Electronic filing 14 October 2025

Dear respected officers,

IEEE 802 LAN/MAN Standards Committee (LMSC) thanks the Ministry of Internal Affairs and Communications (MIC) for issuing the consultation on its draft frequency reorganization action plan (2025 Edition) and for the opportunity to provide feedback.

IEEE 802 LMSC is a leading consensus-based open standards development committee for networking standards that are used by industry globally. It produces standards for networking devices, including wired and wireless local area networks ("LANs" and "WLANs"), wireless specialty networks ("WSNs"), wireless metropolitan area networks ("Wireless MANs"), and wireless regional area networks ("WRANs"). Technologies produced by implementers of our standards are a critical element for all networked applications today.

IEEE 802 LMSC is a committee of the IEEE Standards Association and of Technical Activities, two of the Major Organizational Units of the IEEE. IEEE has over 460,000 members in more than 190 countries and its core purpose is to foster technological innovation and excellence for the benefit of humanity. IEEE is also a major accredited standards development organization whose standards are recognized worldwide. In submitting this document, IEEE 802 LMSC acknowledges that other components of IEEE Organizational Units may have perspectives that differ from, or compete with, those of IEEE 802 LMSC[1].

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

Wi-Fi access to the 6425 MHz to 7125 MHz is needed to support the Gigabit connectivity

In our response to the frequency reorganization action plan (2024 Edition) issued last year, we emphasized that authorizing the entire upper 6 GHz band (i.e., 6425 MHz to 7125 MHz) for Wi-Fi is essential to support the Gigabit connectivity. Availability of the entire 6 GHz band for license-exempt use will unleash emerging latency-sensitive, high-throughput applications such as real-time XR in healthcare, education, and gaming, as well as robotics, industrial automation, and sensory systems

In January 2024, Wi-Fi Alliance introduced[2] Wi-Fi CERTIFIED 7™ based on IEEE Std 802.11be-2024 technology[3]. With Wi-Fi 7 products already in the market, Wi-Fi deployments are going through a second-generation upgrade in the entire 6 GHz band globally[4]. The global 6 GHz channelization plan in IEEE Std 802.11be-2024 standard is designed to accommodate multiple 160 MHz and 320 MHz channels throughout the 5925 MHz to 7125 MHz band, if available. MIC's current designation of 500 MHz of the 6 GHz band from 5925 MHz to 6425 MHz for license-exempt operation provides for only one 320 MHz channel, while the entire 5925 MHz to 7125 MHz band would allow three such channels to support the Gigabit connectivity in Japan.

With only the lower 500 MHz available for Wi-Fi, there will not be sufficient number of 80 MHz channels in the 6 GHz band to enable deployments of dense networks that will require at least 7 to 9 nonoverlapping channels. As a result, many dense Wi-Fi network deployments utilizing the 6 GHz band will still be limited to 40 MHz channels. Without larger channel sizes, gigabit speeds in Wi-Fi connections cannot be achieved in Japan.

[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.
[2] See Wi-Fi Alliance: Wi-Fi Alliance® introduces Wi-Fi CERTIFIED 7™, https://www.wi-fi.org/wi-fi-certified-7-resources [accessed: 3 October 2025].
[3] See "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 2: Enhancements for Extremely High Throughput (EHT)," in *IEEE Std 802.11be-2024 (Amendment to IEEE Std 802.11-2024, as amended by 802.11bh-2024)* , vol., no., pp.1-1020, 22 July 2025, doi: 10.1109/IEEESTD.2024.11090080. (With introduction of 320 MHz channel bandwidth, Wi-Fi 7 doubles throughputs relative to Wi-Fi 6E and significantly improves latency for Extended Reality (XR), bringing determinism through enablement of Multi-Link Operation (MLO) over multiple bands in 2.4 GHz, 5 GHz, and 6 GHz bands. Wi-Fi 7 also provides higher efficiency, relative to Wi-Fi 6E, through offering of 4096 QAM. In addition, spectrum puncturing improves flexibility in utilizing spectrally efficient wide channel bandwidth, e.g., 160 MHz and 320 MHz, while protecting incumbent operation in the band.)
[4] 7 See Wi-Fi Alliance: Wi-Fi 7 market momentum: Wi-Fi 7 is here – is your network ready?, https://www.wi-fi.org/beacon/chris-hinsz/wi-fi-7-market-momentum-wi-fi-7-is-here-is-your-network-ready [accessed: 3 October 2025].

Figure 1 illustrates a 7-channel plan which minimizes co-channel interference between APs. With only 500 MHz spectrum available in the 5 GHz and 6 GHz bands, there will be less than seven 80 MHz channels, which would limit the use of wider channels. Wider channels equate to higher throughput and lower latency.

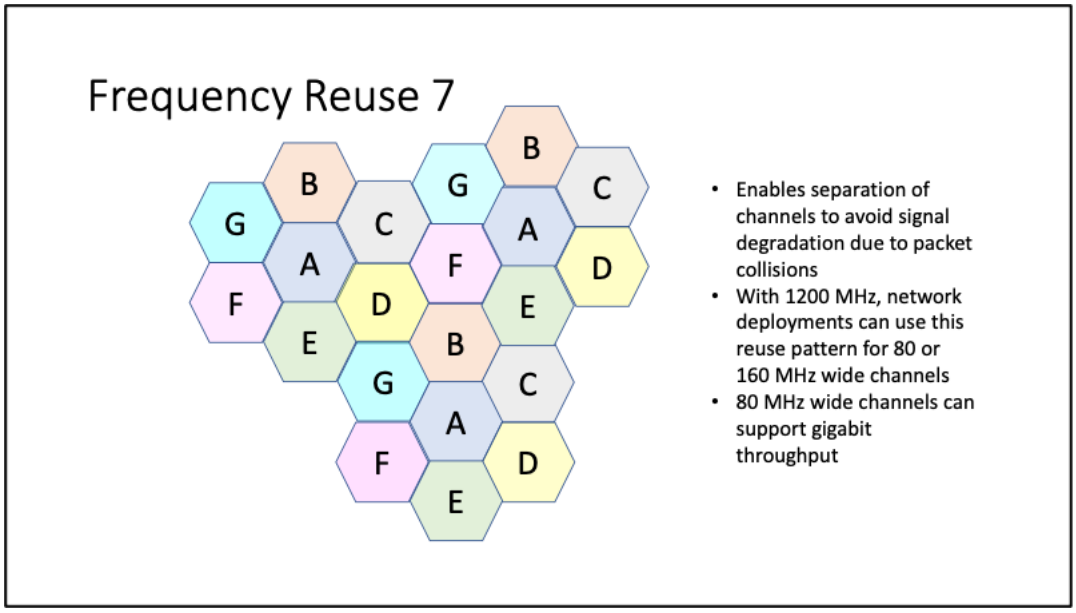

Figure 1: Frequency Reuse 7 Channel Plan

If RLAN were given access to the 6425 MHz to 7125 MHz band however, it would allow 80 MHz channels but would provide seven 160 MHz channels supporting the high throughput requirements of high-density networks such as those in universities, hospitals, schools and shopping centres. In addition, 1200 MHz is needed to support novel applications which would benefit from three 320 MHz channels. Scaled deployment of technologies such as augmented, virtual and mixed reality require multiple of wide channels to maintain required performance (lower latency and high throughput) on multiple simultaneous sessions. Please refer to a medical school training use case demonstration by Wi-Fi Alliance[5][6]. Similarly, local processing of artificial intelligence workloads will require higher throughput to support the large datasets.

Moreover, with access to additional 320 MHz channels, Wi-Fi devices can build upon IEEE Std 802.11az-2022[7] to offer sub-1 meter positioning accuracy, which results in enabling new innovative use cases such as micro-targeting for retail and warehouse asset tracking.

Enabling higher-power RLAN (Standard Power (SP) Wi-Fi) operation using Automated Frequency Co-ordination (AFC)

IEEE 802 LMSC commends MIC's plan to consider authorizing SP mode under the supervision of an AFC system in the 6 GHz band. SP mode enables Wi-Fi operation at higher power levels than the low power indoor (LPI) mode, to optimally utilize the 6 GHz spectrum. AFC technology is used to protect incumbent services during SP outdoor and indoor Wi-Fi operation.

[5] See Wi-Fi Alliance: Wi-Fi Alliance® demonstrates the impact of 6 GHz Wi-Fi® for advanced AR/VR in healthcare, https://www.wi-fi.org/beacon/the-beacon/wi-fi-alliance-demonstrates-the-impact-of-6-ghz-wi-fi-for-advanced-arvr-in [accessed: 3 October 2025].
[6] See Intel: Spectrum Needs of Wi-Fi 7, https://www.intel.com/content/dam/www/central-libraries/us/en/documents/spectrum-needs-wi-fi-7-whitepaper.pdf [accessed 3 October 2025].
[7] "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 4: Enhancements for Positioning," in *IEEE Std 802.11az-2022 (Amendment to IEEE Std 802.11-2020 as amended by IEEE Std 802.11ax-2021, IEEE Std 802.11ay-2021, IEEE Std 802.11ba-2021, and IEEE Std 802.11-2020/Cor 1-2022)* , vol., no., pp.1-248, 3 March 2023, doi: 10.1109/IEEESTD.2023.10058117.

Existing AFC systems are designed with the flexibility that enables an AFC system to be customized based on local spectrum regulatory requirements. Therefore, with proper consideration of protection criteria for the existing incumbent services, we believe that AFC systems can properly implement the frequency coordination and maximize allowable power settings in AFC-enabled devices in Japan. In the USA, AFC systems determine frequency and channel availability and maximum permissible power levels for AFC devices considering incumbent fixed services and radio astronomy services. AFC systems already consider neighbouring country incumbent services at the country border. AFC systems are designed to automatically calculate the available frequencies and corresponding permissible transmit power levels for the AFC devices. AFC systems are required to use the updated incumbent system database to keep calculations and frequency availability up-to-date as 6 GHz incumbent links are changed. This means that incumbent services are protected from harmful interference by AFC systems, and that any expansion of such incumbent services over time can be achieved without a need to redesign the AFC systems.

Additionally, AFC systems have been certified not only by the Federal Communications Commission in the USA, but also by the Innovation, Science and Economic Development Canada, indicating a significant maturing of AFC system design as well as industry-wide general acceptance of the AFC system operational model. Of note is that the certification process for AFC systems and devices is based on the industry developed recommended compliance specifications[8,9]. Therefore, IEEE 802 LMSC strongly recommends MIC to consider conducting AFC trials at the earliest possible time,. Further, we would also note that adoption of SP Wi-Fi operation using AFC has low barriers to entry because of maturing of AFC systems

IEEE 802.11ah-based Wi-Fi HaLow and IEEE 802.15.4-based Wi-SUN for IoT

In addition to the IEEE 802.11-based Wi-Fi technologies operating in 2.4 GHz, 5 GHz, and 6 GHz frequency bands, other IEEE 802 standards-based technologies in the sub-1 GHz bands, specifically IEEE 802.11ah-based Wi-Fi HaLow and IEEE 802.15.4-based Wi-SUN (Smart Utility Network), should be considered as short-range technologies for various IoT applications.

IEEE Std 802.11ah-2016[10], known as Wi-Fi HaLow in the marketplace[11] and now incorporated into the IEEE Std 802.11-2024 standard,[12] specifies mechanisms for the operation of Wi-Fi in the license exempt sub-1 GHz bands. IEEE 802.11ah was developed for long range, low power sensor and IoT networks and applications, which support many use cases of relevance to Japan. It excels in the long range coverage of over 1 km (subject to the maximum allowed transmit power)[13] and has excellent capability to penetrate through walls and obstacles. The standard supports a wide range of data rates that allow support for sensors and new applications that may combine video applications with sensing operation. It also introduces many features to increase energy efficiency and optimize device power consumption.

In our earlier response to the MIC consultation issued in October 2023, IEEE 802 LMSC supported MIC's initiative to promote rapid technical development and commercialization of IEEE Std 802.11ah-based Wi-Fi HaLow devices through its proposed experimental trial in the license exempt 800 MHz band (i.e., 853 MHz to 860 MHz). It was IEEE 802 LMSC's opinion that the license exempt model is a very effective way to deploy new IoT applications and allow them to scale. Experience gathered from such deployment and operation will be very valuable to MIC and we respectfully suggest that MIC considers including IEEE 802.11ah-based Wi-Fi HaLow as an additional

[8] See Wi-Fi Alliance: 6 GHz AFC resources, Specifications, test plans, and training modules to enable implementation of the 6 GHz standard power devices under AFC system control, https://www.wi-fi.org/discover-wi-fi/6-ghz-afc-resources [accessed: 3 October 2025].
[9] See Wireless Innovation Forum: Specifications, https://6ghz.wirelessinnovation.org/baseline-standards [accessed: 3 October 2025].
[10] 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 2: Sub 1 GHz License Exempt Operation, IEEE Std 802.11ah-2016 (Amendment to IEEE Std 802.11-2016, as amended by IEEE Std 802.11ai-2016), vol., no., pp.1-594, 5 May 2017, doi: 10.1109/IEEESTD.2017.7920364.
[11] Wi-Fi Alliance: Wi-Fi CERTIFIED HaLow, https://www.wi-fi.org/discover-wi-fi/wi-fi-certified-halow [accessed: 3 October 2025].
[12] 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, in *IEEE Std 802.11-2024 (Revision of IEEE Std 802.11-2020)*, vol., no., pp.1-5956, 28 April 2025, doi: 10.1109/IEEESTD.2025.10979691.
[13] See Morse Micro: Pushing the limits: Wi-Fi HaLow Testing in Joshua Tree National Park, https://www.morsemicro.com/2024/09/09/pushing-the-limits-wi-fi-halow-testing-in-joshua-tree-national-park/ [accessed: 3 October 2025].

radio-based technology that provides low-power and short-range communications in its frequency reorganization action plan.

IEEE Std 802.15.4-based Wi-SUN[14] specifies physical layer radio and medium access control mechanisms for operation in sub-1 GHz license exempt frequency bands from 169 MHz to 928 MHz. The technology was initially developed for SUN and other large scale IoT networks[15], such as smart city networks. Devices using IEEE Std 802.15.4-2020 SUN are extensively deployed as Wi-SUN home area network (HAN) and Wi-SUN field area network (FAN) in a range of applications not only for smart utilities and smart cities[16] but also for smart agriculture and healthcare[17]. These technologies are widely used worldwide in applications that include door entry systems, environmental sensors, fire and security alarms, smart meters, smart-parking devices, smart signs, streetlights, and structural integrity sensors. To name a few examples, an estimated 120+ million smart electric meters[18] deployed across the North America, and approximately 1 million smart meters already deployed by Dubai Energy and Water Authority[19]. In addition, the development of IEEE Std 802.15.4-based Wi-SUN aligns with one of the important MIC's initiatives on next generation smart meter systems. In this regard, we strongly believe that IEEE Std 802.15.4-based Wi-SUN should be included as another radio-based technology that provides efficient communications for various smart meters/sensors applications that are of particular relevance to Japan.

Cybersecurity

Classic public key cryptography is vulnerable to compromise from a quantum computer adversary. There is a strong market need to define post-quantum protocols that support algorithms that are resistant to attacks by quantum computer (a.k.a. quantum-resistant) in the standard to address this anticipated vulnerability. As an example, the National Institute of Science and Technology in the United States of America will disallow use of key establishment and digital signatures based on classic cryptography for us in the United States government systems after 2035. The European Commission encourages member States to develop comprehensive national strategies for post-quantum cryptography adoption. So, in September 2025, the IEEE 802.11 Working Group has begun work on IEEE P802.11bt dedicated to extending IEEE 802.11 security to support algorithms for post-quantum cryptography (PQC).

Conclusion

IEEE 802 LMSC thanks MIC for the opportunity to provide a submission to the consultation, and kindly requests consideration of our response.

Respectfully submitted,

By: /ss/.
James Gilb
IEEE 802 LAN/MAN Standards Committee Chairman
em: gilb_ieee@tuta.com

[14] "IEEE Standard for Low-Rate Wireless Networks," 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.

[15] See Wi-SUN Alliance: Wi-SUN Alliance marks a year of strong growth in membership and 91 million devices awarded globally, https://wi-sun.org/news/wi-sun-alliance-marks-a-year-of-strong-growth-in-membership-and-91-million-devices-awarded-globally-2/ [accessed: 3 October 2025]. Wi-SUN Alliance has also seen its influence grow, with more than 91 million Wi-SUN capable devices (Navigant Research) awarded globally as service providers and city developers deploy new IoT applications and services for smart cities and utilities.

[16] National Institute of Information and Communications Technology: World's First Application of Wi-SUN Radio Sensor Network to Fishery Industry, MOZUKU Seaweed Aquaculture, 25 December 2015, https://www.nict.go.jp/en/press/2015/12/25-1.html [accessed: 3 October 2025].

[17] Japan Science: Successful multi-stage relay demonstration experiment performed at Kyoto University medical institution, 26 July 2021, https://sj.jst.go.jp/news/202107/n0726-03k.html [accessed: 3 October 2025].

[18] Information derived from Guidehouse Global AMI Tracker 4Q23 research data.

[19] Wi-SUN Alliance: DEWA Develops Integrated Smart Energy Grid Using Wi-SUN Technology, https://wi-sun.org/blog/dubai-smart-energy-grid/ [accessed: 26 September 2025].