Before

INNOVATION, SCIENCE AND ECONOMIC DEVELOPMENT CANADA

Ottawa, ON K1A 0H5

In the Matter of	)	
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Consultation on Releasing Millimetre Wave Spectrum to Support 5G	)	Canada Gazette, Part 1 June 17, 2017 Notice No. SLPB-001-17
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COMMENTS OF INTEL CORPORATION

September 15, 2017

Intel Corporation ("Intel") respectfully submits these comments to the ISED consultation on spectrum to support millimeter wave (mmW) 5G[1]. Intel is a leader in designing and building the essential technologies that serve as the foundation for the world's computing and communications devices. Intel's 5G and millimeter wave development efforts include new technologies to enable heterogeneous 5G networks[2] and we appreciate that the market success of such advances is reliant on the development of sound, flexible spectrum policy by regulators.

Intel commends Innovation, Science and Economic Development Canada ("ISED") for undertaking this consultation on the use of millimeter spectrum. Intel believes both licensed and unlicensed uses of this spectrum will create tremendous value for future mobile communications, and our comments reflect that view.

Intel has a long history of advocacy for service and technology flexibility in the rules created for new spectrum allocations, and these bands are no different. We believe ISED should strive to expeditiously provide such flexibility and incentives to put the spectrum to its highest-valued use, subject to minimal regulatory constraints.

In our comments, we address specific questions asked in the consultation. The question numbering from the consultation and the full text of each question is listed as part of each question Intel responds to.

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[1] ISED SLPB-001-17 "Consultation on Releasing Millimetre Wave Spectrum to Support 5G," ("Consultation").

[2] *See:* https://www.intel.com/content/www/us/en/wireless-network/5g-connectivity.html

Question 4-1: Given the disruptive nature of 5G, will new business models and network applications develop that may require policy and regulatory consideration from ISED? Please describe potential new business models and network applications as well as their benefits to Canadians.

The development of 5G is still in the early stages. The history of mobile communications shows us that market demand may steer applications and business models in unanticipated directions. As such, regulators should exercise caution in taking presumptive actions that may impede or constrain innovation. 5G is expected to enable a heterogeneous network, built to capitalize on a variety of air interfaces and capacities across licensed, licensed-shared, and unlicensed spectrum in low, mid, and high-frequency range bands. A variety of use cases will be supported, including enhanced mobile broadband; machine-type communications and the "Internet of Things"; and ultra-reliable, low-latency applications and services. 5G is expected to support significant and unprecedented growth in connected devices and demands on the network, with more than 50 billion smart devices and "things" projected to be enabled with communications capabilities and computing power.[3]

In terms of network applications, 5G is expected to shift the way networks deliver information to users. Previous network generations have scaled capacity uniformly from the core to the edge. 5G networks will diffuse processing power from the data center to the device—with greater capacity at the edge to support augmented user experiences, rather than capacity concentrated at the core, as computing, networking and storage services move outwards.

On the device side, billions of sensors and smart "things" are expected to pack increased processing capabilities into even smaller form factors, connected via virtualized core networks with intelligent edge services. Many of these devices will support the delivery of low-latency, ultra-reliable applications and/or low-power, coverage-extended services to smart homes, buildings, and cities. Additionally, the next generation of devices will be equipped with massive MIMO and advanced antenna capabilities in order to operate in previously untapped frequency ranges, such as the millimeter wave bands.

Examples of 5G-enabled applications and business models that could benefit Canadians include:

- Smart Grids – As an integrated communication and sensing network, the smart grid provides both the utility and the customer with increased control over the efficient use of electricity, water and gas.[4]
- Agriculture – 5G can enable precision farming systems (PFS), which use sensor data to measure crop yields, moisture levels, and topography to enable targeted application of

[3] Dave Evans, Cisco: "The Internet of Things How the Next Evolution of the Internet Is Changing Everything," available at: http://www.cisco.com/c/dam/en_us/about/ac79/docs/innov/IoT_IBSG_0411FINAL.pdf

[4] Report ITU-R SM.2351-1 "Smart Grid Utility Management Systems".

water and fertilizer, thus increasing yields while reducing costs.[5]

- Healthcare – 5G can enable consistent, reliable patient experiences to improve healthcare, where the multi-band network is particularly applicable. Mission-critical functions such as remote surgery require high reliability with very low latency. Monitoring devices and wearable medical equipment will require comparatively low data rate transmission. Further, high resolution imaging and video conferencing have potential to be used for diagnostic purposes.[6]
- Smart Homes - Analysts predict that by 2020, the global market for smart home technology will reach USD 100 billion with more than 50 connected devices in the average home.[7] Advancements in 5G networks and devices will facilitate secure connectivity to content and services stored at the edge of the cloud, delivering home security, automation and high-quality video and entertainment services.

Question 5-1: ISED is seeking comments on developing a flexible use licensing model for fixed and mobile services in the 28 GHz and 37-40 GHz frequency bands, and allowing licence-exempt use of the 64-71 GHz frequency band ahead of WRC-19 and before 5G technology standards are finalized.

Intel supports the ISED proposal of a flexible-use licensing model for the 28 GHz and 37-40 GHz bands, as well as license-exempt use of the 64-71 GHz band. Standards development efforts are well underway in 3GPP: the 28 GHz and 37-40 GHz bands are on the priority list in 3GPP, and standards should be available by the second half of 2018. Regarding the 64-71 GHz license-exempt band, the approved IEEE 802.11-2016 standard already supports IEEE 802.11ad ("WiGig") devices operating in the 64-71 GHz range, and product developments motivated by the U.S. FCC's recent authorization of this band for unlicensed use are underway. In addition, amendments to the standard, known as IEEE 802.11ay, will enable higher throughput and lower latency for 60 GHz operations.

Intel also strongly supports moving forward in advance of WRC-19. We concur with ISED that this is "expected to help further promote innovation as well as the development and adoption of 5G technology in Canada…and would also provide flexibility to accommodate a variety of use cases and therefore support innovative technologies and business cases as they emerge." We further note that all these bands already have a primary mobile allocation in the Radio Regulations and therefore ISED can move forward in advance of any WRC-19 decisions in order to rapidly provide the benefits of 5G to Canadian businesses and consumers.

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[5] Franziska Kreische, Angela Ulrich, Kathleen Ziemann, German Federal Ministry for Economic Cooperation and Development, https://10innovations.alumniportal.com/internet-of-things/iot-in-agriculture-increasing-smallholder-productivity.html

[6] https://www.brookings.edu/wp-content/uploads/2016/07/5G-Health-Internet-of-Things_West.pdf

[7] Markets and Markets Smart Home Market – Global Forecast to 2022, May 2016.

Question 6-1: ISED is seeking comments on the changes proposed above to introduce flexible use licensing in the 28 GHz band, including consequential changes to the CTFA domestic footnotes and the policy on this band contained in SP 3-30 GHz, *Revisions to Spectrum Utilization Policies in the 3-30 GHz Frequency Range and Further Consultation***.**

Intel concurs with the proposed changes (subject to the additions noted below) to the Canadian Table of Frequency Allocations, which give fixed and mobile services priority over Fixed Satellite Service. We also agree that in light of this priority, FSS implementations should be "limited to applications which will pose minimal constraints upon the deployment of fixed service systems and mobile service systems, such as a small number of large antennas for feeder links," as noted in Modification C47C.[8] While paragraph 32 of the consultation states that Modification C47C "does not allow for ubiquitous FSS deployment in the band," the actual language of C47C notes limited "applications," which is open to interpretation. We believe the language of paragraph 32 which states that ubiquitous FSS deployment is not allowed, should be added explicitly to Modification C47C and should reference more specific numeric limitations (e.g. those addressed by Question 6-5 of this consultation) in order to avoid conflicting interpretations of the word 'ubiquitous' and its threshold.

ESIMs on a non-interfering basis[9]:

Intel supports the ISED proposal for use of airborne and maritime ESIMs, with deployment evaluated on a case-by-case basis, and on conditions of not causing interference and not receiving interference protection. Intel concurs with ISED's proposal to preclude the use of land-based ESIMs, which pose the most problematic interference scenario due to the likelihood of ESIM terminals and mobile terminals operating in close geographic proximity. The condition of not causing or receiving interference protection is important as it would permit ESIM use for certain airborne and maritime applications while ensuring protection for mobile and fixed services in the band. For ISED evaluation of airborne and maritime ESIM use on a case-by-case basis, Intel recommends the ESIM interference analysis submitted by the GSA (Global Suppliers Association) into the FCC's ESIM NPRM[10] be considered.

[8] Consultation at ¶25.
[9] Consultation at ¶¶23, 26.
[10] GSA reply comment in FCC Docket No. IB 17-95, available at: https://ecfsapi.fcc.gov/file/10830940623166/Compatibility%20between%20ESIM%20and%20MS%202017-08-30.pdf

Question 6-2: ISED is seeking comments on the moratorium for new site-specific fixed service licences as described above

Intel supports the moratorium on new site-specific fixed licenses in order to facilitate implementation of ISED's proposal in this band. As ISED notes, due to the lack of existing deployments there should be little impact on incumbent fixed services, and the moratorium serves a useful purpose in incentivizing future investments under a new, flexible framework.

Question 6-3: ISED is seeking comments on its proposal to adopt the band plan (as shown in figure 3 above) in the 28 GHz band.

Intel supports ISED's proposed 28 GHz band plan (i.e. two 425 MHz channels and duplexing flexibility). We concur that harmonization between the Canadian and U.S. band plans facilitates equipment harmonization and simplifies coordination between terrestrial services along the Canada-US border. We note that in the U.S., incumbent fixed service deployments exist in the band, and an open Petition for Reconsideration seeks to exempt fixed incumbents from the splitting into two bands. However, the pending state of this reconsideration—regardless of whether it results in changes or not—should not impact Canada due to the lack of incumbent fixed deployments in the band.

Question 6-4:

A. ISED seeks comments on its proposal to require site-by-site coordination between proposed flexible use terrestrial stations and FSS earth stations in the 28 GHz band when a pre-determined trigger threshold is exceeded.

B. If site-by-site coordination is proposed, what coordination trigger and value would be the most appropriate (e.g. PFD or distance threshold)?

C. ISED is also inviting proposals for specific technical rules on proposed flexible use stations and FSS earth stations (e.g. site shielding) that could facilitate more efficient sharing between terrestrial and earth stations.

Historically, Power Flux Density (PFD) values have been often used as a coordination trigger for protecting coexisting systems, whether among applications of the same service such as cellular operators, or between co-primary services, in a given band. Intel believes this method could be applicable in this case. The PFD protection level could be considered as a coordination

threshold where if the level is exceeded, the FSS and 5G operators would coordinate (*e.g.* through implementing interference mitigation techniques such as shielding.

The 5G protection requirement defined as a PFD level at the 5G receive antenna can be obtained using the following expression:

$$pfd = I / N + 10\log(4\pi / \lambda^2) - G + k + T \qquad \text{(Equation 1)}$$

where:

pfd = power flux density, dBW/m^2 in 1 Hz
I/N = interference-to-noise protection requirement, dB
λ = wavelength, m
G = 5G receive antenna gain, dBi
k = Boltzmann constant, −228.6 dBJ/K
T = 5G receive noise temperature, K

In order to arrive at a reasonable PFD value, we note that assuming an acceptable intra-system carrier to noise and interference (CINR) of -3 dB as the onset of outage for a typical cellular base station, one can translate into I/N as follows:

$I_{ext}/N = C/N - C/I_{ext}$;

Where:

C is the received wanted signal level of the terrestrial system,
$N = N_{th} + I_{intra}$ is the sum of thermal noise and intra-system interference of the terrestrial system (or CINR of the terrestrial system), and
I_{ext} is the interference added to the receiver noise floor due to external interference, in this case from FSS earth station transmissions.

Therefore, I_{ext}/N = -6 dB represents a reasonable value associated with a C/I_{ext} of 3 dB.

The following table shows the resulting protection requirement expressed as a PFD level using a set of 5G receiver characteristics assumed for this case.

Table 1 - 5G protection requirement expressed as PFD level

Parameter	Base Station	CPE	Mobile Station
I/N requirement (dB)	-6	-6	-6
Frequency (GHz)	28	28	28
Receive antenna gain (dBi)	29.1	23	14
Implementation loss (dB)	3	3	3
Receive noise figure (dB)	6.5	7.5	8.5
Receive noise temperature (K)	1005.4	1340.8	1763.0
Boltzmann constant (dBJ/K)	-228.6	-228.6	-228.6
Noise power density (dBW/Hz)	-198.6	-197.3	-196.1
Wavelength (m)	0.011	0.011	0.011
PFD (dBW/m^2 in 1 Hz)	-180.3	-172.9	-162.7
PFD (dBm/m^2 in 1 MHz)	-90.3	-82.9	-72.7

While we believe the assumptions in Table 1 are reasonable, we note that using different assumptions would change the obtained PFD levels. However, the basic concept expressed by Equation 1 remains the same and valid as long as realistic assumptions are being used.

Question 6-5:

A. **ISED is seeking comments on whether there should be restrictions on the geographic areas in which new FSS earth stations can be deployed in the 28 GHz band.**
B. **If geographic restrictions on FSS earth stations are proposed, ISED is inviting detailed proposals on how they could be implemented, and what areas should be targeted.**

As we noted in our response to Question 6-1, more specific, quantifiable direction in new Canadian footnote C47C (beyond stating that FSS is not permitted to ubiquitously deploy in the band) is needed. Intel does not have a specific recommendation at this time, but we encourage the development of specific guidance, which should consider not only overall quantities but also a geographic density component. The U.S. FCC deliberations on this matter, which remain subject to Petitions for Reconsideration, may be useful in ISED deliberations.

Question 6-6: ISED is seeking comments on whether it should impose any limits on the aggregate emissions of the terrestrial services. If limits are proposed, ISED is inviting detailed proposals on why they should be implemented, and what the limits should be.

Intel strongly supports ISED's (as well as the FCC's) view that given the operational characteristics of both the new flexible use systems and satellite stations, harmful interference due to aggregate interference from flexible use services to space stations is not likely, and therefore is not proposing any limits on the aggregate power levels produced by flexible use

systems. ISED, like the FCC, should not impose any limits on aggregate skyward emissions in the 28 GHz band since technical analysis does not support a conclusion of a problem. The FCC fully considered the technical record on this subject, and in its millimeter wave (mmW) Report & Order concluded: "We do not believe the record demonstrates that there is a risk of interference to satellites from aggregate interference caused by [terrestrial mobile] stations"[11] and "we decline to establish any regulatory limit on aggregate power levels."[12] More explicitly, the FCC states, "specific technical limits on [terrestrial mobile] stations are not necessary at this time to address aggregate interference."[13]

Also notable, the FCC stated that its "decision not to set specific limits on aggregate interference is consistent with our treatment of that issue in other bands."[14]

Question 6-7: ISED proposes that all existing FSS earth stations and those in applications pending approval for operation would be permitted to continue to operate under the current conditions of licence as described above. Comments are sought on this proposal.

Intel concurs with the ISED proposal and deadline as described in the consultation, that "existing FSS earth stations and those in applications already submitted as of the publication of this [consultation] document be excluded from the band sharing mechanism."[15]

Question 7-1: ISED is seeking comments on the proposal to implement flexible use licensing in the frequency band 37-40 GHz, including the consequential changes to CTFA footnote C51, while continuing to allow for fixed-satellite service (space-to-Earth) in the band.

Intel supports the ISED proposal to implement flexible use licensing in the 37-40 GHz band, as defined in the proposed change to CFTA footnote C51. While paragraph 57 of the consultation notes that C51 does not allow for the ubiquitous deployment of FSS in the band, the actual language of C51 notes limited "applications," which is open to interpretation. Analogous to our response to Question 6-1 on 28 GHz, we believe the language of paragraph 57 (which states that ubiquitous FSS deployment is not allowed) should be added explicitly to footnote

[11] U.S. Federal Communications Commission, *Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, Report and Order and Further Notice of Proposed Rulemaking, GN Docket No. 14-177, released July 14, 2016 ("FCC mmW Order") at ¶294.
[12] FCC mmW Order at ¶61.
[13] FCC mmW Order at ¶294.
[14] FCC mmW Order at ¶68.
[15] Consultation at ¶39.

Modification C51 and should reference more specific numeric limitations in order to avoid conflicting interpretations of the word 'ubiquitous' and its threshold.

Question 7-3: ISED is seeking comments on the proposal to adopt the band plan as shown in figure 7 for the frequency band 37-40 GHz.

Intel concurs with the ISED proposal to adopt the band plan in figure 7 of the consultation. We agree that this approach would maximize the ecosystem harmonization efforts and simplify cross-border coordination. Further, we agree that the 37-37.6 GHz range, which is still under consideration and development by the FCC, is best deferred until the FCC resolves the issue in order to maximize harmonization.

Question 7-4:

A. ISED seeks comments on the proposal to require site-by-site coordination between proposed flexible use terrestrial stations and FSS earth stations in the frequency band 37.5-40 GHz when a pre-determined trigger threshold is exceeded.

B. If site-by-site coordination is proposed, what coordination trigger and value would be the most appropriate (e.g. PFD or distance threshold)?

C. ISED is also inviting proposals for specific additional technical rules on flexible use stations and FSS earth stations (e.g. site shielding) that could facilitate more efficient sharing between terrestrial and earth stations

Since this is band does not have any current FSS deployments and site-by-site coordination requirements are in place, we believe maintaining those requirements is the best course of action at present. Further, by limiting FSS to feeder links, as proposed, sharing is relatively straightforward because FSS feeder link locations would be known and deployment location would likely be chosen sufficiently distant from terrestrial deployments so as to avoid interference. The lack of FSS deployments and associated lack of technical and parametric information on those deployments makes the development of specific coordination thresholds challenging at this time.

Question 7-6: It is proposed that, should SRS and/or MSS systems be deployed, flexible use licensees in the band 37.6-40 GHz may be subject to technical provisions to facilitate co-existence.

Comments are sought. ISED notes that any such technical provisions would be established through a future consultation process.

Intel agrees with ISED's approach to address any technical provisions to facilitate coexistence (e.g. coordination zones) with potential future SRS and/or MSS systems via a future consultation process.

Question 8-1: ISED is seeking comments on its proposal to designate the band 64-71 GHz for licence-exempt operations on a no-protection, no-interference basis.

Intel strongly supports the ISED proposal to designate the 64-71 GHz band for license-exempt operations on a no-protection, no-interference basis. In our comments to the FCC expressing the same support for license-exempt (*a.k.a.* unlicensed) use of the 64-71 GHz band, we note that the 64-71 GHz band is ideally situated to extend the growing demand for high capacity wireless LAN applications, and that industry stakeholders have assembled a strong ecosystem for developing products, services, and standards for IEEE 802.11ad (WiGig®).

The approved IEEE 802.11-2016 standard already supports IEEE 802.11ad devices operating in 64-71 GHz range, and product developments are underway. In addition, the draft amendments to the standard, known as IEEE 802.11ay, will enable higher throughput and lower latency for 60 GHz operations. The IEEE 802.11ay draft process is well underway and a certifiable draft, which permits product introductions to take advantage of the enhancements in 802.11ay, is expected to be voted on in early 2018.

The 802.11ay project to extend 802.11ad capabilities has defined nine usage models so far.[16] As the IEEE Project Authorization Request (PAR) for 802.11ay explains, wireless LAN usage continues to grow and find new applications demanding additional capacity. As an example for the replacement of wired interfaces, the speed of wired interfaces such as Ethernet, HDMI, USB and DisplayPort can far exceed 10 gigabits per second.[17]

The envisioned indoor and outdoor applications and usages for 802.11ad and 802.11ay (*e.g.* cellular offload, wireless docking, wireless display, in-flight entertainment systems, backhaul,

[16] IEEE usage models document can be downloaded from:https://mentor.ieee.org/802.11/dcn/15/11-15-0625-03-00ay-ieee-802-11-tgay-usage-scenarios.pptx

[17] IEEE PAR can be downloaded from: https://mentor.ieee.org/802.11/dcn/14/11-14-1151-08-ng60-ng60-proposed-par.docx

etc.) require additional spectrum and much higher throughputs (20 Gbps and higher) than are currently attainable in the 57-64 GHz band alone. Such data rates are achieved by employing novel techniques such as channel bonding and MIMO, and a lesser amount of spectrum would diminish the growth potential and limit the usage cases and the simultaneous users of high bandwidth services.

In its mmW Report and Order, the FCC concurred with the majority of commenters, and allocated the 64-71 GHz band for unlicensed use. While several parties favored licensed use of part of that band, the supporters of unlicensed use of the 64-71 GHz band made a sustained, stronger, and more complete case than supporters of licensed use, and also outnumbered them. Thus, the public interest argument was more compelling for unlicensed use of this band. Canadian and U.S. consumers would benefit from both nations authorizing a common framework for license-exempt use in the 64-71 GHz band since it would lead to synergies in market development. We re-iterate our strong support for the ISED proposal to designate 64-71 GHz for license-exempt use, under the same technical rules to the extent possible.

Question 9-1: ISED is seeking comments on:

A. Whether flexible use access in these bands should be exclusively licenced or licence-exempt.

B. If a licencing approach is proposed, which types of licences (radio licences, spectrum licences with user-defined licence areas, spectrum licences with service areas for competitive licensing, or others) are expected to best lend themselves to licensing flexible use in the 28 GHz and 37-40 GHz frequency bands in order to support a variety of 5G technologies, applications and business cases?

C. Whether a licence-exempt dynamic access using data base should be implemented in all, or portions of the 28 GHz, 37-40 GHz, particularly in the band 37-37.6 GHz.

Regarding the question of exclusive licenses versus license-exempt, as noted earlier, Intel supports exclusive licensing of the 28 GHz and 37-40 GHz bands, and license-exempt use of the 64-71 GHz band. This would harmonize the respective bands since it aligns with the U.S. assignment schemes, as well as associated equipment design commonality and availability.

Regarding the question of license types, we believe service area licenses (including allowances for secondary-market transactions, and partitioning and disaggregation) best lend themselves to flexibly licensed use in the 28 GHz and 37-40 GHz bands. Among the proposed variations, the tier-4 licensing would seem to be most applicable.

Regarding the question of dynamic access schemes (including consideration of their associated intermediaries, the policy and regulatory limitations imposed, and the costs and complexities in developing and operating the framework), we do not see such schemes as viable or necessary in any of the mmW bands. As noted above, Intel supports the proven, straightforward exclusive licensing-by-service-area framework for the 28 GHz and the 37-40 GHz bands (which includes interference protection rights for licensees), as this will put the spectrum to use more expeditiously and efficiently.

More generally, dynamic sharing approaches are not suitable in many bands, and they would insert unnecessary complexity and cost compared to other, simpler approaches to achieving the same end. Indeed, the more dynamic approaches which have been targeted at bands with particularly complex sharing arrangements (*e.g.* involving multiple tiers of users including government/military users) are still experimental, and also involve novel policy choices that may affect their viability.

In addition, the business model viability and sustainability for the intermediaries controlling the dynamic spectrum assignments remain to be sorted out by the market, and there is no guarantee of success. While Intel is supporting the dynamic sharing development efforts for a band with complex sharing conditions (the 3.5 GHz band in the U.S.), this new combination of technical, policy, and operational constraints must be proven to work harmoniously through sustained and stable operations before being replicated in other spectrum bands. Indeed, lessons will be learned in introducing and operating this novel dynamic sharing framework, and it may call for material changes to the technical, policy, and/or operational aspects of the framework before it can be considered successful. At that point it could be considered for introduction in other bands, but replicating such a complex framework before that level of operational maturity has been reached will simply spread the potential flaws into multiple bands, which in turn would cause disruption to all the entities operating in the band.

Specific to the 37-37.6 GHz band, given the pre-conditions, there is no justification for a complex dynamic sharing framework in either Canada or the U.S. This band does not have significant incumbent use and a simpler framework can enable the straightforward forms of sharing envisioned. Intel believes Canada/U.S. harmonization is valuable for this band segment as well, and ISED is taking the right approach in awaiting the eventual framework developed for this band by the FCC.

The detailed framework development discussions have not yet begun for the 37-37.6 GHz band, and numerous requirements remain to be decided due to pending FCC Petitions for Reconsideration and the pending Further Notice of Proposed Rulemaking. We encourage all interested parties to actively participate in those discussions so that the framework is robust

and does not contain unnecessary complexity. This participation should include commentary on any aspects of proposed frameworks that would either complicate or facilitate Canada/U.S. harmonization for this band.

Question 9-2: If an exclusive licensing approach is implemented, preliminary comments are sought on the benefits and risks related to longer licence terms for these frequency bands.

Regarding license term, Intel concurs that longer terms incentivize investment. For the 28 GHz and 37-40 GHz bands, the FCC adopted 10 year license terms with renewal expectancy if the licensee meets the service requirements at the license term. Since the same technology and service development considerations will exist for these bands in both the U.S. and Canada, a ten year license term with renewal expectancy and a streamlined renewal process could be appropriate for Canada as well.

Respectfully submitted,

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