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Re: Consultation "Proposed allocation of 6 GHz band in Singapore"

Dear Singapore IMDA,

IEEE 802 LAN/MAN Standards Committee (LMSC) thanks Singapore Infocomm Media Development Authority (IMDA) for issuing the consultation "Proposed allocation of 6 GHz band in Singapore" and for the opportunity to provide feedback on this 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[1].

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

IEEE 802.11-based devices operating in the 6 GHz band

The IEEE Std 802.11ax-2021 [1] standard supports operation in the 2.4 GHz, 5 GHz, 6 GHz (i.e., 5925 MHz to 7125 MHz) bands, and products based on this standard are seeing significant adoption where regulatory rules permit deployment [2]. IEEE 802 technologies are designed to not cause interference with incumbent services in these bands. The Wi-Fi industry is taking the lead in specifying a number of coexistence strategies for bands with incumbent users, such as automated frequency coordination (AFC) [3] [8].

A new generation of IEEE 802.11 technologies, currently under development in the IEEE P802.11be amendment, will continue to improve performance and enhance spectrum coexistence capacities. In order to achieve these target performance measures, IEEE P802.11be introduces advanced features including channel bandwidths of up to 320 MHz, 4K-quadrature amplitude modulation (QAM), multiple resource units (RUs) to a single station (STA), multi-link operation, enhanced quality of service (QoS), improved Target Wake Time (for improved battery life for IoT or other applications), and improved punctured transmission/subchannels to accommodate coexistence with incumbents more effectively and efficiently.

[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.

IEEE P802.11be is designed to meet the target application performance requirements and at the same time to scale to meet the requirements of enterprise, commercial and dense deployments when multiple simultaneous sessions of similar or different applications on multiple Wi-Fi networks are coexisting with incumbent service operation. To effectively support this scaling requirement, IEEE P802.11be's global 6 GHz channelization is designed to accommodate multiple 160 MHz and 320 MHz channels throughout the entire 6 GHz band, if available. IMDA's proposed designation of 500 MHz of the 6 GHz band for RLAN use provides for only one 320 MHz channel, while the full 5925 MHz to 7125 MHz band would allow three such channels.

IEEE 802 LMSC commends IMDA's effort and suggests further action

Expanded availability of spectrum for license-exempt use is critical to supporting ever-increasing demands for wireless connectivity traffic as well as enterprise and commercial level scaling of performance-demanding innovative applications (such as VR/AR) in Singapore. IEEE 802 LMSC commends IMDA's efforts in opening the 6 GHz band for RLAN use and we recommend license-exempt operation in this band.

Significant economic value is provided by IEEE 802-based systems today. 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 [4]. In addition, the list of Wi-Fi 6E certified products (which are based on IEEE 802.11 technologies) is already growing. In 2022, over 350 million Wi-Fi 6E devices entered the market [5]. As mentioned, the deployment of new applications targeted by the IEEE 802.11ax-2021 standard and the upcoming IEEE 802.11be standard can be effectively scaled when multiple 320 MHz channels (as defined in IEEE P802.11be) are enabled. Extension to the upper portion of the 6 GHz band would greatly facilitate scaling of services for enterprise and dense deployments. 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 [13] and IEEE Std 802.15.4z-2020 [14] 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.

Many countries and regions including the USA, Canada, Brazil, South Korea, and Saudi Arabia have already allocated the entire 6 GHz band of license-exempt operation. Availability of the entire 6 GHz band for license-except use will create economies of scale and produce a robust equipment market, benefitting Singapore's businesses, consumers, and the economies as well as increasing the societal benefits in Singapore [6]. IEEE 802 LMSC recommends that IMDA authorize license-exempt operation to the entire 6 GHz band.

Regarding authorized modes of operation in the 6 GHz band, IEEE 802 LMSC supports authorization of the VLP (very low power) and LPI (low power indoor) modes but kindly requests IMDA to consider the following three changes to the proposed technical requirements, which are adopted by national regulatory authorities in other countries [9]. The summary of the proposed changes in technical requirements is also shown in Table 1.

1. 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.
2. 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 US FCC requirements [9] to enable license-exempt operation at large channel bandwidth of 160 MHz and 320 MHz in the downlink.
3. Authorize client to client operation under LPI mode, which is aligned with the ECC decision for the 6 GHz band [10].

Table 1: Suggested changes to IMDA's proposed technical requirements for RLAN use in the lower 500 MHz. Changes are underlined and bold.

Use case	RF power requirements	Remarks
Very Low Power (VLP)	Max EIRP: • 14 dBm (25 mW) for channel bandwidth of 160 MHz • **17 dBm for channel bandwidth of 320 MHz or higher.** Max EIRP density: 1dBm/MHz or 10 dBm/MHz for narrowband usage	For use indoor and outdoor Use on unmanned aircraft systems/drones is prohibited
Low Power Indoor (LPI)	Max EIRP: **30 dBm (1W)** Max EIRP density: 11 dBm/MHz	For use indoor only **An LPI client device is a device that is connected to an LPI access point or another LPI client device**

In addition to VLP and LPI modes, IEEE 802 LMSC recommends IMDA consider authorizing Standard Power (SP) mode under supervision of an AFC system [8]. 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 [11] [12] for consideration by the US FCC for its AFC system and device certification program.

Conclusion

IEEE 802 LMSC thanks the Singapore IMDA for the opportunity to provide this submission and kindly requests Singapore IMDA to take into account our responses in its decision towards the proposed allocation of 6 GHz band for RLAN use.

Respectfully submitted

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References:

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[6] UK Ofcom: Update on the upper 6 GHz band.

[7] CEPT: Section 6.2.6, ECC Report 302 - Sharing and compatibility studies related to Wireless Access Systems including Radio Local Area Networks (WAS/RLAN) in the frequency band 5925-6425 MHz, May 2019.

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[9] FCC: 15.407 General technical requirements.

[10] 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

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