

Dragonfly™ Nano

MTQN-MNG1-B02 Device Guide



Dragonfly™ Nano Device Guide

Models: MTQN-MNG1-B02

Part Number: S000702 1.6

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Chapter 1 – Product Overview

Overview

The Dragonfly™ Nano (MTQN) embedded cellular modem is a small version of the Dragonfly (MTQ) embedded cellular modem. Both devices offer developers the functionality of an on-board cellular radio all-in-one compact design. The Dragonfly Nano provides a practical solution to the market's demand for a smaller, low-power modem.

The Dragonfly Nano functions similarly to the Dragonfly and maintains interoperability with legacy systems that use a 40-pin connector and forward mounting hole.

Documentation

The following documentation is available on the product page at <https://www.multitech.com/brands/multiconnect-dragonfly-nano>.

Document	Description	Part Number
MTQN-MNG1-B02 Device Guide	Provides model specifications and developer information regarding the B02 version of MTQN.	S000702
Universal Developer Kit 2.0 Developer Guide.	Provides information for using the developer board with the MTQN.	S000610
Sara-R4 USB Driver Installation Guide	Provides instructions on how to install Windows USB driver.	N/A
Sara-R4/N4 series, AT Commands Manual	Provides AT commands and parameters used to configure your device.	UBX-17003787

Product Build Options

The available Dragonfly™ Nano modules are:

Model	Description	Region
MTQN-MNG1-B02	Embedded LTE Cat M1 Cellular Modem (Verizon/AT&T)	North America
Developer Kit		
MTUDK2-ST-CELL	SocketModem® & Dragonfly™ Nano Developer Kit	Global

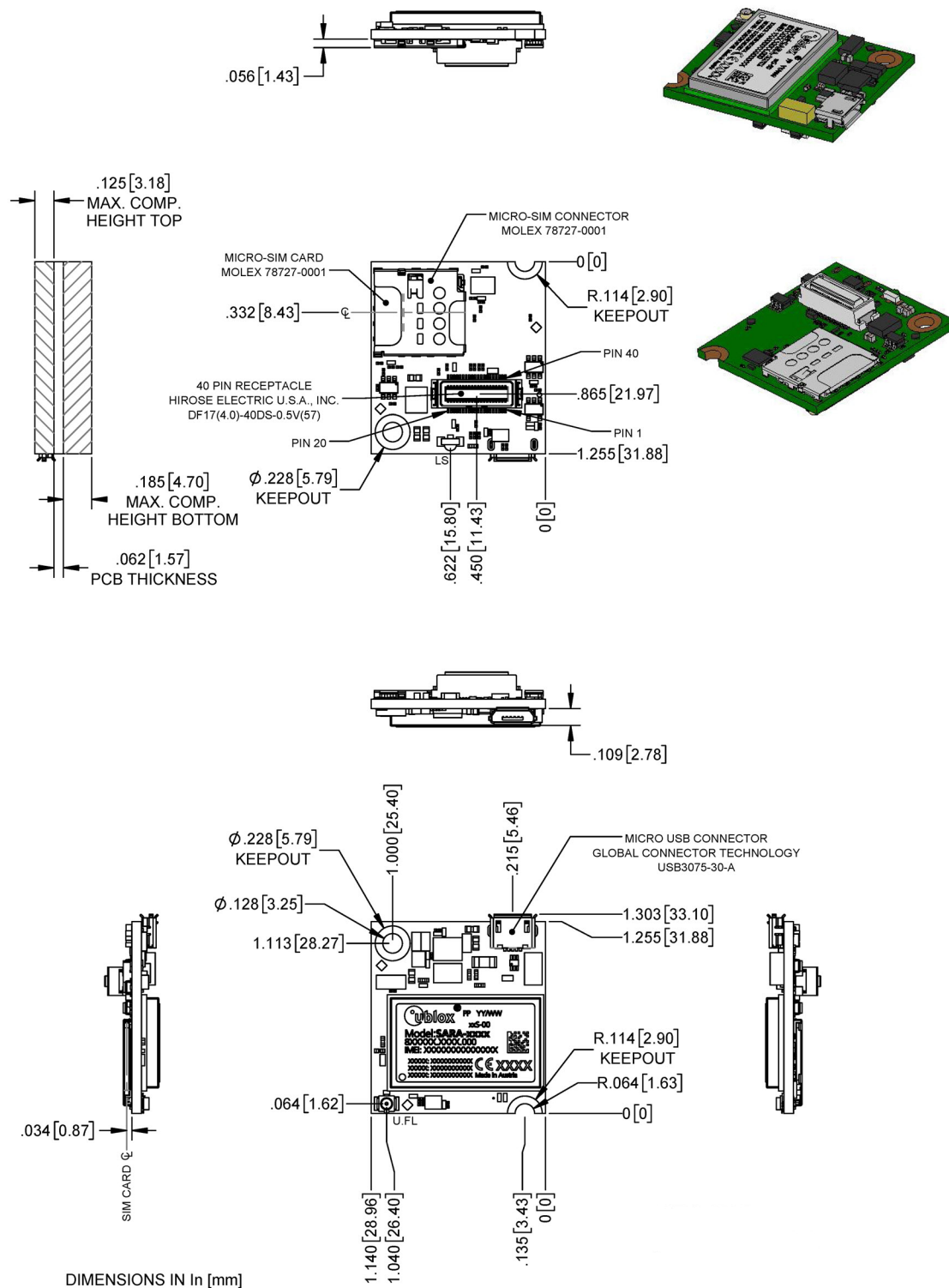
Note:

These units ship without network activation. To connect them to the cellular network, you need SIM cards from your service provider.

The complete product code may end in .Rx. For example, MTQN-MNG1-B02.Rx, where R is revision and x is the revision number. All builds can be ordered individually or in 50-packs.

Chapter 2 – Mechanical Drawings

MTQN-MNG1-B02



Chapter 3 – Hardware and Specifications

Specifications

Category	Description	
Performance ¹	3GPP Release 13 Cat M1 Half Duplex (Up to 375K bps downlink and uplink)	
Frequency Band (MHz)	AT&T	Verizon
	700 MHz (B12), 850 MHz (B5), AWS1700 MHz (B4) and 1900 MHz (B2)	700 MHz (B13)
Interface		
Connectors	1 UFL (Cellular), 1xMicro USB, 1x 40-Pin Board-to-Board	
I/O	1 x UART, 1 x HS USB	
SMS	Mobile Terminate/Mobile Originate PDU / Text mode	
LED	Link Status	
Physical Description		
Weight	less than 0.3 oz (8.5g)	
Dimensions	28.96mm x 32.51mm (1.14 x 1.28 inches). Refer to Mechanical Drawings for details.	
Connectors		
Antenna	1 surface mount U.FL: cellular	
SIM Holder	1.8 V and 3 V Micro SIM (3FF) card. SIM denotes: Subscriber Identity Module.	
Pin header	40-pin female for USB or UART	
Environment		
Operating Temperature ²	-40° C to +85° C (-40° F to +185° F)	
Storage Temperature	-40° C to +85° C (-40° F to +185° F)	
Humidity ¹	15%-93% RH, non-condensing	

¹Actual performance speeds may be affected by a variety of attributes such as cell tower distance, data loads, packet sizes, etc. Radio performance may be affected by temperature extremes. This is normal.

²Device has been tested up to +85° C. UL Recognized @ 85° C.

The following table defines the remaining specifications for the MTQN-MNG1.

Category	Description
Certifications and Compliance	
EMC Compliance	FCC Part 15 Class B

Category	Description	
Radio Compliance	FCC Part 22, 24, 27	
Safety Compliance	UL/cUL 60950-1 2nd ED, IEC 60950-1 2nd ED +Am.2	
Network	PTCRB	N/A
Carrier	AT&T	Verizon

Mounting Hardware

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

Here are some standoffs that can be used with this product.

Recommended Parts

Manufacturer	Part	Part Number
PEM (Penn Engineering & Manufacturing)	Surface Mount Standoff	SMTSO-M3-6
RAF Electronic Hardware	6mm Hex Female Standoff	1251-3005-S-12-Zinc

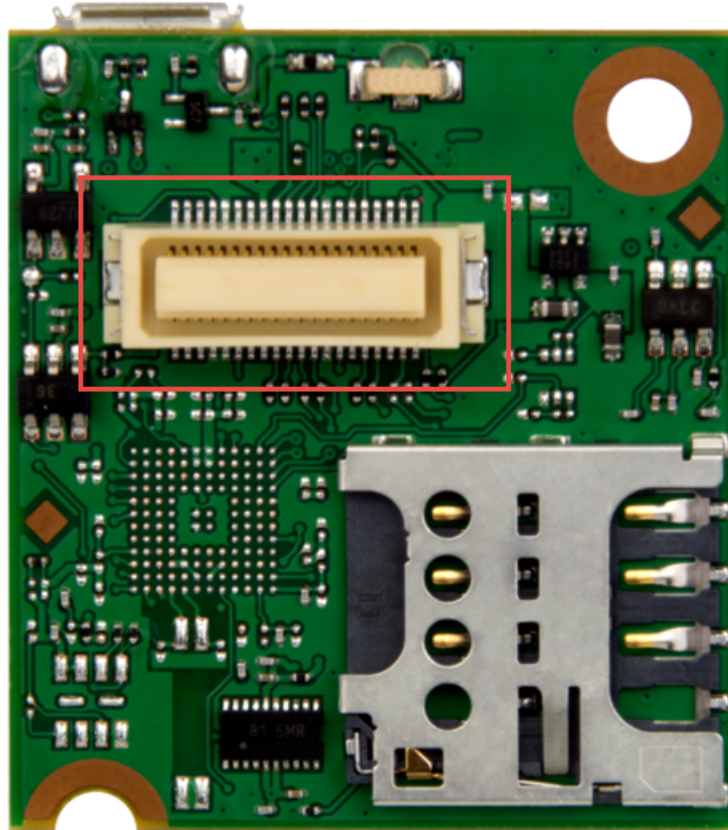
Note 1: We recommend grounding the standoffs to the main PCB for better performance.

Note 2: For other stacking heights, refer to the Hirose DF17 Series 0.5mm Pitch Board to Board Connector Data Sheet to select the appropriate spacers.

40-Pin Connector Definitions

40-Pin Connector

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21



Pin Definitions

Pin	Signal Name	I/O Level	In/Out	Description
1	N/C			
2	N/C			
3	N/C			
4	N/C			
5	GND		Power	Ground Connection
6	USB-DATA+	3.3	I/O	USB Data+ connection to cellular module
7	USB-DATA-			USB Data- connection to cellular module
8	VCC-IN		Power	Power Input
9	RADIO_RX	3.3	O	Cellular Radio UART Data Output
10	RADIO_DCD	3.3	O	Cellular Radio UART DCD Output
11	RADIO_RI	3.3	O	Cellular Radio UART RI Output
12	RADIO_CTS	3.3	O	Cellular Radio UART CTS Output

Pin	Signal Name	I/O Level	In/Out	Description
13	GND		Power	Ground Connection
14	N/C			
15	N/C			
16	N/C			
17	N/C			
18	N/C			
19	N/C			
20	N/C			
21	N/C			
22	N/C			
23	N/C			
24	VUSB-SELECT	5	I	Apply 5V to use USB Interface to cellular modem
25	N/C			
26	N/C			
27	1V8_MON	3.318	O	When high, the radio is powered up. When low, the radio is powered down or in PSM mode.
28	GND		Power	Ground Connection.
29	RADIO_RTS	3.3	I	Cellular Radio UART RTS Input
30	RADIO_DSR	3.3	O	Cellular Radio UART DSR Output
31	RADIO_DTR	3.3	I	Cellular Radio UART DTR Input
32	RADIO_TX	3.3	I	Cellular Radio UART Data Input
33	VCC-IN		Power	Power Input
34	LINK	3.3 - 4.2 (see note)	O	Radio Link Status
35	NRESET	3.3 - 4.2 (see note)	I	Board Reset Input
36	GND		Power	Ground Connection
37	GND			
38	N/C			
39	N/C			
40	N/C			

Note: The I/O level is/cannot exceed VCC or 4.2V whichever is less.

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:

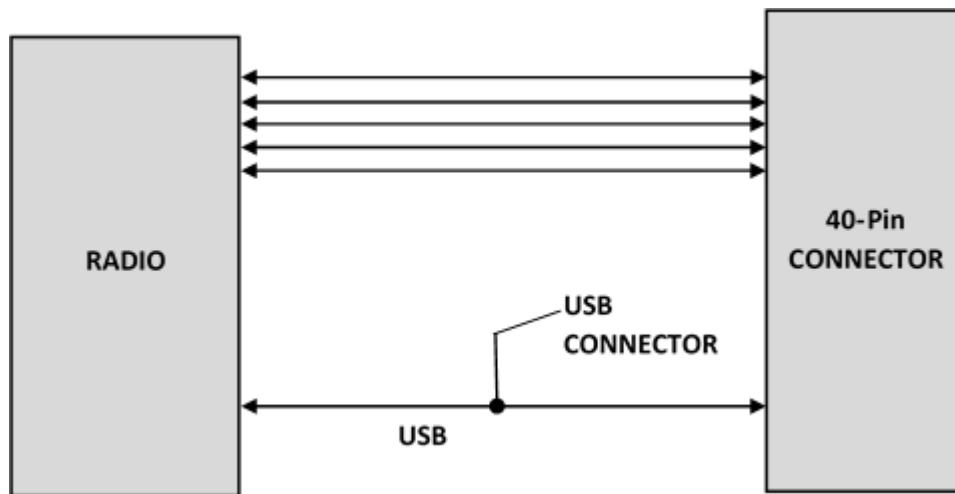
Manufacturer:	Hirose Electric Co LTD
Description:	.5mm 40 pin B.B header MALE
Model Number:	DF17(2.0)-40DP-0.5V(57)

Communications Flow

The MTQN-MNG1-B02 provides a full UART interface from the cellular radio to the user application. Model B02 also provides a USB interface.

Note:

- When the USB interface is used via the 40-pin connector (VUSB_SELECT is 5V) or the USB connector, the serial interface to the radio will not function.
- Pin 24 VUSB_SELECT must be pulled to 5V to enable the USB interface available through the 40-pin connector.
- Switching between the USB interface and serial port requires a reset. The cellular radio checks for a USB connection upon reset. If USB is not present, it will only use the serial port. If USB is present upon reset, it will only use USB.



Electrical Characteristics

Operating Conditions

Parameter	Minimum Volts	Maximum Volts
Supply Range - Vcc	3.2	5.25

Absolute Maximum Rating

Symbol	Description	Conditions	Min.	Max.	Unit
VCC	Module supply voltage	Input DC voltage at VCC pin	-0.5	6.0	V
GDI	Generic digital interfaces	Input DC voltage at Generic digital interfaces pins	-0.5	6.5	V
SIM	SIM interface	Input DC voltage at SIM digital interfaces pins	-0.3	3.9	V
ERS	External reset signal	Input DC voltage at RESET_N pin	-0.5	4.3	V
P_ANT	Antenna power	Input RF power at ANT pin		-22	dbM
Rho_ANT	Antenna ruggedness	Output RF load mismatch ruggedness at ANT pins		10.1	VSWR
tstg	Storage Temperature		-40	85	°C

Parameter	Minimum Volts	Maximum Volts
Voltage at any signal pin	-0.5	6.5

DC Electrical Characteristics

Parameter	Minimum Volts	Maximum Volts
Digital signal input low level	0	1.155
Digital signal input high level	2.145	3.3
Output low level voltage for an I/O pin	-	0.4
Output high level voltage for an I/O pin	2.9	-

(1) Guaranteed by characterization results, not tested in production.

(2) Guaranteed by design, not tested in production.

Input/Output Current Ratings

Output current draw all other output pins	1 mA
---	------

Power Draw

Voltage	Radio Protocol	Power Saving Mode and Power Down	(AVG) Measured Current at Max Power ¹	TX Pulse ² (AVG) Amplitude Current for Peak Current	Total Inrush Charge ³ in MilliCoulombs (mC)
5 Volts with Unit In Dev Card	LTE	15 μ A	172 mA	381 mA	0.04 mC

¹**Maximum Power:** The continuous current during maximum data rate with the radio transmitter at maximum power.

²**Tx Pulse:** The average peak current during a GSM 850 transmission burst period or LTE connection.

³**Inrush Charge:** The total inrush charge at power on.

USB Cable Recommendations

If your device has a USB connector, to avoid enumeration or power issues:

- 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-MICRO-B-3.

Chapter 4 – Antennas

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

Chapter 5 – Safety Information

Handling Precautions

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

Radio Frequency (RF) Safety

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

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

Sécurité relative aux appareils à radiofréquence (RF)

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

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

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

Potential Interference

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

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

Precautions for pacemaker wearers

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

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

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

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

Vehicle Safety

When using your device in a vehicle:

- Do not use this device while driving.
- Respect national regulations on the use of cellular devices in vehicles.
- If incorrectly installed in a vehicle, operating the wireless device could interfere with the vehicle's electronics. To avoid such problems, use qualified personnel to install the device. The installer should verify the vehicle electronics are protected from interference.
- Using an alert device to operate a vehicle's lights or horn is not permitted on public roads.

- UL evaluated this device for use in ordinary locations only. UL did NOT evaluate this device for installation in a vehicle or other outdoor locations. UL Certification does not apply or extend to use in vehicles or outdoor applications.

Device Maintenance

When maintaining your device:

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

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

User Responsibility

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

Chapter 6 – Getting Started

Communicating with the Device

Following are three options for communicating with the device.

1. Install USB drivers and plug into the micro USB connector. No need for a host board.
2. Access the device's USB interface via pins 6, 7, and 24 of the 40-pin connector. Data pins 6 and 7 are parallel with the micro USB connector on the MTQN. There is no connection to pins 6, 7 and 24 on the MTUDK2. VUSB_SELECT is isolated from VUSB of the micro USB connector.
3. Establish serial communication using Multitech developer board MTUDK2. See the *Universal Developer Kit 2.0 Developer Guide* (PN S000610) for more information.

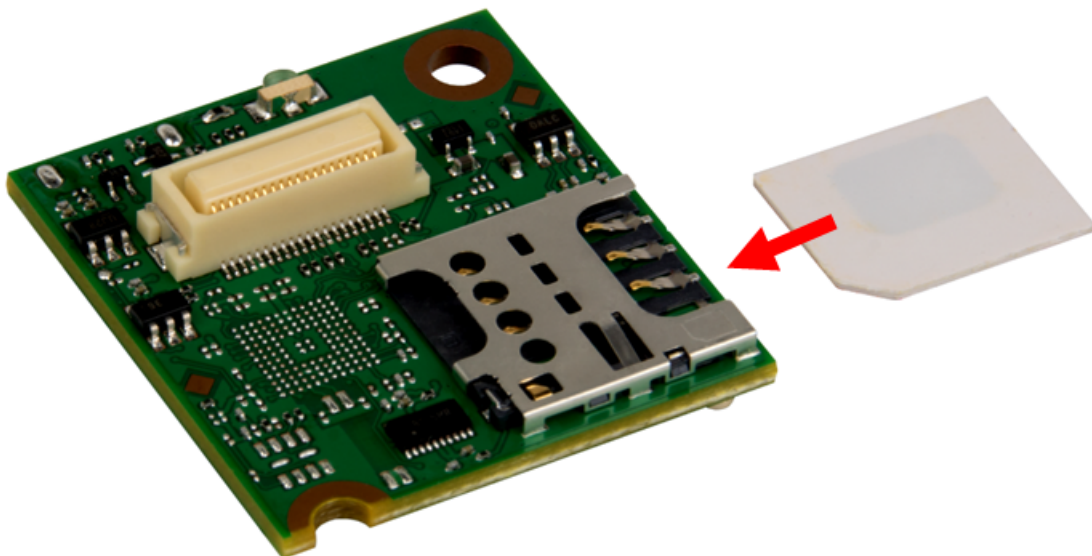
Installing a SIM Card

Note: When using the Dragonfly™ Nano with a developer board, install the SIM card before mounting the Dragonfly™ Nano on the developer board.

Note: All Dragonfly™ Nano models require the use of a Micro SIM (3FF) card.

To install the SIM card:

- Refer to the image below on how to install the SIM card.
- Slide the SIM card completely into the SIM holder.



Configuring u-blox Cellular Radio

This MNG1 device uses a cellular radio that can operate on different carrier networks (not simultaneously).

You must configure your module based on your carrier network and application. This includes setting the applicable MNO profile (based on carrier), RAT (type of technology you wish to use such as Cat M1), and LTE bands intended for the application device and within regulatory compliance. The module is not intended be used in the factory-default setting.

Depending on your MNO profile, certain elements may or may not be available. Refer to the table for details.

Updates to MNO profile version:

- Updates to MNO profile version:

MNO	Version	System Selection	LTE Bands	PSM ¹	eDRX ²	URAT ³	UBANDMASK ⁴
AT&T	v 7.1	M1 only	2, 4, 5, 12	yes	no	no	no
China Telecom	v 7.0	M1->NB1	3, 5, 8	no	no	yes	yes
Deutsche Telekom	v 7.0	M1->NB1	3, 8, 20	yes	yes	yes	yes
Sprint	v 7.0	M1 only	2, 4, 12, 25	no	no	yes	yes
Standard Europe	v 7.0	M1->NB1	3, 8, 20	yes	yes	yes	yes
Telstra	v 7.0	M1 only	3, 5, 8, 28	no	no	no	no
T-Mobile USA	v 7.0	NB1 only	2, 4, 5, 12	no	no	yes	yes
TELUS	v 7.0	M1 only	2, 4, 5, 12	yes	no	no	no
Verizon	v 7.0	M1 only	13	no	no	no	no
Vodafone	v 7.0	NB1->M1	3, 8, 20	yes	no	yes	yes
SW default	N/A	M1->NB1	2, 3, 4, 5, 8, 12, 13, 18, 19, 20, and 25 as M1-only	no	no	no	no

- Note 1: +CPSMS
- Note 2: +CEDRXS
- Note 3: +URAT
- Note 4: +UBANDMASK

If your carrier network is not on the supported list of MNOs, you must set to Cat M1 mode and follow the instructions per that scenario below.

The MNG1 model has regulatory approval on both Verizon or AT&T networks. We continue to work for approval on other networks. Refer to the Sara-R4/N4 series AT Commands Manual for more details.

Note: If your device is on +UMNOPROF: 0 (SW default), there is no network and you must set one.

To set or switch carrier networks:

1. Deregister the module from the network or perform an AT+CFUN=0 cycle:
AT+CFUN=0
2. Set the carrier network (refer to the list of +UMNOPROF values):
To AT&T:
AT+UMNOPROF=2
To Verizon:
AT+UMNOPROF=3
3. Reboot the module in order to apply the new configuration:
AT+CFUN=15

If the APN is known and will not change: We recommend hard-coding the MNO and setting the PDP context manually. The following example of an AT command sequence is for AT&T.

```
AT+CFUN=0
```

```
AT+UMNOPROF=2
```

```
AT+CGDCONT=1, "IPV4V6", "phone"
```

```
AT+CFUN=15
```

If the MNO is not listed: the following command sequence is recommended.

NOTE: We recommend changing +UMNOPROF separately before +UBANDMASK.

```
AT+CFUN=0
```

```
AT+UMNOPROF=0
```

```
AT+CFUN=15
```

```
AT+CFUN=0
```

```
AT+CGDCONT= . .
```

```
AT+UBANDMASK= . .
```

```
AT+CFUN=15
```

To configure the supported radio bands: Use the +UBANDMASK command if your MNO is not listed by the +UMNOPROF command. Refer to your specific carrier regarding available bands.

USB Driver Installation

For the Windows USB driver, refer to the SARA-R4 USB Driver Installation Guide on the product page of the Multitech website. The driver is located under the Downloads section of the product page.

For the Linux USB driver, if your Linux OS does not automatically detect your device, you may need to execute a script. This script adds the MTQN vendor ID and product ID to the USB serial driver. Download the zip file which contains this script and readme file under Downloads on the product page of the website.

Chapter 7 – AT Commands

Powering Down the Device

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

Following are two options that power down the device while maintaining the current parameter settings and allowing for a clean network detach.

- Issue command AT+CPWROFF.

or

- Hold the NRESET signal (pin 35) low for at least 1 second.

To verify that your device is powered down, monitor the 1V8_MON signal (pin 27). When it goes low, the device is powered down.

Note: Signal 1V8_MON operates at 3.318 V not 1.8V.

Note: Note: AT+CPWROFF will not take more than 40s.

Resetting the Device

Software: Use the AT+CFUN command to reset the device. See the AT command guide for specifics.

Hardware: Hold NRESET low for >50ms and <1s.

Note: Use a hardware reset to take the device out of power-down mode.

Configuring Low Power Options

Refer to *Powering Down the Device* for lowest power consumption.

To configure PSM:

AT+CPSMS

To configure eDRX:

AT+CEDRXS

To set device functionality:

AT+CFUN

Note: See the AT commands reference guide for AT command details.

Chapter 8 – Labels

Approvals and Certifications

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

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

Example Labels

The label shown is not the actual size.

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.

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

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

The label shown is not the actual size.

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

Device Label



Package Label



Chapter 9 – Regulatory Information

47 CFR Part 15 Regulation Class B Devices

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

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

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

FCC 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

FCC Grant Part 22, 24, and 27

The u-blox AG: SARA-R4 cellular module has been issued an equipment authorization by the FCC.

Category	Description
FCC Identifier	XPY2AGQN4NNN (for SARA-R410M-02B)
Equipment Class	PCS Licensed Transmitter
Notes	Cellular Module
FCC Rule Parts	22H, 24E, 27
Approval	Single Modular

Component	Description
SARA-R410M-02B	LTE module for North America (AT&T/Verizon); Cat M1

The device operates within approved frequencies overlapping with the following cellular bands:

- LTE 2, 1900 PCS UP
- LTE 25, 1900+ UP
- LTE 35, TD PCS Lower DOWN

- UMTS CH 2 UP
- UMTS CH 25 UP
- UMTS CH 35 DOWN

The following table provides the certified radio frequency data for this device:

FCC Rule Parts	Frequency Range	Output Watts (mW)	Frequency Tolerance	Emission Designator
27	699 - 716 MHz	0.316	1.0 PM	1M11G7D
27	699 - 716 MHz	0.316	1.0 PM	1M11W7D
22H	824 - 849 MHz	0.316	1.0 PM	1M11G7D
22H	824 - 849 MHz	0.316	1.0 PM	1M11W7D
27	1.71 - 1.755 GHz	0.316	1.0 PM	1M24G7D
27	1.71 - 1.755 GHz	0.316	1.0 PM	1M13W7D
24E	1.85 - 1.91 GHz	0.316	1.0 PM	1M12G7D
24E	1.85 - 1.91 GHz	0.316	1.0 PM	1M12W7D

Single Modular Approval. Power output listed is conducted. This device is approved for mobile and fixed use with respect to RF exposure compliance, and may only be marketed to OEM installers. The antenna(s) used for this transmitter, as described in this filing, must be installed to provide a separation distance of at least 20 cm from all persons. Installers and end-users must be provided with operating conditions for satisfying RF exposure compliance.

Maximum permitted antenna gain/cable:

- 3.67 dBi for 700 MHz
- 4.10 dBi for 850 MHz
- 6.74 dBi for 1700 MHz
- 7.12 dBi for 1900 MHz

The final product operating with this transmitter must include operating instructions and antenna installation instructions, for end-users and installers to satisfy RF exposure compliance requirements. 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, spurious emissions, ERP/EIRP, and host/module authentication, or new application if appropriate.

This device contains GSM functions that are not operational in the U.S. Territories. This filing is only applicable for U.S. operations.

Chapter 10 – Environmental Notices

Waste Electrical and Electronic Equipment Statement

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

WEEE Directive

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

Instructions for Disposal of WEEE by Users in the European Union

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

July, 2005



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 chemicals¹:

- 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

Environmental considerations:

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

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

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

REACH 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

The latest **197** substances restricted per the REACH Regulation were **last updated January 2019**. Refer to the following for the most current candidate list of substances: <http://echa.europa.eu/candidate-list-table>.

Information on HS/TS Substances According to Chinese Standards (in Chinese)

依照中国标准的有毒有害物质信息

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

有害/有毒物质/元素

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

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

O 表示不含该物质或者该物质的含量水平在上述限量要求之内。

Information on HS/TS Substances According to Chinese Standards

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

Hazardous/Toxic Substance/Elements

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

X Represents that the concentration of such hazardous/toxic substance in all the units of homogeneous material of such component is higher than the SJ/Txxx-2006 Requirements for Concentration Limits.

O Represents that no such substances are used or that the concentration is within the aforementioned limits.

Chapter 11 – 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, Sprint, 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.

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. In the MultiTech Connection Manager Setup Wizard, read the end-user license agreement and check **I accept the terms in the License Agreement**.
5. 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 only on Windows 10.

6. If a MultiTech device is connected to the computer, disconnect it and click **Next**.
7. 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.

8. To specify a folder for Connection Manager, use the default folder or click **Change** to browse to the folder you want to use.
9. Click **Install**.

A separate wizard opens for installing Telit drivers. Some MultiTech devices use embedded modules from Telit Wireless Solutions to provide cellular connectivity; these devices require Telit drivers.

10. Select **Complete** setup type.
11. When the drivers are installed, click **Finish**.
12. In the Setup Wizard, click **Finish**.

Note:

- To open Connection Manager after installation, check **Start the MultiTech Connection Manager when the installation is finished**.
- After the drivers are installed, you need to restart your computer if prompted by Windows.

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.

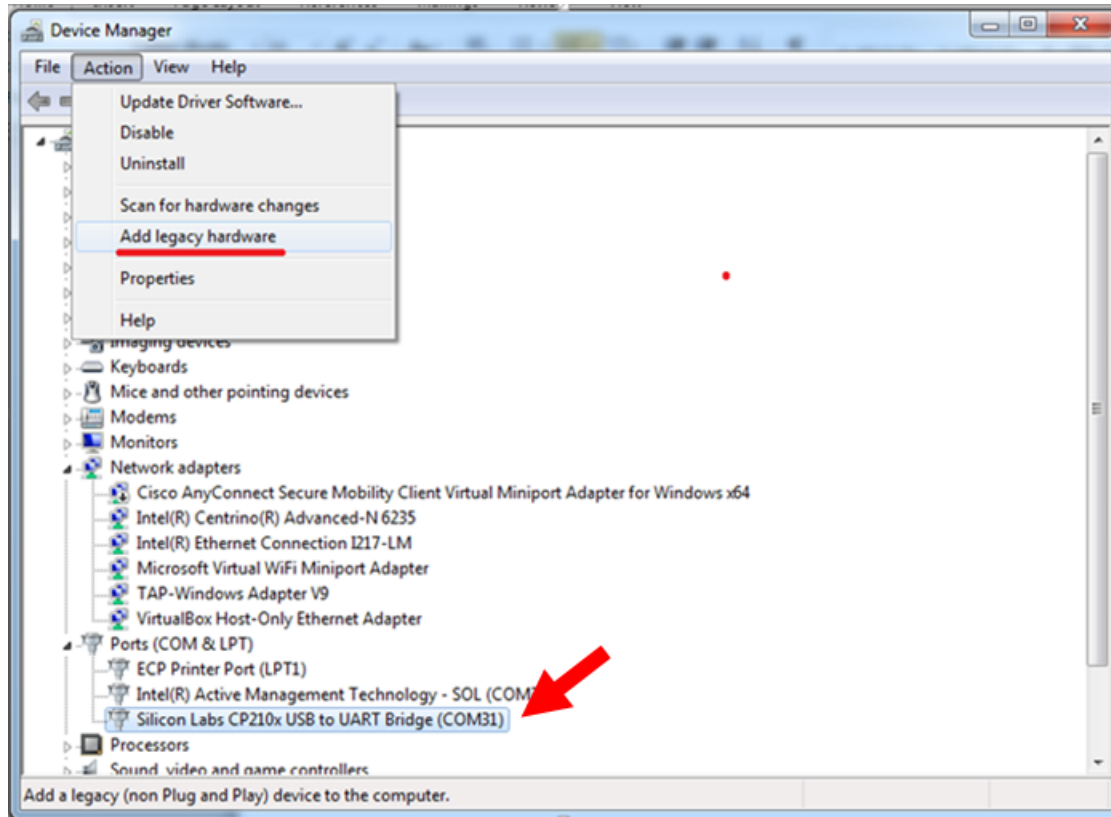
Setting Up a Serial Device in Windows Device Manager

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

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

MultiTech Connection Manager 1.0.6.77

MULTITECH

Main Settings Connector Details Terminal Charts

Statistics

Download:	0 B/s
Upload:	847 B/s
Sent:	37.39 Kb
Received:	24.39 Kb

Connected

58%

Keep-alive check: [Success](#)
Last ping response: 879 ms

Disconnect

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.

MultiConnect Cell 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.

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