Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Unlicensed Use of the 6 GHz Band	)	ET Docket No. 18-295
	)	
Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz	)	GN Docket No. 17-183
	)	

COMMENTS OF FACEBOOK, INC.

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I. Introduction and Summary

Facebook, Inc. ("Facebook") is pleased to submit these comments in response to the Commission's Notice of Proposed Rulemaking on the unlicensed use of the 6 GHz Band.[1] Facebook's mission is to give people the power to build community and bring the world closer together. And connecting people is a critical first step in executing this mission. Today, nearly half of the world's population is still not connected to the Internet.[2] Among those that have connectivity, many are under-connected. Connecting these people is a complicated effort that requires not just bringing network infrastructure to more people, but establishing a regulatory environment that fosters innovation and encourages investment.

Spectrum policies that balance access to licensed, lightly-licensed, and unlicensed spectrum are critical to connectivity both in the United States and around the world. As worldwide progress has been made towards establishing additional licensed spectrum for 5G, additional unlicensed spectrum must be identified and made available. Currently, more than 2.5 billion people use Facebook apps (Facebook, Instagram, and WhatsApp) each month,[3] and many of those users connect through Wi-Fi. Access to unlicensed spectrum will be critically important to the company's future innovations and enhancements of these and other products with more

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[1] *Unlicensed Use of the 6 GHz Band et al*., Notice of Proposed Rulemaking, ET Docket No. 18-295, FCC 18-147 (rel. Oct. 24, 2018) at https://docs.fcc.gov/public/attachments/FCC-18-147A1.pdf. ("6 GHz NPRM").

[2] International Telecommunication Union, Measuring the Information Society Report 2018-Volume 1 at 2 (11 Dec. 2018) *at* https://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2018/MISR-2018-Vol-1-E.pdf.

[3] John Constine, TechCrunch, "2.5 billion people use at least one of Facebook's apps" https://techcrunch.com/2018/07/25/facebook-2-5-billion-people/ (Jul. 25, 2018).

interactive content, retina resolution videos and augmented and virtual reality (AR/VR) as well as artificial intelligence (AI).[4]

For these reasons, Facebook strongly supports the Commission's efforts here to make available additional unlicensed spectrum for both indoor and outdoor use in the 6 GHz band. However, for the 6 GHz band to bring about the innovation and investment the United States has seen in the other unlicensed bands,[5] the Commission should revise its proposed rules to make the band more accessible to a greater variety of use cases. To this end, Facebook offers the following recommendations. *First*, the Commission should permit low power indoor (LPI) devices to access the full 6 GHz band. *Second*, the Commission should permit client devices to operate at the same power level as their associated access point. *Third*, the Commission should allow very low power (14 dBm) devices, including portable and wearable very low power devices, to access the full 6 GHz band. *Fourth*, the Commission should continue to assess the protection criteria for FS links, to ensure that with advancement of technology, the protection criteria do not unduly stifle innovation in the band and protect outdated technologies. *Fifth*, Facebook further recommends that the Commission take the opportunity to encourage rural broadband deployment in the 6 GHz band by allowing new technologies, like phased array high gain antennas to be used on an unlicensed basis for lower cost wireless connectivity. And *sixth*, the Commission should not be overly prescriptive in its rules establishing the automated frequency control (AFC) mechanism. By focusing its rules on the verification of the

[4] *See, e.g.,* Facebook Business, "F8 2018: Augmented Reality Comes to Messenger" (May 1, 2018) https://www.facebook.com/business/news/f8-2018-augmented-reality-comes-to-messenger; Facebook for Developers, "AR Studio: Create and Distribute New, Rich AR Experiences with Ease" (May 1, 2018) https://developers.facebook.com/blog/post/2018/05/01/ar-studio-create-distribute/.

[5] *See* The Economic Value of Wi-Fi: A Global View (2018 and 2023): https://www.wi-fi.org/downloads-registered-guest/Economic%2BValue%2Bof%2BWi-Fi%2B2018.pdf/35675.

effectiveness of an AFC system, the Commission would allow for maximum flexibility in AFC architecture and for multiple AFCs to accommodate a wide range of use cases in the 6 GHz band.

II. The Commission Should Revise Its Proposed Rules to Allow for Greater Use and Innovation in the 6 GHz Band.

In order for the 6 GHz band to reach its full potential for innovation and investment, the Commission should adjust its proposed rules to make the band more accessible to a wider variety of use cases. This can be done without harming the band's incumbents. *First*, the Commission should permit low power indoor (LPI) devices to access the full 6 GHz band. *Second*, the Commission should permit client devices to operate at the same power level as their associated access point. *Third*, the Commission should allow very low power (14 dBm) devices to access certain sub-bands of the 6 GHz band. And *fourth*, the Commission should continue to assess the protection criteria for FS links, which are very conservative, to ensure that as technology advances, the protection criteria do not unduly stifle innovation in the band.

A. The Full 6 GHz Band Should Be Available for Low Power Indoor (LPI) Devices.

The Commission should allow LPI operations throughout the 6 GHz band, rather than limiting them to the U-NII-6 and U-NII-8 sub-bands as currently proposed.[6] In the U-NII-5 and U-NII-7 sub-bands the same technical rules will work to ensure LPI operations would protect FS links. The conservative RKF study supports this conclusion.[7] And in the real world, the impact

[6] 6 GHz NPRM ¶ 59.

[7] *See* RKF Engineering Services, Frequency Sharing for Radio Local Area Networks in the 6 GHz Band 31–32 (Jan. 2018) ("RKF Study"), as attached to Letter from Paul Margie, Counsel, Apple Inc., Broadcom Corporation, Facebook, Inc., Hewlett Packard Enterprise, and Microsoft

of LPI devices should be even less than suggested in the RKF study because, as discussed in more detail below,[8] a number of mitigating factors, including building loss and limited radiated power were not taken into account.

Moreover, band-wide operation for LPI devices is critical to making the 6 GHz band a success. The fragmented approach proposed by the Commission would severely limit efficient use of the spectrum. Additionally, it could limit the public benefit, and as a result, the overall value of the spectrum. Internationally, it is possible that only indoor operations will be permitted in the 6 GHz band for some time as other nations may not have the resources to implement an AFC approach outdoors. As a result, if the Commission limits the available spectrum for indoor devices, this could lead to a confusing patchwork of international availability of the 6 GHz band. This, in turn, would reduce public benefits of using the band, impact economies of scale for equipment in the band and would devalue the spectrum. Lastly, by making the entire 6 GHz band available for LPI operations, the Commission will encourage more innovation and investment sooner. There will be some lag time to develop and deploy outdoor AFC-controlled devices in the 6 GHz band due to the time it will take to develop, implement, and certify AFCs. However, LPI devices could be quickly brought to the market and deployed, and with more spectrum and channels available, a wider range of use cases could take advantage of this spectrum.

Corporation to Marlene H. Dortch, Secretary, Federal Communication Commission, GN Docket No. 17-183 (filed Jan. 26, 2018). The RKF Study demonstrated that nationwide operation of standard-power RLAN devices operating indoors and outdoors, without any additional sharing mechanisms, would result in less than a 0.2% of FS links receiving sufficient energy to even conceivably cause measurable interference to a receiver.

[8] *See infra* Section II. D.

B. The Commission Should Allow Client Devices and Associated Access Points To Operate at the Same Power Level.

The Commission should allow client devices to operate at the same transmitted power level of the access point with which they are associated in all cases. The Commission's proposal to limit all client devices to a lower power level threshold will significantly reduce the utility of power level limits for access points.[9] If client devices are restricted to far lower power levels than their associated access point, the result is unbalanced links (client devices receiving signal at higher power than they can send). This will severely limit future services in the 6 GHz band. For example, in AR/VR use cases, a lot of data will come from the user's client device to the network and will require client device power transmission equivalent to the access point. Increased client device power will not affect the harmful interference potential of either standard-power AFC-controlled devices or LPI devices. The AFC will account for interference potential of the client devices regardless of power level with the difference being that higher power may mean more geographic restrictions, and LPI and very low power 14 dBm devices would already be below the proposed threshold.

C. The Commission Should Permit Very Low Power Devices (14 dBm), Including Portable Devices, Throughout the 6 GHz Band, Both Indoors and Outdoors.

The Commission should permit very-low-power devices, including portable devices, at radiated power levels less than 14 dBm, throughout the entire 6GHz band, both indoors and outdoors. These very low power portable devices may operate both in motion and in fixed positions both indoors and outdoors. This very low power level is sufficiently low, combined with factors such as attenuation loss and propagation conditions, to negate any real-world risk of

[9] *See* 6 GHz NPRM ¶78.

harmful interference to incumbents. Unlicensed operations of portable devices at this very low power level should therefore be permitted without AFC.

By permitting these very low power devices to operate across the 6 GHz band, the Commission would spur innovation for new use cases. Innovators would gain access to 6 GHz band for flexible new use cases with greater flexibility, and lower cost, than either of the two device classes envisioned by the Commission (*i.e.*, standard-power AFC-controlled devices or low-power indoor only devices (LPI)). A very-low-power device class that includes portable devices would complement the other two device classes by providing flexible spectrum access for short-range connectivity between devices such as game console controllers, keyboards, headphones, or other wearable devices, and for other future use cases not yet foreseen.[10]

D. The RKF Study Conservatively Supports These Proposed Rule Adjustments, and the Commission Should Revisit the Protection Criteria as Technology Advances.

The RKF Study made very conservative assumptions and can be relied upon to support the above recommended adjustments to the proposed rules. For instance, the RKF analysis did not consider various sources of real-world attenuation (*i.e.,* feeder and polarization losses), and it overestimates the likelihood of an RLAN device transmitting in or near the main beam of an FS link. In the real world, the probability of an FS link receiving the low level of interference calculated in the RKF study would actually be even lower because the study did not account for a number of mitigation factors in FS link designs, including fade margin, the use of technologies such as adaptive modulation and forward error correction to avoid data loss, and other robustness

[10] *See, e.g.,* Yeung, Ken, Venture Beat, "Oculus's Michael Abrash: AR glasses will change everything in the 'next 50 years'" at https://venturebeat.com/2017/04/20/oculuss-michael-abrash-ar-glasses-will-change-everything-in-the-next-50-years/ (Apr. 20, 2017).

features commonly included in FS links.[11] The study also did not account for the fact that in the real world, indoor devices unlikely to interfere with the main beam of an FS link, as FS link designers avoid links that pass near buildings. The RKF study also included the conservative assumption that all RLAN traffic would be concentrated co-channel with an incumbent. Instead in the real world, RLAN operations would be spread across all available channels and if wider bands available, which would further reduce the likelihood of harmful interference to levels far below the extremely small risk RKF identified.

In addition, the RKF Study assumed a -6 dB I/N threshold for the purpose of protecting FS receivers.[12] This has historically proven to be effective. However, Facebook requests that the Commission reassess whether or not this protection threshold is too conservative and whether it could be relaxed as current and future FS links are capbaple of tolerating higher interference levels as interference can occur only briefly. As technology continues to advance, and as more intense spectrum sharing is required, Facebook believes that on a going-forward basis using outdated protection criteria would hurt both incumbents and new entrants.

III. The 6 GHz Band Has the Potential to Enable New Rural Broadband Connectivity Solutions with Adjustments to the Proposed Rules.

As part of its mission to give people the power to build community and bring the world closer together, Facebook, working with a range of partners, has launched several initiatives focused on connecting the unconnected and the under-connected in rural areas.[13] The high-cost

[11] *See* RKF Study at 44-53 (describing FS sharing analysis and assumptions used).

[12] *See id*. at 5.

[13] Facebook has been investing in research and development efforts in a range of technologies, including mobile, satellite, and aerial such as high altitude platform stations ("HAPS). Facebook is also working with partners to develop different approaches to rural connectivity around the

of rural deployments is a major impediment to connectivity in rural and even suburban areas, Facebook supports policies that enable new technologies that lower the cost of connectivity to these areas. The 6 GHz band presents an opportunity to enhance rural broadband deployment by wireless internet service providers (WISPs) through a lower cost connectivity solution that would still protect incumbents and there are considerably less incumbents in those areas. However, to enable this technology, the Commission should make some adjustments to its proposed rules. As the Commission's *Notice of Proposed Rulemaking* states, the proposed rules, unlike those for the other U-NII bands, do not contain provisions for high gain antennas for unlicensed devices and seeks comment on whether higher power operations could be permitted in rural and underserved areas under certain conditions.[14] To promote rural broadband deployment in the 6 GHz band, the Commission should allow phased array antennas with steerable beams for outdoor unlicensed operations and devices in point-to-multipoint (P2MP) fixed configurations, which would enable a critical rural connectivity use case. At this time, under current Part 101 rules,[15] it is not clear that phased array antennas with steerable beams are permitted, and the rules are burdensome for small operators. Rural wireless internet service providers (WISPs) must use equipment optimized for point-to-point links and register each link under the Part 101 framework. By clarifying that phased array antennas, possibly based on Wi-Fi technology, with steerable beams may be used on an unlicensed basis, the Commission will allow WISPs to use less costly equipment under a less cumbersome registration framework, which would lower costs overall,

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world. *See, e.g.*, "Telefonica and Facebook share their vision of a new approach to connectivity" (Apr. 11, 2018) *at* https://www.telefonica.com/es/web/public-policy/blog/articulo/-/blogs/telefonica-and-facebook-share-their-vision-of-a-new-approach-to-rural-connectivity.

[14] 6 GHz NPRM ¶ 79.

[15] 47 C.F.R. § 101.

ease deployment, and bridge the digital divide with that of urban areas. Although it would not be necessary in the rural deployment scenarios, the Commission could consider imposing AFC on the P2MP networks.

IV. The Commission Should Not Be Prescriptive Regarding AFC Design.

The Commission should adopt rules that allow for a flexible approach to AFC design and operation that would permit different AFC implementations to accommodate a wide variety of use cases, deployment scenarios and business models. Therefore, the Commission's rules should be focused on verification of the effectiveness of AFC systems' ability to correctly determine whether a device operating at a given local, on a given range of frequencies, and at a given power level, would exceed the chosen interference protection criterion for any FS receiver. The rules should otherwise provide for maximum flexibility in the AFC's internal architecture. For example, an AFC could be implemented through a third-party database, through an access point's own integrated AFC services, or a service provider could implement its own AFC system on a private. Furthermore, the Commission should not designate a single AFC operator and should instead allow the marketplace to determine the most efficient AFC implementations as multiple implementations may be best to accommodate different use cases and technologies. Moreover, the Commission should not require registration, identification or tracking of AFC-controlled devices, which would be burdensome and harmful to consumer privacy.[16] Such rules would be unnecessary and ineffective at mitigating interference. And lastly, the Commission should not require coordination or synchronization between AFCs.[17] There is no need for aggregate interference protection or any other need for data to be synchronized between

[16] 6 GHz NPRM ¶¶ 27-28.

[17] *Id*. ¶ 33.

operators. Thus, a coordination requirement would unnecessarily burden AFC operators. This burden would continue to grow as additional AFC implementations are certified and could ultimately make it untenable for new AFC entrants in future.

V. Conclusion

Facebook strongly supports the Commission's efforts to make available additional unlicensed spectrum for both indoor and outdoor use in the 6 GHz band. In order for the 6 GHz band to bring about the innovation and investment the United States has seen in the other unlicensed bands, the Commission should revise its proposed rules to make the band more accessible to a greater variety of use cases. In addition, Facebook further recommends that the Commission take the opportunity to encourage rural broadband deployment in the 6 GHz band by allowing new technologies to be used on an unlicensed basis for lower cost wireless connectivity. Lastly, the Commission should allow for maximum flexibility in AFC architecture and for multiple AFCs to accommodate a wide range of use cases in the 6 GHz band.

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