BEFORE INDUSTRY CANADA

IN THE MATTER OF

CANADA GAZETTE, PART 1, NOTICE NO. SLPB-006-17 CONSULTATION ON THE SPECTRUM OUTLOOK 2018-2022

COMMENTS OF WI-FI ALLIANCE

February 16, 2018

1.0 INTRODUCTION AND BACKGROUND

1.1 On October 6, 2017, Innovation, Science and Economic Development Canada ("ISED" or the "Department") issued Notice No. SLPB-006-17 seeking input on its spectrum outlook for 2018-2022.[1/] Wi-Fi Alliance®[2/] applauds ISED's actions to prepare for the future of wireless technology and appreciates that ISED recognizes the critical role that licence-exempt spectrum will play in that future. As ISED notes, "demand for radio frequency spectrum continues to rise as a result of the growth in wireless broadband,"[3/] with a "significant increase in use and innovation" in licence-exempt devices.[4/]

1.2 Wi-Fi Alliance is a global, non-profit industry association of over 800 leading companies from dozens of countries devoted to connecting everyone and everything everywhere. With technology development, market building, and regulatory programs, Wi-Fi Alliance has enabled widespread adoption of Wi-Fi® worldwide, certifying thousands of Wi-Fi products each year. The mission of Wi-Fi Alliance is to provide a highly effective collaboration forum for Wi-Fi matters, grow the Wi-Fi industry, lead industry growth with new technology specifications and programs, support industry-agreed standards, and deliver greater product connectivity

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1/ *Notice No. SLPB-006-17 – Consultation on the Spectrum Outlook 2018-2022*, Canada Gazette, (October 6, 2017) ("*Consultation*").

2/ Wi-Fi®, the Wi-Fi logo, the Wi-Fi CERTIFIED logo, Wi-Fi Protected Access® (WPA), WiGig®, the Wi-Fi Protected Setup logo, Wi-Fi Direct®, Wi-Fi Alliance®, WMM®, Miracast®, and Wi-Fi CERTIFIED Passpoint® , and Passpoint® are registered trademarks of Wi-Fi Alliance. Wi-Fi CERTIFIED™, Wi-Fi Protected Setup™, Wi-Fi Multimedia™, WPA2™, Wi-Fi CERTIFIED Miracast™, Wi-Fi ZONE™, the Wi-Fi ZONE logo, Wi-Fi Aware™, Wi-Fi CERTIFIED HaLow™, Wi-Fi HaLow™, Wi-Fi CERTIFIED WiGig™, Wi-Fi CERTIFIED Vantage™, Wi-Fi Vantage™, Wi-Fi CERTIFIED TimeSync™, Wi-Fi TimeSync™, Wi-Fi CERTIFIED Location™, Wi-Fi CERTIFIED Home Design™, Wi-Fi CERTIFIED Agile Multiband™, Wi-Fi CERTIFIED Optimized Connectivity™, and the Wi-Fi Alliance logo are trademarks of Wi-Fi Alliance.

3/ *Consultation* at 22.

4/ *Id.* at 44.

through interoperability, testing, and certification. It is also deeply involved in regulatory proceedings related to licence-exempt spectrum around the world.

1.3 As ISED observes in the *Consultation*, Wi-Fi is already a critical tool for getting Canadians and their devices online,[5/] both as stand-alone connections and through mobile network offloading – ISED estimates 63% of Canada's mobile traffic will be offloaded onto Wi-Fi networks by 2021,[6/] though others believe that number will be even higher – up to 75%.[7/] As more Internet of Things ("IoT") devices become available and are deployed, this increase in mobile data demand will accelerate, meaning that the need for spectrum to meet that demand will also increase.[8/] ISED's Spectrum Outlook should therefore consider additional spectrum bands that can be made available on a shared or exclusive basis to support current, developing, and future technologies and the economic growth they will bring.

2.0 QUESTION 1: What future changes, if any, should ISED examine with regard to the existing licensing regime to better plan for innovative new technologies and applications and allow for benefits that new technology can offer, such as improved spectrum efficiency?

2.1 As discussed in further detail in Section 3, the massive increase in licence-exempt devices continues to lead spectrum shortages that may negatively affect Canadian consumers and enterprises. Spectrum is a precious natural resource and ISED should continue to explore ways to maximize its utilization for the benefit of all Canadians. Therefore, ISED and other regulators

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5/ *Id.* at 45.

6/ *Id.* at 53.

7/ *See, Comments of Cisco on Consultation on the Technical and Policy Framework for Radio Local Area Network Devices Operating in the 5150-5250 MHz Band,* at 6, filed Mar. 29, 2017 ("Cisco Comments").

8/ *Consultation* at 52.

must look for alternative methods to permit access to spectrum, including spectrum sharing between incumbent operators and licence-exempt devices.

2.2. Wi-Fi technology has long demonstrated an ability to share frequency bands with other users – both licensed and licence-exempt – and can replicate these successes in other bands. Licensed operations generally require guaranteed spectrum access, which entails clearing, repacking, relocating, or other complex and expensive methods of preparation for reallocation; licence-exempt operations like Wi-Fi are able to access spectrum on non-interference basis, alongside incumbents, thereby making spectrum usage much more efficient. Most incumbent protection can take place through device-based mechanisms, such as listen-before-talk, dynamic frequency selection, power limits, transmit-power-control, antenna gain masks, and other interference mitigation techniques.[9/]

2.3 ISED should take advantage of that capability to identify spectrum with characteristics beneficial to licence-exempt operations and determine if sharing is possible. As discussed below, Wi-Fi Alliance believes this is possible in the 6 GHz band, and that there may be other frequency bands that can be made available for sharing in the future.

3.0 QUESTION 5: Do you agree with the above assessment of demand for licence-exempt spectrum in the next few years? Is there additional information regarding demand, which is not covered above, that should be considered? If so, please explain in detail.

3.1 Wi-Fi Alliance agrees that "there will be growing demand for spectrum in the licence-exempt bands" in the coming years.[10/] Wi-Fi Alliance conducted its own *Spectrum*

9/ As noted below, RKF Engineering Solutions, LLC recently conducted a study demonstrating the feasibility of radio local area networks sharing with incumbent services in the 6 GHz band, an approach that can be replicated in Canada and in other bands.

10/ *Consultation* at 56.

Needs Study that supports ISED's conclusions.[11/] This study showed that, based on traffic predictions for a number of countries around the world, between 500 megahertz and 1.8 gigahertz of new spectrum would be needed for Wi-Fi operations in order to avoid a looming spectrum shortage.[12/]

3.2 Despite the massive growth in Wi-Fi usage since its introduction 20 years ago, there has not been a corresponding increase in the spectrum available to it. In fact, only a few hundred megahertz are delivering the majority of Canada's, and the world's, Internet traffic,[13/] a remarkable feat, but one which cannot be expected to be supported forever. The 2.4 GHz band, which includes only 83.5 megahertz[14/] and carries a large portion of Wi-Fi traffic, is highly congested.[15/] It also can only accommodate 20 megahertz channels, which are too narrow to support today's use cases such as video and virtual reality. The future generation of Wi-Fi technology: 5G Wi-Fi (802.11ax) is designed to implement 80 and 160 megahertz channels where the band permits.[16/] This standard will operate within the 2.4 GHz and 5 GHz bands, as discussed below, and is ideally suited to expand to the 6 GHz band. Products with this

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11/ Wi-Fi Alliance, *Spectrum Needs Study*, Final Report (Feb. 2017) available at: https://www.wi-fi.org/downloads-registered-guest/Wi-Fi%2BSpectrum%2BNeeds%2BStudy_0.pdf/33364.

12/ *Id*. at 1.

13/ CISCO, VNI Complete Forecast Highlights Tool, North America, United States, Wired Wi-Fi and Mobile Growth (2017), http://www.cisco.com/c/m/en_us/solutions/service-provider/vni-forecast-highlights.html (select "Canada" from the "North America" drop-down menu, select "2021 Forecast Highlights" and expand "Wired Wi-Fi and Mobile Growth."). CISCO expects Wi-Fi traffic to account for almost half of all Internet traffic by 2020. CISCO, Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2016–2021 at 21, Feb. 7, 2017, available at https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/mobile-white-paper-c11-520862.pdf.

14/ *See*, *RSS-210 – Licence-Exempt Radio Apparatus: Category I Equipment*, Annex B, Section 10.

15/ *Consultation* at 23.

16/ *See*, National Instruments, *Introduction to 802.11ax High-Efficiency Wireless*, White Paper, Jul. 24, 2017, available at http://www.ni.com/white-paper/53150/en/.

technology are coming online now, and any delay in designating spectrum that supports its use will unnecessarily delay its adoption by Canadian citizens and businesses.

3.3 Given the "critical part" this spectrum plays in mobile connectivity,[17/] as well as the actions being undertaken in other countries to open new spectrum bands to Wi-Fi, ISED should move quickly to make additional spectrum available to meet this growing demand. Rapidly growing needs for broadband wireless connectivity delivered by Wi-Fi to Canadian consumers and enterprises is outpacing available spectrum capacity. Only prompt regulatory action can prevent this looming spectrum crunch from degrading the socioeconomic benefits delivered by Wi-Fi.

4.0 QUESTION 6: What new technologies and/or sharing techniques are expected to aid in relieving traffic pressures and addressing spectrum demand for licence-exempt applications? When are these technologies expected to become available?

4.1 As discussed above, Wi-Fi is capable of protecting incumbent operations, whether licensed or licence-exempt, to allow more efficient use of scarce spectrum resources. The device-based contention mechanisms employed by Wi-Fi devices today have shown remarkable success in improving access and fostering growth while protecting incumbents. These technologies are available today, and with small adjustments, could be applied to new spectrum bands to allow licence-exempt operations alongside additional incumbents. Insofar as existing techniques may be insufficient for incumbent protection, database mechanisms such as those employed in the television white spaces allow even greater flexibility.

17/ *Consultation* at 45.

5.0 QUESTION 7: What existing licence-exempt frequency bands will see the most evolution in the next five years? Are there any IoT applications that will have a large impact on the existing licence-exempt bands? If so, what bands will see the most impact from these applications?

5.1 As discussed above, the next generation of Wi-Fi for the 2.4 GHz band, 5 GHz band and potentially the 6 GHz band is 802.11ax, which will complement existing specifications such as 802.11n and 802.11ac in the 2.4 GHz and 5 GHz bands. This standard will combine these bands to provide the ideal connection for different operations. IoT applications are enabled and supported by multiple 802.11 technologies, including 802.11ax, in sub-1 GHz, 2.4 GHz, 5 GHz and 6 GHz bands. Wi-Fi HaLow is expected to be introduced to operate in sub-1 GHz bands, *e.g.* 902-928 MHz. Wi-Fi HaLow is based on 802.11ah which is designed specifically for battery powered IoT applications requiring secure bi-directional traffic and with a range of up to 1 kilometer. This means that all bands that host licence-exempt operations will witness growth, but Wi-Fi Alliance expects to see particularly heavy growth in the mid-band, where larger, contiguous channels will allow this spectrum to take over much of the traffic currently in the 2.4 GHz band.

5.2 Mid-band spectrum is perfect for licence-exempt operations like Wi-Fi. The need to protect incumbents, in particular fixed wireless and fixed satellite operators, prevents the use of the spectrum by licensed mobile services. This fact, combined with the propagation characteristics which balance range and bandwidth, make it ideally suited for the kind of short-range, networks, able to offer speeds up to 20 Gbps, offered by 802.11ax.

5.3 Without new spectrum made available, existing bands are likely to see increased crowding in the next few years. As ISED notes in the *Consultation*, the 5350-5470 MHz band is unavailable for licence-exempt operations in Canada[18/] Wi-Fi Alliance strongly supports making

[18/] *Id.* at 146.

this spectrum available for licence-exempt operations, taking into consideration measures to protect incumbent operations. As discussed below, ISED should also consider other mid-band spectrum, such as the 6 GHz band (5.925-7.125 GHz), to meet this increasing need for mid-band spectrum. Other counties have already initiated consideration of allowing licence-exempt operations in the 6 GHz spectrum.[19/]

6.0 QUESTION 8: Will the trend for offering carrier-grade or managed Wi-Fi services continue to increase over the next five years? If so, will this impact congestion in Wi-Fi bands and which bands would be most affected?

6.1 Wi-Fi Alliance agrees that the trend for offering carrier-grade or managed Wi-Fi services will continue to increase over the next five years. As noted above, ISED has estimated that the percentage of total smartphone data carried by Wi-Fi, will be 63% by 2021;[20/] others have estimated that the number is already far greater -- up to 70%[21/] or even 80%.[22/] In either case, without Wi-Fi connections available, the data demand imposed on already over-taxed carrier networks would grow dramatically.

6.2 Wi-Fi Alliance has worked closely with regulators like the FCC and with carriers that seek to use licence-exempt spectrum in managed networks to develop a coexistence testing system to ensure that those carrier licence-exempt operations coexist fairly with Wi-Fi devices, rather than interfering with them.[23/] It is vitally important that regulators like ISED and the FCC

19/ *See, infra, FN 27, 28.*

20/ *Consultation* at 53.

21/ *Cisco Comments* at 6.

22/ *See, e.g.*, Fierce Wireless, *Cellular and Wi-Fi Use* (Jan. 12, 2018) available at https://www.fiercewireless.com/wireless/cellular-and-wi-fi-use-by-operator-and-data-plan-type-for-verizon-at-t-t-mobile-and-sprint.

23/ *See, e.g., Letter from Edgar Figueroa, President and CEO, Wi-Fi Alliance to Marlene H. Dortch, Secretary, FCC,* ET Docket No. 15-105 (filed Sept. 22, 2016) (providing the FCC with a copy of the Coexistence Test Plan).

monitor developments in this area to protect fair spectrum access for critical licence-exempt operations like Wi-Fi. If the coexistence protections developed by Wi-Fi Alliance and carrier stakeholders are observed, then ISED will likely not be required to take additional actions to protect other licence-exempt operations. Nevertheless, the development of carrier-focused technologies like LAA and LTE-U have the potential to increase demand in licence-exempt spectrum, and ISED should calculate these uses into its spectrum usage projections.

7.0 QUESTION 20: ISED is seeking comments on the potential frequency bands for release in table 7: a) the proposed services and/or applications for each frequency band; b) the potential timing of releasing for each frequency b; and c) the priority of the release of the frequency bands. Provide supporting rationale for your responses.

7.1 Table 7 identifies several bands above 24 GHz (considered the millimetre wave bands) that may be released between 2018 and 2022 for licence exempt use. Wi-Fi Alliance supports this proposal. As it has noted in past filings with ISED,[24/] millimetre-wave spectrum will be of particular importance for 5G Wi-Fi deployments. WiGig, the branding used for Wi-Fi products operating in mmWave bands,[25/] will be a critical component of 5G networks. These Wi-Fi products are able to offer reliable access and gigabit throughputs by using 2.16 GHz channels, channel bonding, and Massive MIMO (Multiple Input, Multiple Output with spatial multiplexing) technologies. This performance mirrors the high data rates and low latency offered by 5G proposals, but Wi-Fi devices are already able to achieve these performance metrics.

7.2 It is therefore essential that ISED continue its efforts to allow licence-exempt operations in the millimetre-wave spectrum identified by ISED. This includes not just the 64-71 GHz band, which is part of ISED's ongoing spectrum releases, but also other bands between 24

24/ *Comments of Wi-Fi Alliance on Notice No. SMSE-002-17*, March 29, 2017; *Comments of Wi-Fi Alliance on Notice No. SLPB-001-17*, August 4, 2017.

25/ *See*, Wi-Fi Alliance, *Discover Wi-Fi Certified WiGig*, available at http://www.wi-fi.org/discover-wi-fi/wi-fi-certified-wigig.

GHz and 57 GHz, the 71-76 GHz and 81-86 GHz bands, and spectrum above 95 GHz, which ISED considers a "potential" release.[26/] Wi-Fi Technology has already been adopted for use in the millimetre wave bands that have been made available by other administrations and are supported by IEEE standards for use any country. If ISED evaluates any of this spectrum for terrestrial operations, it should consider designating some of the allocated spectrum for licence-exempt use.[27/] These bands share many of the same characteristics of the 64-71 GHz band, and will allow for more, wider channels for WiGig operations in Canada. ISED has itself noted that this spectrum will be used for enhanced, ultra-fast mobile broadband, massive machine type communications, and ultra-reliable/low latency communications.[28/] These ultra-reliable/low latency communications will enable groundbreaking applications like virtual reality and augmented reality, as well as others being developed.[29/]

8.0 QUESTION 21: Are there any other bands that should be considered for release in the next five years for commercial mobile, fixed, satellite, or licence-exempt that are not discussed above? Provide rationale for your response.

QUESTION 22: Are there specific frequency ranges/spectrum bands that should be made available for specific applications?

8.1 As noted above, Wi-Fi Alliance agrees with ISED that the coming years will bring substantial increases in demand for spectrum. This demand will stem from the deployment of 5G networks, of which Wi-Fi will be a crucial component and, for devices using licence-exempt spectrum, the use of 802.11ax devices, which will allow gigabit connections over wide channels.

26/ *Consultation* at Table 7.

27/ In the U.S., the FCC continues to evaluate the potential use of the 37-37.6 GHz band for unlicensed operations and ISED should consider the same designation when the FCC further addresses the use of that band.

28/ Notice No. SLPM-001-17, *Consultation on Releasing Millimetre Wave Spectrum to Support 5G*, Canada Gazette at ¶ 8 (June 5, 2017) ("5G Consultation").

29/ See, Wi-Fi Alliance, *Discover Wi-Fi Certified WiGig*, available at http://www.wi-fi.org/discover-wi-fi/wi-fi-certified-wigig.

802.11ax devices will operate in different spectrum bands for different operations and will work alongside the high-band (millimetre wave) and low-band (such as the TV White Spaces) spectrum already targeted by ISED.[30/] Yet, as noted above, there is an urgent need to identify and make available mid-band spectrum as well.

8.2 Accordingly, ISED should also consider making the 5.925-7.125 GHz band available for licence-exempt use. The use of this band is under consideration for wireless operations in the U.S. and Wi-Fi Alliance has urged that it be dedicated for licence-exempt use.[31/] Wi-Fi Alliance has similarly urged other administrations to make the spectrum available to meet the capacity requirements for licence-exempt devices.[32/] As noted above, 6 GHz spectrum can support 802.11ax technologies that can be migrated from the existing licence-exempt 5 GHz band. As in the U.S., this band hosts fixed satellite and microwave operations and limited mobile microwave operations in Canada. As Wi-Fi Alliance and other have explained in the U.S. proceeding,[33/] licence-exempt operations are ideally suited to sharing with these incumbents, and the propagation characteristics of the 6 GHz band, along with its proximity to existing operations in the 5 GHz band, make it an ideal home for future licence-exempt operations.

30/ 5G Consultation; Notice No. SMSE-018-17, *Consultation on the Technical and Policy Framework for White Space Devices,* Canada Gazette, (November 15, 2017).

31/ *See, Comments of Wi-Fi Alliance,* GN Docket No. 17-183 (FCC) (filed Oct. 2, 2017); *Reply Comments of Wi-Fi Alliance,* GN Docket No. 17-183 (FCC) (filed Nov. 15, 2018).

32/ *See, e.g., Comments of Wi-Fi Alliance* on ACMA (Australia) Five Year Spectrum Outlook, 2017-2021, (filed January 24, 2018); *Comments of Wi-Fi Alliance* on IMDA (Singapore) 5G Mobile Services and Networks Consultation Paper, (filed Jul. 10, 2017).

33/ *See, In the Matter of Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz,* Docket No. 17-183.

8.3 RKF Engineering Solutions, LLC ("RKF") recently completed a study that demonstrates that radio local area networks can share spectrum with incumbent operations.[34/] The conclusions that RKF reached with respect to the 6 GHz band in the U.S. are equally applicable to potential shared use of the band in Canada. The EU is also considering rules covering Wi-Fi operations in the 6 GHz band.[35/] ISED should therefore initiate a consultation proposing to open this spectrum to licence-exempt operations and allow Canadians to quickly take advantage of the new products that will use this spectrum once they become readily available.

9.0 CONCLUSION

Wi-Fi Alliance applauds the Department's efforts to develop plans for future spectrum use. Based on the growing importance of Wi-Fi networks to Canadian businesses and consumers, ISED should begin to take action to avoid a spectrum crunch that will prevent the growth of critical of Wi-Fi and developing technologies, like IoT, that will rely on licence-exempt spectrum. ISED should identify and make available spectrum which can be opened for licence-exempt operations, both in high frequency bands such as 64-71 GHz, 71-76 GHz, 81-86 GHz, and above 95 GHz, and in the mid-band, in particular in the 5 GHz and 6 GHz bands. This diversity of spectrum bands, each with their own unique propagation and bandwidth characteristics, will allow device manufacturers to introduce a variety of different use-cases and

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34/ RKF Engineering, *Frequency Sharing for Radio Local Area Networks in the 6 GHz Band*, Jan. 2018, available at https://s3.amazonaws.com/rkfengineering-web/6USC+Report+Release+-+24Jan2018.pdf.

35/ European Commission, Radio Spectrum Committee, *Working Document, Commission Paper on a draft mandate to CEPT on RLAN in the 6 GHz band*, Oct. 9, 2017 (available at https://circabc.europa.eu/d/d/workspace/SpacesStore/d63ea67f-8171-4619-a53d-8feb57387c27/RSCOM17-40_RLAN%206%20GHz.pdf).

will allow the future of Wi-Fi, 802.11ax, IoT and other not-yet-identified applications to meet their full potential.