

March 20, 2020

Spectrum Policy and Analysis
Ofcom
Riverside House
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RLANSpectrum@ofcom.org.uk

Re: Improving spectrum access for Wi-Fi – spectrum use in the 5 and 6 GHz bands

Dear Sir or Madam:

The Dynamic Spectrum Alliance (“DSA”)¹ respectfully submits the following comments in response to Ofcom’s consultation, “Improving spectrum access for Wi-Fi: Spectrum use in the 5 and 6 GHz bands.”²

Ofcom’s proposal to remove the Dynamic Frequency Selection requirement from the 5725-5825 MHz frequency band for licence-exempt Wi-Fi channels and opening up the 5925-6425 MHz frequency band for low power indoor only devices and very low power indoor / outdoor devices is a significant step in the right direction to address the UK’s growing demand for wireless broadband. As the next step, Ofcom should consider opening access to the adjacent 6425-7125 MHz frequency range to low power indoor only devices and very low power indoor / outdoor devices.

Ofcom’s technical rules for the 5925-6425 MHz frequency should seek to optimize the performance of the of the new non-overlapping 160 MHz Wi-Fi channels. Similarly, the technical rules for the 5725-5850 MHz band should be optimized for the smaller channel sizes. Finally, core to DSA is the idea of dynamic spectrum management. To these ends, we have advocated globally for the idea of Automated Frequency Coordination as a mechanism by which higher power Wi-Fi networks can operate indoors and outdoors without causing harmful interference to

¹ 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. A full list of DSA members is available on the DSA’s website at www.dynamicspectrumalliance.org/members

² Ofcom Consultation on ‘Improving spectrum access for Wi-Fi: Spectrum use in the 5 and 6 GHz bands’ (“Consultation”).

the incumbent fixed service operations. The DSA hopes that Ofcom will consider AFC mechanism in its continued effort to make for efficient use of spectrum in the UK.

Question 1: Do you have any comments on our proposal to open access to the 5925-6425 MHz band for licence-exempt Wi-Fi use?

The DSA encourages Ofcom to open access to the entire 5925-7125 MHz frequency range -- ‘6 GHz band’ -- to licence-exempt Wi-Fi use. The DSA envisions three classes of Wi-Fi devices operating in the 6 GHz band, each operating within one or more segments in the band, each serving a different set of use cases. The three class are higher power indoor / outdoor Wi-Fi, low power indoor (LPI) Wi-Fi, and very low power (VLP) indoor / outdoor Wi-Fi.

The DSA agrees with Ofcom’s proposal to open access to the lower 6 GHz band (5925-6425 MHz) for low power indoor only Wi-Fi devices. Most Wi-Fi consumption occurs indoors, and the overall demand for Wi-Fi spectrum is increasing. Recent studies have concluded additional Wi-Fi spectrum is required just to keep pace with the demand from existing uses, let alone enable innovators to push the envelope with new and innovative ones.³

The channel plan for the 5925-6425 MHz frequency band allows for three new non-overlapping channels of 160 MHz and six new non-overlapping channels of 80 MHz that can be used for high-bandwidth applications. While there will be new multiple non-overlapping 20 MHz and 40 MHz channel, the focus of the 6 GHz band use cases will be for those applications that can leverage the larger channels sizes and more efficient Wi-Fi technologies. For these reasons Ofcom’s technical rules for radiated power and radiated power spectral density, for example, should be optimized for the 160 MHz (and future 320 MHz) channels, rather than for 20 MHz channels. The 5 GHz band will become the home for 20 MHz and 40 MHz channels used by legacy Wi-Fi equipment. In fact, Ofcom models that 50 percent of lower 6 GHz Wi-Fi devices will have a nominal channel bandwidth of 80 MHz, and 30 percent of Wi-Fi device will have a nominal channel bandwidth of 160 MHz.⁴

The skew towards larger channel sizes in the lower 6 GHz band gives greater importance to the radiated power spectral density limit for protecting fixed links from Wi-Fi devices. What matters most is not necessarily the Wi-Fi device’s radiated power, but the portion of the radiated power that is co-channel with fixed link. For example, UK fixed point-to-point links in the lower 6 GHz band operate with carrier spacings of 29.65 MHz and 59.3 MHz.⁵

³ Steve Methley and William Webb, Quotient Associates Ltd., *Wi-Fi Spectrum Needs Study 26* (2017); Rolf de Vegt et al., Qualcomm Technologies Inc., *A Quantification of 5 GHz Unlicensed Band Spectrum Needs* (2016).

⁴ Consultation at ¶ Table A7.5: Nominal channel bandwidth percentages.

⁵ “OfW 446: Technical Frequency Assignment Criteria for Fixed Point-to-Point Radio Services with Digital Modulation”, Ofcom, 5 February 2020, page 36. https://www.ofcom.org.uk/_data/assets/pdf_file/0017/92204/ofw446.pdf.

For Wi-Fi devices operating in a 160 MHz channel, there is considerably more radiated power outside of point-to-point link's operating channel than within it. This is also true of Wi-Fi devices operating in an 80 MHz channel, but to a lesser extent. What counts is the Wi-Fi device's radiated power per megahertz multiplied by the number of megahertz that is co-channel with the point-to-point link.

Consequently, the DSA believes the focus on interference mitigation should be on the radiated power spectral density limit. The radiated power spectral density limit for the lower 6 GHz band should be constant. Based on input from our members, we believe a reasonable value for low power indoor only Wi-Fi base stations is 8 dBm/MHz. At a high level, DSA believes Ofcom's rules should enable 6 GHz Wi-Fi low power indoor networks utilizing a 160 MHz channel to have a comparable coverage footprint as the lower frequency 5 GHz Wi-Fi low power indoor networks operating in a much smaller channel. Existing 5 GHz Wi-Fi access points can then just be swapped out for the next generation Wi-Fi equipment at very low cost to the consumer. It is important for the transmission in the uppermost 6 GHz 160 MHz channel to be strong enough to penetrate at least one wall. For the same reason, Ofcom's technical rules for low power indoor client devices should be as symmetric to those of the low power indoor access point as practicable to ensure that links traveling through walls in the coverage area can be closed.

The DSA supports Ofcom's proposal to open the 5925-6425 MHz band for indoor and outdoor VLP licence-exempt use at a radiated power level of up to 25 mW.⁶ VLP use cases are geared towards personal area networks intended for operations over a short range. An example is an individual connecting her / his mobile phone to their augmented reality / virtual reality headset over a 160 MHz VLP channel. At the proposed power levels, DSA believes that Ofcom should explore whether VLP devices could operate across other segments within the 6 GHz band or even the entire band.

The DSA is disappointed that Ofcom is not considering the use of Automated Frequency Coordination (AFC) mechanisms as a means for allowing higher-power indoor and outdoor Wi-Fi operations on these channels. The AFC concept lies along the continuum of established spectrum management techniques. Indeed, as Ofcom itself stated in the agency's 2016 *Framework for Spectrum Sharing*: "Geolocation databases are making it easier for devices to identify spectrum that is available for sharing while protecting the operation of existing services. . . the fundamental principle is not frequency specific and can be extended to a broader range of frequencies" beyond the well-established TV bands databases certified to coordinate sharing and safeguard incumbents in the UK, U.S. and several other nations.⁷ In December 2018, Ofcom released a consultation stating its intention

⁶ Consultation at ¶ 4.26.

⁷ Office of Communications (Ofcom), *A Framework for Spectrum Sharing*, Statement, at 27 (April 14, 2016), available at https://www.ofcom.org.uk/data/assets/pdf_file/0028/68239/statement.pdf. See also Ofcom, *Spectrum Management Strategy* (April 30, 2014), available at https://www.ofcom.org.uk/data/assets/pdf_file/0021/71436/statement.pdf.

“to work towards a Dynamic Spectrum Access approach in bands where this is appropriate and practical to implement.”⁸

DSA believes that given the fixed nature of both band incumbents and Wi-Fi deployments, an AFC mechanism is particularly practical in the 5925-6425 MHz band. In the UK, there are fewer than 400 holders of point-to-point fixed link licences in the 5925-6425 MHz frequency band.⁹ While coordination relying on an AFC may seem more complicated than traditional, manual frequency assignment, the inputs and algorithm that objectively determine the coordination will be completely transparent to the user, to incumbents, and to Ofcom. Last year, the DSA released a study entitled *Automated Frequency Coordination: An Established Tool for Modern Spectrum Management*.¹⁰ The report provides greater detail on AFCs and how it would work in the context of the 6 GHz band specifically, based on the pending proposal by the U.S. regulator (FCC) to authorize outdoor use at standard Wi-Fi power levels by relying on AFCs to protect incumbents.¹¹

Because incumbents in this band are fixed in location and static by design, an AFC would do nothing more than automate the process of manual spectrum coordination. The ability of geolocation databases to coordinate spectrum access is well enough proven that there should be little doubt that Ofcom can certify a system (whether agency-run or delegated to third parties) with the technical ability to automate frequency coordination, lower transaction costs, speed time to market, use the spectrum more efficiently, protect incumbents from interference with certainty, and generally expand the supply of unlicensed Wi-Fi capacity that is fast becoming, like electricity, a critical input for most industries and economic activity.

Moreover, AFC systems in this band would be significantly less complicated than the commercial Spectrum Access Systems used to coordinate spectrum assignments for operators in the Citizens Band Radio Service (CBRS) in the U.S. while protecting the highest-priority user, the U.S. Navy. The DSA recognizes that it will take some time to develop, test and certify one or more AFCs – and that Ofcom could bear some cost for administering the process. However, even if Ofcom did not task this out to a multi-stakeholder industry group, as the FCC did for CBRS, the DSA believes the effort would be well worth the cost in the longer term. An AFC can allow higher power Wi-Fi networks that facilitate a wider variety of use cases than does low power indoor only use and will overall increase the spectrum utilization in the band. With sufficient separation from incumbent sites, these use cases include very high-capacity point-to-multipoint fixed wireless broadband networks in rural

⁸ Ofcom, *Enabling Opportunities for Innovation: Shared Access to Spectrum Supporting Mobile Technology*, Consultation, at 10 (Dec. 18, 2018) (“Ofcom 2018 Consultation”), available at https://www.ofcom.org.uk/data/assets/pdf_file/0022/130747/Enabling-opportunities-for-innovation.pdf.

⁹ See Consultation at ¶ 4.21.

¹⁰ See Dynamic Spectrum Alliance, DSA Report, *Automated Frequency Coordination: An Established Tool for Modern Spectrum Management*, March 2019, available at http://dynamicspectrumalliance.org/wp-content/uploads/2019/03/DSA_DB-Report_Final_03122019.pdf

¹¹ See *id.* at 37-41.

and other areas, as well as enterprise IoT networks both indoors (at a more robust power level) and across campuses and between facilities.

Allowing outdoor Wi-Fi networks to share spectrum with incumbent fixed links on a no interference / no protection basis through AFC governance is something the DSA hopes Ofcom considers in the future. The DSA is happy to answer any question you may have regarding our publication.

Question 2: Do you have any comments on our technical analysis of coexistence in the 5925-6425 MHz band?

Low power indoor only Wi-Fi devices and Very-Low Power Wi-Fi devices are intended for consumer markets. As such, the DSA agrees with Ofcom’s philosophy to propose “...a simple regulatory solution without the need for the need for a more complex interference management approach.”¹² Presumably, Ofcom’s views were shaped by its review of UK consumer experience accessing Wi-Fi in spectrum bands where DFS is required. Interference management exclusively through radiated power levels and radiated power spectral density is straightforward and eliminates one potential barrier to adoption by end users.

With that said, DSA is comfortable with Ofcom’s technical analysis of coexistence in the 5925-6425 MHz frequency band between the incumbent fixed links in the UK and low power indoor only Wi-Fi devices and between the incumbent fixed links in the UK and very low power indoor / outdoor licence-exempt devices.

Question 3: Do you agree with our proposal to remove DFS requirements for indoor Wi-Fi up to 200mW from the 5725-5850 MHz band?

The DSA welcomes Ofcom’s proposal to remove DFS requirements for indoor Wi-Fi in the 5725-5850 MHz band. We agree that this action will make additional spectrum available to meet Wi-Fi demand and allow for more efficient use of spectrum.

DSA is a global organization with members operating in every ITU region. For many of DSA’s United States based members, based on their domestic experience, Ofcom’s proposal -- 200 mW EIRP and EIRP densities up to 10 mW / MHz and indoor only operations -- is viewed as overly conservative, bordering on the disappointing. Conversely, for DSA’s European based members, Ofcom proposed action represents a breakthrough. If adopted, the UK would be the sole EU country to allow licence-exempt operations in the 5.8 GHz band without requiring DFS.

¹² Consultation at ¶ 4.5.

As Ofcom points out, 5725-5850 MHz is a NATO class A band that, among other things, is used by military radars. Additionally, Ofcom reported in its 2017 statement that earlier that year there were over 12,000 Broadband Fixed Wireless Access (BFWA) links licenced. These BFWA links still will require DFS.

The DSA trusts that Ofcom's proposal is likely the best it can offer for licence- exempt use today in the 5725-5850 MHz range given the need to protect incumbents. At these operational parameters, the UK marketplace will sort out which commercial Wi-Fi use cases are viable, and which will likely be underpowered. Unlike its analysis of Wi-Fi networks sharing with incumbents in the 5925-6425 MHz frequency band, there was no detailed analysis provided. In time, the DSA hopes that Ofcom will consider whether indoor EIRP levels and EIRP power spectral density levels can be increased.

Question 4: Do you have any comments on other options that may be available for Wi-Fi and RLANs within the 5 GHz band?

WRC-19 amendments to the Radio Regulations for RLAN operations in the 5150-5250 MHz band,¹³ among other things, provided Administrations with the option of allowing controlled and / or limited outdoor usage with a maximum mean EIRP of 200 mW. Additionally, Administration were given the further option to permit indoor or controlled outdoor RLAN use, up to a maximum mean EIRP of 1 W. In this instance, there were conditions placed on operations that would limit the maximum EIRP at various elevation angles to protect incumbent satellite services. There is also a suggested cap on the maximum percentage of these high power outdoor RLANs devices with respect to all RLAN devices operating in the band.

The DSA commends Ofcom's for its intention to study low power outdoor use in the 5150 -5250 MHz band within the UK. We hope the EIRP levels considered will be significantly above those permitted for SRDs. DSA's members believes there is a need for Ofcom to consider allowing controlled use of fixed outdoor stations up to 1 W EIRP with the appropriate antenna mask. A consequence of the U.S. Federal Communications Commission's 2014 rule change that allowed outdoor use of RLANs and at higher powers is greater competition in the provision of broadband services. The availability of higher power outdoor Wi-Fi devices in the UK may also lead to changes in the competitive landscape for broadband services – especially in more densely populated areas.

DSA is aware of the concern regarding aggregate interference that continues to be raised by the MSS incumbent. This should not deter Ofcom from examining the technical compatibility of fixed outdoor Wi-Fi

¹³ ITU Resolution 229 (WRC-19).

stations of up to 1W EIRP with the appropriate mask. The DSA filed an Opposition¹⁴ in response to a Petition filed at the Federal Communication Commission to open up a new proceeding with the intent to undo its 2014 rule changes. The DSA concluded that the data presented in the Petition, “...even if it were not flawed, could not reasonably lead to a conclusion that its satellite services are experiencing either actual or imminent harmful interference due to unlicensed operations in the [5150-5250 MHz] U-NII-1 band”.

Respectfully submitted,



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¹⁴ See Opposition of the Dynamic Spectrum Alliance, RM-11808, July 23, 2018. http://dynamicspectrumalliance.org/wp-content/uploads/2018/07/ReplyComments_OTI-DSA_5GHz-Petn_FINAL_Subm_072318.pdf