Your response

Introduction

This consultation response is provided by Professors Simon Saunders, William Webb and Stephen Temple on an independent basis, not as representatives of any organisation. Two have us have been Directors at Ofcom and the other a leading figure in government and industry on spectrum policy, all with decades of experience in the wireless industry, academia, policy and regulation.

We welcome Ofcom's proposals for hybrid sharing between licensed mobile and Wi-Fi applications in the upper 6 GHz band. Both applications have strong arguments for additional spectrum, but with considerable uncertainties as to the quantity and timing of their requirements, and as to the size of the associated benefits. In these circumstances, a command-and-control approach to allocation of the band to either service carries considerable risks, while a hybrid approach – if appropriately designed – could follow the actual market requirements, increasing the total benefit and reducing the risks.

In particular we agree that:

- There is considerable scope for sharing the band on the basis of a split by both geography (both spatially and between indoors and outdoors) and frequency.
- Technology already exists in other parts of the world, applied to both cellular and Wi-Fi, which could be adopted and adapted without excess cost or detriment for application in the UK context.
- While demand for the services may often be geographically complementary, this will be impossible to determine in advance and will not follow simple urban/rural splits. Likewise while building penetration losses may allow sharing between nearby indoor and outdoor systems in many cases, the losses involved and the system parameters are very variable, and will have to be evaluated on a site-specific basis to avoid inefficient assignments or excessive interference risks.
- A database driven approach to assignment is an ideal approach to managing hybrid sharing in this band, allowing the assignments to adapt to market conditions, propagation parameters, and changing technology capabilities over time.

However, there is much to consider in the successful implementation of the hybrid scheme. Ofcom is right to suggest that the database-to-equipment interfaces already implemented in the CBRS (for mobile) and AFC (for Wi-Fi) systems are a good starting point which can be adopted with little or no adaptation. However, the database business logic embodying the assignment rules will be very different to either of those schemes. For example, Wi-Fi and mobile applications will need different timescales for retention of assignments in order to achieve a positive business case, and need different levels of interference protection. And as well as assignment for active systems, the database will need to allow reservation in advance of deployment and different levels of pre-emption rights for different systems.

To assist in the design of that database, we would like to draw attention to work that the authors conducted within the UK Spectrum Policy Forum in 2019, to create a framework for Dynamic Spectrum Allocation (DSA) in the UK context. The result is a highly adaptable framework which meets all of the above requirements, and could be configured for application to the upper 6 GHz band.

Attached please find the following documents for consideration:

- "Explanatory Guide to the DSA Functional Specification" – the detailed definition of the proposed framework.
- "Proposed principles for UK DSA" – a short explanatory slidepack providing an overview of the framework.

We would be pleased to discuss the application of this framework to the upper 6GHz band in more detail.

Question	Your response
Question 1: Hybrid sharing could mean that the upper 6 GHz band will be used for mobile outdoors and Wi-Fi indoors. What are your views on the priorities for each of these two services, assuming that suitable coexistence mechanisms are developed?	*Is this response confidential? – Y / N (delete as appropriate)* Both services have a reasonable case to generating value, and priorities should be determined based on actual propensity to deploy rather than set *a priori* by Ofcom.
Question 2(a): Hybrid sharing could mean that the upper 6 GHz ban will be used for mobile in some locations, and Wi-Fi in others. We would like feedback on the priorities for each of these two services, assuming that suitable coexistence mechanisms are developed. From the point of view of mobile, is the upper 6 GHz band most useful to provide outdoor coverage, or indoor coverage? Is it most useful in urban areas, or in those base stations that are currently carrying more traffic, or some other split?	*Is this response confidential? – Y / N (delete as appropriate)* The band is useful for both environments, and for both services: mobile both indoors and outdoors, and Wi-Fi both indoors and outdoors. We would expect that mobile use will be mainly in localised regions of high traffic density, but note that these are not necessarily in urban areas.
Question 2(b): Similarly, what are the priorities from the point of view of Wi-Fi deployments?	*Is this response confidential? – Y / N (delete as appropriate)* We would expect Wi-Fi to have a case for usage anywhere that high peak speeds, low latencies or multiple concurrent users are found. Again we note that these are not necessarily in urban areas but should be determined based on actual demand with an intent to deploy and use.
Question 3: What are your views on a modified AFC or SAS-type approach to enable hybrid sharing? What additional work do you think would be required?	*Is this response confidential? – Y / N (delete as appropriate)* We agree that reusing existing standardised mechanisms such as AFC and SAS is efficient and will facilitate rapid deployment in the UK.

	An adaption layer to use these interfaces will be needed, as will different database logic and priorities from that used in AFC or SAS. The UK DSA framework we have cited could be a suitable starting point for that logic.
Question 4: How could existing access protocols and sensing mechanisms be leveraged (i.e., those in Wi-Fi or 5G NR-U) to enable hybrid sharing?	*Is this response confidential? – Y / N (delete as appropriate)* No comment.
Question 5: What mechanisms could potentially enable device-to-device connectivity?	*Is this response confidential? – Y / N (delete as appropriate)* No comment.
Question 6: If hybrid sharing is eventually adopted, and requires licensed mobile to operate at medium power, in what way would mobile networks use the upper 6 GHz band?	*Is this response confidential? – Y / N (delete as appropriate)* No comment.
Question 7: How would you suggest that the mechanisms presented here can be used, enhanced, or combined to enable hybrid sharing or are there any other mechanisms that would be suitable that we have not addressed?	*Is this response confidential? – Y / N (delete as appropriate)* Database-driven sharing, with appropriate opportunities for pre-emption and protection, and appropriate timescales to suit mobile and Wi-fi deployment.
Question 8(a): Assuming the future of the band includes indoor use for Wi-Fi and outdoors use for mobile: How could this be achieved without creating or suffering interference?	*Is this response confidential? – Y / N (delete as appropriate)* By automatically registering all intent to use and actual usage, appropriate protection can be built into the database logic, and adjusted over time in the light of practical experience to maximise spectrum efficiency.
Question 8(b): Could there be a combination of technical adjustments such as power limits and other mechanisms (including databases or sensing mechanisms)?	*Is this response confidential? – Y / N (delete as appropriate)* A combination of approaches is appropriate. But a flexible approach to parameters should be adopted to ensure a wide range of applications should be adopted. For example, excessive restriction on power levels could unnecessarily hinder the utility of the band, when geographical and other techniques for avoiding interference on a local basis would be more effective.
Question 9(a): We are interested in input about the importance of the upper 6 GHz band for its incumbent users, and on the potential impact of hybrid sharing of the band.	*Is this response confidential? – Y / N (delete as appropriate)* No comment.

What evidence do you have on whether incumbents are likely to coexist with hybrid sharing of the band with mobile and Wi-Fi? Are there unique advantages of the upper 6 GHz band for these uses?	
Question 9(b): What are your views on the initial analysis we have conducted around hybrid sharing and coexistence with incumbents?	*Is this response confidential? – Y / N (delete as appropriate)* The initial analysis is a useful initial indication , but further analysis and measurement will be required.
Question 9(c): For any incumbent uses that you view as unlikely to be able to coexist, what alternatives are there? What are the barriers that might prevent those alternatives?	*Is this response confidential? – Y / N (delete as appropriate)* No comment.
Question 10: Do you have any other thoughts that you would like to share about hybrid sharing in the upper 6 GHz band, or about hybrid sharing more generally and its potential for applications in other bands?	*Is this response confidential? – Y / N (delete as appropriate)* Hybrid sharing in this band brings an excellent opportunity to ensure the value of this band while pioneering an approach which could be applied to other bands in the future. It allows market mechanisms and flexibility to brought to the overall *allocation* of bands rather than only the *assignment* of individual authorisations.
Question 11: Do you have any other comments to make on these proposals or on the future use of the upper 6 GHz band?	*Is this response confidential? – Y / N (delete as appropriate)* No further comment.

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