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Dear Ms. Chia,

Qualcomm Incorporated appreciates the opportunity to provide comments on Info-communications Development Authority of Singapore's (IDA) Consultation Paper on the allocation of an additional 2 x 5 MHz of 1800 MHz Spectrum ("Consultation Paper").

Qualcomm is a world leader in developing innovative digital wireless communications technologies and enabling products and services based on the technologies that it develops. It is one of the leading enablers of 3G wireless as well as other wireless solutions and services, including those based on Code Division Multiple Access (CDMA) and Orthogonal Frequency Division Multiplexing (OFDM). The 3G CDMA family of wireless technologies, which includes CDMA2000/EV-DO and Wideband CDMA/High Speed Packet Access (HSPA), currently enables over one billion subscribers around the world to enjoy advanced, high speed, and ubiquitous voice and mobile broadband data services in rural, suburban, and urban areas.[1] Qualcomm broadly licenses its technology to over 180 manufacturers around the world that make infrastructure equipment, handsets and other consumer devices and develop applications based on the 3G CDMA and HSPA air interfaces.

Qualcomm CDMA Technologies (QCT), a division of Qualcomm, is the world's largest supplier of wireless chipsets.[2] QCT has helped lead the diversification of mobile broadband into many new types of mobile broadband enabled devices, ranging from smartphones, PC cards and USB dongles to embedded laptops, netbooks, and a wide variety of pocketable computing devices with mobile broadband capability. Many of these devices are ultra-portable, personalized, easy-to-use, and powered all day on a single battery charge delivering a unique mobile broadband experience different from other types of devices on the market today. These types of devices are already used today by millions of wireless users and provide low-cost, mobile access to the Internet and to broadband applications.

Qualcomm MEMS Technologies, Inc., a wholly-owned subsidiary, has developed the world's first MEMS display for mobile devices—a new display technology that offers dramatically lower power consumption and superb viewing quality in a wide range of environmental conditions, including bright sunlight. Qualcomm Internet

[1] Wireless Intelligence as of 3Q2010.
[2] http://www.qualcomm.com/who_we_are/businesses/index.html.

Services offers software platforms which aim to bring any application to any device on any network in any location. These platforms began with BREW, a thin software layer which was the first platform that enabled the downloading of applications into wireless phones. More recently, Qualcomm Internet Services began offering Plaza Mobile Internet, a platform that allows mobile devices to access widgets, thereby bringing the features and interactivity of Web 2.0 applications to mobile devices, and Plaza Retail, which provides support for multiple app stores, giving wireless subscribers a uniform and easy shopping experience on a wide variety of wireless devices. Finally, Qualcomm recently formed a joint venture with Verizon Wireless in the United States by the name of nPhase. The joint venture will provide machine-to-machine communications and smart service offerings across a wide variety of market segments including healthcare, manufacturing, utilities, distribution, and consumer products over 3G mobile broadband networks.

Qualcomm is highly appreciative of the IDA's decision, resulting from public submissions on the "Allocation of Spectrum in the 1800 MHz Frequency Band" and the "Spectrum Framework for 4G Mobile Communication Systems", to release additional spectrum in the 1800 MHz band for PCMTS. Qualcomm is pleased to respond to the specific questions posed by IDA in its Consultation Paper. Qualcomm's comments are aimed at ensuring that the remaining 1800 MHz spectrum is released in a manner which makes the most efficient use of this scarce resource to promote innovation in, and growth of a vibrant infocomm industry in Singapore.

Question 1

IDA invites views and comments on whether IDA should make available one 2x5 MHz Additional 1800 MHz Spectrum for PCMTS for allocation.

Mobile telephony and mobile broadband usage is growing at an unprecedented pace. 3G technologies are currently providing mobile telephony and mobile broadband services to significantly more than one billion subscribers worldwide.[3] On average, 23 million 3G subscribers were added every month in Q4 2009. IDA indicates that between April 2009 and April 2010, 3G subscriptions grew by about 25 percent while High Speed Packet Access (HSPA) subscriptions grew by 240 percent.[4] ABI research estimates that worldwide wireless data traffic grew by 5,800 percent during the two year period from 2006 to 2008; and only slightly decreased growth rates of 4500 percent are forecast over the next few years.[5]

Anticipating how future demand for mobile data traffic will impact existing wireless and mobile networks may be challenging, yet it is clear that the phenomenal growth in traffic will put more pressure on current networks as more users adopt Internet-enabled wireless devices, increase their data consumption over each device and substitute wireless for wireline broadband. While new technologies provide for greater spectral efficiency and throughput rates that will help to offset strains on existing networks, the rising demand for network capacity will outpace technological advances of currently deployed networks. The roll-out of mobile broadband networks intensifies the demand for mobile broadband service as new applications and devices take advantage of these advanced networks. This growth depends on sufficient access to spectrum, particularly since the supply and demand of bandwidth are interdependent—increased access to bandwidth enables more data-intensive applications, which in turn leads to the need for more bandwidth.

To meet the exponential demand for data traffic, mobile broadband technologies such as Long Term Evolution (LTE) are being deployed. LTE standardization is now complete and has been approved by 3GPP[6], and as of

[3] Wireless Intelligence as of 3Q2010
[4] See IDA Statistics on Telecom Services and IDA 3G Consultation Paper at para 3.
[5] http://www.abiresearch.com/press/1466-In+2014+Monthly+Mobile+Data+Traffic+Will+Exceed+2008+Total
[6] www.3GPP.org

October 27 one hundred and fifty operators in 64 countries are investing in LTE[7], including all three mobile network operators in Singapore each of which have conducted LTE trials.

Furthermore, there is worldwide interest in re-farming existing mobile bands (including 1800 MHz) for LTE:

- in Europe regulators have relaxed conditions pertaining to use of the 1800 MHz band to allow for technologies other than GSM[8];
- in Australia Telstra, Vodafone Hutchison Australia, and Singtel's subsidiary Optus have completed LTE trials and some of these trials have been conducted in the 1800 MHz band[9],
- in Hong Kong CSL has launched the world's first DC-HSPA/LTE network currently deployed in 2.6 GHz spectrum although some 1800 MHz sites have been equipped for LTE[10], and
- On September 7, 2010 the world's first LTE network in 1800 MHz spectrum (LTE1800) was commercially launched by Poland's Mobyland and CenterNet. This network utilizes 20 MHz LTE carrier bandwidths which is the maximum possible under the existing LTE standard. The company is targeting to have 700 base stations in operation covering over 7 million people by 2010.

LTE is best suited for channel bandwidths of 10 MHz or more, and operation in wider channel bandwidths, such as 20 MHz, will enable the full promise of LTE to be achieved. LTE deployed using a 20 MHz carrier can deliver 300 Mbps peak data rate in the downlink when coupled with 4 x 4 MIMO antenna configuration.

From a practical standpoint, most mobile network operators that choose to deploy LTE in 1800 MHz must accommodate their existing (2G) 1800 MHz services and customers during technology transition. To maximize the opportunities for operators to implement LTE carrier bandwidths up to 20 MHz and maintain existing services, additional 1800 MHz spectrum should be made available. **Qualcomm believes that releasing both of the unused 2 x 5 MHz spectrum lots will provide operators with the greatest opportunity to achieve maximum utility in the 1800 MHz band.**

Question 2

IDA seeks views and comments on the proposed allocation parameters.

Qualcomm is of the view that assigning spectrum for the greatest length of time possible provides the licensee with certainty and hence the opportunity to maximize its return on investment in the use of that spectrum.

In terms of lot size, Qualcomm supports the IDA's proposal to release the spectrum in 5 MHz lots. Maximum utility can be provided by allocating both lots of 2 x 5 MHz spectrum, and considering that technologies such as HSPA and LTE can be built using carrier bandwidths based on multiples of 5 MHz, there does not appear to be any technical advantage in offering narrower spectrum lots especially considering the benefits of LTE are realized with >10 MHz carrier bandwidths.

The IDA's proposal to allow a successful bidder to use the 1800 MHz spectrum in question to provide PCMTS using 2G or 3G technologies and other technologies which share a similar platform and allow higher speed data services is supported by Qualcomm. In addition to HSPA, Qualcomm considers LTE to be a technology of choice in the band.

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[7] www.gsacom.com/news/gsa_311.php4

[8] European Commission Decision of 16 October 2009 on "the harmonisation of the 900 MHz and 1 800 MHz frequency bands for terrestrial systems capable of providing pan-European electronic communications services in the Community"

[9] Global Mobile Suppliers Association GSM/3G Market/Technology Update October 26, 2010

[10] Ibid.

Considering the maturity in the PCMTS market in Singapore, the healthy state of competition between existing operators, and the greater than 100% mobile penetration, , Qualcomm agrees it will be difficult for a new entrant to enter the market with this new spectrum. Qualcomm therefore supports the IDA's proposal to limit participation to the existing PCMTS operators unless IDA receives a bona fide indication of interest otherwise.

Where demand for spectrum exceeds supply, spectrum auctions provide a transparent, unbiased mechanism for choosing the bidder that values the spectrum the most. Setting a suitable reserve price ensures that there is a financial incentive in place to seek a return on spectrum investment.

In summary, Qualcomm supports IDA's initiative to release additional spectrum in the 1800 MHz frequency range and believes that this release should encompass all the remaining spectrum (being two 2 x 5 MHz lots) to provide operators flexibility to achieve maximum utility in the 1800 MHz band.

Should you have any questions or comments on this submission, please do not hesitate to contact me at +852 6901 0087 (mobile) or alexorange@qualcomm.com.

Sincerely,

Alex Orange
Director, Government Affairs
Southeast Asia & Pacific

cc: John Stefanac, Vice President and President Qualcomm SEA and Pacific.