

QuickCarrier™ USB-E

MT100UCC-C2 Developer Guide



QuickCarrier™ USB-E MT100UCC-C2 Developer Guide

Models:

MT100UCC-C2

Part Number: S000575 Version: 1.1

Copyright

This publication may not be reproduced, in whole or in part, without the specific and express prior written permission signed by an executive officer of Multi-Tech Systems, Inc. All rights reserved. **Copyright © 2013 by Multi-Tech Systems, Inc.**

Multi-Tech Systems, Inc. makes no representations or warranties, whether express, implied or by estoppels, with respect to the content, information, material and recommendations herein and specifically disclaims any implied warranties of merchantability, fitness for any particular purpose and non-infringement.

Multi-Tech Systems, Inc. reserves the right to revise this publication and to make changes from time to time in the content hereof without obligation of Multi-Tech Systems, Inc. to notify any person or organization of such revisions or changes.

Legal Notices

The MultiTech products are not designed, manufactured or intended for use, and should not be used, or sold or re-sold for use, in connection with applications requiring fail-safe performance or in applications where the failure of the products would reasonably be expected to result in personal injury or death, significant property damage, or serious physical or environmental damage. Examples of such use include life support machines or other life preserving medical devices or systems, air traffic control or aircraft navigation or communications systems, control equipment for nuclear facilities, or missile, nuclear, biological or chemical weapons or other military applications ("Restricted Applications"). Use of the products in such Restricted Applications is at the user's sole risk and liability.

MULTITECH DOES NOT WARRANT THAT THE TRANSMISSION OF DATA BY A PRODUCT OVER A CELLULAR COMMUNICATIONS NETWORK WILL BE UNINTERRUPTED, TIMELY, SECURE OR ERROR FREE, NOR DOES MULTITECH WARRANT ANY CONNECTION OR ACCESSIBILITY TO ANY CELLULAR COMMUNICATIONS NETWORK. MULTITECH WILL HAVE NO LIABILITY FOR ANY LOSSES, DAMAGES, OBLIGATIONS, PENALTIES, DEFICIENCIES, LIABILITIES, COSTS OR EXPENSES (INCLUDING WITHOUT LIMITATION REASONABLE ATTORNEYS FEES) RELATED TO TEMPORARY INABILITY TO ACCESS A CELLULAR COMMUNICATIONS NETWORK USING THE PRODUCTS.

The MultiTech products and the final application of the MultiTech products should be thoroughly tested to ensure the functionality of the MultiTech products as used in the final application. The designer, manufacturer and reseller has the sole responsibility of ensuring that any end user product into which the MultiTech product is integrated operates as intended and meets its requirements or the requirements of its direct or indirect customers. MultiTech has no responsibility whatsoever for the integration, configuration, testing, validation, verification, installation, upgrade, support or maintenance of such end user product, or for any liabilities, damages, costs or expenses associated therewith, except to the extent agreed upon in a signed written document. To the extent MultiTech provides any comments or suggested changes related to the application of its products, such comments or suggested changes is performed only as a courtesy and without any representation or warranty whatsoever.

Contacting MultiTech

Knowledge Base

The Knowledge Base provides immediate access to support information and resolutions for all MultiTech products. Visit <http://www.multitech.com/kb.go>.

Support Portal

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

Support

Business Hours: M-F, 8am to 5pm CT

Country	By Email	By Phone
Europe, Middle East, Africa:	support@multitech.co.uk	+(44) 118 959 7774
U.S., Canada, all others:	support@multitech.com	(800) 972-2439 or (763) 717-5863

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.

World Headquarters

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

Contents

Chapter 1 – Product Overview	5
About the QuickCarrier USB-E MT100UCC-C2	5
Documentation	5
Selecting the Correct Model and Accessories	5
Chapter 2 – Design Considerations.....	6
USB Design	6
Noise Suppression Design	6
Electromagnetic Interference	6
Electrostatic Discharge Control.....	7
Chapter 3 – Cellular Information.....	8
Antenna System Cellular Devices.....	8
CDMA Antenna Information	8
CDMA Antenna Requirements/Specifications	8
Coax Cables Specifications	8
SMA-to-UFL and RSMA-to-UFL Coaxial Cables	8
Coaxial Cable Specifications	9
Approved Antenna Cable Parts	9
Activating Accounts for Cellular Devices.....	9
Notice for Devices that Use Aeris Radios.....	10
Cellular Approvals and Labeling Requirements	10
Modem Label Example.....	10
QuickCarrier USB-E Label	11
Chapter 4 – OEM Integration	13
FCC Grant Notes.....	13
Grant Limitations	13
KDB 447498 Section 8	13
FCC Definitions	13
Host Labeling.....	14
Chapter 5 – Safety Warnings.....	15
Radio Frequency (RF) Safety	15
Interference with Pacemakers and Other Medical Devices	15
Potential interference	15
Precautions for pacemaker wearers	15
Vehicle Safety.....	16
Device Maintenance	16
Handling Precautions	16
User Responsibility.....	16

Chapter 6 – Regulatory Compliance Statements 17

- 47 CFR Part 15 Regulation Class B Devices 17
- Industry Canada Class B Notice..... 17
- Restriction of the Use of Hazardous Substances (RoHS) 17

Chapter 7 – MT100UCC-C2 Model Overview 19

- Specifications 19
- Mechanical drawing..... 21
- Power Draw MT100UCC-C2 22
- Powering Down Your Device 22
- Pinout Specifications..... 22

Chapter 8 – Application Notes 23

- MT100UCC-C2 Application Notes 23
- LED Interface 23
- RF Interfaces 23
- RF Performances 23

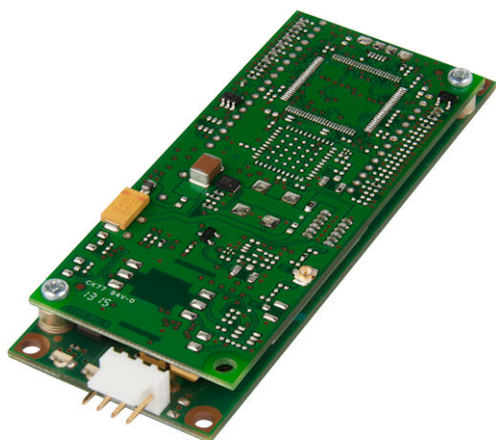
Chapter 9 – Configuring and Communicating with Your Device 25

- Interacting with Your Device Overview 25
- Before Using the Device..... 25
- Using Command Mode and Online Data Mode..... 25
- Verifying Signal Strength..... 26
- Example 26
- Checking Network Registration..... 27
- Sending and Receiving Data..... 27
- Connecting Device to TCP Server as TCP Client 27
- Configuring Device as UDP Listener to Accept UDP Client Connections 28
- Configuring Device as UDP Client to Connect to UDP Server 29
- Configuring Device as UDP Listener to Accept UDP Client Connections 30
- Transferring FTP File to FTP Server 31
- Downloading File from FTP Server..... 32
- Reading, Writing and Deleting Messages 34
- Reading Text Messages..... 34
- Writing Text Messages..... 34
- Deleting Messages 35

Chapter 1 – Product Overview

About the QuickCarrier USB-E MT100UCC-C2

This guide describes how to use the QuickCarrier USB-E to embed M2M connectivity into your Windows or Linux device. The embedded cellular modem is a complete, ready-to-integrate communications device that offers 2G cellular connectivity options. The quick-to-market product combines a network approved cellular SocketModem® and a USB carrier card in one compact design. With its 4-pin USB interface the embedded cellular modem cables to an existing device's internal USB port and can be secured using the four mounting holes located at the corners of the printed circuit board.



Documentation

The following table describes additional documentation for your device.

The guides are available on the Multi-Tech support web site at www.multitech.com/man.go.

Guide Description	Part Number
MT100UCC-C2 Developer Guide	This guide. (S000575)
AT Commands Reference Guide	MT100UCC-C2 (S000546)

Selecting the Correct Model and Accessories

The following table describes which model and accessory kit to select for your needs.

Model	Description
MT100UCC-C2-N2	Sprint 2G CDMA 1xRTT
MT100UCC-C2-N3	Verizon 2G CDMA 1xRTT
MT100UCC-C2-N16	Aeris 2G CDMA 1xRTT
MT100UCC-AK	Accessory kit, includes USB cables, antenna cable and antenna

Chapter 2 – Design Considerations

USB Design

MultiTech recommends that you review Intel's High Speed USB Platform Design Guidelines for information about USB signal routing, impedance, and layer stacking. Also:

- Shield USB cables with twisted pairs (especially those containing D+/D-).
- Use a single 5V power supply for USB devices. See Power Draw for current (ampere) requirements.
- Route D+/D- together in parallel with the trace spacing needed to achieve 90 ohms differential impedance for the USB pair and to maintain a 20 mil space from the USB pair and all other signals.
- If power is provided externally, use a common ground between the carrier board and the device.
- Your device may not power up on all Host PCs or host USB devices due to the higher current requirements of the cellular radio. Check your particular USB host port or PC motherboard's electrical specs for details on max current capabilities of the particular USB port you are trying to use.
- Depending on your design, you may be able to use a dual USB cable to share the current between two low power USB ports or create a custom USB cable that provides external power.

Noise Suppression Design

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

Any OEM board design must 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 certification requirements that must be met for use in specific environments.

Proper PC board layout (component placement, signal routing, trace thickness and geometry, and so on) 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 guide. Consult noise suppression techniques described in technical publications and journals, electronics and electrical engineering text books, and component supplier application notes.

Electromagnetic Interference

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. To minimize the contribution of device-based design to EMI, you 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 device's 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 to avoid coupling from high frequency circuits.
- Lay out the highest frequency signal traces next to the ground grid.
- If using a multilayer board design, 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

Handle all electronic devices with precautions to avoid damage due to the static charge accumulation.

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.

MultiTech strives to follow these recommendations. Input protection circuitry is incorporated in MultiTech devices to minimize the effect of static buildup. Take precautions to avoid exposure to electrostatic discharge during handling.

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

Chapter 3 – Cellular Information

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.

CDMA Antenna Information

CDMA devices were approved with the following antenna:

Exceltek Electronics, Ltd.

Description: Quad band antenna

Part number: C0081-ANG0002

Multi-Tech part number: 45009713L

CDMA Antenna Requirements/Specifications

Frequency range	824-894 MHz / 1850-1900 MHz
Impedance	50 ohm
VSWR	Make sure VSWR does not exceed 2.0:1 at any point across the bands of operation
Typical antenna gain	2 dBi on azimuth plane
Radiation pattern	Omni directional
Polarization	Vertical

Coax Cables Specifications

Category	Description
Cable type	Coaxial cable
Attenuation	<1.0 db
Connector impedance	50 ohm
Maximum cable length	16 inches (40 cm)

SMA-to-UFL and RSMA-to-UFL Coaxial Cables

Your product includes the following cables:

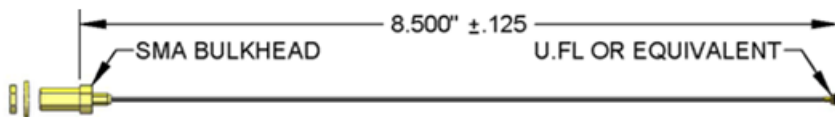
- Two SMA-to-UFL cables.
- One RSMA-to-UFL cable for use with products that include a GPS receiver.
- RSMA-to-MMCX for socket modem, if needed.

Note:

RSMA cables are not supported for CDMA products.

Coaxial Cable Specifications

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



The SMA bulkhead can also be an RSMA bulkhead if RSMA cables are supported by your product.

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)

Approved Antenna Cable Parts

GC Protronics: 20930C

Samtec: ASP-116785-01

The coaxial cable is an RG-178/U

Activating Accounts for Cellular Devices

Some Multi-Tech products have been pre-configured to operate on a specific cellular network. However, before you can begin to use the modem, you must set up a cellular data account with your cellular network provider. Refer to Multi-Tech's Cellular Activation Web site <http://www.multitech.com/activation.go> for information on activating your cellular modem.

The cellular carrier asks you for device identification information:

- For CDMA: The modem's MEID is printed on the label.

Refer to the device labels for the location of the device identification.

IMPORTANT: When the cellular carrier asks you to provide the modem's model identification, give them the Multi-Tech model identification, not the host device model number. 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.

Notice for Devices that Use Aeris Radios

One component of your device is a radio. A radio algorithm prevents your device from repeatedly attempting to connect to the network when the radio:

- Cannot establish a packet data connection or
- Fails to access the application server.

When writing applications for your devices, ensure that your applications do not interfere with the radio's connection retry algorithm. If you fail to do so, Aeris might block network access for your devices.

After your devices reach the end of their commercial lifespan, you must remove them from the Aeris network. To do so, remove power from the devices and remove their antennas. If your devices continue to attempt to register with the network after you cancel device subscriptions, Aeris can bill you for any traffic generated by those devices.

Cellular Approvals and Labeling Requirements

Approvals and Certification

The Multi-Tech SocketModem used in the product is an industry or Carrier Approved 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, EV-DO has a few exceptions) for the device you develop as long as the following are met:

- The antenna system cannot be altered.
- Model Identification 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.

Modem Label Example

Note: The label is shown larger than actual size.

1 **Model:MTSMC – C2**
B/O: – N3 – LP
FCC ID: R17CE910 – DUAL
SKU #:92503269LF
Serial#:xxxxxxxxK

DOM:2013.12.11
IC:5131A – CE910DUAL



FC Home or Office Use
CA US
E150299

2  **MEID:**

www.multitech.com
Produced in the US of U' and non – US components

- 1 Multi-Tech model information
- 2 MEID (C2) for the attached modem

QuickCarrier USB-E Label

Note: The label is shown larger than actual size.

1 **M/N:MT100UCC – C2**
B/O: – N3
SKU:92503086LF
SERIAL #:XXXXXXXX
 2 **ORDER P/N: MT100UCC – C2 – N3 – SP**

www.multitech.com
DOM:2013.12.11



XXXXXXXXXXXX

3  **MEID:**

CA US
E150299
FC
 Home or Office Use

- 1 Multi-Tech model information
- 2 Multi-Tech ordering part number

3 MEID (C2) for the attached modem

Chapter 4 – 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

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:

The closest separation among all simultaneous transmitting antennas is ≥ 20 cm;
or

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 ≥ 5 cm from all other simultaneous transmitting antennas. 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.

Chapter 5 – Safety Warnings

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.

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.

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.

User Responsibility

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

Chapter 6 – Regulatory Compliance Statements

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.

Industry Canada Class B Notice

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 license-exempt RSS standard(s). The operation is permitted for the following two conditions:

1. the device may not cause interference, and
2. this device must accept any interference, including interference that may cause undesired operation of the device.

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'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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 7 – MT100UCC-C2 Model Overview

Specifications

MT100UCC-C2

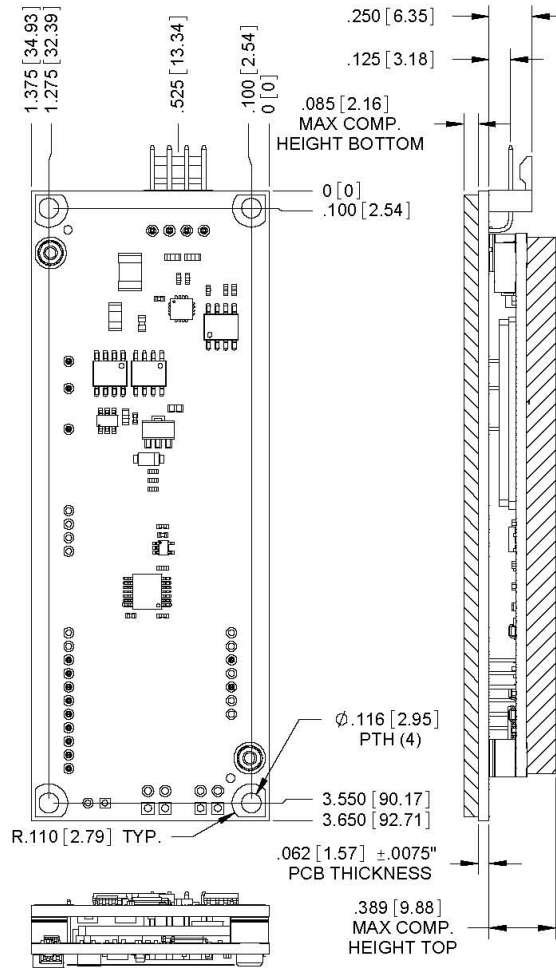
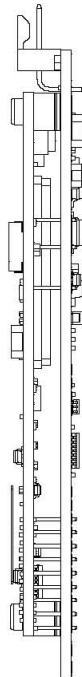
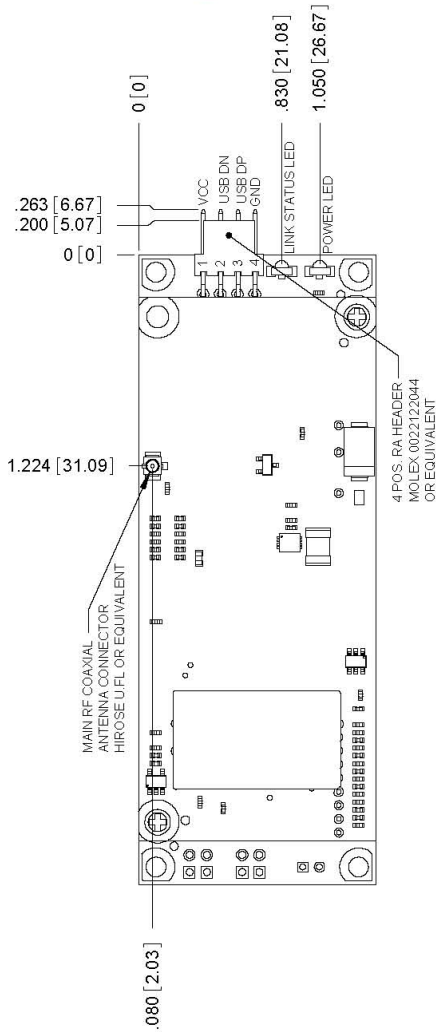
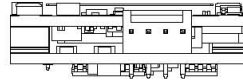
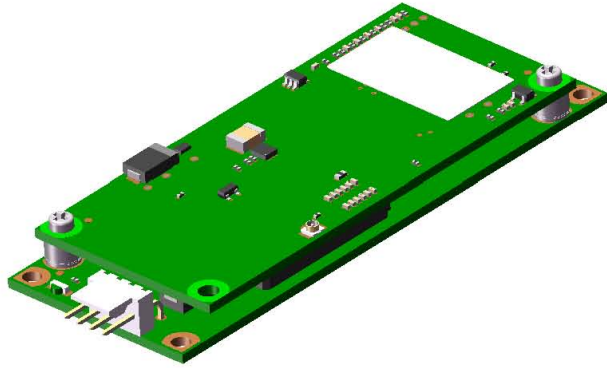
Category	Description
General	
Performance	2G CDMA 1xRTT
Frequency Bands	Dual band 800/1900 MHz
Speed	
Data Speed	Up to 153 Kbps downlink and uplink
Interface	
USB	USB 2.0 full speed compliant
Driver support	
Operating systems	Drivers are available for Windows and Linux operating systems. You can download drivers from the Multi-Tech Installation Resources website at www.multitech.com/setup/product.go
Physical Description	
Weight	1.536 oz 43.5 g
Dimensions	3.15 in x 1.375 in 80.010 mm x 34.93 mm
Connectors	
Antenna	All models have surface mount UFL antenna connectors.
Environment	
Operating Temperature	-40° C to +85° C
Storage Temperature	-40° C to +85° C
Humidity	20% to 90% non-condensing
Power Requirements	

Category	Description
Operating Voltage	Supply range: 4.75 V to 5.25 V 1.1A nominal current Device may be damaged if voltage exceeds 5.5 V
Input Power	USB bus powered
SMS	
	Point-to-Point messaging Mobile-Terminated SMS Mobile-Originated SMS
Certifications, Compliance, Warranty	
EMC Compliance	FCC Part 15 Class B
Radio Compliance	FCC Part 22 FCC Part 24
Safety Compliance	UL 60950-1 2nd edition cUL 60950-1 2nd edition IEC 60950-1 2nd edition
Network Compliance	Verizon Sprint Aeris
Warranty	2 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.

You may need to reduce the temperature range if airflow is limited around the cellular radio. Test and verify the temperature range if the QuickCarrier USB-E is designed into an enclosed chassis.

Mechanical drawing



DIMENSIONS IN In [mm]

MT100UCC-C2-Nx

Power Draw MT100UCC-C2

5 volts	Cellular call box connection no data (amps)	Average measured current (amps) at maximum power	Peak TX amplitude current (amps)	Total inrush charge measured in MilliCoulombs (mC)	Total inrush charge duration during power up (uS)
US Cellular 800 Mhz	0.066	0.516	0.568	0.36	193
US PCS 1900 Mhz	0.066	0.686	0.748	0.36	193

Note:

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

Peak Tx: The peak current during a CDMA connection transmitting data at max power.

Maximum Power: The continuous current during maximum data rate with the radio transmitter at maximum power.

Inrush Charge: The total inrush charge at power on.

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 :

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

Pinout Specifications

Pins	Signal Name	Logic Level Voltage	I/O	Description
JP2-1	VCC	5.0	PWR	DC input power
JP2-2	USB DN	3.3	I/O	USB data
JP2-3	USB DP	3.3	I/O	USB data
JP2-4	GND	GND	GND	Ground

Chapter 8 – Application Notes

MT100UCC-C2 Application Notes

LED Interface

The LED signal indicates the working status of the QuickCarrier.

Power LED

Signal	Description
OFF	No power to the unit.
ON	The unit is functioning.

Link Status LED

Signal	Description
OFF	No power to the unit.
ON	Continuously lit: Powered and connected, but not transmitting or receiving. Slow blink (0.2Hz): Powered and searching for a connection. Fast blink (3Hz): Transmitting or receiving.

To ensure the Link Status LED works properly, issue the following AT Command sequence to the GPIO:

```
AT#GPIO=1,0,2
```

```
AT#SLED=2
```

RF Interfaces

Radio Characteristics

	CDMA/EV-DO 800	CDMA/EV-DO 1900
Frequency	824.7 to 848.31 MHz	1851.25 to 1908.75 MHz
Impedance	50 ohms	50 ohms
VSWR	<2	<2
Typical Radiated Gain	0 dBi in at least one direction	0 dBi in at least one direction
Output Power	.25W in CDMA/EVDO	.25W in CDMA/EVDO

RF Performances

All values indicated are conducted.

Receiver Features

Category	Description
CDMA 1xRTT US Cellular 800 (Verizon) sensitivity	< -108 dBm
CDMA 1xRTT US PCS 1900 (Sprint) sensitivity	< -107 dBm
EV-DO 1x Rev 0 US Cellular 800 (Verizon) sensitivity	< -111 dBm
EV-DO 1x Rev 0 US PCS 1900 (Sprint) sensitivity	< -109 dBm

Transmitter Features

Category	Description
Maximum output power (CDMA 1x RTT & EV-DO 1x Rev 0/Rev A)	+24 dBm \pm 1 dBm

RF Connection and Antenna

The RF connector on the QuickCarrier is a UFL standard type.

Chapter 9 – Configuring and Communicating with Your Device

Interacting with Your Device Overview

This section describes how to use AT commands to interact with your device. Using terminal software such as Kermit, you can issue AT commands to communicate with and configure your modem. The AT commands let you establish, read and modify device parameters and help you control how the device operates. This section documents basic interactions with your device, such as verifying signal strength and network registrations, sending and reading SMS text messages, and sending and receiving data.

Generally, USB modems are used as unintelligent bit pipes. In Windows, this means you create a dial-up network connection that uses the Windows IP stack to use the modem to create a PPP connection to the cellular network. The modem is assigned an IP address from the cellular carrier. This connection provides Internet access and is the basis for TCP/IP communication for sending and receiving email, creating TCP/UDP Sockets, or putting and getting files from an FTP server.

In Linux, PPPD is used to dial the modem and create the connection to the cellular TCP/IP network. This provides Internet access for sending and receiving email, creating TCP/UDP Sockets, or putting and getting files from an FTP server.

Before Using the Device

Before using the device:

- Install any drivers. Refer to the separate driver installation guide for your device.
- Power up your device and ensure it is connected to your computer that issues AT commands.
- Install terminal software that can communicate with the device, such as HyperTerminal, Tera Term, Kermit, or Putty.

Using Command Mode and Online Data Mode

Modems have two operation modes, command and online data. After power up, the modem is in command mode and ready to accept AT commands.

Use AT commands to communicate with and configure your modem. These commands establish, read, and modify device parameters and control how the modem works. The device also generates responses to AT commands that help determine the modem's current state.

If the modem is in online data mode, it only accepts the Escape command (+++).

To send the modem AT Commands from terminal emulation software, set the software to match the modem's default data format, which is:

- Speed: 115,200 bps
- Data bits: 8
- Parity: none
- Stop bit: 1
- Flow control: hardware

To confirm communication with the device:

- Type **AT** and press **Enter**.

If the device responds with OK, it is properly communicating.

Verifying Signal Strength

To verify the device signal strength, enter:

AT+CSQ

The command indicates signal quality, in the form:

```
+CSQ: <rssi>,<ber>
```

Where:

<rssi>	Received signal strength indication.
0	(-113) dBm or less
1	(-111) dBm
2-30	(-109) dBm - (-53) dBm / 2 dBm per step
31	(-51) dBm or greater
99	Not known or not detectable
<ber>	Bit error rate, in percent
0	Less than 0.2%
1	0.2% to 0.4%
2	0.4% to 0.8%
3	0.8% to 1.6%
4	1.6% to 3.2%
5	3.2% to 6.4%
6	6.4% to 12.8%
7	More than 12.8%
99	Not known or not detectable

Note: Signal strength of 10 or higher is needed for successful packet data sessions.

Example

A example response to AT+CSQ:

```
+CSQ: 15,1
```

Checking Network Registration

To verify that a device is registered on the network, enter:

```
AT!STATUS
```

The device returns several lines of modem status information. The second to last line indicates either:

```
Modem has registered.
```

or

```
Modem has NOT registered.
```

Sending and Receiving Data

Connecting Device to TCP Server as TCP Client

To send data through a connect socket:

- 1. Define PDP Content (APN for SIM)**

Enter

```
AT+CGDCONT=1,"IP","XXX.APN.com"
```

where XXX.APN.com is the APN your cellular provider assigned to your SIM card.

The device responds with OK

- 2. Bring up Data Connection Using Internal IP stack**

Enter:

```
AT#SGACT=1,1
```

The device responds with the IP Address the cellular provider assigned to the device on connection, followed by OK. For example:

```
#SGACT: 25.194.185.116
```

```
OK
```

- 3. Create Client Connection to TCP Server on Port 500**

Enter:

```
AT#SD=1,0,500,"###.##.###.##"
```

where ###.##.###.## is the TCP server IP Address.

The device responds with OK. You can now send or receive data without entering additional commands.

Closing the Socket and the Connection

To close the socket:

- Enter the escape sequence:

```
+++
```

- To close Socket 1, enter:

```
AT#SH=1
```

The device responds with OK.

To close the data connection:

- Enter:

```
AT#SGACT=1,0
```

The device responds with OK.

Configuring Device as UDP Listener to Accept UDP Client Connections

To configure the device as a UDP client:

1. Check signal strength.

Enter:

```
AT+CSQ
```

2. If using a SIM card, configure the APN.

Enter:

```
AT+CGDCONT=1,"IP","XXX.APN.com"
```

where XXX.APN.com is the APN your cellular provider assigned to your SIM card.

3. Verify device is registered on the cellular network.

Enter:

```
AT+CREG?
```

Should return:

```
+CREG 0,1
```

OK

4. Configure socket parameters

Enter:

```
AT#SCFG=1,1,300,240,600,50
```

5. Activate context one

Enter:

```
AT#SGACT=1,1
```

6. Set firewall rule to accept connections:

```
AT#FRWL=1,"###.##.###.#","###.##.###.#"
```

where ###.##.###.# represents the IP range. For example:

```
AT#FRWL=1,"204.26.122.1","204.26.122.255"
```

7. Set connection ID 1 for UDP listening mode on port 7000.

Enter:

```
AT#SLUDP=1,1,7000
```

The device responds with and unsolicited indication that a host is trying to connect to connection ID 1 on port 7000.

```
SRING: 1
```

8. Accept incoming connection ID 1

Enter:

```
AT#SA=1
```

The device indicates a client successfully established a listener connection.

```
CONNECT
```

You can send and receive data.

Exit Data Mode and Close Connection

To exit data mode and close the socket:

- Enter the escape sequence:

```
+++
```

- To close Socket 1, enter:

```
AT#SH=1
```

The device responds with OK.

- To close the data connection, enter:

```
AT#SGACT=1,0
```

The device responds with OK.

Configuring Device as UDP Client to Connect to UDP Server

Configure and Connect the Device

To configure the device as a UDP client:

- 1. Check signal strength.**

Enter:

```
AT+CSQ
```

- 2. If using a SIM card, configure the APN.**

Enter:

```
AT+CGDCONT=1,"IP","XXX.APN.com"
```

where XXX.APN.com is the APN your cellular provider assigned to your SIM card.

- 3. Verify device is registered on the cellular network.**

Enter:

```
AT+CREG?
```

Should return:

```
+CREG: 0,1
```

OK

- 4. Configure socket parameters**

Enter:

```
AT#SCFG=1,1,300,240,600,50
```

- 5. Activate context one**

Enter:

```
AT#SGACT=1,1
```

- 6. Create UDP connection to Server port**

Enter:

```
AT#SD=1,1,####,"###.##.###.##"
```

where #### is the server port and ###.##.###.## is the IP number.

The device responds with OK, which indicates a successful connection. You can send and receive data through the socket connection.

Exit Data Mode and Close Connection

To exit data mode and close the socket:

- Enter the escape sequence:

```
+++
```

- To close Socket 1, enter:

```
AT#SH=1
```

The device responds with OK.

- To close the data connection, enter:

```
AT#SGACT=1,0
```

The device responds with OK.

Configuring Device as UDP Listener to Accept UDP Client Connections

To configure the device as a UDP client:

1. Check signal strength.

Enter:

```
AT+CSQ
```

2. If using a SIM card, configure the APN.

Enter:

```
AT+CGDCONT=1,"IP","XXX.APN.com"
```

where XXX.APN.com is the APN your cellular provider assigned to your SIM card.

3. Verify device is registered on the cellular network.

Enter:

```
AT+CREG?
```

Should return:

```
+CREG 0,1
```

OK

4. Configure socket parameters

Enter:

```
AT#SCFG=1,1,300,240,600,50
```

5. Activate context one

Enter:

```
AT#SGACT=1,1
```

6. Set firewall rule to accept connections:

```
AT#FRWL=1,"###.##.###.#","###.##.###.#"
```

where ###.##.###.# represents the IP range. For example:

```
AT#FRWL=1,"204.26.122.1","204.26.122.255"
```

7. Set connection ID 1 for UDP listening mode on port 7000.

Enter:

AT#SLUDP=1,1,7000

The device responds with an unsolicited indication that a host is trying to connect to connection ID 1 on port 7000.

SRING: 1

8. Accept incoming connection ID 1

Enter:

AT#SA=1

The device indicates a client successfully established a listener connection.

CONNECT

You can send and receive data.

Exit Data Mode and Close Connection

To exit data mode and close the socket:

- Enter the escape sequence:

+++

- To close Socket 1, enter:

AT#SH=1

The device responds with OK.

- To close the data connection, enter:

AT#SGACT=1,0

The device responds with OK.

Transferring FTP File to FTP Server

To connect to FTP server and upload files:

1. Check signal strength.

Enter:

AT+CSQ

2. If using a SIM card, configure the APN.

Enter:

AT+CGDCONT=1,IP,"XXX.APN.com"

where XXX.APN.com is the APN your cellular provider assigned to your SIM card.

3. Verify device is registered on the cellular network.

Enter:

AT+CREG?

Should return:

+CREG: 0,1

OK

4. Activate context one

Enter:

AT#SGACT=1,1

5. Set FTP operations timeout to 10 seconds

Enter:

```
AT#FTPTO=1000
```

6. Configure FTP server IP address with username and password.

Enter:

```
AT#FTPOPEN="###.##.###.#", "username", "password", 0
```

where ###.##.###.# is the IP address and the username and password for the FTP server.

7. Configure file transfer type.

Enter:

```
AT#FTPTYPE=#
```

where # is 0 for binary or 1 for ASCII.

8. Enter the file name to be sent to the FTP server and initiate connection.

Enter:

```
AT#FTPPUT="file.txt"
```

The device responds with:

```
CONNECT
```

9. Send the file through the device.

Closing the FTP Data Connection

When you finish sending the file:

1. Enter the escape sequence.

Enter:

```
+++
```

The device responds with:

```
NO CARRIER
```

2. Close the FTP connection.

Enter:

```
AT#FTPCLOSE
```

3. Close the PPP data connection.

Enter:

```
AT#SGACT=1,0
```

The device responds with OK.

Downloading File from FTP Server

To connect to an FTP server and download files:

1. Check signal strength.

Enter:

```
AT+CSQ
```

2. If using a SIM card, configure the APN.

Enter:

```
AT+CGDCONT=1,IP,"XXX.APN.com"
```

where XXX.APN.com is the APN your cellular provider assigned to your SIM card.

3. Verify device is registered on the cellular network.

Enter:

```
AT+CREG?
```

Should return:

```
+CREG: 0,1
```

OK

4. Activate context one

Enter:

```
AT#SGACT=1,1
```

5. Set FTP operations timeout to 10 seconds

Enter:

```
AT#FTPTO=1000
```

6. Configure FTP server IP address with username and password.

Enter:

```
AT#FTPOPEN="###.##.###.#", "username", "password", 0
```

where ###.##.###.# is the IP address and the username and password for the FTP server.

7. Configure file transfer type.

Enter:

```
AT#FTPTYPE=#
```

where # is 0 for binary or 1 for ASCII.

8. If required, change the working directory to "folder1".

Enter:

```
AT#FTPCWD="folder1"
```

9. Enter the file name.

Enter:

```
AT#FTPGET="filename.txt"
```

where filename.txt is the file you want to download.

The device responds with:

```
CONNECT
```

The file is received through the device. The device responds with:

```
NO CARRIER
```

The data connection closes automatically when the file sending ends.

Closing the FTP Data Connection

When you finish sending the file:

1. Close the FTP connection.

Enter:

```
AT#FTPCLOSE
```

2. Close the PPP data connection.

Enter:

```
AT#SGACT=1,0
```

The device responds with OK.

Reading, Writing and Deleting Messages

Reading Text Messages

To read a text message in text mode:

1. **Put the device in text mode.**

Enter:

```
AT+CMGF=1
```

2. **Read message.**

Enter:

```
AT+CMGR=1
```

Example response:

```
+CMGR: "REC UNREAD", "+10001112222z`z", "", "13/09/05,13:39:40-20"
How are you?
OK
```

Where 0001112222 is the phone number.

Writing Text Messages

To send a text message in text mode:

1. **Put the device in text mode.**

Enter:

```
AT+CMGF=1
```

The device responds.

OK

2. **Enter the recipient's number and your message.**

Enter:

```
AT+CMGS="#####"
```

```
>Your message here
```

where ##### is the recipient's number.

3. **Send the message.**

Enter CTRL+Z.

The device responds:

```
+CMGS: #
```

OK

where # is the reference number of the sent message.

For example:

```
AT+CMGF=1
OK
AT+CMGS="0001112222"
> How are you? <CTRL+Z to send>
+CMGS: 255
OK
```

Where 0001112222 is the phone number.

Deleting Messages

To delete one text message, enter:

AT+CMGD=I , #

where I is the index in the select storage and # is the delflag option. Enter:

- | | |
|---|---|
| 0 | Deletes message in the specified index. |
| 1 | Deletes all read messages. Leaves unread messages and stored device-originated messages. |
| 2 | Deletes all read and sent device-originated messages. Leaves unread messages and unsent device-originated messages. |
| 3 | Deletes all read messages and sent and unsent device-originated messages. Leaves unread messages. |
| 4 | Deletes all messages. |

For example:

```
AT+CMGD=1 (delete message at index 1)
AT+CMGD=2 (delete message at index 2 )
AT+CMGD=1,0
AT+CMGD=1,1
AT+CMGD=1,2
AT+CMGD=1,3
AT+CMGD=1,4
```