Annual licence fees for 900 MHz and 1800 MHz spectrum:

Ofcom Consultation

3 August 2018

Telefónica UK Ltd response

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Section 1

I. INTRODUCTION

1. Telefónica UK Ltd ("Telefónica") is grateful for the opportunity to provide comments on Ofcom's Consultation on Annual Licence Fees (ALFs) for 900 MHz and 1800 MHz, published 8 June 2018.[1]

2. We have serious concerns over Ofcom's impartiality in the circumstances of the present consultation. [✂]

4. We recognise that, Ofcom has the power to set ALFs at full market value. However, we do not agree that it follows logically that setting ALFs at market value is necessarily in the interests of citizens and consumers. There is little to no downside from setting ALFs too low, whereas there are severe risks from setting them too high. This risk asymmetry means that Ofcom should be conservative when setting ALF at market value.

5. Despite Ofcom's claims, its current methodology is far from conservative. We urge Ofcom to revisit its approach, with a view to increasing its confidence (to an indicative 90-95% level) that it is being conservative in its estimate of market value. There are several ways it could do this, including (a) revisiting its position on Tier 1 country benchmarks, such as the new Danish benchmark; and (b) applying a general mark-down to its ALF levels to reflect concerns about risk asymmetry and future developments that are expected to reduce the value of mobile spectrum.

6. Ofcom has revised its estimate of the market value of 900 and 1800 MHz in the UK using evidence from recent auctions. In general, Ofcom continues to adopt a mixed approach when analysing benchmark evidence, being conservative on some issues (e.g. its appropriate focus on price ratios) but aggressive on others (e.g. its interpretation of country benchmarks). In the new consultation, it continues its aggressive approach with respect to country benchmarks. Ofcom adopts the highest possible benchmark for Denmark when this auction produces a wide range of possible price points. Its incorrect calculations of this benchmark leads it to conclude that the value of 1800 MHz has increased. In contrast, as we show in the following, a more measured and conservative approach would have led Ofcom to conclude that the value of 1800 MHz has not changed since 2015 and should be no higher than its previous estimate of £14 million per MHz (in 2018 prices).

[1] Ofcom, Consultation on Annual licence fees for 900 MHz and 1800 MHz frequency bands, 8 June 2018 (hereafter "June 2018 Consultation").

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7. Prices from recent auctions across Europe show that the values of 900 and 1800 MHz spectrum are converging. As we discuss in the following, this is linked to a growing focus of operators on adding capacity spectrum in urban areas, where the propagation advantages of sub-1 GHz spectrum are increasingly irrelevant (owing to network densification) and higher frequencies are better suited for new technologies, as they work with smaller antennas. It is also linked to a more general decline in spectrum value which is primarily a result of a big increase in the available supply and a lack of additional industry revenues. Owing to its wide adoption in handsets and its general status as a key LTE band, 1800 MHz spectrum has held its value much better than 900 MHz which has led to a convergence in the prices of the two bands. This trend is expected to continue, so a lump-sum value for 900 MHz of no more than £14 million per MHz would be appropriate.

8. To convert lump-sum values to ALFs, Ofcom adopts the same annualisation approach as in previous consultations which requires the use of a discount rate. To estimate this rate, it uses a cost of debt estimate derived from operators' observed debt yields and adjusts this for a risk-sharing premium. We have asked NERA Economic Consulting to review Ofcom's methodology (see Annex). NERA finds that Ofcom's approach to estimating the discount rate in the 2018 Consultation is far from conservative.

9. NERA's concerns can broadly be grouped into two areas:

    a. Mistakes in calculating key elements of the discount rate. NERA identifies several elements in Ofcom's technical determination that lack a sound theoretical basis. For instance, Ofcom's approach fails to account for the "one-off" nature of the ALF transaction when determining the weighted average cost of capital (WACC), which leads to an overestimation of the WACC by 0.5 to 1.5 percentage points. Ofcom also fails to make a number of other adjustments, including for liquidity and securitisation. These adjustments alone imply that Ofcom has overestimated the discount rate by 0.4 to 0.7 percentage points.

    b. The risk-sharing adjustment is too high. Ofcom's justification for choosing an adjustment factor of 25% is flawed and entails a certain degree of arbitrariness. Building on NERA's analysis in our previous submissions, NERA evaluates the degree of risk sharing using real option modelling. It finds that the appropriate risk sharing adjustment should be at most 20% and not 25%.

    In combination, these adjustments mean that Ofcom should be applying a discount rate of between 0.52% to 0.84% (real, post-tax) to derive ALFs. A discount rate at the lower end of this range would be consistent with Ofcom's stated intention of taking a "conservative approach".

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10. If we apply all of these adjustments, we arrive at an ALF of **£775,000 per MHz for both 900 and 1800 MHz spectrum**. Our adjustments are modest and are by no means a lower bound on a conservative estimate of market value. They are, however, lower than Ofcom's proposed ALFs which reflects the fact that Ofcom's approach is insufficiently conservative in its approach, in particular with regards to how it treats evidence from European benchmarks and how it calculated the discount rate.

Structure of this response

11. In the following sections, we set out our views on a series of issues raised in the June 2018 consultation:

- **Section II: The requirement of impartiality**
  [✂]

- **Section III: Assessment of ALF in light of Ofcom's statutory duties**
  We set out our assessment of the role of Ofcom's statutory duties in determining its approach to setting annual licence fees.

- **Section IV: Developments in technology, mobile data demand and spectrum availability**
  We assess the impact of market developments on the value of mobile spectrum in general, and the 900 MHz and 1800 MHz bands in particular.

- **Section V: Impact of spectrum awards since 2015**
  We analyse the impact on ALFs of the new evidence points from European auctions identified by Ofcom.

- **Section VI: Deriving ALFs from lump sum values**
  We set out our views on the adjustments that should be applied when converting lump sum values to annual fees.

- **Section VII: Proposed levels of ALF for 900 MHz and 1800 MHz**
  We set out our views on the appropriate levels of ALF for the two spectrum bands in light of the new evidence presented by Ofcom and our own analysis.

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Section 2

II. THE REQUIREMENT OF IMPARTIALITY

12. Under the Common Regulatory Framework, the principal tasks of telecommunications regulation are assigned to national regulatory authorities ("NRAs"). These tasks include among other things the imposition of fees for rights to use radio frequencies: see Article 13 of the Authorisation Directive, discussed further below.

13. Article 3 of the Framework Directive imposes certain minimum requirements of any NRA, including as to competence (paragraph 1), independence (paragraph 2) and impartiality (paragraph 3). There is rarely any question of Ofcom failing to meet these requirements.

[✂]

17. Alternatively, Ofcom should wait until the litigation has been finally determined before making any decision on the appropriate level of ALFs going forward.

18. Telefonica submits this consultation response without prejudice to its position that, as matters currently stand, Ofcom lacks the necessary impartiality to make any such decision.

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Section 3

III. ASSESSMENT OF ALF IN LIGHT OF OFCOM'S STATUTORY DUTIES

19. A key conclusion of Ofcom's assessment of ALFs in light of its statutory duties in section 5 of the June 2018 consultation is that it is appropriate to set ALFs at the full market value of the spectrum. Ofcom concludes in particular that "ALFs at full market value promote the optimal use of spectrum which we consider to be in the interests of UK citizens and consumers."[2]

20. We do not agree that setting ALFs at full market value is in the interests of citizens and consumers. First, in accordance with our legitimate expectations and the interests of regulatory predictability and promoting investment, prices should be discounted as a quid pro quo for our GCO commitment to invest in uneconomic coverage, even if (which we do not accept) the GCO does not impair the market value of the spectrum. More generally, pricing at full market value is not a necessary pre-condition to ensure spectrum is used efficiently. This approach may even deter efficient trades, as it may reduce the potential revenues from any trade to close to zero. It is widely understood that operators are reluctant to sell spectrum directly to rivals; this disincentive is likely even stronger if the only benefit is savings in annual fees as opposed to a cash windfall that can be reinvested in the network.

21. We consider that there is little or no downside risk from setting ALFs below market value. In contrast, if ALFs are set above the market price, this will at best deprive efficient operators of money that they could otherwise invest in their network and services, and at worst lead to spectrum being returned. This risk asymmetry has been discussed at length in previous consultations and Ofcom has acknowledged it[3].

22. It therefore follows that Ofcom should adopt a conservative approach in estimating market value. Specifically, it should set ALFs for each band at the low end of a reasonable range of estimates for the value of the frequencies. In statistics, it is common to use 90% or 95% confidence intervals as a definition of "reasonable certainty". Thus, a conservative approach would be to set ALFs at a level where Ofcom is 90-95% certain that the market value of the spectrum is above its price.

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2 June 2018 Consultation § 5.16(a)

3 See, for example, §2.228 Annual licence fees for 900 MHz and 1800 MHz spectrum Statement 24 September 2015: https://www.ofcom.org.uk/__data/assets/pdf_file/0033/79764/statement.pdf

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A. Ofcom's statutory duties under European law

23. This requirement to be conservative also flows from Ofcom's statutory duties. Ofcom must have regard to the Community requirements, including the Authorisation and Framework Directives. These two directives, which are linked, establish high-level principles which regulators should follow when allocating and pricing spectrum.

24. Article 13 of the Authorisation Directive states that:

> *"Member States may allow the relevant authority to impose fees for the rights of use for radio frequencies or numbers or rights to install facilities on, over or under public or private property which reflect the need to* ***ensure the optimal use of these resources****. Member States shall ensure that such* ***fees shall be objectively justified****,* ***transparent, non-discriminatory and proportionate*** *in relation to their intended purpose and shall take into account the objectives in Article 8 of Directive 2002/21/EC (Framework Directive)."* [our emphasis]

25. The requirements of Article 13 of the Authorisation Directive that are most relevant to spectrum pricing are as follows:

i. **Ensuring the optimal use of spectrum.** For primary awards, almost all European regulators ensure optimal use of spectrum by adopting market-based allocation processes such as auctions. If designed properly, an auction prices spectrum at the market-clearing level, i.e. market value. There is thus a clearly-recognised link between charging a price based on market value and ensuring optimal use. As Ofcom is attempting to estimate market value using an administrative approach based on partial information, this obligation implies a need to adopt a conservative approach in estimating market value as there is an asymmetric risk between setting prices above market level (high risk of spectrum laying fallow) or below (potential inefficient use). While we are in agreement with Ofcom that a conservative approach is required, we remain concerned that Ofcom is not being sufficiently conservative and thus failing to ensure the spectrum's optimal use.

ii. **Objectively justified, transparent and non-discriminatory.** While Ofcom's process of determining ALFs is complex and relies in large parts on qualitative arguments, Ofcom has proactively provided detailed reasoning and information for each step in its analysis. Therefore, we agree that the process is transparent. Ofcom already applies the same charge per MHz within each band, so its methodology is also non-discriminatory.

iii. **Proportionate.** This clause requires that fees be no more than necessary to achieve their objectives, the most relevant of which is to promote efficient use of the spectrum. It is not open to Ofcom to set fees at full market value if Ofcom's objectives could be met by fees at a lower

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level; extracting the market value of the spectrum from operators or maximising revenues are of course not in themselves permissible objectives for Ofcom under the statutory framework. It is inadequate to ask whether setting fees at full market value 'will have a positive impact in terms of [Ofcom's] statutory duties' (§6.1) without considering whether the same or greater impact could be achieved by setting fees at below market value.

26. Article 8 of the Framework Directive states that:

> *"2. The national regulatory authorities shall promote competition in the provision of electronic communications networks, electronic communications services and associated facilities and services by inter alia:*
>
> *a)* ***ensuring that users****, including disabled users, elderly users, and users with special social needs* ***derive maximum benefit in terms of choice, price, and quality****;*
>
> *b) ensuring that there is* ***no distortion or restriction of competition*** *in the electronic communications sector, including the transmission of content;*
>
> *c) …*
>
> *d)* ***encouraging efficient use*** *and ensuring the effective management of radio frequencies and numbering resources.*
>
> and
>
> *5. The national regulatory authorities shall, in pursuit of the policy objectives referred to in paragraphs 2, 3 and 4, apply objective, transparent, non-discriminatory and proportionate regulatory principles by, inter alia:*
>
> *a) promoting* ***regulatory predictability*** *by ensuring a consistent regulatory approach over appropriate review periods;*
>
> *b) ensuring that, in similar circumstances, there is no discrimination in the treatment of undertakings providing electronic communications networks and services;*
>
> *c)* ***safeguarding competition*** *to the benefit of consumers and promoting, where appropriate,* ***infrastructure-based competition****;*
>
> *d)* ***promoting efficient investment and innovation*** *in new and enhanced infrastructures, including by ensuring that any access obligation takes appropriate account of the risk incurred by the investing undertakings and by permitting various cooperative arrangements between investors and parties seeking access to diversify the risk of investment, whilst ensuring that competition in the market and the principle of non-discrimination are preserved"*

27. The objectives in Article 8 of the Framework Directive that are most relevant to spectrum pricing are as follows:

i. Ensuring that users derive maximum benefit in terms of choice, price and quality. There is a growing body of theoretical and empirical work that links excessive pricing of key inputs (such as spectrum) to high prices and lower competition in downstream

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markets. For example, three recent reports by NERA Economic Consulting for the GSMA[4] identified evidence linking spectrum prices being set above market values to poor outcomes for users. In particular, these reports provide theoretical and empirical evidence linking excessive prices for spectrum to lower-quality networks and higher prices for consumers. The findings presented by NERA provide a strong case for not pricing spectrum above market value. This reinforces the argument that spectrum fees, if set administratively, should be set conservatively to ensure they are not above market value.

ii. **No distortion or restriction of competition and safeguarding infrastructure competition.** We broadly agree with Ofcom's assessment that setting ALF at market value is consistent with this objective. The approach ensures that all operators face the same cost for the spectrum they hold regardless of the mix of ALF vs non-ALF spectrum they hold. By acting conservatively, Ofcom avoids the risk it over-prices spectrum which might unduly constrain less profitable operators.

iii. **Regulatory predictability.** Ofcom does not consider this requirement in its assessment. There is one aspect of Ofcom's approach where the regulator has failed to provide predictability, which is the failure to compensate operators for GCO commitments. As we discuss below, operators have reasonable expectations, based on good faith commitments from the Government, that they would be compensated for the GCO commitments they made through a reduction in ALF. Ofcom's decision not to compensate operators through a lowering of ALF was unexpected and unpredictable.

iv. **Promoting efficient investment and innovation in new and enhanced infrastructures.** While we agree with Ofcom's assessment that setting ALF at market value does not lead to a reduction in the efficient level of investment per se, we maintain that Ofcom's failure to compensate operators for the GCO in the form of a discount on ALF will likely have a negative impact on future investments. Ofcom does not make any adjustment for GCO commitments despite the reasonable expectation of operators that this cost increase would be at least partially offset by a reduction in spectrum fees for all operators.

As Telefónica (and other operators) have pointed out in previous submissions, Ofcom's failure to at least partially offset this cost will have two consequences:

a. It reduces the returns that operators will generate on their sunk investments. If this happens repeatedly, it will lead to operators reducing their expectations with regards to the returns they can earn on future investments. This is commonly

[4] http://www.gsma.com/spectrum/wp-content/uploads/2017/02/Effective-Spectrum-Pricing-Full-Web.pdf.

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referred to as the hold-up problem and will lead to lower investment in the long term.[5]

b. It removes incentives for future cooperation with the Government. Operators may no longer agree to undertake socially beneficial (but unprofitable) initiatives if they do not expect to be reasonably compensated.

Ofcom has argued that the GCO has no impact on the market value of spectrum because it is levied on operators regardless of the amount of their holdings, so has no impact on marginal value. This argument is disingenuous, as it is based on a simplistic interpretation of economic theory that ignores the context in which operators committed to the obligations. At the least, Ofcom should have acknowledged that the GCO reduces the overall value of the spectrum, and addressed this by identifying ways to be more conservative in its estimates of the market value of the bands.

B. Failure to adopt a sufficiently conservative approach

28. Based on our analysis above, we agree with Ofcom that setting ALF at market value is not inconsistent with its statutory duties. As there is considerable uncertainty about the actual level of market value, Ofcom has a duty to adopt a conservative estimate for the purposes of setting fees. This avoids a situation in which Ofcom inadvertently sets ALFs above market value which would violate the provisions in the Authorisation Directive and the Framework Directive.

29. Ofcom claims that its approach to setting ALFs is conservative. However, our view remains that Ofcom is not nearly conservative enough, and that its failure to be sufficiently conservative is therefore at odds with its duties.

30. On multiple issues, Ofcom has been considerably more aggressive in its approach to setting prices than we would expect under a conservative approach:

[5] Hold-up occurs when the return on one party's sunk investments can be expropriated *ex post* by another party. In the case of the GCO, operators entered the voluntary agreement based on an expectation of receiving a reduction in the level of ALF. This would have left their returns on sunk investments unchanged. However, Ofcom's proposal not to compensate operators for the costs associated with the GCO would mean that they would have to fund them themselves, which would reduce the fair returns on their sunk investments. Operators may factor in the risk of similar moves by Ofcom and/or the Government in the future which would increase their risk premium and therefore lower their future investment. See for example, William P. Rogerson, "Contractual Solutions to the Hold-Up Problem", *Review of Economic Studies*, Vol 59, 1992, p. 777-794.

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a. Ofcom's focus on setting prices based on the 4G auction has led it to pay insufficient attention to recent market developments which are changing the value of spectrum. Ofcom repeatedly acknowledges that spectrum values can change over time and are sensitive to developments in technology, mobile data demand and spectrum availability, but its analysis of such issues is perfunctory. As we describe in Section 3, there is strong evidence that spectrum values, and especially the premium values historically applied to sub-1 GHz spectrum, are in long-term decline.

b. Ofcom adopts a mixed approach when analysing benchmark evidence, being conservative on some issues (e.g. its appropriate focus on price ratios) but aggressive on others (e.g. its interpretation of country benchmarks). In the new consultation, it continues its aggressive approach with respect to country benchmarks. As we discuss in Section 4, Ofcom adopts the highest possible benchmark for Denmark when this auction produces a wide range of possible price points. Ofcom also largely ignores new evidence that the value of 900 MHz has converged downwards towards the value of 1800 MHz since its September 2015 decision (see Section 3 and 4 below).

c. Ofcom grossly overestimates the discount rate. This severely inflates annual licence fees. Ofcom makes a number of errors when determining the cost of debt and then grossly overstates the risk-sharing adjustment (see Section 5). In short, the way Ofcom estimates the discount rate is neither correct nor conservative.

d. Ofcom does not make any adjustment for GCO commitments despite the reasonable expectation of operators that this cost increase would be at least partially offset by a reduction in spectrum fees for all MNOs. As discussed above, not compensating operators for the GCO commitment may reduce investment and have a profound impact on operators' willingness to cooperate with the Government in the future.

31. We urge Ofcom to revisit its approach, with a view to increasing its confidence (to an indicative 90-95% level) that it is being conservative in its estimate of market value. There are several ways it could do this, including (a) revisiting its position on Tier 1 country benchmarks, including the new Danish benchmark; and (b) applying a general mark-down to its ALF levels to reflect concerns about risk asymmetry and future developments that are expected to reduce the value of mobile spectrum. Such changes would be consistent with Ofcom's statutory duties which require it to be conservative.

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Section 4

IV. DEVELOPMENTS IN TECHNOLOGY, MOBILE DATA DEMAND AND SPECTRUM AVAILABILITY

32. The mobile communications sector is one of the most dynamic components of the UK and global economies. It is indisputable that mobile data is becoming ever more important in the lives of citizens and consumers, and that the social value generated by our sector is growing exponentially. As our ability to service demand for mobile data rests on access to a growing number of frequency bands, it follows that the social value being generated by that spectrum is also growing exponentially.

33. These benefits to society, however, should not be confused with the market value of the spectrum. The market value of spectrum is primarily driven by two factors: the ability of operators to generate revenues or avoid costs by deploying spectrum; and the scarcity of mobile spectrum. Both of these factors are trending downwards: operators are increasingly struggling to monetise their investments in spectrum (and mobile data in general); and new spectrum releases are reducing the scarcity value of spectrum. Meanwhile, changes in the way spectrum is deployed are driving a convergence in the value of 900 MHz and 1800 MHz, and across spectrum bands below 4 GHz. We provide evidence for each of these trends in the following paragraphs.

A. Declining revenues from mobile services

34. Although mobile operators are the conduit for growth in use of mobile data, they are capturing an ever-decreasing share of the value generation – in large part because potential profits are competed away in the downstream market. This is reflected in the decline of both total mobile service revenues and average revenues per user (ARPUs) in the UK over the past 10 years, as shown in Figure 1.[6] From 2009-2016, mobile service revenues declined by almost 15% and ARPUs dropped by 24%. During this period, the mix of services (from voice/text to data) has changed, but mobile operators have been unable to profit from these changes. If this trend continues, it implies that operators must satisfy rapid growth in demand for their services without being able to charge more per user.

35. Thus, even though the overall importance of spectrum as an input into an operator's business is increasing, the available revenues to be reinvested in spectrum acquisition appear to be in

[6] Telegeography data is only available from 2009 to 2016. We did not adjust these figures for inflation which would likely have led to an even higher reduction in both figures.

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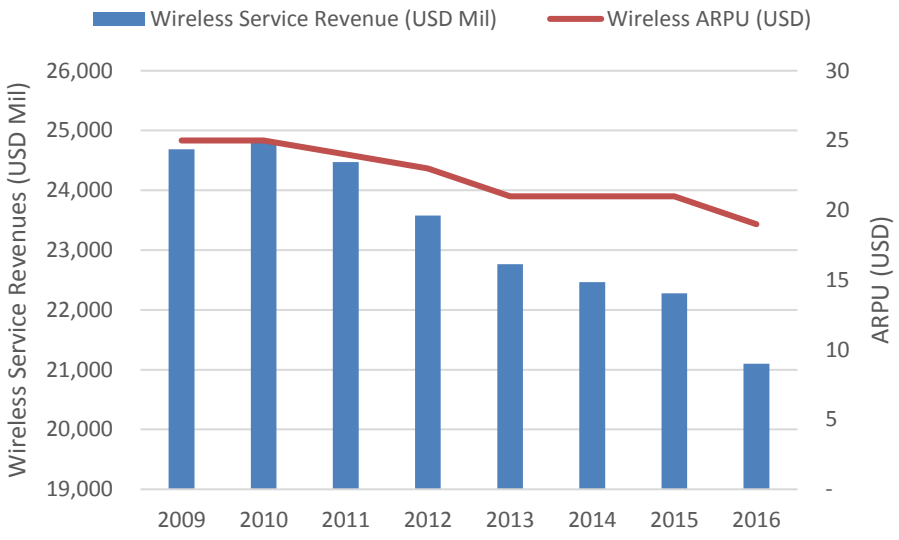
long-term decline. This, coupled with the second trend of increasing availability of spectrum, is likely to lead to a long-term decline in spectrum prices on a per MHz basis.

Figure 1: Wireless service revenue and ARPU in the UK



Source: Telegeography

B. Increase in supply of spectrum

36. The period after the UK 4G auction, from 2012-2018, was one of growing spectrum scarcity. Demand for mobile data grew at an exceptional pace, whereas the only increase in supply of spectrum for 4G came from the re-farming of frequencies previously used for 2G and 3G. The latter part of this period was an exceptionally challenging one for Telefónica UK, owing to our low spectrum holdings. Our plight was exacerbated by regulatory and competition decisions that allowed some of our competitors to sit on large volumes of unused spectrum in the 2.6 GHz band, which we assume they are holding for future use.

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37. Happily, this period of exceptional spectrum scarcity is now over. After a six-year hiatus in new spectrum releases, a large volume of new spectrum has come or will come to market over the next few years:

    - Ofcom sold 190 MHz across the 2.3 GHz and 3.4 GHz bands in March and April 2018. A further 40 MHz in the 1.4 GHz band and up to 124 MHz[7] at 3.4-3.6 GHz has been acquired by mobile operators through secondary trades.
    - A further 80 MHz at 700 MHz and at least 110 MHz at 3.6 GHz will be made available in the next auction, scheduled for 2019.
    - Ofcom also intends to release a large volume of mmWave spectrum in the 26 GHz band.

38. These releases followed a long period of uncertainty over when and what spectrum would be released, and also uncertainty regarding how these bands would be integrated into the mobile ecosystem. Excluding mmWave spectrum, these releases will increase the total stock of usable mobile spectrum from 620 MHz to 1,150 MHz, an 85% increase. This is a huge increase in spectrum supply, which should be sufficient to allow operators to service rapid growth in demand for mobile services over the short-to-medium term.

39. Importantly, these increases in spectrum availability have occurred across the total range of frequencies usable for mobile:

    a. With the release of 700 MHz and launch of 1400 MHz, the stock of so-called "coverage spectrum" below 1.5 GHz[8] will increase from 130 MHz to 230 MHz (a 77% increase). Since the UK 4G auction, all UK operators have had some of this spectrum and will have the opportunity to buy more in 2019.

    b. With the release of 2.3 GHz and 3.4-3.8 GHz spectrum, the stock of so-called "capacity spectrum" (from 1.5 GHz up to 4 GHz) will increase from 480 MHz to 920 MHz (i.e. a 92% increase). Since the UK PSSR award, all four UK operators

7 Three's UKB holdings include 84 MHz of shared use spectrum that has not yet been converted to mobile use. Ofcom is consulting on the approach to converting this spectrum to mobile use, which may involve some of the spectrum being retained by UKB and other spectrum being returned to Ofcom for auction.

8 We use 1.5 GHz here rather than 1 GHz, as the high power limits adopted for 1.4 GHz supplementary downlink spectrum mean that the spectrum offers similar propagation to sub-1 GHz bands.

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now have a critical mass of capacity spectrum for the next few years, and the opportunity to buy more in 2019.

40. In this context, it is simply not credible for Ofcom to conclude that "*On balance, we do not consider that recent technological or commercial developments provide clear evidence as to whether the forward-looking value of 900 MHz or 1800 MHz spectrum is higher or lower than in our 2015 assessment*." [9] It should be obvious that if the supply of spectrum is increased by nearly 100%, the market value of spectrum will fall. This is especially true when considered against a background of declining mobile revenues and ARPUs. The fact that demand for mobile data is rising is of secondary importance when assessing market value (as opposed to social value), given that the spectrum is not expected to generate any increase in revenues.

C. Convergence in the value of all spectrum bands below 4 GHz

41. The following trends are driving a convergence in the value of sub-1 GHz bands and higher frequencies:

- Historically, the key advantage of the 900 MHz band was its strong propagation relative to 1800 MHz and 2100 MHz, which supported cost-effective coverage of rural areas. This has always been a less important factor in the UK than many other countries, owing to the UK's relatively high population density which made it economical for EE and Three to roll out nationwide networks based on 1800 MHz and 2100 MHz grids. This premium for 900 MHz has been eroded by the release of 900 MHz and will be further eroded by the release of 700 MHz and 1400 MHz, all bands that off similar or even superior propagation to 900 MHz.

- For base stations supporting rural coverage, much less spectrum is needed than at urban sites, owing to much lower traffic levels. Moreover, even at rural sites, the majority of traffic is typically located close to the base station and can be handled by bands such as 1800 MHz, with sub-1 GHz bands needed only to support more distant users. Thus, the incremental benefits of deploying lower frequency spectrum over higher frequency spectrum diminish very rapidly after the first 2x5 MHz block.

- The types of rural areas where sub-1 GHz spectrum is most beneficial tend to be ones where there are few customers, with the implication that the deployment is uneconomic. Therefore sub-1 GHz spectrum may save some costs in meeting coverage objectives but offers no revenue benefits.

[9] June 2018 Consultation, para 4.41.

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- Lower frequency bands continue to offer some advantages with respect to in-building signal penetration. However, this advantage matters less as operators increasingly invest in densifying urban networks and deploying small cell solutions to meet capacity demands. And again, the low frequency spectrum is being used to support residual customers further from the base station.

- From a technical perspective, higher frequency bands are increasingly preferred over lower frequencies for increasing urban capacity. With dense base station or small cell deployment, low frequency signals travel too far and are harder to manage. Moreover, new technologies such as MIMO rely on the use of small antennas which only work with higher frequencies.[10]

42. These trends are only likely to get stronger as the urban-rural divide in total capacity requirements rises and new technologies become more important for 5G deployments. Operators can anticipate these trends. Consequently, even if operators value their existing holdings of sub-1 GHz spectrum highly, the marginal value they place on additional low frequency spectrum is likely to fall, both in absolute terms and relative to higher frequency bands. As Ofcom recognises, it is the marginal value of 900 MHz, not the average value, that is relevant for setting ALF.

43. There is already evidence from international price benchmarks of this convergence between the value of 900 MHz and higher frequency bands. Ofcom's own analysis has found that recent auctions have produced higher prices for 1800 MHz than 900 MHz. In addition, in the United States, 600 MHz spectrum sold at a big discount to the prior AWS auction (equivalent to 1800 and 2100 MHz), in large part because three major operators, AT&T, Sprint and Verizon decided to (largely) sit out the auction. This is consistent with there no longer being any premium for 900 MHz over 1800 MHz.

44. One explanation why 1800 MHz has apparently held its value better than 900 MHz is that the 1800 MHz bands was a pioneer band for 4G and offered sufficient capacity for many European operators to deploy 2x20 MHz LTE carriers. However, with the growth in the number of bands suitable for 4G deployment and the launch of 5G, this advantage may be coming to an end.

45. Looking forward, we expect the following trends to drive a convergence in the value of spectrum across all mobile frequency bands below 4 GHz:

    a. New handsets support a wide range of frequencies for 4G, including 700, 800, 900, 1400, 2100, 2300, 2600 and 3400 MHz. All the bands from 1400 MHz up are

[10] Ofcom recognises this point at §4.40 of the July 2018 Consultation.

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large enough to support multiple 20 MHz carriers, so the 1800 MHz band will soon be seen as just another 4G band.

- Although the 1800 MHz band offers propagation advantages over higher bands, such as 2600 MHz and 3400 MHz, this is increasingly unimportant as urban networks are densified. Directional antennas have also extended the distance which can reliably be reached using signals at frequencies up to 3.8 GHz (and higher). Thus, these higher frequency bands are increasingly closer substitutes for 1800 MHz.
- With increasing importance of small antennas in new technologies, higher frequency bands may offer capacity advantages over 1800 MHz.
- 1800 MHz (like 900 MHz) is not a pioneer band for 5G.

D. Implications of market trends for ALF

46. Ofcom's discussion of developments in technology, mobile data demand and spectrum availability is perfunctory. It is particularly weak with regards to the forward-looking market value of the existing mobile bands. Ofcom intends to set ALFs for an indefinite period and without any regular review (§§6.12-6.14). Given the risk asymmetry associated with setting prices too high, it is important that Ofcom consider the potential for the market value of 900 MHz and 1800 MHz to fall before any future review is carried out. Ofcom's failure to account for this risk – which is very real given recent market trends – is a dereliction of the requirement under its duties to adopt a conservative approach.

47. The technology leap from 2G/3G to 4G did not lead to additional revenue for operators, and in fact coincided with a decline. There is no reason to suppose that the leap to 5G will reverse this trend. In other words, the expectation is that operators must do more with less revenue. Given the huge volumes of spectrum that operators will need to deploy, it is inevitable that spectrum values across all bands will decline. If we assume that operators are able to devote the same share of revenues for spectrum as they do today, an 85% increase in spectrum supply implies that spectrum value on a per MHz basis may decrease by 50% or more.

48. We urge Ofcom to take a more considered view of market trends since the 4G auction. With operators facing new demand to launch 5G networks and expand coverage to remote areas, now is not the time for Ofcom to be taking an aggressive approach to spectrum pricing. We believe that if Ofcom undertakes a full assessment along the lines discussed above, it will conclude that it should be more conservative in its assessment of market value. In particular, taking into account the benchmark evidence we discuss in Section 4, we expect Ofcom to conclude that lump-sum values (LV) for both bands should be set at the low end of

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expectations for market value, and that there is no longer any meaningful premium for the marginal value of 900 MHz over 1800 MHz.

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Section 5

V. IMPACT OF SPECTRUM AWARDS SINCE 2015

49. In this section, we address the adjustments that Ofcom has made to the lump-sum values (LV) of 900 MHz and 1800 MHz spectrum in the UK. In summary, Ofcom proposes to make the following adjustments:

    - It proposes to express the LV of 900 MHz and the LV of 1800 MHz in May 2018 prices rather than March 2013 prices. As the formula for deriving annual fees from LVs includes an inflation adjustment, rebasing the LV does not have an impact on the final level of fees. We therefore have no objection to this adjustment and do not consider it further.

    - It proposes to increase the LV for 1800 MHz in light of new evidence from recent European auctions, specifically the Danish 1800 MHz auction. While we agree that the Danish auction meets the criteria for a Tier I benchmark, Ofcom has made errors in its calculations that lead it to overstate the value of 1800 MHz. Accordingly, we do not agree that this new evidence warrants any upward adjustment in the LV of 1800 MHz. Rather, in accordance with its commitment to taking a conservative approach in estimating market value, Ofcom should either maintain or reduce its previous estimate of the LV of 1800 MHz.

    - Ofcom proposes not to change its estimate of the LV of 900 MHz. We agree that there is no evidence to support an upward adjustment. In fact, the evidence suggests that Ofcom should consider a downward adjustment of 900 MHz, potentially to the same level as 1800 MHz. Evidence from recent European auctions supports our view (and Ofcom's view too) that the values of 900 and 1800 MHz spectrum are converging.

A. Lump-sum value of 1800 MHz spectrum in the UK

50. Ofcom proposes to increase the LV of 1800 MHz spectrum from £13 million per MHz (in May 2013 prices) to £15 million per MHz (in April 2018 prices). This exceeds a pure inflation adjustment by £1 million per MHz. Ofcom justifies this increase by pointing to evidence from the Danish 1800 MHz auction in 2016 which, according to Ofcom, suggests that the value of 1800 MHz may have increased.

51. Ofcom identifies two auctions of 1800 MHz spectrum which have taken place since its Statement on ALF in 2015: the Danish 1800 MHz auction; and the Norwegian 1800 MHz auction. The Danish auction is identified as a Tier I benchmark. As there is no suitable price point for 800 MHz or 2.6 GHz spectrum in Norway, Ofcom only uses the Norwegian absolute

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value of 1800 MHz as a cross check. We agree with Ofcom's finding that the Danish auction is the only substantive new evidence point for benchmarking the LV of 1800 MHz.

52. We note that Ofcom omits the 2016 auction of 1800 MHz and 2.6 GHz in the Czech Republic. Including this auction would likely have the effect of slightly raising the 1800 MHz distance method benchmark for the Czech Republic, which Ofcom classified as Tier 3. As Ofcom would likely deem this auction Tier-3 evidence again, we do not think that this omission is material.

53. With regards to the Danish auction, Ofcom proposes to use a price benchmark which excludes the coverage obligation lots (A lots). It then derives a benchmark value for the LV of 1800 MHz in the UK of £24.8 million per MHz using its preferred distance method. However, there is an inconsistency between the data Ofcom presents in the June 2018 consultation and the accompanying spreadsheet showing its calculations. Our review has identified errors in Ofcom's spreadsheet calculations which in turn lead to mistakes in its interpretation of the Danish benchmarks.

54. Ofcom makes the following errors:

    a. Ofcom updates the PPP exchange rates for all auctions in Denmark even if they were held before 2015. This is inconsistent with how Ofcom treats the other International benchmarks which, to our knowledge, are still based on the old dataset. The PPP rates that Ofcom uses are taken from the World Bank and are known to fluctuate from one release of the dataset to the next. For consistency with the other international benchmarks, Ofcom should have kept the PPP rates from 2015 for all awards before 2015 and only used new rates for awards from 2016 onwards.

    b. Ofcom appears to have noticed the impact that the new PPP rates have on its distance-method benchmark and therefore converts all benchmarks back to DKK before calculating the necessary ratios. However, this reconversion leads to flawed estimates. The Y/X ratio is effectively based on an absolute value benchmark in DKK which is adjusted for inflation using UK CPI rather than the appropriate inflation rate for Denmark. To properly adjust for inflation, Ofcom has two options: it should either keep all benchmarks in local currency and then adjust them using an appropriate inflation rate for that country or convert benchmarks to GBP at the time of award and then apply UK CPI to adjust for inflation. In the latter approach, the PPP rates effectively account for differences in national inflation rates. This is also the approach Ofcom adopted for all its other benchmarks.

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55. It appears that Ofcom did initially calculate the correct absolute values for Denmark, as these are reported in Table A4.7 of the June 2018 consultation:

    a. The existing benchmarks for 800 MHz, 900 MHz and 2.6 GHz were adjusted for UK CPI inflation and expressed in April 2018 prices. They were converted using the PPP rates Ofcom also used in 2015, and

    b. The new benchmark for 1800 MHz was converted to GBP using the new PPP rates for 2016 and then adjusted for UK CPI inflation and expressed in April 2018 prices.

56. Table 1 compares both datasets: the flawed absolute value benchmarks and distance-method benchmarks from Ofcom's spreadsheet and the correct absolute value benchmarks and distance-method benchmarks as reported in Table A4.7 but not used in Ofcom's analysis.

Table 1: The flawed and the correct absolute value benchmarks for Denmark

		800 MHz	1800 MHz	2.6 GHz	Y/X ratio	Distance-method benchmark
Flawed benchmarks from Ofcom's spreadsheet	All lots	£18 m	£11.5 m	£11.5 m	-6%*	£4.2 m
	B lots only	£18 m	£16.4 m	£11.5 m	68%*	£24.8 m
Correct benchmarks from Ofcom's consultation document	All lots	£17.6 m	£11.5 m	£11.1 m	6%	£7.6 m
	B lots only	£17.6 m	£16.4 m	£11.1 m	82%	£28.6 m

**The Y/X ratios presented here are those calculated by Ofcom using the flawed reconversion to adjust for changes in PPP.*

57. Using the wrong numbers, Ofcom determines two distance-method benchmarks for 1800 MHz. The first one is based on the price of "All lots" in the Danish auction and the second one is based on "B lots only":

    a. "All lots": Ofcom calculates a negative Y/X ratio of -6% for this benchmark. This would imply an 1800 MHz distance method benchmark of £4.2 million per MHz that is less than the value of 2.6 GHz. Ofcom discards this benchmark as it does not consider it to be credible in a UK context.

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b. "B lots only": Ofcom calculates a positive Y/X ratio of 68% for this benchmark which implies an 1800 MHz distance method benchmark of £24.8 m. This is the benchmark Ofcom uses in its determination of the LV of 1800 MHz in the UK.

58. Had Ofcom used the correct numbers, it would have found that the "All lots" benchmark produces a positive Y/X ratio (of 6% as indicated in the table above) and thus a distance-method benchmark that is above the value of 2.6 GHz which is credible in a UK context. It therefore should not have discarded this value in its determination of the LV of 1800 MHz in the UK.

59. As our calculations show, the Danish auction provides a wide range of possible benchmarks for the LV of 1800 MHz in the UK, and there is uncertainty how the Danish benchmark should be interpreted. A prudent, conservative approach would be to take an estimate within this range rather than picking the upper end of the range as Ofcom has done. In calculating the prices for other auctions in its dataset, Ofcom always included all available lots irrespective of the coverage obligations associated with them. It then considered qualitatively the impact of the obligation. However, for the Danish auction, Ofcom has proposed to pick the "B lots only" benchmark at the top end and discard the "All lots benchmark", on the basis that the Danish Energy Agency described the obligations as "ambitious". This is not sufficient evidence to justify ditching a valid benchmark, but may be a valid reason to be concerned about understatement of the "All lots" benchmark.

60. In summary, Ofcom should have identified two benchmarks from the Danish auction:

a. £7.6 million per MHz based on all lots. This estimate may carry a risk of understatement of market value owing to the coverage obligation and the restrictions on A lots which meant that each operator could acquire an A lot at the reserve price.

b. £28.5 million per MHz based on B lots only. This estimate carries a risk of overstatement as it may include payments for the assignment of a particular coverage obligations.[11] The lower price for the A lots may also have focused competition on these lots, driving prices above the true market value.

[11] Despite Ofcom's efforts to disentangle the auction outcome, it is actually unclear how the Danish auction unfolded and how much bidders paid to for the assignment of a particular coverage obligation. The CMRA can close with highly asymmetric prices. For example, one or two bidders may have paid significantly less for B lots than others in the 3rd stage, but paid considerably more for the assignment of a particular coverage obligation in the 4th stage. We note that TDC and Hi3G paid slightly more on a per MHz basis than TT-Netvaerket. So the result is also

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61. These two values effectively create a lower and an upper bound. A conservative approach would put more weight on the lower bound than the upper bound. When selecting a conservative estimate of market value from tier-1 benchmarks, Ofcom has used the midpoint between the average and the lower bound in the past. It makes sense to adopt the same methodology here which produces a **distance-method benchmark of £12.9 million per MHz**. As we include both the upper and lower bound in this benchmark, there is no reason to believe that this benchmark either systematically over- or underestimates true market value.

62. Adding this data point to the existing tier-1 benchmarks, reduces the average slightly to £16.5 million per MHz. In the 2015 statement and the 2018 consultation, Ofcom proposes to use the benchmark closest to the midpoint between the average and the lowest tier-1 benchmark as the LV of 1800 MHz in the UK. This would again be Ireland at £14.3 million or **£14 million per MHz** (rounded down).

63. Even if Ofcom disagree with how we derive the absolute value benchmarks for Denmark in Table 1, it should still reconsider how it selects a representative distance-method benchmark. Ofcom proposes to put 100% of the weight on the upper bound of the value estimate and completely ignores the lower bound. This is certainly not a conservative approach when evaluating the evidence from the Danish 1800 MHz auction. It would be far more prudent to pick a point within the range even if the lower bound implies a LV of 1800 MHz which is below the value of 2.6 GHz in the UK.

64. Telefónica has argued in previous submissions that Ofcom's approach to estimating the LV of 1800 MHz was insufficiently conservative. This reflects the fact that a number of key benchmarks that it used to set the LV for 1800 MHz are suspect:

    - As discussed at length in multiple responses from Telefónica and other MNOs, the Austrian auction should not be considered a reliable benchmark for either 900 MHz or 1800 MHz.[12] It is widely understood that prices in this auction were grossly distorted by strategic bidding behaviour. We continue to believe that this auction should be treated as a Tier III benchmark, not Tier I. The only part of Ofcom's assessment that we agree with is that the benchmark risks (grossly) overstating the LV of 1800 MHz. If we included the corrected Danish benchmark as tier-1, the Austrian benchmark looks even more out of

consistent with a scenario in which these two bidders finished the 3rd stage on a secondary bid (at a much lower price) and used the discount in the 4th stage to get their preferred coverage obligation. In the 4th stage, TT-Netvaerket imposed symmetric opportunity cost on TDC and Hi3G that raised their final price back to the level that TT-Netvarket had to pay on a per MHz basis.

12 See, for example: Annual licence fees for 900 MHz and 1800 MHz spectrum, Telefónica UK Ltd response to Ofcom provisional decision and further consultation, February 2015, Sections IV and V.

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kilter. While the other benchmarks create a narrow range from £12.9 million to £17.2 million, the Austrian benchmark is almost twice as high. This highlights again, that the Austrian benchmark is an outlier and Ofcom should not rely on it. It would be conservative to remove this benchmark from tier 1 which would reduce the LV of 1800 MHz in the UK to **£13 million per MHz** (rounded down) – using the midpoint between the average and the lowest tier-1 benchmark.

- Sweden 1800 MHz should be Tier 2, not Tier 1, as it is derived from proxy values. As we discussed at length in our September 2014 response, the use of a proxy value introduces uncertainty and risk of error.[13] It is therefore inappropriate to put substantial weight on this benchmark.

- Germany should be revised from risk of understating to risk of overstating the value of 1800 MHz. The marginal price for 1800 MHz was set by the competition between Telefónica and Vodafone for a fifth block. This battle was won by Vodafone despite it having no obvious immediate use for a 5th 1800 MHz block, given that it was no longer using this band for 2G and needed only 4 blocks for an LTE carrier. As previously discussed, the logical conclusion is that Vodafone was bidding beyond intrinsic value, and that a large proportion of the value it attached to 1800 MHz was associated with a broader strategic goal of maintaining a target spectrum share relative to Telefónica and T-Mobile.[14] Put differently, if incremental 2100 MHz or 2600 MHz capacity had been available in the auction, Vodafone might have bought this instead and 1800 MHz would have sold more cheaply.

65. To summarise, the fact that the Danish auction produces a wide range of plausible prices suggests that there is considerable uncertainty in how this benchmark should be interpreted. Ofcom made a number of mistakes when calculating the benchmarks for the Danish auction which may have led it to misinterpret the evidence. We have corrected Ofcom's calculations and hope this will lead Ofcom to re-evaluate this data point. At the very least, we would expect Ofcom to conclude based on these corrected values that the Danish auction does not provide any evidence for Ofcom to revise its estimate of the LV of 1800 MHz upwards, in particular given its commitment to adopting a conservative approach. The corrected Danish benchmark also highlights the excessive level the Austrian benchmark. Ofcom should reconsider its

13 Annual licence fees for 900 MHz and 1800 MHz spectrum, Telefónica UK Ltd response to Ofcom provisional decision and further consultation, September 2014, para 152-158.

14 Annual licence fees for 900 MHz and 1800 MHz spectrum, Telefónica UK Ltd response to Ofcom Update, July 2015, Section D.

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classification of Austria as tier-1 evidence. Downgrading it to tier-2 evidence would lead to a reduction in the LV of 1800 MHz in the UK.

B. Lump-sum value of 900 MHz spectrum in the UK

66. Ofcom proposes to increase the LV of 900 MHz spectrum from £18 million per MHz (in May 2013 prices) to £19 million per MHz (in April 2018 prices). The difference is purely driven by inflation. As the formula to derive annual fees from the LV includes an inflation adjustment, the net effect on actual fees of this revision is small.

67. We agree with Ofcom's assessment that there is no significant new evidence from spectrum auctions in Europe that would warrant an upward revision to the LV of 900 MHz spectrum in the UK. The 900 MHz auction in Norway in 2017 is the only award of 900 MHz spectrum in Europe since Ofcom's Statement on ALF in 2015. Owing to the lack of a suitable price point for 800 MHz in Norway, Ofcom's ratio methodology is not applicable. Ofcom therefore only uses the absolute value benchmark from that auction as a cross-check on the proposed LV of 900 MHz in the UK. We support Ofcom's analysis of Norway and its focus on ratios rather than absolute benchmarks.

68. There is, however, evidence that Ofcom should consider a downward revision of the 900 MHz price. The Norwegian auction is the latest in a series of evidence points that support Telefónica's (and Ofcom's) view that the values of 900 MHz and 1800 MHz are converging. Figure 2 plots the premium of 900 MHz over 1800 MHz spectrum for all price points included in Ofcom's sample (0% indicates no premium). The figure highlights an obvious trend: in spectrum auctions before 2014, the 900 MHz sold at a premium whereas in all auctions since then, 900 MHz sold at a discount.

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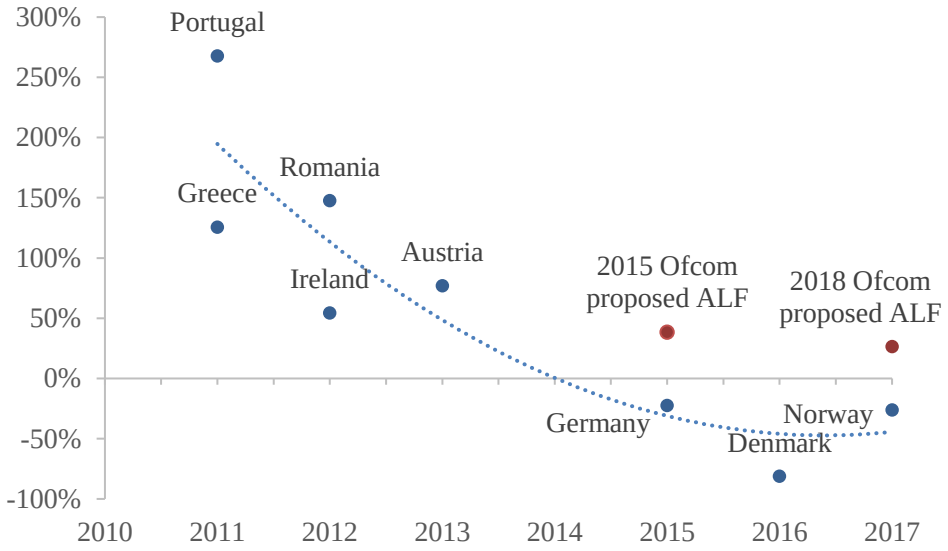
Figure 2: Observed premium for 900 MHz in Ofcom's sample of international benchmarks



69. Ofcom picks up on this point at paragraph 4.57 of the June 2018 Consultation:

> *"The fact that prices for 1800 MHz have been higher than for 900 MHz in recent awards in two countries (Germany in 2015, and Norway in 2016 and 2017) may indicate that the values of the two bands are moving closer together. We do not consider the evidence from these two countries to be definitive. However, to the extent it is relevant, as we do not have clear evidence that the value of 900 MHz has decreased, on balance we consider it more likely that the value of 1800 MHz has increased." (Paragraph 4.57 of the consultation).*

70. Convergence could be a result of either the value of 1800 MHz spectrum going up or the value of 900 MHz spectrum coming down. Ofcom believes the former is the case, but fails to provide any reasoning why it does not believe the price of 900 MHz may have fallen. In fact, as we discussed, above in Section 2, there are good reasons to believe that the value of all spectrum bands is going down, owing to the huge increase in IMT spectrum suitable for deployment in macro base stations and the decline in industry revenues. Amongst IMT bands, the marginal value of sub-1 GHz bands has been significantly reduced both because supply is increasing (700 MHz) and because low frequency bands no longer offer any advantage over higher frequency bands for addressing urban capacity. 1800 MHz may have held its value better than other bands owing its emergence as the key 4G capacity band and adoption in the widest range of handsets, but these advantages are now disappearing.

71. There is clear evidence of the declining value of 900 MHz in Ofcom's benchmark data. Figure 3 plots the 900 MHz paired ratio benchmarks Ofcom used to derive its proposed LV of 900

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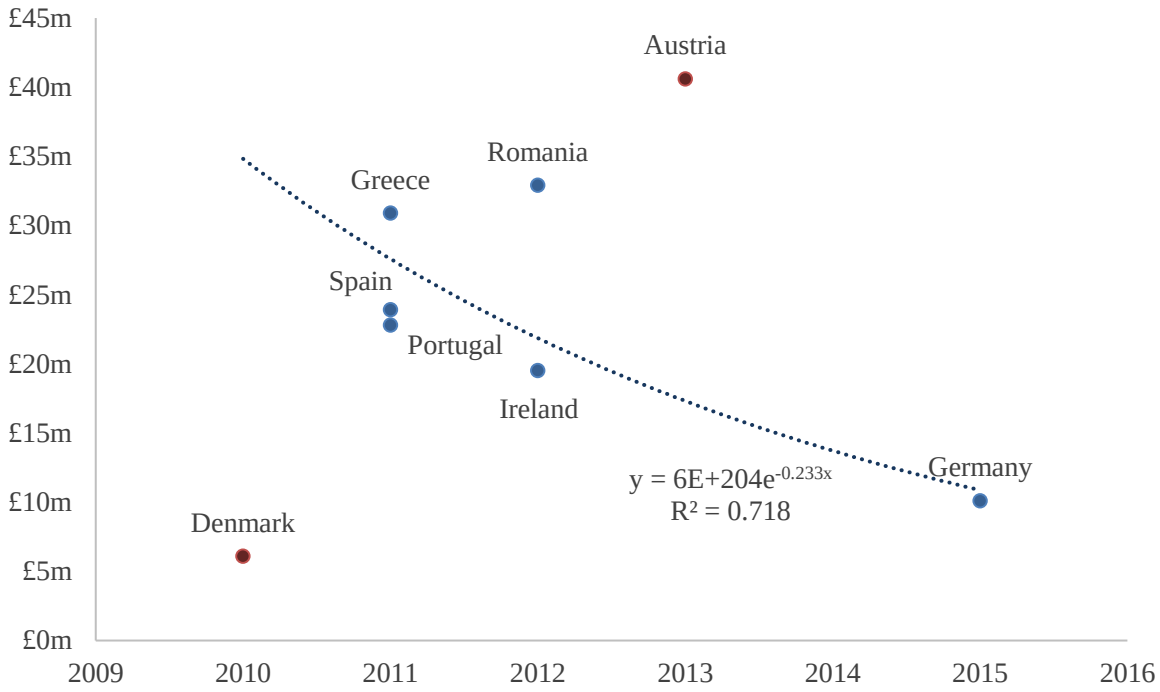
MHz spectrum over time. If we exclude the two widely recognised outliers – the Austrian auction (whose inclusion we have criticised in previous submissions[15]) and the Danish auction (in which the leading incumbents were not allowed to bid) – we can identify a clear downward trend in the value of 900 MHz in Ofcom's sample.

Figure 3: Ofcom's 900 MHz paired ratio benchmarks plotted over time



72. Given this further evidence of the declining relative value of 900 MHz, it is no longer safe for Ofcom to assess any premium for 900 MHz over 1800 MHz. Based on its own evidence, Ofcom should revise down the LV of 900 MHz to the same level that is adopted for 1800 MHz.

[15] See, for example, §120 of Telefonica UK's response to Ofcom's consultation of February 2015: https://www.ofcom.org.uk/__data/assets/pdf_file/0038/79796/telefonica.pdf

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Section 6

VI. DERIVING ALFs FROM LUMP SUM VALUES

73. In this section, we address Ofcom's approach to deriving the discount rate used to calculate ALFs from the lump sum values discussed above. We address (i) the calculation of the cost of debt and the weighted average cost of capital (WACC); and (ii) the risk-sharing adjustment to weight them.

74. In summary, Ofcom proposes the following approach:

    a. It derives the discount rate based on two polar cases for the allocation of risks associated with changes in the value of the licence. According to Ofcom, in the lower polar case, the licensee alone bears all the risk and hence the cost of debt is the appropriate discount rate. In the upper polar case, changes in the economic value of spectrum translate into changes of the ALF payments such that the government bears all the risk. In this case, Ofcom argues that the appropriate discount rate is the WACC.

    b. As in 2015, Ofcom uses a risk-sharing framework to account for the perceived balance of risk sharing between the government and the MNO. Therefore, it adds a risk-sharing premium of 25% of the difference between the upper polar case (i.e. WACC) and the lower polar case (i.e. cost of debt) to the cost of debt.

75. Ofcom determines a cost of debt of 2.7% (pre-tax nominal) based on MNOs' observed debt yields. Correcting this value for an inflation risk premium and the corporate tax rate yields a post-tax real cost of debt of 0.2%. For the WACC, Ofcom uses an estimate from its 2018 Mobile Call Termination (MCT) Market Review, which amounts to 5.5% (post-tax real). Applying a risk-sharing adjustment of 25% to these values, Ofcom derives a final discount rate of 1.5%.

76. We have commissioned an expert report from NERA Economic Consulting that shows that Ofcom's approach overstates the true discount rate. As the attached NERA report shows, the true discount rate ranges from 0.52% to 0.84%. Given Ofcom's objective of setting ALF conservatively at market value, the lower bound is more appropriate.

77. NERA finds that Ofcom's discount rate implies a very substantial default assumption compared to other debt rates and historical default probabilities. NERA's findings suggest that Ofcom's discount rate is consistent with the yields on "junk bonds" that have expected default rates of more than 20% over a 20-year period. This is implausible in the context of setting ALF.

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A. Calculation of cost of debt and WACC

78. Ofcom uses a slightly lower cost of debt of 2.7% (nominal, pre-tax), compared to 3.3% in 2015 reflecting general market conditions rather than a change in methodology. On the other hand, the WACC actually increases (!) from 5.2% to 5.5% on a real post-tax basis while most other regulators have significantly reduced their WACC estimates over time.

79. As highlighted in NERA's report, Ofcom makes a number of errors in deriving the cost of debt and the WACC:

    a. Ofcom continues to use a long-run estimate of the WACC, despite the fact that this is inconsistent with its use of current estimates of the cost of debt. "Buying spectrum" is a one-off transaction with no ongoing capex even if the payment conditions allow for some risk-sharing. Hence the relevant upper bound financing cost is the *current short-run* WACC. Correcting this error, NERA shows that a WACC estimate of 3.9% to 5.0% is more appropriate than the value of 5.5% used by Ofcom.

    b. Ofcom fails to correct the observed cost of debt for liquidity risk. Doing so is necessary to fulfil Ofcom's own stated objective of making the government indifferent between a lump sum payment and ALFs. The difference between the two is the MNOs' risk of default and not liquidity risk. NERA therefore proposes to adjust the cost of debt downward by 0.30 to 0.41 percentage points.

    c. Ofcom does not consider the effect of securitisation in the cost of debt. As ALFs represent a debt obligation that is secured against the value of the spectrum licence, it is wrong to use a cost of debt estimate that is based on unsecured corporate debt without any adjustment. NERA's findings suggest that a modest reduction of 0.10% to 0.12% to the cost of debt is appropriate to adjust for securitisation.

80. Due to the above errors, Ofcom overestimates the discount rate, even before accounting for the 25% risk-sharing adjustment. Adjusting for these aspects alone reduces the discount rate to between 0.8% and 1.1% (real post-tax).

B. Risk-sharing adjustment

81. Ofcom continues to use a 25% risk-sharing premium to account for any risk sharing between the government and MNOs. Ofcom derived this premium in 2015 through a series of stylised examples to assess the degree of both the MNOs' and the government's exposure to changes in

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the market value of spectrum over time and then applied its regulatory judgement to arrive at this figure.

82. In the attached report, NERA assesses the degree of risk sharing by expanding the real-option approach it first developed in response to an earlier Ofcom consultation on ALF in 2015. The possibility for an MNO to hand back spectrum is akin to the government selling a real option to the MNO. NERA uses well-established option-pricing theory to estimate the degree of risk sharing between the government and the MNOs.

83. In its 2015 Final Statement, Ofcom agreed with this approach in principle stating that it is "consistent with [its] conceptual approach." It nevertheless dismissed NERA's initial approach, arguing that it was based on a stylised example and simplifying assumptions. NERA has extended its initial model taking onboard Ofcom's concerns about the initial version.

84. In extending the model NERA uses very cautious (in the sense of discount rate enhancing) assumptions, namely:

    a. NERA does not consider the Government's upward potential arising from the possibility to review and increase ALFs (even though the Government through Ofcom has already used this option as part of the 2018 consultation). Instead NERA exclusively focuses on the Government's downside risk, i.e. downward review and / or hand back of spectrum.

    b. NERA adopts a modelling framework where the option is valued "at the money", i.e. without any materiality threshold. This assumption maximises the flexibility afforded to MNOs and thus the option value the Government grants to the MNO. Further detail is provided in NERA's expert report.

    c. NERA uses Ofcom's estimates of the cost of debt and WACC despite the issues it identified with Ofcom's methodology as described above.

    Based on these assumptions, NERA concludes that the risk-sharing factor should be no higher than 20%.

85. To address Ofcom's main criticism of the real options approach, NERA runs further sensitivities on the volatility of spectrum value and the trigger threshold for review. NERA finds that Ofcom's 25% risk sharing can only be justified when spectrum volatility is assumed to be similar to BT Group's asset volatility, a comparator that Ofcom has previously discarded as unsuitable for estimating the risk / volatility of UK MNOs.

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86. Correcting for all of the issues mentioned above, NERA finds that a plausible range for the discount rate is between 0.52% and 0.84% (real post-tax). This is well below the highly-inflated 1.5% proposed by Ofcom. Our range is derived based on a number of cautious (i.e. discount rate enhancing) assumptions and, most importantly, does not incorporate the Government's option to increase ALFs when the value of spectrum increases. This is despite the fact that, as the current consultation shows, the Government through Ofcom is already attempting to make use of this option for the 1800 MHz band. **Ofcom should pick the lower bound of this range (0.52%) as a conservative estimate of the discount rate.**

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Section 7

VII. PROPOSED LEVELS OF ALFs

87. In this section, we revisit our own estimates of lump sum values for 900 MHz and 1800 MHz, based on the evidence presented in Ofcom's June 2018 consultation and the analysis presented in this response. Our estimates are set out in Table 2.

88. Regarding the lump-sum values:

    a. We conclude that the lump sum value of 1800 MHz should be left unchanged from Ofcom's previous decision, except for the inflation adjustment. This is because the price point from the Danish 1800 MHz auction, if calculated correctly and conservatively, falls just below the lump-sum value established in 2015. This shows that market value has not changed and that the **lump-sum value for 1800 MHz should be no higher than £14 million per MHz** which is the 2015 lump-sum value adjusted for inflation. There is also a case for revisiting the inclusion of (a) the Austrian benchmark in Tier 1 due to the controversies surrounding this auction and the high likelihood of overstatement; and (b) the Sweden benchmark which is only based on proxy values. Removing these benchmarks would have the effect of bringing down the lump-sum value for 1800 MHz to £13 million per MHz.

    b. Prices from recent auctions across Europe show that the values of 900 and 1800 MHz spectrum are converging. This is part of a more general decline in spectrum value which reflects changes in the way that spectrum is sued in urban areas, as wells as the huge increase in the available supply and lack of additional industry revenues. Owing to its wide adoption in handsets and its general status as a key LTE band, 1800 MHz spectrum has held its value better than 900 MHz, leading to a convergence in the values of the two bands. This trend is expected to continue, so a **lump-sum value for 900 MHz of no more than £14 million per MHz** would be appropriate.

89. These changes would be consistent with Ofcom's own view that it should be conservative in estimating market value, especially having regard for its obligations under UK and European law.

90. We also apply our recommendations regarding the adjustment factors to be used in converting lump sums to annual fees. Ofcom proposes a discount rate of 1.5% - a figure inflated by errors in the way Ofcom determines the cost of debt and the risk-sharing adjustment. As we discuss in Section 5, a conservative estimate of the discount rate would be 0.52%.

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Table 2: Appropriate levels of ALFs for 900 MHz and 1800 MHz

	900 MHz	1800 MHz
STEP 1		
Lump sum market value 800 MHz based on UK auction (£m/MHz)	£32.2m per MHz net of expected DTT co-existence costs £35.5m per MHz gross of expected DTT co-existence costs	
Lump sum market value 2600 MHz based on UK auction (£m/MHz)	£5.5m per MHz	
STEP 2		
Lump sum values (2018 prices) based on European benchmarks	£14m per MHz	£14m per MHz
STEP 3		
Discount factor for determining ALFs (%)	0.52%	
Tax adjustment factor	1.055	
Annualisation rate	5.54%	
STEP 5		
Annual licence fee (ALF) (£m per MHz pa) before adjusting for coverage obligation*	£0.775m per MHz	£0.775m per MHz

Source: Ofcom, June 2018 Consultation and Telefónica calculations as set out in this response.
Notes: We omit step 4 as we accept that Ofcom has the power to set prices at market value and our adjustments in steps 1-3 address the obligation on Ofcom in light of its duties to take a conservative approach in estimating market value.

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