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? – No* *First*, it is important to recognize that extensive technical analyses along with the subsequent decision[1] have already established regulatory conditions that are necessary for coexistence with important incumbent operations in the 6.425-7.125 GHz ("upper6 GHz) band. These conditions are acceptable for low-power Wi-Fi networks but are not feasible for *commercially viable*, high-power mobile network deployments ("Mobile"). To maintain the necessary quality of service, licensed mobile networks require priority access to the spectrum. With priority spectrum access, outdoor Mobile networks cannot avoid interfering with or tolerate interference from incumbent transmissions in the 6.425 - 7.125 GHz band. Restricting the 6 GHz Mobile licensed deployments to "predominantly outdoor" deployments would exacerbate commercial viability of these networks by further limiting their service area and increasing potential interference to the incumbent services. *Second,* as recognized by Ofcom, the outdoor licensed transmissions have a great potential to trigger Wi-Fi's Listen Before Talk detection.[2] Wi-Fi Alliance respectfully asks Ofcom to note that the IEEE specification for Wi-Fi requires energy detection at -62 dBm/20 MHz, but Wi-Fi Alliance members report that their implementations can sense at much lower thresholds. Even with structural attenuation, it would be impractical to contain Mobile transmission at levels below these thresholds. *Third*, as the demand for Wi-Fi connectivity continuous to grow, the 6 GHz Wi-Fi use cases are expanding to airports, train stations, maritime ports, stadiums, malls,

[1] Improving spectrum access for Wi-Fi-Spectrum use in the 5 and 6 GHz, Ofcom, 24 July, 2020; Commission Implementing Decision (EU) 2021/1067 of 17 June 2021

[2] Consultation at 4.11-4.13

	industrial facilities, public transportation, and many other high user/device density environments. For example, driven by consumer demand, connectivity has become one of the top design priorities in the automotive segment. The 6 GHz-enabled Wi-Fi devices support multiple vehicle infotainment, maintenance, tracking, security and other applications. Importantly, Wi-Fi access to greater spectrum bandwidths significantly facilitate in-vehicle coexistence among multiple unlicensed technologies. But the use cases and coexistence are not feasible in the presence of high power licensed mobile transmissions. And importantly, it is simply impractical to expect the licensed Mobile to strictly limit transmissions only to outdoors. *Fourth*, as is the case in the 5.925-6.425 GHz ("lower 6 GHz) band, access to the 6 GHz spectrum is needed for operation of the very low power (VLP) devices. The 6 GHz VLP devices will usher in a new wave of applications that can provide large quantities of information in near real-time. But functionality and commercial viability of these VLP devices requires access to both, indoor and outdoor environments. For example, many 6 GHz VLP devices are body worn to support a variety of use cases such as healthcare, location, advanced connectivity, wireless casting, augmented- and virtual-reality, with many applications still to be defined. Segregation of the Wi-Fi VLP devices to indoor-only would preclude many of these promising use cases.
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? – No* Please see response to Question 2(b).

are currently carrying more traffic, or some other split?	
Question 2(b): Similarly, what are the priorities from the point of view of Wi-Fi deployments?	*Is this response confidential? – No* Wi-Fi Alliance respectfully disagrees with the assertion that "[h]*ybrid sharing might be more robust in the face of uncertainties around the future nature of demand*".[3] Only with ubiquitous access to the 6.425-7.125 GHz spectrum, Wi-Fi applications can fully serve UK's public interest by unlocking numerous innovative use cases. Current and future generations of Wi-Fi (Wi-Fi 6E and Wi-Fi 7) are transformative, force multipliers for other innovative technologies – including IoT, cloud, and edge computing. Without Wi-Fi access to the upper 6 GHz band, UK's consumers and enterprises cannot realize the full benefits of Wi-Fi 6E, Wi-Fi 7 and future generations of Wi-Fi technologies. And, importantly, there are no alternative frequency bands that can accommodate expanding demand for Wi-Fi connectivity, now or in the future. Wi-Fi Alliance respectfully asks Ofcom to consider that "mobile data traffic concentrations"[4] are anything but static or well defined. It is not feasible to develop hybrid sharing solutions, that need to function on at least semi-permanent basis, based on exclusion zones which may change with new use cases, applications, economics, shifts in population and several other unpredictable factors. As Ofcom recognizes, there are "*uncertainties around the future nature of demand*".[5] Clearly, the "mobile data traffic concentrations" are just as uncertain as the nature of demand. It is therefore impractical to dynamically manage geographic contours of the "busy areas". Moreover, it is impractical to preclude 6 GHz Wi-Fi operations in high-population density areas, exactly where they are most needed. .
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? No* Geolocation database solutions such as AFC are intended to identify permissible frequencies and associated power levels for Wi-Fi operations at a specific geographic location. In broad terms, the AFC functionality is premised on exclusion of Wi-Fi transmission in the vicinity of Fixed (i.e., stationary) network deployments.

[3] *Consultation* at 3.28-3.30
[4] *Consultation* at 3.19-3.27
[5] *Consultation* at at pg. 18

	But geolocation database solutions, such as AFC, are not practical for sharing between Wi-Fi and Mobile networks which, by definition, are not stationary. It would be impossible for Wi-Fi or Mobile user terminal to maintain geographic separation without excluding large swaths in coverage of populated areas – rendering either network commercially not feasible. Implementation of SAS geolocation database approach adds another degree of complexity by introducing hierarchical priority spectrum access. Schemes prioritizing Wi-Fi or Mobile spectrum access by "day and time" are likely to result in negative user experiences when either service's functionality is degraded outside of the prescribed period. Such hybrid approaches further undermine Wi-Fi feasibility. Wi-Fi Alliance respectfully asks Ofcom to note that, following years of development, the 6 GHz AFC ecosystem framework is available and can be readily repurposed for the UK market. Set of 6 GHz AFC specifications, test plans, test cases, test harnesses and other elements by which AFC systems and devices may be assessed is available at: https://www.wi-fi.org/discover-wi-fi/6-ghz-afc-resources. Such framework does not exist for the licensed Mobile implementations in the 6 GHz band.
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? – No* Wi-Fi has demonstrated the ability to coexist with and protect other spectrum users. Implementing contention-based protocol allows multiple users to share spectrum by providing a reasonable opportunity for the different users to transmit. Built on IEEE 802.11 standards, Wi-Fi's "listen-before talk" spectrum access scheme based on the Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) protocol functions as a contention-based algorithm to provide access to all traffic. Before initiating any packet delivery, a Wi-Fi station listens to the wireless medium and if the medium is idle, the station may transmit; otherwise, the station must wait until the current transmission is complete before transmitting. These protections are inherent to Wi-Fi technology and are critical to its efficient operations on license-exempt basis worldwide. And Wi-Fi industry is committed to implementing technical, operational, and regulatory solutions that ensure coexistence in the 6 GHz band. Wi-Fi can achieve coexistence with 5G NR-U and other license-exempt technologies with implementation of reasonable CSMA/CA protocols.

Question 5: What mechanisms could potentially enable device-to-device connectivity?	*Is this response confidential? – No* Ofcom correctly recognizes that device-to-device Wi-Fi indoor only connectivity can be effectively implemented with regulatory mechanism requiring each device to detect the AP's enabling signal.[6] But imposing an indoor-only constraint on such connectivity, would effectively forecloses on device connectivity operating under the control of the VLP. There are multiple use cases that require VLP device-to-device connectivity (*e.g.*, screen-casting in vehicles, wearables, monitoring, security, etc.). It is also unclear what regulatory mechanism can restrict Mobile devices' transmissions only to outdoors or to ensure that these signals remail below Wi-Fi's energy detect thresholds.
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? – No* Setting aside the fact that, even at "medium power", the 6 GHz Mobile networks cannot protect incumbent services or coexist with Wi-Fi, such implementations will lack the economies of scale necessary for a robust equipment ecosystem or commercial viability. Mobile transmission at "medium power" will lack coverage or require increased macro-cell installations, again undermining network's economic feasibility. It is doubtful that hypothetical medium-power Mobile networks will achieve sufficient scale to justify significant upfront investment for development of the 6 GHz equipment or for commercial deployment and operation.
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? – No* The 1200 MHz of spectrum in the 6 GHz band enables major advances in Wi-Fi applications, infrastructure, and services. Increased data throughput rates, ultra-low and deterministic latencies, better mobility, and high densities of users/devices all become more achievable and practical with access to the entire 6 GHz spectrum. Bifurcation of the 6 GHz band between Wi-Fi and Mobile (i.e., "separate assignments") approach would preclude these capabilities and associated benefits while reserving spectrum for likely unsustainable Mobile implementations. That is why, Wi-Fi Alliance respectfully asks Ofcom to avoid segmentation in the 6.425-7.125 GHz band.

[6] *Consultation* at 4.51

	Moreover, Wi-Fi Alliance respectfully takes issue with the "***fair sharing***" premise of this proposal.[7] If fair sharing is the predominate objective, then the need for access to the 6 GHz spectrum needs to be evaluated holistically, in the context of existing spectrum allocations.
	The licensed mobile services ("Mobile") already have access to multiple alternative spectrum bands:
	• Existing mid-band allocations are still underutilized by Mobile. In Europe, for example, years after the "5G Pioneer Bands" designation, assignments stand at 60 percent:[8]
	  ○ 700 MHz is assigned at less than 75 percent
	  ○ 3.6 GHz is assigned at less than 80 percent
	  ○ 26 GHz is assigned at less than 30 percent
	• Existing 2G, 3G, and 4G frequency with sizeable allocations around 2.1 GHz and 2.5 to 2.7 GHz can be repurposed for 5G use.
	• The 4 to 5 GHz and 7 to 8 GHz frequency ranges are of increasing interest to the mobile industry. In fact, Mobile proponents maintain that 4.4 to 4.9 GHz and 7.125 to 8.5 GHz are "well suited to meet the requirements both from a coverage and capacity perspective"[9]
	• Mobile proponents expressed significant interest in the 12 GHz band for 5G deployments. Interestingly, proponents use the same arguments and claims for both 6 GHz and 12 GHz. For dense "hotspot" and indoor use, 5G can use 26 GHz mmWave cells, where a large ecosystem of devices, radios, and chipsets already exists. 39 GHz and 42 GHz options are also available.
	• Mobile deployments may also use unlicensed 6 GHz spectrum under appropriate sharing and coexistence conditions (e.g., 5G NR-U).
	In short, Mobile's proponents' claims that 6 GHz is essential appear to be exaggerations at best. There are ample other frequency options for addressing Mobile spectrum needs. In contrast, Wi-Fi spectrum access options are highly limited and restricted. Without access to 6.425-7.125 GHz, optimal performance of current and future Wi-Fi technologies cannot be achieved.

Question 8(a): Assuming the future of the band includes indoor use for Wi-Fi and outdoors use for mobile:	*Is this response confidential? – No*

[7] *Consultation* at 4.56
[8] European 5G Observatory, July 2022
[9] Ericsson, 2022

How could this be achieved without creating or suffering interference?	To maintain the necessary quality of service, Mobile wide-area networks with high-power rooftop deployments, require priority access to the spectrum. Priority access is contradictory to hybrid sharing and fair coexistence because it can be achieved only by precluding Wi-Fi spectrum access. Restrictions such as indoor-only, scheduled-periods or exclusion zones will degrade Wi-Fi performance that, most likely, will not justify billions of pounds in investment required for Wi-Fi implementation in the 6.425-7.125 GHz band.
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? – No* See answer to Question 8a.
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? – No* Wi-Fi Alliance agrees with Ofcom's that, for the purposes of protecting the 6 GHz Fixed link incumbents, there are no significant difference between the upper and lower 6 GHz bands and that conclusion of the ECC Report 302 are applicable.[10] With that in mind, it is difficult to understand, how the Fixed links in the upper-6 GHz will be protected from the Mobile networks' transmissions. Even if coexistence between the Mobile base stations and Fixed links can be achieved, as proposed, through coordination, the transmissions from Mobile user terminals (e.g., handsets), at power levels that are orders of magnitude higher than what was deemed acceptable for outdoor operations in the ECC Report 302 (i.e., VLP eirp at 25 mW) will cause harmful interference. It is unclear how this harmful interference to the Fixed links can be managed. Moreover, coordinated separation distances between higher power mobile base stations and Fixed links at 4 km to 58 km, largely negate business cases for the ubiquitous Mobile deployments.[11] And, of course, such coordination arrangements limit evolutionary modifications in networks' configurations for both Fixed and Mobile deployments. A flexibility to adjust network configuration is an inherent prerequisite for commercially successful Fixed and Mobile deployments. Operations of Mobile networks at "medium power" would require even denser base station deployments, further complicating coordination with the Fixed links.

[10] *Consultation* at 5.14-5.15
[11] *Consultation* at 5.8

	Similarly, Mobile coexistence with 6 GHz incumbent satellite services is not guaranteed. Importantly, under the international treaty, UK has an obligation to protect all on-orbit fixed-satellite receivers from Mobile transmissions. Ofcom's assumption that "*sharing would be possible with the global beams of fixed satellite systems if mobile network densities remain relatively low*" appears inconsistent with conclusions of the ECC Report 302.[12] Also, Ofcom may wish to evaluate the feasibility and potential benefits of constrained to low density Mobile deployments in the upper 6 GHz band.
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? – No* No response
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? – No* No response
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? – No* No response
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? – No* Wi-Fi Alliance respectfully asks Ofcom to take into account the benefits gained from an internationally harmonized regulatory framework for Wi-Fi in the upper-6 GHz, including commonality of equipment, economies of scale, larger market, increased competition, lower product prices, and a wider choice of products, to name just a few.

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

[12] *Consultation* at 5.11