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 co-existence mechanisms are developed?	*Is this response confidential? – N* As an opening remark, we acknowledge the Ofcom statement that this consultation is not related to WRC-23 Agenda Item 1.2, but we want to reiterate that Apple has always maintained that an IMT identification for the upper 6 GHz band is not required and that licensed access to the upper 6 GHz band for IMT is not justified. Our preference is for licence-exempt access to the whole 6 GHz band (5925-7125 MHz). In principle Apple is not opposed to studying a hybrid approach for upper 6 GHz (6425-7125 MHz) if this helps secure timely access for licence-exempt technologies. Apple would prefer this hybrid approach without an IMT identification. Similar to Ofcom, we note coexistence between IMT and the incumbents is challenging in most instances and that coexistence between IMT and Wi-Fi has never previously been studied. Wi-Fi coexistence with incumbents has already shown to be possible as demonstrated by making the lower 6 GHz band available for licence-exempt use; the incumbents are practically the same. We see a significant difference in deployment timescales since certified Wi-Fi 6E equipment for the full 6 GHz band (5925-7125 MHz) is shipping today, e.g. for the USA market and others where regulations are established, and it is unclear when IMT will be available. It was interesting to note that the GSMA have stated it is typically 10 years between harmonisation at ITU level and implementation [Policy Tracker news article dated 3 March 2023 "What spectrum will be needed for a 6G future?"]. We recommend that Wi-Fi should not be constrained by any protracted IMT timelines. As previously mentioned, Wi-Fi 6E is already shipping thus it will be challenging to place additional regional mitigation requirements on Wi-Fi above and beyond that already implemented. Ideally, mitigations and regulatory access should be harmonized globally to the greatest extent possible. Also, it is important to Apple to consider the need for Very Low Power (VLP) portable licence-exempt use cases that will also have an outdoor element. This

	particular use case is not easily covered in the scenario where IMT is outdoors, and Wi-Fi is indoor only. Apple recommends allowing Wi-Fi 6E deployments immediately and then (if indeed possible) find a way for IMT to coexist but assuming Wi-Fi as a "incumbent", e.g., allow LPI under the same rules as the lower 6 GHz immediately.
Question 2(a): Hybrid sharing could mean that the upper 6 GHz band 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? – N* Apple agrees with Ofcom's view that "operators have the scope to increase the capacity of most of their sites by adding other bands which are already licensed to them." We do question whether IMT access to the upper 6 GHz band is required to provide additional capacity even in a subset of sites that are in the busiest areas. We do agree that access to the upper 6 GHz "is unlikely to be needed everywhere." That said, whatever mid-band is being considered, we believe that for the vast majority of instances mobile is better suited to provide coverage outdoors. Wi-Fi is significantly better suited for the provision of indoor coverage.
Question 2(b): Similarly, what are the priorities from the point of view of Wi-Fi deployments?	*Is this response confidential? – N* We believe that Wi-Fi should have licence-exempt access the upper 6 GHz as soon as possible noting there is WFA certified Wi-Fi 6E equipment for the full 6 GHz band available and shipping today. As previously mentioned, the GSMA have indicated that there is a 10-year gap between harmonisation at the ITU and implementation, thus Wi-Fi 6E should not be delayed by unknown and protracted IMT timescales. Clearly IMT in upper 6 GHz is not suitable, desirable, or indeed economically feasible to deliver outdoor-to-indoor coverage. There are far better solutions in the form of fibre and Wi-Fi for indoor coverage not to mention the more appropriate energy efficient, significantly reduced carbon footprint from a Wi-Fi solution[1]. Mobile is far better suited for outdoor deployments but whether upper 6 GHz is the answer to addressing capacity problems in these isolated geographical (i.e., on a basestation-by-basestation basis), and likely time-limited instances, is difficult to justify. Apple's priority is for licence-exempt access to the full 6 GHz band for products that are already Wi-Fi Alliance

[1] https://www.wi-fi.org/news-events/newsroom/wi-fi-access-to-6-ghz-promotes-environmental-sustainability

	certified and shipping today; we do not want to be held to protracted IMT timelines.
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? – N* Apple has concerns if modified AFC system or SAS would be applied to indoor low power Wi-Fi access points. Adding this requirement would unduly delay the roll out of existing products. Further, Apple has concerns with implementing a SAS at 6 GHz as this system is not currently being developed for the 6 GHz band. Based on the existing Wi-Fi 6E product on the market and AFC rule applications, it would be something to consider for IMT since this is the technology operating outdoors. AFC was originally designed to mitigate high power Wi-Fi outdoor interference to FS links and satellite gateways; therefore, it is more applicable to the outdoor IMT use case in the event the incumbents are not requested to vacate the band. We believe it is reasonable to expect any mechanisms that require new mitigation methods / techniques to be implemented more so by IMT and not Wi-Fi due to Wi-Fi market penetration at the time of IMT deployment.
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* Apple suggests that 3GPP technology in the form of 5G NR-U could coexist with licence-exempt Wi-Fi under the same regulatory framework that exists today for the lower 6 GHz band and/or 5 GHz band. We see hybrid sharing with licensed IMT as likely to be challenging and could result in additional restrictions on both technologies.
Question 5: What mechanisms could potentially enable device-to-device connectivity?	*Is this response confidential? – N* Apple has concerns if device-to-device use in the upper 6 GHz band is constrained to indoor operation only since not all device-to-device use cases are indoor only. VLP should be enabled for both outdoor and indoor environments; we are interested in enabling VLP everywhere. Nevertheless, the question is which mechanisms can be used to enable VLP mode outdoors should high power IMT be allowed in the same band.
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* Apple has not responded to this question.

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? – N* Apple has not responded to this question.
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? – N* A shared framework inherently will create some level of mutual interference but in order for it to be successful, the impact of that has to be small. In any case, mobile will have access to other frequency bands and therefore benefit from frequency diversity to combat potential interference. This frequency band diversity from a Wi-Fi perspective is significantly limited especially when one considers wider channel bandwidths such as those supported by Wi-Fi 7 which also include 320 MHz channels. High reliability on a mobile network requires the use of multiple bands anyways.
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? – N* Apple has not responded to this question.
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? – N* Incumbents can clearly coexist with Wi-Fi as demonstrated in the lower 6 GHz ECC Reports and subsequent ECC/EC regulations allowing licence-exempt use in the lower 6 GHz band, but IMT coexistence with incumbents is highly questionable as many studies show unacceptable interference from IMT to incumbents and/or will require substantial geographical separation distances. Any hybrid regulatory framework is likely to place further restrictions on Wi-Fi, e.g., lower transmit power, thus Wi-Fi coexistence with incumbents will actually be improved but likely at the detriment to Wi-Fi coverage / capacity.

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? – N* Apple agrees with Ofcom's initial analysis that low power indoor Wi-Fi can share with incumbent services in the upper 6 GHz with negligible risk of interference as this was confirmed after coexistence studies for the lower 6 GHz band. Apple also agrees with the Ofcom view that allowing outdoor high power licensed mobile into the upper 6

	GHz band there is the potential for interference to fixed links and there is also potential for interference to fixed satellite service receivers unless international measures are agreed to protect these receivers. Apple prefers that Ofcom focus only on enabling licence-exempt use in the upper 6 GHz band, and any hybrid technique be applied to IMT should it be required to access the band.
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? – N* Apple has not responded to this question.
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? – N* Apple believes that hybrid sharing (or sharing in general) will most likely be needed in the future as more spectrum dependent technologies are developed in already congested areas of the spectrum. For the 6 GHz band, it is unique since there are already existing Wi-Fi 6E products on the market, which is why Apple supports opening of the upper 6 GHz band for licence-exempt use as quickly as possible under the same regulatory framework that exist for the lower 6 GHz. Any additional mitigations (beyond Low Power Indoor continuing to be limited to indoor and low power use) should be applied to the IMT new entrant. If hybrid sharing excludes outdoor VLP and allows only indoor LPI, it will create a huge disadvantage for some use cases.
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? – N* As previously mentioned, Apple suggests that the upper 6 GHz regulatory framework should not be compromised to force some form of licensed IMT access considering 3GPP technology in the form of 5G NR-U could coexist with licence-exempt Wi-Fi under the same regulatory framework that exists today for the lower 6 GHz band. As previously mentioned, it is important to Apple to consider the need for Very Low Power (VLP) portable licence-exempt use cases that will also have an outdoor element. This particular use case is not easily covered in the scenario where IMT is outdoors, and Wi-Fi is indoor only.