Cellular LTE910XF CAT-M1 Socket XF Footprint Modem User Manual
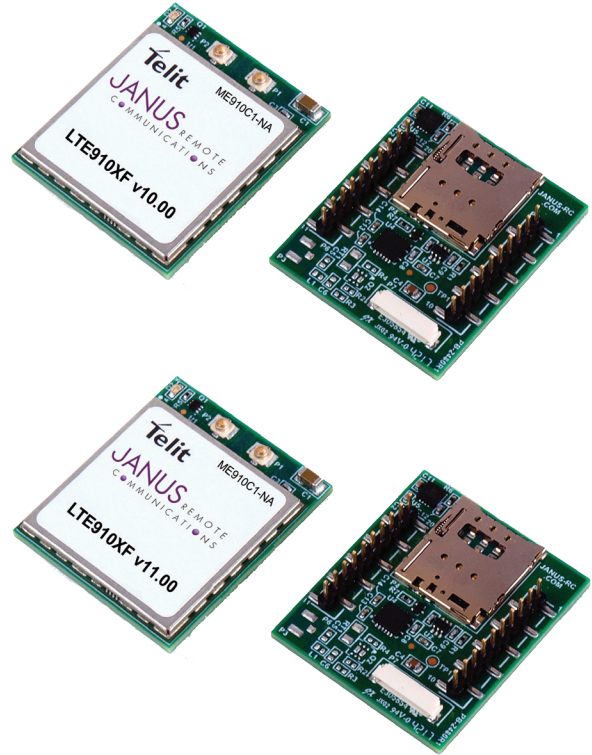

JANUS REMOTE COMMUNICATIONS

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DISCLAIMER

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1. INTRODUCTION

1.1 Ordering Part numbers

Ordering Information	Description
LTE910XF v10.00	LTE Cat M1 Plug-In Modem AT&T, T-Mobile
LTE910XF v11.00	LTE Cat M1 Plug-In Modem Verizon

1.2 Additional Resources

The following documents or documentation resources are referenced within this document.

Telit ME910C1 Hardware User Guide

Telit ME910C1 AT Commands Reference Guide

Telit Single SKU AT Command Application Note

Janus Application Note 117 - FOTA (Firmware Over The Air)

1.3 LTE910XF Product Overview

Add robust, scalable, cellular connectivity to your IoT hardware solutions with the Janus line of "X" footprint (industry standard 20- pin connector) Socket Modems. Our Extensive experience in designing and manufacturing embedded radio solutions, along with our commitment to quality and reliability, makes the LTE910XF CAT.M1 cellular modem the most cost effective and flexible end device certified cellular modem available in the market today. It supports multiple LTE bands and fallback capability minimizing costs of hardware and network access. "End device" certification allows users to integrate any certified cellular XF modem into their application with no further carrier certification requirements, giving customer the quickest go-to-market option for their end solutions.

1.4 Block Diagram

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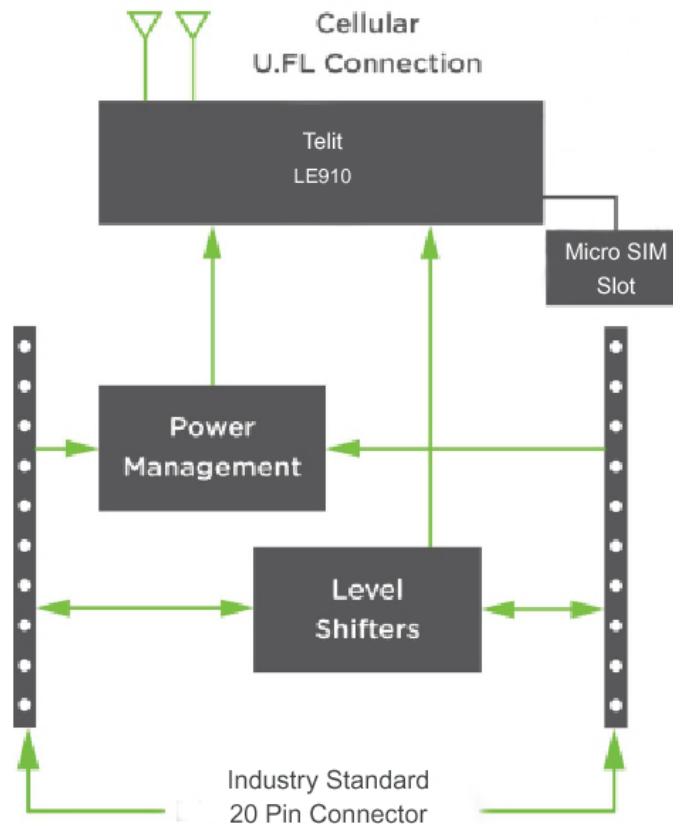
2. TECHNICAL SPECIFICATIONS

2.1 Electrical Specifications

2.1.1 Absolute Maximum Ratings

Parameter Signal	Signal	Maximum Rating
Main Power Supply	VCC	6.3V
I/O Voltage Reference	VREF	6.5V

2.1.2 Recommended Ratings & Module Pin out

2.1.2.1 Connectors J1 and J2

Pin	Name	Direction	Description	Min	Typical	Max	If not used
1	VCC	Input	Main Power supply	3.5V	3.9V	5.5V	Must be implemented
2	DOUT	Output	UART data out, I/O level tied to VREF	VOL: GND to 0.55V		VOH: VREF x 0.67 to VREF	Must be implemented if USB not used, No connection
3	DIN	Input	UART data in, I/O level tied to VREF	VIL: GND to 0.15V		VIH: VREF-0.4 V to VREF	Must be implemented if USB not used, No connection
4	GND	Input	Ground Pin		0		Must be implemented
5	RESET_nIN	Input	Controls HW_SHUTDOWN input on Telit module, tie low for 200mS and released to activate. Internally pulled up to VCC. Drive with open collector output. Assert only in an emergency as the module will not gracefully exit the cellular network when asserted.		VREF		No Connection
6	VUSB	Input	Supply for USB interface	4.4V	5V	5.25V	No connection
7	USB_D+	I/O	USB differential Data + signal				No connection
8	USB_D-	I/O	USB differential Data - Signal				No connection
9	DTR	Input	Modem Data Terminal Ready input	VIL: GND to 0.15V		VIH: VREF-0.4 V to VREF	Tie to GND
10	GND	Input	Ground Pin		0		Must be implemented
11	GND	Input	Ground Pin		0		Must be implemented
12	CTS	Output	Modem Clear to Send hardware flow control output	VOL: GND to 0.55V		VOH: VREF x 0.67 to VREF	No Connection
13	ON/nSLEEP	Output	Signal drives the onboard LED indicating network status. OFF = Device OFF, Fast blink = Searching for Network & Not Registered, Slow Blink = Registered wtih full service, Permanently on = call is active. See Telit AT Command Guide for additional information.	0		1.8V	No Connection
14	VREF	Input	Voltage reference for offboard I/O signals. This signal drives the input voltage side of an onboard buffer which converts all external I/O voltage from VREF range to 1.8V range to drive the onboard Telit module.	1.8V	1.8V or 3.3V	5.5V	Must be Implemented
15	GND	Input	Ground Pin		0		Must be implemented

2. TECHNICAL SPECIFICATIONS continued

2.1 Electrical Specifications

2.1.2 Recommended Ratings & Module Pin out
2.1.2.1 Connectors J1 and J2 continued....

Pin	Name	Direction	Description	Min	Typical	Max	If not used
16	RTS	Input	Modem Request to Send hardware flow control input	VIL: GND to 0.15V		VIH: VREF-0.4 V to VREF	Tie to GND
17	DIO3	I/O	Programmable GPIO_03 on Telit module	0		1.8V	No connection
18	DIO2	I/O	Programmable GPIO_02 on Telit module	0		1.8V	No connection
19	ADC1	Input	ADC_IN1 input on Telit module (10bit resolution, <1.8mV)	0		1.8V	No connection
20	ON_OFF	Input	Modem On/Off signal. Assert low for at least 5 seconds and then release to activate start sequence. Drive with open collector output. Internally pulled up to internal I/O rail with pull up. Do not use any external pull ups. Note: If you want modem to turn on automatically when power is applied, permanently tie this signal to GND.	0		1.8V	Must be implemented

2.1.2.2 Connectors P4, P1, P3

Connector Designator	Description	Connector Location
P4	Micro SIM Connector	Bottom Side of Module
P1	Primary Antenna Connection	Topside of Module
P3	GPS/GNSS Satellite Receiver	Bottom Side of Module

2.1.2.3 Power Consumption [1,2]

Mode		Network	Average Current (mA)	Notes
Idle modes				
Off			1	
TX/RX disabled	+CFUN=4	n/a	12	Not registered on network
Idle	+CFUN=1	LTE	14	Normal mode, full function
Power Saving	+CFUN=5	LTE	3.3	0.64s DRx
Power Saving	+CFUN=5	LTE	2.4	1.28s DRx
Power Saving	+CFUN=5	LTE	2.1	2.56s DRx
Operative Modes				
Data call		LTE	112	Tx=0dBm
Data call	Maximum power	LTE	190	Tx=23dBm

Note 1: These figures are derived from the component data sheets including the Telit Hardware User Guide. Per Telit, "The reported values are an average among all the product variants and bands for each network wireless technology." Results can vary depending network conditions.

Note 2: Power consumption figures are with on-board Status LED disabled.

2. TECHNICAL SPECIFICATIONS continued

2.2 Mechanical Specifications

2.2.1 Mechanical Characteristics

Parameter	Typical	Unit	Note
Dimensions (excluding pin height, for solder to board applications)	1.14" x 1.3" x 0.256	Inches	
Dimensions (including pin height, for board to board connector applications)	1.14" x 1.3" x 0.422	Inches	
Weight	9	Grams	
Connector Insertion/Removal	Hundreds	Cycles	

2.2.2 Mating Connectors

Connector Designator	Manufacture	Populated On Modem	Recommended Mate	Mate Manufacture
J1, J2	3M	951110-2530-ARPR	950510-6102-AR	3M
			Acceptable Alternate NPPN101BFCN-RC	Sullins Connector Solutions
P4	JAE	SF56S006V4B	Micro SIM Card (3FF)	Cellular Carrier
P1, P3	Hirose	U.FL-R-SMT(10)	CAB.011	Taoglas

2.2.3 Device Placement

Make sure the LTE910XF is installed in the correct orientation; failure to do so will damage the device and void the warranty.

2.3 Environmental Specifications

Parameter	Min	Typical	Max	Unit	Note
Operating Temperature	-40	25	+85	°C	
Storage Temperature	-40	25	+85	°C	
Operating Humidity	20		90	%	Non-condensing

3. IMPORTANT DESIGN CONSIDERATIONS

3.1 ON_OFF Signal

To conserve power, the Telit module does not automatically start up when power is applied. The baseboard design must supply a means to assert the ON_OFF signal for the specified time (at least 5 seconds) and then released to start-up the module. After asserting the ON_OFF signal, software must wait for 15 seconds before attempting to communicate with the Telit module. To make module automatically start when power is applied, tie ON/OFF signal to GND permanently. See Telit Hardware User Guide for additional details regarding the ON_OFF signal.

3.2 Power Supply Requirements

The equipment must be supplied by an external limited power source in compliance with the clause 2.5 of the standard IEC-60950-1. The Telit module will regularly consume high amounts of current on the Main Power Supply (VCC), up to 2A during active transmits and receives. The baseboard power supply should be designed to support peak currents up to 2 Amps. A 100uF capacitor should be placed near the VCC pin on the module to ensure ample energy is available, with a low inductance path to the VCC pin. For example power supply designs, there are multiple references available. See the Telit Hardware User Guide which has an example of both Linear and Switching regulator designs.

3.3 Serial Communications

The Telit module can communicate over UART and/or USB. Design should implement one or both serial interfaces to be able to send commands to the modem.

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3. IMPORTANT DESIGN CONSIDERATIONS continued

3.4 Network Connection Status LED

The ON/nSLEEP signal on pin 13 drives the on-board LED indicating network status. By default, the LTE module has this setting disabled. Use the following commands to enable and save this feature.
First, configure the GPIO for alternate function:

> **AT#GPIO = 1,0,2**

The modem should respond with:

> **OK**

Next, set the desired LED behavior with this command:

> **AT#SLED=2,10,10**

The modem should respond with:

> **OK**

Finally, commit the changes to non-volatile memory so the setting will persist across power down/power up:

> **AT#SLEDSAV**

The modem should respond with:

> **OK**

LED Status	Network Status Indication
Permanently OFF	Device OFF or setting disabled (see above)
Permanently ON	Searching for Network & Not Registered
Slow Blinking	Registered with full service
Permanently ON	Call is active (Modem has been registered)

3.5 FOTA

> The certification of the following devices for use on the Verizon Wireless network REQUIRES that the end user implement an automated FOTA procedure on their devices that would allow the cellular module firmware to be updated if required:
>
> | | |
> |---|---|
> | LTE910CF V3.0 | LTE910XF V6.0 |
> | LTE910CF V6.0 | LTE910XF V8.0 |
> | LTE910CF V11.0 | LTE910XF V11.0 |
>
> Failure to implement an automated FOTA procedure violates the certification requirements of the cellular modem and may result in units becoming unusable on the cellular network in the future. Your end device must support the firmware over the air update for the cellular modem
>
> You may use your own FOTA system to update the cellular modem firmware over the air. You may also be able to use the Verizon Wireless FOTA system, and FOTA services may be available from other 3rd party vendors.
>
> To inquire about Verizon Wireless FOTA system information and technical specifications,
> contact VZW.FOTA-Services@VerizonWireless.com

See Janus Application Note 117 – FOTA (Firmware Over The Air)

3.6 Firmware Selection

The LTE910XF V10.00 and V11.00 use the Telit ME910-NA Single SKU module which has firmware to support both AT&T/T-Mobile/Canada and Verizon cellular networks.
The firmware load can be changed by issuing command **AT#FWSWITCH=<image_number>,1** where <image_number> is 0 for AT&T/T-Mobile/Canada (V10.00 version) and 1 for Verizon (V11.00 version). The module will automatically reboot with the new firmware image. Current firmware status can be checked with the **AT#FWSWITCH?** command. The response will be **#FWSWITCH: <image_number>** where <image_number> is as described above.
Note than normally different SIM cards will be required for operation under the different carrier versions.

More information can be found in the Telit Single SKU AT Command Application Note.

4. MOUNTING GUIDELINES

The LTE910XF embedded cellular modem supports multiple connection methods, the two primary methods are board to board connectors and soldering directly to the baseboard.

4.1 Board to Board connectors approach

The Standard Industry 20-pin form factor calls for two, 10 pin, 2mm pitch female receptacles.
There are many connector manufacturers that can be used; below is one readily available product:
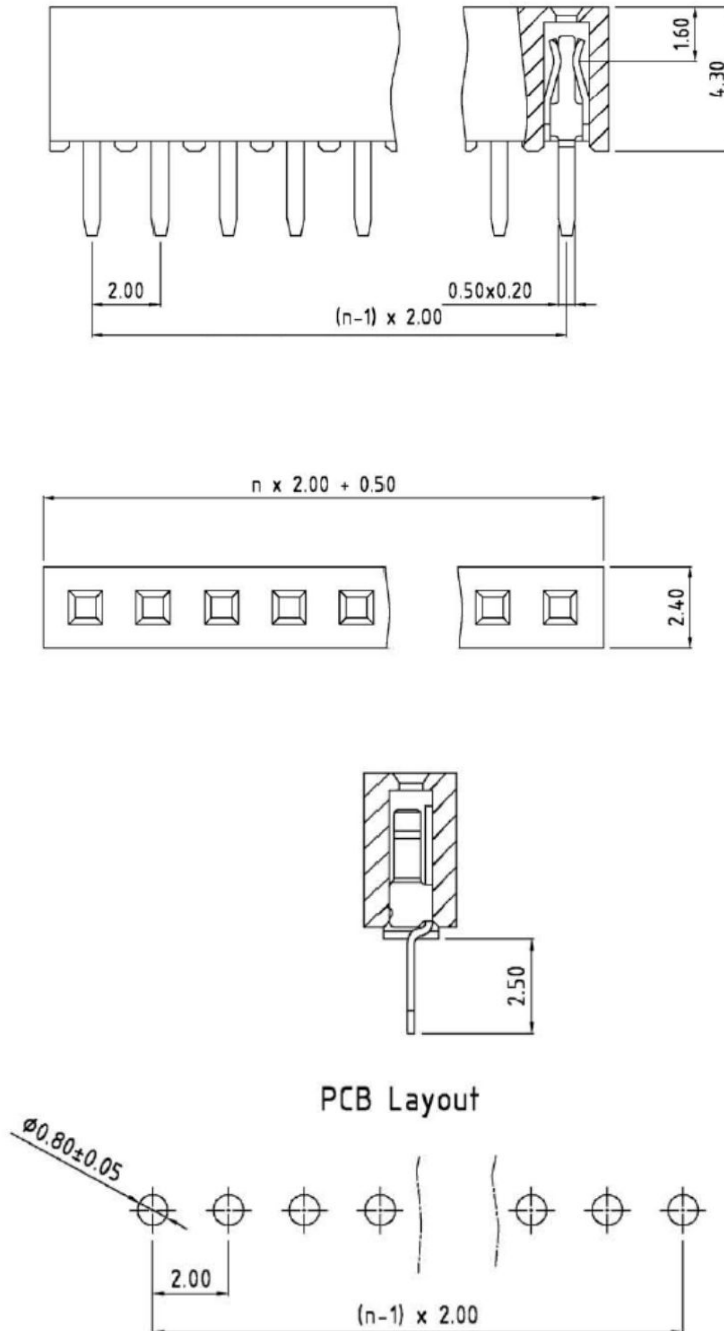
Manufacturer: 3M   Alternate: Sullins Connector Solutions
Part Number: 950510-6102-AR   Alternate P/N: NPPN101BFCN-RC

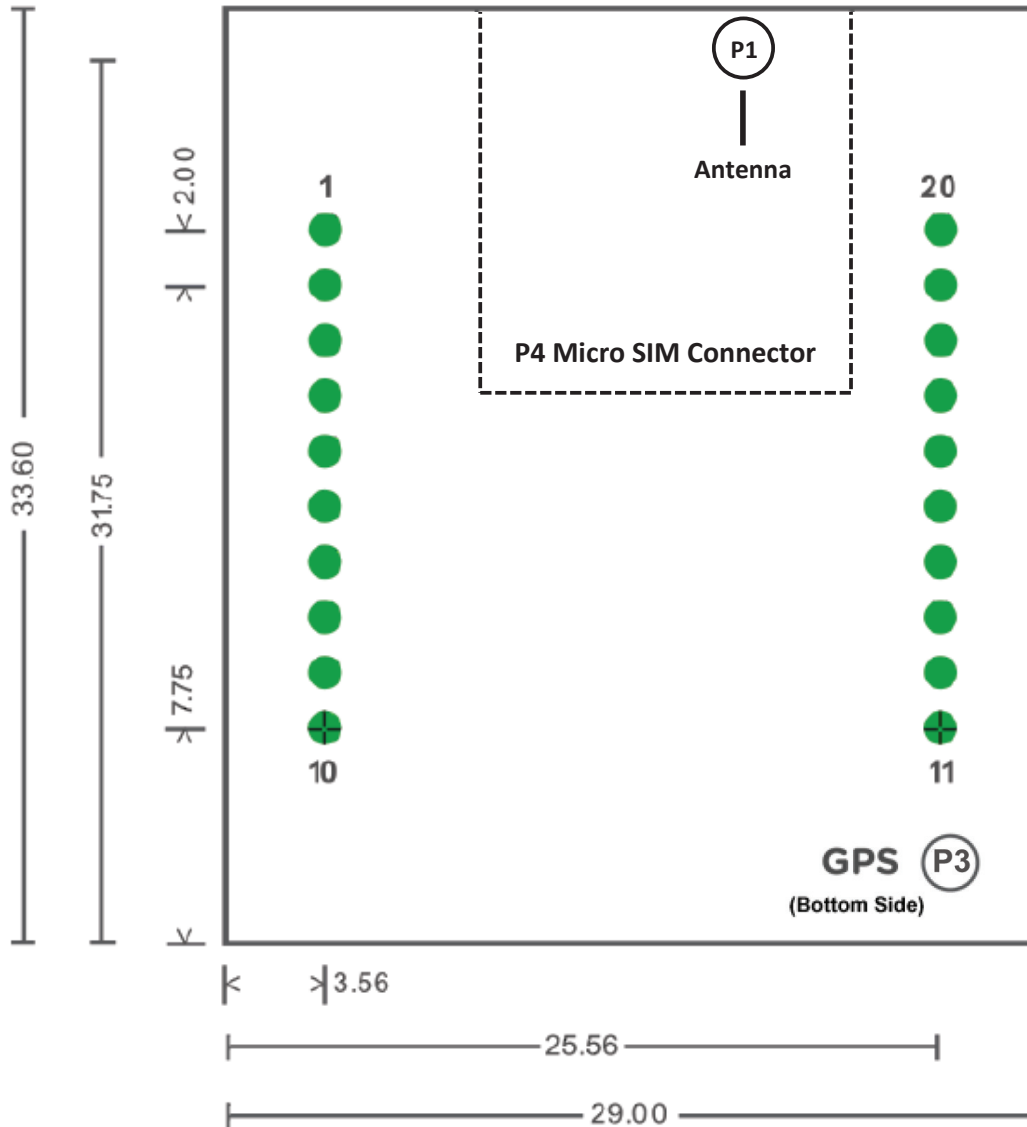Typical part drawing and footprint information:

4. MOUNTING GUIDELINES continued

### 4.2 Solder to Board Connection Approach

The module can be soldered directly to a PCB. The PCB should be designed with two rows of ten, 0.8mm plated thru holes spaced 2mm apart. The two rows should be 22mm apart. See drawing for recommended footprint. U.FL locations are marked with circles, P1 and P2 on top side of board, P4 is Micro SIM card connector on bottom side of board.
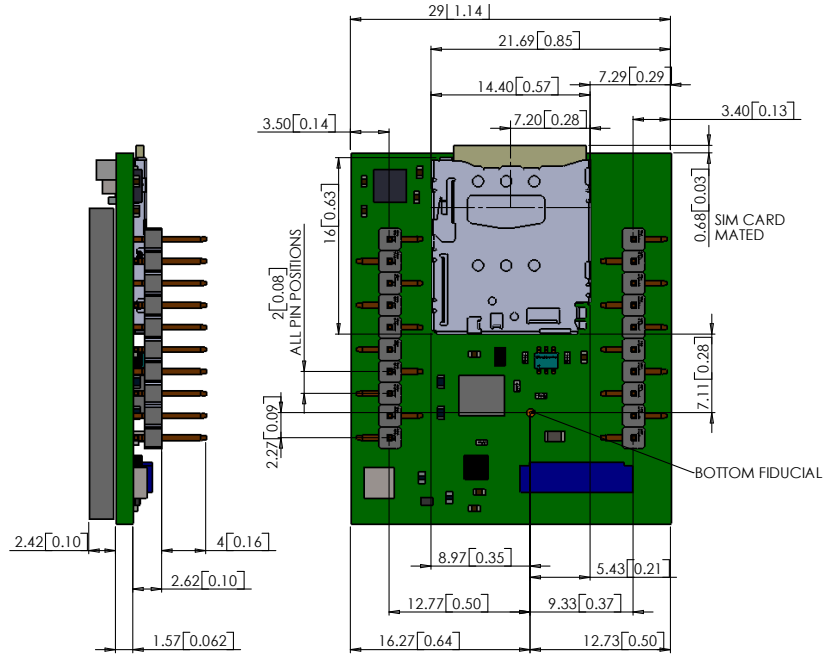
TOP VIEW

4.3 Mechanical Dimensions

TOP FIDUCIAL

TOP VIEW
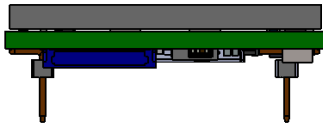
BOTTOM FIDUCIAL

SIM CARD MATED
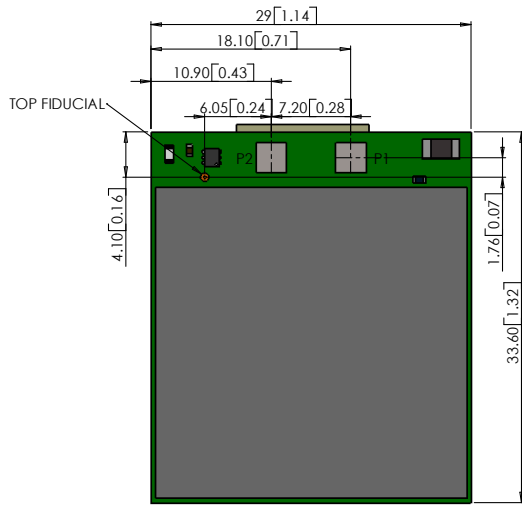
BOTTOM VIEW

Dimensions: mm
[inches]

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5. ANTENNA CONSIDERATIONS

5.1 Cellular Antenna Requirements

These tables are copied from Telit LE910 V2 Hardware User Guide. Designers should review latest LE910 V2 Hardware User Guide to ensure the information is up to date.

Antenna Requirements	
Frequency Range	Depending by frequency band(s) provided by the network operator, the customer shall use the most suitable antenna for that/those band(s).
Bandwidth	140 MHz in LTE Band 2 445 MHz in LTE Band 4 47 MHz in LTE Band 12 41 MHz in LTE Band 13
Impedance	50 ohm
Input Power	>24Bm Average power
VSWR Absolute Maximum	$\leq$ 10:1 (limit to avoid permanent damage)
VSWR Recommended	$\leq$ 2:1 (limit to fulfill all regulatory requirements

5.2 Recommended Cellular Antenna

Type	Manufacturer	Part Number
Antenna	Taoglas[1]	TG.30.8113

Note 1 : U.FL to SMA adapter required.

5.3 GPS/GLONASS Antenna Requirements

Frequency range	1559.0 ~ 1610.0 MHz
Gain	20 ~ 30dB
Impedance	50 ohm
Noise Figure of LNA	< 1.5 (recommended)
VSWR	$\leq$ 3:1 (recommended)

6. CERTIFICATIONS

6.1 Carrier Specific

LTE910XF V10.00 (PTCRB, AT&T)
LTE910XF V11.00 (Verizon) Pending

6.2 Geography Specific

Federal Communications Commission (FCC47) part 22, 24
Complies with FCC47 Part 15 Class B Radiated and Conducted Emissions

7. FEDERAL REGULATORY LICENSING

7.1 Export Control Classification Number (ECCN)

ECCNs are five character alpha-numeric designations used on the Commerce Control List (CCL) to identify dual-use items for export control purposes. An ECCN categorizes items based on the nature of the product, i.e. type of commodity, software, or technology and its respective technical parameters.

All LTE910XF Modems: 5A992.a

7.2 Harmonized Tariff Schedule Code

HTS Code: 8517.62.0010

8. END PRODUCT LABELING REQUIREMENTS

LTE910XF V10.00 -   Contains FCC ID: RI7ME910C1NA
LTE910XF V11.00 -   Contains FCC ID: RI7ME910C1NV
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 interferences, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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