

## Consultation response form

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<b>Consultation title</b>	Hybrid sharing: enabling both licensed mobile and Wi-Fi users to access the upper 6 GHz band
<b>Full name</b>	Martha Suarez
<b>Contact phone number</b>	57-317-5179455
<b>Representing (delete as appropriate)</b>	Organisation
<b>Organisation name</b>	Dynamic Spectrum Alliance
<b>Email address</b>	<a href="mailto:martha.suarez@dynamicsspectrumalliance.org">martha.suarez@dynamicsspectrumalliance.org</a>

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## Your response

Question	Your response
<p><b>Question 1:</b> 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?</p>	<p><i>Is this response confidential? – N</i></p> <p>The Dynamic Spectrum Alliance (DSA) appreciates the opportunity to respond to Ofcom’s consultation on opportunities to “maximise consumer benefits and result in optimal use” of the 6 GHz band through shared access.<sup>1</sup> We agree that there is high demand for next-generation wireless connectivity for both consumer and enterprise networks.</p> <p>Spectrum sharing, including use of automated Dynamic Spectrum Management Systems (DSMS), will be an important component to meet this demand, as will both licensed (including shared, local licensing) and licence-exempt access options.</p> <p>With regard to the 6 GHz band, the DSA supports licence-exempt low-power indoor (LPI) operations, very low power (VLP) indoor / outdoor operations, and standard power (SP) operations, the latter under control of an Automated Frequency Coordination (AFC) system, across the entire 6 GHz band (5925-7125 MHz), wherever feasible. Licence-exempt use across the entire 6 GHz band allows for devices using the latest generation of Wi-Fi and 5G NR-U standards to employ multiple high bandwidth 160 MHz and 320 MHz channels that support the channel diversity needed in dense deployments that exist both indoors and outdoors.</p> <p>With carefully crafted technical and operational conditions, these licence-exempt operations can share the band with incumbent operations</p>

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<sup>1</sup> The Dynamic Spectrum Alliance (DSA) is a global, cross-industry, not for profit organization advocating for laws, regulations, and economic best practices that will lead to more efficient utilization of spectrum, fostering innovation and affordable connectivity for all. Our membership spans multinationals, small-and medium-sized enterprises, as well as academic, research and other organizations from around the world all working to create innovative solutions that will benefit consumers and businesses alike by making spectrum abundant through dynamic spectrum sharing.

that include the fixed satellite service (FSS) and fixed service (FS).

Indoor Wi-Fi operations in the 6 GHz band will include LPI, SP, VLP and LPI / SP composite devices. While in developed economies, most 6 GHz licence-exempt use is envisioned to be indoors, in developing countries, particularly in the Americas, there is a conscious effort for Wireless Internet Service Providers (WISPs) to utilize outdoor SP devices, base stations, and customer premise equipment (CPE) to provide broadband access. In addition, some VLP devices will be wirelessly tethered to mobile phones, which operate both indoors and outdoors.

The majority of wide-area IMT networks are designed for outdoor and mobile operation. There are also IMT networks with smaller outdoor coverage areas. IMT networks are also intended to operate indoors both through private 4G / 5G networks and slices of standalone 5G networks (assuming these become more widely available). In fact, one of the rationales for initiating 5G around a decade ago was to expand 3PPG technologies to verticals, where Wi-Fi is the technology of choice indoors.

While the DSA is optimistic that sometime in the future suitable coexistence mechanisms could be developed to share the 6425-7125 MHz band between 3GPP (and other) IMT technologies and IEEE-based Wi-Fi, we believe there are economic forces that make it impractical, particularly as operators of networks using both technologies will want to support both indoor and outdoor operations.

However, before there can be consideration of a framework in the 6425-7125 MHz band that will support both mobile outdoor services and licence-exempt operations indoors, there needs to be a satisfactory resolution regarding the EIRP limit and IMT emissions mask characteristics required to protect FS and FSS incumbents from the proposed IMT service in the 6425-7125 MHz band in Europe.

	<p>The DSA’s view is that using realistic assumptions, the sharing and coexistence studies submitted to the ITU regarding WRC-23 Agenda Item Agenda Item 1.2, Bands 4 and 5, clearly demonstrate that IMT systems, as proposed, cannot coexist with FSS. Even at this late stage in the process, there remains fundamental disagreement between satellite and mobile industry stakeholders at the ITU-R regarding the IMT EIRP limit and emissions mask. For other incumbents such as FS and RAS, studies have shown that separation distances of up to several hundred kilometres between IMT macro base stations and victim receivers may be required to avoid harmful interference.</p> <p>It is important to note that because Wi-Fi devices operate in a licence-exempt regime, incumbents such as FSS and FS are protected by regulation from receiving harmful interference and can continue to grow without constraint.</p> <p>If Ofcom’s goal is global harmonization of a hybrid sharing approach for 6425-7125 MHz band and the creation of a corresponding global ecosystem of enabled equipment and DSMS solutions, there is considerable work that needs to be done to fill in the details of the proposed high-level concept. Administrations that have made the entire 6 GHz band available for licence-exempt use will need to be convinced sufficiently of the public benefits to roll back their hard-fought rules. For some Administrations, such a hybrid sharing approach will raise questions in the context of RR 4.4.</p>
<p><b>Question 2(a):</b> 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.</p> <p>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?</p>	<p><i>Is this response confidential? – N</i></p> <p>The DSA does not have comments on the use of the upper 6 GHz band from the perspective of the mobile community.</p>

**Question 2(b):** Similarly, what are the priorities from the point of view of Wi-Fi deployments?

*Is this response confidential? – N*

From the perspective of DSA' members, the priority is for national regulatory agencies to make the entire 6 GHz band available for licence-exempt use.

For LPI operations, having seven 160 MHz wide channels available provides the channel diversity necessary in dense deployments to ensure that each device can access the full channel. An example is the LPI deployment at the University of Michigan in the United States, where the goal is for each student's device to have access to a high-definition video feed in the lecture hall. These lecture halls seat hundreds of students. The ability of Wi-Fi devices to utilize the entire 6 GHz band allows for sufficient bandwidth and channel diversity, thus enabling the University to meet its goals. There are numerous other examples where equally dense deployments of Wi-Fi devices can be found.

Regarding SP devices under control of an AFC system, WISPs are interested in accessing licence-exempt spectrum at power levels that will support the provision of broadband access. While this may not necessarily be of interest to U.K. WISPs, it certainly is of interest to WISPs operating in other parts of the world. The greater amount of bandwidth available, the more subscribers that can be supported by a single transceiver and better the economics for both the operator and their customers.

In more developed economies, the DSA expects to see SP devices as part of composite devices that also include LPI functionality. Composite devices are intended to operate both indoors and outdoors.

VLP devices are envisioned to be used in education, training, maintenance, and gaming, among other verticals. Instruction for education and training is usually provided to a group or class setting. If a VLP AR/VR/MR headset is required for the training, then there needs to be sufficient Wi-Fi capacity for each group / class member to each receive sufficient bandwidth to concurrently experience the

	<p>learning / training as designed. Here too, there needs to be sufficient channel diversity. The DSA believes that use of VLP devices for education and training will occur both indoors and outdoors. In September of 2023, DSA member Apple Inc. announced the launch of iPhone 15 models that incorporate a Wi-Fi 6E radio that can operate across the entire 6 GHz band in countries where use of the full band is authorized.</p>
<p><b>Question 3:</b> 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?</p>	<p><i>Is this response confidential? –N</i></p> <p>Ofcom is describing a DSMS that will allow IMT technologies to operate outdoors while allowing Wi-Fi technologies to operate indoors. Assuming outdoor IMT base stations and user equipment can protect incumbent FS and FSS operations, the challenge is not going to be ensuring that indoor Wi-Fi devices will protect IMT devices operating outdoors, but rather ensuring that: (1) IMT devices will not operate indoors and (2) Signals from IMT devices operating outdoors will not overwhelm Wi-Fi receivers operating indoors.</p> <p>Ofcom should be able to open the entire upper 6 GHz band to LPI and VLP devices immediately. There are mitigations in place for LPI devices to ensure that these devices will be used indoors. With respect to SP devices that can operate both indoors and outdoors, these devices would require use of an AFC. A feature will need to be added to the SP device so it can know and report to the AFC whether it is indoors or outdoors. Multiple vendors have announced that they are working on such location reporting solutions.</p>
<p><b>Question 4:</b> How could existing access protocols and sensing mechanisms be leveraged (i.e., those in Wi-Fi or 5G NR-U) to enable hybrid sharing?</p>	<p><i>Is this response confidential? – N</i></p> <p>Our members’ experience with the potential sharing between LTE-U and Wi-Fi, and between LAA and Wi-Fi elsewhere, indicate that schedule-based 3PPG compliant devices and contention-based and IEEE compliant devices share spectrum like oil and water.</p> <p>There are plans to develop more deterministic Wi-Fi protocols to reduce latency of time-sensitive traffic, but there will still be a good</p>

	<p>portion of Wi-Fi traffic that will continue to operate over a contention-based protocol.</p> <p>The DSA is uncertain at this time whether there is any intent to modify future IMT standards to enable hybrid sharing.</p> <p>For scheduled IMT and Wi-Fi traffic, one issue is which entity (IMT base station, Wi-Fi access point or both) would manage the scheduling.</p>
<p><b>Question 5:</b> What mechanisms could potentially enable device-to-device connectivity?</p>	<p><i>Is this response confidential? – N</i></p> <p>In the lower 6 GHz band, Wi-Fi devices operate using a contention-based protocol based on energy detection at -72 dBm in a 20 MHz channel, which will add another layer of protection.</p>
<p><b>Question 6:</b> 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?</p>	<p><i>Is this response confidential? – N</i></p> <p>The DSA believes that if IMT use is authorized in the upper 6 GHz band, in addition to outdoor (mobile and fixed wireless access) flexible use, the IMT industry will seek to use the upper 6 GHz band for indoor verticals, either through private 5G/6G networks or network slicing. At the recent ECC PT1#76 meeting in Berlin, the mobile industry expressed its intention to deploy IMT in the upper 6 GHz band not only in certain urban areas, as assumed in the WP5D studies of IMT coexistence with incumbents, but nationwide in urban and rural areas as well as indoors. If Ofcom opens the upper 6 GHz band for IMT use, it will be challenging to limit IMT use to only outdoor operation.</p> <p>The DSA notes that Ofcom has made available the 3.8-4.2 GHz band for indoor private networks. There is no evidence that additional capacity will be needed in the 6 GHz band.</p>
<p><b>Question 7:</b> 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?</p>	<p><i>Is this response confidential? – N</i></p> <p>An approach for Ofcom to consider is the use of sensing, combined with some form of DSMS, together with an IMT system EIRP limit comparable to that of Wi-Fi systems operating in the same frequency range.</p>

	<p>However, to be successful, any technical solution will need to be both transparent to the user and affordable.</p> <p>While DSA has concerns about the feasibility of sharing in the upper 6 GHz, we believe that Ofcom will gain useful knowledge that can be applied to spectrum sharing in higher frequency bands, particularly the millimetre wave bands.</p>
<p><b>Question 8(a):</b> Assuming the future of the band includes indoor use for Wi-Fi and outdoors use for mobile:</p> <p>How could this be achieved without creating or suffering interference?</p>	<p><i>Is this response confidential? –N</i></p> <p>Implicit in the discussion of using sensing, EIRP limits, and DSMS solutions to manage sharing in the upper 6 GHz band is the question of how the licensing framework would be crafted. Were Wi-Fi systems operating in the upper 6 GHz band subject to light-licencing requirements, rather than operating on licence-exempt basis, there would be significant impact on the ecosystem and on user expectations.</p> <p>While a local licensing framework has been demonstrated to be suitable for verticals and other enterprises, the DSA believes additional thought is needed to understand if this model would work with respect to consumers in individual residences and multi-family dwelling units where considerable Wi-Fi operations occur.</p> <p>Were a licence-exempt approach adopted, some other mechanism would have to be developed to ensure residential Wi-Fi use in the upper 6 GHz would be protected from receiving interference from outdoor IMT systems.</p>
<p><b>Question 8(b):</b> Could there be a combination of technical adjustments such as power limits and other mechanisms (including databases or sensing mechanisms)?</p>	<p><i>Is this response confidential? – N</i></p> <p>The DSA believes that Ofcom needs to consider ease of implementation and affordability for consumers when exploring potential technical adjustments.</p>
<p><b>Question 9(a):</b> 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.</p>	<p><i>Is this response confidential? – N</i></p> <p>The technical and operational conditions established by Administrations that have opened the upper 6 GHz band to licence-</p>



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?

exempt Wi-Fi operations for different categories of devices are designed to protect incumbent operations from receiving harmful interference.

There is ongoing work at ECC SE45 looking at Wi-Fi coexistence with upper 6 GHz band incumbents. If the assumptions used for ECC Report 302 are used for this work, the outcome will be the same.

Based on studies submitted to ITU-R for WRC-23 Agenda Item 1.2, Bands 4 and 5, the DSA believes that even with the most stringent of the proposed emissions masks, the EIRP limit for IMT base stations would have to be set considerably lower than proposed by IMT advocates. Sharing and coexistence studies will have to be conducted to determine the appropriate EIRP limit for IMT base stations under a proposed hybrid sharing scheme.

**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*

The DSA agrees with Ofcom's statement in 5.15, "Our own analysis was in line with the conclusions in ECC Report 302, that the risk of interference from Wi-Fi into incumbent services would be negligible. We see no reason to change our earlier conclusions that, due to the similarity in use between the lower and upper 6 GHz bands, low power indoor Wi-Fi can share with incumbent services."

The DSA notes that Ofcom references studies in 5.5 that coexistence between higher power mobile and fixed links in the upper 6 GHz band is possible with site-by-site coordination. It should be noted that the extra capacity sought by the IMT community is in more urbanized areas, such as London. Figure 6 indicates that many of the fixed links in and around London are associated with the financial service. DSA member experience with 6 GHz fixed links operated by the financial services industry in the U.S. is that every millisecond counts.

Ofcom believes that if the power of IMT base stations is limited appropriately, then coexistence may be possible. Ofcom leaves open the possibility of requiring the relocation of fixed links to a to-be-determined different

	<p>frequency band. The DSA’s view is that it would take years for the relocation of fixed links to occur, be disruptive to those relying on the fixed links, and possibly create a contentious and litigious situation for establishing all the costs associated with the relocation and eligibility for reimbursement, which party or parties ultimately pays for the relocation, and how much do they pay. Limiting the EIRP of the mobile base stations would appear to be a better approach.</p> <p>With respect to protecting FSS, in 5.12, Ofcom states, “We note there is activity underway internationally to agree on base station antenna emission limits at elevations above the horizon, as a mitigation mechanism to ensure coexistence in case higher densities of base stations are deployed. If agreed internationally, it is likely that we will implement these or similar restrictions in the U.K., if we were to enable high power licensed mobile in the upper 6 GHz band.” The DSA hoped Ofcom would have included content or reference to the U.K. study that was submitted to WRC-23 CPM-2 meeting in this Consultation document.</p> <p>Based on DSA’s review of the submitted ITU studies regarding the upper 6 GHz band, we believe IMT proponents used unsubstantiated assumptions regarding base station density and clutter among others. Without these favourable assumptions, on paper, IMT systems could not coexist with FSS in the upper 6 GHz band at the proposed EIRP limits.</p>
<p><b>Question 9©:</b> 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?</p>	<p><i>Is this response confidential? – N</i></p> <p>See DSA’s response to 9(a) regarding FS links.</p> <p>With respect to the FSS uplink, there is an IMT base station EIRP limit above a certain angle to the horizon, as well as an IMT emissions limit, both of which are hotly contested by stakeholders.</p> <p>For other incumbents such as FS and RAS, studies have shown that separation distances of up to several hundred kilometres between IMT macro base stations and victim receivers may be required to avoid harmful interference. FS links would have to be migrated to other</p>

	<p>bands, but this may not be possible or acceptable for some Administrations. It would also create a need for cross-border coordination and possibly result in cross-border interference issues. While this may not be of immediate concern for the U.K., it would create a regulatory patchwork contradicting the objective of European spectrum harmonisation.</p> <p>For RAS, large protection zones would have to be established.</p>
<p><b>Question 10:</b> 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?</p>	<p><i>Is this response confidential? – N</i></p> <p>The potential for hybrid sharing depends on the frequency bands and incumbent services. The DSA believes that the propagation characteristics of the upper 6 GHz band will not support a hybrid approach. The DSA does see the hybrid approach as more promising for upper mid-band (&gt; 11 GHz) and millimetre-wave bands (26 GHz and 42 GHz bands) where the physics (i.e., greater path loss) is more favourable. In general, the higher the frequency range, the easier it is to consider a hybrid approach.</p> <p>Ofcom may consider a hybrid sharing / local licensing approach for the 12.7 – 13.25 GHz band, which is a satellite uplink band. There is also a primary allocation for the FS in the band. After sharing and coexistence studies have been completed, it might turn out that lower-power 6G IMT operations might be able to operate indoors and possibly even outdoors under certain conditions while protecting incumbents. A DSMS will likely be required to protect FS links and ensure spectrally-efficient packing of neighbouring local licensing applications.</p>
<p><b>Question 11:</b> Do you have any other comments to make on these proposals or on the future use of the upper 6 GHz band?</p>	<p><i>Is this response confidential? – N</i></p> <p>There is a healthy amount of scepticism amongst DSA members regarding the potential of the proposed hybrid approach. Several DSA member companies have history with previous LTE-U / Wi-Fi and LAA / Wi-Fi co-existence discussions at various national regulatory agencies and standards organizations.</p>

	<p>A confidence building measure for Wi-Fi ecosystem participants would be for Ofcom to open the upper 6 GHz band to LPI and VLP devices immediately, while the necessary technical analysis and work starts on examining potential hybrid sharing schemes. While LPI devices could be affected by IMT devices operating outdoors, the reverse is not true. Thus, the regulatory risk for Ofcom to authorize LPI and VLP devices to operate today in the upper 6 GHz band is extremely low.</p>
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