



TELUS COMMUNICATIONS INC.

Comments for

**CONSULTATION on the TECHNICAL and POLICY
FRAMEWORK for the 3650-4200 MHz BAND and
CHANGES to the FREQUENCY ALLOCATION of the
3500-3650 MHz BAND**

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Introduction

1. TELUS appreciates the opportunity to comment on the *Consultation on the Technical and Policy Framework for the 3650-4200 MHz Band and Changes to the Frequency Allocation of the 3500-3650 MHz Band* (“the Consultation”)¹.
2. TELUS notes that while ISED is consulting on its own proposal, it has also offered the opportunity to comment on an alternative proposal by Telesat. The most fundamental differences between the two proposals are the amount of spectrum to be cleared, the process through which the cleared spectrum will be licensed, and the timelines for clearance. As such, TELUS’ comments are applicable to both proposals, except where explicitly noted.

¹ *Consultation on the Technical and Policy Framework for the 3650-4200 MHz Band and Changes to the Frequency Allocation of the 3500-3650 MHz Band*, Canada Gazette SLPB-002-20, published August 2020. Link: <http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf11627.html>

Executive summary

Correcting course on Canada's 5G spectrum policy

3. Canada is very late to release 5G mid-band TDD spectrum. While many jurisdictions globally have allocated large swaths (in the order of 100 MHz) of mid-band TDD spectrum since 2018, Canada will be the last of the G7 countries to release spectrum in the 3 GHz range², which is widely acknowledged to be the prime mid-band spectrum for 5G applications. **In order to keep Canada competitive in our increasingly global economy, and connect all of Canada by 2030, ISED needs to make as much mid-band TDD spectrum as possible available, as soon as possible.**
4. In doing so, ISED must not just focus on the quantity of mid-band spectrum made available, but the quality of it as well. **Quality 5G spectrum has to be allocated in large contiguous³ blocks.**
5. Canada is already starting at a disadvantage. The 3500 MHz auction is set to start in June 2021, and the Consultation outlines that a 3800 MHz auction “would be expected to take place in 2023.” This approach would result in piecemeal licensing of the 3500 MHz and 3800 MHz bands, delivering speeds incremental to 4G instead of the full capabilities of 5G. A sequential approach to auctioning 3500 MHz and then 3800 MHz creates the potential (and high likelihood) of a very inefficient outcome, where every operator has a collection of small unconnected blocks, with each assigned in a different licensing process, which cannot be practically aggregated for the foreseeable future. We expect this

² *Global update on spectrum for 4G & 5G*, Qualcomm, September 2020; Link: <https://www.qualcomm.com/media/documents/files/spectrum-for-4g-and-5g.pdf>

³ Contiguous here refers to spectrum blocks that are connected, or right beside each other on the band. This allows for the more efficient use of spectrum, ultimately providing higher speeds and a better user experience, at a lower cost.

will require multiple base station radios to be deployed, **driving up costs, slowing down deployment, and ultimately resulting in Canadians not enjoying the full benefits of improved connectivity and 5G, especially in rural areas where the economics of 5G deployment are most challenging.**

6. However, with ISED considering a reallocation of the 3800 MHz band in this Consultation to take place before the 3500 MHz auction, Canada has the opportunity to change this path. Canada can continue to lead the world in mobile network quality and experience if – and only if – ISED modifies its plan to yield large contiguous mid-band 5G allocations for all operators, allowing them to leverage the single converging equipment ecosystem that spans both the 3500 and 3800 MHz bands.

ISED must seize the opportunity for Canada to catch up to and surpass its global peers on 5G mid-band spectrum availability and rural and remote broadband connectivity

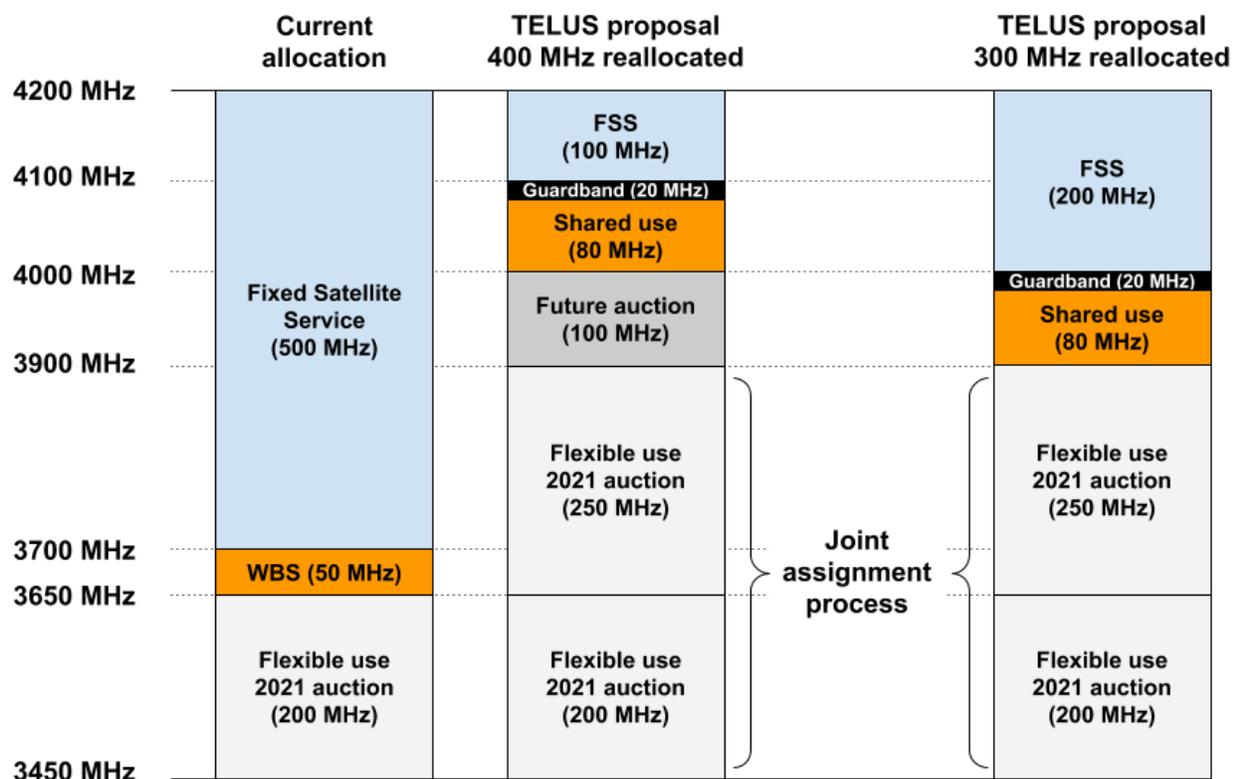
7. **Repurpose a meaningful amount of 3800 MHz spectrum for 5G use as early as possible and make it contiguous with the 3500 MHz band**
 - a. Release 250 MHz (3650-3900 MHz) of 3800 MHz spectrum in 2021 so that in combination with 3500 MHz, all operators have the opportunity to get ~100 MHz of contiguous spectrum.
 - b. Assign the frequency blocks for 3500 MHz and 3800 MHz spectrum in a joint assignment process which guarantees contiguity so as to enable access to large blocks of 5G spectrum for all operators by 2021.

- c. Displace the Wireless Broadband Service (WBS) out of 3650-3700 MHz, and transition the Fixed Satellite Service (FSS) out of 3700-3900 MHz, both in parallel with the 3500 MHz clearance timelines: by the end of 2021 for urban areas and between 2023 to 2024 for the rest of the country.
 - d. Repurpose an additional 100 MHz (3900-4000 MHz) or 200 MHz (as proposed by Telesat, 3900-4100 MHz) from FSS to flexible use, and address licensing issues in that part of the band in a future process.
- 8. Make the repurposed 250 MHz of spectrum (3650-3900 MHz) available through an open and fair process that ensures a level playing field in 5G**
- a. Implement a time-limited spectrum aggregation limit (i.e., a cap) of 100-130 MHz across the 450 MHz being made available across the 3500 MHz and 3800 MHz bands, which will ensure access to this critical spectrum for at least four operators per market.
 - b. Abandon the over-used set-aside policy. A set-aside in 3800 MHz is not necessary and the proposed range of caps provide a generous effective set-aside for regional providers.
- 9. Ensure enough mid-band spectrum is available for rural connectivity and emerging applications, today and in the future**
- a. Allocate an incremental 30 MHz of spectrum for shared use, for a total of 80 MHz (in 3900-3980 MHz if following ISED's clearance plan, or in 4000-4080 MHz if adopting Telesat's clearance plan) to facilitate the WBS transition and to provide for the growing need for shared mid-band TDD spectrum in Canada.

10. Minimise the impact to ongoing FSS operations

- a. Implement a 20 MHz guard band to protect FSS operations from terrestrial use (in 3980-4000 MHz under the ISED plan or 4080-4100 MHz under the Telesat plan).
- b. Maintain FSS operations across the entire 3700-4200 MHz band in remote areas where C-band satellite services are truly needed to support connectivity, and where their continued operation does not constrain 5G deployment.
- c. Allow ongoing operation of FSS in the top of the band (4000-4200 MHz if following ISED’s clearance plan, 4100-4200 MHz if adopting Telesat’s clearance plan) across the country to support the migration over time to other satellite-based or terrestrial services.

Figure 1: TELUS proposal for accelerated release of mid-band TDD spectrum



Other major points addressed in TELUS' response

11. The imminent release of the 3700-3980 MHz band by the FCC later this year, and plans by U.S. operators to adopt 3GPP Band n77 for this frequency range, have accelerated the creation of an ecosystem for 5G equipment that spans across Canada's entire 3500 MHz and 3800 MHz bands, with terminal devices supporting this band already today and base station radios being actively developed for the North American market.
12. Given the declining use of C-band, the accelerated transition process in the U.S., and the ongoing migration of C-band services to more capable technologies, TELUS supports the allocation of the 3700-4000 MHz band for mobile services as proposed by ISED. TELUS recommends extending this allocation to 4200 MHz to support further clearance (such as outlined in the Telesat proposal) and the potential for the implementation of a flexible use (fixed/mobile) licensing (exclusive or shared) model for the entire band.
13. TELUS further recommends the following with regards to the licensing process for spectrum in the 3650-3900 MHz frequency range:
 - a. An open and transparent auction with price discovery;
 - b. The use of unpaired 10 MHz blocks licensed on a Tier 4 basis;
 - c. Frequency assignments determined in a holistic assignment process for spectrum in 3450-3900 MHz; and
 - d. The implementation of a mid-band TDD spectrum aggregation limit.
14. With regards to the definition of "satellite-dependent areas", where ISED proposes to allow continued operation of FSS across the 3700-4200 MHz band to support remote connectivity, TELUS opposes the use of Tier 4 service areas to define satellite-dependent

areas; the use of such a coarse definition would unnecessarily constrain 5G deployments in areas that have access to terrestrial broadband connectivity today and are not dependent on C-band services. TELUS proposes to use a more granular definition that accounts for the availability of terrestrial broadband connectivity options and the expected demand for 5G services in urban, rural and suburban communities.

15. TELUS proposes to adopt a First-Come First-Served licensing model in rural areas for the proposed 80 MHz of shared spectrum (in 3900-3980 MHz if following ISED's clearance plan, or in 4000-4080 MHz if adopting Telesat's clearance plan), with strong deployment requirements and limits on the number of licensees, and with priority given to existing WBS licensees. For urban areas, TELUS recommends exclusively licensed access that will be defined in a future consultation process. Further, TELUS encourages ISED to consider a shared use model for the entire 3980-4195 MHz band (such as was introduced by Ofcom in 2019 for the 3800-4200 MHz frequency range).
16. TELUS supports all the moratorium decisions rendered by ISED in the Consultation as they will facilitate an orderly and timely transition process, and recommends extending the WBS moratorium to rural areas, so that prospective licensees bidding on spectrum in the 3650-3700 MHz band in an upcoming auction can have certainty around the encumbrances on their licences and where and when they could expect to put the spectrum to use.

17. TELUS supports the following proposed measures with some minor modifications:
- a. Restrict new FSS licensing only to the portion of the band where FSS will remain, i.e. 4000-4200 MHz (under ISED's proposed transition plan) or 4100-4200 MHz (under Telesat's plan);
 - b. Remove the FSS allocation from 3500-3650 MHz as coordination between grandfathered FSS stations and new flexible use operators is already contemplated in SRSP-520;
 - c. Eliminate the primary FSS allocation in 3500-3650 MHz as there are no remaining licensed stations in the band; unlicensed stations remaining in this band can be permitted to continue operating on a no-protection basis;
 - d. Modify existing FSS authorisations to limit operations in 3700-4000 MHz in non-satellite-dependent areas to be on a no-interference basis, and to remove the high expectation of renewal for that portion of the band;
 - e. Consolidate existing FSS gateway sites into two locations away from major population centres, to accommodate all future C-band uplink demands;
 - f. Issue interim authorisations for existing license-exempt earth stations in 3700-4200 MHz that (i) qualify under the eligibility criteria proposed by ISED in the Consultation, (ii) apply within 90 days a decision being issued for the Consultation and (iii) have responded to SAB-001-19 with their technical site data. Stations operating under these authorisations should be granted in-band protection from flexible use operations in 3700-3980 MHz (or 3700-4080 MHz) in all areas before the FSS transition deadline, and only adjacent band protection

from flexible use operations in 3700-3980 MHz (or 3700-4080 MHz) after the transition deadline;

- g. Issue interim authorisations under similar conditions for new receive-only FSS stations operating in 4000-4200 MHz (under the ISED clearance plan) or 4100-4200 MHz (under the Telesat clearance plan); and
 - h. Stop issuing new fixed point-to-point licenses in 3700-4200 MHz, and apply a “when and where necessary” displacement policy where existing fixed systems will be notified and given six months to either cease operations, or continue operating with its licence on a No-Interference, No-Protection basis.
18. TELUS proposes measures for coexistence amongst flexible use systems, and between flexible use systems and adjacent services (i.e., FSS, WBS and radionavigation), that protect those services without constraining the deployment of 5G systems in non-satellite-dependent areas.
19. The detail behind TELUS’ recommendations and TELUS’ comments in response to the various questions raised by ISED follows in the main body of this document.

TELUS' Comments on Specific Questions Posed by ISED

Q1: 3800 MHz equipment ecosystem

Q1. ISED is seeking comments on the timelines for the development of an equipment ecosystem using 5G technologies in the 3800 MHz band. In particular:

- a. the ecosystem maturity level and readiness of equipment under band classes n77 or n78 for the Canadian market
- b. the ability of existing or future base station radios to handle multiple technologies and band classes at the same time (i.e. whether all four band classes (B42, B43, n77 and n78) or a subset of these band classes are able to operate on the same base station radio) and how it may affect the adoption of 5G technologies in the 3800 MHz band

20. As TELUS noted in its response⁴ to the 3500 MHz Transition Consultation, in the early years of 5G (i.e., 2019-2020) a stronger ecosystem has developed for Band n78 compared to Band n77. Most spectrum releases supporting initial 5G launches globally in that timeframe have been focused on the 3400-3800 MHz frequency range. Further, the wider bandwidth of n77 compared to n78 made it more technically challenging to develop fully optimised radios and devices that support both bands.
21. While TELUS expected the development of the Band n77 ecosystem to lag Band n78 by a few years, adoption of Band n77 has accelerated considerably. This acceleration has been driven primarily by U.S. operators' plans to use n77 equipment for the 3700-3980 MHz band, as the band is scheduled to be auctioned later this year (December 2020) by the FCC. For example, AT&T, Verizon Wireless and T-Mobile USA have introduced 225

⁴ *Consultation on Revisions to the 3500 MHz Band to Accommodate Flexible Use and Preliminary Consultation on Changes to the 3800 MHz Band*, Canada Gazette SLPB-004-18, published June 2018. Link to consultation: <https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf11401.html>; TELUS response: [http://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/SLPB-004-18-Telus.PDF/\\$file/SLPB-004-18-Telus.PDF](http://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/SLPB-004-18-Telus.PDF/$file/SLPB-004-18-Telus.PDF)

E-UTRAN New Radio – Dual Connectivity (EN-DC) and 320 NR Carrier Aggregation combinations (545 in total) within the 3GPP Release-17 cycle⁵ so far (i.e., since June 2020).

22. The accelerated adoption of Band n77 will create a robust ecosystem for radios and devices in the 2020-2022 timeframe. As early indication of this, all global variants of the Apple⁶ iPhone 12 family of devices support Band n77, as does the upcoming Google⁷ Pixel 5.
23. While some existing early generation 5G radios and devices that support Band n78 will not support Band n77, TELUS expects that in the next several years the ecosystems for Bands n77 and n78 will converge, in a similar way that the ecosystems for 3GPP Bands 4/66 and Bands 12/17 have converged over time.

⁵ https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_89e/Docs

⁶ <https://www.apple.com/iphone/cellular/>

⁷ https://store.google.com/ca/product/pixel_5_specs

Q2: Linkages between 3500 MHz and 3800 MHz equipment ecosystems

Q2. ISED is seeking comments on the potential linkages between the equipment ecosystems using 5G technologies in the 3500 MHz and 3800 MHz bands. In particular:

- a. whether contiguity between the 3500 MHz band and 3800 MHz band is preferred given that 3GPP specifications allows for non-contiguous carrier aggregation
- b. whether there are any technical or operational impediments (e.g. equipment limitations/challenges to support aggregated use of spectrum, or requirements for additional base station radios) that would be incurred if operators have a large frequency separation between frequency blocks in one or both bands, and at what point (i.e. how wide the frequency separation) such impediments would become significant
- c. whether the equipment ecosystem deployed for the 3500 MHz band will be able to operate in the 3800 MHz band, and whether this equipment could easily be extended to 3800 MHz after being deployed

24. 5G NR was explicitly designed to take advantage of larger channel bandwidths than 4G LTE, specifically up to 100 MHz for bands below 6 GHz. While TELUS has supported the release of 3500 MHz spectrum as soon as possible to ensure Canada can catch up to our global peers, ISED must take steps to ensure large contiguous channels of ~100 MHz are available in the long term across the 3500 MHz and 3800 MHz bands so Canadians can fully benefit from 5G.
25. While carrier aggregation technology has been instrumental in making full use of Canada's fragmented mobile spectrum, there are limitations and tradeoffs to the use of this technology.
26. One such tradeoff is spectrum utilisation efficiency. For example, a single 100 MHz channel consists of 273 resource blocks, whereas a 40 MHz channel consists of 106 resource blocks and a 50 MHz channel consists of 133 resource blocks (using the same subcarrier spacing of 30 kHz). If we compare their individual spectral utilisation, we see

that a 40 MHz channel utilises around 95.4% of the channel bandwidth, a 50 MHz channel utilises 95.8%, and a 100 MHz channel utilises 98.3% of the spectrum.

27. From a terminal device perspective, carrier aggregation drives additional complexity, cost and power consumption. These considerations do impose a limit on the number of carriers that can be practically aggregated on a device, especially for battery-powered consumer devices such as smartphones.
28. Several variables impact the number of base station radios required to support multiple channels in the same band, including transmit power requirements, number of channels, and separation between the channels. Current generation radios for this frequency range support instantaneous bandwidths (IBW) of ~200 MHz; this is expected to improve as technology evolves, but it's unclear to TELUS whether IBW of over 400 MHz will be practical in the near future, which means an operator with non-contiguous holdings across the 3500 and 3800 bands may require multiple radios depending on the frequency assignment of their holdings.
29. As indicated in its response to Question 1 above, TELUS expects that in the 2021/2022 timeframe a robust ecosystem will be in place for equipment supporting both Bands n77 and n78. While earlier generations of Band n78 capable radios and user devices may not have the capability to be extended to support Band n77, this is a temporary issue vs. the long-term opportunity to make the best possible use of this critical mid-band spectrum for 5G.

Q3: Differences in technical rules between U.S. and EU ecosystems

Q3. ISED is seeking comments on how the difference in technical rules between the U.S. and EU could impact Canada's ability to leverage the economies of scale from the global 3800 MHz ecosystem. In particular:

- a. would the difference in technical rules (such as out-of-band-emission (OOBE) power limits) result in two distinct region-specific equipment ecosystems
- b. which equipment ecosystem would be more suitable in the Canadian environment (noting that Canada has, for the most part, aligned with the U.S. on low- and high-band spectrum for 5G but in the mid-band, Canada is more aligned with the EU in the 3500 MHz band (3450-3650 MHz)) and specifically, whether Canada should generally align its technical rules with the U.S. or the EU in the 3800 MHz band

30. Large differences in technical rules can create distinct region-specific equipment, as is the case with OOBE power limits for the EU equipment ecosystem today when compared to radios that will be designed to meet the U.S. 3800 MHz technical rules. TELUS reminds ISED that Canada departed from the ECC recommendation for FSS protection for base station requirements above 3650 MHz in RSS-192 (i.e., adopting the in-band block edge mask), which enabled Canada to leverage existing designs for EU radio equipment.
31. While Canada's RSS-192 employs OOBE limits following the ECC's technical rules, the specific band edge differs. Despite this minor difference, it is still possible for Canada to make use of base station radios designed for the EU market, since the Canadian band edge falls within the EU operating band while the OOBE rolloff was defined to match the (in-band) block edge mask. TELUS notes that the OOBE limits adopted may enable the option to include 3650-3700 MHz without substantial impacts to base station radios designed for the EU market and leveraged in Canada.

32. In its recent decision (referred to in the remainder of this response as the “C-Band Report & Order”)⁸, the FCC did not adopt a stringent OOB power limit, but instead relied upon a conducted power limit of -13 dBm/MHz out-of-block-emission level – a limit that is compliant with 3GPP standards for band edge requirements of radios.
33. TELUS recommends ISED align with the FCC technical rules for the proposed 3700-3980 MHz band (an approach which would also be compatible with extending the band to 4100 MHz).
34. TELUS anticipates that despite having rules for the 3500 MHz band built around ECC requirements and for the 3800 MHz band based on FCC requirements, the two bands should be reconciled under one RSS for flexible use equipment in the 3500 MHz and 3800 MHz bands. TELUS strongly recommends ISED consult with the industry and study the best set of technical rules to enable seamless equipment certification and operations across both the 3500 MHz and 3800 MHz bands, and without delaying the release of both bands by 2021. However, if this consultation process were to extend beyond 2021, an interim solution could be designing a new (temporary) RSS for the 3700-3980 MHz frequency range and modifying RSS-192 to include 3650-3700 MHz by extending the band edge up to 3700 MHz to leverage both ecosystems.
35. While minor variations in technical rules can typically be adopted for base station radios, it is critical to ensure that technical rules are established for user equipment (i.e., devices) which are fully compliant with a common set of 3GPP standards. As long as there are no substantive deviations from 3GPP standards for user equipment, all Band n78 and/or n77

⁸ FCC Report & Order and Order of Proposed Modification, *In the Matter of Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, published March 2020.
Link: <https://docs.fcc.gov/public/attachments/FCC-20-22A1.pdf>

devices designed for global markets will be able to operate in Canada, whether under the limits defined by the ECC or the FCC.

Q4: Mobile service allocation in the 3700-4000 MHz band

Q4. ISED is seeking comments on the proposal to add a primary mobile service, except aeronautical mobile, allocation in the 3700-4000 MHz band to the CTFA and the specific changes shown in annex B.

36. The proposed changes are both necessary and appropriate in order to make the 3800 MHz band suitable for flexible use licensing for 5G. TELUS supports the proposed update to the Canadian Table of Frequency Allocations, adding mobile services as a primary allocation.
37. However, TELUS recommends that ISED consider the potential for shared use operations in the upper portion of the band (as further discussed in TELUS' response to Question 19) in areas where it would not interfere with FSS and thereby allow the introduction of mobile services on a primary basis throughout the entire band from 3700-4200 MHz. A broader mobile allocation is further supported in paragraph 57 of the Telesat proposal (appended to the Consultation in annex H), noting that the primary Canadian satellite services provider Telesat could repack FSS operations into 4100-4200 MHz.
38. TELUS notes that other administrations, such as the U.S., the EU, Japan and the U.K. have made provisions to allow flexible use in all or parts of the 3700-4200 MHz band. Should ISED follow these leading nations, it would allow ISED to introduce flexible use

to ensure that the use of this valuable 5G mid-band spectrum is maximised throughout the band.

39. As such, as a means of future proofing and to ensure that the use of this key mid-band spectrum is maximised, TELUS recommends that in addition to the proposed changes to the Canadian Table of Frequency Allocations found in annex B of the consultation, that “MOBILE except aeronautical mobile” also be added under the 4000-4200 MHz frequency range (as well as to 3700-4000 MHz).

Q5: Flexible use licensing in the 3650-4000 MHz band

<p>Q5. ISED is seeking comments on developing a flexible use licensing model for fixed and mobile services in the 3650-4000 MHz band.</p>
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40. ISED implemented a flexible use licensing model for the soon to be auctioned 3500 MHz band allowing for the deployment of both fixed and mobile services. TELUS fully supports the extension of the flexible use licensing framework into the 3800 MHz band. This is a positive step toward enabling the deployment of meaningful 5G services within the 3500/3800 MHz bands.
41. TELUS further recommends extending the notion of flexible use licensing to the entire 3650-4200 MHz band as decided upon in other jurisdictions. This application of a flexible use licensing model across the entire band is consistent with TELUS’ recommendation in Question 4 to add a co-primary mobile allocation to the 4000-4200 MHz frequency range

and its proposal to consider extended shared licensing models in the upper portion of the band, as discussed in TELUS' response to Questions 14, 17 and 19.

Q6: Restrictions on new FSS licensing

Q6. Given the proposal in section 7.2 on developing a flexible use licensing model for fixed and mobile services in the 3650-4000 MHz band, ISED is seeking comments on the proposal that no new FSS earth stations be authorized in the 3700-4000 MHz band in the future and that the authorization of new FSS earth station licences be limited to the 4000-4200 MHz band.

42. With the focus of this Consultation being the transition of the 3800 MHz band to enable flexible use licensing, the fundamental principle that should be considered in the creation of any rules that would see expanded deployment of (legacy) FSS earth stations should be one of not constraining the deployment of new flexible use systems. TELUS further addresses this notion in its response to Questions 21 and 29 below.
43. While it may be necessary to maintain the operation of FSS earth stations within the portion of the band being repurposed for flexible use in certain remote areas (i.e., for a limited number of consolidated teleport sites and within appropriately defined satellite-dependent areas), TELUS agrees that any new FSS earth station authorisations should be limited to the portion of the band which is being retained nationally for FSS use, whether they are located in satellite-dependent or non-satellite dependent areas.
44. Under ISED's proposal, the application of this principle would lead to only licensing new FSS earth stations in the 4000-4200 MHz frequency range; however, if ISED were to

repurpose 3700-4100 MHz (as TELUS recommends), new FSS earth stations would only be licensed in the 4100-4200 MHz frequency range.

Q7: Guard band between flexible use and FSS

Q7. ISED is seeking comments on the proposal to implement a 20 MHz guard band between 3980-4000 MHz to protect FSS operations in 4000-4200 MHz band from proposed flexible use operations in the 3700-3980 MHz band.

45. TELUS endorses the proposal to use a 20 MHz guard band separating flexible use and FSS operations, noting that such a guard band is an integral component of the coexistence framework being contemplated by ISED and decided upon by the FCC. TELUS notes that this guard band, when combined with specifications for in-band power levels, out-of-band emission limits, minimum earth station filter specifications and PFD limits (as addressed in Question 48), enables the coexistence of flexible use systems operating adjacent to FSS earth stations.
46. Should ISED decide to adopt Telesat's proposal, TELUS would still support a 20 MHz guard band separating flexible use and FSS, but in this case the guard band would be located at 4080-4100 MHz.

Q8: Maintaining FSS allocation to support satellite-dependent areas

Q8. ISED is seeking comments on the proposal to maintain a primary allocation to FSS in the entire 3700-4200 MHz band and the proposal that existing FSS earth stations in satellite-dependent areas remain licensed in the entire 3700-4200 MHz band.

47. TELUS does not oppose ISED’s proposal to maintain a primary allocation to FSS in the entire 3700-4200 MHz band to support of the notion of ensuring continuity of service for existing FSS earth stations in a limited number of regions which will be deemed “satellite-dependent”. However, TELUS questions whether the full 500 MHz (i.e., 3700-4200 MHz) co-primary allocation for FSS is necessary to support sustained connectivity in satellite-dependent areas and suggests that such a dependency on 3800 MHz spectrum is a transitional need at most.
48. TELUS notes that in Telesat’s proposal, Telesat asserts that a transition of all FSS operations can take place “with no loss of service to existing end users” by December 2025, while reducing FSS spectrum use to 100 MHz of FSS spectrum on a national basis. With that in mind, it is hard to understand why ISED would preserve more than 100-200 MHz of spectrum for sustained satellite operations.
49. With GEO-HTS, MEO and LEO satellite systems all being deployed to add capacity and modern broadband capabilities in the service of remote communities, it seems that the benefit of maintaining a full 500 MHz allocation in the 3800 MHz band may be unnecessary today, but certainly would not be needed over the long-term. If some or all of the 3800 MHz spectrum is going to have its co-primary allocation to FSS maintained to support continuity of service in satellite-dependent areas, the need for sustained operation

should be monitored throughout the transition process and beyond (e.g., via annual reporting) and the policy reassessed once the FSS transition for non-satellite-dependent areas is complete.

50. TELUS offers further details on the definition for satellite-dependent areas in its response to Question 21 below.

Q9: Future demand for C-band in rural, remote and northern areas

- Q9.** ISED is seeking comments on the future demand for C-band in rural and remote areas such as the North, including the following:
- a. the trend towards using higher frequencies by FSS operations to provide broadband connectivity
 - b. the ability of using higher frequencies to replace current C-band capacity and the potential timelines
 - c. the possibility of a trend towards using 4000-4200 MHz in combination with other connectivity options (e.g. higher frequencies satellites or wireline solutions) and when it would be expected to be available for satellite-dependent areas

51. TELUS recognises that there are areas in northern and remote Canada that will depend on satellite transport connectivity for the foreseeable future. Such satellite-dependent areas are not necessarily dependent on C-band FSS specifically (except perhaps for when there are no meaningful alternatives in Ka/Ku bands). They are dependent on satellite connectivity in general going forward, particularly requiring newer modern Ka/Ku satellite services to deliver broadband speeds, with C-band relegated to a backup link for redundancy, or displaced by a growing direct-to-home (DTH) data services alternative.
52. TELUS supports the proposal to define, in the short term for the purposes of C-band spectrum, satellite-dependent areas in which Canada will temporarily not re-allocate a

large portion of C-band to terrestrial flexible use. This alleviates any near term pressure to transition in these areas while promising new MEO and LEO satellite systems are brought to market.

53. Given C-band FSS does not use spot beams to disperse the customer load across multiple transceivers, it is not capable of delivering broadband service at CRTC service standards for end users nor effectively backhauling 5G.
54. In contrast, newer satellite technologies operating in more spectrum-rich, higher frequency bands use spot beam coverage with much more efficient frequency reuse and as such should largely eliminate over time the dependency on C-band FSS in satellite-dependent areas.
55. It seems clear to TELUS that at some point in the near future, C-band FSS in satellite-dependent areas should and will be able to be migrated into the top 200 MHz (or 100 MHz in the Telesat plan).

Q10: Additional considerations for satellite-dependent areas

<p>Q10. In addition to capacity requirements, ISED is seeking comments on other issues that should be considered in maintaining broadband connectivity in satellite-dependent areas.</p>

56. TELUS recommends that the various levels of government continue to support funding for the expansion of fibre connectivity into the smaller and more remote population centres of Canada where it is needed, including whatever areas ISED determines as a result of this consultation will be labelled satellite-dependent.

Q11: Change in status of FSS in 3500-3650 MHz

Q11. ISED is seeking comments on its proposal to remove the FSS allocation in the 3500-3650 MHz band and to suppress Canadian footnote C20 in the CTFA as detailed in annex B. In addition, ISED is seeking comments on the proposed grandfathering of the existing earth station operations listed in annex C, such that fixed or mobile stations in the 3500-3650 MHz band will be required to coordinate with these earth stations as specified in SRSP-520.

57. TELUS supports ISED's proposal to remove the FSS allocation in the 3500-3650 MHz band.
58. TELUS further supports the proposal to suppress Canadian footnote C20 in the CTFA, as the limitation in that footnote (to avoid constraining the deployment of fixed or mobile services) would no longer be needed with the elimination of the licensing of earth stations in that frequency range.
59. TELUS does not oppose grandfathering the one existing earth station operation that is authorised to operate within the 3500-3650 MHz frequency range (i.e., the one licence listed in annex C under licence number 010001485 which is issued to Inmarsat Canada authorising operation on a 12.5 kHz channel at centre frequency 3616.3725 MHz in Weir, Quebec).
60. TELUS notes that the other Inmarsat station listed in annex C (under licence number 010001493) authorises operation of a 64 kHz channel at centre frequency 3899.5 MHz. TELUS suggests that if this data is accurate, the treatment of that particular earth station should fall under the transition policy being proposed in this Consultation.
61. Finally, TELUS notes that the coordination rules for the Weir site were established through a joint industry/ISED process at the RABC, leading to a consensus view and the

adoption of the rules published in SRSP-520. These coordination rules balance the protection of the FSS earth stations with the coordination burden to flexible use operators in the 3500 MHz band, defining for this particular installation an 80 km distance trigger for coordination with exclusions for deployments within the adjacent large and medium population centres (e.g., Montreal and other densely populated areas in the vicinity). These exclusion zones for coordination/protection of the Weir sites with the Greater Montreal Area are aligned with TELUS' recommendation to exclude metropolitan and urban Tier 5 service areas from any obligations related to protection of consolidated gateway sites, as proposed in TELUS' responses to Question 30.

Q12: Change in status of FSS in 3650-3700 MHz

Q12. ISED is seeking comments on its proposal to remove the primary FSS allocation from 3650-3700 MHz and suppress Canadian footnote C33 in the CTFA as detailed in annex B.

62. TELUS supports ISED's proposal to remove the primary FSS allocation from 3650-3700 MHz, along with the proposal to suppress Canadian footnote⁹ C33 in the CTFA.
63. According to paragraph 77 of the Consultation, there are no longer any grandfathered FSS earth stations operating in the band. Additionally, it does not appear that any licensed FSS earth stations remain in the band.¹⁰ Finally, if there were any non-registered (unlicensed) earth stations operating in the 3650-3700 MHz band, they would presumably be operating

⁹ Canadian footnote C33 being proposed for suppression states that "As of June 11, 2009, in the frequency band 3650-3700 MHz, new fixed-satellite service earth stations are only authorized to operate on a secondary basis so as not to constrain the implementation of wireless broadband services."

¹⁰ According to the most recent SMS authorisation Data Extract for the Satellite Earth Station Service available at the time analysis, dated 2020-09-29. Link:
http://www.ic.gc.ca/engineering/SMS_TAFL_Files/TAFL_LTAF_Satellite.zip

under secondary status and thus fall into a category of lower priority than legacy WBS systems or the new flexible use systems to be introduced into the band through the proposals in this Consultation.

64. For these reasons, TELUS agrees that removing the FSS allocation from 3650-3700 MHz aligns with the policies being proposed in the Consultation.

Q13: Band plan and block sizes

Q13. ISED is seeking comments on:

- a. establishing unpaired blocks of 10 MHz for the 3650-3700 MHz band
- b. establishing unpaired blocks of 10 MHz for the 3700-3980 MHz band

65. TELUS supports establishing 10 MHz blocks to construct the band plan for both the 3650-3700 MHz band and the 3700-3980 MHz band, noting that it is also consistent with the block size for the 3500 MHz band. Adopting a 10 MHz block size allows operators to aggregate spectrum for contiguous use in an auction of the spectrum bands, and potentially with blocks acquired in the 3500 MHz band.

Q14: Future considerations for a new shared spectrum licensing process

Q14. Subsequent to changes to the spectrum utilization described in section 7 and recognizing the need to change the current WBS licensing model, ISED is seeking comments on its proposal to displace the existing WBS licensees and designate 80 MHz of spectrum available for the development of a new shared licensing process in the 3900-3980 MHz band as described in Option 2. Specifically, ISED is seeking comments on:

- a. the amount of spectrum proposed (80 MHz) under a shared spectrum licensing process
- b. whether there should be a provision that allows certain users (e.g. existing WBS licensees) priority licensing (e.g. an initial application window before accepting applications from others)

Preliminary comments on a future shared spectrum licensing process are being sought in section 9.1.4 below.

66. TELUS strongly supports ISED's proposal to relocate WBS from its current allocation (i.e., 3650-3700 MHz), because its current location in the middle of the new 3500/3800 MHz band precludes spectrum contiguity across these bands and diminishes the resulting efficient use of the spectrum. Supporting flexible use spanning 3500 MHz and 3800 MHz for 5G services better serves Canadians by potentially enabling all MNOs to leverage contiguous blocks up to 100 MHz and creating a world class competitive 5G market.
67. TELUS notes that exclusively licensed spectrum is the most efficient and reliable way to provide rural connectivity and meet the targeted 50/10 Mbps speeds, while recognising that the 50 MHz allocated to WBS did attract investments in the 4G development cycle to target rural broadband.
68. Consistent with many whitepapers, studies, and field trials, TELUS estimates that 80 MHz of TDD spectrum would deliver peak cell capacity over 800 Mbps downlink or over 700 Mbps uplink, which when combined with additional licensed and unlicensed spectrum to be made available by ISED, will support the national connectivity target of 50/10 Mbps

while providing time for existing licensees to deploy systems that are able to meet those targets.

69. TELUS does not oppose ISED's Option 2 to designate 80 MHz for shared use in 3900-3980 MHz if following ISED's clearance plan, and in 4000-4080 MHz if adopting Telesat's clearance plan.
70. Further, TELUS proposes a geographically differentiated policy for addressing WBS displacement and shared licensing reflecting the different needs of rural and urban areas, where only rural areas (as defined in TELUS' response to Question 17) would be designated for shared licensing of flexible use spectrum in 3900-3980/4000-4080 MHz. Within the urban geography, the repurposed spectrum would be designated for exclusive use licensing and made available in a future licensing process.
71. TELUS proposes that the new (rural) shared licensing band would fall under the same technical rules governing the entire 3800 MHz band, from 3650-3980 MHz (or 3650-4080 MHz).
72. In order to facilitate WBS transition out of 3650-3700 MHz, TELUS would support the notion of offering priority licensing of the proposed new shared licensed band to existing rural WBS licensees.
73. For priority licensing, deployment conditions of licence would be necessary. Priority licensing should only be available within an application window following a 3800 MHz decision and linked to a commitment to invest in the new shared licensing band and at the prescribed transition milestones.

74. In consideration of vertical industries and incumbents in urban Tier 5 service areas, TELUS further considers those needs in the context of ISED's wireless innovation policy in its response to Questions 17 and 19 below.

Q15: Cost of WBS displacement

Q15. Given the proposal to implement Option 2, ISED is seeking information on potential costs such as upgrading equipment, which may be incurred by WISPs that are displaced from 3650-3700 MHz to provide services using the 3900-3980 MHz band.

75. Two of TELUS' subsidiaries, WBS licensees, understand the importance of cost considerations of upgrading equipment and also the time required to move customers to new equipment while sustaining service. These subsidiaries already have plans to upgrade to 5G for both improved service and unit cost benefits to the operator and the customer. The market segment is highly competitive, and in many markets TELUS anticipates its competitors are incented to invest in 5G.
76. Canada needs a new RSS for the 3800 MHz band so that WBS licensees can acquire n77 equipment to future proof their transition path and their future use of the proposed shared spectrum in 3900-3980 MHz.
77. TELUS foresees the potential of the 3400-3450 MHz band as another tool for facilitating the timely displacement of WBS operators from 3650-3700 MHz. In the absence of a full 3400-3450 MHz band coexistence study, ISED could rely upon interim licensing measures for some WBS equipment to operate before a final move to 3900-3980 MHz or 4000-4080 MHz in the expanded band plan proposal.

78. TELUS understands that many radios deployed in WBS systems today can operate in this portion of the band (part of the 3GPP Band 42 ecosystem) and further notes that future Band n77 radios will also support operation in the 3400-3450 MHz range. In other words, rural WISPs making investments in new radios in anticipation of the displacement to new shared spectrum whether in 3900-3980 MHz or 4000-4080 MHz would be able to first deploy in 3400-3450 MHz and then retune their equipment into the new range while fully realising their radio investment.

Q16: Displacement deadlines for existing WBS operations

Q16. Based on the proposal to implement Option 2, ISED is seeking comments on the proposed displacement deadlines, with WBS operations in urban areas being displaced by December 2023 and all others by December 2025. Respondents are invited to propose other protection and displacement options for consideration, provided they include a strong rationale.

79. In its response to Question 14, TELUS proposes that no shared spectrum be allocated in ‘urban’ markets in 3900-3980 MHz (under ISED’s proposed plan, or 4000-4080 MHz if clearing 400 MHz of spectrum), as enterprise / vertical / private networks could make use of spectrum shared with FSS and mmWave spectrum in the 37.0-37.6 GHz band expected to be licensed for shared use. In contrast, spectrum would be allocated in the upper 80 MHz of the repurposed band to support shared use by WISPs in rural markets. We assess ISED’s proposals for the displacement of WBS operations with this geographically differentiated treatment in mind.

80. Given that the WBS spectrum band plays a small role in urban markets today, TELUS suggests an accelerated displacement timeline be adopted. Systems operating in 3650-3700 MHz spectrum in ‘urban’ markets should be displaced as soon as possible, especially if ISED is going to adopt TELUS’ proposal to include this spectrum in next year’s 3500 MHz auction (see TELUS’ response to Question 52). While there may be as little as 6-9 months between the closing of this Consultation and the end of the 3500 MHz auction, TELUS proposes that a one-year notification of displacement be announced for all urban WBS operations in the decision resulting from this Consultation process. This would create a timeline for WBS clearing in urban markets that is broadly aligned to the transition of the 3500 MHz spectrum (and of the 3800 MHz spectrum proposed for early repurposing by Telesat), thereby maximising the amount of spectrum that could be made available for 5G deployment in large contiguous spectrum blocks in a harmonised assignment process. This one-year notification would be consistent with previous displacement policies for urban areas (e.g., fixed point-to-point links in the WCS, FWA and PCS bands and TV stations in the 600 MHz band).
81. TELUS proposes an advanced displacement date of December 2023 for rural areas.
82. The December 2023 displacement date would be supported by ISED’s proposal for the completion of the FSS transition, meaning that 3900-3980 MHz would be clear for WISP deployment of shared licensing systems in rural markets by that date.
83. If instead 400 MHz of spectrum is repurposed, the 3980-4080 MHz spectrum would presumably not be available to accommodate displaced WBS operations until December 2025 (assuming Telesat does not revise its proposed end date). However, as discussed in

response to Question 15, TELUS suggests that ISED investigate whether the 3400-3450 MHz band could be used as a temporary displacement location for WBS systems moving out of the 3650-3700 MHz.

Q17: Urban service areas for WBS displacement

Q17. ISED is seeking comments on the Tier 4 service areas that would be considered urban as defined above and as listed in annex D.

84. In this Consultation, ISED proposes applying the ‘urban’ classification to certain service areas to support the application of a geographically differentiated policy that defines different timelines for urban and rural WBS displacement and one that imposes a complete moratorium on urban deployments.
85. TELUS does not support ISED’s proposal to classify Tier 4 service areas containing a large population centre (24 service areas in total, as listed in annex D of the Consultation) as ‘urban’.
86. TELUS agrees that service areas containing large population centres should be included in the definition of ‘urban’ tiers, as proposed by ISED.
87. TELUS further proposes that service areas containing medium population centres should also be included in the ‘urban’ definition.
88. However, TELUS suggests that it is not necessary to include the portions of Tier 4 service areas beyond the large and medium population centres within the ‘urban’ definition, especially since some substantial portions of several Tier 4 service areas containing large

and/or medium population centres are rural and are often served by WISPs using the WBS spectrum band to deliver fixed wireless access solutions.

89. In order to classify large and medium population centres as ‘urban’ (and supporting the application of a moratorium and early displacement of WBS licensees) while preserving the continued ability of WISPs to operate suggests that the application of a Tier 5 service area to this classification would be appropriate.
90. TELUS proposes that Tier 5 service areas categorised as ‘metropolitan’ (the Greater Toronto, Montreal and Vancouver areas) and ‘urban’ (other large and medium population centres) as defined in ISED’s *Decision on a New Set of Service Areas for Spectrum Licensing*¹¹ should be classified as ‘urban’ for the purposes of this Consultation with regard to the treatment of WBS licensees and for defining geographically differentiated policy for future shared licensed spectrum.

Q18: Service areas for WBS moratorium

<p>Q18. ISED is seeking comments on whether the moratorium should be extended to include all Tier 4 service areas.</p>

91. TELUS supports ISED’s decision to announce a moratorium upon the release of the consultation on new WBS licences in urban tiers. ISED is proposing to provide WBS licensees with priority access to a new expanded band and so there are good reasons for the moratorium. It allows the transition plans in and out of the current WBS band to begin.

¹¹ *Decision on a New Set of Service Areas for Spectrum Licensing*, Canada Gazette DGSO-006-19, published July 2019. Link: <https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf11525.html>

92. TELUS maintains that these same reasons would equally apply to rural tiers and proposes that ISED should expand the moratorium to all service areas. A moratorium applied to all service areas would give prospective licensees bidding on spectrum in the 3650-3700 MHz band in an upcoming auction certainty around the encumbrances on their licences and when they could expect to put the spectrum to use, according to the displacement timelines proposed in Question 16.

Q19: Future licensing process for 3900-3980 MHz

Q19. ISED is seeking preliminary comments on the future spectrum licensing process for 3900-3980 MHz, including the following:

- a. what type of applications are envisioned for this spectrum
- b. what type of shared licensing process ISED should consider (e.g. database approach, licensee to licensee coordination)
- c. what additional measures ISED should consider employing to manage access to the band in high demand areas, such as major metropolitan centres
- d. what technical restrictions should be considered (e.g. technical rules similar to adjacent 3500 MHz flexible use band with reduced power levels, a guard band between new flexible use systems below 3900 MHz, shared use above 3900 MHz, etc.)
- e. what type of eligibility criteria, if any, should be established

Applications for future shared licensed spectrum

93. As TELUS indicates in its response to Question 5, flexible use licensing provides for the most efficient use of mid-band spectrum. By allocating the spectrum as flexible use the applications are not limited, making the spectrum available for mobile, fixed wireless access as well as vertical industries such as utilities, mining, manufacturing and private broadband networks. All flexible use applications play a role in supporting Canada's goal

to be at the forefront of 5G innovation and to create a prosperous digital economy.

Shared licensing approach

94. The “all-come/all-served” notion of the WBS band was established assuming an equipment ecosystem with contention protocols would become available for the band. However, most if not all equipment deployed to date in the WBS band does not employ a contention-based protocol. As a result, the band has effectively become a type of First Come First Served (FCFS) area licensing process requiring licensee to licensee coordination. Given the precedent set by WBS, TELUS recommends that ISED consider authorising the shared spectrum users through an area licence and with an in-band licensee coordination mechanism. To provide more certainty for licensees investing in significant network deployment, TELUS recommends limiting the number of FCFS licences to a maximum of two in a given area . If there is only one user licensed in the area they should be able to use all the spectrum but with the expectation that they may need to reduce their quantity of spectrum deployed if a second applicant comes along. Further, licences must have strict ‘use-it-or-lose-it’ deployment requirements that are both timely, aggressive and assessed on a regular basis to ensure the spectrum is effectively put to use for Canadians.
95. The Consultation contemplates the use of a dynamic database to facilitate a coordination mechanism as a means of increasing the overall efficient use of the spectrum. However, it remains unclear as to how such a database could be implemented. Recognising that Canadian operators rely on a global equipment ecosystem, or at a minimum a North American ecosystem, TELUS notes that a dynamic database ecosystem for the 3800 MHz

band does not exist. TELUS recommends that ISED not implement a dynamic database spectrum sharing mechanism in this band.

Additional measures for high demand areas

96. TELUS recommends that 3900-3980 MHz in urban markets should be exclusively licensed based on a future licensing consultation per TELUS' answer to Question 14.

Potential “extended” shared spectrum as an additional measure for high demand areas

97. To support urban areas with high demand for shared spectrum, TELUS proposes that ISED study and consider a low power shared licensing scheme in 3980-4195 MHz such as adopted by Ofcom¹². TELUS notes that mmWave spectrum (such as the spectrum being considered for shared licensing in the 37.0-37.6 GHz band) is better suited for spectrum sharing in high demand areas such as urban environments.

Technical restrictions

98. For shared spectrum in 3900-3980 MHz or 4000-4080 MHz, TELUS does not recommend any additional technical rules beyond what is proposed by TELUS for flexible use in 3700-3900 MHz in response to Question 43.

¹² Ofcom, *Enabling wireless innovation through local licensing: Shared access to spectrum supporting mobile technology*, 25 July 2019. Link: https://www.ofcom.org.uk/_data/assets/pdf_file/0033/157884/enabling-wireless-innovation-through-local-licensing.pdf

Eligibility criteria

99. In urban areas eligibility requirements for exclusive use licences in 3900-3980 MHz should be the same as for any Canadian mobile spectrum auction.
100. Eligibility criteria for rural shared licences in 3900-3980 should not be limited either beyond normal criteria, but existing WBS licensees could be given priority licensing for an initial period as proposed in Question 14.

Q20: Ongoing operations of FSS in 3650-3700 MHz without protection

Q20. ISED is seeking comments on its proposal that existing FSS earth stations licensed in 3650-3700 MHz after June 11, 2009, be permitted to continue to operate on a no-protection basis with respect to proposed new flexible use operations.

101. As noted in TELUS' response to Question 12 above, there do not appear to be any licensed FSS earth stations operating today in the 3650-3700 MHz frequency range. If any (unlicensed) earth stations are operating, they are presumably operating under a secondary basis with regards to WBS (per *SP 3650 MHz*)¹³.
102. As such, if any FSS earth stations are operating (under a secondary basis), TELUS does not object to ISED's proposal that their continued operation be permitted on a no-protection basis with respect to new flexible use operations. Operators deploying new flexible use systems should not be restricted under any technical limitations by such systems operating under a secondary status, nor should any obligation to coordinate with

¹³ *SP 3650 MHz - Spectrum Utilization Policy, Technical and Licensing Requirements for Wireless Broadband Services (WBS) in the Band 3650-3700 MHz*, published June 2009.
Link: <https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09540.html>

such stations engaged in “no-protection” operations be imposed on operators deploying flexible use systems. For further clarity, TELUS suggests that operators deploying flexible use systems should not even have to inform earth stations operating under secondary / no-protection operations regarding the status or technical parameters of its new flexible use deployments.

Q21: Defining satellite-dependent areas: Service area definition

Q21. ISED is seeking comments on whether the Tier 4 service areas identified for exemption of certain provisions in GL-10 for mmWave bands as listed in annex E would be appropriate to apply for FSS operations in the 3700-4200 MHz band. ISED invites alternative proposals for areas that would be considered satellite-dependent (e.g. based on Tier 5 categories).

103. TELUS disagrees with ISED's proposal to treat Tier 4 service areas identified for exemption of certain provisions in GL-10 for mmWave bands¹⁴ (as listed in annex E) as appropriate to apply for FSS operations in the 3700-4200 MHz band.
104. In TELUS' view, the Tier 4 resolution in GL-10 applied to the definition of satellite-dependent areas does not sufficiently distinguish between the regions of Canada that may require C-band satellite service to support telephony and broadband connectivity and the more densely populated parts of rural Canada where terrestrial wireless and wireline connectivity options are available.
105. To offer some examples, the proposed satellite dependent areas listed in GL-10 include a number of population centres within TELUS' historical ILEC footprint in Alberta and British Columbia that are clearly not dependent on satellites for broadband connectivity (e.g., Peace River, Prince Rupert, Kitimat and Terrace – all of which have fibre to the home connectivity within their boundaries). TELUS further notes that small population

¹⁴ In fact, TELUS also disagrees with the use of the Tier 4 service areas identified in GL-10 for ongoing application to mmWave bands. TELUS notes that GL-10 is an "Interim Guideline", intended to be applied until a final set of mmWave licensing and coordination rules is published. For the same reasons as those outlined in this response for the 3800 MHz band, TELUS recommends that ISED take into account TELUS' proposals in the mmWave (and Addendum) consultations to define regions where restrictions on the siting of satellite earth stations in mmWave bands should apply on the basis of population density and the mid-band mobile network footprint. See TELUS' reply comments to the mmWave consultation. Link: [https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/SLPB-001-17-reply-comments-TELUS.pdf/\\$file/SLPB-001-17-reply-comments-TELUS.pdf](https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/SLPB-001-17-reply-comments-TELUS.pdf/$file/SLPB-001-17-reply-comments-TELUS.pdf)

centres in the Territories (e.g., Whitehorse, Yellowknife, and Inuvik) also have fibre facilities, and that efforts are underway to further connect northern communities (e.g., in Nunavut) such that they may no longer be satellite-dependent by the end of the FSS transition.¹⁵ If these areas are deemed satellite-dependent, under ISED’s proposal, they would not be able to enjoy the benefits of flexible use 5G systems deployed in the 3800 MHz band.

106. While the above is an issue of significant concern, a potentially greater problem is the issue of coordinating flexible use systems deployed outside of satellite-dependent areas with FSS earth stations that land within satellite-dependent areas but perhaps near their borders.
107. TELUS has investigated the potential impact of ISED’s proposal to use the Tier 4 markets listed in GL-10 to define satellite dependent areas, assessing the population that would potentially be precluded from flexible use of the 3800 MHz band if a range of separation distances is applied from the edge of the Tier 4 areas. This analysis is presented in Table 1 below.

¹⁵ “[T]he design plan for the connection will be finalized by 2021 and the cable laid in 2022. Iqaluit and Kimmirut are expected to have access to the high speed internet — around 1 gigabit per second — by 2023.” <https://www.cbc.ca/news/canada/north/nunavut-fibre-internet-funding-1.5250217>

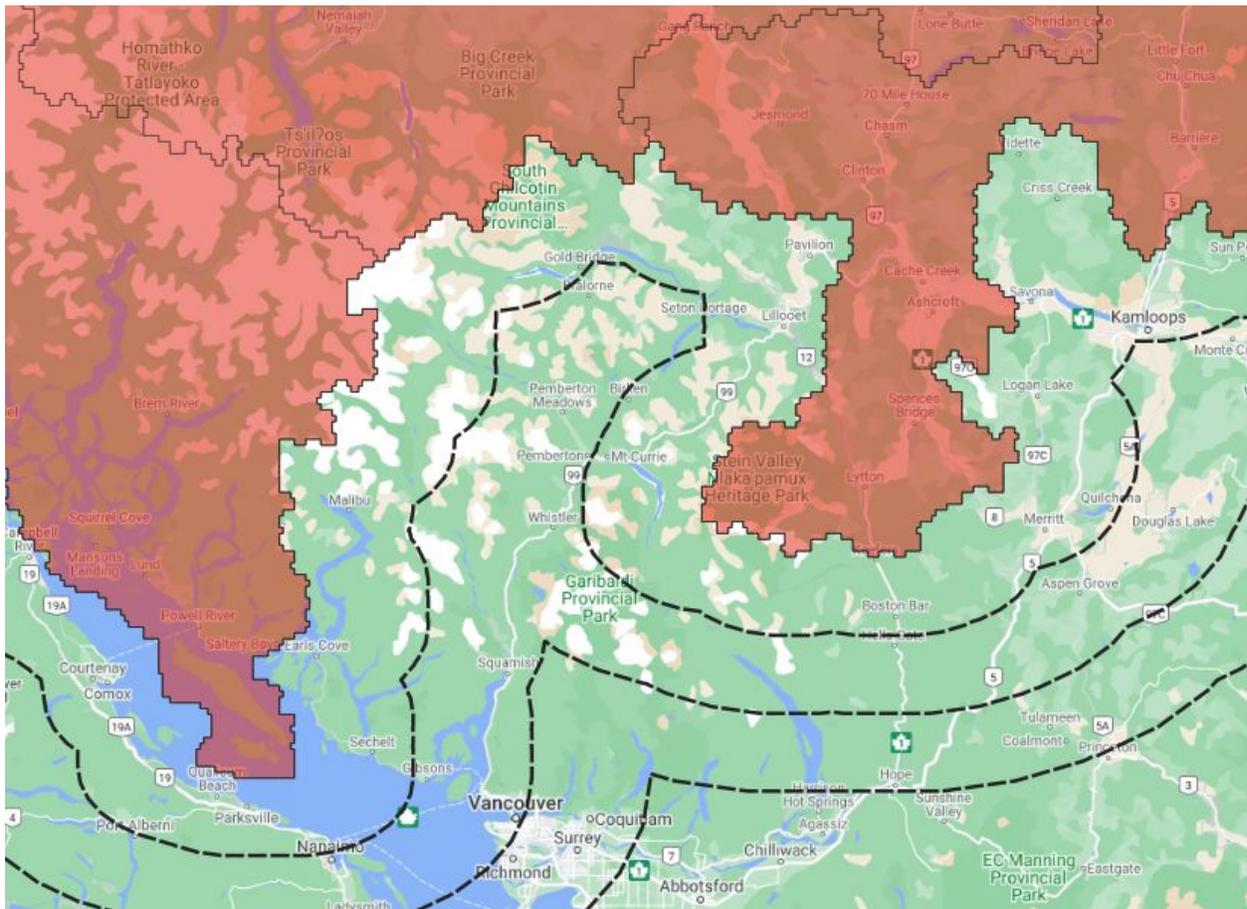
Table 1: Population vs. buffer distance from proposed satellite-dependent Tier 4 area boundaries as listed in GL-10

Buffer distance (km)	2016 Population	Percentage of national population precluded from 5G in 3800 MHz
0	941,856	2.7%
25	2,048,842	5.8%
50	3,658,509	10.4%
75	6,033,579	17.2%

108. In paragraph 59 of the Consultation, ISED indicates that “studies undertaken by ISED have demonstrated that, without other mitigation measures, to protect FSS earth stations from co-frequency flexible use operations, a separation distance of about 60 km around the FSS earth station may be required in Southern latitudes. Larger separation distances may be required to protect FSS earth stations located at latitudes of about 60°N and increasing separation distances with higher latitudes.”
109. TELUS notes that under an even smaller separation distance (i.e., 50 km) than what was noted by ISED in the Consultation, over 10% of Canada’s population could be adversely impacted. That 10% includes a significant number of large and medium population centres either partially or in their entirety, including Vancouver, Kamloops, Prince George, Grande Prairie, Fort McMurray, Winnipeg, Thunder Bay, Sault Ste. Marie and Sudbury. These areas of significant population density could be prevented from being served by mobile providers seeking to deploy 5G flexible use systems in the 3800 MHz band.

110. Figure 2 visualises this analysis for markets in southern BC by drawing contours (denoted by three dashed lines) at 25 km intervals starting at the boundaries of ISED's proposed satellite-dependent Tier 4 service areas (highlighted in red). A separation distance of as little as 25 km would have a significant impact on markets like Kamloops, Whistler, and Nanaimo; a separation distance of 75 km would impact a significant portion of the Greater Vancouver area including all of its downtown core.

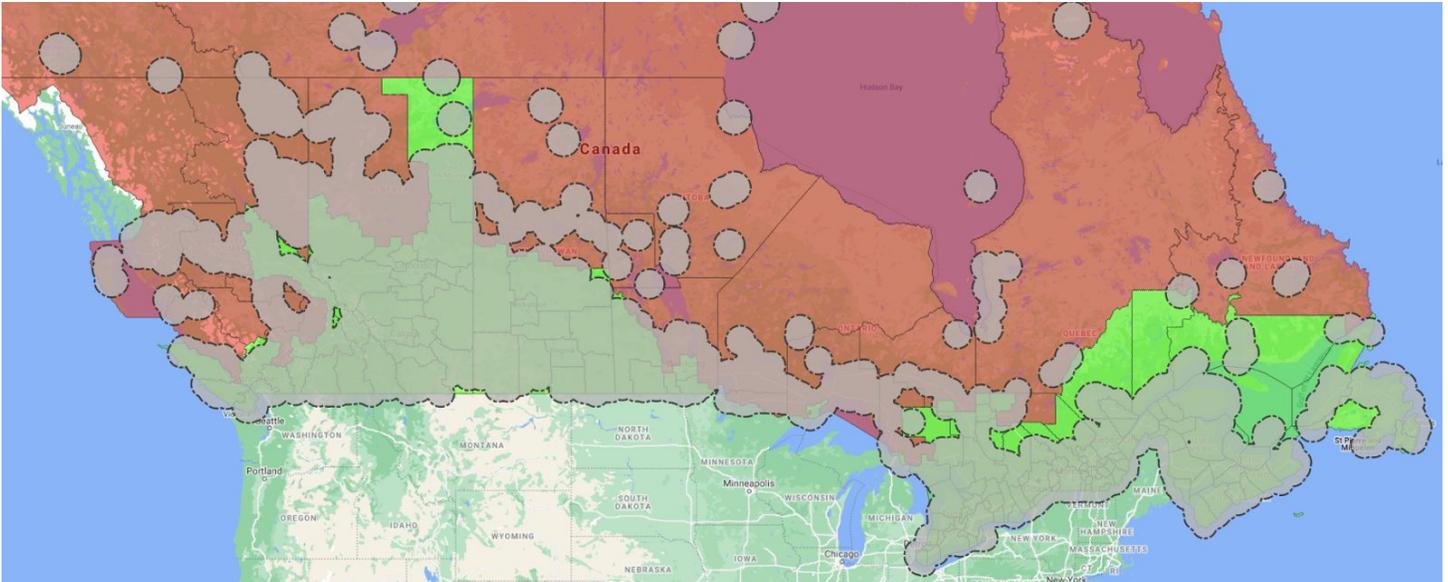
Figure 2: Illustrating the potential impact of satellite-dependent areas on population centres in British Columbia



111. In its response to the mmWave consultation, TELUS proposed that no satellite earth station siting request be approved if its interference contour (in the case of the 28 GHz band) or its protection zone (in the case of the 37 GHz band) overlaps any existing mobile network's base station where mid-band or high band spectrum is deployed.
112. TELUS suggests the adoption of a similar rule that could be applied for the 3800 MHz band. That is, once ISED has developed an algorithm to determine the required minimum separation distance needed to protect satellite earth stations at various latitudes, maps would be constructed to denote satellite-dependent areas as the complement to the mid-band (or high band) mobile footprint buffered by that required separation distance (where mid-band mobile sites are those with PCS, WCS, AWS, BRS, and in the future, 3500 MHz and high band mobile sites are those with mmWave spectrum deployed).
113. Figure 3 illustrates how such exclusion zones could be used to provide a more refined definition of satellite-dependent areas using a separation distance of 60 km (the illustrative value offered by ISED in the Consultation) around existing mid-band mobile sites¹⁶. Using this methodology and defining satellite-dependent areas as its complement would adjust for the areas of density, including in small population centres (such as those in fibre-connected communities in the Territories, BC Interior and northern Alberta as described above), while also ensuring sufficient separation from large and medium population centres.

¹⁶ Constructed using most recent SMS Spectrum Licences Site Data Extract available at the time of analysis, dated 2020-10-02. Link: http://www.ic.gc.ca/engineering/SMS_TAFL_Files/Site_Data_Extract.zip

Figure 3: Illustrating an exclusion zone with 60 km buffers beyond the mid-band mobile footprint



114. TELUS understands that in defining satellite-dependent areas, ISED is aiming to strike a balance between the needs of remote communities that require satellite services to maintain connectivity with those of urban, suburban and rural communities that can certainly expect extensive 5G deployments. TELUS further recognises that defining such a balance is a challenging task given the propagation characteristics of the 3800 MHz band (i.e., that a certain “no-man’s land” of roughly 60 km likely needs to be defined between the two regions). With that in mind, TELUS suggests that the area that is complementary to the mid-band mobile footprint is the appropriate way to define satellite-dependent areas.
115. Regardless of whether ISED adopts TELUS’ proposal, the ultimate definition of satellite-dependent areas and the implications for imposing protection obligations on flexible use operations must include:

- a. Exemptions from protection obligations for flexible use systems located in non-satellite dependent areas (i.e., if the list of Tier 4 service areas listed in GL-10 is used, separation buffer zones must be included within the boundaries of those satellite-dependent areas and not beyond, and earth stations within the buffer zone would be responsible for establishing their own shielding or other measures to mitigate interference from flexible use systems serving non-satellite-dependent areas); and,
- b. On a case-by-case basis, “exemption zones” within satellite-dependent areas around small population centres where fibre (or similar high speed broadband) connectivity is widely available or will be available before the end of the transition timeline. These markets should not be excluded from the benefits of 5G networks.

Q22: Defining satellite-dependent areas: Remote industry operations

Q22. ISED is seeking comments on whether certain remote industry operations, for example offshore oil drilling platforms, should be included in the definition of satellite-dependent areas.

116. If ISED determines that certain areas will be satellite-dependent, TELUS would not oppose the inclusion of certain remote industry operations (such as offshore oil drilling platforms) within this category.
117. The same principle TELUS suggests for the definition of satellite-dependent areas in Question 21 should be applied in this case as well. If the FSS earth station operating on an offshore oil drilling platform is close enough to non-satellite-dependent areas (as discussed in TELUS' response to Question 21) such that a protection requirement would constrain the ability of a flexible use licensee to operate a network there, the FSS earth station should be allowed to use the full 3700-4200 MHz band only if accepting the condition above and taking measures to protect its operations.

Q23: No-interference operation of FSS in 3700-4000 MHz

Q23. ISED is seeking comments on its proposal to modify the existing FSS satellite authorizations to limit FSS operations in 3700-4000 MHz in non-satellite-dependent areas of Canada to a no-interference basis. ISED is also seeking comments on the proposal to adjust the conditions of licence for FSS operations to reflect the proposals as of the FSS transition deadline, including the possible removal of a high expectation of renewal for the 3700-4000 MHz portion of the band.

118. TELUS supports ISED's proposal to modify existing FSS satellite authorisations to limit FSS operations in 3700-4000 MHz (or 3700-4100 MHz if adopting the Telesat proposal) in non-satellite-dependent areas of Canada to operating on a no-interference basis. TELUS also supports the proposal to remove the high expectation of renewal for the 3700-4000 MHz (or 3700-4100 MHz) portion of the band.
119. TELUS notes that it does not expect this change to have a meaningful impact (if any) on FSS satellites. Since the U.S. repacking will eliminate operations in the 3700-4000 MHz frequency range for the continental U.S., it seems likely that the majority of transmissions in this band in beams covering areas closer to the more densely populated (and non-satellite-dependent) parts of Canada will be shut down due to the U.S. transition process.
120. Additionally, TELUS does not generally expect that FSS transmissions received on the ground in non-satellite-dependent areas would be powerful enough to cause any meaningful issues for terrestrial flexible use services – the already low power level would likely be further attenuated by significant off-axis rejection due to the natural downtilt of terrestrial operations.

121. Nonetheless, TELUS supports ISED’s recommendations here that would protect the priority of flexible use services in the 3700-4000 MHz (or 3700-4100 MHz) frequency range in non-satellite-dependent areas, should a conflict ever arise.

Q24: FSS transition timing

Q24. ISED is seeking comments on its proposed date of December 2023 as the Canadian FSS transition deadline.

122. TELUS is supportive of an FSS transition plan that enables the maximum amount of mid-band spectrum to be made available to support 5G network deployments using large, contiguous blocks in the shortest time.
123. If ISED were to adopt its own proposal for repurposing 50 MHz of WBS spectrum and 300 MHz of FSS spectrum and auctioning the resulting 3800 MHz band for flexible use in 2023, a satellite transition completed by December 2023 would seem to be a sensible approach. This December 2023 date would align with the accelerated timeline for clearing the full 300 MHz of FSS spectrum in the U.S. – a process which presumably has significant interdependencies with the Canadian clearing process.
124. However, TELUS does not believe that ISED’s proposal is the preferred path to creating the best 5G outcomes for Canada. Telesat’s proposal would seem far better suited to create positive outcomes in two meaningful ways.
125. First, Telesat’s proposal would make 200 MHz of spectrum available far sooner than ISED’s tentatively proposed 2023 auction date – as soon as early in 2021, before the 3500

MHz auction. Making an additional 250 MHz of flexible use spectrum available along these timeframes is a critical element of the overall 3500+3800 MHz licensing strategy TELUS outlines in its response to Question 52, including a harmonised assignment process for 3500 MHz spectrum, repurposed WBS spectrum, and the first 200 MHz of repurposed 3800 MHz spectrum.

126. Second, Telesat's proposal would see this 200 MHz of "early access spectrum" complete its transition far sooner than in ISED's proposal for repurposing the 3800 MHz band, with contemporaneous timelines to the 3500 MHz transition process. In other words, Telesat's proposed process would make 200 MHz of additional 5G spectrum available in urban markets by the end of 2021, while still clearing the spectrum in rural markets over the 2022-2023 timeframe (i.e., still meeting ISED's proposed timeline for FSS clearing, at least in the first 200 MHz of the band).
127. The only apparent detriment to Telesat's proposal is that the remainder of the band (including 3900-3980 MHz and the additional 100 MHz of repurposed FSS spectrum in 3980-4080 MHz) would not be cleared until two years beyond ISED's proposed clearing date (i.e., by the end of 2025, rather than December 2023).
128. In summary, TELUS recommends to transition FSS out of 3700-3900 MHz in parallel with the 3500 MHz clearance timelines: by the end of 2021 for urban areas and between 2023 to 2024 for the rest of the country. Further TELUS recommends that ISED endeavour to clear 3900-4000 MHz (or 3900-4100 MHz if adopting Telesat's proposal) as soon as possible to enable the timely transition of WBS.

Q25: Canadian FSS capacity: Impact of U.S. transition

Q25. ISED is seeking comments on how the U.S. transition will impact the availability of FSS capacity in Canada.

129. TELUS notes that there are ramifications in Canada as part of the U.S. transition that are in motion regardless of what ISED does or does not do in its decisions. Canadian earth stations pick up U.S. (and international) video distribution content from foreign satellites. Regardless of Canadian decisions, all of this content is migrating to 4000-4200 MHz (or to alternative bands) and this has been determined to be feasible in an accelerated timeline (due to funding). This ostensibly means that these U.S. and foreign satellites may have substantial spare transponder capacity in the 3700-4000 MHz range to use to serve Canadian satellite-dependent areas, at least in the short term. (It also means that Canadian earth stations will need to retune and potentially repoint their non-Telesat dishes along U.S. timelines.)
130. Further, these U.S. and foreign satellites are intimately involved in this consultation process (as evidenced by RABC working group participation) and given that we are still more than two years away from the final target deadline for the US accelerated transition, they should consider reacting (as it is in their best interest) to any ISED decision which veers from the U.S. 3980 MHz upper band edge such as to Telesat's proposed 4080 MHz upper band edge. That is to say, if a 4080 MHz decision is made by ISED, these U.S. and foreign satellites should endeavour (in concert with their broadcast partners) to

locate all or as much as possible of the content that is received by Canadians earth stations into the 4100-4200 MHz portion of the forthcoming U.S. C-band 4000-4200 MHz band plan.

131. Lastly, Telesat, the only Canadian C-band licensee, serves customers in the US and Canada and has stated that it can service all its C-band demand in the 4100-4200 MHz sub-band. In other words there appears to be no negative impact of the U.S. transition on Telesat's ability to repack into the 4100-4200 MHz sub band.

Q26: FSS RFI

Q26. ISED is requesting information to assist with the consequent decision following this consultation. This information includes satellite transponder migration plans, frequencies, and how satellite operators serving the Canadian market will accommodate all Canadian customers, and on which frequencies. Requested information could include, but is not limited to:

- the names and number of satellites that will need to migrate to the 4000-4200 MHz band
- the number of new satellites that may be required to serve the Canadian market
- the locations of earth stations communicating with these satellites
- the number of antennas and locations of associated earth stations that will need to be retuned and/or repointed
- the flexibility of existing satellites to modify operations according to the different areas of Canada

This information should be submitted on a confidential basis, as instructed in section 13.

132. This question is not applicable to TELUS as TELUS is not a Canadian satellite licensee nor is TELUS authorised to provide satellite service in Canada.

Q27: FSS transition timing (earth stations)

Q27. ISED is seeking comments on its proposed transition deadline of December 2023 for FSS earth stations, in which existing FSS earth station licences would be modified to 4000-4200 MHz in the relevant areas.

133. TELUS refers the reader to its response to Question 24 above, where it discusses in detail considerations that apply to both space stations and earth stations in light of the transition timelines contemplated in both ISED's and Telesat's proposals.

Q28: FSS transition: Interference protection

- Q28.** ISED is seeking comments on making amendments to the relevant conditions of licence and technical rules in the 3700-4200 MHz band as well as the 3450-3700 MHz band in order to implement the following proposals with respect to protection from interference:
- a. **prior to the transition deadline**, existing licensed FSS earth stations may operate in the entire 3700-4200 MHz band in **all areas** and be protected from interference from flexible use operations both in-band (3700-3980 MHz) and the adjacent 3450-3700 MHz band
 - b. **after the transition deadline**, existing licensed FSS earth stations may continue to operate in the entire 3700-4200 MHz band in **satellite-dependent areas** and be protected from interference from in-band flexible use operations in 3700-3980 MHz, but would not be protected from flexible use operations in the adjacent 3450-3700 MHz band; however, ISED also proposes that flexible use licensees deploying stations in the 3450-3700 MHz band within 25 km of an existing licensed FSS earth station in the 3700-4200 MHz band be required to provide a notification to these operators, one year prior to the deployment of fixed or mobile stations
 - c. **after the transition deadline**, FSS earth stations would only be licensed to operate in the 4000-4200 MHz band in **non-satellite-dependent areas** and would be protected from flexible use operations in the adjacent 3700-3980 MHz band
 - d. **after the transition deadline**, FSS earth stations operating in 3700-4000 MHz, in all areas, which are not eligible for licensing could continue to operate as a licence-exempt station without protection from flexible use operations both in-band and adjacent band(s)

Prior to the transition deadline, 3700-4200 MHz in all areas

134. TELUS supports ISED's proposal to continue to protect existing licensed FSS earth station operations with respect to both in-band and adjacent-band interference prior to the transition deadline.
135. With respect to adjacent-band interference, this proposal would maintain the status quo for the notification processes as currently implemented in SRSP-520 and SRSP-303.65.
136. With respect to in-band interference, this proposal would limit the ability for new flexible use licensees to deploy spectrum in the 3700-3980 MHz frequency range (or 3700-4080

MHz, under Telesat's proposal) in all areas near operating FSS earth stations if spectrum was auctioned before the FSS transition was complete.

After the transition deadline, 3700-4200 MHz in satellite-dependent areas

137. TELUS does not oppose ISED's proposal to protect operations of existing licensed FSS earth stations in the areas that ISED determines will be deemed as "satellite-dependent" with respect to in-band flexible use operations in 3700-3980 (or 3700-4080) MHz, at least for the period of time during which it is determined that satellite dependent areas need access to the spectrum to maintain connectivity. However, per TELUS' response to Questions 8 and 21, requirements for protection should not constrain the deployment of flexible use systems in non-satellite-dependent areas. In other words, if there is an interference conflict between an FSS earth station in a satellite-dependent area and a 5G base station in an urban or metropolitan Tier 5, the FSS earth station operator should be responsible for remediating the interference (through shielding or other preventive measures) or accepting the increased interference levels.
138. TELUS supports ISED's proposal to eliminate protection requirements for flexible use operations in the 3450-3700 MHz band (see also TELUS' response to Question 47). TELUS does not oppose ISED's proposal to maintain a requirement (consistent with SRSP-520 and SRSP-303.65) for operators deploying flexible use systems in the 3450-3700 MHz band to notify FSS earth stations operating in the portion of the adjacent 3700-4200 MHz band that ISED determines will be retained for exclusive use in satellite-dependent regions if flexible use deployments are within 25 km of existing

operations of licensed FSS earth stations.

After the transition deadline, 4000-4200 MHz in non-satellite-dependent areas

139. TELUS supports ISED's proposal to limit licensing of FSS earth stations in non-satellite-dependent areas to the portion of the band retaining an allocation for fixed satellite service. Under ISED's proposal, this would correspond to the 4000-4200 MHz band; however, TELUS recommends that ISED adopt Telesat's proposal that would repurpose 400 MHz of spectrum and limit FSS operations to the 4100-4200 MHz band.
140. TELUS further supports ISED's proposal to protect FSS earth stations operating in the 4100-4200 MHz band from adjacent band flexible use operations in the 3700-4080 MHz band.

After the transition deadline, 3700-4000 MHz in all areas (licence-exempt)

141. TELUS does not oppose ISED's proposal to allow FSS earth stations operating in 3700-4000 MHz (or, if ISED adopts the 400 MHz repurposing, in 3700-4100 MHz) which are not eligible for licensing to continue operation as a licence-exempt station without protection from flexible use operations (either in-band or adjacent-band).
142. As per TELUS' comments in response to Questions 20 and 33, TELUS suggests that operators deploying new flexible use systems should not be restricted under any technical limitations by such systems operating under a "no-protection" status. TELUS recommends that no obligation to coordinate or notify such stations engaged in "no-protection" operations should be imposed on operators deploying flexible use systems.

Q29: CTFA changes to support geographically differentiated policy

Q29. ISED is seeking comments on the proposed change to the CTFA to add the new footnote CZZ proposed above and shown in annex B.

143. Assuming that ISED maintains the primary allocation for FSS in the 3700 to 4200 MHz frequency range in order to support its proposals for the band's ongoing use in satellite-dependent areas, the proposed footnote CZZ seems effective in achieving the desired policy goal of maintaining protection for earth stations in satellite-dependent areas while allowing flexible use to be deployed in non-satellite-dependent areas. TELUS suggests that a clause be added to clarify that the policy provision to support satellite-dependent areas should not constrain the deployment of flexible use systems in non-satellite-dependent areas, as follows:

ADD CZZ: As of [Transition deadline], FSS earth stations in the band 3700-4000 MHz will operate on a no-protection basis, except for in satellite-dependent areas, as per [future decision paper]. Protection of the fixed-satellite service in this band shall be limited to applications that do not constrain the deployment of fixed and mobile service systems in non-satellite-dependent areas, as per [future decision paper].

144. If ISED adopts the proposal to repurpose 400 MHz of FSS spectrum, the frequency range should be adjusted to 3700-4100 MHz accordingly.

Q30: FSS gateway sites

- Q30.** ISED is seeking comments on how to ensure the continued operation of gateways that support the provision of services in satellite-dependent areas, specifically:
- a. how much spectrum would be required at these gateway sites
 - b. if these stations could be consolidated into two sites, away from major population centres, and where the best locations for those sites would be

145. TELUS references the U.S. as a benchmark of consolidating from the fourteen unique locations in the contiguous U.S. to four gateway locations providing TT&C functions for the entirety of the C-band. This transition plan was acknowledged by the C-Band Alliance. TELUS fully expects that Canadian gateways can consolidate to two locations, as proposed by ISED, to accommodate all future C-band uplink demands.
146. Additionally, TELUS notes the FCC C-band decision to only allow future gateway locations in areas not heavily populated or in “another country that is maintaining C-band FSS”.
147. TELUS recommends ISED only allow consolidated gateways to be sited in locations that meet a low population impairment criteria and at the very least, do not constrain the deployment of flexible use systems in metropolitan and urban Tier 5 service areas (i.e., those which contain large or medium population centres).

Q31: Interim authorisations for existing licence-exempt earth stations (general)

Q31. ISED is seeking comments on its proposal to issue interim authorizations for certain existing licence-exempt earth stations in the 3700-4200 MHz band.

The majority of the receive only earth stations operate on a licence-exempt basis, with satellite operators providing broadcast content to cable head-ends and broadcast distribution undertakings. TELUS recognises the need for broadcast service continuity while FSS services are transitioned to the upper end of the band. Despite these receive only earth stations operating on a licence-exempt basis, some form of registration is necessary to facilitate protection during the transition. ISED suggests following CPC-2-6-01 to require individual site information for each earth station in order to facilitate the transition across the whole band and future coordination in satellite dependent areas. TELUS agrees that the proposed authorisations would permit the continued operation of existing receive-only FSS earth stations through the transition period in the entire band and after the transition in the relevant portion of the band.

Q32: Interim authorisations for existing licence-exempt earth stations (timing)

Q32. ISED is seeking comments on the proposed deadline of up to 90 days after the publication of a decision for submitting applications for these interim authorizations of existing licence-exempt FSS earth stations in the 3700-4200 MHz band.

148. TELUS supports the proposed use of a 90 day window after the decision for submitting applications for these interim authorisations of existing licence-exempt FSS earth stations in the 3700-4200 MHz band. Any applications received after this date would be considered new sites whose treatment should fall under the process addressed in Question 37.
149. TELUS recommends that ISED limit its acceptance of applications to sites that have responded to SAB-001-19 with their technical site data and which qualify under the eligibility criteria as discussed in Question 39. This will allow ISED to make a fact-driven decision based on available information about existing earth stations.

Q33: No-protection operations of licence-exempt earth stations without interim authorisations

Q33. ISED is seeking comments on its proposal that receive-only earth stations that are not eligible for an interim authorization or whose operators do not seek authorization, could continue to operate as a licence-exempt earth station on a no-protection basis.

150. TELUS does not object to ISED's proposal to allow receive-only earth stations that are not eligible for an interim authorisation or whose operators do not seek authorisation to continue to operate as a licence-exempt earth station on a no-protection basis.

151. Since earth stations operating in such a manner pose no risk of interference to nearby flexible use deployments (by virtue of the fact that their operation is receive-only), TELUS sees no harm in permitting their continued operation, as long as the expectation of “no protection” is clearly set out for them.
152. As per its recommendation above in its response to Questions 20 and 28, TELUS suggests that operators deploying new flexible use systems should not be restricted under any technical limitations by such systems operating under a secondary status. No obligation to coordinate with such stations engaged in “no-protection” operations should be imposed on operators deploying flexible use systems.

Q34: In-band protection of existing licence-exempt earth stations under interim authorisations (non-satellite-dependent areas, pre-transition)

Q34. ISED is seeking comments on its proposal that in non-satellite-dependent areas, existing earth stations that operate under interim authorizations receive in-band protection from flexible use operations in the 3700-3980 MHz band until the transition deadline.

153. Consistent with its recommendation on Question 28a for licensed FSS earth stations, TELUS supports ISED’s proposal to protect existing earth stations that operate under interim authorisations from in-band flexible use operations in the 3700-4080 MHz band until the transition deadline, under the same technical requirements for protection that would apply to licensed FSS earth stations.

Q35: In-band protection of existing licence-exempt earth stations under interim authorisations (satellite-dependent areas)

Q35. ISED is seeking comments on its proposal that in satellite-dependent areas, existing earth stations that operate under an interim authorization receive in-band protection from flexible use operations in the 3700-3980 MHz band before and after the transition deadline.

154. TELUS understands that nearly all licence-exempt earth stations operating today are used for the collection of television services (i.e., they are television receive-only, or TVRO operations). Since significant changes to frequency planning for video distribution content will take place as part of the U.S. transition, many/most earth stations being used for TV reception will be forced to make changes (e.g, requiring retuning or repointing) regardless of what decisions are reached in Canada. TELUS acknowledges that some of these existing earth stations, if located near flexible use operations, may also need new filters to ensure proper operations.
155. With the above in mind, TELUS does not oppose eligible licence-exempt TVRO earth stations, as TELUS acknowledges in its response to Question 39, that operate under an interim authorisation process receiving in-band protection before the transition deadline.
156. However, TELUS opposes the extension of such in-band protection after the transition deadline for licence-exempt stations. With appropriate filtering, eligible stations would not experience any negative service impact while continuing to operate in only the 4000-4200 MHz (or 4100-4200 MHz) portion of the band.

Q36: No adjacent-band protection of existing licence-exempt earth stations under interim authorisations (all areas)

Q36. ISED is seeking comments on its proposal that in all areas, existing licence-exempt earth stations that operate under an interim authorization receive no protection from adjacent band WBS stations and flexible use stations operating below 3700 MHz before and after the transition deadline.

157. Consistent with its recommendation on Question 28b, TELUS supports ISED's proposal that in all areas, existing licence-exempt earth stations that operate under interim authorisations receive no protection from adjacent band WBS stations and flexible use stations operating below 3700 MHz both before and after the transition deadline.
158. This recommendation reflects maintenance of the status quo; i.e., no adjacent band protection for licence-exempt stations. Given that there are no current rules requiring the issuance of notification to licence-exempt (receive-only) FSS earth stations, TELUS recommends that ISED not introduce any new notification requirement for adjacent band operations, as this requirement would introduce additional unnecessary process overhead for deployments in the 3450-3700 MHz band.

Q37: Interim authorisations and new FSS earth stations

Q37. ISED is seeking comments on whether the interim authorization process should also apply to new receive-only FSS earth stations in the 4000-4200 MHz band.

159. To ensure that ongoing coordination between flexible use licensees and FSS earth stations is possible, some form of registration is necessary for new receive-only FSS earth stations. TELUS would not oppose the application of the interim authorisation process for new receive-only FSS earth stations in the 4000-4200 MHz band which would have previously fallen under the licence-exempt regime. This approach would be consistent with the granting of interim authorisations to existing eligible licence-exempt earth stations addressed in the questions above. TELUS is of the view that a single authorisation process (following the procedure in CPC-2-6-01) should apply for both existing and new FSS earth stations for the portion of the band which is not being repurposed for flexible use.
160. TELUS supports ISED's proposal to only authorise new receive-only FSS earth stations in the 4000-4200 MHz frequency range; however, if ISED were to repurpose 3700-4100 MHz (as TELUS recommends), new FSS earth stations should only be registered in the 4100-4200 MHz frequency range.

Q38: Conditions for interim authorisations of FSS earth stations

Q38. ISED is seeking comments on the proposed conditions for interim authorizations for licence-exempt FSS earth stations in 3700-4200 MHz and new receive-only FSS earth stations in the 4000-4200 MHz portion of the band as detailed in annex G.

161. TELUS is not opposed to the proposed conditions for interim authorisations outlined in annex G being applied to existing licence-exempt FSS earth station throughout the entire band during the transition period and to both existing and new receive-only FSS earth stations for the portions of the band not being repurposed for flexible use. TELUS notes that if ISED were to repurpose 3700-4100 MHz (as TELUS recommends), the frequency ranges outlined in annex G would need to be adjusted accordingly.

Q39: Interim authorisations for licence-exempt earth stations (eligibility)

Q39. ISED is seeking comments on the proposed eligibility of licence-exempt stations that could apply for an interim authorization.

162. The Consultation makes a distinction between two types of licence-exempt earth stations in use in Canada. The first type consists of earth stations that make up an enterprise network such as those used for broadcast distribution; the second type consists of earth stations that are used by the general public such as those used for direct-to-home (DTH) satellite television. ISED proposes to limit eligibility for interim authorisations to the first type listed above.

163. ISED further proposes that interim authorisations be limited to entities that currently have stations deployed, that an agreement is in place with the space station operator which provides for access to the space station capacity or signals and that full site information for all of its eligible existing sites be provided.
164. TELUS supports ISED’s proposed basic eligibility criteria applying to “those stations that are not exempt under paragraph 4(1)(b) of the [Radiocommunication] Act, i.e. entities that are part of enterprise networks.” TELUS also supports the additional limitations outlined in paragraph 151 of the Consultation.

Q40: Fixed point-to-point applications in 3700-4000 MHz

Q40. ISED is seeking comments on its proposal to no longer issue new licences for fixed services to operate fixed point-to-point applications in the 3700-4000 MHz band.

165. TELUS supports ISED’s proposal to no longer issue new licences for fixed services to operate fixed point-to-point applications in the 3700-4000 MHz band, given that there is very little usage and no modern equipment ecosystem in the band.

Q41: Fixed point-to-point applications in 4000-4200 MHz

Q41. ISED is seeking comments on whether to allow new licences for fixed services to operate fixed point-to-point applications in the 4000-4200 MHz band.

166. TELUS recommends that fixed point-to-point applications should no longer be allowed in the 4000-4200 MHz band given that there is very little usage and no modern equipment ecosystem in the band.

Q42: Grandfathering existing fixed point-to-point applications

Q42. ISED is seeking comments on the proposal to grandfather existing point-to-point operations in the 3700-4000 MHz band under existing licences for fixed service (as identified in annex A), such that flexible use systems in these two tiers may not claim protection from, nor cause interference to these fixed service stations.

167. TELUS opposes grandfathering existing point-to-point operations in the 3700-4000 MHz band given the policy to make flexible use available in the band. For the two existing fixed systems in Canada, TELUS supports a “when and where necessary” displacement policy where fixed systems can be notified and given six months to either cease operations from a the associated flexible use licensee or continue operating with its licence on a No-Interference, No-Protection (NINP) basis.
168. TELUS recommend fixed systems migrate to more widely supported fixed equipment in a different band (e.g., upper 6 GHz and 8 GHz); otherwise, operators could leverage equipment in a new shared licensing band or a potential shared spectrum regime as proposed by TELUS in its response to Question 19.

Q43: Coexistence between flexible use systems

Q43. ISED is seeking comments on the proposal to rely on technical limits and coordination procedures rather than mandate specific technology solutions (e.g. TDD synchronization between systems) to address interference issues between TDD flexible use systems in the 3650-3980 MHz band.

169. TELUS supports ISED's proposal to rely on technical limits and coordination procedures rather than mandate specific technology solutions (e.g. TDD synchronisation between systems) to address interference issues between TDD flexible use systems in the 3650-3980 MHz band.
170. TELUS notes that a similar approach was recently adopted for the 3500 MHz band, as implemented in the recent SRSP-520 policy and supported by the companion RSS-192 standard.

Q44: Additional measures to limit interference between flexible use systems

Q44. ISED is seeking comments on whether any additional measures should be taken to limit potential interference issues between flexible use systems in the 3650-3980 MHz band.

171. TELUS does not believe that any additional measures should be taken to limit potential interference issues between exclusively licensed flexible use systems in the 3650-3980 MHz band.

Q45: Coexistence between flexible use and WBS before WBS displacement

- Q45.** ISED is seeking comments on whether specific technical measures should be adopted to address potential interference issues between flexible use systems and WBS systems until the displacement deadline.
- a. **For co-channel flexible use and WBS operations in the 3650-3700 MHz band**, what specific measures may be needed to protect WBS? For example, should new flexible use stations be required to coordinate with WBS stations within a specified distance prior to deployment? Alternatively, should a technical parameter such as a power flux density (pfd) trigger for coordination measured at the WBS receive antenna be adopted? Are there other more appropriate measures that ISED should consider? Should multiple measures, such as a combination of distance and pfd trigger for coordination, be adopted? How would these requirements impact the deployment of new flexible use stations?
 - b. **For adjacent band flexible use systems**, is there a need to adopt any additional measures, beyond what is currently specified in RSS-192 and SRSP-520, to further address coexistence between these flexible use and WBS systems? If so, what should they be? How many flexible use frequency blocks (or MHz) immediately adjacent to the 3650-3700MHz band could potentially affect WBS systems? How would these requirements impact the deployment of flexible use stations?

Co-channel flexible use and legacy WBS operations

172. TELUS does not propose any specific additional measures to protect WBS prior to its displacement. The “general requirement to coordinate as necessary” for adjacent band operations (per SRSP-520 for the 3450-3650 MHz band) should be applied to new flexible use licensees operating co-channel with WBS in the 3650-3700 MHz band, as needed.
173. TELUS notes that its recommendation in Question 18 to extend the moratorium such that it applies to the deployment of new WBS sites in all Tier 4 service areas will effectively create priority for new flexible use licensees over the expansion of legacy WBS users.
174. TELUS notes that the displacement timelines it proposes in its response to Question 16 (combined with the definition of ‘urban’ service areas proposed in Question 17) should

strike a balance between the needs of current WBS licensees in delivering connectivity to rural fixed wireless access customers vs. promoting innovation through the deployment of flexible use 5G systems by prospective new licensees in the 3650-3700 MHz band. TELUS' recommendation to ensure that the urban WBS displacement is realised promptly with a one-year notification of displacement at the time of publication of this Consultation's decision would help to realise this outcome.

Adjacent band flexible use and legacy WBS operations

175. TELUS does not recommend any additional measures to promote the coexistence of new flexible use systems in the 3700-4080 MHz band with legacy WBS systems prior to displacement. As noted in the response above, the obligation of general coordination "as necessary" defined in SRSP-520 can and should be applied to new flexible use systems prior to the respective WBS displacement dates in urban and rural service areas.

Q46: Flexible use to FSS: Adjacent band coordination prior to transition (3650-3700 MHz)

Q46. Until the transition deadline, in all areas for flexible use in the 3650-3700 MHz band: ISED is seeking comments on the proposal that until the transition deadline, those flexible use licensees deploying stations in 3650-3700 MHz within 25 km of a licensed FSS earth station (not including interim FSS authorization) in the 3700-4200 MHz band will be required to coordinate with the operators in these earth stations.

Note: In providing comments to Q46-Q49, respondents are requested to consider the coordination burdens such coexistence and protection measures could impose on either flexible use services or FSS earth stations.

176. TELUS supports ISED's proposal that flexible use licensees deploying stations in 3650-3700 MHz within 25 km of a licensed FSS earth station in the 3700-4200 MHz band will be required to coordinate with the operators in these earth stations if they are deploying before the transition deadline.
177. TELUS notes that this proposal is consistent with ISED's current policy requiring requiring flexible use licensees in 3450-3650 MHz and WBS licensees in 3650-3700 MHz that are deploying stations within 25 km of a licensed FSS earth station to notify the FSS earth station operator (SRSP-520 and SRSP-303.65, respectively).

Q47: Flexible use to FSS: No adjacent band protection post-transition (3450-3650 MHz)

Q47. After the transition deadline, in all areas for flexible use in the 3450-3650 MHz band: ISED is seeking comments on its proposal that the current SRSP-520 coexistence requirements for flexible use operations in the 3450-3650 MHz band to protect FSS operations in the adjacent band 3700-4200 MHz be removed.

178. TELUS supports ISED's proposal to remove the current SRSP-520 coexistence requirements for flexible use operations in the 3450-3650 MHz band to protect FSS operations in the adjacent band 3700-4200 MHz after the transition deadline has passed (see also TELUS' response to Question 28b).

Q48: Flexible use to FSS: Adjacent band coexistence measures

Q48. For FSS earth stations licensed in the 4000-4200 MHz band and flexible use in the 3800 MHz band, in all areas: ISSED is seeking comments on adjacent band coexistence measures, taking into account the coexistence measures adopted by the EU (i.e. a stringent OOB limit) and the U.S. (i.e. a combination of guard band, a typical OOB limit, pfd limits, and baseline minimum filter specifications for earth station operations) and the current Canadian requirements (i.e. a typical OOB limit and coordination distance):

- a. What are the benefits and technical limitations associated with the above coexistence measures?
- b. Which set of coexistence measures above (i.e. EU, U.S., Canada) is preferred? If applicable, comments are sought on the values of the limits in relation to the supported measures.
- c. Given the proposal in section 9.1 to displace WBS in 3650-3700 MHz and identify 3900-3980 MHz for shared use, are there any additional considerations that may impact the response to a) and b) above?
- d. Which portion of the 3800 MHz band should the above measures be applied to in order to protect FSS in the 4000-4200 MHz band (i.e. how many frequency blocks or MHz)?

179. As noted in TELUS' response to Question 3, there are ecosystem benefits associated with adopting the type of adjacent band coexistence measures used in the U.S. (as they comply with the standard 3GPP operating band unwanted emissions limits). In response to this question, TELUS specifically addresses the operational benefits of following the FCC-style framework with a focus on the PFD limits, which is only made possible by the FCC's adoption of an integral set of technical rules.

180. Though the use of a stricter OOB limit (as in the ECC's technical rules) could reduce the burden of coordination while providing similar mitigation of interference issues, the FCC's well studied technical rules and instantiated PFD limits of -124 dBW/m²/MHz and -16 dBW/m²/MHz for receiver desensitisation and blocking respectively simplify 5G deployment. Imposing this set of "FCC-style" rules for use in Canada would drastically

minimise the logistical coordination volume anticipated between operators of the adjacent band services (such as the licensed incumbent earth stations, and potentially expanded to include licence-exempt earth stations should they be granted interim authorisations) and a multitude of future flexible use operators deploying radios across Canada.

181. ISED's traditional coordination notion is optimal for adjacent bands with FSS earth stations where there are limited locations where coordination is necessary (such as the Weir site considered in the development of SRSP-520 and the limited licensed earth stations adjacent to WBS under SRSP 303.65).
182. Simply put, TELUS recommends adopting the two FCC PFD limits as operational limits only (i.e., without specifying a coordination distance) for blocks between 3700-3980 MHz to enable adjacent channel coexistence.
183. If ISED were to licence the flexible use spectrum between 3900-3980 MHz as shared spectrum, TELUS recommends that no additional technical limits or coexistence measures would be necessary for the purpose of adjacent band coexistence with FSS.

Q49: Flexible use to FSS: Co-channel coexistence measures

Q49. ISED is seeking comments on what technical requirements should be imposed to ensure co-channel protection of FSS earth stations from flexible use systems, in the relevant scenarios and timeline as stated in sections 9.5 and 9.6. For example, could the pfd limit of -124 dBW/m²/MHz measured at the earth station antenna proposed by FCC above be used to protect co-channel FSS earth station? Alternatively, should other measures be adopted, such as a separation distance as described in section 7.3? Or should a combination of measures be adopted? If applicable, what are the specific values that should be adopted?

184. For the purposes of co-channel coexistence with FSS when operating within 3700-3980 MHz or 3700-4080 MHz, TELUS recommends to adopt a similar approach to the FCC's, applying a PFD limit to protect satellite earth stations and consolidated gateways. According to the technical discussion on the FCC record, individual flexible use licensees would need to target a -6 dB interference-to-noise ratio (I/N) protection design (i.e. an aggregate PFD limit of -120 dBW/m²/MHz) to prevent flexible use operations from impacting satellite earth stations operating in satellite-dependent areas (as proposed by TELUS) or at consolidated gateways.
185. TELUS proposes that the protection criteria described above should not apply to flexible use stations operating in large or medium population centres, which, under TELUS' proposal, would not have an obligation to protect satellite earth stations in satellite-dependent areas.

Q50: Earth station technical parameters

Q50. ISED is seeking comments on whether the assumptions made by the FCC about earth stations, including baseline minimum filter specifications for earth station operations as stated above, are applicable to Canadian operations. Is there any additional information that ISED should consider in the development of appropriate technical rules to enable coexistence both co-channel and in adjacent bands?

186. TELUS recommends that the earth station parameters (I/N of -6dB, a noise temperature of 142.8K, and an aggregation factor of 4dB) according to the FCC proposal are correct and that those parameters lead to a PFD protection limit of -124 dBW/m²/MHz for the protection of the FSS service from adjacent band emissions. A -16 dBW/m²/MHz PFD requirement to protect earth stations from receiver blocking relies on the 20 MHz guard band and also earth station baseline minimum filter specification described in Table 2 for coexistence with flexible use in the adjacent band with similar technical parameters adopted by the FCC or with potentially the same parameters found in SRSP-520.

Table 2: Satellite earth station minimum filter specifications

Frequency Range	Attenuation
From 3.7 GHz to 100 megahertz below FSS band edge	-70 dB
From 100 megahertz below lower FSS band edge to 20 megahertz below lower FSS band edge	-60 dB
From 20 megahertz below lower FSS band edge to 15 megahertz below lower FSS band edge	-30 dB
From 15 megahertz below lower FSS band edge to lower FSS band edge	0 dB

Q51: Coexistence between flexible use and radionavigation

Q51. ISED is seeking comments on its proposal to not implement any technical requirements for the coexistence between flexible use operation in the 3650-3980 MHz band and radionavigation operations in the 4200-4400 MHz band, noting the 220 MHz frequency separation between the bands of operation. If this is not sufficient for coexistence, what other measures would be appropriate?

187. TELUS has researched the available literature on the matter, and based on our technical review of the RTCA report¹⁷ and comments by the FCC in its C-Band Report & Order, TELUS supports ISED’s proposal not to implement any technical requirements for the coexistence between flexible use operation in the 3650-3980 MHz band and radionavigation operations in the 4200-4400 MHz band. TELUS notes that 220 MHz of frequency separation appears to be sufficient for coexistence with radionavigation services. The FCC notes¹⁸ that “under reasonable scenarios (or even reasonably ‘foreseeable’ scenarios)... the technical rules on power and emission limits we set for the 3.7 GHz Service and the spectral separation of 220 megahertz should offer all due protection to services in the 4.2-4.4 GHz band.” The FCC calls for the aviation industry and others to illustrate “why there may even be a potential for some interference given that well-designed equipment should not ordinarily receive any significant interference (let alone harmful interference) given these circumstances.” The FCC further states that they “expect the aviation industry to take account of the RF environment that is evolving

¹⁷ *Assessment of C-Band Mobile Telecommunications Interference Impact on Low Range Radar Altimeter Operations*, RTCA Paper No. 274-20/PMC-20731, October 2020. Link: https://www.rtca.org/wp-content/uploads/2020/10/SC-239-5G-Interference-Assessment-Report_274-20-PM-C-2073_accepted_changes.pdf

¹⁸ FCC C-Band Report & Order, paragraph 395.

below the 3980 MHz band edge and take appropriate action, if necessary, to ensure protection of such devices.”

188. Further to TELUS’ proposal of shared spectrum use in its response to Question 19 following the well studied Ofcom framework for coexistence with radionavigation (not to mention FSS), TELUS notes that Ofcom uses a 5 MHz guard band in 4195-4200 MHz to offer protection of radionavigation services and a per site licensing process that incorporates radionavigation coexistence analysis during the licence application where necessary. Ofcom’s framework and analysis incorporates radionavigation service requirements at airports or other controlled airspaces. Ofcom’s analysis¹⁹ concludes that sufficient protection margin (i.e., 6 dB for receiver desense, and 8 dB for receiver blocking) exists for the worst case scenario using the ITU-R M.2059 thresholds for the worst performing radio altimeters (i.e. A3).

¹⁹ The maximum interference observed was around -117 dBm/2MHz while the receiver desensitisation threshold was set to -111 dBm/2MHz, see Figure 24 in Ofcom’s consultation, *Enabling Opportunities for Innovation Consultation*, 18 December 2018. Link: https://www.ofcom.org.uk/_data/assets/pdf_file/0022/130747/Enabling-opportunities-for-innovation.pdf

Q52: Preliminary questions on 3800 MHz licensing process

Q52. ISED is seeking comments on the use of an auction as the licensing process for the flexible use spectrum that would be considered as the 3800 MHz band, noting a separate consultation process would be issued, if required, to determine the licensing framework for the range 3900-3980 MHz.

189. TELUS supports the use of an auction as the licensing process for the 3800 MHz band. TELUS focuses its input on the overall licensing structure and timing and on competitive measures.
190. The primary goal in licensing 3500 MHz and 3800 MHz spectrum is to achieve large contiguous assignments of circa 100 MHz per operator for four operators in every region so that Canada can continue to lead the world in mobile network quality and experience. With its Option 2 proposal for WBS, ISED has created an opportunity at this pivotal juncture to achieve a best in class allocation of the 450 MHz of flexible use spectrum in terms of putting it to efficient use which will serve Canada for decades and decades to come. All involved would be very remiss if a disjointed set of licensing processes was allowed to hamstring Canada with a fractured and inefficient spectrum assignment.

Overall licensing structure and timing

191. To achieve large contiguous assignments of circa 100 MHz per operator, ISED needs to hold an assignment stage (with a guarantee of contiguity) which includes all the spectrum allocated across 3450-3900 MHz.

192. TELUS recommends that in order to best achieve this outcome, ISED should modify its upcoming 3500 MHz auction by incorporating the 3650-3900 MHz spectrum into the auction process. By including this additional 250 MHz of spectrum in next year's auction, ISED would be able to conduct a single joint assignment stage that creates contiguous allocations across all of the spectrum allocated from 3450-3900 MHz.
193. A single assignment could mean that some licensees will be moved out of Band 42/43 when they previously had not contemplated it. However, given that ISED is recommending moving shared licensing to 3900-3980 MHz, this already looks to be a trend and the impact is somewhat lessened by ISED's proposed transition timeline of 2 to 3 years for all but urban centres. As such, it should not pose significant issues given the need for all operators to eventually upgrade equipment to be compliant to RSS-192 or a new RSS for the 3800 MHz band.
194. Similarly, for any mobile operators who might be concerned about being located above 3800 MHz due to a current lack of equipment, TELUS again maintains that recent developments (i.e., the FCC conducting its C-band auction later this year with early transition/clearing in its top markets by the end of next year, as well as the latest 5G flagship devices from major manufacturers shipping with Band n77 onboard) have made this concern moot. There will be readily available Band n77 equipment and devices by late 2021 when the first 3500 MHz transitions have been completed.
195. TELUS makes the recommendation to auction 3450-3900 MHz in June 2021 despite the quick action required by ISED because TELUS perceives that the mobile industry has a strong preference for getting more mid-band TDD spectrum into the hands of operators

earlier, almost all of which can be cleared by late 2021 in urban markets. It would provide the mobile industry with the most certainty in planning and executing their mid-band TDD spectrum investments with respect to what will arguably be the most important band in this generation of wireless technology.

196. To be clear, TELUS is in no way advocating for any delay in the start of the 3500 MHz auction on June 15th, 2021. Thus, if ISED deems the above proposal too challenging to implement in the time available given the rigorous ISED operating model, then TELUS would not be opposed to ISED allowing for a conversion and a Telesat-driven auction process of 3700-3900 MHz to facilitate achieving the same objective, as long as such sale is completed in an open and transparent manner (as discussed in TELUS' response to Question 57). In other words, in such an alternate approach, ISED would add the 3650-3700 MHz (WBS) blocks into the allocation stage of next year's 3500 MHz auction, allow for a timely conversion and private sale of 3700-3900 MHz spectrum, and then include all licences (from 3500 MHz conversions, the 3450-3700 MHz auction, and the 3700-3900 MHz sales processes, i.e., 3450-3900 MHz) in its 3500 MHz auction next summer in a single assignment stage guaranteeing that every licensee's holdings from across the 450 MHz received a contiguous assignment.
197. Failing all of the above, ISED must complete its auction for 3500 MHz next summer and auction 3650-3900 MHz as soon as possible thereafter. TELUS would recommend in this case that the 3800 MHz auction be prioritised over a potential 2022 mmWave auction. ISED should still build an assignment stage as part of the 3800 MHz auction that includes

all 3500 MHz and 3800 MHz licences, guaranteeing all licensees auto-contiguity across the full 450 MHz.

198. This approach would require an interim assignment in the 3500 MHz band²⁰ and a final assignment in the harmonised 3500+3800 MHz band. As such, it introduces an extra retuning requiring any incumbent FWA operators (operating under fixed use licences in the 3500 MHz band today) in urban markets to retune twice and band entrants once. Rural FWA incumbents and WBS incumbents would likely only need to move once in the 2023/24 timeframe. All mobile operators are likely buying new equipment and hence should not be averse to a final assignment above 3800 MHz and a retune. The upcoming transition and the likelihood of needing to potentially purchase new equipment has been on every incumbent FWA licensee's radar for almost a decade. This extra step can be avoided in the accelerated process recommended by TELUS, but could also be accommodated should industry actually prefer interim 3500 MHz assignments, as described above.
199. The use of an interim and final assignment should not be the primary reason for selecting the path of multiple sequential auctions. If the majority of existing or prospective licensees still prefer early use of the n78 ecosystem in the short term, different interim and final assignments could still be accommodated by a two stage²¹ assignment process that temporarily positions the licensee in a preferred band location.

²⁰ A minor update to SLPB-001-20 *Policy and Licensing Framework for Spectrum in the 3500 MHz Band* would be required to note that assignments were transitional.

²¹ In such a process, operators could bid on both an interim assignment in 3450-3650 MHz and on a final contiguous spectrum assignment in 3450-3900 MHz in the assignment stage of a single auction. The transitions from interim assignment to final assignment would not take effect until some agreed upon date certain once all parties' spectrum has been cleared.

200. Alternatively, within a single harmonised assignment stage, ISED could consider mechanisms to help address potential concerns regarding the location of certain licensees' final assignments:

- a. If a small number of prospective licensees are concerned about being located outside of Band n78, ISED could consider allowing certain parties to “opt out” of assignment bidding in exchange for a guaranteed assignment in 3450-3800 MHz, presumably at the lower band edge.
- b. WISPs (i.e., existing WBS or future shared licensed spectrum users) could be preferentially placed adjacent to the new shared licensing band at the 3900 MHz edge if they so choose.
- c. Though not specifically linked to TELUS' assignment proposal, if ISED were to adopt the use of the 3400-3450 MHz band as a temporary tool to accommodate the displacement of WBS (pending the final clearing of shared licensed spectrum), no flexible use licensee would need to be concerned about landing in 3650-3700 MHz as part of the new assignment, as the spectrum could be cleared at the same time as all the other spectrum in the 3450-3900 MHz range.

Investment certainty

201. Given the uncertainty at present going into the 3500 MHz auction in less than 8 months, a key goal for potential acquirers of flexible use licences in the 3450-3900 MHz range is to be provided more clarity by ISED in advance of the 3500 MHz auction (via a decision on

this Consultation) as to generally how and when the various tranches of the 3450-3900 MHz spectrum will be released, frequency assigned and transitioned.

Competitive measures

202. Whether ISED adopts an approach resulting in the same long-term end result of contiguous holdings for all or whether ISED settles for a piecemeal approach resulting in a fractured band with fragmented and inefficient spectrum allocations, there will be 450 MHz²² of exclusive use, flexible use spectrum in the 3450-3900 MHz range in-market. This is the quantum that should guide ISED's assessment of competitive measures. ISED should not consider the approach for each tranche of 3500 and 3800 MHz spectrum separately.
203. TELUS recommends that ISED implement an appropriately dimensioned²³ one-size-fits-all mid-band TDD aggregation limit to ensure four operators in each region have access to a meaningful amount of critical mid-band TDD to promote 5G competition. In other words, TELUS recommends a logical spectrum cap across the 3500 and 3800 bands be applied to all bidders.
204. Using an aggregation limit for 3500/3800 MHz is appropriate because:

²² There is a possibility of expansion upward by another 100 MHz per Telesat as well as the potential for accessing 3400-3450 MHz for flexible use in the future per 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*, published June 2019, Para 55: "As sharing technologies continue to evolve, ISED is exploring other mechanisms for optimizing spectrum use in the 3400-3450 MHz band. Many countries are including this band in their plans for 5G flexible use, and equipment is being developed to support this frequency range."

²³ Aggregation limits or caps are simple to design. An appropriate dimension for a cap in Canada's four operator per region market is greater than $n/3$ and typically somewhere in and around the $n/4$ mark where n is the total spectrum under consideration. ($n/4 = 112.5$ MHz when $n = 450$ MHz). Where the cap is set is guided by, among other factors, the effective set-aside it creates.

- a. The last time ISED held an auction with a set-aside and no cap, the open spectrum was all won by one bidder in 10 of the 16 markets including Canada’s largest market;
 - b. When it comes to mid-band TDD spectrum, two set-aside-ineligible bidders already have 46 MHz of mid-band TDD (~30 MHz of 3500 MHz mid-band TDD and also ~16 MHz of 2600 MHz mid-band TDD, the only other mid-band TDD spectrum in Canada) while the third of three set-aside-ineligible bidders has to date only ~3 MHz of mid-band TDD in the 3500 MHz band. A cap helps address this disparity; and
 - c. Spectrum caps moderate spectrum prices²⁴ and thus support affordability and increased investment (in things like increased rural coverage). The GSMA in its September 2019 spectrum pricing report²⁵ finds that “Spectrum prices can also play a significant role by influencing investment and pricing decisions. High spectrum prices can impact the mobile sector by reducing the funds available to undertake investments and generating upward pressure on consumer tariffs.”
205. As examples, for the aggregate band across 3450-3900 MHz (or 450 MHz, 45 blocks), ISED could implement a 120 MHz cap and guarantee at least four winners and create an effective set-aside of 90 MHz. Across the same 450 MHz, a 110 MHz cap would guarantee 5 winners and allow four mobile operators in every region to get 100 MHz+ each. A 130 MHz cap would guarantee at least four winners and create an effective

²⁴ The last time ISED held an auction with a set-aside and no cap, TELUS paid on a unit cost basis more than 6x more than another ILEC (Sasktel) paid, and roughly three times what set-aside-eligible bidders paid on average.

²⁵ GSMA, *The impact of spectrum prices on consumers*, September 2019. Link: <https://www.gsma.com/spectrum/wp-content/uploads/2019/09/Impact-of-spectrum-prices-on-consumers.pdf>

set-aside of 60 MHz. A 100 MHz cap would guarantee 5 winners and allow four mobile operators in every region to get 100 MHz each.

206. Almost every operator called for a 3500 MHz cap and ISED did not use one. In the 600 MHz consultation process, there were also calls for caps and ISED did not use one. Given that in most of Canada's markets (including Canada's largest market), there were only two winners of spectrum in the last auction, ISED might give more consideration to broad support for a cap before dismissing the industry benefit of a cap versus the limited benefits of a set aside coupled with its considerable downsides.
207. The approach of using spectrum caps has been adopted by regulators as a standard of best practice. ISED has overused and misused the set-aside as a tool and is out of step with the rest of the world.
208. The evidence from the balance of the OECD does not support the continued application of set-asides by ISED²⁶. Regulators manage the distribution of spectrum through aggregation limits. They very rarely use set-asides. They don't privilege established operators in a targeted way. Outside of Canada, set-asides are used strictly for market entry or they are cap-like because eligibility is simply based on existing spectrum holdings. Nowhere else in the world are there arbitrary eligibility qualification schemes such as using a national market share limit for regional operators, or arbitrarily limiting geographic expansion or defining set-aside eligibility without any regard to distribution of pre-existing holdings as found in Canada. If ISED continues to tightly market plan spectrum auction outcomes, it

²⁶ From 2014-2021 there will be three large set-asides in Canada; over the same period there will be two set-asides in the entire OECD outside of Canada, none of which involve the setting aside of any 3.x GHz spectrum.

needs to revert to neutral tools, i.e., aggregation limits or set-asides with eligibility based on spectrum holdings.

209. Set-asides are in the toolbox of every regulator around the world but they have only been used repeatedly in Canada. There is an equivalent tool in every regulator's toolbox, the spectrum cap, and it is used ubiquitously by regulators around the world because of its benevolent qualities without adverse side effects.

Q53: Telesat proposal: Impact to 5G deployment

Q53. ISED is seeking general comments on the proposal submitted by Telesat found in annex H, including whether such an approach would be in the best interest of Canadians and more specifically, whether it would result in the faster deployment of 5G services in the affected frequencies; more efficient use of spectrum and what the implications of this repurposing plan would be for other users of the band.

210. The 3500 MHz auction falls short in making enough mid-band TDD spectrum available per operator that is required to offer customers the full benefits of 5G. Due to the 3500 MHz spectrum constraints, there is a need to make more mid-band TDD spectrum available ASAP instead of waiting another 3+ years. Since the Telesat proposal makes 200 MHz available much sooner, the release of that spectrum could be combined with the 50 MHz in 3650-3700 MHz, and made available along the same timelines as the 3500 MHz band transition. ISED should take advantage of the proposed timelines to solve the significant spectrum constraints that exist due to the decisions made in the 3500 MHz process.

211. Although the Telesat proposal would result in the faster deployment of 5G services, TELUS has significant concerns with the implications on the downstream efficient use of the spectrum. Including the 3500 MHz auction, the Telesat proposal would see three separate auctions taking place for the 3500 and 3800 MHz bands. The net result of three separate and independent auctions would result in Canadian operators holding licences for slivers of spectrum throughout the band. Absent a single large auction or reassignment mechanisms such as proposed by TELUS in response to Question 52 which guarantees automatic contiguity following multiple auctions, the Telesat proposal would not result in efficient use of this prime 5G spectrum.

Q54: Telesat proposal: Meeting ISED’s policy objectives

Q54. ISED is seeking comments on whether the Telesat proposal meets ISED’s policy objectives outlined in section 3, including:

- a. supporting rural/remote connectivity
- b. promoting competition in mobile services
- c. making more mid-band spectrum available to support 5G services

212. TELUS believes that Telesat’s proposal partially meets ISED’s policy objectives by making more mid-band TDD spectrum available sooner, with transition timelines aligned to the 3500 MHz band, and clearly taking rural/remote connectivity into consideration through its proposed transition plan. However, Telesat’s proposal falls short by not addressing the displacement of WBS licensees to achieve overall contiguity across the 3500 MHz and 3800 MHz bands, as well as by proposing three auctions that would result

in a set of fragmented bands which are poorly suited for 5G competition. Building on ISED's Option 2 for WBS, TELUS proposes modifications to Telesat's proposal in response to Question 52 and 57 that would meet ISED's policy objectives in a more fulsome way by addressing WBS displacement (to further support rural connectivity) and including a harmonised assignment process for all spectrum in 3450-3900 MHz (to enable true 5G competition across the country).

Q55: Telesat proposal: Considerations regarding allocations, WBS, and coexistence between adjacent services

- Q55.** ISED is seeking comments on what elements from sections 7 to 10 of this consultation would still apply or need to change if ISED were to implement the Telesat proposal, in particular:
- a. the proposal for maintaining the primary allocation for FSS in the 3700-4200 MHz band
 - b. the proposed implementation of an exemption to transition for satellite-dependent areas and the proposed changes to satellite licenses to apply it
 - c. the proposal for treatment of WBS incumbents
 - d. the proposal to issue interim authorizations for certain existing licence-exempt earth stations in the 3700-4200 MHz band
 - e. technical considerations for coexistence between FSS and flexible use
 - f. technical considerations for coexistence between flexible use and aeronautical radionavigation systems
 - g. the overall impact on existing users in the 3700-4200 MHz band

Maintaining the primary allocation for FSS in the 3700-4200 MHz band

213. TELUS reiterates its concerns regarding the definition of satellite-dependent areas, and the notion of preserving all 500 MHz of FSS spectrum to be used within them, especially

when considering that Telesat's proposal indicates an ability to complete a national repacking of all FSS services into 100 MHz of remaining spectrum.

214. TELUS recommends the same treatment of the primary allocation for FSS in the 3700-4200 MHz band under Telesat's proposal as under ISED's proposal; that is, TELUS does not oppose ISED's proposal to maintain a primary allocation to FSS, should it determine such an allocation necessary for maintaining continuity of service for broadband and telephone services to a limited number of satellite-dependent regions, for a limited time.

Exemption to transition for satellite-dependent areas and the proposed changes to satellite licences to apply it

215. TELUS' recommendations for the definition of satellite-dependent areas and for any changes required to support an exemption to transition for satellite-dependent areas remains unchanged under Telesat's proposal (which only changes the quantity of satellite spectrum remaining in the band).
216. TELUS continues to recommend that service areas should only be defined as satellite-dependent in regions where terrestrial alternatives (whether wireless or wireline) for broadband connectivity are unavailable.
217. TELUS' recommendation for the modification of proposed footnote CZZ remains unchanged under Telesat's proposal. TELUS suggests that a clause be added to clarify that the policy provision to support satellite-dependent areas should not constrain the

deployment of flexible use systems in non-satellite-dependent areas (see TELUS' response to Question 29).

Treatment of WBS incumbents

218. TELUS does not envision that any change in the treatment of WBS incumbents would be needed whether ISED adopts its own proposal or Telesat's.
219. TELUS' suggests that under either proposal, WBS displacement in urban markets should be completed to make the 3650-3700 MHz spectrum available in urban markets as soon as possible, with a one-year notification of displacement being issued along with the decision on this Consultation.
220. TELUS further recommends that rural WBS displacement be completed by December 2023 (potentially landing in the 3400-3450 MHz band as a temporary transition location, as discussed in TELUS' response to Questions 15 and 16). However, TELUS notes that in both ISED's proposal and in Telesat's proposal, the displacement of (rural) WBS systems would take place by December 2025. Since this is the date proposed by Telesat in its transition plan, TELUS sees no conflict between ISED's intended treatment for existing WBS licensees in their transition to a new shared spectrum band.

Interim authorisations for certain existing licence-exempt earth stations

221. TELUS' recommendations with regard to the treatment of certain existing licence-exempt earth stations proposed to be issued interim authorisations remain unchanged whether under ISED's transition proposal or Telesat's.

Technical considerations for coexistence between FSS and flexible use

222. TELUS recommends the same technical limits and requirements as proposed by ISED, noting that the flexible use and FSS bands are now adjacent to each other at 4100 MHz, as opposed to 4000 MHz, and the proposed 20 MHz guard band is in 4080-4100 MHz. TELUS acknowledges that a modified U.S. border agreement is necessary to reflect the difference in the band plan of the two respective countries which would juxtapose US FSS with co-channel shared licensing of flexible use (potentially at lower power levels) in Canada. Within Canada, coexistence between FSS and flexible use follows the same application of the PFD limits, a guard band, -6 dB I/N protection of gateways, baseline minimum filter specification for FSS, and OOB limits consistent with 3GPP standards for flexible use.

Technical considerations for coexistence between flexible use and aeronautical radionavigation systems

223. With respect to technical considerations for coexistence between flexible use and radionavigation, TELUS notes that when the FCC was considering the entire 3700-4200 MHz band, Boeing²⁷ was solely concerned with potential interference from flexible use in 4100-4200 MHz. In TELUS' proposal with 400 MHz repurposed, shared use licensing

²⁷ The Boeing Company, *Boeing C-band NPRM Reply Comments* 12 11 2018, p.6, December 2018. Link: <https://ecfsapi.fcc.gov/file/121184623679/Boeing%20C-band%20NPRM%20Reply%20Comments%2012%2011%202018%20final.pdf>

would be below 4100 MHz at 4000-4080 MHz. TELUS recommends that further study is undertaken to determine the appropriate technical rules for potential shared licensing above 4000 MHz in the Canadian context.

Overall impact on existing users in the 3700-4200 MHz band

224. TELUS views the ultimate decision on whether to follow the FCC and repurpose 300 MHz of spectrum vs. following Telesat's proposal and adding an additional 100 MHz for flexible use is a question of need. After taking into consideration all of the input from stakeholders in this Consultation, ISED will need to decide which plan can maximise the economic benefits of 5G while addressing any dependencies of northern and remote data and telephony systems on C-band satellite connectivity.
225. If, as Telesat posits, rural and remote satellite connectivity doesn't demand that extra 100 MHz of C-band spectrum in perpetuity, and that substitutes (like HTS GEO, MEO and LEO systems) can be used, TELUS suggests that the most efficient use of spectrum would be to make 4000-4080 MHz available for shared flexible use across the country.

Q56: Telesat proposal: Considerations regarding conditions of licence

- Q56.** If ISED were to implement the Telesat proposal, ISED would need to consider the licensing framework for the 3700-3900 MHz band. Thus, ISED is seeking comments on:
- a. whether it should, as proposed by Telesat, issue flexible licences in the 3700-3900 MHz band using the same conditions of licence as those contained in annex H of the 3500 MHz Framework, noting that some conditions may need to be adjusted to reflect the differences in the two bands and the decisions resulting from this consultation process
 - b. whether it should issue a single Tier 1 flexible use licence as proposed by Telesat or align with the 3500 MHz band and issue Tier 4 licences
 - c. what deployment conditions should apply to these licences including Telesat's proposal that the deployment requirements would only come into force after the Minister approves a transfer
 - d. any additional conditions of licence that should apply given the nature of the proposal

Applying the same conditions of licence as in the 3500 MHz Framework

226. Recognising the importance of a timely release of spectrum in the 3800 MHz band and of a single assignment process combining the 3500 MHz and 3800 MHz bands, as proposed in TELUS' response to Question 52, TELUS would support applying the same conditions of licence to the 3800 MHz band if such early release and joint assignment were to take place. These licences would be substantially similar to those made available in the 3500 MHz Framework, both in when they are issued and when they are cleared (via transition).

Tier 1 vs. Tier 4 licensing

227. Consistent with TELUS' strong recommendation that the overarching goal of the licensing of 3500 MHz and 3800 MHz spectrum is to get contiguous 100 MHz blocks to all

operators, and an overall assignment round be held encompassing the 3450-3900 MHz frequency range, TELUS recommends that:

- a. the form of licence Telesat is granted is immaterial as assuming licences follow 3500 annex H, they will have the right of geographic divisibility and ISED will be required to approve all transfers;
- b. all approved transfers should have a condition of licence added that the frequency assignment will be changing in an upcoming process; and
- c. all transferred licences should be included in the overall assignment stage encompassing 3450-3900 MHz broken down as applicable to their Tier 4 constituent components.

Deployment conditions of licence

228. In its response to the 3500 MHz licensing framework consultation, TELUS expressed concerns with the asymmetric deployment requirements that were proposed. Given that these requirements will now be in force for 3500 MHz licences, if the 3800 MHz licences were made available via early release and if joint assignment were to take place, TELUS would support applying the same deployment conditions of licence to them as the additional spectrum would not impose any additional challenges on licensees. Since the spectrum would be contiguous, deployment requirements could be met with a single deployment.

229. If ISED does not implement an overarching assignment stage for 3450-3900 MHz, and licensees that purchase 3800 spectrum have a disparate second block with no network

deployment synergies, then the deployment conditions in 3500 must be significantly modified through further consultation.

Additional conditions of licence

230. TELUS has no further recommendations regarding any additional conditions of licence.

Q57: Telesat proposal: Licensing considerations

Q57. If ISED were to implement the Telesat proposal, ISED would need to consider the licensing framework for the 3700-3900 MHz band. Thus, ISED is seeking comments on:

- a. the need for a pro-competitive measure (e.g. spectrum cap or set-aside)
- b. the type of competitive measure that should be applied
- c. the amount of spectrum that should be considered under any such competitive measure

231. If one temporarily ignores the licensing of 3900-3980 MHz (which TELUS supports treating in a future process and for which ISED notes there would be a separate licensing framework consultation), then both the ISED proposal and the Telesat proposal (coupled with ISED's Option 2 displacement of WBS) each boil down to achieving 450 MHz of contiguous and exclusive-use flexible use spectrum in the 3450-3900 MHz range in the short to medium term.

232. As such, TELUS' response to Question 52 with respect to licensing considerations is equally applicable to Question 57. This includes TELUS' key recommendation for ISED to implement a mid-band TDD spectrum aggregation limit sized appropriately for 450 MHz (i.e., applied broadly to the 3450-3900 MHz band). Such a limit facilitates 5G

competition in Canada by preventing any one MNO from acquiring an excessive share of mid-band TDD spectrum while still including a guaranteed quantity of spectrum for regional operators (via an effective set-aside). A mid-band TDD spectrum aggregation limit gives all operators the opportunity to acquire a meaningful amount of contiguous mid-band TDD spectrum.

233. If ISED allows for the conversion and private sale of 3700-3900 MHz spectrum, ISED should mandate that the process is open and transparent, including the following:
- a. No restriction on eligibility to participate beyond the criteria ISED would apply to an auction (i.e., ability to hold Canadian spectrum licences)
 - b. Disclosure of all bidders before bidding starts
 - c. Price discovery
 - d. Disclosure of all bids made, following completion of the process
234. TELUS reiterates as well that a final reassignment of frequencies across all of 3450-3900 MHz including a guarantee of auto-contiguity is critical for Canada to ensure it continues to be a global leader in wireless network speed, latency and reliability. As noted in TELUS' response to Question 56, all approved transfers should have a condition of licence added indicating that the frequency assignment will be subject to change, to be determined by an upcoming process.

Q58: Telesat proposal: Considerations regarding FSS transition

Q58. ISED is seeking comments on Telesat’s proposals for the transition of FSS earth stations and whether any additional measures are required to ensure a smooth transition.

235. TELUS does not believe any additional measures would be required under Telesat’s proposal as compared to ISED’s proposal to ensure a smooth transition for FSS earth stations. TELUS notes that under its proposal, Telesat would “take responsibility for managing and coordinating (and, to the extent necessary, implementing)” the transition.

Q59: Telesat proposal: Implications of differing from U.S. transition plan

- Q59.** Telesat’s proposal includes ISED allocating an additional 80 MHz for flexible use in the 4000-4100 MHz band. ISED is seeking comments on the feasibility of making this extra spectrum available, specifically:
- a. whether there would be standardized 5G equipment available for this 80 MHz, given that it does not align with the U.S. band plan
 - b. whether there would be FSS filters available, given the reduced amount of FSS spectrum and that it would not align with the U.S. band plan
 - c. whether there would be enough capacity to continue FSS services in Canada with the proposal to reduce the amount of FSS spectrum to 100 MHz
 - d. to what degree would the requirement to protect U.S. FSS earth stations in the border areas have an impact on the ability to deploy flexible use stations near the border and to what degree would this impact the value of this spectrum

Availability of standardised flexible use equipment in 3980-4080 MHz

236. As indicated in TELUS’ response to Question 1, a robust ecosystem of base station and terminal equipment supporting Band n77, which spans 3300 – 4200 MHz, will develop and be used in next few years in North America, certainly well within the timeframe of Telesat’s proposed clearance of the 4000-4100 range.

Availability of FSS filters

237. TELUS does not expect that a filter designed for a passband of 4100-4200 MHz would be significantly different, more difficult to design, or more costly than one intended to pass 4000-4200 MHz.
238. Given the quantity of filters that would be required to meet the recommended minimum specifications for all earth stations in non-satellite-dependent areas (i.e., potentially for

thousands of earth stations), it is reasonable to assume that filters could be made available for the Canadian market for the reduced amount of spectrum being proposed by Telesat.

FSS capacity under a reduced quantity

239. Telesat asserts that it will “be fully responsible for ensuring the 3800 MHz band is cleared on schedule, while safeguarding all 3800 MHz customers’ services as they are cleared and transitioned onto the remaining [100 MHz of] spectrum, Telesat LEO or other satellites, as required.”
240. Telesat makes the above commitment while explicitly recognising the potential transitional impact on its own customers and on the customers of foreign satellite providers: “Telesat is not proposing to limit this transition support to its own customers. Telesat will coordinate with the other Satellite Operators to provide the same transitional support to their Canadian customers and end-users or, if necessary, procure or provide comparable alternative services and facilities for the Eligible Earth Station operators.” With that in mind and the magnitude of this obligation that Telesat is committing itself to, it appears that 100 MHz of FSS spectrum is sufficient capacity to support the continued operation of FSS services in Canada.

Border considerations

241. Under Telesat’s proposal, Canadian flexible use stations deployed near the border would be using an additional 80 MHz of spectrum in 4000-4080 MHz. This spectrum would still

be allocated to FSS in the U.S. and flexible use deployments near the border would need to coordinate with those U.S. FSS earth stations, subject to the development of a new border arrangement for the band.

242. TELUS addresses the technical requirements for co-channel coexistence between flexible use systems and FSS earth stations in its response to Question 49 above. In that response, TELUS notes that the FCC adopts a 70 km coordination distance for co-channel coexistence with TT&C systems and an I/N protection criteria of -6 dB (implying an aggregate PFD limit of -120 dBw/m²/MHz).

243. While ensuring co-channel coexistence between flexible use and FSS earth stations is not a trivial task, the relative orientation of FSS earth station receivers in the U.S. (generally pointing in a southward direction towards the equatorial geostationary arc) near the Canadian border should offer substantial front-to-back rejection against flexible use systems located predominantly to the north.

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