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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

**VIA ELECTRONIC FILING**

e-mail: [Consultation@imda.gov.sg](mailto:Consultation@imda.gov.sg)

**Re:** Consultation on Proposed Allocation of 6 GHz Band

Dear Ms. Chia,

Wi-Fi Alliance commends the Infocomm Media Development Authority (“IMDA”) on its ongoing work in the area of spectrum management. The IMDA’s consultation on the proposal to allocate the lower 500 MHz of the 6 GHz band (i.e., 5.925-7.125 GHz) for RLAN/Wi-Fi use (“[Consultation](#)”) is an important mechanism for soliciting feedback that will provide IMDA with the information necessary to proceed. Wi-Fi Alliance welcome the opportunity to provide IMDA with information concerning RLAN/Wi-Fi spectrum requirements for future broadband wireless connectivity services.

Wi-Fi Alliance is a global, non-profit industry association of over 900 leading companies from dozens of countries devoted to seamless interoperability. With technology development, market building, and regulatory programs, Wi-Fi Alliance has enabled widespread adoption of Wi-Fi worldwide, certifying thousands of Wi-Fi products each year.

For additional information or questions, please contact:

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## Summary of Major Points and Statement of Interest

Internet connectivity is an essential socioeconomic function and Wi-Fi is the primary means of delivering it in Singapore and around the world. As with any wireless technology, Wi-Fi functionality depends on access to frequency spectrum. Opening the 5.925-7.125 GHz (6 GHz band) to Wi-Fi access enables a wide range of new technologies and use cases, which aligns with Singapore's leadership position in broadband fiber deployments.<sup>1</sup>

Wi-Fi connectivity is versatile, extremely affordable, and compatible with existing networks, sharing security, management, and authentication implementations. This makes Wi-Fi an ideal "force multiplier." Importantly, Wi-Fi technology, built on IEEE 802.11 standards, has demonstrated its ability to coexist with and protect other spectrum users. Coexistence is inherent to Wi-Fi technology as it is essential to Wi-Fi's efficient operation. Technical, operational, and regulatory solutions already adopted by various countries to ensure Wi-Fi coexistence with ongoing, incumbent operations in the 6 GHz band are also facilitating regulatory harmonization. This creates economies of scale and a robust ecosystem, benefiting businesses, consumers, and economies. Indeed, the connectivity provided by Wi-Fi delivers billions of dollars in value to Singapore's economy.<sup>2/</sup> But these benefits cannot be realized in the absence of Wi-Fi access to adequate spectrum capacity in the 6 GHz band.

As note in the *Consultation*, although several countries already authorized Wi-Fi access in the entire 6 GHz band, the upper portion of this spectrum (i.e., 6.425-7.125 GHz) will be under consideration at the upcoming 2023 World Radiocommunication Conference (WRC-23) for a potential International Mobile Telecommunications (IMT) designation to support licensed 5G networks, devices, and services ("5G/IMT"). The pending WRC-23 decision has caused regulatory uncertainty that is impeding the introduction of advanced 6 GHz Wi-Fi technology and use cases. To rectify the situation and resolve this uncertainty in a timely manner, Wi-Fi Alliance respectfully calls on IMDA to consider that:

- Lack of spectrum access threatens Wi-Fi performance and functionality and the 6 GHz frequency band (i.e., 5.925-6.425 GHz and 6.425-7.125 GHz) is uniquely suited to accommodate the urgent need for additional Wi-Fi spectrum access.
- The 6.425-7.125 GHz frequency band is not viable for 5G deployments.
- Technical requirements for 6 GHz RLANs must ensure fair coexistence among different license-exempt technologies.

## Comments

### **Lack of spectrum access threatens Wi-Fi performance and functionality and the 6 GHz frequency band (i.e., 5.925-6.425 GHz and 6.425-7.125 GHz) is uniquely suited to accommodate the urgent need for additional Wi-Fi spectrum access**

Wi-Fi Alliance commends the IMDA for the proposal to partially mitigate Wi-Fi spectrum shortfall by allowing RLAN access to the 5.925-6.425 GHz band ("lower 6 GHz band"), but Wi-Fi also needs access to the remaining portion of the 6 GHz (6.425-7.125 GHz band (i.e., upper 6 GHz band)) to meet advanced connectivity requirement.

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<sup>1</sup> See Omdia's Fiber Development Index available at <https://telecoms.com/intelligence/singapore-holds-lead-position-in-omdia-fiber-development-index/>

<sup>2/</sup> See <https://www.wi-fi.org/discover-wi-fi/value-of-wi-fi>

As the COVID-19 pandemic demonstrated, high-speed broadband connectivity is critical for working, learning, and staying connected. While high-speed broadband is delivered by either fiber, fixed-wireless, or satellite technologies, Wi-Fi is the primary means of distributing this connectivity to end users. Considering that Singapore's high-speed broadband capabilities continue to increase, toward multi-gigabit broadband, it is important to ensure that Wi-Fi spectrum bandwidth does not constrain this connectivity.

The *Consultation* comes at a pivotal time in the development of Wi-Fi ecosystem. Wi-Fi Alliance introduced new [Wi-Fi 6E](#) terminology to distinguish the latest generation Wi-Fi 6 devices that are capable of 6 GHz operation.<sup>3/</sup> Wi-Fi 6E brings a common industry name for Wi-Fi users to identify devices that offer the features and capabilities of Wi-Fi 6 – including higher performance, lower latency, and faster data rates – extended into the 5.925–7.125 GHz band. Wi-Fi 6E devices are quickly becoming available, following regulatory approvals in several countries.<sup>4/</sup> As the 6 GHz regulatory landscape evolves, Wi-Fi Alliance member companies will expand the Wi-Fi 6E ecosystem even further.<sup>5/</sup> In 2022, over 350 million Wi-Fi 6E devices are expected to enter the market.<sup>6/</sup> Regulatory harmonization in the 5.925–7.125 GHz band will create economies of scope and scale and produce a robust equipment market, benefitting businesses, consumers, and the economy.

Optimal performance of the current (Wi-Fi 6E) and future generations of Wi-Fi depends on access to necessary spectrum. The 1200 MHz in the 6 GHz band enables major advances in Wi-Fi applications, infrastructure, and services. Increased data throughput rates, ultra-low and deterministic latencies, better mobility, and high densities of users/devices all become more achievable and practical with the 6 GHz spectrum. Precluding Wi-Fi access to the 6.425-7.125 GHz portion of the 6 GHz band substantively reduces Wi-Fi 6E performance in terms of latency and data throughput. The 5.925-6.425 GHz band does not offer sufficient spectrum to support future Wi-Fi connectivity needs.

Wi-Fi Alliance respectfully asks IMDA to note that both 5.925-6.425 GHz and 6.425-7.125 GHz bands are uniquely suited to accommodate the urgent need for additional Wi-Fi spectrum access for the following reasons:

- Self-coordinating, multi-channel Wi-Fi networks relying on dynamic random spectrum access and contention-based protocols require access to multiple channels to maintain acceptable performance. The current Wi-Fi standard (Wi-Fi 6/6E) specifies channel bandwidths of up to 160 MHz, while the next amendment under consideration ([Wi-Fi 7](#), Extremely High Throughput) will specify channel bandwidths of up to 320 MHz. The 500 MHz (i.e., 5925-6425 MHz) is simply insufficient to accommodate multiple 320 MHz channels. The 1200 MHz (i.e., 5.925-7.125 GHz) of contiguous spectrum would enable 14 additional 80 MHz channels, 7 additional 160 MHz channels or 3 additional 320 MHz channels which are needed for high-bandwidth applications that require faster data throughput such as high-definition video streaming and virtual reality. Wi-Fi 6E and subsequent generations of Wi-Fi technology will leverage

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<sup>3/</sup> See Wi-Fi Alliance® brings Wi-Fi 6 into 6 GHz, WI-FI ALLIANCE (Jan. 3, 2020) <https://www.wi-fi.org/news-events/newsroom/wi-fi-alliance-brings-wi-fi-6-into-6-ghz>.

<sup>4/</sup> See Countries Enabling Wi-Fi 6E at <https://www.wi-fi.org/countries-enabling-wi-fi-6e>

<sup>5/</sup> See Product Finder, WI-FI ALLIANCE (last visited on Feb. 22, 2021) [https://www.wi-fi.org/product-finder-results?sort\\_by=certified&sort\\_order=desc&certifications=1335](https://www.wi-fi.org/product-finder-results?sort_by=certified&sort_order=desc&certifications=1335).

<sup>6/</sup> See Wi-Fi 6E: The Market Opportunity for Wi-Fi 6 in the 6GHz Spectrum Band, IDC Market Presentation (Apr. 2020) <https://www.idc.com/getdoc.jsp?containerId=US46220720>.

these wider channels and additional capacity to deliver greater network performance and support more Wi-Fi users at once, even in very dense and congested environments.

- Existing Wi-Fi equipment designed for the 5 GHz band can be rapidly adapted and deployed across the 6 GHz frequency range, offering significant economies of scale and other benefits.
- Efforts to enable Wi-Fi in the full 6 GHz range are already underway in many countries.<sup>7/</sup> While European regulators completed the initial step of opening the 5.945-6.425 GHz band (lower 6 GHz) for RLANs, there is broad recognition that a follow-up action is needed to address the projected demand for Wi-Fi spectrum in the upper 6 GHz band (i.e., 6.425-7.125 GHz).<sup>8/</sup>

Importantly, there is no alternative frequency range available to support expanding demand for Wi-Fi and the growing device ecosystem. Therefore, optimal performance of [Wi-Fi 6E](#), [Wi-Fi 7](#), and future Wi-Fi generations depends on access to the entire 6 GHz spectrum (i.e., both 5.925-6.425 GHz and 6.425-7.125 GHz frequency bands)

### **Neither 5.925-6.425 GHz nor 6.425-7.125 GHz Frequency Bands Are Viable Candidates for 5G/IMT Services**

Wi-Fi Alliance respectfully asks IMDA to consider that the plans outlined by the 5G/IMT proponents for deployments in the 6 GHz band are clearly incompatible with ongoing incumbent operations in this frequency range. To maintain the necessary quality of service, 5G/IMT wide-area networks with high-power rooftop deployments require priority access to the spectrum. Hence, licensed 5G/IMT networks cannot avoid interfering with or tolerate interference from incumbent operations in the 6 GHz band. In most countries, the 6 GHz band is used extensively for long distance and high-capacity fixed links. The 5G/IMT proponents have not offered any viable method for coexistence with fixed networks. Similarly, 5G/IMT coexistence with 6 GHz incumbent satellite services is not guaranteed. Importantly, countries are obligated by an international treaty to protect on-orbit fixed-satellite service (FSS) satellite receivers from interference that may be caused by the 5G/IMT network(s) deployed on their territories. Therefore, it is unrealistic to expect that 5G/IMT networks can avoid interfering with and tolerate interference from other incumbent operations in the 6.425-7.125 GHz band. 5G/IMT proponents' claim of achieving coexistence with the 6 GHz incumbents by limiting operations to dense urban-area "hotspots" are unrealistic. Not only does this approach not protect incumbent services from harmful interference, but it is also not commercially viable. 5G/IMT "hotspot" implementations simply lack the economies of scale necessary for a robust equipment ecosystem or commercial viability. Moreover, 5G/IMT already have access to previously designated UHF, C-band, mmWave and other frequency bands, which are intended for the hotspot services and remain significantly underused. For valid reasons, members of the Asia Pacific Telecommunity rejected proposals to consider IMT designation of the 6.425-7.025 GHz band in ITU Region 3 at the upcoming 2023 World Radiocommunication Conference.<sup>9/</sup>

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<sup>7/</sup> See Countries Enabling Wi-Fi 6E at <https://www.wi-fi.org/countries-enabling-wi-fi-6e>

<sup>8/</sup> See ECC Work Item on WAS/RLANs in 6.425-7.125 GHz, available at: [http://eccwp.cept.org/WI\\_Detail.aspx?wiid=795](http://eccwp.cept.org/WI_Detail.aspx?wiid=795)

<sup>9/</sup> See Output of the 5<sup>th</sup> Meeting of APT Conference Preparatory Group for WRC-19, available at: <https://www.apr.int/2019-APG19-5>.

IMDA may also wish to take into account that the 6 GHz 5G/IMT equipment is lacking. Many countries already decided to designate the entire 6 GHz band for license-exempt deployments, negating possible 5G/IMT deployments in the band. It is therefore unlikely that 5G/IMT in the 6 GHz band can attain the sufficient market scale and harmonization necessary for a robust equipment ecosystem or commercial viability.

### **Spectrum access mechanism for 6 GHz RLANs must ensure fair coexistence among different license-exempt technologies**

Wi-Fi Alliance respectfully asks IMDA to consider appropriate regulations to ensure fair spectrum access and coexistence for various license-exempt RLAN technologies in the 6 GHz band. Wi-Fi Alliance considers that an RLAN device transmitting on a license-exempt channel is operating fairly to Wi-Fi if the impact of its transmissions on Wi-Fi users is no worse than the impact that would result from an additional Wi-Fi device introduced into the channel supporting the same traffic load as the RLAN device. Specifically, Wi-Fi Alliance recommends a requirement for a contention-based protocol which will allow multiple RLAN devices to use the same radio channel/spectrum effectively and efficiently without preconditions. Wi-Fi, for example, consistent with IEEE 802.11, implements the “listen before talk” contention-based protocol to ensure fair coexistence and equitable spectrum access for multiple RLAN devices. It is also important to note that implementation of contention-based protocol will augment protection of the incumbent (licensed) services in the 6 GHz band. In this regard, IMDA may wish to note requirements adopted by national regulatory authorities in other countries.<sup>10/</sup>

### **International harmonization of technical conditions for 6 GHz RLANs**

Over the past two decades, license-exempt ecosystem has experienced significant increase in use and innovation stemming from a global marketplace, economies of scale and, importantly, international harmonization of regulatory frameworks. Timely introduction of new license-exempt services and devices in Singapore depends on low barriers to entry that can be best achieved with common but also, to extent feasible, improved technical conditions. Recognizing that technical conditions may vary depending on unique requirements within each administration, Wi-Fi Alliance encourages harmonization of RLAN technical conditions in the 6 GHz band while minimizing unnecessary constraints and regulatory burdens. Wi-Fi Alliance generally supports IMDA’s proposed technical requirements in Annex A, Table 1. But Wi-Fi Alliance asks IMDA to consider allowing higher EIRP limit for the Very Low Power (VLP) devices. An increase in VLP transmit power would better accommodate upcoming [Wi-Fi 7](#) (based on IEEE 802.11be Extremely High Throughput) technology that will be optimized to support higher data throughput and lower latency in channel bandwidths of up to 320 MHz. This EIRP limit would be consistent with the recent decision by Brazil’s Anatel.<sup>11</sup>

Wi-Fi Alliance asks IMDA to consider that a coordinated spectrum access based on Automated Frequency Coordination (AFC), would permit higher-powered RLAN transmissions while avoiding designated locations

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<sup>10/</sup> See for example US FCC §15.407 (d)(6) available at <https://www.law.cornell.edu/cfr/text/47/15.407>

<sup>11</sup> See Brazil’s Anatel, ACT NO. 1306, Feb 26, 2021 at paragraph 11.7.3.1 available at [https://sei.anatel.gov.br/sei/modulos/pesquisa/md\\_pesq\\_documento\\_consulta\\_externa.php?eEP-wqk1skrd8hSlk5Z3rN4EVg9uLJqrLYJw\\_9INcO7uvjUt3vSOWT\\_4Z5fukj9ylzPErY4KWH5cpE9W\\_9hcTZkCG-vLPldpXyuhgMG-L9M-uBLoSdAAXO0clb3SIt1i](https://sei.anatel.gov.br/sei/modulos/pesquisa/md_pesq_documento_consulta_externa.php?eEP-wqk1skrd8hSlk5Z3rN4EVg9uLJqrLYJw_9INcO7uvjUt3vSOWT_4Z5fukj9ylzPErY4KWH5cpE9W_9hcTZkCG-vLPldpXyuhgMG-L9M-uBLoSdAAXO0clb3SIt1i)

and frequencies that may be used by other services or systems. A close regulatory alignment with Canada,<sup>12/</sup> U.S.<sup>13/</sup> and other countries will facilitate development and deployment of standard power RLANs by leveraging the ecosystem built for the broader market. And Wi-Fi Alliance is actively developing technical specifications to enable AFC implementation.<sup>14/</sup> The standard-power 6 GHz RLANs can play an important role in closing the digital divide by providing ubiquitous and inexpensive connectivity to underserved areas. Wi-Fi Alliance respectfully asks IMDA to consider allowing standard-power RLANs operations while harmonizing the regulatory framework with other countries by adopting the following technical conditions:

- Frequency band: 5925-7125 MHz
- Environment: Indoor and outdoor
- Primary restrictions: coordinated spectrum access using AFC
- Access point: Max PSD=200 mW/MHz and Max EIRP=4000 mW
- Client device: Max PSD=50 mW/MHz and Max EIRP=1000 mW

### Conclusion

Policymakers worldwide recognize that wireless connectivity is increasingly dependent on Wi-Fi and that Wi-Fi delivers significant socioeconomic benefits. Regulatory harmonization is essential to ensuring necessary economies of scope and scale to enable commercially viable 6 GHz ecosystem in Singapore. As other countries (e.g., Brazil, Canada, South Korea, Saudi Arabia, US) move forward with RLAN deployments in 5.925-7.125 GHz, timely IMDA decision adopting similar regulatory framework is imperative to enabling wireless connectivity and associated benefits in Singapore. Conversely, lack of spectrum access (e.g., limiting RLAN access only to 5.925-6.425 GHz) may limit commercial viability of Wi-Fi ecosystem and its socioeconomic benefits in Singapore. The advantages of a globally harmonized spectrum include commonality of equipment, economies of scale, larger market, increased competition, lower product prices, and a wider choice of products, to name just a few. With a view towards international harmonization, Wi-Fi Alliance respectfully asks IMDA to proceed with its proposal to allow RLAN access to the 5.925-6.425 GHz band and initiate regulatory action to expand RLAN operations in the 6.425-7.125 GHz band.

Wi-Fi Alliance appreciates the opportunity to contribute to IMDA's efforts.

Respectfully submitted,  
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<sup>12/</sup> Canada ISED, Dynamic Spectrum Access available at <https://ised-isde.canada.ca/site/certification-engineering-bureau/en/node/115>

<sup>13/</sup> U.S. Title 47 Code of the U.S. Federal Regulations. § 15.407(a)(4) and (7) available at <https://www.law.cornell.edu/cfr/text/47/15.407>

<sup>14/</sup> See Wi-Fi Alliance furthers Automated Frequency Coordination specification and compliance development to accelerate Wi-Fi 6E available at: <https://www.wi-fi.org/news-events/newsroom/wi-fi-alliance-furthers-automated-frequency-coordination-specification-and>