



**PUBLIC CONSULTATION ISSUED BY THE
INFO-COMMUNICATIONS MEDIA DEVELOPMENT AUTHORITY**

ON

PROPOSED ALLOCATION OF 6 GHZ BAND IN SINGAPORE

14 FEBRUARY 2023

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PART I: INCREASING DEMAND FOR SPECTRUM FOR WI-FI IN SINGAPORE

1. Wi-Fi is widely used in homes and offices in Singapore today, as Internet connectivity becomes ever more critical in today's fast-moving digital world. To meet this rising demand and to alleviate increasing contention for Wi-Fi connectivity, there is a need for more spectrum to be allocated for Wi-Fi. The additional spectrum will provide increased Wi-Fi capacity to meet Wi-Fi needs in and beyond the near-term.

Demand for Wi-Fi is Expected to Increase

2. Wi-Fi usage has increased across various sectors and user groups, including enterprises and consumers. The consumption of data also continues to rise. Such trends are expected to continue.
3. The anticipated rise in Wi-Fi traffic in Singapore is consistent with findings from international studies, which observed Wi-Fi traffic growth rates of 30% – 40% per annum in countries such as the USA and within Europe¹. The increasing demand for Wi-Fi connectivity within homes and offices is driven by the increasing number of digitally connected user devices and more sophisticated online applications, as well as the movement of business and leisure activities online over the years (e.g., work-from-home arrangements, home-based learning, e-commerce, etc.).
4. This increasing demand has led to more contention for the current limited number of Wi-Fi channels, especially in dense indoor settings, which may result in slower user experience. There is also a need for Wi-Fi to be future-ready for bandwidth-intensive use cases, which will require high throughput and low latency (e.g., Augmented Reality/Virtual Reality and Metaverse applications).

Supply of More Spectrum for Wi-Fi for Seamless User Experience

5. Globally, the 6 GHz band (5,925 MHz – 7,125 MHz, or parts thereof) has recently been identified for the deployment of Radio Local Area Networks (“**RLAN**”), which is predominantly used for Wi-Fi, i.e., **Wi-Fi 6E**. The contiguous spectrum in the 6 GHz band will enable more and wider Wi-Fi channels (such as 160-MHz channels) for use, instead of the current 20-MHz to 80-MHz channels. This allows for faster theoretical maximum speeds of up to 9.6 Gbps and lower latencies, which will help to ease the increasing contention and facilitate the next wave of use-cases.
6. With the multitude of different connectivity options in Singapore, user experience will continue to be key. It is thus important to ensure a seamless experience for users as they transition between different connectivity mediums. For example:

¹ These include: (i) a study conducted by Adaptive Spectrum and Signal Alignment (ASSIA) between 2020 and 2021, published in ‘State of Wi-Fi Reporting’, DSA 2021 Global Summit, 8 June 2021; and (ii) a study commissioned by the Wi-Fi Alliance, which forecasted that various regions (including USA, China, Europe and Japan) will need between 500 MHz and 1 GHz of additional Wi-Fi spectrum by 2025 to satisfy the busy hour traffic scenario, published by Quotient Associates in the ‘Wi-Fi Spectrum Needs Study’, Final Report to the Wi-Fi Alliance, February 2017.

- a. Wi-Fi will need to keep in tandem with Singapore’s nationwide broadband network (“**NBN**”) developments. This is because Wi-Fi is typically the key medium that takes over from fibre broadband connectivity to provide in-unit / in-building wireless connectivity for end user devices in homes and offices. In this regard, Wi-Fi 6E’s (i.e., Wi-Fi on 6 GHz band) theoretical maximum speeds of up to 9.6 Gbps would make it on par with the potential 10 Gbps speeds offered by the next-generation technology upgrade for NBN, i.e., 10 Gbps passive optical network (“**10G-PON**”) technology. Without Wi-Fi 6E, end-users will not be able to get the full experience and benefit that 10G-PON would bring; and
- b. Wi-Fi will also need to keep pace with 5G’s potential peak speeds of up to 20 Gbps, to allow for seamless end-to-end connection and experience for users as they move across mobile broadband and Wi-Fi mediums. This is especially so given that Wi-Fi is expected to remain the preferred mode of connection in fixed indoor settings such as homes and offices, complementing mobile services used by users when on the move.

PART II: INTERNATIONAL DEVELOPMENTS

7. Globally, the 6 GHz band is viewed to comprise two main portions: (i) lower 500 MHz (5,925 MHz – 6,425 MHz); and (ii) upper 700 MHz (6,425 MHz – 7,125 MHz).
8. IMDA notes there is large global consensus to allocate the lower 500 MHz of the 6 GHz band for RLAN / Wi-Fi use.

PART III: PROPOSED ALLOCATION OF 6 GHZ BAND IN SINGAPORE

9. Given the above considerations, IMDA **proposes to allocate the lower 500 MHz of the 6 GHz band, i.e., 5,925 MHz – 6,425 MHz, for RLAN / Wi-Fi use**, for a start.
10. IMDA is of the view that a decision to allocate this initial tranche of the lower 500 MHz of the 6 GHz band to RLAN / Wi-Fi now, is timely. IMDA’s considerations are as follows:
 - a. There is immediate domestic demand for Wi-Fi to meet the growing Wi-Fi traffic and more spectrum is needed to meet increasing demand for Wi-Fi;
 - b. The global equipment ecosystem for Wi-Fi 6E is readily available and mature, allowing domestic industry adoption to take place quickly. More than 1,200 Wi-Fi 6E-capable devices have launched commercially in the global market as at Q4 2022². This is a significant increase from about 100 devices in 2021 and the number of devices is expected to continue to grow; and
 - c. Standards-wise, the Institute of Electrical and Electronics Engineers (“**IEEE**”) standards for Wi-Fi 6E have been adopted since 2020. The upcoming Wi-Fi 7

² Wi-Fi NOW, Intel says Wi-Fi 6E device count surpasses 1200 & fresh rumours about Apple iPhone 15 Wi-Fi 6E support, <https://wifinowglobal.com/news-and-blog/intel-says-wi-fi-6e-device-count-passes-1200-more-apple-iphone-15-wi-fi-6e-rumours/>

standards, which will also allow use of equipment in the 6 GHz band, are being developed, with adoption estimated to take place in 2024³.

PART IV: INVITATION TO COMMENT

11. IMDA would like to seek views and comments on the proposed initial allocation of the lower 500 MHz of the 6 GHz band (i.e., 5,925 MHz – 6,425 MHz) for RLAN / Wi-Fi use.
12. A summary of the technical considerations and proposed technical requirements for allowing RLAN / Wi-Fi use in the lower 500 MHz of the 6 GHz band can be found in the appended Annex A. IMDA also invites views and comments on the proposed technical requirements.
13. Respondents who submit their views or comments regarding the issues identified in this consultation document may organise their submission as follows: (a) cover page (including their personal/company particulars and contact information); (b) summary of major points; (c) statement of interest; (d) comments; and (e) conclusion. Supporting materials may be placed as an annex to the comments raised. All respondents are requested to keep their comments clear and succinct.
14. All views and comments should be submitted in soft copies (in both Microsoft Word and Adobe PDF format) and should reach IMDA by **12 noon, 14 March 2023**. All views and comments should be addressed to:

Ms Aileen Chia
Director-General (Telecoms and Post)
Deputy CE (Connectivity Development & Regulation)
Infocomm Media Development Authority
10 Pasir Panjang Road
#03-01 Mapletree Business City
Singapore 117438

AND

Please submit your soft copies, with the email header “Consultation on Proposed Allocation of 6 GHz Band”, via email to Consultation@imda.gov.sg.

15. IMDA reserves the right to make public all or parts of any written submission and to disclose the identity of the source. Respondents may request confidential treatment for any part of the submission that the respondent believes to be proprietary, confidential or commercially sensitive, with supporting justification for IMDA’s consideration. In such cases, the submission must be provided in a non-confidential form suitable for publication, with any confidential information redacted as necessary and placed instead in a separate annex.

³ IEEE 802.11ax sets standards for Wi-Fi 6 operation in the 2.4 GHz and 5 GHz bands, whereas Wi-Fi 6E specifies operation in the 6 GHz band. IEEE 802.11be is the next potential amendment for Wi-Fi 7, specifying operation in the 2.4 GHz, 5 GHz and 6 GHz bands.

16. If IMDA grants confidential treatment, it will consider, but will not publicly disclose the information. If IMDA rejects the request for confidential treatment, it will return the information to the respondent and will not consider the information as part of its review. As far as possible, respondents should limit any request for confidential treatment of information submitted. IMDA will not accept any submission that requests confidential treatment for all, or a substantial part, of the submission.

Proposed Technical Requirements for Allowing RLAN Use on a Licence-exempt Basis in the Lower 6 GHz Band (5,925 MHz – 6,425 MHz)

1. To give assurance that there shall be no impact to incumbent services operating in the 6 GHz band, such as fixed and fixed satellite services, if it is allocated for RLAN use, IMDA references the studies by overseas jurisdictions such as the European Conference of Postal and Telecommunications Administrations and the UK Office of Communications which have demonstrated the feasibility of Wi-Fi co-existing with such incumbent services in the lower 500 MHz of the 6 GHz band (i.e., 5,925 MHz – 6,425 MHz) and adjacent bands, under certain technical conditions.
2. Currently, the 2.4 GHz and 5 GHz bands are the two most commonly used frequency bands in Singapore for RLAN, e.g., Wi-Fi, with maximum allowable output power between 100 mW EIRP and 1W EIRP. For the lower 6 GHz band, IMDA proposes to adopt the following technical requirements to be included in the IMDA Technical Specification for Short Range Devices (see [Table 1](#) below) for RLAN use⁴ in the 5,945 MHz – 6,425 MHz band, which are largely aligned with key economies that have similarly allocated 6 GHz spectrum for RLAN use, indicating widespread acceptance that these broad restrictions are sufficient to protect incumbent services and allow Singapore to gain access to the global ecosystem.

Table 1: IMDA’s proposed technical requirements for RLAN use in the lower 500 MHz

Use Case	RF Power Requirements	Remarks
Very Low Power (VLP)	Max EIRP: 14 dBm (25 mW)	For use indoor and outdoor
	Max EIRP density: 1dBm/MHz or 10dBm/MHz for narrowband usage	Use on unmanned aircraft systems/drones is prohibited
Low Power Indoor (LPI)	Max EIRP: 24 dBm (250mW)	For use indoor only
	Max EIRP density: 11 dBm/MHz	

3. According to the IEEE’s 802.11ax standard’s channel set for 6 GHz band, the first channel for the various operating classes to support channel spacing of 20, 40, 80 and 160 MHz typically starts from 5,945 MHz. In this regard, IMDA intends to designate 5,925 MHz – 5,945 MHz as the guard band with the possibility to allocate 5,925 MHz – 5,935 MHz for urban rail intelligent transport systems in future, taking reference from the Electronic Communications Committee (ECC)’s decision. Such arrangement would have minimal impact to the deployment of RLAN in the remaining 480 MHz, i.e., 5,945 MHz – 6,425 MHz, and would still enable up to 3 x 160 MHz channels for Wi-Fi 6E/7.

⁴ To give effect for licence-exempt RLAN use in the 5,945 MHz – 6,425 MHz band, the Telecommunications (Exemption from Sections 33, 34(1)(b) and 35) Notification will be amended.

4. For the use of standard power devices to facilitate fixed outdoor deployment at higher power, as such use is still nascent and yet to be widely adopted globally, IMDA will continue to monitor the development and review the demand and feasibility to allow such use in Singapore in the future.