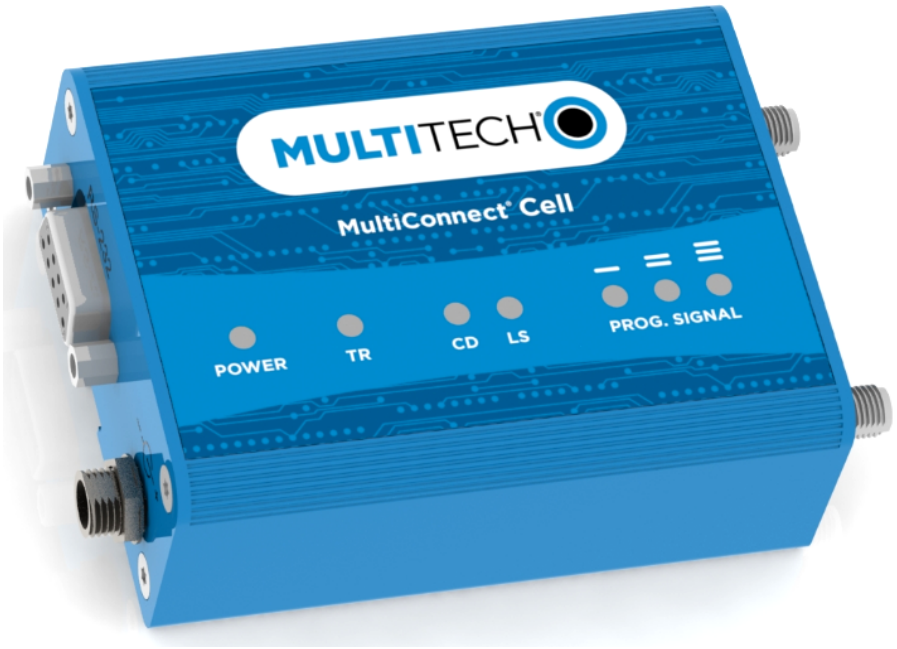

MultiConnect® Cell

MTC-L4G2D User Guide

MultiConnect® Cell Series 100 User Guide

Model: MTC-L4G2D

Part Number: S000807 Rev. 1.2

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Trademarks

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For immediate access to support information and resolutions for MultiTech products, visit https://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.

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To read the warranty statement for your product, visit https://www.multitech.com/legal/warranty.

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Contents

Chapter 1 – Product Overview

About the MultiConnect Cell Modem

MultiConnect® Cell 100 Series MTC-L4G2D cellular modems are ready-to-deploy, standalone LTE Category 4 modems that provide wireless communication. The MTC-L4G2D is a compact communications platform that provides cellular capabilities for fixed and mobile applications. It is intended for use in energy, utility, or industrial settings. The MTC-L4G2D is available with RS-232 or as a USB to Cellular device.

Documentation

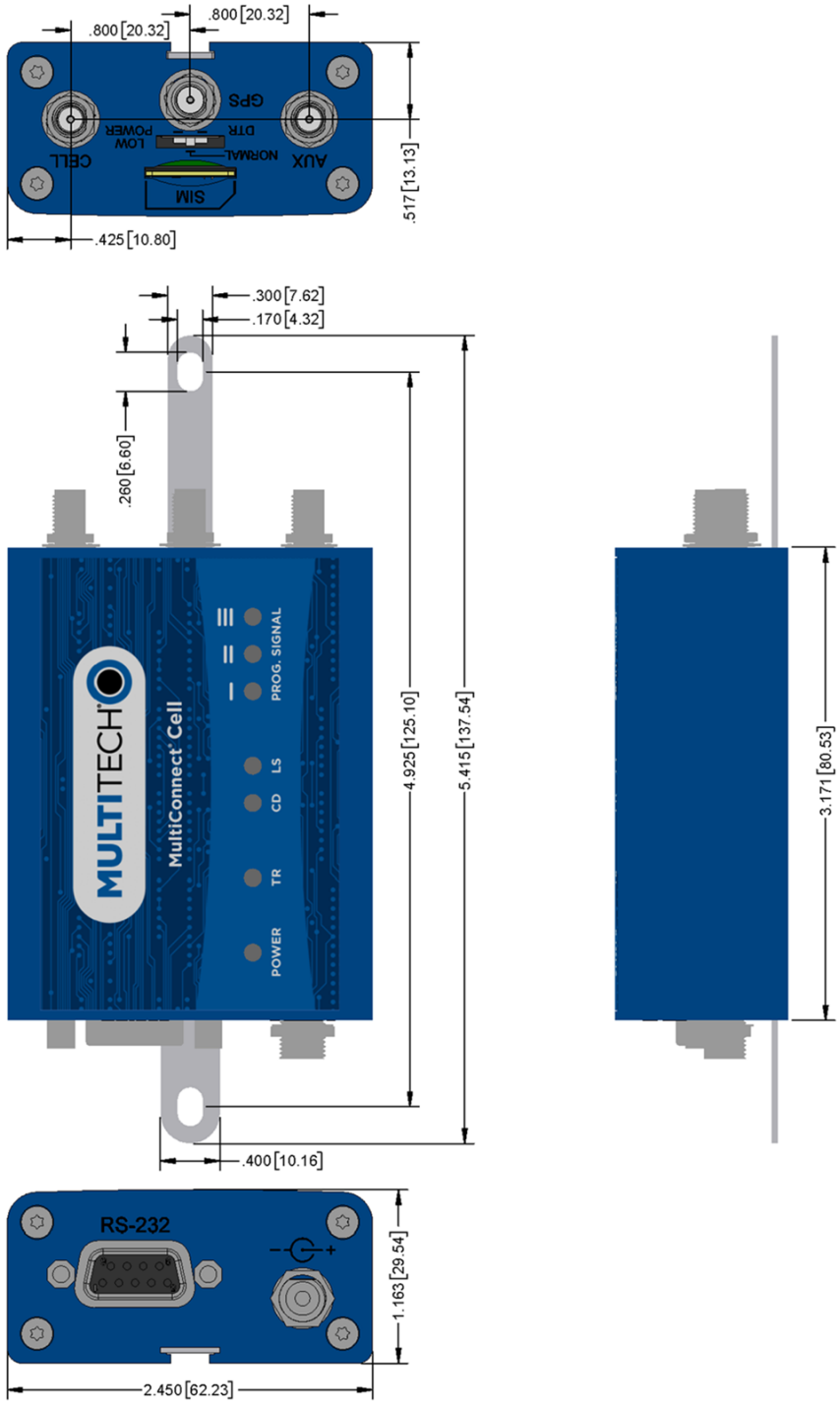
The following documentation is available at https://www.multitech.com/brands/multiconnect-cell-100-series Select your model to get the documentation for that device.

Document	Description
MultiConnect Cell User Guide	This document provides an overview, safety and regulatory information, schematics, and general device information.
Telit LE910Cx AT Commands Reference Guide	You can configure the device using the LTE AT Commands. These commands are documented in the Telit AT Command Reference Guide P/N: 80502ST10950A.
USB Driver Installation Guide for LTE Devices	The document provides instructions on USB driver installation for LTE devices P/N: S000616.

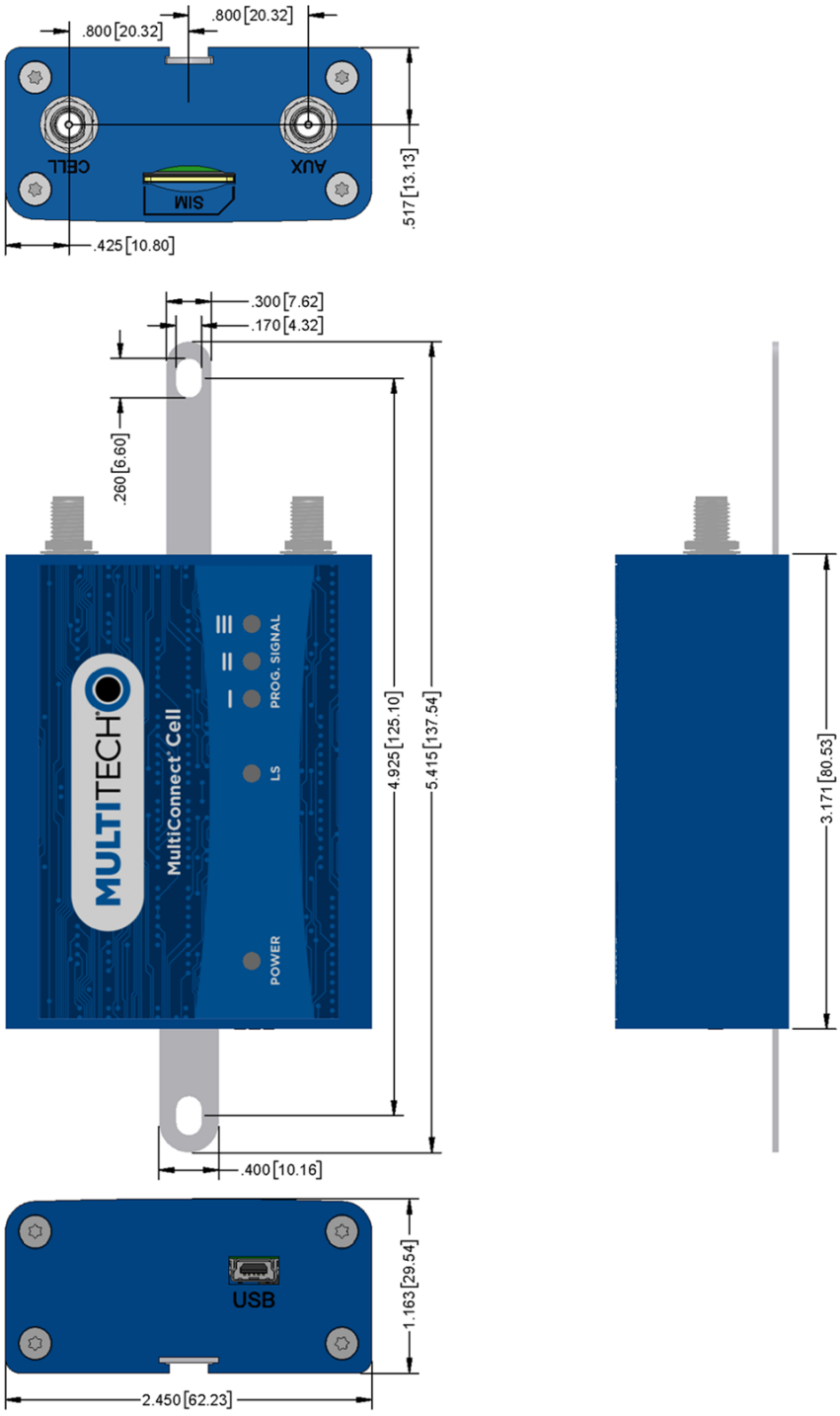
Chapter 2 – Specifications and Hardware Information

Dimensions

Serial



USB


.800 [20.32]
.800 [20.32]
CELL
AUX
SIM
.517 [13.13]
.425 [10.80]
.300 [7.62]
.170 [4.32]
.260 [6.60]
MULTITECH
MultiConnect® Cell
PROG. SIGNAL
LS
POWER
4.925 [125.10]
5.415 [137.54]
3.171 [80.53]
.400 [10.16]
USB
1.163 [29.54]
2.450 [62.23]

LED Descriptions

The top panel contains the following LEDs:

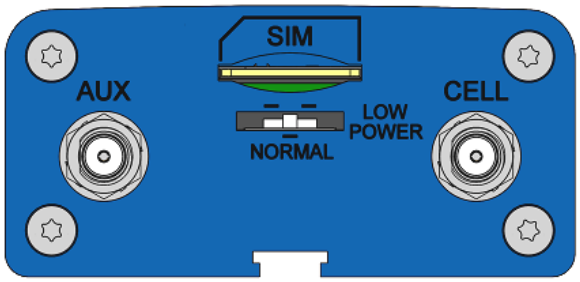
- Power and Terminal Ready LEDs—The Power LED indicates that DC power is present and the TR LED indicates when the unit is ready to receive data.
- Modem LEDs—Two modem LEDs indicate carrier detection and link status.
- Signal LEDs—Three signal LEDs display the signal strength level of the wireless connection.

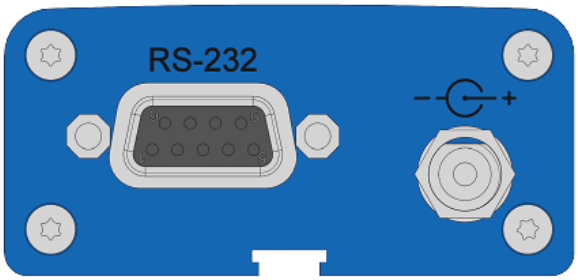
LED Indicators	
POWER	Indicates presence of DC power when lit.
TR	Terminal Ready. When lit, indicates connection to terminal emulation. When not lit, indicates no terminal is present *(for serial only)* .
CD	Carrier Detect. Indicates established data connection when lit *(for serial only)*.
LS	Link Status. ▪ OFF — No power to the cellular radio ▪ Continuously lit — SIM is not installed, or no signal is present ▪ Slow blink — Registered
PROG. SIGNAL	Control these LEDs through the Appzone program which is installed on the device at the factory.

Side Panels

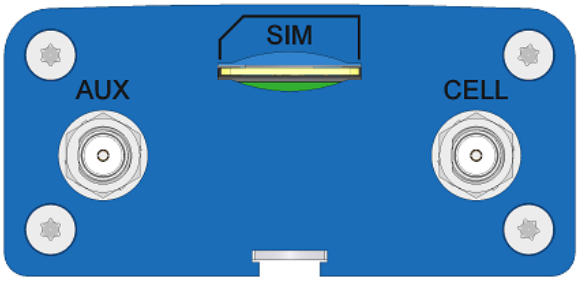
The device has connectors on either side. The figures that follow show the side panels.

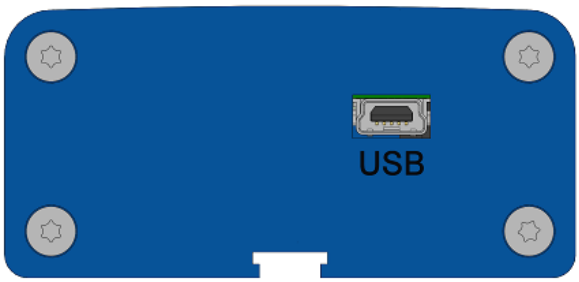
Serial





USB





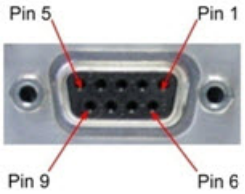
Note: The power-saving switch—which appears with the NORMAL and LOW POWER labels—is included only on models that have a serial connector.

MTC-L4G2D Specifications

Category	Description
General	
Standards	LTE 3GPP Release 10
	HSPA+ 1, 2, 4, 5, 6, 8, 19/GPRS fallback
	USB interface is QMI compliant
TCP/IP Functions	FTP, SMTP, TCP, UDP
Frequency Bands	GSM: 850 MHz, 900 MHz, 1800 MHz, 1900 MHz
	UMTS FDD: Band I (2100 MHz), Band II (1900), Band IV (1700), Band V (850), Band VI (800), Band VIII (2600)
	E-UTRA FDD: Band 1 (2100 MHz), Band 2 (1900), Band 3 (1800), Band 4 (1700), Band 5 (850), Band 7 (2600), Band 9 (1800), Band 12 (700), Band 13 (700), Band 14 (700), Band 18 (850), Band 19 (850), Band 20 (800), Band 25 (1900), Band 26 (850), Band 28 (700)
Speed	
Data Speed	LTE: 150 Mbps downlink/50 Mbps uplink
	HSPA+: 21 Mbps downlink/5.76 Mbps uplink
Interface	
USB Interface	USB 2.0 HS/HSIC
UART Interface	RS-232 levels
Physical Description	
Weight	0.4 oz. (10 g)
Dimensions	Refer to mechanical drawing for dimensions.
Connectors	
Antenna Connectors	2 SMA connectors for cellular, Rx diversity/MIMO
SIM	1.8V and 3V SIM holder for mini-SIM card
Environment	
Operating Temperature	-40° C to +85° C
Storage Temperature	-40° C to +85° C
Humidity	20%-90% RH, non-condensing
Power Requirements	
Operating Voltage	Serial Models: 5-32 VDC
	USB Models: 5V
SMS	
SMS	SMS over NAS, SMS over CS
Certifications and Compliance	

Category	Description
EMC Compliance	FCC Part 15 Class B
	RED 2014/53/EU
Radio Compliance	FCC Part 22, 24, 27
Safety Compliance	UL 60950-1 2nd ED
	cUL 60950-1 2nd ED
	UL 62368-1
	cUL 62368-1
	IEC 623681
Network Compliance	PTCRB
	GCF
Carrier	AT&T
	Verizon

RS-232 9-Pin Female Connector



Pin	Abbreviation	Description	In/Out
1	CD	Carrier Detect	O
2	RX	Receive	O
3	TX	Transmit	I
4	DTR	Data Terminal Ready	I
5	GND	Ground	--
6	DSR	Data Set Ready	O
7	RTS	Request to Send	I
8	CTS	Clear to Send	O
9	RI	Ring Indicator	O

Power Measurements

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

Serial Model: MTC-L4G2D-B01 Power Draw

Radio Protocol	Sleep mode current, connected to wireless (milliamps)	Sleep mode current, connected to live network, active SIM installed (milliamps)	Cellular call box connection, no data (milliamps)	Average measured current (milliamps) at maximum power	Average TX pulse amplitude current (milliamps)	Total inrush charge, in millicoulombs (mC)	Total inrush charge duration during power-up (milliseconds)
9 Volts							
Band 5 LTE 836 MHz	7	23	24	247	316	0.587	9.4
WCDMA 1850 MHz	7	34	23	287	372	0.587	9.4
GSM 850 MHz	8	26	24	122	850	0.587	9.4
12 Volts							
Band 5 LTE 836 MHz	5	25	22	218	280	0.643	7.4
WCDMA 1850 MHz	5	26	21	223	300	0.643	7.4
GSM 850 MHz	6	24	24	95	650	0.643	7.4
24 Volts							
Band 5 LTE 836 MHz	3	14	13	125	188	0.900	7.3
WCDMA 1850 MHz	3	16	13	128	200	0.900	7.3
GSM 850 MHz	4	15	15	56	380	0.900	7.3

USB Model: MTC-L4G2D-B03 Power Draw

Radio Protocol	Sleep mode current (milliamps)	Cellular connection idle, no data (milliamps)	Live Connection idle current (milliamps)	Average current at Max Power (milliamps)	Average TX pulse amplitude current (milliamps)	Total inrush charge in millicoulombs (mC)	Total inrush charge duration during power-up (microseconds)
5 Volts							
Band 5 LTE 836 MHz	N/A	33	32	503	600	0.387	91
WCDMA 1850 MHz	N/A	31	32	534	672	0.387	91
GSM 850 MHz	N/A	32	31	224	1,450	0.387	91

Chapter 3 – 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).

Notice regarding Compliance with FCC, EU, and Industry Canada Requirements for RF Exposure

The antenna intended for use with this unit meets the requirements for mobile operating configurations and for fixed mounted operations, as defined in 2.1091 of the FCC rules for satisfying RF exposure compliance. This device also meets the European RF exposure requirements of EN 62311. If an alternate antenna is used, consult user documentation for required antenna specifications.

Compliance of the device with the FCC, EU and IC rules regarding RF Exposure was established and is given with the maximum antenna gain as specified above for a minimum distance of 20 cm between the devices radiating structures (the antenna) and the body of users. Qualification for distances closer than 20 cm (portable operation) would require re-certification.

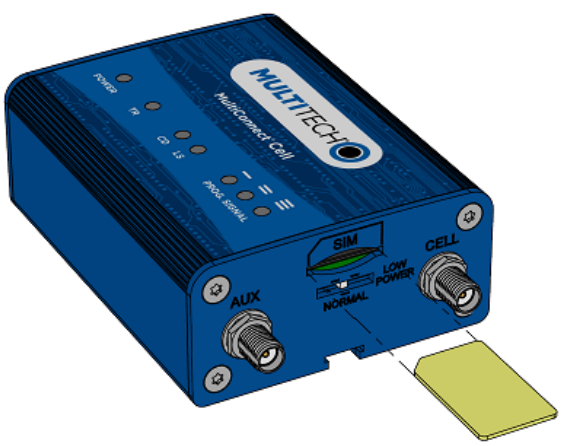
Wireless devices could generate radiation. Other nearby electronic devices, like microwave ovens, may also generate additional radiation to the user causing a higher level of RF exposure.

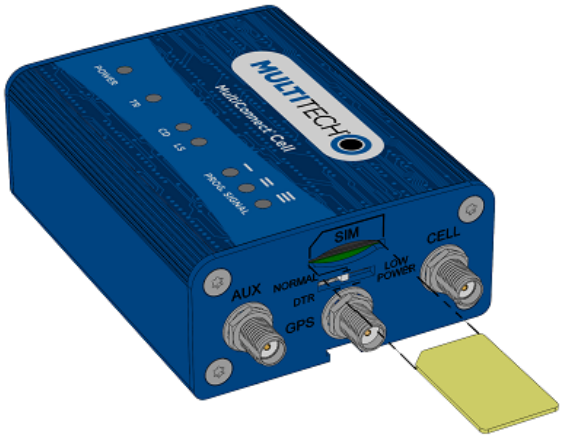
Chapter 4 – Installing and Using the Device

Installing a SIM Card

This model requires a SIM card, which is supplied by your service provider. To install the SIM card:

1. Locate the SIM card slot on the side of the modem. The slot is labeled SIM.
2. Slide the SIM card into the SIM card slot with the contact side facing down as shown. When the SIM card is installed, it locks into place.





Removing a SIM Card

To remove the SIM card, push the SIM card in. The device ejects the SIM card.

Installing the Device

1. Connect the antenna(s) included with your device to the antenna connector(s).
2. If your device is the serial version:
   a. Connect the DE9 male connector (9-pin) of the RS-232 cable to the RS-232 connector on the device, then connect the other end to the serial port on the other desired device.
   b. Screw-on the power lead from the power supply module into the power connection on the device.
   c. Plug the power supply into your power source.
3. If your device is the USB version:
   a. See the section "USB Cable Recommendations" for information about the USB cable that helps power your device.
   b. The USB cable uses power from the USB power line. Connect one end of the USB cable to your computer or other USB high power device, such as a hub.
   c. Connect the other end to the device's USB connector.
4. The POWER LED lights after the device powers up.

Placing Serial Devices in Power Save Mode

The serial devices offer a low power mode (sleep or power save mode) using the power save switch (below the SIM card slot) on the device to change from normal or low power mode. The low power mode is intended for battery or solar-powered, IoT applications such as outdoor remote sensors.

There are other techniques to place the device into low power mode. This example uses data terminal ready (DTR) and the AT command +CFUN=5. For other techniques, review the AT command guide for your device, as described in the Documentation section of this guide.

The device also wakes up from sleep mode by using the wake-on-ring feature. See the following example using the ring indicator line to wake the host processor when the radio receives an incoming call or SMS message. Your application then needs to act on the ring indication and wake up the device by asserting DTR.

Using Low Power Mode

Here are some different configuration options for low power mode:

- To turn on low power mode, set the power-save switch to LOW.
- On the RS-232 interface, ensure your application controls DTR and makes it active (on). To configure the device for DTR control, issue either AT&D1 or AT&D2 for DTR control. The &D0 command does not allow low power to operate.
- To configure the device to enter low power (sleep) mode, issue AT+CFUN=5 to the radio.
- To configure the device to wake from low power mode by using the wake-on-ring feature, issue AT#E2SMSRI=1000. This configures the ring indicator to go active for 1000 ms when an SMS message is received. The ring signal becomes a notification to wake the host processor and use an application to assert DTR to wake up the serial device.
- To have the device enter sleep mode, set DTR to inactive (off) on the RS-232 interface. The clear to send (CTS) signal is off when the device is in sleep mode.

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.
- You can order the USB cable through MultiTech. The part number is CA-USB-A-MINI-B-3

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.

Mounting Device to Flat Surface

1. Locate the groove on the bottom of the device.
2. Slide the mounting bracket through the groove.
3. To secure the bracket to the desired surface, place and tighten two screws in the holes on either end of the mounting bracket. The dimensions illustration in this guide shows the mounting bracket, as well as the dimensions for placement of the screws.

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 and either can be the main receive antenna.

Placing External Antennas

Antennas are usually a quarter wavelength apart from each other. With multiband radios where the quarter wavelengths in each band are diverse from each other, this rule may not be practical. Choose spacing based on the band used most often or the band with connection difficulty. Some environments are harsher on particular bands. MultiTech products have antenna connectors at the best spacing for the product size.

Placing antennas in close proximity to each other is not optimal, but you can do it if necessary. It depends on the signal strength to and from each antenna.

If the antennas are too close together for your application, use a similar antenna on a short cable for the second receive only antenna.

Antenna Approvals and Safety Considerations

Note the following:

- 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.
- Unless otherwise noted, antennas certified by MultiTech are not approved for outdoor use. Do not extend these antennas outside of any building.

Power Draw

There are no significant power draw differences.

Chapter 5 – Antenna and Activation Information

Notice regarding Compliance with FCC, EU, and Industry Canada Requirements for RF Exposure

The antenna intended for use with this unit meets the requirements for mobile operating configurations and for fixed mounted operations, as defined in 2.1091 of the FCC rules for satisfying RF exposure compliance. This device also meets the European RF exposure requirements of EN 62311. If an alternate antenna is used, consult user documentation for required antenna specifications.

Compliance of the device with the FCC, EU and IC rules regarding RF Exposure was established and is given with the maximum antenna gain as specified above for a minimum distance of 20 cm between the devices radiating structures (the antenna) and the body of users. Qualification for distances closer than 20 cm (portable operation) would require re-certification.

Wireless devices could generate radiation. Other nearby electronic devices, like microwave ovens, may also generate additional radiation to the user causing a higher level of RF exposure.

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. Devices were approved with the following antenna(s) and for alternate antennas meeting the given specifications.

Antenna

Devices were approved with the following antenna:

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

MultiTech ordering information:

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

Antenna Specifications

Category	Description
Frequency Range	0.698 - 0.96 GHz 1.710 - 2.170 GHz 2.30 - 2.69 GHz
VSWR	3:1 maximum
Gain	2.06 dBi
Impedance	50Ω nominal
Radiation	Omni-directional
Polarization	Linear, vertical

Account Activation for Cellular Devices

Some MultiTech devices are pre-configured to operate on a specific cellular network. To use the device, you must set up a cellular data account with your service provider. Each service provider has its own process for adding devices to their network.

Device Phone Number

Every device has a unique phone number. Your service provider supplies a phone number when you activate your account. Wireless service provider implementation may vary. Consult with your service provider to get the phone number for your device.

Chapter 6 – Configuring and Communicating with Your Device

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.

  Note: Wait 10 seconds after power-up before issuing any AT commands.

- Install terminal software that can communicate with the device, such as HyperTerminal, Tera Term, Kermit, or Putty.

For additional information, refer to the AT command guide and any related documentation for your device. The AT command guide describes command formatting, syntax, and other basic information.

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.

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 response is:
`#FWSWITCH: 0`
The device is configured for AT&T/other networks.

If 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.

Note: 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).

Multiple Carrier Firmware for Cellular Radio

This device uses a cellular radio with multiple carrier firmware. It can be used on different carrier networks (not simultaneously). The device is configured for AT&T by default.

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

```
AT#FWSWITCH?
```

If response is:	The device is configured for:
`#FWSWITCH: 0`	AT&T
`#FWSWITCH: 1`	Verizon
`#FWSWITCH: 3`	Bell
`#FWSWITCH: 4`	Telus
`#FWSWITCH: 40`	Global

To switch carrier networks:

The carrier network can be switched using the same response values from the table.

```
AT#FWSWITCH=#,1
```

where "#" is the network configuration to be enabled.

> **Note:** 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)

Verizon FOTA (Firmware Over the Air)

At times, your device may require a critical update to radio firmware for devices connecting to the network. To stay compliant to Verizon's LTE requirements, you must implement FOTA. Failure to perform a critical update could result in losing access to the Verizon network.

MultiTech has developed a script for customers to use in order to initiate a FOTA update from the (the customer's) local host processor (pull FOTA). The script is available at: https://www.multitech.com/vzw-catm1

Verifying Signal Strength

To verify the device signal strength, enter:

AT+CSQ

The command indicates signal quality, in the form:

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

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
<sq>	LTE - RSRQ (in dBm):
0	-4 to -3
1	-6 to -5
2	-8 to -7
3	-10 to -9
4	-13 to -11
5	-15 to -14

6	-17 to -16
7	-19 to -18
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

Before establishing a packet data connection, verify the is device registered on the network. To do this enter the network registration report read command:

```
AT+CEREG?
```

If the device returns:

```
AT+CEREG?: 0,1
```

or

```
AT+CEREG?: 0,5
```

The device is registered.

If the device returns:

```
AT+CEREG?: 0,2
```

The device is in a network searching state.

Sending and Receiving Data

Connecting Device to TCP Server as TCP Client

1. `AT+CGDCONT=1,"IPV4V6","apnname"`
   where apnname is the APN your cellular provider assigned to your SIM card.
2. **Reset the radio module**
   Enter:
   ```
   AT+CFUN=1,1
   OK
   ```
3. **Bring up Data Connection Using Internal IP stack**
   Enter:
   Verizon:
   ```
   AT#SGACT=3,1
   ```
   Other Networks:

```
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
```

4. **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. The device can send or receive data now without entering additional commands.

Closing the Socket and the Connection

To close the socket:

1. Enter the escape sequence:
   ```
   +++
   ```
2. To close Socket 1, enter:
   ```
   AT#SH=1
   ```

To close the data connection:

- Enter:

Verizon:
```
AT#SGACT=3,0
```

Other Networks:
```
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. **Verify device is registered on the cellular network.**

   Enter:

   Should return:

   ```
   +CEREG: 0,1 or +CEREG: 0,5
   OK
   ```
3. **Configure socket parameters**

   Enter:

   ```
   AT#SCFG=1,3,300,240,600,50
   ```
4. **Activate context one**

   Enter:

Verizon:

```
AT#SGACT=3,1
```

Other Networks:

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

5. **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"
   ```

6. **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
   ```

7. **Accept incoming connection ID 1**

   Enter:

   `AT#SA=1`

   The device indicates a client successfully established a listener connection.

   ```
   CONNECT
   ```

   The device can send and receive data now.

Exit Data Mode and Close Connection

To exit data mode and close the socket:

1. Enter the escape sequence:

   ```
   +++
   ```

2. To close Socket 1, enter:

   ```
   AT#SH=1
   ```

3. To close the data connection, enter:

   Verizon:

   ```
   AT#SGACT=3,0
   ```

   Other Networks:

   ```
   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. **Verify device is registered on the cellular network.**

   Enter:

   ```
   AT+CEREG?
   ```

Should return:

```
+CEREG: 0,1 or +CEREG: 0,5
OK
```

3. **Configure socket parameters**

   Enter:

   ```
   AT#SCFG=1,3,300,240,600,50
   ```

4. **Activate context one**

   Enter:

   Verizon:

   ```
   AT#SGACT=3,1
   ```

   Other Networks:

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

5. **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 for sending and receiving data through the socket connection.

Exit Data Mode and Close Connection

To exit data mode and close the socket:

1. Enter the escape sequence:

   ```
   +++
   ```

2. To close Socket 1, enter:

   ```
   AT#SH=1
   ```

3. To close the data connection,enter:

   Verizon:

   ```
   AT#SGACT=3,0
   ```

   Other Networks:

   ```
   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. **Verify device is registered on the cellular network.**

   Enter:

   ```
   AT+CEREG?
   ```

   Should return:

   ```
   +CEREG: 0,1 or +CEREG: 0,5
   ```

```
OK
```

3. **Activate context**

   Enter:

   Verizon:

   ```
   AT#SGACT=3,1
   ```

   Other Networks:

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

4. **Set FTP operations timeout to 10 seconds**

   Enter:

   ```
   AT#FTPTO=100
   ```

5. **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.

6. **Configure file transfer type.**

   Enter:

   ```
   AT#FTPTYPE=#
   ```

   where # is 0 for binary or 1 for ASCII.

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

   Enter:

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

   The device responds with:

   ```
   CONNECT
   ```

8. Send the file through the device.

Closing the FTP Data Connection

After the file is sent:

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:

   Verizon:

   ```
   AT#SGACT=3,0
   ```

   Other Networks:

   ```
   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. **Verify device is registered on the cellular network.**

   Enter:

   `AT+CEREG?`

   Should return:

   `+CEREG: 0,1 or +CEREG: 0,5`

   `OK`

3. **Activate context one**

   Enter:

   Verizon:

   `AT#SGACT=3,1`

   Other Networks:

   `AT#SGACT=1,1`

4. **Set FTP operations timeout to 10 seconds**

   Enter:

   `AT#FTPTO=100`

5. **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.

6. **Configure file transfer type.**

   Enter:

   `AT#FTPTYPE=#`
   where # is 0 for binary or 1 for ASCII.

7. **If required, change the working directory to "folder1".**

   Enter:

   `AT#FTPCWD="folder1"`

8. **Enter the file name.**

   Enter:

   `AT#FTPGET="filename.txt"`
   where filename.txt is the file 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

After the file is sent:

1. **Close the FTP connection.**
   Enter:
   `AT#FTPCLOSE`
2. **Close the PPP data connection.**
   Enter:
   Verizon:
   `AT#SGACT=3,0`
   Other Networks:
   `AT#SGACT=1,0`
   The device responds with OK.

Reading, Writing and Deleting Messages

Reading Text Messages

NOTE: For CAT M1 devices, you can only send/receive SMS messages from other CAT M1 devices on the same network.

To read a text message in text mode:

1. **Send a message to the phone number of the currently installed SIM.**
2. **Put the device in text mode.**
   Enter:
   `AT+CMGF=1`
3. **Read message.**
   Enter:
   `AT+CMGR=1`

Example response:

```
+CMGR: "REC UNREAD","0001112222","","20161006135126"
How are you?
OK
```

Where 0001112222 is the recipient phone number and 20161006135126 is received data in the format YYYYMMDDHHMMSS.

Sending Text Messages

To send a text message in text mode:

1. **Check signal strength.**
   Enter:
   `AT+CSQ`
2. **Verify device is registered on the cellular network.**
   Enter:

```
AT+CEREG?
```

Should return:

```
+CEREG: 0,1 or +CEREG: 0,5
OK
```

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

   Enter:

   ```
   AT+CMGF=1
   ```

   The device responds.

   ```
   OK
   ```

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

   Enter:

   ```
   AT+CMGS="##########"
    >Your message here
   ```

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

5. **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=1,#`

where 1 is the index in the selected storage and # is the delflag option. Enter:

0	Deletes message in the specified index.
1	Deletes all read messages from selected storage. 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 from selected storage.

For example:

Delete message at index 1:

```
AT+CMGD=1
```

Delete message at index 2:

```
AT+CMGD=2
```

Deletes messages at index 1:

```
AT+CMGD=1,0
```

Deletes read messages at index 2, leaves unread and stored device-originated messages:

```
AT+CMGD=2,1
```

Deletes read messages at index 2 and sent device-originated messages:

```
AT+CMGD=2,2
```

Check valid memory locations <index> and supported values of <deflag>:

```
AT+CMGD=?
+CMGD: (1,2,3,6,7,17,18,19,20,37,38,39,47),(0-4)
OK
```

Chapter 7 – Using Linux with the L4G2D Radio

Overview

L4G2D products use a Telit LE910C4-WWX radio that provides USB serial and binary interfaces to communicate with an operating system's TCP/IP networking subsystem.

This section uses Raspberry Pi Raspberian distribution to show how to use AT Commands and PPP (serial) or the Qualcomm Media Interface (QMI, binary) to configure and bring up a Linux network interface for communicating over the cellular data network.

If you use a different Linux distribution, the provided examples may need adjustments for your application.

Pre-Requisites

Information in this chapter assumes the following:

- Knowledge of Linux networking, command line tools, and the underlying TCP/IP network protocols.
- Working computer hardware and OS.
- Working SIM and cellular account provisioned by the cellular carrier for an IoT device (refer to carrier for details.)
- Working MultiTech L4G2D hardware.

Modem Manager and Network Manager Applications

Modem Manager and Network Manager are Linux applications used to manage the connection state for the modem hardware and network interface respectively.

Linux examples in this application note assume Modem Manager and Network Manager are disabled or not installed.

> **Note:** Modem Manager and Network Manager may successfully connect to the cellular network using Linux distribution specific defaults. If does not, consult the application specific documentation or reach out to the relevant open source communities for more information.

USB Interfaces

The Telit radio module in the L4G2D provides three USB-based interfaces: two AT command interfaces and one QMI interface.

Device File Names Persistence After Modem Power Cycle or Reboot

Usually modem device file names in /dev correspond with the same USB interfaces after the modem reboots or power cycles. However, the kernel module and related kernel subsystems do not guarantee a USB interface and a device file name will correspond every time the modem is rebooted or power cycled.

AT Command Interface

The AT Command interface provides a text based serial protocol used to configure and issue commands to the modem to implement functionality.

Some Linux distributions may come with pre-installed kernel modules that automatically detect the modem's USB serial interfaces and create TTY device files in the /dev directory.

Qualcomm Media Interface (QMI)

The Qualcomm Media Interface (QMI) provides a binary protocol alternative to issuing AT commands to the modem.

Some Linux distributions may come with preinstalled kernel modules that automatically detect the modem's QMI interface and create a device file in the /dev directory. Command line access to the modem's QMI interface is provided by an application called qmicli.

Examples

Every Linux distribution is different. This section provides an example of creating a cellular network data connection using either the modem's serial AT command interface or the QMI binary interface and bringing up a Linux network interface on a Raspberry Pi running a Raspbian distribution of GNU/Linux. If using another Linux distribution, there may be some differences in commands and responses.

Distribution And Kernel Details

Identifying information of the Raspbian GNU/Linux distribution used to create the examples:

```
$ cat /etc/os-release
PRETTY_NAME="Raspbian GNU/Linux 11 (bullseye)"
NAME="Raspbian GNU/Linux"
VERSION_ID="11"
VERSION="11 (bullseye)"
VERSION_CODENAME=bullseye
ID=Raspbian
ID_LIKE=Debian
HOME_URL=http://www.raspbian.org/
SUPPORT_URL=http://www.raspbian.org/RaspbianForums
BUG_REPORT_URL=http://www.raspbian.org/RaspbianBugs

$ uname -a

Linux raspberrypi 5.15.61-
v7+ #1579 SMP Fri Aug 26 11:10:59 BST 2022 armv7l GNU/Linux
```

Using PPP and Modem AT Command Interface to Create Network Interface

Use the modem's AT command interfaces and PPP to create a network connection. This section provides information about installing dependencies, locating the modem device files, creating and configuring the PPP options, peer, and chat script files, and bringing up the network interface.

Install Dependencies

```
sudo apt-get update
sudo apt install ppp minicom net-tools
sudo adduser pi dip
sudo reboot
```

Finding AT Command Interpreter Device Files

The modem provides several serial USB interfaces which appear as TTY device files in /dev.

Two USB interfaces provide access to separate AT command interpreters running on the modem. One AT command interpreter is used as the data channel for the PPP connection. The other may be used to poll the modem for cellular network statistics.

To find which device files connect to the AT command interpreters on the modem, first list device files and then select one to open with a terminal program.

List files:

```
$ ls -l /dev/ttyU*
crw-rw---- 1 root dialout 188, 0 Oct  6 23:17 /dev/ttyUSB0
crw-rw---- 1 root dialout 188, 1 Oct  6 23:17 /dev/ttyUSB1
crw-rw---- 1 root dialout 188, 2 Oct  6 23:17 /dev/ttyUSB2
```

Opening a Device File with a Terminal Program:

Note: The default serial baud rate for MultiTech products is 115200 baud. In this example the default baud rate for minicom is also 115200.

```
$ minicom -D /dev/ttyUSB2
```

In the terminal program, type:

```
AT
```
and then press **Enter**.

The expected response from the modem is OK. No response indicates that the device file does not connect to an AT command interpreter. Example of an AT command interpreter responding on /dev/ttyUSB2:

```
Welcome to minicom 2.8
OPTIONS: I18n
Port /dev/ttyUSB2, 23:17:13
Press CTRL-A Z for help on special keys

AT


OK
```

AT&T Only - Installing the SIM And Configuring the Modem's Packet Data Protocol (PDP) Context

This configuration step should be done **only once** after installing a new SIM, updating firmware, or following carrier changes to the cellular account provisioning for the existing SIM. **Do not** perform this step every time the network is brought up.

> **Important: Verizon Configuration DO NOT perform this step for Verizon SIMs**.Modems operating on Verizon networks receive configuration information from the Verizon cellular network automatically.

Consult with the carrier to determine IP version and Access Point Name (APN) indicated in the following example. If the network is IPv4 use "IP" , if it's IPv4/6 use "IPV4V6".

Remove power from the modem, install SIM if necessary, and reapply power. Open device file with a terminal program and configure the Packet Data Protocol (PDP) context.

Example (supply values between <> based on carrier provided information):

```
$ minicom -D /dev/ttyUSB2

Welcome to minicom 2.8

OPTIONS: I18n
Port /dev/ttyUSB2, 21:19:36

Press CTRL-A Z for help on special keys

AT
OK
AT+COPS=2
OK
AT+CGDCONT=1,"<IP or IPV4V6>","<APN goes here>"
OK
AT+COPS=0
OK
AT#REBOOT
OK
```

Creating PPP Configuration Files and Scripts

AT&T and AT&T-like carriers and Verizon require different modem configurations for data connections. This example addresses the differences using separate PPP chat scripts.

Copy and paste options, peer, and carrier specific chat scripts from the respective code blocks in *Example PPP Files* into the respective new files and locations indicated:

```
 vi options

$ vi l4g2d_peer

$ vi l4g2d_att_chat

$ vi l4g2d_vzw_chat

$ sudo mv /etc/ppp/options /etc/ppp/options.orig #backup original

$ sudo cp ./options /etc/ppp/options

$ sudo cp ./l4g2d_peer /etc/ppp/peers/

$ sudo cp ./l4g2d_att_chat /etc/chatscripts/

$ sudo cp ./l4g2d_vzw_chat /etc/chatscripts/
```

Editing

/etc/ppp/peer File

Edit
/etc/ppp/peer

Locate and uncomment the lines corresponding to the carrier specific chat script and MTU that will be used to communicate with the modem. If another device file is used for the PPP data channel then replace occurrences of /dev/ttyUSB2 with the desired file path.

Turning Network Interface ppp0 On and Off

Debugging PPP

Example scripts come with debugging output for pppd turned on. Output is logged to /var/log/syslog.

Use the pon and poff applications to turn the ppp0 network interface on and off respectively:

Example On:

```
$$ pon l4g2d_peer

$ ifconfig ppp0

ppp0: flags=4305<UP,POINTOPOINT,RUNNING,NOARP,MULTICAST>  mtu 1500

        inet 30.191.107.82  netmask 255.255.255.255  destination 10.64.64.64

        ppp  txqueuelen 3  (Point-to-Point Protocol)

        RX packets 5  bytes 62 (62.0 B)

        RX errors 0  dropped 0  overruns 0  frame 0

        TX packets 13  bytes 199 (199.0 B)

        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

$ ping -c 4 -I ppp0 8.8.8.8

PING 8.8.8.8 (8.8.8.8) from 30.191.107.82 ppp0: 56(84) bytes of data.

64 bytes from 8.8.8.8: icmp_seq=1 ttl=58 time=289 ms

64 bytes from 8.8.8.8: icmp_seq=2 ttl=58 time=79.4 ms

64 bytes from 8.8.8.8: icmp_seq=3 ttl=58 time=85.8 ms

64 bytes from 8.8.8.8: icmp_seq=4 ttl=58 time=84.8 ms

--- 8.8.8.8 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3004ms
```

```
rtt min/avg/max/mdev = 79.393/134.868/289.429/89.269 ms
```

Example Off:

```
$ poff l4g2d_peer

$ ifconfig ppp0

ppp0: error fetching interface information: Device not found
```

Using QMI Binary Modem Interface to Create Linux Network Interface

Use the modem's QMI binary modem interface to create a network connection. This section provides information about installing dependencies, bringing the QMI interface online, configuring the Linux network interface wwan0 and installing dependencies

Installing Dependencies

```
sudo apt-get update

sudo apt-get install libqmi-utils udhcpc net-tools

sudo reboot
```

Bringing Modem QMI Interface Online

Check QMI operating mode:

```
 $ sudo qmicli -d /dev/cdc-wdm0 --dms-get-operating-mode

[/dev/cdc-wdm0] Operating mode retrieved:

        Mode: 'online'


        HW restricted: 'no'
```

If mode is not 'online' set to 'online':

```
$ sudo qmicli -d /dev/cdc-wdm0 --dms-set-operating-mode='online'

[/dev/cdc-wdm0] Operating mode set successfully
```

Preparing and Configuring the Network Interface

The Raspberian Linux distribution uses wwan0 for the modem's network interface. This section shows how to bring the wwan0 interface down and configure for use with udhcpc.

Bring the wwan0 network interface down:

```
sudo ifconfig wwan0 down
```

The DHCP client udhcpc uses raw ip to bypass the Linux IP stack implementations of various protocols (TCP, UDP, etc) and request an IP address and other information from the cellular carrier's DHCP server. Determine the current state of raw_ip support for the network interface. If the contents of the special file raw_ip are 'N' set to 'Y':

```
$ sudo cat /sys/class/net/wwan0/qmi/raw_ip
N

$ echo Y | sudo tee /sys/class/net/wwan0/qmi/raw_ip

Y
```

Set the Maximum Transmit Unit (MTU) to the value specified in the following table.

Carrier	MTU Value
AT&T and similar carriers	1420
Verizon	1428

This example shows AT&T:

```
$ sudo ifconfig wwan0 mtu 1420
```

Open Cellular Network Data Connection

To open the cellular network data connection, use qmicli. Some cellular networks require an Access Point Name (APN) and credentials to connect. Confirm these details with your cellular provider.

```
$ sudo qmicli -p -d /dev/cdc-wdm0 --device-open-net='net-raw-ip|net-no-qos-
header' --wds-start-
network="apn='<apn goes here>',username='<username>',password='<password>',ip-
type=4" --client-no-release-cid
[/dev/cdc-wdm0] Network started

        Packet data handle: '2248118624'
[/dev/cdc-wdm0] Client ID not released:

        Service: 'wds'
            CID: '6'
```

Bring Network Interface Up and Configure Via DHCP

Bring wwan0 network interface up:

```
$ sudo ifconfig wwan0 up
```

Run udhcpc to get network information from the cellular network data connection and configure interface wwan0:

```
$ sudo udhcpc -i wwan0
udhcpc: started, v1.30.1
No resolv.conf for interface wwan0.udhcpc
udhcpc: sending discover
udhcpc: sending select for 25.33.152.134
udhcpc: lease of 25.33.152.134 obtained, lease time 7200
```

To avoid making wwan0 the default gateway for all IP traffic open /etc/udhcpc/default.script, look for a line containing “route add default”, and edit/comment out accordingly.

Confirm the wwan0 network interface is configured and test network connection:

```
$ ifconfig wwan0
wwan0: flags=4305<UP,POINTOPOINT,RUNNING,NOARP,MULTICAST>  mtu 1420
        inet 25.33.152.134  netmask 255.255.255.252  destination 25.33.152.134
        unspec 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-
00  txqueuelen 1000  (UNSPEC)
        RX packets 3  bytes 688 (688.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 73  bytes 12117 (11.8 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

$ ping -c 4 -I wwan0 8.8.8.8
PING 8.8.8.8 (8.8.8.8) from 33.220.249.223 wwan0: 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=58 time=182 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=58 time=46.3 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=58 time=62.8 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=58 time=54.1 ms

--- 8.8.8.8 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3001ms
rtt min/avg/max/mdev = 46.295/86.218/181.747/55.460 ms
```

Bring Network Interface Down

Bring interface www0 down:

```
$ sudo ifconfig wwan0 down
```

Example PPP Files

PPP Options File

Save as /etc/ppp/options:

```
# /etc/ppp/options
#
# Originally created by Jim Knoble <jmknoble@mercury.interpath.net>
# Modified for Debian by alvar Bray <alvar@meiko.co.uk>
# Modified for PPP Server setup by Christoph Lameter <clameter@debian.org>
#
# To quickly see what options are active in this file, use this command:
#   egrep -v '#|^ *$' /etc/ppp/options

# Specify which DNS Servers the incoming Win95 or WinNT Connection should use
# Two Servers can be remotely configured
# ms-dns 192.168.1.1
# ms-dns 192.168.1.2

# Specify which WINS Servers the incoming connection Win95 or WinNT should use
# ms-wins 192.168.1.50
```

```
# ms-wins 192.168.1.51

# Run the executable or shell command specified after pppd has
# terminated the link.  This script could, for example, issue commands
# to the modem to cause it to hang up if hardware modem control signals
# were not available.
#disconnect "chat -- \d+++\d\c OK ath0 OK"

# async character map -- 32-bit hex; each bit is a character
# that needs to be escaped for pppd to receive it.  0x00000001
# represents '\x01', and 0x80000000 represents '\x1f'.
asyncmap 0

# Require the peer to authenticate itself before allowing network
# packets to be sent or received.
# Please do not disable this setting. It is expected to be standard in
# future releases of pppd. Use the call option (see manpage) to disable
# authentication for specific peers.
auth

# Use hardware flow control (i.e. RTS/CTS) to control the flow of data
# on the serial port.
crtscts

# Use software flow control (i.e. XON/XOFF) to control the flow of data
# on the serial port.
#xonxoff

# Specifies that certain characters should be escaped on transmission
# (regardless of whether the peer requests them to be escaped with its
# async control character map).  The characters to be escaped are
# specified as a list of hex numbers separated by commas.  Note that
# almost any character can be specified for the escape option, unlike
# the asyncmap option which only allows control characters to be
# specified.  The characters which may not be escaped are those with hex
# values 0x20 - 0x3f or 0x5e.
#escape 11,13,ff

# Don't use the modem control lines.
#local

# Specifies that pppd should use a UUCP-style lock on the serial device
# to ensure exclusive access to the device.
lock

# Don't show the passwords when logging the contents of PAP packets.
# This is the default.
hide-password

# When logging the contents of PAP packets, this option causes pppd to
```

```
# show the password string in the log message.
#show-password

# Use the modem control lines.  On Ultrix, this option implies hardware
# flow control, as for the crtscts option.  (This option is not fully
# implemented.)
modem

# Set the MRU [Maximum Receive Unit] value to <n> for negotiation.  pppd
# will ask the peer to send packets of no more than <n> bytes. The
# minimum MRU value is 128.  The default MRU value is 1500.  A value of
# 296 is recommended for slow links (40 bytes for TCP/IP header + 256
# bytes of data).
#mru 542

# Set the interface netmask to <n>, a 32 bit netmask in "decimal dot"
# notation (e.g. 255.255.255.0).
#netmask 255.255.255.0

# Disables the default behaviour when no local IP address is specified,
# which is to determine (if possible) the local IP address from the
# hostname. With this option, the peer will have to supply the local IP
# address during IPCP negotiation (unless it specified explicitly on the
# command line or in an options file).
#noipdefault

# Enables the "passive" option in the LCP.  With this option, pppd will
# attempt to initiate a connection; if no reply is received from the
# peer, pppd will then just wait passively for a valid LCP packet from
# the peer (instead of exiting, as it does without this option).
#passive

# With this option, pppd will not transmit LCP packets to initiate a
# connection until a valid LCP packet is received from the peer (as for
# the "passive" option with old versions of pppd).
#silent

# Don't request or allow negotiation of any options for LCP and IPCP
# (use default values).
#-all

# Disable Address/Control compression negotiation (use default, i.e.
# address/control field disabled).
#-ac

# Disable asyncmap negotiation (use the default asyncmap, i.e. escape
# all control characters).
#-am

# Don't fork to become a background process (otherwise pppd will do so
```

```
# if a serial device is specified).
#-detach

# Disable IP address negotiation (with this option, the remote IP
# address must be specified with an option on the command line or in
# an options file).
#-ip

# Disable IPCP negotiation and IP communication. This option should
# only be required if the peer is buggy and gets confused by requests
# from pppd for IPCP negotiation.
#noip

# Disable magic number negotiation.  With this option, pppd cannot
# detect a looped-back line.
#-mn

# Disable MRU [Maximum Receive Unit] negotiation (use default, i.e.
# 1500).
#-mru

# Disable protocol field compression negotiation (use default, i.e.
# protocol field compression disabled).
#-pc

# Require the peer to authenticate itself using PAP.
#+pap

# Don't agree to authenticate using PAP.
#-pap

# Require the peer to authenticate itself using CHAP [Cryptographic
# Handshake Authentication Protocol] authentication.
#+chap

# Don't agree to authenticate using CHAP.
#-chap

# Disable negotiation of Van Jacobson style IP header compression (use
# default, i.e. no compression).
#-vj

# Increase debugging level (same as -d).  If this option is given, pppd
# will log the contents of all control packets sent or received in a
# readable form.  The packets are logged through syslog with facility
# daemon and level debug. This information can be directed to a file by
# setting up /etc/syslog.conf appropriately (see syslog.conf(5)).  (If
# pppd is compiled with extra debugging enabled, it will log messages
# using facility local2 instead of daemon).
debug
```

```
# Append the domain name <d> to the local host name for authentication
# purposes.  For example, if gethostname() returns the name porsche,
# but the fully qualified domain name is porsche.Quotron.COM, you would
# use the domain option to set the domain name to Quotron.COM.
#domain <d>

# Enable debugging code in the kernel-level PPP driver.  The argument n
# is a number which is the sum of the following values: 1 to enable
# general debug messages, 2 to request that the contents of received
# packets be printed, and 4 to request that the contents of transmitted
# packets be printed.
#kdebug n

# Set the MTU [Maximum Transmit Unit] value to <n>. Unless the peer
# requests a smaller value via MRU negotiation, pppd will request that
# the kernel networking code send data packets of no more than n bytes
# through the PPP network interface.
#mtu <n>

# Set the name of the local system for authentication purposes to <n>.
# This is a privileged option. With this option, pppd will use lines in the
# secrets files which have <n> as the second field when looking for a
# secret to use in authenticating the peer. In addition, unless overridden
# with the user option, <n> will be used as the name to send to the peer
# when authenticating the local system to the peer. (Note that pppd does
# not append the domain name to <n>.)
#name <n>

# Enforce the use of the hostname as the name of the local system for
# authentication purposes (overrides the name option).
#usehostname

# Set the assumed name of the remote system for authentication purposes
# to <n>.
#remotename <n>

# Add an entry to this system's ARP [Address Resolution Protocol]
# table with the IP address of the peer and the Ethernet address of this
# system.
#proxyarp

# Use the system password database for authenticating the peer using
# PAP. Note: mgetty already provides this option. If this is specified
# then dialin from users using a script under Linux to fire up ppp wont work.
# login

# If this option is given, pppd will send an LCP echo-request frame to the
# peer every n seconds. Normally the peer should respond to the echo-request
# by sending an echo-reply. This option can be used with the
```

```
# lcp-echo-failure option to detect that the peer is no longer connected.
lcp-echo-interval 30

# If this option is given, pppd will presume the peer to be dead if n
# LCP echo-requests are sent without receiving a valid LCP echo-reply.
# If this happens, pppd will terminate the connection.  Use of this
# option requires a non-zero value for the lcp-echo-interval parameter.
# This option can be used to enable pppd to terminate after the physical
# connection has been broken (e.g., the modem has hung up) in
# situations where no hardware modem control lines are available.
lcp-echo-failure 4

# Set the LCP restart interval (retransmission timeout) to <n> seconds
# (default 3).
#lcp-restart <n>

# Set the maximum number of LCP terminate-request transmissions to <n>
# (default 3).
#lcp-max-terminate <n>

# Set the maximum number of LCP configure-request transmissions to <n>
# (default 10).
#lcp-max-configure <n>

# Set the maximum number of LCP configure-NAKs returned before starting
# to send configure-Rejects instead to <n> (default 10).
#lcp-max-failure <n>

# Set the IPCP restart interval (retransmission timeout) to <n>
# seconds (default 3).
#ipcp-restart <n>

# Set the maximum number of IPCP terminate-request transmissions to <n>
# (default 3).
#ipcp-max-terminate <n>

# Set the maximum number of IPCP configure-request transmissions to <n>
# (default 10).
#ipcp-max-configure <n>

# Set the maximum number of IPCP configure-NAKs returned before starting
# to send configure-Rejects instead to <n> (default 10).
#ipcp-max-failure <n>

# Set the PAP restart interval (retransmission timeout) to <n> seconds
# (default 3).
#pap-restart <n>

# Set the maximum number of PAP authenticate-request transmissions to
# <n> (default 10).
```

```
#pap-max-authreq <n>

# Set the maximum time that pppd will wait for the peer to authenticate
# itself with PAP to <n> seconds (0 means no limit).
#pap-timeout <n>

# Set the CHAP restart interval (retransmission timeout for
# challenges) to <n> seconds (default 3).
#chap-restart <n>

# Set the maximum number of CHAP challenge transmissions to <n>
# (default 10).
#chap-max-challenge

# If this option is given, pppd will rechallenge the peer every <n>
# seconds.
#chap-interval <n>

# With this option, pppd will accept the peer's idea of our local IP
# address, even if the local IP address was specified in an option.
#ipcp-accept-local

# With this option, pppd will accept the peer's idea of its (remote) IP
# address, even if the remote IP address was specified in an option.
#ipcp-accept-remote

# Disable the IPXCP and IPX protocols.
# To let pppd pass IPX packets comment this out --- you'll probably also
# want to install ipxripd, and have the Internal IPX Network option enabled
# in your kernel.  /usr/doc/HOWTO/IPX-HOWTO.gz contains more info.
noipx

# Exit once a connection has been made and terminated. This is the default,
# unless the `persist' or `demand' option has been specified.
#nopersist

# Do not exit after a connection is terminated; instead try to reopen
# the connection.
#persist

# Terminate after n consecutive failed connection attempts.
# A value of 0 means no limit. The default value is 10.
#maxfail <n>

# Initiate the link only on demand, i.e. when data traffic is present.
# With this option, the remote IP address must be specified by the user on
# the command line or in an options file.  Pppd will initially configure
# the interface and enable it for IP traffic without connecting to the peer.
# When traffic is available, pppd will connect to the peer and perform
# negotiation, authentication, etc.  When this is completed, pppd will
```

```
# commence passing data packets (i.e., IP packets) across the link.
#demand

# Specifies that pppd should disconnect if the link is idle for <n> seconds.
# The link is idle when no data packets (i.e. IP packets) are being sent or
# received.  Note: it is not advisable to use this option with the persist
# option without the demand option.  If the active-filter option is given,
# data packets which are rejected by the specified activity filter also
# count as the link being idle.
#idle <n>

# Specifies how many seconds to wait before re-initiating the link after
# it terminates.  This option only has any effect if the persist or demand
# option is used.  The holdoff period is not applied if the link was
# terminated because it was idle.
#holdoff <n>

# Wait for up n milliseconds after the connect script finishes for a valid
# PPP packet from the peer.  At the end of this time, or when a valid PPP
# packet is received from the peer, pppd will commence negotiation by
# sending its first LCP packet.  The default value is 1000 (1 second).
# This wait period only applies if the connect or pty option is used.
#connect-delay <n>

# Packet filtering: for more information, see pppd(8)
# Any packets matching the filter expression will be interpreted as link
# activity, and will cause a "demand" connection to be activated, and reset
# the idle connection timer. (idle option)
# The filter expression is akin to that of tcpdump(1)
#active-filter <filter-expression>

# ---<End of File>---
```

Minimal PPP Peer Configuration File

Save as /etc/ppp/peers/l4g2d_peer:

```
# Example configuration for a dialup connection to either an
# AT&T, AT&T-like, or Verizon carrier.
#
# Uncomment ONE carrier specific chat script
#
# This is the default configuration used by pon(1) and poff(1).
# See the manual page pppd(8) for information on all the options.

#AT&T and AT&T-like carrier chat script and MTU
#connect "/usr/sbin/chat -v -f /etc/chatscripts/l4g2d_att_chat"
#mtu 1420

#Verizon chat script and MTU
#connect "/usr/sbin/chat -v -f /etc/chatscripts/l4g2d_vzw_chat"
#mtu 1428
```

```
# Serial device to which the modem is connected.
/dev/ttyUSB2

# Speed of the serial line.
115200

# Assumes that your IP address is allocated dynamically by the ISP.
noipdefault

# Try to get the name server addresses from the ISP.
usepeerdns

# Use this connection as the default route.
defaultroute

# Makes pppd "dial again" when the connection is lost.
persist

# Do not ask the remote to authenticate.
noauth
```

Minimal AT&T and Similar Chat Script

Save as /etc/chatscripts/l4g2d_att_chat:

```
ABORT "ERROR"
ABORT "NO CARRIER"
ABORT "BUSY"
ABORT "+CGATT: 0"
'' AT
OK AT+CPIN?
READY AT+CGATT?
OK AT+CSQ
OK ATD*99***1#
CONNECT ''
```

Minimal Verizon Chat Script

Save as /etc/chatscripts/l4g2d_vzw_chat:

```
ABORT "ERROR"
ABORT "NO CARRIER"
ABORT "BUSY"
ABORT "+CGATT: 0"
'' AT
OK AT+CPIN?
READY AT+CGATT?
OK AT+CSQ
OK ATD*99***3#
CONNECT ''
```

Chapter 8 – Regulatory Information

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 Reglement 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.

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.

Waste Electrical and Electronic Equipment Statement

WEEE Directive

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

Instructions for Disposal of WEEE by Users in the European Union

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

July, 2005

REACH-SVHC Statement

Registration of Substances

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, refer to additional regulatory documents at:
https://www.multitech.com/support/support

EMC, Safety, and Radio Equipment Directive (RED) Compliance

CE

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

Council Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment;
and
Council Directive 2014/53/EU on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity.

MultiTech declares that this device is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU. The declaration of conformity may be downloaded at https://www.multitech.com/red

Restriction of the Use of Hazardous Substances (RoHS)

Multi-Tech Systems, Inc.

Certificate of Compliance

2015/863

Multi-Tech Systems, Inc. confirms that its embedded products comply with the chemical concentration limitations set forth in the directive 2015/863 of the European Parliament (Restriction of the use of certain Hazardous Substances in electrical and electronic equipment - RoHS 3).

These MultiTech products do not contain the following banned chemicals[1]:

- Lead, [Pb] < 1000 PPM
- Mercury, [Hg] < 100 PPM
- Cadmium, [Cd] < 100 PPM
- Hexavalent Chromium, [Cr+6] < 1000 PPM
- Polybrominated Biphenyl, [PBB] < 1000 PPM
- Polybrominated Diphenyl Ethers, [PBDE] < 1000 PPM
- Bis(2-Ethylhexyl) phthalate (DEHP): < 1000 ppm
- Benzyl butyl phthalate (BBP): < 1000 ppm
- Dibutyl phthalate (DBP): < 1000 ppm
- Diisobutyl phthalate (DIBP): < 1000 ppm

Chapter 9 – 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. If you cannot activate your device with Connection Manager, refer to *Account Activation for Cellular Devices.*

- 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://www.multitech.com/support/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 1.

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. Refer to Connecting a Device.

If using a serial device, you need to set up the device in Windows Device Manager before connecting the device. Refer to 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.

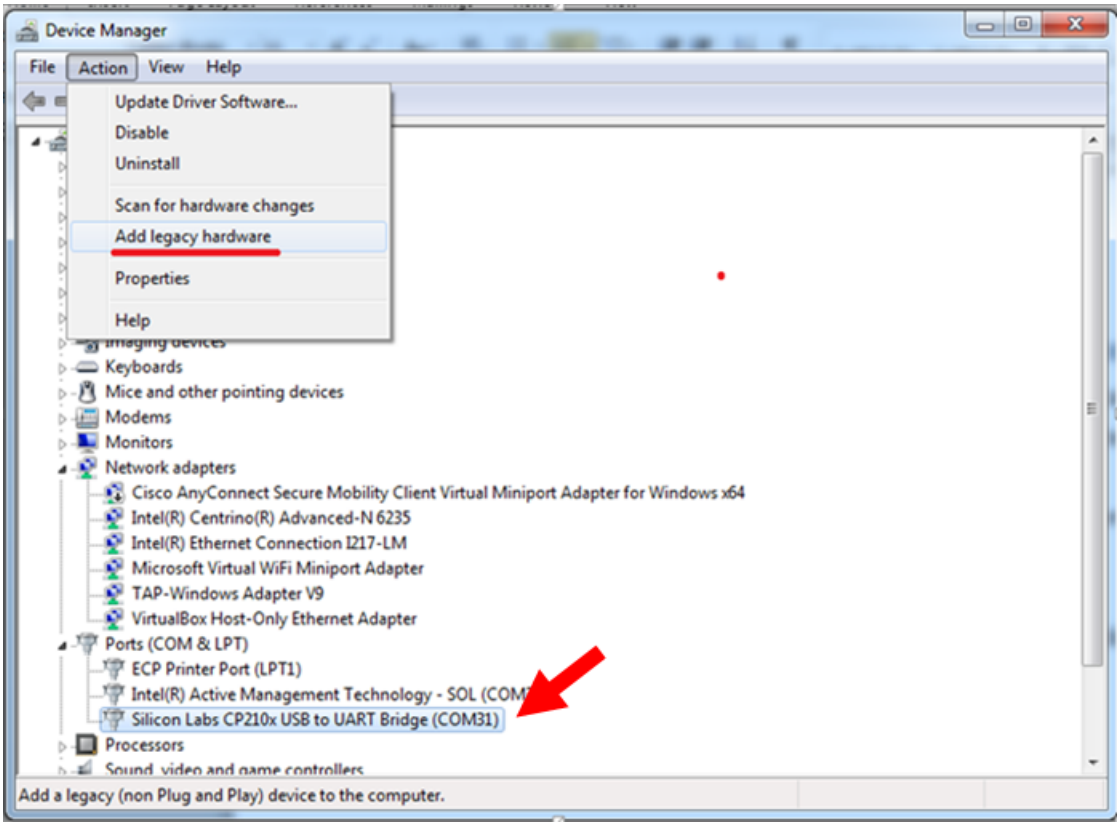
Setting Up a Serial Device in Windows Device Manager

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, refer to Connecting a Device.

Connecting a Device

Before You Begin

- 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. Refer to 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 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

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

Before You Begin

Make sure that Connection Manager is not running.

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**.

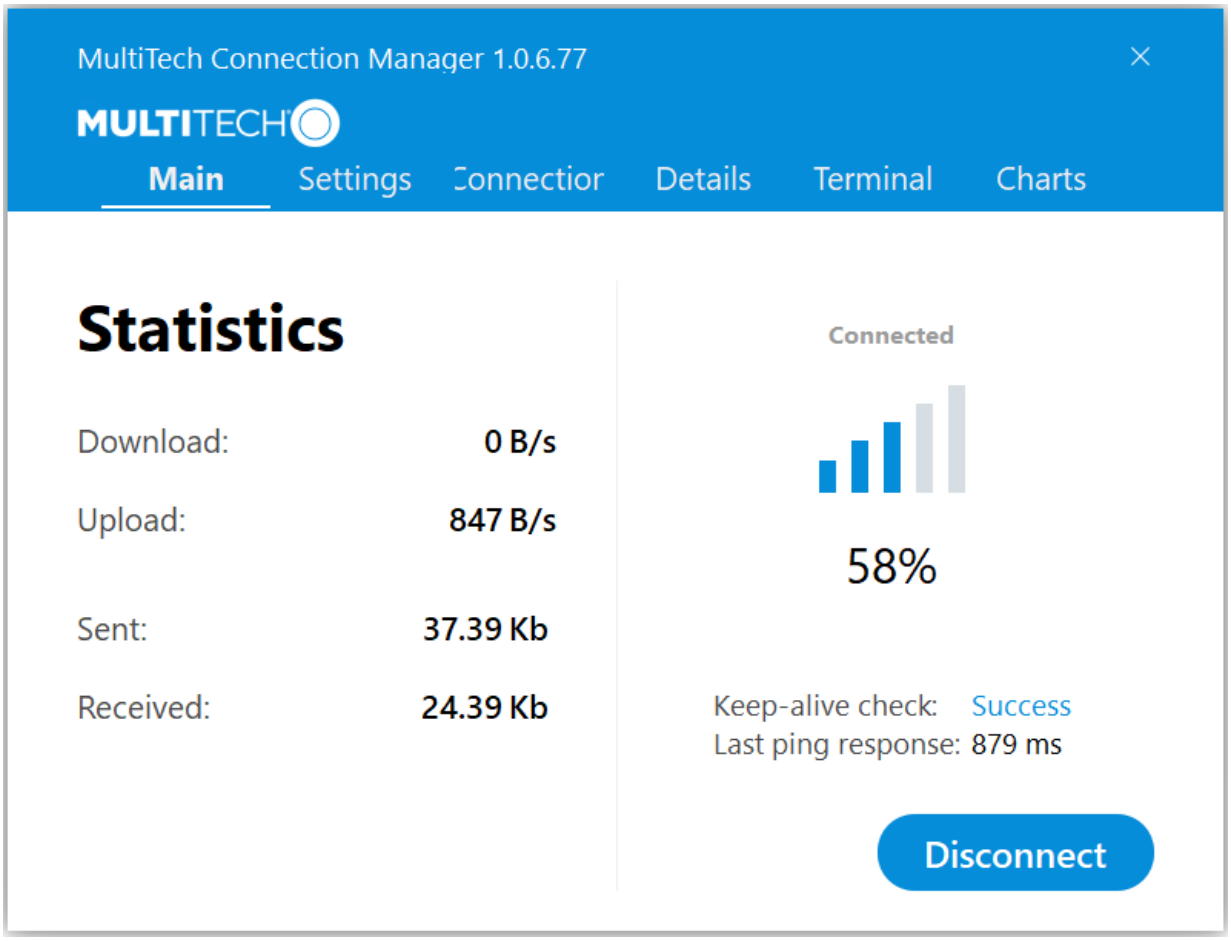
Connection Manager and the installed drivers are removed from the computer.

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, refer to 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 2-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 re-install Connection Manager. During the installation, make sure that you check **Install the modem driver**. Refer to Uninstalling Connection Manager and Installing Connection Manager.

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

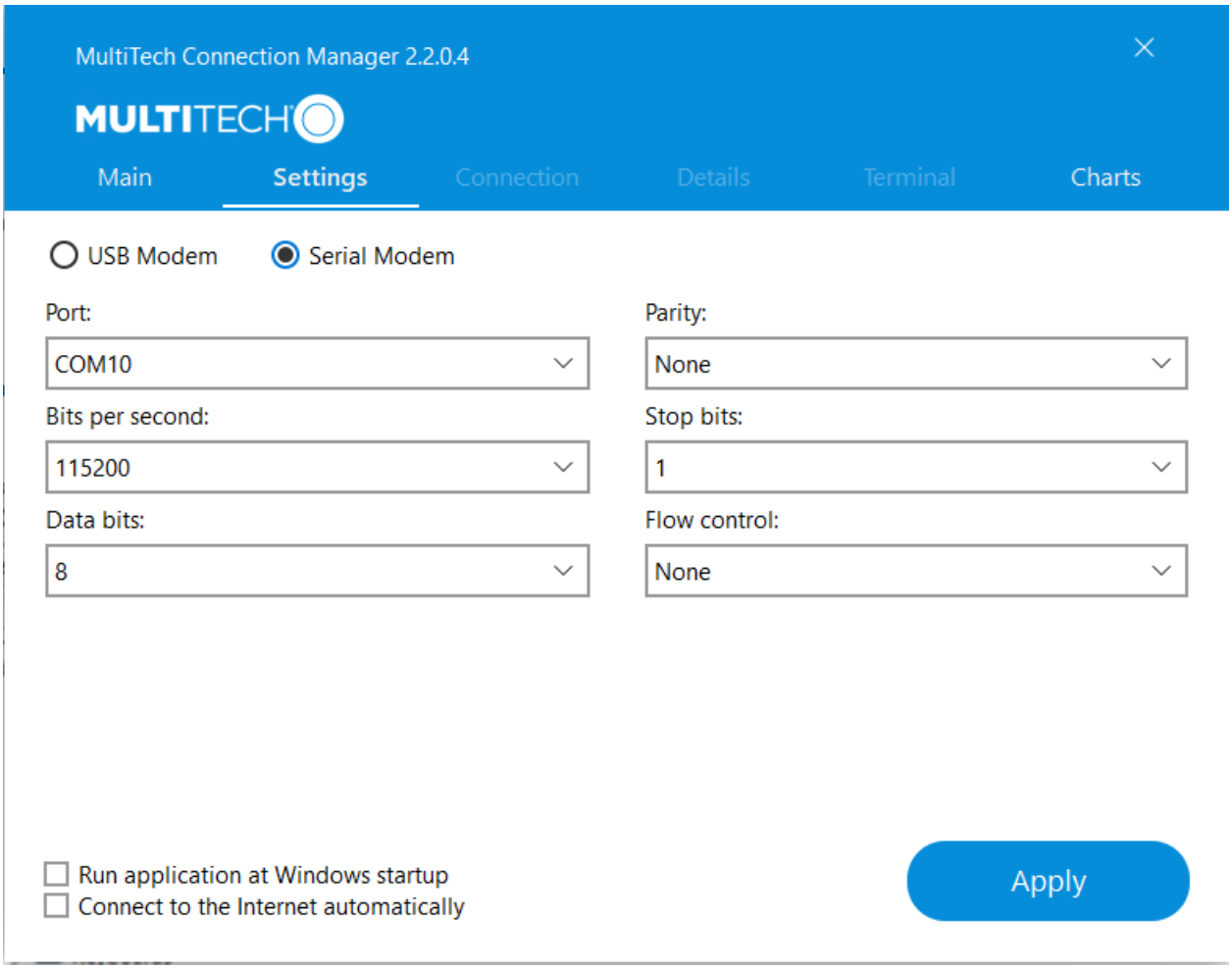
This error has the following causes and solutions.

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.

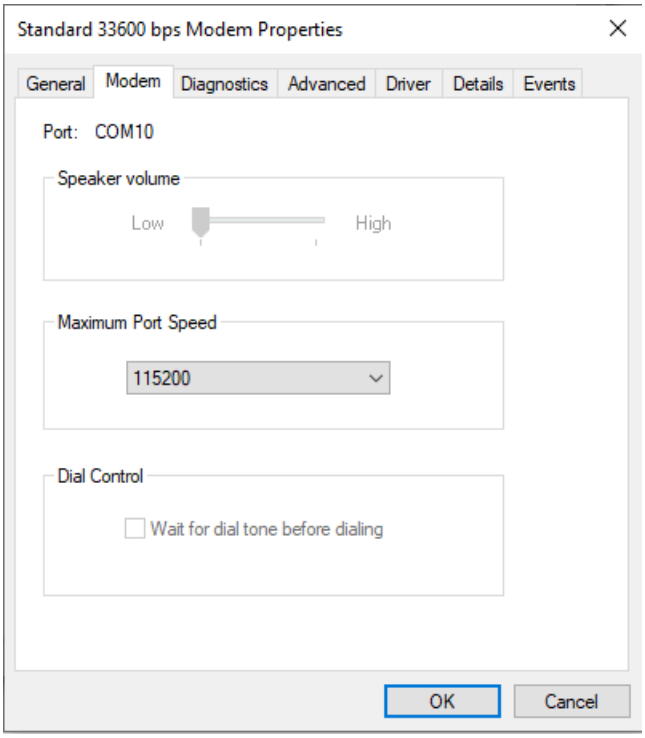
In **Connection Manager**, click on the **Settings** tab.



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

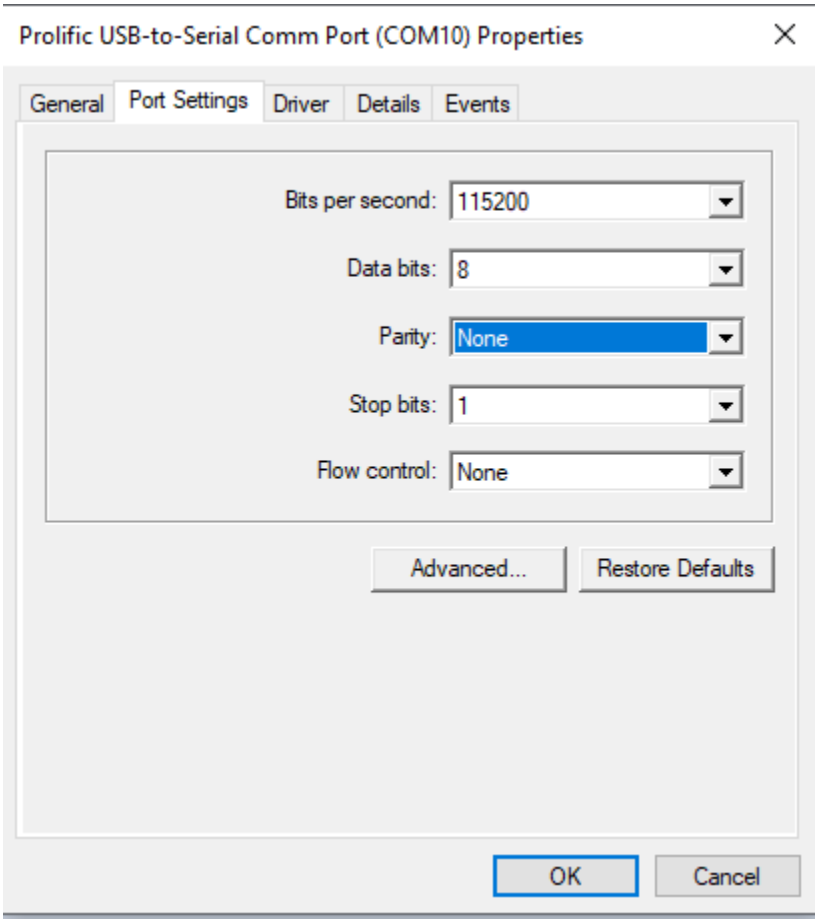
> **Note:** If Modems and Ports don't appear in Device Manager, open the **View** Menu and select **Show hidden devices**.

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


Prolific USB-to-Serial Comm Port (COM10) Properties
General
Port Settings
Driver
Details
Events
Bits per second:
115200
Data bits:
8
Parity:
None
Stop bits:
1
Flow control:
None
Advanced...
Restore Defaults
OK
Cancel