**Cisco Systems, Inc. Comments**
May 2021

# Response to ACMA Consultation on Exploring RLAN use in the 5 GHz and 6 GHz bands

## Introduction

Cisco Systems, Inc. hereby files comments in response to the ACMA's discussion and options paper on *Exploring RLAN use in the 5 GHz and 6 GHz bands* issued in April 2021.

Cisco is a global provider of Internet Protocol (IP)-based networking solutions with a strong presence in Australia. Among Cisco's many products are Wi-Fi network solutions for enterprise, enterprise networking solutions generally, and service provider networking solutions. Cisco applauds the efforts of the ACMA to take steps to enable the latest generation of Wi-Fi in Australia by opening up much needed spectrum in the 6 GHz range. In this submission, Cisco responds to the specific questions called out by ACMA for industry inputs.

## Cisco Responses

1. *What is the demand for spectrum for RLAN use in the 6 GHz band (5925–7125 MHz)?*

   Cisco agrees with ACMA's views in the consultation document on the need for more spectrum for Low Interference Potential Devices (LIPD) Radio Local Area Network (RLAN) devices. The demand for class licensed LIPD RLAN devices has continued to grow exponentially since 2006, the last time LIPD RLAN received a significant influx of new spectrum.[1]

   The proliferation of additional RLAN devices, ever more powerful devices, and higher bandwidth broadband networks, like the Australia National Broadband Network (NBN), is enabling richer and more productive applications. Cisco's Annual Internet Report[2] highlights that for Australia, the devices and connections per capita will grow from 6.0 in 2018 to 10.0 in 2023. There will be 264.4 million network devices in Australia by 2023, up from 148.3 million in 2018 (12.3% CAGR). There will be 168.2 million wired and Wi-Fi connected devices by 2023, up from 97.4 million in 2018 (11.6% CAGR), with 64% of all networked devices in Australia having a wired or Wi-Fi connection. Moreover, these are not just devices that connect people to the Internet, but include an increasingly broad array of consumer products, from connected appliances such as television sets to security systems and gaming consoles.

   In addition, Wi-Fi is also part of the technology enabling today's smartphones, first introduced in 2007. Mobile devices are getting more powerful with every generation, consuming more data with increases in processing power, screen resolution, more use of video in applications, and the mobile networks themselves transitioning from 3G to

[1] In 2006, ACMA implemented the results of the 2003 World Radio Conference, adding 5470-5600 MHz for RLAN, as well as 5650-5725 MHz, and requiring dynamic frequency selection (DFS) on these channels. At the time, that doubled the allocation then available from 5150-5350 MHz.

[2] https://www.cisco.com/c/en/us/solutions/executive-perspectives/annual-internet-report/air-highlights.html#

4G and now, 5G. “Offloading” of mobile traffic to Wi-Fi networks means that 60 to 70% of data utilizes a Wi-Fi/fixed broadband instead of a mobile connection, preventing congestion and enabling mobile operators to more easily adjust to demand spikes.

Every part of the broadband ecosystem is speeding up in response to changing consumer demand. Broadband networks, whether fibre or wireless, are becoming more powerful. Through the transition from 3G to 4G, the use of license-exempt spectrum has continually grown, and will continue to grow as 4G transitions to 5G. In the same period, Australia has transitioned to optical national broadband network and mobile to 4G and now 5G, with RLAN demand continuing to grow without provision for more license-exempt spectrum capacity.

At these growth rates, the RLAN industry faces two fundamental challenges:
(1) The existing license-exempt spectrum in the 2.4 and 5 GHz bands originally allocated 15 years ago to support Wi-Fi are reaching their capacity limits and becoming heavily congested, particularly in venues with larger number of users, such as enterprises, schools, transportation hubs and other public places; and
(2) RLAN technology itself needs an overhaul to address future networking challenges.

In response, industry set out to do two things – first, alert regulators globally that they do not have enough spectrum set aside for RLAN; and second, redesign the technology to address density in device environments and improve spectral efficiency. Out of that effort came the “Wi-Fi 6E” technology, which would, in addition to all the mechanisms supporting improved density and spectral efficiency introduced by Wi-Fi 6, utilize the broader channels available in large, contiguous swaths in the 6 GHz band, unconstrained by any requirement to be backward compatible with previous generations of Wi-Fi, and ultimately would support the next generation of Wi-Fi (Wi-Fi 7) when that standard is complete.[3]

Regulators globally are seeing the benefits of opening 6 GHz to LIPD RLAN use. The economic value of doing so is estimated at US$4.8 trillion globally by 2025, assuming major economies open the 6 GHz band to LIPD RLAN.[4] That study found that in Australia, the economic value of Wi-Fi would grow from US$35 billion to US$42 billion. The main reasons for LIPD’s ability to deliver economic value lie in its ability to provide

[3] The existing Wi-Fi spectrum at 2.4 GHz and 5 GHz currently allows every Wi-Fi protocol since its inception to operate. The additional requirement of interoperability and burden of backward compatibility results in further reductions in efficiency and determinism which further negatively impacts voice and video quality when using the existing 2.4 and 5 GHz bands for Wi-Fi. The 6 GHz band would, for the first time, eliminate outdated and inefficient radio access technology, permitting the far more spectrally efficient Wi-Fi 6 (and above) to operate without the burden of legacy radios. This will dramatically improve the user experience and efficient use of the spectrum. This much-improved experience can only further the adoption of Wi-Fi technologies.
[4] “The Economic Value of Wi-Fi: A Global View (2021-2025)” by Telecom Advisory Services on behalf of the Wi-Fi Alliance (2021) available at https://www.wi-fi.org/download.php?file=/sites/default/files/private/Economic_Value_of_Wi-Fi_Highlights_202102_0.pdf

easy and readily available Internet access at home and on the go, and productivity increases in enterprises as they increasingly rely on LIPD RLAN in their business operations.

From Cisco's perspective, enterprises (governmental, non-profit or for profit) are still early in the process of digitizing their operations with wireless connectivity. However, one of the outcomes of the global pandemic of the past year has been an acceleration of digital transformation initiatives. It is now recognised that what can be delivered digitally, now *must* be delivered digitally.

As an example, the "Internet of Things" remains an enormous opportunity for improving business processes and the connectivity between "things" that will be wireless, as well as powering more and better connectivity to the Internet. Cisco has a large hospital customer in Houston, Texas that sees 35,000 unique devices on its network each day. These range from staff smartphones to connected video screens, medical devices, nursing stations, security systems, and more. While not every customer is so deeply digitized today, there is no question of the direction and trend toward increased use of wireless in many business sectors.

Countries that ignore the need for robust class licensed wireless connectivity for RLAN will lose their competitive edge over time. The European Radio Spectrum Committee, in their own review, have noted that 6 GHz is "necessary to ensure that sufficient spectrum resources are made available on a harmonised basis to support a long-term future for new generations of WAS/RLAN technologies." Industry has responded to the evolving demand landscape by producing a wholly new technology generation, Wi-Fi 6E. Regulators can now do their part by opening the 6 GHz band for license-exempt use.

2. *Should the ACMA proceed, as proposed, to consult on a formal variation to the LIPD class licence that adds the frequency range 5925–6425 MHz for RLAN use, bounded by the parameters described in the ACMA's preliminary view section of this paper?*

We believe that ACMA should proceed to add the new frequency range for LIPD RLAN use. However, ITU Region 3 (unlike ITU Region 1) is not bound only to the lower 500 MHz and may – like Korea, the US, Chile, and Peru – consider the full band. As such, we recommend that ACMA make available the entire 6 GHz band (5925-7125 MHz) for LIPD RLAN use. In doing so, ACMA will join a growing group of regulators opening the band for license-exempt use.

Europe will open 5925-6425 MHz to license-exempt RLAN this year. The European Commission process is winding down, and publication of the European Commission's ruling is expected in May 2021. CEPT member states will then be moving to implement changes in their national regulations by December 1, 2021. Non-CEPT countries have already opened the spectrum (United Kingdom) or launched consultations to do so

(Norway, Turkey). Europe's constraint, and the reason it did not proceed to open the full band, is the existence of an outstanding ITU Region 1 study question on whether IMT can coexist with incumbent fixed satellite uplink services and/or fixed microwave services in the upper portion of the band. It is far from clear what the conclusion of such a study might be, but it appears questionable whether traditional IMT access networks could be deployed successfully to coexist with the incumbents. For example, in the United States, the mobile industry did not propose coexistence – they proposed clearing. The US FCC declined that approach, citing complexity, uncertainty and the length of time to bring the band into use. To our knowledge, no nation has designated 6425-7215 MHz for IMT at this time.

Moreover, many nations in North, Central and South America as well as the Middle East have adopted or are evaluating the full 6 GHz band. Major economies such as the United States, Brazil, South Korea and Saudi Arabia have concluded that the entire band should be made available for license-exempt use under conditions that protect incumbents. Peru, Chile, Costa Rica, Honduras and Guatemala have also allocated the full band. Many more countries – Canada, Mexico, Colombia, Costa Rica, Oman, Jordan, Qatar – are evaluating the full band.

Equipment is already in the market and can be deployed for the full band once regulators authorize its use. Equipment certifications have begun in the United States, and many products were previewed at this year's virtual Consumer Electronics Show. The Wi-Fi Alliance in January announced the availability of its certification program for 6 GHz. Allocation of this spectrum in Australia, and technical rules to enable equipment homologation, will immediately enable Australian consumers and businesses to take advantage of Wi-Fi 6E equipment in a timescale that aligns with the rest of the world.

In addition, if ACMA adopts similar power levels and other mitigations that other regulators have embraced, it will be possible to add LIPD RLAN to the 6 GHz band without disturbing the ability of incumbents to continue to use the band and to grow their networks. For example, both the US FCC and European Commission (based on the recommendation of national regulators) agree that Low Power Indoor devices will not interfere with microwave communications in the band.

*3. If class licensing arrangements are to be made in the lower 6 GHz band (by variation to the LIPD class licence), should alternative/additional power limits and/or other conditions be considered?*

The discussion paper refers to a 24 dBm and a 11 dBm/MHz PSD limit for Low Power Indoor (LPI) devices or access points. This is the same as the power limit adopted by the UK Ofcom in its 6 GHz decision. Cisco supports this proposal, while acknowledging that the power level is conservative, as will be discussed below.

With respect to power levels, Cisco agrees that regulators need to consider both total EIRP as well as PSD. In Cisco's view, regulators should either proceed on the basis of establishing a constant EIRP and letting PSD scale by bandwidth, or establish a constant PSD and let EIRP scale by bandwidth. This is important to ensure that the spectrum can be usefully deployed in the channel configurations supported by Wi-Fi 6E. For LPI, ACMA has proposed a 24 dBm EIRP limitation and a 11 dBm/MHz PSD limitation. If these are proposed as co-equal limitations on power, the rule will support the use of 20, 40 or 80 MHz channels. However, the rule would fail to support the use of 160 MHz channels, or when the 7th generation of Wi-Fi arrives, 320 MHz channels. Table 1 will help to illustrate the problem.

Table 1:

| Power limit | 20 MHz channel | 40 MHz channel | 80 MHz channel | 160 MHz channel | 320 MHz channel |
|---|---|---|---|---|---|
| 24 dBm EIRP | 11 dBm/MHz PSD | 8 dBm/MHz PSD | 5 dBm/MHz PSD | 2 dBm/MHz PSD | -1 dBm/MHz PSD |

For manufacturers to abide by a constant 24 dBm EIRP limit, and a maximum 11 dBm/MHz PSD, channel widths of 160 MHz or more (highlighted in yellow in Table 1) would contain too little power to be useful in any deployment that is analogous to the LIPD RLAN deployments now available in 5 GHz. Stated differently, the 80 MHz channel with its 5 dBm/MHz PSD is at the boundary of usefulness. A greenfield deployment of Wi-Fi 6E in theory could utilize 2 dBm/MHz if the customer is willing to accept deployment of denser access points (which would likely raise cost), but in a "brownfield" deployment with existing 5 GHz access points, the network topology for the existing 5 GHz access points (i.e., where they are located within the enterprise) would likely be too far apart from each other to support a 160-megahertz wide Wi-Fi 6E channel. To the enterprise or government customer, this means a requirement for entirely new Ethernet cabling to support Wi-Fi 6E. Once industry delivers Wi-Fi 7, the problem will become worse, not better. As a result, deployments will likely stay with the existing 40 MHz or possibly 80 MHz channel width. One of the key benefits of Wi-Fi 6E – namely, wider channelization to enable extremely short bursts of large amounts of data – will be lost.

Alternatively, setting a constant PSD and allowing EIRP to scale is also an option, per Table 2 that summarizes the US FCC decision.

Table 2:

| Power limit | 20 MHz channel | 40 MHz channel | 80 MHz channel | 160 MHz channel | 320 MHz channel |
|---|---|---|---|---|---|
| 5 dBm/MHz | 18 dBm EIRP | 21 dBm EIRP | 24 dBm EIRP | 27 dBm EIRP | 30 dBm EIRP |

To reiterate, if the "constant PSD" option is selected, the proposed rules point to the use of only 20, 40 or 80 MHz channels. The 160 MHz channels and 320 MHz channels will not be possible as they would breach the power limitation. In Cisco's view, if the ACMA wishes to utilize an approach based on PSD, then EIRP should be permitted to scale by bandwidth to allow industry to take advantage of the wider channels that are one of the integral design components of Wi-Fi 6E. The power spectral density would remain the same no matter the channel size. If this option is considered, ACMA should give some consideration to an 8 dBm/MHz PSD, as the US FCC is now doing in a further consultation. The higher PSD will enable better use of 6 GHz within residential homes and small business without resort to Wi-Fi range extenders.

Moreover, ACMA should note that the US FCC's selection of 5 dBm/MHz is inextricably tied to the availability of Standard Power devices that will be actively managed to prevent interference to incumbents. By making the PSD rule as low as 5 dBm/MHz, the FCC gave a very strong incentive for providers to develop and utilize automated frequency coordination mechanisms to pro-actively avoid incumbents, since the power differential is large. As Cisco has subsequently conferred with customers in the cable industry, there is a strong concern that 5 dBm/MHz is not sufficient for "whole home" coverage, and that 8 dBm/MHz would better align with their business model and needs.

Finally, ACMA should consider authorizing Standard Power devices at 36 dBm, subject to further consideration of methods to avoid incumbent services. While the US FCC directed industry to develop automated frequency coordination technology to protect incumbents, it is unclear if that solution is appropriate for Australia. Other solutions may be available, such as simple registration of Standard Power devices that requires coordination of channels in use.

4. *Is it appropriate to consider inclusion of the upper 6 GHz band (6425–7125 MHz) in the LIPD class licence or should this be deferred to monitor future developments (for example, in the wide-area International Mobile Telecommunications (IMT) space) as outlined in the ACMA's preliminary view? We invite comments from submitters on the utility of the band for IMT use.*

We encourage ACMA to make the entire 1200 MHz in the 6 GHz band (5925-7125 MHz) available for LIPD RLAN use. This will provide for fourteen (14) 80 MHz channels and seven (7) 160 MHz channels. Not only does this better support the continuing need to manage video streams, it also better supports high density deployments using 5-7 channels simultaneously. Just as fixed broadband speeds continue to rise with the advent of new technology, and mobile networks become more capable with the introduction of 5G, so too must the latest generation of Wi-Fi have access to increased spectrum to meet the needs of consumers and businesses, whether Wi-Fi is at the edge of a fixed broadband network or is being used to offload mobile traffic.

Cisco approaches the question of "how much spectrum" from the perspective of designing networks that function in business, industry, government, schools and hospitals. Today, in Wi-Fi design analysis for 5 GHz, with a typical density of 1 access point (AP) for every 12m (111m2), 40 MHz channels can be supported effectively, even on an ETSI 40MHz channel plan — though requiring proper channel design to minimise overlap and techniques such as tuning receivers in when they start packet detection.

However, there is an increasing need to support higher density designs due to the steep growth in the number of devices per user and the higher bandwidth applications used by those devices, as well as designs to support location-based services. While it would be ideal to simply deploy APs more densely, there are practical obstacles to doing so. Reducing AP spacing by as little as 1m, e.g., 1 AP every 11m (93m2), results in channel reuse which adversely impacts the bandwidth benefit of 40 MHz, affecting signal quality in both a decrease in throughput and an increase in latency. This adversely impacts voice and video applications. As a result, in the 5 GHz bands available today, normal enterprise wireless deployments rarely utilise 80 MHz because it results in poor network quality as compared to the 40 MHz design. However, with both applications and client devices consuming more bandwidth with every new iteration, Wi-Fi networks in dense deployments will not be able to keep up with that evolution supporting the rich media applications that users now expect if they are constrained to 40 MHz channelization, even using Wi-Fi 6 technology in the 5 GHz band.

To solve the bandwidth crunch, the full availability of 5925-7125 MHz is necessary. The additional 1.2 GHz of channels provided by Wi-Fi 6E provides a roughly equivalent number of 80 MHz channels in 6 GHz as there are 40 MHz channels in 5 GHz. For the first time, 80 MHz would be possible from a best practice perspective in dense deployments. Where only 500 MHz is made available, networks would effectively need to operate in a manner similar to the 5 GHz scenario. While it is true that the benefit of 500 MHz would be that the spectrum is "greenfield" and not home to older, less efficient technology, the channelization in these deployments would continue at 40 MHz. In countries allowing just 500 MHz, users would not be able to take full advantage of the benefits of Wi-Fi 6 in the 6 GHz band, and the brunt of that burden in terms of lesser quality and congestion will fall on users of Wi-Fi in enterprises, schools, transportation hubs and other public venues.

It is not at all clear what results will arise from Region 1's efforts to evaluate whether IMT can coexist with satellite uplink or fixed microwave. Thus far, we have not detected a consistent message from the IMT community about how they might utilize the band, which probably reflects the issues that a traditional wide-area IMT deployment would present with respect to coexistence. When the IMT proponents submitted their proposal to the US FCC, it was to clear the upper band of incumbents. The FCC rejected the plan as too costly, complex, and uncertain, and inconsistent with its views of the need for license-exempt spectrum. Since that decision, we have seen individual companies within the IMT community attempt to describe 6 GHz services that would not require clearing. But these have not been consistent so far, and perhaps we will see them gravitate toward a single answer soon. But whatever their answer is, licensed IMT in the 6 GHz band at a minimum reduces the opportunity to utilize the band for fixed microwave services, while license-exempt does not. In comparison, license-exempt is an underlay, and has no spectrum rights as against licensed services. Incumbents would continue to be able to grow and evolve their networks as they wish.

In Cisco's view, the Saudi Arabia CITC got it right in their consultation:

> *"The substantial amount of licensed TDD mid band spectrum already being made available for IMT and 5G. With the release of the 3800 – 4000 MHz band, a total of 890 MHz will be available in large contiguous channels for exclusive IMT use across 2300 MHz, 2600 MHz and 3400 – 4000 MHz. CITC believes that this bandwidth will be sufficient to cover the mid-band spectrum needs of IMT for the foreseeable future. We note that the situation is different in the EU where less exclusive mid-band spectrum (in particular in TDD configuration) is available for IMT. On the other hand, countries with substantial exclusive mid-band spectrum for IMT (such as South Korea) have decided to release the entire 6 GHz band for license-exempt use.*
>
> *"The existing mid-bands for exclusive IMT use have robust ecosystems already as well as superior propagation characteristics. If mobile operators want to access the 6 GHz band, they can do so on a license-exempt basis using NR-U (which 3GPP has defined as band n96)."*

For the moment, no country or international body has concluded IMT could be supported in the band consistent with the incumbent uses there. The European regulatory community remains concerned about licensed microwave systems that have only recently migrated into the band. FSS uplink remains a universal concern. On the other hand, license-exempt equipment is already entering the marketplace and growing quickly. ACMA would be well served by opening the entire band to license-exempt use.

5. *Should standard power (that is, higher power devices, including for outdoor use) operating under a dynamic spectrum access system such as the automatic frequency coordination (AFC) system adopted in the USA, be adopted in Australia for some or all of the 6 GHz band? Is there an appetite and capability for industry to provide the necessary systems to enable such use? We welcome views and evidence on the commercial and technical feasibility of introducing AFC systems in the band.*

ACMA should consider how to deliver standard power, which will be important to enterprise use of 6 GHz.

The AFC system was needed in the US because they have over 100,000 fixed links, with modifications to those links, and new links being established all the time. Moreover, the FCC has a searchable database of license information that is available to inform an AFC on a regular basis of the existence of an incumbent link and the associated frequencies in use. Around the globe, there is significant variance between countries on the number of links that are licensed, and how often changes are made. In some countries, links are being migrated into the 6 GHz band from other bands. In some countries, the link counts are static. For countries where link counts are not large, and the licensing is relatively static, a database approach such as the AFC is not necessary. In such cases, a regulator could consider a "light licensing" or registration system (not conferring any license rights, but just for the purpose of creating a coordination requirement and a searchable record). Should a higher priority fixed operator wish to establish a link, it becomes possible to coordinate with the Standard Power registrant to ensure that there is no interference to the fixed service.

If ACMA considers that its incumbent base is large, constantly changing, or evolving in a direction that is like the US environment, then an AFC system would be helpful. Fortunately, the FCC has already authorized such a system and created the rules for it that specify the outcomes – namely creating of a –6 dBm protection zone for the link receiver, using the propagation models specified by the FCC. Significantly, the FCC's rules did not result in an AFC being created – much work remains to be done by relevant industry forums to provide standards guidance. The FCC will also need to decide how to test AFCs to determine whether a candidate AFC actually produces the outcomes the FCC has specified. That work is now underway and should be completed in 2022. The ACMA could adopt rules similar to the US, allow the US process to complete, and once commercial AFCs are available, those entities could present their AFCs to ACMA for authorization and approval in Australia. This assumes the availability of fixed link data in digital form in sufficient detail to calculate a protection zone.

Whether ACMA chooses a registration or AFC approach, either approach ensures that outdoor unlicensed operations will not interfere with FS operations. The key benefit, of course, is enabling use cases to the benefit of Australian citizens and business, as standard power operations will have more power capability than low power indoor, and will be available for outdoor deployments across a range of enterprises from stadiums to ports or other industrialized settings.

*6. Should the higher power regulatory arrangements and associated interference mitigation measures added to the International Telecommunication Union (ITU) Radio Regulations at WRC-19 (see Resolution 229 (Rev WRC-19)) in the 5 GHz band be included in any amendment to the LIPD class licence?*

Cisco supports re-aligning the rules for 5150-5250 MHz to support 1W and outdoor use with an elevation mask. The current rule, of 200 mW indoor only, does not provide robust networking for RLANs, either for residential or enterprise use. The US FCC adopted its rule specifying higher power and an elevation mask in 2014. Since that time, Globalstar has repeatedly attempted to argue that its satellite system is being degraded by the presence of higher power and outdoor RLAN. Unfortunately, Globalstar's studies amount to nothing more than an "if/then" exercise that contain methodological flaws and ultimately rely strongly on speculation. They have not presented evidence that their system has been degraded. We therefore strongly recommend adoption of 1W, outdoor use subject to the US FCC elevation mask that:

> *"For an outdoor access point operating in the band 5.15 – 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm)."*[5]

Cisco also would like to note that Canada was concerned that the elevation mask would not necessarily protect Globalstar due to the different angle presented by higher northern latitudes. For that reason, Canada opted for a registration system. Unfortunately, Canada only made that registration system open to operators, making the higher power and outdoor use unavailable to enterprises. If ACMA chooses a path like Canada's, we urge ACMA not to make the same mistake. Enterprise networking requires outdoor spectrum for many applications.

**Conclusion**

Cisco appreciates the opportunity to provide the above input to ACMA on the questions raised. This topic is important for the future of Australia, for connecting citizens and accelerating the industry digitalisation of your economy. We would be happy to discuss further on any further questions or follow up that you may have.

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[5] Code of Federal Regulations Title 47 § 15.407 - General technical requirements at (a)(1)(i).