



Deputy Minister

Sous-ministre

Ottawa, Canada  
K1A 0H5

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Contact: Adam Scott, STS, SLPB, 343-291-2608	
Originator: Nicholas Aghajanian, SLPB	
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**ADVICE TO THE MINISTER OF INNOVATION, SCIENCE AND  
ECONOMIC DEVELOPMENT**

**Decision on Releasing Millimetre Wave Spectrum to Support 5G**

**Date for Action:** Approval is sought by June 5 to enable publishing directly following the Minister's Telecom Summit speech.

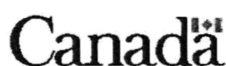
**SUMMARY**

- ISED is preparing to publish a decision to release 11.85 GHz of millimetre wave spectrum for 5G, notably 7 GHz for immediate licence-exempt use and 4.85 GHz of licensed spectrum, which will be made available in a 2021 auction.
- Auction rules will be developed through a public consultation that will be published in 21(1)(a)
- Reactions are expected to be positive as the decision releases a significant amount of spectrum for 5G, while providing measures to allow existing users to continue operating.

**BACKGROUND**

In June 2017 and June 2018, ISED published consultations on releasing high-frequency spectrum in the millimetre wave (mmWave) bands to support the deployment of 5G services. The consultations sought stakeholder feedback on the optimal approach to introducing 5G services in the 26 GHz, 28 GHz and 37-40 GHz bands, and licence-exempt use in the 64-71 GHz band, while also supporting existing users. The Department has reviewed all comments received through the two processes and is now preparing to issue a combined decision (Annex A).

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## CONSIDERATIONS

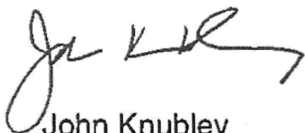
The key determinations are the release of 7 GHz of spectrum for immediate licence-exempt use and the confirmation that 4.85 GHz will be made available through a planned 2021 auction. Additionally, band plans will be aligned with international standards for 5G; current fixed and satellite licensees will be allowed to continue operating; and the Department will work with industry on technical rules to facilitate coexistence between satellite and mobile services.

These decisions balance the needs of existing satellite and fixed services while also maximizing spectrum for 5G. They will also support investment and innovation as all users will have immediate, free access to licence-exempt spectrum to test, develop, and launch IoT applications.

Given that the Department is releasing a significant amount of spectrum for 5G services, while also allowing current users to continue operations, reactions are expected to be positive. As proposed, some fixed licensees will eventually need to transition to other frequencies in the 38 GHz band. These stakeholders will be able to comment on the transition timing through the policy and auction framework consultation.

## NEXT STEPS

I recommend you approve this publication, as it is an important step in supporting the deployment of 5G in Canada. The publication will be ready for publication following your speech at the Canadian Telecom Summit. The consultation on auction rules is planned for 21(1)(a)



John Knuble  
Deputy Minister



I approve

I do not approve

Attachment

CCM BN0002924



Spectrum Management and Telecommunications

# Decision on Releasing Millimetre Wave Spectrum to Support 5G

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## 1. Intent

1. Through the release of this document, Innovation, Science and Economic Development Canada (ISED), on behalf of the Minister of Innovation, Science and Economic Development, hereby announces the decisions resulting from the consultation process undertaken in Canada Gazette notice SLPB-001-17, *Consultation on Releasing Millimetre Wave Spectrum to Support 5G*, hereinafter referred to as the Consultation, as well as SLPB-005-18, *Addendum to the Consultation on Releasing Millimetre Wave Spectrum to Support 5G*, hereinafter referred to as the Addendum.

2. Comments and/or reply comments on the Consultation were received from 5G Americas, Bell Mobility (Bell), British Columbia Broadband Association (BCBA), BSO Coalition (BSO)<sup>1</sup>, Cambridge Broadband Networks Ltd (CBNL), Canadian Astronomical Society (CASCA), Canadian Space Agency (CSA), Ciel Satellite LP and Affiliates (Ciel), Cogeco Communications Inc. (Cogeco), Dynamic Spectrum Alliance (DSA), Ericsson Canada (Ericsson), Facebook Inc. (Facebook), Global mobile Suppliers Association (GSA), Huawei Technologies Canada (Huawei), IEEE LAN/MAN Standards Committee (IEEE), Intel Corporation (Intel), Intelsat Corporation (Intelsat), Microsoft, MobilExchange Spectrum Inc. (MobilExchange), Nokia, Québecor Média (Québecor), Radio Advisory Board of Canada (RABC), Rogers Communications Canada Inc. (Rogers), Samsung Electronics Canada Inc. (Samsung), Saskatchewan Telecommunications (SaskTel), Shaw Communications Inc. (Shaw), Siklu Communication (Siklu), Starry Inc. (Starry), Telesat Canada (Telesat), TELUS Communications Company (TELUS), TeraGo Networks (TeraGo), ViaSat Inc. (ViaSat), Wi-Fi Alliance, Xplornet Communications Inc. (Xplornet), Breast Cancer Action Manitoba, Canadians for Safe Technology, Electromagnetic Pollution Illnesses Canada Foundation, Environmental Health Association Manitoba, Fédération des employées et employés de services publics, Global Union Against Radiation Deployment from Space, Learning Disabilities Association Canada, Prevent Cancer Now, Rassemblement Électro Sensibilité Québec, and 237 private individuals.

3. Comments and/or reply comments on the Addendum were received from 9496041 Canada Inc. (NorthStar), Bell, Ciel, Cogeco, Ericsson, GSA, Huawei, Nokia, Québecor, Rogers, SaskTel, Shaw, Space Exploration Technologies Corp. (SpaceX), Telesat, and TELUS.

## 2. Legislative mandate

4. 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 resource use and for ensuring effective management of the radio frequency spectrum resource.

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<sup>1</sup> BSO is a coalition of satellite broadband operators composed of Hughes Network Systems, LLC and Hughes Network Systems Canada ULC; Inmarsat, Inc.; WorldVu Satellites Ltd. d/b/a OneWeb; The Boeing Company; SES Americom, Inc.; and O3b Limited.

### 3. Background and context

5. In December 2014, ISED published SLPB-006-14, *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* (the 2014 Decision). This document included decisions on the renewal process for the fixed point-to-point and point-to-multipoint broadband wireless access spectrum licences in the 38.70-39.10 GHz and 39.40-39.80 GHz bands that were originally auctioned in 1999 and were set to begin expiring in 2015. While it was not anticipated at that time that these bands would be considered for mobile use, the decision was made to issue new 10-year licences to those licensees in compliance with their conditions of licence at the end of their current term. At the time, ISED noted that there would not be a high expectation of renewal at the end of the new licence term, given that ISED was transitioning the band to site-specific licensing. The document also established a first-come, first-served (FCFS) site-specific licensing process for the 25.25-26.5 GHz, 27.5-28.35 GHz, 38.70-39.10 GHz and 39.40-39.80 GHz bands.

6. Through the Consultation launched in June 2017 and subsequent Addendum launched in June 2018, ISED sought comments on releasing millimetre wave (mmWave) spectrum in the 26.5-27.5 GHz (26 GHz), 27.5-28.35 GHz (28 GHz), 37-40 GHz (38 GHz) and 64-71 GHz frequency bands to support the deployment of 5G wireless networks and systems. These two consultations included proposals on modifications to the Canadian Table of Frequency Allocations (CTFA), new band plans, treatment of existing users, and coexistence measures between new flexible use (fixed and mobile) systems and satellite services in these bands.

7. In June 2018, ISED published SLPB-003-18, *Spectrum Outlook 2018 to 2022* (the Spectrum Outlook), outlining its overall approach and planning activities related to the release of spectrum for commercial mobile services, licence-exempt applications, satellite services and wireless backhaul services over the years 2018 to 2022. The Spectrum Outlook resulted from the consultation process SLPB-006-17, *Consultation on the Spectrum Outlook 2018 to 2022* (the Outlook Consultation). Both documents noted that, internationally, there is significant interest in releasing mmWave spectrum, particularly above 20 GHz, for commercial mobile, licence-exempt, satellite and backhaul services and applications. The International Telecommunication Union (ITU), which allocates global radio spectrum, conducted sharing and compatibility studies on eleven frequency bands between 24.25 and 86 GHz for the future development of broadband mobile services in preparation for the World Radiocommunication Conference 2019 (WRC-19) taking place October 28 to November 22, 2019. At the same time, WRC-19 will also consider some changes to reflect satellite interests and uses in some of these same mmWave bands. Based on the propagation characteristics of these bands and the expected evolution of technologies and techniques that can facilitate spectrum sharing between different services, there is international interest in maximizing the use of these bands by sharing them among multiple services wherever possible.

8. Comments received on the Outlook Consultation supported releasing low-, mid- and high-band spectrum to enable the development and adoption of 5G technologies. Different frequencies possess different propagation characteristics and can be used to offer applications and services that make use of these different characteristics and associated benefits. ISED is undertaking the following processes to address the demand for a variety of frequencies:

- **Low-band spectrum:** In March 2018, ISED published SLPB-002-18, *Technical, Policy and Licensing Framework for Spectrum in the 600 MHz Band* to support increased network capacity and

coverage, and the deployment of next-generation technologies. The auction for the 600 MHz band took place in spring 2019.

- **Mid-band spectrum:** Taking into account the need for mid-band spectrum to complement existing low- and future high-band spectrum, in June 2018 ISED launched SLPB-004-18, *Consultation on Revisions to the 3500 MHz Band to Accommodate Flexible Use and Preliminary Consultation on Changes to the 3800 MHz Band*. This was followed by the publication of SLPB-001-19, *Decision on Revisions to the 3500 MHz Band to Accommodate Flexible Use and Preliminary Decisions on Changes to the 3800 MHz Band* in June 2019.
- **High-band spectrum:** Releasing spectrum in high bands will allow service providers to obtain large blocks of spectrum to increase the capacity and quality of their networks, and will promote innovation by supporting new technologies and business models. Through the Consultation published in June 2017, and subsequent Addendum published in June 2018, ISED sought comments on its proposal to release mmWave spectrum in the 26 GHz, 28 GHz, 37-40 GHz and 64-71 GHz bands. This decision paper responds to the issues raised in the Consultation and the Addendum, taking into consideration the comments provided by respondents and the objectives outlined below.

9. ISED considers that this approach of planning the release of spectrum in low-, mid- and high-frequency bands will be beneficial to the deployment of 5G technologies offering higher speeds, low-latency and improved capacity and coverage.

10. Globally, other nations are also seeking to facilitate the development and adoption of 5G technology and are in the process of making mmWave spectrum available for this purpose.

11. In the United States (U.S.), the Federal Communications Commission (FCC) released on July 14, 2016, the *Spectrum Frontiers Report and Order (R&O) and Further Notice of Proposed Rulemaking (FNPRM)* regarding the use of frequency bands above 24 GHz. As part of the R&O, the FCC made the 28 GHz (27.5-28.35 GHz), 37 GHz (37-38.6 GHz) and 39 GHz (38.6-40 GHz) bands available for flexible mobile and fixed use, and the band 64-71 GHz available for licence-exempt use. In November 2017, the FCC released a *Second R&O and Second FNPRM* that announced the release of an additional 1.7 GHz of spectrum for flexible mobile and fixed use in the 24.25-24.45, 24.75-25.25, and 47.2-48.2 GHz bands (the “24 GHz” bands, collectively, and the “47 GHz” band, respectively). In June 2018, the FCC released a *Third FNPRM*, which sought comments on making the 25.25-27.5 GHz band (26 GHz band in the U.S.) available for flexible fixed and mobile use. The FCC auctioned spectrum licences in the 28 GHz band in November 2018 and licences in the 24 GHz band in March 2019. Licences in the 37 GHz, 39 GHz and 47 GHz bands will be auctioned in the second half of 2019.

12. In November 2016, the European Commission’s Radio Spectrum Policy Group provided an *Opinion on spectrum related aspects for next-generation wireless systems (5G)*, which recommended that Europe develop harmonization measures for the frequency band 24.25-27.5 GHz before 2020. In response, ECC Decision (18)06 was published July 6, 2018, with the harmonised technical conditions for Mobile/Fixed Communications networks in the band 24.25-27.5 GHz. This was followed by the European Commission *Implementing Decision (EU) 2019/784* on May 14, 2019 to harmonize the radio spectrum in the 24.25-27.5 GHz band to facilitate the deployment of 5G across Europe. Many European countries have announced plans or have already auctioned portions of the 26 GHz band (e.g. United Kingdom (UK), France, Italy, Germany) for flexible use. Some Asia-Pacific countries have also

announced planned use of this band (e.g. China, Australia, New Zealand, India) for flexible use. China and India have announced plans for the 38 GHz band for flexible use.

13. The ITU is not currently studying the 28 GHz band (27.5-28.35 GHz). Nonetheless, as noted above, the U.S. has made a commitment to pursue authorizing mobile operations in this frequency band domestically. In 2018, South Korea concluded an auction for the frequency band 26.5-28.9 GHz. Other countries/territories are consulting on or have expressed interest in the 28 GHz band for 5G including Australia, Chile, Hong Kong, India, Indonesia, Japan, Mexico, New Zealand, Norway, Russia, Singapore, Taiwan, Thailand, and Vietnam.

14. Within the frequency bands 26 GHz, 28 GHz and 38 GHz, there are a number of different satellite service allocations. At the international level, the ITU has been conducting extensive studies in the frequency bands 26 GHz and 38 GHz to evaluate the potential for sharing and compatibility between the mobile and satellite services. The U.S., UK and Hong Kong have released public consultations seeking input from stakeholders on coexistence approaches that are intended to balance the benefits derived from new uses without harmful interference to other services in the 26 GHz band. In addition, the U.S. has established a sharing framework for the 28 GHz band that allows the deployment of fixed satellite service (FSS) earth stations that comply with certain sharing criteria. The U.S. 28 GHz framework enables sharing of the band by establishing exclusion or protection zones around earth stations with associated permitted aggregate population limits within these zones.

#### **4. Policy objectives**

15. 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 wireless networks and systems 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.

16. Spectrum is a unique, finite resource that is an integral component of Canada's telecommunications infrastructure. It provides access to a broad range of private, commercial, consumer, defence, national security, scientific and public safety applications and services that benefit all Canadians. Additional commercial mobile and licence-exempt spectrum will allow providers to increase network capacity to meet the traffic demands of applications and uses that require high data 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.

17. There are several trends that are impacting the satellite industry. Businesses, governments and consumers are demanding reliable, low-latency broadband connectivity. Satellites play a vital role in Canada's telecommunication and broadcasting infrastructure in that they are currently the only means of reaching some communities, many of which are located in rural and remote areas such as the North. Next-generation geostationary orbit (GSO) satellites and non-geostationary orbit (NGSO) satellites are expected to play an important role in enabling such connectivity and bridging the digital divide between

rural and urban areas, with NGS0 satellites offering coverage in the Far North of Canada. The mmWave bands remain important for allowing satellite systems to provide advanced services such as broadband Internet throughout Canada. Based on international developments and studies, ISED is of the view that sharing between satellite and commercial mobile services in the mmWave bands can be facilitated such that both 5G and advanced satellite services can be made available to Canadians.

18. In developing this decision document, 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.

19. 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 the 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 that includes 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 by enabling the development of 5G technology
- support sustained competition, so that consumers and businesses benefit from greater choice
- facilitate deployment and timely availability of services across the country

## **5. Spectrum utilization of the 26 GHz and 28 GHz frequency bands**

### **5.1 Flexible use**

20. The Consultation and the Addendum sought comments on whether ISED should develop a flexible use licensing model for fixed and mobile services in the 26 GHz and 28 GHz frequency bands ahead of WRC-19. Under a flexible use licensing model, a licensee would be permitted to deploy mobile and/or fixed services using the same spectrum licence.

21. Making the 26 GHz and 28 GHz bands available for flexible use is expected to help further promote innovation, as well as the development and adoption of 5G technology in Canada. Considering that different 5G use cases are still being developed, flexible use would accommodate a variety of use cases and therefore support innovative technologies and business cases as they emerge.

### **Summary of comments**

22. The majority of respondents supported developing a flexible use licensing model for fixed and mobile services in the 26 GHz and 28 GHz frequency bands ahead of WRC-19 and before 5G

technology standards are finalized, given the uncertainty around what 5G technology deployment will look like, and the probability that it will include both mobile and fixed operations. In particular, the Canadian wireless industry noted the importance of making the 26 GHz and 28 GHz bands available as early as possible for them to remain competitive with the global industry players. BCBA, Bell, CSA, Cogeco, Ericsson, GSA, Huawei, Intel, Microsoft, MobilExchange, Nokia, NorthStar, Québecor, RABC, Samsung, Rogers, SaskTel, Shaw, 5G Americas, TELUS, TeraGo, ViaSat, and Xplornet all supported this proposal.

23. BSO, SpaceX, and Telesat stressed the importance of continued spectrum access for satellite services. Intelsat suggested ISED wait until 3rd Generation Partnership Project (3GPP) standards are finalized before releasing bands for flexible use. Intelsat further suggested that the 28 GHz band not be considered for flexible use, as it is not on the agenda for consideration by WRC-19 for global identification for future mobile broadband services. CSA, while supportive, advocated for proper sharing mechanisms under realistic technical parameters and assumptions to protect current services in these and adjacent bands.

### **Discussion**

24. Although the 28 GHz band is not being considered for identification for the future development of mobile broadband services at WRC-19, ISED recognizes that this band is already allocated to mobile service on a co-primary basis internationally. Countries such as the U.S., South Korea and Japan have authorized, or are currently planning to authorize, the use of mobile systems in the band domestically.

25. In the 26 GHz band, which will be considered by WRC-19 for identification for mobile broadband, some countries have also decided to make spectrum available for mobile broadband systems prior to WRC-19. South Korea has completed an auction that spans the frequency range 26.5-28.9 GHz. As discussed above, the U.S. has begun to consult on making the 26 GHz band available for flexible use. The 26 GHz band has been identified by many countries, in particular in the European Union and Asia-Pacific, as key spectrum for 5G.

26. Given that many countries have begun to make the 26 GHz and 28 GHz bands available for 5G and the bands are included in the 3GPP technical standards, ISED expects that there will be a global equipment ecosystem available for these bands. Therefore, ISED is of the view that in order to make spectrum available in a timely manner, to allow early adoption of 5G technology and to promote innovation, it should not wait for WRC-19.

27. As previously discussed, 5G is expected to be a mix of fixed and mobile services in the mmWave bands and there are a variety of different use cases expected to develop once 5G is deployed. ISED has decided to adopt a flexible use licensing model for mobile and fixed services in the 26 GHz and 28 GHz bands as it will allow licensees to decide whether to deploy fixed systems (e.g. backhaul and fixed wireless access), mobile systems or a combination of fixed and mobile systems to meet the demands of 5G services.

## Decision

**D1. ISED is adopting a flexible use licensing model for fixed and mobile services in the 26.5-27.5 GHz and 27.5-28.35 GHz frequency bands. Under this model, a licensee would be permitted to deploy mobile, fixed or a combination of both services using a single spectrum licence. These bands will continue to be shared with other co-primary satellite services, as per the Canadian Table of Frequency Allocations.**

### 5.2 Changes to spectrum utilization policies and CTFA

28. In line with adopting a flexible use licensing model and facilitating the shared use of the 26 GHz and 28 GHz bands by terrestrial and satellite services, ISED sought comments on the proposed changes below to the CTFA, in the Consultation and the Addendum:

**ADD CXX:** In the frequency band 26.5-27.0 GHz, use of spectrum for fixed service systems and mobile service systems will be given priority over Earth exploration-satellite service systems and space research systems sharing this spectrum on a co-primary basis. Earth exploration-satellite service and space research service implementation in this band will be limited to applications that will pose minimal constraints upon the deployment of fixed service systems and mobile service systems.

**MOD C47A:** In the frequency band ~~27.0~~27.35-28.35 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 that 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.

29. ISED also sought comments on a proposal to continue to allow airborne and maritime earth stations in motion (ESIM) to communicate with geostationary FSS space stations in this frequency band on a case-by-case basis, on the condition of no-interference, no-protection.

### Summary of comments

30. BCBA, Bell, BSO, CASCA, Ciel, Cogeco, CSA, Ericsson, Facebook, GSA, Huawei, Intel, MobilExchange, Nokia, RABC, Rogers, Samsung, SaskTel, Shaw, 5G Americas, Telesat, TELUS, TeraGo, ViaSat, and Xplornet supported proposed 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*.

31. Several satellite operators (BSO, Ciel, Intelsat, Telesat and ViaSat) stressed the importance of satellite communications in rural and remote areas. In particular, Telesat stated the policy should reflect Canada's unique geography and demographics, and align with ISED's goal of making innovative telecommunications services available to all Canadians, including satellite-dependent communities in rural Canada and the North. Furthermore, the RABC pointed out that satellite systems provide

geographic coverage of all of Canada, including territorial waters and where terrestrial networks are not economic or are temporarily affected by natural disaster. It also indicated that innovative new satellite systems could provide backhaul/transport connectivity and capacity for 5G as well as 5G compatible mobile-satellite service/Internet of Things.

32. BSO, Ciel, RABC, SaskTel, Telesat and ViaSat suggested changes to the wording in footnote **C47A** with respect to antenna size, since smaller antennas could be deployed for feeder links as satellite technology advances. TELUS and Ericsson indicated they were not opposed to this proposal.

33. There was also general consensus with respect to the deployment of ESIM in the band 27.5-28.35 GHz. The majority of respondents agreed with the proposal to limit the deployment of ESIM to airborne and maritime and to not permit land-based ESIM. Rogers expressed concerns with potential interference from airborne ESIM and proposed that ISED supply additional information on these devices prior to adopting licensing conditions for this band. Ciel and ViaSat urged ISED to allow all ESIM on a case-by-case basis and continue to study policies and rules to permit access for all services. BSO and Ciel considered that ESIM should not be limited to communicating with GSO satellites and should expand to NGSO satellites as well.

34. While ISED did not address the issue of High Altitude Platform Stations (HAPS) in its consultation paper, both Telesat and Facebook provided comments on the matter. Facebook explained that it is currently developing a solar-powered, high-altitude unmanned fixed wing plane to deliver broadband fixed backhaul connectivity. Facebook was of the view that there is potential to integrate HAPS into the 5G networks, thus extending 5G service coverage to underserved areas. In its reply comments, Telesat argued that it is premature to consider HAPS use of the 27.5-28.35 GHz band, given the “lack of an international allocation to HAPS”.

## Discussion

35. Flexible use terrestrial stations could be subject to interference from FSS transmitting earth stations emissions in the frequency band 27.0-28.35 GHz. Conversely, Earth exploration-satellite service (EESS) and space research service (SRS) receiving earth stations in the frequency band 26.5-27.0 GHz could be subject to interference from flexible use terrestrial stations. However, ISED maintains that sharing between terrestrial and satellite services is feasible in the 26 GHz and 28 GHz bands. The operation of fixed-satellite earth stations in Canada is currently 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*. In order to enable the coexistence of both flexible use systems and satellite services in these bands, ISED will consult on the licensing framework for flexible use, update earth station licensing rules, and develop coordination rules in the future.

36. Given ISED’s decision to facilitate sharing between terrestrial fixed and mobile services and the relevant satellite services in the mmWave spectrum, consequential changes in or addition of footnotes to these bands are required. ISED will adopt changes to footnote **C47A** to provide priority to both the fixed and mobile services over the relevant satellite services in the 27.0-28.35 GHz band.

37. Footnote **C47A** afforded priority to the fixed service over the fixed-satellite service in the 27.35-28.35 GHz segment of the frequency band, while in the immediate adjacent band, 28.35-29.1 GHz, priority is afforded to the fixed-satellite service over the fixed service through footnote **C16F**. In the Consultation and the Addendum, ISED proposed to extend the priority provided to fixed service in the

band 27.35-28.35 GHz to also apply to the mobile service and to apply the provision to the band 26.5-27.35 GHz as well. As indicated in the summary of comments, this priority approach, which has been implemented in the past and is also referred to as soft partitioning in SP 3-30 GHz, was favoured by a wide range of stakeholders. Soft partitioning has been applied in situations where it is desirable to place emphasis on the use of the spectrum by one service over another. In this fashion, access to the spectrum would not be removed, but would be limited to implementations that would not constrain the development of the service for which the priority would be given. This was 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. For example, the Local Multipoint Communication Systems (LMCS) policy in the 28 GHz band was based on a soft partitioning approach; the policy identified specific LMCS market areas that were defined based on highly populated areas where their deployment would be expected. Fixed satellite earth stations may have access to the band outside LMCS market areas subject to spectrum sharing conditions.

38. Using an approach similar to the one described above, while continued sharing with FSS is supported in these bands, the deployment of satellite earth stations shall not be of ubiquitous nature since ubiquitous satellite earth station deployment will likely impose constraints on the fixed and mobile services. To clarify this, footnote **C47A** will be amended to limit the FSS use in the band 27.0-28.35 GHz to low density deployments of earth stations. As well, in order to enable spectrum access by both flexible use systems and satellite services, and recognizing the important and often critical role of satellite communications in providing connectivity in rural and remote areas such as the North, ISED intends to consult, through the licensing framework consultation, on a set of specific areas that could be afforded some flexibility when applying the licensing and coordination rules.

39. Similarly, in the 26.5-27.0 GHz band, a new footnote, **C47C**, will be added to provide priority to both the fixed and mobile services over EESS and SRS. As well, ISED intends to consult on a set of specific areas where flexibility could be afforded.

40. Taking into account comments received, ISED agrees that clarification of certain parts of footnote **C47A** would be beneficial. ISED recognizes that there are different approaches that satellite operators can take to minimize the constraints on mobile and fixed services, such as site selection and site shielding. Given that ISED will establish specific coexistence rules with a view to strike a balance between the needs of satellite and terrestrial services (see section 7), footnote **C47A** will also be amended to remove the example regarding the size of antenna.

41. Preliminary studies indicate that due to the ubiquitous nature of land-based ESIM and the potential lack of geographical or altitudinal separation between land-based ESIM and flexible use stations, there is high potential to create harmful interference to flexible use systems; as such, ISED will not permit land-based ESIM in the band 27.5-28.35 GHz at this time. However, ISED is of the view that airborne and maritime ESIM that communicate with FSS space stations will have less potential to cause interference to flexible use systems since it is not expected that they will be deployed in large numbers and due to the geographical or altitudinal separation. Therefore, airborne and maritime ESIM will be permitted to operate in the band 27.5-28.35 GHz on a case-by-case basis on condition of no-interference, no-protection with respect to flexible use stations.

42. WRC-19 will be considering the spectrum needs and regulatory measures for HAPS in the frequency bands 21.4-22 GHz, 24.25-27.5 GHz and 38-39.5 GHz. ISED will monitor the development

of HAPS at the international level and any changes to allow the use of HAPS in these bands in Canada would be subject to a future consultation.

## Decisions

### **D2. The following Canadian footnotes will be adopted:**

**C47A:** In the frequency band 27.0-28.35 GHz, use of spectrum for fixed service and mobile service systems will be given priority over fixed-satellite service systems sharing this spectrum on a co-primary basis. The use of the frequency band 27.0-28.35 GHz by the fixed-satellite service (Earth-to-space) is limited to low density deployments of earth stations, such as gateways, that will pose minimal constraints upon the deployment of fixed service and mobile service systems.

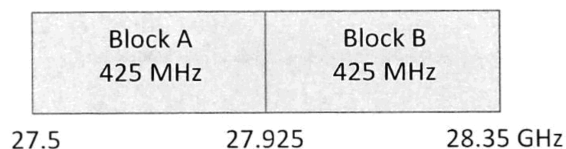
**C47C:** In the frequency band 26.5-27.0 GHz, use of spectrum for fixed service and mobile service systems will be given priority over Earth exploration-satellite service and space research service systems sharing this spectrum on a co-primary basis. The deployment of earth stations of the Earth exploration-satellite service and the space research service in this band will be limited to a small number of earth stations that will pose minimal constraints upon the deployment of fixed service and mobile service systems.

**D3. In the frequency band 27.5-28.35 GHz, airborne and maritime ESIM communicating with FSS space stations are permitted on a case-by-case basis with the condition of no-interference, no-protection with respect to flexible use stations. Due to interference concerns, land-based ESIM are not permitted in this band.**

**D4. ISED will consult on a licensing framework for flexible use, update earth station licensing rules and develop coordination rules in the future. Until the earth station licensing rules and coordination rules are finalized, earth stations in the 26.5-28.35 GHz frequency range will be licensed in accordance with GL-10, issue 1, Interim Guideline for Licensing of Earth Stations in the Fixed-Satellite, Earth Exploration-Satellite and Space Research Services in the Frequency Bands 26.5-28.35 GHz and 37.5-40.0 GHz (the Interim Guideline).**

## 5.3 Band plan

43. In order to facilitate equipment harmonization and simplify coordination between terrestrial services along the Canada-U.S. border, ISED had proposed, in the Consultation, to align the Canadian band plan for the 27.5-28.35 GHz band with the U.S. band plan (shown in figure 1 below) using two 425 MHz unpaired blocks.

**Figure 1: U.S. band plan in the 28 GHz band**

44. In the Addendum, recognizing that the U.S. 26 GHz band plan had not been proposed for 5G services at the time, ISED sought comments on the importance of harmonization with the U.S. band plan, noting the lack of a U.S. 26 GHz band plan and that the U.S. 28 GHz band plan is not a multiple of the 3GPP channel bandwidths (50, 100, 200 and 400 MHz), but rather two blocks of 425 MHz. ISED also sought comments on the importance of adopting a Canadian band plan based on multiples of 3GPP channel bandwidths in the 26.5-28.35 GHz frequency range.

45. Subsequent to its initial rule making, the FCC also released a Third FNPRM to seek comments on the 25.25-27.5 GHz band and proposed that either 100 MHz or 200 MHz blocks be adopted in the band.

#### Summary of comments

46. The majority of the comments received in response to the Consultation, including those from 5G Americas, BCBA, BSO, Ericsson, GSA, Huawei, Intel, Intelsat, MobilExchange, Nokia, RABC, Samsung, Telesat, TELUS, and Xplornet, supported the proposed 28 GHz band plan.

47. However, Cogeco, Microsoft, Rogers, SaskTel, Shaw, and TeraGo favoured a band plan that could accommodate more than two operators. Rogers proposed a band plan with four 200 MHz blocks and one block of 25 MHz at each edge of the band. Shaw proposed a band plan consisting of four blocks of 212.5 MHz each. In their reply comments, Cogeco and SaskTel stated their support for Rogers' proposal and their opposition to Shaw's proposal. In its comments, Bell stated that large block sizes, 100 MHz and up, were preferable and that it would be prudent to defer the decision on block sizes until 3GPP completes their deliberations on bandwidths. CBNL suggested a 28 GHz band plan with Time Division Duplexing (TDD) in the lower portion of the band and Frequency Division Duplexing (FDD) in the upper portion.

48. In response to the Addendum, Bell, Cogeco, Ericsson, Huawei, Québecor, Rogers, SaskTel, Shaw, and TELUS stressed the importance of aligning the use of the spectrum with the U.S. and international standards. However, they also indicated that a full alignment with the U.S. band plan was not essential given that the 26.5-28.35 GHz frequency range is part of the 3GPP band n257, which covers the 26.5-29.5 GHz range, and as such, they were of the view that an ecosystem would be developed. TELUS indicated that although a full alignment with the U.S. was not required, a block edge should fall precisely at 27.5 GHz. Conversely, Nokia indicated that it was important to harmonize the Canadian band plan with the U.S. for roaming purposes and for cross-border coordination. Nokia added that although it was preferable to have frequency blocks that were multiples of 3GPP channel bandwidths, it was not essential.

49. In terms of preferred block sizes, comments varied. Bell and Huawei both favoured 200 MHz or larger blocks to maximize channel efficiency. TELUS was also of the view that larger blocks were preferable, although it did not provide a specific size. Rogers proposed 200 MHz blocks and two blocks

of 25 MHz, to support competition by allowing a greater number of operators. Shaw indicated that blocks should be multiples of 3GPP channel bandwidths. SaskTel stated that there should be a variety of block sizes ranging from 100 MHz to 400 MHz. Cogeco preferred no larger than 100 MHz blocks. Ericsson submitted two band plan options with 18 blocks of 100 MHz and a single block of 50 MHz, with the possibility to aggregate up to 400 MHz of spectrum.

### Discussion

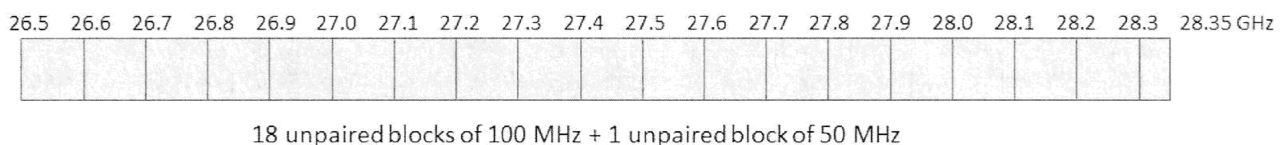
50. 3GPP has three band classes that overlap in the 26 GHz and 28 GHz bands. Band class n257 covers the 26.5-29.5 GHz band, band class n258 covers the 24.25-27.5 GHz band, and band class n261 covers the 27.5-28.35 GHz band. All three band classes support channel bandwidths of 50, 100, 200 and 400 MHz and operate in the TDD duplex mode.

51. While harmonization with the U.S. continues to be an important factor in establishing Canadian band plans, ISED is of the view that complete alignment with the U.S. for the 28 GHz band is not favourable since it limits access in a given area to two licensees, which could artificially constrain competition in the wireless market. Furthermore, in the mmWave bands, a TDD access scheme will likely be used and coordination between operators will depend heavily on time synchronization of networks, and less on alignment of frequency channels. It is noted as well that using any of the current 3GPP bandwidths of 50, 100, 200 and 400 MHz with the U.S. 28 GHz band plan will result in two 25 MHz blocks potentially being unused.

52. ISED is of the view that a Canadian band plan based on multiples of 3GPP channel bandwidths would maximize the use of the spectrum, promote a more vibrant marketplace, facilitate international roaming, and enable Canadian consumers and operators to have access to multiple global ecosystems. In addition, a band plan consisting of unpaired blocks of 100 MHz will allow for the flexible use band plan to be aligned with the allocations for the FSS, EESS and SRS, which could reduce complexity when coordinating with these services. Therefore, ISED is adopting a band plan consisting of 18 blocks of 100 MHz with one remaining block of 50 MHz at the upper edge of the band, as shown in figure 2 below. This band plan will enable the deployment of equipment under 3GPP band classes n257, n258 and n261 in the relevant portions of the 26 GHz and 28 GHz bands.

53. Recognizing that a multitude of 5G services with differing bandwidth requirements are envisioned, different users may require additional bandwidth to deliver their services. These unpaired blocks may be combined to form larger blocks, subject to the future licensing framework consultation.

**Figure 2: Canadian band plan in the 26.5-28.35 GHz frequency band**



54. Industry standards applicable to this band are based on a TDD scheme. As such, ISED expects that most systems deployed in this band will be using TDD equipment and consequently, only TDD systems will be permitted at this time. ISED may consider other options through consultation with stakeholders to take into account future equipment ecosystem development, if necessary.

**Decision**

**D5. ISED is adopting a band plan consisting of 18 unpaired 100 MHz blocks throughout the 26.5-28.3 GHz band with a 50 MHz block in the band 28.3-28.35 GHz, as shown in figure 2. Only TDD systems will be permitted.**

**5.4 Treatment of earth stations licensed prior to June 5, 2017**

55. In the Consultation, ISED proposed that the eight FSS earth stations in the 28 GHz band licensed prior to the Consultation publication date, June 5, 2017, be permitted to continue to operate within the current parameters and conditions of their licences. In addition, terrestrial licensees with new flexible use licences in the same geographic areas would not be allowed to claim protection from these transmitting FSS earth stations.

56. In the Addendum, ISED stated that there were no EESS or SRS earth stations in the 26 GHz band deployed in Canada. As such, there was no need to address the treatment of EESS or SRS earth stations in this band at that time.

**Summary of comments**

57. BCBA, Bell, BSO, Ericsson, Huawei, Intel, Intelsat, RABC, Rogers, Samsung, SaskTel, Shaw, Telesat, ViaSat, and Xplornet supported grandfathering those FSS earth stations licensed prior to June 5, 2017.

58. Ericsson, Huawei and Samsung commented that grandfathering should not exclude detailed coordination changes for individual stations if needed in the future (e.g. to resolve interference issues or to ensure more efficient coexistence of the two systems). This was supported by Rogers in its reply comments.

59. Telesat, ViaSat, and Xplornet suggested that grandfathering should be extended to cover renewals, changes and expansions at, or in close proximity to, the same geographic area. Bell, Ericsson, Huawei, Rogers, and TELUS recommended that negotiated business arrangements be allowed and encouraged to remove barriers to terrestrial deployment.

60. TELUS proposed that existing FSS earth stations comply with several new conditions of licence, including providing earth station power flux density (PFD) contours, to ensure they impose minimal constraints on terrestrial stations and that ISED wait until geographic restrictions are established before finalizing approvals of pending FSS earth station applications. BSO and Telesat opposed TELUS' proposal. Telesat stated that although it makes sense to exchange the PFD contour with the operators they are coordinating with, they do not support general publication of the contours that may disclose commercially and competitively sensitive information to those with no coordination interest.

**Discussion**

61. In order to balance the need to ensure that spectrum is used efficiently and to recognize the infrastructure investments made by existing FSS earth station licensees, ISED will allow the continued operation of existing licensed FSS earth stations based on their current technical parameters for an

extended period of time (a minimum of 10 years from the completion of the future competitive licensing process in the band). Prior to the renewal of flexible use licences, ISED will consult to reassess the spectrum requirements of the FSS earth stations and the terrestrial operations in the bands to determine if changes to these FSS earth station licences are required.

62. ISED intends to develop coordination rules between earth station licensees and flexible use licensees using the PFD contours as a mechanism to enable coexistence in this band. For example, the PFD contour could be used to develop a zone within which a flexible use system cannot claim protection from the earth station. Existing satellite earth station licensees will be required to submit PFD contours to ISED.

63. ISED is also of the view that some flexibility should be allowed to enable satellite operators to deploy the latest technologies to satisfy their business needs and may require modifications to their earth stations. Therefore, ISED will permit modifications to the earth stations listed in table A1 of annex A as long as the impact of these changes will not increase the potential for interference to flexible use systems. Any modification that would increase the potential for interference to flexible use systems will be treated as a new application and will be subject to the provisions in the licensing and coordination rules in effect at the time of the earth station licence application.

64. The method to determine the PFD contour, maximum radius of the PFD contour, details on permitted modifications, and any other pertinent information regarding the treatment of earth stations in table A1 of annex A will be established in consultation with stakeholders including the RABC. In the meantime, provisional rules are included in the Interim Guideline. If the value of the PFD contour adopted in the licensing or coordination rules is different than that included in the Interim Guideline, earth station licensees may be required to resubmit new PFD contours accordingly.

## Decisions

**D6. ISED will permit the FSS earth stations identified in table A1 in annex A to operate under the technical rules and licence conditions attached to their current authorisation for an extended period of time (a minimum of 10 years from the completion of the future competitive licensing process in the band). Prior to the renewal of flexible use licences, ISED will consult on whether to permit these earth stations to continue to operate under the same technical and licence conditions or be subject to new licensing and coordination rules.**

**D7. Modification to the FSS earth stations identified in table A1 in annex A will be permitted as long as changes would not increase the potential of interference to flexible use licensees compared to the original earth stations' operations as of June 5, 2017.**

## 5.5 Treatment of earth stations whose applications were pending approval as of June 5, 2017

65. In the Consultation, ISED proposed that earth stations with applications pending approval as of the publication date of the Consultation (June 5, 2017) be excluded from the proposed band sharing mechanism. In addition, terrestrial licensees with new flexible use licences in the same geographic areas would not be allowed to claim protection from these FSS earth stations.

66. Since the Consultation, two of these pending earth station applications have been approved (see table A2 in annex A) and licences have been issued.

### Summary of comments

67. The majority of respondents supported grandfathering FSS earth stations with applications pending approval as of the publication date of the Consultation (BCBA, Bell, BSO, Ericsson, Huawei, Intel, Intelsat, Rogers, Samsung, SaskTel, Shaw, Telesat, ViaSat, and Xplornet). Comments in paragraphs 57 to 59 equally apply for the treatment of these earth stations.

68. RABC, SaskTel, and Shaw in their comments to the Consultation suggested that ISED work with applicants of FSS earth stations whose approvals were pending, to take into consideration proposed policy changes.

### Discussion

69. For similar reasons discussed in section 5.4 and given the support from the majority of respondents, licensed FSS earth stations listed in table A2 in annex A, whose licence applications were pending approval on the date of publication of the Consultation (June 5, 2017) will be treated in the same manner as those that were licensed as of the date of the Consultation.

### Decision

**D8. ISED will treat the FSS earth stations whose applications were pending approval on June 5, 2017, using the same approach as for the FSS earth stations licensed prior to June 5, 2017, and therefore, ISED will extend Decisions D6 and D7 to the FSS earth stations identified in table A2 in annex A.**

### 5.6 Treatment of earth stations with applications submitted after June 5, 2017, and before the release of this Decision

70. Since the release of the Consultation, ISED has approved 10 earth stations, listed in table A3 in annex A. In order to ensure coexistence with other services in the band, these earth station licences include a condition that requires compliance with the licensing and coordination rules for the mmWave bands, once adopted.

### Summary of comments

71. Intelsat and ViaSat proposed to extend grandfathering to applications received prior to the date of publication of a decision. This was opposed by Shaw and TELUS in their reply comments.

## Discussion

72. Earth stations in table A3 in annex A will be required to comply with the licensing and coordination rules in the future. However, depending on the needs of the future flexible use licensees in the affected licence areas, modifications to these earth stations may or may not be necessary. For example, through licensee-to-licensee discussion, these earth stations may not be required to make any adjustment to their operation.

73. Therefore, earth station licensees in table A3 in annex A are required to submit their PFD contours similar to the licensees listed in tables A1 and A2. Once these areas are licensed for flexible use, a reasonable amount of time will be given to these earth station licensees to implement measures to comply with the earth station licensing and coordination rules. ISED intends to consult on the amount of time allowed for these earth stations to comply with the rules and any other matters related to transition through a future licensing framework consultation. ISED expects affected flexible use and earth station licensees operating in the same band to work together collaboratively towards a possible mutually acceptable agreement to facilitate coexistence.

## Decisions

**D9. FSS earth stations identified in table A3 in annex A will be required to comply with the licensing and coordination rules in the future. Changes to their operations and/or adoption of specific mitigation measures may be required in order to satisfy the rules.**

**D10. Modification to these earth stations will be permitted as long as the changes would not increase the potential of interference to flexible use licensees compared to the original earth stations' operations as of the date of publication of this Decision.**

### 5.7 Moratorium on terrestrial licences

74. There is no existing licensing framework for licensing terrestrial services in the 26 GHz band.

75. For the 28 GHz band, the 2014 Decision established that a site-specific FCFS licensing process would be implemented for fixed systems in the band. To date, there have been no 28 GHz licences issued under this framework. In the Consultation, ISED placed a moratorium, for which it sought comments, on issuing new fixed service licences in the 28 GHz band. The moratorium was effective as of the date of publication of the Consultation.

### Summary of comments

76. All those that responded to this question were in support of the moratorium, including 5G Americas, BCBA, Bell, BSO, GSA, Huawei, Intel, Nokia, RABC, Rogers, SaskTel, Shaw, TELUS, TeraGo, and Xplornet. Bell, Rogers, and Huawei added that ISED should continue to issue developmental licences during the moratorium.

## Discussion

77. A moratorium on the issuance of terrestrial licences at this time is unlikely to have any detrimental effect for spectrum utilization in these bands in the short to medium term, given there has been no demand for fixed services in the 28 GHz band and terrestrial systems have not been allowed in the 26 GHz band. 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. ISED has decided to maintain a moratorium on terrestrial licences in both bands until a new licensing process has been put in place.

78. Presently in Canada, innovators have access to short-term developmental licences issued by ISED that allow for the testing of equipment. ISED considers that the use of developmental licences is an effective way to allow manufacturers and operators to innovate and experiment and will therefore continue to issue developmental licences for both the 26 GHz and 28 GHz bands. Interested parties may apply for developmental licences online using ISED's [Developmental Licence Playbook](#).

## Decision

**D11. A moratorium is in place on issuing new terrestrial service licences in the 26 GHz and 28 GHz bands. Developmental licence applications will continue to be considered.**

## 6. Spectrum utilization of the 38 GHz frequency band

### 6.1 Flexible use

79. As stated in the Consultation, making the 38 GHz band available for flexible mobile and fixed 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. Flexible use will accommodate a variety of use cases and therefore support innovative technologies and business cases as they emerge.

80. In the Consultation, ISED sought comments on whether to adopt a flexible use licensing model for fixed and mobile services in the 38 GHz frequency bands, ahead of WRC-19.

### Summary of comments

81. The majority of respondents supported developing a flexible use licensing model for fixed and mobile services in the 38 GHz frequency band ahead of WRC-19 and before 5G technology standards are finalized, given the possibility of many new innovative use cases as a result of 5G technology deployment and the possibility that it will include both mobile and fixed operations. In particular, the Canadian wireless industry noted the importance of making the mmWave bands available as early as possible for them to remain competitive with the global industry players. BCBA, Bell, CASCA, CSA, DSA, Ericsson, Facebook, GSA, Huawei, Intel, Microsoft, MobilExchange, Nokia, RABC, Samsung, Rogers, SaskTel, Shaw, 5G Americas, TELUS, TeraGo, ViaSat, and Xplornet all supported this proposal.

82. BSO and Telesat were not opposed, but stressed the importance of continued spectrum access for satellite services. Intelsat and Cogeco suggested ISED wait until standards are finalized. CSA was supportive of a flexible use licensing model, however advocated for the development of proper sharing mechanisms using realistic technical parameters and assumptions to protect incumbent services in these and adjacent bands.

### Discussion

83. Given that the U.S. and China are planning to make spectrum available in the 37-40 GHz band and it is included in the 3GPP technical standards, ISED expects that there will be an equipment ecosystem available for this band. ISED is of the view that in order to make spectrum available in a timely manner, allow early adoption of 5G technology and promote innovation, it should not wait for the outcome of WRC-19.

84. 5G is expected to be a mix of fixed and mobile services in the mmWave bands and there are a variety of different use cases expected to develop once 5G is deployed. ISED has decided to adopt a flexible use licensing model for fixed and mobile services in the 38 GHz band as it will allow licensees to decide whether to deploy fixed systems, mobile systems or a combination of fixed and mobile systems to meet the demands of 5G services.

### Decision

**D12. ISED is adopting a flexible use licensing model for fixed and mobile services in the 38 GHz frequency band. Under this model, a licensee would be permitted to deploy mobile, fixed or a combination of both services using a single spectrum licence. These bands will continue to be shared with other co-primary satellite services, as per the Canadian Table of Frequency Allocations.**

## 6.2 Changes to spectrum utilization policies and CTFA

85. In order to accommodate flexible use for terrestrial services in the band, ISED proposed that footnote C51 in the CTFA be modified as follows:

**MOD C51 (CAN-17)** The frequency band 38.637.5-40.0 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.

### Summary of comments

86. BCBA, Bell, BSO, CASCA, Ciel, Cogeco, CSA, Ericsson, Facebook, GSA, Huawei, Intel, Intelsat, Microsoft, MobilExchange, Nokia, RABC, Rogers, Samsung, SaskTel, Shaw, 5G Americas, Telesat, TELUS, TeraGo, ViaSat, and Xplornet supported the changes proposed in the consultation to introduce flexible use licensing in the frequency band 37-40 GHz, including the consequential changes

to the CTFA footnote **C51**, while continuing to allow use by the fixed-satellite service (space-to-Earth) in the frequency band 37.5-40.0 GHz.

87. BSO, RABC, SaskTel, Telesat, and ViaSat suggested improvements to the current wording in footnote **C51** with respect to the antenna size since smaller antennas could be deployed for feeder links as satellite technology advances.

88. As mentioned in section 5.2, while ISED did not address the issue of HAPS in the Consultation, both Telesat and Facebook provided the same comments on HAPS use in the 38 GHz band as for the 28 GHz band.

### Discussion

89. Similar to the 26 GHz and 28 GHz bands, ISED maintains that sharing between terrestrial and satellite services is feasible in the 38 GHz band. Given ISED's decision to facilitate sharing between terrestrial fixed and mobile services and the FSS in the 37.5-40 GHz band, consequential changes to footnote **C51** are required to provide priority to both the fixed and mobile services over the FSS.

90. Footnote **C51** afforded priority to the fixed service over the fixed-satellite service in the 37.5-40.0 GHz frequency band. In the Consultation and its Addendum, ISED proposed to extend this priority to the mobile service as well. As indicated in the summary of comments, this priority approach was favoured by a wide range of stakeholders. Consistent with the discussion for the 26 GHz and 28 GHz bands (see section 5.2 above), ISED will adopt an approach where continued sharing with FSS is supported in the 37.5-40 GHz bands; the deployment of satellite earth stations shall not be ubiquitous since ubiquitous satellite earth station deployment will likely impose constraints on the fixed and mobile services. To clarify this, footnote **C51** will be amended to limit the FSS use in the band 37.5-40.0 GHz to low density deployments of earth stations. As well, in order to enable spectrum access by both flexible use systems and satellite services and recognizing the important and often critical role of satellite communications in providing connectivity in rural and remote areas such as the North, ISED intends to consult, through the licensing framework consultation, on a set of specific areas that could be afforded some flexibility when applying the licensing and coordination rules.

91. As noted in the Consultation, and further addressed in section 7.4, ISED recognizes that the frequency band 37-38 GHz is allocated to the SRS on a primary basis. In addition, the band 39.5-40 GHz is also allocated to the mobile-satellite service (MSS) on a primary basis, limited to the Government of Canada. ISED will consider SRS/MSS licence requests on a case-by-case basis and may consult on changes to the CTFA and relevant policies.

92. As discussed in section 5.2, any changes to allow the use of HAPS in these bands in Canada would be subject to a future consultation.

## Decisions

**D13. The following Canadian footnote will be adopted:**

**C51:** The frequency band 37.5-40.0 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 on a co-primary basis. The use of the frequency band 37.5-40.0 GHz by the fixed-satellite service (Earth-to-space) is limited to low density deployments of earth stations, such as gateways, that will pose minimal constraints upon the deployment of fixed service and mobile service systems.

**D14. ISED will consult on a licensing framework for flexible use, update earth station licensing rules and develop coordination rules in the future. Until the earth station licensing rules and coordination rules are finalized, earth stations in the 37.5-40.0 GHz frequency range will be licensed in accordance with the Interim Guideline.**

### 6.3 Band plan

93. In the Consultation, ISED sought comments on its proposal to adopt the same band plan in the 37.6-40 GHz range as the U.S. and defer the development of the band plan for the 37-37.6 GHz range to a later date. ISED proposed a band plan for the frequency band 37-40 GHz that included 12 blocks of 200 MHz from 37.6-40 GHz and consulted on the potential block size for the 37-37.6 GHz portion of the band.

#### Summary of comments

94. The majority of comments received, including those from 5G Americas, Bell, BCBA, BSO, DSA, Ericsson, GSA, Huawei, Intel, Intelsat, Microsoft, MobilExchange, Nokia, RABC, Rogers, SaskTel, Shaw, Telesat, TELUS, and Xplornet, supported the proposed band plan and delaying the development of a band plan for the 37-37.6 GHz frequency band to a later date.

95. TeraGo also agreed with the proposed band plan but with certain modifications to accommodate terrestrial incumbents. Samsung recommended adopting the proposed band plan and adopting 200 MHz blocks in the 37-37.6 GHz range as well. Cogeco supported the proposed band plan and suggested a licence-exempt approach in the 37-37.6 GHz range.

96. Bell and Rogers were of the view that the band plan should not preclude the deployment of any type of duplexing scheme. CBNL suggested a band plan with TDD in the lower portion of the band and FDD in upper portion. Microsoft was of the view that the 37.0-37.6 GHz range should be preserved as a single band.

#### Discussion

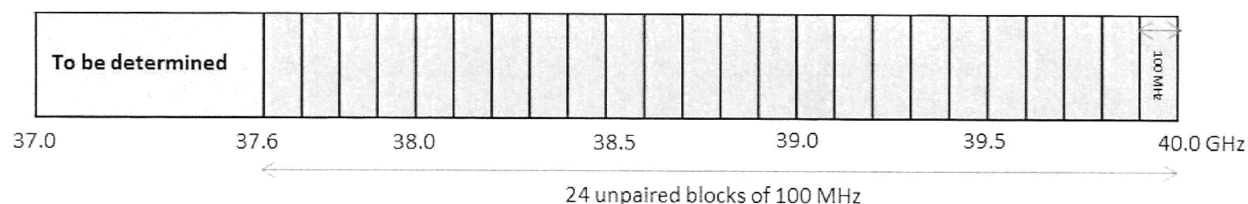
97. Both Canada and the U.S. have decided to permit flexible use services in this band. Therefore, in order to take advantage of a joint North American ecosystem, ISED agrees that a harmonized Canada/U.S. band plan would allow Canadians to benefit from economies of scale and the availability of 5G equipment in these bands.

98. ISED notes that the rules in the U.S. continue to evolve for the 37-37.6 GHz band and that they are considering making this portion available for shared access, where fixed and mobile terrestrial users would access this band through a coordination mechanism that is to be developed more fully through government/industry collaboration. As such, ISED has decided to defer the establishment of a Canadian band plan until a later date for this portion of the band. This view was supported by most commenters.

99. Following ISED's consultation, the FCC decided to move from a band plan consisting of 200 MHz blocks to a band plan of 100 MHz blocks for the 37.6-40 GHz band. ISED is of the view that the establishment of unpaired 100 MHz blocks, aligned with the U.S. band plan, would be most beneficial to Canadians. Similar to the 26 GHz and 28 GHz bands, Canadian operators may aggregate multiple blocks to form large blocks, subject to the future licensing framework consultation, in order to suit their business needs. A 100 MHz block band plan would enable the deployment of 3GPP band class n260 equipment that supports 50, 100, 200 and 400 MHz channels in the 38 GHz band.

100. Similar to the 26 GHz and 28 GHz bands, industry standards applicable to the 37-40 GHz band are based on a TDD scheme for 5G. As such, ISED expects that most systems deployed in this band will be using TDD equipment, and consequently only TDD systems will be permitted at this time. ISED may consider other options through consultation with stakeholders including the RABC to take into account future equipment ecosystem development, if necessary.

**Figure 3: Canadian band plan in the 37-40 GHz frequency band**



## Decision

**D15. ISED is adopting a band plan consisting of 24 unpaired 100 MHz blocks (as shown in figure 3) for the frequency band 37.6-40 GHz. ISED is deferring the development of a band plan in the 37-37.6 GHz frequency band to a later date. Only TDD systems will be permitted.**

## 6.4 Treatment of existing licenced earth stations

101. As of the date of publication of this Decision, no FSS earth station licences have been issued. The licensing of future earth stations in the frequency band 37.5-40 GHz will be subject to the provisions of the licensing and coordination rules applicable at the time of the earth station application.

## 6.5 Treatment of existing terrestrial licences

### 6.5.1 Treatment of existing fixed Tier 3 spectrum licences

102. In 1999, ISED awarded 800 MHz of spectrum (38.7-39.1 GHz and 39.4-39.8 GHz) for licensing via auction. Through the 2014 Decision, ISED determined that site-specific licences were the most efficient and consistent approach to authorizing higher frequency spectrum for fixed services and new fixed Tier 3 spectrum licences issued through the renewal process were not provided with a high expectation of renewal after their new 10-year term. There are 27 fixed Tier 3 licences held by three licensees, TeraGo Networks (25 licences), ABC Allen (1 licence) and Xplornet (1 licence). See annex B for a detailed list of licences.

103. The Consultation proposed two options for the treatment of fixed service Tier 3 spectrum licences at the end of the current term.

104. The first option was to issue new flexible use licences for a lesser amount of spectrum based on the new band plan. The amount of spectrum that a current licensee could be issued would be determined by using a percentage of each licensee's existing holdings. In the Consultation, ISED stated that given flexible use licences would be expected to be more valuable and in demand than fixed use licences, there would be some justification for reducing the amount of spectrum.

105. The second option was 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 6.5.2 below). Given that the majority of deployments using this spectrum are point-to-multipoint use near the large population centre in each licence area, site-based licensing may be sufficient for their current needs while increasing the amount of available spectrum for potential new users.

### Summary of comments

106. BCBA, Bell, MobilExchange, Rogers, SaskTel, TeraGo, and Xplornet generally supported the first option, to issue licensees new flexible use licences at the end of their current terms, with some differing views on how much spectrum should be retained on the new licences. There were also some respondents that agreed with the first option, but suggested a different approach to the proposed reduction in spectrum.

107. MobilExchange suggested there should be no reduction of spectrum for existing licensees. TeraGo indicated that existing licensees should retain their currently licensed amount of spectrum, if they have a multiple of 200 MHz. TeraGo added that any sites using less than a multiple of 200 MHz could have the difference converted to site-specific licences. Xplornet stated that it generally supports grandfathering incumbent licensees in order to provide for continued service to Canadians who are receiving service today.

108. BCBA suggested that licences outside Canada's six major urban centres should be converted to flexible use with no reduction in bandwidth. Bell suggested allowing licensees to maintain their current amount of spectrum, arguing that it is not fair to downgrade their bandwidth in exchange for permission

to operate on a flexible basis. Bell further suggested that ISED could instead impose a 5G deployment requirement on the new licences.

109. Rogers suggested that current licensees be issued new flexible use licences for two thirds of their current licensed bandwidth. SaskTel suggested that existing fixed Tier 3 spectrum licences be converted to flexible Tier 4 spectrum licences in areas where the licensee has deployed systems. SaskTel further suggested that the new flexible Tier 4 licences be reduced to 60% of the current bandwidth, given the higher value of flexible use spectrum versus fixed use spectrum.

110. Two respondents, Shaw and TELUS, supported the second option to convert current spectrum licences to site-specific licences. TELUS noted that if the first option is adopted by ISED, then TELUS supports issuing new flexible use licences for 25% of their current licensed bandwidth. Shaw stated that all incumbents should be converted to site-based licences in the interest of competitive fairness.

## Discussion

111. At the time of the 2014 Decision, there was no indication that the 37-40 GHz band would be considered for mobile systems and it was expected that the band would continue to be used for fixed point-to-point and point-to-multipoint systems, which could be authorized on a site-by-site basis through an FCFS licensing process. Today, however, mmWave spectrum is expected to be a key component in the deployment of 5G applications and services, which will be a mix of fixed and mobile systems.

112. ISED is of the view that converting the existing fixed use Tier 3 spectrum licences to site-specific licences and allowing them to continue operating with their current spectrum would be problematic for future 5G deployments given that it would fragment the new band plan, as these licences are based on paired spectrum. This could also limit 5G deployment in certain areas if the existing fixed sites are to be protected.

113. Existing fixed Tier 3 licensees were not given a high expectation of renewal as part of the 2014 Decision. ISED recognizes that they still have 6 years remaining on their 10-year licence term and that licensees may have made network investments based on this licence term. As such, fixed Tier 3 spectrum licensees may continue to operate under their current conditions of licence until the end of their licence term.

114. ISED recognizes that flexible use licensing will enable the continuation of existing services and support the growing demand for next-generation wireless services. As such, ISED intends to allow existing fixed Tier 3 licensees, who are in compliance with their current conditions of licence, to apply for new flexible use spectrum licences. As previously discussed, following the publication of this Decision, a consultation will be launched on a licensing framework for flexible use licences in this band, as well as the 26 GHz and 28 GHz bands. Existing fixed Tier 3 licensees will be allowed to apply to transition to flexible use licences prior to the end of their current licence term to facilitate the deployment of 5G services in a timely manner. The details of the application process, including timing considerations, for the flexible use licences will be further consulted on through the future licensing framework consultation.

115. In the Consultation, ISED proposed as part of Option 1, to issue fixed Tier 3 licensees new flexible use licences for a lesser amount of spectrum. After further consideration, ISED is of the view that given the large amount of mmWave spectrum being released for flexible use as part of this decision and the limited geographic areas that are currently licensed, there is no need to reduce the current

holdings of incumbent licensees once new flexible use licences are issued. Existing licensees are currently licensed for, at most, 400 MHz in any Tier 3 area. This is a relatively small amount when compared to the large amount of spectrum being released in the 37-40 GHz band. In addition, fixed Tier 3 licensees currently hold licences in 12 Tier 3 areas (see annex B) and, with the exception of Winnipeg and Calgary, these areas do not contain a large urban population centre where 5G is expected to be deployed first. Therefore, ISED will allow existing licensees, who are in compliance with their conditions of licence, to apply for flexible use licences for the same amount of spectrum as their existing holdings.

116. Given that future flexible use licences will be subject to the new band plan of 100 MHz unpaired blocks and that existing licences were issued based on a paired band plan of 50 MHz blocks with various transmit/receive frequency separation amounts, it is likely that existing licensees will be issued new flexible use licences for different frequency blocks than they currently hold. The future licensing framework consultation will address which portions of the 38 GHz spectrum band the existing licensees will need to move to in accordance with the new band plan.

117. To date, fixed deployment has been focused in urban areas, leaving large portions of the Tier 3 areas unutilized. Since mmWave frequencies do not travel far or well through buildings and obstacles, a smaller licence area may be better suited for flexible use licensing. Therefore, existing fixed Tier 3 licensees will be issued a new flexible use licence based on the licence areas chosen for the future flexible use licensing process and will only be allowed to apply for a licence in areas where they have deployed services. This will likely be a smaller geographic area(s) than their current Tier 3 licence areas. ISED will consult on the assessment criteria to determine what level of deployment is required for fixed Tier 3 licensees to be issued a flexible use licence in a specific licence area through the future licensing framework consultation. ISED further notes that new flexible use licences may have different deployment requirements, as part of their conditions of licence, than the current fixed use licences. This new deployment requirement, along with all other conditions of licence, will be consulted on through the future licensing framework consultation.

118. ISED recognizes that changes to existing fixed service deployments in Tier 3 areas will be required, including equipment upgrades. ISED is of the view that existing fixed service Tier 3 licensees will have enough time to transition to, and comply with, the new band plan by the end of their current licence term in 2025. The details of the process by which current licensees may apply will be established through a future licensing framework consultation.

## Decisions

### **D16. Existing fixed Tier 3 spectrum licences in the 38 GHz band will be treated as follows:**

- **Upon expiry of the current 10-year licence term, or voluntary licence cancellation prior to expiry, licensees who are in compliance with their current licence conditions will be eligible to apply for a new flexible use licence for an equal amount of spectrum.**
- **The new flexible use licences available to eligible licensees will be issued using licence areas that align with the new flexible use licence areas, which will be further consulted on, and only for those areas within which the existing licensee has deployed services by the end of its current licence term or voluntary cancellation date. These areas will likely be smaller than the existing Tier 3 licence areas.**

- **The new flexible use licences will be issued based on the new band plan and may be assigned different frequency blocks than their existing licences.**
- **Licensees of new flexible use licences will not be permitted to deploy mobile systems prior to the completion of the future competitive licensing process to award new flexible use licences in the band.**

**D17. With respect to the new flexible use licences for which existing fixed Tier 3 licensees will be eligible to apply, the following details will be established through the future licensing framework consultation:**

- **the assessment criteria used by ISED to determine the level of deployment required to be eligible to apply for a licence area**
- **the process for assigning new frequency block(s) for the new flexible use licences**
- **the new conditions of licence, including deployment requirement for the new flexible use licences**
- **the process by which current licensees can apply for and be issued these new flexible use licences, including matters related to timing**

### **6.5.2 Treatment of existing grid cell and site-specific first-come, first-served licences**

119. In 1999, ISED designated 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 an FCFS process. In addition, the frequency band 38.4-38.6 GHz was made available under the same FCFS licensing process for unpaired point-to-point and unpaired point-to-multipoint communication systems. These licences are renewed on an annual basis, provided that they remain in compliance with their conditions of licence.

120. The 2014 Decision allowed 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 grid cell licences are eligible for renewal; however, all new sites have been issued on an FCFS site-specific basis.

121. There are currently 76 active grid cell licences held by 8 licensees that have collectively deployed roughly 1900 sites. Rogers, TELUS, TeraGo and Freedom Mobile (Shaw) collectively hold 99% of these licences. Since 2014, when site licences were made available under the 2014 Decision, ISED has issued 419 site-specific licences (for 838 individual sites) to 10 licensees. Freedom Mobile holds 75% 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 Montréal.

122. In the Consultation, ISED proposed two options for the treatment of existing fixed grid cell and site-specific users.

123. The first option was to allow these licensees to continue operating in the band and be protected from interference from new flexible use licensees. Under this option, new flexible use licensees would

be required to coordinate with the existing fixed licensees by deploying around their sites or by other means determined between the licensees. This approach would likely be technically feasible; however, it could also limit deployment of 5G in major urban areas as 88% of grid cell and site-specific fixed licences are operating in the six largest urban areas.

124. The second option would be to allow existing fixed licensees to continue operating on a no-interference, no-protection basis with respect to future flexible use licences. This approach would provide no protection for existing fixed licensees from interference caused by new flexible use systems, but would allow them to continue operating on a no-interference, no-protection basis with respect to flexible use licensees, until 5G systems are deployed in their specific area. It was proposed that under this option, a notification period of one year would apply.

### Summary of comments

125. BCBA, Bell, SaskTel, Shaw, TeraGo, and Xplornet supported the first option, to allow these licensees to continue operating in the band as they are now, and protect them from new flexible use terrestrial systems. They indicated that the majority of existing links are heavily used for cell site backhaul and that protection from new flexible use terrestrial systems would minimize the impact to their customers.

126. Rogers and TELUS supported the second option, to allow these licensees to continue to operate in the band on a no-interference, no-protection basis with respect to new flexible use systems, as providing full protection to incumbent licensees could severely limit deployment of 5G in major urban areas. Rogers added that those FCFS licensees operating outside the country's six major urban centres should receive a two-year notification period prior to any action.

### Discussion

127. As discussed in the Consultation and as noted above, there is a significant number of grid cell and site-based licences in the major urban centres across Canada. Allowing these existing licensees to continue operating in the band and be protected from interference from new flexible use licensees would severely encumber the band and may inhibit the deployment of 5G services to millions of Canadians. Consequently, it is ISED's view that allowing these licensees to continue operating in the band with protection from future flexible use licensees is not a viable option.

128. It is noted that ISED began the process to potentially release this band to support the deployment of 5G in June 2017 with the release of the Consultation. ISED also indicated in the Spectrum Outlook that this band would continue to be treated as a Priority 1 band with an expected release of this band for terrestrial flexible use and other services in late 2021. Therefore, existing grid cell and site-based licensees are advised that they will be subject to displacement. ISED will consult on a transition plan for displacement, including notification periods, as part of the licensing framework consultation.

129. Existing grid cell and site-based licensees may, however, choose to transition their operations to any of the available backhaul bands at any time prior to the transition plan. ISED recognizes that in some areas existing backhaul bands may be congested. ISED notes that through SMSE-022-14, *Decisions on Spectrum Utilization Policies and Technical Requirements Related to Backhaul* (the Backhaul Decision), a new band 31.8-33.4 GHz (the 32 GHz band) was designated for backhaul use. The technical rules to make the 32 GHz band are being developed and it is expected to be available for

licensing by the end of 2019. Existing site-specific and grid cell licensees operating in congested areas may opt to transition their operations to the 32 GHz band at that time.

## Decision

**D18. Grid cell and site-specific first-come, first-served licences operating in the 38.4-40 GHz range, issued as of the date of this Decision, will be displaced, subject to a transition plan. ISED will consult on a transition plan for displacement, including notification periods, as part of the licensing framework consultation.**

### 6.5.3 Moratorium on terrestrial licences

130. In the Consultation, ISED sought comments on whether to implement a moratorium on issuing new licences for the 38.4-40 GHz band under the current licensing framework established in the 2014 Decision. ISED stated that it will continue to issue new licences for the 38.4-40 GHz band, but noted that a moratorium on issuing new site-specific licences may be required once alternative licensing processes have been finalized and the timing of their implementation has been determined.

#### Summary of comments

131. Respondents were divided between those that support a moratorium (BCBA, BSO, Shaw, 5G Americas, TELUS, ViaSat, and Xplornet), and those that oppose (Bell, Nokia, Rogers, Samsung, SaskTel, and TeraGo).

132. TELUS noted that a moratorium would support ISED's objective of supporting 5G innovation by minimizing encumbrance in the band prior to new flexible use licensing. Shaw supported a moratorium but argued for an exception to be made for new sites within an existing grid cell licensee's area. In its reply comments, TeraGo added its support for Shaw's proposal if ISED decides to implement a moratorium.

133. Rogers and Bell opposed a moratorium, stressing the importance of this band for backhaul. Rogers added that ISED should open a substitute band for backhaul, suggesting the 31.8-33.4 GHz and 40.5-43.5 GHz bands as options, as ISED indicated in the Backhaul Decision. In the reply comments, Shaw and TELUS noted their support for Rogers' proposal. TeraGo opposed Rogers' proposal stating that a "replacement band would require immense resources, both in costs for new radio equipment and labour to move existing stations off of the 38 GHz band and onto a proposed replacement band".

134. Bell, Samsung, and SaskTel noted that a moratorium would be needed prior to a new flexible use licensing process.

#### Discussion

135. ISED previously proposed to treat the 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 for enterprise wireless solutions as well as to deliver backhaul for mobile services. ISED stated that an immediate moratorium may impact existing and potential users of this band with respect to their current and future deployment plans. ISED noted that

once alternative licensing processes have been finalized and the timing of their implementation has been determined, a moratorium may be implemented.

136. Through the release of this document, ISED has made decisions regarding the future use and licensing of this spectrum, including the treatment of incumbents (see sections 6.5.1 and 6.5.2 above). ISED is of the view that given these decisions and the policy objectives for the release of mmWave bands (see section 4), a moratorium is now needed to prevent further encumbrance of the entire 37-40 GHz band.

**Decision**

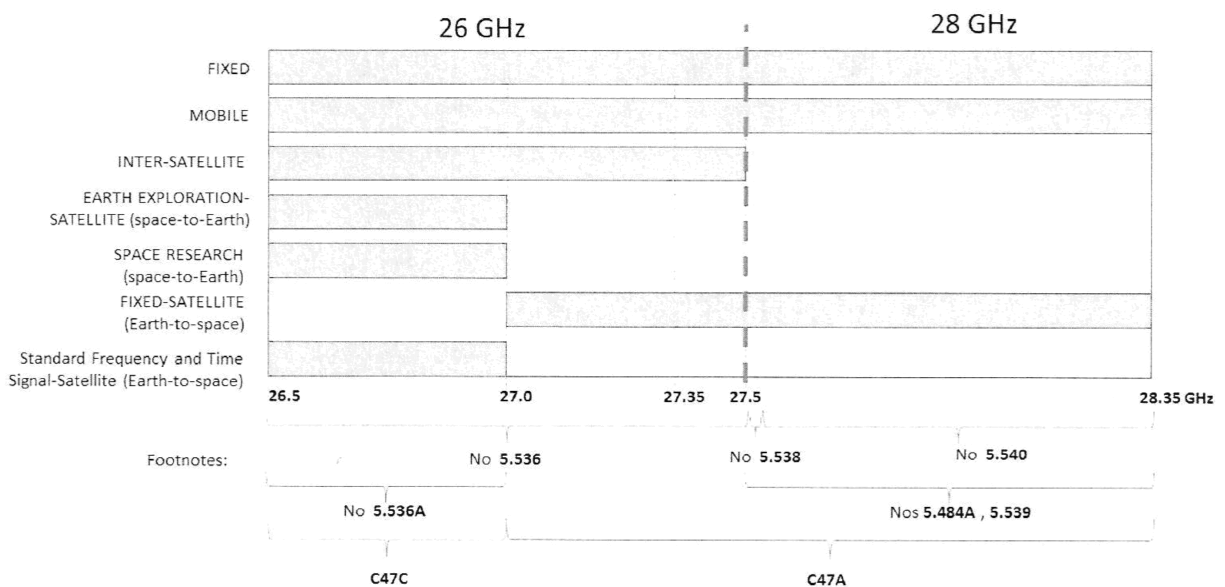
**D19. ISED is implementing a moratorium on issuing new terrestrial service licences in the 37-40 GHz band, effective immediately. The moratorium does not apply to licence applications received prior to the publication of this Decision. Developmental licence applications will continue to be considered.**

**7. Coexistence of flexible use services and satellite services in the 26 GHz, 28 GHz and 38 GHz frequency bands**

137. The Consultation and the Addendum sought comments on mechanisms to ensure coexistence between fixed and mobile services and various satellite services in the 26 GHz, 28 GHz and 37-40 GHz frequency bands.

138. Figure 4 shows the current allocations and existing, revised and newly adopted applicable footnotes for the 26.5-28.35 GHz band.

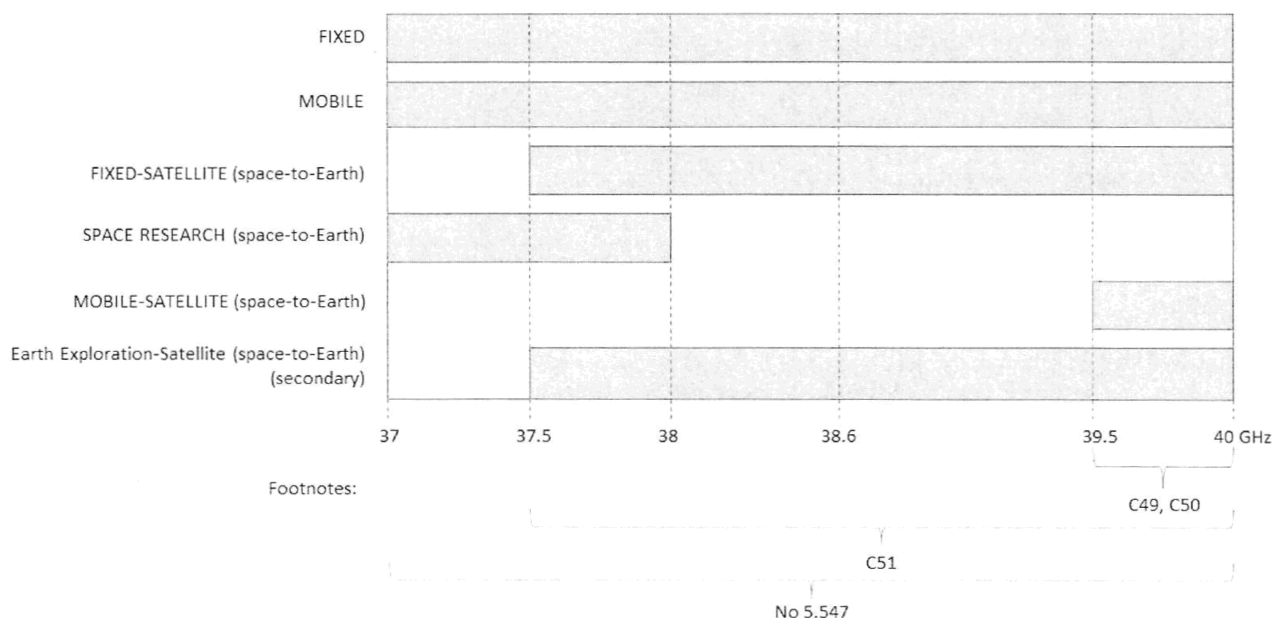
**Figure 4: Allocations and applicable footnotes for the 26.5-28.35 GHz band**



**Notes:** Primary services are shown in all uppercase letters  
 Secondary services are shown with uppercase and lowercase letters  
 See CTFA for definitions of the footnotes

139. Figure 5 shows the current allocations and existing, revised and newly adopted applicable footnotes for the 37.0-40.0 GHz band.

**Figure 5: Allocations and applicable footnotes for the 37.0-40.0 GHz band**



**Notes:** Primary services are shown in all uppercase letters  
 Secondary services are shown with uppercase and lowercase letters  
 See CTFA for definitions of the footnotes

**7.1 Coexistence between flexible use stations and space stations using inter-satellite links in the 26.5-27.5 GHz band**

140. Amongst other services, the 26.5–27.5 GHz band is allocated to inter-satellite service (ISS) on a co-primary basis.

141. In the Addendum, ISED noted that the ITU has been actively studying the impact of 5G systems on ISS and that preliminary results indicate that harmful interference to space stations due to aggregate emissions from 5G systems is not likely. In addition, ISED expects that advanced systems considered for the mmWave bands will employ various technologies including dynamic beam forming with very narrow beamwidths, which will lessen the potential of interference to ISS that communicates between space stations. ISED sought comments on the need to impose limits on the aggregate emissions of terrestrial services in the 26.5-27.5 GHz band to ensure coexistence with ISS stations.

## Summary of comments

142. With the exception of NorthStar, all those who submitted comments in response to the Addendum indicated that in light of the use of dynamic beam forming technologies for 5G deployments and of ITU and other studies indicating that interference between flexible use terrestrial and ISS stations is not likely, no limits are required. Bell and Huawei also stated that aggregate emission limits are not practical due to the expected widely dispersed deployment of 5G stations and the difficulty of assessing the level of aggregate emissions at any point in time. NorthStar, on the other hand, was of the view that it was premature to determine the specific impact of aggregate terrestrial emissions on ISS links.

## Discussion

143. As discussed in the Consultation and the Addendum, taking into account advances in mobile technologies and ITU studies, ISED continues to believe that there is very low potential for harmful interference to ISS from flexible use stations. As such, ISED will not place any limits on aggregate emissions produced by flexible use systems at this time. However, ISED may review this decision in the future if it finds that there is harmful inference or an increased risk for harmful interference to ISS.

## Decision

**D20. ISED is not mandating any limits on the aggregate emissions produced by flexible use systems in the 26.5-27.5 GHz band.**

### 7.2 Coexistence between flexible use stations and new satellite earth stations in the 26 GHz, 28 GHz and 38 GHz bands

144. In the Consultation and the Addendum, ISED sought comments on its proposals to require site-by-site coordination between terrestrial flexible use and FSS, EESS and SRS earth stations when a pre-determined trigger was exceeded. ISED stated that the sharing mechanism in all three bands could be very similar. However, it was recognized that there would be a requirement for different coexistence measures for the 27.0-28.35 GHz band as it is used for transmitting satellite earth stations and for the bands 26.5-27.0 GHz and 37.5-40.0 GHz as they are used for receiving satellite earth stations. ISED also noted that due to the different nature of the satellite services (i.e. FSS, EESS and SRS as shown in figures 4 and 5 above), specific parameters (e.g. specific value of separation distance) to enable coexistence may be different.

145. ISED put forward in the Consultation that the FCC's method for limiting the areas where satellite earth stations can be deployed is not appropriate in the Canadian context. ISED pointed out that existing Canadian space teleports are deployed near fibre links that are close to urban boundaries. ISED also considered that earth station siting must also take into account access to a power source and road accessibility in order to deploy, perform maintenance, upgrade and repair earth stations. ISED expressed concern that, although the FCC's geographic restrictions might ensure the future deployment of flexible use systems in core urban areas and near major infrastructure, they might also unnecessarily deny satellite operators access to locations where that would enable the deployment of Canadian space teleports in both urban and rural areas. As such, ISED sought comments on whether there should be restrictions on the geographic areas in which new earth stations can be deployed and invited proposals.

## Summary of comments

### *Satellite earth station siting*

146. With respect to geographical restriction zones, wireless providers and manufacturers were of the view that earth stations would best be limited to geographic areas outside the most populated areas where terrestrial flexible use stations are likely to be deployed. Satellite operators, with the exception of Intelsat, ViaSat and Xplornet, did not oppose the idea of geographical restriction zones but expressed concerns that overly restrictive limitations like the ones that the FCC introduced are likely to have an adverse impact on satellite operators' ability to deliver satellite services in Canada and that a balanced spectrum sharing approach is preferable. They suggested that a technical study by ISED and the RABC would be necessary before the specific parameters of such restrictions could be properly defined and applied.

### *Coordination of FSS earth stations and flexible use stations*

147. The majority of comments were in favour of site-by-site coordination. However, satellite operators argued that the coordination process should strike an equal balance between satellite and terrestrial users.

148. Rogers, with support from Cogeco, proposed site-by-area coordination, where the site relates to the earth station and the area relates to the flexible use terrestrial stations. They expressed the view that site-by-site coordination would introduce undue overhead costs for both satellite and terrestrial operators.

149. Telesat and Intelsat suggested an FCFS regime, where flexible use stations would need to coordinate with earth stations in operation and vice-versa. This was opposed by Bell. Rogers indicated that it was not opposed to an FCFS approach outside the proposed restriction zones.

150. BCBA, Bell, BSO, Ciel, Cogeco, Ericsson, Huawei, Intel, Intelsat, RABC, Rogers, Samsung, SaskTel, Shaw and Telesat, ViaSat, and Xplornet supported having a coordination trigger.

151. In general, Bell, BSO, Cogeco, Intel, Intelsat, RABC, Rogers, Samsung, SaskTel and Telesat, and ViaSat recommended the use of a PFD coordination trigger. For the 27-28.35 GHz band, BCBA, Huawei and Xplornet favoured a distance coordination trigger. For the 37.5-40 GHz band, Nokia reaffirmed its support for the FCC approach for the 37.5-40 GHz band; BSO and Xplornet noted a one-size-fits-all approach might not be appropriate; and both Intel and TELUS were of the view that deciding on a coordination trigger was premature at this time.

152. With respect to the coordination trigger for the 27-28.35 GHz band, Ericsson, GSA, Nokia and TELUS advocated for the PFD coordination trigger adopted by the FCC:  $-77.6 \text{ dBm/m}^2/\text{MHz}$  at 10 m above the ground. Ericsson further stated that the PFD coordination trigger should be matched with an aggregate I/N value in the range of -6 to -8 dB. Intel proposed three separate PFD coordination triggers: one for base stations, one for the CPE and one for mobile stations.

153. Bell, BSO, Cogeco, Intelsat, RABC, Rogers, Samsung, SaskTel, and Telesat recommended that the PFD coordination trigger be determined through a study. With respect to the coordination trigger for the 27-28.35 GHz band, Intelsat, Rogers and Samsung further suggested using the FCC value as a starting point. With respect to the coordination trigger for the 37.5-40 GHz band, Bell recommended that

the 3GPP report on coexistence studies could be used as a starting point, while Rogers and Ericsson considered the PFD coordination trigger adopted by the FCC for the 28 GHz frequency band could be used as a starting point.

#### *Mitigation techniques*

154. BCBA, Bell, BSO, Ciel, Ericsson, GSA, Intel, Intelsat, RABC, Rogers, SaskTel, Telesat, TELUS, and ViaSat agreed that although shielding was an effective measure to mitigate interference, flexibility in terms of mitigation techniques to facilitate sharing between flexible use stations and satellite earth stations was preferable to mandating a specific technical rule that might not be the most efficient or most cost effective option for every scenario.

#### **Discussion**

155. In the short- to medium-term, flexible use systems will most likely be deployed primarily in more densely populated areas such as urban or sub-urban areas, or in venues where a large number of people congregate, such as airports and stadiums. Moreover, flexible use systems could be deployed along major highways and roadways.

156. Given the limited transmission range of systems in the mmWave spectrum, combined with new technologies being developed for flexible use systems, ISED continues to be of the view that with sound engineering practices and cooperation among the involved parties, sharing between satellite and flexible use services in the mmWave bands can be facilitated.

157. ISED examined how to implement geographic restrictions based on pre-defined urban areas, such as the Census Metropolitan Areas (CMA) or Census Agglomerations (CA) as defined in Statistics Canada's Statistical Area Classification, as boundaries within which the deployment of satellite earth stations may be excluded or limited. ISED determined that such exclusion zone definitions would not strike an appropriate balance to meet the needs of both satellite and flexible use systems. The adoption of hard boundaries based on CMAs or CAs could be overly restrictive to the deployment of satellite in some scenarios, or result in constraining the flexible use services in others.

158. ISED then re-examined more closely the siting rules adopted by the FCC and is of the view that a variation of the U.S. approach can be adapted to the Canadian context and offer the flexibility required to strike a balance between the needs of both satellite and flexible use systems. Taking a similar approach will allow ISED to develop coordination rules that take into account factors such as existing population and potential growth, proximity to major infrastructures, and major highways and roadways. Therefore, ISED will develop coordination rules using a population-impact based approach to enable coexistence between future flexible use stations and FSS earth stations operating in the frequency bands 27.0-28.35 GHz and 37.5-40.0 GHz, as well as EESS and SRS earth stations operating in the frequency bands 26.5-27.0 GHz.

159. Specifically, the population-impact based approach will be based on setting limits on earth station deployments such that deployment would not affect a material amount of the population in a given flexible use licence area. For transmitting earth stations, exclusion zones where flexible use systems would not be able to claim protection could be established. For receiving earth stations, protection zones could be established where flexible use systems would only be able to deploy upon

successful coordination with the earth station licensees. In order to establish these zones, ISED will require earth station applicants to submit transmit or receive contours as appropriate.

160. In order to facilitate sharing between flexible use and satellite operators in the 26 GHz, 28 GHz and 38 GHz bands, ISED recognizes that mitigation techniques such as shielding, power reduction and variation of the elevation angle will have to be an integral part of the coordination process. ISED agrees that there is no one-size-fits-all solution to mitigate interference and that it is in the interest of all parties involved to have the flexibility to select the mitigation technique(s) that best suit their needs and unique situation. Consequently, ISED will not mandate specific mitigation techniques.

161. Under CPC-2-6-01, coexistence of fixed terrestrial stations and domestic FSS earth stations is addressed prior to licensing through coordination on a site-by-site basis. The licensing requirements specified in CPC-2-6-01 for earth station application will continue to apply, including site-by-site coordination with existing fixed terrestrial stations.

162. As mentioned, coordination rules for mmWave spectrum will be established in the near future. In the meantime, the Interim Guideline, discussed in section 5.2 and section 6.2, will include provisions to enable the deployment of earth stations while ensuring they would not constrain the deployment of future flexible use systems. Also, ISED agrees that certain parameters such as the PFD value or distance to trigger coordination could benefit from further discussion with industry stakeholders. The Interim Guideline parameters will be used as starting points to initiate discussion with stakeholders through the RABC in order to establish the licensing and/or coordination rules.

## Decisions

**D21. In order to enable coexistence between flexible use service and earth stations of the satellite services in the 26 GHz, 28 GHz and 38 GHz bands, coordination rules based on a population impact assessment approach will be established.**

**D22. Until coordination rules are established, ISED will consider applications for new earth stations and modifications of existing earth stations in accordance with the Interim Guideline.**

**D23. Authorization for an earth station obtained under the Interim Guideline may also be subject to the licensing and coordination rules to be established in the future.**

### 7.3 Coexistence between flexible use stations and fixed-satellite space stations in the 27.0-28.35 GHz band

163. 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. ISED recognized in the Consultation that 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. As such, ISED sought comments on whether it should impose any limits on the aggregate emissions of terrestrial stations.

### Summary of comments

164. The views were split on the issue of limits on the aggregate power level of terrestrial flexible use systems in the 27.0-28.35 GHz band. BCBA, Bell, Ericsson, GSA, Huawei, Intel, RABC, Rogers, Samsung, SaskTel, Shaw, TELUS, and Xplornet declared no aggregate limits were required. On the other hand, BSO, Intelsat, Telesat, RABC, SaskTel, and ViaSat were of the view that studies on limits on skyward transmission from individual terrestrial stations are more appropriate since such limits are easier to implement and enforce than aggregate limits. Ciel believed it was premature to decide on whether emission limits are required.

### Discussion

165. Similar to sharing with ISS in the 26.5-27.5 GHz band, ISED expects that advanced technologies in the mmWave bands will lessen the potential of interference to FSS 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.

166. 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. Furthermore, as indicated by stakeholders in their comments, ITU studies on the impact of 5G systems on FSS indicate that harmful interference to space stations due to aggregate emissions from 5G systems is not likely. Also, the FCC concluded that there was no need to establish any regulatory limits on the aggregate power levels produced by flexible use operations.

167. ISED considers there is no need to impose aggregate emission limits to flexible use stations in the 27.0-28.35 GHz band. Such limits would be difficult to implement and enforce. However, if necessary, ISED may review whether to apply technical measures to ensure coexistence between flexible use systems and FSS systems in this frequency band in the future.

### Decision

**D24. There will be no mandated limit on the aggregate emissions produced by flexible use systems operating in the 27.0-28.35 GHz band.**

#### **7.4 Band sharing with the space research service (SRS) (space-to-Earth) in 37-38 GHz and mobile-satellite service (MSS) (space-to-Earth) in 39.5-40 GHz**

168. As noted in the Consultation, the frequency band 37-38 GHz is allocated to SRS (space-to-Earth) on a primary basis. In addition, the band 39.5-40 GHz is allocated to MSS, and is limited to use by the Government of Canada.

169. At the time of the Consultation, there was no existing or planned SRS or MSS operation in Canada. Therefore, ISED did not propose specific restrictions on terrestrial services. However, in the event that SRS or MSS begin deployment in these bands, ISED indicated that flexible use licensees may be subject to future technical provisions in order to facilitate coexistence.

### Summary of comments

170. The majority of respondents, including Huawei, Intel, Nokia, RABC, Rogers, Samsung, SaskTel, Shaw, Telesat, TELUS, ViaSat, and Xplornet, agreed with ISED's proposal that such technical provisions to facilitate coexistence are not needed at this time, but should be the subject of a future consultation should the need arise (i.e. when SRS and/or Government MSS systems are deployed).

171. BCBA, Bell, and Ericsson stated that 5G deployments should not be encumbered or hampered by any future SRS or MSS deployments.

172. TELUS is of the view that given the nature of the SRS service, a similar framework as proposed for FSS earth stations be considered in the 37-38 GHz band. It also suggested future MSS deployment within the 39.5-40 GHz range should be limited to rural and remote areas since broad MSS deployment would introduce high levels of interference to flexible use terrestrial systems.

### Discussion

173. To date, no SRS or MSS applications have been submitted to ISED.

174. It is expected that if SRS earth stations begin to deploy in this band, the number of earth stations would be few and likely would deploy in areas with low population or in remote areas. In the event that the SRS operators plan to deploy earth stations in this band, ISED will consider applications on a case-by-case basis. Conditions such as a requirement to coordinate with other users in the band may be imposed. Furthermore, in the event that such application is submitted prior to the completion of flexible use licensing, conditions such as no protection may be imposed on SRS earth stations until coordination may take place.

175. Given the lack of existing or planned MSS earth station deployment, no specific coexistence requirements are imposed on either MSS or flexible use stations at this time. In the event that the Government plans to deploy MSS in this band, a consultation process will take place to determine if any specific technical provisions or policy provisions may be required. In the meantime, any new MSS operation will be considered on a case-by-case basis. Conditions such as no protection from flexible use systems may be imposed.

176. In the event that ISED begins to see a large uptake of SRS or MSS deployment in these bands, ISED will consult on coordination rules and flexible use licensees may then be subject to future technical provisions in order to facilitate coexistence.

### Decision

**D25. ISED will not develop any technical provisions to facilitate the coexistence of flexible use and future SRS and MSS systems at this time.**

## 8. Spectrum utilization of the 64-71 GHz frequency band

177. In the Consultation, ISED proposed to align with decisions made by the FCC in the U.S. to permit licence-exempt operations in the 64-71 GHz band. It is also noted that other countries, such as the UK, are also extending their licence-exempt spectrum and technical conditions from 57-66 GHz up to 71 GHz.

178. While this range is currently allocated for fixed, mobile, and various satellite services, there are no Canadian spectrum utilization policies addressing the band. Furthermore, there are no existing users of this band by any service in Canada and ISED is not aware of any planned usage.

179. Currently in Canada, licence-exempt operations are permitted in the 57-64 GHz band, so this proposal would effectively create 14 GHz of contiguous spectrum for licence-exempt operations.

### Summary of comments

180. The majority of respondents, BCBA, Bell, Cogeco, DSA, Ericsson, Facebook, Huawei, IEEE, Intel, Microsoft, RABC, Rogers, SaskTel, Shaw, Starry, TELUS, TeraGo, ViaSat, and WiFi Alliance, supported allowing licence-exempt use of the 64-71 GHz band, noting that this would harmonize with the U.S. and create 14 GHz of contiguous licence-exempt spectrum.

181. Xplornet was opposed to allowing licence-exempt operations in this band, suggesting a light-licensing model similar to that of the 3650 MHz band instead. It noted that this licensing model would better facilitate coordination. In its reply comments, Rogers disagreed with Xplornet's suggestion, and stated that any risks associated with licence-exempt operations can be mitigated through careful policy setting and spectrum management.

182. Nokia noted its general preference for licenced spectrum, and suggested that allowing licence-exempt use in 7 GHz of spectrum is too much, considering ISED only initially proposed 3.85 GHz for licenced use. In its reply comments, Facebook opposed Nokia's views, stating that comparison of the amounts of spectrum for licenced and licence-exempt fails to account for the differences between the bands (e.g. existing services, propagation characteristics, and device ecosystems) and these differences make distinct regulatory licensing schemes appropriate.

183. CASCA noted that allowing licence-exempt use of this band would not affect domestic astronomical facilities, but may affect observations in partner countries such as the U.S. and Chile.

### Discussion

184. ISED maintains the view that there is strong interest for new licence-exempt wireless devices for various applications, including field disturbance sensor applications and short-range high capacity wireless communication devices for the delivery of multimedia applications. Sufficient spectrum should therefore be made available for licence-exempt applications to ensure that Canadians will benefit from new and innovative technologies.

185. Licence-exempt operations are also increasingly being used by mobile network operators to alleviate spectrum congestion by enabling mobile data off-loading through Wi-Fi networks. The demand for such use is expected to continue to increase.

186. Allowing licence-exempt operations in this band would create a 14 GHz contiguous block of spectrum for a multitude of licence-exempt activities, such as supporting existing wireless systems through Wi-Fi off-loading, and lowering barriers to entry for wireless innovators. It would also align with the U.S. decision, enabling economies of scale and access to affordable consumer devices. Harmonizing with the U.S. would also reduce the risk of U.S. consumer devices being used in Canada and interfering with neighbouring wireless systems. Therefore, ISED will allow licence-exempt operations in the frequency band 64-71 GHz on a no-interference, no-protection basis.

187. Through the normal technical standard development process, Radio Standards Specification RSS-210, *Licence-Exempt Radio Apparatus: Category I Equipment* will be amended to include the technical requirements for the 64-71 GHz frequency band. ISED will develop a proposal for new/amended standards and consult with stakeholders including the RABC before amending RSS-210 or any other relevant equipment standards.

### Decision

**D26. ISED will designate the band 64-71 GHz for licence-exempt operations on a no-interference, no-protection basis. Licence-exempt equipment will be allowed to operate in this band once the relevant technical standards have been issued.**

## 9. Comments received regarding spectrum access and preliminary licensing considerations for the 26 GHz, 28 GHz and 38 GHz frequency bands

188. In the Consultation, ISED sought comments on general spectrum access considerations for the 28 GHz and 37-40 GHz bands, including: 1) whether to issue exclusive licences for these bands or to permit licence-exempt use; 2) if exclusive licensing were adopted, which types of licences would be best; and 3) should a licence-exempt dynamic access database be implemented in this spectrum, particularly in 37-37.6 GHz band. ISED also sought preliminary comments on licensing policy considerations, should an exclusive licensing approach be adopted. These considerations included the benefits and risks associated with longer licence terms, and possible measures that could support competition.

189. In the Addendum, ISED sought additional comments on licensing considerations given the addition of the 26 GHz band, including any that would encourage innovative use cases while also supporting competition for existing mobile network services.

190. ISED will take into consideration the comments received in response to these issues in the development of proposals for the future licensing framework consultation.

191. As noted earlier, the rules in the U.S. continue to evolve for the 37-37.6 GHz band and they are considering making this portion available for shared access, where fixed and mobile terrestrial users would access this band through a coordination mechanism. This coordination mechanism could potentially be facilitated through a dynamic database, which could increase the overall efficient use of the spectrum. However, it remains unclear as to how the U.S. will implement this coordination mechanism. Recognizing that Canada could benefit from the same equipment ecosystem on a North American basis by allowing for a similar coordination mechanism as the U.S., ISED will further consult on the potential of introducing such a coordination mechanism for the mmWave spectrum at a later date.

## 10. Comments received regarding health concerns

192. In response to the Consultation, ISED received submissions from individuals and organizations citing their concerns related to the potential health impact from the anticipated proliferation of antenna systems for 5G deployment.

193. Health Canada is the department responsible for carrying out research into possible health effects of human exposure to radiofrequency electromagnetic energy from wireless devices, monitoring the scientific literature related to such possible effects, and developing exposure guidelines. Health Canada's exposure guidelines are documented in a safety code known as Safety Code 6 (2015), *Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz*. The recommended human exposure limits in Safety Code 6 are based on the most current scientific literature on radio-frequency exposure and are designed to provide protection for all age groups, including infants and children, on a continuous basis. Current exposure limits found in Safety Code 6 cover the frequency ranges that will be used by devices and antenna installations using 5G mmWave technology.

194. ISED, through its approval processes, conditions of authorization, and technical standards, has adopted Safety Code 6. ISED will continue to ensure that all radiocommunication installations and devices are installed and operated in a manner that complies with Safety Code 6 limits, regardless of the wireless technology. ISED will continue to engage manufacturers and operators on their legal responsibility to meet all regulatory requirements, including compliance with Safety Code 6 limits, on an ongoing basis.

## 11. Next steps

195. ISED will consult further on the licensing framework for the 26 GHz, 28 GHz, and 37-40 GHz bands as appropriate. Corresponding coordination and technical rules will also be developed through updates to relevant Radio Standards Specifications and Standard Radio System Plans, and any other applicable documents, as appropriate.

## 12. Obtaining copies

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

197. For further information concerning the decision outlined in this document or related matters, contact:

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

Email: [ic.spectrumauctions-encheresduspectre.ic@canada.ca](mailto:ic.spectrumauctions-encheresduspectre.ic@canada.ca)

**Annex A: List of satellite earth stations****Table A1: List of earth stations licensed prior to June 5, 2017**

Company name	Licence #	Location	Longitude	Latitude	Frequency (GHz)
Hughes Network Systems Canada	010308797-002	London, ON	81°W12'0.4"	42°N55'23.9"	27.52763-27.76363, 27.76388-27.99988, 28.00013-28.23613, 28.23638-28.47238
Hughes Network Systems Canada	010311081-001	White City, SK	104°W23'24.7"	50°N26'57.7"	27.52763-27.76363, 27.76388-27.99988, 28.00013-28.23613, 28.23638-28.47238
Inmarsat Solutions (Canada) Inc.	010304770-001	Winnipeg, MB	97°W02'44"	49°N51'32"	27.5-27.6, 27.625-27.725, 27.75-27.85, 27.875-27.975, 28.00425-28.00975, 28.024-28.056, 28.064-28.096, 28.104-28.136, 28.144-28.176, 28.184-28.216, 28.224-28.256, 28.264-28.296, 28.304-28.336, 28.344-28.376
Telesat Canada	010000233-001	Fort McMurray, AB	111°W19'59"	56°N40'16"	28.0985-28.164, 28.35-28.4125
Telesat Canada	010000809-001	Saskatoon, SK	106°W40'11"	52°N05'09"	28.0985-28.164, 28.1-28.1625, 28.1625-28.225, 28.225-28.2875, 28.2875-28.35
Telesat Canada	010001551-001	St. John's, NL	52°W47'36"	47°N32'34"	28.10565-28.15685, 28.16815-28.21935, 28.23065-28.28185, 28.29315-28.34435
Telesat Canada	010740878-001	Allan Park, ON	80°W56'08"	44°N10'29"	27.4998-27.5042, 28.3478-28.3522
WildBlue Communications Canada	010001269-001	Winnipeg, MB	97°W02'43"	49°N51'32"	28.10000-29.10000

**Table A2: List of earth stations whose applications were pending approval as of June 5, 2017**

Company name	Licence #	Location	Longitude	Latitude	Frequency (GHz)
Xplornet	010735923-001	Sherwood Park, AB	113°W17'07.6"	53°N30'44.9"	27.8575-28.0925, 28.1075-28.3425
Xplornet	010687383-001	Regina, SK	104°W28'42.5"	50°N26'46.8"	27.8575-28.0925, 28.1075-28.3425

**Table A3: List of earth stations with applications submitted after June 5, 2017, and before the release of this Decision**

Company name	Licence #	Location	Longitude	Latitude	Frequency (GHz)
Telesat	010762264-001	Saskatoon, SK	106°W40'08"	52°N05'09"	27.625165-27.758165, 27.62528-27.72628, 27.726565-27.796865, 27.758305-27.812905, 27.796845-27.919845, 27.81288-27.91288, 27.912895-27.961095, 27.919795-28.042795, 27.96112-28.01392, 28.013935-28.057935, 28.042775-28.113075, 28.057985-28.147185, 28.11308-28.13808, 28.138075-28.161375, 28.147245-28.195445, 28.161515-28.322515, 28.195465-28.230665, 28.230675-28.275775, 28.275755-28.318055, 28.375015-28.504015
Telesat	010776769-001	Hague, SK	106°W24'0"	52°N31'18"	27.625165-27.758165, 27.62528-27.72628, 27.726565-27.796865, 27.758305-27.812905, 27.796845-27.919845, 27.81288-27.91288, 27.912895-27.961095, 27.919795-28.042795, 27.96112-28.01392, 28.013935-28.057935, 28.042775-28.113075, 28.057985-28.147185, 28.11308-28.13808, 28.138075-28.161375, 28.147245-28.195445, 28.161515-28.322515, 28.195465-28.230665, 28.230675-28.275775, 28.275755-28.318055, 28.378015-28.501015
WorldVu (1021823 B.C.)	010746495-001	Inuvik, NT	133°W36'37.35"	68°N19'34.14"	27.5245-27.5255, 27.5285-27.5295
Northwestel Inc.	010765286-001	Iqaluit, NU	68°W30'52"	63°N44'44"	27.624985-27.675385, 27.675355-27.725755, 27.725725-27.776125, 27.776725-27.827125, 27.826465-27.876865, 27.876835-27.927235
Northwestel Inc.	010765285-001	Qikiqtarjuaq, NU	64°W01'13"	67°N33'41"	28.02501-28.06501
Northwestel Inc.	010765284-001	Kimmitut, NU	69°W52'07"	62°N50'35"	27.98799-28.02499
Northwestel Inc.	010765283-001	Grise Fiord, NU	82°W54'53"	76°N25'12"	27.958355-27.987955
Northwestel Inc.	010765282-001	Clyde River, NU	68°W35'30"	70°N28'30"	27.869445-27.958345
Northwestel Inc.	010765244-001	Pond Inlet, NU	77°W58'21"	72°N41'43"	27.77315-27.86945
Northwestel Inc.	010758611-001	Pangnirtung, NU	65°W42'26"	66°N08'42"	27.625075-27.773075

**Annex B: Current Tier 3 spectrum licences in the 38 GHz band**

Licensee	Licence number	Tier number	Tier name	Licence expiry
ABC Allen	010305499-001	3-057	Prince George	January 20, 2025
Xplornet	010305500-001	3-040	Brandon	January 20, 2025
TeraGo	010305467-001	3-020	Kingston	January 20, 2025
	010305468-001	3-020	Kingston	January 20, 2025
	010305471-001	3-020	Kingston	January 20, 2025
	010305472-001	3-026	Barrie	January 20, 2025
	010305473-001	3-026	Barrie	January 20, 2025
	010305474-001	3-029	Niagara/St. Catharines	January 20, 2025
	010305475-001	3-029	Niagara/St. Catharines	January 20, 2025
	010305476-001	3-029	Niagara/St. Catharines	January 20, 2025
	010305480-001	3-030	London/Woodstock/St. T.	January 20, 2025
	010305481-001	3-030	London/Woodstock/St. T.	January 20, 2025
	010305483-001	3-032	Windsor/Leamington	January 20, 2025
	010305484-001	3-032	Windsor/Leamington	January 20, 2025
	010305485-001	3-032	Windsor/Leamington	January 20, 2025
	010305486-001	3-032	Windsor/Leamington	January 20, 2025
	010305487-001	3-039	Winnipeg	January 20, 2025
	010305488-001	3-039	Winnipeg	January 20, 2025
	010305489-001	3-047	Calgary	January 20, 2025
	010305490-001	3-047	Calgary	January 20, 2025
	010305491-001	3-048	Red Deer	January 20, 2025
	010305492-001	3-048	Red Deer	January 20, 2025
	010305493-001	3-048	Red Deer	January 20, 2025
	010305495-001	3-051	Okanagan/Columbia	January 20, 2025
	010305496-001	3-051	Okanagan/Columbia	January 20, 2025
	010305497-001	3-051	Okanagan/Columbia	January 20, 2025
	010305498-001	3-053	Victoria	January 20, 2025