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VIA EMAIL: Radio.Spectrum@mbie.govt.nz

Radio Spectrum Management Policy and Planning
Ministry of Business, Innovation and Employment
PO Box 2847
WELLINGTON 6140

RE: **WLAN use in the 6 GHz band**

COMMENTS OF: Apple Inc, Broadcom, Inc., Cisco Systems Inc, Facebook Inc, Google LLC, Hewlett Packard Enterprise, Intel Corporation, Microsoft Corporation and Qualcomm International Inc.

Contents

Introduction

The undersigned companies, representing a cross section of the world's leading silicon vendors, system manufacturers, and application providers, welcome this opportunity to submit comments in response to the public consultation of New Zealand's Radio Spectrum Management (RSM) regarding wireless local area network (WLAN) use in the 6 GHz band.[1] We strongly support the RSM's proposal to make the 6 GHz band available for license-exempt WLAN use. Making the 6 GHz band available on a license-exempt basis is an important opportunity for New Zealand 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 reap the full potential of the 6 GHz band and the device ecosystem that is developing in this band, we respectfully request

[1] Radio Spectrum Management, WLAN Use in the 6 GHz band, Discussion Document (June 2021) *at* https://www.rsm.govt.nz/projects-and-auctions/consultations/planning-for-wlan-use-in-the-6-ghz-band/.

that the RSM make the full 1200 MHz (5925 MHz to 7125 MHz) available via General User Radio Licence for Short Range Devices (GURL-SRD).

As detailed in response to the RSM's specific consultation questions below, we recommend three classes of devices, along with their technical operating parameters, in the 6 GHz band: (1) low power indoor (LPI); (2) very low power portable (VLP); and (3) standard power with automated frequency coordination (AFC). These recommendations are based on numerous technical coexistence studies with incumbent users undertaken in Europe and the United States. By adopting these three device classes and the recommended technical parameters, the RSM would maximize the utility of the 6 GHz band, while also protecting incumbent users from harmful interference.

Responses to the RSM's Consultation Questions:

Q1. Do you agree with RSM's proposal on making the 5925 - 6425 MHz available for WLAN use?

Yes, we support the proposal to open 5925-6425 MHz to license-exempt WLAN use, but we believe it would be a grave mistake to postpone a decision on 6425-7125 MHz for license-exempt WLAN. We urge RSM to promptly consider the full 6 GHz (5925 – 7125 MHz) band for WLAN use on a technology neutral basis via appropriate amendment to the GURL-SRD.

When regulators propose the lower 500 MHz of the 6 GHz band, they generally explain their proposal by pointing to Europe, since there is little else to point to when most non-European jurisdictions have opened the full 6 GHz band to license-exempt use. Europe's 2017 decision to evaluate the lower 500 MHz of spectrum was based on genuine but parochial concerns by a few countries, mostly those that were in the process of migrating narrow band fixed links from other bands into the upper portion of the 6 GHz band. To conserve regulatory administrative resources and to ensure that these narrow band fixed link transitions were completed properly, which then would allow for coexistence to be studied, these countries requested that the license-exempt study be restricted to 5925-6425 MHz. Other countries, however, proposed opening the full 6 GHz band to license-exempt use or suggested 5925-6725 MHz for the scope of the coexistence study.[2] European regulators opted for a "lowest common denominator" approach, resulting in the initial study of 5925-6425 MHz. When the European Commission issued a final revision to the study mandate to reflect the compromise, it said:

> Based on the results of the compatibility and coexistence studies covering the 5925-6425 MHz band to be carried out under this Mandate, *the relevant*

[2] European Union, Radio Spectrum Committee, RSCOM 17-54, "Explanatory document on the draft Mandate to CEPT on RLAN in the 6 GHz band (5925-7125 MHz)," 22 Nov. 2017. At that time, both France and Austria had a migration of FS into upper 6 GHz underway and favored a study up to 6425 MHz. This view was supported by Sweden, Finland, and the Netherlands (the "lowest common denominator" position that was adopted). Germany, Denmark, and Estonia favored a study of the full 6 GHz band, while a third group favored a study up to 6725 MHz.

harmonised technical conditions should enable the coexistence with other systems in this and adjacent frequency bands.

Thus, the initial mandate of the European Commission fully anticipated that once coexistence rules are established for the lower portion of the band, regulators will have completed a significant and relevant portion of the work that would be needed for the upper portion of the band. Understanding the Mandate's meaning requires an understanding of the debate over the size of band to be studied that preceded it – namely, an expectation that the upper portion of the band would and could be studied for license-exempt use in due course.

The approach that European regulators used to define the boundaries of their study in 2017 has no bearing on New Zealand. It was internal-to-CEPT decision-making and should not serve as a limiting factor on how New Zealand studies the 6 GHz band. Nor should it cause New Zealand to fall short of adopting the best public policy outcome possible. Instead, we urge the RSM to evaluate its decision-making from a position similar to that taken by those countries that did not consider Europe's approach to scoping its initial 6 GHz efforts as relevant. We also ask the RSM to follow those regulators' careful consideration of advocacy from the license-exempt community, including the contents of this filing.

Even a cursory examination of recent events demonstrates that global momentum toward opening the entire 6 GHz band for license-exempt[3] WLAN technology has been growing. In 2020, four jurisdictions – the United States, the Republic of Korea, Chile, and Guatemala – took final action to open 5925-7125 MHz to license-exempt use, while many other countries initiated or progressed consultations and studies. Those consultations and studies are now leading a number of jurisdictions to take final action in fully opening the spectrum and/or setting technical rules. Notably, in February 2021, Brazil joined the United States Federal Communications Commission (FCC) in opening the entire 5925-7125 MHz band to license-exempt use, despite vocal opposition to doing so by pro-IMT interests. Likewise, in March, Saudi Arabia's Communications and Information Technology Commission (CITC) announced its decision to open the full 6 GHz band to license-exempt use, becoming the first country in Region 1 to do so. Canada's Innovation, Science and Economic Development (ISED) soon followed in May, announcing that it is opening the full 5925-7125 MHz band as license-exempt. At this time, countries in all three ITU regions have embraced license-exempt use of the full 6 GHz band, with additional decisions expected this year.

Countries opening the full 6 GHz band to license-exempt as of June 2021

Brazil	February 2021	Honduras	March 2021
Canada	April 2021	Peru	April 2021
Chile	November 2020	Republic of Korea	October 2020
Costa Rica	May 2021	Kingdom of Saudi Arabia	March 2021
Guatemala	December 2020	United States	April 2020

[3] In the context of this submission, the terms "license exempt", "unlicensed", "class license", and "general user radio license" are equivalent.

In addition to New Zealand, seven other countries have consultations open or pending decisions to evaluate the entire band, including Mexico, Colombia, Argentina, Jordan, Qatar, Oman and Australia. In May, Mexico's Instituto Federal de Telecomunicaciones (IFT) signaled its tentative conclusion to open the full 6 GHz band to license-exempt use and sought comment on its proposed rules.

By contrast, other than countries in Europe, the list of jurisdictions opting to open only 500 MHz for license-exempt use is quite short: Morocco and the United Arab Emirates. In addition, Europe has published its decision to open the band to license-exempt use, which will enable individual EU countries and non-EU CEPT countries to implement the decision in the coming months.[4]

In all cases, regulators have articulated compelling rationales for expanding license-exempt spectrum to support their broadband access goals. We advise policymakers to open the full band for several reasons – to facilitate deployment of new innovative technologies, to improve broadband access and address the digital divide, and to accelerate economic growth. Those benefits are fully achievable with an approach that opens the full 6 GHz band to license-exempt use, but would fail or be substantially minimized by an approach based on opening the lower 500 MHz only.

Our views on the benefits of opening 5925-6425 MHz to license-exempt use are presented together with the benefits of opening 6425-7125 MHz, in response to Question 2. We also discuss the opportunity cost to New Zealand of a "wait and see" approach to the upper portion of the 6 GHz band. We incorporate by reference our response to Question 2 into our response to Question 1 because the answers are the same for each inquiry.

Q2. What are your views on the potential future use of 6425 - 7125 MHz for new applications (e.g. Wi-Fi or IMT)?

We respectfully request that the RSM consider making the full 6 GHz band (5925-7125 MHz) available for WLAN use. We incorporate by reference our response to Question 1 to avoid repetition. We present our views in five parts. First, we discuss why opening the full 6 GHz MHz band to WLAN technologies via amendment of the GURL-SRD is the best choice for New Zealand, providing new technologies with the spectrum necessary to deliver on current and prospective innovative use cases. Second, by opening just 500 MHz, license-exempt technologies will be unable to support advanced and innovative use cases or support even routine consumer and enterprise networking needs in a few short years. Third, there are important benefits of moving forward with license-exempt use throughout the full 6 GHz band. Addressing the digital divide, innovation in the economy, and improving quality of service are just a few benefits New Zealand can look forward to from this action. Fourth, failure to act brings with it

[4] EU 6 GHz Harmonisation Decision, https://digital-strategy.ec.europa.eu/en/library/6ghz-harmonisation-decision-more-spectrum-available-better-and-faster-wi-fi; Taiwan has issued a consultation on the 6 GHz band for license-exempt use with a focus on 5925-6425 MHz. Technical institute studies are also underway in Japan and India examining opening the full 6 GHz band.

large opportunity costs. Any benefit of reserving a portion of the spectrum for a later decision on whether to allow IMT is essentially nonexistent because no specifications or equipment exist, and significant questions remain about theoretical IMT use. Fifth, we note that the best possible way to support 5G deployment in the 6 GHz band is to authorize license-exempt WLAN to support offloading, facilitate 5G microwave backhaul, and promote New Radio-Unlicensed (NR-U) in the band.

I. Today's advanced technologies require 1200 MHz of license-exempt spectrum to meet current and future use case objectives

This section discusses, from a technology perspective, why the entire 6 GHz band should be considered for license-exempt use today. Because increasing numbers of devices are moving through the certification process in other jurisdictions, as well as through the Wi-Fi Alliance's certification process,[5] RSM can act with full confidence that license-exempt devices will be available immediately upon issuance of its decision. By opening the entire band, deployment of the latest and best license-exempt technologies throughout New Zealand will occur rapidly, to the advantage of citizens and businesses alike.

Demand, density, and high bandwidth needs require a new technology approach and the option for full utilization of 5925-7125 MHz frequencies

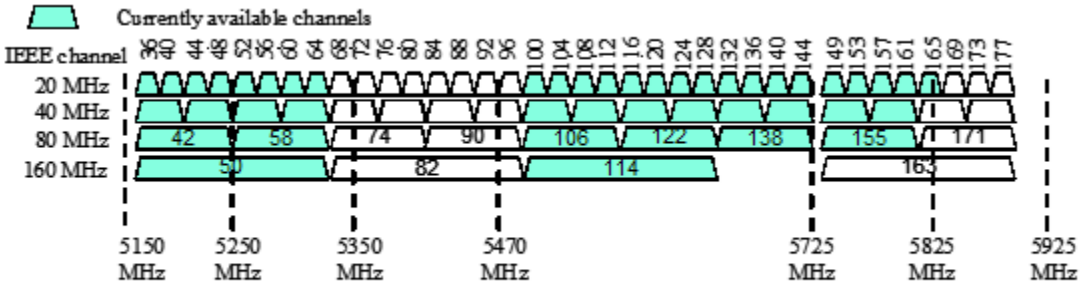
Delivery of broadband access is a continuously evolving challenge. Since broadband access was introduced to consumers in the 1990s, the use of broadband networks, the applications that run on the networks, the throughput capability of devices, and density in device deployment continue in an unrelenting upward trajectory. Most people access their broadband network through Radio Local Area Network (RLAN) devices such as those employing Wi-Fi, thus RLAN access and quality yields broadband access and quality. Companies that develop equipment and networks using license-exempt spectrum must look ahead to future use cases, applications, and demands that are not yet in the market, and do our best to define today a technology that addresses the exponentially increasing consumer and business requirements of tomorrow. Upon RSM adoption of a decision to open the full 6 GHz band for license-exempt use, New Zealand consumers, businesses, and governmental services will be able to take full advantage of the technology evolution that industry has identified. Among other things, a wholly new generation of RLAN technologies in the 6 GHz band will be enabled to address future networking needs for broadband access and beyond.

The last time a significant new allocation of GURL-SRD spectrum for WLAN technology was made available in New Zealand was in the early 2000s, following the 2003 World Radio Conference. This activity opened new bands in the 5 GHz range, which were at

[5] Wi-Fi Alliance Quarterly Beacon: "Wi-Fi 6E Devices Driving Technology Innovation" at https://www.wi-fi.org/beacon/the-beacon/quarterly-update-wi-fi-6e-devices-driving-technology-innovation. Business Wire, "Aruba Introduces Industry's First Enterprise Grade Wi-Fi 6E Router" at https://www.businesswire.com/news/home/20210525005243/en/Aruba-Introduces-Industry's-First-Enterprise-Grade-Wi-Fi-6E-Solution.

that time optimal for earlier generations of WLAN technology such as Wi-Fi 4, and later, Wi-Fi 5.

5 GHz WLAN available channelization today[6]



In the decade-and-a-half since, the equipment used for broadband networking, use cases, applications, and engineering challenges to meet demand have evolved considerably. The number of devices per user is proliferating.[7] The power of those devices – in processing power, screen resolution, video technology (now at 4k/8k HD), camera capability, and antenna functionality just to name a few – is growing.[8] Devices are deployed in increasingly dense residential or enterprise environments, and the broadband networks they connect to, whether wired or wireless, are also greatly improving in throughput and latency. In New Zealand, Cisco projects 9.4 networked devices per capita in 2022, up from 5.2 in 2018,[9] consistent with other leading economies. New applications, such as consumer gaming or enterprise Advanced Manufacturing, demand low latency transmissions. An explosion in Augmented Reality/Virtual Reality/Mixed Reality (AR/VR/MR) technology is soon expected to impact everything from how we learn to how we work and play.[10] Rural Internet access networks that use Wi-Fi (e.g., as part of a 60 GHz mesh) and Wi-Fi at the edge of new low earth orbit satellite constellations are also evolving use cases.

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[6] Important information for users of the Wi-Fi devices in the 5 GHz band (rsm.govt.nz)

[7] Cisco Internet Report at https://www.cisco.com/c/en/us/solutions/executive-perspectives/annual-internet-report/air-highlights.html#
(In New Zealand, there will be 46.5 million networked devices by 2023, up from 24.6 million in 2018).

[8] In 2007 when the iPhone was introduced, it held between 2,000-8,000 songs, had up to 32 Gbps of memory, and had a 3.5 inch screen size with a resolution of 480 x 320. Today's iPhone 12 ProMax holds up to 128,000 songs, has up to 512 Gbps of memory, has a 6.7 inch screen with a resolution of 2778 x 1284, and has more versatile camera capability, powered by a vastly more powerful processor. https://www.lifewire.com/compare-iphone-models-1999430

[9] Cisco Internet Report at https://www.cisco.com/c/en/us/solutions/executive-perspectives/annual-internet-report/air-highlights.html#

[10] See https://www.idc.com/getdoc.jsp?containerId=prUS47012020.

To illustrate the dilemma faced as industry looks to the future, take an example where access points (APs) need to be deployed in a dense configuration, such as a school, manufacturing plant, office, hospital, transportation hub, multi-tenant housing, or stadium. Each of these locations increasingly rely on license-exempt spectrum for their broadband operations. As the demand has increased, Wi-Fi APs have been deployed more densely, adding more capacity within the same overall network area. In general terms, the coverage area for an enterprise indoor AP has decreased from ~500-1000 meters[2] in 2003 (when the last major allocation of GURL-SRD spectrum for WLANs was made in New Zealand), to ~250 meters[2] by 2010, to as little as ~150 meters[2] today. The practical limit of how densely APs can be deployed has been reached due to the resultant increase in radio frequency interference (both co-channel and adjacent channel). The only way to add additional capacity in these situations is through the use of wider channel bandwidths, which RSM would enable by opening the full 1200 MHz of the 6 GHz band to license-exempt use.

Moreover, 40 MHz channel sizes are increasingly insufficient to address the steep growth in the number of devices and higher bandwidth requirements per user. A typical two-stream client device can only achieve up to a 574 Mbps data rate when operating in a 40 MHz channel with Wi-Fi 6. When the channel width is increased to 80 MHz or 160 MHz, the data rate is increased to 1.2 Gbps and 2.4 Gbps respectively, fully enabling the "gigabit wireless" era. *To retain* the current quality of service for users in the future, 80 MHz channels are required; to *increase* the quality of service, 160 MHz channels are required. With those wide channels, radios can get on and off the air more quickly, delivering the high-bandwidth content that users demand while maintaining the ability to share spectrum with other license-exempt transmitters. The lack of wider channels (e.g., 80 MHz and 160 MHz) would create a detrimental impact on real-time voice and video services, and high-bandwidth immersive services such as AR/VR/MR will be starved of sufficient capacity. This will be most pronounced in dense network topologies (e.g., dense urban areas, enterprises) where these new immersive services are expected to launch first. There is no realistic possibility of delivering multiple 160 MHz wide channels on existing 2.4 GHz and 5 GHz spectrum allocations, which are too fragmented and were optimized for now-outmoded generations of WLANs. In a decade where fiber to the home ("FTTH") and 10 Gbps DOCSIS will become widely deployed,[11] and mmWave 5G-NR will provide multi-gigabit FWA services, it is essential that the final Wi-Fi connection to the consumer or business does not become a significant bottleneck. Instead that connection should provide the throughput, latency, and reliability to support next-generation wireless services. The only way that this will be possible is if 80 MHz, 160 MHz, and 320 MHz channel widths are available for use. The 6 GHz band is ideal to address these bandwidth-constraint issues.

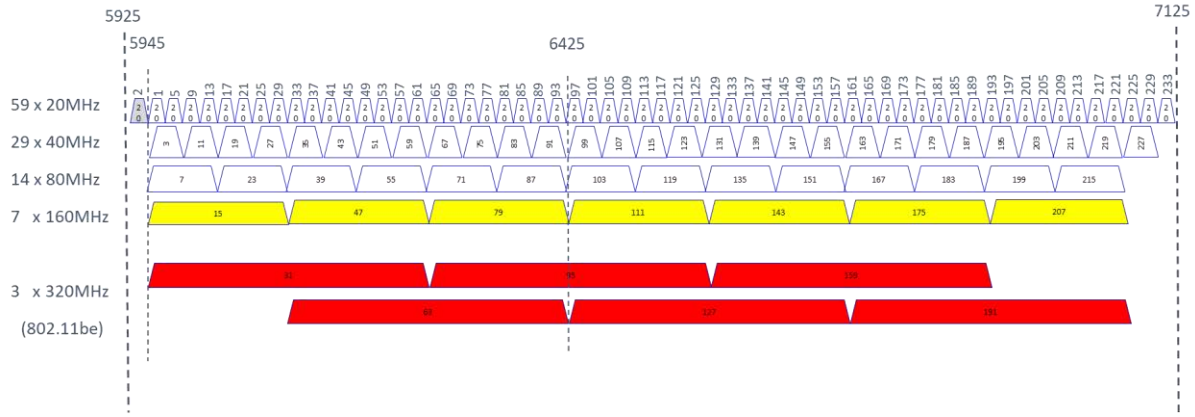
To add to the engineering challenge, radios in the 2.4 GHz and 5 GHz bands today consist of multiple generations of equipment with a variety of less spectrally efficient capabilities. This is a design necessity because networks must be able to communicate with older generations of radios. Therefore, technologies like Wi-Fi are always backward compatible with previous generations of Wi-Fi operating in the same frequencies. The additional requirement of interoperability between Wi-Fi generations and the burden of backward compatibility results in further reductions in efficiency and determinism that in turn

[11] https://www.cablelabs.com/10g

further negatively impact voice and video quality. Wi-Fi 6 in the 6 GHz band (known as Wi-Fi 6E) is not required to interoperate with any previous generation of 6 GHz Wi-Fi technology because no Wi-Fi has yet existed in the 6 GHz band. The 6 GHz band would, for the first time, eliminate outdated and inefficient radio access technology, permitting the far more spectrally efficient Wi-Fi 6E (and above) to operate without the burden of legacy radio interoperability. This will dramatically improve the user experience and spectral efficiency, which can only serve to further the adoption of Wi-Fi technologies.

Considering all these challenges, Wi-Fi 5 and earlier technology will soon be insufficient to deliver broadband and related capabilities for the future. Industry's response was twofold. First, we redesigned the technology to enable a wholly new approach to address dense networking, low latency, and higher-bandwidth needs. For example, deployment of OFDMA as part of Wi-Fi 6 fundamentally improves spectral efficiency, enabling an AP to communicate individual packet streams to multiple clients at the same time.[12] Second, to solve the spectrum crunch and the need to migrate to wider channels, we identified a large and contiguous allocation of spectrum, specifically 5925-7125 MHz, to support the wireless industry's migration to multiple wide channels.

5,926 MHz to 7,125 MHz IEEE 802.11 Channel Plan



**The 320 MHz channel plans will be a part of IEEE 802.11be, which is yet to be finalized.*

The additional 1.2 GHz of spectrum on which Wi-Fi 6E will run provides a roughly equivalent number of 80 MHz channels in the 6 GHz band as there are 40 MHz channels in the

[12] In addition to adopting OFDMA, some of the most important innovations in the Wi-Fi 6 generation of technology are: (1) multi-user MIMO that allows more downlink data to be transferred at one time, enabling APs to concurrently handle more devices and supports uplink as well; (2) 160 MHz channel utilization capability increases bandwidth to deliver greater performance with low latency; (3) Target Wake Time (TWT) significantly improves network efficiency and device battery life, including for IoT devices; (4) 1024QAM modulation increases throughput for emerging, bandwidth-intensive uses by encoding more data in the same amount of spectrum; (5) transmit beamforming enables higher data rates at a given range to increase network capacity; (6) addresses a problem with existing 2.4/ 5 GHz Wi-Fi of sometimes excessive management overhead; (7) supports "Out of Band" discovery of networks, further reducing management overhead; and (8) strict scanning rules prevent unnecessary use of spectrum (e.g., only scans on a subset of the 6 GHz channels).

5 GHz band. For the first time, 80 MHz channel plans would be possible from a "best practices" perspective in dense deployments. Contiguous spectrum would also support seven 160-MHz wide channels and multiple 320-MHz wide channels expected with the next generation of Wi-Fi, which is now going through the IEEE standardization process. With access to the full 6 GHz band, the RLAN industry can continue to play its important role in delivering broadband access, facilitating the Internet of Things, and enriching experiences at work, home, and play.

Looking ahead, Wi-Fi 7, which is currently being standardized in IEEE as 802.11be, relies on access to the greenfield spectrum of the 6 GHz band to deliver its greatest innovations. Among the innovations that are currently in draft and/or under discussion are improvements that would make Wi-Fi even more useful to users and applications. While the need for 320 MHz-wide channels has been widely discussed, other innovations are also important. This new generation of technology will operate at 4096 QAM and permit "multi-link operation" that can use the 2.4 GHz, 5 GHz, and 6 GHz spectrum bands simultaneously. Once standards are complete, these improvements will enable lower latency in transmissions, higher throughput, and more deterministic networking capability (e.g., higher reliability or QoS) relative to Wi-Fi 6E. These features provide a step function increase in terms of enabling Wi-Fi to address immersive services with demanding QoS requirements for a larger number and diversity of applications, devices and use cases. In addition, these improvements scale throughput capability to future upgrades in backhaul (e.g., 10G Fiber, DOCSIS 4.0, Fixed Wireless), allowing the RLAN wireless network to evolve with the backhaul. However, if there is insufficient spectrum available to make Wi-Fi 7 capabilities compelling to someone purchasing a new AP, Wi-Fi 7 is not likely to see widespread use.

An allocation of 500 MHz in lieu of the full 5925-7125 MHz is not sufficient

Where only 500 MHz of 6 GHz spectrum is made available, networks would effectively need to operate in a manner similar to the 5 GHz scenario today. Opening only 500 MHz of the 6 GHz band would require channelization in dense deployments to continue at 40 MHz. In countries allowing license-exempt access to just 500 MHz of 6 GHz spectrum, users would not be able to take full advantage of the benefits of Wi-Fi 6, 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.

For consumers, similar issues arise as the number of devices in a home continues to multiply. Countries like Japan, Korea and the United States are already at 12-14 devices per capita, and the continued integration of license-exempt technology into consumer durable goods promises that the number of devices in a home will continue to grow. No analyst projects that the curve will flatten for the foreseeable future. That is because the advantages of connectivity continue to multiply: smart televisions that allow user choice in video streaming, connected security devices from video camera doorbells to whole home systems, and smart appliances that allow manufacturers to download new generations of software are examples of the types of capabilities not in existence before the mid-2000s.

Nor are the coming challenges limited to consumers. Hospitals increasingly rely on video and robotics. Schools at all levels require connectivity to each student's laptop, and are seeing

increased demands on their wireless networks from security systems to remote learning. Whole industries are transforming how they operate by deeply integrating wireless into their business operations. Globally, machine-to-machine modules will account for 50% (14.7 billion) of all networked devices by 2023, compared to 33% (6.1 billion) in 2018.[13]

With a 500 MHz allocation of 6 GHz spectrum, instead of benefiting from new immersive services, users would experience a significant degradation in their current experience. More devices would contend for airtime in the same frequencies as IoT and cloud-based analytics proliferate. Users would have a very mixed experience where applications might work in some locations, such as within certain portions of their home, and might not work well in businesses, public areas, and venues. Inconsistent bandwidth delivery has consequences well beyond consumer unhappiness – it inhibits innovation generally and may even block developers from successfully developing and delivering new applications.

We discourage a "wait and see" approach, where 500 MHz is allocated now, and the balance of the band is allocated sometime in the future. There is an opportunity cost for countries that decide on a staggered approach to spectrum allocation compared to nations that decide to allocate 1200 MHz from the outset. One main drawback is the opportunity cost of impaired use cases and inability to fully meet broadband needs, especially in dense enterprise and urban environments where more than three wideband channels are required. Countries that only designate only 500 MHz for license-exempt use will be unable to reliably support high throughput and low latency applications in all environments where those applications need to perform. When Wi-Fi 7 standards are completed in about three years, the industry will implement channels up to 320 MHz. Countries that only designate 500 MHz will not be able to enjoy the benefits of applications that are built to take advantage of these channel sizes. RSM should open the full 1200 MHz of the 6 GHz band now to realize a stronger and more diverse license-exempt ecosystem when 6 GHz applications and services are deployed to benefit the entire nation.

Many types of equipment are expected to support the entire 1200 MHz of the 6 GHz band as countries like the United States, Brazil, Canada, Saudi Arabia, and the Republic of Korea are enabling the band for such operations, with many others expected in 2021. Due to the need to limit manufacturing and logistical complexity, most 6 GHz equipment will be designed to support the full 1200 MHz, with firmware settings used as necessary to limit operation to the lower 500 MHz. Without the full 1200 MHz available for license-exempt use, consumers of 6 GHz equipment would not benefit from higher throughput and lower latency but will nevertheless pay for the more complete technology that they are unable to use.

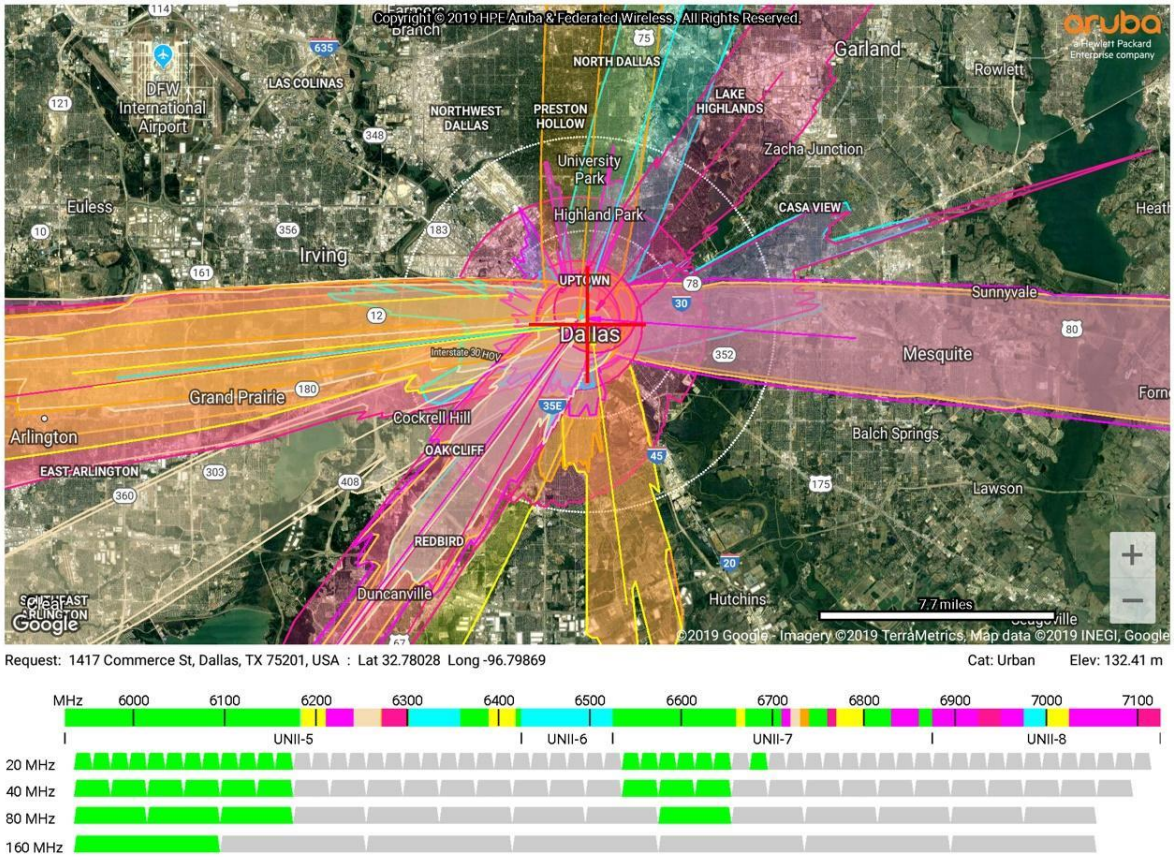
Nor is there some other spectrum band near the value of the 6 GHz band. Most importantly, 6 GHz is adjacent to 5 GHz, enabling easier deployment of tri-band radios using 2.4 GHz, 5 GHz, and 6 GHz frequencies. From a consumer perspective, 6 GHz will deliver a consistent consumer experience similar to that of the 5 GHz band assuming reasonable power levels are adopted. From a regulatory perspective, license-exempt radio systems are highly

[13] Cisco Internet Report, Highlights, Devices/Connections and Applications at https://www.cisco.com/c/en/us/solutions/executive-perspectives/annual-internet-report/air-highlights.html.

complementary to incumbent systems and can coexist with the right regulatory rules – and incumbent systems are similar globally, which facilitates reasonably uniform sharing obligations on license-exempt devices as more countries open the band.

Another important consideration when considering the merits of opening the full 6 GHz band versus just 500 MHz is preserving the opportunity for Standard Power (higher power and outdoor) license-exempt operations in the 6 GHz band. Standard Power use cases are particularly important to a number of deployment types, including manufacturing, logistics, agriculture, rural broadband, higher education, hospitality, healthcare, and municipal. Standard Power typically operates in conjunction with an Automated Frequency Coordination (AFC) geolocation database capability, which is aware of incumbent user operations and can safely authorize Standard Power license-exempt use at a particular location while protecting the incumbents from harmful interference. Because of this requirement to avoid and protect the incumbent services, the frequency ranges or channels that will be available at any particular location will often be only a subset of the overall spectrum that has been allocated for potential Standard Power use by the regulator. Importantly, countries that have either already supported Standard Power or are actively studying it, including the United States, Canada, South Korea, and Saudi Arabia, have all moved to open the entirety of 5925-7125 MHz for license-exempt use in the LPI and/or VLP modes of operation. This allows for blocking or protecting certain frequencies or channels at particular locations, while still yielding enough wide bandwidth channels to support next-generation RLAN services.

Because the AFC must protect incumbent services in proximity to the Standard Power AP, the available channels at a given location will be a subset of the overall "pool" of spectrum that the AFC can evaluate. The image below shows a map with the calculated protection contours for the fixed wireless incumbent links operating near the downtown area of Dallas, TX in the United States. Below the map is a diagram showing the available channels (denoted in green) to an outdoor Standard Power AP operating at the pink "+" location in the center of the map.



While the United States has made the full 5925-7125 MHz range available for license-exempt use, at this location, only four out of 14 and one out of seven channels (80 MHz and 160 MHz channels respectively) in the overall 6 GHz band are available for Standard Power operation. In other words, while 1200 MHz may seem like a large swath of spectrum, for Standard Power, the actual availability will often be much less – only totally an aggregate of 320 MHz (with 80 MHz channelization) or 160 MHz (with 160 MHz channelization) in this example. Allocating the full 1200 MHz for license-exempt use will provide the overall spectrum needed to support Standard Power (AFC), whereas 500 MHz would be insufficient for Standard Power in the age of 80 MHz, 160 MHz, and 320 MHz channels.

II. License-exempt technology provides important benefits, including addressing the digital divide, advancing the information and knowledge economy, and driving productivity across industries.

Important benefits accrue to New Zealand by opening the 5925-7125 MHz band to license-exempt technologies, including how these technologies will help address the digital divide and foster innovation. As discussed below, that analysis is consistent with the conclusions being reached by regulators around the globe.

Benefits multiply if New Zealand can take advantage of technology running on the full 6 GHz band

A recent study commissioned by the Wi-Fi Alliance confirms that New Zealand will benefit from opening the full 6 GHz band to license-exempt use, and that those benefits will arrive expeditiously.

> New Zealand places high importance on their Wi-Fi infrastructure. Ninety percent of households with broadband access in New Zealand include Wi-Fi access, and the country is transforming their educational system with Wi-Fi. New Zealand ranks seventh in the Asia Pacific region in terms of internet speed, and 27th globally. A major contributor to Wi-Fi value comes from New Zealand's enterprise sector: 71 percent of telecommunications traffic is transported through Wi-Fi networks and IoT applications. **Wi-Fi value in New Zealand in 2021 is $6.7 billion and is expected to grow to $9.8 billion by 2025.**[14]

As discussed above, license-exempt technologies are evolving to meet new demands, and by taking these actions, wireless networks and services can provide higher speed, better performance, and improved responsiveness to the new demands of networks and the thousands of devices that will be connected simultaneously to APs.[15]

Economic studies also show how New Zealand can benefit from expanding spectrum availability for license-exempt technologies to address improvements in broadband access for its population and, in particular, help to close the digital divide. With the full 6 GHz band available to license-exempt technologies, the Wi-Fi Alliance estimates a consumer surplus of US$250 million will be generated from using 6 GHz to provide Internet access to the unserved or underserved.[16] This should come as no surprise because RLAN technologies like Wi-Fi have an important role to play in offering low-cost mechanisms for multiple users in a household to connect to the Internet. License-exempt technologies are embedded in a wide array of client devices, from laptops to tablets and smartphones, that are part of a highly competitive market that offers consumers a range of choices in device capability and price. That is only the beginning because Wi-Fi is also used to deliver rural broadband in areas where commercial wireline or wireless operators have not deployed. With backhaul spectrum capability such as in 5 GHz, the TV White Spaces, or 60 GHz, Internet services operators can offer broadband connectivity to a household that is served by a Wi-Fi AP within the home. Similarly, satellite broadband connectivity also enables Internet access to a service provider or to a consumer inside the home by using a Wi-Fi AP to reach the end user device. Ample spectrum for license-exempt operations gives both market participants and government new tools to reach the unserved or underserved and can help provide low-cost broadband arrangements.

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[14] Wi-Fi Alliance, Global Value of Wi-Fi, at https://www.wi-fi.org/discover-wi-fi/value-of-wi-fi (footnotes omitted, emphasis supplied).

[15] Id.

[16] Wi Fi Alliance, Global Value of Wi-Fi, at page 394, 404-405, at https://www.wi-fi.org/download.php?file=/sites/default/files/private/The_Economic_Value_of_Wi-Fi-A_Global_View_2021-2025.pdf

Opening 5925-7125 MHz for license-exempt use would contribute to global harmonization that is supportive of robust technological innovation. As noted in response to Question 1, New Zealand would be the latest of the world's economies to open the full 6 GHz band to license-exempt operations, joining Canada, the United States, Brazil, Saudi Arabia, and the Republic of Korea, along with a number of other nations globally. By opening the same spectrum frequencies under harmonized rules, New Zealand would help to ensure that manufacturers and innovators will be attracted to a substantial market opportunity, promoting expected public interest benefits for New Zealand.

In addition, allocating the entire 6 GHz band as license-exempt will provide important economic benefits. An economic study estimates that New Zealand could expect to generate a total economic value of US $9.8 billion between 2021 and 2025 from this action.[17] The study examined various sources of economic value, including: increased broadband coverage and broadband speeds; reduction of costs by telecommunications providers; deployment of the Internet of Things, AR/VR, municipal Wi-Fi, and free Wi-Fi hotspots; benefits of aligning with other major economies; increased in capacity for cellular offload; and access to Wi-Fi equipment. The study confirms that designating the full 6 GHz band for license-exempt use would align New Zealand with Canada, the United States, Brazil, and the Republic of Korea and allow New Zealand to benefit from the economies of scale and scope for access to equipment.

III. Regulators globally agree on the critical benefits of license-exempt spectrum

By adopting license-exempt rules for 5925-7125 MHz, RSM would join a growing group of leading regulators that have similarly concluded that the benefits of license-exempt technologies are important to their national interests.

> **Canada:** "ISED continues to be of the view that releasing the entire 1200 MHz of spectrum will immediately unleash the full potential of the 6 GHz RLAN technology. Moreover, making the full 6 GHz band available for license-exempt use as soon as possible will maximize the social and economic benefits that Canadians will derive from this spectrum….The increased demand for broadband Internet and, consequently, the spectrum required to support Wi-Fi enabled devices and applications for remote working and virtual learning, has been demonstrated over the past year with the COVID-19 pandemic. Notably, current Wi-Fi capacity and speeds are the main constraint, even in homes with high-speed wireline connections, when a family unit is utilizing numerous Wi-Fi enabled devices. This discrepancy will only become more amplified as available wireline speeds increase. The additional license-exempt spectrum will provide the improvements needed in Wi-Fi throughput for homes and businesses and reduce congestion between neighbours living in close proximity. The additional spectrum will

[17] Wi-Fi Alliance, Global Value of Wi-Fi, at https://www.wi-fi.org/discover-wi-fi/value-of-wi-fi

also support the ability for small wireless Internet service providers to provide cost-effective enhanced broadband connectivity in rural and remote areas." [18]

Saudi Arabia: "CITC is making the entire 5925 – 7125 MHz band license-exempt in 2021 for the following reasons: 1. Importance of WLAN use in the Kingdom and substantial amount of Wi-Fi traffic, which was exemplified during the COVID-19 lockdowns, and the emergence of a promising device ecosystem that can be taken advantage of starting from 2021 to enable a wide range of innovative digital services."[19]

US FCC: "In making broad swaths of 6 GHz band spectrum available for unlicensed use, we envision new innovative technologies and services that will advance the Commission's goal of making broadband connectivity available to all Americans, especially those in rural and underserved areas. Unlicensed devices operating in this band are expected to work in concert with new licensed 5G services by providing consumers' ubiquitous connectivity to a full range of services regardless of location. Our actions taken in this Report and Order will help secure U.S. leadership in the next generation of wireless services."[20]

We urge RSM to join with the world's leading regulators in opening the full 6 GHz band for license-exempt use via appropriate amendment to the GURL-SRD.

IV. With the right regulatory framework, FS and FSS incumbents can continue and grow their primary licensed uses

One important benefit of opening the full 6 GHz band to license-exempt RLAN technologies is that incumbent users are not required to be relocated, and in fact, can grow their network operations over time. Mitigations proposed, such as lower power levels and indoor-only requirements and very low power levels for portable devices will ensure that licensed incumbent operations can continue. Moreover, opening the band to license-exempt technologies will help drive development of new technologies that support shared use.

These findings confirm the coexistence findings made by other jurisdictions throughout the world. According to Canada's ISED:

> ISED has performed detailed technical analysis on the coexistence of RLANs with existing users. Furthermore, ISED has reviewed and analyzed various technical

[18] ISED, "Decision on the Technical and Policy Framework for Licence-Exempt Use in the 6 GHz Band," SMSE-006-21 (May 2021) at page 12, paras. 35-36. https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/SMSE-014-20-2020-11EN.pdf/$file/SMSE-014-20-2020-11EN.pdf

[19] CITC, "Spectrum Outlook for Commercial and Innovative Use 2021-3023" (Mar. 2021) at page 51 https://www.citc.gov.sa/en/mediacenter/pressreleases/PublishingImages/Pages/2021033001/Spectrum%20Outlook%20for%20Commercial%20and%20Innovative%20Use%202021-2023.pdf

[20] FCC, "Unlicensed Use of the 6 GHz Band," ET Docket No. 18-295 at page 2, para. 1 (Apr. 24, 2020) https://www.fcc.gov/document/fcc-opens-6-ghz-band-wi-fi-and-other-unlicensed-uses

> studies submitted in other jurisdictions with similar incumbent users. ISED is of the view that, under the proposed licence-exempt approach, existing licensed users such as public safety agencies, major telecom operators for backhaul connectivity, satellite service providers and broadcasters will be able to continue to operate and grow in this band.[21]

Coexistence is essential as it avoids service disruptions and the regulatory uncertainty associated with migrating users to new spectrum. Regulators are right to consider this as a benefit to license-exempt use of the full 6 GHz band.

V. The opportunity cost of opening less than the full band to license-exempt WLAN is large, and there are limited benefits attributable to an IMT designation

There is a real and significant opportunity cost if the 6 GHz band is not opened for RLAN.[22] A failure to open the full band would put New Zealand behind the rest of the world on spectral planning and on the use of the 5925-7125 MHz frequency band, depriving consumers of the advantages of regional harmonization. Equipment would be available to New Zealand's consumers and businesses as soon as RLAN use is permitted in the 6 GHz band. RLAN operations can be introduced with mitigations to ensure existing users are not adversely impacted, enabling New Zealand to maximize benefits from the band. Enterprise, industrial, and governmental needs today and in the future can also be more easily met with the new generation of technology designed to operate throughout the 6 GHz band.

a. Standards are ready

The IEEE has extended the latest Wi-Fi standard, 802.11ax (also known as "Wi-Fi 6") to include the 6 GHz band. The standard is complete and has now been published.[23] In addition to the IEEE standard, Europe's ETSI BRAN EN 303 687 has reached a "stable draft",[24] providing further support for standards-based deployments.[25]

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[21] ISED at page 13, para 39. See also FCC at page 9 and para. 19 ("The rules we adopt today are designed to optimize unlicensed access to the 6 GHz band while also protecting incumbent services so that they continue to thrive in the band. In our analysis below, we account for the concerns raised by parties representing the various incumbent services that operate in the 6 GHz band, weigh the various technical studies presented by proponents of unlicensed operations as well as representatives of incumbent services, and address how the rules we are adopting will enable unlicensed operations to operate in the 6 GHz band and protect the various incumbent services that operate in the band.")

[22] IFT Regulatory Impact Statement at 7.

[23] See https://www.ieee802.org/11/ noting the publication of 802.11ax on 19 May 2021.

[24] https://portal.etsi.org/webapp/WorkProgram/Report_WorkItem.asp?WKI_ID=58036

[25] 3GPP-based unlicensed technologies are also in standards development. *See* 3GPP Technical Specification Group Radio Access Network; NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone (Release 16), 3GPP TS 38.101-1 V16.5.0 (2020-09), (NR operating bands in Table 5.2-1 lists NR band class n96 covering the entire 6 GHz band – 5925 to 7125 MHz).

In addition, both the Wi-Fi Alliance (for IEEE 802.11) and WInnForum (for 5G NR-U) are engaged in projects to standardize the interfaces between Standard Power APs and AFCs. Standardization of the interface helps simplify AFC implementation because the two interfaces will be known and documented, creating built-in incentive for AFCs to utilize the standards. Standard Power APs can be manufactured and used with the confidence that the equipment will interface with any AFC using the standard.[26]

b. Interoperability testing is ready

The Wi-Fi Alliance has named Wi-Fi 6 products capable of operating in the 6 GHz band as "Wi-Fi 6E" devices and announced a certification plan[27] for global interoperability for January 2021.[28] Interoperability testing has become the hallmark of technologies that use license-exempt spectrum, because it ensures that consumers can purchase devices with the confidence that the device will work with their router and with other devices. According to the announcement, "Multiple product vendors are already announcing Wi-Fi 6E devices that make use of the super wide 160 MHz channels and uncongested bandwidth in 6 GHz to deliver multigigabit, low latency Wi-Fi. Wi-Fi CERTIFIED™ provides a standards-based approach for product vendors to introduce secure and interoperable Wi-Fi 6E products throughout the world, helping to create a diverse device ecosystem."

c. 6 GHz equipment is entering the market

The United States FCC has published its test requirements for 6 GHz,[29] and the first devices are already through test review and approval.[30] According to then-FCC Chairman Ajit Pai:

> We expect Wi-Fi 6[E] to be over two-and-a-half times faster than the current standard. This will offer better performance for American consumers at a time when homes and businesses are increasingly reliant on Wi-Fi. During the COVID-19 pandemic, we've all seen how Wi-Fi has enabled everything from work-at-home to telehealth to remote learning to streaming and gaming. Wi-Fi 6[E] will turbocharge each of these and more, and will also complement commercial 5G

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[26] In contrast, AFCs themselves should not be standardized. While outcome-oriented rules frameworks for AFCs are critical, AFCs themselves should be able to innovate and differentiate offerings above the regulatory minimums.

[27] https://www.wi-fi.org/news-events/newsroom/wi-fi-alliance-delivers-wi-fi-6e-certification-program

[28] For more on interoperability testing, see: https://www.globenewswire.com/news-release/2020/04/23/2021130/0/en/Wi-Fi-Alliance-delivers-more-value-from-Wi-Fi-in-6-GHz.html

[29] Knowledge Data Base (KDB) 987594, released Dec. 10, 2020 https://apps.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?id=277034&switch=P

[30] FCC News Release, "Chairman Pai Statement on Authorization of First 6 GHz Wi-Fi Device," released Dec. 10, 2020 available at https://docs.fcc.gov/public/attachments/DOC-368593A1.pdf. Since December 10, 2020, numerous other client devices and an Access Point have received certification.

networks. Bottom line: The American consumer's wireless experience is about to be transformed for the better.

With final test rules now available, manufacturers can proceed to test equipment, and Telecommunications Certifications Bodies who receive the test reports prior to the certification application proceeding to the FCC laboratory can also begin their review of manufacturer testing and begin independent testing. A number of successful certifications have occurred, with significantly more expected in 2021. Similarly, in Europe, with the ETSI standard reaching the stable stage, and with the European process now completed, equipment is entering the European market as individual countries complete steps to adopt the European findings into national rules. The Republic of Korea's National Radio Research Institute has announced their revision of the test method for conformity assessment of radio equipment for the 6 GHz band, which includes certification requirements for both LPI and VLP.[31] In fact, the Wi-Fi Alliance projects that 340 million 802.11ax devices will be sold in 2021 globally, with about 20% of them 6 GHz ready.

d. Uncertainties surround IMT in the 6 GHz band

Some parties will argue that the portion of the 6 GHz band above 6425 MHz should be reserved for possible IMT use, or that IMT technologies "require" 6 GHz spectrum. These arguments do not stand up to scrutiny. For many years, the IMT community has focused its midband spectrum advocacy on the 3 GHz range. For much of the last decade, the IMT community has advised governments globally that it is essential to make available 100 MHz per operator to support 5G needs.[32] Throughout those years, however, the IMT community did not argue that the 6 GHz band was requisite to their needs. Most importantly from a cost-benefit analysis perspective, IMT stakeholders did not take meaningful steps to advance the use of 6 GHz frequencies beyond ensuring that NR-U be specified in its Release 16 for 5925-7125 MHz.

Today, the established path to midband 5G is through the 3 GHz band (roughly 3300-4200 MHz globally), with the 6 GHz band playing a critical complementary role for wireless backhaul (e.g., microwave links), 5G New Radio Unlicensed (5G NR-U), and Wi-Fi offloading. There is no New Radio specification for standard FDD or TDD 3GPP technology for 6 GHz spectrum, while 5G NR-U has been specified for license-exempt use at 6 GHz. As such, there is neither infrastructure nor client device equipment that can support licensed New Radio in the 6 GHz band. However, there are mature specifications for both LTE and 5G NR for the 3 GHz range, and infrastructure and client device manufacturers have implemented support in a wide variety of equipment that is already in the market.[33] Radios supporting 5G NR bands n77 and

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[31] Official Gazette No. 19856 (Notification No. 2020-585, No. 2020-586, No. 2020-587 of the Ministry of Science and ICT.

[32] GSMA, "5G and the 3.3-3.8 GHz Range in Latin America," (Nov. 2020) at 1 ("Frequencies in the 3.3-3.8 GHz range are already used in a majority of commercial 5G networks and have the biggest ecosystem of devices. That makes them the closest there is to a globally harmonised band. Therefore, it is also expected to unlock 5G in Latin America in the coming years….Regulators should aim to make available 80-100 MHz of contiguous spectrum per operator.") at https://www.gsma.com/spectrum/resources/5g-and-the-3-5-ghz-range-in-latin-america/

[33] See Apple iPhone technical specifications that include n77 (3300-4200) and n78 (3300-3800) https://www.apple.com/iphone-12/specs/. Similarly, the current Samsung Galaxy operates below 6 GHz. https://www.samsung.com/global/galaxy/galaxy-s10/specs/.

n78 in the 3 GHz range offer the path to "instant midband 5G" the moment the 3 GHz band spectrum becomes available.

No country has designated 6425-7125 MHz spectrum for IMT.[34] Therefore, there is an absence of any consensus among the world's regulators – in contrast to many countries embracing license-exempt use of the full 6 GHz band – that any part of the 6 GHz band is necessary for 5G licensed midband use. In light of this and the lack of meaningful development activity for the 6 GHz band among the IMT community discussed above, the benefits associated with reserving the upper 700 MHz for possible future IMT use are very limited, at best.

Regulators around the globe agree that withholding the upper 700 MHz of the 6 GHz band for future consideration for IMT is inadvisable. For example, "ISED is of the view that delaying the release of the spectrum would not meet the policy objectives outlined in section 2, as it would hinder access to affordable broadband services for Canadians in rural and urban areas and would negatively impact the opportunities for innovation."[35] In Saudi Arabia, the CITC noted that it favored 3 GHz spectrum, not the 6 GHz band, for 5G midband needs, and stated that its focus was on making 3 GHz spectrum available for 5G.[36] Regulators also have noted the serious and uncertain issues about satellite uplink coexistence if IMT use is considered, with the FCC stating that such a plan presented "no certain or clear path" toward achieving IMT use. Similarly, the FCC said that microwave incumbents had concerns about the "reasonableness and practicality of relocation" if IMT was considered in the United States, as they did not see an opportunity for IMT and FS to coexist.[37] Moreover, no regulatory proceeding on the 6 GHz band that we are aware of has included a clear expression of how IMT would propose to use the band and at what power levels. IMT networks are typically located outdoors to provide outdoor coverage. In the 6 GHz range, it is expected that IMT networks would need additional EIRP to overcome the steeper building entry losses that occur with higher frequency ranges. This supports regulators' concerns about IMT's inability to coexist.

Waiting for the outcome of WRC-23 is unnecessary – especially in ITU Region 3 where 6425-7025 is not being considered, and only the top 100 MHz is to be studied for a possible IMT identification. The 5925-7125 MHz range is already allocated to the mobile service on a primary basis. Therefore, an IMT identification is not necessary and waiting until the end of WRC-23 for a decision will just delay delivery of advanced mobile technologies to the New Zealand market.

With high opportunity cost for failing to open the band to license-exempt WLAN technologies, and with no benefit to New Zealand's citizens and businesses for reserving part of

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[34] There is only an ITU-R study question on coexistence between IMT and incumbent FS and FSS. networks at 6425-7025 MHz (Region 1) and one for 7025-7125 MHz (global). Moreover, Regions 2 and 3 specifically declined to join in on the coexistence study at the WRC-19.

[35] ISED at page 13, para. 40.

[36] CITC at 51.

[37] FCC at page 77, para 205. See also ISED at page 13, para. 39.

the band for future IMT use, we strongly recommend to RSM to open the full 6 GHz band for WLAN use via appropriate amendment to the GURL-SRD.

VI. License-exempt use is the best way to support both future growth and innovation in 5G through 5G offloading, backhaul, and NR-U

Regulators globally have also recognized the important and critical role that technologies like Wi-Fi play in furthering the 5G market and cite this as a reason to allocate the 6 GHz band for license-exempt use.[38] Many of our companies have interests in both licensed and license-exempt 5G technologies, and view both as necessary to deliver on future wireless demands. The two technologies interact in important ways. Spectrum allocations should be sufficient to support both. For New Zealand, RSM should intend for GURL-SRD technologies and the 6 GHz band rules to play an important role in ensuring a strong 5G future for New Zealand. [39]

First, license-exempt technologies support a substantial amount of mobile traffic offloads for indoor environments, saving operator capital expenses and conserving licensed mobile spectrum. For the category of mobile device traffic offloaded to Wi-Fi networks, the Asia Pacific region is expected to see 63 exabytes of data per month in 2022, compared to 6.7 exabytes in 2018. Economic studies of the benefits of license-exempt in the 6 GHz band show that operators will save substantial capex and opex costs if Wi-Fi can use the full 6 GHz band to continue its traditional role in offloading mobile data to wired connections.[40] For New Zealand, operator cost savings is estimated variously as between US$45 million and $600 million per year (2021-2025). When Canada opened the 6 GHz band for license-exempt technologies, it stated that it expects offloading of mobile traffic to increase over time,[41] which is consistent with more data being consumed inside homes or in indoor business locations.[42]

Second, incumbent microwave uses can remain in the 6 GHz band even after a license-exempt allocation, allowing for microwave links to remain available to support 5G networks.

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[38] FCC at page 86, para. 229.

[39] In contrast, an IMT allocation for part of the 6 GHz band would be "de facto" exclusive to IMT as it would not support coexistence of license-exempt technologies throughout the band. In addition, successful IMT coexistence of IMT with FS and FSS incumbents is questionable at best.

[40] Wi-Fi Alliance, The Economic Value of Wi-Fi: A Global View, at https://www.wi-fi.org/download.php?file=/sites/default/files/private/The_Economic_Value_of_Wi-Fi-A_Global_View_2021-2025.pdf at pages 411-412.

[41] ISED at page 12, para 37.

[42] Moreover, the trend in energy-efficient building codes make indoor coverage from outdoor IMT base stations more problematic because energy efficient insulated windows and walls block radio frequencies to a higher degree. As energy efficiency continues to be prioritized, more offloading to indoor Wi-Fi networks should be expected.

IMT interests cite the 6 GHz band as potentially useful for backhaul.[43] Backhaul uses are licensed on a link basis and do not require large geographic footprints like IMT macrocells do. While fiber optic technology would be the expected backhaul technology of choice for 5G, depending on traffic volume, modern microwave links can be deployed as part of a 5G backhaul network. As 5G backhaul needs grow, more microwave links can be added to the band in support of operator networks; license-exempt technologies will not cause harmful interference to them.[44]

Third, operators can deploy 3GPP unlicensed technology – 5G NR-U – to extend their networks into unlicensed spectrum.[45] Operators can use a 3GPP platform to take advantage of "free" spectrum while delivering 5G services to their subscribers. NR-U was standardized in 3GPP Release 16 for 5925-7125 MHz and is available today. Importantly, the NR-U and Wi-Fi industry have already been working on coexistence.[46] Technology-neutral rules would allow both technologies in the band.

Via growth in offloading, backhaul and NR-U, opening the 6 GHz band for license-exempt use provides strong support for the licensed 5G networks of tomorrow, while also benefiting users of other license-exempt technologies. Maximization of the fulfilment of the broad and affordable mobile 5G vision requires Wi-Fi 6E as a component.

Q3. Do you agree that RSM should include 5925 - 6425 MHz in the GURL-SRD for WLAN low power indoor and very low power use?

We support the RSM's inclusion of 5925-7125 MHz in the GURL-SRD for both LPI and VLP use. In addition, we support the creation of a third device class for Standard Power devices with AFC. In the charts below, we provide our joint proposal for technical parameters for WLAN operations in the 6 GHz band for all three device classes.

Based on the findings of the comprehensive studies of coexistence between Wi-Fi and incumbent users of the 5925-7125 MHz band conducted in the United States and Europe,[47] with

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[43] See https://www.gsma.com/latinamerica/es/peru-la-decision-de-asignar-la-totalidad-de-la-banda-de-6-ghz-para-uso-no-licenciado-compromete-los-beneficios-del-5g-para-los-peruanos/ (criticizing Peru's recent decision to allow license-exempt throughout the 6 GHz band).

[44] While RLAN coexistence with microwave backhaul links has been repeatedly proven in regulatory reviews of the 6 GHz band, RLAN coexistence with Fixed Wireless Access has not been studied. FWA and license-exempt are not good candidates for coexistence.

[45] See CITC at page 51.

[46] No regulatory intervention is required or requested for coexistence. Both license-exempt technologies use spectrum sensing, contention based multiple access, power control and dynamic channel sizing to optimize spectrum usage in an uncoordinated manner. The associated standards already consider the necessary measures to guarantee spectrum sharing. Thus, no additional regulatory measures are necessary to guarantee compatibility between these technologies.

[47] *See CEPT Electronic Communications Committee. ECC Report 302, available at https://docdb.cept.org/download/cc03c766-35f8/ECC%20Report%20302.docx, ECC Report 316: Sharing studies*

specific consideration given to the conditions specified by Ofcom UK[48] and the United States FCC,[49] the undersigned companies encourage the RSM to adopt the following technical conditions for WLAN use of 6 GHz LPI and VLP equipment:

Operating band	5925-7125 MHz	
Device category	Low-Power Access Point	Very Low Power mobile equipment
Operating location	Indoor only	Indoor & Outdoor
Licensing scheme	GURL-SRD	GURL-SRD
Transmit power (e.i.r.p.)	30 dBm	17 dBm

We further invite the RSM to authorize Standard Power equipment in the 5925-7125 MHz band with AFC to further facilitate sharing with incumbent services at higher power levels for outdoor use. (See also response to Question 6).

Operating band	5925-7125 MHz
Device category	Standard-Power Access Point
Operating location	Indoor & Outdoor
Licensing scheme	GURL-SRD (with AFC)
Transmit power (e.i.r.p.)	36 dBm

Q4. Do you agree that RSM should mandate ETSI EN 303 687 as the radio standard for WLAN use in the 6 GHz band? Is there any other regulatory compliance standard we should consider?

We support the technical parameters provided in response to Question 3.

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assessing short-term interference from Wireless Access Systems including Radio Local Area Networks (WAS/RLAN) into Fixed Service in the frequency band 5925-6425 MHz, May 21, 2020, *available at* https://www.ecodocdb.dk/download/8951af9e-1932/ECC%20Report%20316.pdf; and, *ECC Decision 20(01): On the harmonised use of the frequency band 5945-6425MHz for Wireless Access Systems including Radio Local Area Networks (WAS/RLAN)*, Annex 1, A1.2, Nov. 20, 2020, https://docdb.cept.org/document/16737 (listing technical conditions for LPI and VLP in Europe) (*ECC Decision 20(01)).*

[48] Ofcom, *Statement: Improving spectrum access for Wi-Fi, Statement*, 4.51, (July 24, 2020), (https://www.ofcom.org.uk/consultations-and-statements/category-2/improving-spectrum-access-for-wi-fi (confirming that radiated power limits of 25 mW for VLP are "sufficient to manage the risk of interference").

[49] *Unlicensed Use of the 6 GHz Band*, Report and Order and Further Notice of Proposed Rulemaking, ET Docket No. 18-295 (Apr. 24, 2020) https://ecfsapi.fcc.gov/file/0424167164769/FCC-20-51A1_Rcd.pdf.

Q5. What are your views on using a licensing approach to support 30 dBm EIRP WLAN devices?

A total power level of 30 dBm EIRP will not cause harmful interference for LPI devices. This conclusion has been supported by regulators in the United States and Brazil. Adopting a location-specific licensing approach for this power level would add cost and delay to deploying APs. Instead, for a higher power option, as noted in response to Question 6, we support "Approach 2," a 36 dBm EIRP Standard Power device class with an AFC system.

Q6. What are your views on supporting 36 dBm EIRP standard power devices using Automatic Frequency Coordination (AFC) system? Do you have any proposals to provide AFC systems to New Zealand?

Standard Power operations at 36 dBm with AFC are desirable from an industry perspective because this power level will best ensure that a consumer has a consistent experience relative to existing 5 GHz WLAN networks. For example, Standard Power with AFC provides a path for industry to deliver outdoor wireless technologies to enterprises, such as at loading docks and outdoor public areas. AFC systems will allow the 6 GHz band to be used for these use cases while also protecting incumbent users. We suggest that the RSM consider the rules for AFC systems that have been recently adopted in the United States and Canada.

Significant progress has already been made in the areas of AFC standardization and development for the United States market. Of particular importance are the related AFC working programs and the resulting deliverables of the Wi-Fi Alliance[50] and the Wireless Innovation Forum ("WInnForum")[51]. The Wi-Fi Alliance:

- has defined the message types that will be used between the AFC and the Standard Power AP,
- has defined an authorization test framework whereby the AFC and Standard Power AP may be independently tested for proper function as a System Under Test ("SUT") and Device Under Test ("DUT") respectively via standardized test harnesses, and,
- is defining the test cases that could be utilized to certify both AFC and Standard Power APs utilizing the testing framework mentioned above.

The WInnForum 6 GHz committee has the following activities in progress with their outputs expected by September 2021:

- enumerating and defining AFC system requirements,
- general description of the AFC incumbent protection contour calculation,
- evaluation of static parameters/inputs to the protection contour calculation, and,

[50] https://www.wi-fi.org/who-we-are/current-work-areas#Automatic%20Frequency%20Coordination%20(AFC)

[51] https://6ghz.wirelessinnovation.org/

- procedures for identifying and correcting erroneous incumbent information in the United States FCC's Universal Licensing System ("ULS") database.

While this last WInnForum activity is specific to 6 GHz in the United States, the vast majority of these industry efforts and work products are easily transferable to an AFC implementation in New Zealand and could be leveraged to quickly bring Standard Power operation to the market.

Respectfully submitted,

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