RADIO ADVISORY BOARD OF CANADA
CONSEIL CONSULTATIF CANADIEN DE LA RADIO

Submission of the Radio Advisory Board of Canada in response to SMSE-014-20: *Consultation on the Technical and Policy Framework for Licence-Exempt Use in the 6 GHz Band*

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Introduction

1. The Radio Advisory Board of Canada (RABC or the Board) is pleased to respond to SMSE-014-20: *Consultation on the Technical and Policy Framework for Licence-Exempt Use in the 6 GHz Band*. The Board appreciates the opportunity to provide input on this important issue.

Responses to Questions

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*

2. **IEEE Standards.** The IEEE has extended the latest Wi-Fi standard, 802.11ax (also known as "Wi-Fi 6") to include the 6 GHz band (where the equipment will be known as Wi-Fi 6E"). The standard is in the final stages of completion with an expected publication date of very early in 2021.[1] In addition to the IEEE standard, Europe's ETSI BRAN EN 303 687 has reached a "stable draft"[2], providing further support for standards-based deployments.

3. **3GPP Standards.** 3GPP-based unlicensed technologies are also in standards development[3]. 5G NR-U equipment ecosystems for low-power and standard-power will be leveraged by 3GPP band n96 covering the 5925-7125 MHz spectrum range for the US market. NR-U core requirements for both UE and BS are formally finalized for 3GPP Rel-16; there are still open issues related to wideband operation and capabilities.

4. 3GPP has agreed to discuss in early 2021 the need for a new 3GPP band for NR-U operation in the 5925-6425 GHz band, according to European regulations for unlicensed operation in this band[4]. Another alternative for the 5925-6425 GHz band is updating the existing 3GPP band n96 with appropriate network signaling. This work should be completed in 3GPP Rel-17 time frame. 5G NR-U equipment is expected to be available by second half of 2021 or in 2022.

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[1] The IEEE Standard is in the final stage of standards development known as the 'SA ballot phase' and should complete in February 2021. See generally https://www.ieee802.org/11/Reports/tgax_update.htm
[2] https://portal.etsi.org/webapp/WorkProgram/Report_WorkItem.asp?WKI_ID=58036
[3] 3GPP Technical Specification Group Radio Access Network; NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone (Release 16), 3GPP TS 38.101-1 V16.5.0 (2020-09), (NR operating bands in Table 5.2-1 lists NR band class n96 covering the entire 6 GHz band – 5925 to 7125 MHz).. It should be noted that n96 is applicable in the USA only subject to FCC Report and Order [FCC20-51] as stated in Note 14 in Table 5.2-1 of 3GPP specification 38.101-1 V16.5.0 (2020-09).
[4] 3GPP work item (RP-202116) placeholder has been approved in the 3GPP TSG RAN Meeting #89e for European lower-6 GHz (5925-6425 MHz) unlicensed operation.

5. 3GPP has approved the creation of a Work Item placeholder for 5G NR licensed operation in the 6 GHz band[5]. This Work Item is planning to address the upper part of the 6 GHz band (6425-7125 MHz) for Europe and Russia, and the whole 6 GHz band (5925-7125 MHz) for China. As usual, 3GPP work will start only after some relevant regulation is approved.

6. **Interoperability testing is ready for Wi-Fi products.** The Wi-Fi Alliance has announced a certification plan for Wi Fi 6E for global interoperability for January 2021.[6] Interoperability testing has become the hallmark of technologies that use unlicensed spectrum.

7. **6 GHz equipment is poised to enter the market**. The United States (U.S.) Federal Communications Committee (FCC) has published its test requirements for 6 GHz,[7] and the very first device is already through test review and approval.[8] With final test rules now available, manufacturers can proceed to test equipment pursuant to those rules, and Telecommunications Certifications Bodies which receive the test reports prior to the certification application proceeding to the FCC laboratory, can also begin their review of manufacture testing, as well as begin independent testing. A number of certifications are expected during calendar year 2021. Similarly, in Europe, with the ETSI standard reaching the stage to be stable, and assuming the European process remains on track to complete early in 2021, equipment may enter the European market in 2021. The Wi-Fi Alliance projects that 316 million devices will be sold in 2021 globally.

8. **AFCs and AFC-Enabled Devices**. With respect to Automated[9] Frequency Coordination (AFC) and AFC-enabled devices, the FCC has made rules available in its Report and Order specifying the radio emissions requirements for devices, as well as capabilities associated with their operation with AFCs. Specifically, the FCC has issued a detailed set of requirements for AFC-enabled standard-power devices.[10]

9. While the FCC has also specified in its rules a framework[11] for AFC systems which helps interested parties understand what requirements an AFC will have to adhere to so that they can begin development, the FCC has yet to provide test procedures. AFC standards are currently under development in the U.S. by Wi-Fi Alliance.

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[5] 3GPP work item (RP-202114) placeholder has been approved in the 3GPP TSG RAN Meeting #89e for 5G NR licensed operation in the 6 GHz band (5925-7125 MHz).
[6] Wi-Fi Alliance® delivers Wi-Fi 6E certification program, Wi-Fi Alliance® delivers Wi-Fi 6E certification program | Wi-Fi Alliance (wi-fi.org), Jan. 7, 2021.
[7] Knowledge Data Base (KDB) 987594, released December 10, 2020
https://apps.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?id=277034&switch=P
[8] FCC News Release, "Chairman Pai Statement on Authorization of First 6 GHz Wi-Fi Device," released December 10, 2020 available at https://docs.fcc.gov/public/attachments/DOC-368593A1.pdf.
[9] The term "Automated" is specifically used in that permissible frequencies are generated via a database computation and then implemented by an access point. Use of the term "automatic" in lieu of "automated" is not correct, as there are multiple steps in the system that must function together.
[10] U.S. Code of Federal Regulations 47 CFR §15.407 (k)
[11] Ibid. 47 CFR §15.407 (l)

WInnForum has established a 3GPP AFC Special Interest Group to address any differences between the AFC standards (with respect to the operation of NR-U), developed by the Wi-Fi Alliance and 3GPP. It is estimated that the earliest standard-power devices may be available is late 2021 or possibly 2022.

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

10. Regulators in the U.S. (FCC) and Korea (MSIT) have made decisions to allow unlicensed devices in the 5925-7125 MHz band as a matter of rule. Similarly, the Electronic Communications Commission (ECC) of the European Conference of Postal and Telecommunications Administrations (CEPT) issued ECC Decision (20)01[12] in November 2020 allowing unlicensed devices into the 5925-6425 MHz portion of the band. However, each country has adopted somewhat different technical and deployment constraints based on device class as correctly indicated by ISED[13], which is summarized below.

	Very Low-Power	**Low-Power**	**Standard-Power**
U.S. FCC (Apr 2020)	Deferred to FNPRM	5925-7125 MHz **Indoor-only No AFC** Access points: max e.i.r.p. of **30 dBm (1W)** and max e.i.r.p. density **5 dBm/MHz (3 mW/MHz)** Clients: max e.i.r.p. of **24 dBm (250 mW)** and max e.i.r.p. density of **-1 dBm/MHz (0.8 mW/MHz)** Max OOBE e.i.r.p. density of **-27 dBm/MHz** outside 5.925-7.125 MHz.	5925-6425 and 6425-6875 MHz **Indoor or outdoor AFC-controlled** Access points: max e.i.r.p. of **36 dBm (4W)** and max e.i.r.p. density of **23 dBm/MHz (200 mW/MHz)** Clients: max e.i.r.p. of **30 dBm (1W)** and max e.i.r.p. density of **17 dBm/MHz (50 mW/MHz)** Max OOBE e.i.r.p. density of **-27 dBm/MHz** outside 5.925-7.125 MHz.

[12] https://docdb.cept.org/download/50365191-a99d/ECC%20Decision%20(20)01.pdf
[13] SMSE-014-20, paragraphs 52 and 53.

Korea MSIT (Oct 2020)	5925-6455 MHz **Indoor or outdoor** **No AFC** Max e.i.r.p. **14 dBm (25 mW)**	5925-7125 MHz **Indoor-only** **No AFC** Max e.i.r.p. **24 dBm (250 mW)**	Not allowed at this time*
Europe ECC (Nov 2020)	5925-6425 MHz Indoor or outdoor No AFC Max e.i.r.p. **14 dBm (25 mW)** and max e.i.r.p. density of **1 dBm/MHz (1.25 mW/MHz)** for wideband and **10 dBm/MHz (10 mW/MHz)** for narrowband frequency hopping Max OOBE e.i.r.p. density of **-45 dBm/MHz below 5935 MHz**	5925-6425 MHz Indoor-only No AFC Max e.i.r.p. **23 dBm (200 mW)** and max e.i.r.p. density of **10 dBm/MHz (10 mW/MHz)** Max OOBE e.i.r.p. density of **-22 dBm/MHz below 5935 MHz**	Not allowed

11. The FCC is the first regulatory authority to proceed to adopt test procedures for the low-power Indoor device class and the first to see equipment authorized for market. Europe or Korea is likely to be first to authorize the very low-power devices into the market. As with all licence-exempt equipment, RABC agrees that manufacturers must demonstrate compliance with regulations, pass tests specified in a relevant RSS, and ensure that their equipment continues to be compliant going forward.

12. RABC noted the following concerns regarding the protection of licensed incumbents in the frequency range 5925-7125 MHz:

    a. Protection of FSS, currently having hundreds of earth stations[14] deployed across Canada and transmitting in the 5925-6425 MHz band, which "provides connectivity in remote areas, where fibre or terrestrial wireless connections

[14] The ISED SMS system, when perusing the TAFL for earth stations, comprises 869 earth station transmit records in the 5925-6425 MHz band.

are not practical or economically feasible. As such, multiple communities, many of them located in the North, are dependent on satellite services for broadband connectivity"[15]. Examples include Internet services to remote and rural communities (e.g., SSi Micro in Nunavut, KRG in Kativik, and KNET in Ontario), feeding television broadcast signals to remote areas, e.g., CBC, to collect programme information from various sites across the country into video studios, and for a multitude of client-specific applications for entities such as National Defence, Department of Fisheries and Oceans, NAV CANADA, and SaskTel.

b. Consideration that these FSS operators may deploy future satellites with extended uplink C-band capacity, such as the 6425-6725 extended C-band and the 6725-7025 MHz planned Appendix 30B band.
c. Protection of incumbent services providing telephone traffic including 9-1-1 calls and mission critical Public Safety communications. These networks are engineered to provide the operator with high reliability and high availability protected by radio frequency compatibility analysis and ISED licensing
d. Protection of NGSO earth stations in Smith Falls, Ontario and High River, Alberta operating in the Space-to Earth allocation within 6875-7055 MHz, providing safety of life applications. The potential issue relates to tracking receiver antenna which can have elevation angle as low as 10 degrees
e. Protection of Earth exploration-satellite (passive) and space research (passive) services in their future planning of the bands 6 425-7 075 MHz and 7 075-7 250 MHz as per CTFA footnote 5.458.

13. As a technical matter, introduction of licence-exempt RLAN use in the 5925-7125 MHz band must be based on ISED's determination that the licence-exempt 6 GHz device classes, and associated mitigations for each device class, are sufficient to protect incumbent operations (existing, modified in the future or new) from unacceptable interference.

14. In particular, it is important to RABC to ensure adequate AFC security requirements (valid non-hacked RF channel assignments to licence-exempt) and privacy requirements (non-disclosure of non-publicly available fixed links) are in place in order to address AFC concern mentioned above (this is further detailed in response to question 13 below).

15. RABC also notes that since FCC is not expected to finalize standards' development on AFC and associated AFC-enabled devices before late 2021 (possibly later), ISED has time to develop an AFC framework that would take advantage of U.S. AFC standard and address RABC concerns mentioned above.

16. A number of countries have allowed or are considering the use of the 6 GHz band for licence-exempt RLAN services as shown in the table below.

[15] SMSE-014-20, paragraph 39.

Region	Country	Status	Licence-exempt Band
2	United States	Final decision on band June 2020	5925-7125 MHz
2	Chile	Final decision on band October 2020	5925-7125 MHz
2	Canada	Pending consultation	5925-7125 MHz
2	Mexico	Pending consultation	5925-7125 MHz
2	Brazil	Pending consultation	5925-7125 MHz
2	Colombia	Pending consultation	5925-7125 MHz
2	Costa Rica	Pending consultation	5925-7125 MHz
2	Honduras	Pending consultation	5925-7125 MHz
2	Peru	Pending consultation	5925-6425 MHz
2	Argentina	Pending consultation	5925-6425 MHz
3	Korea	Final Decision	5925-7125 MHz
1	Europe/CEPT	Final Decision to be published March 2021	5925-6425 MHz
1	United Kingdom	Final decision	5925-6425 MHz
1	UAE	Pending consultation	5925-6425 MHz
1	Jordan	Pending consultation	5925-6425 MHz

17. Although the consultation is considering the use of 6 GHz for unlicensed services, ISED may wish to consider the following:

- The 6 GHz band could be an important component of the mid-band spectrum for IMT due to its unique balance of capacity and distance (please refer to the Annex at the end of this document for demonstration of similar characteristics of 3.5 and 3.8 GHz.).
- Some administrations are considering 6 GHz for licensed IMT services, mainly above 6425 MHz. In addition, the Chinese Regulator supported potential IMT identification for the whole 6 GHz band (5925-7125 MHz) at WRC-19 and in recent ITU-R meetings. The Chinese regulator has not issued a domestic consultation.
- Agenda item 1.2 for WRC-23 includes studying the possibility of allocating IMT-based licensed spectrum in 6426-7025 MHz in ITU-R Region 1, and globally within 7025-7125 MHz; as well as the investigation of co-existence of IMT with incumbent operations.
- UK plans to continue to review use of the upper 6 GHz band to determine what the optimal use may be.[16]
- Allowing unlicensed operation throughout the 6 GHz band could make it difficult to reverse part of the band for licensed operation later, as devices proliferate and

[16] Ofcom, *Improving spectrum access for Wi-Fi, Spectrum use in the 5 GHz and 6 GHz bands,* 24 July 2020, paragraph 4.40, https://www.ofcom.org.uk/__data/assets/pdf_file/0036/198927/6ghz-statement.pdf

become ubiquitous. In addition, it is noted that standard-power equipment for 6 GHz will not be available prior to 2022.

18. Therefore, it is recommended that ISED adopt a prudent approach in making decisions for the band 5925-7125 MHz, considering the diverse interest and dynamics in the band including those identified above.

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

19. The footnote for RLANs applicable in the 5925-7125 MHz band should adhere more closely to existing footnote C39A in the CFTA, which applies to similar licence-exempt devices in the adjacent 5725-5825 MHz band. Specifically, RABC recommends using the text of footnote C39A with the following modifications to reflect the more complicated framework required for the 5925-7125 MHz band:

> **CXX** The frequency band 5 925-7 125 MHz is designated for use by licence-exempt wireless local area networks and devices in accordance with the established spectrum policy and technical framework and based upon not interfering with, or claiming protection from, licensed services.

20. As discussed in response to Question 2, it is recommended that ISED adopts a prudent approach in making decisions for the band 5925-7125 MHz, considering the diverse interest and dynamics in the 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*

21. Standard-power operations are required from an RLAN industry perspective, because such a power level will best ensure that a consumer has a consistent experience relative to 5 GHz RLAN networks. For this reason, some manufacturers are highly motivated to create this class of devices and believe that ISED is correct to propose indoor and outdoor operation.

22. However, RABC notes that the operation of devices in 5 GHz is very different from the operation envisioned in 6 GHz. For example, the operation of the devices in the band 5150-5250 MHz is under a licensed regime in Canada. Furthermore, there is a requirement on the unwanted emissions from these devices immediately outside the band 5150-5250 MHz.

23. RABC supports the Department's proposal to not permit standard-power RLANs in the 6875-7125 MHz sub-band. RABC understands that the technical requirements of ISED's standard-power RLAN proposal in 5925-6875 MHz, including control by an AFC system, is based on the technical requirements for standard-power access point (AP) devices allowed by the FCC. However, the RABC notes that the FCC also implemented lower power levels for standard-power client devices connected to such access points (APs), with such devices being allowed to transmit only on the frequencies assigned by the AFC-controlled AP to which they are connected. Subjecting client devices to lower power levels and indirect AFC control (through the AP) help to ensure that the operation of such devices outdoors do not cause unacceptable interference to primary services in the band.

Question 4 b)

24. Licence-exempt devices create interference challenges – particularly if deployed outdoors. For that reason, ISED should require that standard-power devices be subject to certain mechanisms to control interference. For example, an AFC system enables operation[17] vis-à-vis fixed services. This requires the standard-power devices to know where they are, which could be accomplished with a GPS-type technology or, if indoors, by an external source or possibly, a professional installer. Once the device knows where it is, it can consult the AFC with its coordinates – as well as other pertinent technical details about its operation[18] – and the AFC will determine a list of permissible frequencies, using an accurate and secure regulatory database to avoid fixed link operations. In this way, the AFC creates a frequency-based "exclusion zone" around the link, preventing the RLAN and its clients from causing unacceptable interference. In addition, should ISED conclude that there may be an issue of aggregate interference impacting satellite operations, it should consider an elevation mask and/or explore how AFC operations can be used to safeguard satellite operations in the future.

25. Standard-power devices should also be required to perform a check-in with the AFC system on a routine basis in case a new microwave link has been authorized or modified. Should an AFC system be unavailable for a recheck, or for other reasons the device fails in the recheck procedure, the device should cease operations in the 6 GHz band until such time as a list of permissible frequencies is once again available.

26. An appropriate implementation of the AFC could allow indoor and outdoor operation of standard-power RLANs under the following considerations:

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[17] *Unlicensed Use of the 6 GHz Band; Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, FCC Report and Order and Further Notice of Proposed Rulemaking, Docket No. 18-295, released April 23, 2020, paras. 20-47. https://www.fcc.gov/document/fcc-opens-6-ghz-band-wi-fi-and-other-unlicensed-uses-0

[18] Ibid., para 44, e.g., Antenna Height Above Ground.

- Adoption of an appropriate protection criterion for the incumbent systems[19].
- Availability and use by the AFC of an accurate and up-to-date incumbent service database.
- Accurate (or conservative) information about the standard-power RLAN AP location for use by the AFC in the determination of available channels and associated maximum allowable transmit powers.
- Relevant radio propagation models and inputs for the determination of available channels and associated maximum allowable transmit powers for the standard-power RLAN AP.
- ISED could consider implementing a mechanism to assist in resolving interference issues to licensed service from licence-exempt devices.

27. Further proposed AFC implementation details can be found in response to questions 13 and 14.

28. RABC notes it is essential for the protection of incumbent systems that any standard-power RLAN AP only be permitted to operate in the ISED defined frequency range under the control of an AFC system. It is equally essential that the operation of standard-power RLANs only begins after the department is confident that AFC is able to protect incumbent services.

Question 4c)

29. Canada could benefit by aligning the rules for standard-power RLAN AP maximum permitted e.i.r.p. and maximum permitted power spectral density with the U.S. rules. It is noted that FCC has received petitions for reconsideration of the maximum permitted e.i.r.p. for standard-power RLAN APs under the control of the AFC, i.e. increase from 36 dBm to 42 dBm, while keeping the maximum permitted power spectral density unchanged at 23 dBm/MHz. The goal is to enable reasonable coverage when using wider channels in outdoor deployments while protecting incumbent services from harmful interference. It is, therefore, advisable that ISED closely monitors the FCC's decision concerning the maximum permitted e.i.r.p. for standard-power RLAN APs.

Question 4 e)

30. The Department has correctly observed[20] that the band 5925-7125 MHz is extensively used by the FSS in the Earth-to-space direction in Canada, including to provide satellite-dependent communities with telephony, Internet and broadband services, and to provide broadcast services country-wide. The vast majority of these services use the 5925-6425 MHz sub-band, although there are also satellites in orbit

[19] For example, FCC has adopted as protection criterion I/N = -6 dB. Internationally, protection of Fixed Service may consider different I/N values, with I/N = -10 dB as default value (Rec. ITU-R F.758-7, Table 5).
[20] SMSE-014-20, paragraphs 37 to 39.

that are capable of providing service in Canada in the upper part of the band (e.g., 6725-7025 MHz Appendix 30B FSS plan frequencies). The Department has also provided a summary[21] of the conclusions of the FCC regarding protection of the FSS in the U.S., specifically that the FCC mandated a vertical elevation mask on licence-exempt transmitters such that the e.i.r.p. would be limited to 125 mW (21 dBm) above a 30-degree elevation from the horizontal.

31. RABC notes that the FCC adopted this e.i.r.p. density elevation mask as a "precautionary measure" to address the concerns raised by FSS operators about the potential for aggregate interference into FSS space station receivers from hundreds of millions of 6 GHz unlicensed devices in the Continental United States (CONUS).[22] Based on a detailed simulation submitted by RLAN proponents, which assumed an average satellite G/T of +2 dB/K and a deployment of 958 million 6 GHz capable devices in CONUS by 2025 of which 2% are deployed outdoors with an activity factor of 0.44%, the FCC concluded that aggregate I/N into FSS space station receivers would "never rise above -20 dB" (or -21.9 dB as estimated by the RKF simulation).[23]

32. To put this number into perspective, ITU-R Recommendation S.1432-1 specifies an overall "aggregate interference budget" for FSS uplinks of 27% of the clear-sky satellite system noise for victim systems practising frequency re-use consisting of no more than 1% of system noise coming from all non-primary sources of interference.[24] This 1% of clear-sky system noise corresponds to an I/N of -20 dB.[25] This implies that, for satellites with uplink beams that cover both the U.S. and Canada (which comprise the vast majority of the 5925-7125 MHz satellites serving Canada), the aggregate interference into geostationary FSS uplinks from the unlicensed RLANs in the U.S. alone is estimated to consume nearly all of the 1% aggregate interference budget for non-primary sources of interference by 2025. Since deployments of licence-exempt 6 GHz devices will not stop in 2025 (and many satellites in this band will operate beyond that date), it can be anticipated that in the future the combined transmissions from hundreds of millions of such devices in the U.S. and Canada will exceed the 1% budget in ITU-R Recommendation S.1432-1, especially if the percentage of outdoor deployments is higher than assumed in the RKF study. Note, however, that the proposed vertical elevation mask limiting e.i.r.p. to 125 mW above 30 degrees was not considered in the RKF study.[26]

33. In addition to the RKF study, the RABC would invite the Department to review the detailed, parametric studies on aggregate interference of RLANs in the 6 GHz band

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[21] Ibid., paragraph 26.
[22] FCC Report and Order and Further Notice of Proposed Rulemaking, Docket No. 18-295, paragraph 92.
[23] Ibid., *referring to* RKF Study submitted Jan. 25, 2018.
[24] ITU-R Recommandation S.1432-1, *recommends* 4. https://www.itu.int/rec/R-REC-S.1432-1-200604-I/en
[25] Ibid., Annex 1, § 3.
[26] RKF Engineering Solutions, "Frequency Sharing for Radio Local Area Networks in the 6 GHz Band", Version 3, January 2018, page 12, item 3e. In addition, Table 3-8 shows that the device e.i.r.p. in the RKF simulation exceeds the 125mW from the FCC elevation mask at 30 degrees 28.7% of the simulation time for all outdoor APs and 53.19% of the time for High Power APs. https://www.fcc.gov/ecfs/filing/10126878417951

into the FSS performed by the ECC leading up to ECC Decision (20)01. Using different assumptions, ECC Report 302[27] found that indoor low-power unlicensed devices at estimated 2025 levels of deployment in Europe generally did not create a significant risk of exceeding the target aggregate interference thresholds of -10.5 dB or -13.5 dB. However, the report also found that such thresholds could be approached and exceeded if the levels of outdoor deployments were higher than assumed (5% vs. 2%).

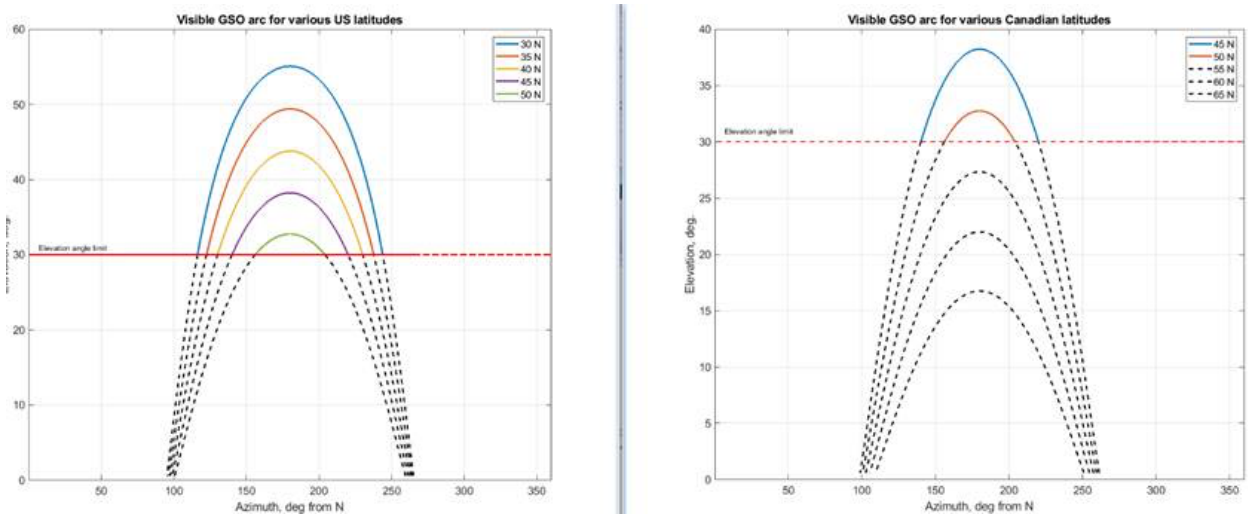
34. Importantly, the aggregate I/N threshold of -10.5 dB applied by the ECC corresponds to the 6% of clear-sky system noise temperature (20% of the time) budgeted for *co-primary* sources into FSS uplinks under ITU-R Recommendation S.1432-1 (and not the 1% budgeted for non-primary sources). The -13.5 dB I/N threshold assumes a simple 3-dB apportionment of that 6% budget to account for the Fixed Service and RLAN devices in the same band. In short, the ECC studies found that aggregate interference from higher numbers of outdoor deployments (> 5%) could cause aggregate interference to exceed even the 6% of clear-sky system noise budget for co-primary services (not just the 1% budget for non-primary sources of interference). Accordingly, ECC Report 302 recommended "taking steps such as limiting the use to indoor only deployment and/or introducing an e.i.r.p. limit, would help further ensuring long term protection of FSS space stations from aggregate interference from WAS/RLAN devices in the band 5925-6425 MHz." ECC Decision (20)01 was to adopt an indoor-only restriction and an e.i.r.p. limit on low-power RLAN operations (allowing outdoor operation only for very low-power operations).

35. In the band 5925-6875 MHz, the Department proposes to adopt measures for FSS protection identical to those adopted by the FCC, namely allowing standard-power operation up to 36 dBm e.i.r.p. but constraining e.i.r.p. to 21 dBm at elevation angles above 30 degrees over the horizon[28]. ISED also notes that e.i.r.p. limitations to avoid interference with satellite systems exist in other cases, such as those described in Standard Radio System Plans (SRSP): 305.9, 306.4, 306.5. These are largely (except for TV pick-up and temporary links) based on an antenna mask to limit e.i.r.p. in the direction of the geostationary orbit (GSO) arc. While arc avoidance measures are effective and appropriate for licensed transmitters using directional antennas, the RABC agrees that they are inappropriate for terrestrial transmitters that are unlicensed, ubiquitous, and might employ near-omnidirectional antennas.

36. The RABC agrees that the approach proposed by ISED to impose skyward e.i.r.p. limitations on standard-power transmitters could help reduce the risk of aggregate interference into FSS uplinks, but notes that there are differences between Canada and the U.S. that should be addressed. Canada is a more northerly country with greater separation from the equatorial plane. Moreover, Canada has a greater east-west extent than the U.S. As a result, elevation angles to the GSO are generally lower in Canada than in the U.S. A 30-degree e.i.r.p. density elevation mask would

[27] https://docdb.cept.org/download/cc03c766-35f8/ECC%20Report%20302.pdf
[28] SMSE-014-20, para. 58

not provide any protection from RLAN operations in parts of Canada (some densely populated) with elevation angles to the geostationary arc of less than 30 degrees. The figures below illustrate just how much of the visible geostationary arc is below 30 degrees in elevation from Canadian latitudes vs. U.S. latitudes, ignoring terrain blockages.



37. The RABC therefore recommends that the Department consider a skyward e.i.r.p. limitation in Canada that applies to outdoor standard-power RLAN devices starting at elevation angles no greater than 15 degrees above the horizon (vs. the 30-degrees required by the FCC). While using a more restrictive mask may require some additional equipment testing, it is not expected to significantly increase the basic RLAN testing, reporting, and user instructions requirements for meeting such a mask, as those would remain the same.

38. For the longer-term protection of FSS systems in the 5925-7125 MHz band, the Department may want to consider a tighter skyward e.i.r.p. limit than the 21 dBm imposed by the FCC, given the sensitivity of the aggregate interference analysis to the number of outdoor transmitters deployed. While the 21 dBm skyward e.i.r.p. is less than the 24 dBm total e.i.r.p. allowed for indoor transmitters, the 3 dB difference does not make up for the building attenuation losses to be expected from indoor deployments.

39. The Department may also want to consider whether the AFC could be used to limit the number of simultaneous transmissions from outdoor standard-power transmitters in a given frequency range Canada-wide, which could be fine-tuned over time to more accurately control for aggregate interference into FSS uplinks. However, the RABC notes that the FCC rejected such an approach due to the complexity that this would add to the AFC system.

40. RABC notes that the current ISED regulations for 5GHz licence-exempt systems require antennas operating outdoors to meet various antenna masks as stated for the specific frequency band. Though it be beneficial to use the same requirements as the FCC, Canada already requires different regulatory requirement and antenna masks in the 5GHz band. In Canada the use of the 5250-5350 MHz band outdoors requires the use of the Canada/ITU-R mask. For the 5150-5250 MHz band SMSE-013-17 agrees with the recommended FCC 5GHz antenna emission mask for outdoor antennas, but under a licensed regime.

41. In both cases the test procedure as specified in RSS-247 Annex A is used to test either antenna mask for compliance. Further this antenna mask test has been incorporated in the latest approved draft to C63.10 standard for testing licence-exempt radios currently awaiting publication. Changes to the actual emission criteria itself may not impact the test procedure themselves. Further under current regulations in US and Canada, the manufacturer is required to provide guidance on the proper installation instructions of the antenna to the user to allow them to maintain compliance.

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.

42. RABC supports that ISED consider allowing the additional 100 MHz expansion for standard-power APs. RABC notes that Mexico's regulator (IFT), in its current consultation[29], is also considering using this block of spectrum for licence-exempt standard-power device, reporting there is no mobile use in the band.

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.

In providing comments, respondents are requested to include supporting arguments and rationale and take the Canadian context into consideration in their response.

43. No delay is foreseen in making standard-power RLAN available in the 6425-6525 MHz band relative to RLAN that will be available in the 5925-6425 MHz for the US, especially noting that Mexico is considering this additional 100 MHz. Manufacturers can support different band configurations in different countries. The far more important issue is the larger set of issues around crafting test requirements for AFC systems, authorizing AFCs, and test requirements for AFC-enabled devices.

[29] Mexico IFT consultation can be found at this link (in Spanish): http://www.ift.org.mx/industria/consultas-publicas/consulta-publica-de-integracion-del-cuestionario-sobre-la-banda-de-frecuencias-5925-7125-mhz

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

In providing comments, respondents are requested to include supporting arguments and rationale and take the Canadian context into consideration in their response.

44. The RABC notes that the Department's proposal for low-power Indoor operation aligns with the US rules for low-power indoor AP devices. For client devices connected to such APs, the FCC imposed more stringent e.i.r.p. and e.i.r.p. density limits of 24 dBm and -1 dBm/MHz respectively. The RABC recommends that the Department adopt both the AP and client power limits adopted by the FCC so as to harmonize the products as best as possible, while protecting the primary services in the band. It is important to note that the power spectral density rule of 5 dBm/MHz effectively constrains e.i.r.p. for the 6 GHz devices. For 20- or 40-MHz channels, e.i.r.p. is actually lower than it is in the 5 GHz band today. Moreover, the 30 dBm maximum would only be achieved after completion of IEEE 802.11be, which will include 320MHz-wide channels, because only 320 MHz-wide channels can utilize 30 dBm. Finally, ISED should ensure that users of low-power Indoor devices are aware that such devices have to be kept indoors.

45. Low-power indoor-only RLANs can also be a source of interference[30] to incumbent services, and are notably not proposed to operate under the AFC control. It is recognized that interference is reduced through building loss and the use of lower e.i.r.p. and PSD values. ISED should take this into account when defining rules and interference resolution process.

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

In providing comments, respondents are requested to include supporting arguments and rationale and take the Canadian context into consideration in their response.

46. As for very low-power systems, the proposed text currently aligns with US proposals being discussed under the Further Notice of Proposed Rulemaking[31]. These rules are also consistent with final regulations announced in Korea, as well as ECC

[30]. CTIA Ex Parte Presentation, November 30, 2020, https://ecfsapi.fcc.gov/file/1201125313014/201130%20CTIA%206%20GHz%20Ex%20Parte%20Letter.pdf
[31] *Unlicensed Use of the 6 GHz Band; Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, FCC Report and Order and Further Notice of Proposed Rulemaking, Docket No. 18-295, released April 23, 2020, paragraphs 233 to 243.

Decision (20)01. ISED should refer to ECC Report 316[32] to review the justification for the very low-power device class.

47. Considering that receive earth stations track NGSO satellites down to elevation angles as low as 10 degrees, even the use of low-power outdoor RLANs in their close proximity could cause interference. It is recommended that exclusion zones around these gateways be defined. As Globalstar may deploy future gateways in Canada, these would also necessitate some form of protection contour to be adopted. In any case, the operation of RLANs in the 6 GHz band will be on a non-protected and no-interference basis, so there will be a recourse should there ever be actual interference.

Question 8 a)

48. Very low-power device manufacturers believe that most of their use cases are body worn or use cases operating near the body. They also believe that most of the uses will be indoors, but that due to the portability of the device class, outdoor use must be permitted. Example of use cases – AR/VR goggles talking to a smartphone; a body-worn device talking to a laptop.

Question 8 b)

49. If very low-power devices are allowed in 5925-7125 MHz, it is recommended to use CBP (Contention Based Protocol), as this would defer to an always-on transmission from licensed transmitters, assisting in preventing unacceptable interference to incumbent services. That being said, it should be recognized that CBP cannot protect receivers (e.g. fixed service receiver). The reason is that CBP is not sensitive enough to detect very low-power signal levels that can be decoded by such receivers, leading to the possibility that very lower-power devices could transmit close to such a receiver and interfere with its operation.

Question 8 c)

50. The European process and Korea have announced rules for very low-power devices that cap e.i.r.p. at 14 dBm. This is tied to the technical studies produced in ECC Report 316.

Question 8 d)

51. There is a divergence in the treatment of power spectral density. While the FCC is considering -8 dBm/MHz[33], the European decision adopted 1 dBm/MHz for broadband applications (and 10 dBm/MHz for Narrowband applications below 20

[32] https://docdb.cept.org/download/8951af9e-1932/ECC%20Report%20316.pdf
[33] FCC Report and Order and Further Notice of Proposed Rulemaking, Docket No. 18-295, paragraph 243.

MHz channel width). As an example, the FCC is generally considering power levels in the range of 4 dBm up to 14 dBm (for a 160-megahertz channel).

52. Very low-power RLANs can also be a source of interference[34] to incumbent services; and are notably not proposed to operate under the AFC control. It is recognized that interference is reduced through building loss and the use of lower e.i.r.p. and PSD values. ISED should take this into account when defining rules and interference resolution processes.

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

53. Although RABC does not comment on potential business model per se, it offers the following comment on potential AFC architectures.

54. The essential requirement for AFC is understood to be that the AFC prevents unlicensed devices from operating in locations and on channels that risk causing unacceptable interference to licensed incumbent[35] operations. With that goal as the fundamental design objective, there are multiple architectures from which to choose depending on business model considered. For example, there could be centralized or decentralized systems; cloud-based or device-based systems; open or proprietary systems; and profit or non-profit systems.

Key reasons to allow design flexibility

55. The market for unlicensed devices is highly diverse and a “one size fits all” architecture would likely result in some market segments unable to participate in AFC-enabled networks. Allowing architecture that would support engineering and business model innovation will best serve user interests in the long term.

Key reasons to restrict design flexibility.

56. It is RABC’s view that regulators and industry have experience with centralized databases. As regulators will have to develop test procedures for AFCs, and it is easier to start with one architecture than to be confronted with many architectures. Some architectures may be simpler than others, and therefore easier to understand and explain.

[34] CTIA Ex Parte Presentation, November 30, 2020.
[35] Use of “incumbent” in this document refers to the services listed in paragraph 57 of SMSE-014-20.

Third Party Data Base Operator

57. Figure 1[36] below illustrates the possible architecture of an AFC implementation using a third-party database provider. In this example, a third party provides stored licensee data— obtained from ISED databases and potentially pre-processed to facilitate rapid calculations—and includes frequency availability calculation features. Channel selection, however, is performed by the AFC device from the available frequencies provided by the third-party AFC system. In this arrangement, the third party could provide these AFC services under a contract with an AP vendor or service provider for that vendor or provider's devices. The third-party provider could service AFC devices produced or deployed by multiple parties, and the interface between the AFC device and AFC system could be based on either an open standard or proprietary/closed standards.

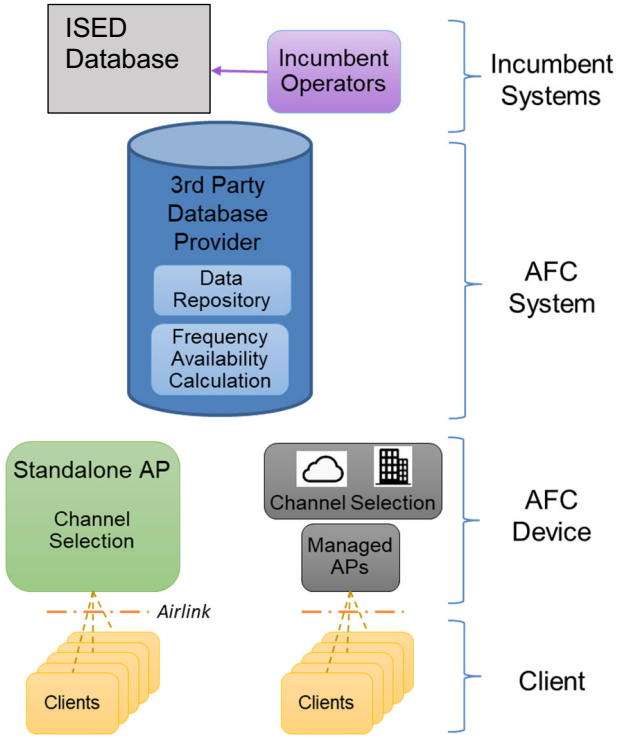


Figure 1—AFC Implementation with Third Party Database.

[36] The four figures are adapted from a Wi-Fi Alliance Ex Parte, filed August 12, 2019 in FCC Docket No. 18-295, https://ecfsapi.fcc.gov/file/10812984812495/WFA%20Ex%20Parte%20-%20August%209%20Meeting.pdf. Modified by RABC to replace references to FCC with references to ISED.

Device-based AFC

58. Figure 2[37] shows a different implementation, where the AP essentially provides its own AFC services using incumbent registration data downloaded periodically from a central repository. Under this physical implementation scenario, the AFC system and the AFC device that it controls are integrated into the same physical system on a user's premises (and perhaps even into the same device). As shown in Figure 2, there may be physical implementations where aspects of the AFC system, such as a mirrored copy of the ISED database, are cloud-based and other aspects are integrated within the same hardware as the stand-alone AP.

59. Under this integrated AFC model, once incumbent link information is retrieved from a central repository into a local data repository, the AP becomes a self-contained, indoor or outdoor solution for determining frequencies on which the AFC device can operate, until it is necessary to obtain updated licensee information. Associated clients will operate in accordance with the direction of the AP, as they would under any other AFC implementation.

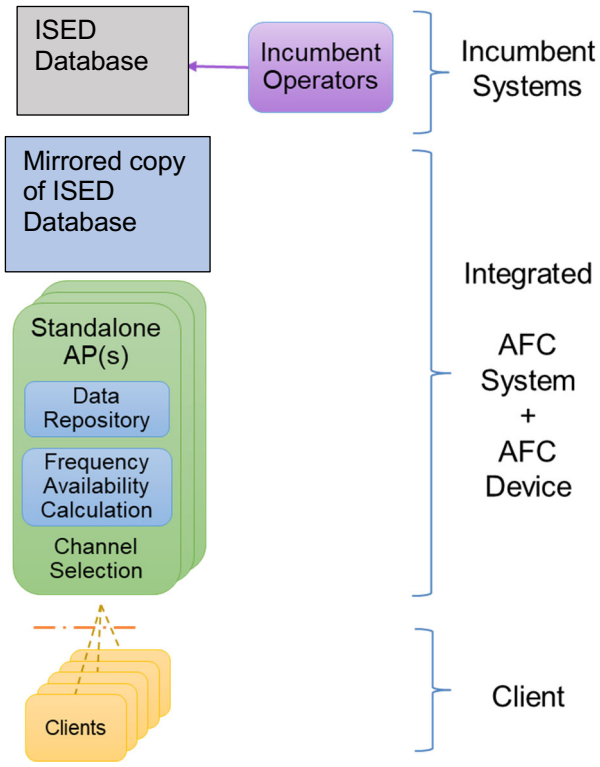


Figure 2—Fully Integrated AFC Implementation to Support Standalone Devices.

[37] Ibid.

Cloud-based AFC

60. Finally, as depicted in Figure 3[38], a service provider, such as a large ISP operating many RLAN devices, could deploy and certify its own AFC system within its private cloud. A proprietary interface and protocol for communication between the AFC system and AFC- controlled devices could be developed, depending on network management needs. These AFC devices would be deployed at each subscriber location and could be unique to, and managed by, the provider's network.

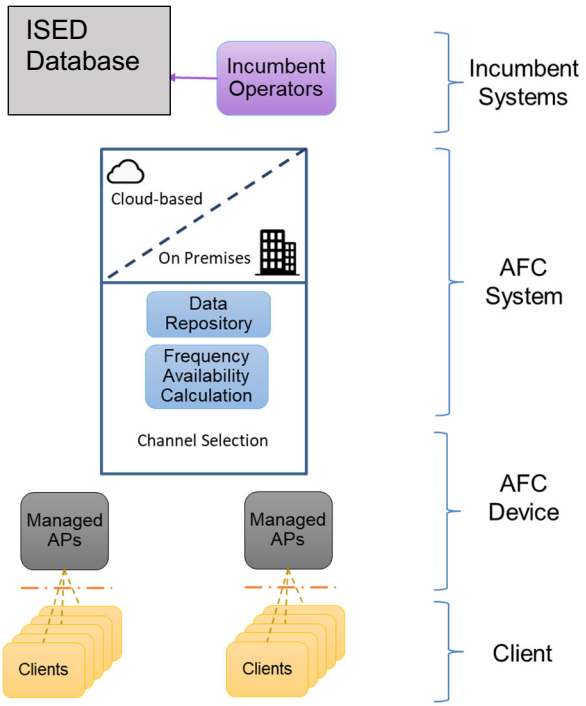


Figure 3—AFC Implementation Using Operator's Private Cloud.

61. Although the internal architectures of these systems would differ, they could be tested and certified using a common set of tools and procedures. Testing should evaluate the AFC's performance at the point where it provides the results of its frequency availability calculations using a suite of input test vectors (horizontal location, vertical location, horizontal uncertainty, vertical uncertainty, client operating parameters) for which AFC performance would be compared to permitted frequencies of operation. These tests could be performed against representative test data or against "live" ISED data as necessary for reliability. Figure 4[39], below,

[38] Ibid.
[39] Ibid.

illustrates the applicable, common test point in each sample AFC implementation described above. A uniform test point would facilitate testing of both AFC implementations and AFC- controlled devices. AFC systems could be tested to ensure that they provide the correct results (i.e., identifying the correct frequencies as available) for each three-dimensional location supplied at the specified test point. AFC-controlled devices could likewise be tested to ensure that they correctly respond to a simulated AFC system response provided at this same test point (i.e., only operating on permitted frequencies).

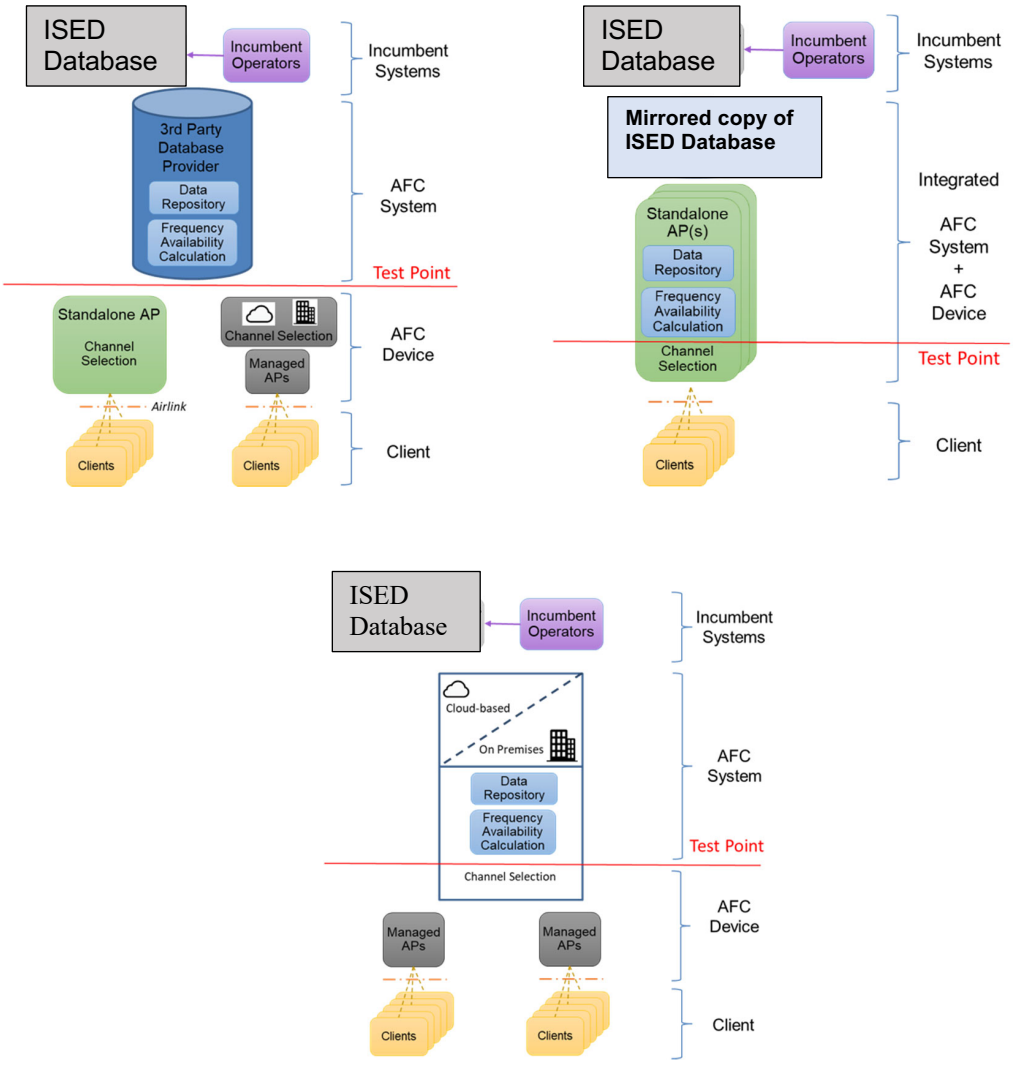


Figure 4—Implementation of a Common Test Point Across Diverse AFC Implementations.

62. RABC recommends that ISED adopts a centralized model where each standard-power AP remotely accesses an AFC to obtain a list of available frequency ranges in

which it is permitted to operate and the maximum permissible power in each frequency range. This is recommended for several reasons. By adopting a centralized model, ISED will only need to architect one set of test requirements. This greatly simplifies the implementation of a 6 GHz AFC class of equipment. Second, if there are any concerns about the accuracy of the permissible frequencies, a centralized AFC architecture enables ISED to more easily investigate if an AFC is mis-calculating the interference protection zones. A de-centralized approach could mean that there is an issue with a particular AP itself that would need to be discovered and addressed. For example, the FCC decided it preferred a centralized model over a distributed model, arguing that this was more similar to databases such as TV White Spaces or CBRS.[40]

63. Having selected a centralized model, ISED should give complete flexibility in terms of how the centralized model is engineered (e.g., whether the AFC is physically housed in the AFC's own network or cloud-based).

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.

64. ISED should allow multiple AFC systems, including third party AFC systems.

65. Every AFC-enabled AP will need to be associated with a particular AFC. As a result, there is no reason to create a monopoly AFC. In fact, there is no reason to limit the business model to "third party" AFCs.

66. All of these operators, and all of these systems, should be subject to the approval of ISED. Systems should be tested for conformity with AFC rules before they are placed in operation, according to the relevant RSS (either by updating the existing RSS-247 or developing a new RSS for the 6 GHz band).

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

In providing comments, respondents are requested to include supporting arguments and rationale.

67. To the extent that multiple AFCs are in operation (covering the same geographic areas), should a specific AFC cease doing business, other AFCs could be available to replace it. ISED could facilitate this by requiring devices to register with AFCs using a serial number or authorization identification, and then requiring that equipment registration information to be retained by AFCs for three months to enable equipment migration to a new AFC.[41]

[40] FCC Report and Order and Further Notice of Proposed Rulemaking, Docket No. 18-295, paragraphs 26 and 27.
[41] Ibid., paragraph 86.

68. As stated above, should an AFC-enabled device be unable to communicate with an AFC for any reason (AFC ceases to function for any reason or device failure) the AFC-enabled device must cease operation in the 6 GHz band.

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.

In providing comments, respondents are requested to include supporting arguments and rationale and take the Canadian context into consideration in their response.

69. It is vitally important for ISED to adopt a framework for an AFC system in its rules, as the FCC has done. This enables interested parties to easily understand ISED's objectives for the AFC and the key operational requirements for AFC operation. Once a test plan can be finalized, it can also serve to speed time to market. But ISED need not specify every detail. For example, industry can provide the standardized protocol to enable any given AFC to communicate with an AFC-enabled device. Moreover, some flexibility needs to remain to account for AFCs that address different needs. An enterprise networking manufacturer may have value added features attractive to that manufacturer's customer base. Market differentiation should not be a concern provided that the AFC can provide the core capability specified in rules – calculation of a protection zone according to the inputs provided in rule. Moreover, by specifying the framework, when it does come time to adopt a test procedure, it may be beneficial for ISED to consider specifying part or the whole of the procedure[42].

70. Canada should monitor the implementation of AFC in the U.S., Korea and other jurisdictions, including any updated regulations. However, the design and implementation of AFCs should take into consideration many factors, specific to the Canadian market, such as incumbency, interference criteria, security and privacy, reliability, accuracy and interference resolution.

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*

Question 13 a)

71. RABC agrees with the implementation considerations identified by ISED at paragraph 68 of the consultation. The Department will need to make the licensing data available in electronic form to enable multiple and frequent downloads. It will likely be necessary for ISED to require that licensees update this information to

[42] FCC rules at 47 CFR §15.407 (k) and (l) provide a template.

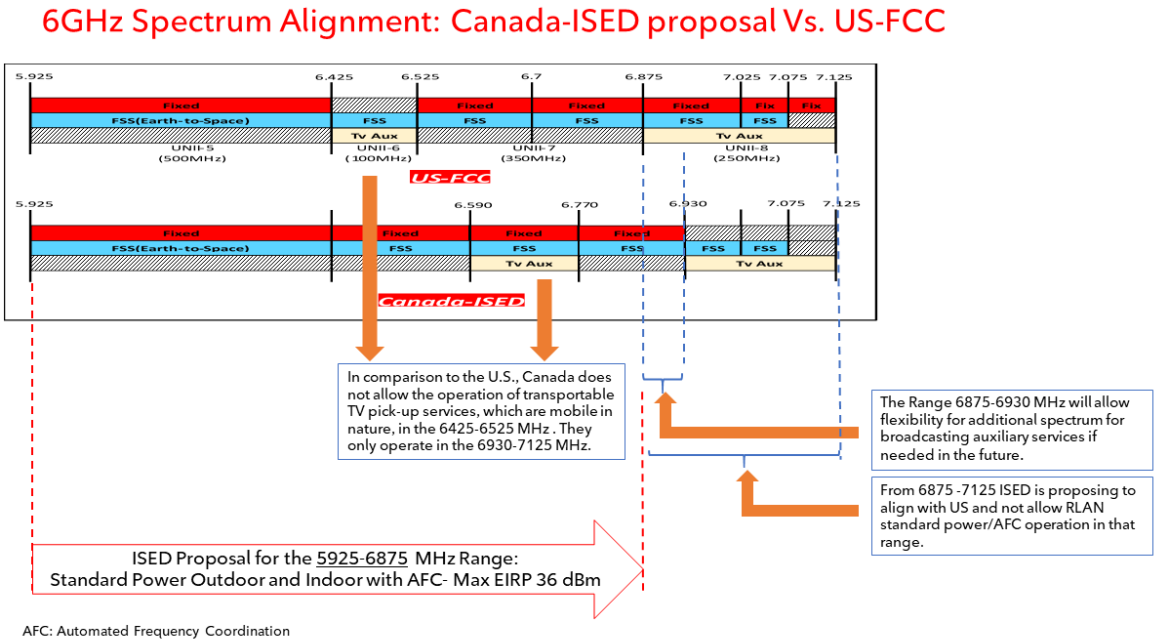
ensure it is accurate and complete, before AFCs become operational. ISED should also determine how to ensure protection of systems not disclosed publicly in its licensing database. A possible approach could be to require AFCs to exclude, in the list of permissible frequencies identified to devices, those frequencies that could potentially cause unacceptable interference to systems that cannot be publicly disclosed in the ISED licensing database (meaning those frequencies would not be available for use by the devices). It is also important to ensure that temporary licences are included in the ISED licensing database and available to the AFCs.

72. To the extent receiver equipment and installation detail is unavailable, default values for parameters such as licensed receiver noise figure and licensed receive antenna discrimination should be specified as they are essential in order for the AFC to properly calculate allowable unlicensed device power levels. There is 6 GHz activity in this area in WinnForum 6 GHz committee Work Stream#1 and the US FCC related 6 GHz Multi-Stakeholder Group.

73. The AFC system used in Canada should benefit from the development of the AFC system for the US market and include as many aspects as possible. However, it is expected to be separate from the system deployed in the US. The Canadian AFC system would reside in Canada and apply Canadian spectrum rules. It would include a data base of all Canadian FS incumbent links as well as relevant US links within a certain distance to the US border (the distance criteria to be developed with the technical rules). The US AFCs should also follow the same approach and include in their Databases the Canadian links within a certain distance of the Canadian border. This should be part of a coordination agreement between ISED and FCC to manage the services at the borders.

74. As an example of where coordination at the border would be required, the nature of the TV Aux service using the spectrum 6425-6525MHz (UNII-6) is different between US and Canada. Unless precautionary measures are taken, Canadian RLAN using standard-power and the 6425-6525 MHz spectrum at the border might interfere with US transportable TV pick-up services, which are mobile in nature. In such a scenario, one possible solution would be to program the AFCs to not allow UNII-6 band close to the border.

75. Below is a diagram to further illustrate the issue.



Question 13 b)

76. ISED must dictate the protection criteria for incumbent licensed operators. In the case of fixed link operators, at para. 71 of its Report and Order, the FCC selected -6 dB I/N. In the view of the FCC, this criterion is more conservative than necessary to protect against unacceptable interference, but was supported by US fixed link operators. In fact, Frequency Coordination System Association (FCSA) uses the I/N value of -6 dB in its interference analysis for frequency coordination activities in Canada.

77. As stated in response to Question 9, ISED may consider having AFC's collaborate through an exchange of data, or via a centralized system, to assess the total aggregate emissions from all active standard-power AP's in order to estimate aggregate interference of active RLANs into FSS satellite receivers (uplinks). This could be performed on a channel-by-channel basis, or a pre-determined frequency block structure, so that AFC's can better distribute the allocation of frequencies over the active Canadian RLANs in order to spread the PFD across the entire 5925-6425 MHz band. Using this technique, such an AFC system would also be able to estimate the aggregate e.i.r.p. towards the GEO satellite arc and warn operators when protection criteria are close to being exceeded. It is also worth noting that the protection criteria for FSS satellite receivers are provided in Recommendation ITU-R S.1432.

78. Ensure protection of adjacent channel operations for incumbent services. For example, The FCC decided to utilize the out-of-band emission mask it adopted for

unlicensed devices which is designed to keep energy outside an unlicensed device's operating channel to low levels and the same -6dB I/N protection criterion for co-channel exclusion zones.

Question 13 c)

79. Regulations should require standard-power APs to deliver geolocation data, antenna height, directivity, and antenna gain pattern to an AFC[43].

Question 13 d)

80. The Department should establish a recheck interval that AFCs and APs must support to ensure that the list of permissible frequencies is up to date. For example, in the US, the volume of links (more than 100,000), link modifications and new filings warranted a recheck interval of once per 24 hours. RABC suggests that ISED require a once per day check-in.

Question 13 e)

81. The Department should require communications between its licensing database and the AFC, and between the AFC and standard-power APs to be secure, ensuring information accuracy. Security and privacy of AFC systems should be such that information contained within them cannot be altered in any way. Third parties should not be able to access this data. RABC recommends that these requirements be stated in terms of outcome desired, and not methodology, to allow innovation in privacy and security practices.

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.

In providing comments, respondents are requested to include supporting arguments and rationale and take the Canadian context into consideration in their response.

82. In addition to the proposed requirements indicated in response to question 13 above, RABC is proposing that ISED considers the following requirements for an AFC.

83. Require AFCs to perform frequency exclusion zone calculations for RLANs operating at different power levels. For example, the FCC stated that it would require "that the AFC system be capable of determining frequency availability in steps of no greater than 3 dB below the maximum 36 dBm permissible e.i.r.p., down to a minimum level of 21 dBm."[44]

[43] More information available at FCC 47 CFR §15.407 (k).
[44] FCC Report and Order and Further Notice of Proposed Rulemaking, Docket No. 18-295, paragraph 37.

84. Require devices to be registered by the AFC using either a serial number and/or certification identifier.[45] If an RLAN ceases to communicate with an AFC, AFCs should store device registration for a short period before discarding it.[46]

85. Specify that multi-device networks, such as those found in enterprises, may have a single interface to the AFC.[47]

86. Approve who is allowed to operate as an AFC and approve the systems for conformance with requirements. [48] Multiple AFC operators should be permitted. If multiple AFCs exist, there may not be a need for them to synchronize their data.[49]

87. As discussed previously, ISED could consider implementing a mechanism to assist in resolving interference issues by requiring licence-exempt devices to provide frequency ranges actually used, including potentially a time stamp. As an additional benefit, frequency usage reporting could also provide spectrum usage data that can be used to understand 6 GHz spectrum utilization by geography and time as well as possibly enable better spectrum allocations. It should be noted however that the current state of development and the FCC rules for implementation of AFCs planned for the U.S. will not know the frequencies actually used by standard-power unlicensed devices. Similarly, the FCC rules do not require logging information about frequencies the AFCs identify for use by standard-power licence-exempt devices.

88. In addition, ISED should dictate the propagation models that the AFC will use in its calculations. This ensures consistency if multiple AFCs exist. For example, the FCC selected the free-space model for short distances, where it accurately predicts signal path loss, the WINNER II for medium distances, and the Irregular Terrain Model (ITM) for longer distances to more realistically account for terrain and clutter losses.[50]

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

In providing comments, respondents are requested to include supporting arguments and rationale.

89. AFC systems should be required to protect incumbent licensed stations (including fixed microwave stations, fixed point-to-point television auxiliary stations and radio

[45] Ibid., paragraphs 82 and 83.
[46] Ibid., paragraph 86.
[47] Ibid., paragraph 85.
[48] Ibid, paragraphs 48 to 57.
[49] Ibid., paragraphs 57 and 58.
[50] Ibid., paragraphs 63 to 67.

astronomy stations) from AFC-enabled AP operation, together with associated client devices.

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

90. The RABC has re-framed this question to address the possibility of flexible implementations of AFC systems in Canada. AFC systems should operate pursuant to a rules framework that allows AFC operators to define diverse business plans, including geographies that an AFC system will address, a customer group, and/or equipment to be served. This flexibility can be expected to result in AFCs offering nationwide service (for example, AFCs serving enterprise customers), AFCs serving particular provinces or service areas (for example, an AFC focused on serving an Internet broadband company's customers), AFCs serving particular sectors, public or private, regardless of location, or AFCs serving a particular manufacturer's brand of AP. Providing flexibility for AFC deployments is possible because there is a common rules framework for all AFCs that applies, such as rules for security and privacy, device registration, device "check-in" requirements, and protection of incumbents.

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.

91. The following 6 GHz AFC aspects have similarities to TV white spaces
    - Use of a database and maintenance of data
    - Secure communication with ISED licensing database and with device (further details are provided in response to question 13)
    - Security of operation; third parties should not be able to access the data (further details are provided in response to question 13)
    - Centralized architecture, if this approach is retained by ISED as proposed by RABC in its response to question 9
    - Approval of AFC operator and AFC system

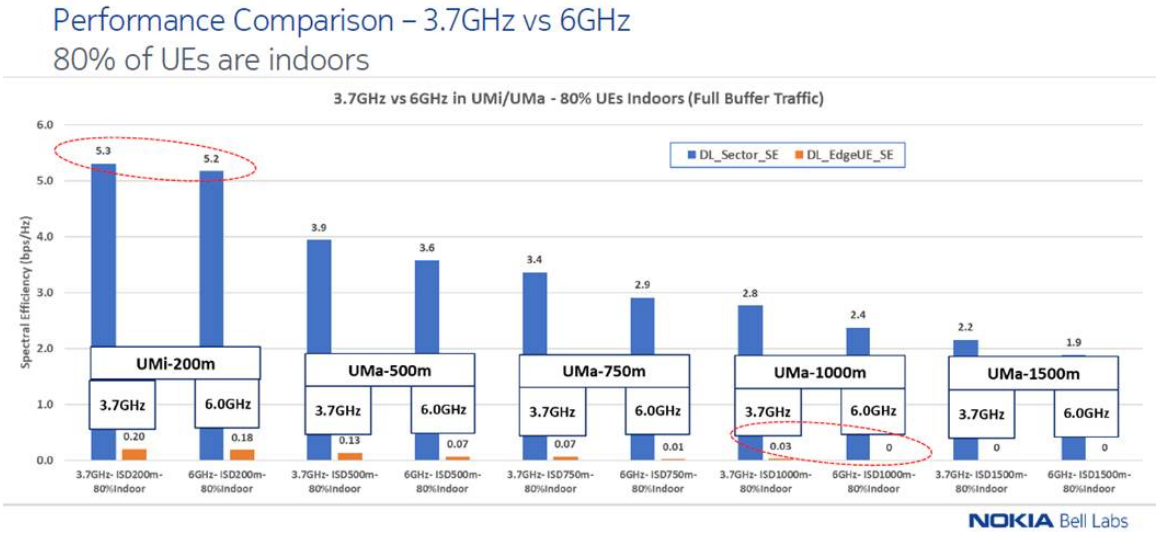
92. However, the following 6 GHz AFC aspects are different from TV white space operation
    - Required licensed data, as receiver data is critical for proper AFC operation (further details are provided in response to question 13).
    - Database synchronization is not required[51] (further details are provided in response to question 14)
    - RLAN technical rules

[51] FCC Report and Order and Further Notice of Proposed Rulemaking, Docket No. 18-295, paragraph 72.

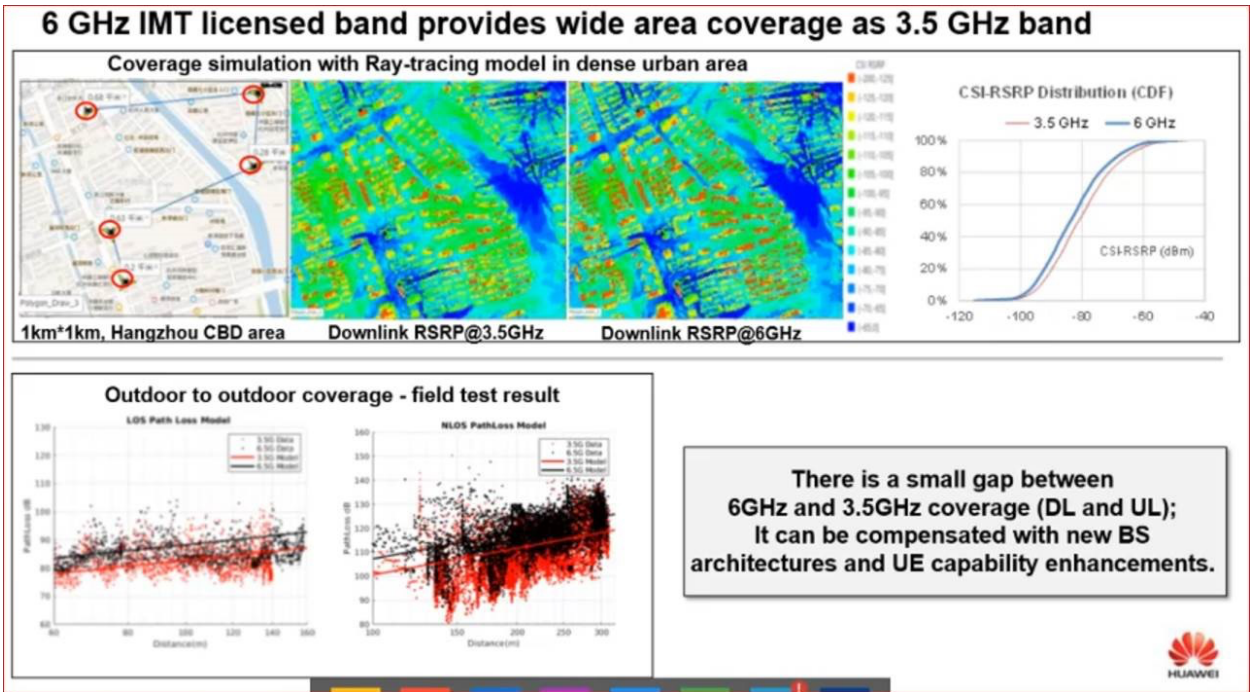
- Licensed operation to be protected. In the TV White Spaces band, the key criterion is the signal level from the broadcast transmitter. In 6 GHz, the key criterion is protection of multiple types of incumbent service, which in the case of fixed service, for the FCC example, is -6 dB I/N
- The recheck interval time for updating AFC database. Proposal is for a daily basis, as described in response to question 13 considered sufficient to gather information about changes in operation of incumbents' systems. In the case of fixed links, this is to take into account any new links or additional RF channel to an existing link. This is contrary to broadcast TV operations where frequencies and service areas rarely change once the station is licensed.
- Propagation model to be used by AFC for its calculations (further details are provided in response to question 13).
- Protection criteria for incumbent service operations (further details are provided in response to question 13).
- Protection of adjacent channel operations for incumbent licensees (further details are provided in response to question 13).
- AFCs to perform calculations for RLANs operating at different power levels, which is not the case for TV white space as only a single answer per location and device is required (further details are provided in response to question 14).
- Device registration to the AFC (further details are provided in responses to questions 11 and 14).
- Multi-device networks, such as those found in enterprises, to use a single interface to the AFC (as proposed in response 14).

Annex

Studies from Nokia Bell Labs, reproduced below, have shown that comparable spectrum efficiency is achievable between 3.5 GHz and 6 GHz, assuming similar inter site distance and transmit power for the two bands and considering technological evolution to compensate for the propagation loss at higher frequencies.



Similar conclusions are drawn in studies from Huawei, including field test results, as shown below illustrating comparable performance of IMT systems at 6 GHz and 3.5 or 3.8 GHz frequency ranges.



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