Your response

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? – N* Additional spectrum to support both licence-exempt and licensed mobile spectrum is important to enable ongoing market growth and technology innovation and development. It is also recognised that spectrum is a finite resource and that as demands for spectrum continue to increase it is important to explore whether approaches such as hybrid sharing could enable a more intensive utilisation of spectrum while maintaining service integrity and maximise commercial value. Such an approach should be carefully considered and should result in an approach that is better than the more classical approach of segmentation between licensed and licence-exempt. It is therefore very important to ensure the suitable coexistence in aspect of stable service to users for each application. It is also important to recognise that mobile deployments require the option for high power operation so that outdoor base stations can serve indoor mobiles in addition to outdoor mobiles thereby increasing the commercial attractiveness to invest in rolling out mobile networks in this band. For the question of the priorities, the operation of Mobile near a building and the operation of Wi-Fi indoors near a window may be not a stable environment and this should be one of the areas for further study before any decisions are made.
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	*Is this response confidential? – N* *If suitable mechanisms are developed (and Samsung remains cautious whether this is feasible and there would need to be a high degree of industry confidence in any potential approach) then Wi-Fi (indoors, D2D, in vehicle etc.) and high power cellular (serving outdoors and indoors) should be the target generally. For mobile cellular it is assumed at this stage that 6GHz could be used for city wide deployments*

are currently carrying more traffic, or some other split?	*that serve both outdoor but also indoor areas with some densification (compared with a 3.5 GHz grid) required in some areas. It is not clear at this stage if 6GHz will extend outside of the cities.* *As the same matter with Q1, that suitable coexistence mechanisms are developed.*
Question 2(b): Similarly, what are the priorities from the point of view of Wi-Fi deployments?	*Is this response confidential? – N* *Indoor Wi-Fi remains important such access points, TVs, consumer electronics, device to device, industrial applications, etc. There are some scenarios such as vehicular communications where Wi-Fi is also important.*
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)*
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? – N.* *It is suggested that there would be benefit in a wider industry discussion and evaluation in potential techniques that could be considered.*
Question 5: What mechanisms could potentially enable device-to-device connectivity?	*Is this response confidential? – N .* *Again it is suggested that there would be benefit in a wider industry discussion and evaluation in potential techniques that could be considered.*
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? – N.* *The mobile network operators have indicated that the option for high power operation is important so that the mobile networks can serve both the outdoor and indoor areas with a significant amount of traffic generated from an indoor location.*
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)*
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)*

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)*
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. 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?	*Is this response confidential? – Y / N (delete as appropriate)*
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)*
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)*
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)*
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)*

Please complete this form in full and return to Hybridupper6ghz@ofcom.org.uk.

1. Introduction

Samsung Electronics is pleased to have the opportunity of response to Ofcom's consultation paper which is to ask Hybrid Sharing.

As Ofcom has stated, Samsung is also aware that there has been a significant growth in traffic on both mobile broadband and Wi-Fi networks over the last decade and that this trend of growth is expected to continue. Additional spectrum to support both licence-exempt and licensed mobile spectrum is important to enable ongoing market growth and technology innovation and development. It is also recognised that spectrum is a finite resource and that as demands for spectrum continue to increase it is important to explore whether approaches such as hybrid sharing could enable a more intensive utilisation of spectrum while maintaining service integrity and maximise commercial value. Such an approach should be carefully considered and should result in an approach that is better than the more classical approach of segmentation between licensed and licence-exempt. It is therefore very important to ensure the suitable coexistence in aspect of stable service to users for each application. It is also important to recognise that mobile deployments require the option for high power operation so that outdoor base stations can serve indoor mobiles in addition to outdoor mobiles thereby increasing the commercial attractiveness to invest in rolling out mobile networks in this band. Spectrum for Device to Device communication it is also so important and its demands are also continuously increasing in order to support a direct multi-media data transmission such as mobile to audio device or AR/VR headset, screen mirroring to a TV or a Display or to directly control appliances, digital door and so on. Because Samsung provides many kinds of products such as mobile devices, base station, PCs, appliances including TV and multi-media devices.

In aspect of spectrum demands and a finite spectrum resource, Hybrid sharing mechanism could be a potential alternative solution to meet both the needs of licensed mobile and licence-exempt devices.

2. Consideration

"Samsung must consider not only quantitative but also qualitative aspects when developing products to maximize user experience."

Additional frequency supply enables extremely high-quality multimedia services, high-speed data transmission, and simultaneous data transmission to many devices. On other hand, services that require real-time performance (streaming, VoIP, etc.) also requires the stability of connection performance. If the connection performance is unstable, the quality of the service may be severely affected, as picture or movie quality may deteriorate rapidly when using streaming services or connection may be disconnected or delayed when using high quality video call with VoIP or real-time internet broadcasting. Therefore, there is a need to provide sufficient and stable bandwidth or speed to provide related services.

> *"Before prioritizing mobile or Wi-Fi, it is more importance and necessary to be confident that coexistence between mobile and Wi-Fi is possible without causing any critical interference to each other in a given deployment or operational scenarios."*

One of the scenarios to enable Hybrid sharing is to deploy mobile in outdoor and Wi-Fi in indoor by using a building penetration loss in the same frequency band. However, this building penetration loss is not constant and the amount of building penetration loss varies greatly depending on not only the building material but also the angle through which signals pass. This factor causes many difficulties in determining the transmission power of a base station or the separation distance from Wi-Fi. Otherwise, this brings up an interference area or a shaded area between mobile and Wi-Fi, eventually makes degradation of service quality. On the other aspect, low transmission power of a base station for easily coexisting with Wi-Fi may also reduce the value of spectrum due to increase of costs when operators deploy network.

> *"The current sharing technologies presented by Ofcom may not operate perfectly in deployment environment for hybrid sharing considered by Ofcom. A wider industry and regulatory discussion and evaluation is required before any decisions are taken"*

Ofcom explores the existing mechanisms to enable hybrid sharing (i.e., managed database, spectrum sensing and a combination of both). Among the existing mechanism for spectrum sharing, automated frequency coordination or spectrum access system as a type of managed database used in the USA provide available band to avoid interference to each other that are in geographically close location. However, these existing mechanisms based on a database approach do not take into account very precise areas where indoor and outdoor areas are directly attached, and they may not be operated dynamically in time. AFC and SAS are technologies that enable periodic frequency selection/control based on the database. But, for example, in the case of AFC, it was created for the purpose of protecting existing services in the fixed location or without randomly moving such as Fixed Satellite services. AFC may not be suitable for mobile and Wi-Fi where their locations are randomly placed as well as the very precise areas. Furthermore, Device-to-Device communication may have difficulties to access a database.

> *"However, there are a lot of difficulties finally concluding coexistence between mobile in outdoor and Wi-Fi in indoor or timely separate operation due to limited information at the moment."*

It cannot be concluded that a given coexistence environment and existing technology completely avoid or mitigate interference. It is currently unclear if this interference mitigation is at least acceptable to meet quality of services which users need due to limited information. Otherwise, there may be other solution not stated in Ofcom or reviewed to mitigate interference.

3. Summary

It's inevitable that the growth of demand for spectrum for licensed mobile and licence-exempt devices and services is continuously increasing with increasing mobile data traffic in licensed bands and expansion of use cases providing connectivity such as D2D in licence-exempt bands.

In this regard, the efficient and balanced use of the spectrum resource should be considered to maximise the use of the limited spectrum. Therefore, we are of the view that hybrid sharing may be a necessary approach to meet spectrum demand to maximise the efficiency of spectrum use if the interference can be managed sufficiently. However, due to lack of information and uncertainty of hybrid sharing at this stage such as how much hybrid sharing mechanism is technically feasible, how suitable the existing sharing mechanism is to directly apply to hybrid sharing, whether the additional condition and implementation can meet cost and complexity of devices for commercialization. We are aware that the study on hybrid sharing is currently underway in ECC PT1. Taking into account this trend, it is too early to make any decisions at this stage on hybrid sharing, therefore, further investigation of feasibility of hybrid sharing would be needed. We expect that further industry and regulatory discussions should be undertaken in organisations such as ECC PT1 until there is wider confidence on the feasibility of particular approaches.