IEEE P802.18  
Radio Regulatory Technical Advisory Group (RR-TAG)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Proposed response to Singapore IMDA's consultation | | | | |
| Date: 2023-02-23 | | | | |
| Author(s): | | | | |
| Name | Company | Address | Phone | email |
| Hassan Yaghoobi | Intel |  |  | hassan.yaghoobi@intel.com |
| Amelia Andersdotter | Sky Group/Comcast |  |  |  |
| Edward Au | Huawei |  |  | edward.ks.au@gmail.com |

This document drafts a proposed response to Singapore IMDA’s consultation “Proposed allocation of 6 GHz band in Singapore”.

**Notice:** This document has been prepared to assist IEEE 802.18. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.

Electronic filing March 14, 2023

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]](#footnote-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 not only in the 2.4 GHz, 5 GHz, but also 5925 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 co-existence 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 co-existence 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.

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. It is important to note that availability of multiple 320 MHz bands is only possible when the entire 6 GHz band (i.e., 5925 MHz to 7125 MHz) is made available for license-exempt technologies.

***IEEE 802 LMSC commends IMDA’s effort and suggests further action***

Expanded availability of the 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. While IEEE 802 LMSC commends IMDA’s efforts in opening the 6 GHz band for RLAN use, we recommend IMDA to authorize 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 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 licensed-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 authorizes 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 I.

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 at downlink.
3. Authorize client to client operation under LPI mode, which is aligned with ECC decision for 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 AFC [8]. Authorizing SP mode at 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. 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 developed by industry stakeholders [11] [12] for consideration by 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

By: /ss/.

Paul Nikolich

IEEE 802 LAN/MAN Standards Committee Chairman

em: [p.nikolich@ieee.org](mailto:p.nikolich@ieee.org)

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](https://www.wi-fi.org/news-events/newsroom/wi-fi-6e-momentum-underscores-need-for-entire-6-ghz-band) [accessed: 20 February 2023].

[3] Dynamic frequency coalition: Automated frequency coordination - an established tool for modern spectrum management, March 2019. [Available online](https://dynamicspectrumalliance.org/wp-content/uploads/2019/03/DSA_DB-Report_Final_03122019.pdf) [accessed: 20 February 2023].

[4] Wi-Fi Alliance: Value of Wi-Fi. [Available online](https://www.wi-fi.org/discover-wi-fi/value-of-wi-fi) [accessed: 20 February 2023]

[5] Wi-Fi Alliance: Wi-Fi 6E certified products. [Available online](https://www.wi-fi.org/product-finder-results?keywords=wi-fi+6E&op=Search&form_build_id=form-5F5bhfMUfZOoa0Xo4k9oQD8nsj0GQLww76EPepJC5QQ&form_id=wifi_cert_api_simple_search_form) [accessed: 20 February 2023]

[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.

[8] Intel: Spectrum sharing using automated frequency coordination. [Available online](https://www.intel.com/content/www/us/en/wireless-network/spectrum-using-automated-frequency-coordination.html#:~:text=Introducing%204th%20Gen%20Intel%C2%AE%20Xeon%C2%AE%20Scalable%20Processors%20Spectrum,and%20compliance%20considerations%20in%20the%206%20GHz%20band.) [accessed: 20 February 2023]

[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

[11] Wi-Fi Alliance: AFC Specification and Test Plans. [Available online](https://www.wi-fi.org/file/afc-specification-and-test-plans) [accessed: 20 February 2023]

[12] Wireless Innovation Forum: Specifications. [Available online](https://6ghz.wirelessinnovation.org/baseline-standards) [accessed: 20 February 2023]

[13] “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.

[14] “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.

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. [↑](#footnote-ref-1)