Three's response to Ofcom's Enabling Opportunities for Innovation consultation.

Non-confidential

12 March 2019

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Executive Summary

1. Three welcomes the opportunity to comment on Ofcom's Enabling Opportunities for Innovation – Shared access to spectrum supporting mobile technology Consultation, published on 18 December 2018.

2. We are supportive of Ofcom's aim to support further innovation and the adoption of new technologies. Indeed, Three is leading the way on 5G services. We have made significant investments in our network and spectrum holdings to ensure that we are able to offer our customers the best 5G services possible.

3. Our aims are broadly aligned with Ofcom's objectives and we understand Ofcom's ambitions to promote wider access to spectrum. However, in our view, Ofcom's proposals for both the shared access bands and the awarded mobile bands are flawed, and should not be adopted in their current form. We strongly urge Ofcom to take account of our concerns regarding Ofcom's proposals and adopt our suggested alternatives.

4. In particular, we are concerned that Ofcom has failed to consider Three's planned 5G FWA deployment when designing its proposals in the Consultation. Access to our spectrum at 3925 - 4009 MHz is critical to our ambition to bring competition to the home broadband market, as we explain in section 2 of our response. Ofcom's proposals for the shared access bands threaten these plans and dilute our rights to use our 3.9 GHz spectrum, as we explain in section 3.

5. We set out in section 4 our concerns with Ofcom's proposals to widen spectrum sharing in the shared access bands, and why Ofcom's proposals are not consistent with its spectrum management duties.

6. We are particularly concerned that Ofcom has not fully considered the consequences of allowing new users access on a First Come First Served (FCFS) basis, including in our holdings, or the risk that this procedure could be used strategically by other operators to frustrate our FWA rollout plans.

7. In section 5 we detail our alternative proposal for the shared access bands, whereby Ofcom would continue to recognise priority for our nationwide licence in the 3.9 GHz band by carving out our spectrum holding from its sharing proposals. In our view, this approach represents a better balance between Ofcom's aims and its spectrum management duties.

8. In section 6 we explain why Ofcom's proposals for an Ofcom managed sharing regime for the awarded mobile bands should not be adopted:

    - Firstly, we note that they are inconsistent with requests by Government for Ofcom to clarify that spectrum leasing is not prohibited under the Mobile Trading Regulations[1].

    - Secondly, spectrum leasing can promote sharing without the need for further intervention.

9. We have included examples of spectrum leasing in our holdings. In our experience spectrum leasing can work well, and represents a far more realistic, pragmatic and workable solution, whilst giving Government the clarification it is seeking. It is Ofcom's failure to permit leasing for spectrum held under the Mobile Trading Regulations which has limited the adoption of spectrum leasing by mobile operators.

10. As an alternative to its current proposals, Three urges Ofcom to consider either: a) spectrum leasing; or b) a hybrid form of concurrent licensing, for these mobile bands. In our view, either of these approaches would much better serve Ofcom's objectives and would enable the existing rights holder to conduct commercial negotiations with the new user.

[1] DCMS *Statement of Strategic Priorities for telecommunications, the management of radio spectrum and postal services,* published for Consultation on 15 February 2019, paragraph 40

Contents.

1. Introduction.

1. Background

1.1. This document sets out Three's response to Ofcom's Enabling Opportunities for Innovation – Shared access to spectrum supporting mobile technology Consultation, published on 18 December 2018 (the "Consultation").

1.2. Since our launch in 2003, Three has focused on ensuring that our customers can make the most of their devices and data services. We have launched market-leading propositions including 4G at no extra cost (to 3G), Feel At Home roaming and our innovative 123 proposition.

1.3. We are supportive of Ofcom's aim to support further innovation and the adoption of new technologies. Indeed, Three is leading the way on 5G services. We have made significant investments in our network and spectrum holdings to ensure that we are able to offer our customers the best 5G services possible.

1.4. Three will begin deploying 5G technology in H1 2019. A key part of our 5G strategy is the deployment of fixed wireless access (FWA) services. This service will compete directly with traditional home broadband at the retail level and bring network competition to BT and Virgin at the network level. Our FWA service will provide a real alternative to consumers, delivering the broadband speeds and data capacity that they want, using 4G and 5G technologies.

1.5. Crucially, 5G FWA requires far more capacity than 5G mobile. Our own projections show that [✂][2].

1.6. This forecasted growth in data traffic means that, whilst the first tranche of our 5G deployment will be FWA using our 3.4-3.6 GHz spectrum, in the medium term, these bands will be insufficient to support our FWA service at the desired user experience levels. Maintaining full access to, and use of, our 3.9 GHz spectrum holding is critical to both our FWA plans and our subsequent ability to stimulate competition in the home broadband market.

1.7. We have set out in section 2 of this response further details of our planned FWA product and why our 3.9 GHz spectrum is vital to these plans.

1.8. Ofcom must ensure that it adequately considers these 5G capacity requirements when setting its plans for spectrum sharing. These are important decisions which will determine the long-term use of these spectrum bands. Incorrect policy decisions by Ofcom now could have far-

[2] See Figure 1 in section 2 below.

reaching negative consequences for the UK economy and the ability of UK consumers and businesses to benefit from 5G technologies.

1.9. We would like to work with Ofcom to explore ways in which our plans can be supported both under the current coordination procedure regime, and going forward, under any revised sharing regime affecting the band, proposed by Ofcom.

2. Summary of Ofcom's proposals and Three's spectrum holdings

2.1. The Consultation contains two distinct sets of proposals. Firstly, Ofcom is proposing to widen substantially the number of users able to access the shared spectrum bands, namely 3.8-4.2 GHz, the 1800 MHz shared spectrum (DECT guard band) and the 2300 MHz shared spectrum.

2.2. The proposed model is a form of Ofcom managed geographic sharing, and would see two types of licences being made available, distinguished by power level and geographic area:

- **Low power licences for local connectivity (per area licence):** Ofcom states that these licences will be available nationwide, including in urban and dense urban areas.
- **Medium power licences for longer range connectivity (per base station licence):** Ofcom states that these deployments will initially be limited to rural areas only.

2.3. Secondly, Ofcom is proposing to introduce localised shared access to licenced mobile spectrum in areas where this would not adversely affect mobile network operators' (MNO) planned use of mobile spectrum. There would be an opportunity for an MNO to refuse access to their holdings, on reasonable grounds.

2.4. Three holds spectrum and currently operates either mobile or FWA services in several of the spectrum bands within scope of Ofcom's proposals in the Consultation. Specifically, Three and UKB hold:

- **3.8-4.2 GHz band**: UKB holds a nationwide licence for 84 MHz of spectrum in this band. We use this spectrum, along with holdings in the 3.4-3.8 GHz band, to provide 4G FWA services, primarily in Swindon and London, to 20,000 customers. We also have spectrum leasing in this band. The dawning of the 5G age opens up an exciting opportunity to expand greatly our FWA service.
- **DECT Guard band**: UKB, along with 11 other licence holders, were granted shared access to this spectrum under Concurrent Spectrum Access (CSA) licences in 2006. Currently, the Federation of Communication Services (FCS) maintains a register of deployments.
- **Awarded mobile bands**: Three holds spectrum in the 800 MHz, 1400 MHz, 1800 MHz, 1900 MHz, 2100 MHz and 3.4 GHz bands. UKB also holds spectrum in the 3.4-3.6 GHz band. Three and UKB use this spectrum to provide their 3G and 4G services, and plan to deploy 5G services in 2019.

2. Three needs access to its 3.9GHz to bring competition to the home broadband market.

1. Three plans to shake up the UK's home broadband market

1.1. Three has exciting plans to relaunch our FWA product in 2019, which we will be sharing publicly later this month. As a first step, we have recently announced our plan to customers to re-brand UKB's Relish service to Three Broadband from 1 April 2019.

1.2. Also described as wireless fibre, 5G delivers a huge increase in capacity and speed together with ultra-low latency and opens up new possibilities in home broadband.

1.3. In the same way that we have challenged the mobile market, promoting competition and consumer choice, we plan to do the same with 5G FWA. We want to bring network competition to BT and Virgin, compete in the home broadband market and offer customers a real alternative to the current fixed broadband providers at the retail level.[3]

1.4. Our five-year plan is to achieve [✂] FWA subscribers by 2023. On average, these subscribers consume much more data than mobile subscribers. As Figure 1 below illustrates, we predict that [✂]% of our traffic will be 5G FWA by 2023.

[3] On 20 November 2018, Three released a study examining the opportunity for 5G-based FWA services to become an effective substitute for current and future fixed network broadband 5G Wireless Home Broadband: A Credible Solution to Fixed Broadband, Ovum 2018.

Figure 1: 5G FWA traffic will represent [✂] of our traffic by 2023

[✂]

Source: Three

1.5. Our service demand forecasts further show the huge traffic growth that we expect to see on our network, across both 4G and 5G FWA. As Table 1 below illustrates, by 2023 Three's 5G FWA busy hour throughput is forecast to be [✂], representing a [✂] increase on anticipated traffic levels. We expect our combined 4G/5G FWA demand to reach [✂] by 2023.

Table 1: Three's 4G/5G service demand forecast

[✂]

Source: Three

1.6. Our 3.4-3.8 GHz spectrum alone will not be sufficient to service this data demand. We have identified 6,000 priority sites for our massive MIMO

(MMIMO) deployment. We predict that by 2021, [✂] of these sites will be unable to deliver a service rate of [✂] if using only 3.4-3.8 GHz spectrum.

1.7. Therefore, to avoid service degradation to our mobile customers, and to ensure the viability and scalability of our 5G FWA proposition, we plan to deploy MMIMO technology on our 84 MHz of 3.9 GHz spectrum. [✂] sites will need to be upgraded by 2023, by deploying new MMIMO operating on our 3.9 GHz spectrum, to deliver speeds of [✂], as Table 2 shows.

Table 2: No. of sites requiring 3.9 GHz MMIMO deployment

[✂]

Source: Three

1.8. Even at a more conservative service level of [✂], we predict there will be a requirement to deploy 3.9 GHz spectrum on [✂] sites by 2023 to satisfy expected traffic demand.

1.9. Three has a relatively small 4G spectrum bandwidth. Deployment of 5G using our 3.4-3.6 GHz and 3.9 GHz spectrum bands will also help alleviate 4G traffic congestion by allowing Three to offload 4G traffic onto its 5G network as 5G device penetration increases. We will be able to use appropriate load balancing to manage the traffic, enhancing 4G performance for our customers.

1.10. Our plans are not just driven by subscriber numbers and data demand. The speeds we will be able to offer will also be a key competitive differentiator. We estimate that our 5G FWA service could provide residential broadband speeds which are twice as fast as today's average fixed broadband speeds.[4]

1.11. Such speeds will enable our 5G FWA service to become an effective substitute for current and future fixed broadband services, widening consumer choice when selecting home broadband services and increasing competition.

2. Our FWA plans leverage the synergies between FWA and mobile

2.1. Ofcom has previously recognised the growth potential of delivering FWA services using mobile technologies in its Connected Nations Report 2018:

[4] 5G Wireless Home Broadband: A Credible Solution to Fixed Broadband, Ovum 2018

"This year we have also seen mobile technologies such as 4G networks begin to be used in greater volumes to deliver home broadband services to people."[5]

2.2. The synergies between FWA and mobile provide a great opportunity for UK plc to lead the way on 5G innovation, in line with the Government's ambitions.

2.3. The 3.8-4.2 GHz band, in particular, represents a step change in our ability to provide FWA via mobile technologies. The band is ideally suited to help address future 5G capacity constraints and support development of FWA as a credible alternative to BT's dominance in FTTP market.

2.4. We plan to leverage these synergies both at a network level and from a retail perspective, through our FWA deployment in 2019.

3. Technical preparations are already in progress

3.1. We have already begun making preparations for the rollout of 5G services on our 3.9 GHz holding, and are planning significant network investments in 2019 and beyond.

3.2. As part of our network transformation programme, we are carrying out a programme of structural strengthening on our priority sites, including [✂].

3.3. Additionally, we have entered into an agreement [✂]. This agreement makes provision for [✂].

3.4. Finally, the 3.8-4.2 GHz band is identified as a 5G band. It forms part of the 5G NR n77 band (3300-4200 MHz) which has been specified for 5G services and is covered by 3GPP standards (Release 15).

3.5. In terms of timescales, we expect that 3.9 GHz handset support will become available in the eco-system from Q4 2019, and 3.9 GHz CPE support should follow from 2020 onwards.

[5] Ofcom Connected Nations report 2018, page 17

3. Ofcom's proposals dilute Three's rights to use its 3.9 GHz spectrum.

1. Ofcom is diluting UKB's rights to use of 3925 – 4009 MHz

1.1. UKB holds a nationwide licence for 84 MHz in the 3.8-4.2GHz band, which it currently uses to provide 4G FWA services. Satellite earth stations and fixed links also operate within this band subject to the coordination procedure managed by Ofcom.

1.2. In the Consultation, Ofcom states that:

"By introducing additional users in the same spectrum as existing users, we are not proposing to change incumbent users' existing and future rights to deploy. Incumbent users will continue to be able to deploy in accordance with their licence terms and conditions."[6]

1.3. We disagree with Ofcom's assessment. In fact, the proposals represent a change to the way in which we must coordinate with other users in the band, and this change will potentially have a significant impact on Three's ability to offer its 5G FWA service.

1.4. The Consultation also suggests that Ofcom currently coordinates individual assignments within UKB's spectrum on a FCFS basis. Ofcom notes that, although the introduction of new users in UKB's holding may reduce the availability of channels for UKB in some regions, this could happen anyway under the existing sharing arrangements.

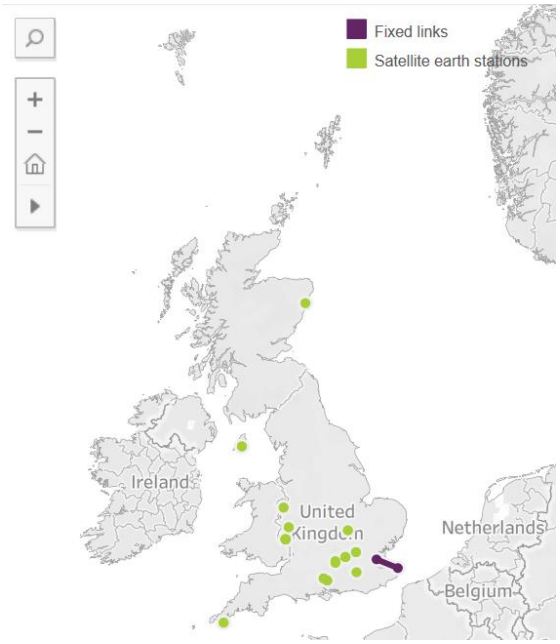
1.5. In reality, however, Ofcom has historically prioritised UKB's use of 3925-4009 MHz and has afforded UKB a greater level of protection than it is currently proposing. As a result, to the best of our knowledge, there have been no new fixed link deployments in our holdings in the band since 2008.

1.6. For instance, in its 2016 Call for Inputs *"3.8 GHz to 4.2 GHz band: Opportunities for Innovation"*[7], Ofcom identified that any new sharing in the band would need to take account of incumbent services. Ofcom recognised that *"Ranges 4, 5 and 6 are prioritised for UKB"*[8].

[6] Consultation, paragraph 2.19
[7] Ofcom, 3.8 GHz to 4.2 GHz band: Opportunities for Innovation, 14 April 2016
[8] Call for Inputs, paragraph 2.20

1.7. As shown in Figure 2 below, at the time of the Call for Inputs, there was a single fixed link assignment and only 25 satellite earth stations authorised to operate in UKB's spectrum.

Figure 2: Ofcom has effectively prioritised use of 3.9GHz spectrum for UKB



Source: Ofcom

1.8. Therefore, Ofcom is being too simplistic and is not showing the full picture, by characterising the current regime as simple FCFS. In practice, as Figure 2 illustrates, UKB's deployments in the band are coordinated with a very small number of other incumbent users. Ofcom's proposals, therefore, represent a significant change to our rights to use our spectrum holding.

1.9. We are very concerned that, in its new Consultation, Ofcom no longer makes reference to the prioritisation of certain ranges for UKB. Three and UKB have a legitimate expectation to rely on this prior treatment. Indeed, part of the rationale for Three's purchase of UKB in 2017 was the ability to use both 3.4-3.6 GHz and 3.9 GHz spectrum to scale the Relish FWA service.

1.10. Ofcom's new sharing proposals undermine this investment. As shown in Figure 2 above, UKB shares the band with a small number of satellite and fixed link users in specific locations of the UK. Opening up use of UKB's frequencies to a large number of low and medium power users effectively dilutes the rights embodied in our 3.9 GHz licence.

2. Ofcom's proposals represent a significant change to the current coordination procedures for the 3.8-4.2 GHz band

2.1. Ofcom documented the process for new UKB deployments in the 3.9 GHz holding in the Call for Inputs, noting that:

"When UKB wishes to request a new assignment in this spectrum, it submits technical info to Ofcom which is then assessed against incumbent deployments using Ofcom's technical coordination tool as given in the coordination guidelines"[9]

2.2. The current coordination procedure is contained in Ofcom's UK Spectrum Co-ordination document OfW188[10]. In that document, Ofcom expressly notes that:

"Ofcom is not making any new FS P-P assignments in the spectrum in the band that is currently available to FWA."[11]

2.3. This has been the position for at least the past 10 years. Therefore, essentially, UKB must only co-ordinate with one historical fixed link and a relatively small of satellite users.

2.4. Ofcom states that the new proposed coordination approach will be similar to that already in place for existing users in the 3.8-4.2 GHz band.[12] We disagree with this assertion.

2.5. The low and medium power licence use cases are still in their infancy, and so the number and range of new users is yet to be determined. However, there is clearly the potential for the number of new deployments to be considerably higher than the existing satellite deployments that we are required to coordinate with. This represents a significant change to the current coordination procedures.

3. Ofcom's proposals may hinder our commercial leasing opportunities and network planning

3.1. We are concerned that Ofcom's proposals may stifle our ability to lease commercially our spectrum to other users.

3.2. On a practical level, it will be much more complicated to coordinate our customers' deployments if sharing with a host of new users, compared to the current arrangements. Even if initial deployments can take place, we foresee that there will be a greater ongoing administrative burden of managing interference across our holding.

3.3. Further, Ofcom's proposals serve to frustrate our network capacity planning and potentially, our marketing strategies. We could conceivably spend months planning deployments only to find that we cannot roll out at the last minute because a new user has applied to Ofcom for a licence across our holding.

[9] Call for Inputs, paragraph 2.5, bullet 3
[10] https://www.ofcom.org.uk/__data/assets/pdf_file/0027/85086/coordination_processes.pdf
[11] Ofcom's UK Spectrum Co-ordination document OfW188, paragraph 4.3.4
[12] Consultation, paragraph 3.10

4. Three's concerns with Ofcom's proposals for the three shared access bands.

1. Summary

1.1. As we have shown in section 2 above, maintaining access to our 3.9 GHz holding is critical for delivering the capacity requirements of our 5G FWA service.

1.2. Three is extremely concerned by Ofcom's proposals to grant low power and medium power licences to new users in the shared access bands. Our concerns are particularly around the impact these proposals will have in the 3.8-4.2 GHz band.

1.3. Our concerns can be summarised as follows:

- Ofcom has not recognised the negative impact on FWA deployment of their proposals to grant low power licences in urban areas;
- Ofcom's has failed to consider the future use of the 3.8-4.2 GHz band for mass area 5G FWA services, including Three/UKB's planned use;
- There are a number of unforeseen consequences that Ofcom has not considered, including the risk of [✂]; and
- Ofcom's proposals are not consistent with Ofcom's duties regarding efficient spectrum use and management.

1.4. We have set out the reasons and evidence why each of these concerns are well founded in this section of our response. We urge Ofcom to take each of these concerns into account when reviewing its proposals for the shared access bands.

1.5. In section 5, we have then identified our alternative proposal which would better achieve Ofcom's objectives.

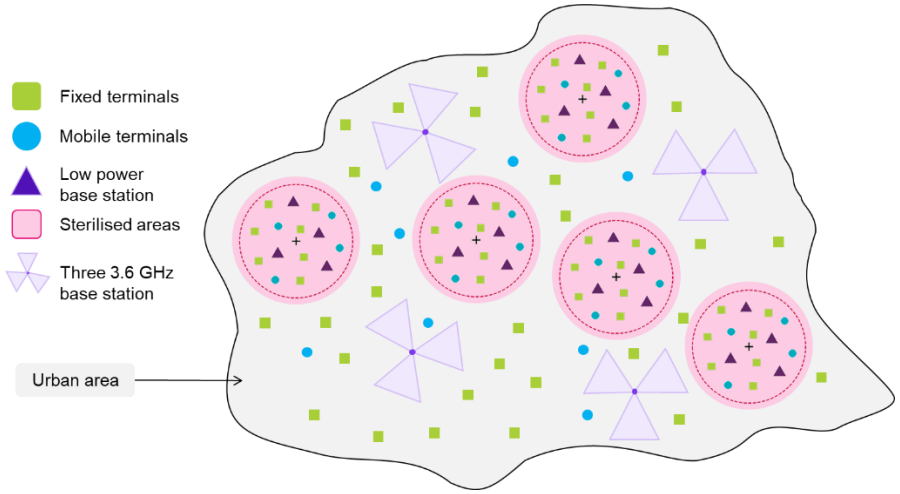
2. Ofcom has not recognised the negative impact on FWA deployment of their proposals to grant low power licences in urban areas

2.1. We are concerned that deployments by new users in our spectrum holdings, particularly of low power devices in urban or dense urban areas, could sterilise that area for any subsequent deployment by Three, potentially denying the benefits of 5G FWA to thousands of our customers.

2.2. As explained in section 2 above, 3.9 GHz is critical to our 5G FWA rollout plans. However, one consequence of Ofcom's proposals would be to create geographical deployment 'no-go' zones which could inhibit our ability to deploy 3.9 GHz [✂].

2.3. Figure 3 shows how the deployment of several low-powered base stations in our 3.9 GHz band, each radiating in a 50m radius, may prevent us from deploying 3.9 GHz on our existing 3.6 GHz site footprint and using our 3.9 GHz spectrum to offload FWA traffic.

Figure 3: Sterilisation of large urban areas by multiple low-powered base stations (for illustrative purposes only)



Source: Three

2.4. Should a low-powered base station be licenced within Three's spectrum holding in a particular geographic area, Three would face a decision to either: a) deploy but manage interference; or b) not deploy at all, in this area.

2.5. If Three decided to deploy, we would be required to **[✂]**.

2.6. Such low power deployments, in effect, erode the business case for our deployment of 3.9 GHz as the density of addressable customers for Three to serve using 3.9 GHz spectrum may diminish to the point where

deployment becomes uneconomic. As a result, Three may decide not to deploy its 3.9 GHz in this area.

2.7. In either scenario, Three's ability to deliver FWA service levels will become increasingly constrained and we would likely need to bring forward investment in other, nascent solutions, e.g. in mmWave bands.

3. Ofcom's has failed to consider the future use of the 3.8-4.2 GHz band for mass area 5G FWA services, including Three/UKB's planned use

3.1. 5G services will need significant capacity. As we illustrated in Table 1 above, our own 5G rollout plans forecast [✂] greater traffic demand by 2023. In our view, the 3.8-4.2 GHz band is crucial to servicing these capacity needs, for the following reasons.

3.2. The 3.8-4.2 GHz band is identified as a 5G band. It forms part of the n77 band (3300-4200 MHz) which has been specified for 5G services and is covered by 3GPP standards (Release 15). Internationally, 5G handsets will be available in the eco-system from Q4 2019, and CPEs will be available for this band from 2020 onwards.

3.3. Three is being proactive in preparing this band for 5G use. In partnership with Huawei, we have submitted a 3GPP Work Item to request that 5G non-contiguous carrier aggregation (CA) be incorporated into the 3.3-4.2 GHz band. This feature will enable higher speeds for our FWA services.

3.4. Once this has been standardised, it will be possible to upgrade the network with a simple software update to deliver this capability but device support will be required before our customers can benefit from it. From a device perspective, we expect devices will support 5G non-contiguous CA within 12 months of standardisation.

3.5. The band is also adjacent to the 5G priority mid-spectrum 3.4-3.8 GHz band. This proximity means it has many of the same propagation characteristics as that band, delivering a good balance of capacity and coverage benefits which would make it ideal for 5G deployment.

3.6. We recognise that this band is different to the 3.4-3.8 GHz band: it is shared with satellite users and fixed links, and unlike in the lower band, Ofcom has no plans to either move these users or clear the band for exclusive 5G mobile use. However, given the more static nature of FWA deployments, it remains a viable band for 5G FWA use.

3.7. If Ofcom goes ahead with its proposals to permit deployments of low and medium power equipment across this band, such use will almost inevitably impede or frustrate attempts to deploy 5G FWA services. This potentially creates a scenario where small scale deployments, each serving only a very small number of consumers, are peppered throughout the 400 MHz bandwidth, leading to significant fragmentation.

3.8. Ofcom must consider the long-term use of 3.8-4.2 GHz and must not ignore the potential of 5G FWA and mobile services to operate in the

band. It is possible to design the sharing framework in a way which does not disincentivise investment in FWA services.

3.9. We are concerned that errors by Ofcom now could have far-reaching and enduring negative consequences for the UK economy and the ability of UK consumers and businesses to benefit from 5G technologies.

3.10. In our view, permitting low and medium power licences across the whole 400MHz of the 3.8-4.2 GHz band does not represent the best use of this prime mid-band spectrum.

4. There are a number of negative consequences that Ofcom has not considered

4.1. There a number of negative consequences from Ofcom's proposals that it has failed to consider in the Consultation.

4.2. Firstly, and most concerning to us, is the opportunity the proposals will present [✂].

4.3. The scenario we foresee is that [✂].

4.4. Absent further structural safeguards, this would [✂].

4.5. Ofcom is not currently proposing any process to check Three's deployment plans before granting a licence to new users in our holding, in direct contrast to its other proposals in the Consultation for the awarded mobile bands.

4.6. Further, there is no mention in the Consultation of any Ofcom-administered process for Three to appeal or otherwise challenge Ofcom's decision to grant such licences. The only route for removal of licences that are unused, or [✂], appears to be revocation with a standard 5-year notice. This is unacceptable.

4.7. The fee structure proposed by Ofcom for the 3.8-4.2 GHz band is illustrated in Figure 4 below. [✂]

Figure 4: Proposed cost-based fees per annum by bandwidth

Channel size	Price per channel
2x3.3 MHz	£80
10 MHz	£80
20 MHz	£160
30 MHz	£240
40 MHz	£320
50 MHz	£400
60 MHz	£480
80 MHz	£640
100 MHz	£800

Source: Ofcom

4.8. This scenario runs the risk not only of failing to achieve Ofcom's statutory duty to optimise the use of spectrum, but in fact to frustrate that ambition. This ability to [✂] means Ofcom's duties regarding efficient use of spectrum are not met.

4.9. Finally, the proposals may impose a significant additional administrative burden on Ofcom, which may arise in two ways:

- **Managing any increase in applications:** Ofcom has not adequately explained how it plans to manage the potential increased number of licence applications that it may start to receive.

- **Ongoing interference issues:** Ofcom has also not explained how it will manage any interference or coordination issues that may arise on an ongoing basis. Clearly, low and medium power equipment is more portable than a satellite earth station or fixed links. Any spectrum sharing regime requires swift intervention and investigation in the event of suspected interference. We are concerned that Ofcom will be inadequately resourced to address this in the longer term.

5. Proposals are not consistent with Ofcom's duties regarding efficient spectrum use and management

5.1. The Wireless Telegraphy Act 2006 ("the WT Act") imposes certain duties on Ofcom when carrying out its spectrum functions.

5.2. Ofcom has a duty under section 3 of the WT Act to have regard in particular to:

i. the extent to which the spectrum is available for use or further use for wireless telegraphy;

ii. the demand for use of that spectrum for wireless telegraphy; and

iii. the demand that is likely to arise in future for the use of that spectrum for wireless telegraphy.

5.3. Ofcom also has a duty under section 3(2) of the WT Act to have regard, in particular, to the desirability of promoting:

i. the efficient management and use of the spectrum for wireless telegraphy;

ii. the economic and other benefits that may arise from the use of wireless telegraphy;

iii. the development of innovative services; and

iv. competition in the provision of electronic communications services.

5.4. In Three's view, Ofcom's current proposals are not consistent with their duties in two ways.

5.5. **Ofcom has not considered the demand that is likely to arise in future for the use of the 3.8-4.2 GHz band:** Ofcom has taken too simplistic a view of the demand for access to this spectrum. It has the potential to be incredibly useful in a 5G world, particularly for spill over capacity for FWA technology subject to co-ordination requirements. As we have shown, the 3.8-4.2 GHz band is an ideal candidate band for future wide area 5G FWA deployment.

5.6. **The proposals do not promote efficient spectrum management or use:** To achieve efficiency, Ofcom must ensure that the spectrum is in the hands of the highest value users. Ofcom's proposal to permit low and medium power deployments across the full 400 MHz bandwidth, without reserving UKB's spectrum for wide area FWA, is not aligned with this duty. Further, a sharing framework which [✂] identified above is clearly not aligned with Ofcom's duties regarding efficient use of spectrum.

5. Three's proposed alternative solution for the three shared access bands.

1. Alternative solution will better achieve Ofcom's objectives

1.1. We acknowledge Ofcom wants to see more intensive spectrum sharing in the shared access bands. However, there are better ways to balance the needs of all of the users in the band; both incumbent and new.

1.2. We set out in this section our alternative approach, namely, to carve out Three/UKB's 84 MHz of 3.9 GHz spectrum from the proposals, which will deliver Ofcom's objectives, whilst addressing the concerns that we have identified in section 4 above.

1.3. We also urge Ofcom to explore how other spectrum bands, e.g. 26 GHz, identified by CEPT as the 'pioneer' mmWave band, could deliver similar service for new users, and would not cut across our use of 3.9 GHz.

2. Carve out Three/UKB's spectrum

2.1. For the reasons identified in section 3 of this response, our nationwide licence in the 3.8- 4.2 GHz band is different to those of the other incumbent users. Ofcom has previously recognised these differences and has applied different treatment, including prioritising the 3925-4009 MHz band for UKB's use. It is disingenuous of Ofcom to change its approach now, with no justification and absent any evidence of harm.

2.2. Furthermore, as explained in section 2, this spectrum is critical to Three's imminent planned 5G FWA deployment and our ability to bring a new, disruptive competitive offering to the home broadband market.

2.3. We urge Ofcom to carve out our holding from its proposals for geographic spectrum sharing. In our view, this is justified and will lead to a more efficient use of spectrum, as it will enable us to push ahead with our rollout plans for 5G FWA under existing coordination requirements (i.e. coordinating with satellite earth stations and fixed links only).

2.4. Carving out our holdings from Ofcom's proposals for geographic sharing would also be in line with Ofcom's previous spectrum sharing ideas for this band, published in its 2016 Call for Inputs.

2.5. In that Call for Inputs, Ofcom proposed a tiering approach. The effect of this tiering approach was that Ofcom effectively carved out UKB's 84 MHz holding. Ofcom said that it would not allow geographic sharing within UKB's band, and instead proposed only to allow opportunistic access to new users. Ofcom has failed to explain fully why it has moved away from the approach it had proposed in its Call for Inputs.

3. Alternative spectrum bands can deliver similar result

3.1. Sub-6 GHz is very valuable spectrum for 5G technologies. In our view, the most efficient use of this spectrum would be for wide area FWA coverage, rather than low or medium power equipment.

3.2. The frequency ranges above 24 GHz offer a significant opportunity for supporting future 5G services, particularly through the deployment of mmWave technology.

3.3. Three has previously welcomed Ofcom's decision to support the identification of 24.25 – 27.5 GHz, 40.5 - 43.5 GHz and 66 – 71 GHz as priority bands for 5G services[13]. These mmWave bands are the final 5G priority bands for Ofcom to make available.

3.4. In our view, Ofcom should consider further the possibility of making available mmWave spectrum, in particular the 26 GHz band, to service the use cases identified in the Consultation. This spectrum would be particularly suited for use for private networks and certain industrial applications.

[13] See Three's response to *Ofcom's Consultation regarding UK preparations for the World Radiocommunication Conference 2019 (WRC-19) Consultation*, dated 13 September 2018

6. The awarded mobile spectrum bands.

1. Three's concerns with Ofcom's proposals

1.1. Three broadly agrees with Ofcom's overall aims of extending coverage and using spectrum as widely as possible. However, we are concerned that Ofcom's proposals for spectrum sharing in the awarded mobile spectrum bands will not achieve these aims.

1.2. Firstly, we do not perceive a need for Ofcom intervention in these spectrum bands. There is no obvious market failure that needs correcting. In our view, the mobile spectrum bands are used intensively by the mobile operators, and this spectrum is held in the hands of those with the highest value for it.

1.3. Secondly, we are concerned that the relatively low fee structure of £950 per licence (as a one off, rather than per annum, fee), combined with the long minimum three-year licence term, may lead to situations where new users are granted licences but then no, or only limited, use is made of the spectrum. This could give rise to negative consequences, for example, by introducing much lower costs to entry for new users compared to MNOs, Ofcom is unnecessarily skewing the playing field in favour of new users.

1.4. Thirdly, Ofcom has provided very little detail regarding the process for MNOs to object to licence requests. Ofcom assumes that we will know with sufficient certainty where we plan to deploy in 3 years' time. This is not always the case - there are many factors that may affect our deployment plans. If these plans do change after a licence has been granted to a new user, there appears to be no mechanism to accommodate this.

1.5. Finally, we foresee several problems with Ofcom's approach of essentially marginalising the MNO from any commercial discussions around the granting of new licences in its own awarded mobile spectrum bands.

1.6. The MNOs have paid significant sums at auction for their licences in these spectrum bands. Ofcom's proposals at best, dilute our rights, and at worst, involve signing them away for a period of time, with no prospect of compensation.

1.7. Ofcom has also not addressed the possibility of disagreements arising between the MNOs and new users regarding access to the mobile spectrum bands. Ofcom has not explained, for example, the procedure if a new user chooses to challenge the decision of the MNO, or how

such disagreements will be resolved. This is of critical importance. It would be wholly unacceptable for the MNO to be compelled to share any commercially sensitive detailed rollout plans with Ofcom or third parties.

1.8. We also urge Ofcom to consider what information it will require of the new user's intention to deploy, and whether it will put in place measures to monitor deployment and use of the spectrum by the new users. Given the low barriers to entry, Ofcom must put in place safeguards to prevent spectrum hoarding or similar activity designed to frustrate roll out by other operators.

2. Alternatives can better achieve Ofcom's objectives

2.1. Ofcom has not adequately considered alternative approaches which would better meet its aims, whilst addressing many of our concerns. We strongly urge Ofcom to reconsider its proposals and pursue an alternative structure.

2.2. In our view, either of the following options would represent a better alternative to Ofcom's current proposals and ought to be explored further by Ofcom:

- **Option 1 - Leasing:** Permit spectrum leasing on a commercial basis by MNOs; or
- **Option 2 - Hybrid model:** Introduce a form of concurrent licensing for new users, based on commercially agreed arrangements between the individual MNO and the new user.

3. Option 1 – Permit leasing for spectrum held under the Mobile Trading Regulations

3.1. We note that each of the awarded mobile spectrum bands in the scope of these proposals are held subject to the Mobile Trading Regulations, which enable Ofcom to carry out a competition assessment before trades take place. Importantly, spectrum leasing is not currently permitted in these mobile bands.

3.2. In its Future Telecoms Infrastructure Review published 23 July 2018, DCMS steers Ofcom "to provide clarity that leasing of mobile spectrum is not prohibited, to promote greater liquidity in the spectrum trading market."[14] DCMS has repeated this request in its recent Consultation on its Statement of Strategic Priorities (SSP) published 15 February 2019.[15]

3.3. To date, however, Ofcom has not taken this approach. In fact, Ofcom states in the Consultation that, as they have not seen demand for an extension of the leasing approach to other licences, including mobile licences, they are not proposing to permit leasing in the mobile bands.[16]

[14] Future Telecoms Infrastructure Review, paragraph 226
[15] SSP, paragraph 40
[16] Consultation, paragraph 1.22

3.4. We disagree with Ofcom's rationale. To the extent there are concerns about the way in which spectrum in the awarded mobile spectrum bands is used or taken up, it seems clear to us that this is due to Ofcom's inaction, contrary to the Government's request, to change the licencing regime to permit spectrum leasing in these bands.

3.5. In our view, the spectrum leasing model could work well in the mobile bands. It would enable MNOs to recover the opportunity costs associated with offering access to a portion of their spectrum in a specific geographic location, whilst also being able to engage directly with the new user to agree the duration of the agreement. Providing this leasing opportunity subject to commercial negotiation, would increase the likelihood of MNOs entering into such arrangements.

3.6. We set out below some examples of our experiences of spectrum leasing. We urge Ofcom to look again at the feasibility of introducing a spectrum leasing model in the mobile bands.

4. Three/UKB's experience of spectrum leasing

4.1. Three, via UKB, has experience of spectrum leasing in both its 3.6 GHz and 3.9 GHz bands.

4.2. In the 3.6 GHz band:

4.2.1. UKB has leased **[✂]**.

4.2.2. UKB has leased **[✂]**.

4.3. In the 3.9 GHz band, UKB has leased **[✂]**.

4.4. Finally, we are also beginning to see 5G technologies presenting new opportunities for spectrum leasing in UKB's bands.

5. Option 2 – Hybrid model

5.1. In the Consultation, Ofcom identifies that it has not seen demand for an extension of the leasing approach to other licences, and suggests that this is because of the potential risks borne by the spectrum holders; i.e. the licensee is required to take responsibility for the actions of the lessees, and by extension, any enforcement action by Ofcom would be taken against the licensee rather than the lessee.

5.2. To address this concern, and as an alternative to a more traditional spectrum leasing model, we suggest that Ofcom explores a hybrid model of concurrent licensing.

5.3. This model would still allow for commercial discussions between the MNO and new users, but once agreement was reached, the parties would then revert to Ofcom. Ofcom could then grant a concurrent licence to the new user for the duration as commercially agreed between the parties.

5.4. Such an approach would ensure that Ofcom was responsible for enforcement directly against the new user, rather than the licensee taking responsibility. It would also enable the MNO to retain control of

the commercial negotiations pertaining to the spectrum it has been awarded.

6. Conclusion

6.1. In conclusion, either of these alternative options strike a better balance between the interests of the mobile operators and the new users. They are also far more likely to encourage spectrum sharing, particularly in rural areas.

6.2. To be successful, any spectrum sharing solution must enable the incumbent spectrum holders to be involved in the commercial negotiations with new users and enable operators to be fairly compensated for giving up a portion of their spectrum rights.