

July 2, 2019

Ex Parte Notification

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

**Re: 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**

Dear Ms. Dortch:

On June 28, 2019, representatives from Apple Inc., Broadcom Inc., Facebook, Inc., Google LLC, Hewlett Packard Enterprise, Intel Corporation, Marvell Semiconductor, Inc., Microsoft Corporation, and Qualcomm Incorporated met with representatives of the Commission's Office of Engineering and Technology. A list of meeting participants is attached to this letter.

During the meeting, the industry participants presented the attached slide deck explaining how the FCC can enable very low power ("VLP") portable device applications in the 6 GHz band and fully protect incumbent Fixed Service ("FS") licensed operations from harmful interference. The Commission's Notice of Proposed Rulemaking sought input on the issue of enabling low-power portable devices,¹ and the undersigned companies explained in their comments and reply comments on the FCC's NPRM that the agency should enable a VLP class of devices.²

As detailed in the slide presentation, we explained that VLP operations in the 6 GHz band operating without Automated Frequency Coordination ("AFC") at 14 dBm EIRP, or -5 dBm/MHz radiated Power Spectral Density ("PSD"), would present no real-world risk of harmful interference to licensed FS operations. We also explained that the 4 dB of body loss included in the PSD analysis on slide 4 of the presentation is a very conservative estimate of losses given the common use cases VLP would support, such as automotive infotainment,

¹ *Unlicensed Use of the 6 GHz Band*, Notice of Proposed Rulemaking, ET Docket No. 18-295, FCC 18-147 (rel. Oct. 24, 2018) ("NPRM") at ¶ 76 (seeking comment on means implementing low power unlicensed communications between portable devices at short ranges).

² *See* Comments Of Apple Inc., Broadcom Inc., Cisco Systems, Inc., Facebook, Inc., Google LLC, Hewlett Packard Enterprise, Intel Corporation, Marvell Semiconductor, Inc., Microsoft Corporation, Qualcomm Incorporated, and Ruckus Networks, An Arris Company (Feb. 15, 2019) at 3, 4, 14, 16, 35-37, 69, 73; Reply Comments Of Apple Inc., Broadcom Inc., Cisco Systems, Inc., Facebook, Inc., Google LLC, Hewlett Packard Enterprise, Intel Corporation, Marvell Semiconductor, Inc., Microsoft Corporation, Qualcomm Incorporated, and Ruckus Networks, An Arris Company (Mar. 18, 2019) at 10-12. *See also* June 24, 2019 *Ex Parte* Letter from Apple Inc., Broadcom Inc., Cisco Systems, Inc., Facebook, Inc., Google LLC, Hewlett Packard Enterprise, Intel Corporation, Marvell Semiconductor, Inc., Qualcomm Incorporated, Att. at 2.

device-to-device video streaming, mobile AR/VR, and tethering. The parties further explained that 4 dB of loss is conservative even absent a human body because unlicensed operations that do not specifically experience body loss would still experience attenuation from being used in a car, around clutter, or when resting on a surface such as a table.

In discussing the viability of VLP unlicensed operations in the 6 GHz band, we explained that our sharing analysis is based on publicly available FS link operating parameters in the FCC's ULS database and that the analysis demonstrates that virtually all FS receivers have substantial excess design margin. Broadcom has separately confirmed this analysis, finding that links in urban areas typically are shorter length and have higher margin and therefore likely to experience less multipath fade than FS links in barren areas.³

* * *

The undersigned companies strongly encourage the Commission to move forward to open the 6 GHz band for unlicensed use as soon as possible in accordance with our Comments and Reply Comments in this proceeding.

Respectfully submitted,

Apple Inc.
Broadcom Inc.
Facebook, Inc.
Google LLC
Hewlett Packard Enterprise
Intel Corporation
Marvell Semiconductor, Inc.
Microsoft Corporation
Qualcomm Incorporated

Atts.

cc (w/ Atts.): FCC OET Meeting Participants

³ See March 29, 2019 *Ex Parte* Letter of Broadcom Inc.

Meeting Participants

Julius Knapp (FCC OET)
Bahman Badipour (FCC OET)
Michael Ha (FCC OET)
Sayed Hasan (FCC OET)
Nicholas Oros (FCC OET)
Barbara Pavon (FCC OET)
Jamison Prime (FCC OET)
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Dan Mansergh, Apple Inc.*
Chris Szymanski, Broadcom Inc.
Alan Norman, Facebook, Inc.
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Hassan Yaghoobi, Intel Corporation*
Yi-Ling Chao, Marvell Semiconductor, Inc.*
Paula Boyd, Microsoft Corporation*
John Kuzin, Qualcomm Incorporated
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Tevfik Yucek, Qualcomm Incorporated*

* Participated via telephone

The FCC can Accelerate 5G Services
while Protecting Incumbent
Operations by Enabling Very Low
Power Portable Class Devices in 6 GHz

June 28, 2019

Overview

- Very low power portable (VLP) device class is expected to be an AP class device that operates without AFC control and is comprised mostly of portable devices (e.g., soft AP, in-vehicular APs) that connect to other devices operating in “client mode” or “peer-to-peer” mode at very short ranges (e.g., < 3m)
 - We believe such devices are at the core of provisioning of 5G digitally immersive cellular services
- These devices are expected to be connected to a battery power source and operate indoors and outdoors
 - Based on current data usage, we expect the lion’s share of transmissions to take place indoors/in-vehicle
 - The very low power signals from these devices are further attenuated by clutter, body loss (incl. from other users), etc., and a device antenna design that further limits energy in the direction of the FS receiver
- We have proposed VLP operations at 14 dBm EIRP in the 6 GHz band, which will present very limited risk of harmful interference in FS operations
- An alternate method could be a simple uniform -5 dBm/MHz radiated PSD limitation for VLP

6 GHz Very Low Power Portable Devices Required for Ultra High Performance Applications



Mobile AR/VR



UHD Video Streaming



High Speed Tethering



In-Vehicle Entertainment

- 5G mmW enabled handsets already in the market can deliver ~ 2 Gbps
 - For American consumers to derive the full benefit of mmW 5G, peripheral devices such as AR/VR goggles, mobile hotspot, etc. will be required
 - VLP devices can provide ~2 Gbps throughput for 160 MHz transmission with sub-ms latency at 3 meters
-

-5 dBm/MHz EIRP for VLP can enable key use cases, and is 6 dB MORE Protective than the Commission's Proposed LPI Rules, even when operating outdoors

PSD Analysis	LPI	VLP
Commission's Proposed PSD	11 dBm/MHz	
Radiated PSD	17 dBm/MHz	- 5 dBm/MHz
Traditional Building Penetration Loss (BEL)	20 dB*	0**
Body Loss	0	4 dB
Total PSD	-3 dBm/MHz	- 9 dBm/MHz

* Compared against the building entry loss for traditional building, we note that an energy efficient building would be expected to have 10 dB more loss

**Assumes worst case with device operating outdoors (outside of buildings and vehicles)

The vast majority of FS Receiver Antennas are located in Rural and Barren Areas – away from where VLP devices are expected to predominantly operate

- According to the ULS as of 01/23/2019, there were 97,573 FS receiver antennas in UNII's 5/7, the following have been identified as being in barren, rural, suburban, and urban population areas*
 - 67,694 (73.5%) are in barren areas
 - 8,875 (9.6%) are in rural areas
 - 4,669 (5.1%) are in suburban areas
 - 10,832 (11.8%) are in urban areas

* We note that some of the links were allocated to a propagation environment because they were outside of the Continental US and/or they were missing geolocation information

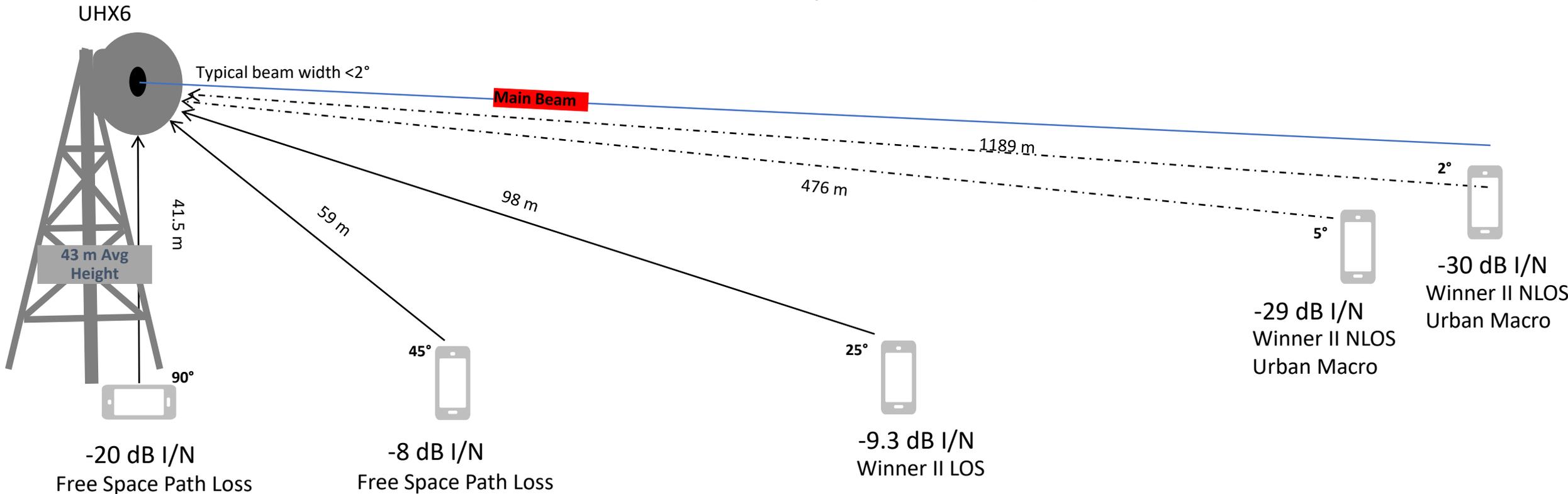
VLP Devices can Coexist with Typical FS Operations even in Line of Sight Scenarios near the FS Receiver

$$\text{Interference} = \text{EIRP} - \text{BL} - \text{Pathloss} + \text{GRX} - \text{OffAxis} - \text{NFR}^* - \text{FL} - \text{PM}$$

-5 dBm/MHz 4 dB
39 dB
2 dB
3 dB

Pathloss
OffAxis
NFR*

Dominates at longer distances
Dominates at shorter distances



* We note that Near Field Rejection was NOT included in this analysis. For a 6 ft antenna at 6.5 GHz, nearfield losses can occur up to 144 meters away

Real-world scenarios further reduce the risk of harmful interference

- VLP applications are expected to operate in urban, suburban, and tourist areas, with 5G mmW coverage, which are typically located well away from FS Receivers
- As indicated in previous filings, FS links typically have 30-50+ dB in margin to handle deep multipath fade in the evening hours; mobile operations are expected to be highly uncorrelated with these fading occurrences
- Portable device antenna design further reduces risk of harmful interference
 - Majority of very low power portable devices will use multiple antennas
 - Like what we've shown with low power indoor APs, both antennas will not exhibit peak gain in the same direction
 - Therefore peak EIRP in the direction of an FS Antenna will always be less than the regulatory limit
- IEEE 802.11ax for 6 GHz operations requires transmit power control further limiting emissions
- ITU body loss model is highly conservative based on our collective experience designing products
- FS operators will typically place their antenna on the highest point of surrounding terrain, which leads to FS Antenna elevations high above what is considered in this analysis
- Such VLP operations would also be subject to additional clutter attenuating the signal in the direction of the FS Antenna

Conclusion

- Future 5G services require wireless broadband portable devices
- The Commission can ensure Americans enjoy the benefits of these next generation wireless services by enabling a very low power portable device class
- The 6 GHz band is ideal for enabling these services
- The risk of harmful interference to incumbent operations from VLP devices is extremely low