

# FRAMEWORK FOR THIRD GENERATION (3G) CELLULAR NETWORK DEPLOYMENT AND SERVICES OFFERING IN SINGAPORE

## RESPONSE FROM QUALCOMM

### a. The development of 3G cellular technology...

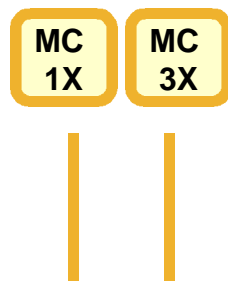
1. *IMT-2000.* QUALCOMM has played a leading role in the development of both 2<sup>nd</sup> and 3<sup>rd</sup> generation wireless standards. QUALCOMM helped develop the original IS-95 CDMA standard, which has been deployed in nearly 30 countries worldwide (including Singapore). CDMA, or Code Division Multiple Access, is the core radio interface technology for the majority of the 3G standards proposals.

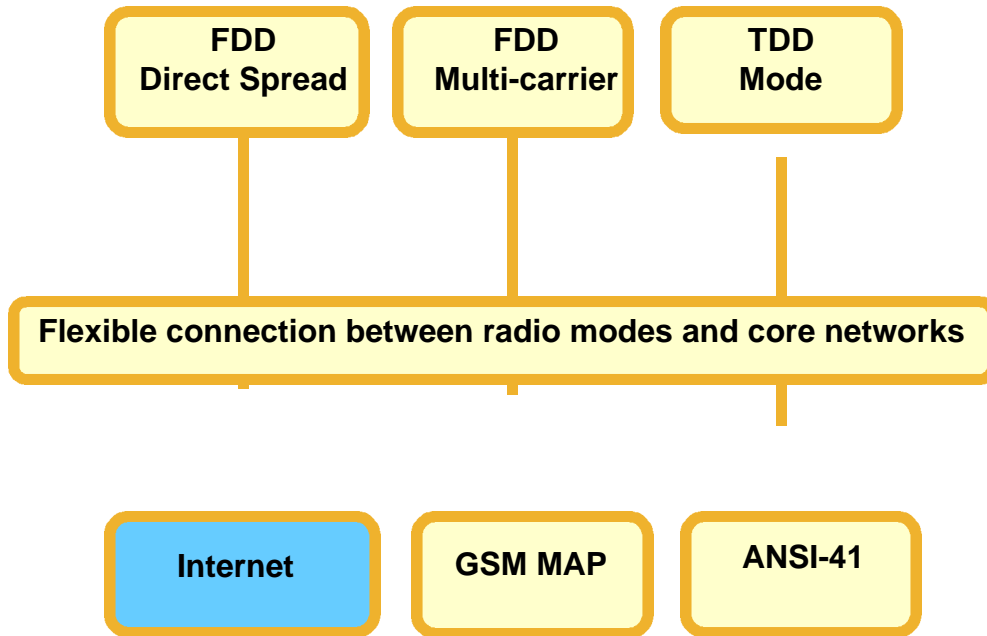
The ITU-R Task Group 8/1, on November 5, 1999, in Helsinki, recommended the approval of a slate of five 3G or IMT-2000 radio interface options for industry. These options are:

- 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)

2. *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 to CDMA IS-95, thereby allowing the smoothest and most cost-effective upgrade path for existing 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, only MC can be deployed in existing spectrum by incumbent mobile operators.

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.

3. *HDR.* 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 this year, 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.

QUALCOMM anticipates that wireless operators in Asian markets will begin trials of HDR in 2000, and that HDR will be a leading option for both “2G” and “3G” operators around the world.

**b. The potential of 3G technology and the scope of the 3G license**

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 will emerge and grow 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, 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.

Given this market uncertainty, QUALCOMM believes that TAS should structure its third generation licensing regime to provide maximum flexibility to prospective network operators. In particular, TAS should maintain its policy of technology and standards neutrality, and allow operators to provide both fixed and mobile services per market demands.

**c. The spectrum allocation mechanism and the spectrum requirements per operator;**

**d. The optimal number of operators to license;**

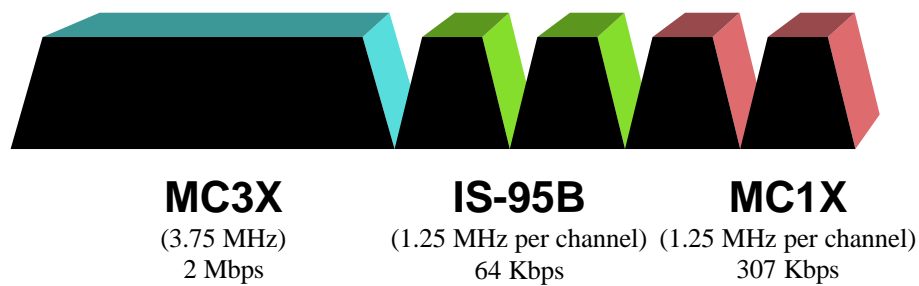
**e. The approach for licensing additional 3G service providers**

The MC mode of the IMT-2000 CDMA standard 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, operators can build their data capabilities in

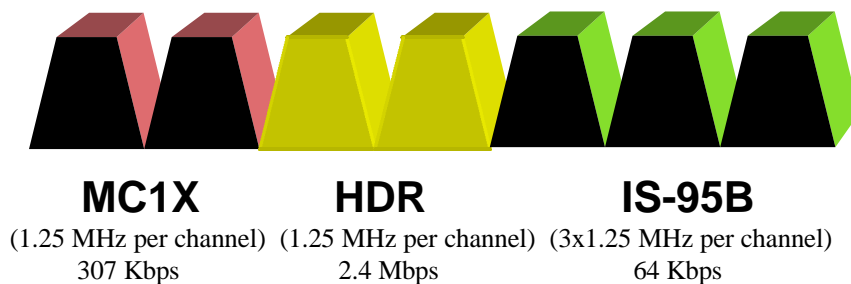
concert with the market, as opposed to deploying an entire wide-band network *before the market exists* for high-speed data.

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 3G licensee in Singapore be able to deploy IS-95 or MC 1X and then evolve to a backwards-compatible wide-band carrier when the market demands higher data rates. This backwards-compatibility would facilitate roaming for consumers on not only CDMA networks in Asia, but also on analog networks through the use of dual-mode dual-band terminals.

Also, because both MC 1X and HDR require only 1.25 MHz of spectrum, TAS can structure the IMT-2000 market to allow maximum competition between operators. For instance, operators could deploy the following services in allocations of 10 MHz.



Or, operators could offer very high-speed data services with a combination of 1X and HDR in a 10 MHz allocation:



This flexibility also allows operators to provide tiered data offerings in relatively small bands of spectrum. For instance, operators could simultaneously provide voice and medium-rate data services to residential users and higher-rate data services as a premium offering to businesses and other high-intensity users.

So, to TAS' four licensing scenarios:

- (i) *License up to 6 operators based on a minimum 10 MHz spectrum requirement;*
- (ii) *License up to 5 operators, with 10 MHz for each of the 3 existing operators and 15 MHz for the 2 new entrants; or*
- (iii) *Leave it to the existing operators and up to 2 new entrants to bid (based on their service and technical proposals) for 10 or 15 MHz; or*
- (iv) *Give each 3G operator a minimum 10 MHz spectrum to begin commercial operations and then allocate additional spectrum on an as needed basis and to the operator who uses spectrum most efficiently.*

QUALCOMM notes that, because of the flexibility and efficiency of CDMA-based third-generation solutions, TAS need not be concerned that allocations of 10 MHz would limit the provision of IMT-2000 services. With a 10 MHz allocation, an operator could deploy two wide-band carriers, or one wide-band carrier and several 1XRTT carriers, or another combination.

It is worth noting that other administrations, most notably the United Kingdom, have expressed support for 10 MHz allocations. Germany is currently planning to issue some UMTS licenses that will be as narrow as 5 MHz each. And, of course, cdmaOne operators around the world will be able to deploy IMT-2000 services in their current spectrum allocations.

**f. How existing mobile phone operators should be treated; and**  
**g. The timing for award of 3G licenses and services launch dates.**

QUALCOMM does not wish to comment on these specific points.