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Attention: Senior Telecommunications Engineer (Spectrum Planning)

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23 December 2021

RE: **Creation of a Class Licence for Regulating the Use of and Trade in 6 GHz Devices for Wireless Local Area Network and Variation to the Class Licence for Provision of Public Wireless Local Area Network Services**

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 the Communications Authority of Hong Kong (CA) regarding wireless local area network (WLAN) use in the 6 GHz band (5925 to 7125 MHz).[1] We strongly support the CA's proposal to make the 6 GHz band available for Class Licence use. Making the 6 GHz band available on a Class Licence basis is an important opportunity for Hong Kong to support broadband connectivity and will open the door to a host of new and innovative use cases. We support the CA's proposal to make the lower 500 MHz of the band (5925-6425 MHz) available for Class Licence. In the future, we recommend that the CA consider making the full 1200 MHz (5925 MHz-7125 MHz) available for licence-exempt use, which would allow Hong Kong to reap even greater benefits from this band.

As discussed in more detail 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) indoor and outdoor; 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 CA would maximize the utility of the whole 6 GHz band, while also protecting incumbent users from harmful interference.

I. High Demand for Wi-Fi Spectrum Supports Designation of the 6 GHz band Under Class Licence.

Demand for high-capacity broadband, increasing network densification, and the emergence of new technologies are driving demand for licence-exempt spectrum in the 6 GHz band.

Delivery of broadband access is a continuously evolving challenge. Meeting the challenges of broadband deployment today and in the future will require access to quality WLAN services like Wi-Fi, since this is how most people access their broadband network.

[1] https://www.coms-auth.hk/filemanager/en/content_711/cp20211126_e.pdf

However, the last time a significant new allocation of spectrum for WLAN technology was more than a decade-and-a-half ago, following the 2003 World Radiocommunication Conference. This activity opened new bands in the 5 GHz range, which were at that time, optimal for earlier generations of WLAN technology such as Wi-Fi 4, and later, Wi-Fi 5.

Since then, 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.[2] 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.[3] 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. 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.[4] Rural Internet access networks that use Wi-Fi, Wi-Fi at the edge of new low earth orbit satellite constellations, and that use Wi-Fi to connect end-users to 5G networks are also evolving use cases.

Currently, industry has kept up with intense demand by deploying access points (APs) more densely. For example, in schools, manufacturing plants, offices, hospitals, multi-tenant housing and stadiums, these locations rely on license-exempt spectrum for broadband access. As 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 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). Therefore, the only way to add additional capacity in these situations is through the use of additional spectrum with wider channel bandwidths, which the CA would enable by opening the 6 GHz band under a Class Licence.

Today, the 40 MHz channel sizes that are readily available in the 2.4 GHz and 5 GHz bands 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

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

[3] 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

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

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.

Thus, *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. A 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[5], 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.

Moreover, 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 that 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 Wi-Fi technology because it is "greenfield" Wi-Fi spectrum. 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.

The 1200 MHz of spectrum in the 6 GHz band on which Wi-Fi 6E would run is the ideal candidate to solve these bandwidth constraint issues. The full 6 GHz band provides a roughly equivalent number of 80 MHz channels as there are 40 MHz channels in the 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 WLAN 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.

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

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 WLAN 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 in Hong Kong.

II. We Support the CA's Proposal to Designate the Lower 500 MHz Under Class Licence, But We Recommend that the CA Consider Designating the Upper 700 MHz for Class Licence in the Future.

We support the CA's proposal to designate the lower 500 MHz of the 6 GHz band for Class Licence. However, we believe that in the longer term, the full 1200 MHz of the 6 GHz band will be required to meet the demand for wider channels needed for WLANs to continue to support broadband deployment. Therefore, the CA should consider allowing Wi-Fi to operate in the full 1200 MHz. First, an allocation of 500 MHz in lieu of the full 5925-7125 MHz is not sufficient to meet demand for wider channels particularly in dense deployments. Second, global momentum is trending toward making the full band available for license-exempt use. Third, there is an opportunity cost to taking a "wait and see" approach and limited benefit to an IMT designation in the upper part of the 6 GHz band since the 3GPP standards for 6 GHz are still very nascent and any resulting product development is speculative, whereas WLAN products are available today. Fourth, limiting available 6 GHz band license-exempt spectrum will impair WLAN ability to support 5G offloading, which will be very important to augment 5G coverage and capacity. And fifth, preserving the opportunity for Standard Power deployments (with Automated Frequency Coordination) requires the full band.

a. An allocation of 500 MHz in Lieu of the Full 6 GHz Band is Not Sufficient in the Long Term.

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 (which as detailed in response to Question 1 limits the capabilities of WLAN technologies). 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.[6]

With a 500 MHz allocation of 6 GHz spectrum, users in Hong Kong would fall behind economies that have designated all 1200 MHz. Instead of incremental benefit from new immersive services, users would either lack the ability use these new services, or experience a significant degradation in their current experience while trying to enjoy these services. 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.

b. Globally, Regulators are Making the Full 6 GHz Band Available for Licence-Exempt Use.

Global momentum has trended toward opening the entire 6 GHz band for licence-exempt use.[7] 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-

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[6] 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.

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

exempt use. 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 licence-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 for licence-exempt use

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

In all cases, regulators have articulated compelling rationales for expanding license-exempt spectrum to support their broadband access goals. In addition, when regulators propose the lower 500 MHz of the 6 GHz band, they generally explain their proposal by pointing to Europe. Europe's 2017 decision to evaluate the lower 500 MHz of spectrum was based on 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.[8] 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 harmonised technical conditions should enable the coexistence with other systems in this and adjacent frequency bands.*

[8] 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.

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 Hong Kong or any country outside ITU Region 1. It was internal-to-CEPT decision-making and should not serve as a limiting factor on how the CA studies the 6 GHz band. Nor should it cause the CA to fall short of adopting the best public policy outcome possible efforts as relevant.

c. The Opportunity Cost of Opening Less Than the Full Band Under Class Licence Is Large and There Are Limited Benefits Attributable to an IMT Designation.

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 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 and countries that only designate 500 MHz will not be able to enjoy the benefits of applications that are built to take advantage of these larger channel sizes. The CA should consider opening the full 1200 MHz of the 6 GHz band to realize a stronger and more diverse license-exempt ecosystem when 6 GHz applications and services are deployed to benefit the entire nation.

Additionally, 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 500 MHz bandwidth 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.

Moreover, 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.[9] 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.[10] Radios supporting 5G NR bands n77 and 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 any portion of 5925-7125 MHz spectrum for IMT.[11] 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.[12]

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[9] 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/

[10] 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/.

[11] 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.

[12] GSMA lacks a consistent message about the 6 GHz band. Compare its statement that the 6 GHz is one of four bands that should be considered for the "long term" future (https://www.gsma.com/spectrum/5g-spectrum-guide/) with its recent press release declaring the absence of 6 GHz spectrum a "clear threat" to 5G (https://www.gsma.com/newsroom/press-release/gsma-calls-on-governments-to-license-6-ghz-to-power-5g/). We urge IFT to evaluate the dearth of IMT actions and the absence of specifications or equipment.

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."[13] 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.[14] 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.[15] Moreover, no regulatory proceeding on the 6 GHz band 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 with incumbents, in particular, Fixed Satellite Services.

Waiting for the outcome of WRC-23 is unnecessary – especially in ITU Region 3 where 6425-7025 is not even being considered, and only the top 100 MHz is to be studied for a possible global 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 more advanced license-exempt mobile technologies to the Hong Kong market.

With high opportunity cost for failing to open the band to license-exempt WLAN technologies, and with no benefit to Hong Kong's citizens and businesses for reserving part of the band for future IMT use, we strongly recommend to the CA to consider opening the full 6 GHz band under Class Licence.

d. Class Licence Spectrum 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.[16] 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

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

[14] CITC at 51.

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

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

two technologies interact in important ways. Spectrum allocations should be sufficient to support both. License-exempt technologies support 5G in three ways:

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.[17] When Canada opened the 6 GHz band for license-exempt technologies, it stated that it expects offloading of mobile traffic to increase over time,[18] which is consistent with more data being consumed inside homes or in indoor business locations.[19]

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. IMT interests cite the 6 GHz band as potentially useful for backhaul.[20] 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.[21]

Third, operators can deploy 3GPP unlicensed technology – 5G NR-U – to extend their networks into unlicensed spectrum.[22] 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

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[17] 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.

[18] ISED at page 12, para 37.

[19] 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.

[20] 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).

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

[22] See CITC at page 51.

industry have already been working on coexistence.[23] Technology-neutral rules would allow both technologies in the band.

e. Allocating the Full Band for Class Licence Preserves the Opportunity for Standard Power Use with Automated Frequency Coordination (AFC).

Another important consideration is preserving the opportunity for Standard Power (higher power and outdoor) with AFC 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 in the 6 GHz band would operate in conjunction with an 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 Low Power Indoor (LPI) and/or Very Low Power portable (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 WLAN services.

For all these reasons, we urge the CA to move forward with making the full 1200 MHz band available under Class Licence.

III. Recommended Technical Specifications for the 6 GHz Band Class Licence Devices

We support three device classes in the 5925-7125 MHz band: Low Power Indoor (LPI), Very Low Power portable (VLP) and 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.

One important benefit of opening the full 6 GHz band to license-exempt WLAN technologies is that incumbent users are not required to be relocated, and in fact, can grow their network operations over time. The proposed mitigations, 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.

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[23] 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.

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,[24] with specific consideration given to the conditions specified by Ofcom UK[25] and the United States FCC,[26] the undersigned companies encourage the CA 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	Class Licence	Class Licence
Transmit power (e.i.r.p.)	30 dBm	17 dBm

We further invite the CA 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.

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

[24] *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 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)).*

[25] 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").

[26] *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.

Harmonizing with these technical and operational parameters with those adopted by other leading regulators would help Hong Kong to benefit from early availability and economy of scale of the fast-emerging Wi-Fi 6E device ecosystem, and help to improve global scale and interoperability.

Additionally, with respect to certification requirements, we believe that a compulsory certification requirement on Access Points covered by the WLAN Device Licence is unnecessary, and that a voluntary certification scheme would suffice. The problem of leakage of non-compliant product is not a new one (the same exists for devices in the 2.4 and 5 GHz band with excessive power levels) and can be dealt with by post-market surveillance for non-compliance, and enforced through the Class Licence where required. Furthermore, we agree with the CA that the certification requirement should not apply to client devices.

We similarly believe that a labelling requirement for 6 GHz access point equipment as proposed by the CA should not be mandatory, but voluntary. Market-specific requirements for labelling add logistic complexity and do not necessarily address challenges of non-compliant products.

IV. Allocating 6 GHz Spectrum Under Class Licence Will Yield Benefits to Hong Kong.

Important benefits accrue to Hong Kong by opening the 6 GHz band to license-exempt technologies, including how these technologies will help address the digital divide and foster innovation. A recent study commissioned by the Wi-Fi Alliance found that the global value of Wi-Fi is $3.3 trillion in 2021 and will grow to $4.9 trillion by 2025.[27] 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. 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.[28]

Economic studies also show how Hong Kong 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. This should come as no surprise because WLAN 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

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[27] 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).

[28] *Id.*

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.

Opening the 6 GHz band for license-exempt use would contribute to global harmonization that is supportive of robust technological innovation. Hong Kong 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, Hong Kong would help to ensure that manufacturers and innovators will be attracted to a substantial market opportunity, promoting expected public interest benefits for Hong Kong.

Submitted by:

Apple, Inc.
Broadcom, Inc.
Cisco Systems, Inc.
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Intel Corporation
Meta Platforms Inc. (formerly Facebook, Inc.)
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