Preamble Information

I am happy to write my reply to this consultation in a personal capacity. Before answering questions it is important that I provide some useful background knowledge in this preamble section I have created to refer to in the answers to the questions I have chosen to select.

Having long term experience of radio frequency engineering, I see a strong need to present a clear independent point of view on this matter since there are a substantial number of independent viewpoints given on the usage of spectrum at this time in the telecommunications community. I take my approach with a first and foremost priority to the needs and benefits of society, while as a secondary point I will draw upon economy particularly from the perspective of how it becomes more economically viable to deploy this spectrum. I have more than ten years experience of the usage of mmWave in communications and radar and through this experience I have been able to narrow down fundamentally useful cases for mmWave that not only have benefit to society (as well as being economically viable) but that are driven by the clear physical limitations as well as the cost of the radio for this particular spectrum. I hope that my response will be taken on board in forming the most accessible and useful way to make use of these bands based on lessons learned from its bad deployment in other parts of the world. My response will give a very clear outline of where usage of mmWave has unsurprisingly failed and would fail if we were to use it in a similar way here in the UK, but also I wish to provide constructive ways I have identified that would be actually technically feasible and provide a societal benefit. This could make the UK a world leader in setting an example to the world to know the best ways to use such spectrum.

Fundamental Facts Regarding mmWave Spectrum

Before responding to points on the consultation and the plans to auction spectrum. It is important to note very well established facts regarding the mmWave Spectrum, which the industry and academia are not sufficiently open about admitting:

1. The first is that by laws of physics, propagation at this frequency and any band above is extremely poor. Therefore, using such spectrum for small cell access from a base station to a mobile terminal more than a few metres apart is nothing other than 100% pathetic. It is clear that embarrassing deployments in the US by mobile network operators (MNOs) prove this very point, exhibited so well in this excellent vlog in downtown Manhattan, and it is ridiculous why any consumer would want to pay extra money for such flimsy service. Furthermore, the radio has high energy consumption and drains the battery fast. For these absolute facts, it is clearly worth repeating that mmWave for small cell access is pathetic and it will never work. That is a certainty and any such deployment should not be entertained either by OfCom or any UK MNO as it will not benefit anybody. The statement "technical characteristics of mmWave spectrum mean it is particularly well-suited to small cell deployment" Is simply not true. We have to move away from cellular access to other use cases if mmWave is to have any hope of being useful.
2. The second very important point is that mobile communications these days have to be regarded as a core utility to the operation of society and the economy. We now rely upon mobile telephony in a way that it is no longer just for casual usage of extra benefit. It matters to emergency services, communication to an individual be they at home or elsewhere and critical monitoring through machine to machine communications to name but a few. The benefit to homeland security and civil justice can bring huge credits as well. Wireless connectivity to people and objects has so many current and future benefits whereby OfCom has to prioritise how this will work best for societal benefit over economic benefit. That is not to say, however, that economy is not important but the way spectrum is provided is crucial with regard to whether it is both an economic and societal gain rather than a drain. A very important vessel through which wireless connectivity can be delivered as a utility comes to the important point of the need to use neutral hosts. As public transport, electricity, gas and water are important utilities in any location, so is wireless connectivity and broadband services. If the same gas comes through the same pipe to the user's home, then the only difference is the price plan offered by the provider the user has subscribed to. Likewise for mobile networks, we must move to a better model where in many places the connection comes through the same infrastructure and on the same license, but there are different ways for the consumer to pay for it. That is where the competition sits, not in what core coverage one provider can or cannot offer.

The above principles form a very strong steer in terms of how the mmWave spectrum should be used and given the mistakes and failings seen in the ways other countries have deployed the spectrum, this gives clear warnings as to how the UK must not follow such patterns that are certain to lead to shambolic results. This should likewise mean there needs to be restraint on preventing MNOs from buying huge quantities of spectrum they may never use.

Use Cases and Requirements for mmWave Spectrum

Based on the above analysis, after many years experience experimenting with mmWave and its practical limits as well as knowing what wider research and development has been carried out, I have been able to identify a limited number of actual useful applications where mmWave is beneficial to society, some of which this consultation does identify. I would summarise these as follows:

- The use of 'Giga Zones' as I would define them. These are indoor environments such as a café where a person may be spending a short time using their portable computer and require extremely fast Internet to upload and download large files ultra fast without fail thus requiring ultra reliable connectivity. With a restrained zone that is indoors and careful planning of distributed antenna systems, the propagation would not reach far outside the indoor location. This setup may also support locations offering augmented reality and Metaverse. Furthermore, industrial and domestic locations may want to deploy private networks within the owner's premises, which can be classed as private Giga Zones. An important point to note though in deployment of these Giga Zones is that multiple distributed antenna systems deployed may mean that the link from an access point to a device may be short, even less than 1m depending on how it is best to ensure reliable connectivity within the environment.
- The use of 'Fast Kiosk Download Stations' to allow a user within a localised area of 0.5m radius to readily download a video, music collection or electronic publication to their device to watch, listen to or read in a location with weak connectivity such as on a train. Such facilities could prove extremely useful at railway stations or airports as a prime example.
- The use of 'Local Level Multicast Solutions'. This has been identified in the consultation as suggested by BT/EE where locations such as stadiums would then be able to deliver enhanced services to spectator's devices at a sporting event or concert. They could essentially 'tune in' to several channels of streaming from cameras on the front stage with the possibility of other information services that could be offered such as names and details of the people they are spectating. Because the users are limited to fixed standing or seating space, it is possible that such connectivity could be made to work effectively. However, it will be vulnerable to some flaws found in small cell access albeit to a lesser extent.
- The need to backhaul/fronthaul with fixed links is identified by this consultation and there will always be locations in the immediate term where it is impractical to deliver fibre to the home/premises. Therefore, mmWave can rightly be made available for this as indeed in some instances it is already the case. The use of the 26GHz band is substantially cheaper to deploy physically than other 60GHz or higher bands. I see that both FWA and IAB have been identified as use cases, though some FWA will need to be re-deployed but it is important that alternate solutions are provided.
- The need to backhaul in rail transportation is another clear need for mmWave that has already been deployed at higher bands and this use case is very important to take on board and ensure that enough spectrum is available for such usage. Another great weakness of mmWave in small cell access is the difficulty in tracking the moving device with the 'pencil beam' radiated by the access point. However, for rail communications, though speed is fast, this problem is suppressed because it is known where the moving transceiver on board the train roof will go and the steering angle needed to track at long distances is small for long straight rail tracks. This is a clear case where mmWave deployment is increasing at the unlicensed 60GHz band and better opportunities for this could be offered at 26GHz and 40GHz.

Other backhaul nodes such as drones could for similar reasons have such opportunity because the position and trajectory of movement can be known. Therefore we can generalise this use case as 'Guided Transportation Links'.

These five cases I have been able to successfully narrow down as actually technically feasible, with the exclusion of communication to satellites and high altitude platforms that are not directly related to the purpose of this consultation. In all my years I have not seen any other feasible solutions since mmWave cannot work unless there is either a suitably short link, or a longer link with necessary physical restraints. This gives no room for deploying mmWave in the same ways as sub 6GHz cellular or WiFi.

It is very clear that the five identified cases actually should rely upon a neutral host, or at least some substantial degree of shared network infrastructure and spectrum. It is not economically sensible, nor is it environmentally acceptable, that multiple MNOs should deploy access points in the same Giga Zones (just like electricity from different providers must come out of the same socket). MNOs cannot go putting multiple Fast Kiosk Download Stations in the same location (just like banks share their ATM cash machines). Local Level Multicast Solutions cannot have multiple deployments by multiple MNOs (just like all television channels use the same transmitter to broadcast to the same televisions). Backhaul and fronthaul services cannot use multiple fixed links owned by different MNOs to the same premises or moving transceiver for Guided Transportation Links (just as broadband services come through the same ADSL telephone line). Therefore MNOs would be left with only two options on how to use any spectrum they buy: one to deploy access points in outdoor public streets, where base station deployments will depend on planning permissions by local authorities as well as additional deployment costs but this would be to provide small cell access that has already proven to be shambolic. The second would be to provide fronthauling and IAB where it does not require competing space with other MNOs. These weak use cases provide very little opportunity for MNOs to invest in what will turn out to be extremely expensive licenses that they may never use.

It is very clear, as Vodafone have clearly said in the consultation, that densification is not going to go anywhere near the degree that OfCom expect. Indeed, it is far too cost burdensome on MNOs to go to the expense of buying city wide licenses, which will end up having low partial usage or indeed no usage at all, because the additional cost of renting sites from local authorities and paying the necessary operational costs will go completely against their aim to provide better services to the consumer at lower cost. It is clearly the case that this auction exercise is simply another opportunity to squeeze large quantities of money out of the existing MNOs, who will feel an obligation to hold licenses in every major UK city. Yet the majority of those licenses are sure to become a white elephant with a lifetime of just 15 years. For MNOs that use these licenses they will be competing in a race to the bottom as the extremely poor propagation of mmWave noted above will cause consumers to realise that offerings of ultra fast connectivity will have limited locations and fail abysmally with just one alteration of the orientation of the device, or blockage by a person walking through the line of sight. Consumers will therefore name and shame MNOs for poor delivery of services that is actually a result of how they have been allowed to use the spectrum. Given the minimal worth of these licenses, it is clear that OfCom are unfair to auction these licenses to existing MNOs, which is sure to cause economic decline. Therefore a society needs to be formed in which mmWave is restrained to providing services to consumers in a transparent manner and accessible as a utility in places it is actually of use. Opening the spectrum for auction to allow industry "to decide on the best use of this spectrum", will not result in the spectrum being best used for the benefits of society, which OfCom has to take responsibility for.

Framework and Context for use of Shared Access

While the availability of Shared Access usage of this spectrum, with minimal annual costs is certainly a welcome move to support the five feasible use cases, there is a concern that this availability is not sufficient, while still allowing the right of MNOs to access the spectrum. Auctioning should therefore have limits to ensure that MNOs are not priced out by paying for assets that will give them limited returns. Better Shared Access usage will subsequently help the important point in the consultation to “encourage investment and innovation in new uses” that is a higher priority over the need to “sustain strong competition in mobile markets”.

The proposed spectrum to be made available for Shared Access is up to 800MHz, though less than this accounting for guard bands. This will allow the option to buy low cost proportions of spectrum to be used within a location of 50m radius. First of all, it is to be noted that this kind of radius may be reasonable for Giga Zones or Local Level Multicast Solutions to give sufficient reuse distance, but such a large radius would not be required for Fast Kiosk Download Stations. Thus, flexibility is necessary. It is known by the Shannon limits that for realistic signal to noise ratio values of at least 20dB, in excess of 200MHz is required in a Giga Zone to deliver data rates in the order of Gbits/s. This is concerning where multiple Giga Zones may be required within a space of 50m radius such as in a major railway station or airport. Therefore, the vast spectrum being made available to MNOs to bid for, will be at the expense of sufficient shared access spectrum that has reason to require more than 1GHz of bandwidth. Equally, however, more flexible options on the power requirements operating radius of this part of the spectrum could make huge differences to the accessibility in the areas where there is demand.

Your response

Question	Your response
Question 1: (section 3) Do you have any further comments on the approach we are minded to take to authorising the 40 GHz band?	*No Comment*
Question 2: (section 5) Do you agree with the method that we have outlined in annex 16 for identifying which licences authorising the use of fixed links around high density areas will be subject to revocation on the basis that the authorised links would be likely to suffer interference from new users in the high density areas? If not, please give reasons.	*No Comment*
Question 3: (section 7) Do you agree that the licence fee for fixed links that we allow to remain in the 40 GHz band should be the same as the fee in place for the 26 GHz band? If not, please give reasons.	*No Comment*
Question 4: (section 9) Do you have any comments on the proposed rules of our auction?	*No Comment*
Question 5: (section 9) Do you have an interest in bidding for specific high density areas in this award? If so, please provide evidence that you have a credible intention to do so.	*No Comment*
Question 6: (section 9) Do you consider it appropriate to have one or two 26 GHz lot categories?	*No Comment*
Question 7: (section 10) Do you agree with our proposed approach to coordinating Shared Access users in the 26 GHz band? If not, please give reasons.	*This relates to the answer to question 17 and specifically there discusses the usage of the deployment ranges discussed in this question.*
Question 8: (section 10) Do you agree it would be appropriate to coordinate Shared Access	*This will be with regard to widening the spectrum in the same way as the 26 GHz band*

users in the 40 GHz band in a similar way to the 26 GHz band if we make it available in 5 years time (noting we would consult on the detail of this coordination). If not, please give reasons.	*to give a sufficient spectrum to shared access innovative applications.*
Question 9: (section 10) Which of the proposed options for coordinating award winners and existing licensees during the (5-year) revocation period do you think would be most appropriate? Do you think alternative approaches to coordination would be more appropriate?	*No Comment*
Question 10: (section 10) Do you agree with our proposal to protect the radio astronomy site at Cambridge (42.5-43.5 GHz) from new mobile users using the 40.5-43.5 GHz band using technical assignment coordination? If not, please give reasons.	*No Comment*
Question 11: (section 10) Do you agree with our proposed approach to coordinating at the boundary of high and low density areas? If not, please give reasons.	*No Comment*
Question 12: (section 10) Do you agree with our proposed approach to international coordination? If not, please give reasons.	*No Comment*
Question 13: (section 11) Do you agree with the non-technical conditions that we propose to include in the award licences to be issued following the award of the 26 GHz and 40 GHz bands? If not, please give reasons.	*No Comment*
Question 14: (section 12) Do you have any comments on our proposal to award fixed term licences with a 15 year term?	*No Comment*
Question 15: (section 13) Do you agree with the proposed technical licence conditions for award licences and local access licences in the 26 GHz and 40 GHz bands? If not, please give reasons.	*No Comment*
Question 16: (section 13) Do you have any comments on our proposed licence conditions relating to antenna elevation?	*No Comment*

Question 17: (section 14) Do you agree with our proposal to make available channel sizes of 50 MHz, 100 MHz, 200 MHz, 400 MHz and 800 MHz? If not, please give reasons.	*Is this response confidential? – N* The final paragraph of the preamble is reached based on the identified use cases and it is of concern that too much spectrum is being made available to MNOs, with limited opportunity for usage at the expense of too little spectrum being made available for shared access that has potential for more wide use. It is clear that more stricter measures for real deployment cases with multiple Giga Zones in a limited area of radius lower than 100m are realistically achieved with the spectrum made available. It is clear that such spectrum needs to exceed 1GHz and shorter reuse distances for indoor scenarios, where such bands can be well contained with suited building infrastructure (e.g. metallised windows) will enable this to work that the 50m radius is far too excessive. Furthermore very low power options for < 1m range for Fast Kiosk Download are clearly necessary.
Question 18: (section 14) Do you have any further comments on the proposal to limit low power outdoor deployments in 24.45-25.05 GHz to three base stations in any 300km$_2$ area in order to comply with the EESS protection requirements?	*No Comment*
Question 19: (section 14) Do you have any further comments on the proposed level of fees for the Shared Access licences in the 26 GHz and 40 GHz bands?	*Is this response confidential? – N* Costing should be maintained to realistic administrative values in order to allow neutral hosts to run their business with feasible expenditure. The larger ends of the spectrum at 400MHz and 800 MHz are arguably more costly than necessary in this regard. It is also the case that for Fast Kiosk Download applications, with less usage, that the costs are unrealistic and such cases may require liberalise spectrum usage.
Question 20: (section 14) Do you have any further comments on the proposed extension of the Shared Access licensing framework (including its standard non-technical licence conditions) to the 26 GHz and 40 GHz bands?	*No Comment*

Please complete this form in full and return to mmWave.allocation@ofcom.org.uk.