**Dynamic Spectrum Alliance Limited**
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July 15, 2024

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.**

The Dynamic Spectrum Alliance (DSA) thanks ACMA for putting forth this consultation and welcomes the opportunity to provide our views on allocation strategies for the upper 6 GHz band (6425 – 7125 MHz).

The DSA is a global, cross-industry, not for profit organization advocating for laws, regulations, and economic best practices that will lead to more efficient utilisation of spectrum and foster innovation and affordable connectivity for all.

The DSA promotes spectrum sharing technology, innovation, and licensing frameworks that will maximize wireless resources. Our team is made up of worldwide technology experts, making the DSA the shared spectrum go-to organisation for regulators and policymakers all over the world. We advocate for policies that promote unlicensed (also known as Class Licenced in Australia) and dynamic access to spectrum to unleash economic growth and innovation. Additionally, we advocate for a variety of technologies that allow dynamic access to spectrum. To that end, we advocate for technology neutral Class Licensed rules.

The DSA and our members are available to discuss these comments and provide any additional information and insights that might be required.

This document represents the joint views of our members and is also submitted on behalf of Intel Corporation.

Respectfully,

[redacted]

Martha SUAREZ
President
Dynamic Spectrum Alliance

**Dynamic Spectrum Alliance Submission on Upper 6 GHz.**

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

DSA believes that the most socioeconomic value for Australia comes with authorizing the full 1200 MHz for class license access, and significantly less value with authorizing the upper 700 MHz for licensed WA WBB, or by taking no action at all.

DSA understands that ACMA is faced with the difficult trade-off between maximizing socioeconomic value for Australia versus supporting interests of mobile network operators (MNOs) and their suppliers.

With over 800 million 6 GHz devices that have been shipped globally since 2021[1], there is already a robust 6 GHz Wi-Fi ecosystem. Wi-Fi is an essential last hop for connecting devices to broadband networks. According to the Internet Activity Report published by the Australian Competition and Consumer Commission, over 87% of Internet traffic in Australia is carried over fixed networks[2]. Limiting spectrum available for Wi-Fi will strand Australia's investment in fibre and non-terrestrial broadband networks. Doing so will also compromise the quality of enterprise and public venue Wi-Fi networks that require dense deployment of access points. These are all benefits that would accrue to the Australian economy and population today.

6 GHz is also essential for innovative new products services such as Augmented and Virtual Reality (AR and VR). The multiple large and uncongested channels made possible by combining access to both the upper and lower 6 GHz enable consumer-friendly form factors and immersive experiences.

Finally, Standard Power Wi-Fi operation can be a key component to lowering the cost of broadband access in rural communities.

In contrast, as ACMA correctly identified, a primary justification for additional spectrum for WA WBB is to provide additional capacity in dense urban areas to complement the already substantial mid-band spectrum available for WA WBB. However, based on studies provided to CEPT[3], without significant technological improvements, the spectrum may not actually be utilized due to poor performance, similar to MNOs' experience with prior aspirations to utilize mmWave bands for mobile services. In particular, because of 6 GHz's propagation characteristics and mobile device power and regulatory restrictions, uplink performance may not be adequate to provide a viable service (this is an especially difficult issue to overcome for any device operating indoors). Even though standards now exist, at best,

[1] The state of connectivity: Wi-Fi® momentum in 2024 | Wi-Fi Alliance, https://www.wi-fi.org/beacon/the-beacon/the-state-of-connectivity-wi-fi-momentum-in-2024
[2] ACCC Internet Activity Report, for the period ending 30 June 2023 https://www.accc.gov.au/system/files/internet-activity-report-june-2023.pdf
[3] See https://api.cept.org/documents/ecc-pt1/81128/ecc-pt1-24-005_telefonica-6-ghz-stuttgart-coverage-test-results

given these technical challenges, it will be multiple years before a viable ecosystem is established for 6 GHz WA WBB.

Please see our detailed analysis below.

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

Although this option permits the ACMA to keep monitoring global technology and regulatory developments on the upper 6 GHz band, doing so would delay the economic benefits derived from leveraging the spectrum now, thereby reducing the economic benefits that would accrue to Australia, as compared to option 2. DSA strongly recommends that ACMA should not go with this option.

According to a study[4] commissioned by Wi-Fi Alliance, the economic value of Wi-Fi is estimated at more than US$42 billion for Australia by 2025. However, realising this economic value depends on regulatory certainty. The uncertainty regarding whether Australia will include the upper 6 GHz band in LIPD class licence has caused enterprise users to postpone upgrading their Wi-Fi network to the latest Wi-Fi 6E or 7 equipment. If the ACMA decides to adopt option 1, it would lead to further delay in investment, resulting in significant opportunity costs for the industry in Australia.

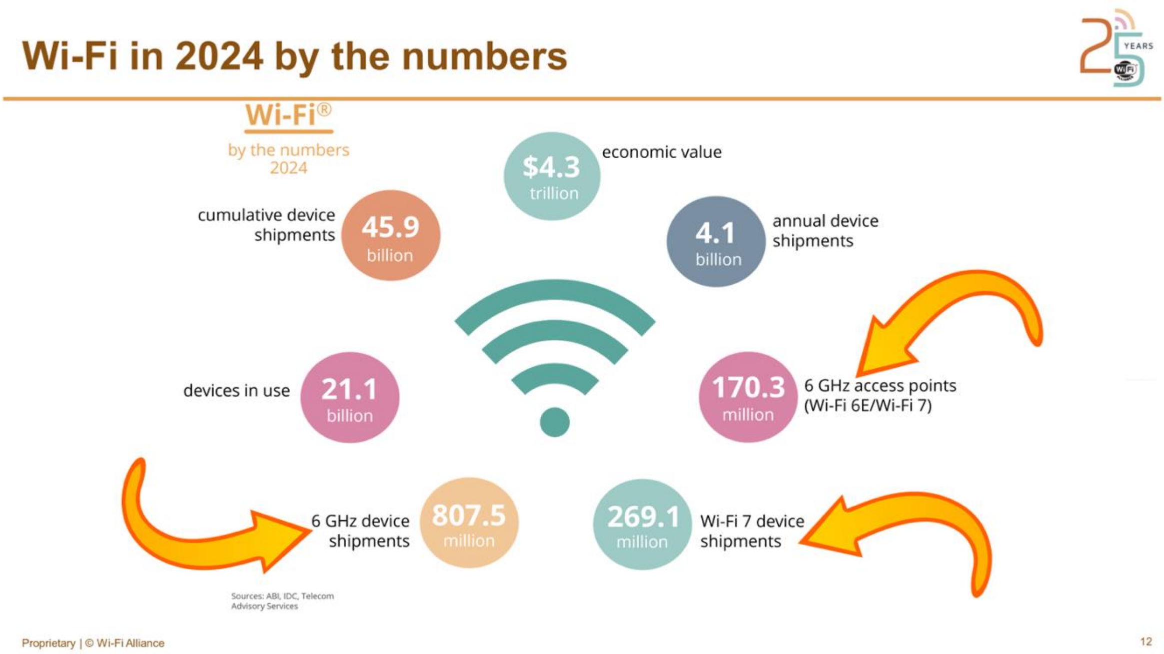


*Figure 1: Wi-Fi in 2024 by the numbers[5]*

[4] Available at https://www.wi-fi.org/file/global-economic-value-of-wi-fi-2021-2025
[5] Source: Wi-Fi Alliance

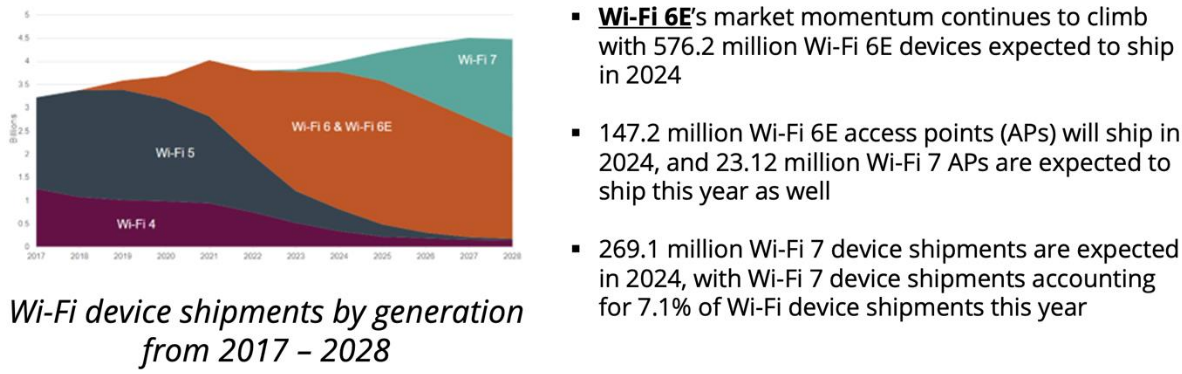


*Figure 2: Wi-Fi device Shipments by Generation*[6]

Option 1 would also lead to delays in upper 6 GHz adoption if and when ACMA eventually does open the upper 6 GHz band for LIPD class license use because a materially substantial number of user equipment devices would have been shipped with only the lower 500 MHz enabled. These shipped devices would be incapable of operating in the upper 700 MHz and there would be a significant transition period before the whole band could be fully utilized.

- **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.

DSA strongly believes option 2 would provide the most economic value for Australia.

With only the lower 500 MHz available for Wi-Fi, there will not be enough 80 MHz channels in the 6 GHz band to enable deployments of dense networks that will require at least 7-9 non-overlapping channels. In some extreme high density venues like sport stadiums, where access points have to be placed very close to each other to provide enough capacity, engineers require more than 15 channels for reducing the co-channel interference. As a result, even with availability of the lower 500 MHz in the 6 GHz band, many dense Wi-Fi network deployments utilizing the 6 GHz band will still have to use 40 MHz channels, thus resulting in little performance improvement compared to current capability available in older generations of Wi-Fi technology. Without larger channel sizes, gigabit speeds in Wi-Fi connections cannot be achieved.

If RLAN were given access to all the upper band however, it will make 7 channels of 160 MHz available for RLAN to enable effective deployments of dense networks such as those in universities, hospitals, schools and TAFE colleges, enterprise level deployments, mines and large agricultural businesses to support maximum throughput. In addition, 1200 MHz is needed to support novel applications in Wi-Fi 7 technology and beyond which require at least three 320 MHz channels.

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[6] Available at https://www.wi-fi.org/beacon/the-beacon/the-state-of-connectivity-wi-fi-momentum-in-2024

In countries that have opened the full 1200 MHz, like US and Canada, we have observed strong growth in Wi-Fi 6E adoption over the past two years. As noted at the ACMA "6GHz Tune-Up", educational institutions such as universities in Australia would also benefit from wider channels if the entire 6 GHz spectrum becomes available. Lecture theatres and libraries are all very high density environments with students accessing large volumes of data. The bandwidth requirements argue for the need to support 80 and 160 MHz channels, and the density of these environments make clear the importance of a 7-channel plan to minimise co-channel interference. Figure  below illustrates the library example we shared at the ACMA Tune-Up showing the density of access point placement.

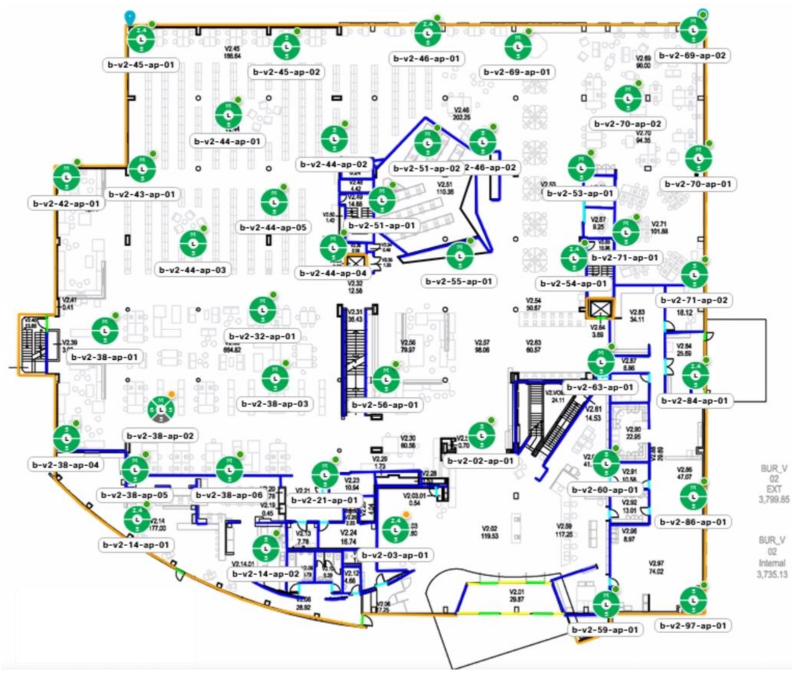

*Figure 3: University Library Example*

Australian universities are also leveraging AR and VR in courses such as medicine, and today they are limited to just 6 headsets for use in a given classroom because of limitations of spectrum bands available. Support for 160 MHz and 320 MHz channels would allow for broader class participation. Examples such as these will only continue to grow over time and expand to the TAFEs and K-12 as well. While not directly in scope for this consultation, we also note that universities and other large campus environments have active requirements today for Standard Power support to allow the use of external antennas and outdoor deployments.

Chase Center and University of Michigan are example deployments in the United States which use the multiple wide channels in the 6GHz band to meet their requirement of fast connectivity in a high density environment[7,8].

[7] See Golden State Warriors: Basketball and Wi-Fi 6E Innovators, available at https://blogs.arubanetworks.com/industries/golden-state-warriors-basketball-and-wi-fi-6e-innovators/
[8] See U-M campuses first in nation to offer new Wi-Fi technology, available at https://record.umich.edu/articles/u-m-campuses-first-in-nation-to-offer-new-wi-fi-technology/

Wider channels can also help to allow Wi-Fi to effectively share the spectrum with incumbent users of the spectrum. Figure 4 shows an example of the OpenAFC analysing the availability of 6 GHz channels around the vicinity of Sofi Stadium in Los Angeles, California. As can be seen, there are a few 20 and 40 MHz channels which would require lower power so as not to interfere with incumbents. However, when the transmit power is spread across an 80 MHz channel, it will not cause interference.

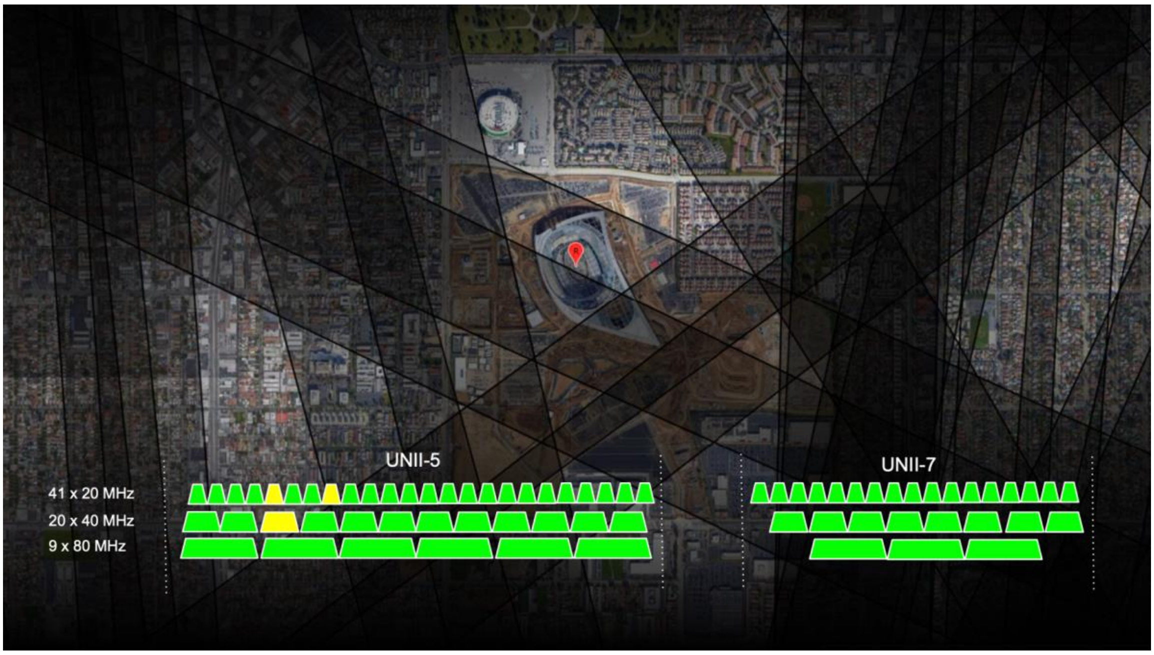


*Figure 4: OpenAFC coordination result at Sofi Stadium, Los Angeles, California*

- **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.

For spectrum allocation to effectively benefit consumers and industries, it must be accompanied by a robust ecosystem of devices that can utilize the allocated frequencies. Without such devices, the spectrum remains underutilized, leading to wasted resources and missed opportunities for innovation and economic growth.

In the absence of IMT devices operating in the 6 GHz band, allocating spectrum for WA WBB hardly provide any benefit to Australian economy. Even MNOs themselves express uncertainty about acquiring spectrum in the 6 GHz band, as evidenced in the recent consultation by Hong Kong Communications Authority (HKCA). In response to HKCA's proposed spectrum auction for upper 6 GHz, all four major MNOs have concerns that the auction is premature due to the lack of ecosystem and available equipment in this band[9].

[9] Joint Statement of the Communications Authority and the Secretary for Commerce and Economic Development Arrangements for Assignment of the Spectrum in the 6/7 GHz Band for the Provision of Public Mobile Services and the Related Spectrum Utilisation Fee. See https://www.coms-auth.hk/filemanager/statement/en/upload/632/ca_statement_20240301.pdf

On the technical side, 6 GHz 'Wide Area' may be a misnomer. As the effects of propagation, blocking and clutter are very high, the actual area coverage would likely be quite variable in cities, hilly areas and those with thick clutter. The result is that 6 GHz utilization for 5G would likely need to be deployed in much smaller cells, more akin to Wi-Fi designs, and as such could potentially be addressed by 5G-NRU – suggesting that even 5G would potentially benefit more from option 2 rather than option 3.

According to UK Ofcom, there is 8 dB additional propagation loss in the 6 GHz band relative to the 3 GHz band[10]. In addition, due to SAR limitations, there may not be sufficient transmit power to overcome building entry loss in the 6 GHz band to achieve usable uplink performance. Figure 5 reflects the findings of a recent field study by Telefonica and Huawei in Germany that was submitted to ECC PT1(24)005[11] reflecting the significant disparity between downlink and uplink speeds.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| DL throughput [Mbit/s] | 1,200 | 1,600 | 1,600 | 2,200 | 1,200 | 700 | 500 | 400...500 | 1400 (peak 2000) |
| UL throughput | 50 | 120 | 50 | 70 | 15...25 | 5...15 | ~1 | <1 | 80 |
| RSRP/Pilot Signal [dBm] | -95 | -82 | -84 | -79 | -105 | -109 | -112 | -115 | -95 |
| Line-of-sight/ non-line-of-sight | NLOS | LOS | LOS | LOS | NLOS | NLOS | NLOS | NLOS | NLOS |
| Distance (projection) | 180 | 230 | 310 | 350 | 380 | 460 | 500 | 530 | 240 |

*Figure 5: Test results at test locations 1-9; similar results were seen in locations 10-24 in the report*

Separately, Telecom Advisory Services recently performed an Economic Study on the 6 GHz band in Brazil[12]. Although DSA acknowledges that there are significant differences between Brazil and Australia, DSA believes the conclusions are informative for ACMA. In particular, we highlight in Figure 6 below the significantly reduced impact on GDP of allocating the upper 6 GHz for WA WBB ($447B) versus allocating the upper 6 GHz band for LIPD access ($708B). A significant contribution to the conclusion is the relatively limited value of the additional outdoor capacity afforded by the upper 6 GHz band for WA WBB.

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[10] See Section 4 "Comparison in Propagation Between the Bands" in UK Ofcom contribution to CEPT PT-1 Correspondence Group on 6 GHz Shared Use available at https://api.cept.org/documents/ecc-pt1/83984/ecc-pt1-24-cg6ghz-24-018_mfcn-was-rlan-sharing-by-implementation-of-power-constraints-on-mfcn-to-facilitate-coexistence-with-was-rlan
[11] Available at https://api.cept.org/documents/ecc-pt1/81128/ecc-pt1-24-005_telefonica-6-ghz-stuttgart-coverage-test-results
[12] See https://dynamicspectrumalliance.org/2024/Assessingtheeconomicvalue6GHzBandBrazil2021-2034.pdf

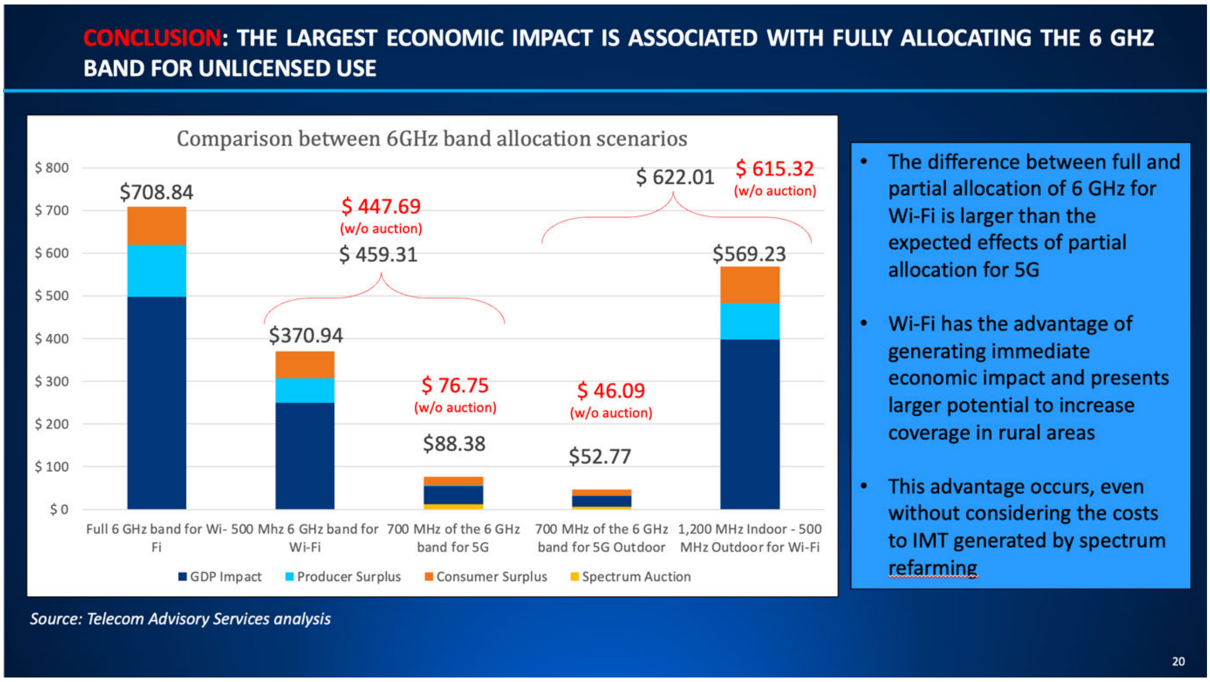


*Figure 6: Economic Impact of allocating the 6 GHz band*

Further, because 6 GHz WA WBB is, in reality, primarily a metropolitan based solution, the economic benefits that could be derived from the use of the band in other areas would be foregone.

- **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.

For the reasons identified above, DSA believes there is no evidentiary basis on which the ACMA could allocate any spectrum to WA WBB in the band.

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

   **a. be a multiple of 100 MHz? This would align with the largest 3GPP 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 the larger wi-fi channels available (by avoiding options that would split these channels).**

Aligned with our support for option 2 above, while recognizing the importance of alignment with 160/320MHz Wi-Fi channels, DSA reiterates the need to support a 7-channel plan to allow effective use of 80 and 160 MHz channels in high density deployments.

3. **Of the segmentation options based on wi-fi channels (options 1–3 in this paper), what is the preferred option and why?**

Per above, the DSA strongly believes that Australia would derive the most economic benefit by allocating both the full lower and upper 6 GHz for LIPD class license.

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 WA WBB and RLAN services?**

DSA agrees with ACMA that the requirement for upper 6 GHz band spectrum for WA WBB and RLAN use would be similar for each area, that is, high need in metro areas, lower need in remote areas, which DSA believe limits the potential benefits of geographic segmentation. DSA believes, however, that if ACMA were to allocate sufficient spectrum for RLAN to serve metro areas, that the same spectrum would be sufficient to serve rural as well.

Another possible approach is to utilize Building Entry Loss and limits on WA WBB EIRP to enable sharing between RLANs operating indoors and WA WBB outdoor. However, based on study ECC PT1(24)094 provided to CEPT[13], DSA believes that effective sharing is only possible under a range of IMT BS EIRP levels between 27 dBm/80MHz and 50 dBm/80 MHz. The report cites at page 19:

- *For maximum spectrum efficiency, the hybrid optimum corresponds to a maximum WA WBB BS EIRP of 27dBm/80MHz, at which point more than 3727 Mbps of indoor capacity and 95 Mbps of outdoor capacity is enabled.*
- *For equal degradation of maximum capacity, the hybrid optimum corresponds to a maximum WA WBB BS EIRP of 40dBm/80MHz, at which point 90+% of both the indoor and the outdoor capacity is enabled.*

Technical modifications to either or both of the RLAN and WA WBB protocols and operation would be required to achieve improvements in capacity and quality of service.

As with geographic segmentation, DSA believes that the benefits of this hybrid indoor/outdoor sharing do not outweigh the costs associated with complexity of implementation, limitation on quality, and possible reduction in available outdoor spectrum, which is already in demand in environments such as higher education, and will be increasingly important for AR/VR and other wearable technologies.

[13] See https://api.cept.org/documents/ecc-pt1/83510/ecc-pt1-24-094_mc-hybrid-sharing-copenhagen-study

## Appendix A: Automated Frequency Coordination

The DSA and our members work to promote new and innovative approaches to spectrum management to increase spectrum access options and extend connectivity. Such innovative approaches include the use of automated dynamic spectrum management systems (DSMS) to make more efficient use of spectrum and support a wide range of commercial services.

In the Spectrum Outlook, the ACMA recognised that regulatory authorities worldwide will need to rely increasingly on automated DSMS tools to handle surging demand for wireless connectivity by sharing underutilised frequency bands. Significant improvements in computation power are enabling more efficient and rapid advanced propagation analysis capability, which in turn enables coordination of devices and users in what is close to real-time. Application of artificial intelligence techniques, such as machine learning for spectrum sensing and for signal classification, also can improve spectrum management. In addition, more agile wireless equipment is being developed that can interact directly with DSMS tools, increasing opportunities for even greater efficiency and scale.

We are encouraged that the ACMA plans to explore the introduction of use of higher-power RLAN class-licensed devices by leveraging the use of commercially available Automated Frequency Coordination (AFC) tools. We bring to ACMA's attention the FCC's certification in February this year of seven AFC system operators, including DSA members, that are now supporting Standard Power operations both indoors (for a wide range of enterprise use cases) and outdoors (for broadband connections to homes and business).[14] We urge ACMA to move forward as quickly as possible with its plan to introduce higher-power RLAN devices in the entire 6 GHz band and to incorporate existing AFC solutions so that Australians may benefit from the increased broadband connectivity and economies of scale.

As ACMA considers future arrangements in the upper 6 GHz band (6425–7125 MHz), the DSA encourages ACMA to leverage dynamic spectrum sharing technology and tools, such as the AFC, to maximise the utility of the band in the immediate future while maintaining flexibility for the future. While an ecosystem exists today for the latest generation of Wi-Fi technologies in the 6 GHz band, an ecosystem for IMT technologies in the band is still many years away.

The DSA urges ACMA to accelerate the work so that the Australia can benefit from the full range of Wi-Fi 6E and Wi-Fi 7 device classes that are available now. By opening the upper 6 GHz band to RLAN devices, including low-power indoor, very low power, and standard power under the management of an AFC, Australians can reap these near-term benefits while the necessary technical analysis development of potential hybrid sharing schemes gets underway.

[14] https://docs.fcc.gov/public/attachments/DA-24-166A1.pdf.