QUALCOMM International
Unit 1701-03, 17th Floor
9 Queen's Road Central
Central, Hong Kong
Telephone: (852) 2537 5000
Facsimile : (852) 2537 1188
www.qualcomm.com

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Office of the Telecommunications Authority
29/F, Wu Chung House
213 Queen's Road East
Wan Chai, Hong Kong

Attention: Senior Telecommunications Engineer (R11)
Fax: 2803-5112
Email: bwa3con@ofta.gov.hk

QUALCOMM Incorporated would like to thank the Hong Kong Telecommunications Authority (TA) for the opportunity to provide comments on *Providing Radio Spectrum for Broadband Wireless Access Services: Third Consultation Paper*.

As the TA may already be aware, QUALCOMM is a leader and innovator in the development of digital wireless technologies including those based on Code Division Multiple Access (CDMA) and Orthogonal Frequency Division Multiplexing (OFDM). These solutions are available today for a number of communications applications, including mobile cellular, fixed wireless access, broadband wireless access, trunking and satellite services. QUALCOMM is interested in the success of all the air interfaces that comprise the International Telecommunication Union's (ITU) IMT-2000 recommendations that use CDMA technologies, including CDMA Multi-Carrier (CDMA2000), CDMA Direct Spread (WCDMA/HSPA) and CDMA Time Division Duplex (UTRA TDD & TD-SCDMA), which share a common technology base.

QUALCOMM has also developed other technology solutions for wireless service providers such as MediaFLO™[1], an end-to-end solution that enables broadcasting of high-quality video streams, audio channels, as well as other multimedia applications (video clips, IP datacasting applications, etc.) to mobile handsets. FLO (Forward-Link-Only) technology, a key component of the MediaFLO system, is a new mobile broadcast air interface – based on OFDM modulation – that is designed and optimized to increase capacity and coverage while reducing the cost of multimedia content delivery to mobile handsets.

QUALCOMM applauds the Government's vision "to make broadband Internet access available to all citizens in Hong Kong, regardless of whether they are at home or on the move." We believe the 3G industry and ecosystem will continue to take a leading role in the provision of broadband wireless Internet access services to the citizens of Hong Kong, as well as to rural and urban consumers in other markets around the world. QUALCOMM strongly support the TA's technology neutral and market-based approach to releasing scare and valuable frequency spectrum resources.

**Question (1): Do you agree that the 2.3 GHz band be allocated for BWA services? If agreed, when the spectrum should be made available?**

Within the Asia Pacific region, a handful of countries have recently allocated the 2.3 – 2.4 GHz ("2.3 GHz") band to BWA or licensed operators to provide BWA-type services within this band. However, there remains

[1] http://www.qualcomm.com/mediaflo/index.shtml.

uncertainty within the wireless industry on the near-term market readiness of infrastructure and user equipment that would be able to operate in this band. To date, there have been a very limited number of commercial deployments in this band and these deployments have not proven as successful as expected. It is worthwhile noting that the New Zealand Ministry of Economic Development was scheduled to auction the 2.3 GHz band in May 2007 for BWA services but the auction was postponed at the last minute. No official reason for the delay has been released by the New Zealand authorities.

QUALCOMM believes further clarity on the technical and operational use of the 2.3 GHz band is needed to ensure success for the TA at auction. Some of the outstanding issues include: a frequency band plan, the amount of guard-band required between differing licensees, and the availability of infrastructure and user equipment. For these reasons, the TA may need to consider allowing the eventual licensees an extended period of time to deploy their networks. Moreover, the 2.3 GHz band is a candidate for WRC-07 identification for IMT which would include both IMT-2000 and IMT-Advanced. If this band were identified at WRC-07, it is likely the ITU-Radiocommunication Sector Study Groups would then begin to analyze technical sharing scenarios and make recommendations on band channelization options appropriate for this band. We encourage the TA to await the outcome of WRC-07 before making final determinations on the detailed use of the 2.3 GHz band.

**Question (2): Do you agree that the opening up of the 2.5 GHz band for BWA should be considered at a later stage? If agreed, when and how much of the bandwidth should be made available to the market?**

Unlike the 2.3 GHz band, the 2.5 – 2.69 GHz ("2.5 GHz") band has already been identified by the ITU-R for IMT-2000.[2] In this regard, it has been targeted for 3G / IMT-2000 expansion and will be needed to sustain the fast market growth of 3G services. 3G technologies are currently providing advanced broadband data and voice services to more than 461 million subscribers worldwide.[3] As of end-June 2007, there were over 391 commercial 3G operators in 135 countries worldwide. HSDPA, part of 3GPP/UTRAN-FDD Release 5 WCDMA specifications, is a software-based enhancement that significantly boosts the air interface capacity of WCDMA networks and delivers a 5-10 fold increase in downlink data speeds of standard WCDMA networks. As of July 8th 2007, there were 115 commercial HSDPA mobile broadband networks in operation in 58 countries and several more in various stages of deployment.[4] Alternatively, CDMA2000 1xEV-DO, part of 3GPP2 specifications, is a data-optimized evolution of the CDMA2000 standard. There are over 82 CDMA2000 1xEV-DO networks in commercial operation today.[5] Importantly, laptops embedded with high-speed HSDPA and EV-DO capability as well as HSDPA and EV-DO multi-band data cards / USB modems are available in the market today and able to meet the demand for portable (or nomadic) BWA services.[6] 3G technologies are forecasted to comprise 95 percent of the world's mobile Broadband Wireless Access (BWA) subscriptions by the year 2010 whereas IEEE 802.16e, for example, is forecasted to comprise 2.5 percent.[7]

Both 3GPP and 3GPP2 are planning to provide continuous enhancements for HSPA and EV-DO to deliver higher bandwidth and better economics. As 3G technologies continue to evolve (e.g., HSPA+, Long Term Evolution (LTE), Ultra Mobile Broadband (UMB)), they will require additional spectrum and large channel bandwidths. Access to the relatively wide bandwidth available from 2.5 – 2.69 GHz will be necessary in order to benefit from these evolved technological capabilities and to deploy richer applications and services. For instance, QUALCOMM recently announced the sampling of HSPA+ chipsets in the 2.5 GHz band by the end of 2007. HSPA+, based on the 3GPP Release 7 standard, provides data rates of up to 28 Mbps on the downlink and 11 Mbps on the uplink, significant increases in network capacity, reduced latency and an enhanced user experience for many data-intensive applications.

As the TA is well aware, the 2.5 GHz band has been the subject of significant controversy within the ITU WRC 2007 preparations with regard to the co-existence between space and terrestrial services. (*See* WRC-

[2] This band was identified at WRC-2000. *See* ITU Radio Regulations **No. 5.384A** and **Resolution 223**.
[3] www.3Gtoday.com as of 30 April 2007.
[4] GSM Association, www.gsmworld.com as of 8 July 2007.
[5] www.3Gtoday.com as of 30 April 2007.
[6] *See* http://hspa.gsmworld.com/devices/default.asp and www.3Gtoday.com for updated figures on HSPA and EV-DO enabled embedded notebook computers, handsets, data cards, USB modems, equipment suppliers etc.
[7] Strategy Analytics "Beyond 3G: Looking for True Mobile Broadband," November 2006.

07 Agenda Item 1.9, **"**to review the technical, operational and regulatory provisions applicable to the use of the band 2 500-2 690 MHz by space services in order to facilitate sharing with current and future terrestrial services without placing undue constraint on the services to which the band is allocated.") Given that Mainland China has been actively involved in these ITU discussions, this international debate is particularly relevant to the TA's plans to release spectrum in the band.

While there is more clarity on the usage of the 2.5 GHz band than the 2.3 GHz band (e.g., channel plan, sharing studies between different standards), commercially available infrastructure and user equipment is still quite limited. It should also be noted that sharing studies between 3G IMT-2000 networks and fixed deployments of IEEE 802.16 TDD have been conducted in various fora. However, the conclusions of these studies have recently been called into question due to the emergence of new information on the IEEE 802.16 TDD emission masks that were submitted to the ITU-R Working Party 8F by the WiMAX Forum on June 15th, 2007.[8]

Given the above, QUALCOMM supports the TA's determination that it is pre-mature to consider the allocation of the 2.5 GHz band for BWA services.

**Question (3): Do you have any preferred frequency bands for BWA services? How much spectrum do you need initially and for future expansion (number of blocks, spectrum width of each block, in which bands) and when the spectrum should be made available to the market?**

Fixed and mobile BWA services are currently available to Hong Kong consumers from 3G systems operating in the paired 1.9 GHz / 2.1 GHz band, and user equipment is expected to soon be available in the 900 MHz and 1800 MHz bands as well. As a general matter, BWA services are or will soon be available in the frequency bands that have been identified in the ITU Radio Regulations for IMT-2000. These bands include: 806 - 960 MHz, 1710 - 1885 MHz, 1885 - 2025 MHz, 2110 - 2200 MHz, and 2500 - 2690 MHz.

BWA services can be provided by a variety of other technologies in addition to 3G systems. While there seems to be varying interpretations within the industry as to what defines BWA services, the ITU-R has developed Recommendation M.1801 noting some standards, "Radio interface standards for broadband wireless access systems including mobile and nomadic applications, in the mobile service operating below 6 GHz." This Recommendation includes references to IMT-2000, IEEE 802.11, IEEE 802.16e, ETSI BRAN HIPERLAN, ARIB HiSWANa, ATIS WTSC wireless wideband internet access (WWINA) and Next-generation PHS. QUALCOMM believes it is important for the TA to recognize the different frequency bands which can be used to provide BWA services and to ensure that a level playing field and equivalent regulatory regime is applicable to each of these bands, thereby allowing all BWA service providers to compete fairly in the marketplace.

**Question (4): Do you agree with the proposed frequency allocation plan given in Annex 1? If not, what is your proposal?**

No comment.

**Question (5): Do you agree that a BWA licensee should be assigned no more than six 5 MHz blocks of the BWA spectrum?**

No comment.

**Question (6): If the result of the coordination with the Mainland authorities confirms that 85 MHz bandwidth in the 2.3 GHz band can be made available, do you agree that the TA should make available all the 85 MHz bandwidth for BWA service? If not, what is your proposal with reasons?**

Please refer to response to Question (1).

**Question (7): Do you have any views on the frequency allocation plan for the 2.5 GHz band?**

[8] Documents 8F/1329 and 8F/1330 found on the ITU-R WP8F website at http://www.itu.int/md/R03-WP8F-C/en.

Irrespective of what technologies or services may be deployed, a common and harmonized band plan facilitates economies of scale which in turn brings benefits to consumers. For the 2.5 GHz band, there has been a great deal of work in various fora on developing and harmonizing a common band plan. For example, Europe (i.e., European Conference of Postal and Telecommunications Administrations) has decided upon a band plan whereby FDD operations would use the outer 70 MHz of the 2.5 – 2.69 GHz band and the center 50 MHz gap from 2.57 – 2.62 GHz would be used for either TDD operations or external FDD downlinks.[9] Also, the ITU has adopted a recommendation which includes three different 2.5 GHz band channeling options, two of which are consistent with the European plan.[10] QUALCOMM believes there are advantages to the European plan (i.e., 70 MHz FDD / 50 MHz TDD or external FDD downlink / 70 MHz FDD) in that it provides separate band segments for FDD and TDD operations, maintains the 120 MHz duplex separation specified by 3GPP and 3GPP2, and would be consistent with the plan expected to be used by many other countries around the world. Deviating from a common band plan would impact Hong Kong consumers due to the need for Hong Kong-specific handsets that would be difficult, if not impossible, to be used for roaming with other countries.

**Question (8): Do you have any comment on the TA's preliminary view that no restrictions should be imposed on the types of applications and services that may be provided using the BWA spectrum?**

No comment.

**Question (9): Do you have any further comments on the preliminary view of the TA that he should not prescribe any particular standard or technology for the BWA deployment?**

QUALCOMM strongly supports and applauds the TA's continued adherence to technology neutral regulatory policies. The auction structure, as proposed by the TA, is truly technology neutral and allows the spectrum to be assigned based on market needs to those who value it most, without pre-selecting the type of technology to be deployed. There are pros and cons to both FDD and TDD modes and, as the TA has pointed out, the prospective spectrum licensee is in the best position to determine its business case and make technology decisions based on that business case.

**Question (10): Do you have any further comments on the TA's preliminary view that assignment of the frequency blocks for BWA services should be made on a territory-wide basis?**

QUALCOMM strongly believes BWA licensees should be subject to the same regulatory regime and licensing requirements as 3G licensees. 3G license assignments were made on a territory-wide basis, therefore, a similar approach should be applied here.

**Question (11): Do you have any further comments on the TA's preliminary view that BWA licensees will be required, under the license, to roll out the services within 24 months from the date when the license is issued and that performance bond will also be required?**

QUALCOMM supports the TA's proposal for roll-out obligations as a means to ensure efficient use of scare and valuable spectrum resources. We believe that further definition of the network/service coverage obligations and license conditions should be specified well in advance of any auction as the TA has done for prior spectrum auctions. BWA licensees should be subject to license requirements and obligations similar to those imposed on 3G licensees. Twenty-four months seems to be a reasonable roll-out requirement based on the expected availability of user equipment in the 2.3 GHz band. However, the TA will need to closely track industry developments over the next few years as it could be some time before economies of scale for 2.3 GHz user equipment materializes.

[9] "ECC Decision of 18 March 2005 on harmonised utilisation of spectrum for IMT-2000/UMTS systems operating within the band 2500 – 2690 MHz." This decision shows the frequency plan agreed upon within the European Conference of Postal and Telecommunications Administrations (CEPT) Electronic Communications Committee (ECC) to be 70 MHz FDD / 50 MHz TDD / 70 MHz FDD. ECC decisions are mandatory for member states.

[10] ITU-R Recommendation M.1036, "Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications-2000 (IMT-2000) in the bands 806-960 MHz, 1 710-2 025 MHz, 2 110-2 200 MHz and 2 500-2 690 MHz."

**Question (12): Do you agree with the proposed frequency assignment method as stated above?**

QUALCOMM strongly supports the TA's continued market-based approach to releasing spectrum and believes that auctions have proven to be an effective method for assigning spectrum in a fair and efficient manner. We agree minimum pre-qualification requirements are needed to ensure that prospective bidders have the technical and financial capability to build and operate the network. Since the services that will be provided to the Hong Kong consumer will be similar to the services already available via networks deployed in other frequency bands, we believe it is critical for the TA to ensure consistent licensing and regulatory frameworks.

**Question (13): Do you have any further comments on the TA's preliminary view that an up-front lump sum payment basis should be adopted for SUF, the amount of which will be determined through an open auction?**

QUALCOMM supports the TA's proposal.

**Question (14): Do you agree that BWA licensees should not be subject to an ex-ante ONA requirement?**

QUALCOMM generally supports the TA's proposal to not mandate *ex-ante* an ONA requirement. Nevertheless, we note this continues to be a requirement for 3G licensees which implies an inconsistency in treatment.

**Question (15): Do you consider that FMC services should be allocated with new number ranges?**

No comment.

**Question (16): Do you agree that numbers with prefixes "2" and "3" should be allocated to fixed/"limited mobility" BWA services while numbers with prefixes "6" and "9" should be allocated to "full mobility" BWA services?**

No comment.

**Question (17): Do you agree that BWA licensees should be subject to the requirement of facilitating both ONP and MNP, including the FMNP to be introduced in the future?**

Yes. As previously stated, QUALCOMM strongly believes BWA licensees should be subject to the same regulatory regime and licensing requirements as 3G licensees including ONP, MNP and possibly FMNP in the future.

**Question (18): Do you agree that BWA licensees should be subject to the requirement of denial of service to suspected stolen apparatus?**

Yes. As previously stated, QUALCOMM strongly believes BWA licensees should be subject to the same regulatory regime and licensing requirements as 3G licensees including the requirement of denial of service to suspected stolen apparatus.

**Question (19): Do you agree with the proposed approach as stated in paragraph 58 to resolve adjacent channel interference issues?**

While sharing studies between 3G IMT-2000 networks and fixed deployments of IEEE 802.16 TDD have been conducted in various fora (e.g., ITU, ETSI BRAN, UK Ofcom) which address the adjacent channel interference issues, the conclusions of these studies have recently been called into question due to the emergence of new information on the IEEE 802.16 TDD emission mask. This new information was submitted to the ITU-R Working Party 8F by the WiMAX Forum on June 15th, 2007 and is relevant to the co-existence scenarios within the 2.3 GHz band. Before making final determinations on the detailed use of the 2.3 GHz band, QUALCOMM encourages the TA to take into account this new information.

**Question (20): Do you agree with the proposed guard bands for the 2.3 GHz band? Do you agree with the arrangement for the spectrum holder at the lower edge of 2.3 GHz band to use the spectrum 2.300 – 2.305 GHz as stated in paragraph 60?**

No comment.

***Conclusion***

QUALCOMM appreciates the opportunity to provide these comments to the TA. QUALCOMM fully supports the TA's continued adherence to technology neutral and market based policies to spectrum release. We believe further clarity is needed on a number of issues in the 2.3 GHz band to ensure success of the band at auction and we support the TA's determination that it is pre-mature to allocate the 2.5 GHz band for BWA services at this time. Finally, we urge the TA to ensure the regulatory framework and licensing conditions for BWA services in the 2.3 GHz band are similar to that required of 3G licensees in the 1.9 / 2.1 GHz paired band.

Should you have any questions, please contact me at +852 6348 6687 (mobile) or jgwelch@qualcomm.com.

Respectfully,

Julie Garcia Welch
Director, Government Affairs
Southeast Asia & Pacific

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