

Re: Consultation on the draft amendment to technical standards for telecommunications equipment and equipment using the frequency 5.925 GHz – 6.425 GHz.

Dear Chairman,

IEEE 802 LAN/MAN Standards Committee (LMSC) thanks the Thailand National Broadcasting and Telecommunications Commission (NBTC) for issuing the consultation on draft amendment to technical standards for telecommunications equipment using the frequency 5.925 GHz – 6.425 GHz and for the opportunity to provide feedback on this important topic.

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 responses of IEEE 802 LMSC to this consultation.

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

#### ***IEEE 802.11***

The IEEE Std 802.11ax-2021 standard<sup>2</sup> 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<sup>3</sup>. 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)<sup>4,5</sup> for the entire 6 GHz band (i.e., 5.925 GHz to 7.125 GHz). Wi-Fi technology, based on the IEEE 802.11 standard, has an estimated 19.5 billion devices in use world-wide, with over 4

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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, the IEEE Standards Association.

<sup>2</sup> “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.

<sup>3</sup> Wi-Fi Alliance: Wi-Fi 6E momentum underscores need for entire 6 GHz band, November 2022. [Available online](#) [accessed: 21 April 2024].

<sup>4</sup> Dynamic frequency coalition: Automated frequency coordination - an established tool for modern spectrum management, March 2019. [Available online](#) [accessed: 10 April 2024].

<sup>5</sup> Intel: Spectrum sharing using automated frequency coordination. [Available online](#) [accessed: 21 April 2024].

billion devices added annually<sup>6</sup>. In addition, the list of Wi-Fi 6E certified products<sup>7</sup> (which are also based on IEEE 802.11 technologies) is growing. By the end of 2023, over 473 million Wi-Fi 6E devices entered the market<sup>8</sup>.

A new generation of IEEE 802.11 technologies, currently under development in the IEEE P802.11be amendment<sup>9</sup>, 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 units to a single station, multi-link operation, enhanced quality of service (QoS), improved Target Wake Time, and improved spectrum management by spectrum puncturing to accommodate coexistence with incumbents more effectively and efficiently. Please note that the P802.11be amendment currently supports carrier frequency operation between 1 GHz and 7.125 GHz with extension to 7.250 GHz under consideration.

### IEEE 802.15

Ultra-Wideband (UWB) technology, which is specified in IEEE 802.15 standards, is finding adoption for numerous short-range sensing and ranging applications. IEEE Std 802.15.4-2020<sup>10</sup> and IEEE Std 802.15.4z-2020<sup>11</sup> 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<sup>12</sup> is being developed (as the next generation of UWB technology) based on industry needs to fuel the next round of innovative products. The project is built on IEEE Std 802.15.4z-2020 which is 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, 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 power, 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.

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<sup>6</sup> Wi-Fi Alliance: Value of Wi-Fi. [Available online](#) [accessed: 21 April 2024].

<sup>7</sup> Wi-Fi Alliance: Wi-Fi 6E certified products. [Available online](#) [accessed: 21 April 2024].

<sup>8</sup> Wi-Fi Alliance: Wi-Fi 6E insights. [Available online](#) [accessed: 21 April 2024].

<sup>9</sup> "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/D5.0, November 2023, vol., no., pp.1-1045, 3 Jan. 2024.

<sup>10</sup> "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/IEEEESTD.2020.9144691.

<sup>11</sup> "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/IEEEESTD.2020.9179124.

<sup>12</sup> IEEE P802.15.4ab. [Available online](#) [accessed: 21 April 2024].

## ***It is the right time to update the technical requirements to operate in 5.925 GHz to 6.425 GHz frequency band in Thailand***

As recognized in this proceeding, NBTC have already allocated 5.925 GHz to 6.425 GHz for license-exempt operation, which will create economies of scale and produce a robust equipment market, benefitting Thailand's businesses, consumers, and the economies as well as increasing the societal benefits in Thailand. IEEE 802 LMSC commends NBTC's leadership and effort.

In addition, IEEE 802 LMSC kindly requests NBTC to actively pursue enablement of other modes of operation in the 5.925 GHz to 6.425 GHz band, including Standard Power (SP) mode under supervision of an AFC system in the complying devices that are supported by IEEE 802.11 standard. AFC can be considered as the state-of-the-art mitigation technique to protect incumbent services for outdoor and indoor operation at standard power level. SP mode enables Wi-Fi operation at higher power than VLP mode outdoor and higher power than LPI mode indoor to optimally utilize the 6 GHz spectrum. IEEE 802 LMSC believes that an AFC System, as an effective automated spectrum 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 maximum EIRP of 36 dBm for access points and 30 dBm for client devices for indoor and outdoor operation enables many key applications including next-generation mixed reality experiences like metaverse<sup>13</sup>, multigigabit per second outdoor coverage (e.g., parks, stadiums), multi-gigabit point-to-multipoint connectivity, low-latency applications like industrial IoT, and Voice over IP (Wi-Fi calling). SP operation also improves indoor Wi-Fi performance to match coverage performance of the 5 GHz band. The USA and Canada have already authorized SP mode and started certification of AFC systems. The certification process for AFC system and device is based on the industry developed recommended compliance specification<sup>14,15,16</sup>. On 23 February 2024, Federal Communications Commission (FCC) announced<sup>17</sup> approval of seven AFC systems for commercial operation. A number of AFC devices and Fixed Client devices are already certified too. Many other countries including Brazil, Saudi Arabia, South Korea, and Japan are studying enablement of SP mode.

As it is stated in previous communications with NBTC, IEEE 802 LMSC supports allocation of upper 6 GHz (i.e., 6.425 GHz – 7.125 GHz) band for unlicensed operation and we look forward to NBTC's leadership and effort in achieving this objective.

### **Conclusion**

IEEE 802 LMSC thanks NBTC for the opportunity to provide this submission. We support the proposed change on technical requirements and kindly request NBTC to consider our responses in its future decisions regarding the authorization of Standard Power mode at a maximum EIRP of 36 dBm for access points and 30 dBm for client devices for indoor and outdoor operation under an AFC supervision.

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<sup>13</sup> NBTC press release on metaverse. [Available online](#) [accessed: 21 April 2024].

<sup>14</sup> Wi-Fi Alliance: AFC Specification and Test Plans. [Available online](#) [accessed: 21 April 2024].

<sup>15</sup> Wireless Innovation Forum: Specifications. [Available online](#) [accessed: 21 April 2024].

<sup>16</sup> Wi-Fi Alliance: 6 GHz AFC resources. [Available online](#) [accessed: 21 April 2024].

<sup>17</sup> Federal Communications Commission: OET announces approval of seven 6 GHz band automated frequency coordination systems for commercial operation and seeks comment on C3 Spectra's proposed AFC system. [Available online](#) [accessed: 21 April 2024].

Respectfully submitted

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