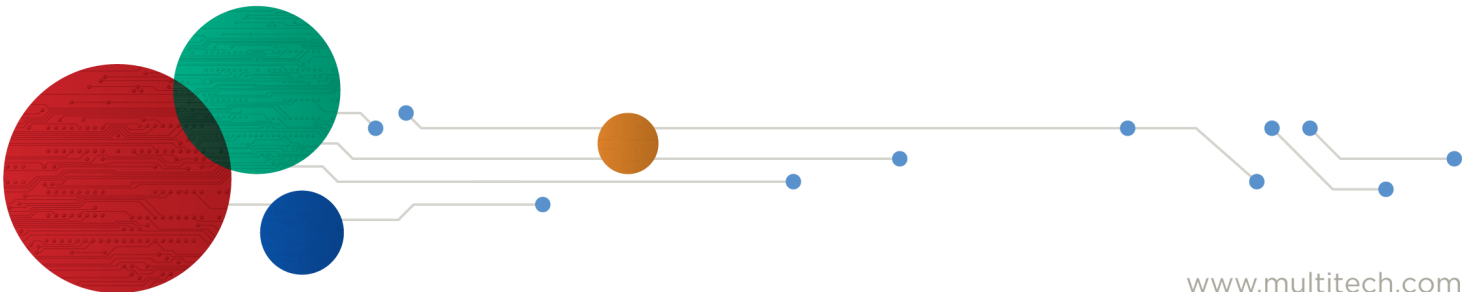




SocketModem®

MTQ-MNA1-B01 Device Guide



SocketModem® MTQ-MNA1-B01 Device Guide

Models: MTQ-MNA1-B01

Document Part Number: S000682 Rev. 1.3

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 © 2025 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.

Trademarks

Multi-Tech and the Multi-Tech logo, DeviceHQ, SocketModem, and Conduit are registered trademarks of Multi-Tech Systems, Inc.

mPower, mCard, and mDot are trademarks of Multi-Tech Systems, Inc.

All other brand and product names are trademarks or registered trademarks of their respective companies.

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.

Disclaimers

Information in this document is subject to change without notice and does not represent a commitment on the part of Multi-Tech Systems, Inc. Multi-Tech Systems, Inc. provides this document "as is," without warranty of any kind, expressed or implied, including, but not limited to, the implied warranties of fitness or merchantability for a particular purpose. Multi-Tech Systems, Inc. may make improvements and/or changes in this manual or in the product(s) and/or the software described in this manual at any time.

Contents

| | |
|---|----|
| 1 About the SocketModem MTQ | 6 |
| Build Options | 6 |
| Firmware Over the Air (FOTA) for Verizon | 6 |
| Additional Documentation | 6 |
| 2 Diagrams | 7 |
| MTQ-MNA1 Mechanical Drawing | 7 |
| 3 Specifications | 8 |
| Descriptions of LEDs | 10 |
| 40-Pin Connector Definitions | 10 |
| MTQ-xx-B01 | 10 |
| 40-Pin Connector | 12 |
| Processor Pin Information (B01 models only) | 12 |
| Serial Flash Embedded Memory | 14 |
| Electrical Characteristics | 15 |
| Operating Conditions | 15 |
| Absolute Maximum Rating | 15 |
| DC Electrical Characteristics | 15 |
| Input/Output Current Ratings | 16 |
| MTQ-MNA1-B01 Power Draw | 16 |
| 4 Antenna Information | 17 |
| Antenna System Cellular Devices | 17 |
| FCC Requirements | 17 |
| Requirements for Cellular Antennas with regard to FCC/IC Compliance | 17 |
| Cellular Antenna | 17 |
| Cellular Antenna Specifications | 18 |
| LTE Antenna MISO | 18 |
| Selecting Antennas | 18 |
| Antenna Approvals and Safety Considerations | 18 |
| Power Draw | 18 |
| OEM Integration | 18 |
| FCC & IC Information to Consumers | 18 |
| FCC Grant Notes | 19 |
| Host Labeling | 19 |
| 5 Safety Instructions | 20 |
| Handling Precautions | 20 |

| | |
|---|--------|
| Radio Frequency (RF) Safety..... | 20 |
| Sécurité relative aux appareils à radiofréquence (RF)..... | 20 |
| General Safety | 21 |
| Interference with Pacemakers and Other Medical Devices..... | 21 |
| Precautions for Pacemaker Wearers | 21 |
| Vehicle Safety | 21 |
| Operation Safety | 22 |
| 6 Labels | 23 |
| Approvals and Certifications | 23 |
| Example Labels | 23 |
| 7 Regulatory Information | 24 |
| FCC 47 CFR Part 15 Regulation Class B Devices | 24 |
| FCC Interference Notice..... | 24 |
| FCC Grant Information..... | 25 |
| 8 Environmental Notices | 26 |
| EU WEEE Directive..... | 26 |
| Instructions for Disposal of WEEE by Users in the European Union..... | 26 |
| EU REACH-SVHC Statement..... | 26 |
| EU RoHS 3 Directive..... | 26 |
| 9 Getting Started | 28 |
| Installing a SIM Card on a SocketModem | 28 |
| Device Drivers..... | 28 |
| USB Cable Recommendations | 28 |
| Communications Flow | 29 |
| Processor Model (B01)..... | 29 |
| Communicating with the Device | 29 |
| Dual Carrier Firmware for Cellular Radio | 30 |
| Powering Down Your Device | 30 |
| Device Reset (NRESET Pin 35) | 31 |
| Processor Models (B01) | 31 |
| Sleep Mode..... | 31 |
| Developing with an MTQ in Mbed | 31 |
| MTSCellularInterface Library | 32 |
| About Mbed™ | 32 |
| Programming the MTQ Microcontroller | 32 |
| Additional Information..... | 32 |
| ST Microelectronics STM32F411xC/E..... | 32 |

| | |
|---|----|
| 10 Using Connection Manager | 33 |
| Installing Connection Manager | 33 |
| Setting Up a Serial Device in Windows Device Manager | 34 |
| Connecting a Device | 35 |
| Uninstalling Connection Manager | 37 |
| Connection Manager User Interface | 37 |
| Main tab..... | 38 |
| Settings tab | 38 |
| Connection tab..... | 39 |
| Details tab | 39 |
| Terminal tab..... | 39 |
| Charts tab..... | 39 |
| Troubleshooting | 39 |
| Serial COM port is not available in the Serial Modem Settings..... | 39 |
| Device is not detected ("No Device") | 39 |
| USB Modem is not detected | 40 |
| Connection Manager is not working, and a device connected to the computer is not detected | 40 |
| Connection Manager displays "Device Error" status for a serial device | 40 |
| System Cannot Connect to Serial Device..... | 40 |
| Warranty..... | 44 |
| Contact Information | 44 |
| Revision History | 44 |

1 About the SocketModem MTQ

SocketModem® MTQ embedded cellular modems are complete, ready-to-integrate communications devices ideal for customers looking to add 4G-LTE cellular communications to their IoT/M2M solutions. These communications devices enable easy technology transitions and allow developers to add wireless communication to products with a minimum of development time and expense. SocketModem MTQ modems are carrier approved and end-device certified, decreasing time to market while saving customers money.

Build Options

| Ordering Part Number | Description | Region |
|----------------------|--|-----------------------|
| MTQ-MNA1-B01 | LTE Cat M1 SoM with GNSS (50 pack) | Canada, United States |
| MTQ-MNA1-B01 | LTE Cat M1 SoM with GNSS (single pack) | Canada, United States |

Note: Devices ship without network activation. To connect devices to the cellular network, contact your service provider and request the correct SIM cards.

The complete ordering part number may include an ".Rx" designation. For example, MTSMC-MNA1.Rx, where x is the hardware revision number.

Firmware Over the Air (FOTA) for Verizon

Also known as Firmware Update Over the Air (FUOTA). At times, your device may require a critical update to radio firmware for devices connecting to the network. To stay compliant to Verizon's requirements you must implement FOTA. Failure to perform a critical update could result in losing access to the Verizon network. For information and examples go to <https://multitech.com/verizon-firmware-over-the-air-fota>.

Additional Documentation

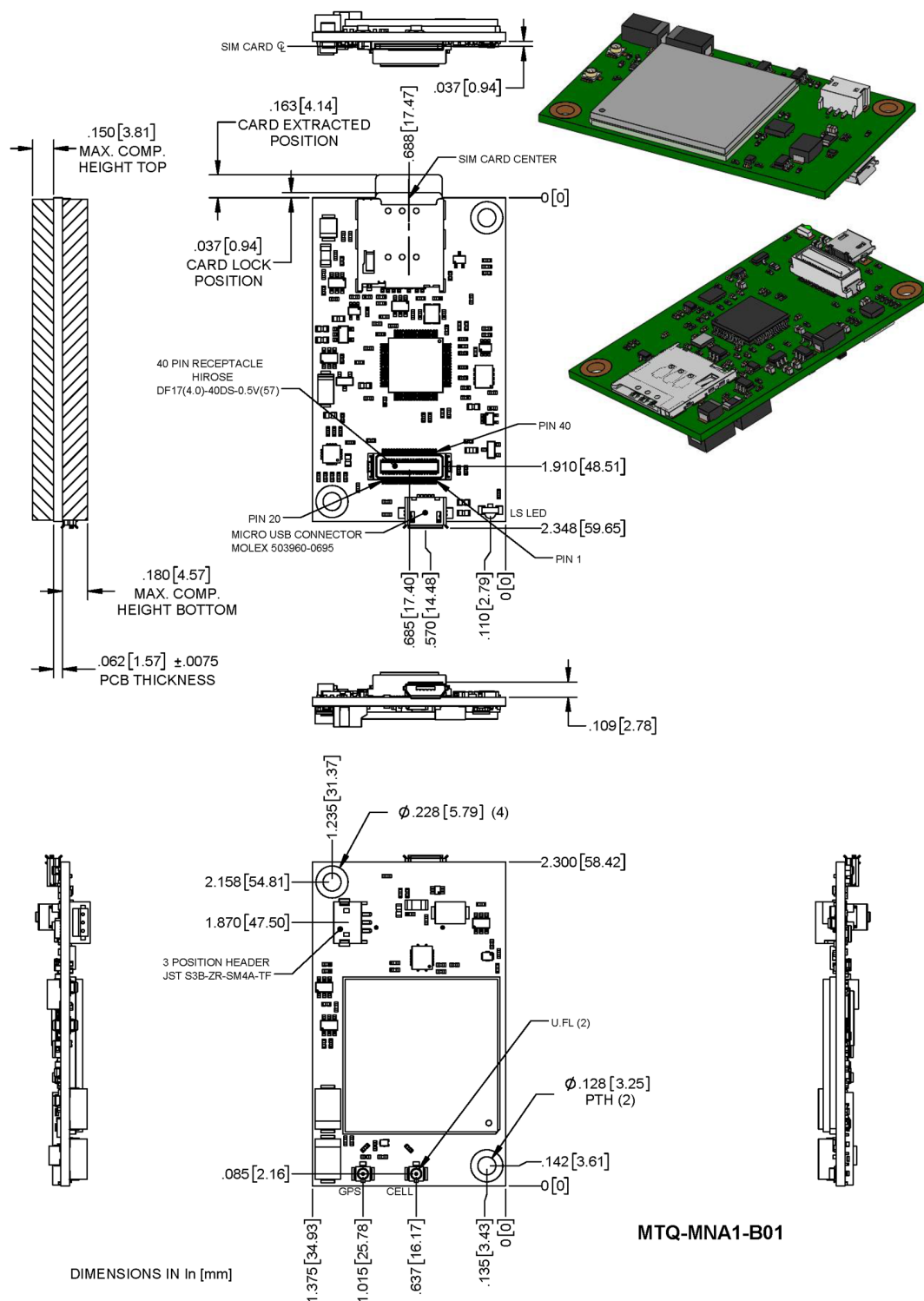
Additional documentation is available at <https://multitech.com/all-products/cellular/embedded-modems/multitech-socketmodem-mtq-iot-cellular-embedded-modem-and-system-on-module/>. Select your model to find the documents specific for your device.

| Document | Description | Part Number |
|--|---|---------------|
| SocketModem MTQ-MNA1-B01 Device Guide | This document. Provides model specifications and developer information. | S000682 |
| SocketModem MTUDK2-ST-CELL Universal Developer Kit Developer Guide | Information for developing with the MTUDK2-ST-CELL.R1 Developer Kit. Includes an overview, design considerations, schematics, and installation and operation information. | S000799 |
| Telit ME910C1 AT Commands Reference Guide | Lists AT commands and parameters used to configure your device. | 80529ST10815A |

Additional documentation is available at www.multitech.net.

2 Diagrams

MTQ-MNA1 Mechanical Drawing



3 Specifications

| Category | Description | |
|---|--|---------------|
| General | | |
| Standards | LTE UE Category M1, 3GPP release 13 compliant | |
| | USB Interface is CDC-ACM compliant | |
| Frequency Bands | AT&T | Verizon |
| | 4G: 1900 (B2) / 700 (B12) /AWS 1700 (B4) | 4G: 700 (B13) |
| LED | One, link status | |
| Speed | | |
| Data Speed | LTE Cat M1: Up to 375 Kbps uplink / Up to 300 Kbps downlink | |
| Interface | | |
| USB Interface | Micro 3FF USB 2.0 high speed | |
| UART | B01 models: Full UART to processor, then RX, TX, RTS, CTS only between the processor and radio | |
| Serial Modem Interface | Up to 921.6 Kbps | |
| Storage | | |
| Serial Flash | SPI bus compatible serial 16Mb flash memory | |
| Physical Description | | |
| Weight | 0.6 oz (17 g) | |
| Dimensions | See Mechanical Drawing | |
| Connectors | | |
| Antenna | 2 surface mount U.FL: cellular, auxiliary | |
| SIM Holder | 1.8 V and 3 V micro | |
| Pin header | 40-pin female for USB or UART | |
| Environment | | |
| Operating Temperature ³ | −40° C to +85° C | |
| Storage Temperature | −40° C to +85° C | |
| Humidity | 20%–90% RH, noncondensing | |
| Power Requirements | | |
| Input Voltage (using micro-USB connector) | 5.0 VDC | |

| Category | Description |
|---|----------------------------|
| Input Voltage (using 40-pin connector) | 3.3 VDC or 5.0 VDC |
| Certifications and Compliance | |
| EMC and Radio Compliance | FCC Part 15 Class B |
| | FCC Part 22 |
| | FCC Part 24 |
| Safety Compliance | UL/cUL 60950-1 2nd Edition |
| Carrier | AT&T/PTCRB/Verizon |

Note:

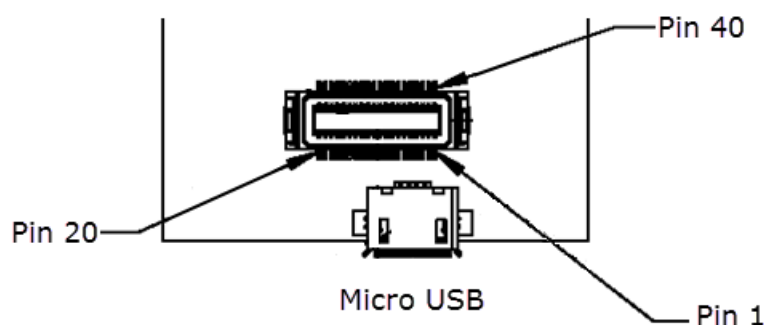
- Mbed has limited USB support for the processor. Software controls routing to processor or directly to radio.
- The battery management circuit is designed for single cell Li-Ion/Li-Poly technology. Acceptability of the battery charge circuit for charging specific batteries/cells is to be determined in the end product.
- Acceptability of the battery charge circuit for charging specific batteries/cells is to be determined in the end product.
- Radio performance may be affected by temperature extremes. This is normal.
- Device has been tested up to +85° C. UL Recognized @ 85° C.

Descriptions of LEDs

The Link Status LED is located on the SIM side of the device to the right of the Micro USB Connector in the lower right corner.

| LED Indicators | |
|----------------|--|
| LS | <p>Link Status</p> <ul style="list-style-type: none"> ■ OFF —No power to the cellular radio ■ Slow Blink (200 ms High/1800 ms Low) — Not registered/searching for network connection ■ Slow Blink (1800 ms High/200 ms Low) — Idle ■ Fast Blink (125 ms High/125 ms Low) — Connected/data transfer |

40-Pin Connector Definitions



MTQ-xx-B01

| Pin | Signal Name | Logic Level Voltage ¹ | In/Out | Description |
|-----|-------------|----------------------------------|-------------|--|
| 1 | DBX_TX | 3V | O | ST Micro UART debug Tx output |
| 2 | SWCLK | 3V | I | See ST Microcontroller Guide |
| 3 | CHARGE_MON | 0 - VCC-IN | O | Open-drain charging status indication output |
| 4 | PWR_GOOD | 0 - VCC-IN | O | Open-drain power good status indication output |
| 5 | GND | GND | GND | Ground |
| 6 | USB-DATA+ | 0 - 3V ² | | |
| 7 | USB-DATA- | | | |
| 8 | VCC-IN | 3.3 VDC or 5.0 VDC +/- 5% | Power Input | Main Power |

| Pin | Signal Name | Logic Level Voltage ¹ | In/Out | Description |
|-----|-------------|----------------------------------|-------------|--|
| 9 | IO_00 | I = 0 - 7V, O = 0 - 3V | I/O | General Purpose I/O from ST Microcontroller (STM 32F411) |
| 10 | IO_01 | | | |
| 11 | IO_02 | | | |
| 12 | IO_03 | | | |
| 13 | GND | GND | GND | Ground |
| 14 | IO_04 | I = 0 - 7V, O = 0 - 3V | I/O | General Purpose I/O from ST Microcontroller (STM 32F411) |
| 15 | IO_05 | | | |
| 16 | IO_06 | | | |
| 17 | IO_07 | | | |
| 18 | IO_08 | | | |
| 19 | IO_09 | | | |
| 20 | IO_10 | | | |
| 21 | IO_11 | | | |
| 22 | IO_12 | | | |
| 23 | IO_13 | | | |
| 24 | IO_14 | | | |
| 25 | IO_15 | | | |
| 26 | IO_16 | | | |
| 27 | IO_17 | | | |
| 28 | GND | GND | GND | Ground |
| 29 | IO_18 | I = 0 - 7V, O = 0 - 3V | I/O | General Purpose I/O from ST Microcontroller (STM 32F411) |
| 30 | IO_19 | | | |
| 31 | IO_20 | | | |
| 32 | IO_21 | | | |
| 33 | VCC-IN | 3.3 VDC or 5.0 VDC +/- 5% | Power Input | Main Power |
| 34 | LINK_STATUS | 3V | O | Radio link status LED |
| 35 | RESET | 0 - 3V | I | NRST pin of ST micro |
| 36 | GND | GND | GND | Ground |
| 37 | GND | | | |
| 38 | SWO | 3V | O | See ST Microcontroller Guide |
| 39 | SWDIO | 3V | I | |
| 40 | DBG_RX | 3V | I | ST Micro UART debug Tx input |

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

² USB D+D-: 5V tolerant inputs / 3V drive-level output

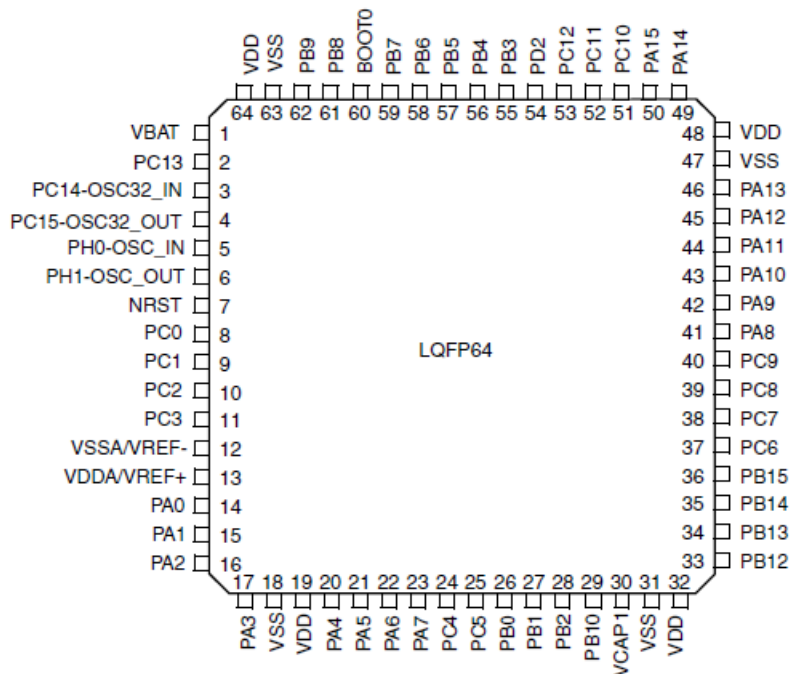
40-Pin Connector

| | |
|--------------|---------------------------|
| Manufacturer | Hirose Electric Co LTD |
| Description | .5MM 40 PN B>B RECEPTACLE |
| Model Number | DF17(4.0)-40DP-0.5V(57) |

Use with:

| | |
|--------------|-----------------------------|
| Manufacturer | Hirose Electric Co LTD |
| Description | .5mm 40 pin B.B header PLUG |
| Model Number | DF17(2.0)-40DP-0.5V(57) |

Processor Pin Information (B01 models only)



Note: Diagram from the STMicro 32F411 datasheet.

The following table lists the processor pins and how the MTQ uses them.

| Net Name | Number | Pin Name | Details |
|-----------|--------|----------|--------------------------|
| VDD3_3 | 1 | VBAT | Power |
| 3G_ONOFF | 2 | PC13 | Enable line to the Radio |
| 32K_XTAL_ | 3 | PC14 | RTC Clock |

| Net Name | Number | Pin Name | Details |
|---------------------|--------|-------------|---|
| 32K_XTAL | 4 | PC15 | RTC Clock |
| 26MHZ_CLK_IN | 5 | PH0-OSC_IN | Main Clock |
| 26MHZ_CLK_DRIVE | 6 | PH1-OSC_OUT | Main Clock |
| N_RESET | 7 | NRST | External Reset in |
| IO_10 | 8 | PC0 | GPIO/Analog capable pin |
| IO_11 | 9 | PC1 | GPIO/Analog capable pin |
| IO_8 | 10 | PC2 | GPIO |
| RADIO_PWR | 11 | PC3 | Voltage enable for Telit |
| GND | 12 | VSSA | Power |
| VDD3_3 | 13 | VDDA | Power |
| IO_18/RTS | 14 | PA0 | GPIO/Analog capable pin/USART2_CTS |
| IO_03/CTS | 15 | PA1 | GPIO/Analog capable pin/USART2_RTS |
| IO_00/RXD | 16 | PA2 | GPIO/USART2_TX |
| IO_21/TXD | 17 | PA3 | GPIO/USART2_RX |
| GND | 18 | VSS_4 | Power |
| VDD3_3 | 19 | VDD_4 | Power |
| SPI-SS1 | 20 | PA4 | SPI1 Select |
| IO_05/SCK | 21 | PA5 | SPI1 Clock/GPIO |
| IO_16/MISO/SDIO_CMD | 22 | PA6 | SPI1 MSIO/SDIO_CMD /GPIO |
| IO_01/DCD | 23 | PA7 | GPIO |
| IO_12 | 24 | PC4 | GPIO/Analog capable pin |
| VDD1_8_MON | 25 | PC5 | Power |
| IO_9 | 26 | PB0 | GPIO/Analog capable pin |
| IO_02/RI | 27 | PB1 | GPIO |
| BOOT1/BC_NCE | 28 | PB2 | Battery charge enabled. Pulled down by default. |
| RADIO_RTS | 29 | PB10 | Serial comm with the radio |
| VCAP | 30 | PB11/VCAP_1 | Power |
| N16612690 | 31 | VCAP_1/VSS | Power |
| VDD3_3 | 32 | VDD_1 | Power |
| RADIO_CTS | 33 | PB12 | Serial comm with the radio |
| IO_13 | 34 | PB13 | GPIO |
| SPI-SS2 | 35 | PB14 | GPIO for use with external SPI |

| Net Name | Number | Pin Name | Details |
|-------------------|--------|------------|------------------------------------|
| IO_7 | 36 | PB15 | GPIO/SDIO_CK |
| RADIO_TXD | 37 | PC6 | Serial comm with the radio |
| RADIO_RXD | 38 | PC7 | Serial comm with the radio |
| IO_17/SS2/SDIO_D0 | 39 | PC8 | GPIO/SDIO_D0 |
| IO_14/SDIO_D1 | 40 | PC9 | GPIO/SDIO_D1 |
| IO_20/DTR | 41 | PA8 | GPIO |
| IO_19/DSR | 42 | PA9 | GPIO/SDIO_D2 |
| USB_DIR/VBUS | 43 | A10 | USB Switch control, 0=Telit, 1=STM |
| FS_DM | 44 | PA11 | USB |
| FS_DP | 45 | PA12 | USB |
| J_TMS /SWDIO | 46 | PA13 | JTAG |
| | 47 | VCAP_2/VSS | Power |
| VDD3_3 | 48 | VDD_2 | Power |
| J_TCK/SWCLK | 49 | PA14 | JTAG |
| J_TDI/C_MON | 50 | PA15 | JTAG |
| SPI-SCK | 51 | PC10 | EPROM/SPI3_SCK |
| SPI-MISO | 52 | PC11 | EPROM/SPI3_MISO |
| SPI-MOSI | 53 | PC12 | EPROM/SPI3_MOSI |
| SPI-SRDY | 54 | PD2 | EPROM/SPI3_SRDY |
| J_TDO/SWO | 55 | PB3 | JTAG |
| J_RST/P_GOOD | 56 | PB4 | JTAG |
| IO_4/MOSI/SDIO_D3 | 57 | PB5 | GPIO/SPI1_MOSI/SDIO_D3 |
| DBG_TX | 58 | PB6 | JTAG |
| DBG_RX | 59 | PB7 | JTAG |
| BOOT | 60 | BOOT0 | Reserved. |
| IO_6/SCL/SS1 | 61 | B8 | GPIO/I2C1_SCL |
| IO_15/SDA/SRDY | 62 | PB9 | GPIO/I2C1_SDA |
| GND | 63 | VSS_3 | Power |
| VDD3_3 | 64 | VDD_3 | Power |

Serial Flash Embedded Memory

This product uses the GigaDevice GD25Q16C serial flash memory device.

For information on features, refer to the serial flash datasheet: <https://www.gigadevice.com/flash-memory/gd25q16c>

For information on processor connections to serial flash, refer to the table in *Processor Pin Information*.

Electrical Characteristics

Operating Conditions

| Parameter | Minimum Volts | Maximum Volts |
|--------------------|----------------|----------------|
| Supply Range - Vcc | 3.3 VDC +/- 5% | 5.0 VDC +/- 5% |

Absolute Maximum Rating

| Parameter | Minimum Volts | Maximum Volts |
|---------------------------|---------------|---------------|
| Voltage at any signal pin | -0.3 | 5.5 |

DC Electrical Characteristics

| Parameter | Conditions | Minimum Volts | Maximum Volts |
|--|-----------------------------|----------------|------------------|
| Digital signal input low level | CMOS port $I_{IO}=+8$ mA | -0.3 | 0.9 |
| Digital signal input high level | CMOS port $I_{IO}=+8$ mA | 2.1 | 5.5 |
| Output low level voltage for an I/O pin | CMOS port $I_{IO}=+8$ mA | - | 0.4 |
| Output high level voltage for an I/O pin | | $V_{DD}-0.4$ | - |
| Output low level voltage for an I/O pin | TTL port $I_{IO}=+8$ mA | - | 0.4 |
| Output high level voltage for an I/O pin | | 2.4 | - |
| Output low level voltage for an I/O pin | $I_{IO}=+20$ mA | - | 1.3 ¹ |
| Output high level voltage for an I/O pin | | $V_{DD}-1.3^1$ | - |
| Output low level voltage for an I/O pin | $I_{IO}=+6$ mA | - | 0.4 ¹ |
| Output high level voltage for an I/O pin | | $V_{DD}-0.4^1$ | - |
| Output low level voltage for an I/O pin | $I_{IO}=+4$ mA | - | 0.4 ² |
| Output high level voltage for an I/O pin | | $V_{DD}-0.4^2$ | - |
| RESET (low active) input low | CMOS port $I_{IO}=+8$ mA | - | 0.99 |
| RESET (low active) input high | CMOS port $I_{IO}=+8$ mA | 2.31 | - |

¹ Guaranteed by characterization results, not tested in production.

² Guaranteed by design, not tested in production.

Note:

See the ST Microcontroller data sheet (STM 32F411REF) and the Pin Connector Definitions table in this guide.

Use $V_{DD} = 3.0V$ when referencing the STM 32F411REF data sheet.

Input/Output Current Ratings

| | |
|---|-------|
| Output current draw PWR_GOOD, CHG_MON | 5 mA |
| Output current draw all other output pins | 25 mA |

MTQ-MNA1-B01 Power Draw

MultiTech recommends that you incorporate a 10% buffer into your power source when determining product load.

| Radio Protocol | Sleep Mode | Cellular Connection Idle (No Data) | (AVG) Measured Current at Max Power ³ | TX Pulse ⁴ (AVG) Amplitude Current for Peak Current for LTE | Total Inrush Charge ⁵ Measured in Millicoulombs | Total Inrush Charge Duration during Powerup |
|--|------------|------------------------------------|--|--|--|---|
| 5.0 VDC USB Only | | | | | | |
| LTE | 3.6 mA | 57 mA | 195 mA | 420 mA | 5.11 mC | 40.9 mS |
| 5.0 VDC Serial Connection ⁶ | | | | | | |
| LTE | 3.6 mA | 54 mA | 191 mA | 412 mA | 3.72 mC | 40.1 mS |

³ The continuous current during maximum data rate with the radio transmitter at maximum power.

⁴ The average peak current during an LTE connection.

⁵ The total inrush charge at power on.

⁶ Serial connection results tested with device in Developer Card.

4 Antenna 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 that the performance is not compromised. Devices were approved with the antenna(s) described below and for alternate antennas meeting the given specifications.

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

FCC Requirements

There cannot be any alteration to the authorized antenna system. The antenna system must be the same type with similar in-band and out-of-band radiation patterns and should not exceed the maximum gain information detailed in the FCC Grant.

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 6.18 dBi for the 700 MHz band, 6.00 dBi for 1700 MHz band, and 9.01 dBi for the 1900 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.

Cellular Antenna

Cellular devices were approved with the following antenna:

| | |
|--------------|--------------------|
| Manufacturer | Wieson |
| Description | LTE GY115HT467-017 |
| Model Number | 11320Y11194A1 |

MultiTech ordering information

| Model | Quantity |
|--------------|----------|
| ANLTE2-2HRA | 1 |
| ANLTE2-10HRA | 10 |
| ANLTE2-50HRA | 50 |

Cellular Antenna Specifications

| Category | Description |
|-----------------|---|
| Frequency Range | 0.069 GHz~0.96 GHz, 1.71 GHz~2.17 GHz, 2.3 GHz~2.69 GHz |
| Impedance | 50 Ohms |
| VSWR | VSWR should not exceed 3:1 at any point across the bands of operation |
| Peak Gain | 3.8 dBi |
| Radiation | Omni-directional |
| Polarization | Linear vertical |

LTE Antenna MISO

LTE devices use Multiple Input and Single output (MISO) to improve the downlink connection (cell tower to mobile). It has no effect on the uplink (mobile to cell tower).

Important: Always connect all included antennas for increased downlink bandwidth and better signal handling in diverse locations. You must deploy with two antennas, unless your carrier has authorized you to deploy with one antenna.

Selecting Antennas

Select an antenna based on your product and application. Typically, both antennas are the same because either can be the main receive antenna. However, if the antenna connectors are too close together, use a similar antenna on a short cable for the second receive only antenna.

Antenna Approvals and Safety Considerations

Note the following:

- The carriers conduct antenna diversity tests.
- There are no EMC concerns about antenna diversity.
- All antennas need to have a minimum flammability rating.
- Safety requirements depend on your final product.
- Antennas are not approved for outdoor use. Do not extend antennas outside of any building.

Power Draw

There are no significant power draw differences.

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 4 Sections 8.3 and 8.4.

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 Information chapter.

5 Safety Instructions

Handling Precautions

To avoid damage due to the accumulation of static charge use proper precautions, such as an ESD strap, when handling any cellular device 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.
- Turn off your wireless device when in an aircraft. Using portable electronic devices in an aircraft may endanger aircraft operation, disrupt the cellular network, and may be illegal. Failing to observe this restriction may lead to suspension or denial of cellular services to the offender, legal action, or both.
- Turn off your wireless device when around gasoline or diesel-fuel pumps and before filling your vehicle with fuel.
- Turn 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 cellulaires. 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.

General Safety

The device is designed for and intended to be used in fixed and mobile applications. Fixed means the device is physically secured at one location and cannot be easily moved to another location. Mobile means the device is used in other than fixed locations.

CAUTION: Maintain a separation distance of at least 20 cm (8 inches) between the transmitter's antenna and the body of the user or nearby persons. The device is not designed for or intended to be used in portable applications within 20 cm (8 inches) of the user's body.

Attention: Maintenir une distance d'au moins 20 cm (8 po) entre l'antenne du récepteur et le corps de l'utilisateur ou à proximité de personnes. Le modem n'est pas conçu pour, ou destinés à être utilisés dans les applications portables, moins de 20 cm du corps de l'utilisateur.

Interference with Pacemakers and Other Medical Devices

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 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 local 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 that 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.

Operation Safety

CAUTION: Read all instructions and safety information before installing or using this device.

Attention: Lisez toutes les instructions et consignes de sécurité avant d'installer ou d'utiliser cet appareil.

- Follow all local laws, regulations, and rules for operating a wireless device.
- Use the device security features to block unauthorized use and theft.
- Unless otherwise noted, antennas are not approved for outdoor use. Do not extend any antenna outside of any building, dwelling, or campus.
- 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 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 an explosion or fire that may result in property damage, severe injury, or death.
- Do not expose the device to any extreme environment where the temperature or humidity is high. Such exposure could result in damage to the device or cause a fire. See the device specifications for recommended operating temperature and humidity.
- Do not expose the device to water, rain, or other liquids. It is not waterproof. Exposure to liquids could result in damage to the device.
- Using accessories, such as antennas, that MultiTech has not authorized or that are not compliant with the device accessory specifications may invalidate the warranty.

If the device is not working properly, contact MultiTech technical support.

6 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. The antenna system must be the same type with similar in-band and out-of-band radiation patterns and maintain the same specifications. Refer to the FCC grant information for details.
- **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.

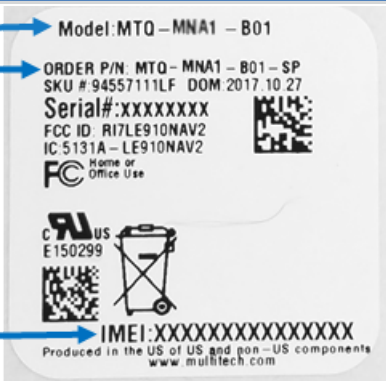
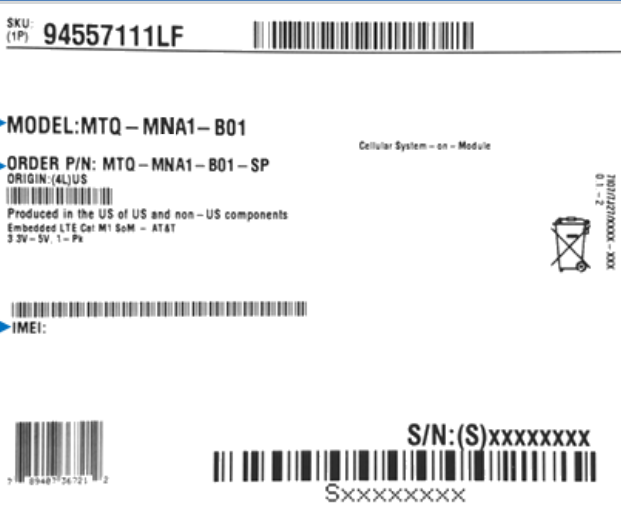
Example Labels

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 labels shown are not their actual sizes.

| Device Label | Package Label |
|--|---|
|  <p>1 → Model: MTQ-MNA1-B01</p> <p>2 → ORDER P/N: MTQ-MNA1-B01-SP SKU # 94557111LF DOM 2017.10.27 Serial#:XXXXXXXX FCC ID: R17LE910NAV2 IC 5131A-LE910NAV2 FC Home or Office Use CUL US E150299 3 → IMEI:XXXXXXXXXXXXXXX Produced in the US of US and non-US components www.multitech.com</p> |  <p>SKU: (1P) 94557111LF</p> <p>1 → MODEL: MTQ-MNA1-B01</p> <p>2 → ORDER P/N: MTQ-MNA1-B01-SP ORIGIN: (4) US Produced in the US of US and non-US components Embedded LTE Cat M1 SoM - AT&T 3.3V-5V, 1-Pk</p> <p>3 → IMEI:</p> <p>S/N: (S)XXXXXXXX SXXXXXXXX</p> |

- 1 - MultiTech Model Identification
- 2 - MultiTech Ordering Part Number
- 3 - IMEI

7 Regulatory Information

FCC 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 Interference Notice

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.

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 |

Output power is conducted.

This device is approved for mobile and fixed use with respect to RF exposure compliance. The antenna of this transmitter must provide a separation distance of at least 20 cm from all persons. Installers and end users must be provided with antenna installation instructions and antenna operating conditions and instructions for satisfying RF exposure compliance. The final product operating this transmitter must include operating instructions and antenna installation instructions for end users and installers to satisfy RF exposure compliance requirements. Multi-transmitter, supporting simultaneous transmission configurations, have not been evaluated and shall be evaluated according to KDB Publication 447498 and §15.31 (h) and §15.31 (k) and §2.1 end product terms and concepts. Compliance of this device in all final product configurations is the responsibility of the Grantee. Installation of this device into specific final products may require the submission of a Class II permissive change application containing data pertinent to RF Exposure, emissions and host/module authentication, or new application if appropriate.

The maximum antenna gain including cable loss for compliance with radiated power limits, RF exposure requirements, and the categorical exclusion requirements of 2.1091 is 6.18 dBi for the 700 MHz frequency band, 6.00 dBi for 1700 MHz band, and 9.01 dBi for the 1900 MHz frequency band.

8 Environmental Notices

EU WEEE Directive

Note: This statement may be used in documentation for your final product applications.

The Waste from Electrical and Electronic Equipment (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, contact your local city office, your household waste disposal service or where you purchased the product.

July, 2005



EU REACH-SVHC Statement

Multi-Tech Systems, Inc. confirms that none of its products or packaging contain any of the Substances of Very High Concern (SVHC) on the REACH Candidate List, in a concentration above the 0.1% by weight allowable limit.

For the current REACH-SVHC statement and additional regulatory documents, go to <https://multitech.com/approvals-and-certifications/>.

EU RoHS 3 Directive

Multi-Tech Systems, Inc. confirms that all products comply with the chemical concentration limitations set forth in the Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS 3) regulations for CE and UKCA, following the standard EN IEC 63000:2018.

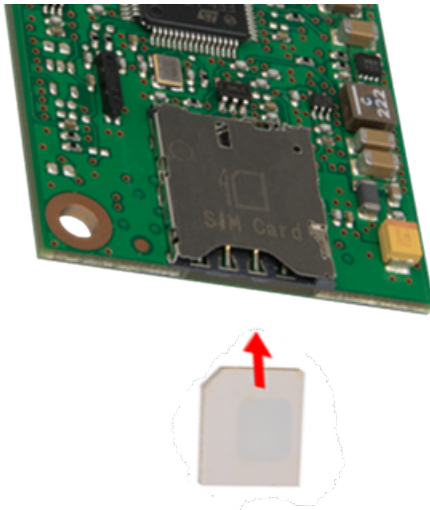
For the current Certificate of Compliance for Hazardous Substances and additional regulatory documents, go to <https://multitech.com/approvals-and-certifications/>.

9 Getting Started

Installing a SIM Card on a SocketModem

When using the SocketModem with a developer board, install the SIM card before mounting the SocketModem on the developer board.

With the contact side facing down, align the notched edge as shown on the SocketModem's SIM holder and slide the SIM card completely into the SIM holder.



Device Drivers

Install drivers on your computer before connecting the device.

The cellular radio's USB device driver is available on your model's page.

- Go to <https://multitech.com/all-products/cellular/embedded-modems/multitech-socketmodem-mtq-iot-cellular-embedded-modem-and-system-on-module/> and click on your model. Download the driver from Downloads.
- The USB Driver Installation Guide (S000616) is included in the driver download and is also available under Manuals on your model's page.

USB Cable Recommendations

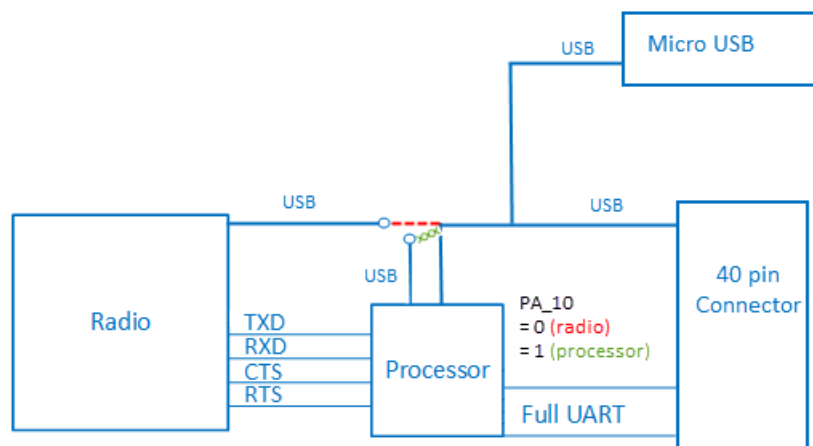
To avoid enumeration or power issues if your device has a USB connector:

- Use a high-speed USB cable that is as short as possible.
- Use a well-shielded cable with at least 24 AWG wire pair for power/ground and 28 AWG wire pair for data lines.
- If possible, use a USB port that connects directly to the motherboard rather than a USB port with added cabling inside the computer chassis.
- Use USB 3.0 ports if available. These ports are typically rated for more current.

- The USB cable is available through MultiTech. The part number is CA-USB-A-MICRO-B-3.

Communications Flow

Processor Model (B01)



Note:

- The device has a UART subset as well as GPIO (4-pin UART [tx/rx/rts/cts]).
- If needed, use the GPIOs for additional UART signaling.
- The USB port can switch between a connection to the radio (red dotted line) or a connection to the processor (green x line). The USB selection is controlled via programming on the processor. There is no USB between the radio and the processor.

Communicating with the Device

Following are three options for communicating with the device.

- Install USB drivers and plug into the micro USB connector. No need for a host board.
- Access the device's USB interface via pins 6 and 7 of the 40-pin connector. Data pins 6 and 7 are in parallel with the micro USB connector on the device. There is no connection to pins 6 and 7 on the developer board.
- Establish serial communication using Multitech developer board MTUDK2. See the Developer Guide, Universal Developer Kit MTUDK2-ST-CELL.R1 (part number S000799) for more information.

Dual Carrier Firmware for Cellular Radio

This device uses a cellular radio with dual carrier firmware meaning that it can be used on different carrier networks (not simultaneously). The device can be used on either the Verizon or AT&T/other networks. The device is configured for AT&T/others by default.

To check that your device is configured for the desired network:

`AT#FWSWITCH?`

- If the response is
`#FWSWITCH: 0`
the device is configured for AT&T/other networks.
- If the response is
`#FWSWITCH: 1`
the device is configured for Verizon.

To switch carrier networks:

- From AT&T to Verizon: `AT#FWSWITCH=1,1`
- From Verizon to AT&T: `AT#FWSWITCH=0,1`

Note: This AT Command reboots the system.

For the Link status (LS) LED to function, you must issue the command `AT#GPIO=1,0,2` any time you use the firmware switch command (`AT#FWSWITCH=0` or `AT#FWSWITCH=1`).

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, do one of the following options:

Option 1:

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 ONOFF line is high, the radio restarts after 60 seconds.

Option 2:

1. Hold signal ONOFF (processor pin PC13) low.
2. Monitor signal VDD1_8_MON (processor pin PC5). When it goes low, the radio is powered off and it is safe to remove power.

Device Reset (NRESET Pin 35)

NRESET pin 35 of the 40 pin connector is routed directly to NRST on the STM32F411RE processor.

There are two components to reset:

1. Processor Reset
Multiple reset methods are available. Refer to STM32F411 documentation for details.
2. Radio Reset
The STM32F411RE processor pin PC_13 is routed to a tiny9 supervisory processor that controls the radio.
 - If PC_13 is driven low for >50ms and <1s, the radio is reset.
 - If PC_13 is driven low for >1s, the radio is powered down.

Processor Models (B01)

- To reset the processor, the minimum recommended reset pulse is 200 μ s. The maximum reset pulse is less than 1 second.
- Refer to STM32F411 documentation for additional reset options available within the on-board microcontroller.
 - Reset is controlled via PC13 on the on-board microcontroller.
 - Refer to 3G_ONOFF Signal for instructions on managing radio module reset.

Sleep Mode

Control radio sleep mode with the GPIO pin PC13 (3G_ONOFF) on the onboard processor. See also *3G_ONOFF Signal*.

- Setting PC13 to Low and holding it low turns the radio off, causing it to draw minimal power.
 - Setting PC13 to High resets and wakes up the device.
 - Refer to +CFUN in the *AT Command Reference Guide* for other sleep options.
- Note:** If using +CFUN commands, then reset the device via the PC13 (3G_ONOFF) toggle low to high to bring the radio out of +CFUN sleep mode.

Developing with an MTQ in Mbed

Build applications written for the MTQ are built on top of the Arm®Mbed™ library and can include the MTSAS library for easy cellular radio use.

The MTQ ships with AT pass-through firmware, which directly connects the cellular radio to the external serial port on the MTUDK2-ST-CELL developer board. The firmware:

- Runs at 115200 baud by default to match with the cellular radio's default baud rate.
- Prints debug messages from the debug port at 115200 baud.
- Allows users to increase or decrease the application's baud rate by entering a plus (+) or minus (–) character on the USB debug port. Issuing a plus or minus character on the USB debug port changes the external serial port speed as well as the speed of the link between the processor and the radio. The speed of the USB

debug port on reset is always 115200 to match the radio's default regardless of the baud rate used at the time of reset.

- Uses RTS/CTS flow control on the serial connection to the radio and on the external serial connection. Enables RTS/CTS flow control on terminal emulators used with the AT pass-through firmware.

MTSCellularInterface Library

The MTSCellularInterface software library on mbed provides a consistent interface to the cellular radio on each MTQ module. The interface includes:

- TCP sockets
- UDP sockets
- HTTP/HTTPS requests
- SMS messaging
- GPS if supported by the radio
- Access to common radio information like signal strength, registration, etc.

The library provides an easy-to-use API for interacting with the cellular radio. It identifies the radio and uses proper AT commands for that radio type, which allows the same application to run on multiple MTQ models with no software changes.

About Mbed™

Arm Mbed is a free, open-source platform and operating system for embedded devices using the Arm Cortex-M microcontrollers. The platform includes a standards-based C/C++ SDK, a microcontroller HDK, and supported development boards, an online compiler and online developer collaboration tools.

Programming the MTQ Microcontroller

With the MTQ and the MTUDK2-ST-CELL developer board, use the Arm Mbed ecosystem to program the microcontroller. Compile in the cloud or locally, copy the resulting binary file to the Mbed USB drive, and reset the MTQ.

All MTQ software is open source.

Additional Information

- Serial Flash Datasheet: <https://www.micron.com/~media/documents/products/data-sheet/nor-flash/serial-nor/m25p/m25p16.pdf>

ST Microelectronics STM32F411xC/E

For information on the STM32F411xC/E microcontroller, refer to:

- Reference Manual: http://www.st.com/st-web-ui/static/active/en/resource/technical/document/reference_manual/DM00119316.pdf
- Datasheet: <http://www.st.com/web/en/resource/technical/document/datasheet/DM00115249.pdf>

10 Using Connection Manager

Use Connection Manager to:

- Install the latest device drivers.
- Connect your device to your carrier's network.
Note: Connection Manager can install drivers and connect your device regardless of your cellular network; however, activation is only supported with Verizon, Aeris, and some regional carriers.
- Switch the firmware in your device to a different carrier (if supported by your device).
- Manage cellular connection and automatically reconnect with the keep-alive feature.
- View device details.
- View line charts of signal level and data rates.
- Use a terminal window for communicating with and troubleshooting the device.

Note: If you have an older version of Connection Manager, uninstall it before installing a new version. For details, refer to [Uninstalling Connection Manager](#).

Installing Connection Manager

Connection Manager installs the appropriate drivers for USB devices along with the application. Serial devices do not require drivers.

Note: Attempting to plug in the device before the appropriate drivers are installed can cause the connection to fail.

To install Connection Manager and the device drivers:

1. Go to <https://multitech.com/all-products/software-management/connection-manager/>.
2. Click Connection Manager.
3. Open or unzip the Connection Manager file and run the installer (.msi file).
4. On the MultiTech Connection Manager Setup Wizard Welcome Panel, click Next.
5. Read the end-user license agreement and check I accept the terms in the License Agreement. Click Next.
6. Click Next to have the installer automatically disable the native WWAN AutoConfig service in Windows.
 The WWAN AutoConfig service manages mobile broadband connections. Connection Manager requires that this service be disabled.
Note: This page appears in Windows 10 and Windows 11.
7. If any Multichannel device is connected to the computer, disconnect it and click Next.
8. If you use a USB device, check Install the modem driver.

CAUTION: Unless you are certain that the drivers for your USB device are already installed on the computer, make sure that you check Install the modem driver. Failure to do this will cause the application to incorrectly detect your device or not detect the device at all.

Note: Because serial devices do not require drivers, it does not matter if you check or uncheck Install the modem driver for a serial device.

9. To specify a folder for Connection Manager, use the default folder or click Change to browse to the folder you want to use. Click Next.
10. Click Install. Windows may prompt you to allow the installer to make changes to your computer. Click Yes.
11. In the Setup Wizard, click Finish.

Note: To open Connection Manager automatically after installation, check Start the MultiTech Connection Manager when the installation is finished.

If using a USB device, you can connect the device to the carrier's network with Connection Manager. See [Connecting a Device](#).

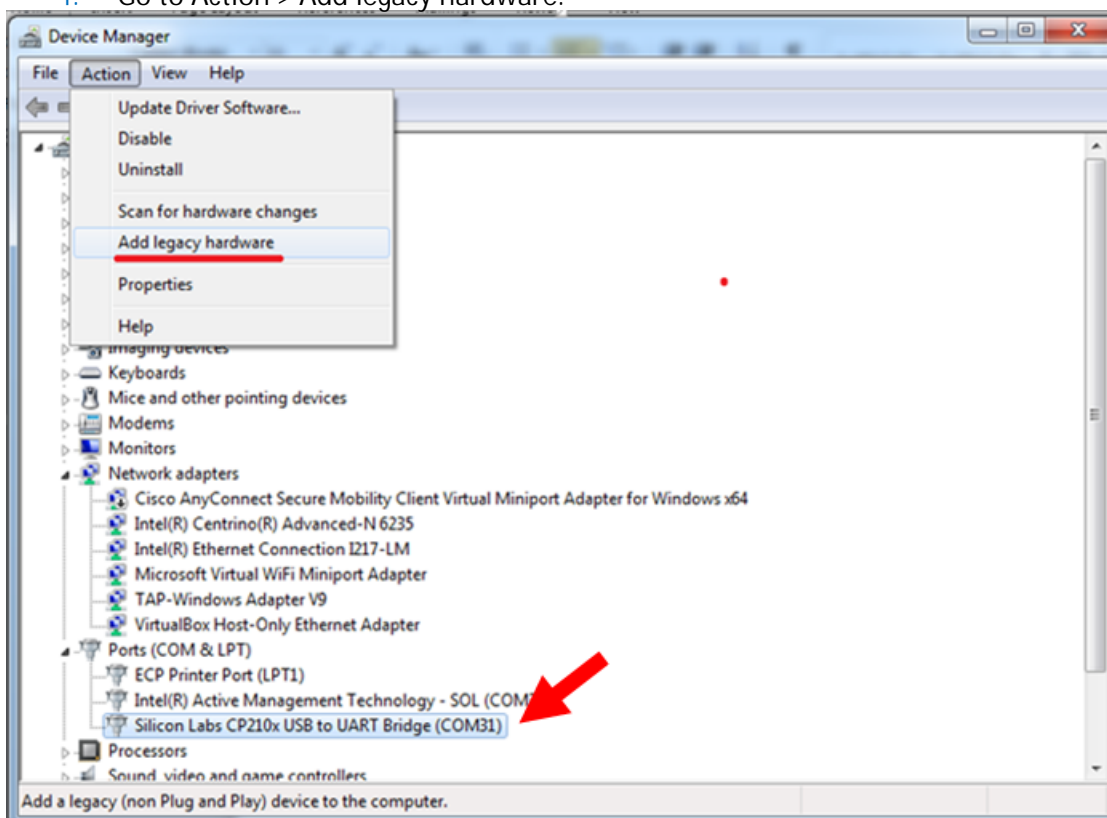
If using a serial device, you need to set up the device in Windows Device Manager before connecting the device. See [Setting Up a Serial Device in Windows Device Manager](#).

Note: The -L6G1 radio establishes a connection automatically as soon as the device is plugged into a PC with Windows OS. No configuration or connection steps are required with this device.

Setting Up a Serial Device in Windows Device Manager

To set up the device in Windows Device Manager:

1. Make sure that your desired COM port for the serial device is available.
2. Connect the serial device to the PC.
3. Go to Control Panel > Device Manager. Make a note of the COM port number for the connected device (in COM Ports). Example: The COM port is COM31.
4. Go to Action > Add legacy hardware.



5. In the Add Hardware Wizard:
 - a. Click Next.
 - b. Select Install the hardware that I manually select from a list, then click Next.
 - c. Select Modems, then click Next.
 - d. Check Don't detect my modem; I will select it from a list, then click Next.
 - e. Select Standard Modem Types, then select Standard 33600 bps Modem on the right.
Important: Make sure that you select *only* Standard 33600 bps Modem. Selecting another model may cause your device to work incorrectly or fail.
 - f. Select your COM port, then click Next.
 - g. Click Finish.
 - h. Go to Device Manager > Modems and confirm that the device is added.
6. To verify that the device is set up correctly, query the device:
 - a. Go to Device Manager > Modems, right-click Standard 33600 bps Modem, and select Properties.
 - b. On the Diagnostics tab, click Query Modem.
Note: The device cannot be queried if the Connection Manager is running and using the device's port.

If the device is ready, diagnostic information from the device appears in the box above.

To connect the device to your carrier's network, see [Connecting a Device](#).

Connecting a Device

Prerequisite:

- Make sure that your device is connected to the computer where Connection Manager is installed.
- If you have a serial device, set up the device in Device Manager. See [Setting Up a Serial Device in Windows Device Manager](#).

Note: The –L6G1 radio establishes a connection automatically as soon as the device is plugged into a PC with Windows OS. No configuration or connection steps are required with this device.

To connect your device to the carrier's network:

1. Open Connection Manager.
 Connection Manager automatically detects the connected device, and the Detect button on the Main tab changes to Connect. If the application cannot detect the device automatically, click Detect to initiate device detection manually.
2. If you are connecting the device to this computer for the first time, on the Connection dialog box, provide values for the connection settings, such as the dial number and access point name (APN).
 You may need to ask the carrier for these settings.
Note: For –L6G1 radios, dial number is disabled.

- a. To monitor Internet connectivity, have Connection Monitor send periodic pings to a host, check Enable keep-alive and enter the IP address or host name to ping in the Host to ping box. For example, you can enter the host name [google.com](https://www.google.com) or IP address 8.8.8.8.
If the keep-alive check fails, Connection Manager automatically reconnects. When the keep-alive feature is enabled, the Connection Manager's Main tab displays the keep-alive check status and when the last ping response was received.
- b. If your device supports dual carriers, switch the firmware to the desired carrier by selecting the carrier in the MNO Firmware list. For example, if your device can switch the firmware between AT&T and Verizon, select Verizon in the list.

Note:

- The MNO Firmware list doesn't appear if your device doesn't support carrier firmware switching.
 - When you change the carrier firmware, the modem automatically restarts to apply the selected firmware.
- c. To save the settings, click Apply.
You can change the connection settings on the Connection tab. The Dial number, APN, User name, and Password cannot be changed after the device is connected.

Note: For –L6G1 radios, dial number is disabled.

3. On the Settings tab, select USB Modem or Serial Modem depending on whether you are connecting a USB or serial device.
4. If you are connecting a serial device, provide the serial settings on the Settings tab:
 - a. In the Modem type list, select the appropriate modem type.
 - b. For the other settings, provide the values that match the serial-port settings for the device in Device Manager.
For Port, expand Ports and notice the COM port number next to the device name. Right-click the device name, select Properties, and find the values for the other settings on the Port Settings tab.
 - c. To save the settings, click Apply.

Note:

- Settings displayed for a USB device on the Settings tab are determined automatically and cannot be changed.
- To set the application to run during Windows startup, check Run application at Windows startup.
- To automatically connect to the Internet, check Connect to the Internet automatically.

Selecting Run application at Windows startup and Connect to the Internet automatically is useful in scenarios where Connection Manager is running on a remote computer. If a power failure occurs on the computer, these settings ensure the application will restart and reconnect to the Internet when power is restored.

5. On the Main tab, click Connect.

When a connection is established, the Main tab displays the download and upload speeds, the amount of traffic sent and received, Connected status, and the signal strength percentage and bars. The statistics on connection speeds and traffic are available only during a current connection session.

Note:

- For serial modems, the signal strength is available only when the device is *not* connected to the carrier's network. When connection to the network is established, the last signal strength value is displayed.
- View the details for the current connection on the Details tab.

To disconnect the device from the carrier's network, click Disconnect.

Important: Disconnect the device in Connection Manager before disconnecting a device from the computer.

Uninstalling Connection Manager

Prerequisite:

Make sure that Connection Manager is not running.

Along with uninstalling Connection Manager, the installed device drivers are also removed.

To uninstall Connection Manager:

1. In Windows, go to Control Panel > Programs > Programs and Features.
2. Right-click MultiTech Connection Manager and select Uninstall.
3. Click Yes to confirm that you want to uninstall Connection Manager.
The native Windows WWAN AutoConfig service is automatically enabled.
4. When the message "Are you sure you want to uninstall this product?" appears, click Yes.

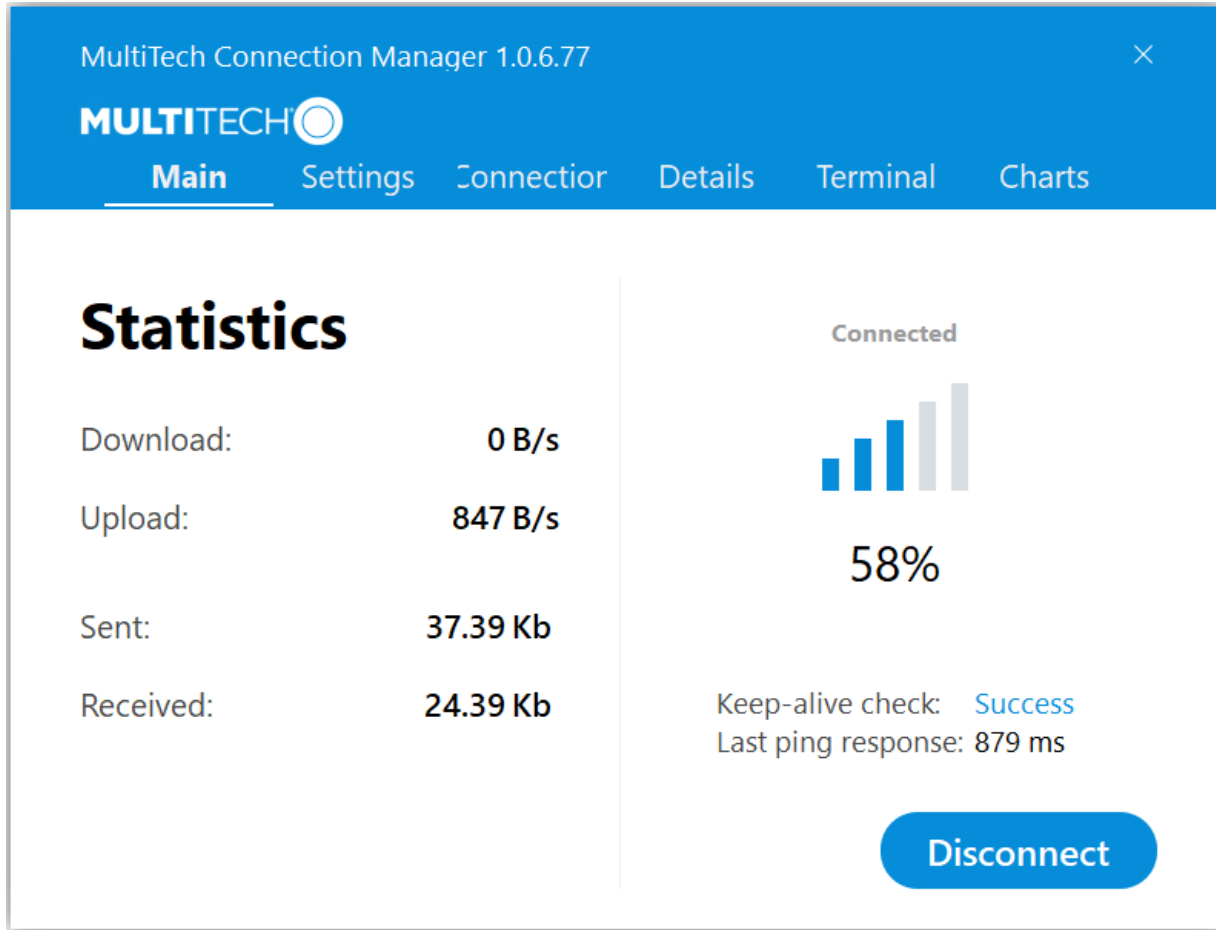
Connection Manager and the installed drivers are removed from the computer.

Note: The steps above describe how to uninstall Connection Manager using Control Panel. You can also uninstall the application by using the installer file (.msi). Double-click the file, in the MultiTech Connection Manager Setup Wizard, click Next, and then select Remove on the next two pages.

Connection Manager User Interface

Connection Manager consists of the following tabs:

- Main
- Settings
- Connection
- Details
- Terminal
- Charts



Main tab

The Main tab displays the following:

- Status of device connection: Searching, Connecting, Connected, Disconnecting, or Disconnected
- The action button, which changes according to the current device connection status: Detect, Connect, or Disconnect
- Signal strength bars and percentage indicator (only when connection to the carrier's network is established)
Note: The signal strength is displayed for a serial device only when the device is not connected to the carrier's network.
- Connection statistics: download and upload speeds, amount of traffic sent and received (only when connection to the carrier's network is established)
- The keep-alive check status and when the last ping response was received if Enable keep-alive check is checked on the Connection tab

Settings tab

Use the Settings tab to specify the type of device: USB Modem or Serial Modem.

- If USB Modem is selected, the tab displays USB settings. These settings cannot be edited.

- If Serial Modem is selected, the tab displays the serial settings that match the serial-port settings for the device. You can edit these settings.

The Settings tab also contains the Run application at Windows startup and Connect to the Internet automatically options.

- Check Run application at Windows startup to open Connection Manager when Windows starts.
- Check Connect to the Internet automatically to set Connection Manager to connect to the carrier's network automatically each time the application opens.

Connection tab

The Connection tab displays the following:

- The carrier-provided connection settings.
- The Enable keep-alive check box. Check this box to monitor connectivity to the Internet. Check Enable keep-alive check and enter the IP address or host name to ping in the Host to ping box. Connection Monitor will send periodic pings to the host. If the keep-alive feature fails, Connection Manager will automatically reconnect.
- The MNO firmware list. If your device supports dual carriers, you can switch the firmware to the other carrier by selecting the carrier in this list.

Note: The Connection tab isn't available if Connection Manager doesn't detect a device.

Details tab

The Details tab displays the modem details when a device is detected and the connection details when a connection is established.

Terminal tab

The Terminal tab contains a terminal window to communicate with the connected device by entering AT commands. For details, see the AT Commands reference guide for your device.

Note: When a serial device is connected to the carrier's network, the terminal window isn't available.

Charts tab

The Charts tab contains line charts that graphically represent signal strength and download and upload speeds for the two-hour interval.

Troubleshooting

Serial COM port is not available in the Serial Modem Settings

Close Connection Manager and reopen it.

Device is not detected ("No Device")

After following the steps to activate your device, the Main tab still indicates "No Device."

Try the following steps:

1. Click the Settings tab and make sure that the appropriate modem type is selected: USB or Serial.
2. If you are connecting a serial device, make sure that all serial modem settings correspond to the serial modem and serial port configuration.
3. Restart Connection Manager.
4. Disconnect and reconnect the device.

USB Modem is not detected

1. Check the LS LED and Power LED (if available) on the device.
If they are not continuously lit, then the problem is with the power supply. Check the cable and connections.
If the LS LED is not blinking, then the problem is with the power supply. Check the cable and connections.
2. USB device: Make sure that the device is connected to the PC and that the correct USB cable is in use.

Connection Manager is not working, and a device connected to the computer is not detected

Connection Manager cannot detect a connected device because the required drivers are not installed. The most likely cause is that Install the modem drivers was not checked during the installation.

Uninstall and reinstall Connection Manager. During the installation, make sure that you check Install the modem driver. See [Uninstalling Connection Manager](#) and [Installing Connection Manager](#).

Connection Manager displays "Device Error" status for a serial device

This error has the following causes and solutions.

| Cause | Solution |
|---|--|
| Connection Manager cannot open the COM port that the device was installed on because the port is being used by another program. | If possible, free up the COM port for the device. |
| The wrong COM port is specified for the device on the Settings tab. | On the Settings tab, select the COM port that matches the port that the device is installed on and click Apply. You can look up the port in Device Manager in Windows. In Device Manager, expand Modems, right-click the name of your device, and select Properties. Note the port on the Modem tab. |

System Cannot Connect to Serial Device

If your system cannot establish a connection with a serial device, verify Connection Manager settings match modem and serial port settings on the computer.

In Connection Manager, click the Settings tab.

MultiTech Connection Manager 2.2.0.4

MULTITECH

Main Settings Connection Details Terminal Charts

☐ USB Modem ☒ Serial Modem

Port: COM10

Parity: None

Bits per second: 115200

Stop bits: 1

Data bits: 8

Flow control: None

☐ Run application at Windows startup

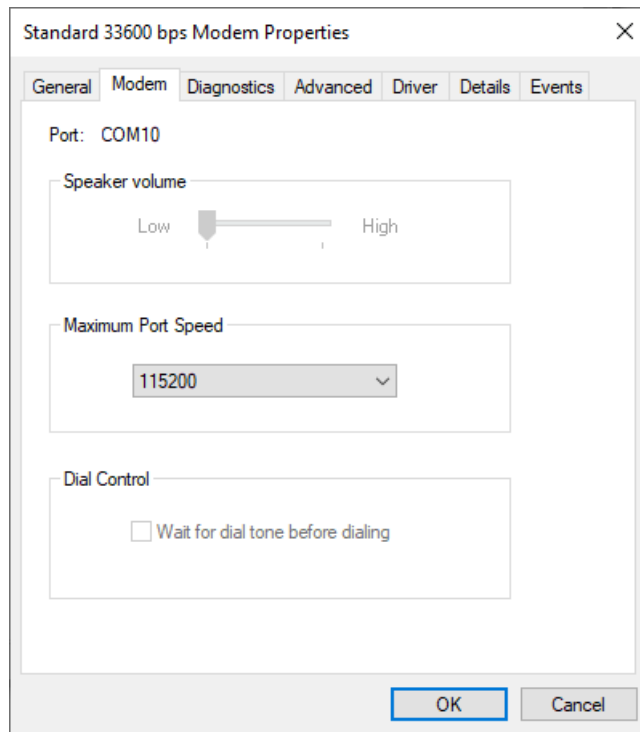
☐ Connect to the Internet automatically

Apply

In Device Manager, open Modems and then right-click on your device and select open the Properties.

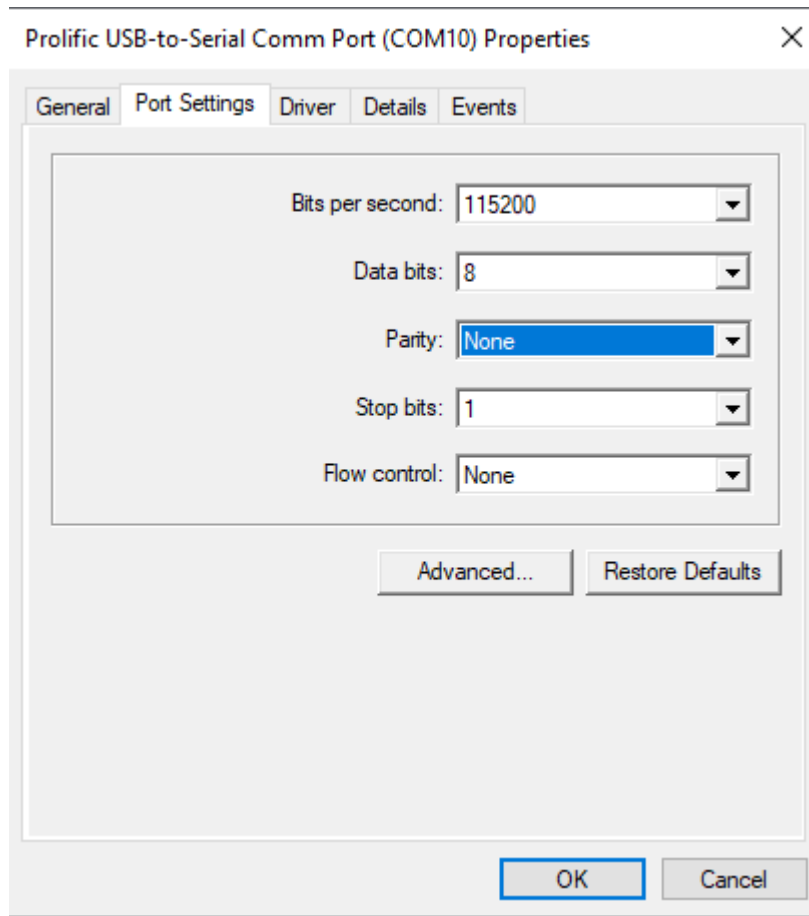
Note: If Modems and Ports don't appear in Device Manager, open the View Menu and select Show hidden devices.

Click the Modem tab to confirm the Maximum Port Speed matches Bits per second setting in Connection Manager.



In Device Manager, open Ports (COM & LPT) and then right-click on the Com Port used by your device and select Properties.

Click the Port Settings tab to confirm the Bits per second, Data bits, Parity, Stop bits and Flow control match those settings in Connection Manager.



Warranty

To read the warranty statement for your product, go to <https://www.multitech.com/warranty>.

Contact Information

| | |
|--------------------------|---|
| General Information | info@multitech.com https://multitech.com/contact-us/ |
| Sales | +1 (763) 785-3500 sales@multitech.com |
| Technical Support Portal | +1 (763) 717-5863 https://support.multitech.com |
| Website | www.multitech.com |
| World Headquarters | 2205 Woodale Drive Mounds View, MN 55112 USA |

Revision History

| Revision Number | Description | Revision Date |
|-----------------|--|---------------|
| 1.3 | Changed DragonFly brand to SocketModem. | January 2025 |
| 1.2 | Updated Carrier Specific Notice, Firmware Over the Air (FOTA). | August 2024 |
| 1.1 | Added Connection Manager information. | October 2019 |
| 1.0 | Original publication. | April 2019 |