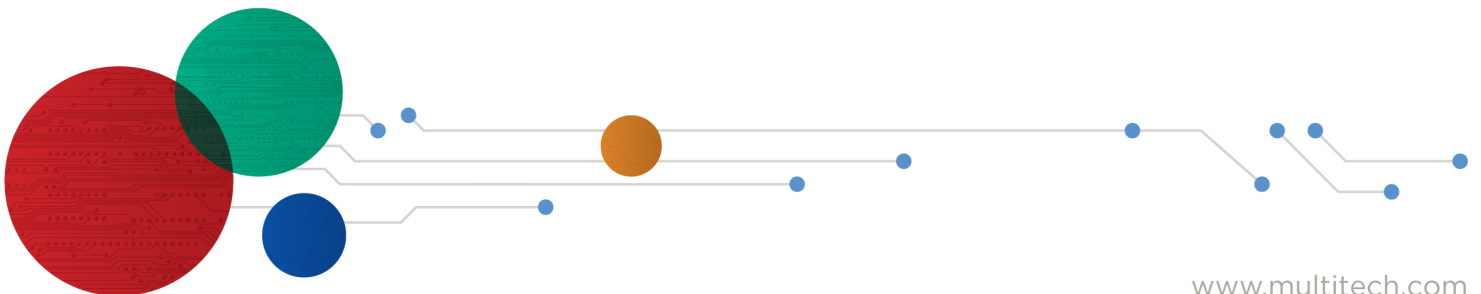# Conduit® Base Station IP67

Getting Started Guide for Versions 1.5 and 2.1

### Conduit IP67 Base Station Getting Started Guide

Models: MTCDTIP-xxx-266x-xxx, MTCDTIP-xxx-267x-xxx, MTCDTIP-xxx-270x-xxx, MTCDTIP-xxx-275x-xxx

Part Number: S000665, Version 3.1

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# Contents

# Chapter 1 – Conduit® IP67 Base Station

MultiTech's Conduit IP67 Base Station is a ruggedized IoT gateway solution, specifically designed for outdoor LoRa® public or private network deployments. The Conduit IP67 Base Station resists the harshest environmental factors including moisture, dust, wind, rain, snow and extreme heat.

## Getting Started - Related Documentation

### Installing the Device

An installation guide ships with the MCDTIP and is also available at https://www.multitech.com/documents/publications/installation-guides/82102802_onscreen.pdf.

### Getting Started with mPower Models

Devices that ship with mPower have -266A or -267A in the model number.

- (S00727) mPower™ Edge Intelligence Conduit AEP Software Guide includes steps for configuring your device and provides details on the user interface.
- http://www.multitech.net/developer/software/aep/ links to advanced information including getting started with LoRa devices and creating custom apps.

   Note: Some users may have mLinux models converted to mPower. These will have mLinux model numbers.

### Getting Started with mLinux Models

Devices that ship with mLinux have -266L, -267L, -270L, or -275L in the model number.

- Getting Started with mLinux models information is available on the multitech.net developer website.
- http://www.multitech.net/developer/software/mlinux/ links to details about using mLinux

### LoRa References

- http://www.multitech.net/developer/software/lora/ links to LoRa information.

### AT Command References

For models with cellular radio, the following AT Command Reference Guides are available at https://www.multitech.com/brands/multiconnect-conduit-ip67. Click your model, then select Manuals to find the AT Command Guide for your device.

| Radio | AT Command Reference Guide |
|---|---|
| L4E1/L4N1 | Telit LE910Cx AT Commands Reference 80502ST10950A |
| LAT1 | Telit LE910 AT Commands Reference Guide 80421ST10585A |
| LVW2 | Telit LE 910 AT Commands Reference Guide 80407ST10116A |
| LEU1 | Telit LE910 AT Commands Reference Guide 80421ST10585A |

# V2.1 Features

V2.1 refers to the Semtech reference design; the previous reference design was V1.5.

Models MTCDTIP **xxx266x-xxx** and **xxx-267x-xxx** are **V1.5**.

Models MTCDTIP **xxx270x-xxx** and **xxx-275x-xxx** are **V2.1**.

The V2.1 hardware design differs from the previous V1.5 design in the following ways:

- The custom, single purpose Semtech RF front-end ASIC was replaced by a popular wideband general purpose single-chip RF front-end from Analog Devices – the AD9361. This change transitioned Semtech's LoRa offering from a purely custom chipset to an SDR (Software-Defined Radio) architecture.

- The Semtech SX1301 baseband processor chips were retained in the design, but now provide much more limited functionality, essentially becoming hardware accelerator blocks whose purpose is to detect and synchronize the preamble (fixed symbol sequence present at the start of every LoRa packet) for incoming packets on multiple frequency slots with multiple spreading factors. This necessary functionality (essentially multiple concurrent FFTs) was more economical in the original ASICs than in an FPGA or a set of general-purpose DSPs.

- Following a popular pattern for SDR architectures, a large FPGA (a lower-end, but still relatively large Altera / Intel part) is at the center of the system, with all the other system components, including the Analog Devices RF front-end, the Semtech SX1301 ASICs, and a set of TI OMAP-L138 ARM/DSP SoC chips connected to it.

- The DSP core of the TI SoCs are used for packet symbol detection, decoding, etc.

- At system startup, the FPGA must first be configured from its associated SPI Flash memory device. The same SPI flash device also contains code which will run on the TI DSPs. After the FPGA is configured, a state machine within the FPGA reads this code from the Flash memory, loads it into the DSP memory space, and starts the DSP.

- The V2.1 design includes a GPS receiver module to provide timing synchronization between geographically-dispersed gateways. The high-accuracy one-pulse-per-second (PPS) output from this receiver module maintains an accurate internal 250 MHz (4 ns period) timing counter within the FPGA. The GPS receiver and the associated high-speed counter were added specifically to enable a server-layer application to estimate the physical location of a node based on the Time Difference-of-Arrival (TDOA) of the same packet transmitted by the node at multiple (at least three) gateways. This TDOA geolocation scheme works successfully, but accuracy is limited by topography and the number of gateways providing timing information. Multi-path (reflected) signals constitute the primary challenge for this scheme since they arrive at different times based on the different path lengths.

- For this initial V2.1 release:

    V2.1 hardware supports geolocation.

    To get the fine timestamp for geolocation, you will need the AES keys. These can be obtained from Semtech, which has licensed the geolocation resolver software.

    Multitech supplies the chip ID that can be used by the network service providers for obtaining the AES keys.

The packet format of the LoRa V2.1 is not backward-compatible with the LoRa V1.5 packet format. Therefore, packet processing at the server layer (which sends/receive packets to/from LoRa gateways) fails for V2.1 packets if the code has not been upgraded to handle them. Our MultiTech server code has not been upgraded yet, and therefore cannot be used to process LoRa V2.1 packets. Therefore, if the customer does not have additional server-layer support, the MultiTech LoRa V2.1 gateway can only be used as a packet forwarder. Also, unlike the

previous LoRa V1.5 packet format (and packet processing source code), this information is not publicly available. Only LoRa operators or service providers having NDA agreements with Semtech currently have the information required for processing V2.1 packets.

# Chapter 2 – Specifications and Related Information

## Base Station Specifications

Base Station specifications depend on the hardware configuration for your model.

### All Models

| Category | Description |
|---|---|
| **General** | |
| USB | USB Port with Type A Receptacle, USB Interface is CDC-ACM compliant |
| SIM | Micro-SIM Holder |
| **Physical Description** | |
| Weight | **V1.5:** 5.15 lbs (2.34 kg) |
| | **V2.1:** 5.65 lbs (2.56 kg) |
| Dimensions | Refer to Dimension Drawing. |
| **Environment** | |
| *Operating Temperature | -30° C to +70° C |
| Humidity | 20%-90% RH, non-condensing |
| **Power Requirements** | |
| Input Power | Power over Ethernet 37-57 Volts DC. |

*Please consult with MultiTech if interested in extended temperatures.

## LoRa Specifications

Depending on the model, your device has one or two LoRa radios. If the model number includes -868/2 or -915/2, the device has two LoRa radios.

| Category | Description |
| --- | --- |
| **General** | |
| Standards | LoRaWAN 1.0.2 specifications |
| Radio Frequency | 915 MHz ISM band for US, AU, and Canada, 868 MHz for Europe, 865 MHz for India, 923 MHz for Japan, and 920 MHz for Korea |
| **Certifications and Compliance** | |
| EMC and Radio Compliance | EN 55032:2012 |
| | RSS-210 |
| | FCC 15.247 |
| | FCC 15.109 |
| | FCC 15.109(g) |
| | FCC 15.107 |
| | ICES-003 |
| | EN 61000-3-3:2013 |
| | EN 61000-3-2:2006 (Amended by A1:2009 and A2:2009) |
| | EN 55022:2010 |
| | EN 300 220-1 v3.1.1 |
| | EN 300 220-2 v3.1.1 |
| | EN 301 489-1 v2.2.0 |
| | EN301 489-3 V2.1.1 (2017-3) |
| Safety Compliance | UL 60950-1 2nd ED |
| | cUL 60950-1 2nd ED |
| | IEC 60950-1 2nd Ed. Am.1 and Am.2 |
| Environment | IEC/CSA/UL60950-22 and IP67 |

## -L4N1 Models

| Category | Description |
| --- | --- |
| **General** | |
| Standards | LTE FDD Cat 4, 3GPP release compliant |
| | HSPA+ 21/GPRS fallback |
| | USB Interface is CDC-ACM compliant |
| TCP/IP Functions | FTP, SMTP, SSL, TCP, UDP |

| Category | Description |
|---|---|
| Frequency Bands | 4G: B2, B4, B5, B12, B13, B14, B66, B71 |
| | 3G: B2, B4, B5 |
| **Speed** | |
| Data Speed | LTE: 150 Mbps downlink/50 Mbps uplink |
| | HSPA+: 42 Mbps downlink |
| **SMS** | |
| SMS | Point-to-Point messaging |
| | Mobile-Terminated SMS |
| | Mobile-Originated SMS |
| | SMS over IMS |
| **Certifications and Compliance** | |
| EMC and Radio Compliance | FCC Part 15 Class B |
| | FCC Part 22H, 24E, 27, 90 |
| Safety Compliance | UL 60950-1 2nd ED |
| | cUL 60950-1 2nd ED |
| Network Compliance | PTCRB |
| Carrier | AT&T/Verizon |

## -L4E1 Models

| Category | Description |
|---|---|
| **General** | |
| Standards | LTE FDD Cat 4, 3GPP release compliant |
| | HSPA+ 21/GPRS fallback |
| | USB Interface is CDC-ACM compliant |
| TCP/IP Functions | FTP, SMTP, SSL, TCP, UDP |
| Frequency Bands | 4G: B1, B3, B7, B8, B20, B28A |
| | 3G: B1, B3, B8 |
| | 2G: B3, B8 |
| **Speed** | |
| Data Speed | LTE: 150 Mbps downlink/50 Mbps uplink |
| | HSPA+: 42 Mbps downlink |

| Category | Description |
|---|---|
| **SMS** | |
| SMS | Point-to-Point messaging |
| | Mobile-Terminated SMS |
| | Mobile-Originated SMS |
| | SMS over IMS |
| **Certifications and Compliance** | |
| EMC and Radio Compliance | CE Mark, RED (EU) |
| Safety Compliance | IEC 60950-1 2nd ED |
| Environment | IEC/CSA/UL60950-22 and IP67 |

## -LAT1 Models

| Category | Description |
|---|---|
| **General** | |
| Standards | LTE 3GPP Release 9 |
| | HSPA+ 21/GPRS fallback |
| TCP/IP Functions | FTP, SMTP, SSL, TCP, UDP |
| Frequency Bands | 4G: 700 (B17)/850 (B5)/AWS 1700 (B4)/1900 (B2) |
| | 3G: 850 (B5)/1900 (B2) |
| | 2G: 850/1900 |
| **Speed** | |
| Data Speed | LTE: 100 Mbps downlink/50 Mbps uplink |
| | HSPA+: 21 Mbps downlink/5.76 Mbps uplink |
| **SMS** | |
| SMS | Point-to-Point messaging |
| | Mobile-Terminated SMS |
| | Mobile-Originated SMS |
| **Certifications and Compliance** | |
| EMC and Radio Compliance | FCC Part 15 Class B |
| | FCC Part 22, 24, 27 |
| Safety Compliance | UL 60950-1 2nd ED |
| | cUL 60950-1 2nd ED |
| | IEC 60950-1 2nd ED |
| Network Compliance | PTCRB |
| Carrier | AT&T |

| Category | Description |
|---|---|
| Environment | IEC/CSA/UL60950-22 and IP67 |

## -LEU1 Models

| Category | Description |
|---|---|
| **General** | |
| Standards | LTE 3GPP Release 9 |
| | HSPA+ 21/GPRS fallback |
| TCP/IP Functions | FTP, SMTP, SSL, TCP, UDP |
| Frequency Bands | Refer to the following Frequency Bands table for details. |
| **Speed** | |
| Data Speed | LTE: 100 Mbps downlink/50 Mbps uplink |
| | HSPA+: 42 Mbps downlink/5.76 Mbps uplink |
| **Interface** | |
| **SMS** | |
| SMS | Point-to-Point messaging |
| | Mobile-Terminated SMS |
| | Mobile-Originated SMS |
| **Certifications and Compliance** | |
| EMC and Radio Compliance | EN55032:2012 |
| | EN 301 511 v12.5.1 |
| | EN 301 908-1 v11.1.1 |
| | EN 301 908-2 v11.1.1 |
| | EN 301 489-1 v2.1.1 |
| | EN 301 489-52 v1.1.0 |
| | CE RED Radio/SAR |
| Safety Compliance | IEC 60950-1 2nd ED |
| | AS/NZS 60950.1 |
| Environment | IEC/CSA/UL60950-22 and IP67 |

## -LEU1 Frequency Bands

| Mode | Freq. TX (MHz) | Freq. RX (MHz) | Channels | TX - RX offset (MHz) |
|---|---|---|---|---|
| **EGSM900** | 890 - 915 | 935 - 960 | 0 - 124 | 45 |
| | 880 - 890 | 925 - 935 | 975 - 1023 | 45 |

| Mode | Freq. TX (MHz) | Freq. RX (MHz) | Channels | TX - RX offset (MHz) |
|---|---|---|---|---|
| **DCS1800** | 1710 - 1785 | 1805 - 1880 | 512 - 885 | 95 |
| **WCDMA850 (band V)** | 824 - 849 | 869 - 894 | Tx: 4132 - 4233 | 45 |
| | | | Rx: 4357 - 4458 | |
| **WCDMA900 (band VIII)** | 880 - 915 | 925 - 960 | Tx: 2712 - 2863 | 45 |
| | | | Rx: 2937 - 3088 | |
| **WCDMA2100 (band I)** | 1920 - 1980 | 2110 - 2170 | Tx: 9612 - 9888 | 190 |
| | | | Rx: 10562 - 10838 | |
| **LTE800 (band XX)** | 832 - 862 | 791 - 821 | Tx: 24150 - 24449 | -41 |
| | | | Rx: 6150 - 6449 | |
| **>LTE1800 (band III)** | 1710 - 1785 | 1805 - 1880 | Tx: 19200 - 19949 | 95 |
| | | | Rx: 1200 - 1949 | |
| **>LTE2600 (band VII)** | 2500 - 2570 | 2620 - 2690 | Tx: 20750 - 21449 | 120 |
| | | | Rx: 2750 - 3449 | |

## -LVW2 Models

| Category | Description |
|---|---|
| **General** | |
| Standards | LTE 3GPP Release 9 |
| | USB Interface is CDC-ACM compliant |
| TCP/IP Functions | FTP, SMTP, SSL, TCP, UDP |
| Frequency Bands | 4G: 700 (B13) / AWS 1700 (B4) |
| **Speed** | |
| Data Speed | LTE: 100 Mbps downlink/50 Mbps uplink |
| **SMS** | |
| SMS | Point-to-Point messaging |
| | Mobile-Terminated SMS |
| | Mobile-Originated SMS |
| **Certifications and Compliance** | |
| EMC and Radio Compliance | FCC Part 15 Class B |
| | FCC Part 27 |

| Category | Description |
|---|---|
| Safety Compliance | UL 60950-1 2nd ED |
| | cUL 60950-1 2nd ED |
| | IEC 60950-1 2nd ED |
| Carrier | Verizon |
| Environment | IEC/CSA/UL60950-22 and IP67 |

## -LAT3 Models

| Category | Description |
|---|---|
| **General** | |
| Standards | LTE FDD Cat 1, 3GPP release 9 compliant |
| | HSPA+ 21/GPRS fallback |
| | SMS is based on CS/Packet-Switched (PS) domain of GSM and WCDMA |
| TCP/IP Functions | FTP, SMTP, SSL, TCP, UDP |
| Frequency Bands | 4G: 700 (B12/B13)/850 (B5)/AWS 1700 (B4)/1900 (B2) |
| | 3G: 850 (B5)/1900 (B2) |
| **Speed** | |
| Data Speed | LTE: 10 Mbps downlink/5 Mbps uplink |
| | HSPA+: Up to 21 Mbps downlink/5.76 Mbps uplink |
| **Certifications and Compliance** | |
| EMC and Radio Compliance | FCC Part 15 Class B |
| | FCC Part 22, 24, 27 |
| Safety Compliance | UL 60950-1 2nd ED |
| | cUL 60950-1 2nd ED |
| Environment | IEC/CSA/UL60950-22 and IP67 |

## -LVW3 Models

| Category | Description |
|---|---|
| **General** | |
| Standards | LTE FDD Cat 1, 3GPP release 9 compliant |
| Frequency Bands | 4G: 1900 (B2) / 700 (B13) / AWS 1700 (B4) |
| **Speed** | |
| Data Speed | LTE: 10 Mbps downlink / 5 Mbps uplink |
| **Certifications and Compliance** | |

| Category | Description |
|---|---|
| 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 |
| Environment | IEC/CSA/UL60950-22 and IP67 |

# Dimensions

3.321 [84.35]

8.925 [226.70]    2.283 [58]

9.318 [236.68]

1.378 [35]

.195 [4.96]

3.545 [90.05]

0.369 [263.37]    8.925 [226.70]

1.248 [31.70]

2.861 [72.67]

DIMENSIONS IN In [mm]

8.650 [219.72]

10.106 [256.70]

MULTITECH
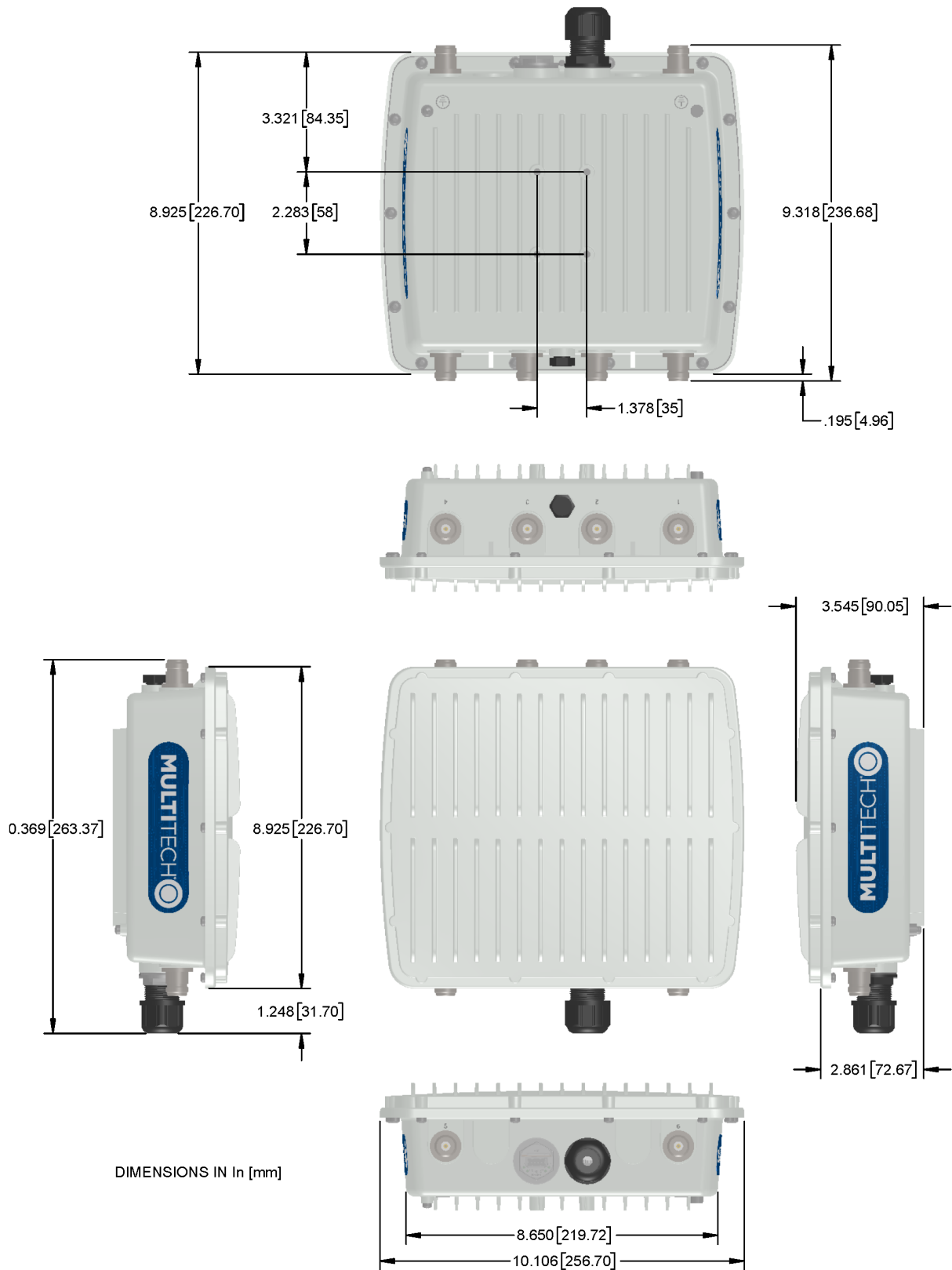
# LEDs and Connectors

## Connectors



Top View

Bottom View

1 LoRa  2 GPS  3 Wi-Fi Bluetooth  4 LoRa  5 Cell  6 Diversity  SIM Slot  Type A USB Connector  Ethernet Port  LEDs and Reset Button
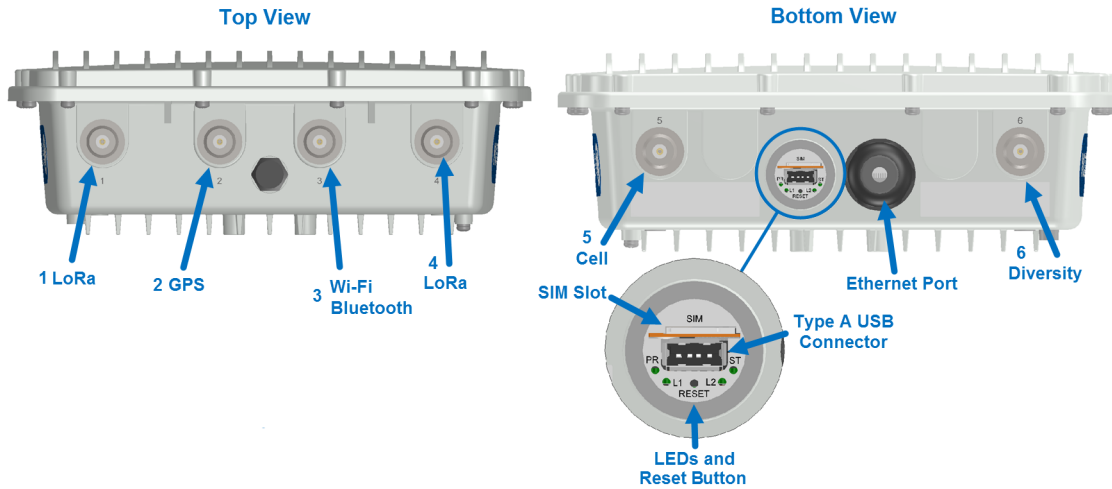
| # | Connector | Description |
|---|-----------|-------------|
| 1 | LoRa | Connector for LoRa antenna. If the model has only one LoRa card, attach the LoRa antenna to this connector. |
| 2 | GPS | Connector for GPS antenna. |
| 3 | Wi-Fi/Bluetooth | For Wi-Fi/Bluetooth models, use this connector for the Wi-Fi antenna. |
| 4 | LoRa | Connector for LoRa antenna. Used only if the model has two LoRa cards. |
| 5 | Cell | For cellular models, use this connector for an LTE antenna. |
| 6 | Diversity | For cellular models, use this connector for the second LTE antenna. |
| -- | USB | Type A USB connector. Behind plastic cover. |
| -- | Ethernet Port | Ethernet port with IP67 rated cable gland. |

## LEDs
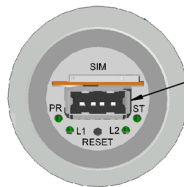


| Label | LED | Description |
|-------|-----|-------------|
| PR | Power | Green when powered up. |
| ST | Status | Red with blinking green. User programmable. |
| L1 | LoRa 1 | User-defined. Can be red or green. |
| L2 | LoRa 2 | |

### LED Programming Notes

#### mPower LED Notes

*For mPower models*

- The default state of the L1 and L2 LEDs depends on the cellular connection (connected/disconnected) and signal strength.
- To change the LED behavior modify the script /sbin/led_cd_ss.

#### mLinux LED Notes

*For mLinux models*

- The default state of the L1 and L2 LEDs is off.
- Users control L1 and L2 LEDs as follows:

**For L1:**

| Turn L1 Green | mts-io-sysfs store led-cd 1 |
|---|---|
| Turn L1 Red | mts-io-sysfs store led-sig1 1 |
| Turn L1 Off | mts-io-sysfs store led-cd 0 |
| | AND |
| | mts-io-sysfs store led-sig1 0 |

**For L2:**

| Turn L2 Green | mts-io-sysfs store led-sig2 1 |
|---|---|
| Turn L2 Red | mts-io-sysfs store led-sig3 1 |
| Turn L2 Off | mts-io-sysfs store led-sig2 0 |
| | AND |
| | mts-io-sysfs store led-sig3 0 |

## V1.5 Power Draw

Power draw for model MTCDTIP-LAT3-267A-915/2 with two LoRa cards and an LTE radio with power over Ethernet:

| Voltage | Cellular Call Box Connection No Data | Measured Current at Maximum Power[1] | TX Pulse [2](AVG) Amplitude Current for GSM850 or Peak Current for HSDPA | Total Inrush Charge[3] Measured in MilliCoulombs |
|---|---|---|---|---|
| 56.0 | 68 mA | 187 mA | 256 mA | 213 mC |
| 42.0 (Safety testing limit) | 88 mA | 246 mA | 316 mA | 230 mC |

**Note:**

[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.

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

## V2.1 Power Draw

Power draw for model MTCDTIP-LAT1-275L-915:

| Voltage | Radio Protocol | Sleep Mode Current (If Applicable | Cellular Call Box Connection No Data | IP Connection to Cellular Call Box with Data: (AVG) Measure Current at Max Power | TX Pulse (AVG) Amplitude Current for GSM850 or Peak Current for HSDPA | Total Inrush Charge Measured in Millicoulombs |
|---|---|---|---|---|---|---|
| 56.0 Volts | LTE | NA | 154 mA | 246 mA | 312 mA | 4.93 mC |
| 42.0 Volts (Safety Testing Limit) | LTE | NA | 207 mA | 332 mA | 404 mA | 4.4 mC |

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.).

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

Inrush Charge: The total inrush charge at power on.

## LE910 Telit Transmission Output Power

| Band | Power Class |
|------|-------------|
| GSM 850/900 MHz | 4 (2W) |
| DCS 1800, PCS 1900 MHz | 1 (1W) |
| EDGE, 850/900 MHz | E2 (0.5W) |
| EDGE, 1800/1900 MHz | Class E2 (0.4W) |
| WCDMA/FDD 800/850/900, 1900/2100 MHz | Class 3 (0.25W) |
| LTE FDD 700/800/850/900, 1800/1900/2100/2600 MHz | Class 3 (0.2W) |

## LoRa Transmission Output Power

### 868 Models

Max output 25 dBm

| Power | Frequency | On Power-up (dBm) | 18 Hours After Power-up (dBm) | Bandwidth |
|-------|-----------|-------------------|-------------------------------|-----------|
| 27 | 869.525 MHz | 24.18 | 25 | 125 kHz |
| 27 | 869.525 MHz | 24.18 | 24.83 | 250 kHz |

### 915 Models

Max output 27 dBm

| Power | Frequency | On Power-up (dBm) | 18 Hours After Power-up (dBm) | Bandwidth |
|-------|-----------|-------------------|-------------------------------|-----------|
| 26 | 923.3 MHz | 26.58 | 25.88 | 500 kHz |
| 26 | 925.1 MHz | 26.76 | 26.34 | 500 kHz |
| 26 | 927.5 MHz | 27.22 | 26.8 | 500 kHz |

## I2C Addresses

| Component | I2C Address (V2.1 Board) | I2C Address (48-Channel Extension Board) | I2C Address (Processor Board) | Comments |
|-----------|--------------------------|------------------------------------------|-------------------------------|----------|
| TCA9535 I/O Expander | 0100000 | 0100001 | | |
| LM 75AIM Temp Sensor | 1001001 | 1001011 | | |
| LPS25HB Pressure Sensor | 1011100 | 1011101 | | |

| Component | I2C Address (V2.1 Board) | I2C Address (48-Channel Extension Board) | I2C Address (Processor Board) | Comments |
|---|---|---|---|---|
| 24C04 EEPROM | | | 101011x | LSB is A8 memory address bit |
| TMP102A Temp Sensor (U2) | | | 1001000 | |
| TMP102A Temp Sensor (U94) | | | 1001001 | Not populated |
| TMP102A Temp Sensor (U95) | | | 1001010 | Not populated |
| TMP102A Temp Sensor (U96) | | | 1001011 | Not populated |
| GPS Receiver | | | 1000010 (default) | Can be changed by software |

## IO Exp V2.1 Board

| Pin Name | Signal Name | Direction | Comments | Where Used |
|---|---|---|---|---|
| P00 | FPGA_nCE | Output | FPGA configuration chip enable (active low) | V2.1 board |
| P01 | FPGA_nCONFIG | Output | Pull low to begin FPGA configuration | |
| P02 | FPGA_RSTn | Output | Input to FPGA | |
| P03 | GPS_RSTn | Output | Input to FPGA | |
| P04 | | | | |
| P05 | FPGA_CONF_DONE | Input | Goes high to indicate the FPGA configuration is complete (V2.1 board) | |
| P06 | | | | |
| P07 | | | | |
| | | Output | | |
| P10 | CPU_EPCS_EN | Output | Enables SPI programming data to V2.1 band | |
| P11 | EXT_EPCS_EN | | Enables SPI programming data to 48-channel extension board | |

| Pin Name | Signal Name | Direction | Comments | Where Used |
|---|---|---|---|---|
| P12 | | | | 48-Channel extension board |
| P13 | | | | |
| P14 | FPGA_EXT_RSTn | Output | Input to FPGA on 48-channel extension board | |
| P15 | EXT_SPI_PROG | NA | Not used (test point on 48-channel extension board only | |
| P16 | EXT_CONF_DONE | Input | Goes high to indicate the FPGA configuration is complete (48-channel extension board) | |
| P17 | | | | |

Outputs are active-low.

# Chapter 3 – Antennas

## Antenna

Depending on the model, your Base Station ships with one or more of the following antennas.

## Pulse Omnidirectional Antenna

| | |
|---|---|
| Manufacturer: | Pulse |
| Description: | Omnidirectional antenna 806-960/1710-2170 MHz radome |
| Model Number: | RO8063/21704NM |

### Antenna Specifications

| Category | Description |
|---|---|
| Frequency Range | 806-960 MHz |
| | 1710-2170 MHz |
| VSWR | 2.5:1 Max |
| Gain, Maximum | 3.0 dBi ± 1 dB at 806-960 MHz |
| | 4.0 dBi ± 1 dB at at 1710-2170 MHz |
| Polarization | Vertical |
| Impedance | 50 Ω |
| Radiation Pattern | 3 dB Beamwidth |
| Horizontal Plane | Omni |
| Vertical Plane - 806-960 | 53° Avg |
| Vertical Plane – 1710-2170 | 39° Avg |
| Dimensions | 15.28 inches (388.5 mm) x 1.45 inches (36.9 mm) |

## GTT IP67 GPS/GLONASS Antenna

| | |
|---|---|
| Manufacturer: | GTT |
| Description: | IP67 GPS/GLONASS Antenna |
| Model Number: | OE-GPSGLO-016-CN |

## Antenna Specifications

| Category | Description |
| --- | --- |
| Frequency Range | 1575 – 1615 MHz |
| Bandwidth (10 dB return loss) | 43 MHz typ. |
| Gain at Zenith | 2.4 dBic @ 1575MHz |
|  | 42.85 dBic @ 1602MHz |
| Polarization | RHCP |
| Dimensions | Diameter: 2.17 inches (55 mm) |
|  | Length: 2.52 inches (64 mm) excluding connector |

# GTT IP67 Wi-Fi Antenna

Manufacturer:        GTT

Description:        IP67 Wi-Fi Dual-Band N Type Antenna

Model Number:        OS-ISMDB-0507-CO

## Antenna Specifications

| Category | Description |
| --- | --- |
| Frequency Range | 2.4 - 2.5 GHz |
|  | 5.15 -5.875 GHz |
| VSWR | 2.0: 1 Max |
| Radiation | Omni |
| Gain, Maximum | 4 dB at 2.4 GHz |
|  | 6 dB at 5 GHz |

| Category | Description |
|---|---|
| Polarization | Linear, vertical |
| Impedance | 50 Ω |
| Antenna Efficiency | 60% Minimum |
| Dimensions | 0.9 inches (22 mm) x 7.0 inches (178 mm) excluding connector |

# GTT LTE N Type Antenna

Manufacturer:                    GTT

Description:                      LTE N Type Antenna

Model Number:                    OS-LTE-11-CO

## Antenna Specifications

| Category | Description |
|---|---|
| Frequency Range | 690-960 MHz |
| | 1710-2170 MHz |
| | 2500 -2690 MHz |
| VSWR | 3.5:1 Max |
| Gain, Maximum | 1.1 dB at 690-960 MHz |
| | 3.5 dB at 1710-2170 MHz |
| | 1.9 dB at 2500 -2690 MHz |
| Polarization | Linear, vertical |
| Impedance | 50 Ω |
| HPBW- Horizontal | 360° |
| HPBW - Vertical | 60° |
| Dimensions | 0.9 inches (22 mm) x 7.0 inches (178 mm) excluding connector |

# Chapter 4 – 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 Notice

Per FCC 15.19(a)(3) and (a)(4) 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.

This device is open development based product that contains a sub GHz radio technology. MultiTech has certified for compliance with US and Foreign compliance bodies including FCC, R&TTE and others. (e.g. FCC 15.247:2015 & IC RSS-210:2010)

MultiTech provides software code meant to operate the radio to a level that maintains compliance with the operating modes under which these radio devices were certified. To ensure this level of compliance, the software code is provided in binary form only. Users are prohibited from making any changes that affect the operation of the radio performance. Accessing or controlling the radio through any means other than the provided binary software will require the user to obtain their own intentional radiator license from the certification body governing their locality, as all pre-certification provided with Conduit Base Station IP67 mDot will have been made invalid.

## 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.

# EMC, Safety, and R&TTE Directive (RED) Compliance

$C \in$

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

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

> and
> Council Directive 2014/35/EU on the harmonization of the laws of Member States relating to Electrical Equipment designed for use within certain voltage limits.

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

# Chapter 5 – Safety Notices

## Installation Safety

This information is also available in the Installation Guide.

## ⚠ Warnings and ⚠ Cautions

Warning and Caution symbols mean potential danger. You are in a situation that could cause bodily injury. Before working on any equipment, be aware of hazards in the installation area and be knowledgeable about electrical circuitry. Be familiar with standard practices for preventing accidents.

For translations of key cautions and warnings, refer Appendix A.

⚠

**Warning:** Only trained and qualified personnel should install, replace, or service this equipment. Installation must comply with local and national electrical codes.

- When installing or replacing the unit, the ground connection must always be made first and disconnected last.

- Disconnect POE power (Ethernet POE port) before servicing IP67 Base Station.

- Do not work on the system or connect or disconnect cables during periods of lightning activity.

- This device is not designed or approved to be used in any Hazardous Locations. Do not install or operate device if area is known to be an explosive environment.

- Externally ground this equipment using a customer-supplied ground wire before applying power. Contact an electrician if you are uncertain that suitable grounding is available. Refer to Installing the Ground Wire instructions. < All wall mounting installations are subject to the acceptance of local jurisdiction.

- Do not locate antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, because they may cause serious injury or death. For proper installation and grounding of the antenna, please refer to national and local codes.

⚠

**CAUTION:**

Power over Ethernet (PoE) Certification does not apply or extend to voltages outside of standard PoE range. Any PoE voltages beyond 0vdc to 60Vdc have not been evaluated by UL or MULTITECH. Nominal PoE voltage is 48Vdc to 57 VDC. The end user supplies the PoE cable. If the cable is to be used outdoors, the cable must be certified for outdoor or burial use.

For models:

MTCDTIP-270x-xxx, MTCDTIP-275x-xxx

- Recommended PoE: 802.3bt-compliant Type 4 Class 7 Power-over-Ethernet (PoE) Powered Devices (PDs) and require PoE Power Supply Equipment (PSE) that is 802.3bt-compliant with minimum 60W output power capability.

For models:

MTCDTIP-266x-xxx, MTCDTIP-xxx-266x-xxx, MTCDTIP-267x-xxx, MTCDTIP-xxx-267x-xxx

- Recommended PoE: 802.3at-compliant Type 2 Class 4 Power-over-Ethernet (PoE) Powered Devices (PDs) and require PoE Power Supply Equipment (PSE) that is 802.3at-compliant with minimum 25.5W output power capability.

Ethernet port is not designed to be connected to a public Telecommunication (PSTN) or any other connection other than IEEE 802.3-2012 power over Ethernet devices.

Do not remove product labels.

**Warning:**

HOT SURFACE DO NOT TOUCH

Note: This symbol is included on the serial label. UL evaluated this device to a safety and outdoor certification temperature of -30c to +70c.

# Lithium Battery

- A lithium battery (3V, coin cell, CR1632) located within the product provides backup power for the timekeeping. This battery has an estimated life expectancy of ten years.
- When this battery starts to weaken, the date and time may be incorrect.
- Battery is not user replaceable. If the battery fails, the device must be sent back to MultiTech Systems for battery replacement.
- Lithium cells and batteries are subject to the Provisions for International Transportation. Multi-Tech Systems, Inc. confirms that the Lithium batteries used in the MultiTech product(s) referenced in this manual comply with Special Provision 188 of the UN Model Regulations, Special Provision A45 of the ICAO-TI/IATA-DGR (Air), Special Provision 310 of the IMDG Code, and Special Provision 188 of the ADR and RID (Road and Rail Europe).

**CAUTION:** Risk of explosion if this battery is replaced by an incorrect type. Dispose of batteries according to instructions.

**Attention:** Risque d'explosion si vous remplacez la batterie par un modèle incompatible. Jetez les piles usagées selon les instructions.

# User Responsibility

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

# 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 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.

## 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.

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

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

Compliance of the device with the FCC, EU and IC rules regarding RF Exposure was established and is given with the maximum antenna gain as specified above for a minimum distance of 35 cm between the devices radiating structures (the antenna) and the body of users. Qualification for distances closer than 35 cm (portable operation) would require re-certification.

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

## 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.

## 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).

# Chapter 6 – Environmental Notices

## Waste Electrical and Electronic Equipment Statement

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

### WEEE Directive

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

### Instructions for Disposal of WEEE by Users in the European Union

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

July, 2005



## Restriction of the Use of Hazardous Substances (RoHS)

**Multi-Tech Systems, Inc.**

**Certificate of Compliance**

**2015/863**

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

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.

# REACH Statement

## Registration of Substances

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

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

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

依照中国标准的有毒有害物质信息

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

有害/有毒物质/元素

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

**X** 表示所有使用类似材料的设备中有害/有毒物质的含量水平高于 SJ/Txxx-2006 限量要求。
**O** 表示不含该物质或者该物质的含量水平在上述限量要求之内。

# Information on HS/TS Substances According to Chinese Standards

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

**Hazardous/Toxic Substance/Elements**

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

**X** Represents that the concentration of such hazardous/toxic substance in all the units of homogeneous material of such component is higher than the SJ/Txxx-2006 Requirements for Concentration Limits.
**O** Represents that no such substances are used or that the concentration is within the aforementioned limits.