



QUALCOMM Incorporated

3775 Morehouse Drive
San Diego, CA 92121-1714

www.qualcomm.com

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Mr. Kwok Shu Wong
Assistant Director
Office of the Telecommunications Authority
36/F Wu Chung House
213 Queen's Road East
Wanchai Hong Kong
Email: kswong@ofta.gov.hk

Re: Licensing Framework for Third Generation Mobile Services

Dear Mr. Wong:

QUALCOMM Incorporated (QUALCOMM) appreciates the opportunity to comment on the Telecommunications Authority's (TA's) framework for third generation (3G) mobile services.

QUALCOMM is a leader in developing and delivering innovative digital wireless communications products and services based on the Company's CDMA digital technology. The Company's business areas include integrated CDMA chipsets and system software; technology licensing; Eudora® email software for Windows® and Macintosh® computing platforms; and satellite-based systems including OmniTRACS® and portions of the Globalstar™ system.

Per the consultation document dated 21 March, 2000, the TA seeks public comment on several points. We have divided our comments into three sections: IMT-2000 Standards and Interoperability; 2G to 3G Evolution; and Individual Operator's Spectrum Allocations.

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IMT-2000 Standards and Interoperability

We applaud the TA's desire to allow the market decide which IMT-2000 standards should be deployed in Hong Kong. Spectrum management policies generally should provide the flexibility for service providers, manufacturers and users to be able to respond quickly to ever-changing technologies and marketplace needs. Providing technology-neutral allocation and license flexibility can be an important regulatory approach for avoiding delays in responding to the marketplace and in introducing the results of new research and development efforts.

Background on IMT-2000 Standards

QUALCOMM has played a leading role in the development of both 2nd and 3rd generation wireless standards. QUALCOMM helped develop the original IS-95 CDMA standard, which has been deployed in nearly 30 countries worldwide (including Hong Kong, which is home to the world's first CDMA network). CDMA, or Code Division Multiple Access, is the core radio interface technology for the majority of the 3G standards proposals.

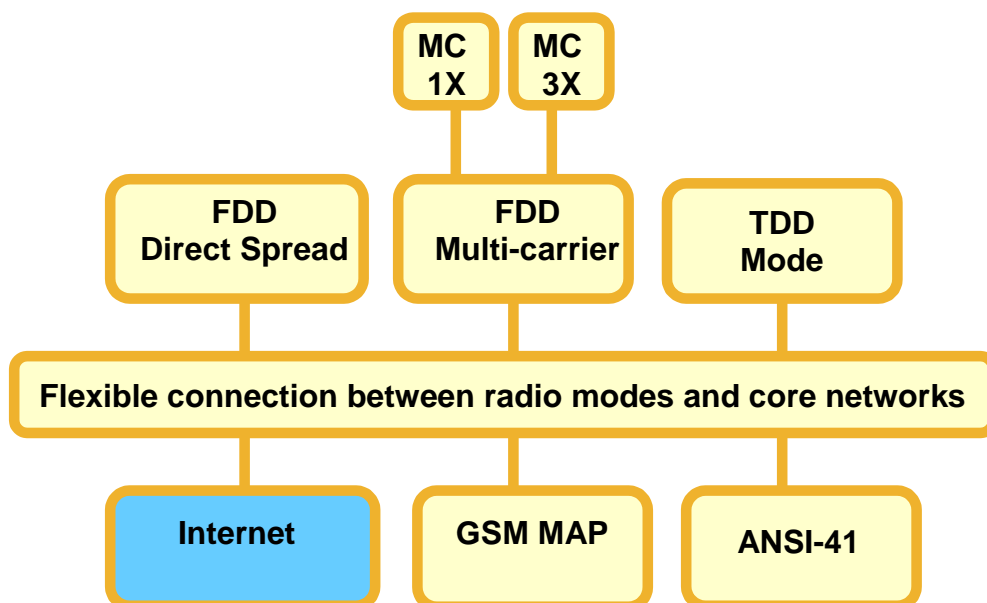
The ITU-R Task Group 8/1, on November 5, 1999, in Helsinki, recommended the approval of a slate of five 3G or IMT-2000 radio interface options for industry. These options are:

- CDMA Multi-Carrier (MC or cdma2000)
- CDMA Direct Spread (DS or W-CDMA)
- CDMA Time-Division Duplex (TDD or TD-CDMA)
- TDMA Single Carrier (based on IS-136)
- IMT-2000 FDMA/TDMA (based on IS-136)

3G CDMA

The CDMA portion of this standard is the result of negotiations between wireless operators and vendors that culminated in an agreement earlier this year in the Operators' Harmonization Group (OHG).

The 3G CDMA standard will offer operators their choice of three "modes" of operation – **Multi-Carrier, or MC** (previously known as cdma2000); **Direct Spread, or DS** (previously known as W-CDMA); and **Time-Division Duplex, or TDD** (previously known as TD-CDMA). Through the process of harmonization under the ITU's auspices, industry is working to enable each of the three air interfaces to communicate with both major network standards in operation today around the world – GSM-MAP and ANSI-41. The 3G CDMA standard is graphically represented below:



Both DS and MC CDMA will meet or exceed the ITU's minimum data rate requirements for IMT-2000, which are 144 Kbps, 384 Kbps and 2 Mbps for vehicular, pedestrian and fixed environments, respectively. MC CDMA is designed to be backwards-compatible with CDMA IS-95, thereby allowing the smoothest and most cost-effective upgrade path for existing cdmaOne operators to 3G services with extensive re-use of network and consumer equipment. Both modes can be deployed in "greenfield" scenarios in new IMT-2000 spectrum allocations; however, MC, with its greater spectral efficiency, is the better option for incumbent mobile operators facing constraints on the use of their existing spectrum.

QUALCOMM has publicly announced that it will design application-specific integrated circuits (ASICs) and software to support both the MC and DS modes of IMT-2000 CDMA. (*QUALCOMM press release October 11, 1999*) We anticipate that QUALCOMM will maintain a leadership position in ASICs and software for all modes of CDMA in all "generations" of the technology.

High Data Rate (HDR) Technology

QUALCOMM would also like to discuss a new wireless data technology that is being developed outside the framework of the IMT-2000 process. In November of 1999, QUALCOMM introduced High Data Rate (HDR), a high-speed, high-capacity wireless data technology also based on CDMA. HDR provides data speeds of up to 2.4 Mbps in a 1.25 MHz channel in fixed, portable and mobile environments, an unprecedented feat for any wireless system. The HDR system is optimized for packet data services, with a decentralized architecture based on IP (Internet protocol) protocols/platforms. HDR can be deployed in conjunction with an existing voice network, or as a stand-alone data network.

HDR system attributes include:

- Use of a single 1.25 MHz channel optimized for packet data
- Peak data rates of 2.4 Mbps on the forward link and 307 kbps on the reverse link
- Average throughput on a loaded sector is an estimated 600 kbps on the forward link and 220 kbps on the reverse link
- Dynamically assigned data rate adjusts as rapidly as every 1.67 mSec, providing every subscriber with the best possible rate at any given moment.

Wireless operators in Asian markets are currently conducting trials of HDR, which will be a leading option for both "2G" and "3G" operators around the world.

Interoperability

The TA expresses a desire that all IMT-2000 handsets be interoperable, presumably offering compatibility with 2nd generation networks as well. As noted above, the CDMA modes of the IMT-2000 standard are designed to be interoperable with both core networks used in Hong Kong – GSM/MAP and ANSI-41. The interoperability among the various modes of the IMT-2000 standard should obviate the need for regulation of handset interoperability, which could otherwise be interpreted as a mandate for a single standard.

QUALCOMM anticipates that vendors will develop and design multi-mode ASICs and multi-mode multi-band handsets that allow roaming between 2nd and 3rd generation systems, and between different 3rd generation systems. The fact that there will be strong markets for not only DS-CDMA and MC-CDMA, but also HDR, suggests that vendors will see a significant market for such products. Therefore, consumers in Hong Kong will have access to cost-effective terminals that accommodate multiple technologies or frequencies.

Additionally, interoperability between different standards can be obtained through the design of terminals that can handle multiple modes of operation, and new software radio technologies promise to minimize any cost implications that might be incurred through the support of multiple standards.

Moreover, the benefits of single standards are minimal in situations where the major consumer cost is for the service, not the hardware, and where competition can be fostered among the largest economically viable number of service operators. In a competitive environment, operators demand equipment at lowest cost with most-valued features, and evolve their networks according to commercial considerations including functionality, service quality and price.

The risks of mandating a single technology are clear, however. The TA will commence its licensing process before a single IMT-2000 licensee has turned on its network in any country. A decision at this point regarding IMT-2000 technology would be premature for this reason.

The TA runs similar risks if it mandates handset interoperability. The market would clearly interpret such a mandate as a de facto mandate to select, in concert, a single technology. Such a result would stifle competition and could endanger the success of IMT-2000 in Hong Kong.

For these reasons, we would strongly urge the TA not to mandate a technology for IMT-2000; we further urge the TA not to mandate handset compatibility, because such a mandate would serve a de facto technology mandate.

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2G Evolution to IMT-2000

It is clear that, for the foreseeable future, voice will remain the predominant application for wireless consumers. However, QUALCOMM believes that the market for wireless data is emerging and growing rapidly as network operators build out advanced networks and make new applications available to their consumers.

What is less clear at this time is *when* that market will emerge in every market, and *which* applications will prove most popular to consumers. For instance, it is not clear that consumers will support high-data rate services such as video-conferencing on a device that also accommodates ordinary voice traffic. Such a device would undoubtedly

be more expensive than a voice-only phone or a phone with low-to-medium rate data services such as e-mail and computer desktop synchronization.

One of the benefits of the MC mode of the IMT-2000 CDMA standard is that it offers operators the choice of both **1.25 MHz (MC 1X)** and full **5 MHz wide-band (MC 3X)** options. As MC1X and MC3X are compatible, operators would be able to deploy MC1X (either in new spectrum or as an extension of their IS-95 networks) and then “upgrade” to MC3X when the market demands higher data rates. In this way, existing operators can build their data capabilities in concert with the market, as opposed to deploying an entire wide-band network *before the market exists* for high-speed data.

The upgrade path from MC1X to MC 3X is similar to that traveled by analog operators who evolved their networks to cdmaOne IS-95. Just as those operators cleared analog channels and replaced them with IS-95, so too would a 2G licensee in Hong Kong be able to overlay MC 1X or HDR 1X on their current network. We anticipate that these “upgrades” will be available to not only IS-95 operators but operators of GSM and IS-136 networks as well.

QUALCOMM applauds the TA’s desire to allow 2G operators to evolve their networks to provide IMT-2000 services. It is clear that operators around the world will evolve in existing spectrum to provide IMT-2000 services. As the TA is aware, several organizations and countries have suggested supporting IMT-2000 services in the bands that currently support 2nd generation services in Hong Kong.

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Individual Operator’s Spectrum Allocations

QUALCOMM believes that innovations such as 1XMC and HDR explodes the notion that operators must utilize “wide-band” channels to achieve high data rate services. This has important implications for the TA’s spectrum allocation decisions with respect to IMT-2000.

The orthodox view expressed by the UMTS Forum – that IMT-2000 operators should be granted allocations of 2x15 MHz + 5 MHz – is predicated on the use of one of the wider-band standards – either DS-CDMA or 3XMC CDMA, which require at least 5 MHz allocations. As HDR and 1XMC demonstrate, operators can provide very high data rates in 1.25 MHz channels.

It should be noted that Motorola has also advanced the notion of a high-data technology utilizing a single 1.25 MHz channel. We believe this development reinforces the notion that 3G need not be confined to “wide-band” channels, or 30 MHz spectrum allocations dedicated strictly to 3G services.

Therefore, with respect to the TA’s four licensing scenarios:

- 1) 4 licenses: incumbents and new entrants compete for 2x15 licenses;
- 2) 4 licenses: incumbents compete for 2x10; new entrants compete for 2x15;
- 3) 4 licenses: similar to 1, but mandating new entrants to the market;

4) 4 licenses: similar to 3, but incumbents only get 2x10

QUALCOMM would suggest that the TA should feel comfortable that 2x10 MHz licenses offer sufficient spectrum to support high-speed data services and high-quality voice services.

We would also encourage the TA to introduce new competition in the IMT-2000 market. Because IMT-2000 is associated with wireless data, it is possible that Hong Kong's licensing procedure could attract interest from non-traditional players from computing or Internet interests. This would represent a new source of investment for Hong Kong's mobile industry.

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Thank you once again for your time and the opportunity to comment in the Telecommunications Authority's IMT-2000 proceeding. I would be eager to answer any questions you might have about this document. I can be contacted by phone at (858) 651-2086 or at wbold@qualcomm.com.

Sincerely,

William Bold
Vice President, Government Affairs