UK Ofcom Consultation

Enabling Spectrum Sharing in the 6 GHz Band

Cisco Systems, Inc. Response

I. Introduction and Summary of Cisco Position

Cisco Systems, Inc. (Cisco) welcomes Ofcom's consultation that would open 6425-7125 MHz (or "upper 6 GHz") to radio local area network technologies (RLAN), while requiring users to obtain a site licence for their networks. This lightly licenced "shared access" approach to the band can be of tremendous benefit to enterprise and government users throughout the United Kingdom provided it is designed to meet users' needs.

Cisco is a San Jose, California, U.S.A. based company that is the leading provider of IP-based networking technologies in the world. Cisco has a significant presence in the UK, with offices in Bedfont Lakes, London, and additional offices around the country, with sales, services and research and development staff, servicing thousands of enterprise customers and partners. Additionally, Cisco has made significant investments in various UK Government (DCMS) 5G projects over the past few years. For wireless broadband, Cisco is the largest vendor of enterprise-grade Wi-Fi in the world. Cisco also recently announced its Private 5G offer.

In this consultation. Ofcom is proposing to open the upper 6 GHz band under its Shared Access Framework. In this context, Ofcom proposes the following:

- Licences would be limited to indoor use; defined geographically as a 50m radius from a central point, although transmitters could be located anywhere within the licence footprint; multiple geographic contiguous licence areas would be permitted; licensees would pay an annual fee of £320 per licence; other than payment of the annual fee, renewal is not required (i.e., the licence term is indefinite).
- Ofcom reserves the ability to amend its rules to displace this proposed use of the band, and can revoke licences on as little as one month's notice, while the consultation notes that a change in band rules would require a consultation that could take many months or more than a year to resolve.
- Technical requirements are proposed to mirror those for indoor use in the lower 6 GHz band; maximum power is set at 250 mW EIRP. Ofcom proposes a 100m separation distance between licence points to guard against interference.

- Ofcom reserves the ability to amend its rules to allow 5G New Radio to use the band, which could include shared access licences being awarded to entities that use 5G New Radio.
- No further coordination with Fixed Service (FS) and Fixed Satellite Service (FSS) incumbents is proposed; an exclusion zone around Radio Astronomy sites would be required.

The consultation document notes that the upper 6 GHz band is under review as part of a WRC-23 agenda item 1.2, in which Region 1 is evaluating technical coexistence conditions as between 5G New Radio and FS and FSS incumbents for 6425-7025 MHz, and all regions are evaluating 7025-7125 MHz. Ofcom states that its licenced shared access approach enables the upper 6 GHz band to be used now, but enables Ofcom to amend the use of the band in the future. While the consultation document is not completely clear, the document appears to leave open various options for future band utilization: (1) permanent retention of any rules adopted as part of this consultation, (2) opening the band generally to licence-exempt use without licence requirements, (3) permitting non-interfering use of the band by multiple technologies, including 5G NR, using this proposed shared access framework, or (4) transitioning the band for the exclusive use of mobile network operators for 5G.

Cisco has been working since 2016, along with industry partners, to open 5945-7125 MHz for licence-exempt use based on our fundamental belief that this additional spectrum is absolutely critical if Wi-Fi is to continue to play its important role of connecting devices to broadband platforms (including 5G), and to meet the increasingly heterogenous demands from enterprises and governments seeking to deploy Internet of Things networks. Because licence-exempt devices share the radio medium in an unmanaged way, the two challenges of exponential demand growth and increasingly diverse applications have resulted in a significant re-engineering of Wi-Fi relative to prior generations. This effort produced Wi-Fi 6E in the 6 GHz band. Wi-Fi 6E is optimized for access to the full 5945-7125 MHz band, and Cisco believes that current and future demands on Wi-Fi require such optimization.

In this consultation response, Cisco recognizes and acknowledges the decisional constraints that Ofcom is labouring under in attempting to utilize the upper 6 GHz band now. Cisco is grateful that Ofcom took a leadership position in the lower 6 GHz, becoming the first European country to open 5925-6425 MHz to licence-exempt use. We thank Ofcom for creatively proposing ways to make the upper 6 GHz more useful to RLAN technologies using a shared access approach and for doing so this year. That said, nothing in Cisco's response to this consultation can or should be interpreted as a deviation from our desire to have the upper 6 GHz band opened for licence-exempt use as soon as circumstances permit. On that basis, Cisco supports Ofcom's idea of using a shared access framework to enable prompt use of the upper 6 GHz, subject to a series of recommendations for how to ensure that the effort will actually yield utilization of the band.

In our response to the questions, below, Cisco identifies key areas in the proposal that require modification if the band is to be sufficiently attractive to users. As proposed, the rules would

create significant impediments to deployment that would negate Ofcom's goal of putting the spectrum to work for the UK economy. We offer a series of suggestions for how the proposal might evolve to provide the outcomes that Ofcom seeks. Finally, Cisco strongly concurs with a regulatory approach that protects incumbent users of the band. Throughout the 6 GHz discussion in Europe, Cisco and the licence-exempt industry have been clear that it is our intent to ensure incumbent systems can continue to operate in the band.

II. Consultation questions

1. Do you agree with our proposals to open the band under the Shared Access Framework?

Cisco agrees that the Shared Access Framework provides the regulatory tools Ofcom needs to introduce RLAN technology into the upper 6 GHz band today, given the unfortunate uncertainties created by WRC-23 Agenda Item 1.2, and in particular the 6 GHz issues reserved for Region 1 discussion. Cisco endorses the Shared Access Framework proposal and urges Ofcom to resolve rules to support such an approach, subject to the specific recommendations that are contained in this comment.

Without action on this proposal, 700 MHz of usable spectrum will remain lightly used for years. Relative to the United States, the UK has few fixed links in the upper 6 GHz band and the FSS uplink supporting C-band satellites can easily operate on top of low power terrestrial uses, as noted by the European examination of the lower 6 GHz band concluding last year, but also considering FSS evaluations by the United States, Canada, Brazil and others. This spectrum can support much more intensive use by low power transmitters, enabling a range of use cases, both public and private.

In offering Cisco's support for the Shared Access approach to RLAN in the upper 6 GHz band, we are reminded that the UK did not support the study for of the 6425-7025 MHz band for possible IMT identification before WRC-19. There was no European Common Position to support IMT studies in 6 the band at the conference. In fact, Russia was the only CEPT country to support an IMT study, due to country-specific issues that made it impossible for Russia to align with the Europe in identifying of 3 GHz as the mid-band "pioneer band" for 5G. In addition to Russia, there were a few country-specific issues on 3 GHz where insufficient 3 GHz spectrum was not available.[1] Since that time, we are not aware of an Ofcom assessment that shows the benefits of breaking with other leading nations, who have allocated the band for licence-exempt use, and to instead provide additional spectrum to UK MNOs for 5G.

Moreover, the ongoing ITU-R Agenda Item 1.2 technical coexistence study is neither probative of spectrum needs, nor does it impact UK spectrum policy. While the technical coexistence

[1] As has been explained to industry by various country representatives, the decision to undertake the coexistence study of 6425-7025 MHz in Region 1 originated in a demand from countries in Africa. China also advocated for a study in Region 3, but was rebuffed by its Region 3 colleagues.

study is far from finished, Cisco's views on that study in 2019 is unchanged today – while it may be possible for a few individual countries to light up 5G New Radio networks without substantial adverse impact to FSS, an across-the-region decision to turn up 5G New Radio will have catastrophic impacts to FSS. We urge all stakeholders to tread cautiously. Moreover, we find it curious that there has been no attempt to create models that prioritize countries that can show that they have a need of the 6GHz band in order to meet the 100 MHz per operator of mid-band spectrum that is recommended for IMT 2020, and we speculate that may be because Russia is the only country that truly possesses that need.

Cisco also is of the view that a shared access license framework, applied to license-exempt technology, more easily fits within the broader framework of regulations for radio transmitters. For example, the ICNIRP limits do not support the use of 6 GHz by 3GPP technologies such as 5G New Radio unless operators are willing to lower power levels and densify their networks relative to their current approach to mid-band deployment. Indeed, operators have resisted incurring an incremental capital cost of broadscale densification. In contrast, lower power license-exempt technologies, densely deployed by enterprises, would enable the UK to reap a much fuller benefit from 6 GHz.

Based on this analysis and agreeing with Ofcom that a consideration of the band for wide area licencing is years away (if ever), moving forward today to utilize the band for RLAN under a Shared Access framework makes good sense. Equipment exists thanks to regulatory developments in other regions. In the United States, more than 200 devices of all types (e.g., access points, smart phones, laptops, televisions) are market-ready, including Cisco's Wi-Fi 6E Access Points, and more devices are on the way. Manufacturers are readying European supply chains with Wi-Fi 6E, and while the equipment will be configured for 5945-6425 MHz, the embedded silicon enables these devices to use the full band. There is no manufacturing or supply chain impediment toward using the upper 6 GHz if a country authorized it.

Nevertheless, as proposed, the plan contains some challenges. Exclusive of the comments Cisco has on licence conditions, fees, and minimum separation distance (discussed in response to Question 3, below), the following concerns require some modification to the proposal.

The first issue is risk. Will licensees make the investments in upper 6 GHz networking capability knowing that there is a risk that – before the equipment lifecycle is complete – their networks might need to be dialled back for use to just 5945-6425 MHz? In our view, the most compelling reason for an enterprise or government user to make the decision to install Wi-Fi 6E is that 1200 MHz of spectrum enables a highly flexible network topology to address various needs. Depending on the enterprise, for example, that could be spectrum that is highly deterministic because network management tools can direct less urgent traffic to other channels. Another value proposition could be the need for highly dense device deployment or very low latencies. Also, many enterprise networks with 7-channel reuse plan that, if 1200 MHz is enabled, can support 80 or even 160 MHz channels. Hospitals, schools, and carpeted office, where video communications are physically distributed within a building, are good examples of a type of users that would see a 7-channel deployment of 80/160 MHz Wi-Fi 6E as compelling. Such a

network would operate more effectively and efficiently from a spectrum utilization perspective, particularly if the licensee is layering on augmented or virtual reality use cases. However, if the licensee believes that there will be a future event that will force the enterprise to drop back to today's 40 MHz wide channels, that contingent future risk could negatively impact uptake. Equally concerning is the network operations team that takes advantage of the upper 6 GHz for an IoT use case requiring dense deployment, or very low latency, only to have those capabilities displaced when the network must shrink by 700 MHz.

The issue of risk is not just about lowering regulatory barriers for users (although lowering regulatory barriers is good), but in enabling the user to be able to understand and realize the return on investment it is making in the network. To be sure, for those enterprises whose existing Wi-Fi network is past its useful life and who must upgrade, this group may see the upper 6 GHz as an option that they can and should enable. But that is a much smaller group of entities than the total group of entities that Cisco expects would consider an investment in a fully optimized, 1200-MHz capable Wi-Fi 6E network in order to improve their own operations.

The second issue is timing. Early adopters of the Shared Access framework may have more favourability in reaching their return on investment in that the upper 6 GHz opportunity may exist for some years. But as time goes by, the market for upper 6 GHz networking may react to its uncertain future by "freezing" as users wait to see what decisions regulators might make. If the market is frozen or shrinking in the face of uncertainty, as Cisco expects it would, it becomes more difficult to support a static group of customers. The closest analogy is how equipment support is addressed when devices are nearing "end of life" when there are fewer customers with older devices in use, and multiple generations of new equipment available. In those cases, the manufacturer ultimately messages to customers that as of some future date, the equipment software will no longer be supported. In the Shared Access framework context, it is entirely unclear how many customers would be using upper 6 GHz equipment or for how long the market might be frozen due to uncertainty. The timing issue is an extension of the risk issue, discussed above - users will want to know how many years before there is a decision about whether my network operates with just 500 MHz or the full 1200 MHz, and will the regulatory decision-making processes create a risk that support for the equipment could be disrupted? We are further concerned that by the time the discussion about wide area licencing could begin, the decline in the market due to freezing will be misrepresented by 5G advocates as waning interest in RLAN in the band.

The third issue is the complication of sharing spectrum with 5G New Radio. The consultation document hold**s** out hope that licence-exempt technologies can coexist with 5G NR. That hope is misguided. In Cisco's view, a 100m separation distance, as a mechanism to keep unlike radio systems from interfering with each other, is wholly insufficient. Wi-Fi's Listen Before Talk protocol means Wi-Fi would lose access to spectrum as the nearby 5G NR occupies it. If co-location in the band is necessary, the only solution is a geographically wider separation distance, which would be highly spectrally inefficient. The lack of coexistence is due to choices that 3GPP has made in the design of its technology. For example, in a 3GPP system, scheduling of transmissions is conducted before there is any listening. For a 3GPP system operating in its

own spectrum silo, this makes perfect sense. When operating in a band where the spectrum must be shared, it's a disaster.

Alternatively, if the Shared Access Framework applies to licence-exempt systems (which include 3GPP's New Radio-Unlicenced), the coexistence issues are well understood and the technology has solved for the coexistence problem. Moreover, Wi-Fi 6E brilliantly addresses band sharing with other Wi-Fi 6E systems. Relative to prior generations, with Wi-Fi 6E there will be fewer collisions due to advanced antenna technology (e.g., Mu-MIMO), there is less overhead when collisions do happen, BSS Coloring assigns specific spectrum to specific data streams, and wider channels enable the devices to get on and off the air more rapidly than in the past, improving the sharing environment for all. These are just some of the innovative ways in which 6E improves the shared spectrum environment.

Conclusion and Policy Recommendations. Hospitals, universities, stadiums and factories have no less need of certainty for the future of their networks than MNOs do. Therefore, Ofcom must do what it can to de-risk the decision to participate in a Shared Access Framework. Certainty with respect to end user return on investment will help to ensure that the flexibility provided by this proposal is actually deployed in the market. Cisco offers two modifications to the Shared Access approach (exclusive of our responses to Question 3):

- First, Ofcom must ensure that technology that in the upper 6 GHz band makes use of polite protocols such as those detailed in ETSI EN 303 687, failure to do so will make equipment developed for the global market unusable near the perimeter of a licence area.
- Second, Ofcom should commit to grandfathering in upper 6 GHz systems for a period of time sufficient to allow users to achieve a return on their investment and migrate to a new solution in the event the band rules change to introduce IMT. Cisco respectfully requests that should Ofcom in the future decide to transition the band to IMT, that as of the date that decision becomes final, upper 6 GHz licensees have 10 years to migrate out of the upper 6 GHz band.

A rule providing a grandfathering period with a sunset date, and specifying the contingency of band reallocation, could easily be added to the rules today. By doing so, Ofcom will ensure that entities seeking to utilize the upper 6 GHz band using licence-exempt technology can make their decision solely based on how a fully optimized Wi-Fi 6E network can improve their business process and/or outcomes, without the uncertainty that the band rules would change in a way that undermines their investment, or the unknown problem of when rules might change. Moreover, should the rules change to enable general licence-exempt use, there would be no disruption to these licenced systems. Finally, this proposal does not ask for IMT to be delayed for a decade, merely that the existing licences remain protected. The licenced Shared Access system allows future IMT users to have complete transparency to the location of licensees are and how many licences exist. Cisco urges Ofcom to adopt a grandfathering provision with a sunset provision to ensure that the band will be utilized as Ofcom intends.

2. Do you have any comments on potential uses for this licence?

Enterprises – inclusive of government agencies at all levels - are the only user group that would be likely users of the upper 6 GHz under the proposed conditions. Payment of fees in the range proposed, having a responsible party associated with licence compliance, managing interactions with Ofcom, are requirements that are too burdensome or complicated for most users. Enterprise organizations, public or private, are more likely to have information technology staff to manage the Ofcom engagement. Small business might utilize licences if third parties can "manage" the administrative interactions with Ofcom. Below, in response to Question 3, we suggest some modifications to the proposed rules that might help improve participating in the Shared Access Framework.

3. Do you have any comments on proposed licence conditions, licence fee, or minimum separation distance?

i. Licence conditions

At section 3.3 of consultation, Ofcom proposes several mandates for licensees that are a significant source of concern.

Device record-keeping. The consultation proposes that licensees must keep a record of their terminals and base stations for inspection by Ofcom if required. Cisco believes that this condition can be met based on software and solutions currently shipping.

Terminal location. The consultation proposes that terminals can be located outside of the licenced area (i.e., the 50m radius circle) but they "must be indoors" and connected to the base station. The requirement that the terminals must be indoors is unnecessary and renders the upper 6 GHz band un-usable by a significant amount of current equipment. Terminal equipment generally is not sold with geolocation capability bundled into its hardware that can readily be accessed by a Wi-Fi Access Point or management software. In a Wi-Fi network, location of devices (i.e., terminal equipment) is generally derived from either adding a sensor or through triangulation techniques, and requires specialized network management tools. These options provide extremely good location capability, but they are not perfect. Nevertheless, while we wish all customers would purchase location capability for their Wi-Fi network operations, they do not do so. If forced to do so by this rule, many would likely not participate in the Shared Access framework proposed here.

Moreover, the requirement is unnecessary for the protection of incumbents. Indoor enterprise networks are engineered to provide RF indoors where the network will be used. Enterprises that perform their "work" indoors have little patience for Wi-Fi networks that provide coverage outdoors. They want to maximize the utility of the wireless network where their employees or IoT devices are. If there is any signal outdoors that permeates building walls, it falls off quickly

and is incidental.[2] No regulator globally that has authorized the 6 GHz band (lower or upper) for licence-exempt use has demanded that when the terminal is associated with an indoor-only access point, that the terminal must be indoors.

Cisco knows of no mechanism that can unfailingly meet this mandate, and automatically disassociate a terminal that is situated outdoors. Nor do we think this is necessary. Indoor-only requirements should attach to access points. We recommend paragraph 16 of the proposed licence be modified accordingly.

Permit limited outdoor use. By restricting the upper 6 GHz to indoor only, there are far fewer use cases that the upper 6 GHz band can address, and participation in the Shared Access framework will be lessened. Ofcom needs to make the upper 6 GHz spectrum attractive across a wider range of use cases if it wants to put the spectrum to work for the UK economy. Cisco suggests a limited outdoor use case could be permitted, enabling only on-premises outdoor use. Loading docks, garden centres, patio seating at restaurants, rail or bus stations, are examples of the types of uses that enterprises want to enable with Wi-Fi 6E integrated into their main network. This modification need not introduce additional risk of interference into incumbent systems if Ofcom enables it with mitigations – (1) access points could be required to come equipped with a vertical antenna mask; and/or (2) downtilt requirements for antennas. These mitigations would ensure that signals are not aimed at FS receivers. Cisco further notes that Ofcom always has the ability to disallow specific frequency use where a licence is located near an FS receiver, limiting the licence to just a portion of the band. Therefore, interference into FS can be both proactively and reactively managed. Moreover, the number of these access points is quite small relative to indoor access points, and with the mitigations proposed, generate no issues for FSS. A professional install requirement would also further ensure compliance with mitigations. While the number of these outdoor-adjacent on-premises transmitters is quite small relative to indoor access points, they make enterprise use of the 6 GHz spectrum much more beneficial and compelling.

ii. Fees

The consultation proposes a flat fee, which will tend to operate as a disincentive for small or medium size enterprise deployments, although that fee structure may be less of an impediment for large enterprises that use hundreds of access points and have a larger investment in their network. As a result, small or even mid-sized businesses will have less of an incentive to participate in the upper 6 GHz band utilizing the full capabilities of Wi-Fi 6E. This could also be an issue for public sector/non-profits (e.g., schools, hospitals). Therefore, payment of the fee could be a limiting factor for the deployment of technology. Ofcom should take this into account, perhaps up to and including waiving fees for certain categories of licensees. For small business, Ofcom should revise its plan to allow payment of lower fee levels. The cost of the licence should not be more than the cost of the equipment. In fact, the cost of the licence

[2] Conversely, when enterprises want to perform work outdoors, the outdoor network is intentionally designed to provide RF coverage in the work area – loading dock, garden center, bus depot, etc.

should not approach a large percentage of the licensee's cost (e.g., 25 or 50% of the equipment cost). One possible alternative is to consider a low "per access point" fee up to X number of Access Points (e.g., 20 or 25 access points), or some other form of discount. Cisco notes that the lowest license cost for a shared access license at 3.8-4.2 GHz is £80/year (similar EIRP and 50 metre conditions) versus £320/year proposed for the upper 6 GHz band. The metric used to determine fees should not be about what spectrum is accessed, but what is the fee relative to the deployment cost, and ensuring that the fee does not become a barrier to entry.

iii. **Minimum separation distance**

If the upper 6 GHz band consists of technologies that make use of polite protocols such as those detailed in ETSI EN 303 687, then the use of minimum separation distance, as a protection between licensees, is completely unnecessary. Contention-based protocols do the work of ensuring that transmitters can coexist.[3] As discussed above in response to Question 1, there is a serious co-existence issue with 5G New Radio. Cisco asks that the pertinent part of our Question 1 response be incorporated here.

4. Do you have any comments on our technical analysis?

No comment

[3] While 5G NR-Unlicenced uses as different sharing mechanism, Wi-Fi and NR-U can coexist in the same band. Ofcom's decision can be technology neutral.