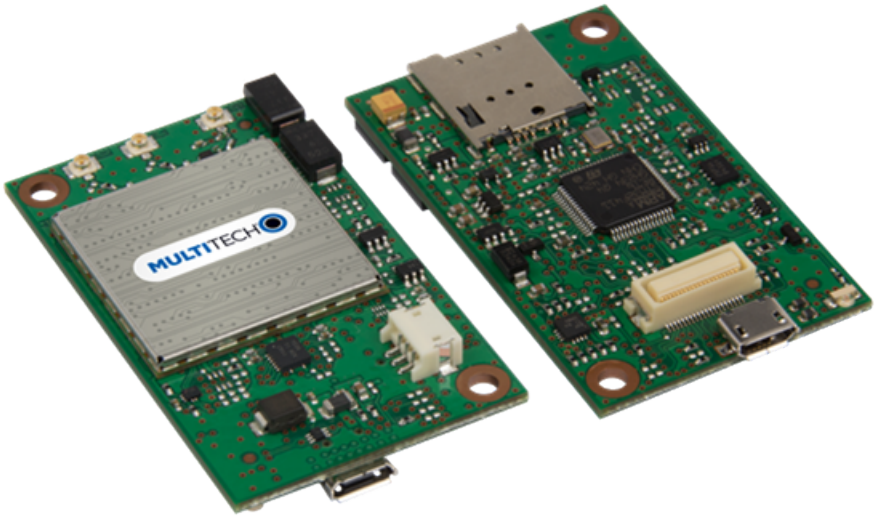


MultiConnect® Dragonfly ™

MTQ-LVW3 Device Guide

MultiConnect® Dragonfly™ Device Guide

Models: MTQ-LVW3-B01, MTQ-LVW3-B02

Part Number: S000657 1.4

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Contents

Chapter 1 – Chapter 1 Product Overview 6
Overview 6
Documentation 6
Product Build Options 6
Chapter 2 – Chapter 2 Mechanical Drawings 7
MTQ-LVW3 Models 7
Processor Model (-B01) 7
No Processor Model (-B02) 8
Chapter 3 – Chapter 3 Hardware and Specifications 9
Specifications 9
Powering Down Your Device 10
40-Pin Connector Definitions 10
MTQ-xx-B01 11
MTQ-xx-B02 12
40-Pin Connector 13
-B01 External Pin Alternate Function Mapping 14
Processor Pin Information (B01 models only) 17
Serial Flash Embedded Memory 19
Communications Flow 20
Processor Model (B01) 20
No Processor Model (B02) 20
Electrical Characteristics 20
Operating Conditions 20
Absolute Maximum Rating 20
DC Electrical Characteristics 21
Input/Output Current Ratings 21
Power Draw 22
MTQ-LVW3-B01 (Processor) 22
MTQ-LVW3-B02 (No Processor) 24
USB Cable Recommendations 25
Device Reset (Pin 35) 25
Device Reset 26
Processor Models (B01) 26
No Processor Models (B02) 26
Sleep Mode 26
Installing a SIM Card on a DragonFly 26

Chapter 4 – Chapter 4 Antennas 28
External Antenna Option 28
LTE Antenna Information 28
SMA to U.FL Cables 29
Connecting an Antenna through the Developer Board Connectors 29
Antenna Diversity 30
Placing External Antennas 30
Selecting Antennas 31
Antenna Approvals and Safety Considerations 31
Diversity and Power Draw 31
OEM Integration 31
FCC & IC Information to Consumers 31
FCC Grant Notes 31
Host Labeling 32
Chapter 5 – Chapter 5 Safety Information 33
Handling Precautions 33
Radio Frequency (RF) Safety 33
General Safety 33
Interference with Pacemakers and Other Medical Devices 33
Potential interference 33
Precautions for pacemaker wearers 34
Vehicle Safety 34
Device Maintenance 34
User Responsibility 35
Chapter 6 – Chapter 6 Getting Started with the MTQ-LVW3-B01 36
Developing with an MTQ in Mbed 36
MTSCellularInterface Library 36
Mbed™ Documentation 36
Programming the MTQ Microcontroller 37
Mbed Links 37
MTQ Platform 37
ST Microelectronics STM32F411xC/E 37
Known Issues 37
Chapter 7 – Chapter 7 Labels 39
Approvals and Certifications 39
Example Labels 39
Chapter 8 – Chapter 8 Regulatory Information 40
47 CFR Part 15 Regulation Class B Devices 40
FCC Interference Notice 40
FCC Grant 40
Industry Canada Class B Notice 42

Canadian Limitations 42
Industry Canada 43
Chapter 9 – Chapter 9 Environmental Notices 45
Waste Electrical and Electronic Equipment Statement 45
WEEE Directive 45
Instructions for Disposal of WEEE by Users in the European Union 45
REACH Statement 45
Registration of Substances 45
Restriction of the Use of Hazardous Substances (RoHS) 46
Chapter 10 – Using Connection Manager 47
Installing Connection Manager 47
Setting Up a Serial Device in Windows Device Manager 48
Connecting a Device 50
Uninstalling Connection Manager 51
Connection Manager User Interface 52
Main tab 52
Settings tab 53
Connection tab 53
Details tab 53
Terminal tab 53
Charts tab 53
Troubleshooting 54
Serial COM port is not available in the Serial Modem Settings 54
Device is not detected ("No Device") 54
MultiConnect Cell USB Modem is not detected 54
Connection Manager is not working, and a device connected to the computer is not detected 54
Connection Manager displays "Device Error" status for a serial device 54
Index 55

Chapter 1 – Chapter 1 Product Overview

Overview

The Dragonfly™ (MTQ) cellular system-on-module (SoM) is a ready-to-integrate processing and communications device that offers developers the functionality of a SoM with the convenience of an onboard cellular radio all in one compact design. Models with the integrated ARM® Cortex®-M4 processor allow developers to host their application and have access to a full suite of interfaces for connecting sensors or other remote assets. Dragonfly features an ARM mbed™ compatible software library for faster development. All Dragonfly software is Open Source.

Documentation

The following documentation is available at www.multitech.com.

Document	Description	Part Number
MTQ-LVW3 Device Guide	This document. Provides a product overview, safety and regulatory information, design considerations, schematics, and device information.	S000657
Universal Developer Kit 2.0 Developer Guide	Provides information on using the developer board with the MTQ.	S000610
USB Driver Installation Guide	Provides steps for installing USB drivers on Linux and Windows systems.	S000616
Telit V2 Series AT Commands Reference Guide	Lists AT commands and parameters used to configure your device.	80446ST10707A Rev 2

Product Build Options

Product	Description	Carrier/Region
MTQ-LVW3-B01	LTE Cat 1 Embedded Cellular SoM without fallback.	Verizon
MTQ-LVW3-B02	Embedded LTE Cat 1 Modem without fallback.	Verizon
Developer Kit		
MTUDK2-ST-CELL	Developer Kit for Dragonfly devices.	Global

Note:

These units ship without network activation. To connect them to the cellular network, you need a cellular account. For more information, refer to Account Activation.

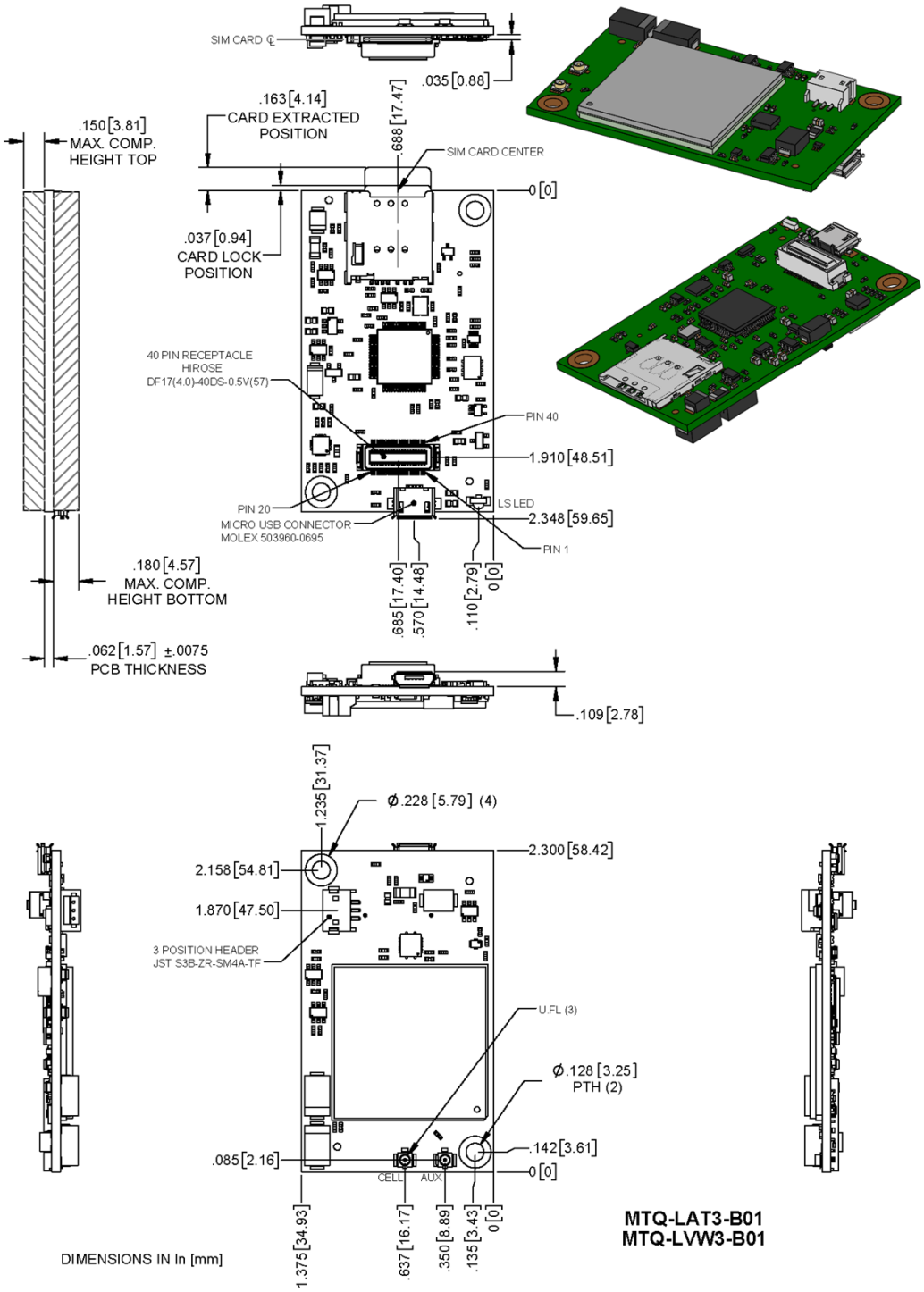
The complete product code may end in .Rx. For example, MTQ-LVW3-B01.Rx, where R is revision and x is the revision number.

All builds can be ordered individually or in 50-packs.

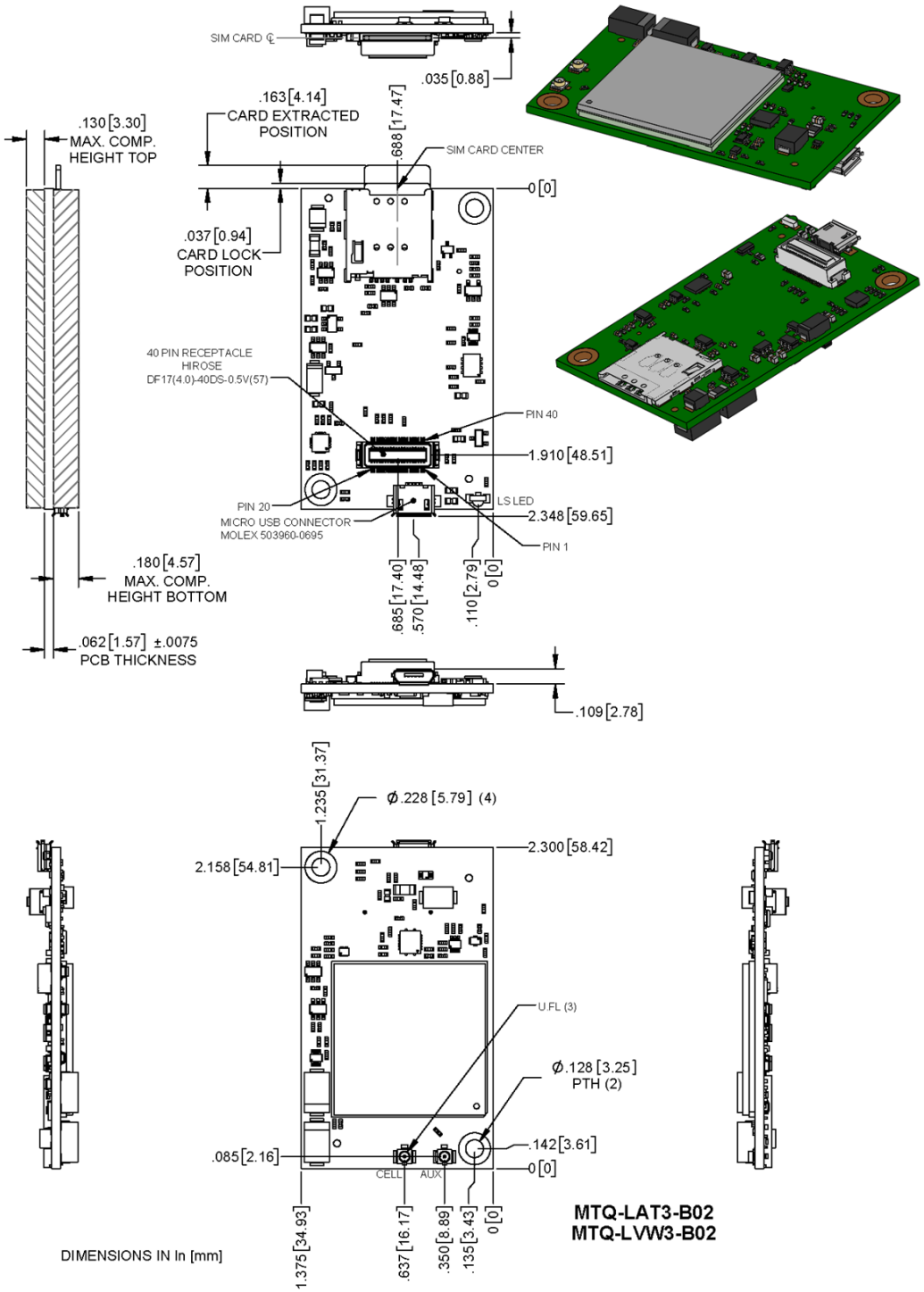
Chapter 2 – Chapter 2 Mechanical Drawings

MTQ-LVW3 Models

Processor Model (-B01)



No Processor Model (-B02)



Chapter 3 – Chapter 3 Hardware and Specifications

Specifications

Category	Description
General	
Standards	LTE FDD Cat 1, 3GPP release 9 compliant
	USB Interface is CDC-ACM compliant
Frequency Bands	4G: 1900 (B2) / 700 (B13) / AWS 1700 (B4)
LED	One, link status
Speed	
Data Speed	LTE: 10 Mbps downlink / 5 Mbps uplink
Interface	
USB Interface	Micro USB 2.0 high speed[1]
UART	**B01 models:** Full UART to processor, then RX, TX, RTS, CTS only between the processor and radio.
	B02 Models: Full UART
Serial Modem Interface	Up to 921.6 Kbps
Storage	
Serial Flash	SPI bus compatible serial 16Mb flash memory
Physical Description	
Weight	0.6 oz (17g)
Dimensions	Refer to Mechanical Drawings for details.
Connectors	
Antenna	2 surface mount U.FL: cellular, auxiliary
SIM Holder	1.8 V and 3 V micro
Pin header	40-pin female for USB or UART
Environment	
Operating Temperature[3]	-40° C to +85° C[4]
Storage Temperature	-40° C to +85° C
Humidity	20%-90% RH, non-condensing

Category	Description
Power Requirements	
Operating Voltage	5 V +/- 5%

Category	Description
Input Current	See Power Draw
Certifications and Compliance	
EMC and Radio Compliance	FCC Part 15 Class B
	FCC Part 22
	FCC Part 24
Safety Compliance	UL 60950-1 2nd Edition
	cUL 60950-1 2nd Edition Am. 1 and Am. 2

[1]mbed has limited USB support for the processor. Software controls routing to processor or directly to radio.

[2]The battery management circuit is designed for single cell Li-Ion/Li-Poly technology. Acceptability of the battery charge circuit for charging specific batteries/cells is to be determined in the end product.

[3]Radio performance may be affected by temperature extremes.

[4]Device has been tested up to +85° C. UL Recognized @ 85° C.

Note: Acceptability of the battery charge circuit for charging specific batteries/cells is to be determined in the end product.

Powering Down Your Device

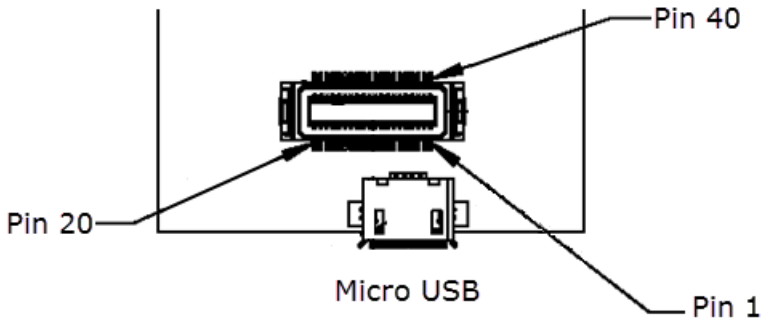
CAUTION: Failing to properly power down the device before removing power may corrupt your device's file system.

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

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

Note: If you send AT#SHDN and do not remove power AND the 3G_ONOFF line is high, the radio restarts after 60 seconds.

40-Pin Connector Definitions



MTQ-xx-B01

Pin	Signal Name	Logic Level Voltage[1]	In/Out	Description
1	DBX_TX	3V	O	ST Micro UART debug Tx output
2	SWCLK	3V	I	See ST Microcontroller Guide
3	CHARGE_MON	0 - VCC-IN	O	Open-drain charging status indication output
4	PWR_GOOD	0 - VCC-IN	O	Open-drain power good status indication output
5	GND	GND	GND	Ground
6	USB-DATA+	0 - 3V[2]		
7	USB-DATA-			
8	VCC-IN	4.35 - 5.25	Power Input	Main Power
9	IO_00	I = 0 - 7V, O = 0 - 3V	I/O	General Purpose I/O from ST Microcontroller (STM 32F411)
10	IO_01			
11	IO_02			
12	IO_03			
13	GND	GND	GND	Ground
14	IO_04	I = 0 - 7V, O = 0 - 3V	I/O	General Purpose I/O from ST Microcontroller (STM 32F411)
15	IO_05			
16	IO_06			
17	IO_07			
18	IO_08			
19	IO_09			
20	IO_10			
21	IO_11			
22	IO_12			
23	IO_13			
24	IO_14			
25	IO_15			
26	IO_16			
27	IO_17			
28	GND	GND	GND	Ground

Pin	Signal Name	Logic Level Voltage[1]	In/Out	Description
29	IO_18	I = 0 - 7V, O = 0 - 3V	I/O	General Purpose I/O from ST Microcontroller (STM 32F411)
30	IO_19			
31	IO_20			
32	IO_21			
33	VCC-IN	4.35 - 5.25	Power Input	Main Power
34	LINK_STATUS	3V	O	Radio link status LED
35	RESET	0 - 5V	I	NRST pin of ST micro, treat as open drain, active low
36	GND	GND	GND	Ground
37	GND			
38	SWO	3V	O	See ST Microcontroller Guide
39	SWDIO	3V	I	
40	DBG_RX	3V	I	ST Micro UART debug Tx input

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

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

MTQ-xx-B02

Pin	Signal Name	Logic Level Voltage[1]	Max Voltage	In/Out	Description
1	N/C				
2	N/C				
3	N/C				
4	PWR_GOOD	0- VCC-IN		O	Open-drain power good status indication output
5	GND	GND		GND	Ground
6	USB-DATA+	0 - 3V	5.5V	I/O	USB Data
7	USB-DATA-				
8	VCC-IN	4.35V - 5.25V		Power Input	Main Power
9	RADIO_RXD	0 - 3V	3.3V	O	
10	RADIO_DCD	0 - 3V	3.3V	O	Data carrier detect
11	RADIO_RI	0 - 3V	3.3V	O	Ring indicator
12	RADIO_CTS	0 - 3V	3.3V	O	Clear to send (flow control)
13	GND	GND		GND	Ground
14	SPI_MOSI[1]	0 - 3V	3.3V	O	

Pin	Signal Name	Logic Level Voltage[1]	Max Voltage	In/Out	Description
15	SPI_SCLK[1]	0 - 3.3V	3.3V	I	SPI clock
16	SPI_CS1[1]	0 - 3.3V	3.3V	I	Serial flash SPI CS
17	N/C				
18	N/C				
19	N/C				
20	N/C				
21	N/C				
22	N/C				
23	N/C				
24	N/C				
25	SPI_SRDY	I = 0 - 3.3V, O = 0 - 3V	3.3V	I/O	SPI Ready
26	SPI_MISO	0 - 3.3V	3.3V	I	
27	SPI_CS2[1]	0 - 3.3V	3.3V	I	Radio SPI CS
28	GND	GND		GND	Ground
29	RADIO_RTS	0 - 3.3V	3.3V	I	Request to send (flow control)
30	RADIO_DSR	0 - 3V	3.3V	O	Data set ready
31	RADIO_DTR	0 - 3.3V	3.3V	I	DTE ready
32	RADIO_TXD	0 - 3.3V	3.3V	I	Serial data input from DTE
33	VCC-IN	4.35 - 5.25V		Power Input	Main Power
34	LINK_STATUS	3V		O	Radio link status LED
35	RESET	0 - 5V		I	Radio reset, treat as open drain, active low
36	GND	GND		GND	Ground
37	GND				
38	N/C				
39	N/C				
40	N/C				

[1] For -B02 models only: Pins 14, 15, 16, and 27 are part of the SPI interface. These pins are inputs. If you do not use them, connect them externally to a high level signal (preferably through a high pull-up resistor) to keep them from floating.

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)

-B01 External Pin Alternate Function Mapping

This table shows alternate functions available on the external pins of the -B01 models. These functions are available in mbed and can be redefined by the user. This table also shows which I/O pins are mapped to specific Arduino shield pins on the MTUDK2-ST-CELL developer board.

Note: For readability, this table has been split into two parts.

MTQ Pin	MTQ Name	MTUDK2 Arduino Pin	mbed GPIO[1]	Programming Interface
1	DBG_TX		PB_6	
2	J_TCK/SWCLK		PA_14	JTCK-SWCLK
3	J_TDI/C_MON		PA_15	JTDI
4	J_RST/P_GOOD		PB_4	JTRST
9	IO_00/RXD	D1	PA_2	
10	IO_01/DCD	D4	PA_7	
11	IO_02/RI	D8	PB_1	
12	IO_03/CTS	D6	PA_1	
14	IO_04/MOSI	D11	PB_5	
15	IO_05/SCK	D13	PA_5	
16	IO_06/SCL/SS1	D15	PB_8	
17	IO_07	D2	PB_15	
18	IO_08	A0	PC_2	
19	IO_09	A3	PB_0	
20	IO_10	A1	PC_0	
21	IO_11	A4	PC_1	
22	IO_12	A2	PC_4	
23	IO_13	D9	PB_13	
24	IO_14	A5	PC_9	
25	IO_15/SDA/SRDY	D14	PB_9	
26	IO_16/MISO	D12	PA_6	
27	IO_17/SS2	D10	PC_8	

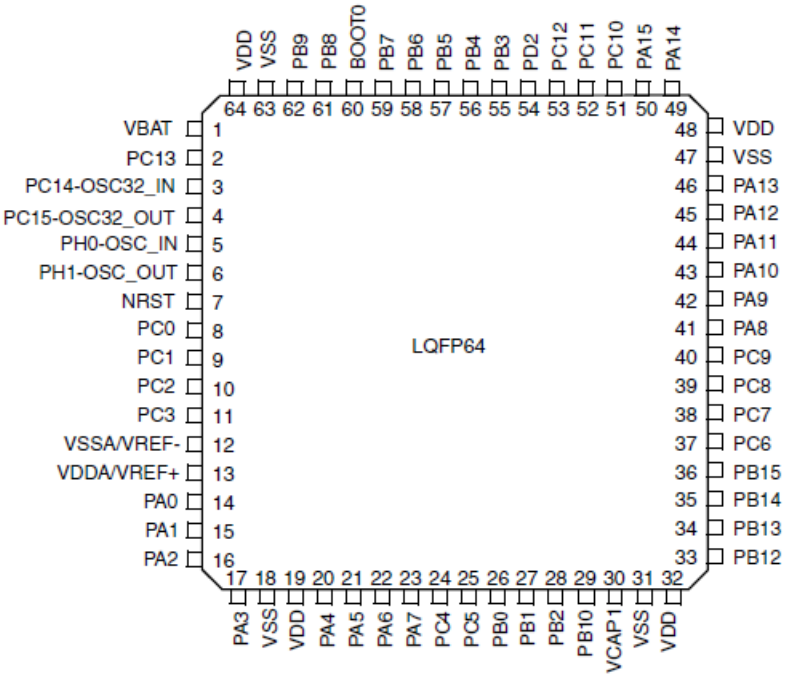
MTQ Pin	MTQ Name	MTUDK2 Arduino Pin	mbed GPIO[1]	Programming Interface
29	IO_18/RTS	D3	PA_0-WKUP	
30	IO_19/DSR	D5	PA_9	
31	IO_20/DTR	D7	PA_8	
32	IO_21/TXD	D0	PA_3	
38	J_TDO/SWO		PB_3	JTDO-SWO
39	J_TMS/SWDIO		PA_13	JTMS-SWDIO
40	DBG_RX		PB_7	

[1]For the ST microprocessor, the pin names are the same, but the underscore is removed.

MTQ Pin	SPI Interface	I2C Interface	USARTs	Timer Functions	SDIO Functions	Event Trigger Output	ADC Channels
1		I2C1_SCL	USART1_TX	TIM4_CH1		EVENTOUT	
2						EVENTOUT	
3	SPI1_NSS		USART1_TX	TIM2_CH1/ TIM2_ETR		EVENTOUT	
4	SPI1_MISO	I2C3_SDA		TIM3_CH1	SDIO_D0	EVENTOUT	
9			USART2_TX	TIM2_CH3, TIM5_CH3, TIM9_CH1		EVENTOUT	ADC1_2
10	SPI1_MOSI			TIM1_CH1N, TIM3_CH2		EVENTOUT	ADC1_7
11				TIM1_CH3N TIM3_CH4,		EVENTOUT	ADC1_9
12			USART2_RTS	TIM2_CH2, TIM5_CH2		EVENTOUT	ADC1_1
14	SPI1_MOSI	I2C1_SMBA		TIM3_CH2	SDIO_D3	EVENTOUT	
15	SPI1_SCK			TIM2_CH1/ TIM2_ET		EVENTOUT	ADC1_5
16		I2C1_SCL, I2C3_SDA		TIM4_CH3, TIM10_CH1		EVENTOUT	
17	SPI2_MOSI			TIM1_CH3N	SDIO_CK	EVENTOUT	
18	SPI2_MISO					EVENTOUT	ADC1_12
19				TIM1_CH2N, TIM3_CH3		EVENTOUT	ADC1_8
20						EVENTOUT	ADC1_10
21						EVENTOUT	ADC1_11
22						EVENTOUT	ADC1_14

MTQ Pin	SPI Interface	I2C Interface	USARTs	Timer Functions	SDIO Functions	Event Trigger Output	ADC Channels
23	SPI2_SCK			TIM1_CH1N		EVENTOUT	
24		I2C3_SDA		MCO_2, TIM3_CH4	SDIO_D1	EVENTOUT	
25	SPI2_NSS	I2C1_SDA		TIM4_CH4, TIM11_CH1		EVENTOUT	
26	SPI1_MISO			TIM1_BKIN, TIM3_CH1	SDIO_CMD	EVENTOUT	ADC1_6
27				TIM3_CH3	SDIO_D0	EVENTOUT	
29			USART2_CTS	TIM2_CH1/ TIM2_ET, TIM5_CH1,		EVENTOUT	ADC1_0
30		I2C3_SMBA	USART1_TX	TIM1_CH2	SDIO_D2	EVENTOUT	
31		I2C3_SCL		MCO_1, TIM1_CH1	SDIO_D1	EVENTOUT	
32			USART2_RX	TIM2_CH4, TIM5_CH4, TIM9_CH2		EVENTOUT	ADC1_3
38	SPI1_SCK		USART1_RX	TIM2_CH2		EVENTOUT	
39						EVENTOUT	
40		I2C1_SDA	USART1_RX	TIM4_CH2	SDIO_D0	EVENTOUT	

Processor Pin Information (B01 models only)



Note: Diagram from the STMicro 32F411 datasheet.

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

Net Name	Number	Pin Name	Details
VDD3_3	1	VBAT	Power
3G_ONOFF	2	PC13	Enable line to the Radio
32K_XTAL_	3	PC14	RTC Clock
32K_XTAL	4	PC15	RTC Clock
26MHZ_CLK_IN	5	PH0-OSC_IN	Main Clock
26MHZ_CLK_DRIVE	6	PH1-OSC_OUT	Main Clock
N_RESET	7	NRST	External Reset in
IO_10	8	PC0	GPIO/Analog capable pin
IO_11	9	PC1	GPIO/Analog capable pin
IO_8	10	PC2	GPIO
RADIO_PWR	11	PC3	Voltage enable for Telit
GND	12	VSSA	Power
VDD3_3	13	VDDA	Power
IO_18/RTS	14	PA0	GPIO/Analog capable pin/USART2_CTS
IO_03/CTS	15	PA1	GPIO/Analog capable pin/USART2_RTS
IO_00/RXD	16	PA2	GPIO/USART2_TX

Net Name	Number	Pin Name	Details
IO_21/TXD	17	PA3	GPIO/USART2_RX
GND	18	VSS_4	Power
VDD3_3	19	VDD_4	Power
SPI-SS1	20	PA4	SPI1 Select
IO_05/SCK	21	PA5	SPI1 Clock/GPIO
IO_16/MISO/SDIO_CMD	22	PA6	SPI1 MSIO/SDIO_CMD /GPIO
IO_01/DCD	23	PA7	GPIO
IO_12	24	PC4	GPIO/Analog capable pin
VDD1_8_MON	25	PC5	Power
IO_9	26	PB0	GPIO/Analog capable pin
IO_02/RI	27	PB1	GPIO
BOOT1/BC_NCE	28	PB2	Battery charge enabled. Pulled down by default.
RADIO_RTS	29	PB10	Serial comm with the radio
VCAP	30	PB11/VCAP_1	Power
N16612690	31	VCAP_1/VSS	Power
VDD3_3	32	VDD_1	Power
RADIO_CTS	33	PB12	Serial comm with the radio
IO_13	34	PB13	GPIO
SPI-SS2	35	PB14	GPIO for use with external SPI
IO_7	36	PB15	GPIO/SDIO_CK
RADIO_TXD	37	PC6	Serial comm with the radio
RADIO_RXD	38	PC7	Serial comm with the radio
IO_17/SS2/SDIO_D0	39	PC8	GPIO/SDIO_D0
IO_14/SDIO_D1	40	PC9	GPIO/SDIO_D1
IO_20/DTR	41	PA8	GPIO
IO_19/DSR	42	PA9	GPIO/SDIO_D2
USB_DIR/VBUS	43	A10	USB Switch control, 0=Telit, 1=STM
FS_DM	44	PA11	USB
FS_DP	45	PA12	USB
J_TMS /SWDIO	46	PA13	JTAG
	47	VCAP_2/VSS	Power
VDD3_3	48	VDD_2	Power

Net Name	Number	Pin Name	Details
J_TCK/SWCLK	49	PA14	JTAG
J_TDI/C_MON	50	PA15	JTAG
SPI-SCK	51	PC10	EPROM/SPI3_SCK
SPI-MISO	52	PC11	EPROM/SPI3_MISO
SPI-MOSI	53	PC12	EPROM/SPI3_MOSI
SPI-SRDY	54	PD2	EPROM/SPI3_SRDY
J_TDO/SWO	55	PB3	JTAG
J_RST/P_GOOD	56	PB4	JTAG
IO_4/MOSI/SDIO_D3	57	PB5	GPIO/SPI1_MOSI/SDIO_D3
DBG_TX	58	PB6	JTAG
DBG_RX	59	PB7	JTAG
BOOT	60	BOOT0	Reserved.
IO_6/SCL/SS1	61	B8	GPIO/I2C1_SCL
IO_15/SDA/SRDY	62	PB9	GPIO/I2C1_SDA
GND	63	VSS_3	Power
VDD3_3	64	VDD_3	Power

Serial Flash Embedded Memory

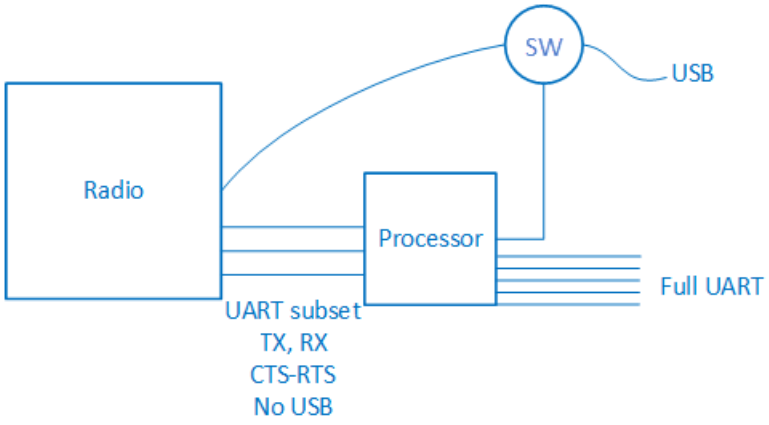
The M25P16 is a 16Mb (2Mb x 8) serial flash memory device with write protection mechanisms accessed by a SPI-compatible bus.

The serial flash is accessible via the processor pinout on B01 devices. Features include:

- 75 MHz clock frequency (maximum)
- Page program (up to 256 bytes) in 0.64ms (TYP)
- Erase capability
  - Sector erase: 512Kb in 0.6 s (TYP)
  - Bulk erase: 16Mb in 13 s (TYP)
- Write protection
  - Hardware write protection (protected area size defined by non-volatile bits BP0, BP1, BP2)
- Deep power down: 1µA (TYP)
- Electronic signature
  - JEDEC standard 2-byte signature (2015h)
  - Unique ID code (UID) and 16 bytes of read-only data available upon customer request
  - RES command, one-byte signature (14h) for backward compatibility
- More than 100,000 write cycles per sector
- More than 20 years of data retention

Communications Flow

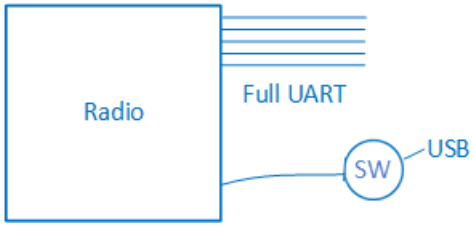
Processor Model (B01)



Note:

- The B01 has a UART subset as well as GPIO (4 pin UART (tx/rx/rts/cts)
- If needed, use the GPIOs for additional UART signaling.
- The USB port can switch between a connection to the radio or a connection to the processor. The USB selection is controlled via programming on the processor. There is no USB between the radio and the processor.

No Processor Model (B02)



Note: B02 provides a full UART interface as well as a USB interface.

Electrical Characteristics

Operating Conditions

Parameter	Minimum Volts	Maximum Volts
Supply Range - Vcc	4.35	5

Absolute Maximum Rating

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

DC Electrical Characteristics

Parameter	Conditions	Minimum Volts	Maximum Volts
Digital signal input low level	CMOS port I_{IO}=+8 mA	-0.3	0.9
Digital signal input high level	CMOS port I_{IO}=+8 mA	2.1	5.5
Output low level voltage for an I/O pin	CMOS port	-	0.4
Output high level voltage for an I/O pin	I_{IO}=+8 mA	V_{DD}-0.4	-
Output low level voltage for an I/O pin	TTL port	-	0.4
Output high level voltage for an I/O pin	I_{IO}=+8 mA	2.4	-
Output low level voltage for an I/O pin	I_{IO}=+20 mA	-	1.3(1)
Output high level voltage for an I/O pin		V_{DD}-1.3(1)	-
Output low level voltage for an I/O pin	I_{IO}=+6 mA	-	0.4(1)
Output high level voltage for an I/O pin		V_{DD}-0.4(1)	-
Output low level voltage for an I/O pin	I_{IO}=+4 mA	-	0.4(2)
Output high level voltage for an I/O pin		V_{DD}-0.4(2)	-
RESET (low active) input low	CMOS port I_{IO}=+8 mA	-	0.99
RESET (low active) input high	CMOS port I_{IO}=+8 mA	5.00	-

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

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

Note:

See the ST Microcontroller data sheet (STM 32F411REF) and the Pin Connector Definitions table in Chapter 3 of this guide.

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

Input/Output Current Ratings

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

Power Draw

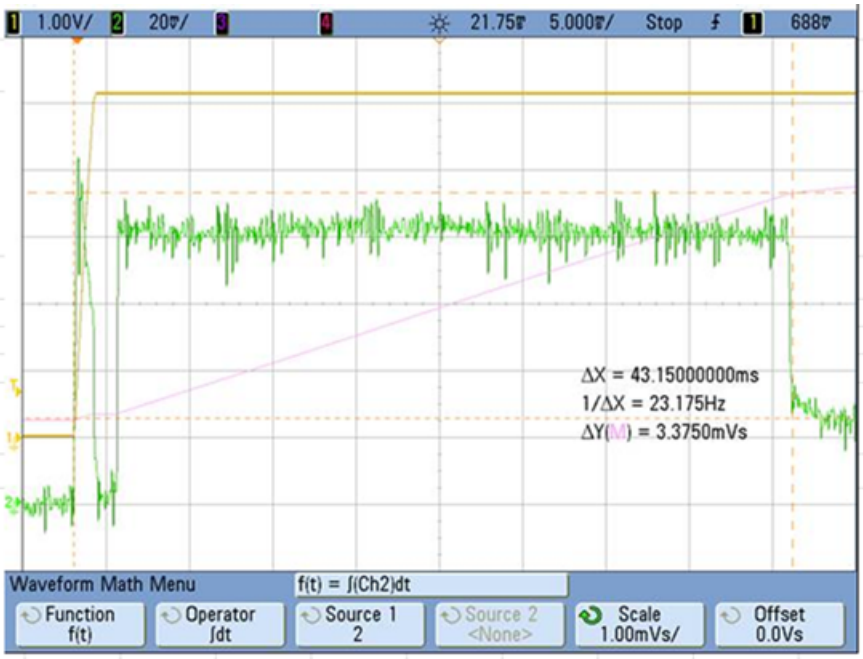
MTQ-LVW3-B01 (Processor)

Radio Protocol	Connection to Live Network (Active SIM Installed)	Sleep Mode	Cellular Connection Idle (No Data)	(AVG) Measured Current at Max Power[1]	TX Pulse[2] (AVG) Amplitude Current for Peak Current for HSDPA/LTE)	Total Inrush Charge[3] Measured in Millicoulombs
5 Volts WITH Unit in Developer Card						
LTE	132 mA	5 mA	57 mA	462 mA	536 mA	3.37 mC
5 Volts WITHOUT Unit in Developer Card						
LTE	135 mA	5 mA	63 mA	468 mA	548 mA	3.96 mC

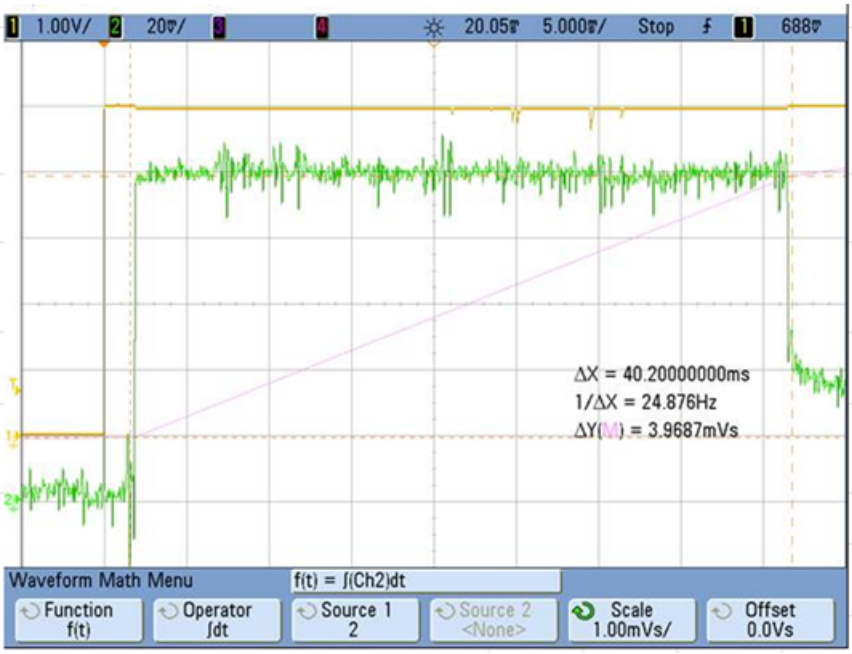
[1]**Maximum Power:** The continuous current during maximum data rate with the radio transmitter at maximum power.
[2]**Tx Pulse:** The average peak current during a GSM850 transmission burst period or HSDPA/LTE connection. The transmission burst duration for GSM850 can vary, depending on what transmission scheme is being deployed (GPRS Class 8, Class 10, GSM, etc.).
[3]**Inrush Charge:** The total inrush charge at power on.

Waveforms

Developer card inrush: Channel 1 5 Volt input. Channel 2 inrush charge of 3.37 mC with 43.1 mS duration.



USB Only Inrush: Channel 1 5 Volt input. Total inrush charge of 3.96 mC with 40.2 mS duration.



MTQ-LVW3-B02 (No Processor)

Radio Protocol	Radio On/Off Mode Current	Cellular Connection Idle (No Data)	(AVG) Measured Current at Max Power[1]	TX Pulse[2] (AVG) Amplitude Current for Peak Current for HSDPA/LTE	Total Inrush Charge[3] Measured in Millicoulombs
5 Volts WITH unit in developer card					
LTE	26 mA	37 mA	450 mA	528 mA	3.64 mC
5 Volts, USB only WITHOUT unit in developer card					
LTE	26 mA	44 mA	470 mA	552 mA	3.34 mC

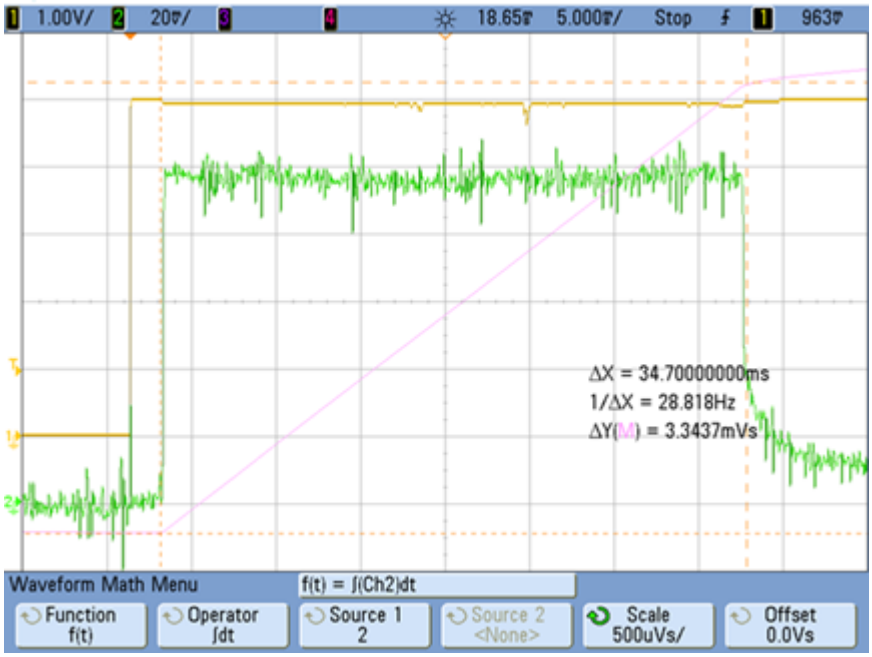
[1]**Maximum Power:** The continuous current during maximum data rate with the radio transmitter at maximum power.
[2]**Tx Pulse:** The average peak current during a GSM850 transmission burst period or HSDPA connection. The transmission burst duration for GSM850 can vary, depending on what transmission scheme is being deployed (GPRS Class 8, Class 10, GSM, etc.).
[3]**Inrush Charge:** The total inrush charge at power on.

Waveforms

Total inrush current of 3.64 mC with 38.6 mS duration



USB only, total inrush current of 3.34 mC with 34.7 mS duration



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-MICRO-B-3.

Device Reset (Pin 35)

- Minimum pulse is 200 µs up to 900 msec.
  - This short pulse causes an unconditional radio shutdown.
  - There is no controlled disconnect from the network.
  - The radio restarts.
  - The radio takes 10 seconds to recover and finish starting.
- Holding RESET low longer than 1 second causes a controlled disconnect from the network and then turns the radio off.
  - The radio stays off as long as RESET is held low.
  - Due to the network disconnect, shutoff can take up to 30 seconds.

Device Reset

Processor Models (B01)

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

No Processor Models (B02)

For the -B02 models, reset is connected to the 3G_ONOFF signal. Refer to the 3G_ONOFF topic for functionality.

The device is ready to accept commands after a fixed amount of time after power-on or reset.

- Minimum recommended reset pulse is 200us.
- Maximum reset pulse is less than 1 second.
- Reset recovery time is 10 seconds. This is the amount of time that it takes the radio to setup after reset is released.

Sleep Mode

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

- Setting PC13 to Low and holding it low turns the radio off, causing it to draw minimal power.
- Setting PC13 to High resets and wakes up the device.
- Refer to +CFUN in the *AT Command Reference Guide* for other sleep options.

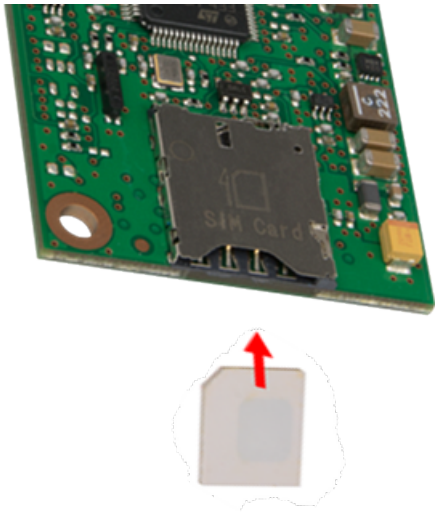
Note: If using +CFUN commands, then reset the device via the PC13 (3G_ONOFF) toggle low to high to bring the radio out of +CFUN sleep mode.

Installing a SIM Card on a DragonFly

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

To install the SIM card:

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


SIM Card

Chapter 4 – Chapter 4 Antennas

External Antenna Option

LTE Antenna Information

The cellular radio portion of the device is approved with the following antenna or for alternate antennas meeting the given specifications.

Manufacturer:	EAD Ltd.
Description:	LTE Antenna with SMA-Male Connector
Model Number:	WTR7270
MultiTech Part Number:	45009760L

MultiTech ordering information:

Model	Quantity
ANLTE3-2HRA	2
ANLTE3-10HRA	10
ANLTE3-50HRA	50

Antenna Specifications

Category	Description
Frequency Range	690-960 MHz
	1710-2700 MHz
Power Rating	10 W
VSWR	< 2.0:1
Gain	1 dBi
Radiating Element	1/2 wave element
Polarization	Linear

SMA to U.FL Cables

The developer kit includes three 4.5" SMA to U.FL cables which are preinstalled on the developer board. Consult the mechanical drawings for your device to determine which antenna to connect to which U.FL connector on the device.



Connecting an Antenna through the Developer Board Connectors

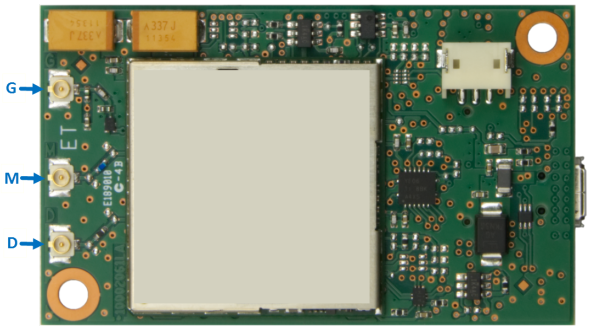
To connect an antenna to the device through the developer board:

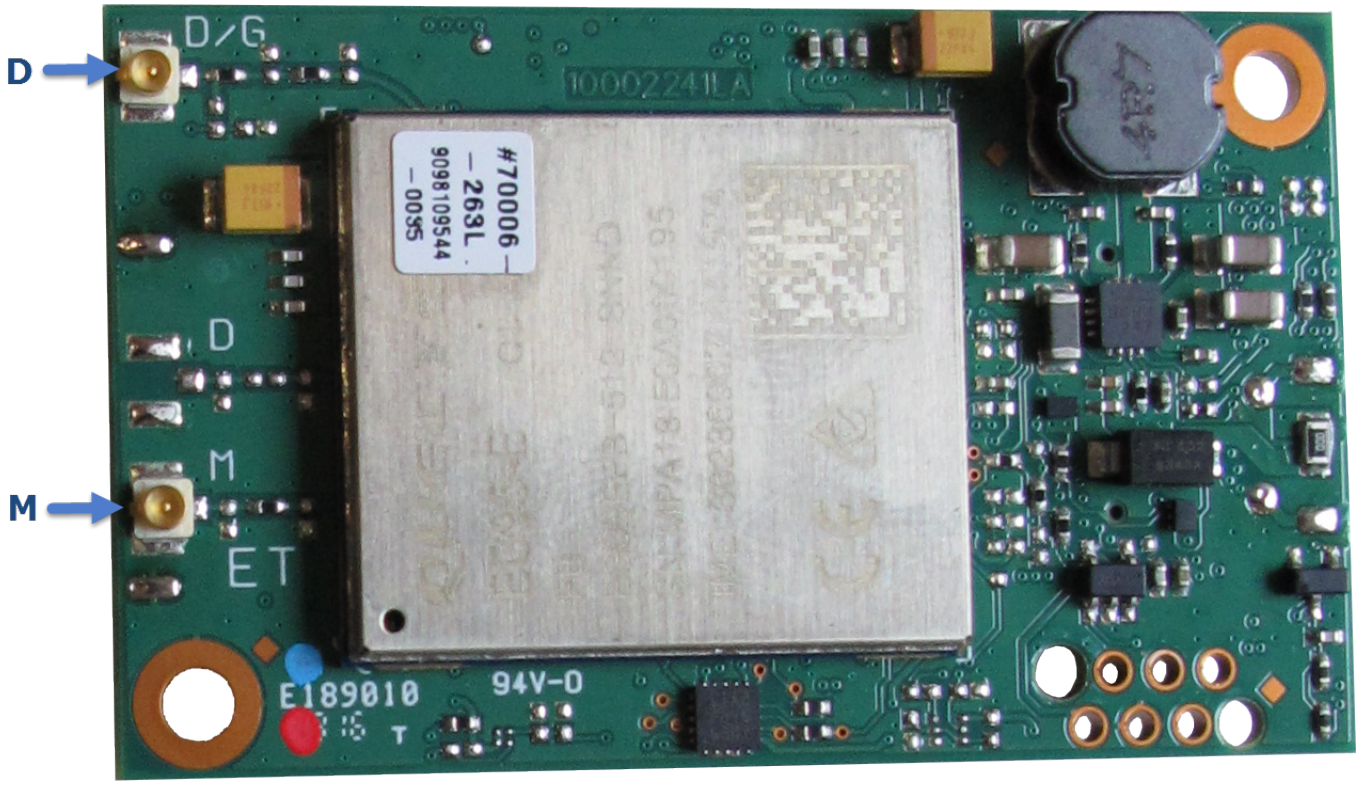
1. Determine which SMA connector you want to use for the antenna.
2. Finger tighten the antenna to the SMA connector.
3. Attach the U.FL connector from the cable to the connector on the device.

   G = GPS (may not apply to your device)

   M = Main

   D = Diversity





Antenna Diversity

Antenna diversity uses two receive antennas to improve the downlink connection (cell tower to mobile). It has no effect on the uplink (mobile to cell tower).

Antenna diversity is useful in environments where the signal arrives at the device after bouncing off or around buildings or other objects. The bounced signal may be attenuated by going through semi-transparent (to the signal) objects. Each signal alteration can change its magnitude, phase, orientation, or polarization. This complex environment can exist in cities, inside buildings or in traffic. In this environment, signal paths from the cell tower form an interference pattern of peaks and nulls. These peaks and nulls can be very close together.

Antenna diversity provides an advantage in complex environments because if one receive antenna has a poor signal due to an interference null pattern, the other antenna is likely not in the null and has better reception. The radio compares the reception from both receive antennas and uses the one with the strongest signal.

Antenna diversity is unnecessary when the device has an unobstructed signal path from the cell tower, such as in a flat area away from buildings. In good reception environments, the product application might prohibit using two receive antennas.

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. Multi-Tech 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.

Selecting Antennas

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

Antenna Approvals and Safety Considerations

Note the following:

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

Diversity and Power Draw

There are no significant power draw differences.

Important: You must deploy with two antennas, unless your carrier has authorized you to deploy with one antenna.

OEM Integration

FCC & IC Information to Consumers

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

FCC Grant Notes

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

FCC Definitions

Portable: (§2.1093) — A portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.

Mobile: (§2.1091) — A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.

Actual content pending Grant: *This device is a mobile device with respect to RF exposure compliance. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons, and must not be collocated or operate in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product guidelines. Installers and end-users must be provided with specific information required to satisfy RF exposure compliance for installations and final host devices. (See note under Grant Limitations.) Compliance of this device in all final host configurations is the responsibility of the Grantee.*

Note: Host design configurations constituting a device for portable use (<20 cm from human body) require separate FCC/IC approval.
Note: Only use antennas approved respectively as listed for the unlicensed radios (Bluetooth/Wi-Fi)

Host Labeling

The following statements are required to be on the host label:

> This device contains FCC ID: {Add the FCC ID of the specific device}
> This device contains equipment certified under IC ID: {Add the IC ID of the specific device}

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

Chapter 5 – Chapter 5 Safety Information

Handling Precautions

To avoid damage due to the accumulation of static charge use proper precautions, such as an ESD strap, when handling any cellular device to avoid exposure to electronic discharge during handling and mounting the device.

Radio Frequency (RF) Safety

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

- Operating your device close to other electronic equipment may cause interference if the equipment is inadequately protected. Observe any warning signs and manufacturers' recommendations.
- Different industries and businesses restrict the use of cellular devices. Respect restrictions on the use of radio equipment in fuel depots, chemical plants, or where blasting operations are in process. Follow restrictions for any environment where you operate the device.
- Do not place the antenna outdoors.
- 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.

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

Do not attempt to disassemble the device. There are no user serviceable parts inside.

When maintaining your device:

- 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. Refer to the device specifications regarding recommended operating temperature and humidity.

- Do not expose the device to water, rain, or spilled beverages. It is not waterproof. Exposure to liquids could result in damage to the device.
- Do not place the device alongside computer discs, credit or travel cards, or other magnetic media. The information contained on discs or cards may be affected by the device.
- Using accessories, such as antennas, that MultiTech has not authorized or that are not compliant with MultiTech's accessory specifications may invalidate the warranty.

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

User Responsibility

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

Chapter 6 – Chapter 6 Getting Started with the MTQ-LVW3-B01

Developing with an MTQ in Mbed

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

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

- Runs at 115200 baud by default to match with the cellular radio's default baud rate.
- Prints debug messages from the debug port at 115200 baud.
- Allows users to increase or decrease the application's baud rate by entering a plus (+) or minus (-) character on the USB debug port. Issuing a plus or minus character on the USB debug port changes the external serial port speed as well as the speed of the link between the processor and the radio. The speed of the USB debug port on reset is always 115200 to match the radio's default regardless of the baud rate used at the time of reset.
- Uses RTS/CTS flow control on the serial connection to the radio and on the external serial connection. Enables RTS/CTS flow control on terminal emulators used with the AT pass-through firmware.

MTSCellularInterface Library

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

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

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

https://developer.mbed.org/platforms/MTS-Dragonfly/

Mbed™ Documentation

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

Programming the MTQ Microcontroller

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

All MTQ software is open source.

Mbed Links

- Explore Mbed: http://developer.mbed.org/explore
- Getting Started with Mbed: http://developer.mbed.org/getting-started
- Mbed Handbook: http://developer.mbed.org/handbook/Homepage
- Serial Flash Datasheet: https://www.micron.com/~/media/documents/products/data-sheet/nor-flash/serial-nor/m25p/m25p16.pdf
- Additional Information: http://www.multitech.net/developer/products/multiconnect-dragonfly/

MTQ Platform

The MTQ Mbed page includes the **MTSCellularInterface** library and example programs.

https://developer.mbed.org/platforms/MTS-Dragonfly

ST Microelectronics STM32F411xC/E

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

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

Known Issues

The issues below have been identified with this device.

On LVW3 version 20.00.12 and LAT3 version 20.00.522 devices:

- A TCP file transfer in USB mode may drop the socket connection if sending as little as 60-62 KB of data. If this occurs, then try the following:

  Re-open the socket

  Resend the file
- The AT#SCFG command won't set sockets 4-6 with #sgact=2,1. The following commands will generate the error +CME ERROR: wrong mode.

  AT#SCFG=4,3,300,240,600,50

  AT#SCFG=5,3,300,240,600,50

  AT#SCFG=6,3,300,240,600,50

On LVW3 version 20.00.12 devices:

- When using AT#PING+, the device will ping, but will not get a response back.

  For example:

AT#PING="www.google.com",4,32,450

#PING: 01,"216.58.192.196",600,255

Warning:(1) IP(216.58.192.196) ReplyTime(600) 100ms Ping Timeout(450) 100ms

- The device will not send an SMS and this message appears: Error! SMS message time out (60) seconds waiting on +CMGS:".

Chapter 7 – Chapter 7 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:

- **Model Identification:** The MultiTech model identification allows the carrier to verify the modem as one of its approved models. This information is located on the modem's label below the bar code.

Example Labels

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

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

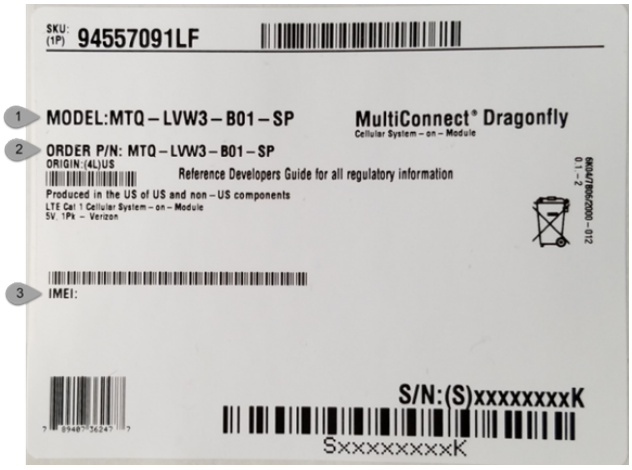
The label shown is not the actual size.

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

Device Label



Package Label



Chapter 8 – Chapter 8 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 24 and 27

FCC Identifier	RI7LE910SVV2
Equipment Class	PCS Licensed Transmitter
Notes	LE910-SV V2 LTE Module
FCC Rule Parts	24E, 27
Approval	Single Modular

FCC Rule Parts	Frequency Range (MHz)	Output Watts	Frequency Tolerance	Emission Designator
24E	1850.7 - 1909.3	0.216	1.0 PM	1M08G7D
24E	1850.7 - 1909.3	0.183	1.0 PM	1M08W7D
24E	1851.5 - 1908.5	0.217	1.0 PM	2M69G7D
24E	1851.5 - 1908.5	0.177	1.0 PM	2M69W7D
24E	1852.5 - 1907.5	0.217	1.0 PM	4M48G7D
24E	1852.5 - 1907.5	0.184	1.0 PM	4M46W7D

FCC Rule Parts	Frequency Range (MHz)	Output Watts	Frequency Tolerance	Emission Designator
24E	1855.0 - 1905.0	0.212	1.0 PM	8M96G7D
24E	1855.0 - 1905.0	0.177	1.0 PM	8M97W7D
24E	1857.5 - 1902.5	0.217	1.0 PM	13M5G7D
24E	1857.5 - 1902.5	0.179	1.0 PM	13M5W7D
24E	1860.0 - 1900.0	0.219	1.0 PM	18M0G7D
24E	1860.0 - 1900.0	0.173	1.0 PM	17M9W7D
27	1710.7 - 1754.3	0.211	1.0 PM	1M08G7D
27	1710.7 - 1754.3	0.18	1.0 PM	1M08W7D
27	1711.5 - 1753.5	0.206	1.0 PM	2M69G7D
27	1711.5 - 1753.5	0.179	1.0 PM	2M69W7D
27	1712.5 - 1752.5	0.208	1.0 PM	4M48G7D
27	1712.5 - 1752.5	0.176	1.0 PM	4M48W7D
27	1715.0 - 1750.0	0.207	1.0 PM	8M97G7D
27	1715.0 - 1750.0	0.175	1.0 PM	8M97W7D
27	1717.5 - 1747.5	0.21	1.0 PM	13M5G7D
27	1717.5 - 1747.5	0.179	1.0 PM	13M5W7D
27	1720.0 - 1745.0	0.209	1.0 PM	17M9G7D
27	1720.0 - 1745.0	0.179	1.0 PM	17M9W7D
27	779.5 - 784.5	0.201	1.0 PM	4M47G7D
27	779.5 - 784.5	0.165	1.0 PM	4M47W7D
27	782.0 - 782.0	0.198	1.0 PM	8M97G7D
27	782.0 - 782.0	0.161	1.0 PM	8M96W7D

Power listed is conducted. The maximum antenna gain including cable loss for compliance with radiated power limits, RF exposure requirements and the categorical exclusion requirements of 2.1091 is 5.22 dBi for part 22H, 3.31 dBi for part 24E and 6.45 dBi for part 27. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operated in conjunction with any antenna or transmitter not described under this FCC id, except in accordance with FCC multi-transmitter product procedures. 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..

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.

Canadian Limitations

Notice: This equipment meets the applicable Industry Canada Terminal Equipment Technical Specifications. This is confirmed by the registration number. The abbreviation, IC, before the registration number signifies that registration was performed based on a Declaration of Conformity indicating that Industry Canada technical specifications were met. It does not imply that Industry Canada approved the equipment.

Notice: The REN assigned to each terminal equipment provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed five.

Limitations canadiennes

Avis: Cet équipement respecte les spécifications techniques des équipements terminaux d'Industrie Canada. Cette conformité est confirmée par le numéro d'enregistrement. L'abréviation IC précédant le numéro d'enregistrement signifie que l'enregistrement a été effectué conformément à une Déclaration de Conformité indiquant que les spécifications techniques d'Industrie Canada ont été respectées. Ceci n'indique pas que cet équipement a été approuvé par Industrie Canada.

Avis: L'IES (indice d'équivalence de la sonnerie) attribué à chaque terminal fournit une indication du nombre maximal de terminaux pouvant être connectés à une interface téléphonique. La terminaison d'une interface peut être constituée de n'importe quelle combinaison d'appareils à la seule condition que la somme des indices d'équivalence de sonnerie de l'ensemble des appareils ne dépasse pas cinq.

Industry Canada

Certification Number/No. de Certification	5131A-LE910SVV2
Type of Radio Equipment/Genre de Matériel	Modular Approval
	Advanced Wireless Services Equipment/Matériel des services sans fil évolués (1710-1755 MHz and 2110-2155 MHz)
	Mobile Broadband Service (MBS)/Matériel du service mobile à large bande (SMLB) (698-756 and (777-787)
	PCS Mobile/Téléphone mobile SCP (1850-1910 MHz)
Model/Modèle	LE910-SA V2

From Frequency/De Fréquences (MHz)	To Frequency/ Á Fréquences (MHz)	RF Power (W) Minimum	RF Power (W) Maximum	Occupied Bandwidth (kHz)	Emmission Designation/Designation D'émission
1850.7	1909.3	0.216	0.216	1078.8	G7D
1850.7	1909.3	0.183	0.183	1077.7	W7D
1851.5	1908.5	0.217	0.217	2689.8	G7D
1851.5	1908.5	0.177	0.177	2687.5	W7D
1852.5	1907.5	0.217	0.217	4478.0	G7D
1852.5	1907.5	0.184	0.184	4462.8	W7D
1855.0	1905.0	0.212	0.212	8963.9	G7D
1855.0	1905.0	0.177	0.177	8967.4	W7D
1857.5	1902.5	0.217	0.217	13466.6	G7D
1857.5	1902.5	0.179	0.179	13458.0	W7D
1860.0	1900.0	0.219	0.219	17955.4	G7D
1860.0	1900.0	0.173	0.173	17937	W7D
1710.7	1753.5	0.211	0.211	1080.1	G7D
1710.7	1753.5	0.18	0.18	1078.6	W7D
1711.5	1753.5	0.206	0.206	2685.7	G7D
1711.5	1753.5	0.179	0.179	2694.9	W7D
1712.5	1752.2	0.208	0.208	4476.5	G7D
1712.5	1752.2	0.176	0.176	4476.0	W7D
1715.0	1750.0	0.207	0.207	8965.3	G7D
1715.0	1750.0	0.175	0.175	8970.5	W7D
1717.5	1747.5	0.21	0.21	13457.9	G7D

From Frequency/De Fréquences (MHz)	To Frequency/ Á Fréquences (MHz)	RF Power (W) Minimum	RF Power (W) Maximum	Occupied Bandwidth (kHz)	Emmission Designation/Designation D'émission
1717.5	1747.5	0.179	0.179	13457.9	W7D
1720.0	1745.0	0.209	0.209	17909.1	G7D
1720.0	1745.0	0.179	0.179	17865.9	W7D
779.5	784.5	0.201	0.201	4470.6	G7D
779.5	784.5	0.165	0.165	4470.1	W7D
782.0	782.0	0.198	0.198	8966.9	G7D
782.0	782.0	0.161	0.161	8958.0	W7D

Certification of equipment means only that the equipment has met the requirements of the above noted specification. License applications, where applicable to use certified equipment, are acted on accordingly by the Industry Canada issuing office and will depend on the existing radio environment, service and location of operation. This certificate is issued on condition that the holder complies and will continue to comply with the requirements and procedures issued by Industry Canada. The equipment for which this certificate is issued shall not be manufactured, imported distributed, leased, offered for sale or sold unless the equipment complies with the applicable technical specifications and procedures issued by Industry Canada.

La certification du matériel signifie seulement que le matériel a satisfait aux exigences de la norme indiquée ci-dessus. Les demandes de licences nécessaires pour l'utilisation du matériel certifié sont traitées en conséquence par le bureau de délivrance d'Industrie Canada et dépendent des conditions radio ambiantes, du service et de l'emplacement d'exploitation. Le présent certificat est délivré à la condition que le titulaire satisfasse et continue de satisfaire aux exigences et aux procédures d'Industrie Canada. Le matériel à l'égard duquel le présent certificat est délivré ne doit pas être fabriqué, importé, distribué, loué, mis en vente ou vendu à moins d'être conforme aux procédures et aux spécifications techniques applicable publiées par Industrie Canada.

Chapter 9 – Chapter 9 Environmental Notices

Waste Electrical and Electronic Equipment Statement

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

WEEE Directive

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

Instructions for Disposal of WEEE by Users in the European Union

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

July, 2005



REACH Statement

Registration of Substances

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.

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

Environmental considerations:

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

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

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

Chapter 10 – Using Connection Manager

Use Connection Manager to:

- Install the latest device drivers.
- Connect your device to your carrier's network.

Note:

- Connection Manager can install drivers and connect your device regardless of your cellular network; however, activation is only supported with Verizon, Aeris, 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.

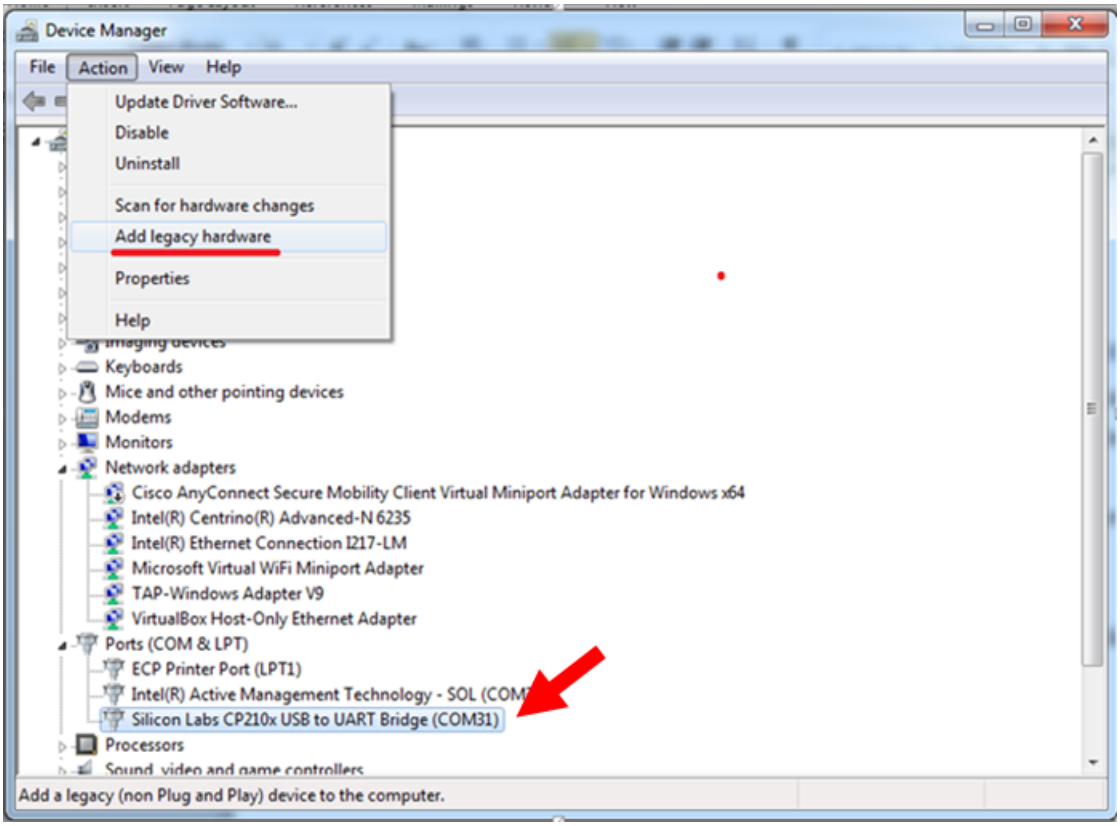
Setting Up a Serial Device in Windows Device Manager

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**.

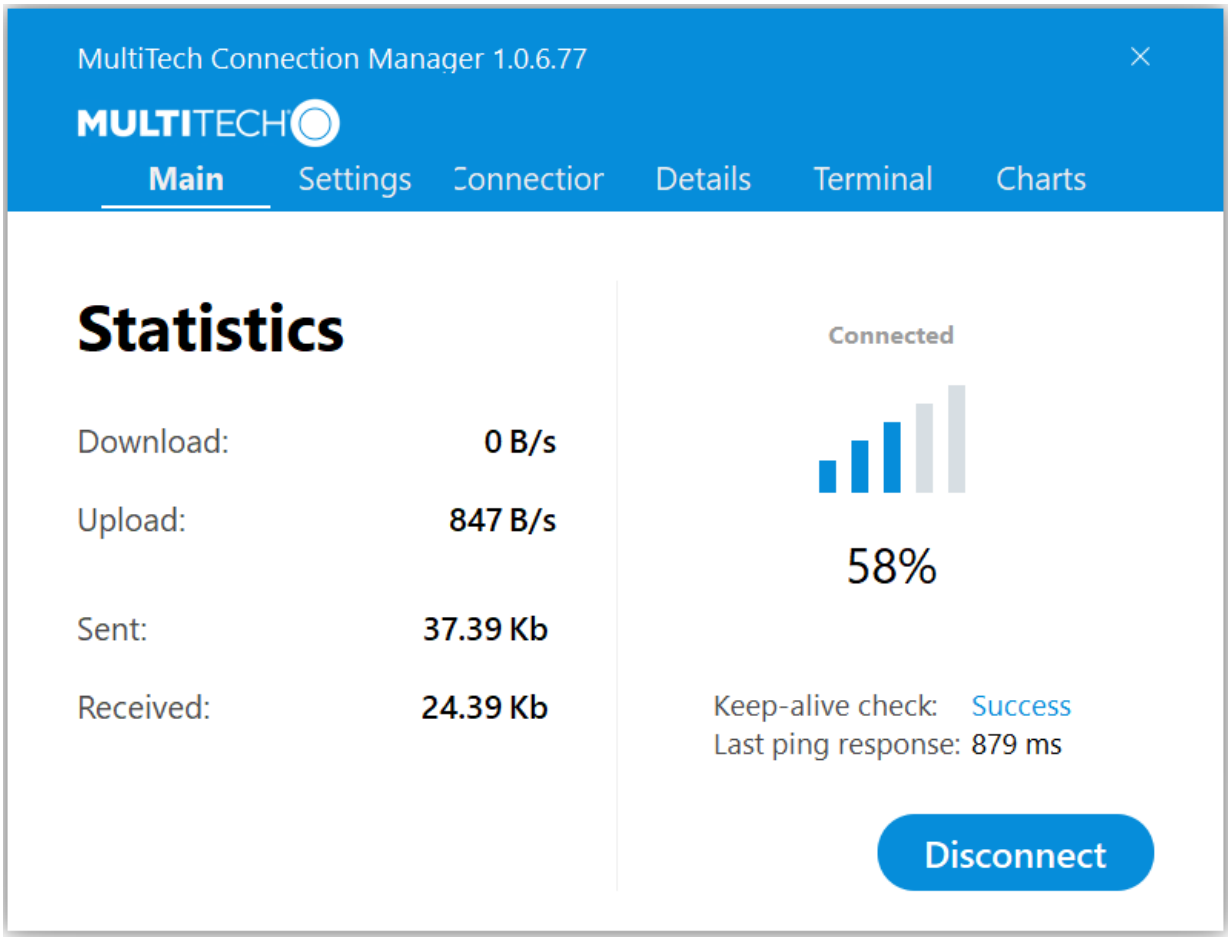
Connection Manager and the installed drivers are removed from the computer.

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



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.

Index

A

absolute maximum rating 20
activation 47
antenna
  connecting 29
  diversity 30
  LTE 28
AT passthrough 36
AT#SHDN 10

B

build options 6

C

cable 29
certification
  Industry Canada 43
Class B 40
  Industry Canada 42
Connection Manager
  Charts tab 52
  connecting device to carrier's network 50
  Connection tab 52
  Details tab 52
  installation 47
  installation of device drivers 47
  Main tab 52
  overview 47
  Settings tab 52
  Terminal tab 52
  troubleshooting 54
  uninstalling 51

D

device
  connecting to carrier's network with Connection Manager 50
  maintenance 34
device drivers
  installation for use with Connection Manager 47
device reset 26
diversity 30
documentation 6

E

electrical characteristics 20

F

FCC
  grant notes 31
FCC Notice
  Class B 40
firmware 36

H

hazardous substances 46
host labeling 31

I

Industrie Canada 42
Industry Canada 42 43
  Class B 42

K

KDB 447498 Section 8 31

L

labeling
  host 31
labels 39
library 36
LTE
  antenna 28

M

maintenance 34
Mbed 36
mechanical drawings 7
model location 39
modem
  safety 33

O

on off signal....25
operating conditions....20

P

pin
  assignment....14
  connector definitions....10
  processor....17
pin connector....13
power down....10
power draw
  MTQ-LVW3-B01....22
  MTQ-LVW3-B02....24
processor pins....17

R

radio frequency interference....33
RoHS....46

S

safety
  modem....33
  RF interference....33
  vehicle....34
shutdown....10
SIM card, installing....26
sleep mode....26
SMA to U.FL....29
SMA to U.FL cable....29
specifications....9
static....33

T

troubleshooting
  Connection Manager....54

U

U.FL....29
user responsibility....35

V

vehicle safety....34