Reply Comments to ISED
by the
Toronto Police Service

in response to

SLPB-002-20

"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"

November 29th, 2020

OUR GOALS

Be where the public needs the Service the most

Embrace partnerships to create safe communities

Focus on the complex needs of a large city

SLPB-002-20 Reply Comments

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1.0 Introduction

These recommendations are submitted to ISED by the Toronto Police Service in accordance with instructions contained in the Canada Gazette, Part I, Volume 154, Number 37 dated September 12th, 2020 relating to the RADIOCOMMUNICATION ACT Notice No. SLPB-002-20 "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".

As a veteran of the Canadian telecommunications industry, and now an independent consultant with the Toronto Police Service, with no business association with any telecom service provider or regulatory body, I welcome the opportunity to address the Consultation for Notice No. SLPB-002-20 "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 suggestions and opinions addressed here concern the spectrum allocation for the present planning and future deployment of the Public Safety Broadband Network (PSBN) in Canada as we begin the migration from legacy 4G/LTE systems to next generation 5G technologies.

Submission to ISED at: ic.spectrumauctions-encheresduspectre.ic@canada.ca

Attention: Chantal Davis, Director
Spectrum Licensing Policy Branch

Respectfully submitted by

Michael Dixon
Consultant, Toronto Police Service

2.0 Executive Summary

Although ISED is planning an Auction in mid-2021 for 3.5 GHz spectrum currently used for Fixed Wireless Access (3475 MHz to 3650 MHz) the Consultation SLPB-002-20 will release additional mid-band spectrum for 5G wireless broadband sometime in 2023.

3.0 Spectrum Policy Framework

In June 2007 (DGTP-001-07[1]) Industry Canada (now the Ministry of Innovation, Science and Economic Development or "ISED") published a Spectrum Policy Framework in which Respondents were generally supportive or silent on the Framework provisions which ensure access to spectrum for security, sovereignty and public safety needs.

However, a number of respondents pointed out that public safety and security communications are often carried by commercial systems, that this should be recognized in the Framework, **and the priority for access to spectrum be afforded for all systems** regardless of ownership.

There was also considerable support for the adoption of interoperability standards for public safety. Most respondents felt that these standards should be derived by industry consensus.

The final Enabling Guidelines are shown below:

(a) Market forces should be relied upon to the maximum extent feasible.

(b) Notwithstanding (a), spectrum should be made **available for a range of services that are in the public interest.**

(c) Spectrum should be made available to support Canadian sovereignty, security and **public safety needs.**

(d) Regulatory measures, where required, should be minimally intrusive, efficient and effective.

(e) Regulation should be open, transparent and reasoned, and developed through public consultation, where appropriate.

(f) Spectrum management practices, including licensing methods, should minimize administrative burden and be responsive to changing technology and market-place demands.

(g) Canada's spectrum resource interests should be actively advanced and defended internationally.

(h) Spectrum policy and management should support the efficient functioning of markets by:

- permitting the flexible use of spectrum to the extent possible
- harmonizing spectrum use with international allocations and standards, except where Canadian interests warrant a different determination
- making spectrum available for use in a timely fashion
- facilitating secondary markets for spectrum authorizations
- clearly defining the obligations and privileges conveyed in spectrum authorizations
- ensuring that appropriate interference protection measures are in place

[1] Spectrum Policy Framework for Canada

- reallocating spectrum where appropriate, while taking into account the impact on existing services; and
- applying enforcement that is timely, effective, and commensurate with the risks posed by non-compliance.

While ISED designated 10 MHz of 700 MHz spectrum for public safety broadband communications in March 2012 and announced an additional 10 MHz in Budget 2015 it must be noted that only "experimental" licenses have been issued without any funding for construction. It must be noted that all public safety agencies consequently rely on commercial Mobile Network Operators for broadband services.

It has also been left to individual agencies to negotiate for improved Quality of Service, Priority and Pre-emption ("QPP"), on a carrier by carrier basis, when commercial networks become congested (often during critical incidents or major emergencies) – with little support from ISED (or the CRTC).

The forthcoming auction of mid-band spectrum and the proposed future Consultation of the Conditions of License for Band 14 spectrum licenses will provide ISED with the opportunity to recognize the needs of public safety organisations and the public sector in general and ensure that the priorities mentioned in the Spectrum Policy Framework for Canada are upheld and reflected in Conditions of License for Band 14 and future mid-band spectrum licenses.

4.0 Migration Challenges for MNO's and Public Safety

If we think back 20 years in Canada, there were only two carriers that provided 3GPP compliant systems (Rogers Wireless and Microcell Solutions with Fido). All other carriers (Bell, TELUS, SaskTel etc.) had followed the CDMA path for 2G systems and noticed that 3G could become be an inflexion point for the telecom industry. The CDMA path would lead to EV-DO, but the 3GPP path would lead to HSDPA – but the question was "which path was the most direct to get to 4G/LTE".

The answer to that question caused the Canadian CDMA carriers to overbuild their networks with HSDPA technology in 2006/2007 so that they could adopt 3GPP technology going forward. Over the next three or four years we will see a similar inflexion point with a migration to all digital (IP based) 4G/LTE and 5G networks so that 3G spectrum can be re-purposed to 4G/5G beginning in 2024/2025.

The current 3GPP roadmap is shown below – the date(s) shown are the dates for the "final" release date of the specifications for 3GPP systems – although the Release 17 end-date is currently delayed to mid-2021 by the pandemic.

Equipment vendors attempt to have updated versions of their systems and products soon after these release dates, but Mobile Network Operators take time to evaluate their upgrade path(s) leading to an "in-service" date often two to three years after the release is completed. Most existing systems in Canada today are likely Release 14. As an example, at the time of this submission of these comments, no Canadian carrier has announced the availability of all the "mission critical" services eagerly awaited by the Public Safety community although these are available in the USA.

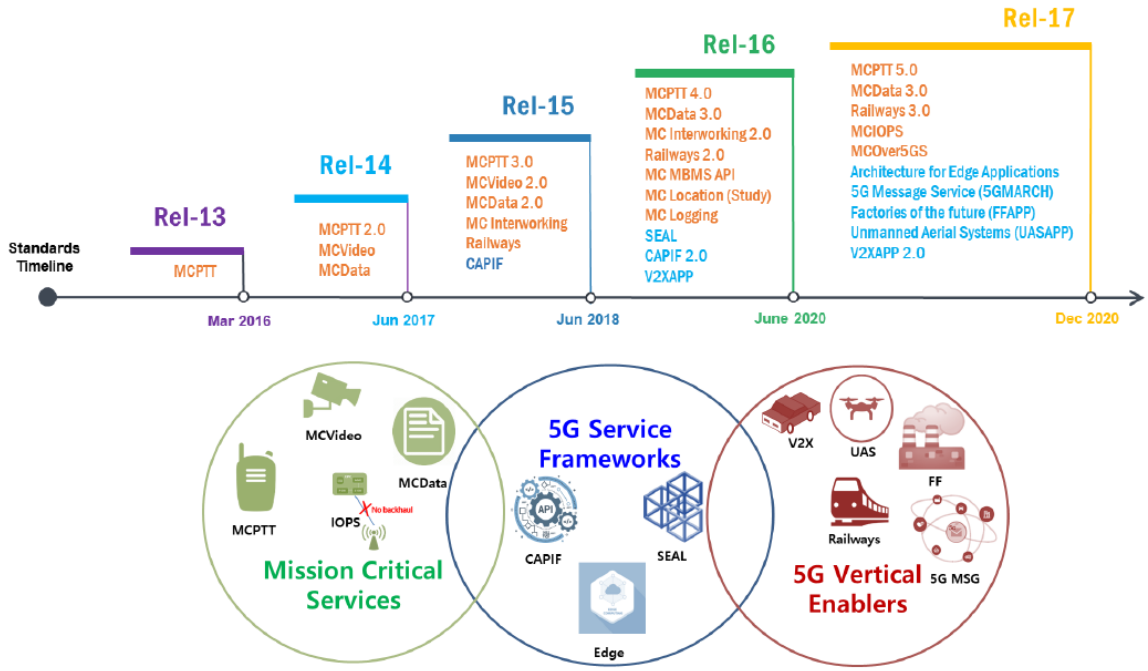

Figure 1 3GPP Release Versions

It must be remembered that some features required by the Public Safety community have been possible in the basic designs of all 3GPP 4G/LTE systems, although not all carriers have made these features readily available to the public safety community. These are improved Quality of Service, Priority and Pre-

Emption (“QPP”) in times of network congestion. It is our position that QPP becomes a Condition of License for all future commercial carrier spectrum licenses (not just Band 14).

4.1 Legacy Features necessary for Public Safety – QPP

In RP-25, the Canadian government defined Policy Principles for Public Safety Radio Interoperability[2] and further defines the categories of users or agencies that may be eligible for licensing in designated public safety spectrum as follows:

Category 1 – police, fire and emergency medical services (**3GPP Access Class 14**)

Category 2 – forestry, public works, public transit, hazardous material clean-up, border protection,4 and other agencies contributing to public safety (**3GPP Access Class 13**); and

Category 3 – other government agencies and certain non-government agencies or entities (**Access Class 12**)

The hierarchy of agencies, as described by the categories above, is applied in the radio licensing process to outline ***priority access to spectrum designated or made available for public safety use***.

The government also encouraged public safety agencies to establish network-sharing partnerships to increase efficiencies and facilitate interoperability. These partnership agreements for shared systems are generally at the discretion of public safety agencies.

Today all public safety agencies rely on commercial broadband networks for 4G/LTE services and share available bandwidth with commercial customers but do require improved Quality of Service, Priority and Pre-Emption whenever a cell site becomes overloaded in times of emergencies or disaster situations.

Mobile Network Operators can activate access class barring (“ACB”) in order to reduce the base station load in times of network congestion at individual cell sites and it is suggested that 4G/LTE Base Stations should automatically activate ACB based on certain overload thresholds. Assuming that First Responders are provisioned as members of Access Class 14, the network can reduce the load by barring commercial users (provisioned as Access Classes 0-9, either completely or in proportion to the degree of congestion.

This feature provides improved Quality of Service, Priority and Pre-Emption for First Responders. This is explained in 3GPP specification TS 22-011 which has been updated to accommodate the transition from 4G/LTE to 5G.

4.2 New 5G Features for Public Safety – Network Slicing

Technologies such as 5G network slicing will allow network operators to adapt their networks to the local environment by making them intelligent and responsive. These slices create virtual networks out of the same physical network used by everyone else, but they will offer the same or better network

[2] RP-25 Public Safety Definitions

performance as if obtained from a dedicated network in terms of capacity, speed, latency, and most importantly, availability.

For example, during emergency situations, network slicing will allow telehealth and first responders to be given priority on the network over casual browsing and texting. Lifeline services can be maintained during periods of extreme congestion despite 5G being shared. Network slicing partitions portions of the network for specific customers and use cases and provides access to additional capacity to ensure their network is prioritized.

For example, network slicing enables public-safety applications to be separately configured, providing quality of service (QoS) parameters to handle push-to-talk and push-to-video mission-critical communications. Consequently, there is no possibility that other applications or virtual network users can affect the performance of the public-safety network slice or compromise its security.

4.3 Moving from 4G/LTE to 5G

The process whereby 5G is being made available is via a series of 3GPP releases as shown in Figure 1. There are three releases of the 5G standard that cover features of most interest to public-safety users.

Release 15 is the current release, and it supports extreme mobile broadband, which is of most interest to consumer mobile smartphone users. It gives them improved video support, as well as enabling augmented and virtual reality.

Release 16 will bring additional interesting features. Its main feature is ultra-reliable, low-latency communication, which provides 99.9999% uptime in addition to MIMO enhancements, vehicle-to-everything communications (V2X), and support for low-powered internet of things (IoT) devices.

5G R16 will allow the use of a multitude of video surveillance wireless cameras, remote control of drones and unmanned vehicle capability at the same given location while guaranteeing the right level of reliability and performance. Not only supporting improved situational awareness these capabilities also allow public-safety authorities to communicate with affected populations on the ground.

Remote control of drones or unmanned vehicles will also be much improved by 5G's low latencies, allowing haptic (tactile) feedback to the remote operator. The massive broadband aspect of 5G also allows the implementation of self-backhauling for deployable solutions that are rolled out in areas with no coverage. Drones can be used to relay such temporary backhauling. This self-backhauling is known as integrated access and backhaul (IAB).

Another exciting application of the Release 16 feature set will be to connect vehicles and field operators with hospitals to provide telemedicine support. Ultra-reliable and low-latency communications will enable patient monitoring and diagnosis in support of paramedics. It is even possible that it will enable remote field surgery using very high-definition video and precise haptic feedback to aid the remote surgeon.

In addition, 5G's support for vehicle-to-everything (V2X) communications is intended to support autonomous vehicle applications. For public safety, that means automated vehicles can be used to deliver food, fuel and logistics for intervention in disaster-stricken areas. 5G also allows vehicles to

connect to road infrastructure, so other drivers can be alerted to dangers at junctions and avoid collisions when ambulance and fire trucks exceed urban speed limits during emergencies.

Releases 17 is still a work in progress, and the standard is not expected to be finalized until late 2021. According to current plans, it will bring the full set of critical machine communication features, such as the integration of time-sensitive networking, to fulfill industrial machine-type communication requirements. Release 17 will also feature the portability of the Mission Critical over 5G Services (MCOver5GS), such as proximity services, use of multicast for group communications and the management of mission-critical quality of service (QOS), to allow seamless interworking between 4G and 5G mission-critical services.

As public-safety authorities look ahead, they can expect 5G Release 16 and Release 17 devices to arrive over the next two to four years. 5G features, such as network slicing, will make it much easier for public authorities to deploy services over public mobile networks. Partnering with Mobile Network Operators will allow agencies to adopt 5G broadband and IoT capabilities faster and more smoothly.

This model can be complemented by deployable broadband wireless systems to provide coverage in case of disaster/recovery, where commercial networks might be down or for operations in remote areas not covered by MNOs.

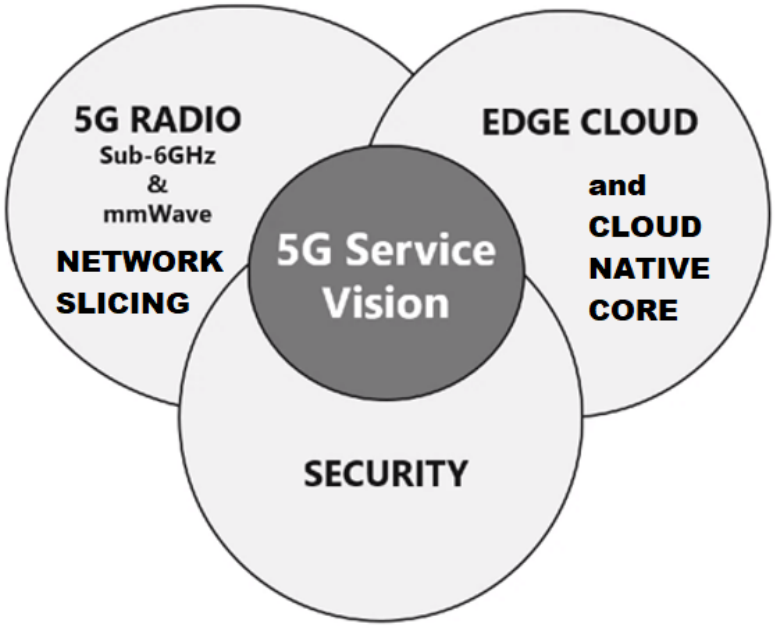

Figure 2 The 5G "Visions" for connectivity

4.4 The arrival of Mobile-Access Edge Computing

As mentioned, the arrival of 5G networks with new features that include low latency and support for large numbers of IoT devices – not to mention video capture devices used by Public Safety Agencies such as Body Worn Cameras, will drive the need for Mobile-Access Edge Computing.

Much of the information needs to be processed in near-real time if it is to be used for improved situational awareness and “smart city” applications going forward.

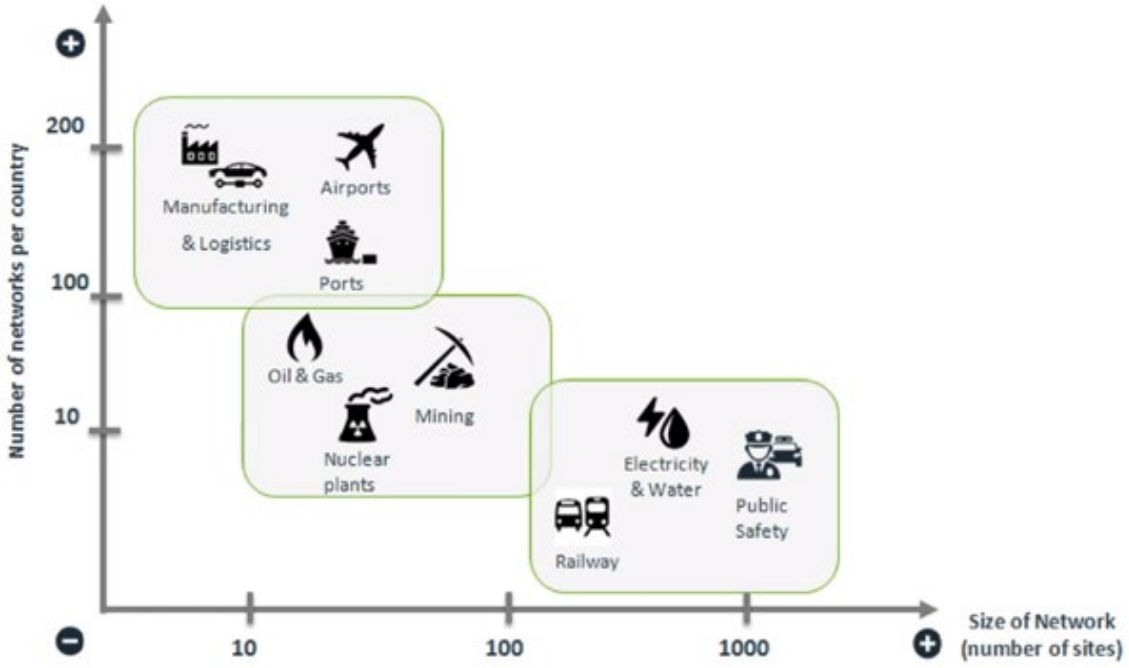

Figure 3 New applications enabled by 5G

Municipalities and their Public Safety Agencies will need to consider the synergies between "Smart City" requirements being developed and the needs and requirements for real-time situational awareness and data analytics going forward.

Plans that are made in "silos" will not be effective to harness the new capabilities offered by 5G and Mobile Edge Computing.

4.5 The need for Public Safety Grade Networks

Most Public Safety narrowband LMR systems are built to meet the requirements of resiliency that far exceed the reliability of commercial broadband networks that are the only current option for First Responders that need access for 4G/LTE mobile access.

The US-based National Public Safety Telecommunications Council ("NPSTC") defined the requirements for defining Public Safety Grade Systems and Facilities in a Final Report[3] in 2014.

Since currently there are no Final Conditions of License for Band 14, Public Safety is unable to build a resilient PSBN using this spectrum band at present and certain "workarounds" are being implemented. Even when the final Conditions of License for Band 14 are known there is much uncertainty as to any funding available and the timeline for the deployment for Band 14 will take many years.

[3] Public Safety Grade

It is clear with the focus on the future development of mid-band 5G networks that public safety agencies should focus on broadband strategies that involve commercial broadband networks

First of these strategies is the use of vehicular modems (initially from Sierra Wireless) which are dual-active SIM enabled devices which can connect to two independent networks simultaneously and can either share the dual connections, or use one connection as "main" and the other as "standby".

On the assumption that in any one geographic area there are usually two competing broadband carriers, the loss of any one network in a disaster situation would not be catastrophic, but this does mean that each vehicle would need two monthly subscriptions (one from each chosen carrier). Alternatively, if any Agency has built a Band 14 network, one connection would be for that network and the other would be a commercial operator.

Band 14 also provides an added advantage in that the mobile vehicular modem is then allowed a much higher uplink power than is allowed for smartphones. This is known as High Power User Equipment ("HPUE") and is restricted by 3GPP specifications to Band 14 only.

Of course, much of rural and remote Canada are NOT served by broadband MNO's today and that problem is not confined to Canada. In the UK the Government (which is providing a broadband service for First Responders called the "Emergency Services Network") has also introduced a Public/Private Partnership called the Shared Rural Network[4] to eliminate so-called "Not Spots" in remote areas.

The Shared Rural Network (SRN) is transforming mobile coverage, countrywide. The project was developed by the UK's four mobile network operators (MNOs) with support from Government. The programme will make 4G mobile broadband available to 95% of the UK. The operators expect this will extend mobile coverage to an additional 280,000 premises and for people in cars on an additional 16,000km of the UK's roads, boosting productivity and investment in rural areas.

Canada could co-ordinate all the proposed government and private funding sources for rural and remote connectivity using a similar Public-Private Partnership Model where appropriate.

[4] UK Shared Rural Network

5.0 Final Comments for 5G Mid-Band Spectrum

A review of many of the original submissions made to ISED in response to SLBP-002-20 reveal some commonality as to best the way forward for maximising the use of mid-band spectrum for Canadians.

Firstly, we should avoid the issue of either "approving" or "rejecting" the Telesat Proposal for a "private auction" process but should rather focus on agreement of the desired "outcomes" and the timeline necessary to achieve the outcomes. Then we can focus on the best way to achieve these outcomes – either a "public/private" solution or the standard ISED Auction Process – either option needs to produce the outcomes on an efficient timeline to enable 5G features to be delivered sooner rather than later!

Fifth Generation technology is not simply an improved "air-interface" from todays 4G/LTE systems – 5G will introduce new latency goals in order to support new applications for end-users – and is NOT restricted to "better" throughput for smart-phones.

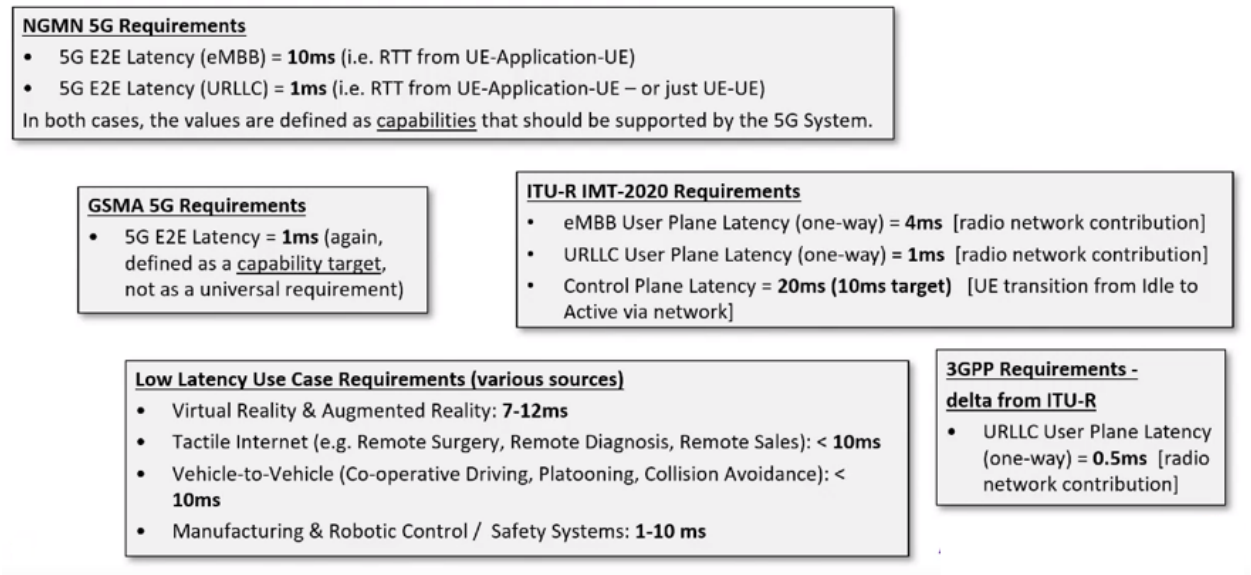

Figure 4 5G latency goals for new applications

It is well known that mid-band spectrum will play a huge role in being able to achieve these goals – but it also needs to enable Mobile-Access Edge Computing as described earlier.

In addition, 5G spectrum bandwidths must accommodate allocations of at least 100 MHz per carrier so we can achieve these latency goals.

TPS agrees with the suggestion from BCE to make spectrum from 3700-3900 MHz available on the same timeline so 3500 MHz spectrum will deliver 5G services to Canadians faster and allow carriers to benefit from access to larger blocks of contiguous spectrum sooner. Also ISED should move the WBS band from its current location as proposed, allocating the 3700-3900 MHz spectrum on the same timeline as the 3500 MHz auction would give operators the opportunity to acquire contiguous spectrum across the entire 3500-3900 MHz spectrum range. TPS also likes the submission from TELUS that suggests a revised allocation model for ISED to consider.

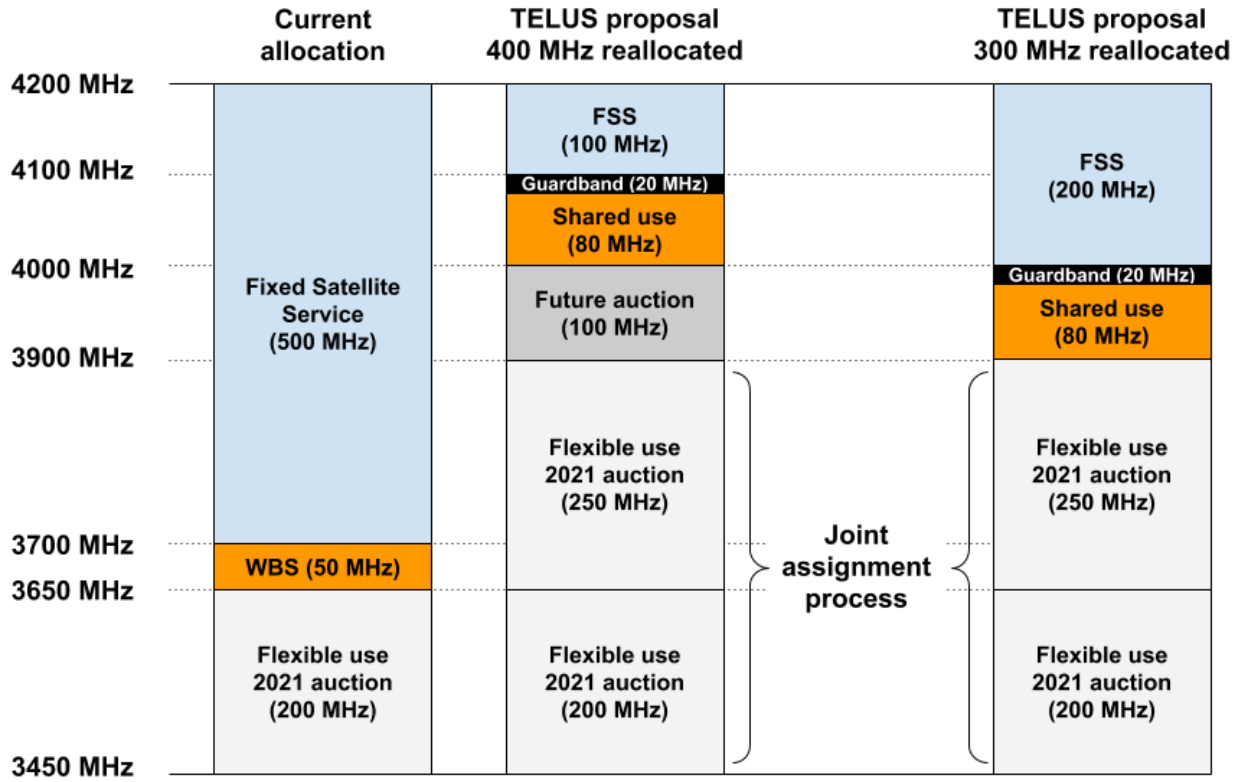

Figure 5 TELUS proposal for accelerated release of mid-band spectrum

TPS is NOT recommending any reservation of mid-band spectrum for Public Safety (or Smart City) applications on the condition that any obligations included as Conditions of License for mid-band spectrum to Mobile Network Operators for ALL licensees to provide appropriate "Network Slicing" capabilities for Public Safety and Smart City Applications in their 5G deployments – regardless of Tier sizes of licenses that are used. We do not feel that the current FWA licensing (for Tier 4 areas) need be the default for 5G.

ISED should also strive to align the 3650-3900 MHz band with the 3500 MHz Band to promote the operation of the 3450-3900 MHz frequency range as a single block of spectrum with common device certification rules and a common RSS.

As discussed earlier, many Public Safety Agencies may adopt the Sierra Wireless Dual Network Modems (model MG90 5G) to provide the necessary connectivity to at least two networks.

This device should be available (and certified) in the next six months and will require many Agencies to prepare for funding in the 2021/2022 timeframe.

	5G
LTE CATEGORY	Cat 20
Peak D/L	Up to 2 Gbps
Peak U/L	Up to 1 Gbps
5G Frequency Bands	n1, n2, n3, n5, n28, n41, n66, n71, n77, n78, n79
4G LTE Frequency Bands	2100(B1), 1900(B2), 1800(B3), AWS(B4), 850(B5), 2600(B7), 900(B8), 700(B12), 700(B13), 700(B14), 700(B17), 850(B18), 850(B19), 800(B20), 1900(B25), 850(B26), 700(B28), 700(B29), 2300(B30), 1500(B32), TDD B38, TDD B39, TDD B40, TDD B41, TDD B42, TDD B46, CBRS B48, 1700(B66), 600(B71)
3G WCDMA/HSPA+ Frequency Bands	2100(B1), 1900(B2), 1800(B3), AWS(B4),850(B5), 800(B6), 900(B8), 1700(B9), 850(B19)
APPROVALS Regulatory	FCC, IC, PTCRB, R&TTE, GCF, CE, RED, RCM
Carrier	Verizon, AT&T
PART NUMBERS	1102695 (Single) 1102716 (Dual)

Figure 6 Sierra Wireless MG90 5G

6.0 Conclusion

TPS would like to thank ISED for the opportunity to document the interest of Public Safety organizations when it comes to mid-band spectrum allocations and we look forward to future developments in 2021 and beyond.

This should ensure that Public Safety and other taxpayer funded social services in urban, rural and remote communities will have necessary access to mid band operating spectrum and infrastructure with the necessary features of Priority and Pre-Emption for critical services in times of network congestion.

Subsequently when the high band be offered by auction to service providers, we request that similar mandatory licence conditions also prevail. Access to all low, mid-band and high band spectrum will ensure that 5G “modern technology” is well incorporated into the Canadian PSBN.

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