

Re: Unlicensed Use of the 6 GHz Band and Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz (ET Docket No. 13–115 and RM–11341)

Dear Commission’s Secretary, Office of the Secretary, Federal Communications Commission,

IEEE 802 LAN/MAN Standards Committee (LMSC) thanks the Federal Communications Commission (FCC) for issuing the call for comments on “Unlicensed Use of the 6 GHz Band and Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz (ET Docket No. 13–115 and RM–11341)” and for the opportunity to provide feedback.

IEEE 802 LMSC is a leading consensus-based industry standards body, producing standards for wireless networking devices, including wireless local area networks (“WLANs”), wireless specialty networks (“WSNs”), wireless metropolitan area networks (“Wireless MANs”), and wireless regional area networks (“WRANs”). We also produce standards for wired Ethernet networks, and technologies produced by implementers of our standards are critical for all networked applications today.

IEEE 802 LMSC is a committee of the IEEE Standards Association and Technical Activities, two of the Major Organizational Units of the Institute of Electrical and Electronics Engineers (IEEE). IEEE has about 400,000 members in over 160 countries. IEEE’s core purpose is to foster technological innovation and excellence for the benefit of humanity. In submitting this document, IEEE 802 LMSC acknowledges and respects that other components of IEEE Organizational Units may have perspectives that differ from, or compete with, those of IEEE 802 LMSC. Therefore, this submission should not be construed as representing the views of IEEE as a whole<sup>1</sup>.

Please find below the IEEE 802 LMSC’s comments on this consultation.

### **General and Summary Comments**

IEEE 802 LMSC closely follows FCC regulatory activities regarding radio local area network (RLAN) and strongly supports FCC proceedings on enabling Very Low Power (VLP) and Client to Client (C2C) communications in the 5925 MHz to 7125 MHz band (a.k.a. 6 GHz). More specifically, IEEE 802 LMSC recognizes that Part 15 Subparts C, E, and F are relevant to the IEEE 802 standards.

Building on the United States of America’s leadership on Low Power Indoor (LPI) and Standard Power (SP) at 6 GHz band, we believe that enablement of Peer-to-Peer (P2P) communications is the natural next step in optimum utilization of the 6 GHz spectrum through multi-modal regulatory framework. More specifically, we believe that enabling VLP and C2C modes in the 6 GHz band is critical in supporting a comprehensive set of use cases and enabling the relevant segment of industries. VLP and C2C modes of communications offer means for spectral and power efficient operation that may be otherwise infeasible or inefficient specially for Real Time Applications (RTA) such as real time gaming, cloud gaming, real time video, and robotics and industrial

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<sup>1</sup> This document solely represents the views of IEEE 802 LMSC and does not necessarily represent a position of either the IEEE or the IEEE Standards Association or the IEEE Technical Activities.

automation. These applications typically have stringent latency, throughput, and determinism performance requirement on the same or various traffic channels enabling the RTA use-cases<sup>2</sup>.

IEEE 802 LMSC welcomes and applauds the Commission's decision on authorizing VLP operation in the U-NII-5 and U-NII-7 bands. We strongly support the Commission to permit VLP devices to also operate in the UNII-6 and U-NII-8 bands without geo-fencing. IEEE 802 LMSC supports the Commission's consideration for increasing maximum VLP transmit power level but recommends increasing the maximum power spectral density for VLP to 1 dBm/MHz without geo-fencing capability restriction. IEEE 802 LMSC supports VLP operation with geo-fencing capability at higher power of up to 21 dBm.

IEEE 802 LMSC notes the Commission addressing of the prohibition of direct communication of 6 GHz unlicensed client devices and the proposed exceptions at 14 dBm power level. IEEE 802 LMSC appreciates the exceptions but believes that enabling various use cases for P2P communication require higher power than 14 dBm. More specifically IEEE 802 LMSC agrees that the Commission should permit direct communications between clients of indoor access points at allowable maximum power levels associated with the indoor access points' clients.

IEEE 802 LMSC recommends the Commission to continue its leadership in enabling 6 GHz unlicensed operation by promoting global harmonization of regulatory requirements for VLP and C2C.

IEEE 802 family of standards, including IEEE 802.11-2020, IEEE 802.11ax-2021, IEEE 802.11az-2022, IEEE P802.11 and IEEE P802.11be, are the basis for suite of P2P communications technologies developed by the industry. In particular, Wi-Fi Alliance's Wi-Fi Direct<sup>®3</sup>, Wi-Fi Aware<sup>™4</sup> and Augmented/Virtual/Mixed Reality (AR/VR/MR)<sup>5</sup> related activities are targeting enablement of various P2P applications and uses cases. These Wi-Fi technologies are using IEEE 802.11 standards for device addressing and device discovery, service discovery, P2P Group Operation, P2P Power Management, P2P Co-existence Operation, Security, Ranging, and Fine Time Measurement, and enables mobile phones, PCs, head-mounted displays (HMD), displays, speakers, cameras, printers, gaming devices, and other consumer products to initiate and establish Wi-Fi networks without the need for network infrastructure, internet connection, or GPS signal.

IEEE P802.11 specifically provisioned regulatory classification for the 6 GHz band not only for LPI and SP modes but also for VLP and C2C operations so that the compliant devices can properly signal their regulatory capabilities according to their certification status for regulatory compliant interoperability when operating in VLP or C2C modes.

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<sup>2</sup> IEEE 802.11 Real Time Application Topic Interest Group Report, <https://mentor.ieee.org/802.11/dcn/18/11-18-2009-06-0rta-rta-report-draft.docx>

<sup>3</sup> Wi-Fi CERTIFIED Wi-Fi Direct<sup>®</sup> enables Wi-Fi devices to connect directly to each other, making it simple and convenient to print, share, sync, play games, and display content to another device. Wi-Fi Direct devices connect to one another without joining a traditional home, office, or public network. See Discover Wi-Fi: Wi-Fi Direct. [Available online](#) [Accessed: 14 March 2024]

<sup>4</sup> Wi-Fi CERTIFIED Wi-Fi Aware<sup>™</sup> extends Wi-Fi<sup>®</sup> capability with quick discovery, connection, and data exchange with other Wi-Fi devices—without the need for a traditional network infrastructure, internet connection, or GPS signal. Wi-Fi Aware<sup>™</sup> provides rich here-and-now experiences by establishing independent, device-to-device Wi-Fi connections based on a user's immediate location and preferences. Examples of Wi-Fi Aware<sup>™</sup> use cases are unsynchronized device discovery, security enhancement, and AR/VR/MR. See Discover Wi-Fi: Wi-Fi Aware. [Available online](#) [Accessed: 14 March 2024]

<sup>5</sup> Wi-Fi Alliance: Discover Wi-Fi: XR. [Available online](#) [Accessed: 14 March 2024 ]

In addition, we would like to bring to the Commission attention that, IEEE 802 LMSC has been conducting different studies on real time communication and low latency communication to support applicability of IEEE 802 family of standards in these areas. As examples, we would like to list the IEEE 802.11 Real Time Application Topic Interest Group Report<sup>6</sup> and IEEE 802.24 Low Latency Communication White Paper<sup>7</sup>. Please note that these are some sample projects and reports that are not only applicable to P2P communication and not necessarily covering all P2P use cases.

### **Expanding Very Low Power Operations to U-NII-6 and U-NII-8**

IEEE 802 LMSC strongly supports the Commission's proposal to expand VLP operation to the U-NII-6 and U-NII-8 bands. Authorizing all 6 GHz sub-bands is critical in fully enabling latency sensitive high throughput applications like real time Extended Reality (AR/VR/XR) for health, education and gaming, robotics and industrial automation. In particular, enabling relevant application in dense residential environment and also to enable scaling of applications in enterprise and industrial when multiple of these application sessions has to support simultaneously and in close proximity. Therefore, it is essential to extend the VLP operation to both the U-NII-6 and the U-NII-8 bands to enable the maximum number of 160 MHz and 320 MHz channels.

The characteristics of incumbent Fixed Services and Fixed Satellite Services is very similar throughout the 6 GHz band on the U-NII-5 and U-NII-7 bands as well as the U-NII-6 and U-NII-8 bands and the same level of protection from VLP operation is achievable on the U-NII-6 and U-NII-8 bands. Therefore, there is no risk of harmful interference in the U-NII-6 and U-NII-8 bands similar to that of the U-NII-5 and U-NII-7 bands. Industry analysis and studies are conducted to demonstrate that there are no harmful interference to incumbent fixed services<sup>8</sup>.

IEEE 802 LMSC also believes that the VLP implementations can effectively protect the electronic news gathering operation in the U-NII-6 and U-NII-8 bands. More specifically, characteristics of Fixed ENG central receive sites are similar to those of Fixed Services and therefore, the same analysis and studies show that there is no risk of harmful interference to the central receive sites. As related to the mobile ENG receivers are concerned, we believe that the combination of low transmit power level of VLP, contention-based mechanism, and TPC will minimize any possible risk of harmful interference to these mobile receivers.

### **Increasing Maximum Power Spectral Density of VLP Devices**

IEEE 802 LMSC welcomes the Commission proposal for improving VLP performance by increasing maximum PSD for VLP devices to 1 dBm/MHz limited to 14 dBm. With this change, the maximum transmit power is only increased for 20 MHz and 40 MHz channel bandwidth sizes to 14 dBm matching that for 80 MHz, 160 MHz, and 320 MHz channels. As a result, there is only a limited incremental performance improvement for a number of applications that use smaller channel sizes. IEEE 802 LMSC welcomes this increase in the PSD level as it also harmonizes

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<sup>6</sup> IEEE 802.11 Real Time Application Topic Interest Group Report, <https://mentor.ieee.org/802.11/dcn/18/11-18-2009-06-0rta-rta-report-draft.docx>

<sup>7</sup> IEEE 802.24 Vertical Applications Technical Advisory Group Low Latency Communication White Paper, <https://mentor.ieee.org/802.24/dcn/23/24-23-0010-06-0000-low-latency-communication-white-paper-word-for-comment.docx>

<sup>8</sup> VLP/FS Interaction Study, Monte Carlo Simulation of the San Francisco Metro Area, Letter from Paul Caritj, Counsel to Apple Inc., Broadcom Inc., Google LLC, Meta Platforms, Inc., and Microsoft Corporation to Marlene H. Dortch, Sec'y, FCC, ET Docket No.18-295, GN Docket No. 17- 183 (filed Feb. 28, 2023)

VLP transmit power in the United States of America with that in other countries and regions including Europe and hence greatly contribute to global harmonization of VLP devices. Having said that, IEEE 802 LMSC believes that the Commission should not require any geo-fencing capability as we do not believe that the minimal elevation of the PSD for 20 MHz and 40 MHz transmissions would cause any risk to incumbent services especially as these smaller channel bandwidth sizes may not be widely used in the 6 GHz band domestically when wider 6 GHz channels are available and devices also have the option to use 20 MHz and 40 MHz channels in the 5 GHz band at higher transmit power level. While IEEE 802 LMSC recognizes and appreciates the Commission initiative in developing the proposed geo-fencing regulatory framework for VLP, we do not believe that the incremental improvement justifies mandating the relatively complex mechanism for VLP applications that are expected to be simple by nature and low cost. In addition, detailing out the geo-fencing system along with its database requirement and development of the compliance mechanism will be time consuming and is potentially a cause of delay in deployment of this VLP mode.

Having said that, IEEE 802 LMSC welcomes the Commission consideration of geo-fencing mechanism and supports VLP operation with geo-fencing capability at higher power of up to 21 dBm.

### **Authorizing C2C Communications**

IEEE 802 LMSC believes that permitting client-to-client (C2C) communications when those devices are under the control of an indoor access point or after they have received an enabling signal from an indoor access point is critical in enabling a new class of P2P applications. Not allowing direct communication between client devices and unnecessarily requiring all traffic to go through access points would significantly degrade the throughput-latency performance of the carrying communication link in a number of important applications such as Extended Reality (XR) applications and hence impacting the performance and user experience. In addition, such restriction limits the scaling of the services, increases the system interference and channel access overhead and is energy inefficient as communications through access points require more power consumption and higher airtime.

In addition, some applications such as sensing, and proximity-based applications are inherently P2P and are only relevant when implemented between client devices directly without access point involvement.

IEEE 802 LMSC believes that permitting client devices to directly communicate with each other's at LPI power level considerably increases the range of Extended Reality based applications and properly matching the typical indoor classroom sizes and open space office areas used in education, health and IoT industry deployments. Without a C2C option at LPI power level, the range and overall performance of such applications would be very limited due to limitation in the VLP power level. In addition, C2C communication makes it possible for P2P networks to operate independently from and in different channels than that of Wi-Fi networks using infrastructure access points. This way, the two networks can coordinate channels for optimum spectrum utilization. IEEE 802 LMSC supports authorizing C2C communication at 24 dBm and -1 dBm/MHz align with that of LPI clients when communicating with access point.

IEEE 802 LMSC notes OET recent approval of AFC Systems to supervise SP operation in the 6GHz band. While we applaud the FCC and OET on this achievement, we expect the early SP deployments to be indoor and supported through Composite LPI/SP access points. Therefore, it

is critical that the Commission moves to authorize C2C communication between client devices under the control of LPI or Composite access points or after they have received an enabling signal from LPI or Composite access points.

IEEE 802 LMSC supports requiring an enabling signal threshold of -82 dBm/20MHz for C2C operation. This threshold is 4 dB higher and hence more conservative relative to the previously proposed numbers by the industry also mentioned in the 2nd FNPRM. IEEE 802 LMSC's understanding is that this higher threshold is adopted by Japan's MIC as technical condition for 6 GHz C2C<sup>9</sup> and also under consideration in ETSI BRAN<sup>10</sup>. At this threshold level, the C2C coverage is restricted well within the LPI coverage area and hence the risk for any harmful interference is negligible. Although IEEE 802.11 receiver sensitivity requirement specifies a threshold of -82 dBm for MCS0, this requirement is based on a very conservative assumption of 10 dB noise figure and 5 dB implementation margin. Receiver characteristics of typical complying devices to the IEEE 802.11 specification perform considerably better on both noise figure and implementation margin.

IEEE 802 LMSC believes that permitting C2C communications in other channels than the channels associated with the enabling access points is a fundamental advantage that C2C mode can offer. More specifically, clients enabled by an LPI access point can use any channels in the 6 GHz band and clients enabled by a Composite access point in SP mode can use any channel authorized by the AFC System. We believe that there would be no harmful interference to incumbent services from C2C communications due to this flexibility in channel usage as both clients are complying with all applicable regularity restrictions, if not more, while operating in C2C mode. The flexibility in channel usage, makes it possible to coordinate C2C channels with infrastructure access point and hence minimize interference, reduce unnecessary channel access overhead and contention and hence optimize spectrum utilization and better overall QoS.

IEEE 802 LMSC supports the industry proposed four second interval as the maximum recheck interval for the enabling signal strength measurement. We believe that a four second interval is a proper tradeoff for disabling the C2C communications quickly enough when a potential client device is moved away from indoor while controlling design complexity and minimizing performance degradation. This is especially important when clients are using other channels for the C2C communication then the enabling access point channel and the device needs to recheck the enabling signal strength periodically.

IEEE 802 LMSC believes that the Commission shall not impose the same access point restriction for enabling of the two clients. This is particularly important in enterprise deployments when there is a considerable chance that close by clients being under control of or subject of enabling by different but adjacent access points. Although we do not believe there would be any risk of harmful interference to incumbent services due to this flexibility, out of an abundance of caution, the Commission may consider limiting the enabling signals from access points with the same network (SSID).

IEEE 802 LMSC recognizes that FNPRM is focusing on the method based on control of or reception of an enabling signal from indoor APs to verify that C2C communications remains indoor. As it is commented earlier, IEEE 802 LMSC supports that and providing comments on

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<sup>9</sup> Japan MIC, Technical Condition [https://www.soumu.go.jp/main\\_content/000901042.pdf](https://www.soumu.go.jp/main_content/000901042.pdf)

<sup>10</sup> Draft ETSI EN 202 687 v0.0.18 6 GHz WAS/RLAN Harmonized Standard for Access to Radio Spectrum

that regard. Having said that, IEEE 802 LMSC recommends that the Commission to draft the rule language in a way that provides the option for compliance by alternative advanced technologies and methods, than utilizing the enabling signal, to demonstrate indoor operation.

### **Conclusion**

IEEE 802 LMSC supports enabling P2P communications at 6 GHz through authorization of VLP and C2C regulatory modes. In particular,

- We strongly support the Commission to permit VLP devices to also operate in the U-NII-6 and U-NII-8 bands without geo-fencing.
- We support the Commission's consideration for increasing maximum VLP transmit power level but recommends increasing the maximum power spectral density for VLP to 1 dBm/MHz without geo-fencing capability restriction.
- We support VLP operation with geo-fencing capability at higher power of up to 21 dBm.
- We support the Commission's decision to authorize C2C communication at 24 dBm and -1 dBm/MHz align with that of LPI clients when communicating with access point, and we recommend that the Commission to draft the rule language in a way that provides the option for compliance by alternative advanced technologies and methods, than utilizing the enabling signal, to demonstrate indoor operation.

We respectfully request the Commission to consider our comments listed in this response. We hope that the new regulation will be enacted in a timely manner.

Respectfully submitted

By: /ss/.

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