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(Attention: Principal Regulatory Affairs Manager (R22))

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Qualcomm Incorporated (Qualcomm) welcomes the opportunity to provide input to the Communications Authority (CA) and the Secretary for Commerce and Economic Development (SCED) on the *Arrangements for Assignment of Additional Spectrum in the 4.9 GHz Band for the Provision of Public Mobile Services and the Related Spectrum Utilisation Fee* (the Consultation).

Qualcomm is the world's leading wireless technology innovator and the driving force behind the development, launch, and expansion of 5G. When we connected the phone to the internet, the mobile revolution was born. Today, our foundational technologies enable the mobile ecosystem and are found in every 3G, 4G and 5G smartphone. We bring the benefits of mobile to new industries, including automotive, the internet of things, and computing, and are leading the way to a world where everything and everyone can communicate and interact seamlessly.

Qualcomm Incorporated includes our licensing business, Qualcomm Technology Licensing (QTL), and the vast majority of our patent portfolio. Qualcomm Technologies, Inc., a subsidiary of Qualcomm Incorporated, operates, along with its subsidiaries, substantially all of our engineering, research and development functions, and substantially all of our products and services businesses, including our Qualcomm CDMA Technologies (QCT) semiconductor business.

In 2019 5G became a reality and in 2020 5G is going mainstream.

To realize the full potential of 5G and support the new and varied eMBB and URLLC use cases that it supports, **a spectrum bouquet for 5G that consists of low band, mid-band, and high band spectrum** is required. The 4.9 GHz band represents an opportunity to provide mid-band spectrum.

Impact of the COVID-19 on provision of Mobile Broadband

The COVID-19 pandemic has highlighted the critical role that broadband plays in facilitating remote workforce, distance learning, telemedicine, communications, entertainment and social connection. It also

has highlighted the critical role for policy makers to ensure access to connectivity. As Qualcomm works with governments and the industry to try and limit the health and economic impacts of the pandemic, it has quickly become clear that widespread access to wireless connectivity offers solutions to some of the greatest challenges we're currently facing.

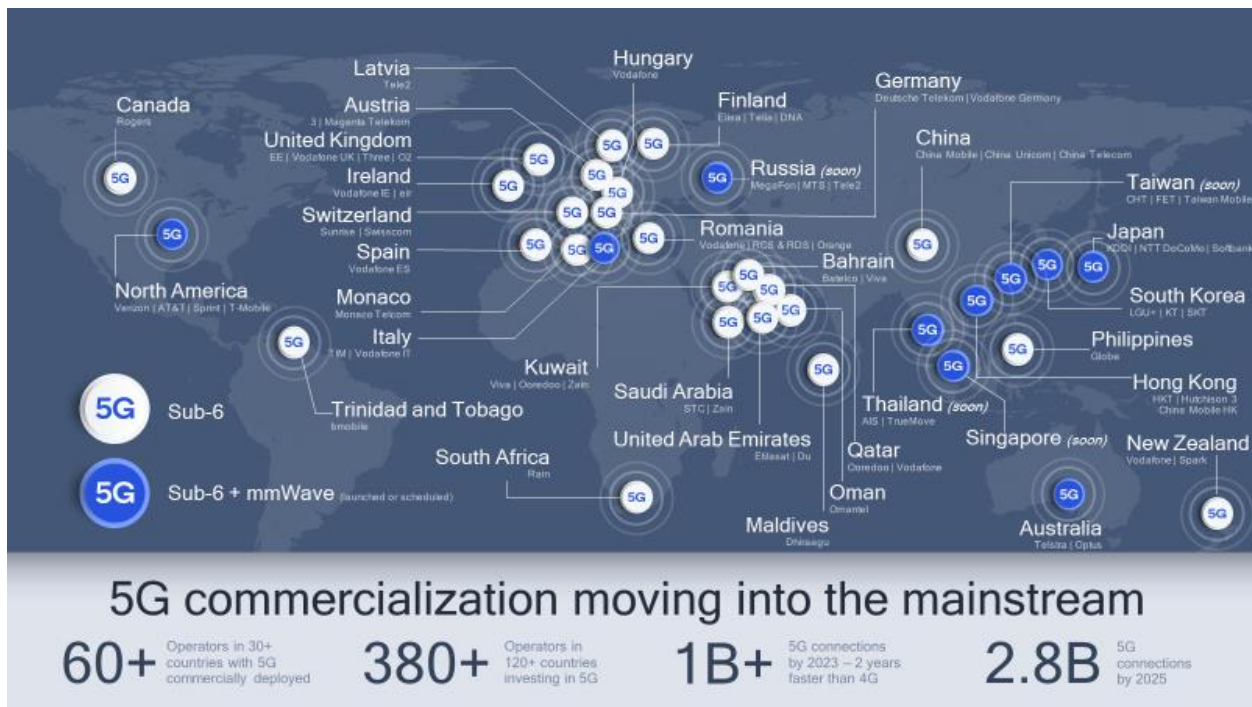
Broadband connectivity, especially 5G is proving to be the economic and educational lifeline that allows so many of us to seamlessly transition to working from home productively and students to continue their studies, whilst at the same time respect social distancing and stay at home requirements.

Broadband is enabling video conferencing with doctors and front-line medical professionals and the exchanging of images and an array of medical records. With the deployment of 5G, even more medical innovation and efficiencies will be made possible.

Fortunately, the first wave of 5G launches is already well underway.

The leading operators have launched around the world, and with more than 380 operators already investing in 5G networks, it will rapidly become the leading connectivity platform. Qualcomm notes that 5G uptake is occurring at a much faster rate than 4G LTE, considering the large number of network operators that have deployed and equipment manufacturers who have developed equipment and governments that have already released or announced the planned release of 5G spectrum.

The current state of global scheduled and launched 5G deployments for mid-band and mmWave spectrum is shown below.



The 5G ecosystem is growing at an unprecedented rate with more than 375 devices launched or in development. These devices include smartphones, hotspots and CPE, and 5G modules from all the major OEMs.

5G smartphones

Hotspots and CPEs

Askey	HTC	Netgear	WNC
Inseego	Netcomm	Nokia	ZTE

5G modules

Compal	Longsung	Sierra	SIMcom
Fibocom	Quectel	Wireless	Telit

Qualcomm Snapdragon

375+ 5G devices launched or in development

Qualcomm Snapdragon is a product of Qualcomm Technologies, Inc. and/or its subsidiaries

In the latest 5G standards release, 3GPP Release 16 recently completed in June 2020, there was a concerted effort to add new capabilities to 5G to expand its reach into new industries. For instance, the full potential of Industry 4.0 can be unleashed by “cutting the wire” in industrial automation¹. Release 16 introduces enhanced ultra-reliable low latency communication (eURLLC) to deliver milli-second latency, time-sensitive networking (TSN) for timing-deterministic transmissions, and unlicensed spectrum (NR-U)² and private network support for more flexible deployments.

Building on Release 15, Release 16 is a concerted effort to deliver further enhancements to the 5G technology foundations (i.e., coverage, mobility, power, reliability, etc.) and expand 5G’s reach to new use cases, spectrum bands, and vertical industries. 3GPP Release 16 projects, include wideband positioning, support for spectrum bands above 52.6 GHz, and integrated access and backhaul (IAB), which could ease the deployment of 5G NR small cells by allowing the reuse of the same spectrum and equipment for access and backhaul.

Question 1: Do you have any views on the proposed amendment to the Hong Kong Table of Frequency Allocations as regards the allocation of the 4.80 – 4.83 GHz band to mobile service on a co-primary basis in addition to fixed service, and the 4.99 – 5.00 GHz band to fixed service on a co-primary basis in addition to radio astronomy service?

Mid-band spectrum range offers a particularly optimal balance between coverage and capacity. It is widely held that this mid-band range will support a broad array of 5G applications – from enhanced Mobile Broadband (including Augmented Reality/Virtual Reality and Ultra High Definition video) and Fixed Wireless Access to a plethora of new and emerging applications that impact, and are impacted by, the

¹ <https://www.qualcomm.com/news/onq/2019/12/17/collaborating-industry-leaders-expand-5g-industry-40>

² <https://www.qualcomm.com/news/onq/2018/12/13/3gpp-commits-5g-nr-unlicensed-spectrum-its-next-release>

ongoing digital transformation of society³. These are applications commonly associated with Industry 4.0, health care, smart cities and drones.

3GPP has standardized band n79 (4400 – 5000 MHz) for 5G services. This mid-band 3GPP band supports a wide-range of use-cases that take advantage of the bands' propagation characteristics, and available bandwidth. Band n79 is a planned for use in Japan and China which suggests that there will be demand for additional spectrum, and a well-developed ecosystem in this range.

For band n79 (4400 – 5000 MHz) there are 101 devices, again predominantly smartphones and also a variety of other formfactors. There are 8 licensed networks in; Japan, China, Hong Kong, Russia and Kuwait, and one launched in Japan.⁴ In Taiwan the 4800 – 4900 MHz band is dedicated for Industrial localized networks use by the public and private sectors for special purposes and it is expected to be used in wireless networks for application of AI, and IoT⁵.

A key consideration for allocating spectrum in the mid-band range is available bandwidth. The optimal bandwidth for provision of 5G using mid-band spectrum is ~100 MHz per operator. In Hong Kong the 3.3 – 3.4 GHz, and the 3.4 -3.6 GHz bands as well as some of the 4.8 – 4.99 GHz band have been made allocated to MNOs. However, not all of this spectrum is available in all locations in Hong Kong e.g. the band 3.4 – 3.6 GHz is encumbered with FSS TT&C uplinks and exclusion zones have been created around these uplink locations. The 4.8 – 4.99 GHz band provides additional spectrum to operators, especially in the exclusion zones.

Qualcomm supports the proposal to allocate the 4.8 – 4.83 GHz to the mobile service to the fixed service and the 4.99 – 5.00 GHz band to the fixed service on a co-primary basis to the radio astronomy service.

Question 3: Do you have any views on the proposal to divide the additional spectrum in the 4.9 GHz band into two 40 MHz blocks?

For band n79, 3GPP specifies possible channel bandwidths of 40, 50, 60, 80, and 100 MHz so it would be sensible to specify a channel width of 40 MHz to maximize the possible band width options for one or more operators when additional licenses are assigned in the 4800 – 4960 MHz range.

Qualcomm supports the CA and SCED efforts to ensure that there is enough available mid-band spectrum (optimal bandwidth with mid-band spectrum ~100 MHz per operator) for licensed 5G services in Hong Kong. It is important that this spectrum is available throughout the SAR and the 4.9 GHz band provides for this.

1.1 Conclusion

Qualcomm is encouraged by the continued CA and SCED efforts to ensure the availability of adequate spectrum to enable deployment of 5G services in Hong Kong. The CA's proactive approach to allocating and the 4.9 GHz band will assist all stakeholders to realise successful 5G deployments that deliver enhanced and innovative services to Hong Kong's users across the SAR while maximizing harmonization with global and regional developments.

³ 3300-4200 MHz: A Key Frequency Band for 5G - How administrations can exploit its potential, GSA, February 2020

⁴ GSACOM 2020 – Gambod database

⁵ <https://www.digitimes.com/news/a20191206PD215.html>

We appreciate the opportunity to provide feedback to the CA and SCED and would be pleased to provide further information or respond on greater detail. Should you have any questions or comments on this submission, please do not hesitate to contact me at +852 69010087 (mobile) or aorange@gti.qualcomm.com.

Sincerely,

A handwritten signature in black ink, appearing to read 'Alex Orange', with a stylized flourish at the end.

Alex Orange
Director, Government Affairs, South East Asia, Taiwan and Pacific
Qualcomm Incorporated