



TELUS COMMUNICATIONS INC.

Comments for

**ADDENDUM to the CONSULTATION on RELEASING
MILLIMETRE WAVE SPECTRUM to SUPPORT 5G**

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Spectrum Management and Telecommunications

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Table of Contents

Executive Summary	3
mmWave spectrum is fundamental to delivering 5G to Canadians	4
TELUS' Comments on Specific Questions Posed by the Department	7
Flexible Use in the 26 GHz Band	7
A1: Flexible Use Licensing for the 26 GHz Band	7
A2: Changes to Spectrum Utilisation Policies	8
A3: Harmonisation of Band Plan	9
A4: Minimum Block Size	11
Band Sharing with Other Services	12
A5: Inter Satellite Service (ISS).....	12
Earth Exploration Satellite Service (EESS) and Space Research Service (SRS).....	13
A6: Coordination Requirements and Triggers	13
A7: Geographic Restrictions on EESS/SRS Earth Stations	15
Fixed Satellite Service (FSS)	17
A8/A9: Coordination Requirements & Triggers and Geographic Restrictions on FSS Earth Stations	17
A10: Aggregate Emissions.....	19
A11: Licensing Considerations	20
Licensing Priority	20
Geographic Tiering of mmWave Spectrum Licences	21
Exclusive Licensing.....	21
Deployment Requirements	22
Competitive Measures	22

Executive Summary

1. TELUS appreciates the opportunity to comment on the *Addendum to the Consultation on Releasing Millimetre Wave Spectrum to Support 5G* (the Addendum). Given the transformational impact that 5G will have on every Canadian and Canadian business, we are pleased to see continued industry consultation on the expansion and accelerated release of 5G spectrum.
2. TELUS strongly supports the commitment to innovation demonstrated by Innovation, Science and Economic Development Canada (the Department) in releasing this consultation and we firmly believe that the addition of the 26 GHz band to the mmWave spectrum already under consideration through the *Consultation on Releasing Millimetre Wave Spectrum to Support 5G* (the mmWave Consultation)¹ is the right thing to do for Canadians and will further support and enable the Government's Innovation Agenda.
3. Globally, the race to 5G is accelerating with countries all over the world quickly releasing spectrum and taking innovative approaches to streamline regulation² to best position their jurisdictions for success. For Canada to maintain and grow its global leadership position both as an innovation hub and as a “global 4G superpower”³, the Department must continue to take steps like this to make ample 5G spectrum available.
4. As TELUS outlined in its response to the 2018-2022 Spectrum Outlook Consultation, 5G will completely revolutionise Canadian society both on a macro and micro level. Through the gigabit speed, scale, ultra-reliability and low latency of 5G, Canadians will soon have access to transformational applications like smart cities, autonomous vehicles, innovative healthcare, enhanced emergency services and the Internet of Things (IoT) in addition to

¹ *Consultation on Releasing Millimetre Wave Spectrum to Support 5G*, Canada Gazette SLPB-001-17, June 2017.
Link: <https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf11298.html>

² <https://www.fcc.gov/5G>

³ <https://opensignal.com/reports/2018/02/canada/state-of-the-mobile-network>

other innovative applications that are currently under development.⁴ This 5G future can only be achieved, however, through the expansion and expedited release of 5G spectrum.

5. The exponential leap in technological capabilities from 4G LTE to 5G has been described in numerous ways, most recently as moving from a black and white television to a colour television⁵. With this in mind it is important to underscore that 5G is a green-field opportunity and it cannot be viewed, or regulated, the same way 4G has traditionally been. Specifically, 5G will demand new innovative ways of approaching regulation and the accelerated release of various spectrum bands in large, contiguous blocks. Considering that mmWave is one part of the larger 5G spectrum ecosystem, TELUS believes that mmWave spectrum must be auctioned off immediately following the auction of 3.5 GHz spectrum and that any delay in either auction will put Canada and Canadians at a disadvantage on the global stage. For all of these reasons, TELUS strongly supports the direction the Department has taken in this consultation.

mmWave spectrum is fundamental to delivering 5G to Canadians

6. As outlined above, TELUS fully supports the introduction of flexible use licensing to the 26 GHz band because of the important impact 5G will have on Canadians, the Canadian economy, and Canadian society as a whole. Specifically, the Department's proposal that flexible use be given priority over satellite systems in this band, in a way that poses minimal constraints on the deployment of fixed and mobile service systems, is key to facilitating the emergence of 5G in Canada.
7. Furthermore, TELUS is generally a strong proponent of spectrum harmonisation with the United States, which has long played an important role in ensuring Canadians benefit from the technology ecosystems created by our neighbours to the south as well as facilitating cross border coordination along the longest two-country border in the world. This is especially true for bands that are attracting global interest such as the 26 GHz and the 28

⁴ TELUS comments for *Consultation on the Spectrum Outlook 2018 to 2022*, executive summary, February 16, 2018. Link: [https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/SLPB-006-17-TELUS-CR.pdf/\\$file/SLPB-006-17-TELUS-CR.pdf](https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/SLPB-006-17-TELUS-CR.pdf/$file/SLPB-006-17-TELUS-CR.pdf)

⁵ T-Mobile press release, April 29th, 2018 ("Going from 4G to 5G is like going from black and white to color TV. It's a seismic shift ...") <https://www.t-mobile.com/news/5gforall>

GHz bands; however, making changes or small deviations from FCC policies would allow the Department to adapt local regulations to the Canadian market without losing the benefits of harmonisation. TELUS therefore believes that the interests of Canadians are best served if the 26 GHz and 28 GHz bands are licensed in large blocks of contiguous spectrum that licensees can combine to aggregate ideally up to 1 GHz or more to achieve the IMT-2020 target of 20 Gbps.

8. TELUS also agrees with the Department's decision not to propose any limits on the aggregate power levels of flexible use terrestrial systems to ensure coexistence with ISS. This is important considering there are no Canadian satellites licensed for the ISS service, and the design characteristics of flexible use 5G systems are unlikely to pose a threat to potential ISS operations.
9. Site-by-site coordination and approval of any potential new EESS and SRS earth stations in the 26.5-27.0 GHz frequency range should be managed using similar processes to those proposed for FSS earth stations operating in the space-to-earth direction in the 37-40 GHz band.
10. Establishing a policy restricting the geographic areas in which new earth stations (FSS, EESS or SRS) operating in mmWave bands are allowed to be sited is necessary to deliver world class 5G service. TELUS recommends that the geographic restriction policy TELUS proposed in response to Question 6-5 of the mmWave Consultation should apply to earth station applications in the 26 GHz band to best enable 5G.
11. TELUS submits that its proposed site-by-site coordination process for earth-to-space FSS stations operating in the 27.5-28.35 GHz frequency range submitted in response to Question 6-4 of the mmWave Consultation should be applied to potential future FSS earth station applications seeking to operate in the 27.0-27.5 GHz band. TELUS also supports the Department's position not to propose any limits on the aggregate power levels produced by flexible use systems operating in the upper portion of the 26 GHz band because such limits are unnecessary to ensure coexistence with FSS space stations.

12. The addition of the 26 GHz band to the consultation process through this Addendum does not generate, in TELUS' view, any new considerations with respect to the licensing of flexible use mmWave spectrum. TELUS recommends that the Department issue spectrum licences using service areas for competitive licensing for the band and believes that any other type of licensing mechanism (for example, site licences or grid licences) would impair the deployment of 5G services in Canada.
13. TELUS submits that the combined 26 GHz and 28 GHz band is to become the most critical flexible use mmWave launch band given its propagation characteristics and expected early global adoption as supported by 3GPP band class n257. As such these bands should be auctioned as soon as possible after the 3.5 GHz auction. The 37-40 GHz band should be auctioned at the same time as the 26 GHz and 28 GHz bands. Bidders must be afforded the opportunity through the price discovery process to decide whether their business case is best supported through spectrum in one band or another or some combination of the bands.
14. The 5G mmWave network business opportunity is completely green-field and must be viewed that way by the Department. No operator has flexible use mmWave spectrum in Canada meaning no parties can be characterised as incumbents. The investment in new 5G networks carries equal market risk for all participants. TELUS recommends that the Department consider a light handed regulatory approach in the upcoming auctions. The Department should set conditions of licence that attract bidders who can make the necessary and sustained capital investments in substantive networks and that will not warehouse and/or solicit additional subsidies and privileges before commercialising valuable 5G mmWave spectrum to serve Canadians. Should the Department deem competitive measures in some form to be necessary for the 26, 28 and 37-40 GHz bands, TELUS would only support a large non-band-specific aggregation limit that is operator neutral however TELUS firmly believes that Canadians are best served by an auction with no competitive measures.

TELUS' Comments on Specific Questions Posed by the Department

Flexible Use in the 26 GHz Band

A1: Flexible Use Licensing for the 26 GHz Band

A1: ISED is seeking comments on the development of a flexible use licensing model for fixed and mobile services in the 26 GHz band (in addition to the bands currently under consultation through the mmWave Consultation), taking into account the timing of WRC-19, 5G technology standards development, international ecosystems and harmonization of spectrum use with other countries.

15. TELUS fully supports the Department's proposal to release the 26 GHz band for flexible use licensing in addition to the bands which have already been addressed through the mmWave Consultation initiated in 2017.
16. In its comments and reply comments to the Department's *Consultation on the Spectrum Outlook 2018 to 2022* (the "Spectrum Outlook Consultation")⁶, TELUS commented on seven mmWave bands addressed in the consultation and assigned priorities for the release of each of these bands in response to Question Q-20 of the Spectrum Outlook Consultation.
17. Among the mmWave bands covered in the Spectrum Outlook Consultation, the band 24.25-27.5 GHz, which includes the 26 GHz band discussed in this Addendum, received TELUS' highest assigned priority by virtue of its inclusion in the list of mmWave bands addressed in WRC-19 (World Radiocommunication Conference 2019) Agenda Item 1.13, and because of the common interest, across multiple jurisdictions in establishing an IMT identification of the band – in whole or in part – for the deployment of 5G services.

⁶ *Consultation on the Spectrum Outlook 2018 to 2022*, Canada Gazette SLPB-006-17, October 2017. Link: <http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf11333.html>

18. For example, in its November 2016 study on spectrum suitability for 5G⁷, the European Commission's Radio Spectrum Policy Group (RSPG) recommended the 24.25-27.5 GHz frequency range as its 5G pioneer band in the mmWave range.
19. As recently as June 8th, 2018, the FCC, through the release of FCC 18-73 Third Further Notice of Proposed Rulemaking⁸, is proposing to make the 26 GHz band available for flexible use.
20. As stated by the Department in Paragraph 4 of this Addendum, 3GPP currently supports two band classes for the 26 GHz band. South Korea has already completed an auction of 26 GHz and 28 GHz band spectrum in June 2018 releasing 2400 MHz of contiguous spectrum from 26.5 GHz – 28.9 GHz in 100 MHz blocks. Nations such as China and Japan have also shown significant interest in releasing this band. Various pilot projects have already taken place or are currently underway and deployment of 5G commercial networks and systems is expected to begin in 2019.
21. Given the considerations above, TELUS strongly supports this Addendum proposing to add the 26 GHz band to the other mmWave bands currently considered for release to support 5G in Canada under the recent and still open mmWave Consultation.

A2: Changes to Spectrum Utilisation Policies

A2: ISED is seeking comments on the changes proposed above to introduce flexible use licensing in the 26 GHz band, including the ensuing changes to the CTFA Canadian 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*](#).

22. TELUS fully supports the introduction of flexible use licensing in the 26 GHz band.

⁷ European Commission Radio Spectrum Policy Group, *Strategic Roadmap Towards 5G for Europe: Opinion on spectrum related aspects for next-generation wireless systems (5G)*, published November 2016. Link: http://rspg-spectrum.eu/wp-content/uploads/2013/05/RPSG16-032-Opinion_5G.pdf

⁸ FCC 18-73 Third Further Notice of Proposed Rulemaking <https://docs.fcc.gov/public/attachments/FCC-18-73A1.pdf>

23. TELUS supports the Department's proposed changes to the CTFA domestic footnotes and to SP 3-30 GHz and views such changes as both appropriate and necessary in order to make the 26 GHz band suitable for flexible use licensing in 5G. Specifically, TELUS agrees with the proposed changes to footnote C47A (reducing the lower limit to 27.0 GHz so the upper half of the 26 GHz band is fully included and adding mobile service systems to the list of systems fixed-satellite applications will pose minimal constraints to) as well as with the addition of footnote CXX to define the interactions of EESS and SRS with fixed and mobile service systems in the lower half of the 26 GHz band.
24. TELUS notes and appreciates the fact that both footnotes restrict satellite service systems in the 26 GHz band to applications that will pose minimal constraints to the deployment of fixed service systems and mobile service systems.
25. TELUS believes that the fact that there is only one EESS satellite licence issued to Telesat for the operation of the Polarsat satellite in the Arctic region and no licence issued under any other service in the 26 GHz band as stated in Paragraphs 12 and 13 of the Addendum mean that the changes proposed by the Department to the spectrum utilisation policies in the 26 GHz band will have minimal impact on existing users.
26. TELUS supports the Department in initiating a consultation to discontinue the certification, manufacturing and sale of vehicular radars in the 22-29 GHz band as this will certainly minimise the interference experienced by 5G systems operating in the 26 or 28 GHz band while allowing vehicular radar system manufacturers to follow industry trends and take advantage of the technical benefits of operating in the 76-81 GHz band instead.

A3: Harmonisation of Band Plan

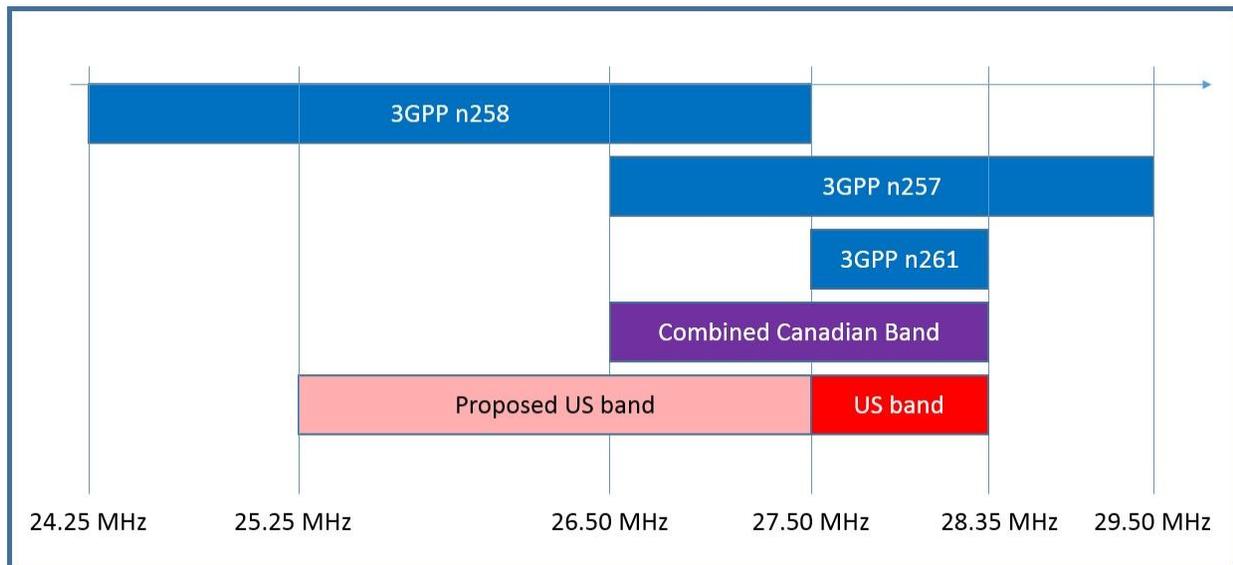
A3: ISED is seeking comments on the importance of harmonizing the Canadian band plan with the United States in the 26 GHz and 28 GHz bands, recognizing that the 26 GHz band is not available for 5G services in the United States at this time.

27. TELUS agrees with the Department that if the 26 GHz band is to be made available for flexible use in Canada, that the entire 1.85 GHz of contiguous spectrum across both the 26

and 28 GHz bands be reviewed and considered as a whole (as supported by 3GPP band class n257).

28. TELUS also notes that on June 8th, 2018, a few days after the Department released this Addendum, the FCC issued document FCC 18-73 Third Further Notice of Proposed Rulemaking (NPRM)⁹, seeking comments on a proposal to make the 26 GHz band (25.25-27.5 GHz) available for flexible use in the U.S, including the associated band plan and licensing framework.
29. While the FCC’s proposed 26 GHz band has a wider bandwidth than that proposed by the Department (it is 1250 MHz wider), TELUS notes that the FCC does not seem concerned about reviewing the 26 GHz and 28 GHz bands as a whole and that based on comments sought by the Commission, the licensing framework for both bands could end up containing significant differences, including different geographic licence areas.

Chart 1: 26 GHz and 28 GHz Bands and Supporting 3GPP 5G Band Classes



30. In the absence of any certainty over the band plan to be adopted by the FCC for the 26 GHz band, TELUS believes that the Department should ensure in its determination of the band

⁹ FCC 18-73 Third Further Notice of Proposed Rulemaking <https://docs.fcc.gov/public/attachments/FCC-18-73A1.pdf>

plans for the 26 GHz and 28 GHz bands in Canada that a block edge falls precisely on 27.5 GHz, as this frequency delimits the lower edge of the 28 GHz band in the US.

A4: Minimum Block Size

A4: ISED is seeking comments on the minimum block size that should be made available for the 26.5–28.35 GHz band. Is it necessary that the frequency blocks be multiples of the 3GPP channel bandwidths (50 MHz, 100 MHz, 200 MHz and 400 MHz)?

31. As per its comments in Section 6-3 of the Department’s mmWave Consultation referring to the proposed band plan for the 28 GHz band, TELUS reiterates its support for band plans including large contiguous channel bandwidths as the enabler of new 5G use cases. For example, 3GPP’s 5G Phase 1 development implements carrier bandwidths of up to 400 MHz (as stated by the Department in Paragraph 18 of the Addendum) with the possibility of aggregating up to 1 GHz¹⁰ to achieve the target of 20 Gbps peak downlink throughput defined by ITU-R in its M.2410-0 Report, *Minimum requirements related to technical performance for IMT-2020 radio interface(s)*¹¹.
32. TELUS notes that in its NPRM proposing the release of the 26 GHz band, the FCC is seeking comments on whether its band plan should include 100 MHz or 200 MHz blocks. TELUS recommends that achieving the IMT-2020 target of 20 Gbps can be most efficiently accomplished by releasing large blocks of contiguous spectrum (at a minimum of 50 MHz) that licensees can combine to aggregate ideally up to 1 GHz or more.
33. In conclusion, TELUS proposes that the frequency block size(s) must be selected as multiples of the supported 3GPP channel bandwidths (50 MHz, 100 MHz, 200 MHz and 400 MHz), with a preference for larger contiguous allocations that facilitate achievement of the ambitious IMT-2020 data rate targets.

¹⁰ 3GPP TR 38.802 v14.1.0, *Study on New Radio Access Technology Physical Layer Aspects*, June 2017. http://www.3gpp.org/ftp/Specs/archive/38_series/38.802/38802-e10.zip

¹¹ Report ITU-R M.2410-0, *Minimum requirements related to technical performance for IMT-2020 radio interface(s)*, November 2017. <https://www.itu.int/pub/R-REP-M.2410-2017>

Band Sharing with Other Services

A5: Inter Satellite Service (ISS)

A5:

- A. ISED is seeking comments on whether it should impose any limits on the aggregate emissions of the terrestrial services in the 26.5–27.5 GHz band to ensure coexistence with ISS.
- B. If limits are proposed, ISED is inviting detailed proposals on what the limits should be, and why they should be implemented.

- 34. TELUS agrees with the statement made by the Department in Paragraph 20 of the Addendum to the effect that it is expected that 5G technologies considered for mmWave bands will employ dynamic beam forming with very narrow beam widths, which will lessen the potential interference to ISS. In fact, TELUS made similar comments in response to Question 6-6 of the mmWave Consultation and agrees with the Department's proposal to not introduce any limits on the aggregate power levels of flexible use terrestrial systems to ensure coexistence with ISS.
- 35. Given that there is no Canadian satellite system licensed for the ISS service to date, and based on the Department's proposed changes to both SP 3-30 GHz¹² and the relevant CTFA footnotes (establishing the priority of fixed and mobile services systems over satellite service and research systems and limiting satellite implementation in the 26 GHz band to applications that will pose minimal constraints upon the deployment of fixed and mobile service systems), TELUS concludes that there is no need for the Department to impose any limits on the terrestrial services in the 26.5–27.5 GHz band to ensure coexistence with potential future inter-satellite service.

¹² *Revisions to Spectrum Utilisation policies in the 3-30GHz Frequency Range and Further Consultation*, Canada Gazette DGTP-008-04, October 2004. Link: <http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf05617.html>

Earth Exploration Satellite Service (EESS) and Space Research Service (SRS)

A6: Coordination Requirements and Triggers

A6:

- A. ISED is seeking comments on the proposal to require site-by-site coordination between proposed flexible use terrestrial stations and EESS/SRS earth stations in the 26.5–27.0 GHz band when a pre-determined trigger threshold is exceeded.
 - B. If the proposed site-by-site coordination is supported, what coordination trigger and value would be the most appropriate (e.g. power flux density or distance threshold)?
 - C. ISED is also inviting proposals for specific additional technical rules for flexible use terrestrial stations and EESS/SRS earth stations (e.g. site shielding) that could facilitate more efficient sharing between terrestrial and earth stations.
36. Understanding that the current EESS and SRS allocations in 26.5-27.0 GHz allow for communications in the space-to-earth direction, TELUS believes that site-by-site coordination considerations and geographic restrictions should be the same as those proposed by TELUS in response to the mmWave consultation for FSS earth stations in the 37.5-40 GHz range, as the allocation for satellite use in that frequency range is also space-to-earth.
37. In its reply comments to Question 7-4 of the mmWave Consultation, TELUS submitted that specific coordination based on a PFD threshold cannot be recommended at this time for FSS earth stations operating in the space-to-earth direction over the 37.5-40 GHz range due in part to the absence of any Canadian FSS deployments in this band as noted by the Department at Paragraph 56 of the mmWave Consultation.
38. Similarly, given that no EESS or SRS earth station has been licensed or deployed in Canada to date, as highlighted by the Department at Paragraphs 12 and 13 of the Addendum, TELUS again submits that specific coordination based on a PFD threshold cannot be recommended at this time for EESS or SRS earth stations operating in the space-to-earth direction over the 26.5-27.0 GHz range.
39. In Attachment 1 to Annex 3 of Task Group 5/1 Chairman's Report on '*Sharing and compatibility of EESS/SRS and IMT operating in the 24.25-27.5 GHz frequency range*'¹³

¹³ Source: Document 5-1/TEMP/108(Rev.1), Attachment 1 to Annex 3 to Document 5-1/406-E, 17 May 2018

released in May 2018, the ITU-R Study group shares the result of six different compatibility studies between EESS/SRS and 5G systems. The results vary widely from one study to the other, depending on the assumptions and methodology used and the protection sought. They also contain several limitations such as validity only for the specific earth stations under study or applicable to specific scenarios. TELUS submits that although the ITU-R is making progress on the matter, the results presented by Task Group 5/1 to date do not yet allow for the establishment of proper protection criteria, PFD or distance based, for site-by-site coordination.

40. Flexible use terrestrial stations in the 26.5-27.0 GHz range would act as potential interferers to new EESS/SRS earth stations that could be licensed in the band. Therefore, coordination requirements should apply in the consideration for new deployments of EESS/SRS earth stations in proximity to existing or planned flexible use terrestrial stations. EESS/SRS licensees requesting earth station siting in areas of planned or likely future flexible use terrestrial station deployments would not be approved under TELUS' geographic restriction policy proposed in response to Question 7-5 (and by extension Question 6-5) of the mmWave Consultation.
41. However, for potential new EESS/SRS station sitings granted approval (by successfully passing the three filters of TELUS' proposed geographic restriction policy), flexible use terrestrial stations would be excluded from the satellite earth station licensee's protection zone (unless granted consent to operate within it).
42. As a precursor to facilitating coordination between flexible use terrestrial stations and EESS/SRS earth stations in the 26.5-27.0 GHz band, TELUS recommends that the Department require EESS/SRS earth station licensees to submit their technical site data as part of the approval process, including specifications for their requested protection zones, and publish this data and any associated maps on the Department's website. Furthermore, any subsequently proposed modifications to approved protection zones should be subject to reassessment under TELUS' proposed geographic restriction requirements as if it was a new application.

A7: Geographic Restrictions on EESS/SRS Earth Stations

A7:

- A. ISED is seeking comments on whether there should be restrictions on the geographic areas in which new EESS and SRS earth stations can be deployed in the 26.5–27.0 GHz band.
- B. If geographic restrictions on EESS and SRS earth stations are proposed, ISED is inviting detailed proposals on how they could be implemented, and what areas should be targeted.

- 43. TELUS maintains the view that establishing a policy restricting the geographic areas in which new earth stations (FSS, EESS or SRS) operating in mmWave bands considered for flexible use licensing under the mmWave Consultation or this Addendum to the mmWave Consultation is an essential step in transitioning the bands to flexible use licensing for 5G.
- 44. Future satellite licensees may be the victim of interference from terrestrial flexible use licensees, who are proposed as priority in the band, if sited in proximity to flexible use terrestrial stations. Geographic restrictions should be applied to FSS, EESS or SRS earth station sitings to ensure that their presence does not constrain 5G deployment in areas where, in the long term, 5G is likely to be deployed. TELUS notes that once a space-to-earth earth station siting request is approved; a protection zone would be defined for requiring coordination from flexible use stations in its proximity.
- 45. TELUS suggests that the satellite industry be encouraged to use frequencies outside of the mmWave bands (where flexible use licensing will be approved for the deployment of 5G services) for new earth stations that they would like to site in areas subject to potential interference from the ongoing long-term deployment of terrestrial 5G services. Applications for new earth stations in mmWave bands to be designated for flexible use should only be approved when these earth stations can be sited away from existing and planned terrestrial mobile network deployments.
- 46. TELUS therefore recommends that the same three geographic restriction filters (as detailed in TELUS' response to Question 6-5 of the mmWave Consultation) apply in qualifying EESS/SRS earth station sites in the 26.5-27.0 GHz range. TELUS supports the notion that outside of the restricted areas EESS/SRS licensees should be allowed to define a protection zone for their earth stations.

47. In contrast to the 28 GHz band, where satellite operation is earth-to-space and the interference contour associated with an FSS earth station is a measurable quantity, the notion of a “protection zone” for the 26.5-27.0 GHz band is subject to the specific requirements of each EESS/SRS earth station. As such, TELUS proposes a set of guidelines for the definition of protection zones in the 26.5-27.0 GHz band:
- a. Applications for earth stations in the 26.5-27.0 GHz band must define a protection zone, specifying the area in which the earth station will require protection from transmissions of terrestrial flexible use licensees.
 - b. The earth station applicant shall demonstrate in its application, using reasonable engineering methods, that the requested protection zone is the minimum area necessary to protect its proposed earth station from terrestrial flexible use transmissions.
 - c. The protection zone may not overlap areas defined as exclusions under the geographic restriction filters described in TELUS’ response to Question 6-5 of the mmWave Consultation.

Terrestrial flexible use licensees who wish to locate new facilities within the protection zone must receive consent from the earth station licensee prior to operation.

Fixed Satellite Service (FSS)

A8/A9: Coordination Requirements & Triggers and Geographic Restrictions on FSS Earth Stations

A8:

- A. ISED is seeking comments on the proposal to require site-by-site coordination between proposed flexible use terrestrial stations and EESS/SRS earth stations in the 26.5–27.0 GHz band when a pre-determined trigger threshold is exceeded.
- B. If the proposed site-by-site coordination is supported, what coordination trigger and value would be the most appropriate (e.g. power flux density or distance threshold)?
- C. ISED is also inviting proposals for specific additional technical rules for flexible use terrestrial stations and EESS/SRS earth stations (e.g. site shielding) that could facilitate more efficient sharing between terrestrial and earth stations.

A9:

- A. ISED is seeking comments on whether there should be restrictions on the geographic areas in which new FSS earth stations can be deployed in the 27.0–28.35 GHz band.
- B. If geographic restrictions on FSS earth stations are proposed, ISED is inviting detailed proposals on how they could be implemented, and what areas should be targeted.

48. In its comments and reply comments filings to the mmWave Consultation (Questions 6-4 and 6-5), TELUS submitted a detailed methodology on how to implement site-by-site coordination establishing a power flux density contour of $-77.6 \text{ dBm/m}^2/\text{MHz}$ (at a prescribed height and distance from the earth station) for new FSS earth station applications, subject to a geographic restriction policy consisting of three filters posing conditions that new applications should meet in order to be approved by the Department. The three conditions of the geographic restriction policy proposed by TELUS were designed to ensure prospective new FSS earth stations would not be allowed in areas with a population density of more than 100 people per square kilometer, close to existing mobile network sites operating technology at frequencies above 1 GHz or in areas of high transient populations such as transportation hubs including but not limited to railway stations, airports, and cruise ship ports, highways, mass transit routes as well as major event venues and resorts.

49. In Attachment 3 to Annex 3 of Task Group 5/1 Chairman's Report on '*Sharing and compatibility of FSS and IMT operating in the 24.25-27.5 GHz frequency range*'¹⁴ released in May 2018, the ITU-R Study group shared the result of fourteen different compatibility studies between FSS and 5G systems. TELUS notes that those studies considering interference between FSS earth stations and 5G systems concluded there is a need for a separation distance varying from less than 100 m up to about 10 km between the FSS earth station and the 5G stations deployed, which is consistent with the geographic restriction policy proposed by TELUS in response to Question 6-5 of the mmWave Consultation.
50. TELUS notes that questions A8 and A9 of this Addendum involve lowering the lower limit of the frequency band under consideration for site-by-site coordination and geographic area restrictions from 27.5 GHz down to 27.0 GHz as FSS services are authorised in the upper half of the 26 GHz band.
51. As stated by the Department in Paragraph 13 of the Addendum, there is no FSS service (space or earth station) licensed in the 26 GHz band in Canada. Furthermore, the changes proposed by the department to the CTFA C47A footnote establish the priority of fixed and mobile service systems over fixed satellite services systems and limit new FSS implementations to applications that will pose minimal constraints upon the deployment of fixed and mobile service systems.
52. As such, TELUS submits that the power density threshold discussed in its response to Section 6-4 of the mmWave Consultation along with the geographic restriction policy proposed in its response to Section 6.5 should govern new FSS earth station licence applications for both the 27.0-27.5 GHz and the 27.5-28.35 GHz frequency bands.

¹⁴ Source: Document 5-1/TEMP/108(Rov.1), Attachment 3 to Annex 3 to Document 5-1/406-E, 17 May 2018

A10: Aggregate Emissions

A10:

- A. ISED is seeking comments on whether it should impose any limits on the aggregate emissions of the terrestrial services in the 27.0–28.35 GHz band to ensure coexistence with FSS space stations.
- B. If limits are proposed, ISED is inviting detailed proposals on why they should be implemented, and what the limits should be.

- 53. TELUS agrees with the statement made by the Department at Paragraph 37 of the mmWave Consultation to the effect that it is expected that 5G technologies contemplated for the 28 GHz band (and by extension to the 26 GHz band or mmWave frequencies in general) will tend to limit transmissions towards the space stations, and that 5G base stations and user terminals will likely employ dynamic beam forming with very narrow beam widths, which would reduce the chance of pointing directly toward satellite receivers.
- 54. TELUS notes that the FCC, in FCC 17-152 Order on Reconsideration¹⁵, released on November 22nd, 2017, rejected requests from FSS providers to limit the aggregate skyward transmissions of Upper Microwave Flexible Use Service providers (UMFUS) in the 28 GHz band in part due to the expectation that *‘the systems contemplated for these bands have characteristics that would tend to limit skyward transmissions’*.
- 55. TELUS also notes, as pointed out by the Department in Paragraph 13 of the Addendum, that there is no FSS service in Canada operating in the 26 GHz band.
- 56. As stated in its response to Question 6-6 of the mmWave Consultation, TELUS agreed with the Department to the effect that given the operational characteristics of both the new flexible use systems and satellite stations, harmful interference due to aggregate interference from flexible use services to space stations is not likely, and TELUS supported the Department’s position not to propose any limits on the aggregate power levels produced by flexible use systems.

¹⁵ FCC 17-152 Order on Reconsideration https://docs.fcc.gov/public/attachments/FCC-17-152A1_Rcd.pdf

57. TELUS' reply expanded on the technical concept and provided further arguments to support the Department's position.
58. The fact that the technical characteristics of flexible use systems to be deployed in the 26 GHz and the 28 GHz bands will be similar, that this Question A10 solely relates to changing the lower limit of the spectrum band under consideration in Question 6-6 of the mmWave Consultation from 27.5 GHz down to 27.0 GHz and that there is no FSS service in Canada to date operating in the 26 GHz band, TELUS extends its original position stated in its response to the mmWave Consultation to the 27.0-27.5 GHz band and submits that the Department should not impose any limits on the aggregate emissions of terrestrial services in the 27.0-27.5 GHz band or on the 27.5–28.35 GHz band to ensure coexistence with FSS space stations.

A11: Licensing Considerations

A11:

- A. Further to section 9 of the mmWave Consultation, are there any new considerations or suggested approaches regarding the licensing of flexible use mmWave spectrum, given the addition of the 26 GHz band?
- B. ISED is also seeking comments on licensing considerations in the 26 GHz and 28 GHz bands that would encourage innovative use cases while also supporting competition for existing mobile network services.

59. TELUS does not believe the addition of the 26 GHz band to the consultation process through this addendum has generated any new considerations with respect to the licensing of flexible use mmWave spectrum. TELUS has the following recommendations for the licensing of flexible use mmWave spectrum, given the addition of the 26 GHz band.

Licensing Priority

60. TELUS submits that the combined 26 GHz and 28 GHz band is to become the most critical flexible use mmWave launch band given its propagation characteristics and expected early global adoption as supported by 3GPP band class n257. (See Chart 1 in TELUS' response to Question A3.) As such, these bands should be auctioned as soon as possible after the 3500 MHz auction. The 37-40 GHz band should be auctioned at the same time as the 26 GHz and 28 GHz bands. Bidders must be afforded the opportunity through the price

discovery process to decide whether their business case is best supported through acquiring spectrum in one band or another or some combination of the bands.

Geographic Tiering of mmWave Spectrum Licences

61. TELUS recommends issuing spectrum licences using service areas for competitive licensing. Given the ultra-dense deployment of sites anticipated for 5G mmWave networks, a licensing approach based on radio licences would be inappropriate due to the heavy administrative burden associated with coordination. Given that the demand for mmWave spectrum in the 26 GHz, 28 GHz and 37-40 GHz bands is expected to be high, TELUS views the use of service areas for competitive licensing in an auction process with price discovery as the only practical approach to assign the spectrum.

Exclusive Licensing

62. In TELUS' view, because flexible use deployments require a high degree of coordination between fixed and mobile services, they are only feasible with an exclusive licence under one licensee per block.
63. TELUS considers this spectrum too important and too limited in quantity to allow any kind of shared licensing mechanism to disrupt or impair the deployment of 5G services and therefore opposes the implementation of an all-come, all-served licensing approach for a small portion of the combined 26 GHz and 28 GHz band. TELUS suggests that the Department should be able to find a small piece of spectrum outside of the prime 5G mmWave launch bands to support the type of innovation envisioned.
64. TELUS also opposes any dynamic access using databases in the 26 GHz, 28 GHz or the 37.6-40 GHz frequency ranges. Creating a unique Canadian licence-exempt dynamic access solution in any of these bands would introduce unnecessary costs and fracture the ecosystems, significantly delaying investment in 5G.
65. TELUS notes that with 14 GHz of contiguous mmWave spectrum proposed to be allocated for licence-exempt use following the mmWave Consultation, there is ample opportunity for innovators to innovate and for the Department to experiment with dynamic shared access

in the 57-64 GHz (already harmonised with the U.S per paragraph 74 of the mmWave Consultation) and 64-71 GHz frequency ranges.

Deployment Requirements

66. The Department should give careful consideration to finding deployment requirements which are not excessively onerous (given the unique propagation characteristics of the mmWave bands compared to all other commercial mobile spectrum available today), but ones which are sufficiently stringent to act as a deterrent to speculators and ensure that the spectrum is put to use in a timely manner for the benefit of Canadians.

Competitive Measures

67. TELUS cannot overstate the importance of the Department implementing an open and competitive auction process in assigning the 26 GHz, 28 GHz and 37-40 GHz spectrum bands to maximise spectrum utilisation by relying on market forces. TELUS does not believe that an open and competitive auction process attracts speculators that aim to opportunistically profit by acquiring spectrum with an intention only to sell the spectrum at a higher price rather than to deploy (with the result being Canadians not being adequately compensated for a public resource and spectrum remaining fallow in Canada), as open auctions create efficient outcomes that reflect market value. TELUS suggests that any concerns about spectrum speculation could be further mitigated through the careful selection of appropriate deployment requirements, which TELUS believes will be an important issue in the upcoming licensing framework consultation.
68. The 5G mmWave network business opportunity is completely green-field and all interested parties are starting from scratch in terms of flexible use mmWave spectrum in Canada, meaning that there are no parties that can be characterised as incumbents. The investment in new 5G networks carries equal market risk for all participants. TELUS recommends that the Department consider a light handed regulatory approach in the upcoming auctions. The Department should set conditions of licence that attract bidders who can make the necessary and sustained capital investments in substantive networks and that will not warehouse and/or solicit additional subsidies and privileges before commercialising valuable 5G mmWave spectrum to serve Canadians.

69. Given the significant amount of mmWave spectrum available in these bands (regardless of the selection of final band plan or block size), any party with a serious interest and a strong business case will be able to acquire spectrum in these bands (or in the 37-40 GHz band which is expected to be released in the same licensing process). An open and competitive auction would ensure that fair market prices are paid for all spectrum across the country without the unintended market distortions or subsidies that serve to enrich speculators.
70. Should the Department deem competitive measures in some form to be necessary for the 26 GHz, 28 GHz and 37-40 GHz bands, TELUS would only support a large non-band-specific aggregation limit that is operator neutral.
71. By making a mmWave aggregation limit non-band-specific, the Department would enable bidders to pick both the appropriate band(s) and the amount of spectrum in each required to deliver a variety of 5G mmWave services according to their business needs. In contrast, a band-specific aggregation limit could introduce spectrum portfolio fragmentation and network deployment inefficiencies which would impose additional costs on licensees as a result (e.g., requiring two radios for their mmWave deployments).
72. By making an aggregation limit operator neutral, in other words, “one-size-fits-all”, the Department eliminates the risk of an overconcentration of spectrum without picking winners and losers in this green-field opportunity.
73. If the Department chooses to introduce an aggregation limit for mmWave spectrum, it must account for the large bandwidth and contiguity requirements for 5G mmWave applications (e.g., the 20 Gbps peak downlink targets for IMT-2020 referenced in our response to Question A4 requiring the aggregation of 1 GHz or more).
74. TELUS proposes that the Department implement an open and competitive auction or, if deemed necessary, apply minimally restrictive competitive measures (via a non-band-specific and operator-neutral aggregation limit) to the 26 GHz, 28 GHz and 37-40 GHz spectrum bands. The Department must avoid creating artificial limitations on the competitive marketplace that subsidise well-capitalised regional players at the expense of Canadian taxpayers. Rather, the Department should implement policy that relies on market

forces to promote Canadian investment and facilities-based competition in 5G mmWave network deployments. Finally, spectrum should be viewed as an enabler of innovation and not simply as a revenue generating tool at the eventual expense of Canadian mobile subscribers. 5G will revolutionise Canadian society and every step must be taken to position Canadians and Canadian business for success.

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