



**DECISION ISSUED BY THE
INFO-COMMUNICATIONS MEDIA DEVELOPMENT AUTHORITY**

ON

PROPOSED ALLOCATION OF 6 GHZ BAND IN SINGAPORE

12 MAY 2023

BACKGROUND

1. On 14 February 2023, IMDA issued a public consultation on the proposed allocation of the lower 500 MHz of the 6 GHz band in Singapore.
2. IMDA assessed there was increasing demand for spectrum to meet Wi-Fi needs in Singapore, both in and beyond the near-term. This was in view of the following:
 - a. Wi-Fi, as a key medium for Internet connectivity, is widely used in homes and offices in Singapore today;
 - b. The demand for Wi-Fi is expected to continue increasing across various sectors and user groups, including enterprises and consumers. This is due to rising data consumption patterns, driven by an increasing number of digitally connected user devices and a growing ecosystem of online applications and activities; and
 - c. Wi-Fi would need to keep pace with other technological advancements (e.g., Singapore's nationwide broadband network ("NBN") and 5G networks), to help facilitate a seamless experience for users as they transition between different connectivity mediums.
3. At the close of consultation on 14 March 2023, IMDA received written comments from 29 respondents ("Respondents"). IMDA thanks all Respondents for their feedback.
4. IMDA has taken into account and given thorough consideration to all the comments received which are relevant to the consultation. The key comments are highlighted and addressed below.

PROPOSED ALLOCATION OF 6 GHZ BAND IN SINGAPORE

IMDA's Proposal in Consultation Document: Allocation

5. IMDA proposed to allocate the lower 500 MHz of the 6 GHz band, i.e., 5,925 MHz – 6,425 MHz, for Radio Local Area Networks ("RLAN") / Wi-Fi use. This allocation would be timely given the following considerations:
 - a. There is immediate domestic demand for additional spectrum to support growing Wi-Fi traffic; and
 - b. The global equipment ecosystem for Wi-Fi 6E technology is mature, enabling domestic adoption to take place quickly.

Summary of Responses to IMDA's Proposal

6. All Respondents were supportive and agreed with IMDA's assessment and proposal, as summarised below:
 - a. Most Respondents recognised that additional Wi-Fi spectrum is needed to meet increasing capacity needs, brought about by the proliferation of Wi-Fi adoption and growing demand for wireless connectivity in Singapore. Further, the additional spectrum would also facilitate access to the latest Wi-Fi technologies (e.g., Wi-Fi 6E as well as the emerging Wi-Fi 7), which will enable improved

capabilities to better support bandwidth-intensive use-cases, ultimately benefitting consumers and businesses in terms of better user experience and providing a wider range of use-cases / applications;

- b. Some Respondents recognised that Wi-Fi plays an important role in Singapore’s overall connectivity ecosystem, and is thus critical for Wi-Fi developments to keep in tandem with NBN and 5G developments; and
- c. Some Respondents also acknowledged that IMDA’s proposed allocation is aligned with large global consensus and Singapore would be able to capitalise on the commercial readiness of the Wi-Fi 6E global ecosystem.

IMDA’s Views

- 7. IMDA notes Respondents’ strong support and consensus on the proposed allocation. IMDA will proceed to allocate the lower 500 MHz of the 6 GHz band, i.e., 5,925 MHz – 6,425 MHz, for RLAN / Wi-Fi use.

Ancillary Comments

- 8. IMDA notes there were ancillary comments on two issues, as set out below.

Allowing Other Unlicensed Technologies in the Lower 500 MHz of 6 GHz Band

- 9. A few Respondents suggested that IMDA should also allow other unlicensed technologies, in particular 5G New Radio Unlicensed (“NR-U”), to be deployed alongside Wi-Fi in the lower 500 MHz of the 6 GHz band. One Respondent commented that this would enable more efficient usage of spectrum and bring about potential benefits such as increased innovation and competition in the telecommunication market, allowing consumers to benefit from better services at lower costs.

IMDA’s Views

- 10. IMDA notes Respondents’ suggestion, as well as current market developments:
 - a. NR-U refers to the deployment of 5G NR in unlicensed spectrum (e.g., 5 GHz and 6 GHz bands), operating under the same technical conditions as Wi-Fi for fair access, on a shared basis; and
 - b. NR-U is an evolution of Licence Assisted Access (“LAA”), which is a similar technology that allows low-powered 4G / Long Term Evolution deployments to co-exist with other deployments (e.g., Wi-Fi) in unlicensed bands. While LAA deployments have been permitted in Singapore since 2020, there are no deployments to-date.
- 11. IMDA is open to allowing NR-U deployments in Singapore at the appropriate time. IMDA notes that NR-U continues to be a nascent space with no known commercial deployments and relatively immature global ecosystem development today. Hence, IMDA will monitor this space closely and review further when the technology and ecosystem become more mature and viable, before allowing such deployments.

Proposals on Possible Approaches to Allocate Upper 700 MHz of 6 GHz Band

12. While this issue was not consulted on, IMDA received varying views regarding the potential allocation of the upper 700 MHz of the 6 GHz band (i.e., 6,425 MHz – 7,125 MHz), as summarised below:
 - a. One group of Respondents recommended to allocate the upper 700 MHz for RLAN / Wi-Fi, supplementing the lower 500 MHz of the 6 GHz band in IMDA’s proposal. With the full 1,200 MHz of the 6 GHz band made available for Wi-Fi, this would maximise the full potential and capabilities of latest and emerging Wi-Fi technologies such as Wi-Fi 6E and Wi-Fi 7, hence better supporting Wi-Fi growth and future networking needs;
 - b. In contrast, another group of Respondents recommended to allocate the upper 700 MHz for International Mobile Telecommunications (“IMT”) / 5G use. The Respondents commented that the upper 6 GHz spectrum offers valuable mid-band spectrum for mobile services and would be a viable option to support the expansion and adoption of 5G services; and
 - c. One Respondent from the satellite industry indicated that it would not be opposed to the allocation of the upper 700 MHz for RLAN / Wi-Fi use, at the same power limits proposed for the lower 500 MHz. However, it would have concerns with any allocation for IMT use in view of greater interference concerns.

IMDA’s Views

13. IMDA is studying the potential allocation of the upper 700 MHz of the 6 GHz band and monitoring relevant international developments. One such development is the ITU World Radiocommunication Conference slated for end-2023, which will discuss the potential identification of parts of the upper 700 MHz for possible IMT use. Hence, these discussions will have an impact on the IMT global ecosystem in the 6 GHz band.
14. IMDA notes Respondents’ comments and will take these into consideration in its assessment of the proposed allocation for the upper 700 MHz of the 6 GHz band.

IMDA’s Proposal in Consultation Document: Technical Requirements

15. Most Respondents provided feedback on the proposed technical requirements (see Table A below) for allowing RLAN / Wi-Fi use in the lower 500 MHz of the 6 GHz band on a licence-exempt basis.

Table A: Technical requirements for RLAN / Wi-Fi use in the lower 500 MHz

Use Case	RF Power Requirements	Remarks
Very Low Power (VLP)	Max EIRP: 14 dBm (25 mW)	For indoor and outdoor use
	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 indoor use only
	Max EIRP density: 11 dBm/MHz	

16. These Respondents were mostly supportive of the proposed technical requirements, although some gave further suggestions to consider adjusting the power limits for specific scenarios / usage or to include some additional technical requirements beyond power requirements (detailed discussions set out in Annex A).

IMDA's Views

17. IMDA notes the overall support for the proposed technical requirements in Table A above. The IMDA Technical Specification for Short Range Devices ("TS SRD") will be revised to include these technical requirements. Should there be requests for higher power limits, IMDA will assess them on a case-by-case basis.
18. The further suggestions on the additional technical requirements and parameters, such as spectrum access mechanism and out-of-band emission limits, will be addressed separately during the IMDA TS SRD revision.
19. As part of IMDA's telecommunications standards setting process, a technical committee comprising industry professionals and academics will help to review the technical requirements before a draft of the revised IMDA TS SRD is released for public comments prior to its finalised publication.

Clarifications on IMDA's Proposal in Consultation Document: Equipment Registration

20. One Respondent sought clarification regarding the registration of RLAN / Wi-Fi equipment and the treatment of existing RLAN / Wi-Fi equipment already in the market.

IMDA's Views

21. IMDA would like to clarify that telecommunication and radio-communication equipment to be sold for local use in Singapore is subject to equipment registration with IMDA. Under IMDA's Equipment Registration Framework, devices must comply with the IMDA TS SRD and register with IMDA under the Enhanced Simplified Equipment Registration ("ESER") scheme. The registration is based on the submission of the Supplier's Declaration of Conformity¹. Suppliers are to obtain the relevant radio test reports from the equipment manufacturers to conduct conformity assessment to ascertain that the operating frequencies RF output power of the devices are within the specified limits, including compliance to the Safety and EMC aspects as indicated in the IMDA TS SRD before registering the devices with IMDA. The requirement to comply with the IMDA TS SRD and register under the ESER scheme applies to all RLAN / Wi-Fi equipment to be sold for local use in Singapore.
22. IMDA notes that there are existing RLAN / Wi-Fi equipment with Wi-Fi 6E capability registered with IMDA, but with the Wi-Fi 6E function disabled to prevent transmission in the 6 GHz band. IMDA would like to clarify that if the supplier intends to enable the Wi-Fi 6E function, a new registration under the ESER scheme is to be submitted to IMDA to include the Wi-Fi 6E capability after the IMDA TS SRD is revised and finalised.

¹ For more information details on IMDA's Equipment Registration Framework, please visit www.imda.gov.sg/EquipmentRegistrationFramework.

IMDA'S DECISION

23. IMDA will proceed to allocate the lower 500 MHz of the 6 GHz band, i.e., 5,925 MHz – 6,425 MHz, for RLAN / Wi-Fi use in Singapore on a licence-exempt basis.
24. In this connection, IMDA will adopt the technical requirements for the 5,945 MHz – 6,425 MHz band as indicated in Table A. The IMDA TS SRD will be revised to include these requirements.
25. The ESER scheme will apply to the registration of short range / low power devices that operate on the 5,945 – 6,425 MHz band for RLAN / Wi-Fi use.
26. To give effect to the allocation of the 5,945 MHz – 6,425 MHz band for RLAN / Wi-Fi use on a licence-exempt basis, and for the equipment referred to in paragraph 25 above to be registered with IMDA under the ESER scheme, IMDA will be amending the Telecommunications (Exemption from Sections 33, 34(1)(b) and 35) Notification and Telecommunications (Dealers) Regulations. The above amendments will be published in the Government Gazette.
27. The revised IMDA TS SRD and the legislative amendments are expected to be finalised in 3Q 2023. IMDA will inform the industry when the amendments take effect.

TECHNICAL REQUIREMENTS FOR ALLOWING RLAN USE ON A LICENCE-EXEMPT BASIS IN THE LOWER 6 GHz BAND (5,925 MHz – 6,425 MHz)

IMDA's Proposal in Consultation Document

- 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 ("FS/FSS"), if it is allocated for RLAN use, IMDA referenced the studies by overseas jurisdictions such as the European Conference of Postal and Telecommunications Administrations ("CEPT") and the UK Office of Communications ("Ofcom") 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.
- 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 had proposed to adopt the following technical requirements to be included in the IMDA TS SRD (see Table below) for RLAN use 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.

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 indoor and outdoor use
	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 indoor use only
	Max EIRP density: 11 dBm/MHz	

- IMDA had proposed to designate 5,925 MHz – 5,945 MHz as the guard band with the possibility of allocating 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.
- 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.

Summary of Industry Responses and IMDA's Views

Incumbent Use and Interference Issues

5. The main comments are summarised below:
 - a. A few Respondents submitted that the continued operations of FSS in the 5,925 MHz – 6,425 MHz band should be ensured and the conditions for existing and future FSS use in the band should remain unchanged;
 - b. The same group of Respondents and a few other Respondents also submitted that the operation of RLAN in the band would need to be on a non-protection and non-interference basis vis-à-vis incumbent services such as FSS; and
 - c. One Respondent requested for IMDA to be open to reviewing the technical measures for RLAN use in the event of interference issue and recommended for IMDA to appoint an entity to resolve interference problems.

IMDA's Views

6. IMDA would like to highlight that in considering the allocation of the lower 500 MHz of the 6 GHz band for RLAN use on a licence-exempt basis, IMDA's key focus is to ensure that existing and future use of incumbent services such as FS/FSS will not be impacted. As with the use of any other licence-exempt frequency bands in Singapore, including existing frequency bands for RLAN, e.g., the 2.4 GHz and 5 GHz bands, the devices are intended for operation in shared frequency bands on an unprotected basis and shall not cause interference to other authorised radio-communication services and be able to tolerate any interference caused by other radio-communication services. This is a requirement as specified in the IMDA TS SRD. Once allocated for RLAN, the lower 6 GHz band will be included in Table 1 of the IMDA TS SRD² and the requirement for operation on non-interference and non-protection basis will similarly apply.
7. IMDA would also clarify that in the event of interference from RLAN to incumbent services in the 6 GHz band, there is an established process where the affected user can report the issue to IMDA via spectrum_monitoring@imda.gov.sg. If there is empirical evidence that the use of RLAN in 6 GHz is causing interference to incumbent services in Singapore, IMDA would review the technical requirements of RLAN use and revise them where necessary to ensure these conditions remain fit for use in Singapore.

Technical Requirements for RLAN Use as Proposed by IMDA

8. Respondents were mostly supportive of the technical requirements proposed by IMDA, with some suggestions as summarised below:
 - a. Some Respondents submitted that IMDA should consider increasing the power for VLP and LPI devices to facilitate the future use of 320 MHz channel for Wi-Fi 7 and/or for better alignment with US FCC's requirements;

² Table 1 of the IMDA TS SRD contains the minimum technical requirements for SRD to operate in one of the authorised frequency bands or frequencies, and transmit within the corresponding output power levels and restricted conditions.

- b. On the other hand, some Respondents submitted for IMDA to restrict or lower the power limit for outdoor use while some other Respondents suggested to limit RLAN to indoor use only to protect existing and future licensed services within or adjacent to the lower 6 GHz band; and
- c. Some Respondents suggested for IMDA to consider including additional technical requirements such as spectrum access mechanism, out-of-band emission limits and to authorise client-to-client operation under LPI use.

IMDA's Views

- 9. IMDA had made reference to the studies done by other administrations and organisations such as CEPT, Ofcom etc. The proposed power limits were determined based on the outcome of these studies. IMDA is of the view that the proposed power limits of 14 dBm EIRP and 24 dBm EIRP for VLP and LPI use respectively are adequate in ensuring coexistence with incumbent services.
- 10. IMDA is mindful that any increase in power limits may potentially affect the coexistence of RLAN with incumbent services, especially for VLP devices that can operate outdoors. Should there be requirement for higher power limits for VLP and/or LPI, IMDA would assess on a case-by-case basis, and such operations may only be allowed on an exceptional basis subject to proper technical study and justification.
- 11. With regard to the inclusion of additional technical requirements such as spectrum access mechanism and out-of-band emission limits for the use of RLAN in the lower 6 GHz band, IMDA will address these separately during the revision of the IMDA TS SRD. As part of IMDA's telecommunications standards setting process, a technical committee comprising industry professionals and academics will help to review the technical requirements before a draft of the revised IMDA TS SRD is released for public comments prior to its finalised publication.

Authorisation of Standard Power Devices

- 12. Some Respondents submitted for IMDA to consider authorising outdoor use of standard power devices at up to 36 dBm EIRP with the implementation of Automatic Frequency Coordination. However, some Respondents raised opposition to any outdoor use of standard power devices, with one Respondent raising concern on the long-term threat of aggregate interference to FSS uplinks.

IMDA's Views

- 13. In relation to the use of standard power devices, IMDA considers that the proposed technical requirements to allow VLP and LPI devices will enable a large majority of devices to be used and also address most RLAN use-cases, hence meeting the current demand without the need for a more complex interference management approach. Regarding the use of standard power devices, IMDA will continue to monitor the development and progress of lab tests / public trials and review the demand and feasibility to allow such use in Singapore in the future.