1 Executive Summary

The next generation of wireless devices holds great promise for consumers - everything from high-speed data communications to multimode phones that can be used practically anywhere in the world. But manufacturers will have to solve a variety of perplexing issues, ranging from current limitations in multimode transceiver operation, large displays, through manufacturing-yield problems and overheated handsets to insufficient battery life and performance before they can realise the promise of 3G. The traditional mouse and alphanumeric keyboard have been replaced with a scaled down keyboard or numeric keypad. Perhaps most noticeable is that the computational capacity of these devices is often limited by the low-power CPUs needed to conserve battery life.

Furthermore, communications applications are expanding their service features to meet the rapid growth in usage of the Internet and related technologies. One new function that needs to be integrated on the keypad is the "@" key.

It is also important for content providers or application developers to know what types of devices and capabilities will be available in both the short and long term for 2.5G and 3G services. Different applications will have different requirements on device hardware. Many applications will require a larger screen with higher resolution than today's cellular handsets. Other applications will require better CPU performance and therefore better battery performance and memory storage. It is also important that component manufacturers understand the wishes of the network operators and design components to meet fast-growing market needs. But hardware constraints will have to be considered thoroughly when developing applications and content.

1.1 Barriers

Many of today's wireless devices use programmable microcontroller and digital-signal-processor cores combined with embedded memories and numerous peripheral modules all on a single chip. Microcontrollers are a specific type of microprocessor that have more I/O ports and interrupts than a general CPU as well as on-chip random-access memory (RAM) and read-only memory (ROM). External Flash and Burst Flash memories are also used. But the complexity extends beyond mere technology and process challenges.

Future gadgets will be made to 0.1 µm designs, have more than 200 million transistors, operate at 500 MHz and work within 1V constraints. Processor cores will be configurable, and re-configurable processors will handle image, speech, data, web connectivity, mobile and in-home needs. As devices and services become more complex the demands on memory will

increase enormously. Within just the last 24 months, myriad audio, video, PDA and cellular products have equipped people not only to carry around data, images and audio but also to swap devices between various types of hardware. New technologies include flash memory cards and small disk drives. Flash devices, a relatively young technology, contain one or more non-volatile solid-state memory chips. They have no moving parts and retain data in the absence of power. Like these, but an industry unto itself, is the PC card; now almost 10 years old, the business-card-sized memory and application device is widely used to add functions to mobile computers.

1.2 Memory

Memory is key to retaining complex data on a device. It enables storage of programs, audio and video files and provides users with more efficient data compression methods. Sufficient memory also allows devices to run Java applications that require large amounts of memory to implement.

In order to run the GPRS protocol stack and service-associated applications, a minimum code size is necessary to perform the communication and application parts of the software. The code size for GPRS and UMTS requires up to eight times the memory requirements of classical GSM.

1.3 CPU

The physical implementation of the UMTS receiver coupled with the applications that will be provided on mobile networks requires fast DSPs that will exceed the requirements for GSM by one or two orders of magnitude.

New applications on mobile devices will require a greater MIPS performance, for example MPEG-4 needs 130-160 MIPS processing power.

1.4 Batteries and Power Consumption

The overall power consumption of a device is very important and should be kept to a minimum. The development cycle for batteries is quite slow and has not yet reached maturity for full-scale deployment. It takes battery manufactures between 5 and 12 years to develop batteries with increased power that maintain the size required for a UMTS device. Current battery technologies (Ni-Cd, Ni-MH, Li-Po) are not always able to support the increased power requirements.

Hardware developers, application developers and content providers should take great care when laying out the structure and design of feature capabilities in mobile devices.

1.5 Displays

Display manufacturers have recognised the potential that 3G communications will bring. In Japan, i-mode phones are currently equipped with colour screens. Cellular phones, with a few exceptions, do not come equipped with colour screens, which are considered to be an extra cost factor. Users will however wish to have colour displays at no extra cost. Cost is a major issue; large screens are the predominant cost element of a handset.

This Report addresses a number of these issues and provides a fundamental guideline for components required in 3G devices. It also serves as a reference document.