Title:

Mr

Forename:

Michael

Surname:

Thompson

Representing:

Organisation

Organisation (if applicable):

Iridium

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:

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?:

The high bitrate performance promised for these mobile systems are only designed for very short ranges. Existing technologies in unlicensed bands at 2.4 GHz and 5 GHz provide excellent high bitrate short-range performance and achieve very high frequency re-use factors. The demand for the ultra-high bitrate services described (10 - 50 Gbit/s) is entirely unproven. Aggregation of bands below 6 GHz clearly offers a more predictable migration path for the development of higher-rate services.

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?:

No comment.

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?:

a) No comment.b) No comment.

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?:

Given the practicalities of building a network for short-range service, it can be reasonably concluded that the deployment would follow a similar pattern to that of existing public Wi-Fi access points -around areas of high-density public traffic such as airports, train stations, shopping centres and so on. The very short range indicates that mobility would not be a factor, but instead that users would exhibit a 'nomadic' profile, connecting for a period while stationary before disconnecting and moving on. Usage could therefore be on a national basis, but concentrated in high-density hotspots with large areas of territory unserved.

However, existing mobile network operators deploy small repeater stations, typically to compensate for poor localised coverage. It can be expected, therefore, that such repeaters would be considered if higher bands were utilised, to compensate for the short-range limitation. Such deployment would greatly increase the likely territory over which compatibility would need to be studied.

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?:

a) The short-range nature of the proposed technologies indicates that frequency re-use can be very high. Existing Wi-Fi technologies typically permit uncoordinated deployment and very high frequency re-use factors. This suggests that small amounts of dedicated spectrum may be more efficient than larger amounts of shared spectrum.

b) The compatibility studies for sharing in the bands above 6 GHz have not been initiated. However, compatibility between mobile and other services (particularly backhaul and trunk networks) are usually extremely difficult due to the different grades of acceptable service. For example, a trunk network is typically designed for an availability of 99.999% compared to the target availability of (say) 90% for a mobile network. A mobile network is therefore typically far more tolerant of interference than a trunk network. The impact from mobile interference into other networks is therefore far more critical than the impact in the other direction.

c) There are no suitable mitigation techniques currently identified.

d) No Comment

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?

:

a) No comment.b) No comment.

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

Iridium believes that the range should not be increased but instead reduced to bands only above 31 GHz, to avoid severe compatibility issues with densely used bands.

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?:

No comment.

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?:

The premise that 1 GHz of spectrum is required, potentially for each operator, is an extraordinary and unprecedented assumption with which to begin such a study. There are few other services below 30 GHz that enjoy such an allocation, let alone an assignment of that magnitude. When compared to the (typical) operator assignments of 10 - 30 MHz per network, such an assumption seems highly unrealistic and inefficient. A more realistic

assumption of (say) a 200 MHz shared band - in line with other IMT identifications in the Radio Regulations - may permit a much wider range of potential candidate bands.

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

Iridium strongly supports investigation of bands above 31 GHz for the following reasons: the bands exhibit higher propagation loss, and therefore potentially reduced compatibility risks with any sharing service; networks within these the bands are much less developed and extensive, and the flexibility to manage frequency avoidance will be greater; frequency reuse, a key factor in the efficiency use of such high bandwidths, will be greater.

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.:

We support bands above 31 GHz only.

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

Iridium believes that the bands below 31 GHz are unsuitable for any kind of high-density mobile deployment such as 5G. Extensive use of these bands by existing fixed and mobile services render sharing extremely difficult, even between planned services such as microwave links. Frequency congestion is a significant factor in most administrations, and this precludes any potential for the addition of a new mobile service. This congestion has resulted in terrestrial and satellite services moving to higher bands to accommodate the capacities being demanded by consumer and industrial customers, and a very large amount of investment is currently being made in satellite systems operating in bands in the 27.5 - 31 GHz range.

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?:

The current consultation appears to have taken the stated demand for 5G capacity at face value. Given the unprecedented allocations that are being sought, Ofcom should begin with a rigorous review of capacity demand, based upon existing mobile network demand and identifying a potential development path to higher capacities. Without such a step, the burden placed on existing users of the radio spectrum to consider very onerous sharing scenarios is unreasonable, and will impact likely investment in new network capacity.

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

As stated, examination of bands above 31 GHz should be prioritised due to the relative lowdensity use in them currently. However, the actual demand for such very high bitrate services should be assessed, including the timeframe when they are likely to be needed (if at all).