QUALCOMM Incorporated

1730 Pennsylvania Ave., NW ■ Suite 850 ■ Washington, DC 20006 ■ Tel: 202.263.0020 www.qualcomm.com

February 16, 2018

Via Email

Director, Spectrum Regulatory Best Practices
Innovation, Science and Economic Development Canada
235 Queen St
Ottawa, Ontario K1A 0H5

Re: **Canada Gazette Notice, SLPB-006-17, Consultation on the Spectrum Outlook 2018 to 2022, Publication Date in Canada Gazette, December 30, 2017**

On behalf of Qualcomm Incorporated ("Qualcomm"), I am pleased to submit the following comments on two important, related issues raised in the above-referenced consultation (the "Consultation").

The first issue on which Qualcomm wishes to comment pertains to Sections 6.1.2 and 6.3.5 and Question 23 of the Consultation, which state as follows:

> ***6.1.2 3500 MHz***
>
> 109. The 2013 Outlook included a potential release of 100-175 MHz of spectrum for commercial mobile services from the 3500 MHz band in the 2016 to 2017 timeframe. However, ISED indicated that there could be some uncertainty for this band based on international developments. In the past few years, the potential international use of this band has become clearer with consultation and decision processes underway or completed in several countries, including in Japan, the U.S., the UK, and Ireland. In addition, in 2014, ISED released DGSO-007-14, *Decisions Regarding Policy Changes in the 3500 MHz Band (3475–3650 MHz) and a New Licensing Process*, which included a fundamental reallocation of the band 3475-3650 MHz to allow mobile services and indicated that future mobile use would be subject to consultation. ISED recognizes that the 3500 MHz band is being considered as one of the key bands for future 5G networks in many countries and that there have been developments in making the larger 3400-4200 MHz band available internationally. As such, ISED will be considering this when consulting on the 3500 MHz band. See section 6.3.5 for further discussion.
>
> **6.3.5 3500 MHz**
> **International context:** Portions of the band 3400-3800 MHz are being made available for commercial mobile or flexible fixed and mobile use in several countries, such as Japan, the United Kingdom, Ireland, China and Australia. In November 2016, the European Commission's Radio Spectrum Policy Group (RSPG) provided an Opinion on spectrum related aspects for next-generation wireless systems (5G), which indicated that they consider the 3400-3800 MHz band to be the primary band suitable for the

introduction of 5G services in Europe before 2020, since the band is already harmonized in Europe for mobile networks and consists of up to 400 MHz of continuous spectrum.

The United-States has made the 3550-3700 MHz band available for shared wireless broadband use through a dynamic spectrum access system. Furthermore, in July 2017 the U.S. released a Notice of Inquiry entitled Exploring Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz, seeking comments on the use of 3700-4200 MHz for expanded flexible use.

In June 2016, the UK's Ofcom closed their 3.8 GHz to 4.2 GHz band: Opportunities for Innovation consultation indicating that they believe there is potential for further exploration of sharing of this band on a geographic basis with their current and future deployments of fixed and FSS systems. In June 2016, Japan indicated that the band 3600-4200 MHz is a suitable candidate band for 5G.

Potential equipment ecosystem: There are currently three 3GPP band classes that cover the 3400-3800 MHz band. Band class 42 and 43 cover the bands 3400-3600 MHz and 3600-3800 MHz, respectively. Band class 48 covers the U.S. band 3550-3700 MHz. In addition, the band 3400-4200 MHz had been identified as a single band for the work underway at 3GPP for 5G New Radio (NR) standards and could result in a new band class covering this entire range. Currently, there is equipment available in the 3400-3800 MHz band and 5G NR equipment is expected to become available as early as 2019.

Current and potential use in Canada: The 3400-4200 MHz frequency band is currently used for radiolocation, fixed point-to-point, fixed wireless access, wireless broadband service (WBS) and the FSS systems. The 3400-3450 MHz portion of the band is reserved for use for aeronautical and maritime radars, although some radars also operate as high as 3650 MHz. The band 3475-3650 MHz is currently being used for fixed wireless access systems; however, as discussed in section 6.1.3, ISED has indicated this band will be subject to a future consultation for mobile use. The band 3650-3700 MHz is available for WBS, which are licensed on a shared basis and can be used for both fixed and mobile applications. There are currently limited fixed point-to-point links in operation in the 3400-3475 MHz and 3700-4200 MHz portions of the band. The band 3700-4200 MHz is primarily used by the FSS for the delivery of broadband services as well as feeder links for television broadcasts. In addition, there are unlicensed broadcast receivers used to receive TV programing from the satellite, which are used to distribute TV programming over cable infrastructure or in broadcast studios to receive multimedia to create programming.

Given the international interest in this band for 5G, the expected global equipment ecosystem, and the expected decline in future FSS use in this band, ISED will expand the band for the consultation on 3500 MHz to include a review of 3400-4200 MHz.

Then, the Consultation poses the following question:

Q23 – Are there any factors that would impact the potential release of these frequency bands between 2018 and 2022?

Qualcomm urges ISED to release the 3.5 GHz band as quickly as possible for commercial mobile use. As the Consultation itself acknowledges, spectrum regulators around the world either have already released or are in the process of releasing 3.5 GHz spectrum for commercial mobile use. In particular, this band is slated to be a key global sub-6 GHz spectrum band for 5G. (Section 6.3.5 correctly points out that in the 3GPP standards body, 3.5 GHz is one of the bands identified for the 5G NR standard. Actually, there is work underway at 3GPP to define two bands for 5G NR that include 3.5 GHz: 3300-3800 MHz and 3300-4200 MHz.)

As ISED may be aware, Qualcomm is a global leader in the development of 5G in keeping with our legacy of leading the development and proliferation of commercial mobile technologies. Qualcomm, working with our many partners around the world, has accelerated the completion of the initial version of the 5G NR standard by a year, and we are committed to producing chips for 5G NR-based devices to enable broad commercial launches of 5G in early 2019, using both sub-6 GHz and millimeter wave spectrum. One of the sub-6 GHz bands that our initial 5G chips will support is 3.5 GHz.

Qualcomm looks forward to supporting broad launches of 5G in Canada. In order for Canada to keep pace with other nations and regions around world, we urge ISED to make the 3.5 GHz band available for commercial mobile use as soon as possible.

The second issue also relates to the need for ISED to make the 3.5 GHz band and other frequency bands available for 5G. Sections 5.2.3 and 5.2.4 followed by Questions, 2, 3, and 4 state as follows:

> ***5.2.3 Technology advancements for commercial mobile***
> 37. In response to the projected global mobile traffic growth, the ITU has developed a vision of the future of mobile technologies towards 2020 and beyond.8 This vision sets the stage for the next generation of commercial mobile systems or "5G" technologies. According to the ITU, there is a need to improve access to and efficient use of spectrum to accommodate the large amount of data traffic that is expected to be generated by advanced mobile devices.
>
> 38. 5G will be the next major advancement in mobile telecommunications standards. Forecasted use cases include enhanced/ultra-fast mobile broadband, massive machine type communications, and ultra-reliable/low latency communications, all of which are predicted to drive increased usage and facilitate deployment of integrated verticals such as healthcare, transportation, and smart cities, while leveraging massive IoT growth. A number of other new technologies to support these use cases are emerging or are being researched as part of 5G standards development. These emerging technologies include, among others, the use of massive multiple input, multiple output (MIMO) technology, full-duplexing, and carrier aggregation techniques. These technology advancements, in conjunction with existing technologies, are expected to improve network capacity and spectral efficiency.
>
> 39. As with all technologies, access to appropriate frequency ranges is essential for 5G. For example, some applications will require high throughput over short distance (e.g.

frequencies above 24 GHz) while others may need high reliability over long ranges (e.g. lower frequencies, below 1 GHz). Consequently, the type and amount of spectrum necessary to deliver 5G services will vary based on usage requirements.

5.2.4 Overall impact on commercial mobile spectrum requirements in Canada

41. Mobile technology is constantly evolving to make more efficient use of spectrum in order to meet the increasing traffic demands. However, some technology advancements require new spectrum for reasons other than increased demand. For example, some specific bands may be required due to their ability to accommodate large bandwidths or due to their specific propagation characteristics.

42. Mobile operators have several options available to optimize the use of their spectrum to meet increased traffic demand, such as densifying their networks, deploying efficient equipment and employing more sophisticated traffic management techniques. However, ISED recognizes that the continued growth in data traffic generated by an increasing number of users in various sectors and the data-intensive applications running on mobile networks may not be sustainable with the use of existing mobile spectrum only.

43. The new applications and services that are expected to be made available through 5G technologies will likely need bands in different frequency ranges in order to be realized. 5G networks will require low frequency bands for coverage, mid-range frequency bands to provide both coverage and capacity, and high frequency bands to provide large bandwidths to meet high broadband speeds. When considering spectrum releases for commercial mobile services ISED will also take into account the different frequency ranges needed for the deployment of 5G networks.

Q2 –Do you agree with the above assessment on demand for commercial mobile services in the next few years? Is there additional information on demand, which is not covered above, that should be considered? If so, please explain in detail.
Q3 – What new technology developments and/or usage trends are expected to address traffic pressures and spectrum demand for commercial mobile services? When are these technologies expected to become available?
Q4 – Recognizing the trend of increasing commercial mobile traffic, what operational measures (e.g. densification, small cells or advanced traffic management) are being taken to respond to, and support, increasing traffic? To what extent are these measures effective?

As one of the global leaders in the development of 5G NR technology, and in working around the world to drive the rapid, broadest possible rollouts of 5G, Qualcomm believes it is essential for ISED and regulators everywhere to make low band, mid band, and high band spectrum available for 5G. As reflected already in the first 5G NR standard that 3GPP recently adopted, 5G will use each and every sliver of spectrum to deliver multi-gigabit connectivity, to support enhanced mobile broadband, the massive Internet of Things, and ultra-low latency and ultra-high reliability wireless connections. Low band spectrum, below 1 GHz, will support wide area connectivity across wide swaths of geography. Mid-band spectrum will cover metropolitan, urban, and rural areas. And, millimeter wave spectrum will support hot spots and dense metro cores. All three types of spectrum bands will play important roles in enabling 5G in Canada and elsewhere.

And, while 5G is built out and as 5G is adopted and proliferates, gigabit LTE will be extremely important to provide an excellent, uniform user experience. Just this week, Qualcomm announced its next modem supporting 2 gigabits per second LTE.[1] This technology, which uses Licensed Assisted Access to enable combined operations in the 5 GHz unlicensed band and licensed bands, as well as advanced MIMO and up to 7x carrier aggregation, will provide much faster mobile broadband in the near term as 5G is being built out. Qualcomm strongly believes that small cells, which bring connectivity closer to the user, will play an important role delivering an excellent user experience via both Gigabit LTE and 5G.

Finally, 5G NR will take advantage of shared and unlicensed spectrum. Qualcomm, working with companies around the world, is developing a version of 5G NR optimized for shared and unlicensed spectrum (known as 5G NR SS/U). Variants of this technology will use both existing and new unlicensed bands to deliver wireless broadband that will be far better in terms of capacity and speeds than what is possible today. We look forward to working with our Canadian partners and ISED as 5G NR SS/U technology is developed and deployed.

Respectfully submitted,

Dean R. Brenner
Senior Vice President, Spectrum Strategy &
Technology Policy

[1] https://www.qualcomm.com/news/releases/2018/02/14/qualcomm-continues-gigabit-lte-leadership-worlds-first-announced-2-gbps-lte