Three's response to Ofcom's Consultation on Award of the 700MHz and 3.6-3.8GHz spectrum bands: Revised proposals on auction design

Non-confidential

09 December 2019

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Executive Summary

Three wants to compete in the 2020 auction, but we want to be able to do so fairly and on a level-playing field.

Following threats of litigation from Telefónica, in its June 2019 decision on Annual Licence Fees ('ALFs') for 3.4-3.6GHz spectrum Ofcom suggested it might review our ALFs after the 3.6GHz auction if a "material misalignment" arises based on the 3.6GHz price.

We now urge Ofcom to clarify that the other ALFs (particularly 900MHz) will also be open for revision after the auction if a "material misalignment" arises. The 700MHz auction price will be the best available benchmark for the value of 900MHz in the UK. We expect the 700MHz price to expose a "material misalignment" between the measly £190m lump-sum value that each of Telefónica and Vodafone currently pay per 2x5MHz block and the true market value of 900MHz spectrum.

Failing to adopt a consistent approach before the award will risk inefficiency, discrimination and the distortion of competition in the auction, inviting a legal challenge to the award itself. Three would also have to reserve its right to challenge any discriminatory re-opening of ALFs after the award.

Three raised its own ALF by £9m pa in trying to compete for 3.4GHz in 2018 (because Ofcom used the 3.4GHz auction price, which Three had set, as the basis for Three's 3.4-3.6GHz ALF). Three (and only Three) now risks increasing its ALF again if it competes for 3.6GHz in 2020. With 120MHz subject to ALF, Three will also be very vulnerable to rivals' attempts to drive up the 3.6GHz price.

Our rivals on the other hand can bid aggressively for all spectrum in the auction without fear of raising their ALFs in the process: their ALFs will not be revised in five years ("save in very exceptional circumstances").

Opening our ALFs for revision while not doing the same with the other MNOs' ALFs is bad policy and is contrary to Ofcom's statutory duty to promote competition and not to discriminate. There can be no justification for treating the two situations differently and Ofcom has not put forward any reasons for doing so.

We provide evidence in our response showing that 900MHz should have very similar value to 700MHz but is significantly more valuable than 800MHz spectrum. The 900MHz ALF is pegged to an outdated 800MHz value of £355m per 2x5MHz (from the February 2013 4G auction) which Ofcom had major difficulties in estimating. That there already is a material misalignment is evident from the fact that the value of 900MHz for the purposes of ALF is only about half (54%) of Ofcom's UK 800MHz value estimate.

The other key consideration is the lack of a low frequency cap in the auction. The 700MHz award is the last opportunity for MNOs to buy low frequency spectrum. Any competition issues that arise due to concentration of sub 1GHz spectrum will persist indefinitely. Without a limitation on the amount of 700MHz Vodafone and Telefónica can buy Ofcom is risking [✂].

To be credible in the medium term, all MNOs will need access to sub 1GHz spectrum. There are many parts of the country that can only be served economically with sub-1GHz spectrum. We estimate that [✂].

We strongly believe that traditional views on the amount of sub 1GHz spectrum that is needed to be competitive are no longer valid with 5G. 5G will enable extreme mobile broadband, massive IoT connectivity and ultra-reliable critical communications.

Ubiquitous coverage is the most important aspect of reliable connectivity, especially for massive IoT and critical communications.

Without 700MHz FDD, [✂].

[✂]. For this reason, we ask Ofcom to ensure that no bidder can bid for more than 2x10MHz of 700MHz spectrum (one third of the available supply).

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1. Executive summary.

1.1. Leaving Three's 3.4-3.6GHz ALFs open for revision in light of the auction outcome while not doing the same with other ALFs (particularly 900MHz) would be bad policy and contrary to Ofcom's statutory duties to promote competition and not to discriminate.

1.2. Three urges Ofcom to clarify that all operators' ALFs (particularly 900MHz) might be revised after the auction based on the 2020 auction prices (particularly for 700MHz FDD).

1.3. There already is a "material misalignment" between the measly £190m lump-sum value that the 900MHz MNOs pay for that spectrum (per 2x5MHz block) and its real market value. The notion that the market value of 900MHz is half (54%) of the 800MHz UK value is grossly out of line with market reality.

1.4. The 900MHz ALF is pegged to an outdated (February 2013) 800MHz value which Ofcom had major difficulties in estimating due to the combinatorial nature of the 4G auction. The 700MHz FDD price in 2020 will provide the best available benchmark for Ofcom to reassess the UK market value of 900MHz spectrum after the auction.

2. Three risks raising its ALFs again by competing for 3.6GHz spectrum in 2020.

2.1. Three wants to compete strongly in the 2020 auction, but we want to be able to compete fairly and on a level playing field. Subject to clarification from Ofcom, this may not be the case: Ofcom appears to have left open the possibility of revising our 3.4-3.6GHz ALFs immediately after the auction if a material misalignment arises between the level of those fees and the 3.6GHz auction price.

2.2. As a result of this ALF distortion:

- Three would be at risk of increasing its 3.4-3.6GHz ALFs if it competes for 3.6GHz. Furthermore, with 120MHz in the band subject to ALF Three would be very vulnerable to rivals' attempts to drive-up the 3.6GHz price; and
- By contrast, our rivals could bid aggressively for 700MHz without fear of raising their 900MHz (and 1800MHz) ALFs in the process.

2.3. As the highest losing bidder for 3.4GHz in 2018, Three may have been expected to win some 3.6GHz spectrum in 2020: Three dropped demand for additional 3.4GHz at £37.8m per 5MHz, higher than Telefonica's £31.1m and Vodafone's £29.6m. Leaving our ALF open for revision after the auction will necessarily distort Three's bidding incentives, potentially leading to an inefficient outcome.

The ALF distortion will allow the larger MNOs to buy more 3.6GHz spectrum than they otherwise would at low prices.

2.4. At some point between December 2018 (when Ofcom first consulted on the design of the award) and this Consultation Ofcom may have changed its approach to reviewing ALFs, leading to this distortion. In the 900/1800MHz ALFs Statement of December 2018,[1] Ofcom assured all MNOs that those ALFs will not be revised within five years "except in very exceptional circumstances":

"We consider that there is benefit in a period of relative certainty for licensees. We would therefore be unlikely to review ALFs in the next five years save in very exceptional circumstances and would also propose to retain them beyond that date unless there were grounds to believe that a material misalignment had arisen between the level of these fees and the value of the spectrum, in keeping with our general policy on fee reviews."

2.5. In its December 2018 Consultation on UKB's 3.4-3.6GHz ALFs, Ofcom proposed the same assurance for UKB's ALFs, concluding that "*we do not intend to review the level of ALFs for UKB's 3.4 GHz and 3.6 spectrum after the forthcoming auction for 700MHz and 3.6-3.8 GHz spectrum*".[2]

2.6. However, the 3.4-3.6GHz ALFs Statement of June 2019 no longer contains a five-year assurance:[3]

"… we always retain the ability to revise fees in the future in appropriate circumstances, including after the forthcoming auction of 700MHz and 3.6-3.8 GHz spectrum, if we consider there is evidence to suggest a revision to fees is warranted. However, we also consider that there is benefit for licensees in a period of certainty on fees. This remains our general position, and we intend to retain the fees as set unless there is strong evidence that a material misalignment has arisen between the level of the fees and the value of the spectrum."

2.7. Ofcom states in respect of both 900/1800MHz and 3.4-3.6GHz ALFs that it would not change the level of the fees unless a "material misalignment" arises. Some may, however, perceive a difference in approach: the 3.4/3.6GHz ALF decision does not say that Ofcom is unlikely to review the ALFs "*in the next five years save in very exceptional circumstances".*

2.8. If there is a difference in approach, Telefónica seems to have been instrumental in introducing it. We are aware that from December 2018, Telefónica has lobbied Ofcom to preserve the option of revising our 3.4-3.6GHz ALFs after the 2020 auction.[4] In February 2019, Telefónica even threatened to legally challenge

[1] Para 6.20, Annual Licence Fees for 900 MHz and 1800 MHz frequency bands (Ofcom Statement, 17 December 2018) available at: https://www.ofcom.org.uk/__data/assets/pdf_file/0020/130547/Statement-Annual-licence-fees-900-MHz-and-1800-MHz.pdf

[2] Para 5.14, Annual Licence Fees for UK Broadband's 3.4 GHz and 3.6 GHz spectrum (Ofcom Consultation, 17 December 2018) available at: https://www.ofcom.org.uk/__data/assets/pdf_file/0013/130540/Annual-Licence-Fees-for-UK-Broadbands-3.4-GHz-and-3.6-GHz-spectrum.pdf.

[3] Annual Licence Fees for UK Broadband's 3.4 GHz and 3.6 GHz spectrum (Ofcom Statement, 7 June 2019) available at: https://www.ofcom.org.uk/__data/assets/pdf_file/0013/151231/statement-annual-licence-fees-uk-3.4-ghz-and-3.6-ghz-spectrum.pdf. Para 4.34, ibid.

[4] Paras 40-47, Telefónica UK Limited Response to Annual Licence Fees for UK Broadband's 3.4 GHz and 3.6 GHz spectrum (26 February 2019) available at: https://www.ofcom.org.uk/__data/assets/pdf_file/0017/142136/Telefónica-UK.pdf. We note that the

Ofcom's decision to vary UKB's 3.6GHz licence if Ofcom followed its usual policy of not reviewing ALFs for five years save in very exceptional circumstances.[5]

2.9. As far as we can see, Telefónica has never asked Ofcom to also preserve the option of revising its own 900MHz ALF immediately after the auction if the 700MHz price reveals a "material misalignment". The arguments made by Telefónica about the relationship between future ALFs and bidding in the auction apply in just the same way to 700MHz/800MHz/ 900MHz spectrum as they do to 3.6GHz. In particular:

- Telefónica suggested that Three has no need for more 3.6GHz spectrum and is likely to engage in price-driving because it already has so much 3.6GHz. The same can be said of Telefónica in relation to sub 1GHz spectrum. It and Vodafone hold far larger quantities than either Three or BT/EE: 54.8MHz each vs. 10MHz each. According to Telefónica's logic, Telefónica (and Vodafone) would have an incentive to engage in price-driving for 700MHz spectrum, as it will be obvious to them that Three and BT/EE have a greater need for the 700MHz on offer; and

- If it could be said that to stop price-driving from Three there needs to be a threat of a higher ALFs for 3.6GHz spectrum, the same is even more true in relation to Telefónica and 700MHz spectrum, since ALFs only currently apply to part of their low frequency holdings (i.e. not the 800MHz spectrum acquired at auction).

2.10. Telefónica's allegations have little merit and Ofcom did not seem to adopt them in its 3.4-3.6GHz ALF statement. Indeed, Ofcom gave no reasons at all for changing its approach (if indeed it has done so).

3. All operators' ALFs (particularly 900MHz) should be open for revision in light of the 2020 auction prices (particularly for 700MHz FDD).

3.1. Three expects Ofcom to clarify that it will take the same approach in relation to both 3.4-3.8GHz and 900/1800MHz ALFs. There can be no justification for treating the two situations differently and Ofcom has certainly not put forward any reasons for doing so (let alone consulted on the same). A consistent approach is required to preserve the integrity of the award and maximise the likelihood of an efficient, pro-competitive auction outcome.

3.2. The 700MHz auction price in 2020 will provide the best available benchmark for the UK market value of 900MHz spectrum. Telefónica's 900MHz (and 1800MHz) ALF is currently pegged to the February 2013 800MHz UK auction price. Ofcom estimated an inflation-adjusted value of £355m per 2x5MHz for 800MHz, which after adjustment (via relative value benchmarks in comparable auctions) produced a 900MHz value of only £190m per 2x5MHz.

3.3. The notion that the market value of Telefónica's 900MHz may be roughly half (54%) of the 800MHz UK value is grossly out of line with market reality. The UK 800MHz value on which Telefónica's 900MHz (and 1800MHz) ALF is based is nearly seven years old now and Ofcom had major difficulties in estimating it. The ALF process dragged on for years because there were no separate prices for

version on Ofcom's website is marked "Confidential". We are not sure if this is an error or if Telefónica waived any claims to confidentiality before publication.

[5] https://www.ofcom.org.uk/__data/assets/pdf_file/0017/142136/Telefónica-UK.pdf; paragraph 4

different bands (due to the CCA format used in the 2013 4G auction) and no uniquely correct way of estimating one.

3.4. Ofcom had to use four different methods and various relative benchmarks from other countries producing a wide range of values,[6] from which it picked a single 800MHz value by exercising regulatory judgement. In producing its estimates Ofcom enumerated a formidable list of "complicating factors", mostly having to do with the impact of competition measures (spectrum reservation and caps), differences between the auctioned band (800MHz) and the band to be priced (900MHz) and the combinatorial nature of the auction.[7]

3.5. There is no realistic prospect that this 800MHz estimate from 2013 (and the 900MHz value derived from it) will reflect market value today. By contrast, the SMRA 2020 auction will straightforwardly produce a separate 700MHz price. That value will suffer from none of the difficulties that beset Ofcom's 800MHz UK value and will require neither estimation nor regulatory judgement.

3.6. We expect the 700MHz auction price in 2020 to expose that there already is a huge gap between the measly £190m lump-sum value that Telefónica currently pays for each 2x5MHz block and the real market value of its 900MHz spectrum (as proxied by the 700MHz). The 700MHz price will give Ofcom much more recent and relevant evidence with which to re-set the 900MHz ALFs if a material misalignment arises.

3.7. The main determinants of the long-term value of the spectrum are its propagation characteristics, international harmonization and handset support. The 700/800/900MHz bands are all internationally harmonised. In terms of handset support, 900MHz should be more valuable than 700MHz as it is more widely supported in UK handsets:

- The penetration of 4G-enabled 800MHz and 900MHz devices is identical, with 700MHz lagging behind: for instance, [✂]% of devices in Three's base already support 800MHz (n20) and 900MHz (n8), but only [✂]% support 700MHz (n28);
- In terms of 5G, the penetration of 5G-enabled handsets for these bands in the UK is minimal. 900MHz (n8) and 800 MHz (n20) are on the chipset roadmap from key players. Penetration will depend on market demand and could commence in 2020 in high end devices. Demand for 700MHz (n28) is emerging with key chipset vendors planning to support n28 from end 2019-2020 and handsets anticipated to become available from 2020.

3.8. In terms of propagation characteristics, in its previous auction consultation Ofcom estimated the relative coverage of different spectrum bands (using 800 MHz as the baseline) in three propagation environments: urban, suburban and rural.[8] The results are presented in Figure 1. According to this Ofcom evidence, on the basis of its propagation characteristics the value of 900MHz should be significantly

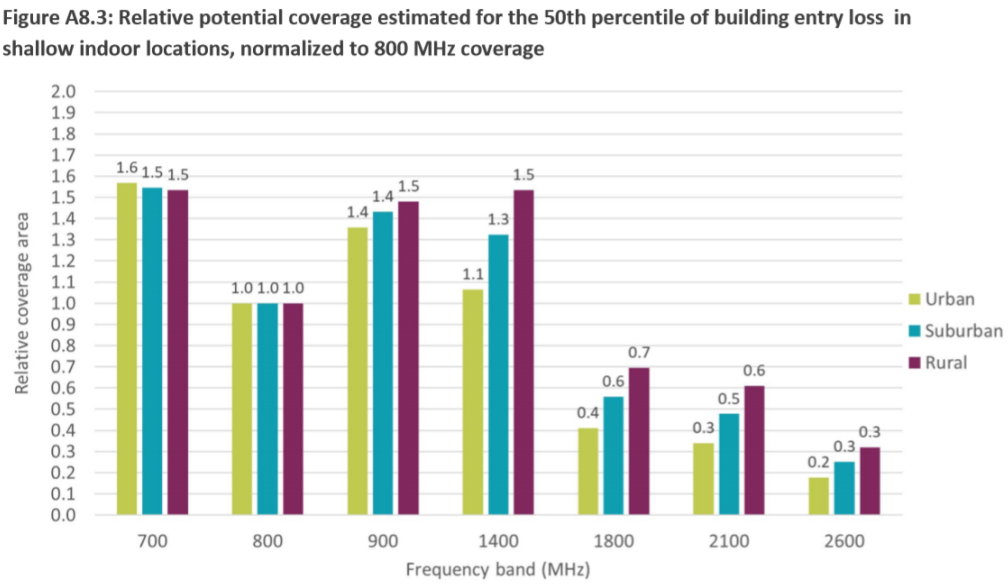
[6] I.e. prices in the 4G auction, opportunity costs in the auction, Linear Reference Prices method and the Marginal bidder analysis.

[7] Ofcom listed the following complicating factors: effect on the 800MHz price of reserve prices and the overall spectrum cap; the possibility that forward-looking market values had reduced over time; differences between the value of 800MHz and 900MHz (e.g. due to contiguity premiums); the informative value of the 2x5MHz of 800MHz won by BT/EE; dealing with rearrangements when deriving auction prices and opportunity cost; and choosing the relevant marginal increment.

[8] Figure A8.3, https://www.ofcom.org.uk/__data/assets/pdf_file/0021/130737/Annexes-5-18-supporting-information.pdf

higher than (rather than 54% of) the 800MHz value, and similar to the value of 700MHz.

Figure 1: Ofcom's estimate of the relative coverage of 700MHz, 800MHz, 900MHz and 1800MHz spectrum.



Source: Ofcom

3.9. The available market evidence confirms that the 2020 UK auction price for 700MHz will provide the best available benchmark for the UK value of 900MHz. The only comparable country that has auctioned both bands simultaneously to date (i.e. Germany) suggests that the market value of the bands is similar or, if anything, slightly higher for 900MHz (as shown in Figure 2).

Figure 2: Results of the German auction suggest that 900MHz is slightly more valuable than 700MHz

Rundenergebnis der Runde 181				
Frequenzbereich	Block	Ausstattung	Höchstbieter	Höchstgebot (€ in Tsd.)
700 MHz (gepaart)	700 A	2x5 MHz konkret	TEF DE	166.397
	700 B	2x5 MHz abstrakt	Vodafone	165.509
	700 C	2x5 MHz abstrakt	TEF DE	166.847
	700 D	2x5 MHz abstrakt	Telekom	166.567
	700 E	2x5 MHz abstrakt	Telekom	171.649
	700 F	2x5 MHz abstrakt	Vodafone	163.476
900 MHz (gepaart)	900 A	2x5 MHz konkret	TEF DE	195.520
	900 B	2x5 MHz abstrakt	Vodafone	211.807
	900 C	2x5 MHz abstrakt	Vodafone	203.298
	900 D	2x5 MHz abstrakt	Telekom	183.671
	900 E	2x5 MHz abstrakt	Telekom	180.968
	900 F	2x5 MHz abstrakt	Telekom	180.465
	900 G	2x5 MHz abstrakt	TEF DE	189.958

Source:
https://www.bundesnetzagentur.de/DE/Sachgebiete/Telekommunikation/Unternehmen_Institutionen/Frequenzen/OeffentlicheNetze/Mobilfunknetze/Frequenzauktion/projekt2016-node.html

3.10. For the reasons set out above, Three expects Ofcom to clarify that if bidding in the 2020 auction provides “strong evidence of a material misalignment”, then that would also be sufficient to represent “very exceptional circumstances” justifying a re-opening of Telefónica’s (and all MNOs') ALFs.

3.11. Failing to provide clarity on this matter before the award will risk inefficiency and the distortion of competition in the auction, inviting a legal challenge to the award itself. Three would also have to reserve its right to challenge any discriminatory re-opening of ALFs after the award.

2. Ofcom should restrict bidders to winning at most 2x10MHz of the 700MHz FDD spectrum.

6. Executive summary.

6.1. We urge Ofcom to revisit its proposal not to impose a sub-1GHz cap and give proper weight to dynamic competition in doing so. In particular, it must recognise that since there is no prospect of further low-frequency spectrum being released for mobile use, any competition concerns that arise will persist indefinitely.

6.2. The biggest threat to dynamic competition is that [✂].

6.3. Furthermore, without any additional low-frequency spectrum, [✂].

6.4. We strongly believe that traditional views on the amount of sub 1GHz spectrum that is needed to be competitive are no longer valid with 5G. 5G will enable extreme mobile broadband, massive IoT connectivity and ultra-reliable critical communications. Ubiquitous coverage is the most important aspect of reliable connectivity, especially for massive IoT and critical communications.

6.5. The persistent asymmetry in MNOs' low-frequency spectrum holdings will significantly weaken competition for significant customer segments. This is true for both the retail and wholesale markets in the UK because coverage and capacity in hard-to-reach areas are key drivers of competition and consumer choice.

6.6. The recent announcement on the Shared Rural Network (SRN) is a huge success, delivering 4G coverage to 95% of the UK. This was made possible because the four MNOs all hold low-frequency 4G spectrum and so have similar 4G coverage. If all MNOs do not hold sufficient low-frequency 5G spectrum, a 5G network-sharing arrangement will be impossible.

6.7. There is a very real risk of these competition and coverage concerns manifesting. Vodafone and Telefónica both have significant advantages which increase their intrinsic values for the 700MHz FDD spectrum, such as the configuration of their grids. This may well cause Vodafone and Telefónica to win all of the 700MHz FDD spectrum available. The importance of this spectrum to Three (and BT/EE) and the fact that no more low-frequency spectrum is likely to be available for many years increases the strategic value of the 700MHz spectrum to Vodafone and Telefónica.

6.8. Ofcom should therefore impose a restriction which limits each bidder to winning at most 2x10MHz of 700MHz FDD spectrum. This is a necessary condition to ensure that the market is as competitive as it could be. Imposing such a cap meets Ofcom's criteria and is consistent with precedent.

7. Ofcom's proposals conflict with its competition and coverage objectives for the award.

7.1. In its December 2018 Consultation, Ofcom set out its four objectives for the award, in line with its statutory duties. These were:

- Improving mobile coverage;
- Ensuring the efficient allocation of spectrum;
- Sustaining strong competition in mobile markets; and
- Ensuring the timely availability of spectrum.[9]

7.2. Ofcom now considers that the first objective has been solved through agreement on the Shared Rural Network (SRN), and so focuses on the remaining three objectives.

7.3. Below, we demonstrate that there are three key issues in relation to Ofcom's competition assessment which conflict with two of its objectives for the auction. Ofcom should remedy these issues by imposing a cap on the amount of 700MHz FDD spectrum that bidders can win.

7.4. Specifically, the issues are that, in the absence of winning 700MHz FDD spectrum:

- **Competition issue 1**: [✂];
- **Competition issue 2**: [✂]; and
- **Coverage issue**: asymmetries in low frequency spectrum will critically undermine future attempts to improve 5G mobile coverage.

7.5. Ofcom's previous assessment of these issues is underpinned by the view that current low frequency spectrum allocations do not harm current competition. Ofcom must instead undertake a more forward-looking analysis to properly assess the impact of its proposals on competition.

7.6. This section is structured as follows:

- Section 8 highlights why Ofcom must undertake a more forward-looking assessment of future mobile competition;
- Section 9 outlines the first competition issue: [✂];
- Section 10 outlines the second competition issue: that [✂];
- Section 11 demonstrates the weakening of retail and wholesale competition that will arise if these two competition issues occur;
- Section 12 outlines the coverage issue: that future policy initiatives to increase coverage will be impossible without similar 5G coverage across industry;
- Section 13 highlights the likelihood of the three issues occurring due to Vodafone and Telefónica holding higher relative intrinsic and strategic values for the spectrum than Three and BT/EE; and
- Section 14 demonstrates that a cap of 2x10MHz on bidders for the 700MHz FDD spectrum meets Ofcom's criteria and is consistent with precedent.

[9] Ofcom, Consultation: Award of the 700 MHz and 3.6-3.8 GHz bands, December 2018. Paragraph 1.3.

8. Ofcom must give proper weight to future dynamics in its competition assessment.

8.1. The award of the 700MHz band is a rare opportunity for mobile operators to obtain important low frequency spectrum. As Ofcom recognises in its December 2018 consultation[10], there is no prospect of further low frequency spectrum being released for mobile use in at least the medium-term once the 700MHz spectrum has been awarded. As such, any competition issues that arise as a result of the award of the 700MHz spectrum band will persist indefinitely.

8.2. It is critical, therefore, that Ofcom gives proper consideration to the long-term implications of its proposal not to impose a low frequency spectrum cap in the auction. However, Ofcom fails to do this. In determining whether to propose a low-frequency cap, Ofcom puts the most weight on competitive dynamics today. For example, it states that:

'Evidence relating to customer satisfaction and network reliability suggests current asymmetries are not affecting perceived consumer experiences'.[11]

8.3. The evidence by Rootmetrics and itself that Ofcom refers to in justification of this statement rely on the services that mobile operators are able to provide with their spectrum holdings in 2018. This is not relevant to competition over the period from the auction, at least two years after these studies were carried out, to the next award of low frequency spectrum in the distant future.

8.4. In failing to take a forward-looking approach to its competition assessment, Ofcom risks creating a market where Vodafone and Telefónica hold almost all low frequency spectrum. The distortions that arise because of this will persist until further low frequency spectrum becomes available and, most importantly, the impact on competition will worsen over time as network traffic increases and consumers increasingly demand widespread 5G services.

9. Competition issue 1: [✂].

<u>Low frequency spectrum is critically important to provide a quality of service that consumers value</u>[12]

9.1. Previous discussions about the importance of low frequency spectrum have simply focused on MNOs' abilities to connect customers to their networks in hard-to-reach areas. The SRN has solved this issue for 4G and so Ofcom has rightly removed coverage obligations from this award as a result.

9.2. What is more important (and increasingly so) for consumers is the quality of service that they can receive in these areas. Ofcom appears to recognise this in its December Consultation where it states that operators currently have low frequency spectrum holdings which will *'allow them to provide good quality coverage in most contexts'*[13]. Although we disagree with the statement, Ofcom appears to rightly draw the distinction between simply providing a mobile service (basic coverage) and providing a meaningful, good quality, mobile service to consumers. The quality of service is what consumers value.

9.3. In its competition assessment, Ofcom proposes a 37% cap on how much spectrum any one MNO can hold after the award. The cap is calculated by simply

[10] Ofcom December 2018 Consultation. Paragraph 5.299.
[11] Ofcom December 2018 Consultation. Paragraph 5.312.
[12] See Peha, J: "Cellular Competition and the Weighted Spectrum Screen"
[13] Ofcom December 2018 Consultation. Paragraph 5.271.

adding the bandwidths held by each MNO, ignoring the frequency of each licence. Ofcom proposes no low frequency cap for this auction.

9.4. Holding a sufficient bandwidth of low frequency spectrum is the only means by which an MNO can offer a good quality service to these consumers in both the uplink and downlink. For an MNO that wants to compete nationally, low frequency spectrum is in very short supply and disproportionately concentrated in the hands of Vodafone and Telefónica. As Ofcom treats all bands the same in this award, those two MNOs could make all sub 1GHz spectrum unavailable to competitors (except the 2x10MHz of 800MHz already held between Three and BT/EE).

9.5. As Ofcom says, having more spectrum allows an MNO to serve customers with a given quality of service at lower cost (i.e. without needing extra sites). The issue is cost and quality of service: adding one new site means spending hundreds of thousands of pounds on infrastructure. As Ofcom has found, MNOs with smaller spectrum holdings tend to have higher marginal costs of adding capacity because they need many more sites to do so. In general, spectrum holdings determine an MNO's ability to serve users with a minimum quality of service.

9.6. The same is true of low frequency spectrum. Sub-1GHz spectrum also allows an MNO to provide good quality coverage and capacity to a greater area at lower cost. Frequency determines an MNO's ability to serve users with a minimum quality of service. MNOs with smaller holdings of low frequency spectrum face higher marginal costs of adding capacity in the coverage layer (because they need extra sites to do so), whereas an MNO with a large sub-1GHz portfolio can deploy it on existing sites with lower equipment costs.

9.7. As Ofcom has noted, customers in harder-to-serve areas (deep indoors, or not close enough to an existing higher frequency site) can only be served economically by using low frequency spectrum (absent alternatives such as Wi-Fi).

9.8. Three has 2x5MHz 800MHz [✂].

9.9. [✂].

9.10. Three has estimated the amount of traffic on its network that can only be served using its low frequency spectrum. [✂].

9.11. [✂].

Table 1: UK population served only by our 800MHz layer.

Tier	Population (millions)	Within our 1800MHz coverage	Within our 800MHz coverage	Outside 1800MHz but within 800MHz coverage
1	[✂]	[✂]	[✂]	[✂]
2	[✂]	[✂]	[✂]	[✂]
3	[✂]	[✂]	[✂]	[✂]

Source: Three

9.12. This means that [✂].

Consumers demand good quality data services both indoors and in rural areas

9.13. Ofcom's December 2018 Consultation underestimates the importance of low frequency spectrum for providing the capacity to deliver the services that consumers demand in hard-to-reach areas. Ofcom's interpretation of the analysis it presents is that it has:

'…no evidence which shows that additional capacity in harder-to-serve areas is a particularly important aspect of the consumer experience or driver of consumer choice…'[14]

9.14. Contrary to Ofcom's assessment, the availability of good quality data services indoors and in rural areas is critical to consumers. There is a significant evidence base to support this.

9.15. Firstly, a 1Mbit/s upload speed is critical to allow consumers to access the services they value, wherever they use their mobile. Ofcom has recognised that a 1Mbit/s upload speed is the minimum required for a 'decent' broadband service in rural areas.[15] Similarly, Government has stated that an upload speed of 1Mbit/s ensures consumers '*can get a service which allows them to engage effectively on a social and business basis and minimises social and economic exclusion'*[16].

9.16. Secondly, consumers may actually expect (and value) significantly faster upload speeds from their 4G mobile service. Ofcom's 4G and 3G mobile broadband speeds research in 2014[17] found that 4G mobile upload speeds were 12.4Mbit/s on average. Even average 3G mobile speeds (1.6Mbit/s) were faster than 1Mbit/s. We, therefore, consider that an upload speed of 1Mbit/s is the absolute minimum required for a good quality 4G mobile service.

9.17. Thirdly, we also consider download speeds given their dependency on uplink capacity. Ofcom has consistently considered that a download speed of 2Mbit/s is the benchmark against which to assess the quality of 4G services, regardless of where the consumer is located. For example:

- In the coverage obligations Ofcom proposed in the December 2018 Consultation, it defined a 4G service as having '*…a sustained downlink speed of not less than 2 megabits per second'.* The same benchmark is being used for the coverage obligations in the Shared Rural Network; and
- Ofcom's 2018 Connected Nations report defined areas as having a good mobile reception if '…*there is a good data connection with speeds of at least 2Mbit/s'.* It also stated that this speed was '*fast enough to browse the internet and watch glitch-free mobile video'.*

9.18. Fourthly, consumers often actually require much greater download speeds to undertake the activities they most demand. For example:

- Over [✂]% of Three's mobile traffic is accounted for by video streaming which requires speeds in excess of 2Mbit/s. We expect this proportion to grow over time; and

[14] Ofcom December 2018 Consultation. Paragraph 5.317.
[15] Ofcom, Achieving Decent Broadband for Everyone, 2016. Section 3.
[16] DCMS, A New Broadband Universal Service Obligation: Government's response to consultation on design.
[17] Ofcom, 4G and 3G Mobile Broadband Speeds Research, 2014.

- Ofcom reports that its consumer research shows that *'…web browsing is clearly the most important mobile service for customers'*.[18] As we explained in our response to the December Consultation[19], to load the average webpage in around 3 seconds requires a data speed of around 8-10Mbit/s.

9.19. Finally, Ofcom recognises that mobile operators '*need to provide a consistent and reliable customer experience across a range of services and locations'*.[20] This is supported by the 2017 Ender's report which showed that 'reliability' is the most important aspect of network quality.

9.20. Consumers consider a service to be 'reliable' if it meets their demand wherever they use it, including both deep indoors and in rural areas. A definition of reliability must, therefore, require that consumers are able to receive the good quality 4G service they are accustomed to, wherever they need it.

9.21. Therefore, consumers' preferences for reliability of service wherever they consume mobile services and the types of services they demand, provide strong evidence that consumers do demand good quality 4G services indoors and in rural areas. These are services that can only be delivered with sufficient holdings of low frequency spectrum.

9.22. For the purpose of the rest of this document, we take the conservative view that a good quality 4G mobile service, valued by consumers wherever they access mobile networks, consists of at least a 2Mbit/s download speed and a 1Mbit/s upload speed.

[✂]

9.23. We have undertaken analysis which shows that [✂].

9.24. [✂].

9.25. [✂]:

- [✂];
- [✂];
- [✂];
- [✂]; and
- [✂]:
  - i) [✂]; and
  - ii) [✂].

9.26. [✂].

[18] Ofcom December 2018 Consultation. Paragraph 5.34.
[19] Three's Response to Ofcom's Consultation on the Award of the 700MHz and 3.6-3.8GHz spectrum bands
[20] Ofcom December 2018 Consultation. Paragraph 5.282.

Table 2: [✂]

[✂]

Source: Three

9.27. [✂].

9.28. [✂].

9.29. [✂].

[✂].

9.30. We have undertaken a similar analysis [✂].

9.31. [✂].

Additional low frequency spectrum is the only way to [✂]

9.32. In the December 2018 consultation, Ofcom suggests that an alternative to deploying 700MHz spectrum is to build more mobile sites.[21] Although building new sites can be used to increase an MNO's capacity in hard-to-reach areas, it is not a viable substitute to deploying further low frequency spectrum.

9.33. It is neither feasible nor economical to match the level of capacity in hard-to-reach areas that sub-1GHz spectrum can provide through network densification. This is recognised by MNOs in their spectrum valuations for low frequency spectrum, which include a "commercial value" in addition to the avoided costs of building new sites or "technical value".

9.34. As our analysis above indicates, it would be [✂]. However, as has been recognised by the Federal Communications Commission (FCC), it is not simply the cost of deploying additional sites that is the issue. There are also feasibility and timing implications with deploying new sites as a substitute to deploying additional low frequency spectrum:

'In any event, the record contains substantial evidence that the … obstacles today to siting of new wireless facilities are more than mere cost disadvantages. As AT&T itself has recognized, building new cell sites is not only difficult and expensive but also "- most importantly – prone to multi-year delays." Given "real-world customer imperatives that place a premium on timely deployment of

[21] Ofcom December 2018 Consultation. Paragraph 5.295.

services to the public, wireless carriers are hardly indifferent" to the unique propagation characteristics associated with low-band spectrum."[22]

9.35. Under the most conservative estimate, [✂]. The practicalities of finding these sites, acquiring them, receiving planning approval and then finding the resource to build new masts (at the same time as we are using the same resource for our 5G upgrades) will mean that, [✂].

9.36. The precedent was set when [✂].

Table 3: [✂]

[✂]	[✂]
[✂]	[✂]
[✂]	[✂]
[✂]	[✂]
[✂]	[✂]

Source: Ofcom

9.37. Ofcom considers other alternatives to deploying 700MHz spectrum (upgrading existing sites, WiFi offload, voice over WiFi, small outdoor and indoor cells). We provided evidence in our previous response[23] which demonstrates that they are also not feasible substitutes to deploying additional low frequency spectrum. This evidence still stands, but for simplicity we have not repeated it here.

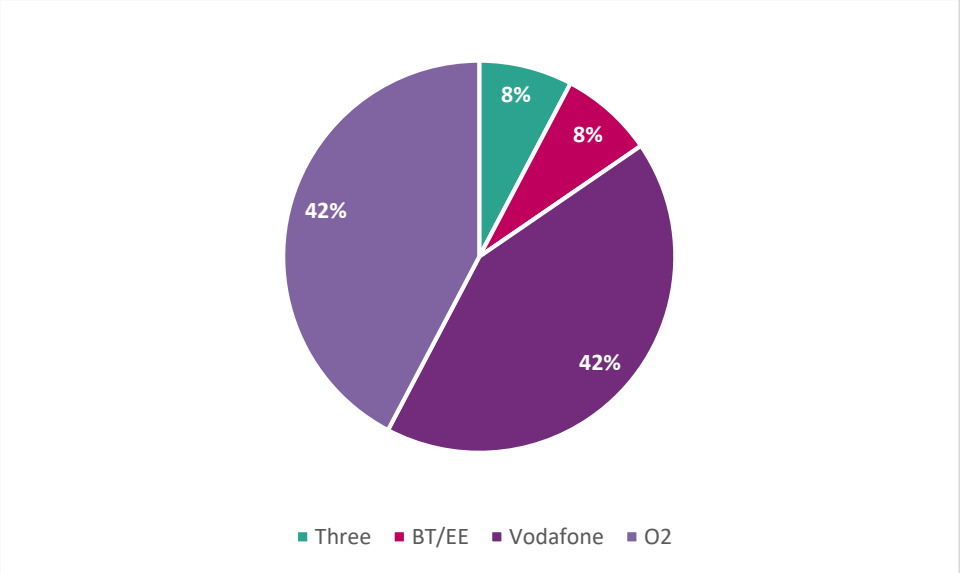
Vodafone and Telefónica's existing spectrum holdings will prevent them from [✂] in their low frequency spectrum bands

9.38. The distribution of low-frequency spectrum holdings between the UK MNOs is already extremely distorted. Ofcom understates the imbalance when it states that *'The MNOs' existing holdings of low frequency spectrum are fairly asymmetric'.*[24] In fact, existing holdings are very asymmetric. While both Three and BT/EE hold only 2x5MHz of sub-1GHz spectrum, Telefónica and Vodafone have over five times as much, at 55MHz each.

9.39. The asymmetry also applies to uplink-only spectrum. Today each of BT/EE and Three hold only 8% of the available uplink-only low frequency spectrum, while Vodafone and Telefónica hold almost 85% between them.

[22] *In the Matter of Policies Regarding Mobile Spectrum Holdings. Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions* (2014) paragraph 65.
[23] Three's Response to Ofcom's Consultation on the Award of the 700MHz and 3.6-3.8GHz spectrum bands.
[24] Ofcom December 2018 Consultation. Paragraph 5.270.

Figure 3: Low frequency uplink-only holdings today.



Source: Three

9.40. These vast asymmetries [✂].

9.41. [✂].

10. Competition issue 2: [✂]

[✂]

10.1. Ofcom makes the argument in the December 2018 Consultation that mobile coverage is only one dimension of competition and *'H3G's 3.4GHz and 3.6GHz holdings put it in a strong position with regard to 5G'*.[25]

10.2. Although we recognise that there will be a number of dimensions to competition in 5G mobile services and that it is not necessary for each mobile operator to provide exactly the same geographic 5G coverage, the 5G coverage discrepancies which will arise from an entrenchment of the current asymmetries in low frequency spectrum will be harmful to competition.

10.3. We estimate that [✂].

[25] Ofcom December 2018 Consultation. Paragraph 5.278.

Figure 4: [✂]

[✂]

Source: Three

10.4. Although the 800MHz band will eventually be capable of providing 5G services, there are a number of reasons why we cannot rely on our existing holdings as a substitute for 700MHz spectrum in providing a nationwide 5G network. Most importantly:

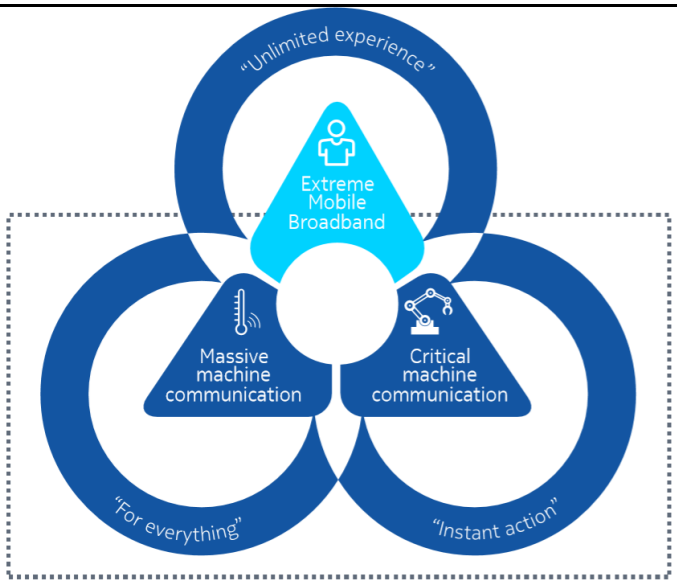
- [✂] (as discussed in section 4, above). Without additional low frequency spectrum, [✂]; and
- Support for the 800MHz band by multiple handset manufacturers will be dependent on market demand. Ofcom should not assume that the handset eco system for 800MHz in 5G will develop at the same rate as the 700MHz in 5G. This is dependent on how handset manufacturers might respond to the requirements of a small number of operators which do not win 700MHz spectrum.

10.5. It is therefore clear that [✂]. We could realistically expect them to provide 5G coverage similar to their 4G coverage, which will be 88% of the UK landmass within four years as a result of the SRN coverage obligations.

A number of 5G applications require near-ubiquitous 5G coverage

10.6. We strongly believe that traditional views on the amount of sub 1GHz spectrum needed to be competitive are no longer valid with 5G. As shown below, 5G will enable extreme mobile broadband, massive IoT connectivity and ultra-reliable critical communications. Ubiquitous coverage is the most important aspect of reliable connectivity, especially for massive IoT and critical communications.

Figure 5: Ubiquitous coverage is the most important aspect of reliable connectivity, especially for massive IoT and critical communications



Source: Nokia_5G_Deployment_below_6GHz_White_Paper_EN.pdf

10.7. The latency and throughput improvements of 5G will enable a number of Internet of Things use cases which are impossible with other technologies. We expect that the range of these cases will broaden as the technology evolves. Some initial examples include:

- Smart manufacturing, where workers with 5G-enabled AR/VR headsets can interact with autonomous robots to add precision to their work;[26]
- Smart and driverless vehicles which require reliable, low-latency, nationwide 5G coverage;
- Smart city applications such as intelligent lighting, waste management and water metering which rely on 5G's ability to quickly handle large data flows; and
- Smart farming applications such as using 5G-powered intelligent drones to monitor crops and livestock.

10.8. All these use cases require near-ubiquitous 5G coverage, either over large geographic areas or deep indoors. [✂].

10.9. [✂].

[26] https://home.kpmg/xx/en/home/campaigns/2019/06/converging-5g-and-iot.html

11. Implications for competition: enduring asymmetric low frequency spectrum holdings will significantly weaken competition for large customer segments

11.1. In its December Consultation, Ofcom sets out two potential competition concerns that could arise from the spectrum auction:

- *"Competition concern 1: The likelihood of there ceasing to be four credible MNOs as a result of the auction; and*
- *Competition concern 2: The likelihood of very asymmetric mobile spectrum shares weakening competition (even if there are four credible MNOs) through:*
  - *a) Asymmetry in overall spectrum*
  - *b) Asymmetry in 'capacity' spectrum*
  - *c) Asymmetry in 'spectrum that can be used for 5G', 3.4-3.8GHz spectrum in particular*
  - *d) Asymmetry in low frequency spectrum"*[27]

11.2. We consider that Ofcom's second competition concern is most relevant to our analysis in the short term. There is a material risk of a weakening of competition in [✂] the UK from further asymmetries in low frequency spectrum which [✂].

11.3. However, [✂].

Three and/or BT/EE not winning 700MHz spectrum would lead to a significant weakening of retail competition

The impact of [✂] on retail competition

11.4. If we do not win further paired low frequency spectrum in the forthcoming auction, we [✂]. This will weaken competition in two ways:

- Firstly, [✂]; and
- Secondly, [✂].[28]

11.5. Ofcom recognised the potential harm that [✂] could have on competition in its competition assessment for the 800MHz spectrum band:

'…some quality dimensions could be very important to particular customer groups, and a lack of competition for provision of services to such consumers might be a concern.'[29]

11.6. This is consistent with our assessment in Section 9 that the quality of service consumers receive in hard-to-reach areas is particularly important to consumers and competition.

11.7. Ofcom also recognises the effect on competition of [✂] in its assessment of the overall safeguard cap for this auction:

"An MNO with a very large share of 'capacity spectrum' could have an unmatchable competitive advantage, especially for services that:

[27] Ofcom December 2018 Consultation. Paragraph 5.72
[28] For example, [✂].
[29] Ofcom, Second Consultation on Assessment of Future Mobile Competition and Proposals for the Award of 800 MHz and 2.6 GHz spectrum and related issues, 2012. paragraph 4.101.

a) require high throughput rates (i.e. high data rates in Mbit/s) and service consistency and reliability; and

b) if the user is in an area where demand is close to capacity; and

c) at times of the day when the network is close to capacity."[30]

11.8. This assessment clearly also applies to hard-to-reach areas served by low frequency spectrum. In these areas the capacity problem, as highlighted above, is more severe than in any other spectrum bands, given the scarcity of low frequency spectrum. We would, therefore, expect a significant impact on competition, particularly given [✂].

11.9. Ofcom does not give a reasonable justification for why the ability to offer sufficient capacity is a viable competitive differentiator for mid frequency spectrum, but not for low frequency spectrum which [✂].

The impact of substantial [✂] on retail competition

11.10. A mobile operator [✂] that do for a significant proportion of customers, most notably those that demand 5G coverage outside of the main urban areas in the UK. This will significantly weaken competition.

11.11. Based on 4G coverage, we estimate that [✂].

11.12. This is important for competition because we know that consumers value mobile coverage. The Ender's analysis report that Ofcom cites in its December Consultation finds that coverage is the second most important factor in a mobile service to consumers, after 'reliability'. Similarly, we would not expect the Government to be investing approximately £500m in the SRN programme if it did not believe that consumers valued mobile coverage.

11.13. 5G coverage discrepancies may not represent an immediate concern for Ofcom as all mobile operators will continue to offer widespread 4G coverage (albeit with material differences in capacity in the low frequency layer). However, consumer demand will evolve, and we would reasonably expect that the focus of competition will move on to 5G services in the medium term.

11.14. The precedent for this is the equivalent move from 3G to 4G networks as a competitive differentiator. We can see this in the marketing campaigns of the four mobile operators. For example, BT/EE's website claims that it has '4G in more places than any other network'[31] but makes no mention of its 3G network coverage. Even Ofcom's own 2018 Connected Nations report relegated the reporting of 3G coverage to a footnote. It is reasonable to expect that we will see the same transition from the importance placed on 4G to 5G coverage in the medium term.

11.15. Again, the crux of the concern is that there is no prospect of further low frequency spectrum becoming available to mobile operators in the foreseeable future. Therefore, when 5G coverage does become a genuine competitive differentiator, as is inevitable, those [✂].

[30] Ofcom's December 2018 Consultation, paragraph 5.169.
[31] https://ee.co.uk/our-company/about-ee [accessed 01/12/2019]

Three and/or BT/EE not winning 700MHz spectrum would lead to a significant weakening of wholesale competition

The impact of [✂] on wholesale competition

11.16. An MNO's ability to offer a wholesale service is determined by the capacity it has on its network. As we set out in section 9, [✂].

11.17. Similarly, [✂].

11.18. Ofcom considers that MVNOs such as iD Mobile, Virgin Mobile and Sky Mobile have recently been performing well[32]. This is in contrast to its previous position where it told the European Commission that MVNOs are becoming increasingly less relevant because they are unable to compete for customers with high data usage, due to the pricing structures offered by mobile network operators[33]. It is notable that MVNOs appear to now be offering much greater data allowances. For example:

- Sky Mobile offers a plan with a data allowance of 40GB; and
- Virgin Mobile and iD Mobile both offer plans with unlimited data allowances.

11.19. This suggests that mobile network operators may be beginning to offer wholesale pricing structures which better suit the requirements of MVNOs as a result of competition.

11.20. If Three and/or BT/EE do not win 700MHz FDD spectrum, [✂].

The impact of [✂] on wholesale competition

11.21. MVNOs are only [✂].

11.22. As we have set out in paragraphs 10.6-10.7, above, there are a number of Internet of Things use cases that only MNOs with near-ubiquitous 5G coverage will be able to offer. [✂].

12. Coverage concern: asymmetries in low frequency spectrum will critically undermine future network sharing arrangements

We support Ofcom's proposals to remove coverage obligations from the auction

12.1. Geographic mobile coverage has been a public policy concern that has persistently troubled policymakers. Historically, Ofcom and Government have attempted to solve the problem through the imposition of coverage obligations. These, however, have proven insufficient and Ofcom has repeatedly been required to intervene to improve coverage over recent years.

12.2. In its December 2018 Consultation, Ofcom proposed to include two freestanding coverage obligation lots in the auction which would have required the winners to provide 90% geographic 4G coverage within four years of the auction. In response to that Consultation, Three set out its concerns that the proposed coverage obligations would have:

- Represented a government subsidy of £400m-800m to the two operators who would bear the lowest costs in meeting them;

[32] Ofcom December 2018 Consultation. Paragraph A6.5.
[33] Phase 1 submission to the European Commission in relation to Three's proposed acquisition of Telefonica. Paragraph 1.5.

- Resulted in a third of that subsidy not being used to improve mobile coverage but instead representing a direct transfer of taxpayers' money to the lowest-cost provider;
- Caused the inefficient duplication of infrastructure in areas where there is scarcely enough traffic to justify the existence of a single network; and
- Biased the auction in favour of the operators that can most cheaply provide the coverage because they would receive a 'gift card' that could only be used to bid spectrum away from higher value bidders.

12.3. We proposed two alternative options which would address our concerns with Ofcom's proposed coverage obligations and result in increased coverage from all four MNOs.

12.4. Our first alternative was the Shared Rural Network (SRN) which would lead to 95% of the UK receiving a 4G mobile service from at least one MNO. All but the most remote roads and premises will also be covered by the programme. These results are more comprehensive and will provide much improved consumer outcomes than could have otherwise been achieved through the imposition of traditional coverage obligations.

12.5. Both Ofcom and Government have now publicly backed the MNOs' SRN proposal and we strongly support Ofcom's proposal to consequently remove coverage obligations from the auction. This will result in much better coverage outcomes at a lower cost to the taxpayer.

12.6. Our second option was for Ofcom to impose a single coverage obligation in the auction with an attached Rural Roaming obligation. Compared to Ofcom's proposed coverage obligations, this would have led to better coverage at a lower cost, while reducing inefficiency in the auction. We are pleased that agreement on the SRN should mean Ofcom now does not need to impose a Rural Roaming obligation. However, we maintain our support for Rural Roaming as the best alternative if, for whatever reason, the SRN programme was to be unsuccessful.

A 5G SRN would be impossible without similar 5G coverage starting points

12.7. The reason why agreement on the SRN has been possible is that the four MNOs' starting 4G coverage levels are reasonably close. Ofcom reported only 8 percentage points difference in the MNOs' geographic 4G coverage in the 2018 Connected Nations Report. This has been critical to the success of the negotiations between the mobile operators as no operator has such a large coverage advantage to lose from sharing its infrastructure that it was unwilling to ultimately participate.[34]

12.8. The similarities in 4G coverage between the mobile operators is driven by the fact that each of us holds 800MHz spectrum, which we use to deliver widespread 4G coverage across the UK.

12.9. Now that the 4G mobile coverage problem is close to being solved, focus will inevitably turn to 5G coverage. In fact, Government Ministers have already enquired into the possibility of providing 5G via the SRN and it is clear that 5G coverage will be on the political agenda in the coming months, not years.

12.10. A 5G SRN would be no different to 4G. An agreement would also require that each mobile operator has a similar starting level of 5G coverage so that incentives

[34] [✂].

are aligned to share existing infrastructure. If all MNOs do not win 700MHz FDD in the forthcoming auction, incentives to share infrastructure for 5G deployment would not be aligned. Figure 6[35] forecasts Three and BT/EE's 5G coverage if neither win 700MHz FDD spectrum and illustrates why agreement would be impossible.

Figure 6: [✂]

[✂]

Source: Three

12.11. It is clear from Figure 6 that Vodafone and Telefónica would have no incentive to participate in a 5G SRN based on infrastructure sharing if they were the only winners of 700MHz FDD spectrum. Sharing Three and BT/EE sites would not significantly improve their 5G coverage.

12.12. Although mobile operators [✂]. It will not be possible to reach such an agreement with the coverage asymmetries that would arise from Vodafone and Telefónica winning all the 700MHz FDD spectrum. This would, therefore, scupper any possibility of an SRN deal which resulted in uplifts in 5G coverage in partial not spots.

12.13. The 4G SRN also includes [✂]. This would not be possible if all four MNOs did not win 700MHz spectrum, undermining the case for Government funding of both new site build and the (active and passive) upgrade of existing sites in non-commercial areas of the UK.

13. Vodafone and Telefónica have significant advantages which increase their relative intrinsic and strategic values for 700MHz spectrum

13.1. The competition and coverage issues set out above are a realistic possibility given that both Vodafone and Telefónica hold advantages in bidding for the spectrum given their higher relative intrinsic and strategic values for the 700MHz FDD spectrum.

<u>Vodafone and Telefónica's network architecture increases their intrinsic value for 700MHz spectrum</u>

13.2. Ofcom underestimates the importance of the historic difference between the site grids based on 900MHz spectrum (Vodafone and Telefónica) and those based on 1800MHz spectrum (Three and Telefónica) to the relative intrinsic values of mobile operators for low frequency spectrum in its 2018 Consultation:

[35] The 4G geographic coverage is as reported by Ofcom in its December 2018 Consultation. [✂].

'In our view, the overall impact of differences in grid configurations on the MNOs' relative intrinsic values is unlikely to be so large as to significantly influence their likelihood of winning 700MHz spectrum'[36]

13.3. In fact, Three and BT/EE's grid configurations confer a large, enduring, relative disadvantage in deploying low frequency spectrum compared to Vodafone and Telefónica.

13.4. This disadvantage is driven by the fact that Three and BT/EE will need to deploy new antennas and strengthen existing masts to mitigate against the risk of interference between sites that are not optimally placed to transmit low frequency spectrum. It increases both the costs and time to deploy low frequency spectrum relative to a mobile operator with a 900MHz grid.

13.5. We are unable to provide a robust estimate of the incremental cost and time implications of a MNO with a 1800MHz grid deploying 700MHz spectrum, relative to a 900MHz operator. However, we know from our experience of deploying 800MHz in 2013-15 that:

- The average time it took for us to be granted access to [✂]% of our sites when deploying 800MHz in 2013/14 was [✂]. This compares to our 1800MHz deployment where we were able to gain access within [✂], on average; and
- The impact of potential interference due to our site grid, which Vodafone and Telefónica did not bear in deploying their own 800MHz spectrum, resulted in us deploying 800MHz spectrum on only [✂] we upgraded in 2015. In many cases, we have had to revisit those sites to deploy 800MHz at a later date, at additional cost.

13.6. Three and BT/EE's relative disadvantage was borne out in bids for the 800MHz band in the 800MHz and 2.6GHz auction. Table 4, below, reports the bids for standalone lots of 800MHz spectrum in the 4G auction.[37]

[36] Ofcom December 2018 Consultation, para 5.331.

[37] The exception is Vodafone which did not make a standalone bid for 800MHz spectrum. Instead, we take its combined bid for 2x10MHz of 800MHz spectrum and 2x10MHz of 2.6GHz spectrum and subtract the estimated value of 2x10MHz of 2.6GHz spectrum (based on Ofcom's assessment in its decision on the 900MHz and 1800MHz Annual Licence Fees that 2.6GHz spectrum has a market value of £5.9m per MHz.

Table 4: 800MHz value based on auction bids.

Operator	1 lot	2 lots	3 lots	Average per lot
Vodafone	N/A	£1.626bn	N/A	£813m
Telefónica	N/A	£1.219bn	N/A	£609.5m
EE	£230m	£650m	£1.177bn	£315.7m
Three	£225m[38]	N/A	N/A	£225m

Source: Three

13.7. The most notable finding from Table 4 is that Vodafone and Telefónica's valuation of a 2x10MHz lot of 800MHz spectrum was around double that of BT/EE. It is less straightforward to make comparisons between Vodafone, Telefónica and Three's valuation of 800MHz spectrum since we bid on different lot sizes. However, a simple analysis shows that Vodafone and Telefónica's average valuation of a 2x5MHz lot was around £400m-£600m higher than Three's.

13.8. The differences between the values of the bids are likely to reflect Vodafone and Telefónica's much higher relative intrinsic valuation of low frequency spectrum, driven by their 900MHz grid configuration, than BT/EE or Three. We expect that the safeguard cap in the 800MHz auction would have prevented strategic bidding so these valuations are only explained by differences in intrinsic value.

13.9. The discrepancy in the optimal grid configurations was determined by the 900MHz spectrum that Vodafone and Telefónica were administratively assigned in 1985. It is entirely unreasonable that this should be a factor that increases the probability of these operators winning further valuable low frequency spectrum 35 years later.

<u>The importance of this award to Three and BT/EE increases Vodafone and Telefónica's strategic value for 700MHz FDD spectrum</u>

13.10. As discussed above, there is a material risk that Vodafone and Telefónica will win all available 700MHz spectrum due to their grid configurations giving them a greater intrinsic value for the spectrum than Three or BT/EE. Even if this is not the case, they have strong incentives to bid beyond their intrinsic value to strategically prevent other operators winning 700MHz spectrum.

13.11. Ofcom dismisses the possibility of strategic investment for 700MHz spectrum on the basis that:

- There is no material risk to competition if BT/EE and/or Three win no 700MHz spectrum[39]; and

[38] Three bid £565m for 2x5MHz of 800MHz, but its bid strategy was designed to guarantee that it would not pay more than the reserve price (£225m) for its winning spectrum floor (2x5MHz of 800MHz).
[39] Ofcom December 2018 Consultation, paragraph 5.336.

- BT/EE and Three are currently performing well on many measures of coverage, even with their currently low holdings of low frequency spectrum.[40]

13.12. Section 11 demonstrates that there is, in fact, a material risk to both retail and wholesale competition from only Vodafone and Telefónica winning 700MHz FDD spectrum in the auction. They would both have a very strong incentive to bid above their intrinsic valuation of 700MHz spectrum to preclude Three and/or BT/EE from remaining viable competitors for (retail or wholesale) customers that value good quality data services in hard-to-reach areas and/or 5G mobile coverage across the UK.

13.13. Ofcom's second assumption is based on analysis completed in 2018. It does not reflect the forward-looking competitive advantage that Vodafone and Telefónica would gain if Three and/or BT/EE did not win 700MHz FDD spectrum. Both issues we have covered in sections 9 and 10 relate to forward-looking competition problems which Vodafone and Telefónica can bid strategically to influence. These would not be captured in Three or BT/EE's performance in 2018.

13.14. Therefore, Vodafone and Telefónica are incentivised to strategically bid beyond their intrinsic value to prevent both us and BT/EE from winning any 700MHz spectrum as it will give them a substantial competitive advantage for significant customer segments[41]. This is not an incentive that Three or BT/EE have since Telefónica and Vodafone already have sufficient low frequency spectrum to [✂] and re-farm some of the low frequency spectrum they already own for 5G.

13.15. Vodafone and Telefónica's incentives to bid strategically are exacerbated by the time over which they would receive a payoff for limiting competition in the market. Given that there is no further low frequency spectrum to be auctioned in the foreseeable future, Vodafone and Telefónica are aware that any competitive distortion resulting from this auction will persist indefinitely.

13.16. Ofcom considers that Three could trade some of its existing holdings to acquire 700MHz spectrum if we had a strong need for it.[42] Given the strategic advantage of this spectrum to Vodafone and Telefónica, it is highly unlikely that they would be incentivised to trade the spectrum away at any cost.

13.17. In our response to Ofcom's December 2018 Consultation, we provided evidence that Vodafone and Telefónica are able to undertake strategic investment. This reasoning remains relevant.

14. Ofcom should impose a cap which restricts participants from winning more than 2x10MHz of 700MHz FDD spectrum in the upcoming award

A low frequency cap is critical to maintaining a competitive four player mobile market in the UK

14.1. The analysis above has demonstrated material competition concerns that could result from Vodafone and Telefónica winning all the 700MHz FDD spectrum in the auction, alongside the risks it would pose to future infrastructure sharing deals. We have also demonstrated why this represents a likely outcome of the auction given relative intrinsic and strategic values. Ofcom must, therefore,

[40] Ofcom December 2018 Consultation, paragraph 5.340.
[41] I.e. around [✂] of consumers that value receiving a good quality service and consumers that value 5G coverage living in [✂]% of the UK.
[42] Ofcom December 2018 Consultation, paragraph 5.339.

impose a cap on the amount of 700MHz spectrum a participant in the auction can win to prevent these outcomes.

14.2. Ofcom sets out four criteria against which it assesses whether to impose spectrum caps in the 700MHz and 3.6-3.8GHz auction. These are:

- Appropriate - it must be effective in achieving the aim in question;
- Necessary - it must be no more onerous than is required to achieve that aim;
- The least onerous of all equally effective measures; and
- Not likely to produce adverse effects which are disproportionate to the aim being pursued.

14.3. Below, we illustrate why all four criteria apply to a 2x10MHz 700MHz FDD spectrum cap.

A 2x10MHz 700MHz FDD spectrum cap would be appropriate

14.4. Our proposed cap will be appropriate since it will eliminate the possibility of both Vodafone and Telefónica winning all available 700MHz FDD spectrum, leaving at least 2x10MHz of 700MHz FDD spectrum for BT/EE and Three. Critically, the proposed cap would significantly reduce (although, not eliminate) the risk of Ofcom's competition concerns occurring as a result of the material asymmetry in low frequency paired spectrum increasing further.

A 2x10MHz 700MHz FDD spectrum cap would be necessary

14.5. Our proposed spectrum cap is no more onerous than is required to reduce the risk of the competition concerns arising. It represents a reasonable trade-off between limiting the risk of these competition concerns arising and restricting the bidding of Vodafone and Telefónica, who might put a high value on 2x10MHz of 700MHz FDD spectrum.

A 2x10MHz 700MHz FDD spectrum cap would be less onerous than equally effective measures

14.6. A more intrusive measure than our proposed cap would be to impose a tighter 2x5MHz cap on the amount of spectrum that Vodafone and Telefonica can win in the auction. [✂].

A 2x10MHz 700MHz FDD spectrum cap would be proportionate

14.7. Our proposed cap is proportionate to the competition concerns we have identified. There are two further possible options for the form of a safeguard cap. Both are less proportionate to the competition concerns we have identified.

14.8. Firstly, a cap on the total amount of low frequency spectrum (including downlink) would not be proportionate to the competition concerns if it still allowed Vodafone and Telefónica to win all the 700MHz FDD spectrum between them. Our proposed cap is focused on paired spectrum since we have demonstrated that a scarcity of low frequency uplink spectrum is likely to become increasingly damaging to the competitive dynamics in the UK mobile market.

14.9. A second alternative would be for Ofcom to reserve 2x5MHz of 700MHz FDD spectrum for both Three and BT/EE. Although we would support this measure as it would completely mitigate the competition concerns, we recognise that Ofcom may be concerned that this measure would be disproportionate as it could lead to an inefficient outcome. For example:

- The spectrum could go unsold if Three and/or BT/EE's value for it was less than the reserve price; and
- It would reduce the amount of 700MHz FDD spectrum that potential entrants could win.

There is precedent for setting low frequency spectrum caps

14.10. There is international precedent which suggests that imposing measures to protect competition when auctioning the 700MHz band is a proportionate response to protect against large asymmetries of low frequency spectrum. For example:

- 2x10MHz of 700MHz FDD spectrum was reserved for a market newcomer in the Italian 5G auction; and
- The Swiss authority imposed a cap of 2x15MHz of 700MHz FDD spectrum and a cumulative cap of 2x25MHz of 700MHz FDD spectrum for two bidders (so long as there was demand from another bidder).

14.11. Similarly, there is precedent of Ofcom setting low frequency spectrum caps in the combined award, where Ofcom imposed a safeguard cap of 2x27.5MHz on low frequency spectrum (equivalent to a 2x10MHz cap on 800MHz spectrum for Vodafone and Telefónica) in addition to an overall spectrum cap of 2x105MHz. There are be even more compelling reasons to impose a similar measure in this auction, given the forward-looking capacity issues and the fact that there is no prospect of further low frequency spectrum being auctioned in the near future.

14.12. Ofcom should, therefore, follow this precedent by imposing a 2x10MHz cap on the winners of 700MHz spectrum as the most proportionate measure to protect forward-looking retail and wholesale competition in the mobile market.

3. Comments on Ofcom's proposals for the Principal Stage.

15. Executive Summary.

15.1. We agree with Ofcom's proposal to auction all the spectrum bands in a single Principal Stage. Although [✂].

15.2. We agree with the proposal to auction generic lots and for small lot sizes as determined by technical requirements. Small lots leave maximum flexibility for bidders and enable a wider range of auction outcomes, which increases competition and efficiency.

15.3. While we agree with Ofcom's proposed small lot sizes, in an SMRA auction this can create the risk that bidders win fewer lots than they want, at a price that exceeds their valuation. We consider this risk to be manageable for the 700MHz FDD and 3.6GHz bands but the ability for bidders to specify a Minimum Spectrum Requirement (MSR) is warranted for the 700MHz SDL band.

15.4. We support Ofcom's proposal not to allow bids to be withdrawn because we do not believe [✂]. We agree with Ofcom that the benefits of bidders being able to play waivers outweigh any potential downsides, and that each bidder should be allowed to play up to three waivers.

15.5. We agree with the proposed eligibility points for each band. Ofcom is right to reject BT/EE's argument for a 4:1 ratio (on a per-MHz basis) between the 700MHz FDD and 3.6GHz bands, as this would make it difficult for bidders to substitute large quantities of 3.6GHz spectrum for 700MHz FDD. Ofcom is also right to reject Telefónica's argument that the two 700MHz bands should have equal eligibility points (on a per-MHz basis) as the value of the bands is likely to be significantly different.

15.6. We urge Ofcom to set the reserve price for each 2x5MHz lot of 700MHz FDD at the bottom of its proposed range, i.e. £100m per lot. Doing so will increase the potential for price discovery, reduce the chance of unsold spectrum and avoid the risk of precluding bidders from having the opportunity to compete in the auction.

16. We agree with Ofcom's proposal to auction all bands in a single Principal Stage.

16.1. Telefónica has invited Ofcom to award the 700MHz and 3.6GHz spectrum in separate stages of the auction. We agree with Ofcom's proposal not to do so. Like Telefónica, [✂].

16.2. 700MHz SDL may be used to add capacity in an MNO's coverage layer. We see [✂].[43] Due to its characteristics (low frequency and downlink only) it is only likely to appeal to MNOs. The market value of this spectrum is currently unclear: there is no device support for 4G 700MHz SDL and the band is not on any device vendor roadmap.

16.3. Even though [✂], bidders may still find it desirable to switch between them in the auction (including for budget reasons). It would not be appropriate to preclude

[43] [✂]

that option by awarding the bands in separate stages, as Telefónica has proposed.

17. We support Ofcom's proposal to auction generic lots and its proposed lot sizes.

17.1. We support Ofcom's proposal to auction generic spectrum lots for each of the three lot categories in the Principal Stage. Spectrum blocks within each band are broadly of similar value, and any differences within the bands can be addressed in the Assignment Stage. The combination of generic lots in the Principal Stage followed by an Assignment Stage is now well understood and has worked well in past UK spectrum auctions.

17.2. We also support Ofcom's proposal of using the minimum lot sizes set by technical requirements: i.e. 2x5MHz for FDD spectrum and 5MHz for TDD and SDL spectrum. Small lots leave maximum flexibility for bidders to assemble the portfolio they want, with the auction determining which combinations generate greater value. Small lot sizes also enable a wider range of auction outcomes, which increases competition and efficiency.

17.3. With an SMRA format, these small lot sizes can create an "aggregation risk" if strong complementarities exist, either within a band or across bands, i.e. if a bidder values a combination of lots more than the sum of the standalone values. In that case bidders may end up winning less spectrum than they bid for (at prices which exceed their valuation).

17.4. As explained above, however, we see [✂]. In our view, any complementarities within each band can be managed through bidding (3.6GHz and 700MHz FDD) or are best addressed through the ability to specify a Minimum Spectrum Requirement (700MHz SDL). On balance, we therefore support Ofcom's proposed lot sizes, as we explain below.

<u>We support the proposed 700MHz FDD lot sizes of 2x5MHz</u>

17.5. A 2x5MHz block is in line with international practice, leaves maximum flexibility for bidders and promotes competition and efficiency. There are many examples of low-frequency auctions in Europe where bidders have won a 2x5MHz block, including the UK's 800MHz award.[44] This suggests 2x5MHz is the minimum usable bandwidth and can be attractive for bidders.

17.6. Using 2x10MHz instead would be too restrictive. It would limit possible assignments and competition for this spectrum: bidders would not be able to bid for 2x15MHz and a four-winner outcome would be impossible.

<u>We support the proposed 700MHz SDL lot sizes of 5MHz</u>

17.7. We agree with BT/EE and Telefónica that the minimum economic deployment is likely to be 10MHz, with usable sizes being 10, 15 and 20MHz. Bidders are unlikely to value just 5MHz because the cost of deployment would exceed the anticipated benefit (given the severe limitations of this spectrum set out above).

17.8. However, this does not mean that the 700MHz SDL should be sold in two lots of 10MHz. Bidders may demand 15MHz at certain prices and as Ofcom points out, using a 10MHz block would prevent these bidders from bidding for their desired

[44] Other examples include the 2015 French 700 MHz award or the more recent 700 MHz auctions in Switzerland and Denmark.

spectrum in order to protect other bidders from being stranded with an unwanted 5MHz.

17.9. In any case, bidders may not face aggregation risk in this band in practice: if no bidder values 5 or 15MHz, then a winner of 700MHz SDL will win 10 or 20MHz anyway. This has been the case in all European auctions that have managed to sell this spectrum: Switzerland and Denmark.

17.10. Ofcom's proposed lot size is consistent with international practice: 700MHz SDL can be aggregated with 800MHz in 5, 10, 15 and 20MHz SDL carriers (to achieve a maximum of 40MHz aggregated across both bands). We support Ofcom's proposed lot size of 5MHz as it maintains flexibility, but we consider that bidders should be allowed to specify a Minimum Spectrum Requirement (MSR) of 10MHz in this band (see below).

We support the proposed 3.6GHz lot sizes of 5MHz

17.11. Some bidders may want multiples of 5MHz, and as such it is not appropriate to use a 10MHz lot size as BT/EE and Telefónica suggested in response to Ofcom's December 2018 Consultation.

17.12. We agree with Ofcom that if an MNO won a multiple of 5MHz, it would be able to use the spectrum to deploy 5G. This is because 3GPP 5G NR channel sizes in the band already include 15MHz, and we expect 25MHz to be standardised by Q1 2020. As Ofcom highlights, Vodafone, Telefónica and Airspan all bid for multiples of 5MHz in last year's 3.4GHz UK auction. Airspan, Meteor and Vodafone also won multiples of 5MHz in the 2017 Irish auction.

17.13. We therefore agree with Ofcom that a 5MHz lot size is best, to avoid unduly constraining bidder choices and to provide greater flexibility.

18. Bidders should be allowed to specify a Minimum Spectrum Requirement of 10MHz for 700MHz SDL.

MSR can be useful but can also create risks to the efficient allocation of spectrum

18.1. Ofcom proposes to sell spectrum in small lots which may be below some bidders' minimum requirements, i.e. they may face aggregation risk. This occurs when a bidder values a combination of lots more than the sum of the standalone values. In an SMRA auction where bidders cannot specify MSR, a bidder may win less spectrum than it bid for at a round price that exceeds their valuation.

18.2. Ofcom therefore considers whether bidders should be allowed to specify MSR. The advantage would be that a bidder could mitigate any aggregation risk, as it would not win less spectrum in a given lot category than its MSR. However, the ability for bidders to specify MSR has two disadvantages which can negatively impact on the efficient allocation of spectrum:

- **Unsold spectrum:** Spectrum can go unsold even if bidders are only bidding according to their intrinsic valuations (i.e. with no strategic considerations). In addition, a strategic bidder could specify a MSR and submit bids with the intention of causing some spectrum to go unsold; and
- **Inefficient allocation:** A strategic bidder with a MSR may place bids aimed at pushing up prices in a band, but it may accidentally win unwanted spectrum.

18.3. As Ofcom sets out, it is therefore necessary to balance the benefits of MSR (mitigating aggregation risk) with the risks of unsold spectrum or an inefficient allocation.

18.4. The potential for unsold spectrum or an inefficient allocation, regardless of whether it occurs due to intrinsic or strategic bidding, is a particular concern for the 700MHz FDD and 3.6GHz bands due to the value of the spectrum. Therefore, we agree with Ofcom that bidders should not be allowed to specify MSR in these bands.

18.5. However, we consider these risks to be much less significant for the 700MHz SDL band due to the low value of the spectrum. Our assessment suggests that bidders should be allowed to specify a MSR of 10MHz in this band.

We agree that bidders should not be able to specify MSR in the 700MHz FDD band

18.6. Some bidders may face an aggregation risk in this band if they have increasing marginal valuations for the first two blocks (i.e. they value a 2x10MHz block more than twice the value of the first 2x5MHz). As Ofcom notes, in the UK's 2013 4G auction, BT/EE's incremental bid values for the first and second 800MHz blocks were £230m and £420m, respectively.

18.7. To address the aggregation risk, BT/EE has invited Ofcom to allow bidders to specify a MSR of up to 2x10MHz in the band. We agree with Ofcom that this should be rejected, due to the potential for MSR to cause the most valuable spectrum in the auction to go unsold.

18.8. This is possible even in the absence of strategic bidding. BT/EE (or another bidder) may specify a MSR of 2x10MHz and once the round price was high enough that bidding for 2x10MHz would exceed its valuation, it would wait to be partially outbid and then make no new bids. This could cause 2x5MHz of valuable spectrum to go unsold, which could instead have been used by another bidder.

18.9. On this basis alone, we agree with Ofcom that bidders should not be allowed to specify MSR in the 700MHz FDD band. Allowing bidders to specify MSR also increases the potential for strategic bidding, which further strengthens the case against MSR being allowed in this band. For example, [✂].

We consider that bidders should be allowed to specify a MSR of 10MHz in the 700MHz SDL band

18.10. As discussed above, it is unlikely to be economic for MNOs to deploy only 5MHz of 700MHz SDL. Bidders wanting a minimum of 10MHz will face an aggregation risk if Ofcom packages this spectrum in 5MHz lots (which we support because it allows maximum flexibility and does not preclude certain allocations).

18.11. Instead of adopting a 10MHz block as BT/EE and Telefónica propose, we consider it is preferable to allow operators to specify a MSR of 10MHz in this band. The combination of a 5MHz lot size and a MSR of 10MHz in this band would give bidders the flexibility to bid for 15MHz, while also protecting other bidders from winning an unwanted 5MHz block.

18.12. For the 700MHz FDD band, we argued above that MSR should not be allowed due to the large efficiency losses that could result from unsold spectrum. As the 700MHz SDL spectrum is expected to be significantly less valuable, these efficiency losses would be significantly smaller and therefore less concerning. In any case, some or all of the 700MHz SDL may go unsold even without MSR: it

went unsold in the Swedish and Italian auctions in 2018, and only 10MHz sold in the 2019 Swiss auction (with 5MHz unsold).

18.13. The low value of the 700MHz SDL spectrum also means that strategic bidding is less likely. It seems unlikely that a bidder [✂].

18.14. Therefore, Ofcom need not be overly concerned with the potential for some of the 700MHz SDL spectrum to go unsold. We therefore consider that the benefits of allowing bidders to specify MSR in the 700MHz SDL band (managing aggregation risk) outweigh the potential disadvantages, and as such bidders should be allowed to specify a MSR of 10MHz in this band.

We agree that bidders should not be allowed to specify a MSR in the 3.6GHz band

18.15. It is true that an isolated 5MHz block is of limited use to an MNO, as the minimum channel size defined by 3GPP for 5G NR in this band is 10MHz. It is also possible that some bidders may not want to win less than a certain amount (e.g. 20MHz) in the band. However, as Ofcom notes, an opportunistic bidder could use the MSR to drive-up prices in the band and/or leave valuable spectrum unsold.

18.16. Further, there are likely to be trades in the 3.4-3.8GHz band after the auction, due to Ofcom's proposed negotiation phase. This further mitigates any aggregation risk in the 3.6 GHz band for all bidders. When considering whether new entrants to the band should be allowed to specify MSR for 3.6GHz, Ofcom notes that if such a bidder won less than 20MHz which was unwanted, it would have opportunities to trade post-auction. Ofcom considers that post-auction trading would mitigate the impact to efficiency[45], and we believe that the same logic applies to existing holders of 3.4-3.8GHz spectrum.

18.17. We therefore agree with Ofcom's proposal not to allow bidders to specify MSR in the 3.6GHz band, given the low aggregation risk and the potential for unsold spectrum or price-driving.

19. We support Ofcom's proposals on withdrawals and waivers.

19.1. A withdrawal allows a bidder to withdraw its Standing High Bid(s), such that its eligibility can be freed up and used for other lots the bidder wants to switch its demand to. [✂]. This reduces the rationale for allowing withdrawals, and so we agree with Ofcom's proposal not to allow them.

19.2. As Ofcom is proposing not to allow withdrawals or Minimum Spectrum Requirements, some bidders may face some level of aggregation and/or substitution risks. However, Ofcom proposes to allow waivers which can assist bidders in managing both of these risks.

19.3. On behalf of Three, Power Auctions argued in response to the PSSR auction Consultation that in general, the ability to abstain from active bidding to observe opponent's decisions can severely undermine the price discovery process in the Principal Stage. Waivers can also invite market division by allowing a bidder to hold a credible threat of retaliation while waiting for the opponents to disarm.[46]

19.4. Ofcom has considered this submission in the current Consultation, finding that the benefits of the waivers (helping bidders mitigate residual aggregation, substitution and bidding risks and possible technical difficulties) outweigh the

[45] Para 55, https://www.ofcom.org.uk/__data/assets/pdf_file/0028/172648/revised-proposal-auction-design.pdf
[46] Page 20, https://www.ofcom.org.uk/__data/assets/pdf_file/0024/71817/three_annex_1.pdf

potential downsides. We are satisfied with this and support Ofcom's proposal to allow bidders to play a maximum of three waivers during the auction. We also agree that where the failure to submit a bid would result in a bidder losing eligibility, a default waiver should be used on the bidder's behalf. For the avoidance of doubt, we believe this should include the first round of the Principal Stage.[47]

20. We support the proposed eligibility points.

20.1. Ofcom explains that there are two broad reasons that underpin the ratio at which bidders substitute their demand between bands in response to a change in relative prices:

- For technical or commercial reasons, in which case eligibility point ratios reflecting suitable relative MHz amounts in each band could facilitate such substitution; or
- For budget reasons, in which case eligibility points ratios reflecting the relative market prices on a per-MHz basis could be appropriate.

20.2. Ofcom proposes 4 eligibility points per 2x5MHz lot of 700MHz FDD spectrum and 1 point for each 5MHz lot of 700MHz SDL and 3.6GHz spectrum. The proposed eligibility points ratio is 2:1 on a per-MHz basis from 700MHz FDD to either of the two other bands. That is to say a bidder would need to give up 20MHz of 3.6GHz or 700MHz SDL to switch to 2 x 5MHz of 700MHz FDD.

20.3. [✂].[48] Therefore, there is no basis for setting smaller relative ratios, for example by assigning 1 eligibility point to each band or reducing the number of eligibility points attached to the 700MHz FDD spectrum.

<u>We agree that the eligibility points ratio between the 700MHz FDD and 3.6GHz bands should be 2:1 on a per-MHz basis</u>

20.4. While Ofcom appears to accept BT/EE's argument that a 4:1 ratio may be more reflective of the relative market value between the 700MHz FDD and 3.6GHz bands, Ofcom correctly identifies an additional consideration, namely the practicality of switching between the two bands.

20.5. A 4:1 ratio would make it significantly more difficult for bidders to substitute demand from the 3.6GHz band to 700MHz FDD, compared to a 2:1 ratio. Under BT/EE's proposal, a bidder would need to substitute 80MHz of 3.6GHz spectrum for 2x10MHz of 700MHz FDD. We agree with Ofcom that bidders are unlikely to find it useful to substitute such large quantities of 3.6GHz spectrum, especially as this represents two-thirds of the available spectrum.

20.6. We also agree with Ofcom that a 4:1 ratio may result in bidders deviating from straightforward bidding to manage the difficulties of switching demand from the 3.6GHz band to the 700MHz FDD band, which could in turn have impacts on efficiency. Bidders may bid for significantly more 3.6GHz spectrum than they ultimately desire, so that they could transfer their demand to the 700MHz FDD band.

[47] The Proposals to make the Auction Regulations (para 2.54) and the Draft Regulations (Regulation 39) explain that a waiver (eligibility event) may not be played in the first round of the Principal Stage. We believe that Ofcom's proposals on waivers should be the same in every round with no distinction for the first round.

[48] [✂]

20.7. We therefore agree that Ofcom's proposed ratio of 2:1 (on a per-MHz basis) between the 700MHz FDD and 3.6GHz bands strikes the right balance.

We agree that the eligibility points ratio between the 700MHz FDD and 700MHz SDL bands should be 2:1 on a per-MHz basis

20.8. Ofcom accepts Telefónica's argument that a 1:1 eligibility ratio (on a per-MHz basis) may facilitate technical substitution between the two 700MHz bands. However, we consider there [✂]. We therefore agree with Ofcom that the 700MHz FDD band should attract more eligibility points than the 700MHz SDL band, on a per-MHz basis.

20.9. We also agree that if a 1:1 eligibility ratio were used between the two 700MHz bands (on a per-MHz) basis, strategic bidding may be incentivised. Bidders may "park" demand in the 700MHz SDL band, even though they may prefer the 700MHz FDD spectrum. As this would involve bidding on less-preferred spectrum in some rounds, we agree with Ofcom that this would be undesirable.

20.10. We therefore agree that Ofcom's proposed ratio of 2:1 (on a per-MHz basis) between the 700MHz FDD and SDL bands strikes the right balance.

21. Ofcom should set the reserve price for the 700MHz FDD spectrum at £100m per 2x5MHz lot.

21.1. Ofcom's proposed range for the reserve price of 700MHz FDD (£100m to £240m per 2x5MHz lot) is based on auction prices, rather than reserve prices. Ofcom uses the auction prices of 700MHz FDD and 800MHz FDD spectrum in other countries and the UK auction price of 800MHz to give relative benchmarks for the possible value of a 2x5 block of 700MHz FDD in the UK.

21.2. The risk of setting reserve prices above or below market value is highly asymmetric: if reserve prices are set too low, they can be bid up to market value, but setting the reserve price even slightly higher than market value causes unsold spectrum. Ofcom's benchmarks also show significant uncertainty on the possible value of 700MHz FDD spectrum in the UK, ranging from £95m to £507m per 2x5MHz lot. This should give Ofcom even more reason to be conservative.

21.3. Ofcom acknowledged in its December 2018 Consultation that high reserve prices may deter participation, especially from smaller bidders.[49] It also explained that price discovery allows bidders to improve their individual expectations about the likely value of spectrum and adapt their bidding strategy, which is desirable.

21.4. We urge Ofcom to set the reserve price at £100m per lot, to increase the potential for price discovery and reduce the chance of unsold spectrum. In response to Ofcom's December 2018 Consultation, BT/EE argued that the reserve price should be "significantly lower" than what Ofcom proposed, while Telefónica preferred prices "at the lower end" of the range to create more room for price discovery. BT/EE went further and argued that Ofcom's proposed range of reserve prices for 700MHz FDD is not materially lower than possible market value.[50]

[49] Para 7.231, https://www.ofcom.org.uk/__data/assets/pdf_file/0019/130726/Award-of-the-700-MHz-and-3.6-3.8-GHz-spectrum-bands.pdf
[50] Para 5.63, https://www.ofcom.org.uk/__data/assets/pdf_file/0019/143281/bt-ee.pdf

4. Comments on Ofcom's proposals for the 3.6-3.8GHz Assignment Stage, including the negotiation phase.

22. Executive Summary

22.1. We welcome the addition of a negotiation phase for 3.6GHz and Ofcom's clarification that winners can negotiate with other parties that do not win spectrum. This will facilitate post-auction trades to agree the overall configuration of the 3.4-3.8GHz band.

22.2. We disagree with Ofcom's proposals to allow a fallback option of partial agreement as it may deny some parties the ability to bid for and secure their preferred locations in the band.

22.3. We also disagree with Ofcom's proposals to impose restrictions on "small winners" in the Assignment Stage, which actually risk further fragmentation to the band. Instead, if the holder of 3675-80MHz wins any additional spectrum it should be placed at the bottom of spectrum to be auctioned and any new entrants should only be allowed to bid for the top position(s) of the band.

22.4. Even if a restriction on "small winners" were warranted, there is no basis for Ofcom to increase the definition of such winners from less than 20MHz to 20MHz or less. Ofcom's proposed change of approach is based on BT/EE's arguments which we consider to be flawed, and Vodafone and Telefónica supported the previous definition of less than 20MHz.

23. We welcome the additional negotiation phase and Ofcom's clarification that 3.6GHz winners can negotiate with other parties that do not win spectrum.

23.1. We support an additional negotiation phase and welcome Ofcom's proposal not to include any restrictions on winners of 3.6GHz spectrum negotiating with other parties, regardless of whether they win spectrum.[51]

23.2. We believe that the discussion of post-auction trades and the overall configuration of the 3.4-3.8GHz band is more likely to be fruitful with all licence holders involved. As we explained in response to Ofcom's June 2019 Consultation, while some MNOs might be able to achieve a contiguous holding without Three's involvement, our participation would be essential for all MNOs to achieve contiguity in the 3.4-3.8 GHz band.

24. Ofcom should not allow partial agreement as it may deny some bidders the opportunity to secure their preferred positions in the band.

24.1. In Ofcom's June 2019 Consultation, Ofcom set out two sub-options for the proposed negotiation phase:

[51] Footnote 65, https://www.ofcom.org.uk/__data/assets/pdf_file/0028/172648/revised-proposal-auction-design.pdf

- **Unanimous agreement:** Winners must unanimously agree the new allocations, failing that the outcome would be determined by the Assignment Stage bids; or

- **Partial agreement:** If unanimous agreement were not reached, there would be a fallback option where a subset of winners could agree to receive adjacent 3.6 GHz spectrum. Failing this, the outcome would be determined by the Assignment Stage bids.

24.2. In response to Ofcom's June 2019 Consultation, we argued that both options have merits and the choice was finely balanced. We considered overall that unanimous agreement should be allowed, but that Ofcom should not allow partial agreement. This remains our view as partial agreement may deny excluded parties the ability to bid for and secure their preferred locations.

24.3. Ofcom rejected our proposal that if the holder of 3675-80MHz wins 3.6GHz spectrum, it should automatically be awarded contiguity. Ofcom accepted that this may be more efficient but considered it inappropriate to "deny other bidders the opportunity to bid to be located at the bottom of the 3.6-3.8GHz band for this reason."[52]

24.4. Using the same logic, Ofcom should not allow partial agreement. Any parties excluded from a partial agreement may not have the opportunity to bid for (and therefore secure) their preferred locations. For example:

- If all four MNOs win all of the available 3.6GHz spectrum (say 30MHz each, with none of them being "small winners") [✂]; or

- If BT/EE, Telefónica and Vodafone win all of the available 3.6GHz spectrum (with none of them being "small winners"), BT/EE and Telefónica may well partially agree. This would prevent Vodafone from bidding for and securing the middle position.

25. Ofcom should not impose restrictions on "small winners". Instead the holder of 3675-80MHz should be guaranteed contiguity if it wins more spectrum and new entrants should only be able to bid for the top of the band.

25.1. Ofcom explains that the intention of the restriction on "small winners" is to "mitigate the risk that bidders would strategically bid for a small amount of spectrum to insert themselves between other bidders".[53] If Ofcom allows partial agreement, there is no need for any restrictions in the Assignment Stage bids because two or more winners can avoid another party inserting itself between them, completely mitigating Ofcom's concern.

25.2. If partial agreement is not allowed, then Ofcom may still be concerned about strategic bidding. Ofcom's proposed restrictions on "small winners" seem to be targeted at either Three or a new entrant (a bidder that does not hold 3.4-3.8GHz spectrum at the time of the auction). We urge Ofcom to adopt a superior approach, namely to:

[52] Para 2.59, https://www.ofcom.org.uk/__data/assets/pdf_file/0011/152102/consultation-defragmentation-spectrum-holdings.pdf
[53] Para 3.310, https://www.ofcom.org.uk/__data/assets/pdf_file/0028/172648/revised-proposal-auction-design.pdf

- Ensure that if the holder of 3675-80MHz wins additional 3.6GHz spectrum in the auction, it is automatically assigned at the bottom of the spectrum to be auctioned; and
- Only allow new entrants (those without 3.4-3.8GHz spectrum at the start of the auction) to bid for the top position(s) of the 3.6-3-8GHz band.

25.3. The only exception to these two rules should be if winners reach unanimous agreement or if the relevant parties (the holder of 3675-80MHz and any "small winners" form part of a partial agreement (if Ofcom allows such agreements).

<u>If the holder of 3675-80MHz wins more spectrum, it should be guaranteed contiguity and any new entrants should only be allowed to bid for the top of the band</u>

25.4. Ofcom's proposals for "small winners" risk further fragmentation to the band. For example, a new entrant (or entrants) may win 20MHz or less and secure the bottom position of the spectrum being auctioned. A far superior approach is to ensure that the holder of 3675-80MHz is guaranteed contiguity and only allow new entrants to bid for the top of the band.

25.5. Ofcom rejected our proposal to guarantee contiguity to the holder of 3675-80MHz because other bidders may want to express their value for the bottom position. Indeed, [✂].[54]

25.6. If any new entrants win 3.6-3.8GHz spectrum, they should only be allowed to bid for the top position(s) in the band to prevent further fragmentation. If there were one new entrant, it should be awarded the top of the band. If there were more than one new entrant, we propose a process similar to that Ofcom proposed for "small winners" but limited to the top positions in the band. New entrants could bid for all possible positions, subject to them all being adjacent and at the top of the band.

26. Even if a restriction on "small winners" were warranted, there is no basis to increase the definition of such winners from less than 20MHz to 20MHz or less.

26.1. Notwithstanding our arguments that Ofcom should not adopt the proposed restrictions on "small winners", there is no basis for Ofcom changing the definition of "small winners" from those winning less than 20MHz (as proposed in Ofcom's June 2019 Consultation) to those winning 20MHz or less (proposed in this Consultation). Vodafone and Telefónica agreed with Ofcom's original proposed definition of less than 20MHz but BT/EE argued that the restriction should be broadened to include winners of 20MHz because:

- 20MHz is a more suitable threshold above which spectrum would be relevant to trades rather than being an obstacle or strategic opportunity to prevent trades; and
- 20MHz is a more likely amount to win than 15MHz (because it does not expect bidders to want multiples of 5MHz).

26.2. We strongly oppose the extension of the small winners' restriction to 20MHz. 20MHz is not a "small block". The prospect that a bidder may win 20MHz purely for the purpose of frustrating trades aimed at defragmenting the band is fanciful. Based on the 2018 auction price such a bidder would have to invest c£150m with little prospect of recouping that investment.

[54] [✂]

26.3. As Ofcom anticipated, the disadvantages of non-contiguity in the 3.4-3.8GHz band, which are inherent to the early stage of a new technology, are quickly disappearing. mMIMO units capable of covering the whole 3.4-3.8GHz frequency range are due in 2020. Non-contiguous intra-band carrier aggregation has now been standardized and will also be supported in handsets in early 2020. Ofcom should assess the probability of such strategic investment (including risks and payoffs) before placing burdensome restrictions on bidders' flexibility.

26.4. BT/EE's second point is also wrong. As we have explained above in support of Ofcom's proposed lot sizes of 5MHz, some bidders may want multiples of 5MHz. 3GPP 5G NR channel sizes in the band already include 15MHz, and we expect 25MHz to be standardised by Q1 2020. As Ofcom highlights, Vodafone, Telefónica and Airspan all bid for multiples of 5MHz in last year's 3.4GHz UK auction. Airspan, Meteor and Vodafone also won multiples of 5MHz in the 2017 Irish auction.

26.5. In addition, increasing the definition of "small winners" from those winning less than 20MHz to 20MHz or less increases the amount of spectrum that could be given to "small winners" at the bottom of the spectrum to be auctioned, increasing the disruption to other bidders who may value that position.

5. [✂]

27. [✂].

27.1. [✂].

28. [✂].

28.1. [✂].

Figure A1: [✂]

[✂]

Source: Three

29. [✂].

29.1. [✂].

Figure A2: [✂]

[✂]

Source: Three

30. [✂].

30.1. [✂].

30.2. [✂].

Table A1: [✂]

[✂]

Source: Three

31. [✂].

31.1. [✂]:

[✂]

31.2. [✂].

32. [✂].

32.1. [✂].

32.2. [✂].

[✂]

32.3. [✂]:

[✂]

32.4. [✂].

[✂]

32.5. [✂]:

[✂]

32.6. [✂].

32.7. [✂]:

- [✂].
- [✂].

32.8. [✂]:

- [✂].
- [✂].[55]

32.9. [✂].

[55] [✂]

Table A2: [✂].

[✂]

Source: Three

[✂]

33.1. [✂].

33.2. [✂].

34. [✂].

34.1. [✂].

Figure A3: [✂]

[✂]

Source: Three

35.1. [✂].