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# GPRS SocketModem®

## Developer's Guide



**GPRS SocketModem Developer's Guide**  
**MTSMC-G2, MTSMC-G2-V, MTSMC-G2-IP, MTSMC-G2-GP**  
**S000521A, Version A**

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## Warranty

To read the warranty statement for your product, please visit: <http://www.multitech.com/warranty.go>

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# Chapter 1 – Universal Socket Connectivity

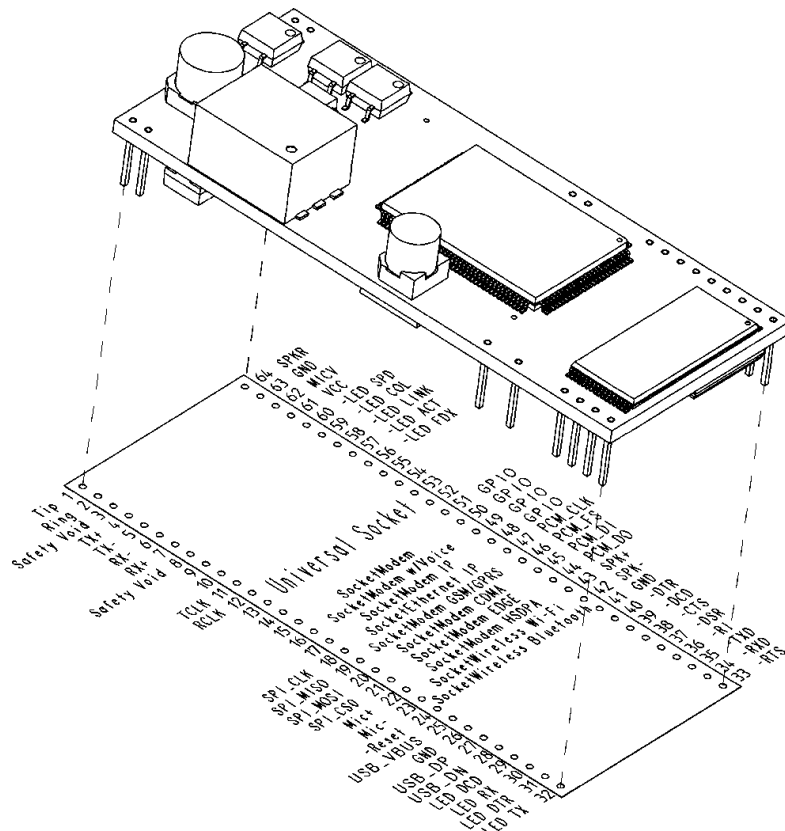
Multi-Tech's embedded device networking solutions instantly add communication ability to your existing or new product with minimal engineering effort giving you an edge on your competition while accelerating your time-to-market. Our Universal Socket is a flexible comm-port architecture that provides cellular, Ethernet, PSTN or Wi-Fi network access with interchangeable communications devices. This means you can use one system design and populate it with your connectivity device of choice.

## Universal Socket Connectivity Features

- Flexible comm-port architecture
- Interchangeable socket devices
- Cost-effective system design
- Easy migration to future technologies
- Complete global compliance

## Universal Socket Design

Each pin on a SocketModem corresponds to a particular function. The universal socket design provides a universal location for each function pin. This allows each SocketModem to be used in a common board.



# Universal Developer Kit Contents

Products described in this guide can be used to develop and evaluate your products and applications using the MTSMI-UDK (Universal Developer Kit).

- Developer Board: One MTSMI-UDK Developer Board
- Power Supply: One 100-240V 9V-1.7A power supply with removable blades:
  - One US blade/plug
  - One EURO blade/plug
  - One UK blade/plug
- Cables
  - One RS-232 DB9F-DB25M serial cable
  - One RJ-11 phone cable
  - One RJ-45 Ethernet cable
  - One 1.5 meter USB cable
- Antenna Cables
  - One SMA-to-MMCX antenna cable (for cellular antennas)
  - Two SMA-to-UFL antenna cables (one for select cellular antennas and one for GPS antennas)
  - One RSMA-to-MMCX antenna cable (for Bluetooth antennas)
  - One RSMA-to-UFL antenna cable (for Wi-Fi antennas)
- Antennas
  - One quad band antenna 850/1900/900/1800 (for cellular modems)
  - One 2.4GHz, ½ WAVE antenna with reverse polarity (for Bluetooth and Wi-Fi devices)
  - One GPS antenna
- Modem Activation Customer Notices
  - Aeris Communications, Inc.
  - GSM
  - Sprint Nextel
  - Verizon Wireless
- One Universal Socket Connectivity Developer CD
- One Promotional Screwdriver

# Universal Socket Pin Out

(I/O) Tip	1	○	○	64	SPKR (O)
(I/O) Ring	2	○	○	63	GND (I)
Safety Void	3	×	○	62	MICV (I)
(O) TX+	4	○	○	61	VCC (I)
(O) TX-	5	○	○	60	-LED SPD (O)
(I) RX-	6	○	○	59	-LED COL (O)
(I) RX+	7	○	○	58	-LED LINK (O)
Safety Void	8	×	○	57	-LED ACT (O)
	9		○	56	-LED FDX (O)
	10			55	
(O) TCLK	11	○		54	
(O) RCLK	12	○		53	
	13			52	
	14		○	51	GPIO (I/O)
	15		○	50	GPIO (I/O)
	16		○	49	GPIO (I/O)
	17		○	48	GPIO (I/O)
	18		○	47	
	19		○	46	
	20		○	45	
	21		○	44	
(I) MIC+	22	○	○	43	SPK+ (O)
(I) MIC-	23	○	○	42	SPK- (O)
(I) -RESET	24	○	○	41	GND (I)
(I) USB_VBUS	25	○	○	40	-DTR (I)
(I) GND	26	○	○	39	-DCD (O)
(I/O) USB_DP	27	○	○	38	-CTS (O)
(I/O) USB_DN	28	○	○	37	-DSR (O)
(O) LED DCD	29	○	○	36	-RI (O)
(O) LED RX	30	○	○	35	-TXD (I)
(O) LED DTR	31	○	○	34	-RXD (O)
(O) LED TX	32	○	○	33	-RTS (I)

**Top View – Universal SocketModem Pin Out**

**Note:** Not all products include all pins as shown above and listed below. See the Mechanical Drawings section in each product chapter for the pins used by that product.

## Universal Pin Descriptions

Pin	Signal Name	In/Out	Description
1	Tip	I/O	Tip Signal from Telco. Tip connection to the phone line (RJ-11 Pin 4). The SocketModem is Tip/Ring polarity insensitive.
2	Ring	I/O	Ring Signal from Telco. Ring connection to the phone line (RJ-11 Pin 3). The SocketModem is Tip/Ring polarity insensitive.
3	Safety Void	NA	Safety Clearance. 2.5 mm is required between TNV circuits and SELV circuits.
4	TX+	O	Transmit Outputs (TX+ and TX-). Differential transmit outputs for Ethernet and ISDN.
5	TX-	O	Transmit Outputs (TX+ and TX-). Differential transmit outputs for Ethernet and ISDN.
6	RX-	I	Receive Inputs. Differential receive input pins for Ethernet. Dummy pin for MT810SWM-IP.
7	RX+	I	Receive Inputs. Differential receive input pins for Ethernet.
8	Safety Void	NA	Safety Clearance. 2.5 31mm is required between TNV circuits and SELV circuits.
9	Dummy		Dummy pin for EDGE.

Pin	Signal Name	In/Out	Description								
11	TCLK	O	Transmit Data Sync Clock. TX synchronous data clock for ISDN sync data mode.								
12	RCLK	O	Receive Data Sync Clock. RX synchronous data clock for ISDN sync data mode.								
22	MIC+	I	Microphone positive input. Refer to <a href="#">Microphone Inputs</a> in Chapter 2.								
23	MIC-	I	Microphone negative input. Refer to <a href="#">Microphone Inputs</a> in Chapter 2.								
24	–RESET	I	<p>Device Reset (with pull-up). The active low –RESET input resets the device logic and returns the configuration of the device to the original factory default values or "stored values" in the NVRAM. –RESET is tied to VCC through a time-constant circuit for "Power-on-Reset" functionality. The SocketModem is ready to accept commands after a fixed amount of time ("X" Time) after power-on or reset.</p> <table border="1"> <thead> <tr> <th>Model</th><th>Time</th><th>Constant "X" Time</th><th>Minimum Reset Pulse*</th></tr> </thead> <tbody> <tr> <td>MTSMC-G2</td><td>250 ms</td><td>6 seconds</td><td>100us</td></tr> </tbody> </table> <p>*The SocketModem device may respond to a shorter reset pulse. Reset Line Interface for the MT5692SMI. The modem's reset line employs a 10K pull up resistor. If an open collector driver is to be used, run that output to the modem only and use a separate driver for other embedded components. The modem's reset signal may also be driven by a circuit that both sinks and sources current if desired. It is also important to note that these modems do not require an external reset. They have their own internal reset circuitry and voltage monitor and will function correctly even if the reset input is open.</p> <p><b>Reset GPRS (MTSMC-G2).</b> This signal is used to force a reset procedure by providing low level during reset of at least 500us. The signal is considered an emergency reset only. A reset procedure is already driven by internal hardware during the power-up sequence. If no external reset is necessary, this input can be left open. If used (emergency reset), it has to be driven by an open collector or an open drain.</p> <p><b>RESET – A Design Consideration:</b> Allowing the host processor to control the RESET line of the SocketModem provides the benefit of allowing the host to reset the device in the event of a failure to respond normally. Resetting the SocketModem will return it to a known functional state.</p>	Model	Time	Constant "X" Time	Minimum Reset Pulse*	MTSMC-G2	250 ms	6 seconds	100us
Model	Time	Constant "X" Time	Minimum Reset Pulse*								
MTSMC-G2	250 ms	6 seconds	100us								
25	USB_VBUS	I	USB Voltage Sense. Senses the voltage level of the USB to determine if the bus is available.								
26	GND	GND	Logic Ground.								
27	USB_DP	I/O	USB Data Positive. Positive pin of the USB data pair.								
28	USB_DN	I/O	USB Data Negative. Negative pin of the USB data pair.								
29	LED DCD	O	DCD (Active High). Output from 74LCX14 with a 1000 Ohms resistor in series. SocketWireless Bluetooth (MTS2BTSMI): When lit, indicates a connection. No series resistor.								
30	LED RX	O	RX (Active High). Output from 74LCX14 with a 1000 Ohms resistor in series. SocketWireless Bluetooth (MTS2BTSMI): No series resistor.								
31	LED DTR	O	DTR (Active High). Output from 74LCX14 with a 1000 Ohms resistor in series. SocketWireless Bluetooth (MTS2BTSMI): No series resistor.								
32	LED TX	O									



Pin	Signal Name	In/Out	Description
33	–RTS	I	Request to Send (Active Low). –RTS is controlled by the DTE to indicate whether or not the DTE is ready to receive data. –RTS ON (low) indicates that the DTE is ready to receive data from the modem on RXD. –RTS OFF indicates to the SocketModem that it should not transfer data on the RXD. <b>Note:</b> When the –RTS pin is not in use, it should be tied low.
34	–RXD	O	Received Data. The SocketModem uses the RXD line to send data to the DTE and to send SocketModem responses to the DTE. In command mode, –RXD data presents the SocketModem responses to the DTE. SocketModem responses take priority over incoming data when the two signals are in competition for –RXD. When no data is transmitted, the signal is held in mark condition.
35	–TXD	I	Transmitted Data. The DTE uses the –TXD line to send data to the SocketModem for transmission or to transmit commands to the SocketModem. The DTE holds this circuit in mark state when no data is being transmitted or during intervals between characters.
36	–RI	O	RING (Active Low). Incoming ring signal from phone. Ring Indicate. –RI output ON (low) indicates the presence of an ON segment of a ring signal on the telephone line. The modem will not go off-hook when –RI is active; the modem waits for –RI to go inactive before going off-hook.
37	–DSR	O	Data Set Ready (Active Low). –DSR indicates SocketModem status to the DTE. –DSR OFF (high) indicates that the DTE is to disregard all signals appearing on the interchange circuits except Ring Indicator (–RI). It reflects the status of the local data set and does not indicate an actual link with any remote data equipment.
38	–CTS	O	Clear to Send (Active Low). –CTS is controlled by the SocketModem to indicate whether or not the SocketModem is ready to transmit data. –CTS ON indicates to the DTE that signals on TXD will be transmitted. –CTS OFF indicates to the DTE that it should not transfer data on TXD.
39	–DCD	O	Data Carrier Detect (Active Low). –DCD output is ON (low) when a data connection is established and the SocketModem is ready to send/receive data.
40	–DTR	I	Data Terminal Ready (Active Low). The –DTR input is turned ON (low) when the DTE is ready to communicate. –DTR ON prepares the modem to be connected, and, once connected, maintains the connection. –DTR OFF places the modem in the disconnect state under control of the &Dn and &Qn commands. <b>Note:</b> When the –DTR pin is not in use, it should be tied low.
41	GND	GND	Logic Ground.
42	SPK-	O	Negative analog speaker output.
43	SPK+	O	Positive analog speaker output.
48	GPIO	I/O	General Purpose Input/Output. User-configurable input or output pin. **
49	GPIO	I/O	General Purpose Input/Output. User-configurable input or output pin. **
50	GPIO	I/O	General Purpose Input/Output. User-configurable input or output pin. **
51	GPIO	I/O	General Purpose Input/Output. User-configurable input or output pin. **
56	–LED FDX	O	LED Full Duplex (Active Low). LED Output. During normal operation, this pin lights the FDX LED to indicate a full duplex mode.
57	–LED ACT	O	LED Active (Active Low). LED Output. During normal operation, this pin lights the Activity LED when transmitting or receiving. It flashes at a rate of 50ms

Pin	Signal Name	In/Out	Description
			high and 50ms low when active.
58	–LEDLINK	O	LED LINK (Active Low). LED Output. During normal operation, this pin lights the LINK LED to indicate a good link is detected.
			<b>Pin 58 LED Mode</b> <b>Operating Status</b>
			<b>Note:</b> Pin 58 may or may not be available on some GPRS SocketModems currently shipping.
			Off      Subscriber Carrier Mode is OFF or running in SLEEP mode or Alarm mode.
			600 ms ON / 600ms OFF      No SIM card inserted or no PIN entered, or network search in progress, or ongoing user authentication, or network login in progress.
			75 ms ON / 75 ms OFF / 75 ms ON 3 s OFF Flashing or Blinking      One or more GPRS contexts activated. Indicates GPRS data transfer: When a transfer is in progress, the LED goes on within 1 second after data packets were exchanged. Flash duration is approximately 0.5 s.
			ON      Depending on type of call: Voice Call: Connected to remote party. Data Call: Connected to remote party or exchange of parameters while setting up or disconnecting a call.
59	–LEDCOL	O	LED Collision (Active Low). LED Output. During normal operation, this pin lights the COL LED to indicate a collision. It flashes at 50ms high and 50ms low when active.
60	–LEDSPD	O	LED Speed (Active Low). LED Output. During normal operation, this pin lights the SPEED LED to indicate 100Mbps is selected.
61	VCC	PWR	DC Input Power. 3.3V or 5VDC power, depending upon the build.
62	MICV	I	Single-Ended Microphone. Single-ended microphone input for dial-up SocketModem speakerphone and TAM functions.
63	AGND	GND	Analog Ground. Analog ground is tied common with DGND on the SocketModem. To minimize potential ground noise issues, connect audio circuit return to AGND.
64	SPKR	O	Speaker. Dual purpose output for call progress signals or speakerphone functions.

## Design Considerations

### Noise Suppression Design Considerations

Adhere to engineering noise-suppression practices when designing a printed circuit board (PCB) containing the SocketModem. Noise suppression is essential to the proper operation and performance of the modem and surrounding equipment.

Any OEM board design that contains a SocketModem should consider both on-board and off-board generated noise that can affect digital signal processing. Both on-board and off-board generated noise that is coupled on-board can affect interface signal levels and quality. Noise in frequency ranges that affect modem performance is of particular concern.

On-board generated electromagnetic interference (EMI) noise that can be radiated or conducted off-board is equally important. This type of noise can affect the operation of surrounding equipment. Most local

government agencies have stringent certification requirements that must be met for use in specific environments.

Proper PC board layout (component placement, signal routing, trace thickness and geometry, etc.) component selection (composition, value, and tolerance), interface connections, and shielding are required for the board design to achieve desired modem performance and to attain EMI certification.

Other aspects of proper noise-suppression engineering practices are beyond the scope of this developer's guide. The developer should consult noise suppression techniques described other sources, such as technical publications, electronics and electrical engineering text books, and component supplier application notes.

## PC Board Layout Guidelines

In a 4-layer design, provide adequate ground plane covering the entire board. In 4-layer designs, power and ground are typically on the inner layers. All power and ground traces should be 0.05 inches wide.

The recommended hole size for the SocketModem pins is 0.036 in. +/-0.003 in. in diameter. Spacers can be used to hold the SocketModem vertically in place during the wave solder process.

All creepages and clearances for the SocketModem have been designed to meet requirements of safety standards EN60950 or EN60601. The requirements are based on a working voltage of 125V or 250V. When the recommended DAA\* circuit interface is implemented in a third party design, all creepage and clearance requirements must be strictly followed in order to meet safety standards. The third party safety design must be evaluated by the appropriate national agency per the required specification.

User accessible areas: Based on where the third party design is to be marketed, sold, or used, it may be necessary to provide an insulating cover over all TNV exposed areas. Consult with the recognized safety agency to determine the requirements.

**Note:** Even if the recommended design considerations are followed, there are no guarantees that a particular system will comply with all the necessary regulatory requirements. It is imperative that specific designs be completely evaluated by a qualified/recognized agency.

\*DAA stands for Data Access Arrangement. DAA is the telephone line interface of the SocketModem.

## Electromagnetic Interference (EMI) Considerations

The following guidelines are offered specifically to help minimize EMI generation. Some of these guidelines are the same as, or similar to, the general guidelines but are mentioned again to reinforce their importance. In order to minimize the contribution of the SocketModem-based design to EMI, the designer must understand the major sources of EMI and how to reduce them to acceptable levels.

- Keep traces carrying high frequency signals as short as possible.
- Provide a good ground plane or grid. In some cases, a multilayer board may be required with full layers for ground and power distribution.
- Decouple power from ground with decoupling capacitors as close to the SocketModem power pins as possible.
- Eliminate ground loops, which are unexpected current return paths to the power source and ground.
- Decouple the telephone line cables at the telephone line jacks. Typically, use a combination of series inductors, common mode chokes, and shunt capacitors. Methods to decouple telephone lines are similar to decoupling power lines; however, telephone line decoupling may be more difficult and deserves additional attention. A commonly used design aid is to place footprints for these components and populate as necessary during performance/EMI testing and certification.
- Decouple the power cord at the power cord interface with decoupling capacitors. Methods to decouple power lines are similar to decoupling telephone lines.
- Locate high frequency circuits in a separate area to minimize capacitive coupling to other circuits.
- Locate cables and connectors so as to avoid coupling from high frequency circuits.

- Lay out the highest frequency signal traces next to the ground grid.
- If a multilayer board design is used, make no cuts in the ground or power planes and be sure the ground plane covers all traces.
- Minimize the number of through-hole connections on traces carrying high frequency signals.
- Avoid right angle turns on high frequency traces. Forty-five degree corners are good; however, radius turns are better.
- On 2-layer boards with no ground grid, provide a shadow ground trace on the opposite side of the board to traces carrying high frequency signals. This will be effective as a high frequency ground return if it is three times the width of the signal traces.
- Distribute high frequency signals continuously on a single trace rather than several traces radiating from one point.

## Electrostatic Discharge Control

All electronic devices should be handled with certain precautions to avoid damage due to the accumulation of static charge.

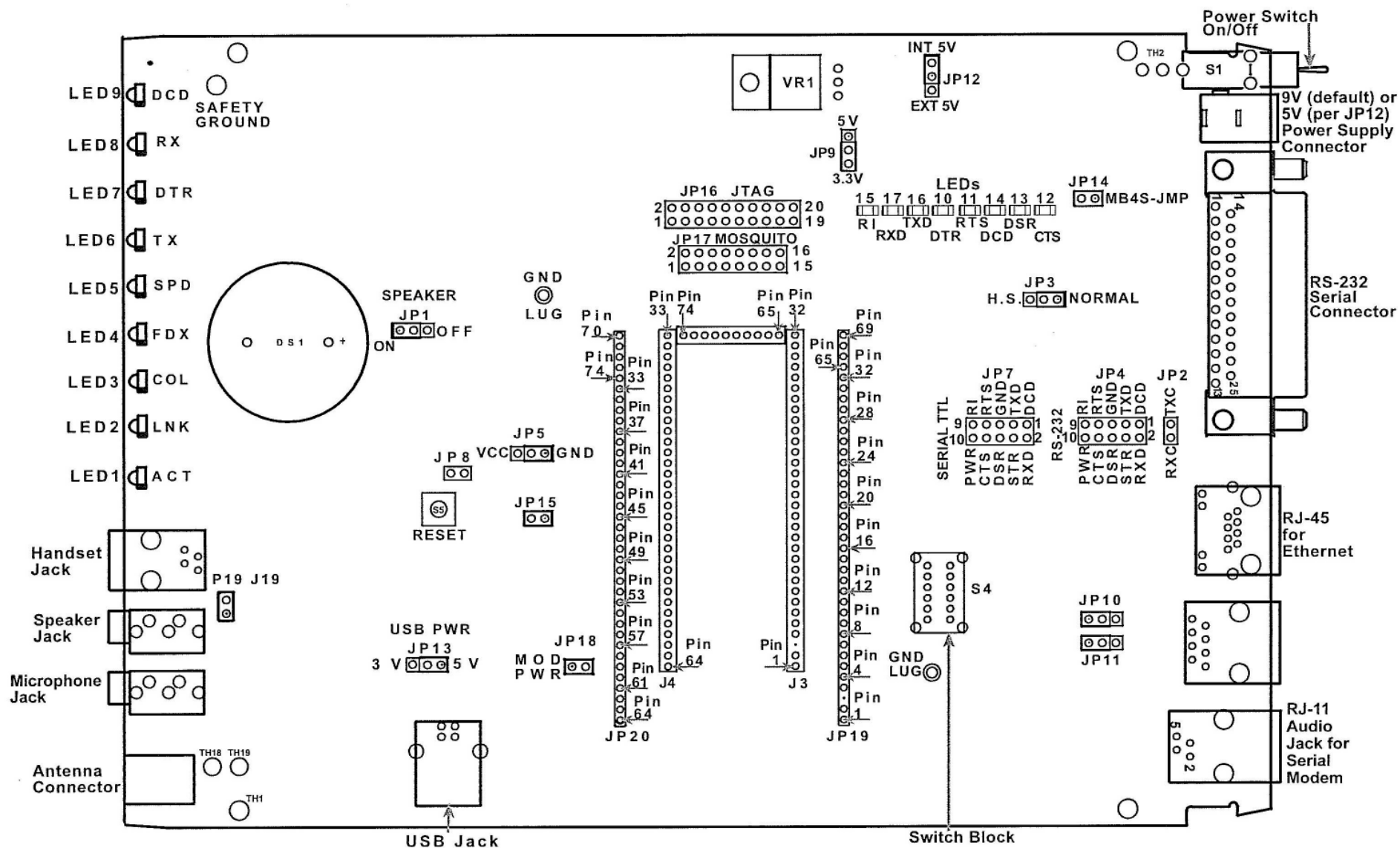
See the ANSI/ESD Association Standard (ANSI/ESD S20.20-1999) – a document “for the Development of an Electrostatic Discharge Control for Protection of Electrical and Electronic Parts, Assemblies and Equipment.” This document covers ESD Control Program Administrative Requirements, ESD Training, ESD Control Program Plan Technical Requirements (grounding/bonding systems, personnel grooming, protected areas, packaging, marking, equipment, and handling), and Sensitivity Testing.

Multi-Tech Systems, Inc. strives to follow all of these recommendations. Input protection circuitry has been incorporated into the Multi-Tech devices to minimize the effect of this static buildup, proper precautions should be taken to avoid exposure to electrostatic discharge during handling.

Multi-Tech uses and recommends that others use anti-static boxes that create a faraday cage (packaging designed to exclude electromagnetic fields). Multi-Tech recommends that you use our packaging when returning a product and when you ship your products to your customers.

# SocketModem Developer Board

This developer board drawing shows the major board components for all SocketModems.



Board Revision B. Refer to the next section for a description of Board Components.

## Board Components

Jumper	Description
JP1	Mutes the speaker. Default positions are 1 and 2 (speaker is not muted).
JP2	Ties the TX and RX clock lines together. Default positions are 1 and 2 (transmit and receive clock act independently).
JP3	Sets the data rate. NORMAL sets the data rate at 250kbps. H.S. (high speed serial communications) sets the data rate at 1Mbps.
JP4	Testing interface (debugging) for the RS-232 signals.
JP5	JP5 acts as a replacement for pin 45 when pin 45 is used for another function.
JP7	Testing interface (debugging) for the serial TTL signals.
JP9	JP9 is the 5V / 3.3V regulator. The factory default operating voltage is 3.3V. Warning – Be sure that the 5V / 3.3V jumper is set to match the requirements of your SocketModem. If this jumper is set incorrectly, damage to the SocketModem and/or the Test/Demo card could result. <b>Caution:</b> Use only the provided Multi-Tech Systems, Inc. transformer with the Test/Demo board. Use of any other power source will void the warranty and will likely damage the Test/Demo board and the SocketModem.
JP12	JP12 allows you to select either the internal 5V regulator (INT 5V) or to choose EXT 5V. For the EXT 5V, you can use your own external 5V power source and plug it into J7.
JP13	Set either 5V or 3.3V for USB_VBUS line (supplied by the VCC of the USB jack).
JP14	Internal testing.
JP15	JP15 disconnects pin 45 from SLP with JP5 (the RS-232 driver sleep mode).
JP16	JTAG header.
JP17	Mosquito header. If used to debug the SocketModem while using the USB port, then the JP14 would have to be removed to disconnect USB_VBUS.
JP18	Power feed for area where SocketModems are placed (J24).
JP19 & JP20	Debugging probes.
JP25 & JP26	Ground lug.
S4	Set the switch block to the product being used.
S5	Reset

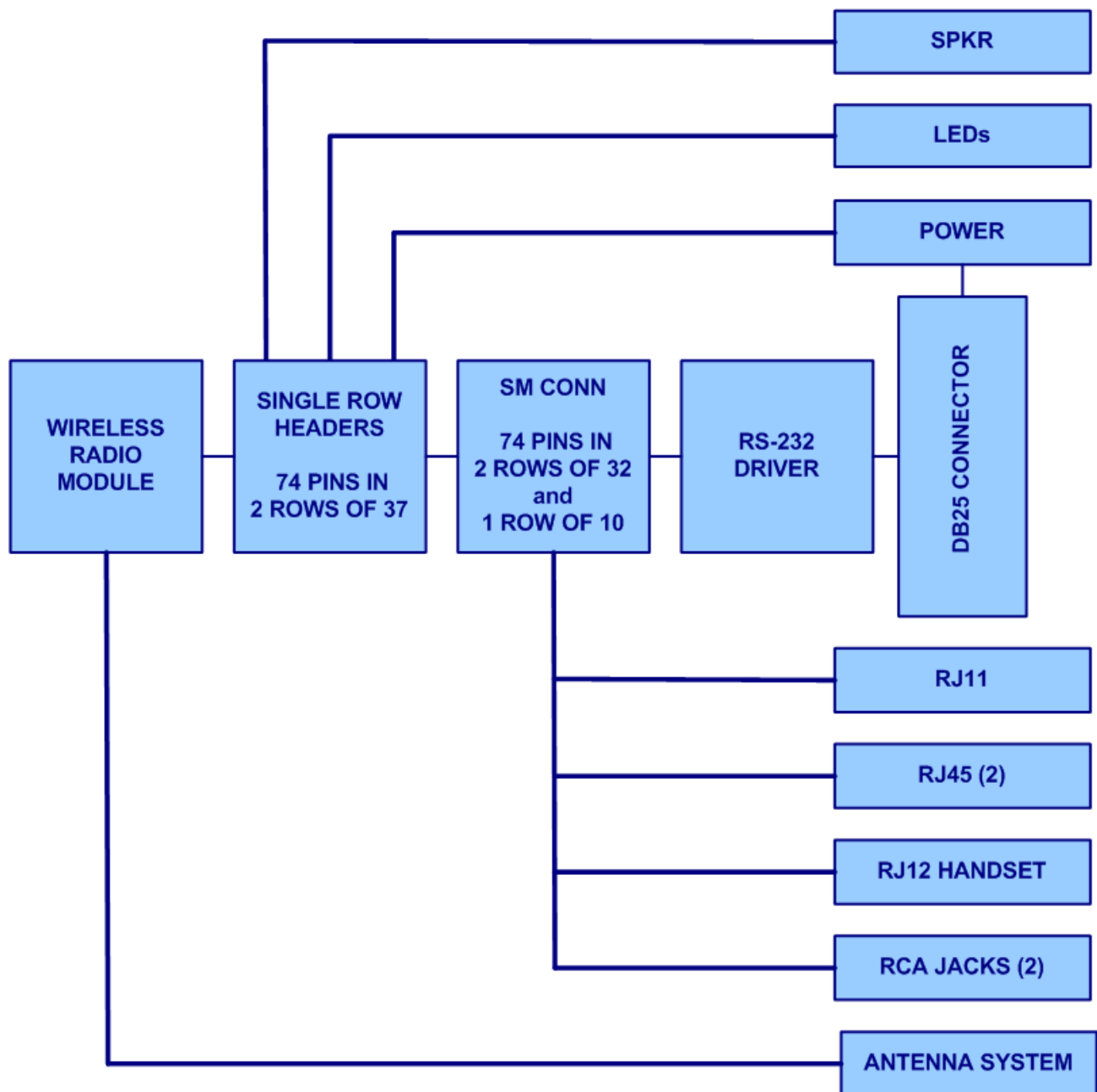
## Jumpers and Corresponding Signals

J4 and J7	
10 PWR	9 RI
8 CTS	7 RTS
6 DSR	5 GND
4 DTR	3 TXD
2 RXD	1 DCD

J2 and J13	
2 RXC	1 TXC

JP10	JP11
TX Term	RX Term

# SocketModem Developer Board Block Diagram

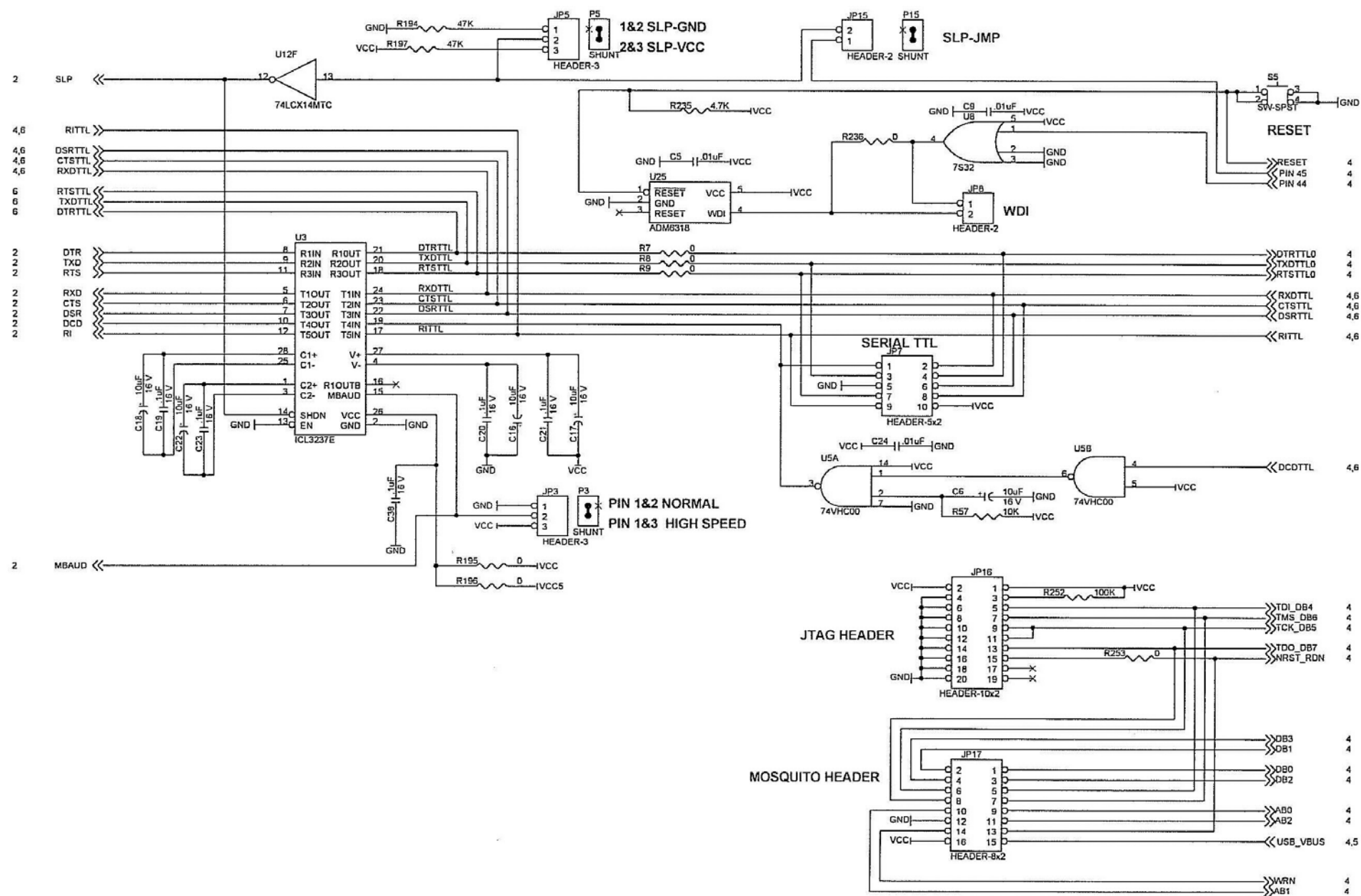






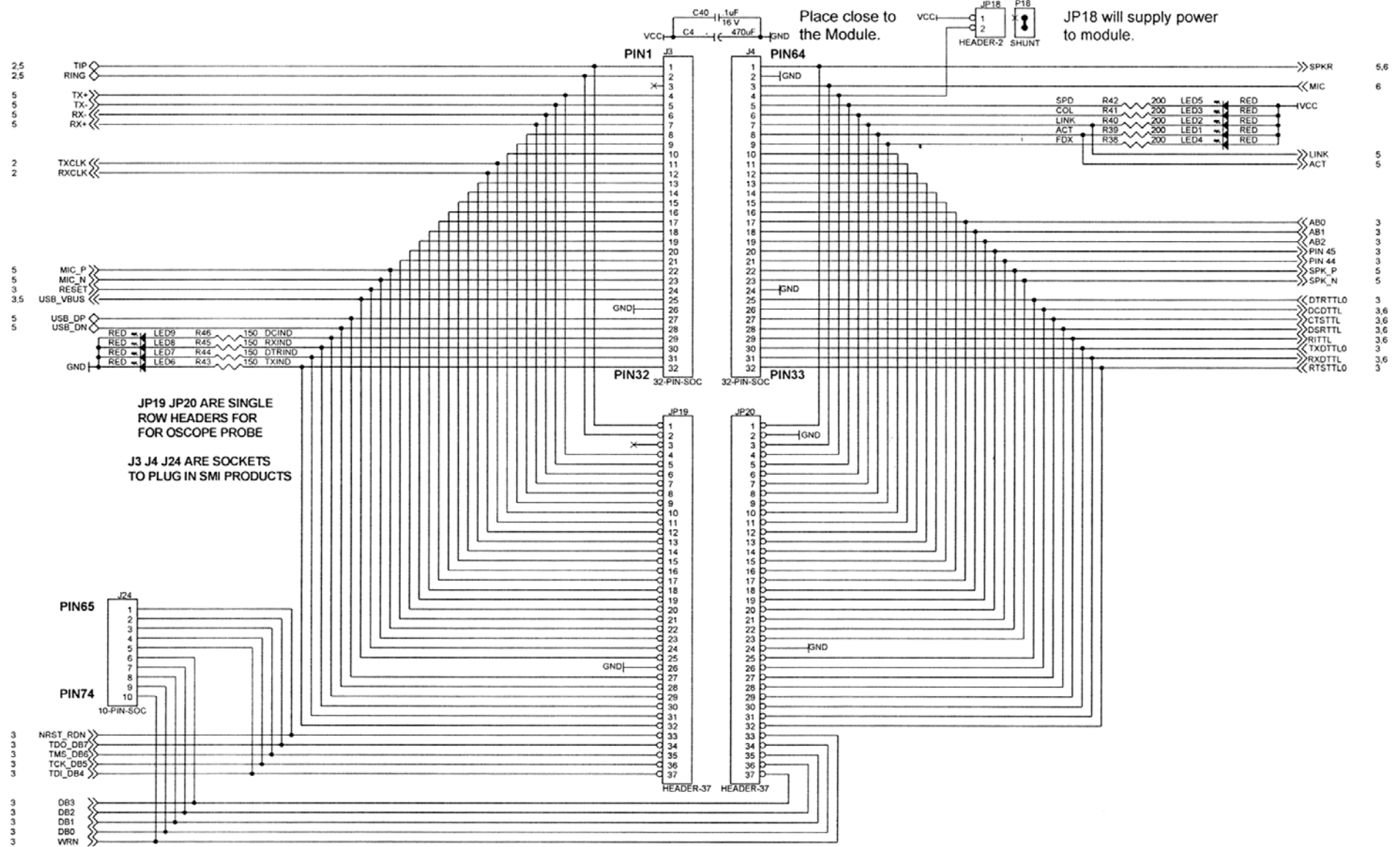


# Developer Board Schematics



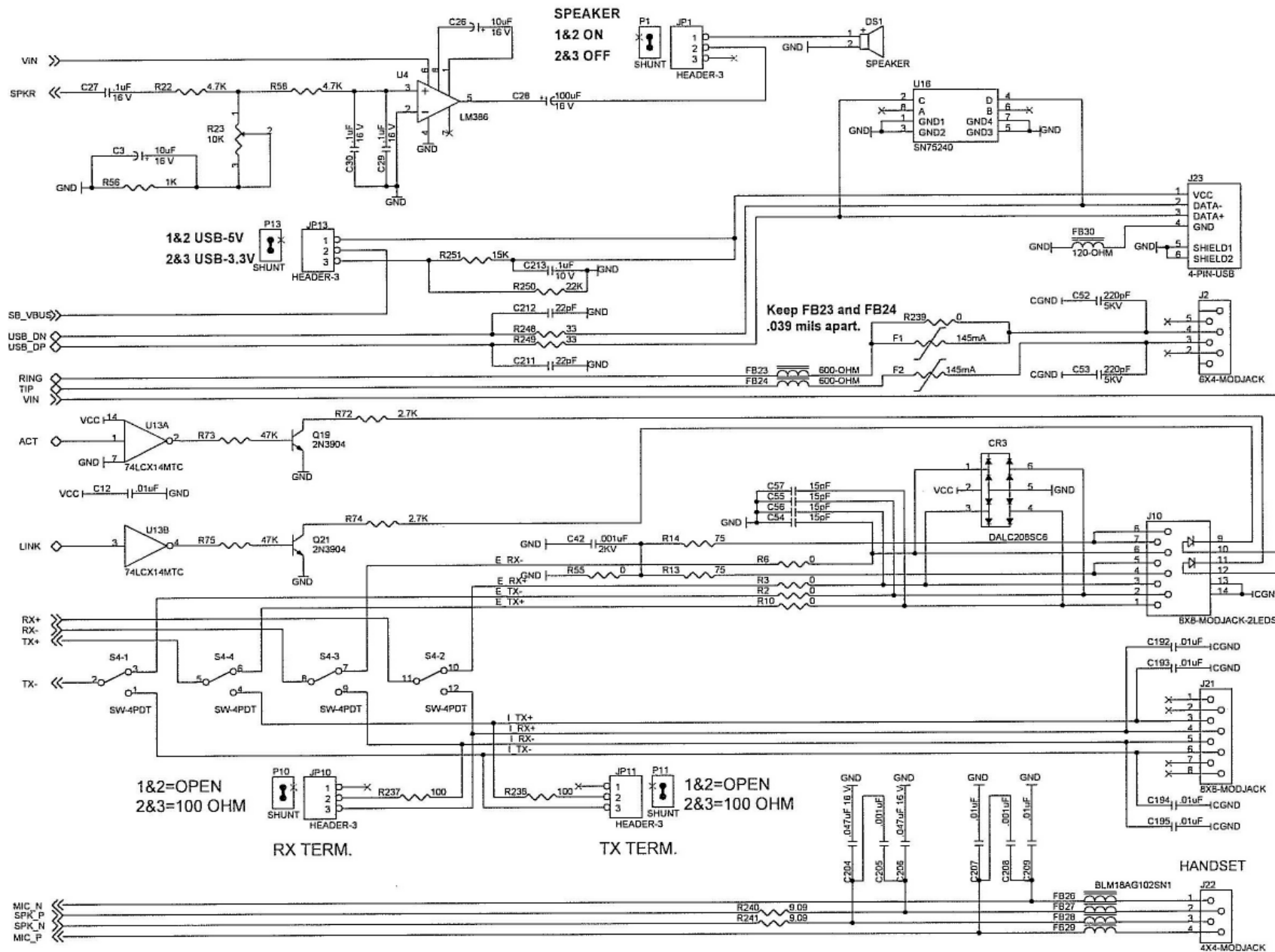
Board Revision B

# Developer Board Schematics



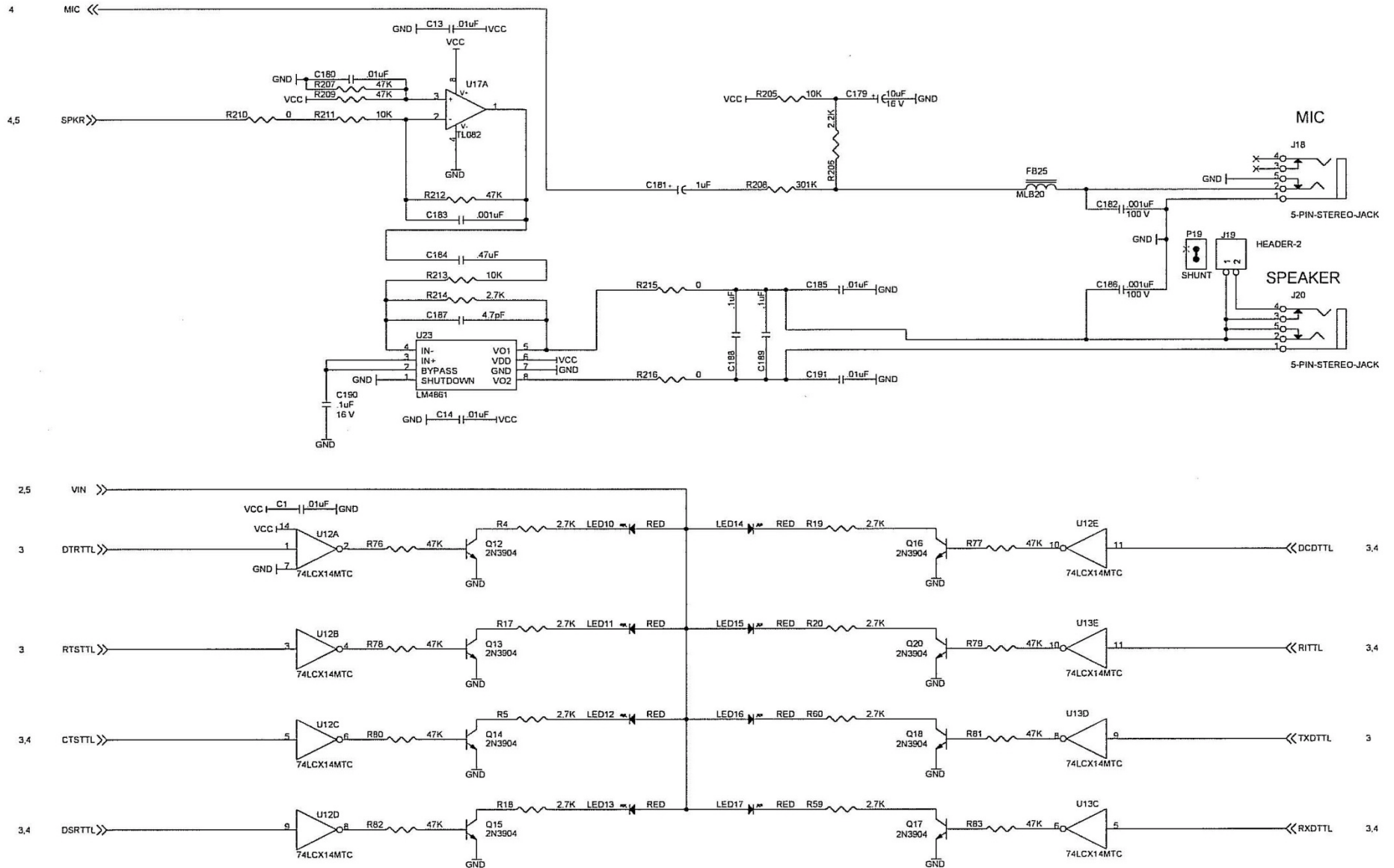
Board Revision B

# Developer Board Schematics



Board Revision B

# Developer Board Schematics



Board Revision B

# Cellular Information

## Antenna System for Cellular Devices

The cellular/wireless performance is completely dependent on the implementation and antenna design. The integration of the antenna system into the product is a critical part of the design process; therefore, it is essential to consider it early so the performance is not compromised. If changes are made to the certified antenna system of the SocketModem, then recertification will be required by specific network carriers such as Sprint. The Antenna System is defined as the UFL connection point from the SocketModem to the specified cable specifications and specified antenna specifications.

## Antenna Specifications

### PTCRB Requirements for the Antenna

There cannot be any alteration to the authorized antenna system. The antenna system must maintain the same specifications. The antenna must be the same type, with similar in-band and out-of-band radiation patterns.

### GSM/EGSM RF Specifications

	<b>GSM 850</b>	<b>EGSM 900</b>	<b>GSM 1800</b>	<b>GSM 1900</b>
Frequency RX	869 to 894 MHz	925 to 960 MHz	1805 to 1880 MHz	1930 to 1990 MHz
Frequency TX	824 to 849 MHz	880 to 915 MHz	1710 to 1785 MHz	1850 to 1910 MHz

### GSM Antenna Requirements/Specifications

Frequency Range	824 – 960 MHz / 1710 – 1990 MHz
Impedance	50 Ohms
VSWR	VSWR shall not exceed 2.0:1 at any point across the bands of operation
Maximum Radiated Gain Allowed by FCC	6.9/3.1 dBi
Radiation	Omni-directional
Polarization	Vertical
TRP/TIS	Including cable loss the total radiate power (TRP) at the antenna shall be no less than +22/24.5 dBm for 850/1900 MHz respectively, and the total isotropic sensitivity (TIS) at the antenna shall be no less than -99/101.5 dBm for 850/1900 MHz respectively.

### GPS Antenna Requirements/Specifications

Frequency	1575.24MHz
Impedance	50 Ohms
VSWR	2.0:1 Max
Gain	10-30dB
LNA Current Consumption	40mA Max
Noise Figure	< 2dB
Polarization	RHCP
Input voltage	3.0V ± 0.3V



## Wi-Fi RF Specifications

	IEEE 802.11 b/g
Frequency	2.4000 to 2.4835 GHz
Modulation	OFDM & DSSS
Receiver Sensitivity	-88dBm @11Mbps -72dBm @54Mbps
Means Transmit Output Power	14.5dBm for 802.11b 14dBm for 802.11g
Range	Up to 100 meters in free space

## Wi-Fi Antenna Requirements/Specifications

Frequency Range	2.4000 to 2.4835 GHz
Impedance	50 Ohms
VSWR	2.0:1 Max
Radiation	Omni-directional
TRP/TIS	The total radiated power (TRP) at the antenna shall be no less than +10 dBm for OFDM/DSSS, 11Mbps, free space and the total isotropic sensitivity (TIS) at the antenna shall be no less than -85dBm for OFDM/DSSS, 11Mbps, free space.

## Bluetooth RF Specifications

	IEEE 802.11 b/g
Frequency	2402 to 2480 MHz
Modulation	FHSS & GFSK
Number of Channels	79
Channel Intervals	1MHz
Receiver Sensitivity	-83dBm typical
Transmit Rate	721kbps
Means Transmit Output Power	12dBm maximum
Range	Up to 100 meters in free space

## Bluetooth Antenna Requirements/Specifications

Frequency Range	2402 to 2480 MHz
Impedance	50 Ohms
VSWR	2.0:1 Max
Radiation	Omni-directional

# OEM Integration

## FCC Grant Notes

The OEM should follow all the grant notes listed below. Otherwise, further testing and device approvals may be necessary.

The antenna gain, including cable loss, for the radio you are incorporating into your product design must not exceed the requirements at 850 MHz and 1900 MHz as specified by the FCC grant for mobile operations and fixed mounted operations as defined in 2.1091 and 1.1307 of the FCC rules for satisfying RF exposure compliance. Power output listed is conducted.

This device is a mobile device with respect to RF exposure compliance. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons, and must not be collocated or operate in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product guidelines. Installers and end-users must be provided with specific information required to satisfy RF exposure compliance for installations and final host devices. (See note under Grant Limitations.) Compliance of this device in all final host configurations is the responsibility of the Grantee.

## Grant Limitations

This device has been granted modular approval for mobile applications. Portable applications may require further RF exposure (SAR) evaluations. Examples of mobile devices include wireless routers, desktop computers, utility meters, etc. Examples of portable applications include devices such as a laptop, USB dongle, mobile phone, tablet PC, and any device that can be worn on the body during use.

Your final product with this embedded device may need to pass FCC Part 15B.

This device has not been evaluated or approved for simultaneous transmission. Any simultaneous transmission conditions should be evaluated per the current FCC KDB 447498 requirements. Simultaneous transmission requirements for mobile devices are contained in Section 8.

## KDB 447498 Section 8

- a. Transmitters and modules certified for mobile or portable exposure conditions and categorically excluded by § 2.1091(c) can be incorporated in mobile host devices without further testing or certification when:
  - i. The closest separation among all simultaneous transmitting antennas is  $\geq 20$  cm;
  - or
  - ii. The antenna separation distance and MPE compliance boundary requirements that enable all simultaneous transmitting antennas incorporated within the host to comply with MPE limits are specified in the application filing of at least one of the certified transmitters incorporated in the host device. In addition, when transmitters certified for portable use are incorporated in a mobile host device the antenna(s) must be  $\geq 5$  cm from all other simultaneous transmitting antennas.
- b. All antennas in the final product must be at least 20 cm from users and nearby persons.

If the host device requires further authorization, consult an accredited FCC laboratory for guidance.

## FCC Definitions

**Portable: (§2.1093)** — A portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.

**Mobile: (§2.1091)** — A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.

## Host Labeling

The following statements are required to be on the host label:

This device contains FCC ID: {Add the FCC ID of the specific device}

This device contains equipment certified under IC ID: {Add the IC ID of the specific device}

For labeling examples, see Cellular Approvals and Labeling Requirements.

## Coax Cables Specifications

### SMA-to-UFL and RSMA-to-UFL Coax Cables

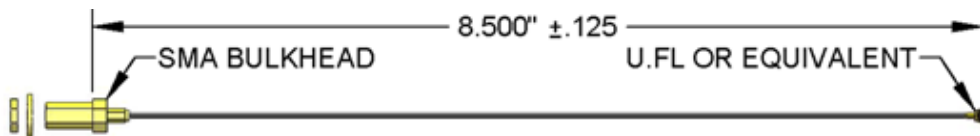
One SMA-to-UFL cable is included in the Developer Kit for use with all cellular modems that have a UFL antenna connector.

A second SMA-to-UFL cable is included in the Developer Kit for use with products that include an optional GPS receiver.

One RSMA-to-UFL cable is included in the Developer Kit for use with the SocketWireless Wi-Fi (MT810SWM-IP).

### Coax Cable Specifications

Cable Type	Coaxial Cable
Attenuation	<1.0db
Connector Impedance	50 ohm
Maximum Cable Length	16" (40 cm)



Optional antenna cables can be ordered from Multi-Tech Systems, Inc.

Part Number	Description
CASMA-UFL-1	SMA-to-UFL Coax Cable (Single Pack)
CASMA-UFL-10	SMA-to-UFL Coax Cable (Ten Pack)
CARSMA-UFL-1	RSMA-to-UFL Coax Cable (Single Pack)
CARSMA-UFL-10	RSMA-to-UFL Coax Cable (Ten Pack)



## Antennas Available from Multi-Tech

Part Number	Quad Band Description	Qty
ANQB-1HRA	Hinged Right Angle 800/900/1800/1900 MHz Cellular Antenna, 7.5"	1
ANQB-10HRA	Hinged Right Angle 800/900/1800/1900 MHz Cellular Antenna, 7.5"	10
ANQB-50HRA	Hinged Right Angle 800/900/1800/1900 MHz Cellular Antenna, 7.5"	50
Part Number	Dual Band Description	Qty
ANF1-1HRA	Hinged Right Angle 900/1800 MHz Cellular Antenna, 4"	1
ANF1-10HRA	Hinged Right Angle 900/1800 MHz Cellular Antenna, 4"	10
ANF1-50HRA	Hinged Right Angle 900/1800 MHz Cellular Antenna, 4"	50
ANCF2-1HRA	Hinged Right Angle 800/1900 MHz Cellular Antenna, 4"	1
ANCF2-10HRA	Hinged Right Angle 800/1900 MHz Cellular Antenna, 4"	10
ANCF2-50HRA	Hinged Right Angle 800/1900 MHz Cellular Antenna, 4"	50
Part Number	Bluetooth and Wi-Fi Description	Qty
ANBT-1	Hinged 2.4 MHz Bluetooth / Wi-Fi Antenna, 4"	1
ANBT-10	Hinged 2.4 MHz Bluetooth / Wi-Fi Antenna, 4"	10
Part Number	Mag Mount Dual Band Description	Qty
ANF1-1MMHW	Mag Mount 900/1800 MHz 1/2 Wave Cellular Antenna, 12.5"	1
ANF1-10MMHW	Mag Mount 900/1800 MHz 1/2 Wave Cellular Antenna, 12.5"	10
ANF1-50MMHW	Mag Mount 900/1800 MHz 1/2 Wave Cellular Antenna, 12.5"	50
ANF1-1MMQW	Mag Mount 900/1800 MHz 1/4 Wave Cellular Antenna, 4"	1
ANF1-10MMQW	Mag Mount 900/1800 MHz 1/4 Wave Cellular Antenna, 4"	10
ANF1-50MMQW	Mag Mount 900/1800 MHz 1/4 Wave Cellular Antenna, 4"	50
ANCF2-1MMHW	Mag Mount 850/1900 MHz 1/2 Wave Cellular Antenna, 12.5"	1
ANCF2-10MMHW	Mag Mount 850/1900 MHz 1/2 Wave Cellular Antenna, 12.5"	10
ANCF2-50MMHW	Mag Mount 850/1900 MHz 1/2 Wave Cellular Antenna, 12.5"	50
ANCF2-1MMQW	Mag Mount 850/1900 MHz 1/4 Wave Cellular Antenna, 4"	1
ANCF2-10MMQW	Mag Mount 850/1900 MHz 1/4 Wave Cellular Antenna, 4"	10
ANCF2-50MMQW	Mag Mount 850/1900 MHz 1/4 Wave Cellular Antenna, 4"	50
Part Number	GPS Description	Qty
ANGPS-1MM	Mag Mount GPS Antenna, 5 Meter Cable	1
ANGPS-10MM	Mag Mount GPS Antenna, 5 Meter Cable	10

## Additional Source of Wi-Fi Antennas

Wi-Fi antennas can be ordered from: Aristotle Enterprises <http://www.aristotle.com.tw>

Part Number	Description
RFA-02-5-F7M3	2.4 GHz 5dBi Swi-Reverse-F Antenna

## Additional Sources of Bluetooth Antennas

Bluetooth antennas can be ordered from the following manufacturers. For the manufacturers listed without specific part numbers, be sure to select the antenna that meets the requirements/specifications.

<http://www.nearson.com> (part number: S131AH-2450S)

<http://www.ead-ltd.com>

<http://www.lairdtech.com/Products/>

<http://www.mobilemark.com>

<http://www.woken.com.tw/>

## Approved Antenna Cable Parts

GC Protronics:20930C

Samtec: ASP-116785-01

The Coax Cable is an RG-178/U

## Global Positioning System (GPS)

This information applies only to the SocketModem iCell GPRS with the GPS option.

### Technical Specifications

Receiver Type	L1 Frequency GPS C/A code SBAS Capable 51 Channel Acquisitions 14 Channel Tracking
Accuracy	Position 2.5m CEP Velocity 0.1m/sec Timing 300ns
Open Sky TTFF	Hot start 1 second Cold start 29 seconds average Reacquisition < 1s
Sensitivity Tracking	-161dBm
Update Rate	1Hz standard
Dynamics	4G
Operational Limits	Altitude < 18,000m or Velocity < 515m/s
Datum	Default WGS-84
Interface	UART
Protocol	NMEA-0183 V3.01, GGA, GLL, GSA, GSV, RMC, VTG

## Features

- Tests 8 million time-frequency hypothesis per sec
- Open sky cold start 29 second
- Signal detection better than –161dBm
- Reacquisition sensitivity –155dBm
- Accuracy 2.5m CEP
- Multipath detection and suppression
- Supports active or passive antenna

## Underwriters Laboratories Required Global Positioning System (GPS) Statement

Note the following information required by Underwriters Laboratories:

Underwriters Laboratories, Inc. (“UL”) has not tested the performance or reliability of the Global Positioning System (“GPS”) hardware, operating software or other aspects of this product. UL has only tested for fire, shock or casualties as outlined in UL’s Standard(s) for Safety. UL60950-1 Certification does not cover the performance or reliability of the GPS hardware and GPS operating software. UL MAKES NO REPRESENTATIONS, WARRANTIES OR CERTIFICATIONS WHATSOEVER REGARDING THE PERFORMANCE OR RELIABILITY OF ANY GPS RELATED FUNCTIONS OF THIS PRODUCT.

## Activating Cellular Device Accounts

Some Multi-Tech cellular modems have been pre-configured to operate on a specific cellular network, such as Sprint or Verizon Wireless.

However, before you can begin to use the modem, you must set up a cellular data account with your cellular network provider. Please refer to Multi-Tech’s Cellular Activation Web site <http://www.multitech.com/activation.go> for information on activating your cellular modem.

## Cellular Approvals and Labeling Requirements

### Approvals and Certification

The Multi-Tech SocketModem is Industry and/or Carrier Approved as an End Product modem. In most cases, when integrated and used with an antenna system that was part of the Multi-Tech modem certification, no additional approvals or certifications are required (however, CDMA has a few exceptions) for the device you develop as long as the following are met:

### PTCRB Requirements:

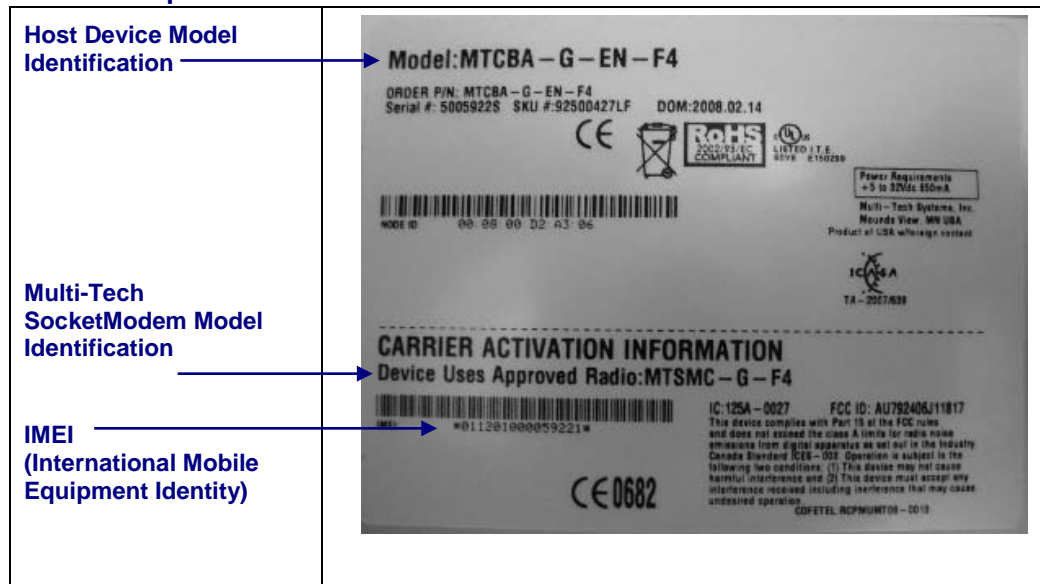
- The antenna system cannot be altered.

### Model Identification:

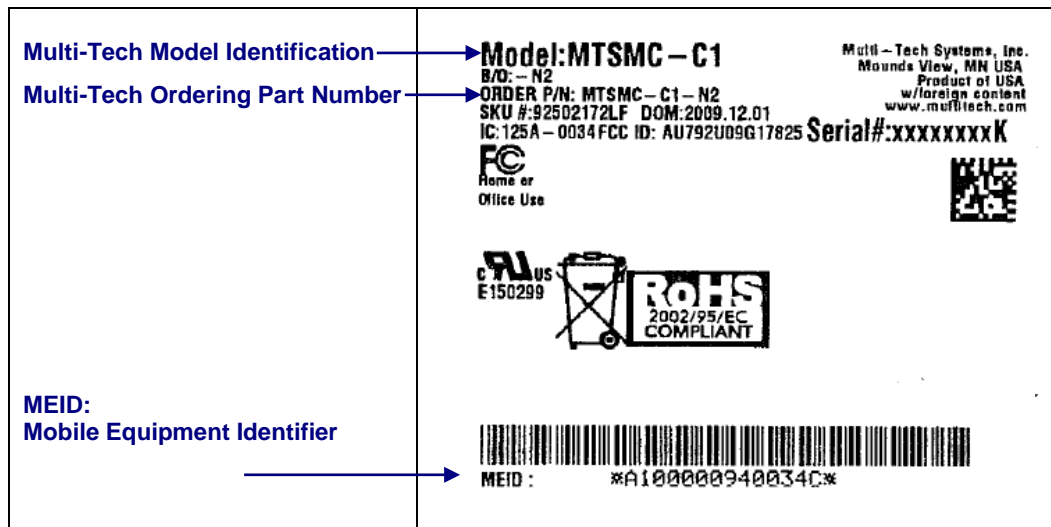
#### **IMPORTANT**

When the cellular carrier asks you to provide the modem's model identification, give the Multi-Tech cellular model identification, not the identification of the host device model. See the label example below.

The Multi-Tech model identification allows the carrier to verify the modem as one of its approved models. This information is located on the modem's label.

**End Product GPRS Label Example:****CDMA-C1 SocketModem Label Example:**

**Note:** The label is shown larger than actual size.

**Other Information the Cellular Carrier Asks You to Provide:**

- **For CDMA** SocketModems: The modem's MEID (Mobile Equipment Identifier) is printed under the barcode on the modem.
- **For GSM** SocketModems: The modem's 15-character IMEI (International Mobile Equipment Identity) number is printed on the modem's label.

# Safety Notices and Warnings

**Note to OEMS:** The following safety statements may be used in the documentation of your final product applications.

## Cellular Safety

### RF Safety

The remote modems are cellular devices. It is important to follow any special regulations regarding the use of radio equipment due in particular to the possibility of Radio Frequency (RF) interference.

**Caution:** A separation distance of at least 20 cm must be maintained between the modem transmitter's antenna and the body of the user or nearby persons. The modem is not designed for or intended to be used in portable applications within 20 cm of the body of the user.

Check your local standards regarding safe distances, etc.

- Operation of a cellular modem close to other electronic equipment may also cause interference if the equipment is inadequately protected. Observe any warning signs and manufacturers' recommendations.
- Different industries and businesses have their own restriction governing the use of cellular devices. Please observe the local restriction of the environment where you intend to operate the cell modem.
- Under no circumstances should antenna be placed outdoors.

### Vehicle Safety

- Do not use your cellular device while driving.
- Respect national regulations on the use of cellular telephones in vehicles. Road safety always comes first.
- If incorrectly installed in a vehicle, the operation of a cellular telephone could interfere with the correct functioning of vehicle electronics. To avoid such problems, be sure that qualified personnel have performed the installation. Verification of the protection of vehicle electronics should be part of the installation.
- The use of an alert device to operate a vehicle's lights or horn on public roads is not permitted.
- UL has evaluated this device for use in ordinary locations only. Installation in a vehicle or other outdoor locations has not been evaluated by UL. UL Certification does not apply or extend to use in vehicles or outdoor applications or in ambient above 40° C.

### Maintenance of Your Cellular Device

Your cellular device is the product of advanced engineering, design, and craftsmanship and should be treated with care. The suggestions below will help you to enjoy this product for many years.

- Do not attempt to disassemble the cellular device. There are no user serviceable parts inside.
- Do not expose the cellular device to water, rain, or spilled beverages. It is not waterproof.
- Do not place the cellular device alongside computer discs, credit or travel cards, or other magnetic media. The phone may affect the information contained on discs or cards.
- The use of accessories not authorized by Multi-Tech or not compliant with Multi-Tech's accessory specifications may invalidate the warranty of the cellular device.
- In the unlikely event of a fault in the cellular device, contact Multi-Tech Tech Support.

## 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 build-up, proper precautions should be taken to avoid exposure to electronic discharge during handling and mounting.

## Your Responsibility

This cellular device is your responsibility. Please treat it with care respecting all local regulations. It is not a toy. Therefore, keep it in a safe place at all times and out of the reach of children.

Try to remember your Unlock and PIN codes. Become familiar with and use the security features to block unauthorized use and theft.

## Regulatory Compliance Statements

### Country/Region-Specific Statements



### EMC, Safety, and R&TTE Directive Compliance

Some models have received CE certification. If you need CD compliance, check with your sales representative.

The CE mark is affixed to this product to confirm compliance with the following European Community Directives:

- Council Directive 2004/108/EC of 15 December 2004 on the approximation of the laws of Member States relating to electromagnetic compatibility;

- and

- Council Directive 2006/95/EC of 12 December 2006 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits;

- and

- Council Directive 1999/5/EC of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity.

### International Modem Restrictions

Some dialing and answering defaults and restrictions may vary for international modems. Changing settings may cause a modem to become non-compliant with national telecom requirements in specific countries. Also note that some software packages may have features or lack restrictions that may cause the modem to become non-compliant.

## EMC Requirements for the United States

### 47 CFR – FCC Part 15 Regulation – Class B

This equipment has been tested and found to comply with the limits for a **Class B** digital device, pursuant to 47 CFR – FCC Part 15 regulations. The stated limits in this regulation are designed to provide reasonable protection against harmful interference in a residential environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Plug the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with 47 CFR – FCC Part 15 rules. Operation of this device is subject to the following conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference that may cause undesired operation.

**Warning:** Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

## EMC Requirements for Industry Canada

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement Canadien sur le matériel brouilleur.

This device complies with Industry Canada RSS Appliance radio exempt from licensing. The operation is permitted for the following two conditions:

- (1) the device may not cause harmful interference, and
- (2) the user of the device must accept any interference suffered, even if the interference is likely to jeopardize the operation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

## Waste Electrical and Electronic Equipment Statement

**Note to OEMs:** The statement is included for your information and may be used in the documentation of your final product applications.

### WEEE Directive

The WEEE directive places an obligation on EU-based manufacturers, distributors, retailers, and importers to take-back electronics products at the end of their useful life. A sister Directive, ROHS (Restriction of Hazardous Substances) complements the WEEE Directive by banning the presence of specific hazardous substances in the products at the design phase. The WEEE Directive covers all Multi-Tech products imported into the EU as of August 13, 2005. EU-based manufacturers, distributors, retailers and importers are obliged to finance the costs of recovery from municipal collection points, reuse, and recycling of specified percentages per the WEEE requirements.

### Instructions for Disposal of WEEE by Users in the European Union

The symbol shown below is on the product or on its packaging, which indicates that this product must not be disposed of with other waste. Instead, it is the user's responsibility to dispose of their waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service or where you purchased the product.

July, 2005





# Restriction of the Use of Hazardous Substances (RoHS)



## Multi-Tech Systems, Inc. Certificate of Compliance 2002/95/EC

Multi-Tech Systems Inc. confirms that its embedded products now comply with the chemical concentration limitations set forth in the directive **2002/95/EC** of the European Parliament (Restriction Of the use of certain Hazardous Substances in electrical and electronic equipment - **RoHS**)

These Multi-Tech Systems, Inc. products do not contain the following banned chemicals:

- Lead, [Pb] < 1000 PPM
- Mercury, [Hg] < 1000 PPM
- Hexavalent Chromium, [Cr+6] < 1000 PPM
- Cadmium, [Cd] < 100 PPM
- Polybrominated Biphenyl, [PBB] < 1000 PPM
- Polybrominated Diphenyl Ether, [PBDE] < 1000 PPM

Additionally:

- Moisture Sensitivity Level (MSL) =1
- Maximum Soldering temperature = 260C (wave only)

Notes:

1. Lead usage in some components is exempted by the following RoHS annex; therefore, higher lead concentration would be found in some QuickCarrier USB devices (>1000ppm).
  - a. Lead in high melting temperature type solders (i.e., tin-lead solder alloys containing more than 85% lead).
  - b. Lead in electronic ceramic parts (e.g., piezoelectronic devices).
2. Moisture Sensitivity Level (MSL) – Analysis is based on the components/material used on the board.

## Information on HS/TS Substances According to Chinese Standards in English

In accordance with China's Administrative Measures on the Control of Pollution Caused by Electronic Information Products (EIP) # 39, also known as China RoHS, the following information is provided regarding the names and concentration levels of Toxic Substances (TS) or Hazardous Substances (HS) which may be contained in Multi-Tech Systems Inc. products relative to the EIP standards set by China's Ministry of Information Industry (MII).

Name of the Component	Hazardous/Toxic Substance/Elements					
	Lead (PB)	Mercury (Hg)	Cadmium (CD)	Hexavalent Chromium (CR6+)	Polybrominated Biphenyl (PBB)	Polybrominated Diphenyl Ether (PBDE)
Printed Circuit Boards	O	O	O	O	O	O
Resistors	X	O	O	O	O	O
Capacitors	X	O	O	O	O	O
Ferrite Beads	O	O	O	O	O	O
Relays/Opticals	O	O	O	O	O	O
ICs	O	O	O	O	O	O
Diodes/ Transistors	O	O	O	O	O	O
Oscillators and Crystals	X	O	O	O	O	O
Regulator	O	O	O	O	O	O
Voltage Sensor	O	O	O	O	O	O
Transformer	O	O	O	O	O	O
Speaker	O	O	O	O	O	O
Connectors	O	O	O	O	O	O
LEDs	O	O	O	O	O	O
Screws, Nuts, and other Hardware	X	O	O	O	O	O
ac-dc Power Supplies	O	O	O	O	O	O
Software / Documentation CDs	O	O	O	O	O	O
Booklets and Paperwork	O	O	O	O	O	O
Chassis	O	O	O	O	O	O

- X** Represents that the concentration of such hazardous/toxic substance in all the units of homogeneous material of such component is higher than the SJ/Txxx-2006 Requirements for Concentration Limits.
- O** Represents that no such substances are used or that the concentration is within the aforementioned limits.

# Information on HS/TS Substances According to Chinese Standards in Chinese

## 依照中国标准的有毒有害物质信息

根据中华人民共和国信息产业部 (MII) 制定的电子信息产品 (EIP)

标准—中华人民共和国《电子信息产品污染控制管理办法》(第 39 号), 也称作中国 RoHS, 下表列出了 Multi-Tech Systems, Inc. 产品中可能含有的有毒物质 (TS) 或有害物质 (HS) 的名称及含量水平方面的信息。

成分名称	有害/有毒物质/元素					
	铅 (PB)	汞 (Hg)	镉 (CD)	六价铬 (CR6+)	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印刷电路板	O	O	O	O	O	O
电阻器	X	O	O	O	O	O
电容器	X	O	O	O	O	O
铁氧体磁环	O	O	O	O	O	O
继电器/光学部件	O	O	O	O	O	O
IC	O	O	O	O	O	O
二极管/晶体管	O	O	O	O	O	O
振荡器和晶振	X	O	O	O	O	O
调节器	O	O	O	O	O	O
电压传感器	O	O	O	O	O	O
变压器	O	O	O	O	O	O
扬声器	O	O	O	O	O	O
连接器	O	O	O	O	O	O
LED	O	O	O	O	O	O
螺丝、螺母以及其它五金件	X	O	O	O	O	O
交流-直流电源	O	O	O	O	O	O
软件/文档 CD	O	O	O	O	O	O
手册和纸页	O	O	O	O	O	O
底盘	O	O	O	O	O	O

**X** 表示所有使用类似材料的设备中有害/有毒物质的含量水平高于 SJ/Txxx-2006 限量要求。

**O** 表示不含该物质或者该物质的含量水平在上述限量要求之内。

## Chapter 2 – SocketModem® Cell & iCell GPRS (MTSMC-G2)

The MTSMC-G2 is a serial to cellular quad-band GPRS SocketModem. It is a complete, ready-to-integrate SocketModem that offers standards-based multi-band GSM/GPRS Class 10 performance. It is based on industry-standard open interfaces and utilizes Multi-Tech's universal socket design. The SocketModem is available with the Multi-Tech's *Universal IP™* stack to bring embedded Internet connectivity to any device.

### Network Activation

Note the following:

- These units ship without network activation.
- To connect to the cellular network, you will need a cellular account. See the Cellular Activation procedures in Chapter 1.

### Product Build Options and Ordering Information

Product	Description	Region
MTSMC-G2	Quad-band SocketModem Cell GPRS	US Default
MTSMC-G2-ED	Quad-band SocketModem Cell GPRS	EU Default
MTSMC-G2-V	Quad-band SocketModem Cell GPRS with Voice	US Default
MTSMC-G2-V-ED	Quad-band SocketModem Cell GPRS with Voice	EU Default
MTSMC-G2-IP	Quad-band SocketModem iCell GPRS with Universal IP	US Default
MTSMC-G2-IP-ED	Quad-band SocketModem iCell GPRS with Universal IP	EU Default
MTSMC-G2-GP	Quad-band SocketModem Cell GPRS with GPS with Universal IP	US Default
MTSMC-G2-GP-ED	Quad-band SocketModem Cell GPRS with GPS with Universal IP	EU Default
<b>Developer Kit</b>		
MTSMI-UDK	Universal Developer Kit	Global

#### Product Codes in the Table Above:

- G2 GPRS
- GP Dedicated GPS Receiver
- ED European Default is 900/1800 MHz  
**Note:** US Default is 850/1900 MHz
- V Voice (microphone and speaker)
- IP Universal IP™ Stack
- UDK Universal Developer Kit

#### Other Product Codes:

- The complete product code may end in **.Rx**. For example, MTSMC-G2.Rx.
- "R" indicates product revision. "x" is the revision number.

**Note:** All products can be ordered in single packs or 50-packs. Single pack product codes end in SP.

# AT Commands

Your Developer Kit CD contains AT Reference Guides for all embedded products. They are also available by email request to [oemsales@multitech.com](mailto:oemsales@multitech.com) or through the online Developer's Guide Request Form on the Multi-Tech website.

Products	AT Commands Reference Guide Title & Document Number	Voice Commands
SocketModem Cell (MTSMC-G2 and MTSMC-G2-V )	GPRS AT Commands for Multi-Tech G2 Cellular Modems (S000463x) AT Commands for Multi-Tech G2 Cellular Modems with IP Connectivity (S000469x)	For G2-V (Voice) build only
SocketModem iCell (MTSMC-G2-IP & MTSMC-G2-GP)	GPRS AT Commands for Multi-Tech G2 Cellular Modems (S000463x) Universal IP Commands (S000457x)	For G2-V (Voice) build only

# Technical Specifications

The SocketModem Cell and SocketModem iCell (MTSMC-G2 and MTSMC-G2-V) meet the following specifications:

Category	Description
Standards	GPRS Class 10
Frequency Bands	Quad-band GSM/EGPRS 850/900/1800/1900 MHz
Serial/Data Speed	Serial interface supports DTE speeds up to 921.6K IP interface supports DTE speeds at the fixed rate of 115.2 Packet data up to 85.6K bps Circuit-switched data (GPRS) up to 14.4K bps transparent and non-transparent Supports data rates of 921600, 460800, 230400, 115200 bps
Data Format	10 bit Serial Asynchronous
Data Error Correction	MNP2
Data Compression	V.42bis
Weight	1 oz. (28 g)
Size	3.15" x 1.375" (80.010 mm x 34.925 mm)
Operating Temperature	-40° C to +85° C
Storage Temperature	-40 °C to +85°C
Humidity	10% to 90%
Input Power	5VDC
Operating Voltage	Supply Range: VCC Maximum: 5.5
Voltage at Any Signal Pin	Minimum: GND Maximum: VCC
Antenna Connector	Surface mount UFL (one for cellular and one for GPS)
SIM Holder	Standard 1.8V and 3V SIM holder
IP Protocols Supported	MTSMC-G2, MTSMC-G2-V DNS Resolve, FTP Client, LCP, PPP (dial-out),TCP socket, UDP socket, PAP & CHAP authentication MTSMC-G2-IP, MTSMC-G2-GP DNS Client, FTP Client, ICMP (Ping), POP3 Client, SMTP Client, TCP Client & Server, UDP Client & Server, IP, PPP (dial-out) with PAP & CHAP authentication
M2M Applications	MTSMC-G2-IP, MTSMC-G2-GP Automatic connect/reconnect, device monitor, modem emulation, Ping & TCP

Category	Description
	keep alive, wake-up on caller ID, wake-up on ring, GPS tracking (GP model only)
Compliance	EMC Compliance FCC Part 15 EN55022 EN55024 Radio Compliance FCC Part 22 FCC Part 24 RSS 132 RSS 133 EN 301 511 EN 301 489-1 EN 301 489-7 AS/ACIF S042.1 AS/ACIF S042.3 Safety Compliance UL 60950-1 cUL 60950-1 IEC 60950-1 AS/NZS 60950-1 Network Compliance PTCRB
Warranty	Two years

**Note:** The radio's performance may be affected at the temperature extremes. This is considered normal. The radio is designed to automatically fallback in class and reduces transmitter power to avoid damage to the radio. There is no single cause for this function. Rather, it is the result of an interaction of several factors, such as the ambient temperature, the operating mode and the transmit power.

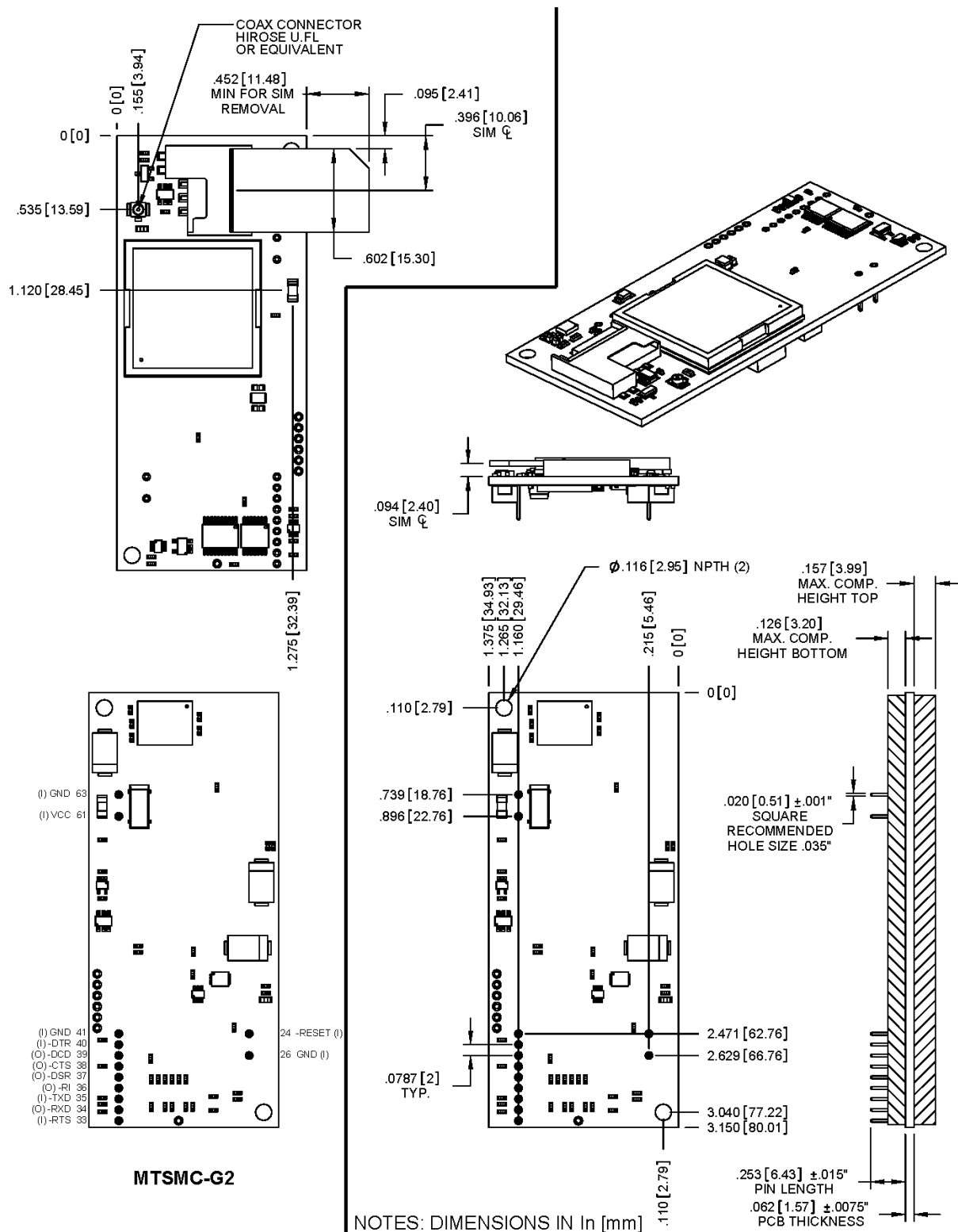
## Mounting Hardware on the Board

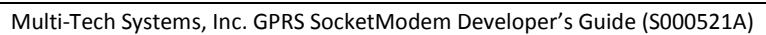
It is recommended that nylon hardware be used if the SocketModems are to be mounted on the board using the two tooling holes on the board due to possible traces and vias around the tooling holes.

- Use #4 or M2/M3 hardware to mount the SocketModem® Cell & SocketModem® iCell GPRS (MTSMC-G2) to the board.

# Mechanical Drawings

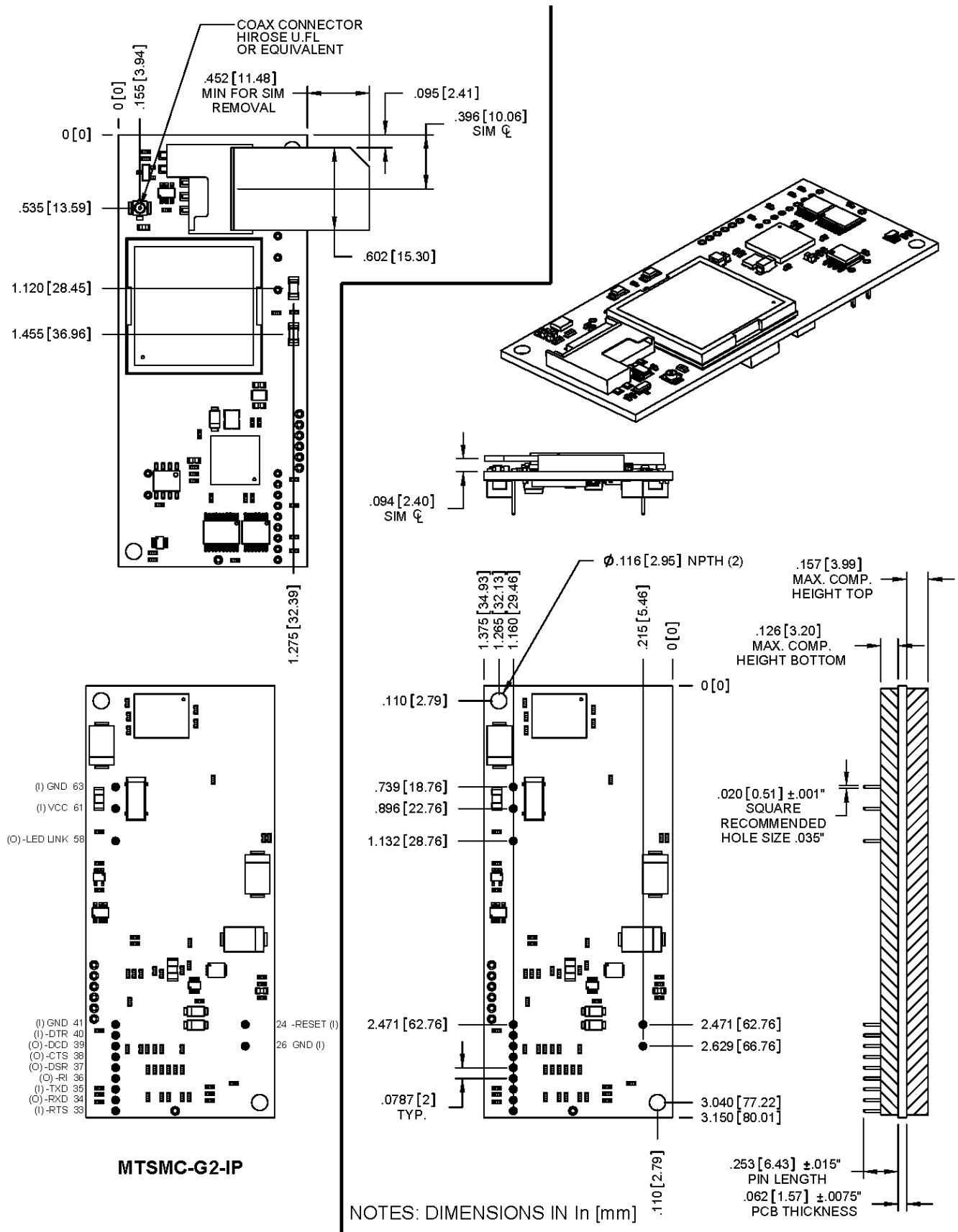
## MTSMC-G2 Build



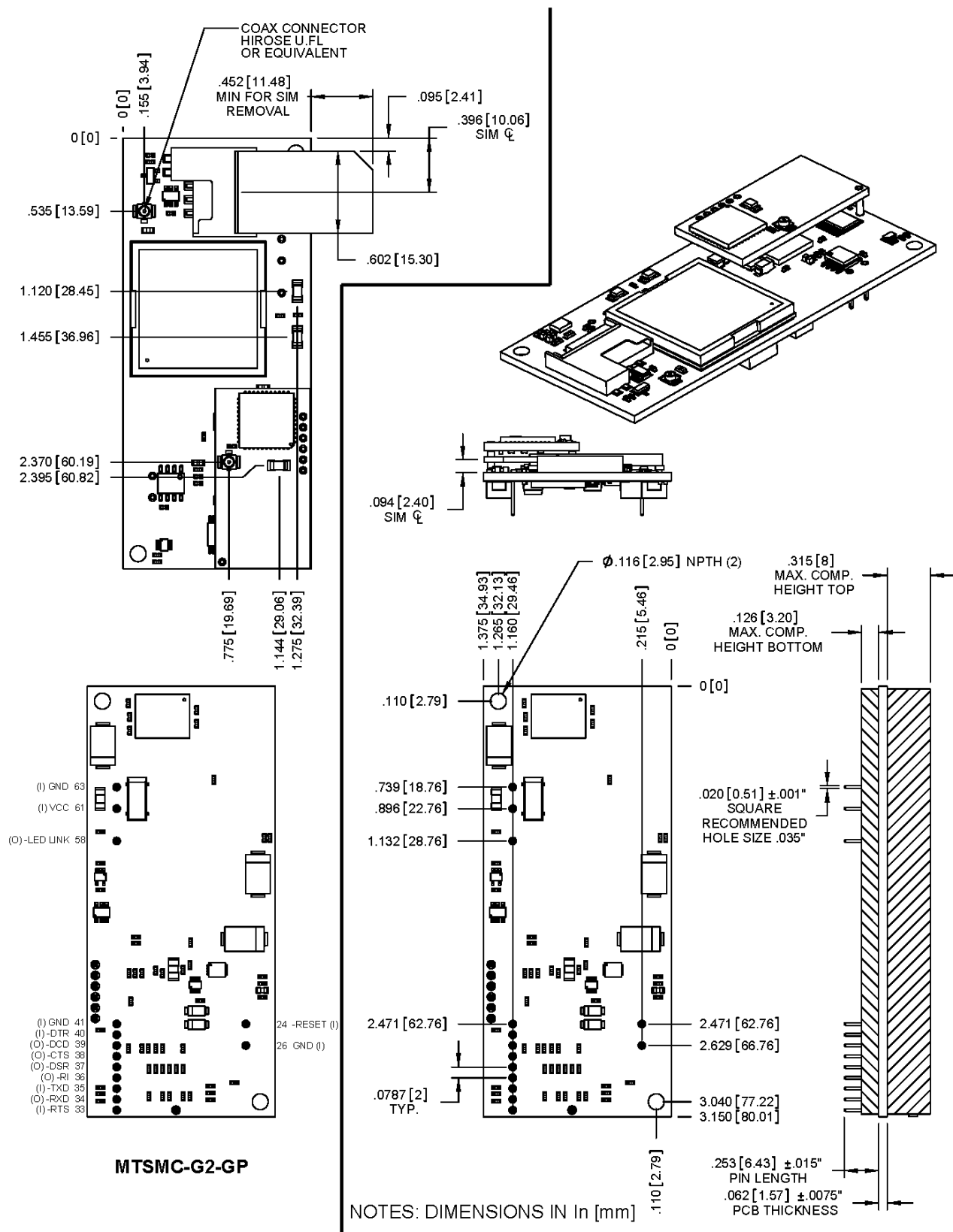




# MTSMC-G2-IP Build



# MTSMC-G2 GP (GPS) Build



# DC Electrical Characteristics

Units: Volts

5V DC Characteristics (VDD = 5V ± 0.25V) VDDMAX = 5.25V

Parameter	Minimum	Maximum
<b>Digital Signal Input Low Level</b> –DTR (40), –TXD (35), –RTS (33)	GND	0.8
<b>Digital Signal Input High Level</b> –DTR (40), –TXD (35), –RTS (33)	2	Vcc
<b>Digital Signal Output Low Level</b> –DCD (39), –CTS (38), –DSR (37), –RI (36), –RXD (34)		0.4
<b>Digital Signal Output High Level</b> –DCD (39), –CTS (38), –DSR (37), –RI (36), –RXD (34)	3.84	
<b>Reset (Low Active) Input Low Level</b> –Reset (24)		0.8
<b>Reset (Low Active) Input High Level</b> –Reset (24)	2	
<b>Digital Input Capacitance</b>	14pF	

## Power Measurements

Basic and Voice Builds, MTSMC-G2 and MTSMC-G2-V, Measured Power\* at Input Voltage 5.00

	Sleep Mode	Typical	Maximum	Peak TX	Peak RST
Current (AMPS)	0.015	0.113	0.24	1.40	1.60
Watts	0.074	0.564	1.195		

IP Build, MTSMC-G2-IP, Measured Power\* at Input Voltage 5.00

	Sleep Mode	Typical	Maximum	Peak TX	Peak RST
Current (AMPS)	0.080	0.135	0.280	1.40	1.70
Watts	0.382	0.664	1.358		

GP Build, MTSMC-G2-GP (for GPS,) Measured Power\* at Input Voltage 5.00

	Sleep Mode	Typical	Maximum	Peak TX	Peak RST
Current (AMPS)	0.121	0.225	0.370	1.60	1.85
Watts	0.598	1.11	1.81		

\* Multi-Tech Systems, Inc. recommends that the customer incorporate a 10% buffer into their power source when determining product load.

# Application Notes

## LED Interface

The LED signal is used to indicate the working status of the SocketModem.

### LED 1 – Link Status – Available for G2, G2-V, G2-IP, and G2-GP Builds

LED 1 Signal	Link Status LED	
OFF	Download mode or switched OFF	
ON	Continuously lit	Switched ON (not registered on the network)
	Blinking	Switched ON (registered on the network)

### LED 2 – Heartbeat LED – Available for G2-IP and G2-GP Builds

LED 2 Signal	Heartbeat LED
OFF	No power to the unit
Blinking	The unit is functioning

## RF Performances

RF performances are compliant with the ETSI recommendation 05.05 and 11.10.

### Receiver Features

Category	Description
850 GSM Sensitivity	-108
900 E-GSM Sensitivity	-108
1800 DCS Sensitivity	-107
1900 PCS Sensitivity	-107

### Transmitter Features

Category	Description
Maximum output power (GSM/E-GSM)	+33 dBm $\pm$ 2 dB
Maximum output power (DCS/PCS)	+30 dBm $\pm$ 2 dB

### RF Connection and Antenna

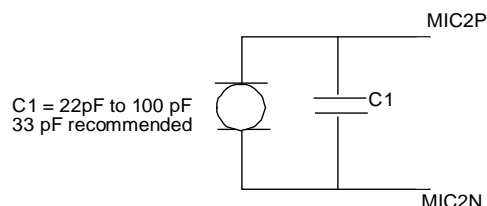
The RF connector on the SocketModem GPRS is a UFL standard type. See Chapter 1 for [Antenna](#) details.

## Microphone Inputs

**Note:** For Voice Build Only.

The MIC inputs are differential ones. They already include the convenient biasing for an electret microphone (0.5 mA and 2 Volts). This electret microphone can be directly connected on these inputs. The impedance of the microphone has to be around 2K. These inputs are the standard ones for a handset design.

The gain of the MIC inputs is internally adjusted. The gain can be tuned from 30dB to 51dB. The connection to the microphone is direct.



## Changing the Quad Band

If for any reason, such as moving the modem from one geographical area to another, you want to change the band, you can accomplish this by using the **+WMBS** AT Command.

### Steps for Changing the GSM Band

Use a terminal application such as HyperTerminal for entering the AT Command.

1. To open HyperTerminal, click **Start**. Then select **Programs > Accessories > Communications**. Then click **HyperTerminal**.
2. When the command window opens, type **AT+WMBS=<Band><Param>**. Press **Enter**.
3. For **<Band>**, enter the option you desire:
  - 4** = Dual-band mode 850/1900MHz
  - 5** = Dual-band mode 900/1800MHz
 For **<Param>**, enter the option you desire:
  - 0** = Modem must be reset in order to use the specified band(s). This is the default.
  - 1** = Modem restarts immediately using the specified band(s).

Example: **AT+WMBS=4,0**. Press **Enter**.