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16 July 2024

VIA ELECTRONIC FILING AT: ONLINE SUBMISSIONS

The Manager
Spectrum Planning Section
Australian Communications and Media Authority
PO Box 78
Belconnen ACT 2616

Re: **Future Use of the Upper 6 GHz Band Options Paper**

Dear Colleagues,

Wi-Fi Alliance commends the Australian Communications and Media Authority (the "ACMA") on its ongoing work in the areas of spectrum management and frequency planning. The *Future Use of the Upper-6 GHz Band Options Paper* ("*Options Paper*")[1/] is a useful update on the ACMA's priorities and a valuable tool to solicit feedback that will provide the ACMA with the information necessary to decide on the optimal use of the upper 6 GHz band (6.425-7.125 GHz). Wi-Fi Alliance enthusiastically supports the ACMA's efforts and appreciates the opportunity to provide its recommendations on how to advance the long-term public interest objectives in the upper 6 GHz frequency band.

I. Access to the upper-6 GHz band is imperative for enabling advanced Wi-Fi connectivity that delivers significant socioeconomic benefits

In recently published *Five Year Spectrum Outlook 2024-29 and 2024-25 Work Program*, the ACMA astutely recognized that Wi-Fi has become indispensable to delivering wireless connectivity to consumers and enterprises in Australia.[2/] Wi-Fi devices are now the primary means by which Australians connect to the Internet. This central role continuous to grow with Wi-Fi established as an essential complement to Fifth Generation wireless ("5G") networks.[3/] It is also important to consider that connectivity provided by Wi-Fi through low-cost, Low Interference Potential Devices (LIPD) class license, delivers billions of dollars in value to Australia's economy. Indeed, a study by Telecom Advisory Services found that class-licensed networks like Wi-Fi generated over A$50 billion in economic value to the Australia in 2021, a number expected to grow to A$63 billion by 2025.[4/]

1/ *Future Use of the Upper-6 GHz Band Options Paper*, available at future_use_of_the_upper_6_ghz_band_options_paper.pdf (acma.gov.au)

2/ *Five Year Spectrum Outlook 2024-29 and 2024-25 Work Program, Draft for Consultation*, March 2024 ("*Spectrum Outlook")* at page 18, available at Draft Five-year spectrum outlook 2024–29 | ACMA

3/ *Spectrum Outlook* at footnote 17

4/ *Economic Value of Wi-Fi* available at http://valueofwifi.com

According to governmental statistics, Australians spend 90% or more of their time indoors,[5/] where they consume most of their data traffic. Correspondingly, most of that data traffic (over 90%) is transferred over fixed (e.g., fiber, cable) networks and more than 90% of it is delivered to end-users by Wi-Fi.[6/] Thus, Wi-Fi functionality is integral to the future of broadband connectivity in Australia. But ever-increasing data traffic volumes combined with expanding performance requirements (e.g., lower latencies, lower power consumption, etc.) along with rapidly growing number of active Wi-Fi devices continue to strain spectrum capacity available for Wi-Fi operations. Wi-Fi Alliance commends the ACMA's recent decision to enable RLANs in the lower 6 GHz band (5.925–6.425 GHz) which partially mitigates Wi-Fi spectrum shortfall, but access to the remaining upper portion of the 6 GHz band is urgently needed to meet advanced Wi-Fi technology and connectivity requirement.

The *Options Paper* comes at a pivotal time in the development of Wi-Fi ecosystem. Earlier this year, Wi-Fi Alliance introduced the latest generation of Wi-Fi technology, ***Wi-Fi 7***. Wi-Fi 7 devices are now available to support applications that require higher levels of interactivity and reliability. Wi-Fi 7 implements powerful new features, summarized below, that boost performance and improve connectivity across consumer and commercial market segments with cutting-edge capabilities that deliver high throughput, deterministic latency, and greater reliability.

- 320 MHz channels: Doubles today's widest channel size to facilitate multi-gigabit device speeds and high throughput.
- Multi-Link Operation (MLO): Allows devices to transmit and receive data over multiple links for increased throughput and improved reliability.
- 4K QAM: Achieves 20% higher transmission rates than 1024 QAM.
- 512 Compressed Block Ack: Improves efficiency and reduces overhead.
- Multiple RUs to a single STA: Improves flexibility for spectrum resource scheduling to enhance. spectrum efficiency.
- Triggered Uplink Access: Optimizes Wi-Fi 6 defined triggered uplink access to accommodate latency sensitive streams and satisfy QoS requirements.
- Emergency Preparedness Communication Services (EPCS): Provides a seamless National Security & Emergency Preparedness (NSEP) service experience to users while maintaining the priority and quality of service in Wi-Fi access networks.

With these features, Wi-Fi 7 provides an unprecedent performance which is necessary for enablement of the innovative use cases including multi-user AR/VR/XR, immersive 3-D training, cloud computing, hybrid work, AI, industrial automation, and many others. In 2024, over 269 million Wi-Fi 7 devices will be introduced into the global market. And by 2028, the annual shipments of the 6 GHz enabled Wi-Fi devices are projected to exceed 2.5 billion. In short, regulatory harmonization in the 6 GHz band will create economies of scope and scale and produce a robust equipment market, benefitting Australia's businesses, consumers, and the economy. But Wi-Fi 7 optimal performance depends on access to the upper-6 GHz spectrum band.

5/ *Indoor air, Australian Government Department of Climate Change, Energy, the Environment and Water* available at https://www.dcceew.gov.au/environment/protection/air-quality/indoor-air#:~:text=It%20is%20generally%20recognised%20that,%2C%20offices%2C%20or%20inside%20cars.

6/ See Arthur D. Little analysis

A recently completed study analyzed the impact of spectrum availability on Wi-Fi's ability to support gigabit connectivity in residential deployments.[7] The simulation modeled high-density Wi-Fi deployments in a typical residential apartment building with gigabit fiber connectivity to every apartment. The model was set to ensure that Wi-Fi spectrum congestion does not constrain (i.e., bottleneck) the gigabit connectivity. The results of this study confirm that Wi-Fi access only to the 5.925-6.425 GHz (i.e., lower-6 GHz) frequency band constrains gigabit connectivity. The study demonstrates that the five 160 MHz channels (two 160 MHz channels in 5 GHz and three 160 MHz channels in the lower-6 GHz) can only support gigabit coverage to approximately 50-60% of residential building areas. To ensure whole-building coverage, a minimum of ten 160 MHz channels are necessary.

Wi-Fi Alliance respectfully asks the ACMA to note that optimal Wi-Fi performance depends on access to multiple wider (e.g., 160 MHz and 320 MHz) channels in the 6 GHz band. Access to less than the entire 6 GHz band (i.e., 5.925-6.425 GHz and 6.425-7.125 GHz bands) substantively reduces Wi-Fi 7 performance in terms of latency and data throughput. Without Wi-Fi access to the upper-6 GHz band, Australia's consumers and enterprises will not realize the full benefits of Wi-Fi 7 and future generations of Wi-Fi technologies.

II. Leveraging 6 GHz Spectrum Policy for Environmental Sustainability

Deciding on the most beneficial use of the upper-6 GHz spectrum is not trivial, requiring balanced evaluation of competing priorities and resulting socioeconomic benefits. One factor that is gaining prominence in the spectrum management processes is the environmental consequences, particularly the impact on carbon footprint associated with alternative deployments. The recent *Sustainability Benefits of 6 GHz Spectrum Policy* study offers a methodical analysis of this issue for the upper-6 GHz band.[8/] The study provides clear evidence that allowing Wi-Fi to access the upper-6 GHz band spectrum capacity results in a sizeable reduction in energy consumption and corresponding reduction in the CO_2 emissions. In this study, WIK-Consult analyzed two upper-6 GHz spectrum utilization scenarios. The first scenario assessed the impact of making the upper-6 GHz band available for Wi-Fi. Under this scenario, fiber-to-the-home capacity was not constrained by a lack of spectrum for Wi-Fi, which in turn allowed for sufficient bandwidth to meet advanced indoor connectivity needs. In the second scenario, WIK-Consult modeled assigning the upper-6 GHz to cellular networks, which limited the amount of spectrum available to Wi-Fi. The analysis confirmed that lack of spectrum access reduced Wi-Fi performance and increased data traffic congestion, which in turn, drove frustrated consumers from the fixed/Wi-Fi onto cellular networks. The forced transfer in the second scenario resulted in a 15% increased shift in data traffic from fixed/Wi-Fi to 5G cellular, resulting in an estimated 16% higher energy consumption. The higher energy consumption by cellular networks resulted in an additional 3.2 megatons of CO_2 emissions per year in Europe alone. According to WIK-Consult, similar results in the CO_2 levels reductions can be expected in other parts of the world (e.g., Australia).

III. Achieving the *Desirable Planning Outcomes*[9/]

Wi-Fi Alliance supports the four *Desirable Planning Outcomes* presented in the Options Paper and is of the view that these outcomes can be best achieved with RLAN implementation in the upper-6 GHz band.

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7 *Wi-Fi Spectrum Requirements*, Plum Consulting, March 2024

8/ *See* Sustainability Benefits of 6 GHz Spectrum Policy, by WIK-CONSULT, 31 July 2023 available at SustainabilityBenefitsof6GHzSpectrumPolicy202307.pdf (wi-fi.org)

9/ *Spectrum Outlook* at 18

Desirable Planning Outcome 1: *Optimize the efficiency and utility of the upper 6 GHz band by introducing arrangements for RLAN and/or WA WBB services*.

In the *Options Paper*, the ACMA correctly observes that WA WBB implementation in the upper 6 GHz would trigger a protracted and complex incumbent relocation process.[10/] Wi-Fi Alliance respectfully asks the ACMA to consider that in addition to costly, multi-year incumbent relocation process, more time (i.e., years) and investments (i.e., billions of dollars) would be required to develop, implement, deploy and operate the WA WBB networks in the upper-6 GHz band. It is unlikely that such WA WBB networks would be economically viable given questionable ROI and limited market scale and harmonization. In the meantime, the latest Wi-Fi technology, operating in the 5.925-7.125 GHz band, is already on the market, empowering tremendous connectivity benefits.

Desirable Planning Outcome 2: *Maintain regulatory arrangements to the extent possible for existing services within the upper 6 GHz band when optimizing its utility*.

Extensive technical studies along with real-world LIPD deployments in the lower-6 GHz band provide the ACMA with ample evidence of regulatory arrangements that are necessary for coexistence with important incumbent operations in the 6 GHz band. These arrangements are acceptable for RLAN networks (e.g., Wi-Fi) that can operate under constraints that do not cause unacceptable interference to incumbent services. But these arrangements are not feasible for *commercially viable* WA WBB (e.g., 5G) deployments because, to maintain the necessary quality of service, the WA WBB networks require priority access to the spectrum. With priority spectrum access, the WA WBB networks cannot avoid interfering with and/or tolerate interference from the incumbent operations in the upper-6 GHz band. Conversely, Wi-Fi, built on IEEE 802.11 standards, has demonstrated its ability to coexist with and protect other spectrum users. These protections are inherent to Wi-Fi technology and are critical to its efficient operations on license-exempt basis worldwide. And Wi-Fi industry is committed to implementing technical, operational, and regulatory solutions that ensure coexistence with ongoing and future incumbent operations in the upper-6 GHz band.

Desirable Planning Outcome 3: *Ensure coexistence with other services in the upper 6 GHz band.*

Wi-Fi is uniquely capable of sharing spectrum without impacting the operation of the upper-6 GHz incumbents, producing a spectrum win-win. The successful RLAN implementation in the lower-6 GHz demonstrates that incumbents can continue to operate unaffected by the introduction of RLANs (e.g., Wi-Fi) that operate on an unprotected, non-interference basis. Wi-Fi is capable of that kind of sharing because it is designed to share spectrum with services that have primary rights and operate at significantly higher power levels. This type of sharing is particularly effective for the 6 GHz band by using different Wi-Fi device classes such as, Very Low Power (VLP), Low Power Indoor (LPI) and Standard Power (SP) controlled by Automated Frequency Coordination (AFC) system.

These connectivity demands can be addressed by restricting low-power devices to indoor use, while further minimizing their interference potential with mitigation techniques, such as:

- *Limit on LIPD transmit power in the upper-6 GHz band at 25mW for outdoor use (i.e., VLP)*. This method protects incumbent operations with a mandatory limit on an unlicensed device's transmit power. Limiting a device's maximum transmit power effectively controls unwanted energy at the incumbent receiver.

10/ *Options Paper* at 2

- *Limit LIPD transmit power in the upper-6 GHz band at 250 mW for indoor use only (i.e., LPI).* This method shields incumbent receivers from RLAN transmissions through building structures and other obstacles. Low-power, indoor transmissions are significantly attenuated when passing through building walls. The effectiveness of this coexistence technique will continue to increase with improvements in the energy efficiency of buildings across Australia. And the LIPDs with indoor-only constraints have already been successfully introduced in the lower-6 GHz in Australia and in several other countries. This spectrum sharing approach is particularly effective when incumbent operations are outdoors, as is the case in the upper-6 GHz while predominate demand for Wi-Fi connectivity is indoors. Australians need broadband wireless connectivity for work, school, entertainment, telemedicine, industrial automation, IoT and a myriad of other primarily indoor uses.[11/]
- *Require mandatory implementation of AFC if operators use EIRP greater than 250mW for both indoor and outdoor (i.e., SP).* ACMA already offers both online and offline register of radiocommunications license database to the public.[12/] AFC system operator can easily access the database to coordinate with incumbent services. Internationally, implementing of AFC is at an early stage, ACMA can keep monitoring the operation of AFC system in other countries before making any regulatory provision in Australia.
- *Mandate an EIRP mask for any 6 GHz RLAN devices deployed outdoor.* The EIRP mask provides robust protection to satellite space receivers. This is similar to the ACMA's LIPD class license requirements in the 5150 - 5250 MHz band.
- *Require mandatory implementation of contention-based protocol for LIPD in the upper-6 GHz*. Wi-Fi incorporates features that maximize spectrum utilization while preserving flexibility to accommodate current and future spectrum users. Self-coordinating, multi-channel Wi-Fi networks share spectrum using an energy detect contention-based protocol based on a "listen-before talk" spectrum access scheme, also known as Carrier Sense Multiple Access with Collision Avoidance ("CSMA/CA") protocol. This protocol ensures equitable spectrum access among Wi-Fi devices, but also, importantly, protects other operations in a shared spectrum band. With the CSMA/CA implementation, before initiating any transmission, a Wi-Fi device listens to the radio medium and, only if the medium is idle, the station may transmit; otherwise, the Wi-Fi device must wait until the active transmission is complete before transmitting on a given channel. The CSMA/CA significantly enhances Wi-Fi's ability to coexist with current incumbents as well as future deployments in the upper 6 GHz. That is why a requirement for contention-based protocol was adopted by the US Federal Communication Commission for unlicensed operations in the 6 GHz band.[13/]

Desirable Planning Outcome 4: *Maintain coexistence with adjacent band services.*

The LIPD operations in the 5 GHz and lower-6 GHz band offer real-world, practical confirmation that RLANs can effectively protect operations in the adjacent frequency band. RLANs signal transmissions at lower power levels and/or predominately indoors result in negligible out-of-band emissions interference potential.

11/ *See Wi-Fi® Industry Leaders Offer Insights About the Year Ahead*, WI-FI ALLIANCE (Jan. 30, 2023) https://www.wi-fi.org/beacon/the-beacon/wi-fi-industry-leaders-offer-insights-about-the-year-ahead; Value of Wi-Fi Report at 14.

12/ *See* Radiocomms Licence Data available at https://www.acma.gov.au/radiocomms-licence-data#rrl-access-via-web-api

13/ *See* US FCC §15.407(d)(6).

The higher-power RLANs adjacent band emissions can be effectively managed by the AFC system as is being done in the US and Canada. [14/]

IV. Protection of Television Outside Broadcast (TOB) operations in the 7100-7125 MHz

For protection from interference, the characteristics of the 6 GHz fixed and TOB networks are essentially identical. Hence, Wi-Fi Alliance supports the ACMA conclusion that the VLP/LPI RLANs can effectively protect the TOB operations in the 7100-7125 MHz band.[15/] The ACMA may further augment this protection by requiring RLANs to implement contention-based protocol and other interference mitigation techniques such as transmit power control. [16/] Also, the ACMA may consider allowing higher power RLAN operations (i.e., SP) under control of an automated dynamic spectrum access system. Such system's reference database on the protected, incumbent operations can be updated in near real time to preclude higher power RLAN transmissions in the vicinity of active TOB receivers.

V. Wi-Fi Alliance Responses to Questions for Comment

Question 1: What are your views on the 4 broad planning options identified for the upper 6 GHz band?

- ***Option 1: Maintain existing arrangements, with potential reconsideration at a later date***.

Wi-Fi Alliance is not in favor of this option. As explained above, the latest Wi-Fi technology, operating in the upper 6 GHz band, is already available on the market, empowering tremendous connectivity benefits which are ready to be provided to Australia's businesses, consumers, and the economy. Delaying these readily available and much needed benefits would be contradictory to the public interest objectives. Moreover, the upper-6 GHz realities and decision factors are not going to change over time. Thus, a delay will only perpetuate regulatory uncertainty and discourage introduction of advanced Wi-Fi technology in Australia.

- ***Option 2: Introduce arrangements to enable RLAN access to some or all of the upper 6 GHz band, via a variation to the LIPD Class Licence. There would be no introduction of arrangements introduced for WA WBB***.

Wi-Fi Alliance strongly supports this option. Wi-Fi has become increasingly important in connecting people and devices everywhere and access to the upper-6 GHz spectrum is critical for futureproofing of Wi-Fi's ability to deliver connectivity in Australia. As explained above, the latest Wi-Fi technology (Wi-Fi 7), designed to operate in the upper-6 GHz band, is already on the market, empowering connectivity benefits which are ready to be delivered to the Australian businesses, consumers, and the economy. As the 6 GHz regulatory landscape evolves, Wi-Fi Alliance member companies continue to expand the Wi-Fi 7 ecosystem even further. Initial deployments in the band included Wi-Fi 7 consumer access points, smartphones,

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14/ *See* US FCC §15.407(l)

15/ *Options Paper* at 13

16/ *For most recent sharing study on this topic see* Report on Frequency Sharing Between Very Low Power RLAN Devices and Broadcast Central Receive Stations in the 6 GHz Band, RKF Engineering Solutions, LLC, June 2024 available at https://www.fcc.gov/ecfs/document/10628696224385/1 computers, and televisions, followed by enterprise-grade access points. Industrial environments are also seeing a strong adoption of Wi-Fi 7 technology that supports various applications including machine analytics, remote maintenance, and virtual employee training. Access to less than the entire 6 GHz band (i.e., lower and upper 6 GHz bands) substantively reduces Wi-Fi 7 performance in terms of latency and data throughput. The lower-6 GHz band alone does not provide sufficient spectrum bandwidth to support advanced Wi-Fi connectivity. And, importantly, there are no alternative frequency bands that may address expanding Wi-Fi spectrum requirements in the future. Wi-Fi Alliance asks the ACMA to note that Wi-Fi 7 is designed to deliver unprecedented quality of service (QoS) benefits at higher data rates and lower latencies. But Wi-Fi 7 optimal performance depends on access to multiple wider (e.g., 320 MHz) channels in the 6 GHz band– without Wi-Fi access to upper 6-GHz band, Australian consumers and enterprises will not realize full benefits of Wi-Fi 6E, Wi-Fi 7 and future generations of Wi-Fi technologies.

- ***Option 3: Introduce arrangements to enable WA WBB access to some or all of the upper 6 GHz band, using apparatus and/or spectrum licensing. There would be no arrangements introduced for RLANs***.

Wi-Fi Alliance is not in favor of this option. The spectrum needs of WA WBB (IMT) networks are questionable at best, particularly in light of recent decisions on the 700/800 MHz, 3.4-4.0 GHz, 26/28 GHz and other frequency bands. According to statistics published by the UK[17] and German[18] regulators, only 1-3% of broadband traffic is carried over mobile networks. Thus, the IMT proponents' assertions on the need for yet another frequency band reservation (i.e., upper-6 GHz) are simply irrational. This fact is clearly evidenced by the recent European Commission report on 2024 State of the Digital Decade, in which the Commission observed that the "stand-alone" 5G networks are "still not deployed on any meaningful scale, except in very few cases of private networks."[19] The Commission further observed that 5G networks' coverage in the 3.4-3.8 GHz band, considered the primary pioneer band for 5G in the European Union and the only available mid-band on a large scale offering a good balance between coverage and capacity, stands at only 51% in 2023. Considering that 5G deployments in Australia are analogous to Europe, it is difficult to rationalize reserving even more spectrum with less favorable propagation characteristics (i.e., 6 GHz vs. 3.5 GHz) for future WA WBB (IMT) deployments.

Importantly, with the 2027 World Radiocommunication Conference (WRC-27) agenda item 1.7, the IMT proponents already moved on to other "mid-band spectrum priorities" in the 4.4-4.8 GHz, 7.250-8.4 GHz and 14.8-15.35 GHz frequency bands. Given that purported IMT/cellular spectrum needs can be accommodated in a variety of other frequency bands, while Wi-Fi is specifically engineered for the 6 GHz band, Wi-Fi Alliance respectfully asks the ACMA to consider that the 6.425-7.125 GHz is the only mid-band spectrum that can accommodate rapidly growing need for Wi-Fi connectivity. Without access to the upper-6 GHz band, Wi-Fi capabilities in Australia will be permanently impaired, undermining the overall connectivity goals and objectives.

Designating the upper 6 GHz frequency band for WA WBB is unlikely to result in commercial cellular network deployments but will create regulatory uncertainty and prevent other technologies from delivering much needed and readily available connectivity benefits to Australia's consumers and enterprises. Moreover,

[17] Communications Market Report 2021, UK Ofcom (p. 3)
[18] Tätigkeitsbericht Telekommunikation 2020/2021, BNetzA (p. 20 ff.)
[19] *See* 2024 State of the Digital Decade report, July 2024 at pg. 3, fn 5

several countries have already decided that the upper-6 GHz frequency band is not suitable for IMT implementation. Sporadic IMT deployments only in some countries is contrary to the very premise of spectrum harmonization (intended goal of the IMT identification), negating potential benefits.

In considering Option 3 or 4, Wi-Fi Alliance calls on the ACMA to note that multiple IMT frequency sharing studies in preparation for WRC-23 determined that separation distances in the order of 10s of kilometers are required to protect fixed links from interference. Such arrangements (separation distances) are unworkable for the *Wide Area* WBB network deployments, necessitating, therefore, the migration of fixed links and TOB operations out of the upper-6 GHz band. As discussed above, this migration entails significant costs and operational risks. Also as noted in In the *Options Paper*, the upper-6 GHz frequency band is extensively used by the Fixed Satellite Service (FSS) uplinks in many countries. The international treaty obligates *all* countries to protect on-orbit FSS satellite receivers from interference that may be caused by the WA WBB network(s) deployed on their territories. Specifically, Resolution 220 (WRC-23) prescribes a complex regulatory regime to control e.i.r.p. spectral density emitted by IMT base stations for the protection of the FSS (Earth-to-space) link. In evaluating feasibility of Options 3 and 4, the ACMA should account for the burden of continually managing evolving WA WBB network deployments for compliance with this obligation. Also, it is worth noting that in recent (post WRC-23) CEPT studies, the IMT proponents assert that the e.i.r.p. limits adopted at WRC-23 are too stringent for commercially viable IMT network deployments.

Option 4: Introduce arrangements to enable both RLAN and WA WBB access to different frequency segments within the upper 6 GHz band, using the respective authorisation arrangements in options 2 and 3.

Wi-Fi Alliance appreciates this Option's underlying goal of trying to make everyone happy with a 'split the band' approach but is concerned that such approach would devalue the upper-6 GHz for both RLAN and WA WBB. The Option 4 approach is analogous to trying to share one Wi-Fi signal with a whole neighborhood—no one's going to be satisfied with the result, and it's likely to just end in frustration and buffering.

Wi-Fi Alliance agree with the ACMA's preliminary view that geographic segmentation between RLAN and WA WBB in the upper 6 GHz band is not feasible.[20/] Obviously, most demand for either application is in populated, overlapping areas and it is not practical to segregate these technologies by geographical areas.

Wi-Fi Alliance also agrees with the ACMA's preliminary view that multiple unresolved issues preclude implementation of non-traditional spectrum sharing mechanisms.[21/] In addition to the issues noted in the *Options Paper*, Wi-Fi Alliance respectfully asks the ACMA to consider the following:

- regarding "*indoor/outdoor separation"*:

To maintain the necessary quality of service, the WA WBB networks require priority access to the spectrum. With priority spectrum access, outdoor WA WBB networks cannot avoid interfering with or tolerate interference from incumbent transmissions in the upper-6 GHz band. Restricting the WA WBB to predominantly outdoor deployments would exacerbate commercial viability of such networks by further limiting their service area and increasing interference potential to the 6 GHz incumbent services.

As the demand for Wi-Fi connectivity continuous to grow, the 6 GHz Wi-Fi use cases are expanding to airports, train stations, maritime ports, stadiums, malls, industrial facilities, public transportation, and many

[20/] *Options Paper* at 24
[21/] *Options Paper* at 28

other high user/device density environments. But these use cases and coexistence may not be feasible in the presence of higher-power WA WBB "outdoor" transmissions.

Access to the upper-6 GHz spectrum is needed for operation of the very low power (VLP) devices that operate under the LIPD class license. The 6 GHz VLP devices offer a new wave of applications that provide large quantities of information in near real-time. But functionality and commercial viability of these VLP devices requires access to both indoor and outdoor environments. For example, many 6 GHz VLP devices are body worn to support a variety of use cases such as healthcare, location, advanced connectivity, wireless casting, augmented- and virtual-reality, with many applications still to be defined. Segregation of the VLP devices to indoor-only would preclude many of these promising use cases and possibly VLP feasibility.

- regarding "*reduced WA WBB base station power*"

For a WA WBB network to maintain necessary coverage and QoS, a reduced base station power limit requires deployment of additional base stations (i.e., network densification) which, in turn, significantly increases costs. But besides additional costs, there are other practical complexities (e.g., lack of available sites for additional base station deployments) that will impede the WA WBB network densification, particularly in densely populated, metropolitan areas. Also, the ACMA may wish to consider that radio signal propagation in the upper-6 GHz band requires additional energy (i.e., compared to 3.5 GHz) just to overcome additional pathloss at higher frequencies. Reducing the base station transmit power of the upper-6 GHz WA WBB networks would be contrary to their commercial viability.

- regarding "*database-assisted coordination*"

Geolocation database solutions such as Automated Frequency Coordination (AFC) system are intended to identify permissible frequencies and associated power levels for Wi-Fi operations at a specific geographic location. In broad terms, the AFC functionality is premised on exclusion of Wi-Fi transmission in the vicinity of Fixed (i.e., stationery) network deployments. But geolocation database solutions, such as AFC, are not practical for sharing between Wi-Fi and the WA WBB (i.e., mobile) networks which, by definition, are not stationary. Likewise, it would be impossible for Wi-Fi or WA WBB user terminal to maintain necessary geographic separation without excluding large swaths in coverage of populated areas – rendering either network commercially not feasible. Hierarchical priority spectrum access geolocation database approaches (e.g., Spectrum Access System) add yet another layer of complexity. Schemes prioritizing Wi-Fi or WA WBB spectrum access in some predefined geographic zones are likely to result in negative user experiences when either service's functionality is degraded outside (or at the edge) of the prescribed zone. Such hybrid approaches are not workable for either Wi-Fi or WA WBB coexistence.

- regarding "*spectrum sensing*"

The WA WBB transmissions have an unrestrained potential to trigger Wi-Fi's Listen Before Talk detection. The IEEE specification for Wi-Fi requires energy detection at -62 dBm/20 MHz, but Wi-Fi Alliance members report that their implementations sense at much lower thresholds. Even with structural attenuation (i.e., with in/out-door segregation), it would be impractical to contain the WA WBB base station transmission at levels below these thresholds. Moreover, it would be unrealistic to expect that the WA WBB user equipment (highly portable) would be effectively controlled from transmitting within RLAN coverage area. In short, hybrid solutions based on spectrum sensing would significantly increase cost and complexity for both RLAN and WA WBB and, importantly, spectrum sensing cannot effectively manage a cacophony of the RF signals generated under such arrangements.

Question 2: **If we decide to divide the band into different RLAN and WA WBB segments, should the WA WBB segment**:

a. **be planned based on multiples of 100 MHz? This would align with the largest WA WBB channel size (noting that the ability for WA WBB operators to deploy one or more 100 MHz channels will depend on the outcome of the assignment process).**

b. **align with the 160/320 MHz wi-fi channel raster? This would maximise the number of larger wi-fi channels available (by avoiding options that would split these channels)**.

As explained above, Wi-Fi Alliance is not in favor of segmentation approach in the upper 6 GHz band. Such segmentation will undoubtedly result in inefficiencies and reduced performance for both RLAN and WA WBB technologies. Wi-Fi Alliance respectfully calls on the ACMA to consider that as the demand for spectrum continues to intensify, conventional spectrum management approaches that are centered on static spectrum segmentation need to be reassessed. Static spectrum allocations necessarily produce inefficiencies because radio communication networks rarely require continuous and exclusive access to spectrum. When that access is not required, the spectrum remains unused while other connectivity requirements in the same geographic area go unfulfilled or under-fulfilled. In contrast, spectrum sharing implemented under the LIPD Class Licence framework with innovative spectrum access techniques promotes increased spectrum utilization while protecting incumbents –without any additional constraints. RLAN technologies such as Wi-Fi can operate in the upper-6 GHz spectrum on a noninterference basis. Wi-Fi is adaptable and is designed to protect the incumbent operations while the WA WBB networks cannot.

Setting aside the above concerns with the segmentation approach, Wi-Fi Alliance agrees with ACMA's preliminary view that the segmentation should follow the 160/320 MHz Wi-Fi channel raster.[22/] The 6 GHz Wi-Fi product ecosystem is thriving with thousands of products already on the market. In the meantime, the 6 GHz WA WBB commercial equipment is nonexistent with the most optimistic predictions estimating possible commercial deployments only after 2030. It'd be contrary to the public interest to warehouse and channelize the upper-6 GHz spectrum resource for a notional WA WBB network(s).

Question 3: Of the segmentation options based on wi-fi channels (schemes 1–3 above), which is the preferred option and why?

Wi-Fi Alliance respectfully asks the ACMA to note that high-density Wi-Fi deployments in public venues, such as stadiums or university campuses, require a minimum of thirteen non-overlapping channels. Understandably, availability of wider channels increases overall network throughput and reduces network load. With that consideration, Wi-Fi Alliance is concerned that Scheme 3 does not fully address the current or future needs for additional Wi-Fi spectrum capacity in the upper-6 GHz band.

Question 4: Is it appropriate to limit our consideration of hybrid options for accommodating multiple services to frequency segmentation only? For example, should geographic segmentation or less traditional sharing models be considered when determining models for enabling access to the upper 6 GHz band by both WAWBB and RLAN services?

[22/] *Options Paper* at 22

Wi-Fi Alliance respectfully asks the ACMA to consider that wireless data traffic concentrations are anything but static or well defined. It is not feasible to develop hybrid sharing regulatory solutions, that need to function on at least semi-permanent bases, based on exclusion zones which may change with new use cases, applications, economics, shifts in population and several other unpredictable factors. It is therefore impractical to dynamically manage geographic contours of the "busy areas" or operational environments. Moreover, it is impractical to preclude 6 GHz Wi-Fi operations in high-population density areas, exactly where they are most needed.

VI. Enabling higher power RLANs in the 6 GHz band

Wi-Fi Alliance agrees with the ACMA's assessment that there are two regulatory models for enabling higher power RLAN operations in the 6 GHz band:

(1) Traditional, licensee coordinated access
(2) Automated dynamic spectrum access (DSA)

Wi-Fi Alliance is of the view that the complexity of the traditional, licensee coordinated access is not practicable for RLAN deployments. Coordination with incumbent terrestrial services (e.g., fixed links) cannot be performed on the scale required for over the counter, consumer devices. Instead, an automated DSA approach maximizes spectrum availability for the higher power RLAN devices, such as Wi-Fi 7, by dynamically determining channel availability to avoid and protect other operations in the 6 GHz frequency band. Wi-Fi Alliance commends the ACMA for plans to consider regulatory arrangements that would allow operation of higher power RLANs under control of a DSA system in the 6 GHz band. Wi-Fi Alliance is leading development of specifications, test plans, and training modules to support the 6 GHz AFC implementations (see 6 GHz AFC Resources). Already, these resources facilitated authorization of the AFC system operations in Canada[23/] and the United States[24/]. Wi-Fi Alliance is committed and ready to support the ACMA efforts to implement the 6 GHz DSA system and higher power 6 GHz RLAN devices in Australia.

VII. Conclusion

Policymakers worldwide recognize that wireless connectivity is increasingly dependent on Wi-Fi. And the *Options Paper* represents an important step toward making much-needed 6 GHz spectrum available to address growing demand for Wi-Fi connectivity in Australia. Wi-Fi Alliance appreciates the opportunity to contribute to ACMA's spectrum management efforts.

Respectfully submitted,

/s/ Alex Roytblat

WI-FI ALLIANCE
Alex Roytblat

23/ *See* ISED Canada, List of Designated Spectrum Access System Administrators available at https://ised-isde.canada.ca/site/certification-engineering-bureau/en/node/116

24/ See FCC Public Notice, OET Announces Approval of Seven 6 GHz Band Automated Frequency Coordination Systems for Commercial Operation and Seeks Comment on C3 Spectra's Proposed AFC System, DA 24-166, ET Docket No. 21-352 (rel. Feb. 23, 2024) available at: https://docs.fcc.gov/public/attachments/DA-24-166A1.pdf

Vice President of Regulatory Affairs
[redacted]