Cisco Systems, Inc. Comments
June 2021

Response to RSM Consultation on WLAN use in the 6 GHz band

Introduction

Cisco Systems, Inc. hereby files comments in response to the Radio Spectrum Management (RSM)'s discussion document on *WLAN use in the 6 GHz band* issued in June 2021. Cisco applauds the efforts of RSM to take steps to enable the latest generation of Wi-Fi in New Zealand by opening up much needed spectrum in the 6 GHz range. In this submission, Cisco responds to the specific questions called out by RSM for industry inputs, and urges RSM to consider making 5925-7125 MHz available to license-exempt uses now to sustain and grow the economic activity that Wi-Fi has historically supported.

Cisco is a global provider of Internet Protocol (IP)-based networking solutions with a strong presence in New Zealand. Among Cisco's many products are Wi-Fi network solutions for enterprise, enterprise networking solutions generally, and service provider networking solutions.

Enterprise networks are rapidly evolving to wireless as the edge technology of choice for reasons of networking efficiency, the expanded use of data in core business operations, and to supply new capabilities associated with advanced manufacturing, training, quality control and more. Much of this data will never leave the enterprise's own network, or will be transmitted via dedicated connections to a private, public, hybrid or a multi-cloud environment.[1] The Covid-19 pandemic has accelerated and expanded this trend for business and government, as a variety of applications (including collaboration tools) must now operate on employee, student or patient home networks powered by Wi-Fi.[2] Whether Wi-Fi is on-premises or relied upon by the enterprise to support remote working, telehealth or education, demands on the spectrum for license-exempt technologies are rising quickly. While much of the public policy focus is on Wi-Fi at the edge of service provider networks (wired broadband, satellite, other), from Cisco's perspective, public policy should focus equally on whether business entities and governmental uses of license-exempt spectrum are adequately supplied for the future.

[1] Cloud capability enables enterprises to quickly increase or modify computing power without the need to order and install servers or other network hardware on premises. If properly incorporated into an IT strategy, cloud enables IT management and integration of applications with user devices in a secure way.

[2] When working from home and communicating with enterprise networks, employees are generally utilizing Virtual Private Networks (VPNs) that securely "tunnel" through a public service provider network to connect with the enterprise. VPN usage has surged to new never-before-seen levels during the pandemic. See https://www.businesswire.com/news/home/20201127005318/en/Global-Virtual-Private-Network-VPN-Market-Report-2020-VPN-Adoption-Surges-as-COVID-19-Pandemic-Leads-to-a-Rise-in-Remote-Work-and-WFM-Culture---ResearchAndMarkets.com

Cisco Responses to Consultation Questions

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

Cisco agrees that there is a need for more spectrum to be made available for license-exempt use, including for WLAN use. However, this should not only include the 5925 – 6425 MHz range, but also the 6425 – 7125 MHz range. Having a single large contiguous block of spectrum to support the coming generations of Wi-Fi is essential to support continued growth in connectivity needs of New Zealand and the expanding uses that Wi-Fi supports within enterprises.

The proliferation of additional, ever more powerful WLAN devices, and higher bandwidth broadband networks, such as the deployments under the New Zealand Ultra-Fast Broadband Initiative, is enabling richer and more productive applications. Cisco's Annual Internet Report[3] highlights that for New Zealand, the devices and connections per capita will grow from 5.2 in 2018 to 9.4 in 2023. There will be 46.5 million network devices in New Zealand by 2023, up from 24.6 million in 2018 (13.6% CAGR). There will be 26.5 million wired and Wi-Fi connected devices by 2023, up from 14.8 million in 2018 (12.4% CAGR), with 57% of all networked devices in New Zealand having a wired or Wi-Fi connection. These the devices that connect people to the Internet, and increasingly a broad array of "things" from consumer products (like connected appliances, television sets, security systems and gaming consoles) to vehicles and industrial machines.

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 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, New Zealand has transitioned to an optical national broadband network and mobile to 4G and now 5G, WLAN demand continued to grow without provision for more license-exempt spectrum capacity.

At these growth rates, the WLAN industry faces two fundamental challenges:

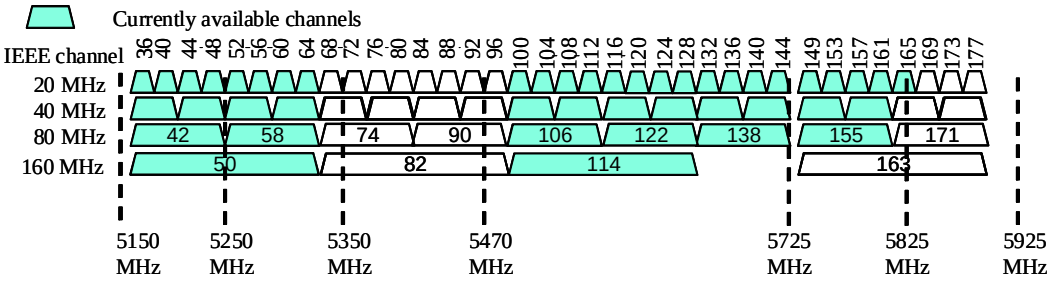
(1) The existing license-exempt spectrum in the 2.4 and 5 GHz bands originally allocated 15 years ago to support Wi-Fi are reaching their capacity limits and becoming heavily

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

congested, particularly in venues with larger number of users, such as enterprises, schools, transportation hubs and other public places; and

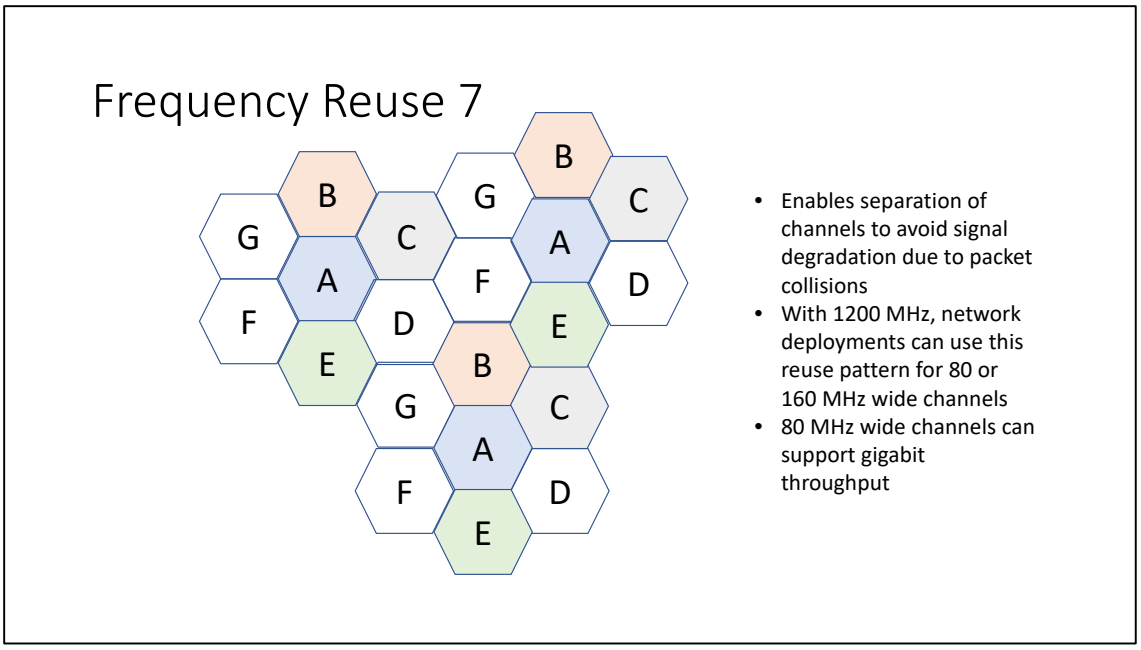
(2) WLAN technology itself needs an overhaul to address future networking challenges.

For a decade and a half, the Wi-Fi industry has been innovating new generations of technology on spectrum that was identified for license-exempt use in the 5 GHz range by the World Radio Conference (WRC) of 2003. Over the years, numerous technological improvements – both standardized and vendor specific – were made to ensure that Wi-Fi networks could be relied upon to serve a variety of purposes in government and enterprise settings, even as the number of use cases and amount of data continued to increase. During this period, industry learned to deploy dense networks of the type found in convention centers, stadiums, college campuses, and transportation hubs. We learned, for example, that the minimum practical distance between access points in a network is 12m, because anything less does not contribute to the overall throughput needs, and in fact diminishes them. One way to boost throughput is to widen channels, which the industry set out to do in Wi-Fi 5. As customers migrated from Wi-Fi 4 to Wi-Fi 5, however, 40 MHz wide channels remained the norm for government and enterprise networks. While the Wi-Fi 5 generation could take advantage of 80 or 160 MHz wide channels, there simply are not enough of these wider channels to enable a networked deployment, as is shown in the following 5 GHz channel plan. For that reason, enterprise networks have continued to operate using 40 MHz wide channels.

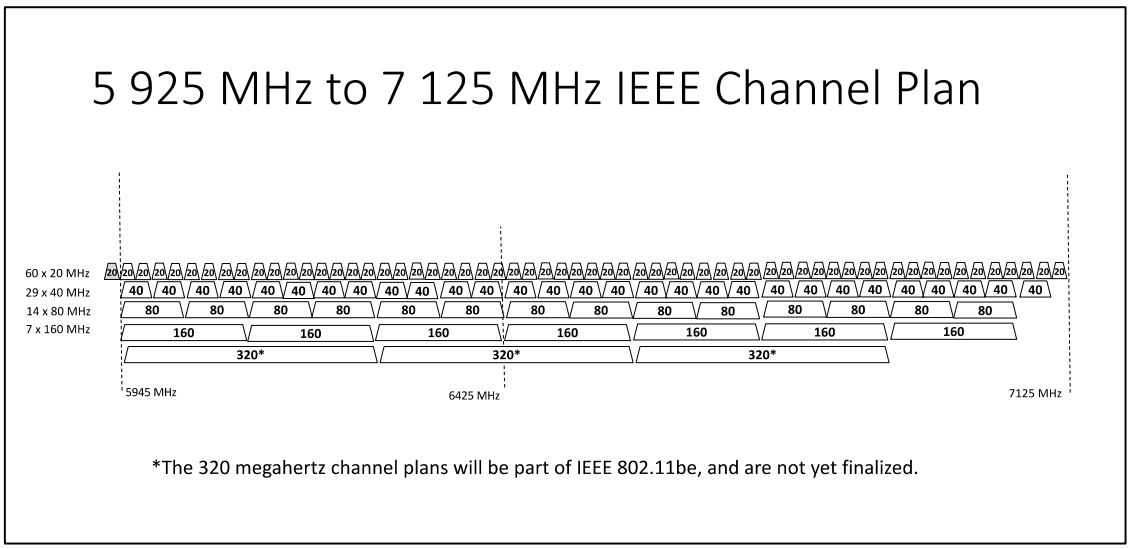


As industry began to evaluate what it would need for its sixth generation of product (known as Wi-Fi 6), it was clear that technological innovation by itself would no longer be sufficient to address the demands of the future – such as more intensive wireless networking with denser deployments, more end points due to the Internet of Things, increasingly data heavy applications such as Augmented or Virtual Reality, and more. Not only did we need a new set of technologies to address these issues, but we also needed the spectrum to enable them to run on wide channels in networked configurations. The concept of Wi-Fi 6 was not just to make a step change function in Wi-Fi capability, but also to create a technology that could take full advantage of a contiguous swath of spectrum supporting the use of wide channels. That contiguous swath of spectrum became 6 GHz – selected because it afforded manufacturing and operational synergies with 5 GHz but also because license-exempt equipment is highly

complementary to the incumbent licensed services in the band – coexistence with the right mitigations is possible. In Cisco's view, the use of Wi-Fi 6 in the 6 GHz band enables networks to be designed with "frequency reuse 7" channel plans featuring 80 or 160 MHz wide channels, as follows:



The frequency reuse 7 methodology minimizes packet collisions that degrade throughput by keeping "like" channels separated. With the full 1200 MHz authorized, government and enterprise deployments have access to up to fourteen 80 MHz wide channels and up to seven 160 MHz wide channels. This is important because the 80 MHz wide channels are what can deliver gigabit throughput, which will be a necessity soon and is desirable now.



Even today, these advanced networking capabilities can be needed in government and enterprise networks. This is particularly true when the use case is broadband access. While in some cases users and their devices might be uniformly distributed inside a facility – or at least predictably distributed – we find that most networks users will move around and cluster in meeting rooms, lecture halls, training rooms, at specific booths or event spaces inside convention halls, etc. We not only need better technology to deliver a good user experience, we need to rely on more than one access point that can reach these dense spaces. These problems only get more challenging as we look ahead to deployments of AR/VR or robotics where the pressures on the network become more extreme. With Wi-Fi 6 in the full 6 GHz band (known as Wi-Fi 6E), industry will finally have sufficient spectrum to meet the challenges we are already experiencing with technology and with spectrum that is future-proofed.

The alternative result – where administrations allocate just 500 MHz instead of 1200 MHz for license-exempt RLAN – leaves license-exempt users in a predicament. With just 500 MHz, deployments will be stuck at 40 MHz channels. While the lower 6 GHz spectrum is greenfield in that there are no prior generations of Wi-Fi operating in it,[4] there are not enough 80 MHz channels for an enterprise deployment using a frequency reuse 7 model. As a result, the channel size cannot support the gigabit throughput needed.

Cisco is well aware that RSM is or will be hearing from 5G vendor interests who would like a deferred decision on the upper 700 MHz of spectrum (6425-7125 MHz) so that regulators may evaluate ITU-R coexistence studies to be conducted in Region 1 looking at IMT's ability to coexist with fixed satellite or microwave fixed services. We understand that this argument is generally made with an appeal to "balance" the interests of the technology camps. Cisco is a big supporter of 5G and we have in our offerings for mobile core and transport enabled the advancements that 3GPP has promulgated for the 5G era. But "balance" to us is about regulators finding a way for each technology to succeed on its own merits. At 500 MHz, Wi-Fi 6E will not succeed in its efforts to address the networking needs of governmental entities and enterprises. In our view, license-exempt WLAN needs the full 1200 MHz by sharing that band with long-time incumbents who continue to have superior spectrum rights.

Regulators globally are seeing the benefits of opening 6 GHz to WLAN use. The economic value of doing so is estimated at US$4.8 trillion globally by 2025, assuming

[4] The existing technology supporting 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.

major economies open the 6 GHz band to WLAN.[5] For New Zealand, the values are US$7 billion in 2021 and US$10 billion by 2025. The main reasons for Wi-Fi's ability to deliver economic value lie in its ability to provide easy and readily available Internet access at home and on the go, along with productivity increases in enterprises as they increasingly rely on WLAN 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.

We therefore support RSM's proposal to open 5925-6425 MHz to license-exempt WLAN use, and urge RSM to consider opening the full 6 GHz band now.

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

The issue that New Zealand confronts in the decision of when and how to further utilize the upper portion of the 6 GHz band is the same one that regulators globally have faced – fixed link incumbents and fixed satellite services uplinks. According to RSM:

> In New Zealand, the frequency range is currently used by fixed links and fixed satellite service earth stations. 5925 - 6725 MHz is used by C-band Satellite earth station uplinks. Part of the band (5925 - 6425 MHz) also has a shared use with fixed links in the "6 GHz" fixed service band. The frequency range 6440 - 7125 MHz is predominantly used by fixed links in rural areas for data backhaul.[6]

From decisions in Canada, the United States, Brazil and Europe (among others), it is evident that there is growing consensus that license-exempt technology can share the band with these incumbents. In fact, with the proper mitigations on WLAN, the incumbents could continue to grow their networks, adding links and earth stations.

The US FCC was explicit in rejecting calls to defer a decision on the upper 6 GHz or to explore an IMT allocation:

> Repurposing large portions of the 6 GHz band for new licensed services would diminish the benefits of such use to the American public. Accordingly, we agree with the unlicensed proponents that we should reject these requests. Similarly, repurposing substantial portions of the band, as CTIA and Ericsson request,

[5] "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

[6] RSM, "WLAN Use in the 6 GHz Band Discussion Document" at Annex 1, page 14.

> would substantially affect existing licensed services in the band. This would be contrary to the Commission's stated goal in this proceeding to ensure that existing incumbents can continue to thrive in the 6 GHz band. Representatives of the incumbent fixed microwave services also raise concerns about the reasonableness and practicality of relocation, and question whether other appropriate spectrum can be found.[7]

Canada's ISED concluded that waiting was not an option:

> ISED has noted the arguments cited by some respondents towards their position for releasing only the 5925-6425 MHz band and withholding the release of the 6425-7125 MHz band in case international momentum develops in favour of commercial mobile use of the 6425-7125 MHz band following WRC-23. However, 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. Furthermore, ISED notes that through the upcoming 3500 MHz auction and planned 3800 MHz and millimetre wave auctions, significant amounts of spectrum will be made available for licensed commercial mobile services.[8]

In fact, other than a 2017 decision by Europe to evaluate the lower portion of the 6 GHz band, only two countries have opted for 500 MHz – the United Arab Emirates and Morocco. That compares to 10 countries who have considered the issue and opened the full band – Canada, the United States, Guatemala, Honduras, Costa Rica, Chile, Brazil, Peru, Saudi Arabia, South Korea. In addition, Mexico has announced its tentative decision to open the full band.

In the case of Europe, their 2017 decision to pursue 5925-6425 MHz evolved from a discussion among the European national regulators where very diverse views about the size of the band to be studied were aired. In the end, the recommendation to the European Commission was a "lowest common denominator" approach to satisfy the requests coming from member states who were in the process of migrating new fixed links into the upper part of the band, and who did not want to complicate the migration. This rationale simply has no applicability to New Zealand.

It was not until WRC-2019 that Region 1 committed to a coexistence evaluation as between IMT and band incumbents. Of course, that evaluation is wholly incomplete, but based on the coexistence work completed in the lower portion of the band for license-exempt technologies, new entrant operating conditions for the upper part of the band are going to have to be substantially constrained in ways that appear inconsistent

[7] FCC, Unlicensed Use in the 6 GHz Band, Report and Order, ET Docket No. 18-295, released April 24, 2020 at para. 205 (footnotes omitted).
[8] ISED, Decision on the Technical and Regulatory Framework for License-Exempt Use in the 6 GHz Band, SMSE-006-21, May 2021 at para. 40.

with most IMT use. In Cisco's view, regulators interested in supporting 5G in the 6 GHz band should focus on license-exempt, which supports mobile offloading from devices, permits fixed link expansion for backhaul, and supports NR-U.[9] Nor should New Zealand, in Region 3, be limited by Region 1 commitments.

We encourage RSM to make the entire 1200 MHz in the 6 GHz band (5925-7125 MHz) available for General User Radio Licence for Short Range Devices (GURL-SRD) WLAN use. Licensed IMT in the 6 GHz band at a minimum reduces the opportunity to utilize the band for fixed microwave services and fixed satellite services uplinks, because licensing implies spectrum rights while license-exempt must not cause harmful interference to incumbent uses.

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)."[10]

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. Equipment based on 3GPP standards is not available in 6 GHz, and other than NR-U, there are not even standards to support it.

[9] Further points on this topic were raised in the recent Canada Innovation, Science and Economic Development (ISED) Decision on the Technical and Policy Framework for Licence-Exempt Use in the 6 GHz Band at para 37: "Over 60% of mobile data traffic is offloaded on Wi-Fi technology today and this is expected to increase in the coming years. With the release of the full 6 GHz band for licence-exempt use, existing and emerging commercial mobile operators will be able to increase the ability to offload data traffic from exclusively-licensed bands to this newly released licence-exempt band. Such cost savings could be passed on to consumers in the form of lower prices."

[10] CITC, Spectrum Outlook for Innovative and Commercial Use 2021-2023, Public Consultation, January 28, 2021 at page 52.

On the other hand, for countries that have authorized a full license-exempt approach for the band, license-exempt equipment is already entering the marketplace and growing quickly, supported by completed IEEE 802.11 standards, interoperability certification through the Wi-Fi Alliance, and device certification testing rules. RSM would be well served by opening the entire band to license-exempt use with mitigations necessary to protect incumbents.

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?

Yes, although we recommend rules that permit license-exempt in the full 6 GHz band, we agree that RSM should include 5925 – 6425 MHz in the General User Radio License for Short Range Devices (GURL-SRD) for WLAN low power indoor (LPI) and very low power (VLP) use.

We support the 24 dBm (11 dBm/MHz) power limitation for low power indoor uses. As indoor access points are a focus for our products, we do not offer comment on the proposal of 14 dBm for indoor/outdoor devices.

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?

Cisco has no objection to ETSI EN 303 687. However, Cisco urges RSM to consider the lower band edge protection for Intelligent Transportation Systems (ITS) operating in the adjacent 5.9 GHz band. (5850-5925 MHz). For the ITS band to be utilized for critical safety communications between vehicles, the band cannot be subject to harmful interference from adjacent 6 GHz uses. Cisco therefore supports a rule applicable to the very low power (VLP) device class (e.g., 14 dBm) that limits out-of-band emissions for license-exempt devices in the vehicle of -37 dBm/MHz and requires VLP devices to prioritize license-exempt use operations on channels above 6000 MHz before beginning to operate below 6000 MHz. This limit represents a compromise view of Broadcom, Cisco, Facebook, Intel and Qualcomm, and has been submitted to the U.S. FCC, Brazil's ANATEL and Canada's ISED. Compliance with the prioritization rule would consist of a statement filed by manufacturers that their equipment complies. Cisco believes this rule would help promote both license-exempt use technologies and ensure ITS transmissions can perform their intended function.

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

Licensing of higher power WLAN devices, or even a "light licensing" approach for higher power WLAN devices, raises new obstacles to deployment. Whether users are consumers or businesses, Wi-Fi users are not familiar with applying for and maintaining a radio license. A few large enterprise IT departments may have some familiarity with licensing, but even they are often unprepared for the administrative burden of a licensing requirement. A light licensing regime that enables a simple registration with contact name could work for larger enterprises and for service providers, but not for small or medium sized businesses.

Moreover, if New Zealand technical regulations will point toward ETSI, and given the strong need for the license-exempt industry to utilize wide channels, RSM should note that a 30 dBm transmitter operating on an 80 MHz wide channel is producing only 11 dBm/MHz, a power spectral density that is no different than a 24 dBm limit in a 20 MHz channel. Of course, the power spectral density drops even further for 160 or 320 MHz channels.

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?

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

The AFC database system was needed in the US because the US has 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. For countries such as New Zealand where link counts are not large, and the licensing is relatively static, a database approach such as the AFC is not strictly necessary, although it has operational advantages. The chief advantage is that in the event of interference, the access points in the area of a link can be directed to frequencies that are further removed from the frequencies in use by microwave – testing whether the access point is in fact the cause of interference. Moreover, when AFCs are stood up in the US and in Canada, the software and protocols are universally applicable, and would result in a reasonably low cost to establish such a sharing mechanism in New Zealand. Note that in the US and Canada, it is expected that both vendor-specific, carrier, and third-party AFCs will operate in the band.

Alternatively, RSM 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. This approach could also warn higher power device operators from co-channel operations near existing links. The drawback here is that only more sophisticated users would likely take advantage of such a system.

Whether RSM 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 New Zealand 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.

Conclusion

Cisco appreciates the opportunity to provide the above input to RSM on the questions raised. This topic is important for the future of New Zealand, 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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