Response to call for input on 5G spectrum access at 26 GHz and update on bands above 30 GHz.

UK Space Agency

Introduction

The UK Space Agency thanks Ofcom for the opportunity to respond to the call for input on 5G spectrum access at 26 GHz published on 28th July 2017.

The UK Space Agency does not oppose sharing in these bands as long as the protection and future growth potential of the space science and fixed satellite services operating within these allocations can be ensured. However, we consider that the use of 5G in this spectrum under the criteria and conditions outlined in this call, would adversely and permanently impact the Fixed Satellite Service (FSS), the Earth Exploration Satellite Service (EESS), the Space Research Service (SRS) and the Inter Satellite Service (ISS). Therefore this band should not be used for 5G until acceptable criteria and conditions have been developed and implemented that ensure the protection and future usability of this spectrum by these services.

Sharing criteria would normally be expected to be agreed through the 2019 World Radio Conference (WRC19) and we are therefore puzzled by Ofcom's pushing of these pioneer 5G bands within Europe's regional spectrum grouping (CEPT), in 2018, well before WRC19. This appears to pre-judge the conference outcome and we would strongly recommend that Ofcom pause until international discussions have completed at WRC19 before making any decision on the use of this band for 5G.

We understand and support the need to develop technology but at this stage, we recommend a staged approach beginning with a trial would be the most appropriate way forward that would minimise risk. There is no guarantee the band will be made available at WRC19 and if an allocation is made it is possible the technical parameters could be quite different. We also note that Ofcom's decision-making appears to be largely based around UK geographic use and does not reflect the wider international UK interest nor our obligations as members of ESA and the EU, through which the UK has made significant investments towards missions operating within this spectrum.

Question 2.1: What are your planned timelines for commercial availability of network equipment and devices for the 26 GHz band? When will equipment for testing and trials be available? Please specify the specific mmWave tuning ranges supported and their timing.

We assume this question was intended for 5G operators as space sector services are already operating in the 26 GHz EESS, ISS and FSS allocations. Information of the tuning ranges and operational parameters of these systems are already available to Ofcom.

Question 2.2: Given the 3GPP studies into NR-based operations in licence-exempt spectrum, when (if ever) do you expect to support licence exempt operation and/or coordinated sharing in the 26 GHz band in your products?

We find it surprising Ofcom are seeking views from the mobile sector on license exemption as this would not be compatible with the current sharing study assumptions in PT-1 and TG5/1 where it has always been assumed that the deployment of 5G services would be based on individual authorisation. We are concerned that moving from authorisation to license exemption removes the ability to mitigate and if necessary remediate any interference that may arise to incumbent users. We therefore do not support license exemption. Potential sharing will need to be coordinated and

this coordination should not adversely impact science use of this band, nor the ability of science use to increase in future, for example into the commercial EESS use.

Question 2.3: When do you expect to support standalone New Radio in the 26 GHz band in your products?

This question is not applicable to the space sector.

Question 3.1: Are there any other aspects related to the existing use of 26 GHz not covered in this CFI that you believe need to be considered?

The use by the fixed satellite service, which is allocated 24.65- 25.25GHz is not considered in the consultation. We understand this work has not progressed very far in TG5/1 as there is no current agreement on protection criteria for FSS, however agreement will need to be reached before any implementation of 5G in this band. With respect to interference from FSS to 5G, which is possible as this is an Earth-Space allocation, the introduction of 5G should not place limits on the location and operation of fixed satellite service ground stations.

We do not consider the future expansion of science services use of this spectrum has been properly evaluated. The UK invests in science and innovation because it leads to growth. As outlined in the Industrial Strategy Green paper, research and development leads to the creation of new products and services, more effective processes and better ways of doing business. These improvements are the essence of economic growth. Excellence in science, research and innovation is recognised by our international competitors as an important source of future competitive advantage and many are taking significant steps to increase their own investment in this area.

The EESS/SRS allocation is identified as the growth band and Ofcom recognised this in their statement on space spectrum[1] (paragraph 3.62 onwards), also highlighting the potential for coexistence. The assumption of no demand is flawed. The analysis has been focused on the UK but neglects to recognise the UK as a major contributor to ESA and EU programmes. The 25.5-27 GHz band is expected to be heavily used by many future commercial, national and ESA Earth Observation and Space Research satellite missions for data downlink.

The consultation does not appear to consider adjacent band issues. If this band is made available to 5G, protection of the adjacent 23.6-24 GHz EESS (passive) band protected under RR No. 5.340 should be ensured by identifying and implementing sufficient unwanted emission limits for 5G devices.

Question 3.2: What options for the existing services in the 26 GHz band do you believe need to be considered to allow for the introduction of new 5G services? Please give as detailed a response as possible along with all relevant information and explain how you would see any potential option you provide working in practice.

Space use of this spectrum needs to be fully protected so that there is no adverse impact on current and future use. The UK has, through ESA and the EU, invested heavily in systems using the science allocations and in data relay satellites. UK industry has growing interests in commercial exploitation of EESS and FSS. There are being developed through the UKRI, the Satellite Applications Catapult and the UK Space Agency's Space for Smarter Government and International Partnerships Programmes.

[1] https://www.ofcom.org.uk/__data/assets/pdf_file/0030/96735/Statement-Space-Spectrum.pdf

Inter-satellite links are allocated in 24.45-24.75 GHz and 25.25-27.5 GHz (primary). The Harwell Earth Station identified in the consultation as operating in this band is a primary downlink for ESAs' European Data Relay Satellites (EDRS). This site will need to be fully protected and it is probable that this will require an exclusion zone to be implemented and enforced around the site. In practice, this may be difficult to achieve if user-installed 5G base station equipment is permitted in the band, for deployment for example in a manner similar to Wi-Fi hotspots. It is likely further UK ground stations will be required in support of commercial missions and allowance for this growth needs to be accommodated.

We have a concern that, although this is a CFI, it together with Ofcom's lead in CEPT and ITU around early introduction of 5G into this band has already demonstrated a potential for discouraging future investment in the space use of 26GHz in the UK. ESA have even hinted that it is unlikely ESA will invest further in UK facilities at Harwell. This would be a grave development and we ask Ofcom please be clearer around messaging that the UK strongly supports the future development of 26GHz space services in the UK and will protect them.

Question 3.3: Should a moratorium be placed on issuing new licences in the 26 GHz band for existing services? E.g.to ensure that the 26 GHz band is not unnecessarily encumbered prior to the development of a new authorisation / licensing approach for 5G services?

Absolutely not. As recognized in Resolution 238 (WRC-15) (footnote 2 of resolves 2) for the 25.5-27 GHz band, it is important that use by EESS and SRS earth stations can expand in the future, both in terms of number of satellites and the number of earth stations. RSA licenses for these earth stations, to provide protection from interference [by 5G systems], must not be denied or restricted on the basis that this may limit 5G operational coverage. We are disappointed to note from paragraph 3.10 that there are no plans to grant RSA to Earth Exploration across the entire 25.5 – 27 GHz allocation, despite this being a primary allocation.

Question 4.1: What service would be delivered and to which consumer and/or organisations?

We assume this is around the 5G terrestrial service and therefore not applicable to the space sector.

Question 4.2: Where in the UK would the 26 GHz spectrum be used to deliver services? For example, will deployments be focussed on:

a. Areas of existing high mobile broadband demand?
b. Rural areas?
c. Rail and road corridors?
d. Specific types of enterprise or industrial sites?
e. Indoors or outdoors?
f. Specific nations or regions of the UK?

In our view, any use of this band for 5G should limited to urban and suburban areas of high demand. WP 5D have stated 5G systems will only be deployed in these areas and therefore all the compatibility studies have been based on this assumption. There should not be 5G any deployments outside areas that have been studied. We expect that deployments outside urban areas would need careful planning to avoid interference to incumbent users. Such a requirement may not be compatible with the licensing schemes proposed.

Question 4.3: Where 5G cells are deployed, are they expected to be individual cells or as clusters of cells required to give wider areas of contiguous coverage? What would be the area of a typical contiguous coverage cell cluster?

We assume this is around the 5G terrestrial service and therefore not applicable to the space sector.

Question 4.4: What capacity and bandwidth (i.e Channel Bandwidth in MHz) would be required at each cell to meet initial capacity requirements? How will this change over time?

We assume this is around the 5G terrestrial service and therefore not applicable to the space sector.

Question 4.5: What quality of service is required? How sensitive is the service being offered to variations in radio interference from other operator's 5G cells and other spectrum users?

We assume this is around the 5G terrestrial service and therefore not applicable to the space sector.

Question 4.6: Will end users be fixed or mobile?

We assume this is around the 5G terrestrial service and therefore not applicable to the space sector.

Question 4.7: What are the characteristics of 5G at 26 GHz which make this band particularly suited to the service you plan to deploy? What other spectrum bands could be used as an alternative, or in preference to, the 26 GHz band? To what extent could carrier aggregation and other techniques reduce your reliance on 26 GHz?

We assume this question is not aimed at the satellite service, where the band is well suited to the incumbent services operating within it. Prior experience of delivering mm-wave terrestrial broadband at 28GHz and 42GHz has not been especially good, with line-of-sight being found necessary to deliver a reliable service. ITU-R Recommendation P.1410 indicates the diffraction losses in the spectrum are very high and the scattered energy is difficult to use reliably due to multipath fading. Therefore, this band is not suitable for service provision on non line-of-sight-paths. Given this constraint, there will be little difference in coverage compared to the spectrum already available around 60GHz. The main difference is likely to be the cost of hardware, which we believe is driving industry to punch for these bands. This cost differential is likely to become insignificant with mass production.

Question 5.1: Should Ofcom consider licencing options other than the 3 examples set out above (licence exempt, shared coordinated and area defined) for the 26 GHz band? If so, what other options do you consider should be included?

Not allocating this band to 5G at all would be our first choice. In our view, in order to fully protect the space science use, 5G stations should be individually licensed with powers to revoke licenses should harmful interference arise.

License exemption is unsuitable as it can not be coordinated with existing use. Shared coordinated licensing may allow for the protection of incumbent services, however it is not clear how a new ground station might be inserted into an existing 5G deployment area. Area defined licenses are inappropriate as there is no requirement proposed for operators to coordinate with incumbent users.

Finally, it might be best to wait for WRC19 to conclude as this may provide alternative options. It will be very difficult to change the licensing regime retrospectively. Future UK 5G deployments will need to be compatible with international deployments to realise economies of scale.

Question 5.2: What methodologies could be used to pre-define 'high demand areas' for area defined licences?

What is the rationale for Ofcom making these pre-definitions? Operators will plan their roll out based on existing mobile traffic statistics. The question should really be around how much of that demand can be economically satisfied by base stations with a 50-200m range. As the analysis in section 4 indicates, it is likely that 5G demand will be similarly distributed to 4G users.

Question 5.3: What mechanism could be used to coordinate cell deployments by different operators in shared spectrum?

We recommend an approach whereby 5G operators share infrastructure with differentiation appearing above the physical layer. This would mean that operators would not need to roll out overlapping cellular systems. Sharing deployment extends the neutral host concept to all areas where IMT is permitted. It would make coordination with incumbents much easier as any specific frequency use restrictions required for protection would be equally shared. It will also give customers service when in range of any base station, whichever operator they choose and thereby promote faster roll out. As indicated in 4.17, neutral hosts will really have to be neutral and provide equal service to all operators. Perhaps this function could be best realised as a public sector service.

Previous auctions have been based on specific spectrum slices going to up to 5 operators who were each then expected to deploy duplicative coverage. 3G coverage, where cell sizes are relatively large still took considerable time for service to reach some customers. For 5G, this deployment mechanism breaks down. Coverage areas of only a few 100m would need vast infrastructure to be deployed and it is unreasonable to expect each area to covered by several operators. There is plenty of evidence even in the 3G/4G traditional market, that the cost of deploying adequate physical network infrastructure has required consolidation. There are now only 4 mobile network operators (MNO) and further consolidation to 3 was only prevented through EC intervention. Many areas of the UK still have no 3G/4G coverage.

Question 5.4: What methodologies could be used for determining the proportion of spectrum to allocate using area defined licences and coordinated deployment?

See response to Question 5.3 above.

Question 5.5: Do you agree that the 26 GHz band should be released progressively? What risks do you envisage with such an approach and how can these be best mitigated?

We do not agree the band should be released. Any allocation of the band to 5G should be based on sharing with existing incumbents. That sharing would need to be progressive and with the ability to roll back should unforeseen problems occur.