



Innovation, Science and
Economic Development Canada

Innovation, Sciences et
Développement économique Canada

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Spectrum Management and Telecommunications

Consultation on Releasing Millimetre Wave Spectrum to Support 5G

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Canada

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1. Intent

1. Through the release of this document, Innovation, Science and Economic Development Canada (ISED) is hereby initiating a consultation on releasing millimetre wave (mmWave) spectrum in the 28 GHz, 37-40 GHz and 64-71 GHz frequency bands to support the deployment of 5th generation (5G) wireless networks and systems. Comments are being sought on all aspects related to the release of this spectrum. After this consultation is completed and decisions are made, ISED will consult further on licensing policies and technical standards for radio apparatus in the relevant frequency bands.

2. Legislative mandate

2. The Minister of Innovation, Science and Economic Development, through the [Department of Industry Act](#), the [Radiocommunication Act](#) and the [Radiocommunication Regulations](#), with due regard to the objectives of the [Telecommunications Act](#), is responsible for spectrum management in Canada. As such, the Minister is responsible for developing goals and national policies for spectrum resources use and for ensuring effective management of the radio frequency spectrum resource.

3. Policy objectives

3. ISED is committed to ensuring that Canadian consumers, businesses and public institutions continue to benefit from the latest wireless telecommunications services across the country. A robust wireless telecommunications industry drives the adoption and use of digital technologies and enhances the productivity of the Canadian economy and its international competitiveness. The development and deployment of 5G is essential to Canada becoming a global centre for wireless innovation, and will bring Canada to the forefront of digital development and adoption through the creation and strengthening of world-leading wireless infrastructure.

4. Spectrum is a critical resource for wireless carriers. Additional spectrum will allow providers to increase network capacity to meet the traffic demands of higher usage rates, and support the provision of next-generation wireless technologies, such as 5G. ISED views the release of mmWave spectrum as an opportunity to support investment and improve services for both existing and potential new wireless service providers. In addition, it presents a key opportunity to support competition and the provision of high quality and innovative wireless services to Canadians.

5. In developing this consultation paper, ISED has been guided by the policy objectives of the [Telecommunications Act](#), and the [Spectrum Policy Framework for Canada](#) (SPFC), which states that the objective of the spectrum program is to maximize the economic and social benefits that Canadians derive from the use of the radio frequency spectrum resource. These objectives and enabling guidelines, as listed in the [SPFC](#), remain relevant for guiding ISED in delivering its spectrum management mandate.

6. Through Canada's [Innovation and Skills Plan](#) and its focus on people, technologies and companies, the Government of Canada is committed to promoting innovation-led growth across all sectors of the Canadian economy. Today's economy is digital. The ubiquity of digital technologies and services across sectors is a defining feature of this digital economy. Decisions made arising from this Consultation will support the [Innovation and Skills Plan](#) priorities and the SPFC policy objective by positioning Canada at the leading edge of the digital economy through the release of mmWave spectrum

to support 5G technologies. This spectrum will enable Canadians to use next-generation technologies and participate in the digital economy. A world-class communications infrastructure utilizing mmWave spectrum can create a platform for sustainable growth, allowing Canadian companies to take advantage of the latest technologies to better compete globally. Consequently, ISED's objectives for the release of mmWave bands are to:

- foster innovation, investment and the evolution of wireless networks through the adoption of 5G technology, to support sustained competition, so that consumers and businesses benefit from greater choice; and
- facilitate deployment and timely availability of services across the country.

4. Background and context

7. Wireless connectivity is driving demand for new services, technologies, and consequently, spectrum. Mobile data traffic is expected to grow seven-fold between 2016 and 2021¹ and new applications are expected to emerge that require even higher capacity and lower latency networks. Since 2008, ISED has more than doubled the amount of spectrum made available for commercial mobile services to 648 MHz, but increased demand for large data consumption and faster transmission dictates that Canada will need to release more spectrum for wireless services to unlock the potential of new applications enabled by 5G.

8. 5G will be the next major advancement in mobile telecommunications standards. Forecasted use cases include enhanced/ultra-fast mobile broadband, massive machine type communications, and ultra-reliable/low latency communications, all of which are predicted to drive increased usage and facilitate deployment of integrated verticals such as healthcare, transportation, and smart cities, while leveraging massive Internet-of-Things (IoT) growth. A more flexible and effective use of mmWave spectrum has the potential to facilitate the development and adoption of 5G technology. The technology and applications will be disruptive to the business models of equipment providers, service providers and other industries. Canadian firms have the opportunity to participate in the development and implementation of this new technology.

9. As outlined in the [Innovation and Skills Plan](#), ISED recognizes the importance of innovation in digital technologies and is seeking to maximize the benefits of current and emerging digital technologies by positioning Canada in the forefront of wireless communications. As new technologies, such as 5G, promise to foster innovation among businesses and offer consumers advanced products and applications, Canada will seek to capitalize on these technology advancements to give businesses, research institutions and cities a competitive edge.

10. Globally, other nations are also seeking to facilitate the development and adoption of 5G technology in a timely manner and are in the process of making high frequencies available for this purpose. In the United States (U.S.), the Federal Communications Commission (FCC) adopted new rules on July 14, 2016² that will support the development of 5G wireless networks in the U.S. According to the FCC, the new rules aim to facilitate innovation and “allow new technologies and innovations to

¹ Cisco, [VNI Mobile Forecast Highlights, 2016-2021](#).

² Federal Communications Commission (FCC), Report and Order (R&O) and Further Notice of Proposed Rulemaking (FNPR), [Use of Spectrum Bands Above 24 GHz For Mobile Radio Services](#), et al, July 2016.

evolve and flourish without needlessly prescriptive regulations.” They are also intended to balance different uses of the bands, from fixed and mobile services to satellite services as well as between commercial and non-commercial federal use.

11. The new U.S. rules open up nearly 11 GHz of high-frequency spectrum for mobile and fixed wireless broadband – 3.85 GHz of licensed spectrum and 7 GHz of unlicensed spectrum. The rules allow flexible use of the 28 GHz (27.5-28.35 GHz), 37 GHz (37-38.6 GHz) and 38 GHz (38.6-40 GHz) frequency bands, and additional unlicensed frequencies in the 64-71 GHz range. The FCC adopted spectrum holding policies for the 28 GHz, 37.6-38.6 GHz, and 39 GHz³ frequency bands that will apply to licences acquired through auctions and the secondary market. These bands will be made available for flexible deployment of fixed and mobile services, known as Upper Microwave Flexible Use Service (UMFUS). The band 37-37.6 GHz will be available to fixed and mobile terrestrial operations on a site-coordinated basis; this subcategory UMFUS is known as Shared Coordinated Service. While the FCC has finalized many of their rules for UMFUS, some of the rules, particularly in relation to band sharing for the Shared Coordinated Service in the band 37-37.6 GHz, are still being consulted on as part of their Further Notice of Proposed Rule Making (FNPRM) process. In addition to the frequency band 37-37.6 GHz, the FNPRM is seeking comments on authorizing fixed and mobile use in a number of other bands⁴ above 24 GHz.

12. The International Telecommunication Union (ITU), which allocates global radio spectrum, is conducting sharing and compatibility studies on eleven⁵ frequency bands between 24.25 and 86 GHz for the future development of broadband mobile services. Canada is leading the group performing the ITU studies for these bands. The ITU is not currently studying the 28 GHz band (27.5-28.35 GHz). Nonetheless, the U.S. and South Korea have made a commitment to pursue authorizing mobile operations in this frequency band domestically and Japan is studying 28 GHz in addition to the frequency bands being studied by the ITU.

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.

5. Canadian approach and timing

13. Traditionally, Canada has worked closely with the international community to globally harmonize frequency allocations and has sought to harmonize the use of spectrum through the adoption of common industry equipment standards. This approach allows for economies of scale in equipment manufacturing and facilitates cross-border coordination of spectrum use. In the case of 5G, the ITU

³ Note that the FCC 39 GHz band (frequency range 38.6–40 GHz) is the same frequencies as the Canadian 38 GHz band. In this document when discussing Canadian context we refer to it as 38 GHz to be consistent with existing departmental policies.

⁴ 24.25-24.45 GHz together with 24.75-25.25 GHz (24 GHz band), 31.8-33 GHz (32 GHz band), 42-42.5 GHz (42 GHz), 47.2-50.2 GHz (47 GHz), 50.4-52.6 GHz (50 GHz band), and the 71-76 GHz together with 81-86 GHz (70/80 GHz bands) and bands above 95 GHz.

⁵ 24.25-27.5 GHz, 31.8-33.4 GHz, 37-40.5 GHz, 40.5-42.5 GHz, 42.5-43.5 GHz, 45.5-47 GHz, 47-47.2 GHz, 47.2-50.2 GHz, 50.4-52.6 GHz, 66-76 GHz, 81-86 GHz.

World Radiocommunication Conference 2019 (WRC-19) will consider identification of frequency bands for the future development of mobile broadband services, and industry standards are being developed (in such bodies as 3GPP) that will be input to the ITU.⁶ As such, there remains a level of uncertainty at this point in time regarding how 5G technologies will be deployed and in which bands.

14. Nonetheless, there may be opportunities to promote innovation and early adoption of 5G technology with a “flexible use” licensing model. The flexible use licence would allow a licensee to decide whether to deploy fixed systems, mobile systems or a combination of fixed and mobile systems as they see fit. This approach is intended to allow new technology and innovations to evolve without overly prescriptive requirements, while meeting a variety of different needs and use cases.

15. Presently in Canada, innovators have access to short-term developmental licences issued by ISED that allow for the testing of equipment. These developmental licences have been used by innovators to conduct experiments and test the viability of new services and technology such as mobile systems, sensing equipment and video transmission utilizing non-conventional frequencies, including the mmWave spectrum bands that are the subject to this consultation. ISED will continue to issue such authorizations.

16. Making the 28 GHz and 37-40 GHz bands available for flexible mobile and fixed use and the 64-71 GHz band available for licence-exempt use is expected to help further promote innovation as well as the development and adoption of 5G technology in Canada by providing certainty around which frequency bands will be available for these uses over the long-term. This approach would also provide flexibility to accommodate a variety of use cases and therefore support innovative technologies and business cases as they emerge. Other bands, such as those being considered by the FCC in their FNPRM, as well as those being considered internationally, particularly by the ITU, will be addressed in the future.

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.

6. 28 GHz frequency band (27.5-28.35 GHz)

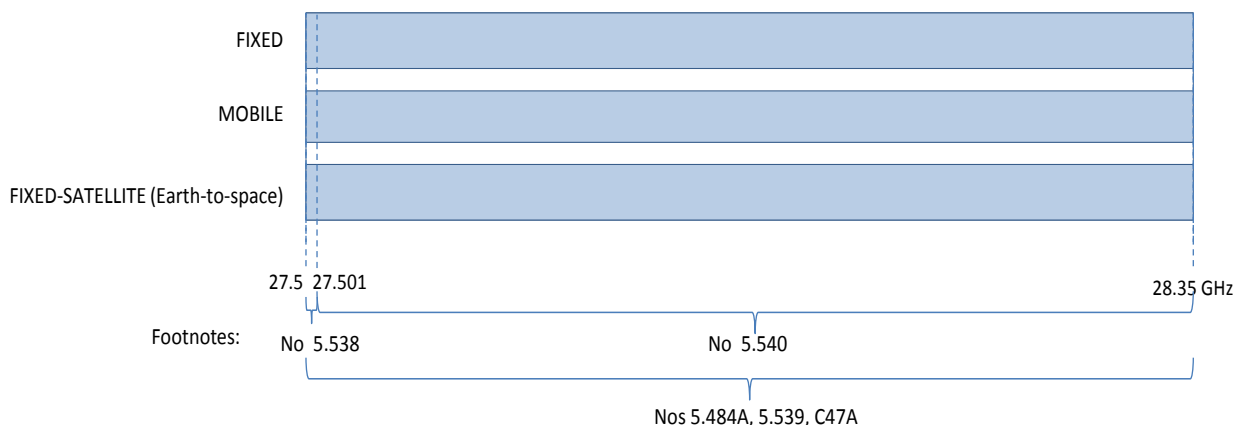
6.1 Current use of the spectrum

17. Spectrum from 3 GHz to 30 GHz is generally shared between fixed services and fixed-satellite services (FSS) based on a soft partitioning concept that allows both services to access the spectrum, but with priority given to one or the other in different cases. This is intended to facilitate the implementation of applications or services where the deployment of terminals would occur in a ubiquitous manner, with minimal burden of coordination and the possibility of authorization on a spectrum and geographic area basis.

⁶ International Telecommunication Union (ITU), [ITU towards “IMT for 2020 and beyond”](#) .

18. The 28 GHz frequency band is currently allocated for fixed, fixed-satellite (Earth-to-space) and mobile services on a co-primary basis. An illustration of the Canadian frequency allocations in the 28 GHz band is shown in figure 1 below.

Figure 1 – Canadian frequency allocations in the 28 GHz band



Notes: Primary services are shown in all uppercase letters
 Secondary services are shown with uppercase and lowercase letters

19. The frequency band 27.500-27.501 GHz is also allocated to the fixed-satellite service (space-to-Earth) on a primary basis for the beacon transmissions intended for up-link power control (No. **5.538**), while the frequency band 27.501-29.999 GHz is allocated to the same service and use on a secondary basis (No. **5.540**). The band 27.5-30 GHz may be used for the provision of feeder links for the broadcasting-satellite service (No. **5.539**). Additionally, there are provisions applicable to the coordination between GSO and NGSO systems (No. **5.484A**).

20. The use of spectrum in this band is consistent with the soft partitioning concept that allows several services to access the spectrum, but with priority given to one service over the others. In the 28 GHz band, fixed services are given priority over fixed-satellite service systems sharing this spectrum. Fixed-satellite service implementation in this band is limited to applications which pose minimal constraints upon the deployment of fixed service systems, such as a small number of large antennas for feeder links.⁷ The band is currently allocated to the fixed service for Local Multipoint Communication Systems (LMCS).⁸ Fixed radio systems with frequency-division duplexing (FDD) and/or time-division duplexing (TDD) operation are permitted to be deployed.⁹

21. In December 2014, ISED published the [New Licensing Framework for the 24, 28 and 38 GHz Bands and Decision on a Licence Renewal Process for the 24 and 38 GHz Bands](#). This framework established a first-come first-served (FCFS) licensing process for the 28 GHz band (25.25-26.5 GHz and

⁷ Innovation, Science and Economic Development Canada (ISED), [Canadian Table of Frequency Allocations](#) (CTFA), footnote **C47A**.

⁸ ISED, SP 3-30 GHz, [Revisions to Spectrum Utilization Policies in the 3–30 GHz Frequency Range and Further Consultation](#), October 2004.

⁹ ISED, SP 25.25 GHz, [Spectrum Utilization Policy, Decisions on the Band 25.25-28.35 GHz](#), June 2011.

27.5-28.35 GHz) with site-specific licences. To date, there have been no licences issued under this licensing framework for the 28 GHz frequency band; however there are two licensees operating mobile stations using developmental licences.

22. FSS licences in this frequency band are issued on a FCFS basis.¹⁰ There are four geostationary-satellite orbit (GSO) service providers operating eight Earth-to-space feeder link earth stations in this band (see annex A for a list of the eight stations). Seven of these earth stations are located close to urban boundaries where connections to fibre optic nodes are available. Furthermore, two Canadian non-geostationary-satellite orbit (NGSO) FSS networks have been authorized to operate in this band in the Earth-to-space direction. These NGSO FSS networks are required to be in service by 2018 and 2021, as per their conditions of licence. Two foreign satellite networks – Viasat (GSO) and O3b (NGSO) – are also approved to use this band to provide service in Canada; however, no earth stations are deployed to date in association with these networks.

23. There are no Canadian spectrum utilization policies on earth stations in motion (ESIM)¹¹ communicating with FSS space stations. However, there are about 80 ESIMs terminals from four FSS satellite operators that have been authorized to operate in Canada for airborne and maritime use on a no-interference no-protection basis in this frequency band. ISED believes that interference from airborne ESIMs to flexible use service is unlikely or manageable, while interference from maritime ESIMs to flexible use service requires further study. Furthermore, ISED believes that interference is likely to occur from land-based ESIMs to flexible use service due to the ubiquitous nature of both services.

6.2 Changes to spectrum utilization policies

24. ISED recognizes that sufficient and appropriate spectrum resources should be available to ensure that Canadians continue to benefit from advancements in wireless technology. Internationally, it is recognized that access to additional spectrum is needed to meet the exponentially increasing demand for wireless services. Several countries have been looking at 28 GHz spectrum as an option for commercial mobile services and most recently the U.S. decided to introduce flexible fixed and mobile services in this band.¹²

25. ISED is of the opinion that soft partitioning continues to be an effective approach to sharing spectrum between different services in this band and plans to continue facilitating the deployment of earth stations while ensuring that minimal constraints are imposed on the future deployment of fixed and mobile services. Specific band-sharing mechanisms between the different services in this band are discussed in section 6.5. In order to facilitate flexible use of the 28 GHz band for terrestrial services, ISED is proposing the following changes to the [Canadian Table of Frequency Allocations](#) (CTFA):

MOD C47A: In the [frequency](#) band 27.35-~~28.35~~ [27.5](#) GHz, use of spectrum for fixed service systems will be given priority over fixed-satellite service systems sharing this spectrum on a co-primary basis. Fixed-satellite service implementation in this band will be limited to applications

¹⁰ ISED, RP-008, [Policy Framework for Fixed-Satellite Service \(FSS\) and Broadcasting-Satellite Service \(BSS\)](#), November 2013, and CPC-2-6-02, [Licensing of Space Stations](#), November 2013.

¹¹ ESIM's are sometimes referred to as earth stations on mobile platforms (ESOMP).

¹² FCC, R&O and FNPR, [Use of Spectrum Bands Above 24 GHz For Mobile Radio Services](#), et al, July 2016.

that will pose minimal constraints upon the deployment of fixed service systems, such as a small number of large antennas for feeder links.

ADD C47C: In the frequency band 27.5-28.35 GHz, use of spectrum for fixed service systems and mobile service systems will be given priority over fixed-satellite service systems sharing this spectrum on a co-primary basis. Fixed-satellite service implementation in this band will 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.

26. ISED proposes that airborne and maritime ESIMs continue to be allowed to communicate with geostationary FSS space stations in this frequency band on a case-by-case basis on conditions of no-interference, no-protection. Due to interference concerns, land-based ESIMs would be prohibited from communicating with FSS space stations at this time.

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](#).

6.3 Moratorium

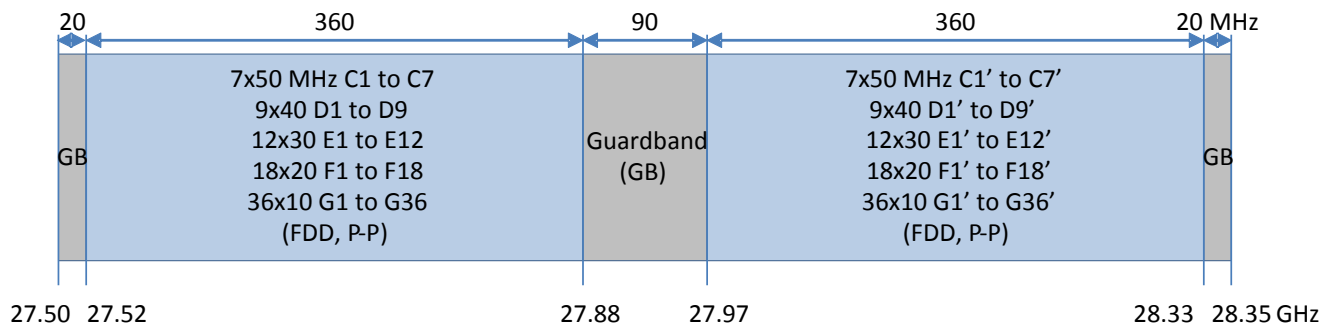
27. As a result of the considerations and potential changes raised in this consultation, ISED is now placing a moratorium on issuing new site-specific fixed service licences in the 28 GHz band under the [New Licensing Framework for the 24, 28 and 38 GHz Bands and Decision on a Licence Renewal Process for the 24 and 38 GHz Bands](#). It is expected that a moratorium will help ensure that the band is not unnecessarily encumbered prior to the development of a new licensing framework for flexible use in the band. Furthermore, given that there have been no licences issued under the current licensing framework for the 28 GHz band; a moratorium is unlikely to have any detrimental effect for spectrum utilization in this band in the short to medium term. As such the moratorium will be in place starting from the date of publication of this consultation until further notice.

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

6.4 Changes to band plan

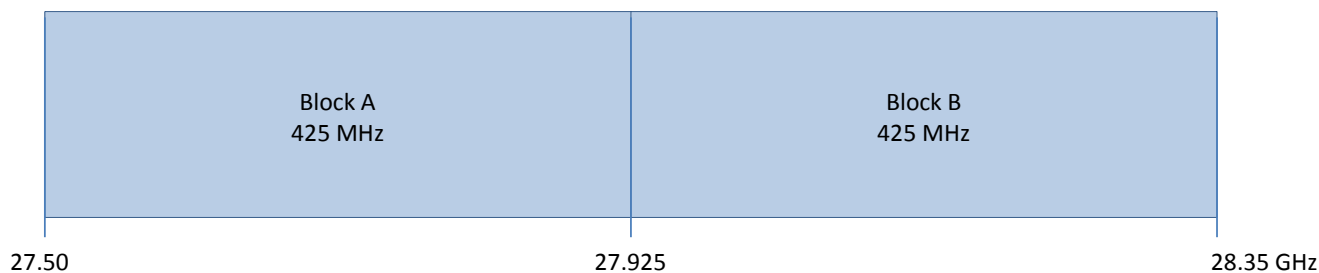
28. The existing Canadian band plan (see to figure 2) is divided into paired frequency blocks, facilitating FDD point-to-point systems. The band plan is contained in Standard Radio System Plan SRSP-325.25, [Technical Requirements for Fixed Radio Systems Operating in the Bands 25.25-26.25 GHz and 27.5-28.35 GHz](#).

Figure 2: Current Canadian band plan in the frequency band 27.5-28.35 GHz



29. Following its decision to allow flexible use in this band, the FCC adopted a new U.S. band plan consisting of two unpaired 425 MHz blocks (2 x 425 MHz). In order to facilitate equipment harmonization and simplify coordination between terrestrial services along the Canada-U.S. border, ISED proposes to align with the FCC decisions and adopt the same band plan, as shown in figure 3 below. This band plan does not specify any frequency block pairing, and does not preclude any type of duplexing scheme to be deployed.

Figure 3: Proposed new Canadian band plan in the 28 GHz band



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.

6.5 Band sharing with other services

30. In Canada, new flexible use services would share the 28 GHz band with FSS earth and space stations.

6.5.1 Coexistence between flexible use terrestrial stations and earth stations in the fixed-satellite service (Earth-to-space)

31. Currently, the operation of fixed earth stations in Canada is authorized by means of radio licences as described in CPC 2-6-01, [Procedure for the Submission of Applications to License Fixed Earth Stations and to Approve the Use of Foreign Satellites in Canada](#). Coexistence of fixed terrestrial stations and domestic FSS earth stations is addressed prior to licensing through coordination on a site-by-site basis. If coordination is required, the applicant will be advised of the requirement and will be

given a list of other users with whom to coordinate. The potential of interference from a new station into an existing station must be addressed during the coordination process between the applicant and the users, as identified. The results of coordination are then submitted to ISED as part of an overall licensing process. Similarly, applicants for new fixed terrestrial¹³ licences must confirm through coordination with other potentially affected users that their proposed systems will not cause harmful interference into existing or proposed terrestrial systems and earth stations.

32. Flexible use terrestrial stations could be subject to interference from the emissions of FSS earth stations in this frequency band. Preliminary studies indicate that flexible use terrestrial stations require a separation distance of between 50 meters and 400 meters from an FSS earth station.¹⁴ New Canadian footnote **C47C** (see above) does not allow for ubiquitous FSS deployment in the band. As a result, the coordination of flexible use terrestrial stations and FSS earth stations would be limited to a manageable number of cases. Sharing of this frequency band by flexible use terrestrial stations and FSS earth stations could be managed by applying the existing site-by-site coordination process to all flexible use stations (i.e. both fixed and mobile stations) and FSS earth stations.

33. ISED seeks comments on whether a trigger for coordination should be established to further facilitate coordination. For example, a power flux density (PFD) limit or a separation distance threshold can be used as a coordination trigger. If a new earth station exceeded the threshold value with respect to existing terrestrial stations, coordination with the operators of those identified terrestrial stations would be required. Additional technical rules could be used to facilitate better sharing of spectrum between the two aforementioned services. For example, ISED could require FSS operators to employ site-shielding around their earth stations in order to reduce the amount of interference that could be caused to terrestrial stations. ISED believes that such site-by-site coordination between stations of flexible use and satellite services could be implemented equally well regardless of whether the flexible use terrestrial services are licensed on a site-by-site basis or on an area basis. The discussion on potential licensing mechanisms is included in section 9 of this document.

¹³ ISED, RSP-113, [Application Procedures for Planned Radio Stations Above 960 MHz in the Fixed Service](#), October 2007.

¹⁴ FCC, R&O and FNPR, [Use of Spectrum Bands Above 24 GHz For Mobile Radio Services](#), et al, July 2016, paragraph 45 cites an AT&T, Nokia, Samsung, T-Mobile, and Verizon, Ex Parte [letter](#) submitted to the FCC, which describes the results of simulations conducted by Nokia.

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.

6.5.2 Geographic restrictions on the deployment of fixed-satellite services earth stations

34. In the U.S., the FCC has adopted new rules to enable sharing between UMFUS stations and new FSS earth stations in the 28 GHz band, with FSS being secondary¹⁵ to UMFUS. Notwithstanding that status, a new FSS earth station is not required to provide any additional protection to UMFUS stations (other than as required under the terms and conditions specified in its authorization) if the FSS earth station is authorized under an UMFUS licence, enters into an agreement with an UMFUS licensee in the area or the FSS earth station conforms to a set of conditions that restrict the geographic areas in which an FSS earth station can be deployed. In addition, there are provisions that would limit the number of geographic zones where UMFUS stations would not be able to claim protection from FSS earth stations within each licence area.

35. ISED is of the view that the FCC's approach for limiting the areas in which fixed-satellite services can be deployed is not appropriate in the Canadian context. As discussed above, there are currently a limited number of earth stations operating in this band. Also, existing Canadian space teleports are deployed near fiber links that are close to urban boundaries. Given that these teleports would likely also be utilized for feeder links in the 28 GHz band, the adoption of the FCC's approach in Canada may unnecessarily rule out the use of these locations. At the same time, ISED is cognizant of the potential deployment of flexible use terrestrial systems in and near urban areas. In addition, noting the new Canadian footnote **C47C** that would limit the deployment of FSS systems in the band to applications which will pose minimal constraints upon the deployment of fixed and mobile service systems, ISED is considering whether there is a need to prescribe specific rules to limit the growth of FSS earth stations in core urban areas and near major infrastructure where the deployment of flexible use systems would be most desirable.

¹⁵ FCC, R&O and FNPR, [Use of Spectrum Bands Above 24 GHz For Mobile Radio Services](#), et al, July 2016, Appendix A-Final Rules, Part 25, Section 25.136, Earth Stations in the 27.5-28.35 GHz and 37.5-40 GHz bands.

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.

6.5.3 Coexistence between flexible use terrestrial stations and space stations in the fixed-satellite services (Earth-to-space)

36. Space stations operating in the 28 GHz band receive transmissions from earth stations and, as a result, are also currently subject to the interference from the emissions of fixed terrestrial systems deployed in the band. It is expected that ISED's decision to designate the band for flexible use services will lead to ubiquitous and widespread use of this frequency band by the flexible use services. An increase in the number of terrestrial stations may also, on the aggregate, have the potential to increase the magnitude of the emissions received by space stations from terrestrial stations in this band.

37. The FCC decided not to establish any regulatory limits on the aggregate power levels produced by UMFUS operations. In the U.S., the fixed-satellite service is secondary to fixed and mobile services, and the FCC does not believe that there will likely be coexistence issues between UMFUS systems and fixed-satellite services systems. It is expected that 5G technologies contemplated for this frequency band will tend to limit transmissions towards the space stations. For example, it is expected that 5G base stations and user terminals will employ dynamic beam forming with very narrow beam widths, which would reduce the chance of pointing directly toward satellite receivers. In addition, it is expected that most mobile handset use will be indoors, which would significantly attenuate the propagation of these signals towards space stations. The signals coming from indoor devices will probably need an exterior repeater to be delivered to a base station. Such repeaters are also expected to have the beam forming capability to limit skyward transmissions.

38. Unlike the U.S., fixed-satellite services operate on a co-primary basis in Canada, subject to Canadian footnote **C47A** and the proposed new footnote **C47C**. However, ISED shares the FCC's view, as noted above, 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. However, if necessary, ISED may decide to review whether to apply protection measures for satellite receivers operating in this frequency band in the future.

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.

6.6 Treatment of existing users

39. It is proposed that existing FSS earth stations and those in applications already submitted as of the publication of this document be excluded from the band sharing mechanism described above. These stations would continue to operate within the current parameters and conditions of their licences. Terrestrial licensees under the new flexible-use licence in the same geographic areas could not claim protection from these grandfathered stations. New FSS earth station facilities operating in the 28 GHz band would be subject to the proposed new sharing mechanism or other sharing mechanism (as discussed in section 6.4 above) that will be developed as a result of this consultation.

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.

7. Frequency band 37-40 GHz

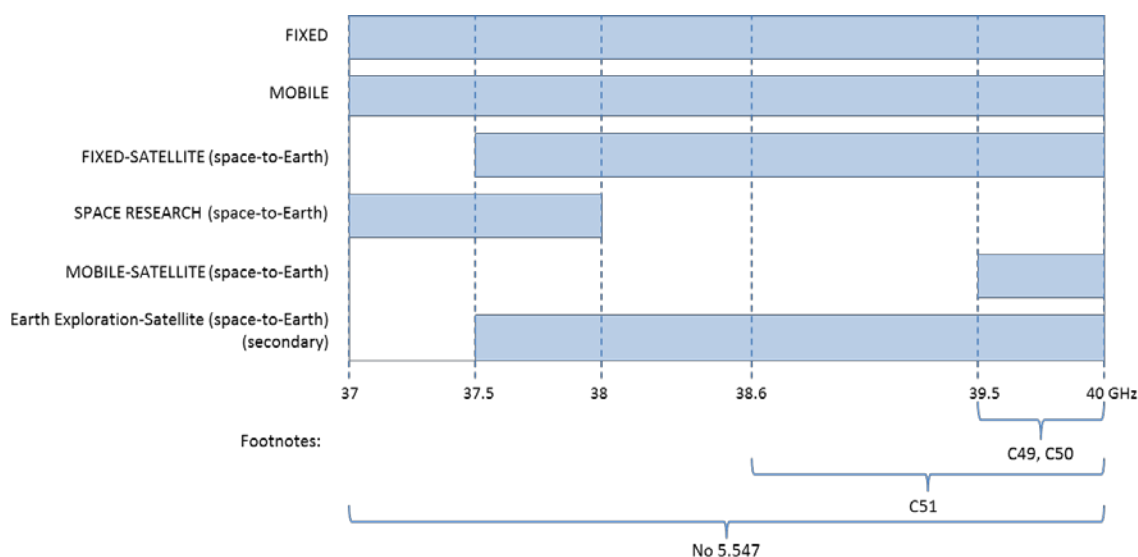
7.1 Current use of the spectrum

40. In Canada, fixed and mobile services are allocated in the frequency band 37-40 GHz, fixed-satellite service¹⁶ (space-to-Earth) in the frequency band 37.5-40.0 GHz, space research service (space-to-Earth) in the frequency band 37-38 GHz, and mobile-satellite service¹⁷ (space-to-Earth) in the frequency band 39.5-40 GHz all on a co-primary basis while Earth exploration-satellite service (space-to-Earth) is allocated on a secondary basis in the frequency band 37.5-40 GHz. In addition, the frequency band 37-40 GHz is available for high-density applications in the fixed service in accordance with footnote 5.547 of the ITU's *Radio Regulations*. An illustration of the Canadian frequency allocations in the frequency band 37-40 GHz is shown in figure 4 below.

¹⁶ The use of the fixed-satellite service applications in this band is currently limited to those that would pose minimal constraints upon the deployment of fixed service systems, such as a small number of large antennas for feeder links, as specified in footnote C51 in the [CTFA](#).

¹⁷ The use of all or portions of the band for fixed-satellite service and mobile-satellite service is limited to the Government of Canada. See footnotes C49, and C50 in the [CTFA](#).

Figure 4 – Canadian frequency allocations in the band 37-40 GHz



Notes: Primary services are shown in all uppercase letters
 Secondary services are shown with uppercase and lowercase letters

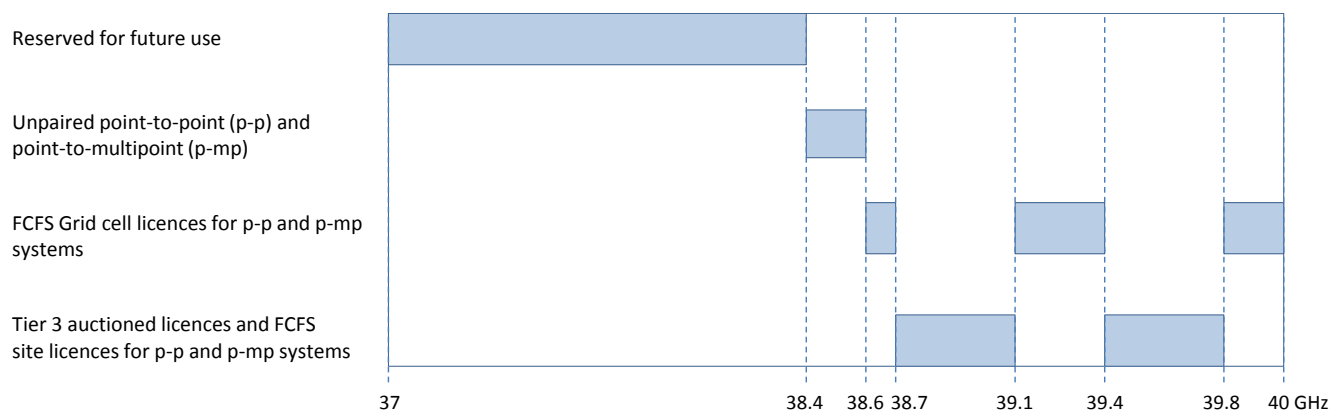
41. In 1999, ISED designated 800 MHz of spectrum (38.7-39.1 GHz and 39.4-39.8 GHz) for licensing via auction and 600 MHz of spectrum (38.6-38.7 GHz paired with 39.3-39.4 GHz, and 39.1-39.3 GHz paired with 39.8-40 GHz) for point-to-point microwave systems, licensed on a grid-cell basis through a first-come first-served (FCFS) process.¹⁸ Also, the frequency band 38.4-38.6 GHz was made available under the same FCFS licensing process for unpaired point-to-point and unpaired multipoint communication systems. The remaining 1400 MHz (37-38.4 GHz) were reserved for future use by the fixed service.

42. In December 2014, ISED published the [New Licensing Framework for the 24, 28 and 38 GHz Bands and the Decision on a Licence Renewal Process for the 24 and 38 GHz Bands](#). This framework allows for point-to-multipoint systems in the frequency ranges 38.6-38.7 GHz, 39.1-39.4 GHz, and 39.8-40 GHz and it established a new FCFS licensing process for available spectrum in the frequency bands 38.7-39.1 GHz and 39.4-39.8 GHz with site-specific licences. Existing auctioned licences were eligible for a 10 year renewal term if conditions of licence were met and annual FCFS licences with deployment were renewed.¹⁹ Furthermore, it was recognized that site-specific licences were the most efficient and consistent approach to authorizing high frequency spectrum for backhaul and, therefore, renewed auctioned licences were not provided with a high expectation of renewal after their renewed 10 year term. Figure 5 shows how fixed services are currently using the frequency band 37-40 GHz.

¹⁸ ISED, [Final Policy and Licensing Procedures for the Auction of the 24 and 38 GHz Frequency Bands](#), 1999.

¹⁹ ISED, [New Licensing Framework for 24, 28, and 38 GHz Bands and Decision on a Licence Renewal Process for the 24 and 38 GHz Bands](#), December 2014.

Figure 5 – Current use of the frequency band 37-40 GHz by fixed service



43. According to the ISED’s records, the frequency band 38.6-40 GHz is used by operators of fixed point-to-point and point-to-multipoint systems for wireless backhaul and to offer broadband wireless access to clients. There are currently 28 tier 3 auctioned licences held by four licensees. TeraGo Networks is the major licence holder with 25 licences and ABC Allen, I-Netlink Inc. and Telus each hold one licence. The Telus licence was issued in 2003 and is scheduled for a renewal decision in 2018; the other licences were renewed in 2015. These licence areas include a mixture of rural and urban areas in British Columbia, Alberta, Manitoba and Ontario.

44. There are 80 active grid cell licences held by nine licensees that have collectively deployed roughly 1900 sites. Rogers, Telus, TeraGo Networks and Freedom Mobile collectively hold 90% of these licences. Since 2014, when site licences were made available under the [New Licensing Framework for the 24, 28 and 38 GHz Bands and Decision on a Licence Renewal Process for the 24 and 38 GHz Bands](#), ISED has issued 245 licences for 386 individual sites to seven licensees. Freedom Mobile holds 80% of these licences. Data from ISED’s licensing database shows that approximately 88% of all sites (including both grid cell and site-specific licences) are located within the greater areas of Vancouver, Calgary, Edmonton, Toronto, Ottawa and Montreal.

45. Finally, there are also two fixed stations operated on a developmental basis in the frequency band 37.6-38.6 GHz.

46. There is currently no satellite use, including fixed-satellite, space research, mobile-satellite, or Earth exploration-satellite services, in the frequency band 37.5-40 GHz. However, the fixed-satellite industry has expressed interest in this band paired with the Earth-space band around 50 GHz as the next bands to be commercially developed since the Ku and Ka bands are becoming more and more congested.

7.2 Changes to spectrum utilization policies

47. Similar to the 28 GHz frequency band, ISED is proposing to make the frequency band 37-40.0 GHz available for flexible use for terrestrial services.

48. The use of the fixed-satellite service applications in this band is currently limited to those that would pose minimal constraints upon the deployment of fixed service systems, such as a small number of large antennas for feeder links, as specified in footnote C51 in the [CTFA](#). In making available the band 37-40 GHz for flexible use for terrestrial services, ISED believes that we should uphold the principle of not unduly constraining the deployment of terrestrial services throughout the band where satellite service also has an allocation. Therefore, ISED proposes to continue the limitation of the fixed-satellite service to applications which would pose minimal constraints to terrestrial services (including both fixed and mobile services) and extends the limitation to 37.5-40 GHz. However, ISED also recognizes the need for the FSS to continue having access to the band. A sharing mechanism to accommodate these services would be developed in collaboration with stakeholders, (see section 7.4).

49. In order to accommodate flexible use for terrestrial services in the band (as discussed above), footnote C51 in the [CTFA](#) would be modified as follows:

MOD C51 (CAN-17) The [frequency](#) band ~~38.637.5~~-40 GHz is being licensed for applications in the fixed [and mobile](#) services, which will be given priority over fixed-satellite service systems sharing this [frequency band-spectrum](#) on a co-primary basis. Fixed-satellite service implementation in this [frequency band-spectrum](#) will be limited to applications that will pose minimal constraints upon the deployment of fixed [and mobile](#) service systems, such as a small number of large antennas for feeder links.

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.

50. ISED will continue to license the 38.4-40 GHz band under the [New Licensing Framework for the 24, 28 and 38 GHz Bands and Decision on a Licence Renewal Process for the 24 and 38 GHz Bands](#). In the future, when alternative licensing processes have been finalized and the timing of their implementation has been determined, a moratorium on issuing new site-specific licences may be required. ISED is proposing to treat 28 GHz and 38.4-40 GHz bands differently with respect to moratoriums on issuing new licences. Unlike the 28 GHz band, which currently has no fixed service users, the 38.4-40 GHz band is currently used to deliver backhaul for mobile services and for enterprise wireless solutions. An immediate moratorium may impact existing and potential users of this band with respect to their current and future deployment plans.

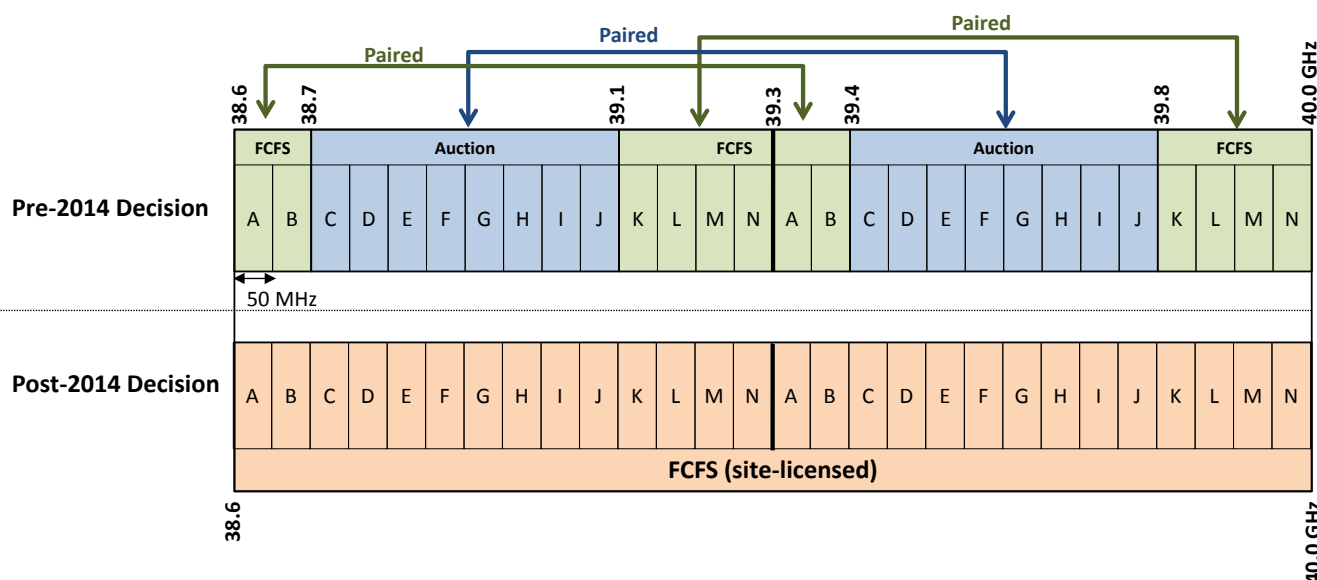
Question 7-2: ISED is seeking comments on whether a moratorium on the issuance of new licences under the [New Licensing Framework for the 24, 28 and 38 GHz Bands and Decision on a Licence Renewal Process for the 24 and 38 GHz Bands](#) is required at this time.

7.3 Changes to band plan

51. For the terrestrial services, there is no existing band plan defined in the frequency band 37-38.4 GHz. The frequency band 38.4-38.6 GHz is divided into four blocks of 50 MHz each.

52. In the frequency band 38.6-40.0 GHz, the current Canadian band plan comprises fourteen (14) 50 MHz frequency blocks (see figure 6), with both FDD and TDD systems permitted.²⁰ As stated earlier, licences in this band have been granted through both auction and first-come, first-served (FCFS) processes and include a mixture of area licences (based on Tier 3 areas as well as licensee-defined areas using grid cells) and site licences; therefore, the licence duration and authorized frequency blocks may differ.

Figure 6: Current Canadian band plan for 38.6-40 GHz



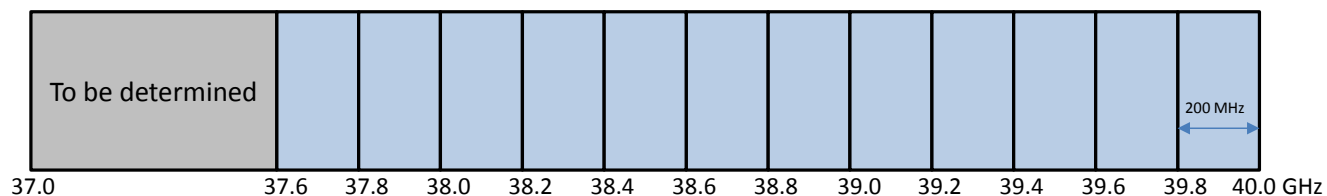
53. In the U.S., as part of its further consultation on band sharing and coordination mechanisms for the frequency band 37-37.6 GHz, the band plan for this frequency band is currently under development. In particular, the FCC is considering whether or not to establish a 100 MHz minimum channel size while allowing users to aggregate these channels into a larger channel size, up to a maximum of 600 MHz, where available. Other options are also being considered. The FCC has not finalized its rules on this matter at this time. For the band 37.6-40 GHz, the FCC has adopted a new band plan comprised of 200 MHz blocks. The FCC also adopted rules that allow both FDD and TDD implementations.

54. In order to benefit from the ecosystem that develops in the U.S. and simplify coordination of fixed and mobile services along the Canada-U.S. border, ISED is proposing that Canada adopt the same band plan in the entire 37-40 GHz range as the U.S. Given the development in the U.S. with respect to a new band plan in the frequency range 37-37.6 GHz, adopting a Canadian band plan at this time would

²⁰ ISED, SRSP-338.6, [Technical Requirements for Fixed Radio Systems Operating in the Band 38.6-40.0 GHz](#), April, 2008.

be premature and could undermine the benefits of equipment harmonization. It is therefore proposed that the development of a Canadian band plan for this frequency range be deferred to a later date. The overall proposed band plan for the frequency band 37-40 GHz is shown in figure 7 below. Similar to the 28 GHz band, this band plan would not preclude any type of duplexing scheme to be deployed.

Figure 7: Proposed Canadian 37-40 GHz frequency band plan



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.

7.4 Band sharing with other services

55. In order to facilitate the introduction of flexible use services in this frequency band, provisions will need to be developed to ensure their co-existence with existing services.

7.4.1 Coexistence between flexible use terrestrial stations and earth stations in the fixed-satellite service (space-to-Earth)

56. Currently, the coexistence of fixed terrestrial stations and FSS earth stations is addressed through coordination on a site-by-site basis, as described in section 6.5 above. It is noted, however, that there has been no deployment by the satellite service in this band yet.

57. Since FSS earth stations receive signals from satellites transmitting in this frequency band, they could be subject to interference from the emissions of new flexible use terrestrial stations. Preliminary studies provided to the FCC indicate that FSS earth stations would require a separation distance of no more than 2 km from a flexible use terrestrial station.²¹ The proposed modification to Canadian footnote C51 does not allow for the ubiquitous deployment of FSS in the band. As a result, the coordination of flexible use terrestrial stations and FSS earth stations is likely to be manageable as the number of FSS earth stations will likely be limited to a small number.

58. The considerations above are very similar to those concerning the coexistence of flexible use terrestrial stations and FSS earth stations in the frequency band 27.5-28.35 GHz. Therefore, ISED

²¹ FCC, R&O and FNPR, [Use of Spectrum Bands Above 24 GHz For Mobile Radio Services](#), et al, July 2016, para. 90.

proposes to adopt similar mechanisms, using a PFD or a distance threshold as a trigger for coordination, to manage the band sharing in this band.

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.**

7.4.2 Geographic restrictions on the deployment of earth stations

59. Similar to the decisions made in the 28 GHz band, the FCC adopted new mechanisms to restrict the areas in which new FSS earth stations can be deployed. This was done to ensure that fixed-satellite services do not restrict the deployment of new UMFUS systems in core urban areas and around major infrastructure where implementation of flexible use systems would be most likely. Unlike the 28 GHz band, in the frequency band 37.5-40 GHz, it is the FSS earth station that could experience interference from the flexible use terrestrial stations. In the U.S., an FSS earth station can obtain protection from flexible use stations by obtaining an UMFUS licence, entering into an agreement with an UMFUS licensee or if the FSS earth station conforms to a set of conditions that restrict the geographic areas in which an FSS earth station can be deployed. In addition, there are provisions that would limit the number of earth stations that would be protected from harmful interference by UMFUS stations in a given licence area.

60. ISED is of the view that the FCC's approach is not appropriate in the Canadian context. However, similar to the potential band sharing mechanisms in the 28 GHz band, ISED may consider using other methods to facilitate flexible use systems deployment in core urban areas and major infrastructure by limiting the deployment of FSS earth stations in these areas.

Question 7-5:

- 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 frequency band 37.5-40 GHz.**
- 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?**

7.4.3 Band sharing with the space research service (SRS) (space-to-Earth) and mobile-satellite service (MSS) (space-to-Earth)

61. As noted above, the frequency band 37-38 GHz is allocated to the space research service (space-to-Earth) on a primary basis. Also, the band 39.5-40 GHz is allocated to the MSS, and is limited to use by the government of Canada. In the U.S., in order to enable band sharing, the FCC created coordination zones around its three SRS earth stations where deployment by UMFUS licensees within these zones requires prior coordination. There is no existing or planned SRS or MSS operation in Canada; therefore, ISED is not proposing specific restrictions on terrestrial services at this time. However, in the event that SRS or MSS begins deployment in these bands, flexible use licensees may be subject to future technical provisions in order to facilitate co-existence.

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.

7.5 Treatment of existing users

62. At mmWave frequencies, the difference between certain technical characteristics of fixed and mobile operations may be hard to distinguish. The high signal attenuation in mmWave bands will require the use of highly directive antennas for both fixed and mobile systems, and could offer the opportunity to reuse frequencies in the band at much closer distances than in lower frequency bands. On the one hand, this could enable very effective coordination between existing fixed users and future flexible use licensees. On the other hand, some of the new flexible use systems are expected to be ubiquitous in coverage, which could present coordination challenges in areas that already contain fixed systems, particularly if the two systems are operated by two different service providers. As 5G technology continues to develop, there will be more clarity on how effectively flexible use systems and existing fixed service systems will be able to co-exist. In the meantime, ISED is considering several options on the treatment of existing users as described in the following paragraphs.

7.5.1 Tier 3 licences

63. In 2014, when the decision²² was made to renew these licences, it was determined that site-specific licences were the most efficient and consistent approach to authorizing high frequency spectrum and therefore new licences issued through the renewal process were not provided with a high expectation of renewal after their 10-year term. The use of this spectrum is evolving to include mobile in addition to fixed use services and as such, a licensing process that does not distinguish between the two will provide more flexibility for operators to deploy and adapt their networks as they see fit. In moving

²² ISED, [New Licensing Framework for the 24, 28 and 38 GHz Bands and Decision on a Licence Renewal Process for the 24 and 38 GHz Bands](#), December 2014.

from fixed licensing to flexible use, ISED is considering two options for the treatment of existing Tier 3 licences at the end of the renewed 10 year term.

64. The first option is to convert the Tier 3 fixed service licences to flexible use licences for a lesser amount of spectrum based on the new band plan. The existing licences were issued in accordance with the current band plan, i.e., in paired blocks of 50 MHz (see figure 6) and would not align with the proposed new band plan (see figure 7). Therefore, if ISED decides to convert existing Tier 3 area licences to flexible use licences without changing the frequency blocks on which they are currently licensed, some flexible use blocks would be partially occupied, thereby making fewer blocks available for potential future licensing processes. Given that flexible use licences would be expected to be much more valuable and in demand than fixed, there would be some justification for reducing the amount of spectrum assigned. Therefore, ISED could issue new licences at the end of the current term, for a lesser amount of spectrum. The new amount of spectrum could be determined by using a percentage of the current amount.

65. The second option is to issue site-specific licences for sites currently in operation at the end of the licence term. These new site-specific licences could then be treated the same way that the current site-specific licences would be treated, i.e. either with or without protection from new flexible use licensees (see section 7.5.2 below).

7.5.2 Grid cell and site-specific FCFS licences

66. Grid cell and site-specific licences are issued on an annual basis. Licensing under these approaches provides for very efficient access to spectrum in that a licence is only issued for the area or site in which the licensee intends to deploy. Furthermore, these licences could make co-ordination with future flexible use licensees relatively straight-forward as the specific location of each transmitter is known. As such, ISED is considering two options for the treatment of existing grid cell and site-specific users.

67. First, given the potential for improved coordination (both through the expected improvements in technology capability and the limited geographic areas of licences), ISED could allow these licensees to continue operating in the band and be protected from interference from new flexible use licensees. New licensees would be required to coordinate with the existing licensees by deploying around their sites or by other means determined between the licensees. This approach to treating these users would provide access to the spectrum for 5G with minimal impact on existing users. Furthermore, given the expected capabilities of technology in this band, this approach will likely be technically feasible. However, it could also severely limit deployment of 5G in major urban areas (as discussed in section 7.1, 88% of grid cell and site-specific licences are operating in the six largest urban areas).

68. A second approach would be to allow for them to continue operating on a secondary basis to flexible use licences. This approach would provide no protection for existing licensees from interference caused by new flexible use systems but would allow them to continue operating, at least until 5G systems are deployed in their specific area. It is proposed that under this option, a notification period of one year would apply.

Question 7-7: ISED is seeking comments on:

A. the options and implications for the treatment of incumbent licensees currently holding Tier 3 licences, the percentage that would apply to option 1 and supporting rationale.

B. the options and implications for the treatment of incumbent licensees currently holding FCFS licences and supporting rationale.

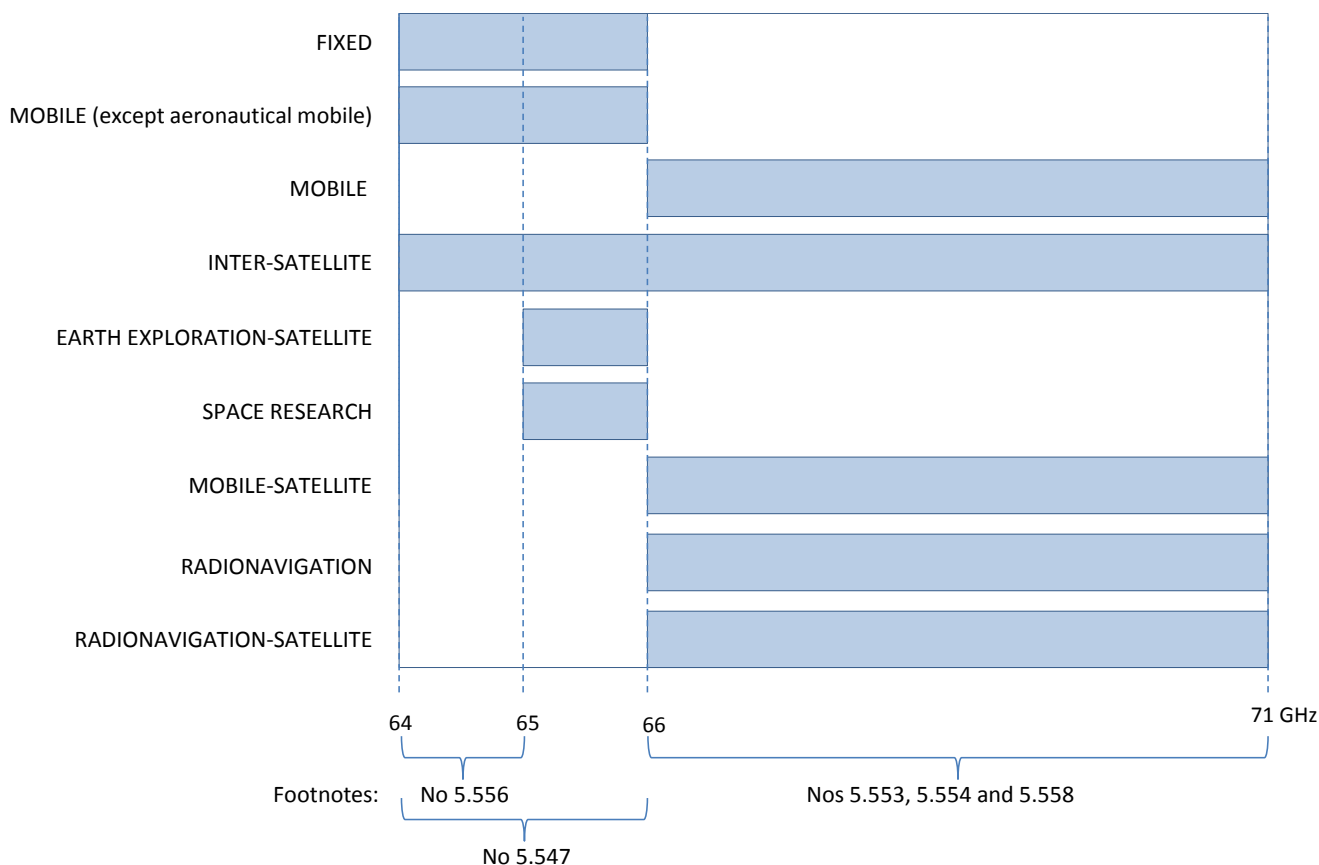
8. Frequency band 64-71 GHz for licence-exempt use

8.1 Current use of the spectrum

69. ISED recognizes that there is strong interest for new licence-exempt (LE) wireless devices for various applications. These include vehicle-mounted field disturbance sensor (vehicle radar) applications and short range high capacity wireless communication devices for the delivery of multimedia applications. LE operations are also increasingly being used by communication carrier networks to alleviate spectrum congestion by enabling mobile data off-loading through Wi-Fi networks. The demand for such use is expected to continue growing. Sufficient spectrum should therefore be made available to ensure that Canadians will benefit from the various new and innovative LE applications that are, and will be, developed.

70. In the [CTFA](#), the frequency band 64-65 GHz is allocated to the fixed, mobile (except aeronautical mobile) and inter-satellite services on a co-primary basis; and radio astronomy observations may also be carried out in the band (No. **5.556**). The frequency band 65-66 GHz is allocated to the fixed, mobile except aeronautical mobile, inter-satellite, Earth exploration satellite and space research services on a co-primary basis. The [CTFA](#) also specifies that the frequency band 64-66 GHz is available for high-density applications in the fixed service (No. **5.547**). An illustration of the Canadian frequency allocations in the frequency band 64-71 GHz is shown in figure 8 below.

Figure 8 –Canadian frequency allocations in the band 64–71 GHz



71. The frequency band 66-71 GHz is allocated to mobile, inter-satellite, mobile-satellite, radionavigation, and radionavigation-satellite services on a co-primary basis. Further, in 66-71 GHz frequency range, land mobile service is subject to not causing harmful interference to space radiocommunication services (No. **5.553**) and aeronautical mobile service is allowed subject to not causing harmful interference to the inter-satellite service (No. **5.558**). Also in this frequency range, satellite links connecting land stations at specified fixed points are allowed when used in conjunction with the mobile-satellite service or radionavigation-satellite service (No. **5.554**).

72. There are no Canadian spectrum utilization policies addressing the frequency band 64-71 GHz. Furthermore, there are no existing users of this band by any service in Canada and ISED is not aware of any planned usage.

8.2 Changes to spectrum utilization policies

73. As there are no spectrum policies nor operations in the 64-71 GHz frequency band, designation of the band for licence-exempt (LE) operations will have no impact on any incumbent services.

74. The U.S. has authorized LE operations in the 64-71 GHz frequency band pursuant to the same technical standards as in the adjacent frequency band 57-64 GHz, creating 14 GHz of spectrum for contiguous LE operation. Canada has already harmonized with the U.S on technical rules for the operation of LE devices in the frequency band 57-64 GHz through the following documents:

- SP-47 GHz, [Spectrum Utilization Policy for Licence Exempt Wireless Devices in the Bands 46.7-46.9 GHz, 57-6 GHz and 76-77 GHz](#)
- SP 3-30 GHz, [Revisions to Spectrum Utilization Policies in the 3–30 GHz Frequency Range and Further Consultation](#)
- RSS-210, [Licence-Exempt Radio Apparatus: Category I Equipment](#)

75. ISED recognizes the value of harmonizing spectrum use with other countries, particularly for applications which involve consumer devices. ISED therefore proposes to allow licence-exempt operations in the frequency band 64-71 GHz on a no-protection, no-interference basis, allowing for 14 GHz of contiguous spectrum for LE operations.

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.

9. General spectrum access considerations for terrestrial services in the 28 GHz and 37-40 GHz frequency bands

76. It is important that all authorization processes be defined with consideration of the physical properties of the spectrum, potential use cases and market conditions. It is noted that mmWave bands do not travel long distances due to their high propagation losses and short transmission paths. However, it is expected that the spectrum could be used by systems that cover large areas with multiple stations. Generally speaking, use cases for the spectrum include enhanced/ultra-fast mobile broadband applications, massive machine type communications, and ultra-reliable, low latency communications.

77. As previously discussed, the U.S. chose to create flexible service and flexible rules while providing a balance of different spectrum access approaches to meet a variety of different needs and use cases, thus allowing new technology and innovations to evolve without prescriptive regulations. These include 3,143 exclusive geographic licences based on counties for the frequency band 27.5-28.35 GHz; exclusive geographic areas licences based on 416 Partial Economic Areas (PEA) for the frequency bands 37.6-38.6 GHz and 38.6-40 GHz; as well as shared access with site-based coordination in the frequency band 37-37.6 GHz. The FCC is also considering whether to implement a static, manual frequency coordination mechanism or a dynamic database mechanism for the frequency band 37-37.6 GHz, as described in the Further Notice of Proposed Rulemaking (FNPRM).²³

78. In considering the authorization of this spectrum for flexible use in Canada, either exclusive licences (i.e. one flexible use licence for terrestrial services in a given frequency range and geographic area²⁴) or licence-exempt use could be possible. Exclusive licences could provide for a stronger

²³ FCC, R&O and FNPR, [Use of Spectrum Bands Above 24 GHz For Mobile Radio Services](#), et al, July 2016.

²⁴ Note that in this context an exclusive licence would not confer a monopoly over the spectrum; any flexible use licensee would be required to share the spectrum in accordance with applicable band sharing mechanisms.

investment environment as a result of increased business certainty and licence-exempt use could facilitate increased access to spectrum for a greater number of users.

79. It is be important to consider different types of spectrum access to accommodate a variety of different technologies, applications and business cases that may develop. A brief description of each type of spectrum access, including their advantages and disadvantages in terms of deployment of 5G technology is discussed below.

9.1 Licence-exempt use

80. Licence-exempt use of the spectrum may facilitate increased access to the spectrum for potential users due to the low barrier to entry, including an absence of fees, and the generally low regulatory burden. However, this type of use would be very challenging in portions of the bands under consideration. In particular, in bands where the spectrum is shared with FSS, it could make coordination with FSS earth stations difficult. ISED does not track licence-exempt devices, so coexistence with FSS earth stations would be impractical without added mechanisms, such as the use of database or a listen before talk protocol, built in to the licence-exempt devices. However, if such added mechanisms were applicable only in Canada, it would require a unique ecosystem. The Canadian market is relatively small and no other countries are currently allowing licence-exempt operations or access without coordination mechanisms in these bands. This could make a viable business case challenging for manufacturers. Furthermore, given our close proximity to the U.S., the proliferation of licence-exempt devices crossing over the border could create interference challenges.

81. Noting that a dynamic database mechanism is being considered in the U.S. in the band 37-37.6 GHz, Canada could benefit from the same equipment ecosystem on a North American basis and potentially allow for licence-exempt operations using a similar approach. This dynamic database mechanism could provide a more opportunistic approach, where, by way of example, use of the band would only be permitted for as long as they are transmitting/receiving. Once a user ceases to transmit/receive, another user would have the opportunity to access the band. Under a dynamic database approach, coordination with other users would also need to be conducted in a dynamic manner. A dynamic database approach could increase the overall efficient use of the spectrum. Therefore, it is ISED's preliminary view that a dynamic database mechanism in the band 37-37.6 GHz may be feasible, whereas in the 28 GHz and 37.6-40 GHz bands, it could be more challenging as discussed above.

9.2 Exclusive licences

82. In Canada, there are currently three options available to ISED that would lend themselves to issuing exclusive licences for the use of mmWave spectrum for 5G: site-specific radio licences, user-defined areas for spectrum licences, and area licensing based on the [Service areas for competitive licensing](#).

9.2.1 Radio licences

83. Radio licences allow applicants to request a licence for an exact location based on their own business plans. Licences are typically issued under this approach through a first-come, first-served basis process. Given the shorter distance mmWave spectrum travels and improved ability to re-use this spectrum (e.g. through beam forming technology), this would allow many licensees to operate relatively close to each other. Radio licences do not, however, provide as much flexibility for licensees to expand their network because they are required to request a licence for each specific site.

9.2.2 Spectrum licences

User-defined service areas

84. The second option available to ISED is to allow for user defined licence areas through the grid cell licensing approach. Under this option, applicants determine their service area, which is mapped as closely as possible to the spectrum grid cells. ISED then licenses these applicants for the areas covered by the matching spectrum grid cells.

85. This approach to defining service areas allows for access to spectrum in the specific area required for a particular business case without including large areas that an applicant does not intend to use. This approach is also typically used for licensing on a first-come, first-served basis.

Service areas for competitive licensing

86. For all competitive licensing processes, ISED uses pre-defined service areas that are based on contiguous groupings of Statistics Canada's [Census divisions and subdivisions](#). ISED has established four tiers of service areas, all of which cover the entire geography of Canada. Tier 1 is a single national service area. Tier 2 consists of 14 large service areas covering all of Canada. There are eight Tier 2 service areas that have provincial/territorial boundaries, and six that are within Ontario and Quebec. Tier 3 contains 59 smaller regional service areas and Tier 4 comprises 172 localized service areas. Predefined licence areas are required for an efficient assignment of licences through a competitive licensing process. More details regarding the tiers can be found in [Service areas for competitive licensing](#).

87. Smaller licence areas may be better suited to the propagation characteristics of mmWave spectrum, and localized or regional business cases; also, smaller licence areas could facilitate access to spectrum for new entrants and smaller providers by increasing the flexibility for them to acquire spectrum for their specific business case.

88. Larger licence areas allow licensees more flexibility in terms of deployment compared to grid cell and site-specific licences. However, the relatively large licence areas, particularly for frequency bands that have short transmission paths, could result in areas being licensed that are largely unused.

89. Tier 4 licence areas in Canada are roughly equivalent to U.S. PEAs. If a licensing approach using service areas for competitive licensing is implemented, ISED proposes the use of Tier 4 service areas as they strike an appropriate balance between advantages of larger areas, and the increased access provided through smaller licence areas.

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.**

9.3 Licensing policy considerations (if exclusive licencing is implemented)

90. If an exclusive licensing approach is proposed, ISED seeks comments on specific licensing policies, discussed below.

9.3.1 Licence term (if a spectrum licence model is implemented)

91. The length of a licence term for spectrum licences provides the business certainty required to invest in the deployment of networks.

92. In the [*Framework for Spectrum Auctions in Canada*](#), published in March 2011, ISED adopted a flexible approach in determining licence terms, which allows for licence terms up to 20 years. Auctioned licences also typically have a high expectation of renewal. This decision was based on the recognition that licence terms in excess of 10 years would create greater incentive for financial institutions to invest in the telecommunications industry and for the industry itself to further invest in the development of network infrastructure, technologies and innovation. Longer terms are particularly appropriate when the use is unlikely to change.

93. The 28 GHz, 37-40 GHz frequency bands have the potential to facilitate the deployment of 5G services. Given that the use cases are still emerging and 5G standards, equipment, and deployment plans are still under development, ISED recognizes that longer licence terms would be favourable for attracting the financial investments required to deploy 5G services. It is also unlikely that any

developments in technology would result in a change to another use that is incompatible with flexible use for terrestrial services in the frequency bands.

94. It is also important to note that ISED recognizes that the current rate of wireless technology development is ever evolving and these developments, such as cognitive radio and dynamic spectrum access, are expected to provide opportunities for increased efficiency for spectrum access. As a result, it is expected that although long-term spectrum licences will continue to provide priority access to spectrum, future consultations will likely explore the possibility of providing for opportunistic access to licensed spectrum.

95. In light of the above, ISED's current view is that the benefits of longer licence terms for licences issued through a competitive process would be greater than the risks of technology developing in unforeseen ways.

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.

9.4 Measures to support competition (if exclusive licencing is implemented)

96. In an effort to ensure that the maximum social and economic benefits are derived from the use of the radio frequency spectrum of the mmWave bands, it will be important that licensees operate in a competitive marketplace. In cases where the licences in the 28 GHz and 37-40 GHz frequency bands are issued through competitive processes, ISED will consider introducing measures to support competition, which are consistent with the [Framework for Spectrum Auctions in Canada](#). In this regard, ISED has previously used measures such as licence transferability and divisibility, spectrum aggregation limits and spectrum set-asides.

9.4.1 Licence transferability and divisibility

97. In general, licences acquired through an auction are transferable in whole or in part (divisibility) to a qualified recipient, in both the bandwidth and geographic dimensions, subject to the policy and licensing frameworks applicable to these specific licences and ISED's approval. The ability to transfer spectrum licences is generally supported by stakeholders and believed to be an important privilege that benefits the licensee by allowing for secondary market for licences which can increase the overall efficiency of the market place. Specifically, it allows companies to negotiate commercial arrangements with limited government intervention, thus relying on market forces to the greatest extent feasible, a key enabling guideline of the [Spectrum Policy Framework for Canada](#).

98. Also, in June 2013, ISED released the [Framework Relating to Transfers, Divisions and Subordinate Licensing of Spectrum Licences for Commercial Mobile Spectrum](#) adopting additional measures in support of competition. The Framework provided guidance to licensees as to how transfers of spectrum licences will be reviewed, stipulating that ISED will analyze, among other factors, the change in spectrum concentration levels that would result from the requested licence transfer.

9.4.2 Spectrum aggregation limits

99. When multiple licences for the use of spectrum in a given geographic area are auctioned, and when these can be used to provide closely substitutable service, aggregation limits (i.e. spectrum caps) may be required on the amount of spectrum that any single bidder is allowed to acquire so as to ensure competitive markets. Spectrum aggregation limits may be imposed in the following circumstances:

- a. a bidder that acquires an amount of spectrum beyond a certain level would not face effective competition from providers of closely substitutable services; and
- y. the anti-competitive effects arising from the acquisition of an amount of spectrum beyond a certain level by a single bidder would not be offset by lower prices or higher valued services resulting from a single entity holding this amount of spectrum.²⁵

100. ISED has applied spectrum caps in various auctions including the PCS (2001), 700 MHz (2014) and 2500 MHz (2015) auctions, to help ensure that new entrants had access to sufficient spectrum to effectively compete with the existing carriers. Spectrum caps have also been used to prevent excessive concentration of spectrum by any single entity when new bands were made available for competitive services such as in the auction of the 2.3 GHz and 3.5 GHz bands.

101. Setting the right cap amount is essential: if the limit is too low, there may not be enough spectrum to satisfy the business needs of some companies; if it is set too high, it might fail to fulfill the goal of preventing spectrum concentration. Another factor to be considered when applying a spectrum cap is how it should be applied, e.g. whether the cap should apply only to the spectrum being auctioned, to spectrum that is held across one or more bands, or whether it should apply differently across various bidders. How it is applied could limit the efficient allocation of the spectrum.

9.4.3 Restricting participation in the wireless market

102. ISED may decide that an entity that currently provides telecommunications services should be restricted from holding certain licences (which are generally referred to as spectrum set-asides) if:

- a. the entity possesses market power in the supply of one or more telecommunications services in a region covered by the licence to be auctioned
- b. a new entrant is likely to use the licence to provide services in competition with the entity's existing services, and
- c. the anti-competitive effects of the entity acquiring a licence are not outweighed by the potential economies of scope arising from the integration of the spectrum in question into the entity's existing network.²⁶

²⁵ ISED, [Framework for Spectrum Auctions in Canada](#), March 2011.

²⁶ Ibid.

103. ISED has used set-asides in the AWS-1 (2008) and AWS-3 (2015) auctions, in the first instance to provide opportunity for new players to enter the market, and in the second instance, to provide operating new entrants an opportunity to acquire additional spectrum to improve their networks, thus allowing for more effective and sustained competition in the post-auction marketplace.

104. A set-aside mechanism is established in the context of specific block(s) sizes and licence areas. Ideally, where there is more than one set-aside block, they should be side by side so that eligible bidders could acquire contiguous spectrum, both spectrally and geographically. Having a set-aside block(s) ensures that one or more designated entities will be assigned spectrum. The size of the set-aside is also a consideration in that it should be a sufficient amount of spectrum so that a designated entity could provide competitive services to Canadians.

105. ISED recognizes that mmWave technology is at a nascent stage of development. It also recognizes, as noted by the FCC, that given their technical characteristics, these bands will likely be used to complement existing lower-band spectrum currently used for the provision of mobile wireless services.

Question 9-3: If an exclusive licensing approach is proposed, ISED is seeking preliminary comments on possible measures that could support competition in light of the current conditions in the Canadian wireless service market and anticipated development and deployment of 5G services if flexible use licensing is developed through a spectrum licensing model.

10. Additional information

10.1 Next steps

106. ISED intends to review the comments received and publish its decision outlining the technical and policy framework. ISED will consult further on the relevant licensing framework(s) and technical standards as appropriate.

10.2 Submitting comments

107. Respondents are requested to provide their comments by [email](#) in either Microsoft Word or Adobe PDF formats.

108. In addition, respondents are asked to specify question numbers for ease of referencing and to provide supporting rationale for each response.

109. Written submissions should be addressed to the following address:

Innovation, Science and Economic Development Canada
c/o Senior Director, Spectrum Licensing and Auction Operations
235 Queen Street, 6th Floor
Ottawa, Ontario K1A 0H5

110. All submissions should cite the Canada Gazette, Part I, the publication date, the title and the notice reference number (SLPB- 001-17). Parties should submit their comments no later than August 4, 2017, to ensure consideration. Soon after the close of the comment period, all comments received will be posted on ISED's [Spectrum Management and Telecommunications](#) website.

111. ISED will also provide interested parties with the opportunity to reply to comments from other parties. Reply comments will be accepted until September 8, 2017.

112. All comments and reply comments will be published, so those making submissions are asked not to provide confidential or private information in their submissions.

113. After the initial comment period, ISED may, at its discretion, request additional information if needed to clarify significant positions or new proposals. Should additional information be requested, the reply comment deadline may be extended.

10.3 Obtaining copies

114. All spectrum-related documents referred to in this paper are available on ISED's [Spectrum Management and Telecommunications](#) website.

115. For further information concerning the process outlined in this consultation or related matters, contact:

Senior Director
Spectrum Licensing and Auction Operations
Innovation, Science and Economic Development Canada
235 Queen Street, 6th Floor
Ottawa, Ontario K1A 0H5

Email: ic.spectrumauctions-encheresduspectre.ic@canada.ca

Annex A: Existing fixed-satellite service feeder-link earth stations in the 28 GHz band

Licensees	Earth Station Locations	Earth Station Coordinates
Hughes Network Systems Canada	London, ON	long. 81°W 12' 0.4" lat. 42°N 55' 23.9"
	White City, SK	long. 104°W 23' 24.7" lat. 50°N 26' 57.7"
		long. 104°W 23' 25" lat. 50°N 26' 58"
Inmarsat Solutions (Canada) Inc.	Winnipeg, MB	long. 97°W 02' 44" lat. 49°N 51' 32"
Telesat Canada	Fort McMurray, AB	long. 111°W 19' 59" 56°N 40' 16"
	Saskatoon, SK	long. 106°W 40' 11" lat. 52°N 05' 09"
	St. John, NL	long. 52°W 47' 36" lat. 47°N 32' 34"
	Allan Park, ON	long. 80°W 56' 08" lat. 44°N 10' 29"
WildBlue Communications Canada	Winnipeg, MB	long. 97°W 02' 43" lat. 49°N 51' 32"