortunately, however, there are now so many anomalous results where the price of spectrum in the band of

[1] BT Group letter from Clive Carter to David Willis at Ofcom of 28 March 2024 on "Request to review 1800 MHz annual licence fees".

[2] In any event, spectrum values are unlikely to increase at the rate of general inflation let alone consumer price inflation. As we previously submitted to Ofcom, the Office of National Statistics adjusted its measure of GVA for the telecoms sector to take into account productivity improvements suggesting that CPI inflation would need to be adjusted for sectoral productivity improvements to reflect spectrum values in real terms.

interest sits above rather than below the low band reference (e.g. for 1800MHz in Austria, Germany, Croatia and Norway)) and subjective decisions are needed on which auctions form more reliable benchmarks than others that the method now generates more noise than clarity.

11. BT has therefore instead proposed a simple "linear interpolation" method to set the price of a spectrum band of interest (e.g. 1800 MHz) relative to the UK reference low and high band prices. The key benefits of BT's proposal include:

    - **Simple, pragmatic solution**: Aligning ALFs with more recent UK auctions saves complexity and of relative value benchmarks
    - **Timely and specific**: UK 700 MHz and 3.6GHz market rates from 2021 are the most relevant benchmarks
    - **Relevance for other bands**: Can be applied to 1400MHz decision too – only other ALFs decision in the medium term
    - **Wider AIP is unaffected**: There is minimal risk to fees in existing AIP band i.e. maritime and private mobile radio where relative prices are already aligned.

12. In the proposal BT put forward the UK 700MHz and 3600 MHz auctions of 2021 were used as the low and high band reference prices, and these were inflated with CPI from the 2021 prices to present.

13. In our subsequent discussion with Ofcom about BT's "linear interpolation" proposal, some significant points and questions were raised, as follows:

    (i) Given BT's concerns about recent abnormal inflation, should the 2021 UK auction 700MHz and 3600 MHz reference prices used in BT's illustration be inflated by CPI as BT had done for the illustration of its proposed method?
    (ii) Given BT and Ofcom's shared concerns about asymmetric risks if ALFs were set above rather than below market value, should an explicit discount be applied to the market value estimated using the linear interpolation method advocated by BT?
    (iii) Would BT share its analysis of international auction benchmarks to illustrate its concern about anomalous results?
    (iv) Would a "modified distance method", where some of the concerns detailed above are addressed, be useful as a cross-check to validate the efficacy of BT's "linear interpolation" proposal?

14. BT agreed to follow up with a further submission to assist Ofcom in its work to prepare consultation proposals. In this present submission, as set out below, we provide further information to respond to these various points that were discussed.

BT's proposed "linear interpolation" method for Lump Sum Values (LSVs) does not need CPI adjustment

15. As mentioned above, the key benefits of BT's proposed "linear interpolation" method are to mitigate material misalignment of ALF spectrum values and to reduce complexity for Ofcom and operators when estimating LSVs.

16. In response to Ofcom's questions on adjustments of LSVs by CPI we provide the following further information.

17. In relation to the rationale for applying CPI to LSVs, Ofcom has previously assumed that the real value of ALF spectrum remains constant in real terms over time. However, this is no longer a reasonable assumption given recent evidence shows:

    - declining (i.e., flattening) marginal efficiencies in terms of cost (per unit of traffic) and
    - flat or declining real revenues (per unit of traffic).

18. Taken together, these demonstrate that operators' unit margins are falling over time, which indicates that the real value of spectrum is also declining over time.

19. Moreover, the ONS has found that previous official telecoms services deflators using CPI were flawed and understated 'true' declines in the price of telecoms products, and understated real sector productivity growth (arising from improvements in the quality of telecoms services including larger mobile data bundles).[3] In the National Accounts (Blue Book) in 2021, the ONS used a revised approach based on quality adjusted prices and found telecoms prices had fallen 37-96% during the 10 year period 2010-2017.[4,5] This suggests that CPI inflation as an indicator of average inflation across a general basket of goods in the economy is unlikely a meaningful indicator of either the evolution of telecoms prices in real terms, nor of spectrum values used as an input.

20. We have therefore now removed CPI inflation of the 2021 UK 700/3600 MHz reference auction prices in BT's "linear interpolation method". It had only been included as we wanted to show, in relation to 2100MHz, that BT's simple approach aligned quite well to what Ofcom's elaborate distance method had arrived at as a 2100MHz LSV in 2021.

21. Given recent levels of inflation we consider removing inflation altogether is likely to be a more appropriate approach than using CPI absent a more accurate approach to estimating sectoral inflation (which may actually indicate spectrum values declining in real terms). This has the advantage of being simpler than trying to infer a real terms change in spectrum values in what has been a relatively short and volatile period of time since the last, most relevant, auctions.

22. Given the above, and that Ofcom wants to set fees conservatively, there is a case to discount the fees further, e.g. by at least 10%, since we don't think this will negatively impact the efficient use of these tradable licences and it would provide some margin if in future if spectrum values reduce further in real terms. For comparison we note Ofcom previously applied a 50% discount in relation to AIP spectrum fees in other sectors, e.g., maritime and private mobile radio, under the Smith-NERA approach.

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[3] In 2016, the Independent Review of UK Economic Statistics identified areas of improvements in the Office for National Statistics's (ONS's) economic statistics and included an important recommendation to improve telecoms deflators based on quality adjusted prices to reflect larger data bundles.

[4] Double deflation methods and deflator improvements to UK National Accounts: Blue Book 2021 - Office for National Statistics (ons.gov.uk) and "A Comparison of Deflators for Telecommunications Services Output", Mo Abdirahman, Diane Coyle, Richard Heys and Will Stewart (2020), ECONOMIE ET STATISTIQUE / ECONOMICS AND STATISTICS N° 517-518-519, Figures 1 and 6.

[5] More recent analysis (by the same authors) in 2022 shows even greater telecoms price reductions of between 64-85% over the same 10-year period ie 2010-2017 See https://www.insee.fr/en/statistiques/6328083?sommaire=6328099.

Modified "distance method"

23. In response to point c) above, we provide details of all the "Tier 1"6 international auction benchmarks considered for "distance method" analysis in the spreadsheet attached as Annex 1. This helps illustrate our point about anomalous data points where the "Y/X" ratio puts the price of the band of interest above the low band price or below the high band price.

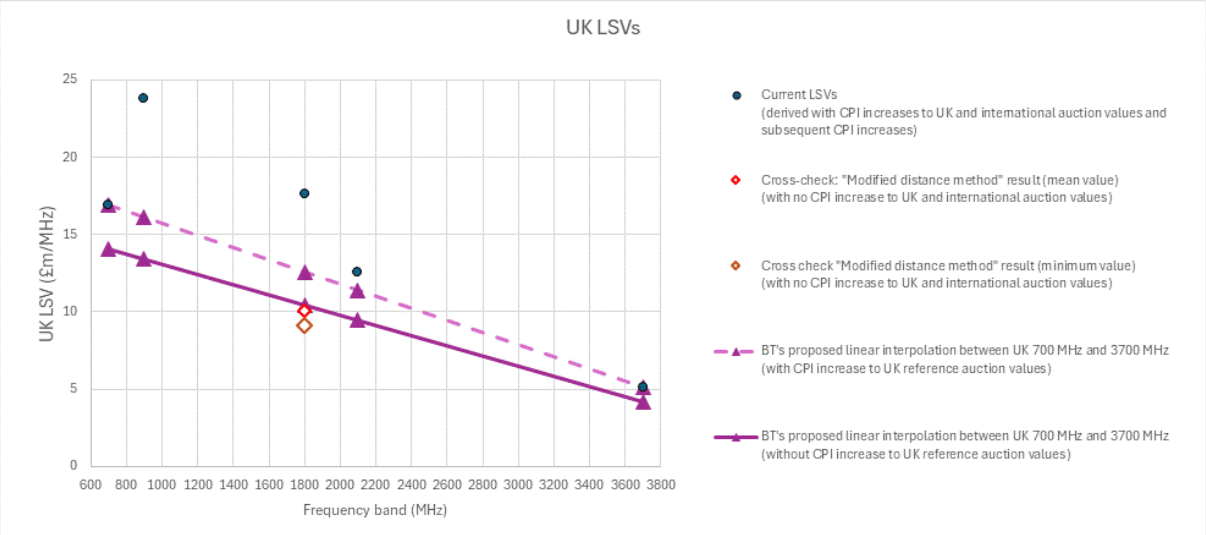
24. We have used a "modified distance method" in which we have:

    (i) stripped out from the benchmark normalisation the CPI inflation adjustment of both the UK low and high reference band prices and the international auction prices from our review of international auction data;
    (ii) removed old auction data points that are more than 5 years old (including the 800, 2600 and 3400 MHz UK reference prices);
    (iii) removed results where the price of the band of interest would not fall between the low and high band reference prices[7];
    (iv) only included auction results that we believe Ofcom would consider as "Tier 1" in terms of the reliability of the result, in accordance with Ofcom's existing framework for tiering of benchmarks.[8]

25. In the figure below we illustrate how, in relation to 1800MHz LSV, the result of the "modified distance method"[9] compares to BT's "linear interpolation method. It can be seen that the results are quite close and are around £10m/MHz.

[6] By Tier 1 we mean auctions that Ofcom has previously considered to provide a reliable indication of market values and not subject to factors that could distort the outcome, or which we anticipate that Ofcom may categorise in the same way in the case of more recent auctions on which Ofcom has not so far been required to make a judgement.
[7] The Y/X ratio (or 'distance ratio') has been capped at 1 within our LSV estimates for individual benchmark countries. In other words, international benchmarks are only included where they imply a UK market value estimate for 1800 MHz spectrum that is no greater than the UK market value of 700 MHz. See Annex 1 for more details.
[8] Adopting this tiering framework is intended to restrict the number of modifications made to the previously used distance method, but is not intended to imply BT's agreement with the way in which Ofcom has previously categorised the available benchmarks.
[9] Adapting Ofcom's existing distance method to remove CPI, remove auctions before 2019, remove results where Y/X>1; and using only "Tier 1" auction results.

Figure 1: "modified distance method" as a cross check of the "linear interpolation" method



Source: BT analysis

B. RECOMMENDED APPROACH FOR ANNUALISATION OF THE LSVs

26. We understand from our meeting with Ofcom on 15 August, that Ofcom may seek to re-estimate the annualisation rate including CoD and WACC at the same time it updates the UK LSVs.[10] For illustration, were Ofcom to use current 10 year BBB bond yields, this would generate an annualisation rate of 6.2% today, which would raise ALFs for BTEE by £11m across 1800 MHz and 2100 MHz combined (assuming no change in LSV).

27. We were surprised to hear this given we understand that Ofcom's concern with the annualisation rate relates mostly to greater market volatility, for example high bouts in inflation.

28. We took this to mean that the key inputs to the annualisation rate in and of itself would not warrant a review for misalignment, except perhaps to correct for a mismatch between forecast and actual inflation where we may be seeing the beginnings of longer-term structural shifts in the economy.[11]

29. When ALFs were set in 2018 (900 MHz and 1800 MHz) and 2021 (2100 MHz), Ofcom used forward looking rates of debt to determine the annual payment that would make an MNO indifferent between a lump-sum payment and a future stream of indefinitely recurring payments for the spectrum.

30. We think there are good reason for Ofcom not to update the annualisation rate at all, given

    - When set, it was already set with MNOs long-term average cost of funding in mind; and
    - Once the LSVs are corrected for there appears to be no longer a source of material misalignment.

31. If Ofcom nonetheless considers that the annualisation rate itself may currently be misaligned with forward looking long-run values, and therefore remains minded to update it, we set out options that avoid volatility (we are still in the midst of relatively volatile macro-economic conditions relative to more stable periods of time) and ensure future rates continue to reflect the long-run average cost of funding MNOs are likely to face as best as possible without adding unnecessary complexity, scope for regulatory judgement and sources of potential misalignment in the near future.

32. When the annualisation rate, meant to reflect a forward looking long-run average cost of funding, materially diverges from it, the fees will again become misaligned. As we illustrate below this wedge between value and cost could increase over time as soon as we exit the period of volatility of recent years. Prices will then again send distorted signals to the market, undermining the very goal the fees seek to achieve.

[10] Under a Total Market Return approach WACC can be expected to remain relatively constant over time although we recognise elements of the WACC such as the risk-free rate and cost of debt can in principle still vary over time.

[11] There may be a case for updating the 2018 decision (900 and 1800 MHz for the latest (higher) corporate tax rates and CPI (see section 2(b)).

Some options Ofcom might consider should it decide to update the annualisation rate

33. BT has previously supported using latest market rates to best represent investors' expectations and forward-looking opportunity costs when setting both the LSVs and the annualisation rate including cost of debt (CoD).[12, 13,14]

34. However, BT (and we expect Ofcom) recognise that this approach may be less informative (and/or carries more risk) now while markets have still not recovered from recent inflation and interest rate shocks. This means its currently unclear whether current higher CoD is transitory or more permanent.

35. This is concern is brought into even sharper relief given Ofcom must take a conservative approach[15] when setting ALFs at market value (including converting LSVs into an ALF using an annualisation rate) and where the annualisation is intended to apply in perpetuity.

36. Indeed, if not set conservatively, and instead revised based on the relatively instable market circumstances today, there is risk of misalignment only a few years hence as inflation and debt markets normalise. For example, 10-year gilts today (as of 5 Sep 2024) yield 3.9% and BBB rated 10-year bonds yield 5.1%. This is materially different from the longer-term average of 1.7% and 3.1%, respectively (2014-2023) as illustrated in Table 3, Annex 2.

37. However, should Ofcom continue to be minded to update the annualisation rate as part of this review, Ofcom could consider the following approaches to avoid 'baking-in' temporarily higher current CoD and inflation.

Current CoD vs more 'stable' measures of the underlying (ie average) long run CoD (see also Annex 2 for more detail)

38. Ofcom could consider the following high-level options to address volatility:

- **Option A: Use longer run historic averages over say the last 10-15 years of BBB bond yields –** This approach would remove some of the current volatility that better represent more stable market conditions also on forward-looking expectations. The average 10-year BBB bond yield over the last 15 years is 3.1% which would produce a similar annualisation rate to what Ofcom determined in 2018 (holding MNOs' current cost of debt constant at 2018 values for illustrative purposes, mitigating the potential increase in ALFs).

[12] See annualisation rates reflecting these market rates from 2018 and 2021 Statements in Table 1 in the Annex.

[13] Ofcom considers that "*yields on bonds with a maturity of around 10 years would give an estimate of the cost of debt appropriate for the lower polar case*", the rationale being "*bonds with a maturity of around 10 years have a similar [Macauley] duration to a 20-year ALF.*" Ofcom 2018 Statement, paragraph A5.16 and footnote 272; and paragraph *A10.22;* also: Ofcom Statement 2015, paragraphs A10.22-A10.26.

[14] In terms of specific 10-year bonds, Ofcom considers "*a sample of the sterling denominated bonds of each MNO parent company with a maturity date of around 10 years in the future, and a BBB rated 10-year bond index (since each MNO parent company had a BBB rating).* Ofcom *"place[s] most weight on the yields from the index of 10-year BBB-rated bonds."* Ofcom 2018 Statement, paragraph A5.16.

[15] See Ofcom 2018 Statement: "*[w]hen interpreting the evidence on market value, we considered that it was right to adopt a conservative approach due to the risk asymmetry of the situation (i.e. the greater cost of erring on the side of overvaluation). In reaching this view, we were informed by and acted consistently with our statutory duties*" paragraph 3.11. Statement-annual-licence-fees-900-mhz-and-1800-mhz

- **Option B: Use a conservative interpolation between previous and current market rates** - If today's yields on 10-year bonds (in an unstable market) are materially higher than the yields calculated in the 2018 decision (when markets were stable) then Ofcom should take a conservative point estimate within the range. This would ensure that current market information was reflected but conservatively weighted with rates from less volatile times. This approach would produce an annualisation rate in the region of 5.9-6.0%, mitigating the increase to LSVs to £5-7m (holding the total LSV constant for illustrative purposes).[16]

39. There might be other options including taking a purely forward looking view of cost of debt by taking various independent forecast of gilt rates (e.g. Capital Economics but there are others) and apply MNOs debt premium to them. However this is likely to be again complex and therefore potentially unnecessary and still influenced by today's instable market conditions.

Addressing concerns in relation to inflation

40. Inflation measured by the CPI enters the annualisation calculation as follows:

- Converting nominal WACC (upper poler case) and CoD (lower polar case) values into real values respectively using forecast of long-run CPI; and
- Inflate the ALF payment each year by outturn CPI to keep it constant in real terms.

41. In theory, outturn and long run forecast CPI should have no effect on the value of the ALF in real terms as these two should balance out over time. However, this has not been the case over the last 10 years as outturn CPI has averaged closer to 3% vs the BoE long run target of 2% (see Annex Table 2).

42. Furthermore, in 2018 the BoE judged the neutral rate of inflation would be 2.25%, while Oxford Economics today estimate the BoE currently assumes the neutral rate is 3.25%-3.5% with a margin of uncertainty on either side".[17] Effectively this means that even the BoE is no longer considering that a 2% target is necessary for price stability to prevail. It also reflects scepticism in markets that a forward-looking assumption of 2% CPI may no longer be appropriate.

43. While we are still developing our views Ofcom could consider the following two high level and simple options to address the divergence in outturn and forecast inflation:

- **Option C: Peg outturn CPI at 2%:** We understand Vodafone has argued that Ofcom should cap the CPI indexation to 2%. This would limit the risk of future mismatches causing excessive annual fee rises compounding over time. Another option would be to peg the annual ALF increase to 2% so that it always increases in accordance with the BoE target rather (consistent with Ofcom's forecast).[18] This, in theory, balances risks evenly between MNOs and government and should result in no asymmetries (vs

[16] If a weight of 50% is applied to each current and 2018 blended cost of debt (MNO book values + BBB bond yields) then this would produce an annualisation rate of 6.0%. If a weight of 75% was applied to 2018 rates and 25% to current rates then this would produce an annualisation rate of 5.9%.
[17] Oxford Economics Research briefing | UK MPC easing - how far and how fast? 4 September 2024.
[18] Another option could be to cap outturn CPI within a range eg 0% - 4%.

Vodafone's proposal which may introduce an asymmetry since CPI is capped from upside risk but not downside risk from lower CPI).

- **Option D: Revise long run forecast CPI from 2% to 3%:** Another approach might be for Ofcom to reflect that the long-term forward-looking value of CPI is above the 2% target ie 2.5% or even 3% (in line with Oxford Economics estimate of the policy neutral rate of inflation). Both the OBR and the BoE agree that inflation risk is predominantly on the upside which supports this approach. The 2% inflation target may already be materially misaligned with forward looking long-run inflation. Furthermore, the value of spectrum has trended downwards and setting a higher CPI forecast would additionally reflect this observation (see above).

ANNEX 1: INTERNATIONAL AUCTION DATA USED SELECTIVELY AND WITHOUT CPI FOR MODIFIED "DISTANCE METHOD" RESULTS

Table 1: 1800 MHz Tier 1 LSVs

1800MHz Tier 1 LSVs

UK anchor prices

Band	UK anchor price	Year of award
700	14,000,000	2021
800	33,000,000	2013
2600	5,500,000	2013
3400	7,564,800	2018
3600	4,200,000	2021

Tier 1 1800MHz lump sum values (LSVs)

Low band	Mid band	High band	Country	Earliest benchmark used (year)	Low band year of award in UK	High band year of award in UK	Earliest year used to calculate LSV	Low band benchmark price (GBP equivalent per MHz)	Mid band benchmark price (GBP equivalent per MHz)	High band benchmark price (GBP equivalent per MHz)	Distance ratio (Y/X)	Low band UK anchor price	High band UK anchor price	1800MHz LSV (GBP equivalent per MHz)
700	1800	2600	Austria	2010	2021	2013	2010	20,615,453	46,618,563	1,925,224	2.39	14,000,000	5,500,000	25,825,775
700	1800	2600	Croatia	2021	2021	2013	2013	8,171,497	16,501,468	2,410,697	2.45	14,000,000	5,500,000	26,290,784
700	1800	2600	Germany	2010	2021	2013	2010	15,030,923	19,724,873	1,591,884	1.35	14,000,000	5,500,000	16,968,857
700	1800	2600	Norway	2015	2021	2013	2013	19,618,399	28,082,047	4,434,067	1.56	14,000,000	5,500,000	18,737,845
700	1800	2600	Sweden	2011	2021	2013	2011	34,207,881	9,851,595	3,972,243	0.19	14,000,000	5,500,000	7,152,834
800	1800	2600	Austria	2010	2013	2013	2010	78,169,124	46,618,563	1,925,224	0.59	33,000,000	5,500,000	21,620,199
800	1800	2600	Croatia	2023	2013	2013	2013	33,658,276	16,501,468	2,410,697	0.45	33,000,000	5,500,000	17,900,839
800	1800	2600	Czech Republic	2013	2013	2013	2013	53,350,249	24,607,844	6,045,929	0.39	33,000,000	5,500,000	16,290,825
800	1800	2600	Denmark	2010	2013	2013	2010	17,314,887	16,905,145	10,312,136	0.94	33,000,000	5,500,000	31,390,930
800	1800	2600	Germany	2010	2013	2013	2010	51,534,639	19,724,873	1,591,884	0.36	33,000,000	5,500,000	15,484,575
800	1800	2600	Ireland	2012	2013	2013	2012	59,558,328	23,344,470	9,064,548	0.28	33,000,000	5,500,000	13,277,153
800	1800	2600	Italy	2011	2013	2013	2011	57,180,727	18,414,885	4,169,022	0.27	33,000,000	5,500,000	12,890,089
800	1800	2600	Sweden	2011	2013	2013	2011	17,570,144	9,851,595	3,972,243	0.43	33,000,000	5,500,000	17,390,230
700	1800	3400	Austria	2013	2021	2018	2013	20,615,453	46,618,563	4,282,789	2.59	14,000,000	7,564,800	24,245,433
700	1800	3400	Belgium	2022	2021	2018	2018	37,550,374	27,304,872	4,273,329	0.69	14,000,000	7,564,800	12,018,699
700	1800	3400	Croatia	2021	2021	2018	2018	8,171,497	16,501,468	2,450,050	2.46	14,000,000	7,564,800	23,369,138
700	1800	3400	Germany	2015	2021	2018	2015	15,030,923	19,724,873	10,457,969	2.03	14,000,000	7,564,800	20,605,470
700	1800	3400	Hungary	2020	2021	2018	2018	75,237,633	43,341,762	10,785,540	0.51	14,000,000	7,564,800	10,815,366
700	1800	3400	Norway	2015	2021	2018	2015	19,618,399	28,082,047	6,873,570	1.66	14,000,000	7,564,800	18,273,519
700	1800	3400	Sweden	2011	2021	2018	2011	34,207,881	9,851,595	2,550,567	0.23	14,000,000	7,564,800	9,048,930
700	1800	3600	Austria	2013	2021	2021	2013	20,615,453	46,618,563	4,282,789	2.59	14,000,000	4,200,000	29,602,506
700	1800	3600	Belgium	2022	2021	2021	2021	37,550,374	27,304,872	4,273,329	0.69	14,000,000	4,200,000	10,982,727
700	1800	3600	Croatia	2021	2021	2021	2021	8,171,497	16,501,468	2,450,050	2.46	14,000,000	4,200,000	28,268,018
700	1800	3600	Germany	2015	2021	2021	2015	15,030,923	19,724,873	10,457,969	2.03	14,000,000	4,200,000	24,059,299
700	1800	3600	Hungary	2020	2021	2021	2020	75,237,633	43,341,762	10,785,540	0.51	14,000,000	4,200,000	9,150,204
700	1800	3600	Norway	2015	2021	2021	2015	19,618,399	28,082,047	6,873,570	1.66	14,000,000	4,200,000	20,508,032
700	1800	3600	Sweden	2011	2021	2021	2011	34,207,881	9,851,595	2,550,567	0.23	14,000,000	4,200,000	6,460,144
800	1800	3400	Austria	2013	2013	2018	2013	78,169,124	46,618,563	4,282,789	0.57	33,000,000	7,564,800	22,138,792
800	1800	3400	Croatia	2021	2013	2018	2013	33,658,276	16,501,468	2,450,050	0.45	33,000,000	7,564,800	19,016,929
800	1800	3400	Czech Republic (2020)	2013	2013	2018	2013	53,350,249	24,607,844	5,887,283	0.39	33,000,000	7,564,800	17,597,068
800	1800	3400	Czech Republic (2017)	2013	2013	2018	2013	53,350,249	24,607,844	3,713,085	0.42	33,000,000	7,564,800	18,271,745
800	1800	3400	Germany	2010	2013	2018	2010	51,534,639	19,724,873	10,457,969	0.23	33,000,000	7,564,800	13,302,986
800	1800	3400	Ireland	2012	2013	2018	2012	74,493,801	28,631,284	2,900,019	0.36	33,000,000	7,564,800	16,706,374
800	1800	3400	Sweden	2011	2013	2018	2011	17,570,144	9,851,595	2,550,567	0.49	33,000,000	7,564,800	19,928,870
800	1800	3600	Austria	2013	2013	2021	2013	78,169,124	46,618,563	4,282,789	0.57	33,000,000	4,200,000	20,701,973
800	1800	3600	Croatia	2021	2013	2021	2013	33,658,276	16,501,468	2,450,050	0.45	33,000,000	4,200,000	17,167,121
800	1800	3600	Czech Republic (2020)	2013	2013	2021	2013	53,350,249	24,607,844	5,887,283	0.39	33,000,000	4,200,000	15,559,428
800	1800	3600	Czech Republic (2017)	2013	2013	2021	2013	53,350,249	24,607,844	3,713,085	0.42	33,000,000	4,200,000	16,323,357
800	1800	3600	Germany	2010	2013	2021	2010	51,534,639	19,724,873	10,457,969	0.23	33,000,000	4,200,000	10,697,285
800	1800	3600	Ireland	2012	2013	2021	2012	74,493,801	28,631,284	2,900,019	0.36	33,000,000	4,200,000	14,550,905
800	1800	3600	Sweden	2011	2013	2021	2011	17,570,144	9,851,595	2,550,567	0.49	33,000,000	4,200,000	18,199,702

LSV aggregation

Note: Excludes older awards (earliest year used set in cell E59) as well as anomalous LSVs (i.e. where the distance ratio is not between 0 and 1)

Earliest year used to calculate LSV	2019
Minimum LSV value	9,150,204
Average LSV value	10,066,465

Source: BT analysis

Treatment of benchmark value falling outside the range of the low and high band reference prices

We have capped the Y/X ratio at 1 when determining the spectrum values using the distance method calculation. Sub-1GHz spectrum, including spectrum in the 700 MHz band, is widely understood to be the most valuable category of mobile spectrum, which is consistently demonstrated by regulatory authorities' choices of reserve prices for sub-1GHz spectrum vs. 1800 MHz and other higher frequency spectrum. This relativity is also generally borne out in the final prices paid in auctions, and in the small number of cases where it is not, this is highly likely to be due to either greater supply constraints in the higher frequency spectrum, strategic demand reduction to achieve low prices in 700 MHz auctions (where there are more often obvious focal points) or other market specific factors that are not applicable in the UK. BT considers that international benchmarks that appear to show 1800 MHz market value

exceeding 700 MHz market value are not reliable indicators of true market value and has therefore excluded them.

Exclusion of CPI consideration

There are a number of supply and demand side reasons why spectrum value does not increase in line with inflation, and in fact has decreased over time. These include the increased supply of mobile spectrum in recent years (and expectations that supply will continue to increase in the coming years), the low and falling returns being made by MNOs (including in the UK), a slowing in the rate of traffic growth, as well as continuing improvements in spectral efficiency.

Sharp CPI increases have actually decreased consumer and business spending power, which has tended to decrease and not increase the amount that is being spent on mobile services. For instance, the same economic shocks causing inflation to increase also caused the Bank of England to increase interest rates and reduce households' and business' purchasing power – including spend on mobile networks and the services delivered over them. This exacerbates the gap between the value of spectrum and the fees paid for it yet further.

More generally, spectrum value accrues in the form of network cost savings ('technical value') and/or increases in revenues / reductions in non-network costs ('commercial value'). Whilst commercial value may be argued to have some link to inflation in principle (though, this can work both ways and we are currently seeing a decrease in consumer spending power linked to higher inflation), technical value, as a general rule does not. Network equipment tends to fall in price over time, and hence network cost savings (the technical value component of spectrum value) also fall over time. Competitive mobile markets ensure that efficiencies are passed on to consumers. As such, BT considers that increasing historic spectrum auction benchmarks by inflation to estimate the market value today is incorrect, and therefore no such inflationary uplifts are applied within our benchmarking.

The above auction data is provided in Excel format for convenience here: [✂: redacted].

ANNEX 2: EXISTING ANNUALISATION AND CPI OUT-TURNS

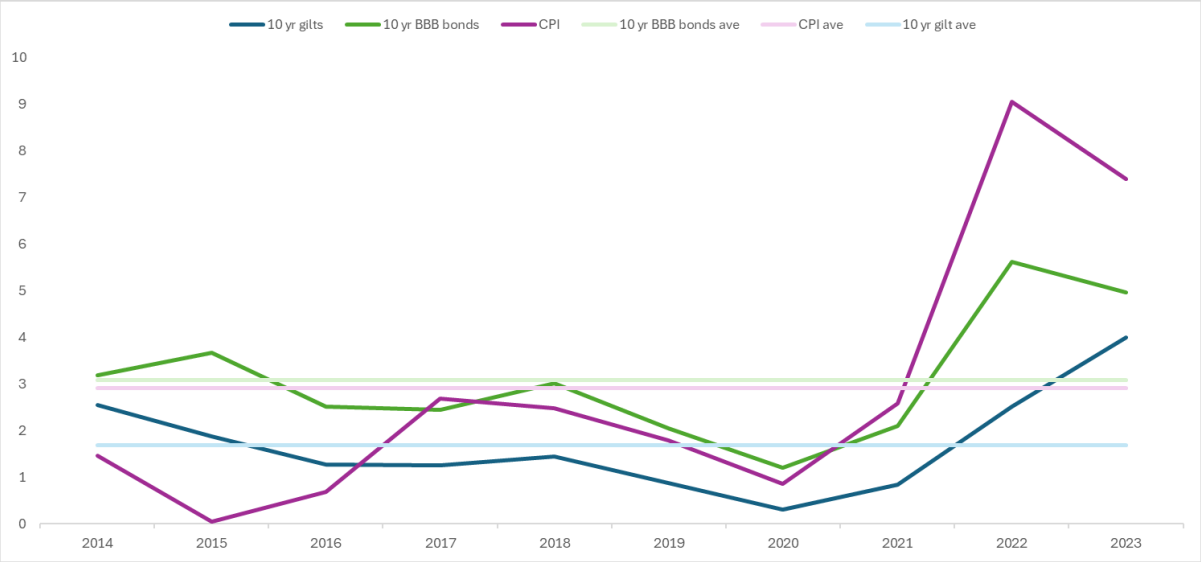
Table 2: Overview of bands, licence duration, annualisation rate and year payment commenced

Spectrum band	Date of initial award	Initial licence term (or indefinite)	Annualisation rate & year determined	ALF payments commence[19]
2100	2000	20 years (amended to indefinite 2011).[20]	5.34%, 2021	2022
1800	Administratively assigned in 1991-1993	Initially term was not specified but had no security of tenure. 2010 Government Direction made required Ofcom to extend the period notice of revocation to 5 years and introduced ALFs.	5.75%, 2018	2015
900	Allocated to two operators around 1985		5.75%, 2018	2015

[19] Following an appeal by EE, Ofcom's decision in the 2015 Statement on ALFs was quashed by the Court of Appeal on the basis that Ofcom should have considered its statutory duties in making its decision - in particular the Article 8 objectives in the Framework Directive which are reflected in section 4(2) of the Communications Act. See: EE Ltd v Ofcom [2017] EWCA Civ 1873. As a result the market based ALFs only commenced in 2018 with the excess fees paid in the 2015-2018 refunded.

[20] Statement (ofcom.org.uk); Mobile Operators Unhappy as Ofcom Set Licence Fees for 2100MHz - ISPreview UK

Figure 2: UK CPI, 10-year gilts and 10 year BBB bond yields, 2014-2023



Sources: ONS, Bank of England and Bloomberg

Currently, the UK is in a period of macroeconomic volatility and most metrics are significantly above long-term averages.

Table 3: Comparing values Ofcom used in 2018 and 2021 against average for period 2014-2023

	Ofcom 2018 value for 1800MHz review	Ofcom 2021 value for 2100 MHz review	Average over the period 2014-2023
CPI	2.0%	2.0%	2.9%
RFR (10yr gilts)	1.5%	0.6%	1.7%
Cost of debt (10yr BBB bonds)	2.8%	1.7%	3.1%

Sources: Ofcom, ONS, Bank of England and Bloomberg

In 2018, for the RFR and CoD, Ofcom selected values that were broadly in line with long-term trends. However, for CPI, Ofcom selected a value that is substantially below long-term trends, regardless of what historical period is viewed as a reasonable estimate of long-term values.

Table 4: Average UK inflation, gilts and bonds over different periods

	1900-2022[21]	2014-2023[22]
Inflation	3.6%	2.9%
Gilts	4.5%	1.7%
Bonds	5.1%	3.1%

Note: Gilts for the two periods may not be directly comparable because DM&S use a basket of financial products to arrive at the 1900-2022 rate for gilts, including maturity. For the 2014-2024 gilt values see Table 3 above.

[21] Credit Suisse Yearbook 2023, Dimon, Marsh and Staunton
[22] CPI: ONS, 10 year Gilts: BoE, BBB Bonds: Bloomberg