Modem*Module* CDMA

Embedded Data/Fax/Voice Wireless Modem

MTMMC-C

Developer's Guide

MultiTech®
Systems

ModemModule Developer's Guide
MTMMC-C
PN S000296B, Version B
10/17/03

Copyright

Revisions

Revision Level	Date	Description
A	7/15/03	Initial release.
B	10/17/03	Update mechanical dimensions drawing.

Patents

This device is covered by patent number 5,673,268.

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World Headquarters

Multi-Tech Systems, Inc.
2205 Woodale Drive
Mounds View, Minnesota 55112
Phone: 763-785-3500 or 800-328-9717
Fax: 763-785-9874

Technical Support

Country	By Email	By Phone
France:	support@multitech.fr	(33) 1-64 61 09 81
India:	support@multitechindia.com	91 (124) 6340778
U.K.:	support@multitech.co.uk	(44) 118 959 7774
U.S. and Canada:	oemsales@multitech.com	(800) 972-2439
Rest of the World:	oemsales@multitech.com	(763) 717-5863

Internet Address: http://www.multitech.com

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Chapter 1 – Product Description and Specifications

Introduction

The Multi-Tech ModemModule CDMA is a complete, ready-to-integrate, embedded data/fax/voice wireless modem packaged in a compact industrial chassis. Designed for global use, it offers standards-based multi-band CDMA2000 1x performance. This quick-to-market module allows developers to add wireless communication to products with a minimum of development time and expense. The ModemModule CDMA is based on industry-standard open interfaces, is fully type approved, and can be board-to-board or board-cable mounted.

Multi-Tech's Wireless ModemModule CDMA

Product	Description	Region
MTMMC-C	CDMA2000 1xRTT, 800/1900 MHz	Global

The MTMMC-C Modem*Module* is used to integrate wireless data and fax communications in numerous embedded applications. This product is based on a Dual Band RF Module; every integrated module includes a CDMA 800/1900 MHz module.

Applications

With packet data speeds up to 153K bps, the ModemModule CDMA is targeted at applications that periodically need to send and receive data over a wireless network. It is an ideal solution for:

- Appliances
- Remote Diagnostics
- ATM Terminals
- Remote Metering
- Automotive
- Security Systems
- Data Collection
- Vending/Gaming Machines
- Gas Pumps
- Other devices requiring wireless connectivity.
- Industrial and Medical Remote Monitoring Systems

Note: The Wireless ModemModule must be mounted with at least 8 inches (20 cm) of clearance from the human body.

Product Features

- CDMA2000 1xRTT operation
- CDMA IS-95-A, IS-95B
- Dual-band 800/1900 CDMA
- Class 2.0 Group 3 FAX
- Board-to-board or board-to-cable mounting
- Short Message Service features including SMS mobile originated, SMS mobile terminated, cell broadcast, Over the Air Activation (OTA), OTASP, OTAPA
- Voice features include DTMF, telephony, OCELP 13K, echo cancellation
- MMCX antenna connector
- 14.4K circuit-switched data
- Serial interface supports DTE speeds to 230K
- AT command compatible
- Phone book management
- Personal Information Management (PIM)
- Fixed dialing number
- Supplementary services including call forwarding, call barring, multiparty, call waiting and call hold, calling line identification, closed user group, call transfer
- Real time clock
- Alarm management

Feature Descriptions

Integration Reduces Space, Power and Cost. The ModemModule CDMA integrates the controller, RF transceiver, and antenna interface in one compact unit. This integration requires low power, low real estate and provides an overall reduction in costs.

Reduces Development Time. The ModemModule CDMA can make your existing and next generation device, machine, or system, communication-ready without requiring significant hardware changes to its design. It actually provides faster time-to-market because it relieves the burden and expense of obtaining network and RF approvals. This complete, ready-to-integrate wireless module allows you to enhance your product while you focus on developing its core features.

Voice Features. The ModemModule CDMA provides telephony and Dual Tone Multi Frequency (DTMF) functionality as well as QCELP (13K) and echo cancellation.

Short Message Services. The ModemModule CDMA offers SMS features such cell broadcast, Over the Air Activation (OTA), OTASP, and OTAPA. The ModemModule CDMA is SMS Mobile as Originated and SMS Mobile Terminated.

Compatible Supplementary Services. The ModemModule CDMA is compatible with supplementary services such as call forwarding, call barring, multiparty, call waiting and call hold, calling line identification, closed user group and call transfer.

Management Features. The ModemModule CDMA provides advanced management features including phone book management, fixed dialing number, real-time clock and alarm management.

Industry-standard Modem Commands. The ModemModule CDMA provides industry-standard AT-style commands for ease of integration into your existing software application.

ModemModule Pin-Out. The ModemModule CDMA interfaces easily with existing products through a standard serial communication channel. The complete on-board RF transceiver interfaces with an antenna for direct connection to wireless SMS, circuit-switched dial-up, or packet data networks. The ModemModule is a Data Terminal Equipment (DTE) device with serial asynchronous protocol support. The serial DTE channel is capable of transfer speeds to 230K bps and can be interfaced directly to a UART or micro-controller. It can be board-to-board or board-to-cable mounted.

Developer's Kit

The ModemModule CDMA Developer's Kit allows you to plug in the ModemModule and use it for testing, programming and evaluation. The kit includes one development board with RS-232 DB-25 connector, universal power supply, antenna and RS-232 cable.

Technical Specifications

Dimensions	2.5" w x 1.8" h x 0.5" d (6.4 cm x 4.6 cm x 1.2 cm)
Weight	88 g
Power Requirements	5 VDC; 400 mA typical, 700 mA maximum
Operating temperature	-30°C to + 60°C
Storage temperature	-35°C to +85°C
Certifications	CD Mark EMC: FCC Part 2, 15, 22, 24, EN55022 & EN55024 Safety: UL60950, EN60950
Casing	Complete shielding-stainless steel/zinc

Related Manuals

At commands for this product are published in a separate document available on the Accessory Kit CD or from Multi-Tech. Multi-Tech manuals and other resources are available on the Multi-Tech Web page at http://www.multitech.com.

Additional Information

European Telecommunications Standards Institute (ETSI) - Contact the ETSI at:
650, route des Lucioles
06921 Sophia-Antipolis Cedex
France
Tel: +33 (0)4 92 94 42 00
Fax: +33 (0)4 93 65 47 16
http://www.etsi.org

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Chapter 2 – Mechanical Specifications

Mechanical Dimensions
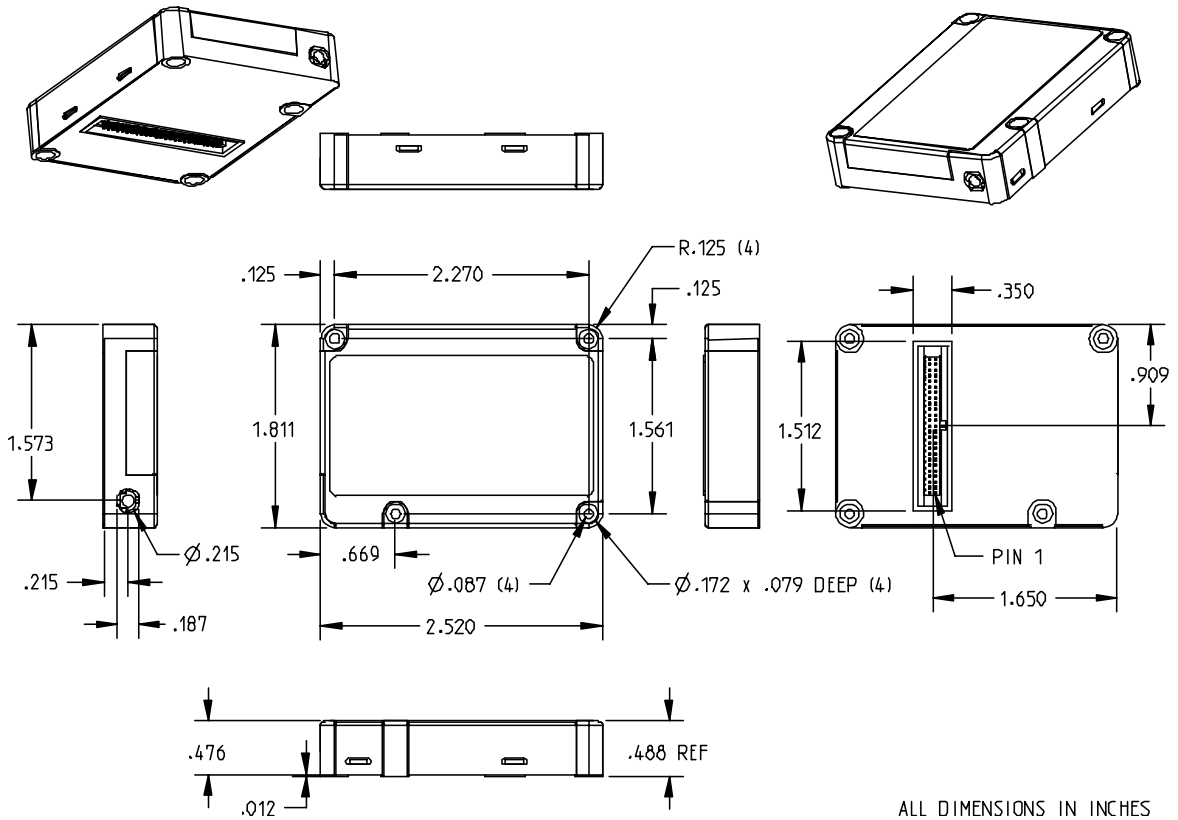
ModemModule Dimensions

ALL DIMENSIONS IN INCHES

Chapter 3 – Electrical Characteristics

Introduction

This chapter describes the ModemModule's electrical interfaces. These are:
- 50-pin connector (power and data/signaling)
- RF interface

50-Pin Connector Interfaces

Pin #	Name	I/O	I/O Type	Description	Comment
1	GND			GROUND	High current
2	GND			GROUND	High current
3	+5V		Supply		High current
4	+5V		Supply		High current
5	CT109/DCD	O	CMOS/2X	Data Carrier Detect	
6	GND			GROUND	High current
7	GPI04	I/O	CMOS/2X	General Purpose I/O	
8	SPK2N	O	Analog	Speaker 2 negative output	
9	CT125/RI	O	CMOS/2X	Ring Indicator	
10	SPK2P	O	Analog	Speaker 2 positive output	
11	Flashing LED	I/O	CMOS/2X	Working mode indication LED	Driven by module
12	SPK1P	O	Analog	Speaker 1 positive output	
13	CT106/CTS	O	1X	Clear to Send	
14	SPK1N	O	Analog	Speaker 1 negative output	
15	ON/~OFF	I		Power ON/OFF control	ON = Vcc
16	MIC2P	I	Analog	Microphone 2 positive input	
17	AUXV0	I	Analog	Auxiliary ADC input	
18	MIC2N	I	Analog	Microphone 2 negative input	
19	~RST	I		Reset active low	Open Collector
20	MIC1P	I	Analog	Microphone 1 positive input	
21	GND	I		Ground	
22	MIC1N	I	Analog	Microphone 1 negative input	
23	BOOT	I		BOOT	Open Collector
24	GND			GROUND	High Current
25	CT103/TX	I		Transmit Data	Pull up with 100K-ohm when not used
26	GPIO0	I/O	CMOS/2X	General Purpose I/O	
27	CT107/DSR	O	1X	Data Set Ready	
28	CT104/RX	O	1X	Receive Data	
29	CT108-2/DTR	I		Data Terminal Ready	Pull up with 100K-ohm when not used
30	CT105/RTS	I		Request to Send	Pull up with 100K-ohm when not used

50-Pin Connector Interfaces (Continued)

Pin #	Name	I/O	I/O Type	Description	Comment
31	COL3	I/O	1X	Keypad column	
32	COL4	I/O	1X	Keypad column	
33	COL1	I/O	1X	Keypad column	
34	COL2	I/O	1X	Keypad column	
35	ROW4	I/O	1X	Keypad row	
36	COL0	I/O	1X	Keypad column	
37	ROW2	I/O	1X	Keypad row	
38	ROW3	I/O	1X	Keypad row	
39	ROW0	I/O	1X	Keypad row	
40	ROW1	I/O	1X	Keypad row	
41	NC			Not Connected	
42	SPI_EN	O	1X	SPI enable	
43	SPI_IO	I/O	1X	I^2C Data or SPI Data	
44	SPI_CLK	O	2X	I^2C Clock or SPI Clock	
45	SIMCLK	O	2X	Clock for SIM interface	3V mode
46	SIMRST	O	2X	Reset for SIM interface	3V mode
47	SIMVCC	O		SIM card supply	3V mode 6mA max.
48	SIMPRES	I		SIM card detect	Connected to SIM connector pin 8. Pin 4 of SIM connector must be pulled down to GND with 1 K-Ohm*
49	SIMDATA	I/O	3X	I/O for SIM interface	3V mode
50	GPO0			General purpose I/O	

* See SIM socket diagram in SIM interface section

** GPO0 is a general purpose output for selection of external SIM, 3V or 5V.

Operating Conditions

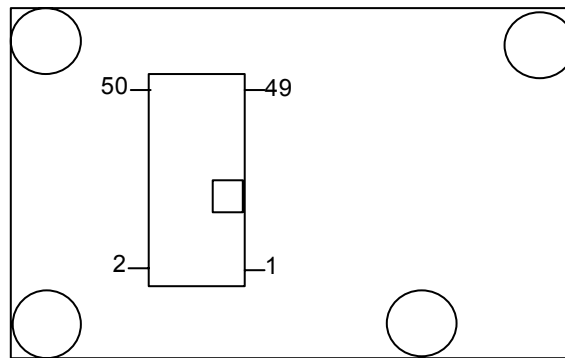| Parameter	I/O Type	Min	Max	Condition
$V_{input\ low}$	CMOS	-0.5V	0.8V	
$V_{input\ high}$	CMOS	2.1V	3.0V	
$V_{output\ low}$	1X		0.2V	I_{OL} = -1mA
	2X		0.2V	I_{OL} = -2mA
	3X		0.2V	I_{OL} = -3mA
$V_{output\ high}$	1X	2.6V		I_{OH} = 1mA
	2X	2.6V		I_{OH} = 2mA
	3X	2.6V		I_{OH} = 3mA

```
GND ———— 1    2 ———— GND
+5V ———— 3    4 ———— +5V
CT109/DCD ———— 5    6 ———— GND
GPIO4 ———— 7    8 ———— SPK2N
CT125/RI ———— 9    10 ———— SPK2P
Flashing LED ———— 11    12 ———— SPK1P
CT106/CTS ———— 13    14 ———— SPK1N
ON/~OFF ———— 15    16 ———— MIC2P
AUXV0 ———— 17    18 ———— MIC2N
~RST ———— 19    20 ———— MIC1P
GND ———— 21    22 ———— MIC1N
BOOT ———— 23    24 ———— GND
CT103/TX ———— 25    26 ———— GPIO0
CT107/DSR ———— 27    28 ———— CT104/RX
CT108-2/DTR ———— 29    30 ———— CT105/RTS
COL3 ———— 31    32 ———— COL4
COL1 ———— 33    34 ———— COL2
ROW4 ———— 35    36 ———— COL0
ROW2 ———— 37    38 ———— ROW3
ROW0 ———— 39    40 ———— ROW1
NC ———— 41    42 ———— SPI_EN
SPI_IO ———— 43    44 ———— SPI_CLK
SIMCLK ———— 45    46 ———— SIMRST
SIMVCC ———— 47    48 ———— SIMPRES
SIMDATA ———— 49    50 ———— GPO0
```

50-Pin Connector

Pin Numbering – Bottom View

Power Consumption

Operating Mode	Band	Average (mA)
CDMA RXTX	Cellular	615
Full Power	PCS	770
CMA RXTX	Cellular	340
Average Power	PCS	445
CDMA Standby	Cellular	20
	PCS	20

Handling Precautions

All devices must be handled with certain precautions to avoid damage due to the accumulation of static charge. Although input protection circuitry has been incorporated into the devices to minimize the effect of this static buildup, proper precautions should be taken to avoid exposure to electrostatic discharge during handling and mounting.

Chapter 4 – Interfaces

This chapter describes the ModemModule interfaces.

- External antenna
- RF Interface

RF Interface

The impedance is 50 Ohms nominal.

RF Connector

The RF connector is MMCX standard type. An antenna can be directly connected through the mating connector or using a small adapter.

Transmitter Specifications

Transmitter performance test specification is CDMA2000 mobile station minimum requirement standard, **3GPP2 TSG C0011-A.**

Operating Frequency	824MHz ~ 849MHz (Cellular Band) 1850MHz ~ 1910MHz (PCS Band)
Modulation	QPSK
Conversion Method	Heterodyne
Oscillation Method	VCTCXO & PLL Synthesizer

RF Output Power
    Maximum
    Minimum
	
	0.2W
	10nW (-50dBm)

Frequency Stability	+/- 300Hz

Open Loop Power Control Output Power
    RX= -25dBm
    RX= -65dBm
    RX= -104dBm
	
	TX= -57.5 ~ -38.5dBm
	TX= -17.5 ~ +1.5dBm
	TX= +18 ~ +30dBm

Spurious Emission
    RX Band
    TX Band
    Other Frequency
	
	-80dBm at 1MHz RBW
	-61dBm at 1MHz RBW
	-47dBm at 30KHz RBW

Receiver Specifications

Receiver performance test specification is CDMA2000 mobile station minimum requirement standard, **3GPP2 TSG C.S0011-A.**

Operating Frequency	869MHz ~ 894MHz (Cellular Band) 1930MHz ~ 1990MHz (PCS Band)
Modulation	QPSK
Conversion Method	Heterodyne
Oscillation Method	VCTCXO & PLL Synthesizer
Receiver Sensitivity	-104dBm @ FER 0.5%
Single Tone Desensitization	-101dBm @ FER 1% (FC+/-1900KHz @ -30dBm)
IMD	-101dBm @ FER 1% (FC+/-900KHz, FC+/-1700KHz @ -43dBm) -90dBm @ FER 1% (FC+/-900KHz, FC+/-1700KHz @ -36dBm) -79dBm @ FER 1% (FC+/-900KHz, FC+/-1700KHz @ -21dBm)

Conducted Spurious Emission
  RX Band
  TX Band
  Other Frequency
	
	-81dBm at 1MHz RBW
	-61dBm at 1MHz RBW
	-47dBm at 30KHz RBW

Chapter 5 – Test Board
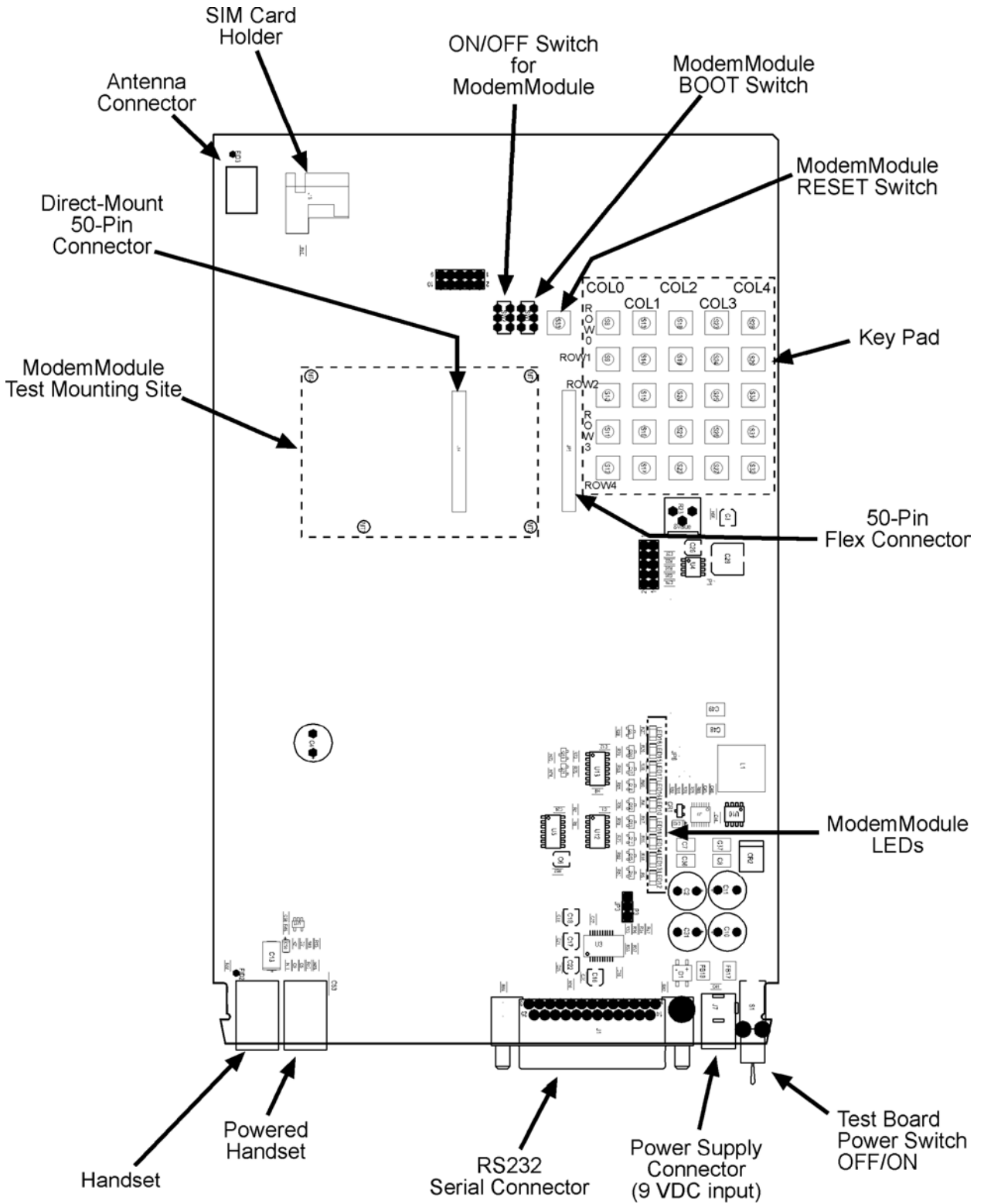
Test Board Block Diagram
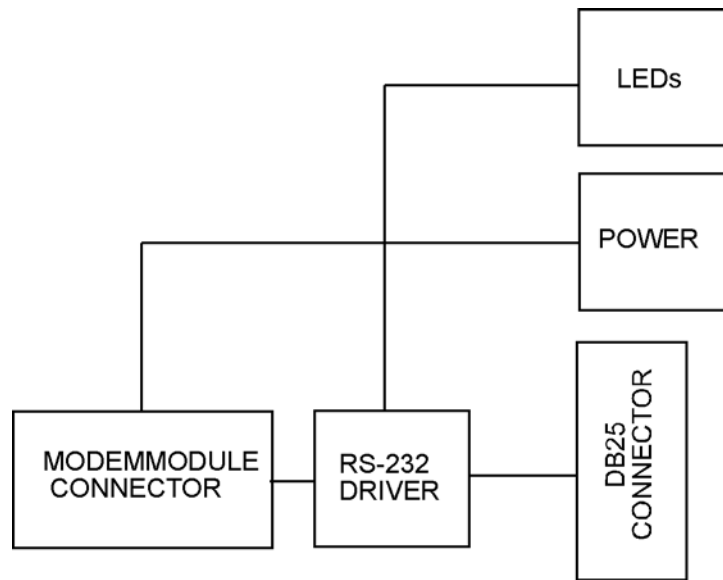
Block Diagram

Chapter 6 – Application Considerations

General Guidelines for the Use of the ModemModule

Hardware and RF

- Ground plane: Multi-Tech recommends having a common ground plane for analog, digital and RF grounds.
- Bias of the Microphone inputs must be properly adjusted when using audio connectors (mic + speaker) 1.
- EMC protection on audio input/output (filters against 900 MHz)
- ESD protection on serial link
- Possible spurious emission radiated by the application to the RF receiver in the receiver band

The Antenna

The antenna sub-system and integration in the application is a major issue. It is a major issue in the choice of the antenna cable (type, length, performances, thermal resistance, etc.)

These elements could affect CDMA performances such as sensitivity and emitted power.

The antenna should be isolated as much as possible from the digital circuitry including the interface signals.

Multi-Tech recommends shielding the terminal. On terminals including the antenna, a poor shielding could dramatically affect the sensitivity of the terminal. Subsequently, the power emitted through the antenna could affect the application.

Firmware Upgrade

The ModemModule firmware is stored in flash memory, and it can easily be upgraded. Contact the factory for details.

Initial Configuration Using Mobile PhoneTools

For Initial configuration of your wireless device, Multi-Tech offers a Windows-based mobile PhoneTools application.

To load Mobile PhoneTools, click on the Mobile PhoneTools icon on the system CD and follow the on-screen prompts.

Getting Started

Minimum Hardware Interface Required To Get Started

At a minimum, it is necessary to connect the following signals too properly operate the ModemModule:

Pin Number	Name	Description
1	GND	Ground
2	GND	Ground
3	+5V	Power Supply
4	+5V	Power Supply
6	GND	Ground
13	CT106/CTS	Clear to Send
15	ON/OFF	Power On/Off *
21	GND	Ground
24	GND	Ground
25	CT103/TX	Transmit
28	CT104/RX	Receive
30	CT105/RTS	Request to Send

* Connected to +5V for example

The serial link signals must be used through the implementation of the serial link level shifter. See "Level Shifter Application Diagram for Serial Link."

Terminal Emulator Setup

Here below is an example based on the Windows™ Hyperterminal application
(terminal emulator program).

Setup:
1. Go to START – PROGRAMS – ACCESSORIES – HYPERTERMINAL.
2. Start the Hyperterminal software.
3. Give the name of your choice, click on the icon of your choice, and click "OK."
4. Choose these operating parameter values:
   Connect using: direct to COM1
   Properties: 115200 bps; 8 bits data; no parity; 1 stop bit; hardware flow control.
5. Click "OK."

Once Hyperterminal is open and configured, it can be used to send AT commands to the ModemModule.

For assistance in testing your ModemModule, see the examples in the AT Command manual for Multi-Tech's CDMA wireless modem products (*CDMA AT Commands Reference Guide*).

Appendix A – Safety Precautions & Regulatory Standards Compliance

Safety Precautions

IMPORTANT!
FOR THE EFFICIENT AND SAFE OPERATION OF YOUR CDMA INTEGRATED MODEM READ THIS INFORMATION BEFORE USE.

RF Safety

General

Your ModemModule is based on the CDMA standard for cellular technology. Your modem is actually a low power radio transmitter and receiver. It sends out and receives radio frequency energy. When you use your ModemModule integrated modem, the cellular system that handles your calls controls both the radio frequency and the power level of your cellular modem.

Exposure to RF Energy

There has been some public concern about possible health effects of using CDMA modems. Although research on health effects from RF energy has focused on the current RF technology for many years, scientists have begun research regarding newer radio technologies, such as CDMA. After existing research had been reviewed, and after compliance to all applicable safety standards had been tested, it has been concluded that the product was fitted for use. If you are concerned about exposure to RF energy there are things you can do to minimize exposure. Obviously, limiting the duration of your calls will reduce your exposure to RF energy. In addition, you can reduce RF exposure by operating your cellular modem efficiently by following the below guidelines.

Efficient Modem Operation

For your modem to operate at the lowest power level, consistent with satisfactory call quality:
- If your modem has an extendible antenna, extend it fully. Some models allow you to place a call with the antenna retracted. However your modem operates more efficiently with the antenna fully extended.
- Do not hold the antenna when the modem is « IN USE ». Holding the antenna affects call quality and may cause the modem to operate at a higher power level than needed.

Antenna Care and Replacement

Do not use the modem with a damaged antenna. If a damaged antenna comes into contact with the skin, a minor burn may result. Replace a damaged antenna immediately. Consult your manual to see if you may change the antenna yourself. If so, use only a manufacturer-approved antenna. Otherwise, have your antenna repaired by a qualified technician. Use only the supplied or approved antenna. Unauthorized antennas, modifications or attachments could damage the modem and may contravene local RF emission regulations or invalidate type approval.

General Safety

Driving

Check the laws and the regulations regarding the use of cellular devices in the area where you have to drive as you always have to comply with them. When using your modem while driving, please: give full attention to driving, pull off the road and park before making or answering a call if driving conditions so require.

Electronic Devices

Most electronic equipment, for example in hospitals and motor vehicles is shielded from RF energy. However RF energy may affect some improperly shielded electronic equipment.

Vehicle Electronic Equipment

Check your vehicle manufacturer representative to determine if any on-board electronic equipment is adequately shielded from RF energy.

Medical Electronic Equipment

Consult the manufacturer of any personal medical devices (such as pacemakers, hearing aids, etc...) to determine if they are adequately shielded from external RF energy. Turn your modem OFF in health care facilities when any regulations posted in the area instruct you to do so. Hospitals or health care facilities may be using RF monitoring equipment.

Aircraft

Turn your modem OFF before boarding any aircraft.
- Use it on the ground only with crew permission.
- Do not use it in the air.

To prevent possible interference with aircraft systems, Federal Aviation Administration (FAA) regulations require you to have permission from a crewmember to use your modem while the aircraft is on the ground. To prevent interference with cellular systems, local RF regulations prohibit using your modem while airborne.

Children

Do not allow children to play with your modem. It is not a toy. Children could hurt themselves or others (by poking themselves or others in the eye with the antenna, for example). Children could damage the modem, or make calls that increase your modem bills.

Blasting Areas

To avoid interfering with blasting operations, turn your unit OFF when in a « blasting area » or in areas posted: « turn off two-way radio ». Construction crews often use remote control RF devices to set off explosives.

Potentially Explosive Atmospheres

Turn your modem OFF when in any area with a potentially explosive atmosphere. It is rare, but your modem or its accessories could generate sparks. Sparks in such areas could cause an explosion or fire resulting in bodily injuries or even death. Areas with a potentially explosive atmosphere are often, but not always, clearly marked. They include fueling areas such as petrol stations; below decks on boats; fuel or chemical transfer or storage facilities; and areas where the air contains chemicals or particles, such as grain, dust, or metal powders. Do not transport or store flammable gas, liquid, or explosives, in the compartment of your vehicle that contains your modem or accessories. Before using your modem in a vehicle powered by liquefied petroleum gas (such as propane or butane) ensure that the vehicle complies with the relevant fire and safety regulations of the country in which the vehicle is to be used.

Safety Standards

THIS WIRELESS MODEMMODULE COMPLIES WITH ALL APPLICABLE RF SAFETY STANDARDS. This cellular modem meets the standards and recommendations for the protection of public exposure to RF electromagnetic energy established by governmental bodies and other qualified organizations, such as the following:

- Directives of the European Community,
- Directorate General V in Matters of Radio Frequency Electromagnetic Energy

RF Exposures

Pursuant to 47 CFR § 24.52 of the FCC Rules and Regulations, personal communications services (PCS) equipment is subject to the radio frequency radiation exposure requirements specified in § 1.1307(b), § 2.1091 and § 2.1093 as appropriate.

The Multi-Tech ModemModule is a CDMA (PCS 1900) terminal which operates in the US licensed PCS frequency spectrum. The device transmits over the 1850-1910 MHz band and receives over the 1930-1990 MHz Band. Mult-Tech Systems, Inc. certifies that it has determined that the Modem complies with the RF hazard requirements applicable to broadband PCS equipment operating under the authority of 47 CFR Part 24, Subpart E of the FCC Rules and Regulations. This determination is dependent upon installation, operation and use of the equipment in accordance with all instructions provided.

The Modem is designed for and intends to be used in fixed and mobile applications. "Fixed" means that the device is physically secured at one location and is not able to be easily moved to another location. "Mobile" means that the device is designed to be used in other than fixed locations and generally in such a way that a separation distance of at least 20cm is normally maintained between the transmitter's antenna and the body of the user or nearby persons. The Modem is not designed for or intends to be used in portable applications (within 20 cm of the body of the user) and such uses are strictly prohibited. To ensure that the unit complies with current FCC regulations limiting both maximum RF output power and human exposure to radio frequency radiation, a separation distance of at least 20cm must be maintained between the unit's antenna and the body of the user and any nearby persons at all times and in all applications and uses.

Finally, the tune-up procedure for the O9EM2113 ensures that the maximum RF output power of the device does not exceed 30.0 dBm within the variations that can be expected due to quantity production and testing on a statistical basis.

Instructions to OEMs

The Multi-Tech product manual includes specific warnings and cautions in order to ensure that OEMs are aware of their responsibilities, with regards to RF exposure compliance, for products into which the modem is integrated. With this guidance, the OEM will be able to incorporate into their documentation the necessary operating conditions and warnings.

OEMs need to provide a manual with the ''final'' product that clearly states the operating requirements and conditions and that these must be observed to ensure compliance with current FCC RF exposure requirements / MPE limits (see the "RF Exposures" section above). This will enable the OEM to generate (and provide the end-user with) the appropriate operating instructions, warnings and cautions, and/or markings for their product.

Regulatory Standards Compliance

CDMA compliance

The ModemModule is in compliance with reference regulations: TBR 19, TBR 20, TBR 31, TBR 32.

CE Label

The Wireless ModemModule is CE compliant, which implies that the modem is in conformity with the European Community directives and it bears the CE label.

Appendix B – Sourcing Guide for Connectors and Peripheral Devices

CDMA Antenna

The integrated modem antenna connector is a MMCX connector. The MMCX connector incorporates a 'Snap On' latching action in order to make the connection easier with an excellent RF performance. An additional advantage is its small physical size, which is 50% of the standard MCX connector.

This type of connector is suitable for the standard ranges of flexible and semi-rigid cables. The characteristic impedance of the MMCX coaxial connector is 50 ohm. The antenna manufacturer must guarantee that the antenna will be working according to the radio characteristics presented in the table below.

Radio Characteristics

	CDMA 850	CDMA 1900
Frequency RX	869 to 894 MHz	1930 to 1990 MHz
Frequency TX	824 to 849 MHz	1850 to 1910 MHz
Impedance	50 ohms	
VSWR	<1.5	
Typical Radiated Gain	0 dBi in at least one direction	

MMCX Plug
The ModemModule requires an MMCX plug to connect to an antenna.

MMCX Connector Example (right angle type)

Antenna
An antenna with matting connector can be ordered, for example, from:
      IMS Connectors Systems GMBH
      http://www.imscs.com/

MMCX / SMA Adapter
A small MMCX / SMA adapter can be ordered, for example, from:
      Amphenol
      http://www.amphenol.com/
      Order No: 908-31100

Appendix C – AT Command List

For comprehensive information about AT Commands, please read the AT Command Manual.

AT Command List

General Commands	
+CGMI	Manufacturer Identification
+CGMM	Request Model Identification
+CGMR	Request Revision Identification
+CGSN	Product Serial Number
+CSCS	Select TE Character Set
+CIMI	Request IMSI
+CCID	Card Identification
+GCAP	Capabilities List
A/	Repeat Last Command
+CPOF	Power Off
+CFUN	Set Phone Functionality
+CPAS	Phone Activity Status
+CMEE	Report Mobile Equipment Errors
+CKPD	Keypad Control
+CCLK	Clock management
+CALA	Alarm management

AT Command List (cont'd)

Call Control Commands	
D	Dial command
H	Hang-up Command
A	Answer a Call
+CEER	Extended Error Report
+VTD, +VTS	DTMF Signals
ATDL	Redial Last Telephone Number
AT%Dn	Automatic Dialing (or SMS send) with DTR
ATSO	Automatic Answer
+CICB	Incoming Call Bearer
+VGR, +VGT	Gain Control
+CMUT	Microphone Mute Control
+SPEAKER	Speaker and Microphone Selection
+ECHO	Echo Cancellation
+SIDET	Side Tone Modification
+VIP	Initialize Voice Parameters
+CSNS	Single Numbering Scheme
Network Service Commands	
+CSQ	Signal Quality
+COPS	Operator Selection
+CREG	Network Registration
+WOPN	Read Operator Name
+CPOL	Preferred Operator List
Security Commands	
+CPIN	Enter PIN
+CPIN2	Enter PIN2
+CPINC	PIN Remaining Attempt Number
+CLCK	Facility Lock
+CPWD	Change Password
Phone Book Commands	
+CPBS	Select Phone Book Memory Storage
+CPBR	Read Phone Book Entries
+CPBF	Find Phone Book Entries
+CPBW	White Phone Book Entry
+CPBP	Phone Book Phone Search
+CPBN	Move Action in Phone Book
+CNUM	Subscriber Number
+WAIP	Avoid Phone Book Init

AT Command List (cont'd)

Short Message Commands	
+CSMS	Select Message Service
+CNMA	New Message Acknowledgement
+CPMS	Preferred Message Storage
+CMGF	Preferred Message Format
+CSAS	Save Settings
+CRES	Restore Settings
+CSDH	Show Text Mode parameters
+CNMI	New Message Indication
+CMGR	Read Message
+CMGL	List Message
+CMGS	Send Message
+CMGW	Write Message to Memory
+CMSS	Send Message from Storage
+CSMP	Set Text Mode Parameters
+CMGD	Delete Message
+CSCA	Service Center Address
+CSCB	Select Cell Broadcast Message Types
+WCBM	Cell Broadcast Message Identifiers
+WMSC	Message Status Modification
+WMGO	Message Overwriting
Supplementary Services Commands	
+CCFC	Call Forwarding
+CLCK	Call Barring
+CPWD	Modify SS Password
+CCWA	Call Waiting
+CLIR	Calling Line Identification Restriction
+CLIP	Calling Line Identification Presentation
+COLP	Connected Line Identification Presentation
+CAOC	Advice Of Charge
+CACM	Accumulated Call Meter
+CAMM	Accumulated Call Meter Maximum
+CPUC	Price Per Unit and Currency Table
+CHLD	Call Related Supplementary Services
+CLCC	List Current Calls
+CSSN	Supplementary Service Notifications
+CUSD	Unstructured Supplementary Service Data
+CCUG	Closed User Group
Data Commands	
+CBST	Bearer Type Selection
+FCLASS	Select Mode
+CR	Service Reporting Control
+CRC	Cellular Result Codes
+ILRR	DTE-DCE Local Rate Reporting
+CRLP	Radio Link Protocol Parameters
+DOPT	Others Radio Link Parameters
%C	Select Data Compression
+DS	V42 bis Data Compression
+DR	V42 bis Data Compression Report
\N	Select Data Error Correcting Mode

AT Command List (cont'd)

Fax Commands	
+FTM	Transmit Speed
+FRM	Receive Speed
+FTH	HDLC Transmit Speed
+FRH	HDLC Receive Speed
+FTS	Stop Transmission and Wait
+FRS	Receive Silence
Fax Class 2 Commands	
+FDT	Transmit Data
+FDR	Receive Data
+FET	Transmit Page Punctuation
+FPTS	Page Transfer Status Parameters
+FK	Terminate Session
+FBOR	Page Transfer Bit Order
+FBUF	Buffer Size Report
+FCQ	Copy Quality Checking
+FCR	Capability to Receive
+FDIS	Current Sessions Parameters
+FDCC	DCE Capabilities Parameters
+FLID	Local ID String
+FPHCTO	Page Transfer Timeout Parameter
V24 - V25 Commands	
+IPR	Fixed DTE Rate
+ICF	DTE-DCE Character Framing
+IFC	DTE-DCE Local Flow Control
&C	Set DCD Signal
&D	Set DTR Signal
&S	Set DSR Signal
O	Back to Online Mode
Q	Result Code Suppression
V	DCE Response Format
Z	Default Configuration
&W	Save Configuration
&T	Auto-Tests
E	Echo
&F	Restore Factory Settings
&V	Display Configuration
I	Request Identification Information

AT Command List (cont'd)

Specific AT Commands	
+CCED	Cell Environment Description
+CCED	Automatic RxLev Indication
+WIND	General Indications
+ADC	Analog Digital Converters Measurements
+CMER	Mobile Equipment Event Reporting
+WLPR	Read Language Preference
+WLPW	Write Language Preference
+WIOR	Read GPIO Value
+WIOW	Write GPIO Value
+WAC	Abort Command
+WTONE	Play Tone
+WDTMF	Play DTMF Tone
+WDWL	Multi-Tech Downloading
+WVR	Multi-Tech Voice Rate
+WDR	Data Rate
+WHWV	Hardware Version
+WDOP	Date Of Production
+WSVG	Multi-Tech Select Voice Gain
+WSTR	Multi-Tech Status Request
+WSCAN	Multi-Tech Scan
+WRIM	Ring Indicator Mode
+W32K	Power saving mode

Appendix D – Acronyms and Abbreviations

ADC : Analog Digital Converter
ASIC : Application Specific Integrated Circuit
BCCH : Broadcast Control Channel
CE : Communauté Européenne
CLK : Clock
CTS : Clear To send
dB : decibel
DCD : Data Carrier Detect
DCE : Data Circuit Terminating Equipment
DSR : Data Set Ready
DTE : Data Terminal Equipment
DTR : Data Terminated Ready
EFR : Enhanced Full Rate
EMC : Electromagnetic Conformity
EN : Enable
ETSI : European Telecommunications Standards Institute
FAC : Final Assembly Code
FR : Full-Rate
FTA : Full Type Approval
GND : Ground
GPIO : General Purpose Input Output
HR : Half-Rate
MO : Mobile Originated
MT : Mobile Terminated
OEM : Original Equipment Manufacturer
PDA : Personal Digital Assistant
PCB : Printed Circuit Board
PRES : Presence
RI : Ring Indicator
RTS : Request To Send
SIM : Subscriber Identity Module
SMD : Surface Mounted Design
SMS : Short Message Service
TAC : Type Approval Code
TDMA : Time Code Multiple Access
TE : Terminal Equipment
VSWR : Voltage Standing Wave Ratio
WAP : Wireless Application Protoc

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