

Re: Consultation on the draft amendment of “Table of Radio Frequency Allocations of the Republic of China (Taiwan)”

Dear Ms. Tong,

IEEE 802 LAN/MAN Standards Committee (LMSC) thanks the Taiwan Ministry of Digital Affairs (MODA) for issuing the consultation on the draft amendment of “Table of Radio Frequency Allocations of the Republic of China (Taiwan)” and for the opportunity to provide feedback on the topic of 5945 MHz to 6425 MHz.

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 whole¹.

Please find below the responses of IEEE 802 LMSC to this consultation.

IEEE 802.11 and 802.15-based devices are already operating in the 6 GHz band

IEEE 802.11

The IEEE Std 802.11ax-2021 standard [1] supports operation in the 2.4 GHz, 5 GHz, and 6 GHz bands, and products based on this standard are seeing significant adoption where regulatory rules permit deployment [2]. Based on IEEE Std 802.11ax-2021, the Wi-Fi industry is taking the lead in developing Wi-Fi 6E certification program and specifying a number of complementary coexistence strategies for bands with incumbent users, such as automated frequency coordination (AFC) [3] [4] for the 6 GHz band. Wi-Fi technology, based on the IEEE 802.11 standard, has an estimated 18 billion devices in use world-wide, with over 4 billion devices added annually [5]. In addition, the list of Wi-Fi 6E [2] certified products (which are based on IEEE 802.11 technologies) is growing. In 2022, over 350 million Wi-Fi 6E devices entered the market [6].

A new generation of IEEE 802.11 technologies, currently under development in the IEEE P802.11be amendment [7], will continue to improve performance and enhance spectrum coexistence capacities. To achieve the targeted performance improvements, IEEE P802.11be introduces advanced features including channel bandwidths of up to 320 MHz, multiple resource

¹ 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.

units to a single station, multi-link operation, enhanced quality of service (QoS), improved Target Wake Time, and improved spectrum management to accommodate coexistence with incumbents more effectively and efficiently. Please note that the P802.11be amendment currently supports carrier frequency operation between 1000 MHz and 7125 MHz with extension to 7250 MHz under consideration.

IEEE 802.15

Ultra-Wideband technology, which is specified by IEEE 802.15 standards, is finding adoption for numerous short-range sensing and ranging applications. IEEE Std 802.15.4-2020 [8] and IEEE Std 802.15.4z-2020 [9] are standards for precision ranging that are capable of using both the 6 GHz and 7 GHz frequency bands and are increasingly used in many high value applications. The capability of IEEE Std 802.15.4z-2020 to support secure ranging has led to a renewed interest in UWB from both industry and regulators. The automotive industry was the driving force behind IEEE Std 802.15.4z-2020 and the first to include UWB in consumer products. Mobile handset makers have followed closely. This is generating significant economic and social value, attracting further interest in developing future UWB standards.

IEEE P802.15.4ab [10] is developing the next generation of UWB standard based on industry needs to fuel the next round of innovative products. The project is built on IEEE Std 802.15.4z-2020 which are capable of using both the 6 GHz and 7 GHz frequency bands and has been widely implemented and is supported by a rich ecosystem of industry alliances, silicon vendors and product developers. New developments supported by the project include features to improve link budget and/or reduce air-time, sensing capabilities to support presence detection and environment mapping, improved accuracy, precision and reliability for high-integrity ranging, interference mitigation techniques to support greater device density and higher traffic use cases and provide improved coexistence in the presence of other services in support of different regulatory regions, additional means to reduce complexity and power consumption, enhance support for ultra low energy, low latency streaming, while ensuring compatibility with the deployed base of products based upon IEEE Std 802.15.4z-2020. In addition, the project is built on the IEEE Std 802.15.4-2020 standard that supports peer-to-peer, peer-to-multi-peer, and station-to-infrastructure topologies and includes enhanced infrastructure synchronization mechanisms.

It is the right time to authorize U-NII equipment to operate in 5945 MHz to 6425 MHz in Taiwan

As recognized in this proceeding, many countries and regions have already allocated part or the entire 6 GHz band of license-exempt operation, which will create economies of scale and produce a robust equipment market, benefitting Taiwan's businesses, consumers, and the economies as well as increasing the societal benefits in Taiwan [11]. IEEE 802 LMSC commends MODA's effect and suggests further action on the proposed technical requirements.

MODA proposes to allow low-power U-NII equipment to operate no greater than 14 dBm outdoor (a.k.a. very lower power (VLP) mode) or no greater than 23 dBm indoors (a.k.a. low power indoor (LPI) mode) without causing harmful interference to existing authorized communications and without protection from any interference caused by existing authorized communications. Remote control drones are not allowed to use this frequency band. Devices using this band must have interference avoidance mechanisms, e.g., Listen-Before-Talk (LBT).

IEEE 802 LMSC supports the authorization of U-NII equipment operating both indoors and outdoors but kindly requests MODA to consider the following three changes to the proposed technical requirements, which are adopted by national regulatory authorities in other countries, such as the United States of America [12]:

- Authorize max EIRP of 17 dBm for VLP mode with channel bandwidth of 320 MHz, in order to make sure that the performance of a device under VLP mode is scaled with bandwidth.
- Authorize max EIRP of 30 dBm for access points under LPI mode and max EIRP of 24 dBm for clients under LPI mode, which are aligned with the US FCC's requirements [12] to enable license-exempt operation at large channel bandwidth of 160 MHz and 320 MHz in the downlink.

In addition, IEEE 802 LMSC kindly requests MODA to actively pursue enablement of other modes of operation in the 5945 MHz to 6425 MHz band, for example, a Standard Power (SP) mode under supervision of an AFC system in the complying devices through protocol level regulatory messaging. AFC can be considered as a potential mitigation for impact on incumbent services for outdoor operation along with VLP mode but at higher power level [3] [4]. IEEE 802 LMSC believes that an AFC System, as an effective automated sharing technology, is critical in enabling essential Wi-Fi technology applications and use cases not only for outdoor operation but also indoor operation at standard power level.

Authorizing SP mode at a max EIRP of 36 dBm for access points and 30 dBm for client devices for indoor and outdoor operation enables many key applications including multigigabit per second outdoor coverage (e.g., parks, stadiums), multigigabit point-to-multipoint connectivity, low-latency applications including industrial IoT and Voice over IP (Wi-Fi calling) applications, and next-generation experiences with AR/VR/XR for indoor and outdoor. The USA, Canada, and Brazil have already authorized SP mode and are currently developing certification process for AFC systems. Many other countries including Saudi Arabia, South Korea, and Japan are studying enablement of SP mode. Recommended compliance specifications are also being developed by industry stakeholders [12] [13] for consideration by the US FCC for its AFC system and device certification program.

Conclusion

IEEE 802 LMSC thanks the MODA for the opportunity to provide this submission and kindly requests MODA to consider our responses in its future decisions regarding the use of U-NII equipment in the 5945 MHz to 6425 MHz band and the authorization of Standard Power mode under an AFC supervision.

Respectfully submitted

By: /s/.

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References:

- [1] "IEEE Standard for Information Technology - Telecommunications and Information Exchange between Systems Local and Metropolitan Area Networks - Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment 1: Enhancements for High-Efficiency WLAN," in *IEEE Std 802.11ax-2021 (Amendment to IEEE Std 802.11-2020)*, vol., no., pp.1-767, 19 May 2021, doi: 10.1109/IEEESTD.2021.9442429.
- [2] Wi-Fi Alliance: Wi-Fi 6E momentum underscores need for entire 6 GHz band, November 2022. [Available online](#) [accessed: 14 May 2023].
- [3] Dynamic frequency coalition: Automated frequency coordination - an established tool for modern spectrum management, March 2019. [Available online](#) [accessed: 14 May 2023].
- [4] Intel: Spectrum sharing using automated frequency coordination. [Available online](#) [accessed: 14 May 2023]
- [5] Wi-Fi Alliance: Value of Wi-Fi. [Available online](#) [accessed: 12 March 2023]
- [6] Wi-Fi Alliance: Wi-Fi 6E certified products. [Available online](#) [accessed: 14 May 2023]
- [7] IEEE Draft Standard for Information technology--Telecommunications and information exchange between systems Local and metropolitan area networks--Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment: Enhancements for Extremely High Throughput (EHT)," in IEEE P802.11be/D3.0, January 2023 , vol., no., pp.1-999, 1 March 2023.
- [8] "IEEE Standard for Low-Rate Wireless Networks," in IEEE Std 802.15.4-2020 (Revision of IEEE Std 802.15.4-2015), vol., no., pp.1-800, 23 July 2020, doi: 10.1109/IEEESTD.2020.9144691.
- [9] "IEEE Standard for Low-Rate Wireless Networks--Amendment 1: Enhanced Ultra Wideband (UWB) Physical Layers (PHYs) and Associated Ranging Techniques," in IEEE Std 802.15.4z-2020 (Amendment to IEEE Std 802.15.4-2020), vol., no., pp.1-174, 25 Aug. 2020, doi: 10.1109/IEEESTD.2020.9179124.
- [10] IEEE P802.15.4ab. [Available online](#) [accessed: 14 May 2023]
- [11] UK Ofcom: Update on the upper 6 GHz band.
- [12] FCC: 15.407 General technical requirements.
- [13] ECC: ECC Decision (20)01, On the harmonised use of the frequency band 5945-6425 MHz for Wireless Access Systems including Radio Local Area Networks (WAS/RLAN), November 2020
- [14] Wi-Fi Alliance: AFC Specification and Test Plans. [Available online](#) [accessed: 14 May 2023]
- [15] Wireless Innovation Forum: Specifications. [Available online](#) [accessed: 14 May 2023]