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January 19, 2021

RE: Consultation on the Technical and Policy Framework for Licence-Exempt Use in the 6 GHz Band, Canada Gazette, Part I, December 2020 (Notice No. SMSE-014-20)

To whom it concerns:

It is with pleasure that TekSavvy Solutions Inc. (TekSavvy) submits these comments in response to ISED's Consultation on the Technical and Policy Framework for Licence-Exempt Use in the 6 GHz Band.

Yours truly,

[transmitted electronically]

Andy Kaplan-Myrth
VP, Regulatory and Carrier Affairs

cc: Marc Gaudrault, CEO
Charlie Burns, CTO

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TekSavvy Solutions Inc.

comments and responses
in

Consultation on the Technical and Policy Framework for Licence-Exempt Use in the 6 GHz Band

Canada Gazette, Part I,
December 5, 2020, Notice No. SMSE-014-20

January 18, 2021

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A. REVIEW OF 6 GHZ POLICY LANDSCAPE

1. TekSavvy Solutions Inc. ("TekSavvy") is submitting its reply comments on ISED consultation "Consultation on the Technical and Policy Framework for Licence-Exempt Use in the 6 GHz Band" in this document.

2. TekSavvy reasserts its position in favour of ISED's decision of opening the 6 GHz (5.925 – 7.125 GHz) as an unlicensed band.

3. TekSavvy supports the introduction of Automated Frequency Coordination (AFC) system for management of the 6GHz band.

4. The 6 GHz Band is rapidly being made available by spectrum regulators globally for unlicensed applications following concerted efforts of industry standards bodies, operators and regulators. Thus, following the lead the U.S. Federal Communications Commission (FCC) to open 1200 MHz of 6 GHz spectrum for Wi-Fi use, the U.K., Europe, Chile, South Korea, and the United Arab Emirates also made the decision to make 6 GHz band available for Wi-Fi. Countries including Brazil, Canada, Mexico, Peru, Taiwan, Japan, Saudi Arabia, Myanmar, and Jordan are currently developing their own plans to open the 6 GHz band for unlicensed operation.

a. Regulators Major Approaches for 6 GHz

5. As summarized below, that there are two major regulatory approaches in transforming this band (5.925 GHz to 7.125 GHz) into an unlicensed band.

6. In the first approach, regulators have chosen to prioritize indoor use and mitigate the risk of interference by outdoor deployments. The targeted band is either the entire band (5.925 GHz to 7.125 GHz) or half of it (5.925 GHz to 6.425 GHz).

7. Indoor use is accompanied by EIRP[1] (equivalent isotropic radiated power), capped at a low level, across the targeted portion of the band.

8. While outdoor use is allowed in a specific segment of this spectrum, corresponding power levels are significantly (four to six times) lower than those for indoor use – whether or not accompanied by the utilization of Automated Frequency Coordination (AFC). Thus, this approach is based on prioritization of indoor use.

9. This approach was followed by many leading international regulators such as UK's Ofcom, EU's European Conference of Postal and Telecommunication Administrations (ECPTAs), and South Korea's Ministry of Science and ICT.

10. The second regulatory approach prioritizes outdoor use of 6GHz spectrum based on the economic potential of outdoor deployments. US's FCC developed its regulatory framework following its standard regulatory procedures of industry consultation and independent studies and issued its Report and Order (FCC-20-51) decision followed by clarifications.

[1] Equivalent Isotropic Radiated Power is the total radiated power from a transmitter antenna times the numerical directivity of the antenna in the direction of the receiver, or the power delivered to the antenna times the antenna numerical gain.

11. The FCC used a different approach to address the issue of potential interference. Instead, the FCC allowed higher EIRP levels for outdoor usage, similar to those for licensed frequency bands, across 850 MHz of the 1200 MHz: 5.925 GHz – 6.425 GHz and 6.525 GHz – 6.875 GHz while at the same time, it permitted very low-EIRP devices to operate both indoors and outdoors across the entire band. Three interesting use cases were mentioned in the FCC-20-51: offloading traffic from carrier networks, Fixed Wireless Access (FWA), and private special-use networks.

12. The FCC approach relies heavily on detailed technical and operational rules for high EIRP outdoor deployments by service providers, as well as the use of Automated Frequency Coordination (AFC) in order to manage the risk of interference amongst users and spillover into other adjacent bands.

13. Given the close linkages between the US and Canadian telecommunication equipment ecosystems, as well as similarity of applications, use cases, telecom market structure and economic impacts, TekSavvy believes the previously listed measures deployed by the FCC would be more applicable to Canada.

14. The development of a commercial equipment ecosystems is critical for the successful use of 6 GHz spectrum by unlicensed users. In sections b. and c. below, TekSavvy presents the findings on the equipment ecosystems: the first operating according to the IEEE 802.11ax standard (Wi-Fi 6) and the second, according to 5G NR-U.

b. Wi-Fi 6E Ecosystem

15. Wi-Fi 6 is the commercial name that Wi-Fi Alliance gave to the products that are based on IEEE 802.11ax standard[2]. Later, new products were called Wi-Fi 6E to indicate the spectrum and channel bandwidth that is being utilized – in this case, 6 GHz and up to 160 MHz channels.

16. All major Wi-Fi original equipment manufacturers (OEMs) are making rapid progress in developing standards-based equipment for the 6GHz band based on the draft version of IEEE 802.11ax[3]. The announcement from the Wi-Fi Alliance on Jan 8th, 2021 stated that some of the major OEMs were in the final phase in the of certification process of their equipment with the Wi-Fi Alliance and were ready to launch production. For example, Intel® and Broadcom have certified their respective products: Wi-Fi 6E AX210 and BCM4389. Samsung Electronics announced that its Galaxy flagship phones will be Wi-Fi 6E certified - as they come available starting this year.

[2] Institute of Electrical and Electronics Engineers. The Standards Association (IEEE-SA) is an Operating Unit within IEEE that develops global standards in telecommunications – amongst a broad range of industries.

[3] IEEE 802.11ax will be published in its final format on Feb 2021.

c. 5G NR-U Ecosystem

17. 3GPP Rel-16[4] introduced 5G NR-U[5] in unlicensed spectrum in two modes: Anchored-NR and Standalone-NR. In Anchored-NR, unlicensed spectrum is combined with other licensed or shared spectrum as anchor. In Standalone-NR, only unlicensed spectrum is used.

18. Leading OEMs like chipset maker Qualcomm and radio equipment manufacturer Ericsson, have indicated that their equipment will be commercially available towards Q4 2021. This indicates that a full commercial ecosystem will be available towards the end of the current year.

19. It is expected that there will be significant demand from different sectors in the industry for equipment that enables rapid utilization of 5G technologies without the need for licensed spectrum. The business case for this technology is based on operator and private network applications and features including the following:

    a. Anchored-NR

        i. Boosts Mobile Network performance and deliver better user experience with higher speeds

        ii. Manages congestion and mobility in malls, campuses and dense urban hotspot.

        iii. Delivers a consistent 5G experience

    b. Standalone-NR

        i. Make 5G private networks easy to deploy

            1. Enables co-existence with Wi-Fi and LTE

            2. Enables Simple network deployment with virtualized RAN and cloud core

            3. Transition from private networks initially to neutral hosts and mobility offload

            4. Enables deployment of networks and scalability across markets with unlicensed spectrum.

        ii. Benefits a wide range of industrial IoT applications in the following industry verticals:

            1. Mines

            2. Warehouses

[4] 3GPP Rel-16 (the 16th release of the standard) was issued in June 2020.

[5] 5G NR-U is the first global cellular standard with both license-assisted and standalone use of unlicensed spectrum.

3. Ports and shipping logistics

20. TekSavvy expects that the 5G NR-U ecosystem to be in high demand – especially for all those applications that can't be addressed by Wi-Fi 6E, including mobility.

d. AFC System Background

21. Automated frequency coordination (AFC) systems have proven to be an essential feature of modern spectrum management systems for both licensed and unlicensed applications. AFC systems have been successfully adopted by leading global regulators for applications in various bands under different names.

22. AFC systems can also be considered dynamic with respect to inputs. However, the basic steps are the same and the outcome is determined by the technical and operating rules and frameworks adopted by each national regulatory authority (NRA).

23. Frequency coordination systems facilitate spectrum sharing by ensuring the following core functions:

    a. Protection of incumbent licensees or other users from interference caused by entrants with lower priority (and, in some cases, coordinate among users with the same priority).

    b. Provision of authoritative - and in some bands, real-time decisions on requests to transmit or assign usage rights.

    c. Enforcement of the use of authorized devices.

    d. Monitoring of spectrum assignments and, in some cases, actual usage.

24. Historically, AFC systems evolved out of automated database coordination systems - initially applied to wireline telecommunication systems where switchboard operators opened and closed phone lines manually. Over the course of a century, this hands-on approach was replaced by automated circuit switching. By the late 1980s, automated databases could near-instantaneously vary the treatment of different calls based on the volume and usage characteristics via established algorithms. This progress culminated in the Signaling System 7 (SS7) architecture. SS7 employed automated databases to support interoperable call initiation, routing, billing, and a variety of information-exchange functions, including call forwarding and wireless roaming, across the entire public switched telephone network (PSTN). The ITU recommended SS7 as an international standard in 1988 and it was swiftly adopted by major carriers worldwide.

25. AFC has. in recent years, evolved from manual, to automated, to dynamic – adding automation and propagation modeling to static licensing data. This AFC evolution has been stepwise:

    a. manual, database-informed coordination of fixed links and satellite earth stations.

    b. database-assisted coordination of point-to-point links on a semi-automated basis (e.g., in the 70/80/90 GHz bands).

c. fully automated frequency coordination of unlicensed sharing of vacant TV channels (TV White Space).

d. dynamic coordination of a three-tier hierarchy of sharing by Spectrum Access System (SAS) databases across the 3550-3700 MHz band with U.S. Navy radar (the Citizens Broadband Radio Service or CBRS). It is important to stress that in determining the frequency to be utilized and corresponding power level, AFC is frequency-agnostic. by definition.

e. AFC Building Block and Structure

26. The basic building blocks and sequential steps of an automated frequency coordination system include the following informational inputs and core functions as shown in fig. 1.

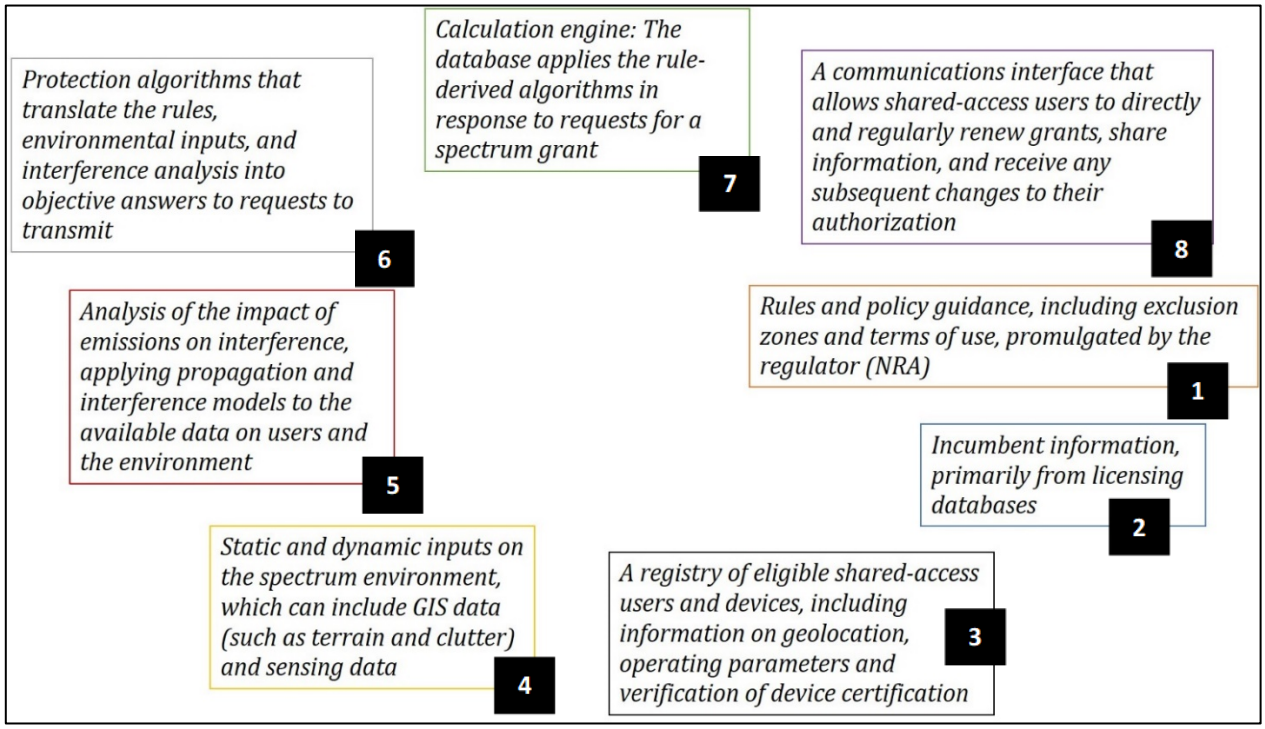

Figure 1: Proposed Building Blocks for the AFC.

f. Ecosystem and AFC availability

27. Various AFC systems are commercially available and have been successfully implemented by spectrum regulators under ecosystems of users and applications.

28. In the UK, Ofcom adopted a database-driven coordination system first in 2015 for TV Whitespace (TVWS)[6]. TV White Space is managed in tiers by a dynamic geolocation database, sharing broadcast spectrum (primary) with wireless microphones (secondary) and opportunistic unlicensed TVWS devices (tertiary). In 2016, Ofcom further developed

[6] Ofcom, Implementing TV White Spaces, Statement, Annex 9 (Feb. 12, 2015), available at https://www.ofcom.org.uk/__data/assets/pdf_file/0025/58921/annexes.pdf

its framework for shared spectrum[7]. In 2018, Ofcom released a consultation[8] on using dynamic spectrum access (DSA), and in July 2019 a statement[9] was released to lay the path on how to proceed with DSA. In its statement, Ofcom explained that DSA, or AFC, is a controlling software and has been available in many forms in the past and provided by mobile operators and independent software companies.

29. In the US, SAS is the AFC system used to manage the CBRS spectrum. Currently, SAS is the most advanced and complex example of AFC, as it is used to enable three-tiers of shared access. SAS combines licensed and opportunistic use with dynamic database coordination for sharing of the 3550-3700 MHz spectrum amongst U.S. Navy radar (primary) with a mix of licensed (secondary) and lightly-licensed (tertiary) users.

30. Global interest and investment in the development of ever-more sophisticated AFC systems increased significantly following the FCC announcement that it was releasing 1200 MHz in the 6 GHz band for unlicensed use. As an example, ARRIS Enterprises LTD filed a patent[10] in May 2020 (published in Nov 2020) in which the inventors claimed methods, systems, and computer readable media for implementing and improving use of AFC, operational deployment of the 6 GHz band for unlicensed devices, and the use of the 6 GHz band for low-latency services, timing distribution, and quality of service.

g. Functional Requirements for AFC System

31. TekSavvy believes that the rapid adoption and implementation of an AFC system is a pre-requisite to the successful roll out of unlicensed application in the 6 GHz band in Canada. TekSavvy requests that ISED, in its evaluation of alternative AFC systems, consider the following features as essential for the efficient management of unlicensed applications:

    a. Coordination of outdoor deployments to insure no interference between tens of thousands of point-to-point microwave links and other incumbents.

    b. Prioritize outdoor deployments based on the size of clients' base for each client in each zone.

    c. Optimize coexistence among users, if relevant, based on ISED rules (for example, among unlicensed or other opportunistic users).

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[7] Office of Communications (Ofcom), A Framework for Spectrum Sharing, Statement, at 28 (April 14, 2016), available at https://www.ofcom.org.uk/__data/assets/pdf_file/0028/68239/statement.pdf.

[8] Ofcom, Enabling Opportunities for Innovation: Shared Access to Spectrum Supporting Mobile Technology, Consultation (Dec. 18, 2018) ("Ofcom 2018 Consultation"), available at https://www.ofcom.org.uk/__data/assets/pdf_file/0022/130747/Enabling-opportunities-for-innovation.pdf

[9] Ofcom, Statement: Enabling wireless innovation through local licensing, Statement (25 July 2019), available at https://www.ofcom.org.uk/__data/assets/pdf_file/0033/157884/enabling-wireless-innovation-through-local-licensing.pdf

[10] Ansley, Carol J. (Johns Creek, GA, US), Cheevers, Charles (Alpharetta, GA, US), Wheelock, Ian (Cork, IE), Gravely, Thomas (Herndon, VA, US), 2020, AUTOMATED FREQUENCY COORDINATION AND DEVICE LOCATION AWARENESS, United States, ARRIS Enterprises LLC (Suwanee, GA, US), 20200367020, https://www.freepatentsonline.com/y2020/0367020.html, available at https://www.freepatentsonline.com/20200367020.pdf

d. On a regular basis, capture data and report on the actual use of the band, as well as any anomalies in order to enable the regulator to take timely corrective actions.

e. Maintain the ability to identify and shut down a device or provider in cases of harmful interference or emergency.

f. Facilitate secondary market transactions.

g. Provide a portal for incumbents and/or users to report corrections or updates to licensing data, operating parameters, or to report incidents of interference.

h. Collect any usage or regulatory fees authorized or required by the regulator.

i. Develop additional value-added services that can be offered to stakeholders in the band, including to incumbents.

h. AFC Ownership and Operational Model

32. TekSavvy believes the application of an AFC system in the 6 GHz band in Canada will enable efficient spectrum sharing, and correspondingly, significantly more users, applications and intensity of spectrum utilization. Availability of inexpensive, secure spectrum will favour the development of new services to subscribers, market entry by new service providers and overall choice, innovation and competitive pricing for subscribers. There will be a demand by new entrants for access to resources such as poles and conduits owned by incumbent operators and utilities.

33. Managers of the AFC system will need to ensure that affordability does not become a barrier to access for users of the AFC. Also, managers will need to ensure the technical and operational rules as well as the underlying technology of the AFC system continue to evolve as new applications are developed and new users are added. The SAS AFC system used for the CBRS band in the US is owned as a for-profit venture, led by a consortium of Google and major operators. This has resulted in exorbitant monthly fees - based on number of subscribers, paid by users and, in the end, correspondingly hurt smaller, innovative players such as independent ISPs.

34. In TekSavvy's view, the Canadian AFC system for the 6 GHz band should not be privately owned as a 'for-profit' venture. TekSavvy suggests that the AFC system be constituted under an independent, public-interest corporation. This entity should be jointly owned and operated by ISED, stakeholders comprised of the equipment manufacturer selected to provide the AFC gear, and a consortium of 6 GHz unlicensed users. This would ensure ongoing technology and regulatory neutrality in the development and application of technical and operational rules, a long-term perspective on the development of AFC software to deal with ever more complex usage and coordination issues.

35. In operational terms, ISED would set the framework of technical and operational rules. ISED and the private stakeholders in the public interest corporation would appoint a board of directors to oversee the operations of the AFC corporation and this board would in turn, hire managers and technical staff. The staff would be responsible for the operation and maintenance of the AFC, the application of ISED technical and operational rules, and the

provision of reports to the Board and ISED on a regular and timely basis. Corporate management would also be responsible for recommending technology upgrades as well as improvements in the framework to accommodate practical user needs, efficiencies in operations and technology changes. While ISED would not get involved in the day-to-day application of the rules, individual users would have the right to appeal management decisions first to the management board and ultimately to ISED and thus, ISED would have authority over the operations of the AFC. The AFC system would be maintained by the management and administered by a team supervised by ISED personnel. The corporate team would work in close coordination with the AFC equipment vendor's software team and the larger wireless forum of users of Canadian and global AFC systems.

36. TekSavvy recommends that the initial AFC system be granted one-time capital funding by ISED – possibly combined with vendor financing by an AFC equipment provider.

37. Once the AFC ownership and operational structure is established and the AFC system is launched, the AFC system should be self-financing through user fees. A key consideration in the setting user fees would be ensuring affordably for smaller and new entrants.

38. In the scenario that ISED funding is not available for launch of the AFC, an alternative solution would be 100% vendor or 3rd party investor financing with 'piecewise pricing' based on a fixed part and variable part of the user fee. The fixed part would cover for the solution development amortized cost over 10 years. The variable part would cover ongoing activities and it would be based on a charge per 10 MHz channel bandwidth usage rather than by subscriber - as is the case in the US CBRS AFC. This structure would ensure that the capital cost has been accounted for and encourage the wireless players to serve more Canadians rather than paying punitive fees for having more customers.

B. ANSWERS TO THE CONSULTATION QUESTIONS

a. International Context

Q1. ISED is seeking comments on the timelines for the availability of:

a) low-power equipment ecosystems, both Wi-Fi 6E and 5G NR-U

b) standard-power equipment ecosystems, both Wi-Fi 6E and 5G NR-U, under the control of an AFC

c) AFC

A1. The commercial ecosystem for Wi-Fi 6E low-power equipment will be available as of Q1 2021. Major OEMs are certifying their products with Wi-Fi Alliance and in the last phase of the process. As to 5G NR-U, the ecosystem is expected to be available starting from Q1 2022.

A2. The commercial ecosystem for Wi-Fi 6E standard-power equipment will be available as of Q1 2021. Major OEMs are certifying their products with Wi-Fi Alliance and in the last phase of the process. As to 5G NR-U, the ecosystem is expected to be available starting from Q1 2022.

A3. AFC is available from many US-based firms and TekSavvy believes that the Canadian ecosystem will develop rapidly to meet the demand from the many applications across virtually all sectors of the economy.

b. Changes to the spectrum utilization for the 6 GHz band

Q2. ISED is seeking comments on its proposals to allow licence-exempt RLAN use in the 5925-7125 MHz band.

A4. TekSavvy strongly supports allowance by ISED of licence-exempt RLAN use in the 5925-7125 MHz band. This will allow new entrants to serve more Canadians and deliver 50/10 services and help to meet the objectives of ISED in Canada Spectrum Outlook 2018 – 2022[11]. It also supports TekSavvy's ongoing activities to reach out to more Canadians in the rural and remote portions of its service areas without licensed spectrum or fibre facilities deployment. It would also enable TekSavvy to provide affordable turnkey solutions to corporate clients seeking to use private networks. Licence-exempt RLAN usage will also enhance the subscriber experience, as TekSavvy will be able to offload traffic from a wireless LTE deployment and ensure subscribers always have access to speeds above the CRTC's Universal Service Objective of 50/10 network speeds.

[11] Available at https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/Outlook-2018-EN.pdf/$file/Outlook-2018-EN.pdf

Q3. ISED is seeking comments on the proposed footnote Cxx and the changes to the CTFA as shown in table 2

A5. TekSavvy agrees with these changes, as they are required to implement the proposal in this consultation.

c. Proposals for the introduction of licence-exempt operation in the 6 GHz band

Q4. ISED is seeking comments on the proposed rules for standard-power RLANs:

a. indoor and outdoor operation would be permitted

b. RLAN access points would only be permitted to operate under the control of an AFC system in the 5925-6875 MHz frequency range

c. maximum permitted e.i.r.p. would be 36 dBm

d. maximum permitted power spectral density would be limited to 23 dBm/MHz

e. use of a vertical elevation mask, with a maximum e.i.r.p. of 125 mW at elevation angles above 30 degrees over the horizon, would be required

A6. TekSavvy strongly agrees that both indoor and outdoor operations should be permitted. Outdoor use cases and applications are vital for the Canadian economy as well as internet users in Canada's rural and remote areas.

A7. TekSavvy strongly agrees that the AFC system needs to be in place to operate in the 5925-6875 MHz frequency range. TekSavvy's view is that AFC is critical to the feasibility and success of unlicensed use in the 6GHz band.

A8. TekSavvy views the values of 36 dBm for EIRP and 23 dBm/MHz as sufficient and comparable to the counterpart levels for technologies operating on exclusive spectrum licence.

A9. TekSavvy agrees with the use of a vertical elevation mask, with a maximum EIRP of 125 MW at elevation angles above 30 degrees over the horizon. This procedure will mitigate the risk of interfering with microwave links and would make the AFC algorithm much more efficient.

Q5. ISED is seeking comments on allowing access to the additional 100 MHz of spectrum in the 6425-6525 MHz sub-band for standard-power operation.

A10. TekSavvy strongly supports allowing access to the additional 100 MHz of spectrum in the 6425-6525 MHz band for indoor and very low-power applications. With an objective to improve end-user experience, the Wi-Fi Alliance has licensed indoor devices for this band as per 802.11ax standards. It should be noted that this spectrum would not be useful for other uses due to the interference resulting from microwave links and unlicensed-spectrum devices working on the upper and lower sides of this 100 MHz of the spectrum.

Q6. ISED is seeking comments on the equipment availability of standard-power RLANs in the 6425-6525 MHz band and the impact on the development of AFC systems for Canada due to a potential lack of international harmonization for that sub-band.

A11. All Wi-Fi Alliance-certified devices work on this band and the IEEE 802.11ax standards allow this operation. Regulators may specify, in their certification of devices, which sub-bands should be required to be locked. The security provided by certification and regulatory frameworks are critical to the creation of viable commercial ecosystems and correspondingly, choice and affordability of equipment and devices for service provider. In the case of the Canadian market, there will be benefits of the economy of scale when the equipment made for the US with the same band specs is made available here.

A12. TekSavvy submits that these elements would have no impact on the development of AFC systems, as they are database-driven, frequency-agnostic controlling system and the sub-bands are simply an attribute that can be configured as needed.

Q7. ISED is seeking comments on the proposed rules for low-power indoor-only RLANs:

a. operation would be permitted indoor only across the 5925-7125 MHz band

b. the use of a contention-based protocol (e.g. listen-before-talk) would be required

c. maximum permitted e.i.r.p. would be 30 dBm

d. maximum permitted power spectral density would be limited to 5 dBm/MHz

A13. TekSavvy agrees on dedicating 5925-7125 MHz for indoor-only operations. We also recommend that the band 5425 – 5525 MHz also be used for indoor-only operations as explained in A10.

A14. TekSavvy agrees that the contention-based protocol is required. TekSavvy sees that this protocol has been always used in all IEEE 802.11 versions with different techniques such Carrier Sense Multiple Access Carrier-Collision-Avoidance (CSMA-CCA).

A15. TekSavvy views the values of 30 dBm for EIRP and 5 dBm/MHz as being sufficient and note that historically (over the last 20 years), where these levels have been applied correspondingly, they have delivered excellent services.

Q8. ISED is seeking comments on the proposed rules to allow very low-power RLAN devices:

a. operation would be permitted indoors and outdoors across the frequency range 5925-7125 MHz band

b. the use of a contention-based protocol (e.g. listen-before-talk) would be required

c. maximum permitted e.i.r.p. would be 14 dBm

d. maximum permitted power spectral density would be limited to -8 dBm/MHz

A16. TekSavvy agrees on permitting 5925-7125 MHz for very low-power operations. As this band is recommended to be used for indoor operations with no standard-power outdoor operations, it will allow IoT and other devices to work and operate as an outdoor "thin-layer" that will be able to support millions of devices and enable many applications such as those for 'smart cities', public safety and industrial use cases.

A17. TekSavvy agrees that the contention-based protocol is required. TekSavvy notes that this protocol has been always used in all IEEE 802.11 versions with different techniques such Carrier Sense Multiple Access Carrier-Collision-Avoidance (CSMA-CCA).

A18. TekSavvy views the values of 14 dBm for EIRP and -8 dBm/MHz as sufficient. These levels are comparable to those for low power devices that have been successfully proven in IoT applications on LTE networks.

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d. Proposals related to the automated frequency coordination system

Q9. ISED is seeking comments on potential business models for AFC administrators to operate their AFC systems in Canada.

A19. TekSavvy supports the Utility Business model where the AFC system would be built and maintained jointly by ISED, a private software company and a consortium of wireless users of the system. TekSavvy suggests that the administration of the AFC system be structured as follows:

a. ISED personnel: In each administrative zone, provincial or municipal, there would be a chief administrator of ISED's technical and operational frameworks and to oversee the operations at the next level.

b. The software company and user consortium would constitute AFC operating entities by appointing a board of directors. It would, in turn, hire a permanent technical team to: operate the AFC system, authorize use of the system, charge fees (see E38), monitor users for compliance with rules and take action according to the ISED rules framework. The technical staff, together with the software company, would monitor the performance of the AFC system and ensure routine maintenance and upgrades.

Q10. ISED is seeking comments on its proposal to permit the approval of multiple, third party AFC systems, taking into account the potential for the development of a sustainable market for AFC systems in Canada.

A20. TekSavvy's preference would be for the selection of a single consolidated national AFC set of standards that encompasses global best design and operating features. Subject to meeting those standards, it would be in the public interest that multiple AFC equipment suppliers be able to compete for the provision of equipment and subsequent operational support of AFC systems.

TekSavvy believes that irrespective of whether a single or multiple AFC groups are created, the entities should be co-managed by a user consortium along with the AFC equipment provider in order to ensure responsiveness to unlicensed user needs as well as fairness and affordability in fee-setting.

TekSavvy would not be in favour of one or more AFCs being owned and operated by private for-profit entities. In the US, the CBRS system is owned by large carriers and technology firms as profit-seeking companies and this has resulted in very high user fees and inequitable fee structures.

TekSavvy notes the risks of operating multiple AFC systems simultaneously. This approach will lead multiple products with differences in performance and quality and require the development of different technical and administrative expertise by the various AFC Boards and technical teams in the regions. As well, if the private partner decides to stop upgrading and further developing AFC system features in the future this could result in divergence in operation and performance in different areas, especially so in border regions such as the Outaouais/Ottawa Valley. TekSavvy anticipates and would seek to avoid any differential application of ISED's framework of operational and technical rules.

TekSavvy underlines the importance of a comprehensive ISED framework for the operation and management of the AFC system(s). The framework of technical and operating rules should be comprehensive, and correspondingly, active overview by technical teams should be rigorous. Examples of oversight activities include regular monitoring reports on activity and on the undertaking of corrective actions where appropriate. There should also be efforts to ensure constant improvements to the AFC system to ensure comparability with best-in-class regulatory use.

Q11. ISED is seeking comments on potential exit strategies if the AFC administrator decides to cease operation in Canada.

A21. As noted in A20, there are risks to unlicensed users in the scenario where there are multiple AFC systems operating in different regions simultaneously - including disruptive cessation of operations which might result in unlicensed users being stranded in a particular region. However, if this multi-AFC option is retained, TekSavvy recommends there should be strict contractual guarantees and contingency plans in place. Each AFC administrator should be required to deposit their full documented code along with their roadmap and product features with ISED's AFC superintendent.

Q12. ISED is seeking comments on adopting an AFC system model that is harmonized to the maximum extent possible with the AFC system model being implemented in the U.S. and other international markets.

A22. TekSavvy is not in favour of harmonizing the Canadian AFC system model with the US or systems in other jurisdictions. Since AFC is frequency-agnostic, there are no obvious benefits to be gained. We believe harmonization might have a negative side effect in

limiting the capabilities of ISED and Canadian ISPs to deal with emerging requirements that pertain to the local regulatory environment.

Q13. ISED is seeking comments on the implementation considerations for the operation of an AFC system, specifically:

a. information required from licensed users.

b. interference protection criteria for computation of exclusion zones

c. information required from standard-power APs.

d. frequency of AFC update of licensee information

e. security and privacy requirements

A23. As shown in Figure 1 in E26, TekSavvy has proposed the type of required information from licensed users, exclusion zones criteria, standard-power APs as well as the frequency of update of 24 hours.

A24. In addition to this required information, TekSavvy strongly recommends the following:

a. That all exclusive licence holders to report their perspective holdings in the geographical zone where they operate in this proposed unlicensed band. This is part of TekSavvy's overall proposal on how to implement the AFC as depicted in A31.

b. That all incumbents are required to report the total aggregate throughput in Gbps on daily basis per channel. This is will be useful in the recommendation found in A29.

A25. TekSavvy recommends the following criteria:

a. **Propagation Channel** – Information collection concerning channel status, such as interference, attenuation and distance to connect, will allow the AFC to decide on the exclusion zone. This way, the AFD could avoid channels in certain sectors that have consistent interference from licensed users in the band such as point to point applications. The threshold can be determined based on the number of unsuccessful connections and the reduced throughput on the licensed applications like point to point connections.

b. **Deployment Density** – The density of deployment for licensed users such as point to point connections can be associated with an attribute that sets a threshold on the unlicensed deployment density.

A26. TekSavvy proposes mandatory information that standard-power access points should report include:

a. **Aggregate Throughput Density** – The aggregate total throughput by each channel utilized per time window. TekSavvy submits that four time windows

should be considered: 6:00 AM - 11:00 AM, 11:00 AM - 5:00 PM, 5:00 PM - 12:00 AM, 12:00 AM - 6:00 AM.

b. **Channel RF Parameters** – All transmitted and received power levels, interference, delays, MIMO mode, used MCS, Channel statistical parameters and path loss.

c. **Logs** – Logs of all successful and failed connection requests, statistical parameters on connectivity, and activities on each channel.

A27. For security and privacy requirements, TekSavvy suggests that these requirements are born from a series of data residency/privacy and industry-specific regulations that describe how data must be treated in the cloud:

a. **Data Residency/Privacy Legislation** – Laws in specific states, countries or governmental associations such as the Personal Information Protection and Electronic Documents Act (PIPEDA) that dictate that sensitive or private information may not leave the physical boundaries of the country or region (residency), and that the information should not be exposed to unauthorized parties (privacy).

b. **Industry-specific Compliance Requirements** – Laws or mandates covering a specific industry, type of business or government agency that prescribe the appropriate treatment and security of private or sensitive information. Examples of these types of requirements include The Payment Card Industry Data Security Standards (PCI DSS)

c. **Third Party Obligations** – Agreements among business partners that outline how a party such as a contractor or vendor will handle and treat private or sensitive data belonging to another organization. Such agreements often hold the external party accountable for securing the data in the same fashion as the owner of the data, including adherence to all residency, privacy and compliance requirements. Additionally, TekSavvy submits that any AFC system partner contracted to provide spectrum coordination for ISED in the Canada must observe all the data protection requirements mandated by Personal Information Protection and Electronic Documents Act.

A28. TekSavvy recommends that encryption is used as a mandatory security method on the cloud and tokenization as a secondary added security measure. Topics to be considered in the encryption process are: Database Level, Field-specific encryption, Strength of encryption, who controls the keys, key management, functionality preservation, format preservation, and data residency/privacy.

Q14. ISED is seeking comments on any additional considerations, limits or general concerns that should be taken into account in setting detailed standards and procedures for AFC operation.

A29. TekSavvy views the following items to be of great importance:

a. **Setting priorities within geographical areas** – As the understanding of the specific applications of AFC systems grow, there should be a differentiation between the sectors so that some sectors can have an increased or decreased number of channels.

b. **Prioritizing business vs residential connections** – The setting of priority based on the customer type is critical for the success of AFC. TekSavvy submits that there are opportunities to dedicate channels for commercial and industrial applications using a static or dynamic approach.

c. **Prioritizing connections with respect to applicant exclusive spectrum** – TekSavvy's view is that the public interest is paramount and as a result, if there is an incumbent that has an exclusive licence, then it should use all of its holdings before it can operate in other portions of the spectrum, allowing the maximum amount of concurrent use.

Q15. ISED is seeking comments on its proposal to require AFC systems to protect the following types of licensed stations from standard-power APs:

a. fixed microwave stations

b. fixed point-to-point television auxiliary stations

c. radio astronomy stations

A30. TekSavvy agrees with ISED's proposal that AFC should protect the three licensed applications listed in the question as these are the principle categories of operation in this spectrum.

Q16. ISED is seeking comments on the sample agreement related to the designation and operation of an AFC system in Canada.

A31. Beyond any answers included in this filing which would bear on components of the sample agreement, TekSavvy reserves comments on the sample agreement at this time.

Q17. ISED is seeking comments on the proposed approach to incremental implementation of an AFC system in Canada.

A32. TekSavvy strongly recommends the following 4-phase incremental approach:

a. **Phase 1: One-Site Deployment** – ISED, in collaboration with the selected AFC equipment providers and the consortium of 6GHz unlicensed users, would select four or five representative environments and corresponding sites for testing of the AFC system(s). Subsequently, the AFC equipment would be installed in the different sites and operated under field conditions for full one month. The outcome of this phase should uncover any performance issues that

pertain to the implemented algorithm, the cloud architecture impact, and the operational deficiencies among the players. It would provide, for example, a demonstration of how exclusion zones are going to be built and tested against the licensed applications. This would also enable an initial application of ISED's framework of technical and operations rules. This would constitute level-1 technical and management performance at the unit, site level.

b. **Phase 2: One-Cluster Deployment** – In this phase, the four or five representative sites would be connected together. This phase would provide stress tested, real world results for a coordinated AFC system and specifically, how well the AFC cloud manages multiple sites in terms of response, stability, reliability and other performance measures. This will also reveal the ability of the AFC algorithm to combine the results from different environments to enhance its capabilities.

c. **Phase 3: Soft-Launch Deployment** – In this phase, all sites, including any contiguous sites, would be interconnected with limited connected devices and customers. In this phase, one private unlicensed network user should be involved and participate in the test to examine how prioritizing consumer and business users are going to be affected.

d. **Phase 4: Full-Launch Deployment** – In this phase, functional and operational AFC should be in place. This would also enable a practical full-scale application of ISED's framework of technical and operations rules.

Q18. ISED is seeking comments on the objective to maximize the potential for synergies, where possible, in defining the technical and administrative requirements for the respective databases addressing different bands under different technical regimes.

A33. TekSavvy views the AFC central theme as an optimization problem. In any optimization problem, the goal is to maximize-, minimize- or set a value to- certain parameter. TekSavvy views the ultimate goal of this AFC is to maximize the throughput density per channel bandwidth per time -window R (Gbps.Hour/Hz).

A34. $$AFC = Max(R_i)\ where\ R_i = \begin{cases} R_1 & 6{:}00\ AM - 11{:}00\ AM \\ R_2 & 11{:}00 AM - 5{:}00\ PM \\ R_3 & 5{:}00\ PM - 12{:}00\ AM \\ R_4 & 12{:}00 AM - 6{:}00\ AM \end{cases}$$

A35. $$R = \frac{Throughput \times Hours}{Channel\ Bandwidth}\ (\frac{Gbps}{Hz}.Hour)$$

A36. Based on the reasoning above, TekSavvy submits that its proposed **utility-model-based, centralized, and frequency-agnostic AFC** the most feasible and appropriate approach. This means the same system could be used to manage all other applications across different bands, including TV White Spaces, and best meet the needs of users as well as the spectrum regulator.
