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# Three's response to Ofcom's Consultation on Exploring Future use of the Unpaired 2100MHz Spectrum

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## Non-confidential

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25 May 2023

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# Executive Summary

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Three welcomes the opportunity to respond to Ofcom's consultation on the future of the unpaired 2100MHz (1900-1920MHz) spectrum. Our key concern is that by proposing to revoke and reallocate the unpaired spectrum we hold in the 1915-1920MHz range, Ofcom is risking significant interference into our 2100MHz FDD spectrum.

It is a well-established engineering fact that coexistence of use in FDD and TDD spectrum bands can cause interference, as out of band emissions leak into adjacent bands. This interference can lead to a significant degradation of mobile signals to the detriment of customer experience.

The standard mitigation against this interference is to introduce a guard band between the TDD and FDD spectrum, along with appropriate out of band emission limits. Our view is that our 2100MHz TDD spectrum should be set aside as a guard band to mitigate interference from TDD spectrum into our FDD spectrum above 1920MHz.

Our analysis has resulted in two main coexistence concerns:

- Ofcom's proposal to allow high power use in the 1900-1915MHz range risks interference with our 2100MHz FDD spectrum without a minimum 5MHz guard band and appropriate out of band emissions limits.
- Ofcom's proposal to allow low power use in the 1915-1920MHz range will lead to interference between its use and our 2100MHz FDD spectrum. The band should instead be left free as a guard band.

Once the use of the spectrum as a guard band is determined, the question then becomes: who should hold the spectrum?

There are two options: (i) leave the spectrum in the hands of the current user; or (ii) Ofcom revokes the spectrum licence and reallocates it to another user.

Option (ii) would require an intrusive intervention by Ofcom, [X] with no benefit – the use of the spectrum would stay the same. We, therefore, cannot foresee a situation where such an intervention would be proportionate, objectively justifiable or targeted only at cases where action is needed.

If Ofcom disagrees that the spectrum must be used as a guard band or if, in the future, technological advancements remove the requirement for a guard band, our view is that Ofcom should rely on market mechanisms to reallocate the spectrum.

The barriers to liberalising and trading that Ofcom considers in the Consultation are not convincing:

- Ofcom's view that changing the use of the spectrum could change the interference environment, affecting users of adjacent spectrum, is warranted. In fact, it is the exact reason why we argue for a guard band for our 5MHz block. Liberalisation and trading can only occur if there are sufficient technical advancements to remove this risk.
- The incentives for us to strategically deny our 5MHz of spectrum to alternative, higher-value, users are indefensible. Firstly, the alternative uses of low power spectrum are unlikely to be in competition with us since we do not and are unlikely to provide these services in the future. Secondly, even if low power mobile use was a higher value use case, we would gain no competitive advantage from

denying 5MHz of TDD spectrum (presumably with severe limitations on its geographic usage) to a competitor.

If Ofcom disagrees with our assessment of the optimal (and only) use of our 2100MHz TDD spectrum, it must take alternative steps to protect our 2100MHz FDD spectrum from interference. This interference will come from high power use in the 1900-1915MHz range and low power use in 1915-1920MHz.

In our view, the minimum requirements on new users in the 1900-1920MHz band must be for them to:

- Adhere to strict out of band emission limits of at least -54dbm/5MHz for use in the 1915-1920MHz range and -52dBm/5MHz in the 1900-1915MHz range.
- Share and coordinate their frequency plans with us in advance of any deployment, with us retaining veto rights.
- Share and coordinate base station and antenna location in advance of any deployment, with us retaining veto rights.
- Immediately switch off any equipment if we experience interference between it and our 2100MHz FDD spectrum.

Although these requirements should help to reduce coexistence issues, only the retention of our 5MHz as a guard band (alongside these) would fully mitigate the risk.

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# 1. The optimal and only use of 1915-1920MHz spectrum is as a guard band.

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## Executive summary

- 1.1. It is a well-established engineering fact that coexistence of use in FDD and TDD spectrum bands can cause interference, as out of band emissions leak into adjacent bands. This interference can lead to a significant degradation of mobile signals to the detriment of customer experience.
- 1.2. The standard mitigation against this interference is to introduce a guard band between the TDD and FDD spectrum, along with appropriate out of band emission limits. We are, therefore, concerned with Ofcom's proposals in this Consultation to revoke our spectrum in the 1915-1920MHz range and reallocate it for new uses. Our view is that it should, instead, be set aside as a guard band to mitigate interference from TDD spectrum into our FDD spectrum above 1920MHz.
- 1.3. Our analysis has resulted in two main concerns which we elaborate on in this section:
  - Ofcom's proposal to allow high power use in the 1900-1915MHz range risks interference with our 2100MHz FDD spectrum without a minimum 5MHz guard band and appropriate out of band emissions limits.
  - Ofcom's proposal to allow low power use in the 1915-1920MHz range will lead to interference between its use and our 2100MHz FDD spectrum. The band should instead be left free as a guard band.

## Summary of Ofcom's proposal and Three's spectrum holding

- 1.4. Ofcom is proposing to revoke current licences in the unpaired 2100MHz band as it is currently unused and its view is that there may be alternative optimal uses, such as for railway communications and the utilities sector<sup>1</sup>.
- 1.5. The consultation contains two distinct sets of proposals.
  - Firstly, Ofcom's provisional conclusion<sup>2</sup> is that spectrum between 1900 and 1915MHz is suitable for high power use (other than for public mobile services) and that national infrastructure uses, such as rail and utilities, may be its most optimal future use.
  - Secondly, Ofcom's provisional view<sup>3</sup> is that the 1915-1920MHz spectrum could be suitable for low power mobile applications (e.g. the ESN Gateway), subject to consideration of coexistence with the FDD mobile base station receiver above 1920MHz.

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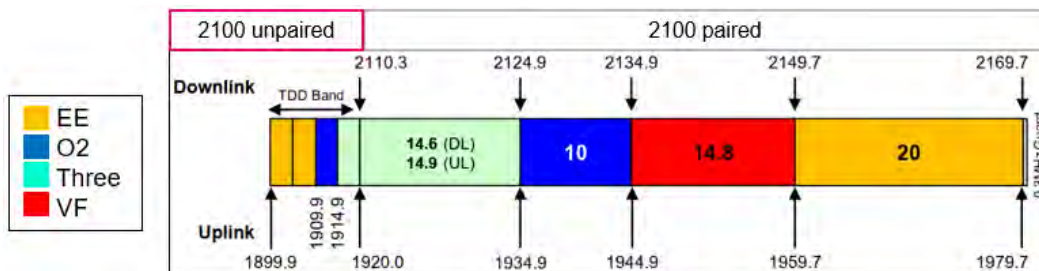
<sup>1</sup> [Ofcom 2100MHz unpaired consultation](#), para 3.32

<sup>2</sup> [Ofcom 2100MHz unpaired consultation](#), para 3.32

<sup>3</sup> [Ofcom 2100MHz unpaired consultation](#), para 3.35

- 1.6. Three currently holds two types of 2100MHz spectrum on one licence:
- 29.5MHz of 2100 paired (FDD) spectrum.
  - 5.1MHz of 2100MHz unpaired (TDD) spectrum. This spectrum is adjacent to our paired spectrum and the subject of this Consultation.
- 1.7. The 2100MHz spectrum holdings are illustrated in Figure 1 below:

**Figure 1: Spectrum holdings in the 2100MHz spectrum**



Source: Three UK

**Why interference between adjacent TDD and FDD spectrum bands can occur.**

- 1.8. Coexistence of FDD and TDD systems in the same spectral and/or geographical space can cause interference problems between the two systems. TDD systems use time division duplexing, which means that they transmit and receive on the same frequency band, but at different times. Whereas, FDD systems use frequency division duplexing, which means they transmit and receive contemporaneously on different, paired, frequency bands.
- 1.9. When TDD equipment is operating in proximity<sup>4</sup> to FDD equipment without an appropriate guard band and out of emission limits, the downlink and uplink transmission from TDD can interfere with the uplink transmission from FDD. Interference will occur even when equipment is transmitting at low power, if the two base stations are in proximity. This interference can lead to degraded signal quality and materially reduce the overall service customers experience (both in the uplink and downlink).
- 1.10. The interference occurs most often when TDD and FDD deployments are not synchronised and there is an insufficiently wide guard band between the two systems. As a result, a guard band of sufficient bandwidth, along with coordination and appropriate out-of-band emission limits, are required to prevent interference between TDD and FDD frequency bands.

**High power use in 1900-1915MHz could interfere with our FDD uplink spectrum.**

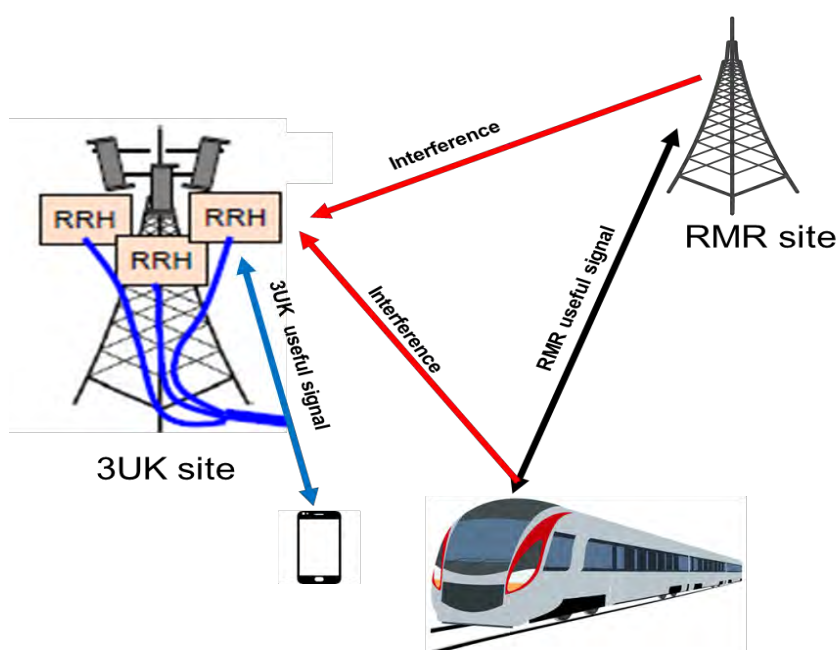
- 1.11. Ofcom’s provisional view is to reallocate 1900-1915MHz for high power use for rail and utilities. However, we believe that Ofcom has not properly considered

<sup>4</sup> The risk of interference differs with proximity. Although the greatest risk is when the equipment is in close proximity, there retains significant risk even at larger distances.

how high-power use in the band could cause interference to our adjacent FDD uplink spectrum, especially if new users deploy near our FDD site.

- 1.12. As mentioned above, interference can occur on the adjacent FDD uplink from both downlink and uplink transmissions from TDD equipment. Our analysis indicates that there could be potential interference, from high power users in the 1900-1915MHz range, primarily due to downlink traffic from a TDD base station when there is no guard band in place.
- 1.13. Figure 2 illustrates the potential interference that may occur on our 2100MHz FDD site due to high power railway usage. This interference occurs when the train communicates with its nearest RMR (Railway Mobile Radio) site, which is in proximity to our FDD site.
- 1.14. In section 3, we discuss that along with a minimum 5MHz guard band, we require proper out-of-band emissions and coordination requirements, to mitigate such interference concerns for high power use in the 1900-1915MHz band.

**Figure 2: Potential interference from high power use in 1900-1915MHz**



Source: Three UK

**Any low power use in 1915-1920MHz could interfere with our FDD uplink spectrum. Therefore, Ofcom should reserve the spectrum as a guard band.**

- 1.15. Ofcom's provisional conclusion is that 1915-1920MHz could be suitable for low power applications (e.g. ESN Gateway), subject to further consideration of coexistence with FDD mobile base station receivers above 1920MHz.
- 1.16. However, even low power use in 1915-1920MHz will likely cause interference to our adjacent uplink FDD 1920-1935MHz, especially when TDD equipment is located near to a Three UK site.

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1.17. To reach its conclusion, Ofcom appears to have mostly relied on CEPT<sup>5</sup> and ECC<sup>6</sup> reports that consider the coexistence of high power TDD mobile base station transmitters immediately adjacent to a FDD mobile base station receiver, mainly in the 2.6GHz band and in the 1900-1920MHz band. These reports state that:

- Either a 5MHz guard band is required, or a lower TDD power of 25dBm EIRP with additional front-end filtering is required to limit interference;
- For TDD mobile services in 1915-1920MHz, 25 dBm is the maximum power for coexistence with a FDD mobile station receiver above 1920MHz; and
- The out-of-block baseline EIRP should be set to -45dbm/MHz.

1.18. However, these reports also state that:

- All actions necessary to avoid implementing a guard band are associated with an increased level of complexity.
- Guard bands should be used in conjunction with other solutions such as front-end filters and restricted channels to limit interference.
- Interference from TDD mobile stations into FDD base stations may be severe, and can be mitigated by the use of guard bands along with additional front-end filters, restricted channels and deployment restrictions.

1.19. We explain below:

- The impact on our network as a result of interference from low power use in 1915-1920MHz.
- That it is not feasible to have consistent geographical separation between TDD and FDD equipment.
- That studies and international best practice show that a guard band is required between TDD and FDD frequency bands.

*Impact on our network as result of interference from low power use in 1915-1920MHz*

1.20. Our adjacent uplink 1920-1935MHz would be significantly impacted by the interference from low power use in 1915-1920MHz. According to ECC report 332<sup>7</sup>, there could be a 25% loss in mobile throughput as a result of interference between low power UAS (Unmanned Aircraft System) operating at 1917.5MHz (5MHz bandwidth) and Mobile/Fixed Communications Network (MFCN) operating above 1920MHz.

1.21. Figure 3 below shows an example of a drone that is controlled by a ground station (GS) user. In this case, the drone is operating at low power at 1917.5MHz and is close to a mobile site operating above 1920MHz.

1.22. Even with low power, two potential scenarios exist:

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<sup>5</sup> [Microsoft Word - CEPTRep019.doc](#)

<sup>6</sup> [Microsoft Word - ECCRep119.doc \(cept.org\)](#)

<sup>7</sup> [ECC Report 332 \(cept.org\)](#)

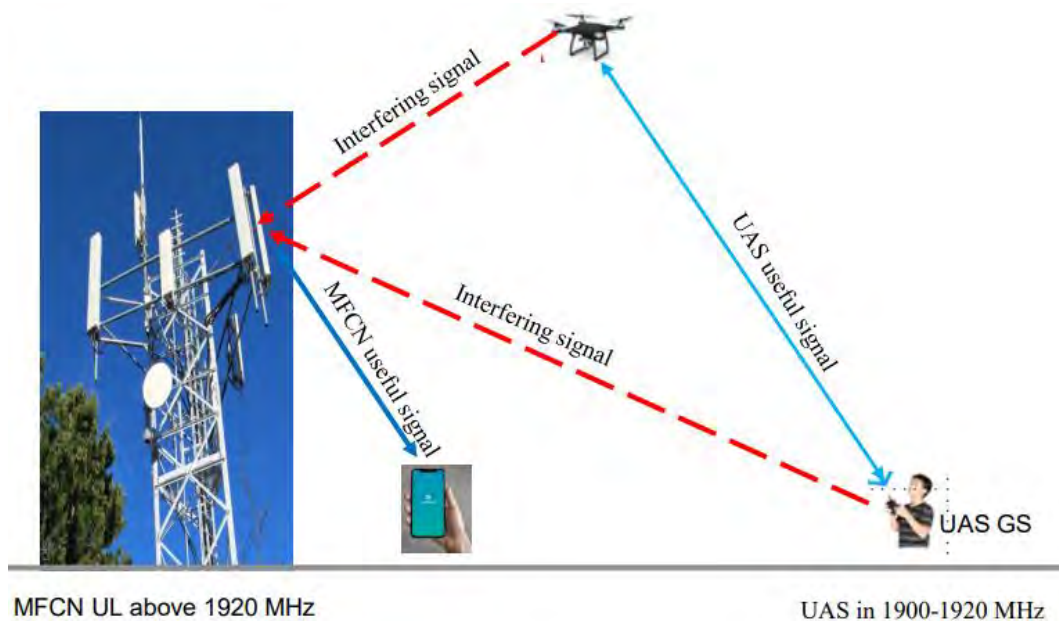


- Potential interference from a low power drone operating at 1917.5MHz (in the 1900-1920MHz band) to an uplink mobile base station operating above 1920MHz; and
- Potential interference from the GS user controlling the drone operating at 1917.5MHz (in the 1900-1920MHz band) to an uplink mobile base station operating above 1920MHz.

1.23. This possible interference can be mitigated by retaining at least a 5MHz guard band between the low power user and the adjacent FDD spectrum.

1.24. The example considers interference between drone use and mobile, however this can be generalised to any low power use of spectrum in the 1915-1920MHz range. We, therefore, reasonably expect a similar effect on our adjacent uplink band, if Ofcom grants licences for low power use in 1915-1920MHz (e.g. ESN Gateway).

**Figure 3: ECC’s co-existence analysis between UAS operating in 1900-1920MHz and MFCN operating above 1920MHz**



Source: ECC report 332<sup>8</sup>

*It is not feasible to have geographical separation*

1.25. According to a study by Real Wireless<sup>9</sup>, interference between TDD and an adjacent FDD band can still occur even with low power use, thus a geographic separation between TDD and FDD deployment is required.

<sup>8</sup> Figure 11, [ECC Report 332 \(ecpt.org\)](http://ecpt.org)

<sup>9</sup> [Microsoft Word - Final Report - Low Power Shared Access to mobile broadband spectrum v2.5 \(ofcom.org.uk\)](http://ofcom.org.uk)

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1.26. Ofcom considers that it should be feasible to deploy low power use in the 1915-1920MHz band, assuming mobile base station receivers above 1920MHz have sufficient selectivity or geographical separation.<sup>10</sup>

1.27. However, we do not consider this separation to be feasible for two reasons:

- Our adjacent 2100 FDD paired spectrum is used as a coverage band for mobile services and is widely deployed [3<]. This materially limits the areas where a new user of the spectrum would be able to operate today. [3<]<sup>11</sup>.
- Depending on the use case, we and/or Ofcom will not be able to control where alternative users of the 1915-1920MHz spectrum use it. Any low power use cases we are aware of require mobility (i.e. emergency vehicles moving around the country and deploying the ESN Gateway as they do). This mobility risks unacceptable repeated and unplanned interference with our FDD spectrum.

*Evidence from CEPT and international best practice shows that a guard band is required between TDD and FDD frequency bands*

1.28. There are CEPT reports which consider that a guard band is required between TDD and FDD frequency bands:

- According to CEPT report 19<sup>12</sup>, there should be a minimum of 5MHz between TDD and FDD carriers (for 1900 to 1920MHz). The report also states that (for 2.6GHz) a 5MHz guard block is necessary to handle the increased interference probability for the case where TDD frequency blocks are used directly adjacent to FDD-uplink frequency blocks.
- CEPT report 39<sup>13</sup> has stated that a guard band is required to be introduced between TDD and FDD networks below 1920MHz.

1.29. International evidence also supports our view that it is necessary to leave a guard band between adjacent TDD and FDD spectrum.

- In Europe, CEPT has harmonised the 1900-1910MHz band for Railway Mobile Radio (RMR). Our understanding is that 1910-1920MHz (10MHz) is used as a guard band to protect the adjacent 2100MHz band.
- Infocomm Media Development Authority of Singapore (IMDA)<sup>14</sup> has proposed a guard band between TDD 1900MHz and FDD 2100MHz and has intended to set aside 5MHz for this purpose.
- In the 700MHz band, Ofcom has set aside a 5MHz guard band between 700MHz SDL (downlink) spectrum and the uplink frequencies of the 700MHz paired spectrum.<sup>15</sup>
- In the 2.6GHz band Vodafone's TDD spectrum (2570-2595MHz) sits next to EE's 2.6GHz FDD spectrum (2640-2690 MHz downlink paired with 2520-2570MHz uplink). Although Vodafone owns 5MHz (2570-2575), our understanding is that its RAN vendor has advised that the 2570-2575MHz cannot be used for mobile, and it has to be set aside as a guard band to protect the uplink of the 2.6GHz paired spectrum.

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<sup>10</sup> [Ofcom 2100MHz unpaired consultation](#), para 3.13

<sup>11</sup> [3<].

<sup>12</sup> [Microsoft Word - CEPTRep019.doc](#)

<sup>13</sup> [Microsoft Word - CEPTRep039.doc](#), response by CEPT to the Mandate from European Commission issued in June 2009.

<sup>14</sup> [Microsoft Word - Consultation Paper for 800 MHz \(16May19\)\(final\).docx \(imda.gov.sg\)](#)

<sup>15</sup> Figure 2.1, [Statement: Award of the 700 MHz and 3.6-3.8 GHz spectrum bands \(ofcom.org.uk\)](#)

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## 2. Reallocating our 2100MHz TDD spectrum for other uses would not be consistent with Ofcom's duties and objectives.

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### Executive summary.

- 2.1. Our view, as set out in Section 1, is that our 5MHz of 2100MHz TDD spectrum can only be used as a guard band between 2100MHz TDD and FDD, to prevent interference. Once this use is determined, the question then becomes: who should hold the spectrum?
- 2.2. There are two options: (i) leave the spectrum in the hands of the current user; or (ii) Ofcom revokes the spectrum licence and reallocates it to another user.
- 2.3. Option (ii) would require an intrusive intervention by Ofcom, [X] with no benefit – the use of the spectrum would stay the same. We, therefore, cannot foresee a situation where such an intervention would be proportionate, objectively justifiable or targeted only at cases where action is needed.
- 2.4. If Ofcom disagrees that the spectrum must be used as a guard band or if, in the future, technological advancements remove the requirement for a guard band, our view is that Ofcom should rely on market mechanisms to reallocate the spectrum.
- 2.5. The barriers to liberalising and trading that Ofcom considers in the Consultation are not convincing:
  - Ofcom's view that changing the use of the spectrum could change the interference environment, affecting users of adjacent spectrum, is warranted. In fact, it is the exact reason why we argue for a guard band for our 5MHz block. Liberalisation and trading can only occur if there are sufficient technical advancements to remove this risk.
  - The incentives for us to strategically deny our 5MHz of spectrum to alternative, higher-value, users are indefensible. Firstly, the alternative uses of low power spectrum are unlikely to be in competition with us since we do not and are unlikely to provide these services in the future. Secondly, even if low power mobile use was a higher value use case, we would gain no competitive advantage from denying 5MHz of TDD spectrum (presumably with severe limitations on its geographic usage) to a competitor.

### The optimal use of our spectrum is for Three UK to retain it as a guard band.

- 2.6. We have shown in section 1 that the optimal (and only possible) use of our 5MHz is as a guard band. Any other use of the spectrum would incur material interference with our 2100MHz paired spectrum.

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- 2.7. The question then is who should hold the guard band spectrum? Should it be the existing licensee, Three, or should Ofcom reallocate it to a third party?
- 2.8. For Ofcom to reallocate our 5MHz of 2100MHz TDD spectrum, it would have to revoke our licence. As we set out in our response to Ofcom's mmWave Consultation and our Representations in response to Ofcom's notice of proposed revocation of our 40GHz spectrum, a decision to revoke mobile spectrum licences should not be taken lightly. It is a highly intrusive regulatory option which represents a dramatic departure from the value that Ofcom has historically put on market mechanisms to allocate spectrum efficiently.
- 2.9. Moreover, Ofcom's move towards taking a much more interventionist approach in the past year<sup>16</sup> has wider implications on mobile spectrum licensees' expectations of how Ofcom will treat their licences in the future. This will impact the confidence of the industry in our property rights, commercial security and investment incentives.<sup>17</sup> We have set out these arguments in our mmWave responses so do not repeat them in detail here.
- 2.10. Given the significant potential impact of revoking spectrum licences, Ofcom should ensure that such a decision clears a very high evidentiary bar. Ofcom's statutory obligations set out in the Wireless Telegraphy Act and Communications Act aim to do this, by requiring that a decision to revoke a spectrum licence on 'spectrum management' grounds is:
- Objectively justified; and
  - Proportionate and targeted only at cases where action is needed.
- 2.11. When assessing the proportionality of different measures to achieve the desired objectives in other cases, Ofcom has also considered the following principles:<sup>18</sup>
- The measure must be effective in achieving Ofcom's aims;
  - The measure must be no more onerous than is required to achieve those aims;
  - The measure must be the least onerous if there is a choice of equally effective measures; and
  - The measure must not produce adverse effects which are disproportionate to the aims pursued.
- 2.12. Ofcom must act in accordance with its statutory duties and general legal principles, including the duties to act reasonably and rationally when making decisions and to take account of any legitimate expectations. Our view is that Ofcom's proposals to revoke our 2100MHz TDD spectrum fail these tests.
- 2.13. In view of the above, Ofcom's intervention should be the minimum necessary to achieve its desired objectives effectively. We do not believe this is the case, and a more proportionate approach would be to leave the licence in our hands. This would:
- A. **Result in the same outcome.** Ofcom revoking our spectrum licence and reallocating it for another user to hold as a guard band would result in exactly the same outcome as today.

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<sup>16</sup> Where is has proposed to revoke licences in two spectrum bands for 'spectrum management reasons' having never previously done so.

<sup>17</sup> [Three \(ofcom.org.uk\)](https://www.ofcom.gov.uk)

<sup>18</sup> [Statement: Award of the 700 MHz and 3.6-3.8 GHz spectrum bands \(ofcom.org.uk\)](https://www.ofcom.gov.uk)

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B. **Be less interventionist.** Ofcom's stated principles require that the measure must be no less onerous than is required to achieve its objectives and be the least onerous if there is a choice of equally effective measures. Clearly, the least interventionist and onerous means by which Ofcom can achieve the optimal use of the spectrum (as a guard band) will be leave to it in the hands of the existing licensee. Anything else would require more intervention with no additional benefit (as per A).

C. **Avoid adverse outcomes.** [X]<sup>19</sup>.

As we discuss above, there are additional adverse outcomes which would impact the industry more widely (such as the impact on expectations and investment incentives) which Ofcom also needs to bear in mind when revoking licences from existing licensees.

2.14. Based on this assessment, it is clear to us that a decision by Ofcom to revoke and reallocate our 5MHz of 2100MHz TDD spectrum would risk imposing large costs on us and industry<sup>20</sup> without having any incremental benefit. We can, therefore, not foresee a situation where a decision to revoke and reallocate the spectrum was consistent with Ofcom's duties to ensure that a decision to revoke licences on 'spectrum management' grounds be proportionate, objectively justifiable and targeted only at cases where action is needed, so long as the optimal use of the spectrum is as a guard band.

**Reallocation may only be relevant in a hypothetical future where technical advancements allowed the use of our 5MHz for something other than a guard band.**

2.15. The evidence we have presented above shows that our 5MHz of TDD spectrum must be used as a guard band. There are no higher value users of the spectrum, since alternative use of the band would result in material interference into our 2100MHz FDD spectrum.

2.16. However, there could be a hypothetical future where significant technical advancements (e.g. to filters) allowed low power use of the spectrum alongside our FDD holding without risking interference. It is clear though, that we are not there today and the spectrum must currently stay as a guard band.

2.17. In that scenario, or if Ofcom disagrees with our assessment in Section 1, it may then consider whether the band needs to be reallocated for other uses. In doing so, it would face the question of whether to rely on market mechanisms to reallocate the spectrum, or resort to intervening by revoking spectrum licences and manually reallocating the spectrum.

2.18. As we have presented in response to Ofcom's mmWave Consultation and our Representations in response to its notice of proposed revocation, we believe that Ofcom has been too quick to dismiss market mechanisms such as trading or leasing. This also holds for the 2100MHz TDD band.

2.19. Spectrum trading and leasing allow for the release of spectrum to those that value it the most, resulting in the most efficient allocation of spectrum. Ofcom has previously recognised that the spectrum trading regime *'is an important part of the*

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<sup>19</sup> [X]

<sup>20</sup> Through the impact on investment incentives and expectations.

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*regulatory regime for spectrum, as it enables licensees, rather than only the regulator, to play a part in deciding what the efficient allocation of spectrum is'.<sup>21</sup>*

2.20. In its Consultation, Ofcom presents two categories of concern regarding liberalising 2100MHz TDD licences and relying on trading:

- i. Potential interference issues due to a change in use; and
- ii. Strategic incentives for existing licensees to hold-out on trades.

2.21. We consider each in turn in a hypothetical future where there are potential alternative, and higher-value, use cases than using our 5MHz as a guard band.

2.22. In this scenario, there would not be the interference issues Ofcom identifies under (i) since the spectrum would only be re-purposed if coexistence conditions allowed (which they do not today).

2.23. In our response to Ofcom's mmWave consultation<sup>22</sup>, we made it clear that MNOs have no strategic reason to refrain from trading with a partner that has a greater value for the spectrum since the costs<sup>23</sup> of doing so would be high and the payoffs uncertain. This also applies to 2100MHz spectrum.

2.24. Furthermore, in relation to our 2100MHz unpaired holding, the potential future payoffs to us of denying the spectrum to other users would essentially be non-existent:

- **Mobile services.** It is highly unlikely that another MNO would be a higher-value user of the spectrum, since they would have no use for it. We cannot foresee a case, even in the future, where the spectrum would be available for medium or high-power mobile use given the potential for it to interfere with adjacent FDD spectrum. If another MNO does not value the spectrum, or has a very low valuation, there will be no benefit to us of denying them access to it if they (for whatever reason) offer a sum which exceeds our value.<sup>24</sup>
- **Non-mobile services.** Ofcom indicates that our 5MHz could be used for low power use cases (such as the ESN Gateway). These services do not compete against the services we offer, so we would have no strategic value in denying them to other users since we would retain no competitive advantage from doing so.

2.25. Ofcom also considers that we may be reluctant to trade our unpaired spectrum 'given its proximity to [our] 2100MHz paired uplink spectrum'.<sup>25</sup> We agree a trade of this spectrum would not take place today, because the spectrum is required as a guard band to protect our adjacent FDD spectrum and allocating it to another user would be pointless since they would not be able to use it.<sup>26</sup> However, we see no technical reason why this would remain the case in a future scenario where the guard band was no longer required.

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<sup>21</sup> [https://www.ofcom.org.uk/data/assets/pdf\\_file/0020/192413/statement-award-700mhz-3.6-3.8ghz-spectrum.pdf](https://www.ofcom.org.uk/data/assets/pdf_file/0020/192413/statement-award-700mhz-3.6-3.8ghz-spectrum.pdf)

<sup>22</sup> [Three \(ofcom.org.uk\)](https://www.ofcom.org.uk/consult/condocs/three/three.pdf)

<sup>23</sup> The opportunity costs of foregone revenues from trading and any ALFs that Ofcom chose to impose on the band (once it determined that there was excess demand for it).

<sup>24</sup> Even if such uses were possible, the size of the spectrum holding (just 5MHz) and the fact that it was TDD spectrum would mean that we would gain no competitive advantage from denying it to an MNO which valued it higher than us.

<sup>25</sup> Consultation, 3.42(c).

<sup>26</sup> And, therefore, have no value for it.



# 3. We ask Ofcom to put in place a coordination process and appropriate OOB limits for any new users of the unpaired 2100MHz spectrum.

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## Executive Summary.

- 3.1. If Ofcom disagrees with our assessment of the optimal (and only) use of our 2100MHz TDD spectrum, it must take alternative steps to protect our 2100MHz FDD spectrum from interference. This interference will come from high power use in the 1900-1915MHz range and low power use in 1915-1920MHz.
- 3.2. In our view, the minimum requirements on new users in the 1900-1920MHz band must be for them to:
  - Adhere to strict out of band emission limits of at least -54dbm/5MHz for use in the 1915-1920MHz range and -52dBm/5MHz in the 1900-1915MHz range.
  - Share and coordinate their frequency plans with us in advance of any deployment, with us retaining veto rights.
  - Share and coordinate base station and antenna location in advance of any deployment, with us retaining veto rights.
  - Immediately switch off any equipment if we experience interference between it and our 2100MHz FDD spectrum.
- 3.3. Although these requirements should help to reduce coexistence issues, only the retention of our 5MHz as a guard band (alongside these) would fully mitigate the risk.

**If Ofcom disagrees with us and grants licences for low power use in 1915-1920MHz, we ask Ofcom to put in place a strict coordination process and enforce an appropriate out-of-band emission (OOB) limit.**

- 3.4. We have set out above that using our 2100MHz TDD spectrum as a guard band is its optimal use, given the risk of:
  - Alternative low power users within the band interfering with our FDD spectrum; and
  - High power users in 1900-1915MHz also interfering with our spectrum.
- 3.5. If Ofcom believes that there is a different optimal use for our 5MHz, despite the evidence we have provided, it must ensure that proper coexistence requirements are put in place to protect the service we provide in our 2100MHz FDD spectrum. Ofcom would also need to enforce an appropriate out-of-band emissions limit in 1915-1920MHz.

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- 3.6. If new users in the 1915-1920MHz range deploy in an area without coordinating with us, and if their TDD downlink interferes with our adjacent FDD uplink, there will be significant interference between both networks, even though they operate in adjacent channels.
- 3.7. Unsynchronized operation would only work if the networks have large geographic separation. As stated in section 1, maintaining a large geographic separation will not be possible given the extent of our 2100MHz FDD rollout and mobility of alternative use cases. This places significant demand on site engineering and co-operation between adjacent channel licensees if interference is to be avoided. As a result, to mitigate interference, new TDD licence holders must be required to coordinate their deployments with existing adjacent FDD licensees.
- 3.8. We ask that, if it does reallocate our 1915-1920MHz spectrum, Ofcom implements a process that would require any deployment in the 1915-1920MHz band to coordinate with us, and that new users coordinate with us on the following:
- **Frequency planning:** The adjacent TDD licensee must share and coordinate their frequency plans with us, as this will ensure that there is sufficient frequency separation between carriers used by different systems (FDD and TDD). This would help mitigate adjacent channel interference.
  - **Base station and antenna location:** Adjacent TDD licensees must coordinate their equipment deployments since interference could occur if it is close to our FDD site. We must retain veto rights if we consider that a base station deployment will interfere with our FDD spectrum.
  - **Interference mitigation:** Adjacent TDD licensees must immediately switch off their equipment if it interferes with equipment operating in our adjacent FDD spectrum.
- 3.9. We would also ask Ofcom to set the out-of-band emission limit for new licence holders in the 1915-1920MHz range at a minimum of -54dbm/5MHz.
- 3.10. Our view is that the above process is unlikely to be compatible with new low power users in the 1915-1920MHz band and is still likely to risk causing significant interference into our FDD spectrum without a guard band in place. However, if Ofcom disagrees, then our view is that this is the absolute minimum required to partially mitigate against coexistence issues.

**We ask Ofcom to put in place a coordination process for high power users in 1900-1915MHz**

- 3.11. Our coexistence analysis shows that, even with a 5MHz guard band in place, there is still a risk of interference from high power usage in 1900-1915MHz into our FDD spectrum. This is particularly likely if the new users of the licence do not coordinate with us and Ofcom does not set the correct out-of-band emission for the new users.
- 3.12. As a result, we ask Ofcom to put in place proper coexistence requirements as set out above and set the restricted out-of-band emission for new licence holders in the 1900-1915MHz as -52dBm/5MHz per cell. This is the same out-of-band emission



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that is now used in the 2.6GHz TDD licence, which was adopted by Ofcom based on a CEPT recommendation<sup>27</sup>.

- 3.13. The ECC and Ireland have also enforced -45 dBm/MHz (which translates to -52dBm/5MHz) as the out-of-band emission to protect the uplink of 2.6GHz paired spectrum. We see no reason for Ofcom to deviate from that approach in the 2100MHz band.

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<sup>27</sup> [New ECC Report Style \(cept.org\)](http://www.cept.org)