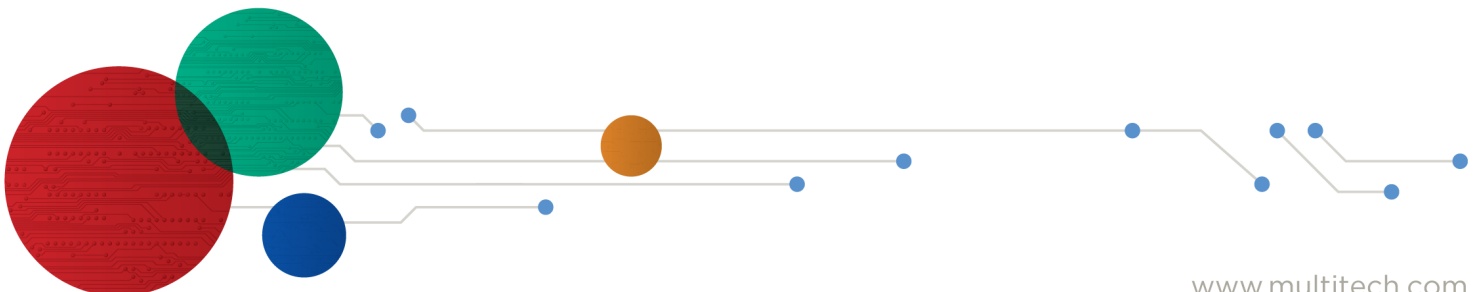


SocketModem® Cell

MTSMC-MAT1 Device Guide



SocketModem® Cell Device Guide

Models: MTSMC-MAT1, MTSMC-MAT1-U

Part Number: S000669, Version 1.0

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To create an account and submit a support case directly to our technical support team, visit: <https://support.multitech.com>.

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Warranty

To read the warranty statement for your product, visit www.multitech.com/warranty.go. For other warranty options, visit www.multitech.com/es.go.

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Chapter 1 – Chapter 1 Product Overview

Product Overview

SocketModem Cell models are complete, ready-to-integrate communications devices that offer standards-based LTE Cat M1 performance. Designed for IoT applications, these models offer enhanced coverage and optimized power consumption. These quick-to-market communications devices allow developers to add wireless communication to products with a minimum of development time and expense. SocketModem Cell models are based on industry-standard open interfaces and use MultiTech's Universal Socket design.

Documentation

The following documentation is available at multitech.com/support.

Document	Description	Part Number
SocketModem Cell Cat-M1 MTSMC-MAT1 Device Guide	This document. Provides overview, safety and regulatory information, design considerations, schematics, and device information.	S000669
Universal Developer Kit 2.0 Developer Guide	Information for developing with the MTUDK2 Developer Kit. Includes an overview, design considerations, schematics, and installation and operation information.	S000610
USB Driver Installation Guide for Cat M1 Devices	Instructions for installing USB drivers on Linux and Windows Systems.	S000676
Telit ME910C1 AT Commands Reference Guide	Lists AT Commands and parameters used to configure your device.	80529ST10815A Rev.2

Product Build Options

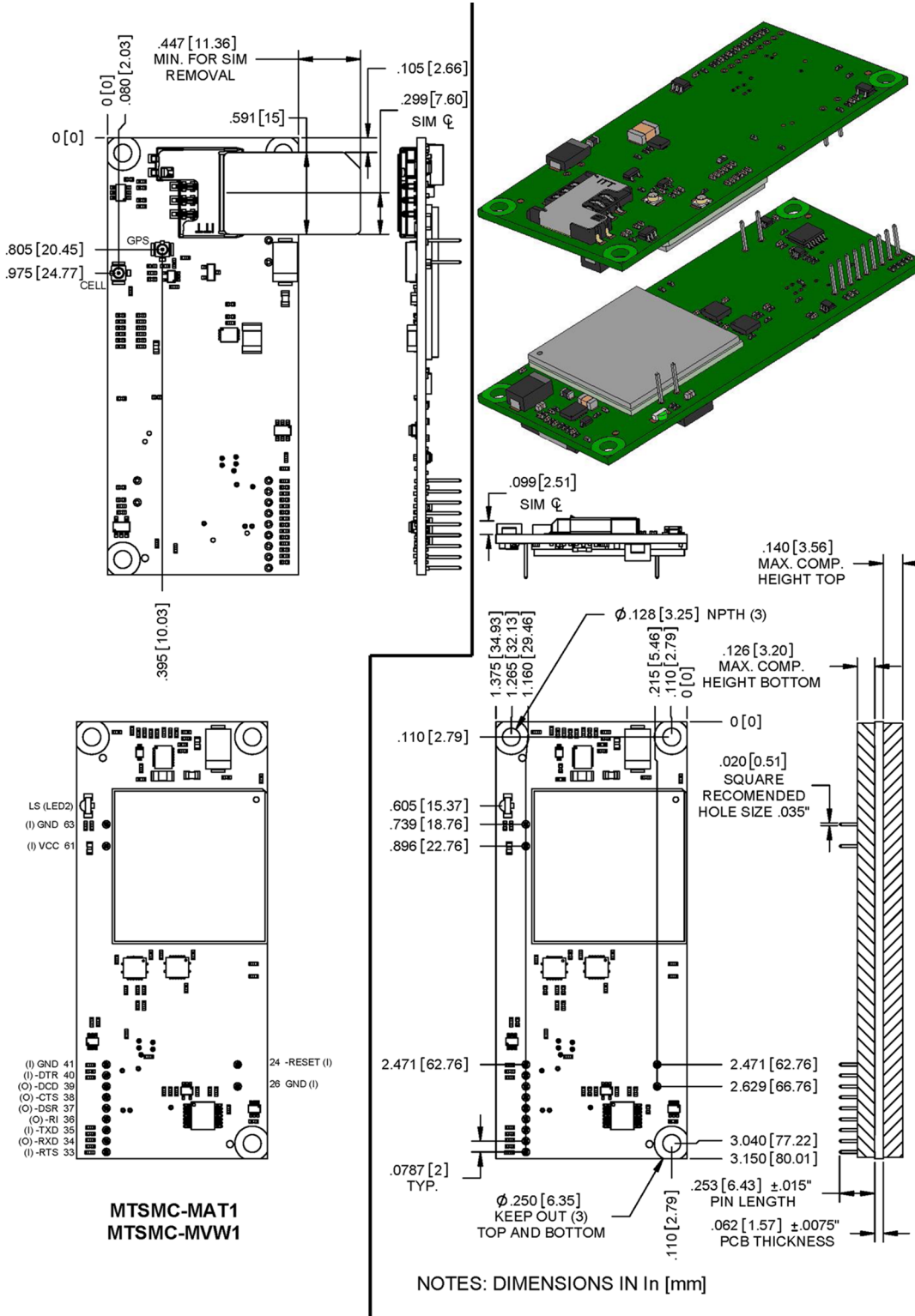
Product	Description	Carrier/Region
MTSMC-MAT1	Embedded LTE Cat M1 serial modem with GNSS	AT&T
MTSMC-MAT1-U	Embedded LTE Cat M1 USB modem with GNSS	AT&T
Developer Kit		
MTUDK2-ST-Cell	Developer Kit for SocketModem and Dragonfly cellular devices.	All

Note:

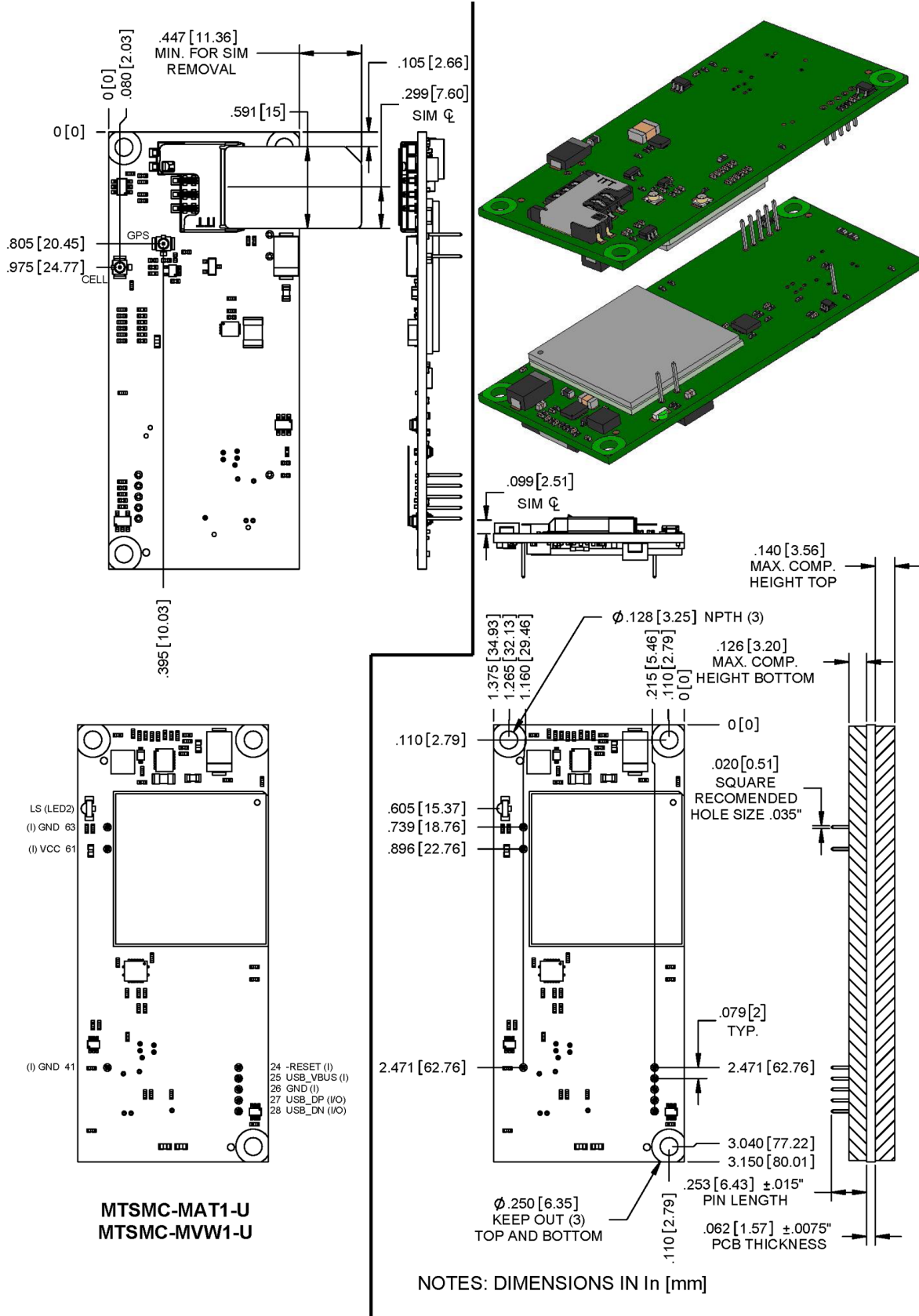
- These units ship without network activation.
- To connect them to the cellular network, you need a cellular account. For more information, refer to Account Activation.
- The complete product code may end in .Rx. For example, MTSMC-MAT1.Rx, where R is revision and x is the revision number.
- All builds can be ordered individually or in 50-packs. Add SP to the model number for a single pack.

Chapter 2 – Chapter 2 Mechanical Drawings

MTSMC-Mxx1



MTSMC-Mxx1-U



Chapter 3 – Chapter 3 Specifications

MTSMC-MAT1 and MTSMC-MAT1-U Specifications

Category	Description
General	
Standards	LTE UE Category M1/NB1, 3GPP release 13 compliant
	USB Interface is CDC-ACM compliant
TCP/IP Functions	FTP, SMTP, SSL, TCP, UDP
Frequency Bands	4G: 1900 (B2) / 700 (B12) / AWS 1700 (B4)
Speed	
Data Speed	LTE Cat M1: Up to 375 Kbps uplink / Up to 300 Kbps downlink
Interface	
USB Interface	USB 2.0 high speed 480 Mbps
Serial Modem Interface	Up to 921.6 Kbps
Physical Description	
Weight	0.4 oz. (10 g)
Dimensions	Refer to Mechanical Drawing for Dimensions.
Connectors	
Antenna Connector	1 surface mount UFL connector for cellular and 1 for GNSS
SIM	1.8V and 3V SIM holder for mini-SIM card
Environment	
Operating Temperature	-40° C to +85° C
Humidity	20%-90% RH, non-condensing
Power Requirements	
Operating Voltage	3.1 V to 3.5 V, normal is 3.3 V
Input Voltage	3.3-5 VDC
SMS	
SMS	Point-to-Point messaging
	Mobile-Terminated SMS
	Mobile-Originated SMS

Category	Description
Certifications and Compliance	
EMC and Radio Compliance	FCC Part 15 Class B
	FCC Part 22
	FCC Part 24
Safety Compliance	UL 60950-1 2nd ED
Carrier	AT&T/PTCRB

Powering Down Your Device

CAUTION: Failing to properly power down the device before removing power may corrupt your device's file system.

To properly power down your device, use the following sequence or pull 3G_ONOFF signal low:

1. Issue the AT#SHDN command.
2. Wait 30 seconds.
3. Power off or disconnect power.

Note: If you send AT#SHDN and do not remove power AND the 3G_ONOFF line is high, the control chip on the device turns the radio back on after 60 seconds.

UART DC Electrical Characteristics

Units: Volts

Applies to the following pins:

Pin	Signal Name	Pin	Signal Name
J33	-RTS	J37	-DSR
J34	-RXD	J38	-CTS
J35	-TXD	J39	-DCD
J36	-RI	J40	-DTR

Parameter	Minimum	Maximum
3.3 Volt Powered		
Input Low Level	0	0.55
Input High Level	1.5	3.3
Output Low Level	0	0.55
Output High Level	2.35	3.3
5 Volt Powered		
Input Low Level	0	0.8

Parameter	Minimum	Maximum
Input High Level	2.3	5
Output Low Level	0	0.55
Output High Level	3.7	5

Absolute Maximum Rating

All models can run with an input voltage of either 3.3V or 5V. The maximum voltage on any signal pin equals the input voltage.

Electrical Characteristics Other Pins

Pin	Signal Name	VIL Min	VIL Max	VIH Min	VIH Max	VOL Min	VOL Max	VOH Min	VOH Max
J24	-RESET	--	0.8	2.0	--	--	--	--	--
J25	USB VBUS	-0.3	0.8	2.0	8.7	--	--	--	--
J26	GND	--	--	--	--	--	--	--	--
J27	USB DP	--	0.8	2	--	--	0.3	2.8	--
J28	USB DN	--	0.8	2	--	--	0.3	2.8	--
J41	GND	--	--	--	--	--	--	--	--
J58	-LED LINK	--	--	--	--	0	0.45	2.85	3.3
J61	VCC	--	--	--	--	--	--	--	--
J63	GND	--	--	--	--	--	--	--	--

Pinout Specifications

Pin	Signal Name	Logic Level Voltage ¹	In/Out	Description
J24	-RESET	3.3 – 5.0	I	Device reset (active low)
J25	USB VBUS	3.3 – 5.0	I	USB power supply input
J26	GND	GND	GND	Ground
J27	USB DP	3.3	I/O	USB data
J28	USB DN	3.3	I/O	USB data
J33	-RTS	5.0	I	Request to send (active low)
J34	-RXD	5.0	O	Received data (active low)
J35	-TXD	5.0	I	Transmitted data (active low)
J36	-RI	5.0	O	Ring indicator (active low)
J37	-DSR	5.0	O	Data set ready (active low)
J38	-CTS	5.0	O	Clear to send (active low)

Pin	Signal Name	Logic Level Voltage ¹	In/Out	Description
J39	–DCD	5.0	O	Data carrier detect (active low)
J40	–DTR	5.0	I	Data terminal ready (active low)
J41	GND	GND	GND	Ground
J58	–LED LINK	3.3	O	Link status (active low, can sink up to 150mA)
J61	VCC	5.0	PWR	DC input power
J63	GND	GND	GND	Ground

¹ A hyphen (-) indicates a range of acceptable logic levels.

Pin Availability by Build

Pin	Signal Name	Serial Only	USB Only
J24	–RESET	X	X
J25	USB VBUS		X
J26	GND	X	X
J27	USB DP		X
J28	USB DN		X
J33	–RTS	X	
J34	–RXD	X	
J35	–TXD	X	
J36	–RI	X	
J37	–DSR	X	
J38	–CTS	X	
J39	–DCD	X	
J40	–DTR	X	
J41	GND	X	X
J58	–LED LINK		X
J61	VCC	X	X
J63	GND	X	X

Power Measurements

Multi-Tech Systems, Inc. recommends that you incorporate a 10% buffer into your power source when determining product load.

Note:

The following notes apply to the following tables.

- **Tx Pulse:** The average peak current during an LTE connection.
- **Maximum Power:** The continuous current during maximum data rate with the radio transmitter at maximum power.
- **Inrush Charge:** The input current during power up, or a reset.

MTSMC-MAT1 Power Draw

Radio Protocol	Sleep Mode Current (if applicable)	Cellular Connection Idle No Data	Average Measured Current (Amps) at Maximum Power	TX Pulse (Avg) Amplitude Current (Amps) Peak Current for LTE	Total Inrush Charge Measured in Millicoulombs
3.3 Volts					
LTE	12 mA	22 mA	164 mA	472 mA	1.65 mC
5 Volts					
LTE	6 mA	13 mA	112 mA	196 mA	1.65 mC

MTSMC-MAT1-U Power Draw

Radio Protocol	Sleep Mode Current (if applicable)	Cellular Connection Idle No Data	Average Measured Current (Amps) at Maximum Power	TX Pulse (Avg) Amplitude Current (Amps) Peak Current for LTE	Total Inrush Charge Measured in Millicoulombs
3.3 Volts					
LTE	NA	54 mA	200 mA	444 mA	1.46 mC
5 Volts					
LTE	NA	32 mA	145 mA	316 mA	1.45 mC

Mounting Hardware

The board has three mounting holes at corners. Use #4 or M3 hardware for mounting the SocketModem to the board. Refer to the Mechanical Drawings for more information.

Recommended Parts

Manufacturer	Part	Part Number
PEM (Penn Engineering & Manufacturing)	Surface Mount Standoff	SMTSO-M3-4ET
RAF Electronic Hardware	3/16" Hex Female Standoff	2051T-440-S-12-Zinc
RAF Electronic Hardware	4.5mm Hex Female Standoff	1251-3005-S-12-Zinc

Chapter 4 – Chapter 4 Antennas

Antenna System Cellular Devices

The cellular/wireless performance depends 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 device's certified antenna system, then recertification will be required by specific network carriers.

The antenna system is defined as the UFL connection point from the device to the specified cable specifications and specified antenna specifications.

Requirements for Cellular Antennas with regard to FCC/IC Compliance

This device has been designed to operate with the antennas listed below and having a maximum antenna gain of 6.63 dBi for the 700 MHz band, 6.00 dBi for 1700 MHz band, and 9.01 dBi for the 1850 MHz frequency band. Antennas not included in this list or that have a gain greater than specified are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

LTE Cat M1 Antenna

Devices were approved with the following antenna:

Manufacturer:	Wieson
Description:	LTE Antenna with SMA-Male Connector
Model Number	GY115IE002-001

MultiTech ordering information:

Model	Quantity
ANLTE4-1HRA	1
ANLTE4-2HRA	2
ANLTE4-10HRA	10
ANLTE4-50HRA	50

OEM Integration

FCC & IC Information to Consumers

The user manual for the consumer must contain the statements required by the following FCC and IC regulations: 47 C.F.R. 15.19(a)(3), 15.21, 15.105 and RSS-Gen Issue 3, Dec 2010; 7.1.2 and 7.1.3

FCC Grant Notes

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

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.

Actual content pending Grant: *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.*

Note: Host design configurations constituting a device for portable use (<20 cm from human body) require separate FCC/IC approval.

Note: Only use antennas approved respectively as listed for the unlicensed radios (Bluetooth/Wi-Fi)

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 additional labeling requirements, see the product's Labeling Requirements. For the FCC and IC IDs, see specific certificate information in the Regulatory Statement chapter.

Chapter 5 – Chapter 5 Safety Information

Handling Precautions

To avoid damage due to the accumulation of static charge, use proper precautions when handling any cellular device. Although input protection circuitry has been incorporated into the devices to minimize the effect of static build-up, use proper precautions to avoid exposure to electronic discharge during handling and mounting the device.

Radio Frequency (RF) Safety

Due to the possibility of radio frequency (RF) interference, it is important that you follow any special regulations regarding the use of radio equipment. Follow the safety advice given below.

- Operating your device close to other electronic equipment may cause interference if the equipment is inadequately protected. Observe any warning signs and manufacturers' recommendations.
- Different industries and businesses restrict the use of cellular devices. Respect restrictions on the use of radio equipment in fuel depots, chemical plants, or where blasting operations are in process. Follow restrictions for any environment where you operate the device.
- Do not place the antenna outdoors.
- Switch OFF your wireless device when in an aircraft. Using portable electronic devices in an aircraft may endanger aircraft operation, disrupt the cellular network, and is illegal. Failing to observe this restriction may lead to suspension or denial of cellular services to the offender, legal action, or both.
- Switch OFF your wireless device when around gasoline or diesel-fuel pumps and before filling your vehicle with fuel.
- Switch OFF your wireless device in hospitals and any other place where medical equipment may be in use.

Sécurité relative aux appareils à radiofréquence (RF)

À cause du risque d'interférences de radiofréquence (RF), il est important de respecter toutes les réglementations spéciales relatives aux équipements radio. Suivez les conseils de sécurité ci-dessous.

- Utiliser l'appareil à proximité d'autres équipements électroniques peut causer des interférences si les équipements ne sont pas bien protégés. Respectez tous les panneaux d'avertissement et les recommandations du fabricant.
- Certains secteurs industriels et certaines entreprises limitent l'utilisation des appareils cellulaires. Respectez ces restrictions relatives aux équipements radio dans les dépôts de carburant, dans les usines de produits chimiques, ou dans les zones où des dynamitages sont en cours. Suivez les restrictions relatives à chaque type d'environnement où vous utiliserez l'appareil.
- Ne placez pas l'antenne en extérieur.
- Éteignez votre appareil sans fil dans les avions. L'utilisation d'appareils électroniques portables en avion est illégale: elle peut fortement perturber le fonctionnement de l'appareil et désactiver le réseau cellulaire. S'il ne respecte pas cette consigne, le responsable peut voir son accès aux services cellulaires suspendu ou interdit, peut être poursuivi en justice, ou les deux.
- Éteignez votre appareil sans fil à proximité des pompes à essence ou de diesel avant de remplir le réservoir de votre véhicule de carburant.

- Éteignez votre appareil sans fil dans les hôpitaux ou dans toutes les zones où des appareils médicaux sont susceptibles d'être utilisés.

Interference with Pacemakers and Other Medical Devices

Potential interference

Radio frequency energy (RF) from cellular devices can interact with some electronic devices. This is electromagnetic interference (EMI). The FDA helped develop a detailed test method to measure EMI of implanted cardiac pacemakers and defibrillators from cellular devices. This test method is part of the Association for the Advancement of Medical Instrumentation (AAMI) standard. This standard allows manufacturers to ensure that cardiac pacemakers and defibrillators are safe from cellular device EMI.

The FDA continues to monitor cellular devices for interactions with other medical devices. If harmful interference occurs, the FDA will assess the interference and work to resolve the problem.

Precautions for pacemaker wearers

If EMI occurs, it could affect a pacemaker in one of three ways:

- Stop the pacemaker from delivering the stimulating pulses that regulate the heart's rhythm.
- Cause the pacemaker to deliver the pulses irregularly.
- Cause the pacemaker to ignore the heart's own rhythm and deliver pulses at a fixed rate.

Based on current research, cellular devices do not pose a significant health problem for most pacemaker wearers. However, people with pacemakers may want to take simple precautions to be sure that their device doesn't cause a problem.

- Keep the device on the opposite side of the body from the pacemaker to add extra distance between the pacemaker and the device.
- Avoid placing a turned-on device next to the pacemaker (for example, don't carry the device in a shirt or jacket pocket directly over the pacemaker).

Vehicle Safety

When using your device in a vehicle:

- Do not use this device while driving.
- Respect national regulations on the use of cellular devices in vehicles.
- If incorrectly installed in a vehicle, operating the wireless device could interfere with the vehicle's electronics. To avoid such problems, use qualified personnel to install the device. The installer should verify the vehicle electronics are protected from interference.
- Using an alert device to operate a vehicle's lights or horn is not permitted on public roads.
- UL evaluated this device for use in ordinary locations only. UL did NOT evaluate this device for installation in a vehicle or other outdoor locations. UL Certification does not apply or extend to use in vehicles or outdoor applications.

Device Maintenance

When maintaining your device:

- Do not attempt to disassemble the device. There are no user serviceable parts inside.
- Do not misuse the device. Follow instructions on proper operation and only use as intended. Misuse could make the device inoperable, damage the device and/or other equipment, or harm users.
- Do not apply excessive pressure or place unnecessary weight on the device. This could result in damage to the device or harm to users .
- Do not use this device in explosive or hazardous environments unless the model is specifically approved for such use. The device may cause sparks. Sparks in explosive areas could cause explosion or fire and may result in property damage, severe injury, and/or death.
- Do not expose your device to any extreme environment where the temperature or humidity is high. Such exposure could result in damage to the device or fire.
- Do not expose the device to water, rain, or spilled beverages. It is not waterproof. Exposure to liquids could result in damage to the device.
- Do not place the device alongside computer discs, credit or travel cards, or other magnetic media. The information contained on discs or cards may be affected by the device.
- Using accessories, such as antennas, that MultiTech has not authorized or that are not compliant with MultiTech's accessory specifications may invalidate the warranty.

If the device is not working properly, contact MultiTech Technical Support.

User Responsibility

Respect all local regulations for operating your wireless device. Use the security features to block unauthorized use and theft.

Chapter 6 – Chapter 6 Regulatory Information

47 CFR Part 15 Regulation Class B Devices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. 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.
- Connect 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.

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.

FCC Grant Information

FCC Identifier:	RI7ME910C1NA
Equipment Class:	PCS Licensed Transmitter
Notes:	ME910C1-NA LTE Module CAT M
Approval:	Single Modular

FCC Rule Part	Frequency Range (MHz)	Output Watts	Frequency Tolerance	Emission Designator
27	699 - 716	0.22751	1.0 PM	1M17G7D
27	699 - 716	0.27861	1.0 PM	1M14W7D
27	1710 - 1755	0.22803	1.0 PM	1M29G7D
27	1710 - 1755	0.22594	1.0 PM	1M03W7D
24E	1850 - 1910	0.22803	1.0 PM	1M20G7D
24E	1850 - 1910	0.22439	1.0 PM	1M06W7D

Chapter 7 – Chapter 7 Environmental Notices

Waste Electrical and Electronic Equipment Statement

Note: This statement may be used in documentation for 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 MultiTech 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



REACH Statement

Registration of Substances

After careful review of the legislation and specifically the definition of an “article” as defined in EC Regulation 1907/2006, Title II, Chapter 1, Article 7.1(a)(b), it is our current view that Multi-Tech Systems, Inc. products would be considered as “articles.” In light of the definition in § 7.1(b) which requires registration of an article only if it contains a regulated substance that “is intended to be released under normal or reasonably foreseeable conditions of use,” our analysis is that Multi-Tech Systems, Inc. products constitute nonregisterable articles for their intended and anticipated use.

Substances of Very High Concern (SVHC)

Per the candidate list of Substances of Very High Concern (SVHC) published October 28, 2008 we have reviewed these substances and certify the Multi-Tech Systems, Inc. products are compliant per the EU “REACH” requirements of less than 0.1% (w/w) for each substance. If new SVHC candidates are published by the European Chemicals Agency, and relevant substances have been confirmed to be greater than 0.1% (w/w), Multi-Tech Systems, Inc. will provide updated compliance status.

Multi-Tech Systems, Inc. also declares it has been duly diligent in ensuring that the products supplied are compliant through a formalized process which includes collection and validation of materials declarations and selective materials analysis where appropriate. This data is controlled as part of a formal quality system and will be made available upon request.

Restriction of the Use of Hazardous Substances (RoHS)



Multi-Tech Systems, Inc.

Certificate of Compliance

2011/65/EU

Multi-Tech Systems, Inc. confirms that its embedded products comply with the chemical concentration limitations set forth in the directive 2011/65/EU of the European Parliament (Restriction of the use of certain Hazardous Substances in electrical and electronic equipment - RoHS).

These MultiTech products do not contain the following banned chemicals¹:

- 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

Environmental considerations:

- Moisture Sensitivity Level (MSL) =1
- Maximum Soldering temperature = 260C (in SMT reflow oven)

¹Lead usage in some components is exempted by the following RoHS annex, therefore higher lead concentration would be found in some modules (>1000 PPM);

- Resistors containing lead in a glass or ceramic matrix compound.

Chapter 8 – Chapter 8 Labels

Approvals and Certifications

This device is an industry and/or carrier approved modem. In most cases, when integrated and used with an antenna system that was part of the MultiTech modem certification, additional approvals or certifications are not required for the device that you develop as long as the following requirements are met:

- **PTCRB Requirements:** The antenna system cannot be altered.
- **Model Identification:** The MultiTech model identification allows the carrier to verify the modem as one of its approved models. This information is located on the modem's label below the bar code.

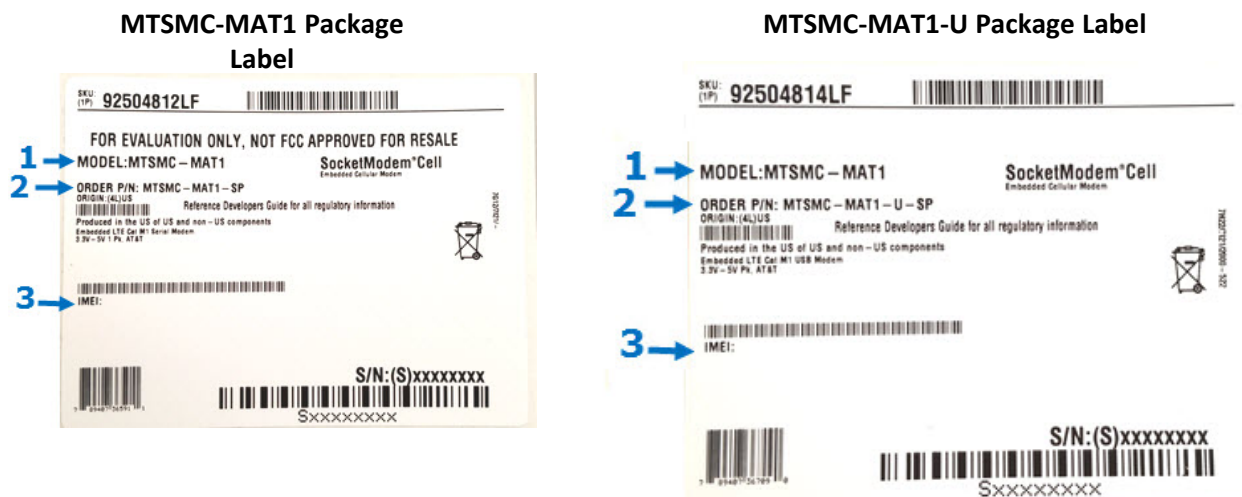
Example Labels

Note: Actual labels vary depending on the regulatory approval markings and content.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The label shown is not than actual size.

- 1 - Multi-Tech Model Identification.
- 2 - Multi-Tech Ordering Part Number.
- 3 - IMEI (International Mobile Equipment Identity).



MTSMC-MAT1 Device Label



MTSMC-MAT1-U Device Label



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