

Consultation on Revisions to the 3500 MHz
Band to Accommodate Flexible Use and
Preliminary Consultation on Changes to the
3800 MHz Band
(SLPB-004-18)

Comments of
Ericsson Canada Inc.

July 12th, 2018

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Sent by email to: ic.spectrumauctions-encheresduspectre.ic@canada.ca

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cc: Aline Chevrier, Senior Director

RE: Canada Gazette, Part I, June 16th, 2018, Notice No. SLPB-004-18 - Consultation on Revisions to the 3500 MHz Band to Accommodate Flexible Use and Preliminary Consultation on Changes to the 3800 MHz Band

Please find attached Ericsson Canada's submission in response to the Canada Gazette, Part I, June 16th, 2018, Notice No. SLPB-004-18 - Consultation on Revisions to the 3500 MHz Band to Accommodate Flexible Use and Preliminary Consultation on Changes to the 3800 MHz Band.

The document is created using Adobe Acrobat X Pro Version 10.0.0, on Microsoft Windows 7.

We appreciate the opportunity to provide comments and as always, we are ready to work with Innovation, Science and Economic Development Canada in the future on this very important topic.

Sincerely,

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INTRODUCTION

Ericsson appreciates the opportunity to respond to the Consultation on Revisions to the 3500 MHz Band to Accommodate Flexible Use and Preliminary Consultation on Changes to the 3800 MHz Band (the “Consultation”). Ericsson would like to commend Innovation, Science and Economic Development Canada (ISED) for inviting industry to comment on this very important issue.

Ericsson is a global leader in delivering ICT solutions. In fact, 40% of the world's mobile traffic is carried over Ericsson networks. We have customers in over 180 countries and offer comprehensive industry solutions ranging from cloud services and mobile broadband to network design and optimization.

With the mobile industry at the dawn of 5G deployment, Ericsson plays a key role in helping our carrier customers in their plans to make 5G a reality. In addition to conducting our internal research¹ and 5G testing using the 3.5 GHz frequency at our own facility², globally, Ericsson has also been involved in several 5G trials and proof of concepts in countries that are at the forefront of the 5G race including South Korea and Japan³.

Since the inception over 140 years ago, R&D is always at the heart of Ericsson business. Through its R&D initiatives, Ericsson has one of the industry's strongest patent portfolios with a total count of over 45,000 granted patents.

In Canada, Ericsson has operated since 1953 and serves Canadian operators and enterprises by providing complete communication solutions, including mobile and fixed network infrastructure, professional services, software and broadband.

¹ <https://www.ericsson.com/en/conference-papers/5g-nr-testbed-3.5-ghz-coverage-results>

² <https://www.ericsson.com/en/news/2018/6/ericsson-and-intel-achieve-5g-new-radio-data-call>

³ <https://www.ericsson.com/en/networks/offerings/5g/5g-trial-case-stories>

As one of Canada's ten largest Research and Development (R&D) investors, in 2017 Ericsson Canada has invested more than \$310 million CAD in R&D and cumulatively more than \$5 Billion CAD to date. Ericsson has more than 2,800 employees in offices in Toronto, Ottawa, and Montreal, where Ericsson fulfills worldwide mandates in the development, testing and support of wireless networks for customers in and outside of Canada.

Again, Ericsson would like to acknowledge ISED for inviting the industry to comment on this very important issue. Below are Ericsson's detailed responses, selective number of questions and additional information pertinent to this Consultation.

EXECUTIVE SUMMARY

In the Radio Regulations, the band 3400-4200 MHz is allocated to the mobile service on a primary basis in Region 2 and the frequency band 3400-3600 MHz is identified for use by administrations wishing to implement IMT. In some countries, including Canada, the frequency band 3600-3700 MHz, or portions thereof, is identified for use by these administrations wishing to implement IMT. In addition, as described in the consultation “*Portions of the band ranging from 3400 to 3800 MHz are either available or being made available for commercial mobile or flexible use in several countries, including the United States, the United Kingdom, Ireland, Japan, China, Singapore and Australia. As the 3500 MHz band is viewed as key spectrum to support 5G technologies, many countries have begun work to make this spectrum available for this purpose*”⁴. There is a clear momentum and interest from the global community to utilize spectrum in the 3.5GHz for commercial mobile 5G flexible use.

From the technical specification point of view, 3GPP has defined bands covering the mid-range spectrum, such as 3GPP band n77 (3300-4200 MHz) and n78 (3300-3800 MHz)⁵.

Ericsson commends ISED’s action in making mid-range frequency spectrum available for next generation, flexible terrestrial mobile 5G services. With global ecosystems available by 2019 at the latest, it is crucial that Canadians have access to this mid-range frequency spectrum to not only take advantage of that global ecosystems but also to keep pace with other countries in the 5G race.

Ericsson supports ISED’s proposal to also allow flexible 5G use in the 3450-3475 MHz band with the addition of a primary mobile allocation to this band. Ericsson also supports ISED’s proposal to remove the radiolocation allocation in the 3450-3500 MHz band.

⁴ The consultation, paragraph 16

⁵ 3GPP standard specification - 3GPP TS 38.101

Ericsson proposes the band between 3400-3450 MHz be considered for terrestrial commercial mobile 5G services. However, detailed and up-to-date information about incumbent government users is needed to understand how to clear the band as in the case of 3450-3475 MHz. If clearing is not possible then ISED should consider establishing a spectrum sharing framework.

For the band between 3450-3650 MHz, even though ISED proposes blocks of 10 MHz, Ericsson encourages ISED to create a regulatory environment to facilitate 5G deployment with as large a channel bandwidth as possible and to allow aggregation up to 100 MHz.

As in current LTE deployment, for 5G, Ericsson believes that the most effective manner to coordinate between TDD service providers is based on bilateral agreements and no prescriptive regulatory measures are needed. However, with radar operations in the band between 3450-3650 MHz, and particularly naval radars, in the United States, crossborder coordination agreement may be required.

Ericsson believe that within the band 3650-3700 MHz, there is an opportunity to immediately identify geographical zones suitable for licensing terrestrial flexible mobile and fixed services, with minimum impacts to existing Wireless Internet Services Providers (WISP) in rural and remote areas.

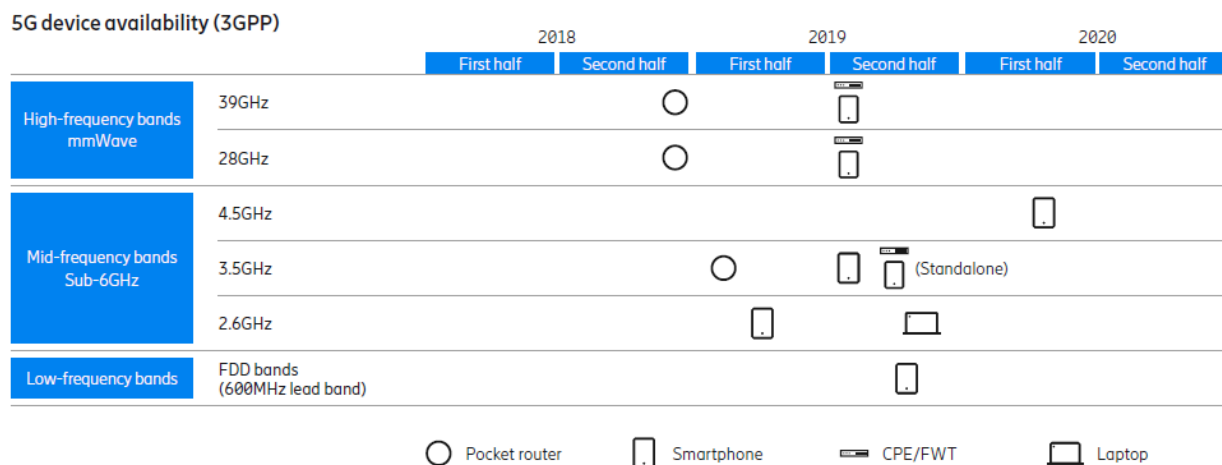
Ericsson believes that the mid-range frequency range 3700-4200 MHz is currently underutilized. To extract the most benefit for Canadians from that valuable spectrum resources, Ericsson proposes the entire 3700-4200 MHz cleared for licensed flexible mobile 5G service as early as possible; A primary goal for Canada should be to ensure that multiple blocks of 100 MHz are available to support multiple operator use of the band.

COMMENTS ON SPECIFIC QUESTIONS

Q1 – ISED is seeking comments on its assessment of the timelines identified for the development of an equipment ecosystem for 5G technologies in the 3500 MHz and 3800 MHz bands, and whether the timelines will be the same in both bands.

For mid-range frequency in the 3.5 GHz, based on Ericsson Mobile report issued June 2018, it is expected that 5G devices will be available in 2019 depending on market region as shown in Figure 1.

FIGURE 1: 5G Device availability (3GPP)⁶



Note: The figure shows device availability for Non-Standalone 5G NR, with the exception of the 3.5GHz band, where Standalone is also shown

In Japan, all three mobile operators have committed to launching 5G services for the August 2020 Summer Olympics in Tokyo⁷. It is understood that spectrum for these 5G commercial launches is both in the mid-range (3.5 GHz) and mmWave frequency bands (Figure 2).

In South Korea, with an investment of KRW 1.6 trillion (USD 1.5 billion) by 2020 and the showcasing of 5G technologies in the PyeongChang Winter Olympics 2018, all three operators,

⁶ Ericsson June 2018 Mobility report, <https://www.ericsson.com/en/mobility-report/reports/june-2018>, page 8

⁷ https://api.ctia.org/wp-content/uploads/2018/04/Analysys-Mason-Global-Race-To-5G_2018.pdf, page 21

KT, SK Telecom and LG UPlus are competing to offer the first 5G services by 2018/2019 using both in the mid-range (3.5 GHz) and mmWave frequency bands⁸ (Figure 3).

FIGURE 2: Japan launch timeline (Source: Analysys Mason, 2018)

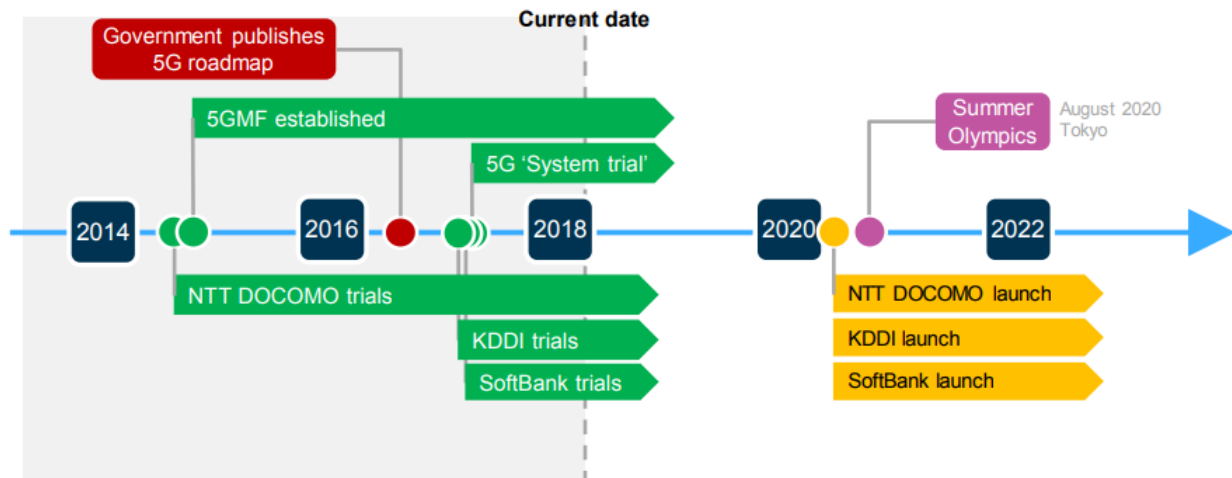
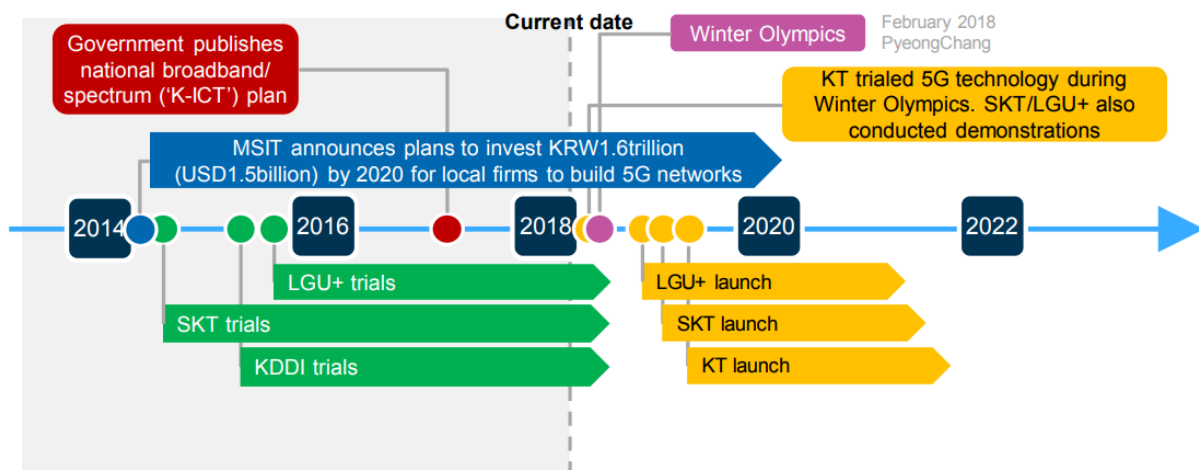


FIGURE 3: South Korea launch timeline (Source: Analysys Mason, 2018)



⁸ https://api.ctia.org/wp-content/uploads/2018/04/Analysys-Mason-Global-Race-To-5G_2018.pdf, page 23

Besides Japan and South Korea, 5G activities from many countries around world demonstrate that mid-range spectrum ecosystems will be available in very near future. In fact, the report for CTIA produced by Analysys Mason confirms that “*Globally, the most referenced spectrum for initial 5G deployment is in the 3.4-3.8 GHz and 24.5-29.5 GHz bands, although adjacent bands are of interest, e.g. 3.7-4.2 GHz in the U. S*”⁹.

Q2 – ISED is seeking comments on the proposals for:

- **adding a primary mobile allocation to the 3450–3475 MHz band**
- **removing the radiolocation allocation in the 3450–3500 MHz band**
- **making the corresponding changes to the Canadian Table of Frequency Allocations**

Ericsson supports ISED’s proposal to add a primary mobile allocation to the 3450-3475 MHz band, to remove the radiolocation allocation in the 3450-3500 MHz band and to remove the corresponding footnote C15 in the Canadian Table of Frequency Allocation (CTFA) as suggested in the Consultation.

Q3 – ISED is seeking comments on the proposal to allow flexible use in the 3450–3475 MHz band.

Ericsson supports ISED’s proposal to also allow flexible 5G use in the 3450-3475 MHz band.

Q4 – ISED is seeking comments regarding interest in sharing spectrum between radiolocation and other services in the 3400–3450 MHz band, and options for doing so.

Ericsson believes that, just as for the 25 MHz between 3450-3475 MHz (where ISED made the decision to remove the radiolocation allocation and add a primary mobile allocation instead, based on information provided by incumbent government users¹⁰), information about government incumbent usage¹¹ in the 50 MHz between 3400-3450 MHz will be needed for possible ways to relocate radiolocation from this band, in favour of flexible mobile 5G services.

⁹ https://api.ctia.org/wp-content/uploads/2018/04/Analysys-Mason-Global-Race-To-5G_2018.pdf, page 3

¹⁰ The Consultation, paragraph 32 “*Based on current use of the band and as confirmed by existing government users, ISED is of the view that removing the priority for radiolocation use in the 3450–3475 MHz band will not negatively impact the operation of government radiolocation systems or the existing fixed point-to-point use*”

¹¹ The Consultation, paragraph 39: “*ISED is of the view that radiolocation, given its intermittent use, may allow for sharing with low power services*”

If relocation is not possible, ISED should consider establishing a spectrum sharing framework based on input from incumbent government users and from industry. Sharing should be implemented based on geographical separation and more efficient spectrum utilization.

Q7 – ISED is seeking comments on a revised band plan using unpaired blocks of 10 MHz in the frequency range of 3450–3650 MHz.

The band proposed by ISED between 3450-3650 MHz is covered by both 3GPP band n78 (3300-3800 MHz) and n77 (3300-4200 MHz).

It should be noted that current common LTE deployments are using channel bandwidth of 10 MHz and 20 MHz. To take full advantage of 5G technologies, larger bandwidths are desired, particularly for enhanced Mobile Broadband (eMBB) use cases. Countries with leading 5G initiatives using 3.5 GHz are considering 100 MHz channel bandwidth^{12,13}.

Therefore, even though the Consultation proposes blocks of 10 MHz, Ericsson encourages ISED to create a regulatory environment which will facilitate 5G deployment with as large a channel bandwidth as possible and to allow aggregation up to 100 MHz¹⁴.

Q8 – ISED is seeking comments on whether any additional measures should be taken to limit potential interference issues with the proposed TDD band plan.

Similar to today's LTE deployments, Ericsson believes that the most effective manner to coordinate between TDD service providers is through bilateral agreements and not prescriptive regulatory measures. 3GPP NR (New Radio) is designed in a manner that provides more flexible determination of TDD configurations. In addition, 3GPP NR has been designed in a way that

¹² <https://www.ctia.org/news/the-time-has-come-for-action-on-the-3-5-ghz-band>

¹³ <https://www.telegeography.com/products/commsupdate/articles/2018/05/04/south-korean-5g-spectrum-auction-set-for-15-june/index.html>

“MSIT has set a limit on the maximum amount of frequencies that can be assigned to one mobile carrier, with this limiting each operator to winning no more than 100MHz in the 3.5GHz band”

¹⁴ 3GPP TS 38.101 http://www.3gpp.org/ftp/Specs/archive/38_series/38.101-1/38101-1-f00.zip

allows the TDD radio frame to be synchronized with LTE TDD configurations, if such a need is identified.

Q13 – ISED is seeking comments on whether the fixed and mobile equipment for LTE and 5G technologies will be able to operate with intermittent interference from radars, including crossborder interference, within the 3450–3650 MHz band and in adjacent bands.

Ericsson believes instances of interference onto LTE and 5G networks are expected to be minimum. However, with radar operations in the band between 3450-3650 MHz, and particularly naval radars, in the United States, crossborder coordination agreement may be required.

Q14 – ISED is seeking preliminary comments on how to optimize the use of the 3650–3700 MHz band, including the potential use of a database access model.

As discussed in the Consultation, in Canada, the band 3650-3700 MHz¹⁵:

- Has co-primary allocations for fixed, mobile and fixed satellite services and is currently primarily used for fixed point-to-multipoint services
- There are a number of grandfathered FSS receive earth stations
- There are currently 927 licenses issued for 281 licensees, where the majority of licensees are using this spectrum to provide broadband internet services, to many rural and remote communities

The WISP (Wireless Internet Service Providers) whitepaper¹⁶ confirms the information about number of licensees and licenses, WISP's focus on rural and remote areas. The whitepaper also discussed that WISP leverages 3GPP specifications-based equipment ecosystems for lower costs.

¹⁵ The Consultation, page 22-23, paragraph 83-84

¹⁶ [https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/SLPB-006-17-CANWISP-whitepaper-CR.pdf/\\$file/SLPB-006-17-CANWISP-whitepaper-CR.pdf](https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/SLPB-006-17-CANWISP-whitepaper-CR.pdf/$file/SLPB-006-17-CANWISP-whitepaper-CR.pdf), page 5 “The 53 CanWISP members provide service to around 160,000 subscribers in hard to reach rural and remote areas across 8 provinces”

Therefore, a number of installed bases have been moved to LTE or are planning to move to LTE and eventually to 5G¹⁷.

Based on the reasons discussed above, Ericsson believe that within the band 3650-3700 MHz, there is an opportunity to immediately identify areas suitable for licensing terrestrial flexible mobile and fixed services, with minimum impacts to existing rural service providers.

Over time, ISED would then establish a practical approach to enable the use of this 3650-3700 MHz spectrum band under common conditions considering all service providers' interests.

Q15 – ISED is seeking comments on the importance of the 3700–4200 MHz band to future FSS operations.

Ericsson would like to cited some key points from the CRTC Inquiry Report¹⁸ as they have also been discussed in many respondents to ISED's consultation on Spectrum Outlook, as follows:

- 1) A significant portion the capacity of C-band satellites remains available
- 2) Additional hardware is required to take advantage of this unused C-band capacity.
- 3) Prices for C-band capacity decreased significantly between 2005 and 2014
- 4) It is unlikely that the C-band market will become any more competitive than it is at present

It is clear that valuable spectrum resource between 3700-4200 MHz is not fully utilized in a manner that bring the most benefits to Canadians.

From the mobile industry's perspective, mid-range spectrum is an important element of the race to 5G, offering a balance of low-band capabilities (favorable signal range and indoor penetration)

¹⁷ [https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/SLPB-006-17-CANWISP-whitepaper-CR.pdf/\\$file/SLPB-006-17-CANWISP-whitepaper-CR.pdf](https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/SLPB-006-17-CANWISP-whitepaper-CR.pdf/$file/SLPB-006-17-CANWISP-whitepaper-CR.pdf), page 15 "However, based on the survey comments and conversations with several WISPs, WiMAX is being transitioned to LTE or at least replaced by LTE in new deployments" and page 23, When asked if WISPs plan to invest in new technology in the 2018-2022 period, 40 of 42 respondents answered "yes" and specified LTE, LTE advanced, 5G and similar technologies as their options

¹⁸ <https://crtc.gc.ca/eng/publications/reports/rp150409/rp150409.htm>, Paragraph 63, 76, 192

and higher-band benefits (increased capacity). This balance allows it to complement mmWave deployments in urban and suburban settings and extend the availability of 5G beyond densely populated areas.

As discussed above, mid-range spectrum also enables the benefits of global harmonization, including early ecosystem availability. These and other factors make the mid-range spectrum critical to Canada's 5G spectrum policy. Clearing as much of the 3700-4200 MHz band as possible for mobile use is critical to extracting the maximum value of the band and ensuring that a sufficient amount of spectrum is available for innovation and development in support of 5G – which is a vital national interest. A study done for CWTA by Accenture, 5G deployment is important to spur innovation, create jobs, generally improve quality of life in Canada and make positive impact on Canadian economy¹⁹. Similar assessments have also been made by the CTIA²⁰.

Ultimately, Ericsson would like to see the entire 3700-4200 MHz cleared for licensed mobile broadband use; A primary goal for Canada should be to ensure that multiple blocks of 100 MHz are available to support multiple operator use of the band.

Q16 – ISED is seeking comments on whether unlicensed operators in the 3700–4200 MHz band should be required to submit their technical parameters to ISED to assist in frequency management.

As in any other band, without accurate knowledge of incumbent use, it is challenging to come up with an effective frequency management plan. Ericsson believes unlicensed users in the 3700-4200 MHz band should be required to submit accurate and up-to-date technical parameters to

¹⁹ https://www.5gcc.ca/wp-content/uploads/2018/06/CWTA-Accenture-Whitepaper-5G-Economic-Impact_Updates_WEB_06-19-2018.pdf “...the adoption of 5G technology in Canada will propel innovation across industries and significantly improve Canadians' quality of life and the economy to the tune of a nearly \$40B annual GDP uplift by 2026. The benefits will be felt not only in national GDP, but also in terms of Canadian jobs. It is estimated that by this same time close to 250K permanent jobs will be added to the Canadian economy”

²⁰ <https://www.ctia.org/news/ctia-statement-on-chairman-pai-mid-band-spectrum-announcement> “CTIA and the wireless industry agree with Chairman Pai that securing U.S. global leadership in 5G is imperative for our economy. Repurposing mid-band spectrum to spur America's 5G leadership against nations like China and South Korea will be a critical part of this effort, and we encourage the FCC to open up the 3.7-4.2 GHz band for commercial terrestrial use as quickly as possible”

ISED. As discussed earlier, this 3700-4200 MHz spectrum band is too valuable to be used for unlicensed services that are obsolete. In addition, it is impractical for licensed users to provide any protection to these unlicensed users.

Q17 – ISED is seeking comments on which steps Canada should take to optimize the use of the 3700–4200 MHz band in consideration of the current services being provided and the developing technologies that would permit the use of new services in this band (e.g. exclusion zones).

As an immediate step, Ericsson proposes that ISED conduct a survey of this 3700-4200 MHz spectrum band to understand how much spectrum can be repurposed for commercial mobile broadband. This will help identify stations and links that are active and require protection. It is essentially the low-hanging fruit process – a reasonably quick survey of the spectrum landscape could provide meaningful immediate opportunities for mobile broadband to have access to a portion of 3700-4200 MHz spectrum band.

Following the survey, the next step we recommend is to delve deeper into what is actually being used to provide services over the frequency range 3700-4200 MHz. That includes the requirement for “full-band, full-arc” use of the band and unused polarization. This investigation should also look at introducing terrestrial flexible 5G uses.

It should be noted that since 2017, in the United States, with FCC’s objective of making additional spectrum available for terrestrial 5G services, there have been activities to vacate a portion of the 3700-4200 MHz band including by a number of satellite companies²¹. These activities by satellite companies confirm the view that spectrum between 3700-4200 MHz is underutilized today.

²¹ [https://ecfsapi.fcc.gov/file/111562396060/C-Band%20NOI%20Reply%2011-15%20\(2\).pdf](https://ecfsapi.fcc.gov/file/111562396060/C-Band%20NOI%20Reply%2011-15%20(2).pdf) “Telesat also is cognizant, however, of the Commission’s objective of making additional spectrum available for terrestrial 5G services and is aware of the joint proposal submitted by Intelsat License LLC and Intel Corporation in this proceeding. This proposal identifies a possible market-based mechanism for enabling terrestrial 5G use of C-band frequencies.”

As early as possible, Ericsson believes that a plan to relocate current satellite users out of the 3700-4200 MHz band in favour of terrestrial mobile services should be considered.

Q18 – ISED is seeking comments on the challenges and considerations related to the coexistence of other services, such as mobile and/or fixed wireless access, in the 3700–4200 MHz band.

With the United States’ activities seeking solutions to introduce terrestrial mobile services to the mid-range spectrum 3700-4200 MHz, Ericsson has provided its view responding to various FCC’s proceedings include studies on co-channel and adjacent interferences.

In terms of co-channel sharing assessment, our analysis “concludes co-channel sharing between IMT and FSS earth stations in this band leads to significantly large separation distances, i.e. >30Km in the best case scenario examined, where the FSS earth station operates with 40 degrees elevation angle and an interference threshold of $I/N = -3dB$ Such large required separation distances diminish sharing possibilities in the populated areas”.²²

In terms of adjacent channel interferences, one of many findings from our studies is that “Coordination zones between IMT base stations and FSS receiver locations will be an important consideration in the successful deployment of mobile broadband in the band. The sizes of such zones could vary between 1 to 5 kilometers radius, depending on the specific IMT and FSS deployment characteristics”.²³

Based on the challenges of sharing between satellites and terrestrial mobile services in the band 3700-4200 MHz, Ericsson maintains its view is that it is in the best interest of Canadians to vacate the mid-range spectrum from 3700-4200MHz in favour of terrestrial mobile services.

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²² <https://ecfsapi.fcc.gov/file/1002209207429/Ericsson%20Mid%20Band%20NOI%20Comments.pdf>, Attachment A

²³ [https://ecfsapi.fcc.gov/file/10531134297936/053118%20Ericsson%203_7%20to%204_2%20GHz%20PN%20Comments%20\(FINAL\)-c.pdf](https://ecfsapi.fcc.gov/file/10531134297936/053118%20Ericsson%203_7%20to%204_2%20GHz%20PN%20Comments%20(FINAL)-c.pdf), Attachment A