

Consultation Title	Hybrid sharing: enabling both licensed mobile and Wi-Fi users to access the upper 6 GHz band
Confidentiality	None
Date	15 September 2023

Dear Colleagues,

The undersigned companies, representing an important cross-section of the world's leading silicon vendors, system manufacturers, and application providers, welcome the opportunity to comment on the Ofcom Consultation on hybrid sharing in the upper 6 GHz band (the "*Consultation*").

In summary, the undersigned companies:

- Support the exploration of options to enable both Wi-Fi and licensed mobile users to access the upper 6 GHz (6425-7125 MHz) band ("*U6*"). However, we would like to make clear that U6 is not, in our view, a suitable band for IMT.
- Note that, if spectrum is made available for IMT, it is likely to be only sparsely used in very specific locations (likely at a base station-by-base station level) and perhaps for limited periods during any busy hour(s). By contrast, Wi-Fi users need access to the band as soon as possible to meet extant UK broadband demand. This demand is predominantly indoor. Also, considering that the 6 GHz Wi-Fi ecosystem is already available in the market, it is particularly important to avoid changes that would delay its use in the UK.
- Consider that licensed mobile users would be better served using IMT technology in other spectrum bands, than in U6, and mobile data capacity hotspots could be better served by the significantly larger bandwidths available in the mmWave spectrum bands.
- Highlight that, if IMT is used in U6, any IMT deployment with higher transmit powers than RLANs deployed in the band and no polite protocol implemented would have a negative impact on Wi-Fi

and its associated benefits. At a minimum, there should be a coordination mechanism to protect enterprise radio local area network (RLAN) deployments from IMT interference. Additionally, in order to protect specific enterprise RLAN deployments, IMT Base Station deployment should be managed for upper 6 GHz on a case-by-case basis where there is a justifiable need rather than by normal means (i.e., unlimited access via auctions).

- Propose a phased approach, starting with a simple solution:
 1. Open the band for Low Power Indoor (LPI) and Very Low Power (VLP) on the basis of the existing UK regulation for the lower 6 GHz band (IR2030/7/6) without any additional requirement;
 2. Once an appropriate coordination mechanism has been identified and implemented for IMT, allow outdoor reduced power IMT deployments on a basestation-by-basestation basis; and
 3. If appropriate and justified, consider the implementation of more sophisticated coexistence mechanisms that achieve a higher level of sharing and introduce these later. For example, enable medium-power RLAN (SP) and medium-power IMT outdoors via AFC-like systems, which would both protect incumbents and help coordinate the two ecosystems.

Our comments on the questions posed in the Consultation are provided below.

Consumer benefits

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 will be developed?

We support the exploration of options to enable licence-exempt (e.g., Wi-Fi) and licensed (e.g., IMT) mobile users to access the upper 6 GHz (6425-7125 MHz) band (“U6”). However, we would like to make clear that Wi-Fi users need access to U6 as soon as possible to meet extant UK broadband demand.

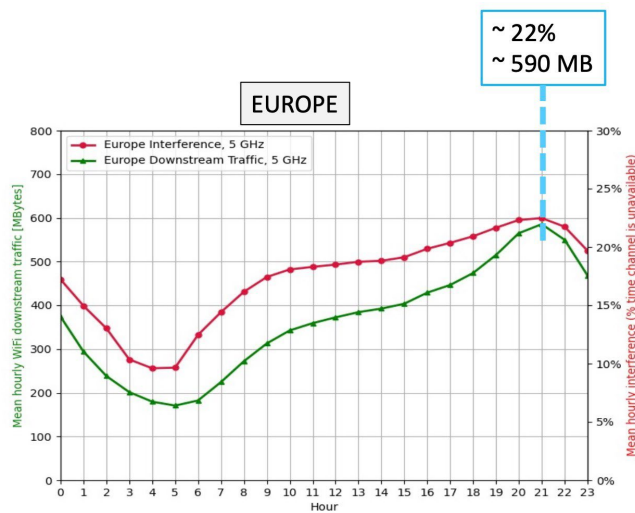


Figure 1: European hourly Wi-Fi interference analysis performed between May and November 2020. Source: Assia¹.

By contrast, U6 is not, in our view, in any way a priority band for IMT. Several studies have found that the growth of mobile IMT data traffic is now significantly slower than it was a few years ago and is well below what was originally anticipated for 5G. The annual growth in global cellular data traffic slowed from more than 90% in 2018 to 34% in 2021 and again to about 22% in 2022, according to research firm Analysys Mason². Data usage per mobile broadband subscription in OECD countries grew a modest 17% in 2022, compared to an average annual growth rate of 29% between 2017 and 2021, according to an OECD report published in July 2023³. The latest Ericsson Mobility Report⁴ shows global mobile data traffic grew 36% year-on-year in the first quarter of 2023 – the lowest figure for at least seven years.

U6 is a band that has raised much interest in the wireless communications industry over recent years. Studies by Quotient⁵, Qualcomm⁶ and ASSIA⁷ have each pointed to major spectrum shortfalls for licence-exempt technologies, with ASSIA highlighting how congestion in both the 2.4 GHz band and the 5 GHz band has been impacting quality of service.

From these studies, it becomes obvious that the 500 MHz of licence-exempt spectrum in the lower 6 GHz (5925-6425 MHz) band (“L6”) will not be sufficient to satisfy the mid- and long-term capacity needs of Wi-Fi. Given the pivotal role that Wi-Fi plays for the broadband ecosystem and its continuing growth, there is a need to make the full 1200 MHz in the 5925-7125 MHz (“6 GHz”) band available on a licence-exempt basis

¹ <https://dynamicspectrumalliance.org/wp-content/uploads/2021/06/ASSIA-DSA-Summit-Presentation-v7.8.pdf>

² <https://www.analysismason.com/research/content/articles/cellular-data-traffic-rdnt0/>

³ <https://www.oecd.org/digital/broadband/broadband-statistics/>

⁴ <https://www.ericsson.com/49dd9d/assets/local/reports-papers/mobility-report/documents/2023/ericsson-mobility-report-june-2023.pdf>

⁵ [Wi-Fi Spectrum Needs Study \(2017\) - Quotient Associates](#)

⁶ [A Quantification of 5 GHz Unlicensed Band Spectrum Needs - Qualcomm](#)

⁷ [Reliably Fast Broadband and Wi-Fi for the Home - ASSIA](#)

to support the ever-increasing demand and enable nations to meet their broadband goals and objectives for a digital society. Indeed, a number of countries have already opened the band for licence-exempt use⁸.

Since the WRC-03 (2003) decision to enable access to new spectrum for Wi-Fi in the 5 GHz range, there have been revolutionary changes in Wi-Fi technology, use cases, and demand. Wi-Fi has become essential to enable businesses and people to get online in urban, suburban, and rural areas. At the same time, the devices running on Wi-Fi networks have become increasingly powerful with each generation making greater demands on Wi-Fi network capacity from video resolution, processing power, camera capabilities and more. Despite the enormous growth in Wi-Fi traffic over the past two decades, no new mid-band spectrum was made available on a licence-exempt basis between 2003 and 2020. As a result, congestion has been increasing, impacting the end-user experience. More than 18 billion Wi-Fi devices are now in use (360 times as many Wi-Fi devices as were in use when WRC-03 provided access to the 5 GHz band), with 4.4 billion new devices shipped every year, according to research firm IDC⁹.

We acknowledge that there are different views on who should access these frequencies, but we notice that the views among Mobile Network Operators (MNOs) are not always the same. For example, a GSMA report sees U6 as an additional capacity band to be used in the densest areas as a preferred option compared to densification of sites, deployment of mmWave technology or leveraging mobile offloading to fixed networks¹⁰. Another GSMA report, instead, highlights that “in dense urban environments, deploying mmWave in a 3.5GHz 5G network can lower total cost of ownership (TCO) by up to 35%.”¹¹

Whilst the two reports have contrasting views, it appears clear that the envisioned capacity crunch would occur only in very specific and limited areas. This would corroborate the idea of evaluating access to additional spectrum on a case-by-case basis.

Overall, during 2024, we request that Ofcom make the band available for Low Power Indoor (LPI) and Very Low Power (VLP) indoors and outdoors.

⁸ Including Brazil, Canada, Saudi Arabia, South Korea and the U.S.

⁹ [Wi-Fi trends \(2022\) - Wi-Fi Alliance](#)

¹⁰ [6 GHz in the 5G Era: Global Insights on 5925-7125MHz - GSMA \(July 2022\)](#)

¹¹ [5G mmWave Coverage Extension Solution Whitepaper – GSMA \(December 2022\)](#)

Question 2

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 will be developed. a) 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? b) Similarly, what are the priorities from the point of view of Wi-Fi deployments?

We note that Wi-Fi users need access to the U6 band as soon as possible to meet extant UK broadband demand. This demand is predominantly indoor.

By contrast, if U6 spectrum is made available for IMT, it is likely to be only sparsely used in very specific outdoor locations and perhaps for limited periods of time. We consider that licensed mobile users would be better served outdoors using IMT technology in other spectrum bands. Outdoor mobile data capacity hotspots could be better served by either densification in bands already available to mobile operators or via the significantly larger bandwidths available in the mmWave spectrum bands. Improvements in antenna technology will also lead to improvements in the reach and capacity of outdoor deployments. However, for indoor locations, we consider that users would be better served using Wi-Fi.

Enabling the benefits

We agree with Ofcom that unmanaged, co-frequency sharing between high-power outdoor IMT and low-power indoor Wi-Fi would result in an unpredictable interference environment. Different methods can be envisioned to allow coexistence between the two ecosystems, but realistically, the primary way to reduce the size of interference areas is to reduce the transmit power of outdoor IMT sites.

We also agree with Ofcom's view that, without international harmonisation, it is unlikely that consumer devices would have the upper 6 GHz band enabled for hybrid sharing in the UK, especially when there would be a need to develop new hardware to make this possible. According to IDC¹², there will be 19.5 billion devices in use globally by the end of 2023. When looking at Wi-Fi 6 and Wi-Fi 6E, IDC predicts [continued momentum for Wi-Fi 6E](#), with 473 million Wi-Fi 6E devices expected to ship in 2023. In terms Wi-

¹² <https://www.wi-fi.org/beacon/the-beacon/wi-fi-by-the-numbers-technology-momentum-in-2023>

Fi 6 and Wi-Fi 6E chipsets, SkyQuest projected that the market will attain a value of USD 34.5 billion by 2030¹³. Wi-Fi users are ready and able to access the U6 band with immediate effect.

For these reasons, we propose that Low Power Indoor (LPI) and Very Low Power (VLP) licence-exempt equipment be allowed in the entire 6 GHz band without any further mitigation measures and any future IMT deployments be required to coexist, noting the environment they are entering.

Question 3

What are your views on reusing a modified AFC or SAS-type approach to enable hybrid sharing? What additional work do you think would be required?

As Ofcom notes, AFC and SAS regimes have been used to manage coexistence variously between standard power Wi-Fi, mobile broadband and incumbent users around the world, and there may be some potential for further internationalisation. However, we note that those systems were developed primarily to protect incumbents, not to coordinate spectrum access between new users of the band.

We also think that any sharing between IMT and RLAN deployments will have a negative impact on the Wi-Fi and its associated benefits there will need to be additional work, including a detailed study of appropriate parameters before specific proposals can be made.

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?

Regarding existing access protocols, we note that 5G NR-U is a 3GPP technology that mobile operators could use to provide additional capacity whilst sharing the band under the same constraints as Wi-Fi and without impacting the operation of existing incumbents.

Regarding spectrum sensing, this is an interesting technique but not always failproof, as also noted by Ofcom when developing the regulatory framework to enable access to the TV white spaces almost a decade ago.

A body of evidence suggests that a cautious approach be taken to any proposed modification, including taking account of the extant deployed base of consumer devices and access points. Indeed, any required change to standards would disproportionately affect the Wi-Fi compared to IMT, given the more advanced state of deployment of the Wi-Fi ecosystem in the 6 GHz band.

¹³ <https://www.globenewswire.com/news-release/2023/08/09/2721665/0/en/Wi-Fi-6-And-Wi-Fi-6E-Chipset-Market-to-Surpass-34-5-Billion-by-2030-Drives-Due-to-the-Escalating-Need-for-Expanded-Network-Capacities.html>

Spatial separation is a reliable method of managing coexistence. Other, more advanced mechanisms can be envisioned but necessitate time to be evaluated and, if appropriate, included in the relevant standards. In terms of access protocols, it is worth mentioning that the current sharing protocols and Energy Detection Thresholds implemented in the 6 GHz standard published by ETSI are based on a limited range of maximum power levels being used in all the devices.

Question 5

What mechanisms could potentially enable device-to-device connections?

Device-to-device communication is inherently very low power (VLP). This means that the risks of causing interference to higher power transmissions are very low. Conversely, device-to-device communication could be easily disrupted by those higher-power transmissions. As consumers often rely on this type of connection, which might be particularly relevant for *spatial computing* applications, we encourage Ofcom to pay particular attention not to constrain how users may want to use this type of connectivity indoors and outdoors.

We also observe that interference between VLP devices and IMT base station or IMT user equipment (UEs) separately could be managed differently and therefore, we encourage Ofcom to treat the two cases separately.

Question 6

If hybrid sharing is eventually adopted, and requires mobile to operate at medium power, in what way would mobile networks use the upper 6 GHz band?

We understand from reports commissioned by the mobile industry that the upper 6 GHz is of interest to the MNOs for local interim cases where some 3400-3800 MHz sectors are full, but the millimetre wave (mmWave) network layer is not deployed yet. Medium to low power outdoor deployment is perfectly adequate for such a goal and could provide flexibility to MNOs in their timing to deploy mmWave network layers.

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?

While the regulatory interest to enable sharing is acknowledged, we believe that the interests of UK citizens, consumers and enterprises are better preserved by promoting market competition in response to market demand.

In this sense, it is important not just to consider technical solutions based on their technical merits but also to acknowledge that very innovative solutions would trigger drastic delays in access to the band and would, therefore, harm the interest of end users. Simple solutions enabling an early use of the band should be considered.

Question 8

Assuming the future of the band includes indoor use for Wi-Fi and outdoors use for mobile: a) how could this be achieved without creating or suffering interference? b) Could there be a combination of technical adjustments such as power limits and other mechanisms (including databases or sensing mechanisms)?

We consider that, in the unlikely event that the upper 6 GHz band is to be used by IMT in certain locations, some degradation to Wi-Fi communication is unavoidable.

In particular, any high-power IMT deployment would have a negative impact on Wi-Fi and its associated consumer benefits. The best way to reduce the size of interference areas is to reduce the transmit power of the outdoor IMT base station(s) combined with a site-by-site authorisation.

For lower power communication, we believe that LPI and VLP operations should largely remain the same and should access spectrum in an uncoordinated way.

More sophisticated coexistence mechanisms that achieve a higher level of sharing might be feasible but only as a result of further study, and these could be introduced later, if indeed needed.

Finally, we are open to exploring how medium-power outdoor deployments for both RLAN and IMT enabled through automated coordination systems (which would both protect incumbents and help coordinate between the two ecosystems) could work.

Sharing with incumbent users

Question 9

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. a) 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? b) What are your views on the initial analysis we have conducted around hybrid sharing and coexistence with incumbents? 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?

Low-power indoor (LPI) and very low-power (VLP) licence-exempt equipment can coexist with incumbents in the 6 GHz band without any further mitigation measures. For standard power Wi-Fi (also referred to as 'higher power') and outdoor operation, mitigation techniques exist that have already been outlined by many regulators worldwide.

There should be no objection to reasonable, evidence-based mitigations, and we have saluted the decisions of regulators around the globe to make the entire 6 GHz band available on a licence-exempt basis with such conditions. The same regulatory conditions relating to indoor and outdoor usage and power levels (i.e. VLP and LPI) can be applied across the whole 6 GHz band and across all technologies.

Unmanaged, co-frequency sharing between high-power IMT and Wi-Fi in the same geographical area would result in an unpredictable interference environment. The best way to reduce the size of interference areas is to reduce the transmit power of the outdoor IMT base stations where there is a particular site-specific need for additional capacity. Once an appropriate coordination mechanism has been identified and implemented, outdoor IMT deployments might be enabled.

Overarching questions

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?

We agree with Ofcom's view that a general framework for hybrid sharing could benefit the mobile and other sectors by opening opportunities in different spectrum bands. For example, mmWave bands that have been brought into focus in recent years by advances in technology could contribute significantly to the 6G Vision for connectivity of the next decade by encompassing a variety of different technologies and operators, enabled through hybrid sharing.

In doing so, it is important to take into consideration not only technical aspects, but also market dynamics, including the effect that the introduction of such frameworks would have on current users and on the applications that are foreseen to benefit the most from accessing the band. In particular, we believe that it is important to be aware of the choices being made with regard to the reduction of the potential benefits that RLAN-only use of the band would bring as compared to any model for hybrid sharing.

Question 11

Do you have any other comments to make on these proposals or on the future use of the upper 6 GHz band?

Overall, we propose a phased approach, starting with a simple solution:

1. Open the band for Low Power Indoor (LPI) and Very Low Power (VLP) on the basis of the existing UK regulation for the lower 6 GHz band (IR2030/7/6) without any additional requirement;
2. Once an appropriate coordination mechanism has been identified and implemented for IMT, allow outdoor reduced power IMT deployments on a basestation-by-basestation basis.
3. If appropriate and justified, consider more sophisticated coexistence mechanisms that achieve a higher level of sharing and introduce these later. For example, enable medium-power RLAN (SP) and medium-power IMT outdoors via AFC-like systems, which would both protect incumbents and help coordinate the two ecosystems.