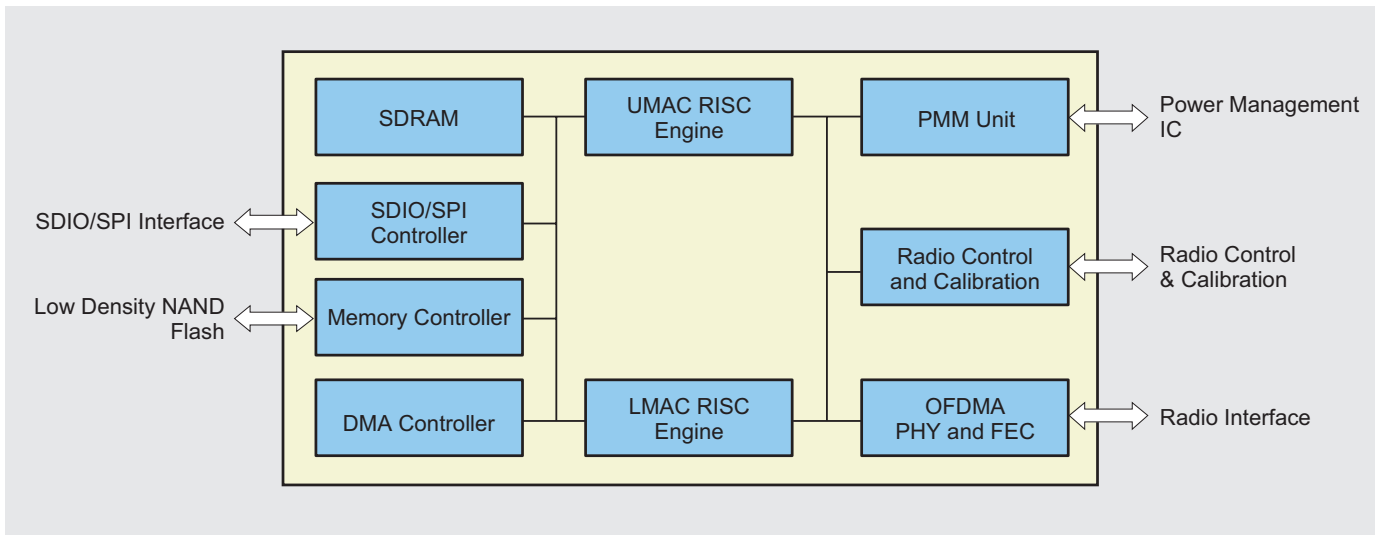


# Fujitsu 2nd Generation Mobile WiMAX Chipset for Embedded Modules



## ► Introduction

While wireless connectivity has expanded rapidly in recent years, broadband wireless access has just begun to gain momentum. WiMAX, which stands for Worldwide Interoperability for Microwave Access, is a promising technology driving this new wave of broadband wireless applications. A technology built to support Internet Protocol (IP); WiMAX delivers significant improvements in speed and capacity, and stands to be the technology that will take users into a true 4G era. WiMAX is attractive to both existing and new service providers worldwide.

The WiMAX standard enables system vendors to create many types of WiMAX-based products, including indoor and outdoor CPEs, as well as mobile handsets in a form similar to traditional cell phones. Fujitsu recognized the increasing demands of attractive Mobile WiMAX handsets, and foresaw the difficulty of including WiMAX into an already complicated mobile handset design. To address these concerns, Fujitsu designed its 2nd generation chipset to enable vendors to modulate the hardware components needed for a Mobile WiMAX handset into a single easy and concise package.

This document introduces Fujitsu's 2nd generation Mobile WiMAX chipset, including its baseband system in package (SiP), RF LSI, and power management IC.

### Recommended Module Application

To allow handset makers to focus on improving user applications and experiences, while paying minimal attention to physically integrating the WiMAX chipset into a handset's hardware design, the Mobile WiMAX chipset must be provided in a single embedded module package. Foreseeing this need, Fujitsu leveraged its knowledge and background from years of experience in working with carriers and handset makers in Japan and around the world.

An embedded module based on this new chipset would be fully compliant with the IEEE and WiMAX Forum™ standards and profiles. The module would be able to support multiple channel bandwidths such as 3.5MHz, 5MHz, 7MHz, 10MHz and 20MHz; and all the popular frequency bands such as 2.3GHz, 2.5GHz and 3.5GHz.

# Fujitsu 2nd Generation Mobile WiMAX Chipset for Embedded Modules

## ► Introduction (Continued)

With a dedicated power management IC that controls the power schemes at the system level, an embedded module based on Fujitsu's new Mobile WiMAX chipset would be optimized for smart phones and PDAs. Fujitsu's new Mobile WiMAX baseband LSI implements leading-edge power-gating technology together with the 65nm low leakage process technology. The chipset consumes little power in both idle and sleep modes. An embedded module based on the Fujitsu chipset would achieve the lowest power consumption, ensuring a longer battery life.

### Best Solution for Handset Makers

In order to provide the best embedded modules to mobile device customers, Fujitsu has partnered with several experienced and highly capable module makers. As Fujitsu's ecosystem

partners, these module vendors will be providing complete, attractive embedded modules to handset makers worldwide.

### System Development Kit (SDK)

To accelerate the handset makers' application software development, and to allow software/hardware integration to be done quickly, Fujitsu's System Development Kit (SDK) gives handset makers a choice of reference modules using Fujitsu's 2nd Generation Mobile WiMAX chipset.

This SDK can be used together with Fujitsu's reference design software platform to offer handset customers a head start while working with Fujitsu's module partners to develop an attractive embedded module.

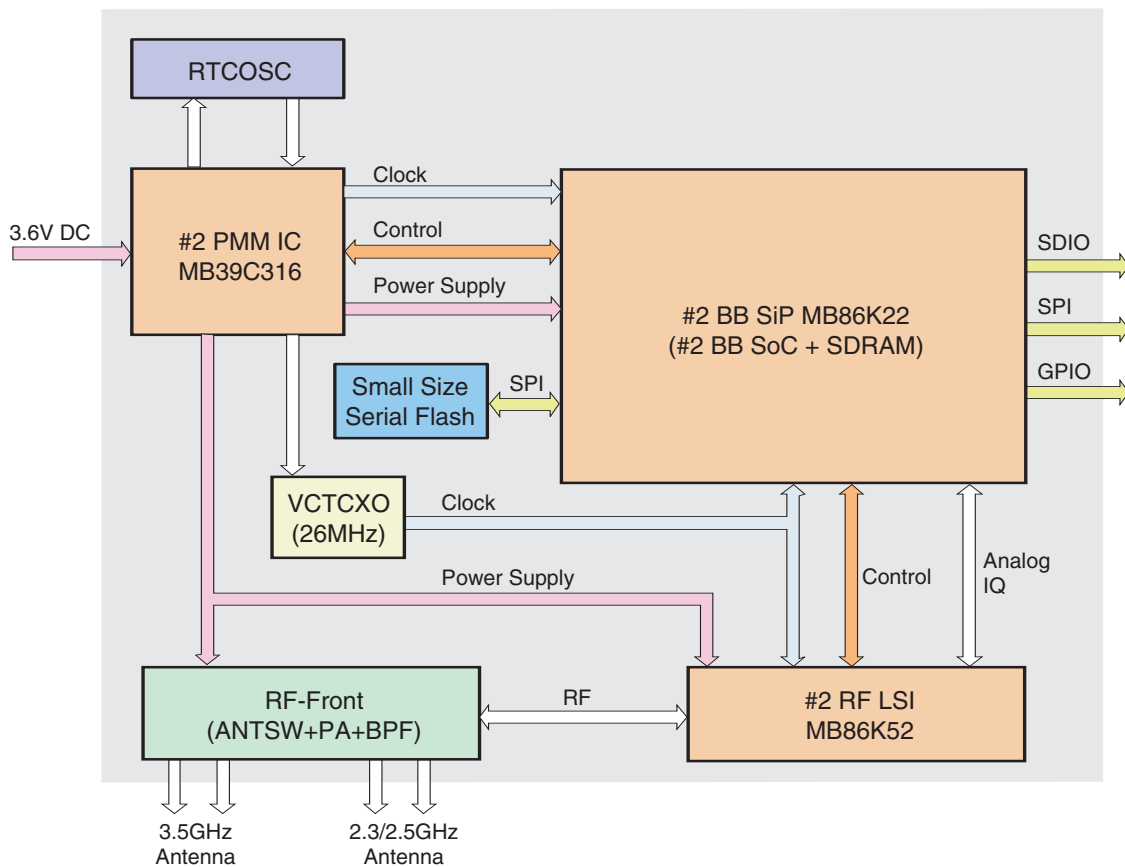


Figure 1 – A Simplified Block Diagram of an Embedded Module Based on Fujitsu 2nd Generation Mobile WiMAX Chipset

# Fujitsu 2nd Generation Mobile WiMAX Chipset for Embedded Modules

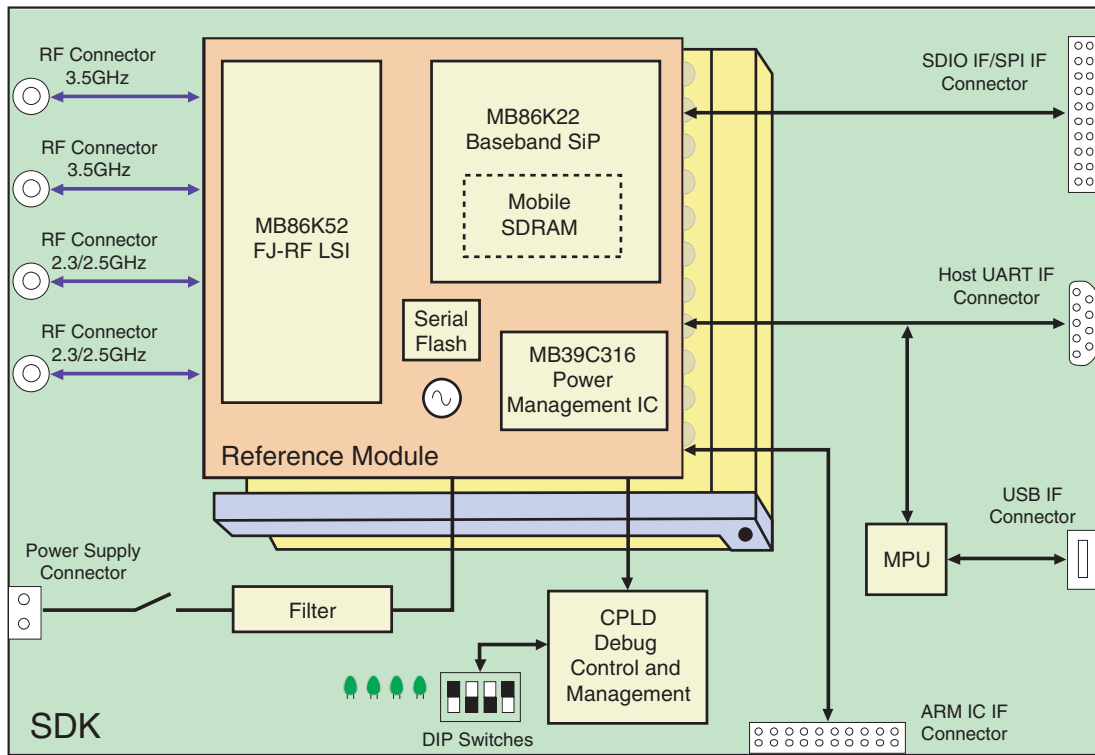


Figure 2 – Block Diagram of Fujitsu's SDK (System Development Kit.)

## ▶ Reference Design Software Platform

Major features of the Fujitsu Mobile WiMAX reference design software platform include the following:

- A fully compliant IEEE802.16e and Mobile WiMAX Wave 2 MAC firmware
- Reference software applications such as connection manager, host driver, and maintenance tool
- Host drivers that support multiple operating systems including embedded Linux, Windows Mobile, Windows CE and Symbian
- Comprehensive and clearly defined software application programming interfaces (APIs) and sample application/driver reference source code are available.

### MB86K22, a Mobile WiMAX Baseband SiP

Fujitsu's 2nd generation Mobile WiMAX baseband SiP (MB86K22), which was designed, based on the 65nm process, fully complies with the IEEE 802.16e-2005 standard utilizing scalable OFDMA PHY, and operates in the Time

Division Duplex (TDD) mode. The SiP supports multiple operating frequencies and channel bandwidth profiles, as well as various subcarrier allocation schemes.

### Key Features

- Fully compliant with the IEEE802.16e-2005 and WMF Mobile WiMAX Wave 2 standards
- Dual-core processor architecture to best support application-rich Mobile WiMAX operations
- Complete System on Chip, no burden on the host system or processor
- Supports 2.3GHz, 2.5GHz, and 3.5GHz operating frequencies
- Supports 512, 1024 and 2048 points FFT
- Supports 3.5MHz, 5MHz, 7MHz, 10MHz, and 20MHz channel bandwidth
- Supports IO-MIMO and IO-Beamforming
- Supports category 4 HARQ and feedback
- Security implementation based on CCM-mode 128-bit AES

# Fujitsu 2nd Generation Mobile WiMAX Chipset for Embedded Modules

## ▶ Reference Design Software Platform (Continued)

- Integrated mobile SDRAM in one single package
- Supports SDIO2.0 and SPI as host interfaces
- Fujitsu's 65nm CMOS process with advanced power-gating technology
- Lead-free and RoHS compliant
- 306-pin, 10mm x 10mm LGA package

### **MB86K52, a Mobile WiMAX RF LSI**

Fujitsu's Mobile WiMAX RF LSI (MB86K52) fully complies with the IEEE 802.16e-2005 standard. The MB86K52 can support multiple operating frequency bands with many channel bandwidths. The LSI provides lower noise figure (NF) at the receiver and better error vector magnitude (EVM/RCE) at the transmitter, compared with the previous generation of RF ICs. The RF LSI connects to a baseband LSI through a four-wire SPI interface and analog IQ interfaces. When paired with Fujitsu's baseband solution, the RF LSI is able to conduct auto-IQ mismatching calibration that further improves system performance.

#### **Key Features**

- Fully integrated 1x transmitter and 2x receiver (DL-MIMO)
- Supports triple band operation in the WiMAX Forum profile 2A, 3A, and 5L
- Supports 3.5MHz, 5MHz, 7MHz, 10MHz, and 20MHz channel bandwidth
- Supports analog I/Q interface to digital baseband device
- Supports 2.9V and 1.2V operating voltages
- RX noise figure of 3.2dB
- TX RCE of < -26dB at -6dBm output
- Low TX current of 85.5mA at -6dBm output
- Small chip size of 5mm x 5mm

### **MB39C316, a Power Management IC**

Fujitsu's power management IC (MB39C316) is designed to meet the power consumption requirement of the next-generation wireless technology. A CMOS-based 3-channel DC/DC converter IC suitable for both up/down conversion. CH1 or CH2 integrates the switching FETs capable of achieving high efficiency while operating at high frequency. This IC is ideal for high-frequency mobile applications such as WiMAX and the next-generation PHS handset.

#### **Key Features**

- Supports current mode up and down conversion topologies
- Supports 1.2V at 800mA, 1.8V at 600mA, and 3.3V at 650mA
- Embedded 5-channel LDO
- LDO supports 2.9V at 190mA, 1.2V at 260mA, 2.92V at 6.5mA, and 1.2/1.3V at 80mA
- Consumes the least power at 150µA (standby mode) by industry standards
- Supports I<sup>2</sup>C as the host control interface
- Supports various protection methods such as output short circuit protection (SCP) and over temperature protection (OTP)
- 49 pins, 3.14mm x 3.11mm x 0.8mm WL-CSP package

## FUJITSU MICROELECTRONICS AMERICA, INC.

Corporate Headquarters  
1250 E. Arques Avenue, M/S 333, Sunnyvale, CA 94085-5401  
Tel: (800) 866-8608 Fax: (408) 737-5999  
E-mail: [inquiry@fma.fujitsu.com](mailto:inquiry@fma.fujitsu.com) Web Site: <http://us.fujitsu.com/micro>

© 2008 Fujitsu Microelectronics America, Inc.  
All company and product names are trademarks or registered trademarks of their respective owners.  
Printed in the U.S.A. BWA-FS-21323-6/2008