

Title:

Ms

Forename:

Ruth

Surname:

Pritchard-kelly

Representing:

Organisation

Organisation (if applicable):

O3b Limited

Email:**What additional details do you want to keep confidential?:**

No

If you want part of your response kept confidential, which parts?:**Ofcom may publish a response summary:**

Yes

I confirm that I have read the declaration:

Yes

Additional comments:

O3b Limited ("O3b") would like to thank Ofcom for the opportunity to comment on this call for input regarding "spectrum above 6 GHz for future mobile communications." In 2014 O3b began full commercial operation of its UK-notified non-geostationary satellite system ("NGSO") of 12 satellites in a medium-Earth orbit ("MEO"). The O3b constellation was launched and now operates under Outer Space Act ("OSA") licences from the U.K. Space Agency. O3b's low latency and broad bandwidth allow it to provide fiber-like connectivity to underserved regions around the world in the Ka band. O3b is currently using spectrum in the 17.8-18.6 GHz, 18.8-19.3 GHz, 27.6-28.4 GHz, and 28.6-29.1 GHz frequency bands. As these bands are among those being examined in this "call for input," O3b are keenly interested in the outcome.

Question 1: Are there practical ways of achieving the very high performance that use of wide channels above 6 GHz could offer, for example using carrier aggregation of lower frequency bands?:

O3b have no comment on this question.

Question 2: What recent or emerging advances in technology may provide effective solutions to the challenges in higher frequency bands? For example can increased propagation losses be mitigated by using the high gains available with massive MIMO?:

O3b have no comment on this question.

Question 3: Are there any fundamental/inherent frequency constraints of the 5G technologies currently being investigated with regard to:

a) minimum contiguous bandwidth per operator? Will the spectrum for multiple operators need to be contiguous (i.e. a single band) or could multiple operators be supported through multiple bands?

b) frequency range over which the technologies are expected to be able to operate, for example due to propagation, availability of electronic components, antenna designs and costs of deployment? For example, is 10-30 GHz better or worse than 30-50 GHz and why?:

On Question 3(a) O3b have no comment.

On Question 3(b) O3b respectfully note that any mobile terrestrial services transmitting in the 10-30 GHz band, specifically in the identified (filtered) band at the 17.8-19.7 GHz ranges, are likely to cause interference into satellite earth stations receiving signals from satellite downlinks currently allocated in the identified band. Thus, this would argue for excluding the identified 17.8-19.7 GHz range from consideration for 5G mobile terrestrial services.

Question 4: Will 5G systems in higher frequency bands be deployed, and hence need access to spectrum, on a nationwide basis or will they be limited to smaller coverage areas? And if so, what sort of geographic areas will be targeted?:

When discussing geographic coverage for any wireless service, Ofcom should bear in mind the inherent regional and even international nature of satellite services. Thus, those allocations need to be harmonized globally, and allocations made on a smaller, single-nation basis should strive not to disrupt this harmonization.

Thus, although the UK's own terrestrial wireless 5G systems may only need access on a UK-national basis or even smaller, any allocations for these systems must be made within the context of the need to maintain the integrity of the international allocations for satellite services. For this reason, O3b respectfully request that Ofcom refrain from introducing new mobile fixed allocations into any bands where there are already allocations for international FSS, BSS, or MSS.

O3b's particular satellite-based service is targeted to underserved areas of the world, such as remote and rural areas, which are often the most prejudiced by the digital divide.

- Question 5: a) To what extent will 5G systems in higher frequency bands need dedicated spectrum on a geographical and/or time basis or can they share?**
b) If they can share, what other types of services are they likely to be most compatible with?
c) What technical characteristics and mitigation techniques of 5G technologies could facilitate sharing and compatibility with existing services?
d) Could spectrum channels be technically shared between operators?:

IN RESPONSE TO 5(A): To repeat O3b's answer to Question 4, when discussing geographic coverage for any wireless service, Ofcom should bear in mind the inherent regional and even international nature of satellite services. Thus, those allocations need to be harmonized globally, and allocations made on a smaller, single-nation basis should strive not to disrupt this harmonization.

Thus, although the UK's own terrestrial wireless 5G systems may only need access on a UK-national basis or even smaller, any allocations for these systems must be made within the context of the need to maintain the integrity of the international allocations for satellite services. For this reason, O3b respectfully request that Ofcom refrain from introducing new mobile fixed allocations into any bands where there are already allocations for international FSS, BSS, or MSS.

5G services are expected to be added onto the networks of existing-generation mobile services, by existing operators, for use by existing customers, as demand and market conditions dictate. O3b submit that it would be more practical and less disruptive to existing services, such as satellite services, if the early development phases of 5G mobile services were introduced in frequency bands already available for terrestrial mobile services.

IN RESPONSE TO 5(B): The 5G mobile use of spectrum proposals are likely to be less compatible with ubiquitously deployed satellite services because, generally, ubiquitously deployed mobile services present issues of harmful interference in sharing with fixed-satellite services. The extent to which interference will be an issue depends on the proposed technology and its characteristics.

As noted above, while 5G goes through its necessary design, standardization and initial commercialization steps, 5G mobile services are best assigned to existing licensed mobile spectrum to more fully develop the 5G mobile technology designs.

O3b have no comment on questions 5(c) or 5(d).

- Question 6: a) Given the capacity and latency targets currently being discussed for 5G how do you anticipate backhaul will be provided to radio base stations? Are flexible solutions available where the spectrum can be shared between mobile access and wireless backhaul?**
b) What, if any, spectrum will be required? What channel sizes will be

needed? Will the bands used be similar to those currently used for wireless backhaul?

:

IN RESPONSE TO QUESTION 6(a):

O3b would just like to remind Ofcom that one of its main services is mobile backhaul. O3b's orbit and broad bandwidth make it fungible with fiber for backhaul. O3b's roundtrip latency is less than 65ms mouth-to-ear, and O3b achieves the very highest mean opinion score for voice quality as defined by the ITU, producing clear voice without echo or noticeable speech delay. Thus when considering mobile backhaul, Ofcom should keep in mind that technologies other than terrestrial mobile can provide this service.

O3b have no comment on question 6(b).

Question 7: Should we expand the scope of bands being reviewed beyond the 6-100 GHz range?:

O3b have no comment on this question.

Question 8: Do you agree that it is likely to be necessary for bands to have an existing allocation to the mobile service? Does this need to be a primary allocation?:

In principle, O3b agrees that 5G should be assigned to frequency bands that already have a primary allocation to the mobile service.

Question 9: Do you agree with the criteria we have used for our initial filter of bands, and are there other criteria that could also be used?:

O3b have no comment on this question.

Question 10: Of the spectrum bands/ranges mentioned in this section, are there any that should be prioritised for further investigation?:

As we have said elsewhere, the bands that should be prioritised for any new allocation for terrestrial mobile services would be bands that do not already have an existing FSS allocation.

Question 11: Are there any bands/ranges not mentioned in this section that should be prioritised for further investigation? If so, please provide details, including why they are of particular interest.:

O3b have no comment on this question.

Question 12: Are there any particular bands/ranges that would not be suitable for use by future mobile services? If so, please provide details.:

As we said in our answer to Question 4, because of the need for global harmonization and long-term regulatory certainty for satellite allocations, any band which already has an FSS allocation should be avoided when identifying a new band for terrestrial mobile.

Question 13: What additional information, beyond that given in Annex 5 would be useful to allow stakeholders to develop their own thinking around spectrum options?:

Of especial note, the Ka band is already widely used by UK satellite operators, and even the higher V band is being tested for fully commercial services. The higher frequency bands are of the utmost importance and value for satellite communications and UK satellite operators have already built and launched numerous satellites that will operate in the Ka band for decades. Billions of pounds have been invested in the development of these satellites and the associated ground segment. Creating uncertainty about spectrum allocations for satellite communications will have far-reaching effects on the vibrant space industry in the UK.

O3b have previously noted to Ofcom that the V band is of great use to the FSS industry, and have suggested that Ofcom study how NGSO and GSO networks can best coordinate and share this band.

In the past few years, there have been many technological advances in non-geostationary satellite communications. Such advances can help bridge the digital divide between developed and developing countries, but uncertainty in the current regulatory framework that applies to satellite systems discourages investment and innovation.

As Ofcom know, it is not technically or economically feasible for the satellite industry to be simply "relocated" from one frequency band to another, and mid-life migration of frequencies used by operational satellite services is not possible. Ofcom must remain cognizant of the practical and real limitations when considering any "repurposing" of frequency allocations. The time horizon for the satellite industry is very long, so certainty about spectrum allocations is paramount to the industry.

We respectfully ask Ofcom to keep in mind the importance of all industry sectors when determining appropriate spectrum assignments for fifth generation terrestrial mobile services. Satellite services like the broadband connections offered by O3b are an important element in the delivery of advanced telecommunications services. Any new spectrum assignments for 5G must be compatible with satellite service in order to ensure that high-bandwidth services reach all markets, irrespective of geography or proximity to the densely populated areas to be targeted by 5G. O3b would strongly oppose any consideration by Ofcom of the migration of commercial communications satellite services using the Ka band.

Question 14: What are the most important criteria for prioritising bands going forward?:

It is O3b's opinion that the most important criteria for prioritising bands are

1. Avoidance of disruption to allocated operational services, such as broadband satellite services operating in the 10-30 GHz range;
2. Bands already allocated to terrestrial mobile services, and ideally those in which mobile services are already well established, are the best candidates for 5G; and

3. Maintaining global, harmonized spectrum allocations for satellite services should be a priority for regulators world-wide.

O3b would like to underscore that there are bands that meet Ofcom's filtering criteria that are not already allocated to any satellite service. The satellite industry has always played a crucial and vital role in the telecommunications infrastructure, nationally and internationally. In many ways, the satellite industry is an enabler to terrestrial communications providers through the creation of demand in unserved and under-served areas.

O3b is a UK satellite operator that demonstrates the ingenuity of the UK space industry through the use of innovative and flexible design. O3b's constellation allows ISPs, telcos, and governments to provide much needed broadband connectivity to countries around the globe, including the UK and its territories. The success and survival of O3b hinges on the certainty of availability of Ka-band spectrum, and on satellite-friendly policies in the UK. Therefore, any changes to existing spectrum allocations should be mindful of and support continued growth and development of the space industry, including O3b.

O3b urge Ofcom to carefully balance the predicted spectrum requirements for 5G against the very long-term spectrum requirements and market cycles for other services (such as the fixed-satellite services).