

June 12, 2018

**BY ELECTRONIC FILING**

Marlene H. Dortch, Secretary  
Federal Communications Commission  
445 12th Street SW  
Washington, DC 20554

Re: *Expanding Flexible Use in Mid-Band Spectrum between 3.7 and 24 GHz*,  
GN Docket No. 17-183

Dear Ms. Dortch:

The Commission's goals in this proceeding are to (1) identify additional unlicensed spectrum to address growing consumer demand and to support 5G and (2) protect incumbents from harmful interference. In pursuit of these goals, the Commission has compiled a substantial technical record regarding the 6 GHz band. Every major incumbent operator has filed comments or reply comments in response to a Notice of Inquiry describing its use of the band and requirements they would like the Commission to establish for protection from harmful interference.<sup>1</sup> Companies proposing to build and deploy unlicensed Radio Local Area Network (RLAN) technologies described the importance of the 6 GHz band for broadband deployment and how to effectuate sharing through technical rules and use restrictions.<sup>2</sup> RKF Engineering

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<sup>1</sup> See, e.g., Reply Comments of AT&T Services, Inc. at 13-21, GN Docket No. 17-183 (filed Nov. 15, 2017); Comments of the Counties of Fauquier and Loudoun, Virginia at 3-5, GN Docket No. 17-183 (filed Nov. 13, 2017); Comments of the National Association of Broadcasters at 8-10, GN Docket No. 17-183 (filed Oct. 2, 2017); Reply Comments of NCTA – The Internet & Television Association at 16-18, GN Docket No. 17-183 (filed Nov. 15, 2017); Comments of the Utilities Technology Council and the Edison Electric Institute at 6-12, GN Docket No. 17-183 (filed Oct. 2, 2017); Comments of Verizon at 21-22, GN Docket No. 17-183 (filed Oct. 2, 2017); Letter from Susan H. Crandall, Associate General Counsel, Intelsat Corporation, & Gerry Oberst, President, SES Americom, Inc., to Marlene H. Dortch, Secretary, Federal Communication Commission, GN Docket No. 17-183 (filed Feb. 23, 2018); Reply Comments of the Wireless Internet Service Providers Association at 3-5, GN Docket No. 17-183 (filed Nov. 15, 2017).

<sup>2</sup> See Comments of All Points Broadband, Amplex Internet, Apple, Blaze Broadband, Broadcom, Cambium Networks, Cisco Systems, Cypress Semiconductor, Dell, Extreme Networks, Facebook, Fire2Wire, Google, Hewlett Packard Enterprise, HP, Intel, Joink, MediaTek, MetaLINK Technologies, Microsoft, New Wave Net, Pixius Communications, Qualcomm, Rise Broadband, Ruckus, a Unit of Brocade, Snappy Internet, Sony Electronics, Western Broadband, Wireless Internet Service Providers Association, Wisper ISP at 5-10, 18-19, GN Docket No. 17-183 (filed Oct. 2, 2017); Reply Comments of Apple Inc., Broadcom

Solutions submitted a comprehensive technical report following this comment cycle, including a thorough and detailed nationwide analysis of the potential for harmful interference.<sup>3</sup> This analysis demonstrated that the risk to licensed incumbents from RLAN devices is very low and could be resolved through FCC rules imposing avoidance and mitigation mechanisms. A wide range of incumbents, equipment makers, semiconductor companies, and software companies deepened the record with a set of detailed and thorough discussions of the proper assumptions, methodologies, and models for analyzing harmful interference.<sup>4</sup> Thus, the Commission possesses a detailed and comprehensive technical record.

Our companies' understanding of the dynamics present in the 6 GHz band has benefited greatly from this record, and from our exchanges directly with incumbents. We appreciate their

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Limited, Cisco Systems, Inc., Facebook, Inc., Google LLC, Hewlett Packard Enterprise, Intel Corporation, MediaTek Inc., Microsoft Corporation, and Qualcomm Incorporated at 3-9, 16-21, GN Docket No. 17-183 (filed Nov. 15, 2017); Comments of Wi-Fi Alliance at 3-9, GN Docket No. 17-183 (filed Oct. 2, 2017).

<sup>3</sup> RKF Engineering Services, *Frequency Sharing for Radio Local Area Networks in the 6 GHz Band* (Jan. 2018), *as attached to* Letter from Paul Margie, Counsel, Apple Inc., Broadcom Corporation, Facebook, Inc., Hewlett Packard Enterprise, and Microsoft Corporation, to Marlene H. Dortch, Secretary, Federal Communication Commission, GN Docket No. 17-183 (filed Jan. 26, 2018).

<sup>4</sup> *See* Letter from Susan H. Crandall, Associate General Counsel, Intelsat Corporation & Gerry Oberst, President, SES Americom, Inc., to Marlene H. Dortch, Secretary, Federal Communication Commission, GN Docket No. 17-183 (filed Feb. 23, 2018); Letter from Karis A. Hastings, Counsel for Sirius XM, to Marlene H. Dortch, Secretary, Federal Communication Commission, GN Docket No. 17-183 (filed Feb. 22, 2018); Letter from Mitchell Lazarus, Counsel for the Fixed Wireless Communications Coalition, to Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 17-183 (filed Mar. 13, 2018); Letter from Stacey G. Black, Vice President, AT&T Services, Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 17-183 (filed Mar. 19, 2018); Letter from Stacey G. Black, Vice President, AT&T Services, Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 17-183 (filed Mar. 26, 2018); Letter from Dave Meyer, Board Member and Former President, National Spectrum Management Association, to Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 17-183 (filed Mar. 27, 2018); Letter from Paul Margie, Counsel, Apple Inc., Broadcom Corporation, Facebook, Inc., Hewlett Packard Enterprise, and Microsoft Corporation, to Marlene H. Dortch, Secretary, Federal Communication Commission, GN Docket No. 17-183 (filed Apr. 10, 2018); Letter from Apple Inc., Broadcom Inc., Cisco Systems, Inc., Facebook, Inc., Google LLC, Hewlett Packard Enterprise, Intel Corporation, Microsoft Corporation, Qualcomm Incorporated, and Ruckus Networks to Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 17-183 (filed May 14, 2018).

good faith efforts to work collectively to find a way to improve broadband access for more Americans while avoiding harmful interference. In an effort to advance this proceeding, and because of our deep commitment to protecting incumbents, including fixed service (FS) and fixed satellite service (FSS) operators, from harmful interference, we present in this letter a framework for an interference-protection system for the 6 GHz band incumbents.

We propose that the Commission adopt a robust framework for preventing harmful interference to FS incumbents: (1) comprehensive *ex ante* interference protection through an automated frequency coordination process that proactively prevents RLAN operation in situations where it could cause harmful interference and (2) a remediation tool to assure incumbents that, in the highly unlikely event that they experience harmful interference from a 6 GHz RLAN device despite automated frequency coordination, the interference can be stopped and prevented from recurring. Our framework will also protect FSS incumbents through the use of antenna pointing restrictions, in addition to the outdoor usage restrictions we describe below.

## **I. EX ANTE RESTRICTIONS ON RLAN OPERATIONS IN THE 6 GHZ BAND**

First, we propose that one option for protecting FS incumbents is for the Commission to adopt rules to restrict outdoor 6 GHz RLAN operation such that these devices will not be permitted to operate co-channel within defined exclusion zones for each fixed link. To achieve this, FCC rules would permit outdoor RLAN master devices to operate in the band if they are location aware and able to determine or obtain a list of permissible channels of operation from an automated frequency coordination function that contains a stored repository of frequencies and exclusion zones associated with each nearby fixed link or other protected incumbent sites.<sup>5</sup> Rules would require these channel lists to have a defined expiration time. In turn, the automated frequency coordination function would be required to update its database periodically based on link-registration data stored in the Commission's Universal Licensing Service (ULS) database.

Second, we propose that the Commission adopt rules to similarly restrict even *indoor* devices, except those operating at lower power levels that pose no material risk of harmful interference to fixed links that operate exclusively outside. We are proposing two classes of indoor RLAN devices (standard and lower power) that are unlikely to cause harmful interference due to building loss and clutter. We nonetheless propose to apply geographic exclusion zones to RLANs operating at standard power levels to help address the concerns of certain incumbents.

Third, we propose that the Commission initially adopt rules that ban all outdoor RLAN operations in the 6.425-6.525 GHz (U-NII-6) band, regardless of power level, mobility, antenna height, and other characteristics. This recommendation is in keeping with accommodating the concerns expressed in particular by public safety mobile users in this band.<sup>6</sup> The Commission

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<sup>5</sup> Client devices should also be permitted if they obtain the necessary channel availability from a master device and restrict their operations to these channels.

<sup>6</sup> U-NII-6 indoor use is subject to further study of public safety mobile usage models.

should remain open to future proposals that could open this band to outdoor RLAN operations under a targeted protection regime while satisfying incumbents' concerns.

While there are other interference protection approaches deserving consideration, and Commission rules should recognize that innovations may yield additional options in the future, this proposal would provide strong and reliable protection.

Notably, the mitigation techniques we propose are technology neutral. In the interest of promoting competition and innovation, we propose that the Commission adopt functional requirements such as those described above. The FCC should not adopt command-and-control style technical design mandates, such as rules prescribing the implementation that the “repository” described above must take or prescribing a specific geolocation technology. These elements may be implemented differently in different settings and by different types of devices. More importantly, the most effective techniques will certainly change with time as technological advances make new mitigation techniques possible that we cannot anticipate today. The Commission is at its best when it adopts clear functional rules that companies can innovate to meet—but often hampers innovation when it locks in its own judgment of the best technological and engineering choices and forces the market to comply. The FCC’s long record of successfully enforcing its equipment rules through the Office of Engineering and Technology’s equipment certification process demonstrates that the agency can permit and has permitted flexibility while ensuring rigorous adherence to its rules before companies can market or sell devices.

## **II. REMEDIATION**

We also propose that the Commission adopt rules that ensure that, in the highly unlikely event that an incumbent experiences harmful interference despite *ex ante* protections, they can stop this interference and prevent it from recurring. In particular, we propose that the FCC adopt rules that require all 6 GHz RLAN access points that implement an automated frequency coordination function, whether they operate indoors or outdoors, to periodically transmit identifying information. This will allow an incumbent or the Commission to identify and notify an offending device if it causes harmful interference.

## **III. ADDITIONAL PROTECTIONS FOR FSS**

In addition to its analysis of FS links, RKF also analyzed potential interference to FSS systems, by considering a worst-case satellite as determined through a review of publicly available Commission FSS licensing data, positioned at longitudes across North America. RKF concluded that the interference risk to FSS is even more remote than to FS systems and found that energy produced by RLANs would be only a tiny fraction of the energy FSS systems already receive from FS operations.

Importantly, RKF’s analysis shows the environment even without the benefits produced by the new restrictions described in Section II of this letter, which would further reduce the intensity of outdoor 6 GHz unlicensed use. Nonetheless, in addition to these protections, we also propose to limit the radiated power and elevation angle of outdoor RLAN devices in U-NII-5 and

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U-NII-8 to reduce the potential impact on FSS still further. We propose to restrict radiated emissions of all outdoor 6 GHz RLAN devices with antennas pointing more than 30 degrees above the horizon to 1W or less. In addition, fixed point-to-point outdoor devices in these bands would be prohibited from pointing within 2 degrees of the geostationary arc as applicable. This will further reduce emissions radiated towards FSS systems.

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Adoption of these proposals, combined with a remarkably robust technical record, will empower the Commission to expand broadband access for the country by permitting RLAN operations in the 6 GHz band without risking harmful interference to incumbents. We request that the FCC move ahead by issuing a Notice of Proposed Rulemaking that contains these proposals.

Respectfully submitted,

Apple Inc.  
Broadcom Inc.  
Cisco Systems, Inc.  
Facebook, Inc.  
Google LLC  
Hewlett Packard Enterprise  
Intel Corporation  
Microsoft Corporation  
Qualcomm Incorporated  
Ruckus Networks, an ARRIS Company