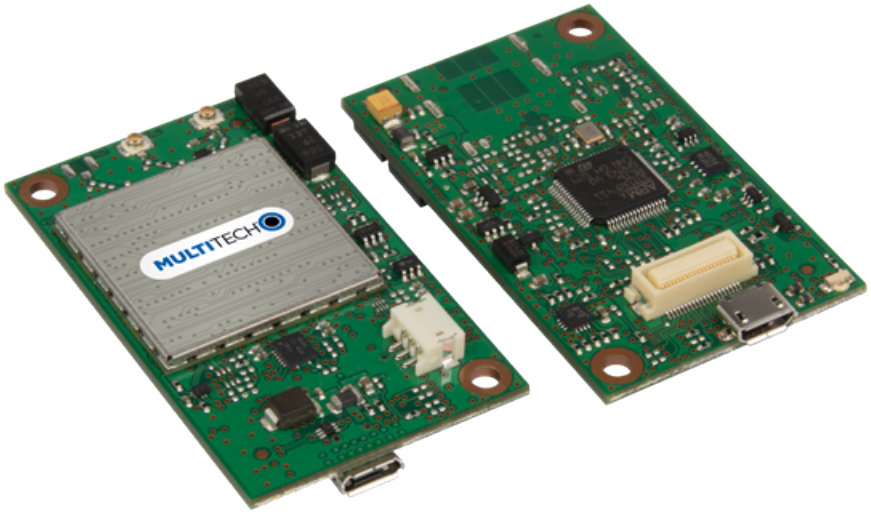

MultiConnect® Dragonfly ™

MTQ-EV3 Device Guide

MultiConnect Dragonfly Device Guide

Models: MTQ-EV3-B01-N2,MTQ-EV3-B01-N16,MTQ-EV3-B02-N2, MTQ-EV3-B02-N16

Part Number: S000627, Version 1.0

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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
Processor Model (B01) 7
No Processor Model (B02) 8
Chapter 3 – Chapter 3 Specifications and Related Information 9
Specifications 9
40-Pin Connector Definitions 10
MTQ-xx-B01 Pin Definitions 10
MTQ-xx-B02 Pin Definitions 12
40-Pin Connector 13
MTQ-EV3-B01 External Pin Alternate Function Mapping 13
Processor Pin Information (B01 models only) 16
Communications Flow 19
Processor Model (B01) 19
No Processor Model (B02) 19
Electrical Characteristics 19
Operating Conditions 19
Absolute Maximum Rating 19
DC Electrical Characteristics 20
Input/Output Current Ratings 20
Power Measurements 21
MTQ-EV3-B01 (Processor) 21
MTQ-EV3-B02 (No Processor) 22
USB Cable Recommendations 22
Powering Down Your Device 23
3G_ONOFF Signal 23
Device Reset 23
Processor Models (B01) 23
No Processor Models (B02) 23
Sleep Mode 23
Link Status LED 24
Chapter 4 – Chapter 4 Antennas 25
External Antenna Option 25
Wieson Antenna 25

Internal Antenna Option 25
Ethertronics Prestta Standard Octa-Band Antenna 25
SMA to U.FL Cable 26
Connecting an Antenna through the Developer Board Connectors 26
OEM Integration 27
FCC & IC Information to Consumers 27
FCC Grant Notes 27
Host Labeling 27
Chapter 5 – Chapter 5 Carrier Specific Notices 28
Notice for Devices that Use Aeris Radios 28
MultiTech Sprint Approved Device Requirements 28
Sprint OMA DM Notifications 28
Sprint #9XX OMA Unsolicited Indications 29
OMA-DM Commands 30
Sprint Successful Indications 31
Chapter 6 – Chapter 6 Safety Information 33
Handling Precautions 33
Radio Frequency (RF) Safety 33
Sécurité relative aux appareils à radiofréquence (RF) 33
General Safety 34
Interference with Pacemakers and Other Medical Devices 34
Potential interference 34
Precautions for pacemaker wearers 34
Device Maintenance 34
User Responsibility 35
Underwriters Laboratories, Inc. Required Global Positioning System (GPS) Statement 35
Chapter 7 – Chapter 7 Getting Started with the MTQ-EV3-B01 36
Developing with an MTQ in mbed 36
MTSAS Library 36
mbed Documentation 36
Programming the MTQ Microcontroller 37
mbed Links 37
MTQ Platform 37
ST Microelectronics STM32F411xC/E 37
Chapter 8 – Chapter 8 Labels 38
Approvals and Certifications 38
Example Labels 38
Chapter 9 – Chapter 9 Regulatory Information 39
47 CFR Part 15 Regulation Class B Devices 39
FCC Interference Notice 39

FCC Grant 39
Industry Canada Class B Notice 40
Canadian Limitations 40
Chapter 10 – Chapter 9 Environmental Notices 42
Waste Electrical and Electronic Equipment Statement 42
WEEE Directive 42
Instructions for Disposal of WEEE by Users in the European Union 42
REACH Statement 42
Registration of Substances 42
Substances of Very High Concern (SVHC) 42
Restriction of the Use of Hazardous Substances (RoHS) 43
Information on HS/TS Substances According to Chinese Standards 44
Information on HS/TS Substances According to Chinese Standards (in Chinese) 45
Index 46

Chapter 1 – Chapter 1 Product Overview

Overview

The MultiConnect® 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
Device Guide	This document. Provides model-specific specifications and developer information.	S000627
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 EV-DO/CDMA USB drivers.	S000569
Telit AT Commands Reference Guide	Use for MTQ-EV3 devices.	80392ST10102A Rev.7

Product Build Options

Product	Description	Region
MTQ-EV3-B01-N2	CDMA EV-DO SoM – Sprint	USA
MTQ-EV3-B02-N2	CDMA EV-DO Embedded Modem, Sprint	USA
MTQ-EV3-B01-N16	CDMA EV-DO SoM, Aeris	USA
MTQ-EV3-B02-N16	CDMA EV-DO Embedded Modem, Aeris	USA
Developer Kit		
MTUDK2-ST-CELL	Developer Kit for SocketModem, and Dragonfly cellular devices.	Global

Note:

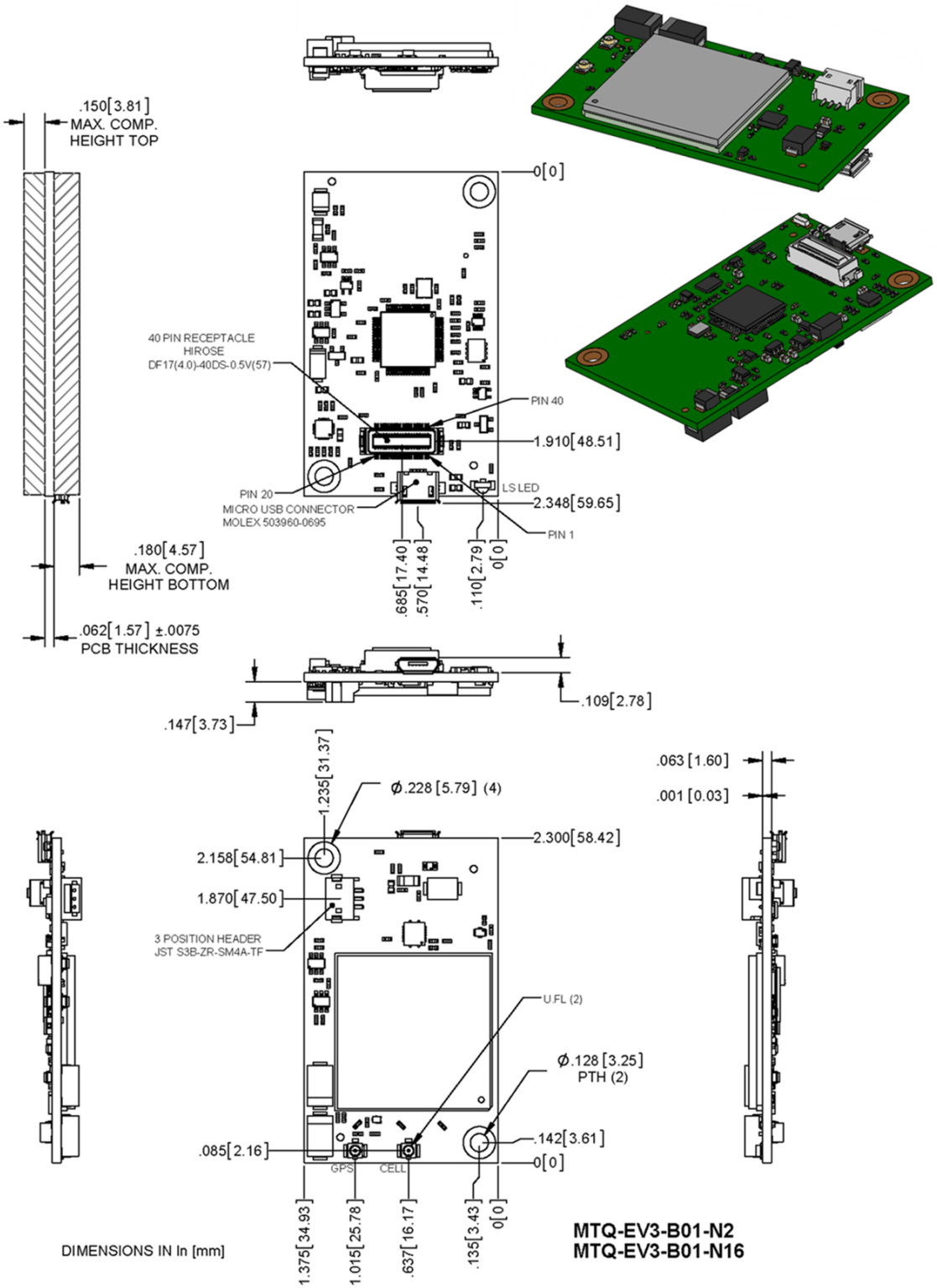
These units ship without network activation. To connect them to the cellular network, you need a cellular account. Refer to MultiTech's Cellular Activation site http://www.multitech.com/activation.go for step-by-step instructions on activating your cellular modem.

The complete product code may end in .Rx. For example, MTQ-EV3-B01-N2.Rx, where R is revision and x is the revision number.

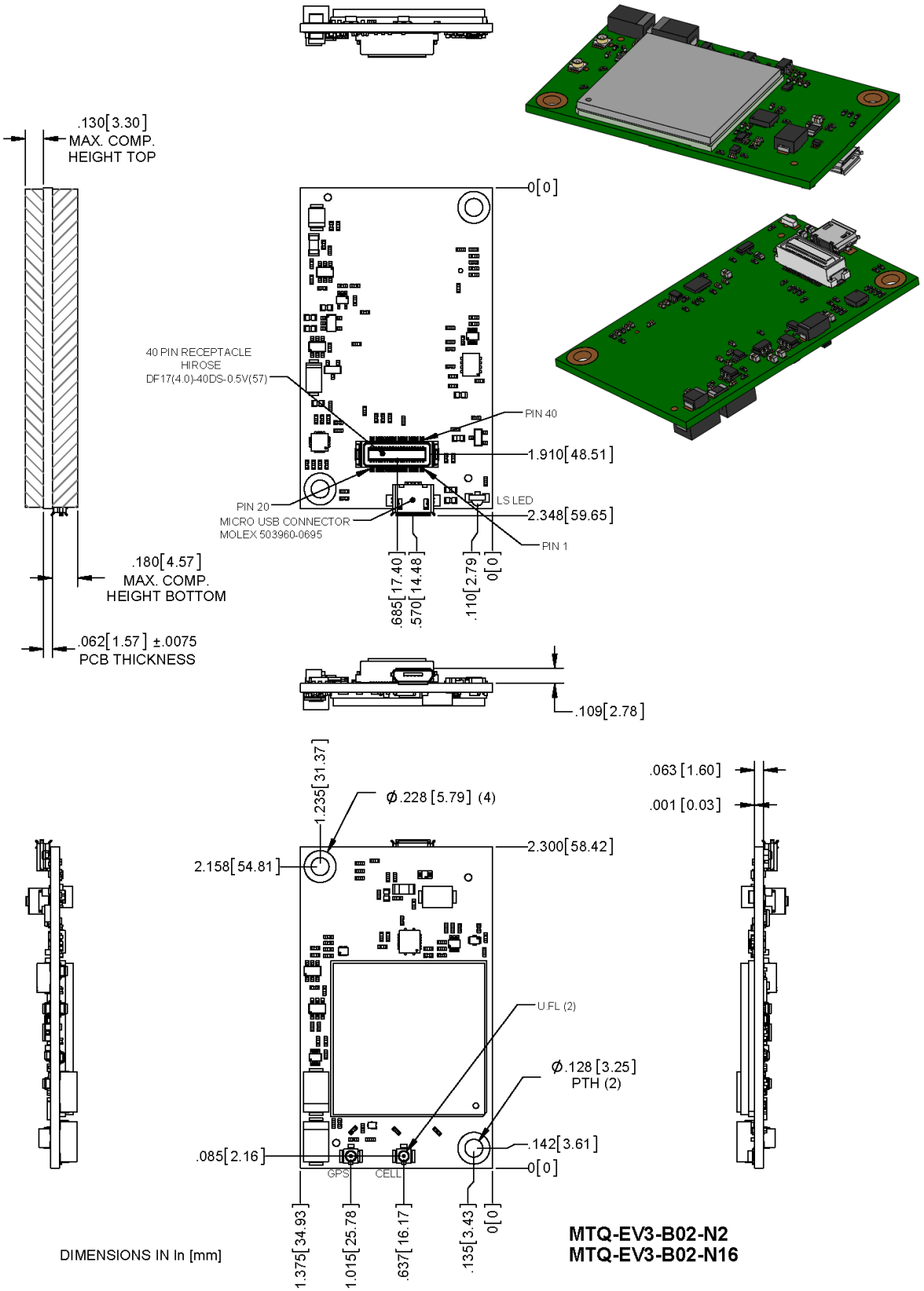
All builds can be ordered individually or in 50-packs.

Chapter 2 – Chapter 2 Mechanical Drawings

Processor Model (B01)



No Processor Model (B02)



Chapter 3 – Chapter 3 Specifications and Related Information

Specifications

Category	Description
General	
Standards	EV-DO Rev. A, CDMA2000 1xRTT
Frequency Bands	800/1900 MHz
TCP	FTP, HTTP, SMTP, SSL, TCP, UDP
LED	One, link status
Data Speed	Peak downlink speeds up to 3.1 Mbps
	Peak uplink speeds up to 1.8 Mbps
Interface	
USB Interface	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
Physical Description	
Weight	0.6 oz (17g)
Dimensions	Refer to Mechanical Drawings for details.
Connectors	
Antenna	2 surface mount U.FL: cellular and GPS
USB	Micro USB
Pin header	40-pin female for USB or UART
Battery [2]	3-pin
Environment	
Operating Temperature[3]	-40° C to +85° C[4]
Storage Temperature	-40° C to +85° C
Humidity	20%-90% RH, non-condensing
Power Requirements	
Operating Voltage	5 V +/- 5%
Input Current	See Power Draw

Category	Description
Certifications and Compliance	
EMC and Radio Compliance	FCC Part 15 Class B
	FCC Part 22
	FCC Part 24
Safety Compliance	UL/cUL 60950-1 2nd Ed.
	IEC 60950-1 2nd Ed. +Am.2

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

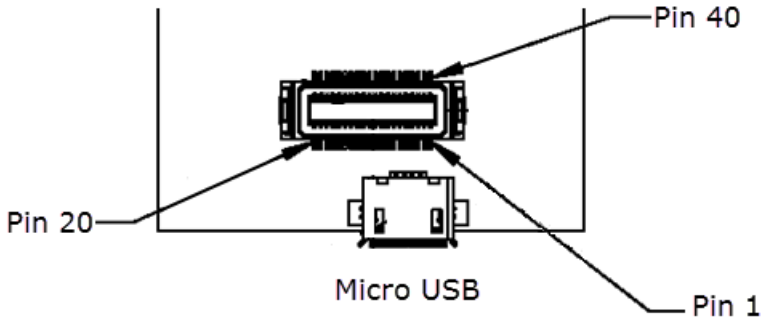
[2]The battery management circuit is designed for single cell Li-Ion/Li-Poly technology. Acceptability of the battery charge circuit for charging specific batteries/cells is to be determined in the end product.

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

[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.

40-Pin Connector Definitions



MTQ-xx-B01 Pin Definitions

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

Pin	Signal Name	Logic Level Voltage[1]	In/Out	Description
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
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

Pin	Signal Name	Logic Level Voltage[1]	In/Out	Description
35	RESET	0 - 3V	I	NRST pin of ST micro
36	GND	GND	GND	Ground
37	GND			
38	SWO	3V	O	See ST Microcontroller Guide
39	SWDIO	3V	I	
40	DBG_RX	3V	I	ST Micro UART debug Tx input

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

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

MTQ-xx-B02 Pin Definitions

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	
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				

Pin	Signal Name	Logic Level Voltage[1]	Max Voltage	In/Out	Description
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 - 3V		I	Radio reset
36	GND	GND		GND	Ground
37	GND				
38	N/C				
39	N/C				
40	N/C				

Note: 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:	Plug
Model Number:	DF17(2.0)-40DP-0.5V(57)

MTQ-EV3-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 (mbed dbgTX)		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	
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 (mbed dbgRX)		PB_7	

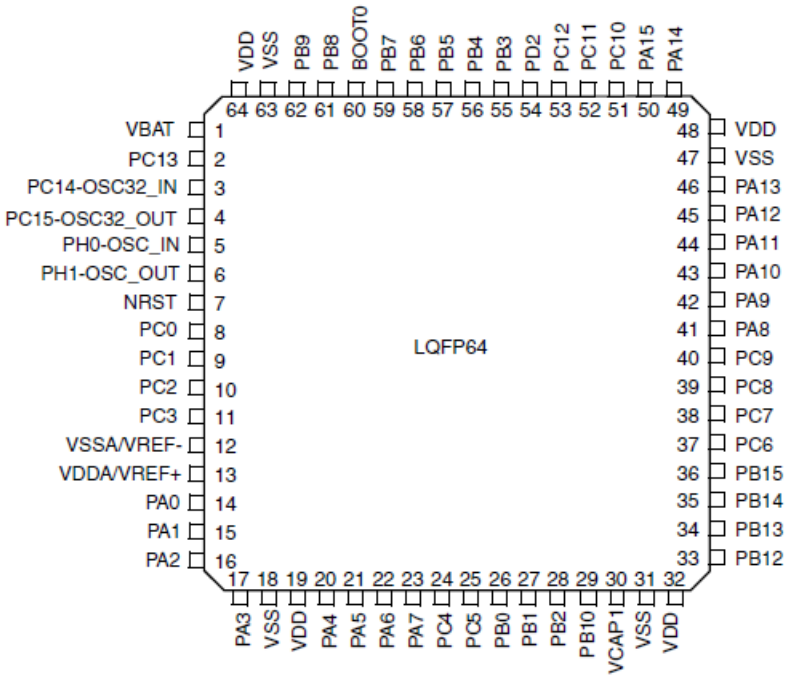
[1]For the ST microprocessor, the pin names are the same, but the underscore is removed.

MTQ Pin	SPI Interface	I2C Interface	USARTs	Timer Functions	SDIO Functions	Event Trigger Output	ADC Channels
1		I2C1_SCL	USART1_TX	TIM4_CH1		EVENTOUT	

MTQ Pin	SPI Interface	I2C Interface	USARTs	Timer Functions	SDIO Functions	Event Trigger Output	ADC Channels
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
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	

MTQ Pin	SPI Interface	I2C Interface	USARTs	Timer Functions	SDIO Functions	Event Trigger Output	ADC Channels
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.

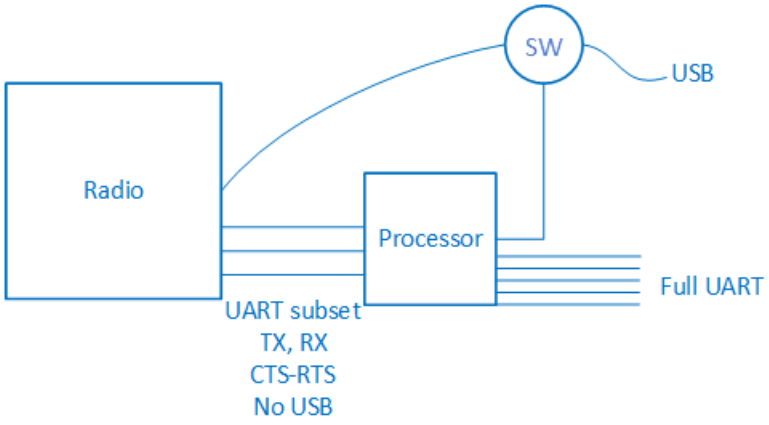
Net Name	Number	Pin Name	Details
VDD3_3	1	VBAT	Power
3G_ONOFF	2	PC13	Enable line to the Radio
32K_XTAL_	3	PC14	RTC Clock
32K_XTAL	4	PC15	RTC Clock
26MHZ_CLK_IN	5	PH0-OSC_IN	Main Clock
26MHZ_CLK_DRIVE	6	PH1-OSC_OUT	Main Clock

Net Name	Number	Pin Name	Details
N_RESET	7	NRST	External Reset in
IO_10	8	PC0	GPIO/Analog capable pin
IO_11	9	PC1	GPIO/Analog capable pin
IO_8	10	PC2	GPIO
RADIO_PWR	11	PC3	Voltage enable for Telit
GND	12	VSSA	Power
VDD3_3	13	VDDA	Power
IO_18/RTS	14	PA0	GPIO/Analog capable pin/USART2_CTS
IO_03/CTS	15	PA1	GPIO/Analog capable pin/USART2_RTS
IO_00/RXD	16	PA2	GPIO/USART2_TX
IO_21/TXD	17	PA3	GPIO/USART2_RX
GND	18	VSS_4	Power
VDD3_3	19	VDD_4	Power
SPI-SS1	20	PA4	SPI1 Select
IO_05/SCK	21	PA5	SPI1 Clock/GPIO
IO_16/MISO/SDIO_CMD	22	PA6	SPI1 MSIO/SDIO_CMD /GPIO
IO_01/DCD	23	PA7	GPIO
IO_12	24	PC4	GPIO/Analog capable pin
VDD1.8_MON	25	PC5	Power
IO_9	26	PB0	GPIO/Analog capable pin
IO_02/RI	27	PB1	GPIO
BOOT1/BC_NCE	28	PB2	Battery charge enabled. Pulled down by default.
RADIO_RTS	29	PB10	Serial comm with the radio
VCAP	30	PB11/VCAP_1	Power
N16612690	31	VCAP_1/VSS	Power
VDD3_3	32	VDD_1	Power
RADIO_CTS	33	PB12	Serial comm with the radio
IO_13	34	PB13	GPIO
SPI-SS2	35	PB14	GPIO for use with external SPI
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

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

Communications Flow

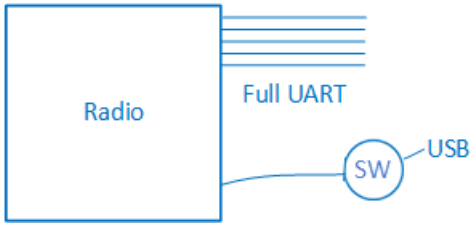
Processor Model (B01)



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	2.31	-

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

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

Note:

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

Note:

- If a battery is connected to the device and is charging, the maximum current will be higher.
- MultiTech recommends that you incorporate a 10% buffer into your power source when determining product load.

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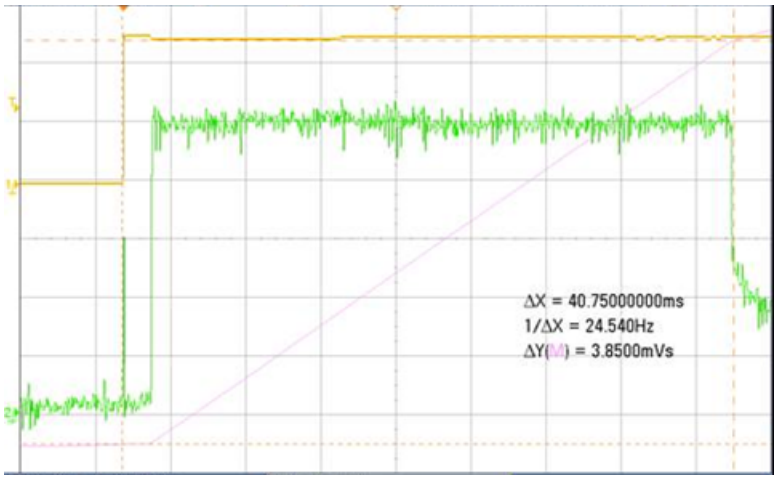
MTQ-EV3-B01 (Processor)

Radio Protocol	Sleep Mode	Call Box Connection No Data (Amps)	(AVG) Measured Current (Amps) at Max Power[1]	Peak TX [2]Amplitude Current (Amps)	Total Inrush Charge[3] Measured in Millicoulombs (mC)
5 Volts, USB					
US Cellular 800Mhz	0.006	N/A	0.664	0.732	3.85
US PCS 1900MHz	0.006	0.057	0.707	0.748	3.85

[1]**Maximum Power:** The continuous current during maximum data rate with the radio transmitter at maximum power.
[2]**Peak TX:** The peak current during a CDMA connection transmitting data at max power.
[3]**Inrush Charge:** The total inrush charge at power on.

Waveforms

USB only, inrush current of 3.85 mC with a duration of 40.7 ms



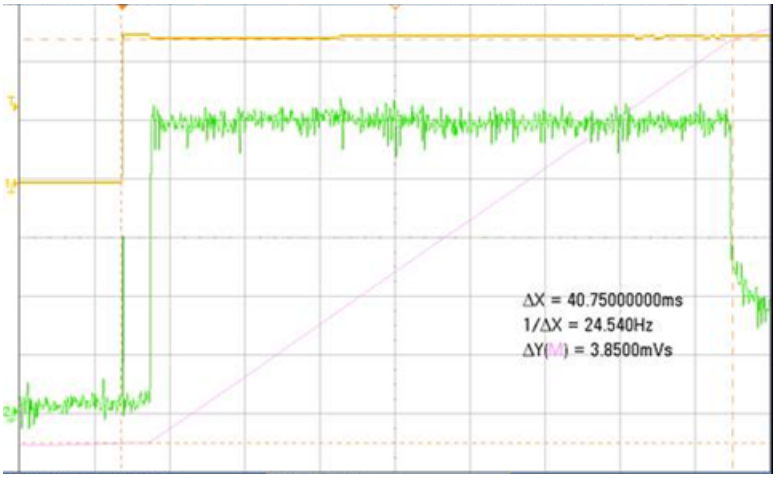
MTQ-EV3-B02 (No Processor)

Radio Protocol	Sleep Mode	Call Box Connection No Data (Amps)	(AVG) Measured Current (Amps) at Max Power[1]	Peak TX [2]Amplitude Current (Amps)	Total Inrush Charge[3] Measured in Millicoulombs (mC)
5 Volts, USB					
US Cellular 800Mhz	0.024	N/A	0.658	0.748	3.78
US PCS 1900MHz	0.024	0.049	0.644	0.760	3.78

[1]**Maximum Power:** The continuous current during maximum data rate with the radio transmitter at maximum power.
[2]**Peak TX:** The peak current during a CDMA connection transmitting data at max power.
[3]**Inrush Charge:** The total inrush charge at power on.

Waveforms

USB only, inrush current of 3.85mC with a duration of 40.7 ms



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.

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 control chip on the device turns the radio back on after 60 seconds.

3G_ONOFF Signal

- 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 3G_ONOFF 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 3G_ONOFF 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.

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.

Link Status LED

LED 2 Signal	Link Status LED	
OFF	Device off.	
ON	Continuously lit	During initial connection to tower or when connected and passing data.
	Slow blink (-0.2Hz)	Registered to tower and idle.
	Faster blink (-3Hz)	Powered not registered/Searching for registration.

Chapter 4 – Chapter 4 Antennas

External Antenna Option

Wieson Antenna

Devices were approved with the following antenna:

Manufacturer:	Wieson
Description:	LTE GY115HT467-017
Model Number:	11320Y11194A1
MultiTech Part Number:	45009890L

MultiTech ordering information:

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

Antenna Specifications

Category	Description
Frequency Range	.069~0.96GHz, 1.71~2.17GHz, 2.3GHz~2.69GHz
Impedance	50 Ohms
VSWR	VSWR should not exceed 3:1 at any point across the bands of operation
Peak Gain	3.8 dBi
Radiation	Omni-directional
Polarization	Linear Vertical

Internal Antenna Option

Ethertronics Prestta Standard Octa-Band Antenna

Manufacturer:	Ethertronics
Description:	Octo-Band Embedded Antenna, 100mm Cable
Model Number:	1002292
MultiTech Part Number:	45009583L

MultiTech ordering information:

Ordering Part Number	Quantity
ANOB-1EMB	1
ANOB-10EMB	10
ANOB-50EMB	50

Antenna Specifications

Category	Low Band	High Band
Frequency Range	704-960 MHz	1710-2200 MHz
Gain	0.5 dBi	3.0 dBi
VSWR	3:1 max, 5:1 max (LTE B13/B17)	
Impedance	50 ohms unbalanced	
Radiation	Omni-directional	
Polarization	Linear	

SMA to U.FL Cable

Use an SMA to U.FL cable to connect your device to an antenna.

Part numbers if ordering the SMA-to-U.FL cable from MultiTech:

Part Number	Quantity
CASMA-UFL-1	1
CASMA-UFL-10	10
CASMA-UFL-50	50

Connecting an Antenna through the Developer Board Connectors

To connect an antenna to the device:

- Attach the U.FL connector on the cable to the connector on the device.

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 Carrier Specific Notices

Notice for Devices that Use Aeris Radios

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

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

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

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

MultiTech Sprint Approved Device Requirements

Any changes to a Sprint approved MultiTech device circuit board or antenna system requires you to contact Sprint certifications. Sprint will determine if additional testing is required due to modification of the approved device circuit board or antenna system.

All applications interacting with Sprint approved MultiTech devices must be written in a manner where they do not interfere/ interrupt the Sprint HFA process or OMA-DM processes outlined in section labeled Telit OMA DM Notifications.

If the MultiTech device will be co-located with any other transmitters you will be required to submit your device to an FCC approved lab for additional FCC testing.

If the Sprint approved MultiTech device/circuit board is embedded into another device/circuit board be aware you will be required to perform EMC and safety testing on your end device.

Sprint OMA DM Notifications

Applications should look for the following unsolicited OMA indications at all times:

#904	HFA Started
#905	PRL - Session started
#906	DC - Session started
#907	FUMO -Session started

If application sees one of these indications it should not attempt to issue commands, attempt data connection, or reset device until the OMA process is complete as indicated by additional #9XX OMA success or failure indications below.

If the device is in a data connection at the time a Network Initiated PRL, DC, or FUMO update alert message is received from Sprint, the radio may close the data connection and start OMA-DM process with a #9xx indication. When this occurs the application should not attempt to issue AT commands, attempt to start data connection

again, or reset device in an attempt to regain control. Application should wait for a #9xx indication the process has completed before proceeding.

Be aware after the HFA process is successfully completed the radio will be reset. The radio may also reset after other OMA functions.

Sprint #9XX OMA Unsolicited Indications

#900	DM Client Ready

Sprint Hands Free Activation HFA Notifications

#901	HFA Attempt #
#902	HFA Countdown Timer (seconds)
#904	HFA Started
#911	HFA Error - credential error
#912	HFA Error - unreachable server
#913	HFA Error - network error
#914	HFA Done - HFA success
#922	HFA Done - No profile received
#923	HFA Error – ETC
#924	HFA Cancelled
#DREL	Data session release

Sprint Network Initiated Device Configuration (NIDC) or Client Initiated Device Configuration (CIDC)

#906	DC - Session started
#911	DC - Error - credential error
#912	DC - Error - unreachable server
#913	DC - Error - network error
#915	DC - Error - update fails for other reasons
#918	DC - Done - success
#924	DC - Cancelled - no profile received
#DREL	Data session release

Sprint Network Initiated or Client Initiated Preferred Roaming List (NIPRL or CIPRL) Download

#905	PRL - Session started
#909	PRL - Done - PRL success
#910	PRL - Done - No PRL update
#911	PRL - Error - credential error
#912	PRL - Error - unreachable server

#913	PRL - Error - network error
#915	PRL - Error - update failed for other reasons
#DREL	Data session release

Sprint Network Initiated (NI) or Client Initiated (CI) Firmware Update Management Object (FUMO) Notifications

#907	FUMO - Firmware DM session started or started again until no more updates are available
#911	FUMO - credential error
#912	FUMO - unreachable server
#913	FUMO - network error
#915	FUMO – update fails with other reasons
#916	FUMO - Firmware done, no firmware update
#919	FUMO - Firmware downloaded successfully
#920	FUMO - Firmware download progress (percent)
#921	FUMO - Firmware download start
#921	FUMO - Firmware size get from the OMA-DM server (byte)
#929: 200	FUMO - Firmware Update Success
#929: 402	FUMO - Firmware corrupted , CRC error
#929: 403	FUMO - Firmware package mismatch
#929: 404	FUMO - Firmware signature failed
#929: 406	FUMO - Firmware update authentication failed
#929: 410	FUMO - Firmware update General Error
#930	FUMO - Firmware reporting firmware update result to server
#DREL	Data session release

Sprint Additional Network Initiated Alert Indications (NIA Retry)

#926	NIA - NIA retry start
#927	NIA - Notification done with no NIFA information
#928	NIA - NIA digest mismatch error

OMA-DM Commands

These commands are available after the unsolicited indication #900 appears, which means DM client is ready.

AT#OMADMSVADDR=<URL>	Set OMA-DM server address (default https://oma.ssprov.sprint.com/oma)
AT#OMADMSVADDR?	Read OMA-DM server address
AT#OMADMSVPORT=<port#>	Set OMA-DM server (default 443)

AT#OMADMSVPORT?	Read OMA-DM server
AT#OMADMPROXY=<port#>,<URL>	Set OMA-DM proxy server port/URL (default http://oma.ssprov.sprint.com:80)
AT#OMADLPROXY=<port#>,<URL>	Set OMA-DL Proxy DL Server Port URL (default http://oma.ssprov.sprint.com:80)
AT#OMADMCEN=<onoff>	Set OMA-DM Client feature; Disable=0, Enable=1 **Important:** Never deploy devices with AT#OMADMCEN=0. Many OMA commands result in error if OMADMCEN is set to 0.
AT#OMADMCEN?	Query the current OMA-DM client status
AT#OMADMCEN=?	Query OMA-DM available values
AT+OMADM=(onoff)	Set OMA-DM Client Initiated Device Configuration; Disable=0, Enable=1, Initiate=2
AT+OMADM=?	Query OMA-DM Client Initiated Device setting
AT+PRL=<onoff>	Set OMA-DM CIPRL Session; Disable=0, Enable=1, Initiate=2
AT+PRL=?	Query OMA-DM CIPRL Session setting
AT+FUMO=	Set OMA-DM FUMO enable parameter; Disable=0, Enable=1, Initiate=2
AT+FUMO=?	Query OMA-DM FUMO parameter
AT#HFA	Initiate Sprint Hands Free Activation (HFA)
AT#HFACANCEL	Cancel Sprint Hands Free Activation (HFA) DM Session
AT$RTN=xxxxxx	HFA reset (after device reboot HFA will occur) xxxxxx= SPC or MSL. **Note:** May not work with all firmware versions.
AT#SPRTN=xxxxxx	After device reboot HFA will occur xxxxxx= SPC or MSL
AT#DCCANCEL	Cancel Device Configuration (DC) Session
AT#PRLCANCEL	Cancel Preferred Roaming List (PRL) Session
AT$PRL?	Query Preferred Roaming List (PRL) ID #
AT#FUMOCANCEL	Cancel Firmware Update Management Object (FUMO) session.

Sprint Successful Indications

Typical Successful HFA Session Indications	Alternate Successful HFA Session Indications	Typical Successful FUMO Session Indications With firmware update
#900	#900	#907
#904	#904	#921
#919	#914	#921: 572 Bytes
#905	#905	#920:23
#909	#910	#920:100
#907	#900	New firmware installing

Typical Successful HFA Session Indications	Alternate Successful HFA Session Indications	Typical Successful FUMO Session Indications With firmware update
#916 #900		#900 #930 #907 #929:200

Typical Successful FUMO Session Indications without Firmware Update	Typical Successful PRL Sessions Indications	Typical Successful DC Session Indications
#907 #916	#905 #909 or #905 #910	#906 #918

Chapter 6 – Chapter 6 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).

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.

Underwriters Laboratories, Inc. Required Global Positioning System (GPS) Statement

Note the following information required by Underwriters Laboratories: Underwriters Laboratories, Inc.

Underwriters Laboratories Inc.(“UL”) has not tested the performance or reliability of the Global Positioning System (“GPS”) hardware, operating software or other aspects of this product. UL has only tested for fire, shock or casualties as outlined in UL’s Standard(s) for Safety. UL60950-1 Certification does not cover the performance or reliability of the GPS hardware and GPS operating software. UL MAKES NO REPRESENTATIONS, WARRANTIES OR CERTIFICATIONS WHATSOEVER REGARDING THE PERFORMANCE OR RELIABILITY OF ANY GPS RELATED FUNCTIONS OF THIS PRODUCT.

Chapter 7 – Chapter 7 Getting Started with the MTQ-EV3-B01

Developing with an MTQ in mbed

Build applications written for the MTQ are built on top of the 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.

MTSAS Library

The MTSAS 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 MTSAS 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

Chapter 8 – 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:

- **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

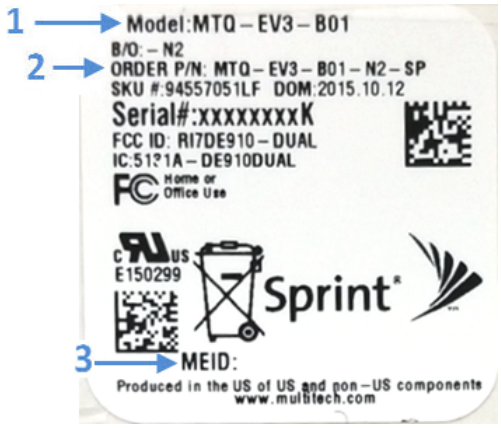
Note: Actual labels vary depending on the regulatory approval markings and content.

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 - MEID

Device Label



Package Label

Chapter 9 – 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

FCC Identifier	RI7HE910
Equipment Class	PCS Licensed Transmitter
Notes	WWAN Module
FCC Rule Parts	22H, 24E
Approval	Single Modular

FCC Rule Parts	Frequency Range (MHz)	Output Watts	Frequency Tolerance	Emission Designators
22H	824.2 - 824.2	1.995	1.0 PM	300KGXW
22H	824.2 - 848.8	0.997	1.0 PM	300KG7W
22H	826.4 - 846.4	0.446	1.0 PM	4M20F9W
27	1712.4 - 1752.6	0.226	1.0 PM	4M20F9W
24E	1850.2 - 1909.8	0.993	1.0 PM	300KGXW
24E	1850.2 - 1909.8	0.38	1.0 PM	300KG7W
24E	1852.4 - 1907.6	0.243	1.0 PM	4M20F9W

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.

Chapter 10 – 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

After careful review of the legislation and specifically the definition of an “article” as defined in EC Regulation 1907/2006, Title II, Chapter 1, Article 7.1(a)(b), it is our current view that Multi-Tech Systems, Inc. products would be considered as “articles.” In light of the definition in § 7.1(b) which requires registration of an article only if it contains a regulated substance that “is intended to be released under normal or reasonably foreseeable conditions of use,” our analysis is that Multi-Tech Systems, Inc. products constitute nonregisterable articles for their intended and anticipated use.

Substances of Very High Concern (SVHC)

Per the candidate list of Substances of Very High Concern (SVHC) published October 28, 2008 we have reviewed these substances and certify the Multi-Tech Systems, Inc. products are compliant per the EU “REACH” requirements of less than 0.1% (w/w) for each substance. If new SVHC candidates are published by the European Chemicals Agency, and relevant substances have been confirmed to be greater than 0.1% (w/w), Multi-Tech Systems, Inc. will provide updated compliance status.

Multi-Tech Systems, Inc. also declares it has been duly diligent in ensuring that the products supplied are compliant through a formalized process which includes collection and validation of materials declarations and selective materials analysis where appropriate. This data is controlled as part of a formal quality system and will be made available upon request.

Restriction of the Use of Hazardous Substances (RoHS)

Multi-Tech Systems, Inc.

Certificate of Compliance

2011/65/EU

Multi-Tech Systems, Inc. confirms that its embedded products comply with the chemical concentration limitations set forth in the directive 2011/65/EU of the European Parliament (Restriction of the use of certain Hazardous Substances in electrical and electronic equipment - RoHS).

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

- Lead, [Pb] < 1000 PPM
- Mercury, [Hg] < 1000 PPM
- Hexavalent Chromium, [Cr+6] < 1000 PPM
- Cadmium, [Cd] < 100 PPM
- Polybrominated Biphenyl, [PBB] < 1000 PPM
- Polybrominated Diphenyl Ether, [PBDE] < 1000 PPM

Environmental considerations:

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

[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.

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.

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。

Index

A

absolute maximum rating 19
antenna 25
  connecting 26
  internal 25
AT passthrough 36
AT#SHDN 23

B

build options 6

C

cable 26
Chinese hazardous substances
  Chinese version 45
  English version 44
Class B 39
  Industry Canada 40

D

device
  maintenance 34
device reset 23
documentation 6

E

electrical characteristics 19

F

FCC
  grant notes 27
FCC Notice
  Class B 39
firmware 36

G

GPS 35

H

hazardous substances 43
host labeling 27

I

Industrie Canada 40
Industry Canada 40
  Class B 40
interférence des radiofréquences 33

K

KDB 447498 Section 8 27

L

labeling
  host 27
labels 38
LED 24
library 36
link status 24

M

maintenance 34
mbed 36
mechanical drawings 7
model location 38
modem
  safety 34

O

OMA DM 28 29 30
on off signal 23
operating conditions 19

P

pin
  assignment 13
  connector definitions 10
  processor 16
pin connector 13

power down 23
power draw
MTQ-EV3-B01 21
MTQ-EV3-B02 22
processor pins 16

R

radio frequency interference 33
RoHS 43

S

safety
modem 34
RF interference 33
shutdown 23
sleep mode 23
SMA to U.FL cable 26
specifications 9
Sprint 28 29 30
static 33
sécurité
interférences RF 33

U

U.FL 26
UL 35
user responsibility 35