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Introduction

QUALCOMM Incorporated would like to thank the Hong Kong Telecommunications Authority (TA) for the opportunity to provide public comments on its *Licensing Framework for Deployment of Broadband Wireless Access (BWA)*.

As you know, QUALCOMM is the primary developer of Code Division Multiple Access (CDMA), the world's fastest growing wireless communications technology, which is used by more than 285 million subscribers around the world.¹ CDMA solutions are available for a number of communications applications, including mobile cellular, fixed wireless, broadband wireless access, trunking and satellite communications. QUALCOMM is interested in the success of all members of the International Telecommunication Union (ITU) IMT-2000 standard that use CDMA technologies, including CDMA Multi-Carrier (CDMA2000), CDMA Direct Spread (WCDMA) and CDMA Time Division Duplex (UMTS TDD), which share a common technology base. QUALCOMM has also developed a number of other technology solutions for wireless service providers including BREW®, QChat®, MediaFLO™ and QPoint™.

In its comments, QUALCOMM will focus on 1) encouraging the TA to conduct its Spectrum Policy Review prior to additional spectrum allocations and 2) specific areas of the TA's BWA consultation: technology neutrality, 3G as a BWA solution and band plan harmonization with mainland China.

I. QUALCOMM Supports OFTA Conducting Spectrum Policy Review Prior to BWA Licensing

The TA has previously noted its intention to conduct a spectrum policy review. QUALCOMM believes it may be in the best interest of operators and consumers if the spectrum policy review were completed prior to the TA allocating additional spectrum for services such as BWA. If

¹ CDMA Development Group, www.cdg.org.

policies regarding spectrum usage, tradability, re-farming, and interference are not resolved through a comprehensive spectrum policy review, industry may have difficulty fully addressing issues in the TA's BWA Consultation. There would also be a high degree of regulatory uncertainty which may give rise to unhealthy market conditions.

II. Specific Comments on BWA Consultation

QUALCOMM Supports Technology Neutrality

QUALCOMM agrees with the TA's policy of maintaining technology neutrality. This is a fundamental cornerstone of effective regulatory policy. Allocating spectrum for generic services rather than specific technologies provides the flexibility necessary to keep pace with changes in technology or consumer preference. Although the TA adheres to technology neutrality, the TA in its BWA document specifically references WiMAX and UMTS TDD as BWA technologies. QUALCOMM encourages the TA to consider the entire scope of BWA technologies when discussing BWA.

3G CDMA2000 and WCDMA are also BWA technologies

Broadband wireless access (BWA) technologies include standardized technologies such as International Telecommunication Union IMT-2000 family of standards as well as the ETSI HiperMAN standards, the IEEE 802.16-2004 standard and the IEEE 802.16e draft "mobile" standard which is about to be approved by the IEEE.

The ETSI HiperMAN standards address interoperability for fixed BWA systems in 2-11 GHz frequencies using Orthogonal Frequency Division Multiplexing (OFDM) downlink and Orthogonal Frequency Division Multiplexing Access (OFDMA) uplink to provide relatively high cell sizes in non-line of sight (NLoS) operation. The IEEE 802.16 standards, or more familiarly named WiMAX, are similar to the 802.11 or WiFi standards. The IEEE 802.16-2004 standard of WiMAX provides fixed wireless access over a much larger area than does the more familiar WiFi standard. There are two versions of the 802.16-2004 standard – one for frequencies below 11 GHz, relying on NLoS radio propagation effects and one for frequencies 10-66 GHz that assume line-of-sight propagation conditions. However, while the standard for 802.16-2004 has been "completed" for some time, certified equipment for 802.16-2004 equipment is still not available in the marketplace. Due to changes in system profiles and the inherently complex process of defining multiple certification profiles for each system profile, delays in interoperability testing could possibly lead to not having certified and fully interoperable equipment for fixed WiMAX readily available until later in 2006.

The first version of the 802.16e standard is currently undergoing the final approval phases within the IEEE; however the mobile solution is not expected to be available in the marketplace for some time to come. It is widely acknowledged that 802.16-2004 and 802.16e will not be compatible. While 802.16-2004 will provide a service for wireless backhaul and fixed broadband access, it is not yet clear what the market opportunity for 802.16e will be when the technology is actually ready for commercial deployment.

QUALCOMM would like to encourage the TA to include other commercial IMT-2000 technologies, in addition to UMTS TDD, in any discussion of broadband wireless access licensing. In ITU Study Group 9 Draft New Recommendation, "Rec. ITU-R F.[9B/BWA] – Radio interface standards for broadband wireless access systems in the fixed service operating below 66 GHz", it is noted that some IMT-2000 radio interface standards may also be used to

provide BWA.² For example, CDMA2000 1xEV-DO is an IMT-2000 technology which a number of wireless carriers with CDMA networks around the world have deployed.³ Revision 0 of this technology delivers data at peak rates of 2.4 megabits per second and at average rates of 300-600 kilobits per second. CDMA2000 1xEV-DO technology has been commercially deployed in Australia, Bermuda, Brazil, Canada, Chile, the Czech Republic, Guatemala, Israel, Japan, Korea, New Zealand, Romania, the United States and Venezuela. Additional EV-DO deployments are expected this year in Belize, Canada, Nigeria, Pakistan, Russia, Taiwan, the United States and Vietnam.⁴ Today, over 15 million people use EV-DO technology for wireless broadband Internet service and the number of subscribers is growing rapidly.⁵

EV-DO Revision A (TIA-856-A) is the first in a series of planned upgrades for EV-DO Release 0. Revision A introduces improvements in forward link capacity, full support for real-time applications and quality of service, and a vastly improved reverse link. The improvements in the forward link include an increase in the peak data rate from 2.4 Mbps (Release 0) to 3.1 Mbps and an increase in sector throughput from 2.61 Mbps to up to 3.15 Mbps in 5 MHz. The improvements in the Revision A forward link are primarily achieved through better rate and packet quantization and equalization, which improves the C/I ratio, as well as the introduction of a new packet type with a transmission format that supports the 3.1 Mbps peak data rate. Additionally, the higher throughput capabilities in the reverse link indirectly improve the forward link data rates by reducing the response time of the acknowledgement messages for packets that are sent in the forward link.⁶

Work is also under way within the 3GPP2 to develop and standardize the next revision of CDMA2000 1xEV-DO, which is Revision B. Revision B, which could be adopted as a standard in the first quarter of 2006 and commercially available in late 2007, builds on the efficiencies contained within Revision A by introducing the concept of dynamically scalable bandwidth. Scalable bandwidth can theoretically combine up to fifteen 1.25 MHz carriers (20 MHz) in the forward link and/or the reverse link to increase available bandwidth. For example, if three 1.25 MHz carriers are combined, the theoretical peak data rate would be three times that available with Revision A, or 9.3 Mbps. If all fifteen carriers are used, the peak data rate would be 46.5 Mbps. With the implementation of 64-QAM modulation, the peak data rate of the reverse link increases to 73.5 mbps. It is important to note that these carriers are not physically combined together (e.g., the spreading of the signal is not across a 20 MHz carrier). Instead, each 1.25 MHz carrier remains its own entity, so there is no loss in spectral efficiency. This also means that the carriers do not have to be directly adjacent to one another and different air links can be inter-mixed within the spectrum band, thus giving the operator flexibility in determining which carriers to use. Latency and quality of service can also be improved since the system can dynamically switch between EV-DO carriers based on the channel quality and traffic load. Put another way, packets can be sent to a mobile device using, for example, three carriers, or the packets can be sent to a mobile on only one carrier, but the active carrier constantly changes in order to provide the best possible throughput and lowest latency.⁷

² Draft New Recommendation ITU-R F.[9B/BWA] – Radio interface standards for broadband wireless access systems in the fixed service operating below 66 GHz.

³ CDMA2000 1xEV-DO, or CDMA2000 1xEvolution-Data Optimized is often referred to as EV-DO. 3GPP2 has standardized both Revision 0 and Revision A of this technology as IS-856. In addition all versions of CDMA2000 are recognized by the ITU as IMT-2000 technologies in ITU-R M.1457.

⁴ www.3Gtoday.com

⁵ As of August 2005, www.3Gtoday.com. This number only represents the number of reported EV-DO subscribers.

⁶ *The 3G Evolution: Taking CDMA2000 into the Next Decade*. Michael Thelander, October 2005.

⁷ Ibid.

Worldwide, operators are also offering high-speed, high quality wireless broadband service over licensed spectrum using another IMT-2000 technology, WCDMA. WCDMA enables users to send and receive data at peak rates of 384 kilobits per second. More than 33 million people have subscribed to over 87 WCDMA networks.⁸

High Speed Packet Access (HSPA) refers to improvements in the WCDMA radio interface in Releases 5 and 6 of the 3rd Generation Partnership Project (3GPP) standards. HSPA refers to both the improvements made in the WCDMA downlink, often referred to as High Speed Downlink Packet Access (HSDPA) and the improvements made in the uplink, often referred to as High Speed Uplink Packet Access (HSUPA). HSDPA enables data transmission speeds of up to 14.4 Mbps. HSUPA enables data transmission speeds of up to 5.8 Mbps. Both HSDPA and HSUPA can be implemented in the standard 5 MHz carrier of WCDMA networks.⁹

QUALCOMM Supports Hong Kong Band Plan Harmonization with Mainland China

QUALCOMM notes that the TA intends to keep Hong Kong's 2.3 GHz band reserved when it becomes fully vacant in the future. The TA states that China has the 2.3 GHz band allocated for 3G TDD expansion and the TA would like the option of harmonizing Hong Kong's band plan with mainland China's band plan. QUALCOMM supports the TA's objective in harmonizing its band plan with China.

Conclusion

Again, QUALCOMM would like to thank the TA for this opportunity to provide comments on its *Licensing Framework for Deployment of Broadband Wireless Access*. Foremost, QUALCOMM encourages the TA to consider postponing its BWA spectrum allocation until such time that the TA completes its spectrum policy review. With regard to the TA's BWA consultation, QUALCOMM supports the TA on its continued stance of technology neutrality, however, QUALCOMM respectfully recommends that the TA broaden its discussion of BWA examples to include mature, commercially available and widely adopted IMT-2000 BWA technologies such as CDMA2000 (EV-DO) and WCDMA (HSPA). Finally, QUALCOMM is in full agreement with the TA's intention to harmonize its band plan with mainland China.

Should you have questions, please contact me on +852-6077-9268 (mobile) or scovell@qualcomm.com.

Sincerely,



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cc: Mr. Edmund Sin, Vice President Hong Kong Business Development, QUALCOMM

⁸ www.3Gtoday.com

⁹ UMTS Forum, *HSPA: High Speed Wireless Broadband – From HSDPA to HSUPA and Beyond*.