February 7, 2020

Via Electronic Filing

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

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

Dear Ms. Dortch:

The Edison Electric Institute ("EEI"), the American Gas Association ("AGA"), the American Public Power Association ("APPA"), the American Water Works Association ("AWWA"), the National Rural Electric Cooperative Association ("NRECA"), the Nuclear Energy Institute ("NEI"), and the Utilities Technology Council ("UTC"), each representing their respective critical infrastructure industry ("CII") members, hereby clarify and correct any misperceptions about the technical parameters relied upon in our study labeled the "Impact of Proposed Wi-Fi Operations on Microwave Links At 6 GHz" (the "CII User Study") submitted into the record in the above-captioned dockets on January 13, 2020.[1]

The CII User Study provides a real-world analysis of the potential impact of unlicensed use of the 6 GHz band on the multitude of CII and public safety providers that currently use the band for essential and mission-critical communications. Specifically, the study is based on the actual and detailed interference impact on the 520 Microwave sites that are operational in the Houston Metropolitan Statistical Area (MSA), as well as "the actual impact of indoor and outdoor Wi-Fi deployments on 2325 point-to-point communications receivers" in the MSA.[2] As explained below, the CII User Study reaches its conclusions based on conservative and realistic assumptions and inputs. Accordingly, the CII User Study provides an appropriate assessment of the Commission's proposal to allow unlicensed use of the 6 GHz band.

Proper Accounting for Wi-Fi Density and Usage

A critical input in any valid study of the impact of shared use of the 6 GHz band is appropriately accounting for widespread use of Wi-Fi devices across the study area. The CII User Study was intentionally conservative in its assumptions in this regard, and fully in line with established industry protocols for measuring density and usage.

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[1] Roberson & Associates, LLC, *Impact of Proposed Wi-Fi Operations on Microwave Links at 6 GHz* (2019) (*the CII User Study*). *See also* Letter from EEI, AGA, APPA, AWWA, NRECA, NEI, and UTC to Marlene H. Dortch, Secretary, FCC Docket Nos. 18-295, 17-183 (Jan. 13, 2020) (*CII Letter*).

[2] *CII User Study*, at 4.

The CII User Study properly assumed that the entire Houston metro area will be evenly populated with RLANs operating on frequencies distributed across the U-NII bands in 5-6 GHz (not just 6 GHz), and that RLAN access points will be deployed not just in residences, but equally in commercial, retail, business, and public indoor places.[3] We also accounted for differences in indoor and outdoor RLAN deployment, with outdoor RLANs (67,000 devices) accounting for a mere 1% of the number of indoor RLANs (6.7 million devices).[4]

As to the aggregate 1 RLAN per population (PoP) density figure used in the study, that figure is well-established in the technical community as representative across a combination of urban and rural areas, including studies of aggregate interference by the ITU's Radiocommunication Sector (ITU-R).[5] The figure is also likely overly conservative for determining the real-world impact of shared use. Actual impact of density in the band would likely be even higher; because the 1 RLAN figure solely accounts for RLAN access points, and responsive client devices, which will certainly be even more numerous, are not counted at all. Indeed, future demand for Wi-Fi access across all user groups will only increase, which the Wi-Fi proponents' submissions acknowledge. In fact, the Wi-Fi proponents' technical study projects 958 million RLAN devices in the 6 GHz band alone, a density of 2.9 RLANs per PoP.[6]

Another important input is how many deployed RLANs are operating on a particular frequency at a given moment in time. The CII User Study's use of a 4% duty cycle is entirely reasonable, again as an accurate, albeit conservative estimate of future RLAN use, especially given anticipated, and almost certain growth in future demand. Most importantly for accurately measuring the impact on CII users, the figure accounts for "busy periods" during which all the RLANs in a particular area are active at a 4% level (in a population of 1000 RLANs, 40 are transmitting simultaneously). The accounting for "busy periods" in the analysis is essential for assessing the potential harm to CII incumbent users as it evaluates moments when the system is under maximum stress and when harmful interference issues are most acute. And given almost certain increased anticipated future commercial and consumer uses, busy periods will likely be frequent and substantial, with many likely to exceed 4% and extend for significant parts of a 24-hour day. Indeed, the 4% duty cycle is anything but excessive – if ***only half*** the RLANs are powered on and operating at 4% duty cycle, unacceptable interference persists as the I/N CDF would be reduced by only 3 dB, an insignificant amount considering that 10% of the links have I/N 18.5 dB in excess of the desired -6 dB I/N receiver threshold.

There are a host of additional reasons why the 4% figure is likely to underestimate actual use should sharing be allowed. Like internet traffic itself, Wi-Fi and RLAN usage are surely to

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[3] *CII User Study* at Page 14.

[4] *CII User Study* at Page 14.

[5] Annex 11 to Document 5A/1065-E, Working Party 5A Chairman's Report. "PRELIMINARY DRAFT NEW REPORT ITU-R M.[RLAN SHARING 5 150-5 250 MHz] Sharing and compatibility studies of WAS/RLAN in the 5 150-5 250 MHz frequency range," at page 44, Table A-1, 13 May 2019.

[6] *Frequency Sharing for Radio Local Area Networks in the 6 GHz Band January 2018*, *attached to* Letter from Paul Margie, Counsel to Apple Inc., *et al.*, to Marlene Dortch, Secretary, FCC, in GN Docket No. 17-183 at 12, Table 3-1 (filed Jan. 26, 2018)

grow exponentially with time, with video and other high-bandwidth traffic continuing to be the largest consumers of spectrum.[7] The corresponding and ever-increasing use of Wi-Fi repeaters and extenders, as well as deployment of next generation mesh relay networks, will all certainly escalate channel activity levels and apparent duty cycle for total spectrum usage, which will result in interference levels well beyond those calculated in the report. Further, once RLANs are approved and deployed, there is nothing to deterministically limit their activity level to any particular value, either individually or in aggregate. We are open and look forward to discussing with other stakeholders and the Commission the appropriate analytical metrics to properly account for what is assuredly increased future use.

Power Spectral Area Density ("PSAD") Calculations

Recent submissions suggest that there is confusion as to whether the Power Spectral Area Density ("PSAD") for Wi-Fi interference used in the CII User Study is based on realistic assumptions.[8] Specifically, concerns have been raised that the assumption of the total bandwidth available improperly excluded U-NII-2, allegedly resulting in a significant reduction in PSAD. To clarify, U-NII-2 was excluded from the study because regulatory restrictions on the use of the U-NII-2 band inhibit unlicensed deployment. Indeed, there are fewer certifications in the Commission's database in U-NII-2 band than in U-NII-1 or U-NII-3 since bands U-NII-1 and U-NII-3 are free of the regulatory restrictions present in U-NII-2.

Even if U-NII-2 is included, the analysis results in the same conclusions, as the decrease (improvement) in I/N is 10 log(1425/1780) or slightly less than 1 dB. This decrease is insignificant because the I/N distributions for the point-to- point links in the nine-county Houston metro area indicate that 10% of the links have I/N levels a full ***18.5 dB*** in excess of the desired -6 dB I/N level as a result of indoor RLANs.[9] In other words, not including U-NII-2 only raises the I/N distribution by an analytically insignificant 1 dB.

The limitations on the viability of wide deployment in the U-NII-2 band is further evident in a recent fine imposed by the Commission on companies operating Wi-Fi transmitters without DFS and TPC features to avoid interference with an FAA doppler radar in San Juan, Puerto Rico.[10] This illustrates an interference hazard that can occur even when the Commission imposes restrictions on equipment in the band. If this interference were to occur in U-NII-5 or U-NII-7, it

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[7] *See Cisco Visual Networking Index: Forecast and Trends*, 2017–2022 White Paper ("Globally, IP video traffic will be 82 percent of all IP traffic (both business and consumer) by 2022, up from 75 percent in 2017. Global IP video traffic will grow four-fold from 2017 to 2022, a CAGR of 29 percent. Internet video traffic will grow fourfold from 2017 to 2022, a CAGR of 33 percent.").

[8] Letter from Alex Roytblat, Senior Director of Regulatory Affairs at Wi-Fi Alliance, to Marlene H. Dortch, Secretary, FCC Docket Nos. 18-295, 17-183 (Jan. 17, 2020) (*Wi-Fi Alliance Letter*).

[9] *CII User Study* at 17.

[10] *In the Matter of CA Solutions, Inc. (d/b/a Boom Solutions), Caguas, Puerto Rico, and Boom Net, LLC (d/b/a Boom Solutions, Caguas, Puerto Rico*, Notice of Apparent Liability for Forfeiture and Order DA 19-801 (Aug. 22, 2019). *See also Enforcement Bureau Takes Actions to Counter Interference to FAA Terminal Doppler Weather Radar Station*, Enforcement Advisory No. 2019-06, DA 19-807 (Aug. 22, 2019).

would have serious consequences for other critical information infrastructure, besides the detection of severe weather conditions.

There should also be no concern regarding the CII User Study's inclusion of interference in the PSAD calculation from standard power unlicensed devices deployed in outdoor locations.[11] The Notice of Proposed Rulemaking ("NPRM") establishes that outdoor devices will require AFC.[12] Nonetheless, outdoor devices were included in the CII User Study, and were actually necessary, in order to provide a proper reference point to compare the potential interference from indoor devices. As expected, the analysis very clearly shows that outdoor devices (without AFC) pose a threat to the operation of point-to-point links.[13] The analysis results for indoor without AFC further show that the interference threat from indoor devices without AFC is similar to that of outdoor devices without AFC.[14]

Interference Mitigation Factors

There should also be no issue as to whether the CII User Study properly accounts for interference mitigation factors, such as feeder-loss and polarization mismatch. Feeder loss is included in the point to point receiver noise figure in the table in Section 7.8.2, and polarization effects are considered in Section 7.2.2; and both are fully accounted for in the study's ultimate conclusions.[15] The inclusion of polarization mismatch is debatable for aggregate interference, and in any case only amounts to 2-3 dB, which does not significantly impact the cumulative I/N results for the 2325 receivers in the nine county metro area.

Two-Slope Model to Account for Path Loss

The CII User Study also properly accounted for path loss, using a well-established "two-slope" model to measure relative propagation in urban/semi-urban areas.[16] The two-slope model accounts for the effects of free-space by using a free-space path loss ("FSPL") model for the first 1 km that attenuates at 20 dB/decade.[17] A direct line-of-sight path to occupied buildings under

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[11] *Wi-Fi Alliance Letter* at *4.*

[12] *Unlicensed Use of the 6 GHz Band*, Notice of Proposed Rulemaking, 33 FCC Rcd 10496 at ¶ 20 (2018).

[13] *CII User Study* at 17-18.

[14] *Id.* at 18.

[15] "Since electromagnetic wave polarization is not controlled in Wi-Fi emitters, and both horizontal and vertical polarization is used in licensed microwave receivers, it cannot be used reliably for interference discrimination. Therefore, polarization discrimination is set to 0 dB in this study." *CII User Study* at 32.

[16] *CII User Study* at Section 7.1.2. Another term for the "two-slope" propagation model is "break point" model which is given in the UMa LOS model of: "ETSI TR 138 901 V14.1.1 (2017-08)", and "5G; Study on channel model for frequencies from 0.5 to 100 GHz (3GPP TR 38.901 version 14.1.1 Release 14)" *available at*

https://www.etsi.org/deliver/etsi_tr/138900_138999/138901/14.01.01_60/tr_138901v140101p.pdf

[17] Note that the Study only applies FSPL to the first 1 km since antenna heights for FS receivers are intended to be high enough to have a direct line-of-sight path to the transmitter that will be an average of 19 km away in Houston. *CII User Study* at Section 4.2.1.2.

the link is only assumed for the first 1 km of the path. Beyond 1 km, the attenuation increases to 38 dB/decade. This is based on the path loss model given in ITU-R Report M.2135, Table A1-2 for Urban Macro Cell scenarios.[18] For indoor devices, building loss at 11 dB median value was also included.[19]

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We hope the foregoing clarifications are useful for the Commission and interested stakeholders to ascertain the real-world risk from the current Commission proposal to allow unlicensed use of the 6 GHz band, especially to the broad cross-section of the nation's CII and public safety users that depend daily on the 6 GHz band for essential and mission-critical communications.

Respectfully submitted,

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[18] ITU-R Report M.2135-1, *Guidelines for evaluation of radio interface technologies for IMT-Advanced*, Dec. 2009 (Rep. M.2135) *available at* https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2135-1-2009-PDF-E.pdf

[19] *CII User Study* at Section 7.1.3.

American Water Works Association
Dedicated to the World's Most Important Resource®

/s/ G. Tracy Mehan, III
Executive Director,
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cc: Office of Engineering and Technology