Hewlett Packard Enterprise

May 5, 2021

The Manager
Spectrum Planning Section
Australian Communications and Media Authority
P.O. Box 78
Belconnen ACT 2616

VIA ELECTRONIC FILING

Reference: RLAN use in the 5 GHz and 6 GHz bands- Consultation 12/2021

Chuck Lukaszewski
Vice President
Chief Wireless Technologist

chuckl@hpe.com
+1.408.227.4500

COMMENTS OF HEWLETT PACKARD ENTERPRISE

Hewlett Packard Enterprise ("HPE") submits these comments in response to the consultation from the Australian Communications and Media Authority ("ACMA") on licence-exempt use of the 6 GHz band.[1] HPE strongly supports the ACMA moving to open that band to the rapidly expanding ecosystem of 6 GHz-capable devices now coming to market. Making the 6 GHz band available on a Class Licence basis is an important opportunity for Australia to support broadband connectivity in both 5G and next generation networks and will open the door to a host of new and innovative use cases. However, to realize the full impact of the 6 GHz band, it is of the greatest importance that the ACMA make the full 1,200 MHz (5925 MHz to 7125 MHz) available for RLAN use.

HPE is one of the world's largest providers of managed wireless local area network ("WLAN" or "RLAN") infrastructure and is a global leader in the Wi-Fi equipment marketplace. HPE's Aruba business unit ships millions of indoor and outdoor Wi-Fi access points ("APs") every year, representing approximately 15% of the global market for such devices. We have been a significant provider of WLAN equipment to Australian enterprises and service providers for nearly two decades. For example, Aruba has been the sole Wi-Fi supplier to the New South Wales Department of Education (DoE) since 2008, supporting its one-to-one initiatives in every elementary, middle and high school in that state.

We are particularly encouraged by the ACMA's recognition of the importance of outdoor use cases and the question regarding an automatic frequency coordination (AFC) regulatory framework. HPE is the second largest provider of outdoor RLAN equipment in the world (by revenue) and as such we look forward to delivering AFC capable products to the Australian market.[2] HPE provides mission-critical outdoor Wi-Fi equipment to a broad set of industries, including mining, petrochemical, hospitals, K-12 schools, universities, sporting facilities and government agencies across Australia.

[1] "RLAN use in the 5 GHz and 6 GHz bands- consultation 12/2021" at https://www.acma.gov.au/consultations/2021-04/rlan-use-5-ghz-and-6-ghz-bands-consultation-122021 ("Discussion Paper").
[2] Wireless LAN Infrastructure (WLAN) Quarterly Market Report and Forecast, 650 Group, 3Q2020

3333 Scott Boulevard
Santa Clara, California 9505

In this proceeding, HPE has partnered with a broad group of equipment manufacturers, software makers, and internet service companies that are working together to make the 6 GHz band available for licence-exempt use ("the RLAN Group") around the world. HPE supports the comprehensive comments filed by this group (the "Joint Filers"). In addition, HPE fully supports comments of the Wi-Fi Alliance (WFA), the Wireless Broadband Alliance (WBA), and the Dynamic Spectrum Alliance (DSA) filed in response to the ACMA's Consultation. We submit these individual comments to highlight issues where HPE has specialized insight and equities.

Q1: What is the demand for spectrum for RLAN use in the 6 GHz band (5925–7125 MHz)?

Other commenters are providing the ACMA with market statistics that directly answer this question. HPE offers these additional insights from our position serving the enterprise and managed services markets.

In a nutshell, Wi-Fi 6E is expected to generate the largest wave of wireless technology refresh in two decades – and that is on top of Wi-Fi's unprecedented history of continuous growth. The RLAN industry is moving rapidly to deliver Wi-Fi 6E certified products in 2021, now that at least 11 countries have formally opened the band for licence-exempt use. [3] Chipmakers announced and began sampling 6 GHz radios products as early as last January. [4] Multiple low power indoor (LPI) consumer-oriented 6 GHz capable routers were introduced at the 2021 Consumer Electronics Show in January. [5] And the Wi-Fi Alliance has begun certifying Wi-Fi 6E products, with a total of 30 certified modules and routers listed on its web page as of the ACMA filing deadline. [6] All these announced and shipping products support LPI operation.

The enterprise sector historically follows the consumer sector by six to nine months for new Wi-Fi technology generations. In keeping with that timeframe, HPE expects most major enterprise OEMs to announce and ship one or more Wi-Fi 6E products before the end of 2021 – and possibly as early as the summer. By moving expeditiously, the ACMA can ensure that enterprise RLAN products are available in Australia this year.

Q2. 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?

Yes. HPE broadly endorses the ACMA proposal laid out in the Consultation. However, it must not stop there. As we argue below in our response to Question #4, it is essential that

[3] United States (April, 2020), United Kingdom (July, 2020), South Korea (October, 2020), Chile (October, 2020), United Arab Emirates (December, 2020), Guatemala (January, 2021), Brazil (February, 2021), Honduras (March, 2021), Kingdom of Saudi Arabia (March, 2021), Costa Rica (May, 2021), Peru (May, 2021)
[4] *See* for example: Broadcom; Intel, Qualcomm
[5] *See* https://www.theverge.com/2021/1/11/22203382/netgear-nighthawk-raxe500-wifi-6e-5g-moden-wireless-router-price-release-date , and https://www.linksys.com/us/wifi-6e/
[6] https://www.wi-fi.org/product-finder-results?sort_by=default&sort_order=desc&certifications=1275&keywords=6%20ghz

3333 Scott Boulevard
Santa Clara, CA 95054
U.S.A

www.hpe.com

Australia harmonize with the United States and 8 other countries (and counting) that have opened all 1,200 MHz from the very beginning.

Q3. 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?

HPE endorses the separate comments of the RLAN Group Joint Filers, plus the WFA, WBA and DSA.

Q4. 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.

As the ACMA has so thoughtfully recognized in the Consultation, the amount of spectrum currently authorized for licence-exempt use is insufficient to meet current, much less future, demand for Wi-Fi and other licence-exempt uses. Various filers such as the WFA provide extensive analysis and documentation of the current and projected future situation. To those examples, HPE can add the following market development. Since 2014 – when gigabit-capable Wi-Fi 5 (802.11ac) access points that default to using 80 MHz or even 160 MHz channels became widely available – the vast majority of enterprise and service provider customers intentionally de-feature those products to use narrower 40 MHz or even 20 MHz bandwidths due to the limited amount of spectrum available in the 5 GHz band. As a case in point, this is how the NSW DoE schools are deployed.

The reason for this behavior is that a shared licence-exempt band requires multiple radio channels in order to distribute load and reduce co-channel interference (CCI). It is well known that 2.4 GHz with only 3 channels is heavily congested around the world. This is depicted on the left of Figure 1. This congestion is actually independent of channel size – having just three 160 MHz channels such as Europe is permitting in the lower 6 GHz band will result in the same problem. Both practical experience and academic research over the last 20 years demonstrates that uncoordinated RLANs such as Wi-Fi require no fewer than about seven to nine non-overlapping radio channels to absorb current demand levels, as shown in the middle diagram of Figure 1. For large venue environments with extreme loading levels such as stadia, arenas, university lecture halls, and airports research and years of experience have proven that having 20 or more independent channels enables RLANs to operate successfully and carry unprecedented levels of traffic. Every major Wi-Fi equipment manufacturer has published detailed design guidelines for such environments calling for 20 MHz channels to be used for large venues. [7]

[7] *See* "Very High Density 802.11ac Networks", Aruba Networks, 2015, https://higherlogicdownload.s3.amazonaws.com/HPE/MigratedAssets/Aruba_Very_High_Density_802.11ac_Networks_VRD.zip

3333 Scott Boulevard
Santa Clara, CA 95054
U.S.A

www.hpe.com

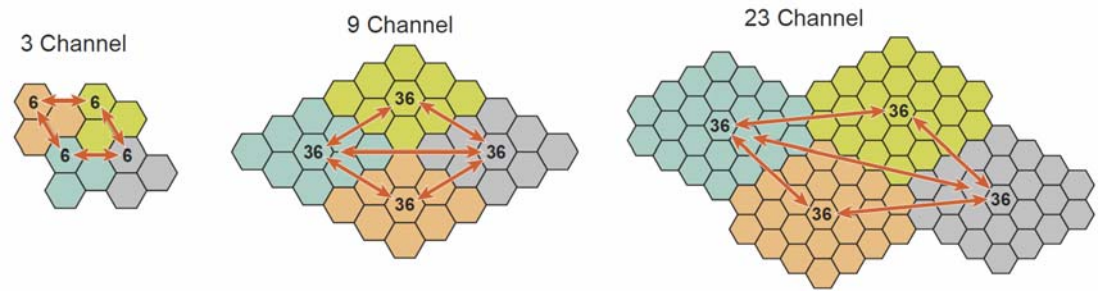

Figure 1. Inter-Cell Distance Increases With Available Channel Count

The mechanism behind this phenomenon is that having fewer channels increases the probability of collisions between co-channel radio cells, even at low load levels. An obvious basic reason for this shown in Figure 1 is that RLANs with small inter-cell distances can hear many more RLANs. But a more subtle effect is the resulting rise in the noise floor from "hidden" RLAN cells. This reduces the available signal-to-noise level, which in turn reduces the data rate, thereby making each transmission take longer and further increasing the collision probability. By contrast, having more channels both reduces the absolute number of audible co-channel cells, and helps keep the noise floor near the thermal limit, which maximizes data rates and clears channels of data more quickly. This attribute of self-coordinating RLANs enables them to absorb extremely high demand surges.

COUNTRIES THAT OPT FOR 500 MHz OF LICENCE-EXEMPT SPECTRUM WILL NOT SEE WIDESPREAD ADOPTION OF GIGABIT-CAPABLE 80-MHz CHANNELS

The reason that most Wi-Fi system owners disable wide channels in 5 GHz is that there are not enough 80 MHz channels in most countries. As a case in point, in Australia there are only five usable 80 MHz channels indoors, of which three require DFS. Outdoors there are only three available 80 MHz channels in Australia. This is not nearly enough to make a working system, but there are ten 40 MHz channels available and twenty-two 20 MHz channels. Wi-Fi system owners in Australia are better off to use one of those narrower widths, which will deliver much better system performance. However, this means sacrificing higher data rates – limiting peak performance to under 600 Mbps for a typical device in optimal RF conditions for 40 MHz. Gigabit speeds are not possible with less than 80 MHz channel widths in Wi-Fi.

As evidence of this widespread behavior, HPE is providing the ACMA with statistics on our own customer base. In Figure 2 you can see that over a sample of 500,000 enterprise APs in North America, only 9% are running gigabit-capable 80 MHz channels, while 51% are using half-width channels, and fully 40% of HPE customers studied are using 20 MHz channels. This data set excludes public venues but does include significant higher education, K-12 and healthcare deployments. We are unable to break out separate data for Australia at this time but the proportions are similar. Cisco has also published similar results, which showed that 89% were using 40 MHz or 20 MHz channel widths, and only 11% were using 80 MHz. [8]

[8] Brian Hart el. al., *Recommended Direction for EHT*, Cisco, (Sept. 9, 2018), https://mentor.ieee.org/802.11/dcn/18/11-18-1549-00-0eht-candidate-technology-review.pptx

3333 Scott Boulevard
Santa Clara, CA 95054
U.S.A

www.hpe.com

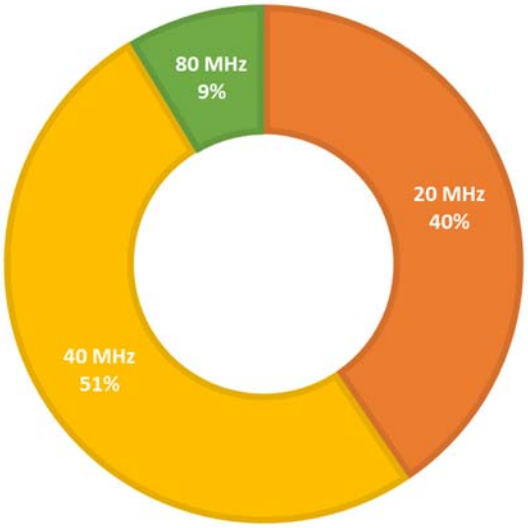

Figure 2. Deployed Channel Widths of 500,000 HPE Customer APs in North America

Returning to the question asked in the Consultation, the first reason that it is so vital that the ACMA proceed with opening the full 1,200 MHz for RLAN devices is that this will permit seven 160 MHz channels and fourteen 80 MHz channels. In countries that take this step, HPE anticipates that its customers will default to multi-gigabit capable 160 MHz channels because seven channels is enough for most RLAN operations, with some backing down to 80 MHz only in high CCI environments.

1,200 MHz IS NECESSARY TO ENSURE THAT OUTDOOR AFC-CONTROLLED NETWORKS HAVE ENOUGH CHANNELS FOR A VIABLE SYSTEM

In our response to Question #5 below we explain why the ACMA should permit outdoor standard power APs under AFC control. But in the context of a decision to adopt 1,200 MHz there is another critical reason why the ACMA should not stop at 6425.

In most cities in developed countries, the existing FS deployments preclude AFC operation on at least some channels, and in areas of dense FS utilization there may be few if any channels at all. For example, here is one sample AFC calculation using an HPE prototype for a hypothetical outdoor RLAN in San Francisco shown in Figure 3.

3333 Scott Boulevard
Santa Clara, CA 95054
U.S.A

www.hpe.com

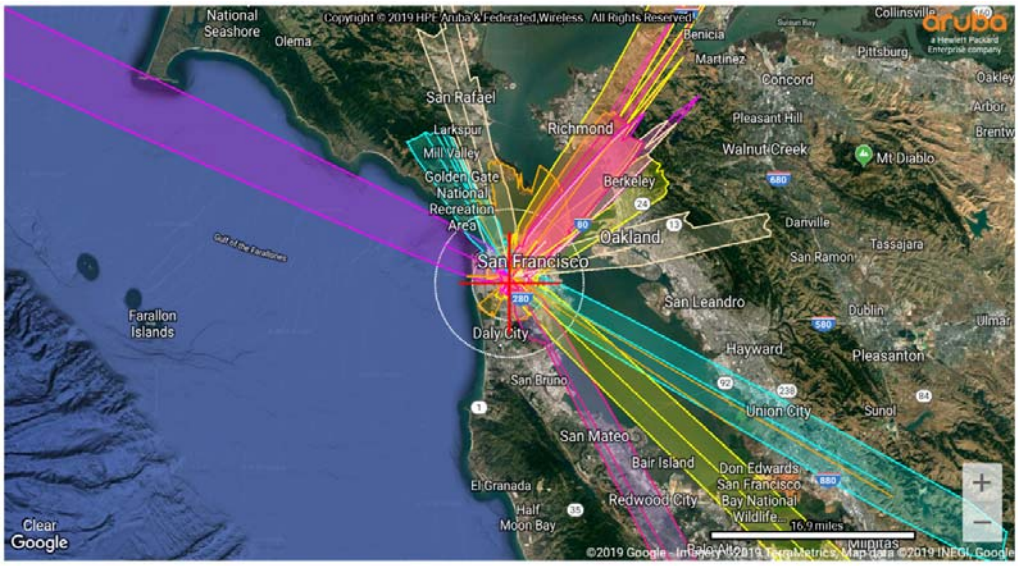

Figure 3. Incumbent Protection Contours Applied to a 6 GHz RLAN in San Francisco

Each of the colored shapes is the calculated protection zone in front of an FS receiver that is applicable to the RLAN. The resulting spectrum availability at this location is shown in Figure 4. Only four 80 MHz and one 160 MHz channels are possible at this location. This scenario is typical of major cities in North America, and availability can be even more constrained in some locations in these cities.

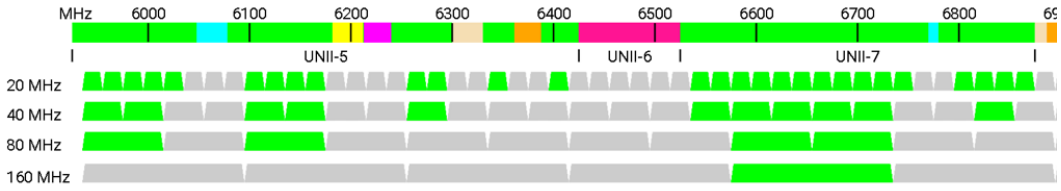

Figure 4. AFC Calculated Spectrum Availability for 6 GHz RLAN in San Francisco

With only 500 MHz of authorized licence-exempt spectrum, these local variations in spectrum availability could render 6 GHz unusable for standard power operation. The additional channels that would be available for standard power operation by permitting RLAN use across all 1,200 MHz will be the difference between having enough channels (of any bandwidth) to operate a network at a given location.

3333 Scott Boulevard
Santa Clara, CA 95054
U.S.A

www.hpe.com

Hewlett Packard
Enterprise

Q5. 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.

Yes!

Fixed and mobile AFC devices – including bundled AFC database services – will be primarily delivered by enterprise vendors like HPE. While outdoor RLANs comprise no more than about one-half of one percent (0.5%) of total consumer and enterprise annual access point shipments by unit volume, virtually all these APs are sold to enterprises. As a percentage of the enterprise market, the outdoor segment is approximately 4% of the units shipped and over 6% by revenue – comprising over U.S.$400 million. [9] All of which is to say that this is a substantial market segment and the ACMA should expect prompt product announcements in this area. Given HPE's role in this market, we fully intend to make outdoor Wi-Fi 6E products available in every country that permits such operation.

HPE has been deeply involved in both the development of AFC technical standards as well as the creation of prototypes. We partnered with Federated Wireless to build and demonstrate a working AFC system to the U.S. Federal Communications Commission (FCC) on October 1, 2019. [10] Federated subsequently announced the availability of its AFC for equipment manufacturers to begin product development. [11] The final rules adopted by the FCC should result in a thriving ecosystem of AFC implementations, some from equipment OEMs and some from third parties like Federated that are already certified to provide spectrum database services for TV whitespace and the U.S. Citizen's Broadband Radio Service (CBRS).

The Wi-Fi Alliance is also working hard to produce the technical specifications that will enable AFC devices and AFC system operators to function. WFA publicly stated in the U.S. 6 GHz multi-stakeholder process that it will deliver candidate certification procedures for AFC devices and systems for evaluation by national regulators later this year.[12] The ACMA should be able to rapidly progress as a result.

HPE advises the ACMA that its planning assumptions should forecast availability for testing of both AFC-capable devices and AFC system operators by the first half of 2022. As a result, Australia is right to consider including outdoor standard power RLAN operations in its initial rules. Indeed, by broadening the market for AFC devices Australia is uniquely positioned to help accelerate both the introduction of affordable AFC solutions, and to take a global leadership position by driving adoption of outdoor RLAN operations in the Pacific region.

[9] Wireless LAN Infrastructure (WLAN) Quarterly Market Report and Forecast, 650 Group, 3Q2020
[10] https://ecfsapi.fcc.gov/file/100302586574/2019-10-01%20OET%20AFC%20Demo%20Ex%20Parte.pdf
[11] https://federatedwireless.com/federated-wireless-extends-spectrum-controller-to-the-6-ghz-band-to-accelerate-wi-fi-6-and-5g-service-delivery/
[12] *See* "Wi-Fi in 6 GHz", presentation to U.S. Multistakeholder Group, https://groups.wirelessinnovation.org/wg/6MSG/document/8227

3333 Scott Boulevard
Santa Clara, CA 95054
U.S.A

www.hpe.com

Hewlett Packard
Enterprise

HPE strongly supports maximum regulatory alignment and harmonization. The RLAN Group was gratified that the final AFC rules adopted by the FCC were identical in all substantive respects to longstanding industry positions argued in the record. The ACMA should model its rules on the following core aspects of the AFC regime adopted by the U.S.:

- The AFC should protect fixed-service ("FS") receivers from RLAN signals that would exceed -6 dB I/N on a single-entry basis.
- No aggregate interference protections are required;
- Multiple entities will be permitted to operate independent AFC implementation, without burdensome AFC-to-AFC synchronization or registration requirements
- The hybrid path loss model specified by the FCC
- AFC implementations should base their interference-protection calculations for the protection of FS links on data held by the regulator
- AFC implementations should provide interference-protection assessments in three dimensions—i.e., taking both FS receiver and RLAN transmitter height into account;
- The AFC should perform interference-protection assessments using accurate terrain, clutter, and both FS and RLAN antenna patterns whenever that information is available or, when it is not available, using conservative models;
- The ACMA's rules should be technology neutral with respect to the geolocation techniques that an AFC-controlled access point may employ, so long as a device is capable of determining its uncertainty in meters at a 95% confidence level.
- Both AFC system operators and AFC-controlled devices, should be subject to robust security requirements to ensure that AFC functionality is not modified or circumvented.
- 24 hour AFC recheck interval, and grace period for an AFC device unable to reach its AFC system until midnight of the following day.
- Limitation on the identifying information that must be exchanged between an AFC device and AFC system to a regulatory device certification identifier and a device serial number or other identifier, along with the required geolocation information.
- Permit the AFC to return a range of spectrum availabilities at different allowable EIRP levels
- No requirement for an AFC device to report its operating state to the AFC system, including channel selections or changes

HPE thanks the ACMA for issuing this Consultation, and commends its careful approach to opening the 6 GHz band to licence-exempt operations. We are working hard to build and ship products that will make the 6 GHz band a success. The framework proposed in the Consultation – augmented by specific proposals made by HPE herein – will allow for the greatest possible impact of the band while protecting licencees from harmful interference.

Respectfully Submitted,

Chuck Lukaszewski
Vice President & Chief Wireless Technologist

3333 Scott Boulevard
Santa Clara, CA 95054
U.S.A

www.hpe.com