Virgin Media O2 response to Ofcom consultation:

Expanding access to the 6 GHz band for mobile and Wi-Fi services

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Proposals for AFC in Lower 6 GHz and mobile / Wi-Fi sharing in Upper 6 GHz

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INTRODUCTION

Virgin Media O2 (VMO2) welcomes the opportunity to respond to Ofcom's consultation on Expanding access to the 6 GHz band for mobile and Wi-Fi services: Proposals for AFC (Automated Frequency Coordination) in Lower 6 GHz and mobile / Wi-Fi sharing in Upper 6 GHz.[1]

The upper 6 GHz band has the potential to deliver significant and widespread benefits, supporting the UK's economic growth. It is therefore important that Ofcom does not make precipitate decisions i.e. before there is clarity on European harmonisation of the band, that would create an otherwise avoidable risk of limiting the benefits that the band can deliver and leaving the UK at a disadvantage to other countries.

EXECUTIVE SUMMARY

VMO2 believes that a balanced approach should be taken to allocation of usage rights across the 6 GHz band. As a converged operator, we have a clear interest in ensuring that our customers continue to receive the best and most reliable mobile service, as well as benefitting from our gigabit broadband connectivity when carried over Wi-Fi attached to our gigabit fixed network. Consequently, our views of the balance of demand could be seen as a litmus test.

We agree with Ofcom's proposal to enable standard power Wi-Fi (up to 4 Watts) to operate in the lower 6 GHz band, under the control of an AFC database. Whilst we have no specific interest in outdoor Wi-Fi deployments, we support standard power and AFC for indoor deployments. As the lower 6 GHz band has already been harmonised for Wi-Fi use at the European level, Ofcom's proposal to allow standard power Wi-Fi does not raise any concerns over limiting the bands future use.

We do not agree with Ofcom's proposal for Phase 1, to authorise Wi-Fi use across the entire 6 GHz band by extending access into upper 6 GHz as early as feasible, and before there is clarity on European harmonisation. It would be an unnecessary and isolating UK-only approach that carries risk of causing detrimental impact to the band, limiting its potential for future mobile use and leaving the UK at a disadvantage compared to other countries in Europe.

The UK and Europe have a shared objective to increase growth and prosperity. This can be achieved by ensuring an investment friendly environment which provides certainty and minimises regulatory burden, whilst integrating a broader industrial policy outlook. Working

[1] Consultation: Expanding access to the 6 GHz band for commercial mobile and Wi-Fi services

closely with strategic partners in Europe is crucial, especially in times of global geopolitical uncertainty. The UK should seek to align, to the extent possible, with European harmonisation involving products and services, including those enabled by spectrum. Ofcom correctly highlights that European harmonisation is important for providing the certainty needed for manufacturers, operators and users, to invest in equipment and services for the band.

A divergent UK approach would create uncertainty and risks negatively impacting both manufacturers and operators investment incentives, reducing economies of scale and ultimately increasing cost per unit, limiting operators appetite to invest in their networks.

Ofcom's proposal poses a significant and otherwise avoidable risk of creating problems not only for Ofcom but for mobile operators by polluting the band with an unknown number of devices raising the noise floor, and as a result, devaluing the spectrum for mobile use, at a time when European harmonisation may well allocate this part of the band to mobile.

Once unlicensed Wi-Fi equipment is operating in the upper 6 GHz band, it will be a significant challenge to stop it from transmitting. Legacy devices would either not have the capability to cease transmitting, or not have the required features implemented to enable effective mitigation of the risk of causing co-channel interference into mobile use of the band.

We do not agree with Ofcom's suggestions to manage legacy Wi-Fi devices that would be transmitting in the scenario of a European harmonisation decision to either authorise the band for mobile use only, or implement a prioritised band split and/or a technology-based sharing solution such as enhanced sensing. Ofcom's suggestions seek to rely on capabilities and features that have not yet been fully developed, nor proven to work successfully in a real-world setting without degrading user experience for either Wi-Fi or mobile use, and are not agreed or standardised, as the European harmonisation process has not concluded. Furthermore, an enhanced sensing mechanism, that either requires mobile to broadcast a specific (Wi-Fi-like) beacon signal; or Wi-Fi sensing an existing mobile control signal, would need changes to IEEE and 3GPP standards before development, and to be introduced in the standards there would need to be support from the manufacturers of both types of equipment.

There is no conclusive evidence yet that sharing in the upper 6 GHz band would offer net benefits over exclusive use by a single service. We also do not believe that the approach suggested by Ofcom complies with its duties with regard to the efficient management of spectrum, quite the opposite in fact. We therefore urge Ofcom not to draw conclusions or take decisions prematurely that prejudge the outcome of European harmonisation decisions or risk leading to a degraded user experience, limiting the benefits that the band can deliver.

The risk of failure is particularly serious due to the sizeable amount of spectrum available in the upper 6 GHz band which can be used to deliver widespread and significant benefits for

the UK. Ofcom should avoid creating unnecessary risk and problems by simply pausing and waiting for clarity on European harmonisation.

Our analysis of the needs of both Wi-Fi and mobile, along with consideration of existing spectrum utilisation, leads us to the view that there is currently sufficient spectrum allocated for Wi-Fi use. We believe that the upper 6 GHz band should be prioritised for high power mobile use, subject to European harmonisation, and an appropriate and timely award process with the opportunity for operators to acquire 200 MHz carriers. This will enable MNOs to invest in capacity improvement, alleviate the growing problem of congestion, enhance 5G, and provide the foundation for the next generation of mobile services to support the UK's economic growth.

MAIN RESPONSE

VMO2 IS A CONVERGED OPERATOR WITH AN INTEREST IN BOTH WI-FI AND MOBILE

As we highlighted in our response to Ofcom's 2023 consultation on Hybrid sharing in the upper 6 GHz band[2], VMO2 is a converged operator, combining Virgin Media's fully gigabit broadband network with O2's nationwide mobile network. Our fixed broadband network covers more than 18 million UK homes and is currently being upgraded to full fibre to the premises. Our mobile network supports over 45 million connections, and we provide 5G outdoor coverage to over 75% of the UK population. Our 5G rollout continues at pace, in line with the UK Government's Wireless Infrastructure Strategy ambition to have 5G Standalone coverage in all populated areas by 2030.

As a converged operator offering high quality 5G mobile services as well as fixed broadband with speeds of up to 2 Gbps, with a significant amount of our fixed broadband traffic carried over in-home Wi-Fi, we have a clear interest in ensuring that our customers continue to receive the best services over mobile and Wi-Fi and benefit from gigabit broadband connectivity, both now and in the future. Our multibillion-pound investments in both fixed and mobile technologies, means that we must take a balanced approach to these services as we are incentivised to ensure that there is capacity available to meet the growth in demand for both.

Our analysis of the needs of Wi-Fi, together with the fact that the lower 6 GHz band was allocated for Wi-Fi use in 2020, but is still seeing a low rate of utilisation, leads us to the view that there is currently sufficient spectrum allocated for Wi-Fi use to enable it to continue to deliver high quality multi-gigabit services to consumers and businesses.

Our analysis of the needs of mobile, leads us to the view that the upper 6 GHz band should be prioritised for mobile use, subject to European harmonisation, and an appropriate and timely award process. Doing so will enable MNOs to invest in capacity improvement, alleviate the growing problem of congestion, enhance 5G, and provide the foundation for the next generation of mobile services to support the UK's economic growth.

OFCOM SHOULD WAIT FOR CLARITY ON EUROPEAN HARMONISATION

Ofcom's proposal to authorise Wi-Fi use in the upper 6 GHz as early as feasible, and before there is clarity on European harmonisation of the band, risks a situation whereby unlicensed Wi-Fi equipment would be operating in the band, and it will be a difficult, or in some cases, impossible challenge to stop devices from transmitting. Legacy Wi-Fi devices would either not have the capability to cease transmitting, or will not have implemented the required

[2] VMO2 response to Hybrid wait: enabling both licensed mobile and Wi-Fi users to access the upper 6 GHz band

features to enable effective mitigation of the risk of causing co-channel interference into mobile use of the band.

The risk of polluting the upper 6 GHz band is, however, easily avoidable if Ofcom simply pauses and waits for clarity on harmonisation at the European level and then aligns appropriately. Proceeding with Phase 1, as proposed, would risk failing to deliver the level of ambition and services that the UK will expect and leave it at a disadvantage relative to countries which prioritise the upper 6 GHz band for licensed mobile use and protect it from being limited in its future use and the benefits that it can deliver.

Ofcom has stated that it is commitment to a thriving telecoms sector. It therefore has a role as market facilitator, in addition to its duties in relation to spectrum management and its work to prevent harmful interference. We are therefore surprised by Ofcom's high-risk proposal to authorise Wi-Fi use in the upper 6 GHz band before there is clarity on European harmonisation, before the conclusion of studies on the feasibility of potential sharing between Wi-Fi and mobile in the band, and before there is agreement on whether sharing can take place without causing a detrimental impact to user experience.

Ofcom's proposals appear to pre-judge the outcome of ongoing discussions and studies on potential sharing of the band between Wi-Fi and mobile. Ofcom seeks to rely on capabilities and features that have not yet been fully developed, nor proven to work successfully without degrading end user experience for either Wi-Fi or mobile use, and have not been agreed and standardised as the European harmonisation process has not yet concluded.

We are concerned that Ofcom's approach and proposals are not consistent with its stated intention to align with European harmonisation. Harmonisation is instrumental for UK growth, enabling operators to invest with confidence as well as innovate, delivering benefits to consumers and businesses. On the one hand, Ofcom is seeking to 'pioneer' sharing in the upper 6 GHz band by taking decisions ahead of the rest of Europe, whilst on the other hand, Ofcom says it intends to align with European harmonisation. Ofcom's current proposal to enable Phase 1 access for Wi-Fi across the entire 6 GHz band as early as feasible, and before European harmonisation, is at odds with the rest of Europe. If Ofcom were to take decisions ahead of Europe, it risks creating problems that will leave the UK at a disadvantage and result in a failure to deliver optimal use of the spectrum.

OFCOM SHOULD PRIORITISE THE UPPER 6 GHZ BAND FOR MOBILE USE, SUBJECT TO EUROPEAN HARMONISATION

As we have consistently made clear to Ofcom, existing mid-band spectrum available to MNOs will be quickly absorbed over the next few years, even with mobile traffic growth recently slowing, compared to previous years, it is still growing significantly. This traffic growth is already resulting in congestion across areas of high demand, resulting in a continued

deteriorating impact on customer experience. MNOs have forecasted that by 2030, existing capacity will become exhausted on a significant number of their sites. VMO2 has provided detailed evidence directly to Ofcom to support this, demonstrating that a growing number of sites that have all available mobile spectrum bands deployed, will be unable to satisfy demand, resulting in congestion and impacting customer experience.

Whilst VMO2 continues to densify its network and add small cells in areas of high demand in an attempt to address this issue, densification has practical, technical and economic limits. We will not be able to practically deliver, nor commercially justify, mass densification, as it would involve limitations on inter-site distance, access to suitable sites locations, and incur prohibitively high costs as well as result in detrimental environmental impact, working against our net-zero ambitions.

The upper 6 GHz band offers a unique and effective solution to the growing capacity problem. It can be deployed on existing macro sites on a high-power basis in a similar way to 3.4-3.8 GHz spectrum, serving as an efficient way to provide the additional capacity required to meet the continued growth in demand. It represents the only viable solution for MNOs to mitigate congestion and provide high-quality mobile services across wide areas, where the deployment of mmWave spectrum and mass densification will not be practically, technically or economically feasible.

VMO2 is of the view that the upper 6 GHz band should be prioritised for mobile use, subject to European harmonisation, and an appropriate and timely award process. Doing so will enable MNOs to invest in capacity improvement, alleviate the growing problem of congestion, enhance 5G, and provide the foundation for the next generation of mobile services to support the UK's economic growth.

Ofcom should ensure that there is enough spectrum prioritised for high power mobile use (>80 dBm/100 MHz EIRP) to provide the opportunity for operators to acquire 200 MHz carriers. This means a minimum of 600 MHz needs to be prioritised and made available for high power mobile use in the UK.

Whilst neither VMO2, nor Ofcom, can predict the future, we should both be guided by evidence. We note that in 2022, Ofcom highlighted that Wi-Fi has access to three different spectrum bands: 2.4 GHz, 5 GHz and the lower 6 GHz band, comprising a total of 1169 MHz, and at the time, there was not a significant amount of traffic being carried over the band as it had only been made available for use in 2020[3]. However, in 2024, data provided by Ookla and analysed by GSMA, shows that in London, the lower 6 GHz band was still only used by 2%

[3] s2.30 Update on the upper 6 GHz band

of Wi-Fi connections[4]. This low rate of utilisation, together with our analysis of the expected needs of Wi-Fi, leads us to conclude that there is currently sufficient spectrum allocated for Wi-Fi use to enable it to continue to deliver high quality services to consumers and businesses.

VMO2 believes that Ofcom has not presented a firm evidence-based case to support its proposal to allow Wi-Fi use in the upper 6 GHz band as early as feasible, ideally before end 2025, and before there is clarity on European harmonisation. Furthermore, we observe that Ofcom's calculations on Annual Licence Fees (ALFs) are showing that mobile spectrum values are rising, rather than declining, so we struggle to see how it can substantiate a position that says Wi-Fi may now be more valuable than mobile at the margin.

Proceeding on the basis of the proposals set out in the consultation would be a case of Ofcom 'jumping the gun' and putting the UK at odds with all other European counties who are waiting for the harmonisation decision. This poses a serious risk of causing detrimental impact to the band, devaluing the spectrum, limiting its potential for future mobile use, leaving the UK at a disadvantage compared to other countries.

The UK and Europe have a shared objective to increase growth and prosperity. This can be achieved by ensuring an investment friendly environment which provides certainty and minimises regulatory burden, whilst integrating a broader industrial policy outlook. Working closely with strategic partners in Europe is crucial, especially in times of global geopolitical uncertainty. The UK should seek to align, to the extent possible, with European harmonisation. Ofcom correctly highlights that European harmonisation is important for providing the certainty needed for manufacturers, operators and users, to invest in equipment and services for the band.

[4] https://www.gsma.com/connectivity-for-good/spectrum/wp-content/uploads/2024/09/GSMA_Mobile-Evolution-in-6-GHz.pdf

RESPONSE TO SPECIFIC QUESTIONS

Question 1: What interest do you have in deploying outdoor or standard power Wi-Fi or other licence exempt RLANs in the Lower 6 GHz band? Please provide details of the types of expected deployments?

We have no specific interest in deploying outdoor Wi-Fi in the lower 6 GHz band. We note that in 2022, CEPT opened a work item to study higher power outdoor Wi-Fi, however, the work item has not progressed due to apparent lack of interest from industry. We understand that as a result, consideration will be given to whether to close the work item.

VMO2 operates a national gigabit broadband network covering more than 18 million UK homes and we offer products with speeds of up to 2 Gbps. With a large proportion of our fixed broadband traffic carried over in-home Wi-Fi, we have an interest in ensuring that our customers can benefit from gigabit broadband connectivity and continue to receive the best possible service. We have an interest in using standard power Wi-Fi for indoor routers in the lower 6 GHz band. We anticipate establishing a power spectral density of 5 dBm/MHz and a cap of 30 dBm for 320 MHz, aligning with the regulation authorised by the FCC in the USA.

Question 2: Are you interested in providing or developing AFC databases for use in the Lower 6 GHz band in the UK?

No.

Question 3: Do you have any views on the operational considerations of setting up and running AFC databases?

No.

Question 4: Do you have any views on how we should manage the approval process for AFC databases and, in particular, whether we should rely on parts of the FCC process rather than requiring the whole process to be re-run in the UK?

We expect there to be efficiency benefits and cost savings from Ofcom relying on parts of the FCC process that are well-established and have been proven to work successfully, rather than requiring the whole process to be re-run in the UK.

Question 5: Please provide any other comments on our proposals for extending access to standard power Wi-Fi and outdoor use, including the overall approach, any details on technical parameters and the running of the AFC databases in this band.

VMO2 supports Ofcom's proposal to enable standard power Wi-Fi (up to 4 Watts) to operate in the lower 6 GHz band, under the control of an AFC database. As the lower 6 GHz band has already been harmonised for Wi-Fi use at the European level, Ofcom's proposal to allow standard power Wi-Fi does not raise any concerns over limiting the bands future use.

Question 6: Do you have any comments on our proposal to use a "phased" approach, or on the alternative to wait for European harmonisation?

VMO2 disagrees with Ofcom's proposal to use a phased approach, as set out in the consultation. We are of the firm view that the best course of action is for Ofcom to wait until there is clarity on European harmonisation, before making authorisation decisions on use of the upper 6 GHz band.

The UK and Europe have a shared objective to increase growth and prosperity. This can be achieved by ensuring an investment friendly environment which provides certainty and minimises regulatory burden, whilst integrating a broader industrial policy outlook. Working closely with strategic partners in Europe is crucial, especially in times of global geopolitical uncertainty. The UK should seek to align to the extent possible with European harmonisation involving products and services, including those enabled by spectrum. Ofcom correctly highlights that European harmonisation is important for providing the certainty needed for manufacturers, operators and users, to invest in equipment and services for the band.

A divergent UK approach would create uncertainty and risks negatively impacting both manufacturers and operators investment incentives, reducing economies of scale and ultimately increasing cost per unit, limiting operators appetite to invest in their networks.

Ofcom's proposal for Phase 1, which seeks to authorise low power indoor Wi-Fi use across the entire 6 GHz band by extending Wi-Fi access into the upper 6 GHz as early as feasible, and before European harmonisation, is unnecessary and carries risk of causing detrimental impact to the band and limiting its potential for future mobile use and the benefits that can be delivered.

Ofcom's proposal for Phase 1 would allow Wi-Fi devices, including legacy devices, to use the upper 6 GHz band before there is clarity on European harmonisation on its future use, and despite the decision made at WRC-23 to identify the upper 6 GHz band for IMT i.e. mobile use. If Ofcom were to proceed on this basis and the subsequent European harmonisation decision was to authorise the upper 6 GHz band for mobile use only, or to implement a prioritised band split and/or technology-based sharing solution, Ofcom, depending on its ability to prevent Wi-Fi devices from transmitting and its willingness to enforce the rights of mobile licensees in the band, risks having to attempt to manage a band with an unknown amount of devices that would either not have the capability to cease transmitting, or not have the required features implemented to enable effective mitigation of co-channel interference into mobile use of the band.

In a sharing scenario, Wi-Fi devices may not be able to reliably detect the presence of mobile coverage indoors in the band, so would not switch to using the lower 6 GHz band or a different channel. Their continued operation in the upper 6 GHz band whilst being exposed to interference from mobile base stations and/or nearby mobile devices also transmitting in the

band, risks degrading the Wi-Fi experience for end users. This would result in an expected high quality Wi-Fi service, instead being unpredictable in terms of performance. Furthermore, Wi-Fi access points that are unable to reliably detect the presence of mobile usage in the band, would continue transmitting and create interference to the mobile service, negatively impacting the performance and capacity of the mobile network and degrading end user experience.

As Ofcom will recall from previous experience of attempting to remove licence exempt use of the 888-889 MHz spectrum by anti-theft devices, once unlicensed devices are operating in a band and a change of use of that band is attempted, the presence of these devices creates problems and has led to lengthy, resource intensive and costly interference investigations. Ofcom's proposal poses a significant and otherwise avoidable risk of creating problems not only for Ofcom but for operators by polluting the band with an unknown number of devices raising the noise floor and as a result, devaluing the spectrum for mobile use, at a time when European harmonisation may well allocate this part of the band to mobile. The risk is particularly serious due to the sizeable amount of spectrum available in the upper 6 GHz band which can be used to deliver widespread and significant benefits for the UK.

VMO2 believes that Ofcom has not presented a firm evidence-based case to support its proposal to allow Wi-Fi use in the upper 6 GHz band as early as feasible, and ideally before end 2025. Proceeding with Phase 1 on this basis and before there is clarity on European harmonisation of the upper 6 GHz band, would be 'jumping the gun' and put Ofcom at odds with all other European counties who are waiting for the harmonisation decision.

VMO2 urges Ofcom not to proceed with Phase 1 as proposed. The sensible course of action is to pause and wait for clarity on European harmonisation before making authorisation decisions on the use of the upper 6 GHz band.

Question 7: Do you have any comments on the above suggestion to manage any "legacy" Wi-Fi devices, or alternative suggestions?

As we have outlined above, it is within Ofcom's control to avoid the scenario of legacy Wi-Fi devices polluting and preventing optimal future use of the upper 6 GHz band. We do not see the need for Ofcom to rush ahead and authorise Wi-Fi use of the upper 6 GHz band before there is clarity on European harmonisation. The best way to avoid a problem is to not create it in the first place. Simply pausing until there is clarity on European harmonisation will align Ofcom with all other European countries, preserve the integrity of the band and provide the best chance of delivering optimal use of the spectrum.

Once unlicensed Wi-Fi equipment is operating in the upper 6 GHz band, it will be a significant challenge to stop it from transmitting. Legacy devices would either not have the capability to cease transmitting, or not have the required features implemented to enable effective mitigation of the risk of them causing co-channel interference into mobile use of the band.

We do not agree with Ofcom's suggestions to manage legacy Wi-Fi devices that would be transmitting following a European harmonisation decision to either authorise the band for mobile use only, or implement a prioritised band split and/or a technology-based sharing solution. Ofcom's suggestions seek to rely on capabilities and features that have not yet been fully developed, nor proven to work successfully without degrading user experience for either Wi-Fi or mobile use, and are not agreed or standardised, as the European harmonisation process has not yet concluded. As Ofcom has highlighted itself, authorising Wi-Fi devices to use the band before there is clarity on European harmonisation, means that those devices may not have implemented some features agreed as part of the harmonisation process that could help reduce the risk of interference with future mobile use of the band.

Ofcom's consideration that the outcome of the European harmonisation process may lead to a need to improve Wi-Fi access points' ability to sense mobile signals to enable Wi-Fi access to the mobile priority part of a band in the scenario of a prioritised spectrum split option, highlights two examples of how such improved sensing could be implemented. This could either be by requiring mobile to broadcast a specific Wi-Fi-like beacon signal; or by Wi-Fi sensing an existing mobile control signal. Ofcom highlights that in both cases, it may mean changes would be needed to the software or hardware of Wi-Fi access points. This means that legacy devices requiring hardware updates will not be able to be implement the improved sensing. Ofcom's powers to exempt equipment from the requirement to be licenced, only apply where its use would not cause undue interference. We struggle to see how this aligns with Ofcom's proposal to allow Wi-Fi devices to transmit in the upper 6 GHz without them first having implemented any required features to enable effective mitigation of the risk of interference into future mobile use of the band.

When considering sharing in the form of either an indoor/outdoor split for Wi-Fi and mobile, or a prioritised band split, which would require a technology-based sensing mechanism, of the two possible methods to implement improved sensing, Ofcom states that it has a strong preference for requiring mobile to broadcast a Wi-Fi-like beacon and that it will advocate for this in European harmonisation discussions. This seem to be a case of the tail wagging the dog. Ofcom appears to use its stated preference and view that it makes more sense to be implemented in thousands of mobile base stations than requiring significant changes in many more access points for Wi-Fi to decode mobile control signals, as a way of supporting its view that legacy Wi-Fi devices can be successfully managed as they are likely to only need a software upgrade. This does not address the scenario whereby implementation of improved sensing would be done by Wi-Fi sensing an existing mobile control signal. In this scenario, it is not possible to rely on the suggestion that such capability could be achieved through a software update.

Ofcom says it believes there should be limited risk from deploying Wi-Fi access points without additional sensing, because the likelihood of interference in practice should only become material in much later stages of adoption, when demand and deployment of both services is

extensive. VMO2 finds this approach and reasoning concerning. Ofcom hypothesises that the overlap in time between the use of legacy Wi-Fi devices and mobile rollout should be short, as it expects the adoption of the upper 6 GHz band for both technologies to be relatively gradual and that Wi-Fi kit is likely to be refreshed after 5–7 years or so, based on feedback it has received from industry. Notwithstanding the fact that the problem of interference is avoidable and would be created by Ofcom, there is evidence of the Wi-Fi devices being in operation over many years and old versions of Wi-Fi also still in use many years after newer versions are available.

As highlighted, data provided by Ookla in 2024 and analysed by GSMA, shows that in London, 48% of devices were using Wi-Fi 5, and 17% were using Wi-Fi 4. This demonstrates that equipment lifecycles can be lengthy and with legacy devices continuing to be purchased and used over many years, it would mean a persistent long tail of problematic devices polluting the band.

Ofcom says it is also considering of an option whereby legacy Wi-Fi access points could be required to stop transmitting on all or a portion of the upper 6 GHz frequencies from a later date, for example 2030, unless confirmed they can continue to do so, by requiring them to periodically consult a simple web interface. It is not clear whether this would work successfully in practice as it has not been fully tested, proven or standardised. It is also not clear how it could be applied to legacy devices which may not have the capability, nor how it would be mandated or its implementation assured, as this will depend on Ofcom's ability and willingness to enforce the rights of future mobile use in the band.

Question 8: Do you have a view on the amount of spectrum that should be prioritised for Wi-Fi under the prioritised spectrum split option? Please provide evidence for your view.

VMO2 believes that a balanced approach should be taken to allocation of spectrum use across the 6 GHz band. With the lower 6 GHz already allocated for Wi-Fi use, but remaining underutilised, our view is that the upper 6 GHz should be prioritised for mobile use, subject to European harmonisation.

Our analysis of the expected needs of Wi-Fi, has concluded that with the lower 6 GHz band assigned for Wi-Fi use, there is sufficient spectrum currently allocated to provide high quality multi-gigabit services to both consumers and businesses.

If additional spectrum is required for Wi-Fi use in the future, to provide additional capacity and support high-bandwidth intensive applications such as AR, VR and new use cases, there is a large amount of high-capacity spectrum in the 57-71 GHz range that can be used for unlicensed use and provides very wide channels of contiguous bandwidth. The characteristics of spectrum in this range mean that it is well-suited to providing the kind of very localised coverage that Wi-Fi provides, and use of such high frequency bands means Wi-Fi is far less likely to suffer from the existing problem encountered in lower frequency bands, whereby

there is congestion and interference due to re-use of channels by nearby users such as neighbours in adjacent houses or within multi dwelling apartment blocks.

Question 9: Do you have any comments on our plan for a "phase 1" when Wi-Fi will be introduced?

Please refer to our comments in response to question 6. VMO2 disagrees with Ofcom's proposal for Phase 1, as set out in the consultation. We are of the firm view that the best course of action is for Ofcom to wait until there is clarity on European harmonisation, before making authorisation decisions on use of the upper 6 GHz band.

Question 10: One variation on "phase 1" would be to only authorise Wi-Fi in client devices to "seed" the market. Would you have any views on this, or suggestions for other variations?

We disagree with Ofcom's variation on Phase 1. The authorisation of Wi-Fi use in the upper 6 GHz band in client devices to "seed" the market before there is clarity on European harmonisation, is unnecessary, not based on consensus and prejudges the outcome of decisions at a European level which have not yet been taken. Ofcom should wait until there is clarity on European harmonisation, before making authorisation decisions on the use of the upper 6 GHz band.

Question 11: Do you have any comments on our plan for a "phase 2" when mobile will be introduced?

The upper 6 GHz band was identified for IMT (mobile use) at WRC-23 and we expect it to become a globally important band for future mobile use. We believe that the band should be prioritised for mobile use, subject to European harmonisation, an appropriately timed release, and a sensible award process being determined. This will maximise mobile operators investment incentives and help to deliver optimal use of the spectrum and maximise benefits to the UK by mitigating congestion, enabling the enhancement of 5G and providing the foundation to launch the next generation of mobile services.

As we have highlighted above, we are concerned that Ofcom's proposals for Phase 1 pose a significant and otherwise avoidable risk of creating problems for the introduction of mobile use in the band. If implemented, it risks polluting the band with an unknown number of devices which are likely to cause co-channel interference to mobile use in the band. This would devalue the spectrum and reduce investment incentives for mobile operators as it would limit its potential for mobile use. This would jeopardise the success of the upper 6 GHz band and fail to deliver optimal use of the spectrum.

As Ofcom highlights in the consultation, the mobile industry, as part of the ongoing CEPT work, have said they would like to use high power (greater than 80 dBm/100 MHz EIRP) to allow MNOs to match the indoor downlink coverage they get from current macro site deployments in 3.4-3.8 GHz. We therefore do not agree with Ofcom's approach to use a

reduced power of 73 dBm/100 MHz EIRP just because it has been used as an assumption in studies, when harmonised technical conditions have not yet been agreed at the European level. It is very important that Ofcom does not impose restrictions on power levels that would devalue the spectrum and impact the investment case for mobile use in the upper 6 GHz band due to artificially restricting the level of coverage, capacity and quality of service that is able to be delivered. As it has indicated in the consultation, Ofcom should decide on the maximum permitted mobile power once the outcome of European harmonisation is clear.

Question 12: Do you have a view on the amount of spectrum that should be prioritised for mobile under the prioritised spectrum split option? Please provide evidence for your view.

VMO2 believes that a balanced approach should be taken to the allocation of spectrum usage across the 6 GHz band. With the lower 6 GHz allocated for Wi-Fi use, but remaining underutilised, our view is that the upper 6 GHz should be prioritised for mobile use.

As we have consistently made clear to Ofcom, existing mid-band spectrum available to MNOs will be quickly absorbed over the next few years, even with mobile traffic growth slowing compared to previous years, it is still growing significantly. This is already resulting in congestion across areas of high demand especially in dense urban areas resulting in a deteriorating impact on customer experience. MNOs have forecasted that by 2030, existing capacity will become exhausted on a significant number of their sites. VMO2 has provided detailed evidence directly to Ofcom to support this. With a growing number of sites which will have deployed all available spectrum bands, still unable to satisfy demand resulting in congestion.

Whilst we continue to densify our network and add small cells in areas of high demand, densification has practical and economic limits. MNOs will not be practically able to, nor commercially justify, densification on a mass scale, as it would involve very high costs and environmental impact.

The upper 6 GHz band offers an effective solution to the impending problem. It can be deployed on existing macro sites on a high-power basis in a similar way to 3.4-3.8 GHz spectrum, as an efficient way to provide the additional capacity required to meet the continued growth in demand. It represents the only viable solution for MNOs to mitigate congestion and provide high-quality mobile services across wide areas, where the deployment of mmWave spectrum and mass densification will not be practically, technically or economically feasible.

The upper 6 GHz band represents the last remaining mid-band spectrum that can be used for high power mobile use to provide capacity over wide areas. Furthermore, it has the unique capability to provide 200 MHz of contiguous bandwidth, which can deliver the highest quality 5G services and provide the foundation to launch the next generation of mobile services. There should be enough spectrum prioritised for mobile use to provide the opportunity for

operators to acquire 200 MHz carriers, this means a minimum of 600 MHz needs to be made available for high power mobile use in the UK.

We note Ofcom's suggestion that spectrum adjacent to the upper 6 GHz band at 7125–7250 MHz, which is the subject of a WRC-27 agenda item considering its potential future use for mobile, could potentially lead to an additional 125 MHz of mobile spectrum contiguous with the upper 6 GHz, which Ofcom says would make between about 400 and 600 MHz of contiguous spectrum prioritised for mobile, depending on the scenario for the future use of the 6 GHz band. However, VMO2 believes that mobile use of 7125-7250 MHz could be compromised by incumbent services within the band and in adjacent bands. Concerns have been raised over interference to EESS (Earth Exploration Satellite Services) in the adjacent band, as well as interference from SRS (Space Research Services) within the band. These issues could result in a failure to identify the band for mobile services, or technical conditions that may either prevent mobile usage, or severely impact the performance of mobile networks using the band.

Furthermore, we urge Ofcom to take into consideration that whilst the USA has enabled the upper 6 GHz band for Wi-Fi use, it has also enabled the 3.8-4.2 GHz band for high power mobile use, something that the UK has, to date, not done.

Question 13: Do you have any evidence or views about the geographical extent of mobile networks' likely deployment in Upper 6 GHz?

The upper 6 GHz band offers an effective solution to the issue of capacity exhaustion across areas of high demand. It can be deployed on a significant number of existing macro sites across wide areas due to its balance of good coverage and capacity, providing a highly efficient way to deliver capacity and performance. Trials carried out by MNOs and equipment vendors have shown that it can be used on a high-power basis using advanced antenna systems to provide capacity and coverage over wide areas, including extending indoors.

MNOs are likely to deploy the spectrum in a broadly similar way to 3.4-3.8 GHz spectrum and reflect a similar end state of deployment. It is important that Ofcom does not impose restrictions on geographical deployment, power levels, or the amount of contiguous bandwidth made available, that would impact the investment case for MNO deployment and artificially restrict the level of capacity and coverage that is able to be delivered.

We note Ofcom's view that 6 GHz spectrum is most likely to be deployed in "high density" areas, primarily the largest cities and towns. As such, it is considering an approach similar to that adopted for the forthcoming mmWave award, whereby it will award wide-area licences based on these high density areas. We would highlight that, unlike mmWave spectrum, 6 GHz is expected to have reasonably good coverage properties and whilst mmWave deployment is expected to be largely deployed at 'hotspots' in specific areas as it has limited coverage properties, the upper 6 GHz band is expected to be deployed much more widely

across key towns and cities, significantly beyond the 68 high density areas that Ofcom has defined for the mmWave award spectrum. As such, any geographic restriction on the deployment of the 6 GHz band by MNOs would need to be much more relaxed to ensure that the business case for deployment is preserved and the benefits are not artificially limited.

Question 14: Do you have any comments on our proposed phased approach to authorisation of both Wi-Fi and mobile in the Upper 6 GHz band?

Please refer to our comments in response to questions 6 and 7. We disagree with Ofcom's proposal phased approach, as set out in the consultation. We are of the firm view that the best course of action is for Ofcom to wait until there is clarity on European harmonisation, before making authorisation decisions on use of the upper 6 GHz band.

Question 15: Do you have any comments on our proposal to not include very low power portable devices in the Upper 6 GHz band at this stage, but to keep this under review?

No.

Question 16: Do you have any comments on our proposal to authorise the use of low-power indoor Wi-Fi access points and client devices to use 6425–7125 MHz?

Please refer to our comments in response to questions 6 and 7. We disagree with Ofcom's proposal to authorise the use of low-power indoor Wi-Fi access points and client devices to use 6425-7125 MHz i.e. within the upper 6 GHz band. Ofcom should wait for clarity on European harmonisation before making authorisation decisions.

Question 17: Do you have any comments on the proposed technical conditions?

We believe that Ofcom's proposed technical conditions should not be implemented. Ofcom should not create technical conditions solely for the UK, but instead wait for clarity on European harmonisation. We are surprised that Ofcom would seek to introduce its own technical conditions ahead of clarity and the availability of European harmonised standards and technical conditions to which it can simply align.

Question 18: Do you have any comments on the proposed VNS draft?

We disagree with Ofcom's proposal to introduce a VNS draft. Ofcom should not create its own VNS, but instead wait for clarity on European harmonisation. Given Ofcom's longstanding involvement in the work of ETSI, we are surprised that Ofcom is seeking to introduce its own technical conditions ahead of the availability of an ETSI harmonised standard covering the upper 6 GHz band, to which it could simply align.

Question 19: Do you have any suggestions for an appropriate mechanism for enhanced sensing, or comments on the proposed solution above?

As there is ongoing work at the European level to evaluate potential shared use of the upper 6 GHz band between Wi-Fi and mobile, including analysis of enhanced sharing mechanisms, we suggest that Ofcom remains engaged in this work and open to aligning with its conclusions.

We note Ofcom highlights that Qualcomm is specifically looking at a cross-technology signalling based on mobile transmitting a Wi-Fi-like signal. We understand that this is still being developed and that Qualcomm have suggested the need for further studies to evaluate this sensing mechanism, accounting for mobility, varying traffic loads, and different device location models.

At the moment, there is little confidence that the work and development on sensing thus far, could be relied upon in the context of highly variable radio propagation conditions without rigorous testing. Such sensing would be non-standard for both mobile and Wi-Fi, driving significant cost into the equipment needed to implement it, with additional risk of interoperability and operational issues due to the unique implementation, that will likely impact market availability of equipment as manufacturers seek to target larger volume solutions for the rest of the world first.

VMO2 believes that further studies need to be conducted before a conclusion can be drawn on sharing, leveraging European activities and following a harmonised approach. Technical feasibility studies are still ongoing, and simulation results need to be validated further, including through real-world testing, to prove usability and the technical and cost implications of any proposed sharing mechanism.

There is no conclusive evidence yet that sharing in the band would offer net benefits over exclusive use by a single service. It has not yet been proven that sharing is feasible in the band without detrimentally impacting end user experience, nor has it been agreed or standardized. We urge Ofcom to remain open-minded and to not draw conclusions or take decisions prematurely that risk prejudging the outcome of European decisions or that could lead to a degraded user experience, limiting the benefits that the band can deliver.

Question 20: Do you agree with our proposal to restrict Wi-Fi from transmitting in the 6650-6675.2 MHz band to protect the radio astronomy service? Please provide any technical evidence to support your view.

We disagree with Ofcom's proposal to introduce Phase 1 Wi-Fi access to the upper 6 GHz band. Ofcom should wait for clarity on European harmonisation before making authorisation decisions.

Question 21: Do you agree with our assessment of Wi-Fi coexistence with existing users of the band? If not, please provide details.

No comment.

Question 22: Do you have any evidence about the costs to operators of moving fixed links in and around "high density" areas (such as urban centres) to other bands?

The benefits to citizens and consumers of using the upper 6 GHz band for mobile are greater than that of fixed links. Enabling mobile use will unlock investment in additional capacity across wide areas which experience high demand. This will help to address the growing problem of congestion, enhance the quality of 5G, and provide the foundation for the next generation of mobile services to further support the UK's economic growth.

Moving fixed links to other bands to enable mobile use is an established practice consistent with Ofcom's previous decisions on key mid-spectrum band, e.g. the 3.6-3.8 GHz band, as the benefits of enabling mobile use outweigh the costs of moving existing users to other bands.

We agree with Ofcom's view that as the number of fixed links in high density areas is relatively small, the costs to operators of moving these links will be relatively low.

Question 23: Do you have any comments on our initial assessment of our likely approach to coexistence between future mobile use and current users in the Upper 6 GHz band?

We are in general agreement with Ofcom's initial assessment of its likely approach to coexistence between future mobile use and current users in the upper 6 GHz band. We encourage Ofcom to continue to follow relevant ongoing work and technical studies that cover coexistence, including at the European level, and to align appropriately with the conclusions of studies and harmonisation decisions, as appropriate.

Question 24: Do you have any other comments on our policy proposals or any of the issues raised in this document?

We have no further comments.