Your response

Your response should include details of:

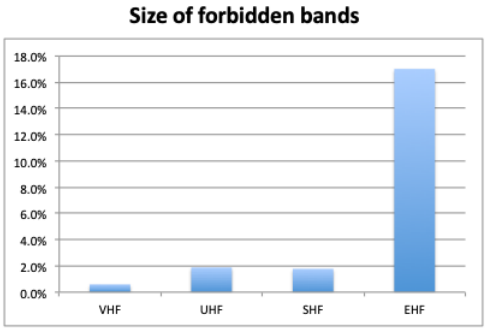
- a description of the relevant technology;
- a view of the potential impact of the technology on the sectors we regulate, preferably
- identifying the impact against the criteria listed in section 3.16 of the call for inputs;
- the current state of development of the technology, including any demonstrations of
- feasibility;
- any unresolved issues which need to be addressed for the technology to achieve full
- potential;
- references to key publications and the leading groups working on the technology; and
- whether you would be open to discussing the technology in more detail with Ofcom.

Your response

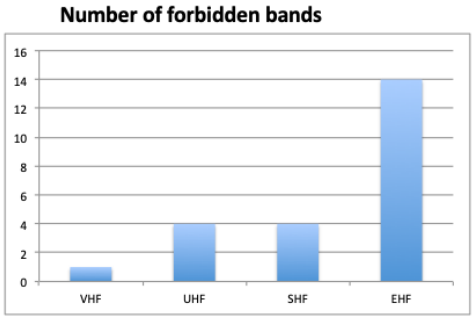
Confidential? –N

The mmWave Coalition is a USA-based alliance of 14 commercial entities and 3 universities united in the objective of removing regulatory barriers to technologies and using frequencies ranging from 95 GHz to 450 GHz. The Coalition does not limit itself to supporting any particular use or technology but rather it is working to create a regulatory structure for these frequencies that would encompass all technologies and all possible uses, limited only by the constraints of physics, innovation, and the imagination. While this consultation formally deals with only "communications", the uses of mmWave technology we are concerned with are BOTH communications uses and short range sensing uses that take advantage of the high frequencies and wide bandwidths uniquely available at these frequencies.

We applaud Ofcom for its recent consultation on "Supporting innovation in the 100-200 GHz range Proposals to increase access to Extremely High Frequency (EHF) spectrum". Spectrum above 100 GHz is basically "virgin spectrum" although its technical characteristics are very different from lower bands presently in use. It is also different in that passive allocations dating back decades before there was any commercial interest in this band have a much greater impact than they do in lower bands.



The diagram above shows how in EHF (30-300 GHz) passive allocations where all other use is prohibited cover 17% of the band. (This chart and the next one are based on US domestic allocations which differ slightly from ITU allocations in some of the lower bands.)



Not only is the fraction of available spectrum decreased by the passive allocations, but the number of passive blocks is much greater than in any other spectrum region as is shown above. This large number of blocks chops up the available spectrum and decreases the maximum contiguous block size that is available.

While passive services protected by ITU Radio Regulation 5.340 include both the Radio Astronomy Service (RAS) and the Earth Exploration-Satellite Service (EESS), in reality EESS is the big issue because radio telescopes in EHF are generally not practical in populated areas and can be protected from Fixed Service interference by careful siting of fixed links and strict attention to antenna design. But EESS systems often have downward pointing antennas on satellites and low earth orbits that cover the whole world. These EESS satellites service key function in weather prediction and pollution monitoring and must be protected from harmful interference.

While RR 5.340 gives passive service total protection in the 9 listed in 100-275 GHz because of its "All emissions are prohibited in the following bands" introductory phrase, WRC-19 Resolution 731 (https://www.itu.int/dms_pub/itu-r/opb/act/R-ACT-WRC.14-2019-PDF-E.pdf at pdf p. 564) calls for "(c)onsideration of sharing and adjacent-band compatibility between passive and active services above 71 GHz". We urge Ofcom to work with UK industry and academia in exploring the key questions in Rs. 731 that are under consideration in ITU-R WP1A. These include both technical methods for spectrum sharing as well as the possibility of "burden sharing" between active and passive users of these bands to assure interference free use of the spectrum.

While total exclusion of transmitters in passive bands is the only effective option in lower bands, that may well not be true in the >71 GHz bands under consideration in Res. 731 since the physics of this spectrum is very different than in lower bands. For 2 reasons:

1) Gaseous absorption has a major impact in upper EHF and for possible interference paths from terrestrial transmitters to EESS satellites that impact is very large at low elevation angles, often in the range of 1000-10000 dB but minimal for high elevation angles where total paths loss is only somewhat greater than for much lower bands. Ofcom noted that main lobe interference from Fixed Service transmitters is NOT a problem, but high elevation angle sidelobes are a major concern. While all finite size antennas must have sidelobes due to the laws of physics, they do not necessarily have strong sidelobes at high elevation angles. Thus, novel antenna design may result in new sharing approaches.

2) The high frequencies in EHF have very low wavelengths and these small wavelengths facilitate novel and complex antenna designs not practical at lower bands with larger wavelengths.

We note that in Ofcom's 100-200 GHz consultation you proposed in Table A6.1 elevation angle-based EIRP masks. We believe that this approach is a very useful tool in maximizing spectrum sharing and urge Ofcom to extend it to other bands also using limits based on both the frequency involved and the design of EESS systems in such bands.

We thank Ofcom for the opportunity to participate in this consultation.

Below are FCC and NTIA filings the we have made that might be of interest to Ofcom in this matter:

https://ecfsapi.fcc.gov/file/105022677816290/MMWC%20Comments%20in%20Docket%2018-21%205-2-18.pdf

https://ecfsapi.fcc.gov/file/10517084821360/MMWC%20Reply%20Comments%20in%20Docket%2018-21%20F.pdf

https://ecfsapi.fcc.gov/file/113010791160/Ex%20Parte%20Supplement%20of%20mmWave%20Coalition%20FINAL.pdf

https://ecfsapi.fcc.gov/file/10130024051912/mmW%20Coalition_NTIA%201%2019%20RFC%20comm%20final.pdf