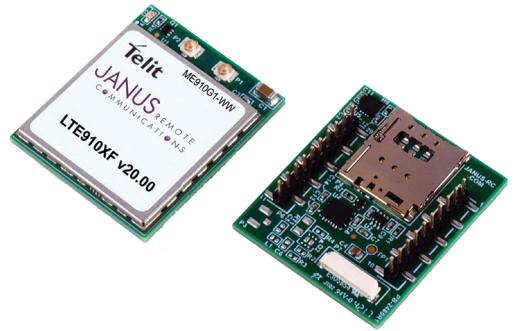


LTE910XF v20.00 CAT-M1/NB-IOT Embedded Cellular Modem Manual



JANUS REMOTE
COMMUNICATIONS

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TABLE OF CONTENTS

TABLE OF CONTENTS and DISCLAIMER	2
1 APPLICABILITY TABLE	3
2 REFERENCES	3
2.1 Janus Document List.....	3
2.2 Telit Document List.....	3
3 OVERVIEW	4-6
3.1 Introduction	4
3.2 Preview	4
3.3 Features.....	5
3.4 Block Diagram	5
3.5 FOTA Notice	6
4 INTERFACES.....	6-11
4.1 UART Interface Voltage Selection	6
4.2 Serial Interface.....	7
4.3 Power Supply	8
4.4 Audio Interface	8
4.5 Pin-Out	8
4.6 GPIO Details	9
4.7 Analog to Digital Converter	10-11
4.8 Internal Interfaces.....	11
4.9 RF Interface	11
4.10 SIM Card Interface	11
4.11 Header Interface Mounting Options	11
5 LTE910XF TECHNICAL SPECIFICATIONS	12-16
5.1 Electrical Specifications	12-15
5.2 Mechanical Specifications.....	16
6 OPERATION	17-21
6.1 Powering ON/OFF	17
6.2 Communicating with the Modem	17
6.3 Testing Communications	17
6.4 Cellular Network Communications.....	17-19
6.5 Data Communications.....	19-20
6.6 SMS.....	20
6.7 GNSS.....	20
6.8 Firmware Selection	21
7. DESIGN CONSIDERATIONS.....	21
7.1 Minimum Required Module Pin Connects.....	21
7.2 Software Debug.....	21
7.3 Hardware Debug	21
APPENDICES.....	22-23
Approvals	22
Antenna Care and Replacement	22
Abbreviations.....	22
Ordering Information	23
Revision History.....	23

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1 APPLICABILITY TABLE

Product	Part Number
LTE910XF	v20.00

2 REFERENCES

2.1 Janus Document List

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

2.2 Telit Document List

Our modem uses Telit ME910G1-WW cellular module.

Please refer to Telit's website at www.telit.com for the latest information on the ME910G1 module family.

Telit ME310G1/ME910G1/ML865 AT Commands Reference Guide

Telit ME910G1 Hardware Design Guide

Telit IP Easy User Guide

Telit Single SKU AT Command Application Note

Telit M/NB-IoT Quick Start Guide

Telit ME310G1/ME910G1/ML865G1 PSM Application Note

Telit MEx10G1/ML865G1 GNSS Application Note

3 OVERVIEW

3.1 Introduction

The User Manual for the Modem devices is intended to illustrate how users can integrate and implement the features of each communication version of the device. The common factors are explained in detail, as well as special considerations and diagrams for each Modem. The Modem differences are highlighted in this manual for design considerations for future model placement.

3.2 Preview

The Modems are self-contained, multi-band, globally capable, IoT and M2M communication devices designed to provide a comprehensive solution to application problems for our customers. They utilize the proven technology of Telit's certified modules for their core communications engines.

3.2.1 Functional Description

Cellular

- LTE Cat-M1

GNSS Functionality

- GPS, GLONASS, Beidou, Galileo

UART

- 115200 bps default supporting 5 standard RS232 signals

USB

- HS/FS USB 2.0 Device (480Mb/s)

Physical Dimensions

- Length and width of all devices are equal
- Heights of different devices will vary

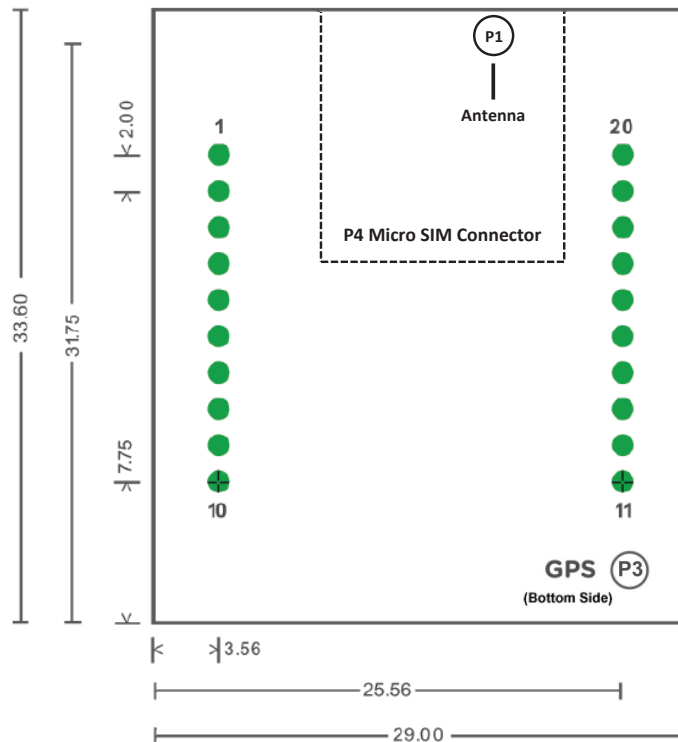


Figure 1 LTE910XF v20.00 Physical Dimensions

3 OVERVIEW continued

3.3 Features

- Multi-Band Support
- LTE (4G) Bands: B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B27, B28, B66, B71, B85
- GSM (2G) Bands: B2, B3, B5, B9
- LTE Output Power: 23dBm (Power Class 3)
- GSM Output Power: 33dBm (Power Class 4)
- LTE: DL: Up to 588 kbps, UL up to 1Mbps
- GNSS (Global Navigation Satellite System) includes GPS, GLONASS, Beidou and Galileo
- Control via standard and extended AT command set
- SIM application Tool Kits 3GPP TS 51.01
- IP stack with TCP/UDP protocol support
- SMS Support
- Through hole for screw mount
- Dimensions: 1.14" x 1.3" x 0.26"
- Operational Temperature Range: -40°C to 85°C
- Input Voltage Range: 3.4 to 5.5 Vdc (5.0 Vdc nominal)
- Variable logic level (UART/GPIO) Adjustable from 1.8 to 5.5 Vdc
- 3FF 'micro' SIM card socket
- Cellular and GNSS antenna connections via Hirose U.FL miniature RF connectors

3.4 Block Diagram

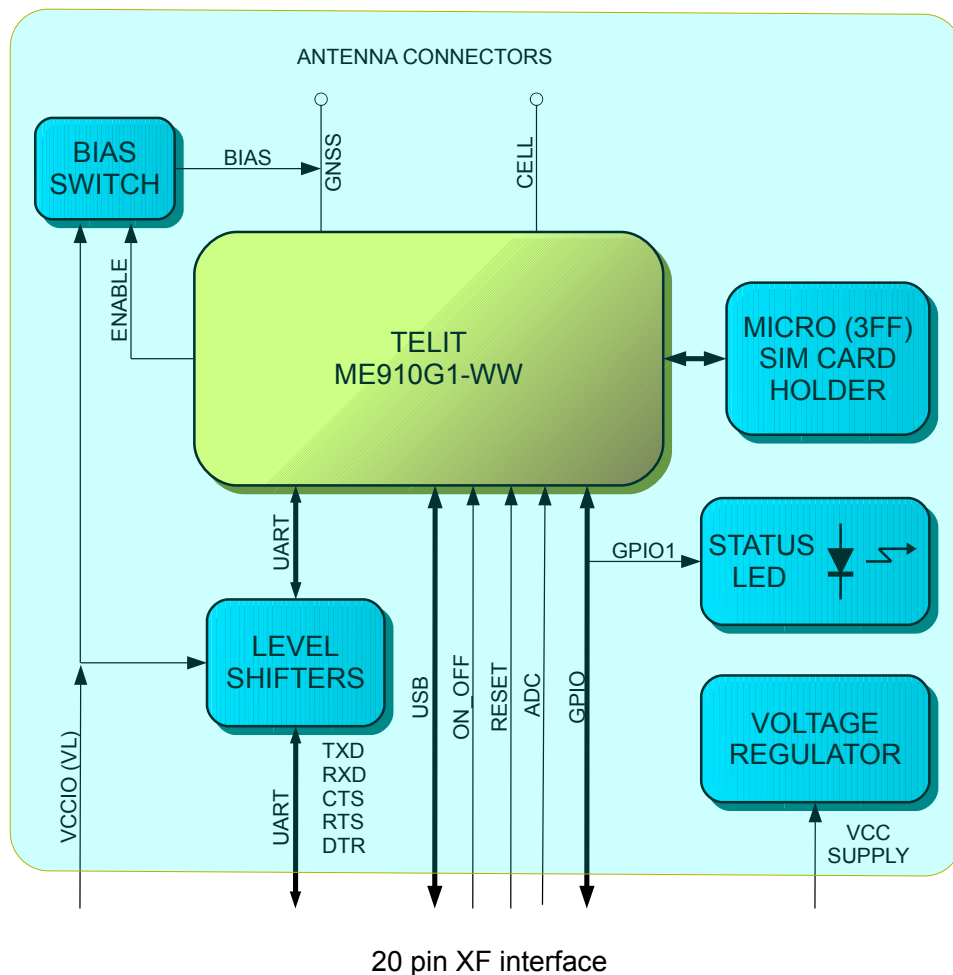


Figure 2 LTE910XF v20.00 Block Diagram

3 OVERVIEW continued

3.5 FOTA Notice

The certification of LTE 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.

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

4 INTERFACES

4.1 UART Interface Voltage Selection

The LTE910XF is equipped with a variable voltage interface solution for the UART interface. This allows the user to match the device to the system's level without extra hardware. The UART signals are internally disabled by the cellular radio when it is off or in Power Saving Mode. The VL_IN signal can be applied or changed to a level within the 1.2V to 5.5V operational range.

Affected I/O:

PIN	NAME
-----	------

2 RXD

3 TXD

9 DTR

12 CTS

16 RTS

4 INTERFACES

4.2 Serial Interface

4.2.1 UART Serial Port

The serial interface is a CMOS level UART. Default Communications settings for this port are as follows:

- Baud Rate: 115.2 kbps
- Bits: 8
- Stop Bits: 1
- Parity: None
- Hardware Handshaking: Yes

Baud rate can be controlled with the AT+IPR command. Default setting is 115200 baud.

Note: If you are not using hardware handshaking, RTS must be connected to GROUND for proper communications when flow control is not used.

4.2.2 USB Port

The Modems that are USB ready include an integrated universal serial bus (USB) transceiver, compliant with USB 2.0 specifications. High data rates for the USB enabled Modems are only available over the USB interface, as the UART has a maximum baud rate of <1Mbps. In order for proper power-up of the Modems, the USB_VBUS line MUST be disconnected until the unit is otherwise fully powered and on. If the USB_VBUS line is attached and powered before the main power is brought up and the Modem turned on, power sequencing issues may occur.

Note: You must implement the USB interface in order to locally update module firmware.

4.2.2.1 USB Connection Diagram

When VBUS_ENABLE is HIGH the VBUS 5.0v signal will be passed to USB_VBUS, (pin 6) turning the USB ON.

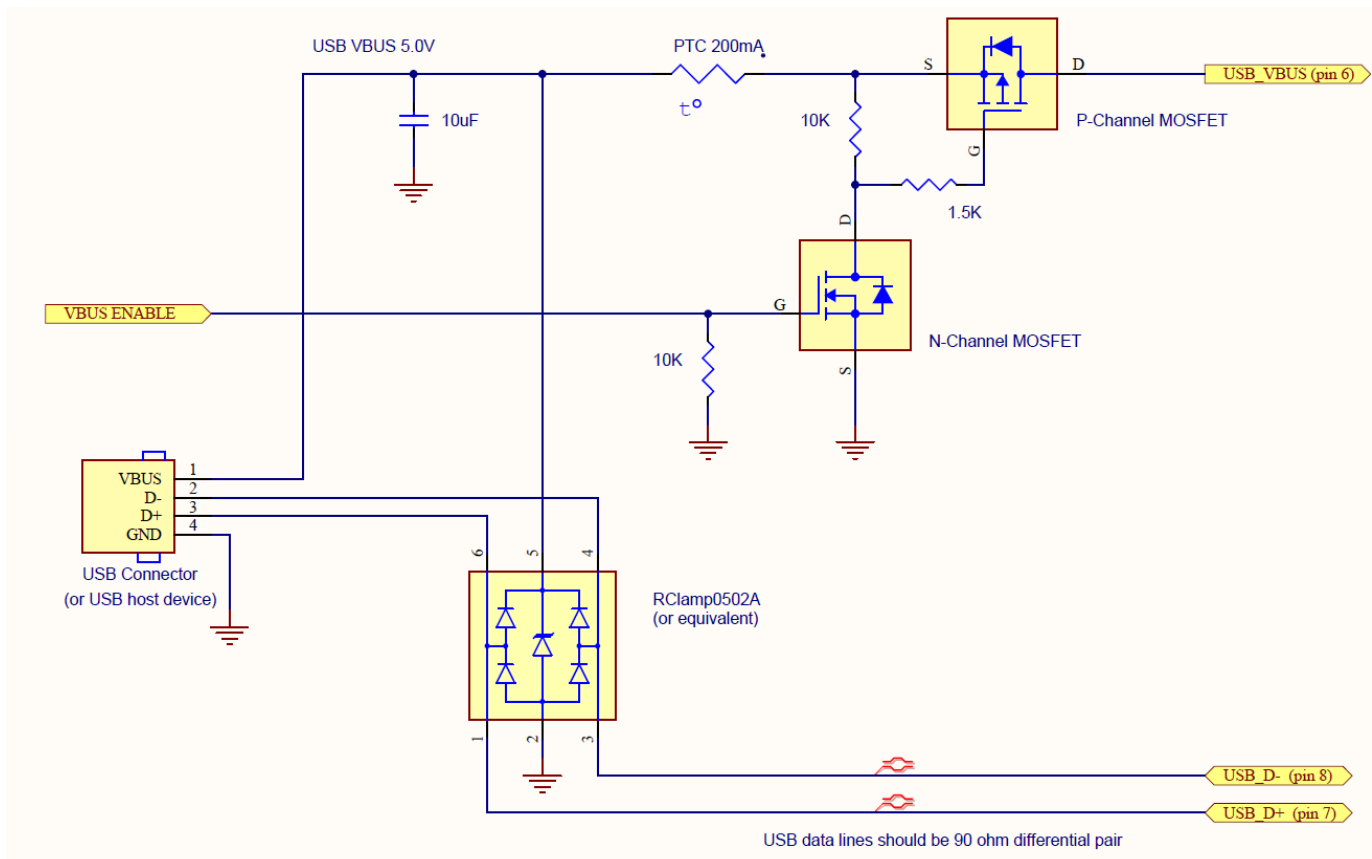


Figure 3 USB Connection Diagram

4 Interfaces continued

4.3 Power Supply

See the Electrical Specifications section for the input voltage range and current requirements of the specific product variant. When transmitting the modem can require peak power events of 5W in 4G (LTE) mode or 10W in 2G fallback modes.

A good understanding of the load transients is required in order to meet the power requirements of a cellular radio. It is recommended that your supply source the full peak current value of the transmission pulse in order to maintain proper cellular operation. LDO (low-drop-out) linear supplies or switching supplies with very fast transient response capabilities along with bulk output capacitors on your supply design is recommended. Power supply design, thermal management and layout are outside the scope of this document. Please refer to power supply manufacturers for product documentation and design application notes.

4.4 Audio Interface

The DVI audio interface is not supported on these modules.

4.5 Pin-Out

PIN	NAME	Description	Direction	Voltage Rating	Notes
1	VCC	Power Supply	Input	3.4v to 5.5v	1
2	RXD	UART Received Data	Output	VL	
3	TXD	UART Transmitted Data	Input	VL	4
4	GND	Ground	---		1
5	RESET	Reset Control	Input	Internal pull-up to 3.8v	2,3
6	USB_VBUS	USB Supply Detect	Input	3.0 to 5.5v	3
7	USB_D+	USB Differential Data (+)	I/O		3
8	USB_D-	USB Differential Data (-)	I/O		3
9	DTR	UART Data Terminal Ready	Input	VL	
10	GND	Ground	---		1
11	GND	Ground	---		1
12	CTS	UART Clear to Send	Output	VL	
13	GPIO_1	General Purpose I/O	Output	1.8v	5
14	VL	Interface Voltage Reference	Input	1.2v to 5.5v	
15	GND	Ground	---		1
16	RTS	UART Ready to Send	Input	VL	
17	GPIO_3	General Purpose I/O	I/O	1.8v	
18	GPIO_2	General Purpose I/O	I/O	1.8v	
19	ADC	Analog to Digital Converter	Input	0v to 1.2v	
20	ON_OFF	On-Off Control	Output	Internal pull-up to 1.8v	2

Notes:

1. Must be implemented.
2. Use external pull-down ONLY.
3. No connection if not used
4. Ground if not used.
5. Connected to on-board LED drive.

4 Interfaces continued

4.6 GPIO Details

GPIO are configurable as input, output, and alternate function. Configuration is controlled by AT commands. Alternate functions include cellular status, ALARM pin function and temperature monitor indication.

4.6.1 Using a GPIO Pin as INPUT

The GPIO pins, when used as inputs, can be connected to a digital output of another device and report its status, provided this device has interface levels compatible with the voltage levels of the GPIO of the modem.

4.6.2 Using a GPIO Pin as OUTPUT

The GPIO pins, when used as outputs, can drive CMOS digital devices or compatible hardware. When set as outputs, the pins have a push-pull output.

4.6.3 Cellular Status LED (GPIO_1)

The GPIO_1 output is used to drive the on-board LED to give feedback on the registration status. For the LTE910XF, this is an alternate function of GPIO_1 and is set via the AT#GPIO command. The default status indication is defined below. See Figure 4 below for a diagram of the on-board LED circuit.

Cellular Status Indication

LED Status	Device Status
Off	Cellular radio is off
Off	On/Searching
Slow Blinking (0.3 sec on / 2.7 sec off)	Registered

4.6.4 User GPIO

GPIO_2 (pin 18) and GPIO_3 (pin 17) are additional GPIO's that can utilized for user applications.

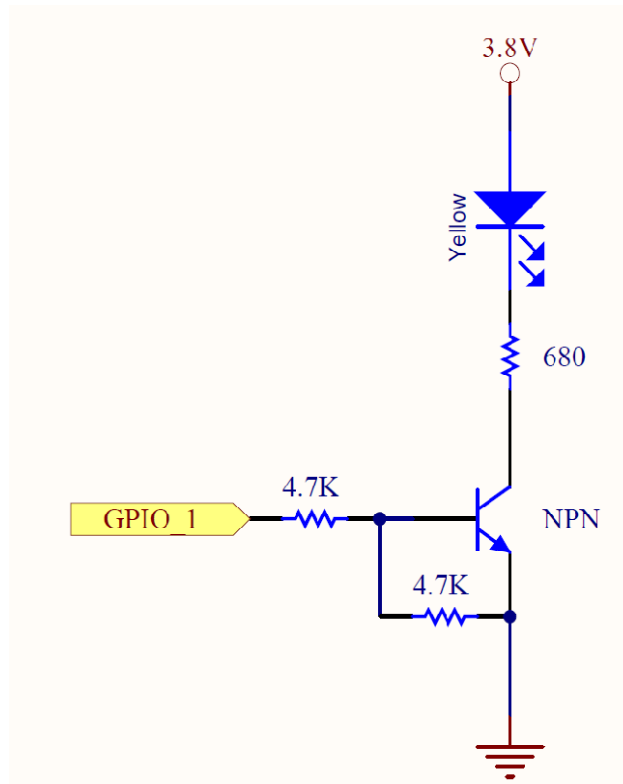


Figure 4 LED Indicators Diagram

4 Interfaces continued

4.7 Analog to Digital Converter

Pin 19 is connected directly to the Telit module ADC pin. It has a 0 to 1.8v range with 10 bit resolution. Use the command `AT#ADC=1,2<cr>` to read the ADC. The returned value is expressed in millivolts.

ADC	Description
ADC1	Analog to digital converter input

4.7.1 RESET Pin

Input Logic State	Description
High-Z	Active state
0	Reset state

Notes:

1. It is required that this input be controlled by an open collector/drain output. Do not use an external pull-up resistor, a pull-up is included internal to the Modem.
2. The RESET pin is offered as a means to reset the Modem when and if the Modem becomes unresponsive. The RESET pin is not intended to be used as a means of turning the Modem off. Use the ON/OFF pin to turn the Modem on or off.
3. RESET state must be held for at least 200ms before returning to active state.

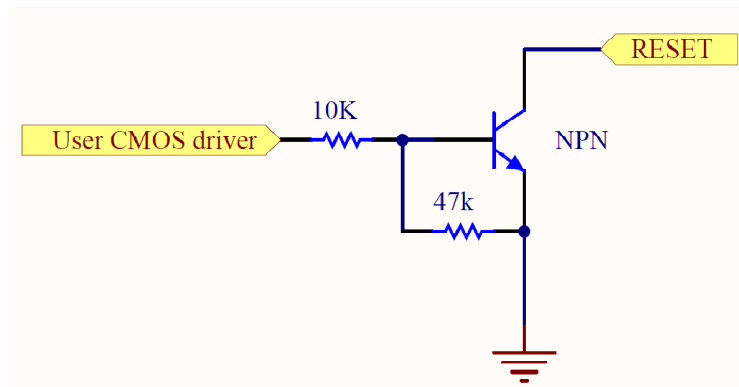


Figure 5 Reset Pin Diagram

4 Interfaces continued

4.7 Internal Interfaces continued

4.7.3 ON/OFF Pin

Input Logic State	Description
High-Z	Modem turned ON or OFF after input returns to this state.
0	Toggle Modem ON or OFF

Notes:

1. It is required that this input be controlled by an open collector/drain output. Do not use an external pull-up resistor, a pull-up is included internal to the Modem.
2. The ON_OFF pin is offered as a means to power-on and power-down the Modem. When the Modem powers-down it informs the cell tower that it is powering down and will not be communicating with the tower any more. This is considered a controlled power-down.
3. To turn ON the Modem, the ON_OFF input must be tied low for 5 seconds then released.
4. To turn OFF the Modem, the ON_OFF input must be tied low for 3 seconds then released.
5. Optionally the Modem may be powered-down with the use of AT commands.
6. It is required to stop driving terminal inputs high when turning ON the Modem by floating or bringing them low. If this is not done, power sequencing issues may occur.

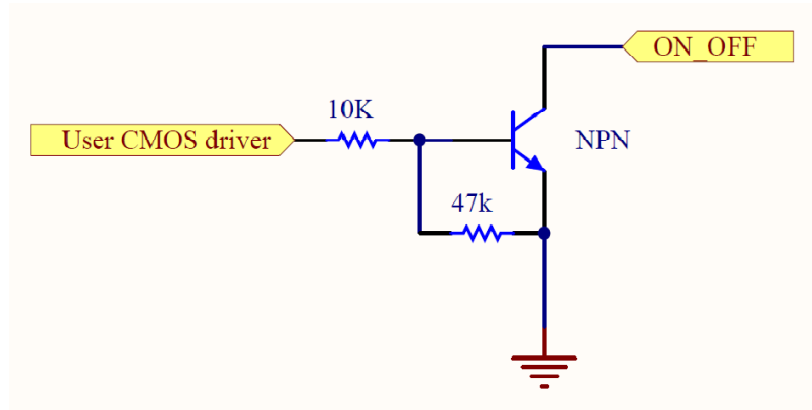


Figure 6 On / Off Pin Diagram

4.8 RF Interface

There are two RF interfaces on the Modem for a cellular antenna and a GNSS antenna. The specifications and requirements for these are as follows:

Type: Hirose U.FL - MALE (Part Number: U.FL-R-SMT(10))

Pin	Description
Center Pin	RF signal
Outer Conductor	Signal ground

4.9 SIM Card Interface

The SIM Card Interface allows the Modem to accept the subscriber card provided by the cellular network provider. It accommodates a 3FF 'micro' sized SIM card operating at either 1.8v or 3.0v.

4.10 Header Interface Mounting Options

The Modems' header pin length has been chosen to allow for direct solder mount to a PCB of standard thickness. For socketing the modem, below are example products compatible with the Janus XF footprint series products.

Manufacturer	Part Number	Mounting Type
Samtec	SMM-110-01-S-S	surface mount
TE	1-2314876-0	through hole
Sullins	NPPN101BFCN-RC	through hole

5 LTE910XF TECHNICAL SPECIFICATIONS

5.1 Electrical Specification⁴

5.1.1 Absolute Maximum Ratings

Parameter	Min	Typ	Max	Unit	Note
VCC Supply	0	-	6	Volt	
VIN (DIGITAL INPUTS 1.8V CMOS)	-0.3	-	2.1	Volt	
VIN UART Digital Inputs VL Selected)	-0.3	-		Volt	
Storage Temperature	-40	-	85	°C	

Operation of the device at these or any other conditions beyond those listed under Recommended Operating Conditions is not implied. Exposure to Absolute Maximum Rating conditions for extended periods of time may affect device reliability.

5.1.2 Recommended Operating Conditions

Parameter	Min	Typ	Max	Unit	Note
Temperature	-40	-	85	°C	
VCC Supply	3.4	5.0	5.25	Volt	
VL IN Selection	1.8	-	5.5	Volt	

Note: 1. When VL IN is utilized, VAUX will match VL.

5.1.3 Power Consumption^{1,2,3}

Mode	Average (mA)	Peak (mA)	Mode Description	
Switched Off				
Module OFF; power ENABLE open (ON)	1		Module supplied but switched off	
Module OFF; power ENABLE low (OFF)	1		On-board power supply disabled	
	CATM (mA)	NB IoT (mA)	2G (mA)	
IDLE MODE				
AT+CFUN=1	9.0	8.8	7.6	Normal mode: full functionality of the module
AT+CFUN=4		6.4		Disabled TX and RX; module is not registered on the network
AT+CFUN=5	2.0	0.8		Paging cycle #256 frames (2.56s DRX cycle)
AT+CFUN=5	1.5	0.5		81.92s eDRX cycle length (PTW=2.56s, DRX=1.28s)
AT+CFUN=5	1.2	0.2		327.68s eDRX cycle length (PTW=2.56s, DRX=1.28s) PSM enabled
AT+CFUN=5	1.1	0.1		655.36s eDRX cycle length (PTW=2.56s, DRX=1.28s) PSM enabled
AT+CFUN=5	1.0	0.1		1310.72s eDRX cycle length (PTW=2.56s, DRX=1.28s) PSM enabled
AT+CFUN=5	1.0	0.1		2621.44s eDRX cycle length (PTW=2.56s, DRX=1.28s) PSM enabled
AT+CFUN=5			0.79	Paging Multiframe 9 PSM MODE Typical (mA)
PSM MODE				
AT+CPSMS=1	1	1	N/A	No current source or sink by any connected pin
CONNECTED MODE				
CATM	320		930	1 RB, RMC, TBS=5, QPSK, 23dBm, Band 85, 28, 12
CATM	270		760	1 RB, RMC, TBS=5, QPSK, 23dBm, Band 13, 26, 5, 18, 19, 20, 8
CATM	260		680	1 RB, RMC, TBS=5, QPSK, 23dBm, Band 3, 2, 25, 4, 1, 66
NB IoT		200	280	3.75KHz, 1 SC, RU 32ms, TBS=0, BPSK, 20dBm, Band 71
NB IoT		510	840	3.75KHz, 1 SC, RU 32ms, TBS=0, BPSK, 23dBm, Band 85, 28, 12
NB IoT		420	720	3.75KHz, 1 SC, RU 32ms, TBS=0, BPSK, 23dBm, Band 13, 26, 5, 18, 19, 20, 8
NB IoT		360	630	3.75KHz, 1 SC, RU 32ms, TBS=0, BPSK, 23dBm, Band 3, 2, 25, 4, 1, 66
NB IoT		58	250	15KHz, 12 SC, RU 1ms, TBS=5, QPSK, 21dBm, Band 71
NB IoT		75	800	15KHz, 12 SC, RU 1ms, TBS=5, QPSK, 23dBm, Band 85, 28, 12
NB IoT		67	680	15KHz, 12 SC, RU 1ms, TBS=5, QPSK, 23dBm, Band 13, 26, 5, 18, 19, 20, 8
NB IoT		66	620	15KHz, 12 SC, RU 1ms, TBS=5, QPSK, 23dBm, Band 3, 2, 25, 4, 1, 66
GPRS		250	1700	1TX + 1RX, CS1, GMSK, Band 850, 900
GPRS		140	840	1TX + 1RX, CS1, GMSK, Band 1800, 1900

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: Values are calculated based on 5.0 volt supply voltage and on-board power supply efficiency.

Note 3: Values do not include GNSS operation or GNSS antenna bias requirements.

Note 4: Electrical specifications applicable to ordering part numbers ending in S; e.g. TA3HS.

5 LTE910XF TECHNICAL SPECIFICATIONS continued

5.1 Electrical Specification continued

5.1.4 I/O Levels

5.1.4.1 1.8v Standard Interface Levels (GPIO 1,2,3)

Parameter	Min	Typ	Max	Unit	Note
Input Voltage High - Vih	1.5	-	1.9	Volt	
Input Voltage Low - Vil	0	-	0.35	Volt	
Output Voltage High - Voh	1.6	-	1.9	Volt	
Output Voltage Low - Vol	0	-	0.2	Volt	

Typical Current Source/Sink = 100uA/1uA

5.1.4.2 VL=5.0v UART Interface Levels)

Parameter	Min	Typ	Max	Unit	Note
Input Voltage High - Vih	0.7*VL	-	5.5	Volt	1
Input Voltage Low - Vil	0	-	0.3*VL	Volt	1
Output Voltage High - Voh	VL - 0.1	-	VL	Volt	1, 2
Output Voltage Low - Vol	0	-	0.1	Volt	1, 2

5.1.4.3 VL=3.3v UART Interface Levels

Parameter	Min	Typ	Max	Unit	Note
Input Voltage High - Vih	2.0	-	5.5	Volt	1
Input Voltage Low - Vil	0	-	0.8	Volt	1
Output Voltage High - Voh	VL-0.1	-	VL	Volt	1, 2
Output Voltage Low - Vol	0	-	0.1	Volt	1, 2

5.1.4.4 ADC Input Levels

Parameter	Min	Typ	Max	Unit	Note
Input Voltage Range	0	-	1.8	Volt	
AD Conversion	-	-	10	Bits	
Input Resistance	1M	-	-	Ohm	
Input Capacitance	-	1	-	pF	

5.1.4.5 Reset Pin Input Levels

Parameter	Min	Typ	Max	Unit	Note
Input Voltage High - Vih	-	-	VIN	Volt	3
Input Voltage Low - Vil	0	-	-	Volt	3

5.1.4.6 ON_OFF Pin Input Levels

Parameter	Min	Typ	Max	Unit	Note
Input Voltage High - Vih	-	1.2	-	Volt	3
Input Voltage Low - Vil	0	-	-	Volt	3

Notes:

1. See Nexperia 74LVC2T45 data sheet for other input and output voltage conditions
2. CMOS load: 100uA
3. It is required that this input be controlled by an Open Collector/Drain Output. Do not use an external pull-up resistor, a pull-up is included internal to the modem.

5 LTE910XF TECHNICAL SPECIFICATIONS continued

5.1 Electrical Specification continued

5.1.5 LTE Cellular Antenna Specifications:

Parameter	Description
Frequency Range	Depending on frequency bands provided by the network operator, the customer should use the most suitable antenna for those frequencies.
Bandwidth	250 MHz in LTE Band 1 140 MHz in LTE Band 2, PCS1900 170 MHz in LTE Band 3, DCS1800 445 MHz in LTE Band 4 70 MHz in LTE Band 5, GSM850 80 MHz in LTE Band 8, GSM900 47 MHz in LTE Band 12 41 MHz in LTE Band 13 60 MHz in LTE Band 18 60 MHz in LTE Band 19 71 MHz in LTE Band 20 145 MHz in LTE Band 25 80 MHz in LTE Band 26 62 MHz in LTE Band 27 100 MHz in LTE Band 28 490 MHz in LTE Band 66
Impedance	50Ω
Input Power	33 dBm average
VSWR Absolute Max	≤ 10:1
VSWR Recommended	≤ 2:1

Maximum Antenna Gain (dBi)

This radio transmitter has been approved by the indicated agency to operate with the maximum permissible gain indicated.

Band	FCC	ISED	RED
GPRS/EGPRS 850	6.93	3.64	5.47
GPRS/EGPRS 1900	10.42	5.13	9.34
FDD1	--	--	11.84
FDD 2	12.01	8.52	--
FDD3	--	--	11.33
FDD 4	12.01	8.29	--
FDD 5	9.41	6.12	--
FDD 85	--	--	8.45
FDD 12	8.70	5.63	--
FDD 13	9.16	5.95	--
FDD 20	--	--	8.20
FDD 25	12.01	8.52	--
FDD 26	9.36	6.09	--
FDD 28	--	--	7.47
FDD 66	12.01	8.29	--
FDD 71	11.47	8.48	--
FDD 85	8.69	5.63	--
Omnidirectional	2.14	2.14	2.14

Notes:

FCC - Federal Communications Commission (US)

ISED - Innovation, Science and Economic Development (Canada)

RED - Radio Equipment Directive (Europe)

5 LTE910XF TECHNICAL SPECIFICATIONS continued

5.1 Electrical Specification continued

5.1.6 LTE910XF GNSS: GPS and GLONASS Antenna Specifications:

5.1.6.1 Antenna Specifications

Parameter	Description	Note
Input Voltage Range	VL	1
Frequency Range	1559.0 to 1610.0 MHz	
Gain	15 to 30 dB	
Impedence	50Ω	
VSWR	≤ 3:1	
Current Consumption	30mA Max, 20mA Typ.	

Note 1: GPS bias voltage will match VL.

5.1.7 USB Transceiver Specifications

Parameter	Comments	Min	Typ	Max	Unit
USB_VBUS					
Supply voltage		4.5	5.0	5.25	Volt
Input levels for low-/full speed					
Receiver threshold (single-end)		0.8	-	2.0	Volt
Differential input sensitivity	D+ - D- , Vin = 0.8V to 2.5V	0.2	-	-	Volt
Differential common-mode range	Includes VDI	0.8	-	2.5	Volt
Output levels for low-/full speed					
Low	RL = 1.5 kΩ to 3.6 V	-	-	0.3	Volt
High	RL – 15 kΩ to GND	2.8	-	3.6	Volt
Output signal crossover voltage		1.3	-	2.0	Volt
Terminations					
Internal pull-up resistor	VTRM to D+, VTRM to D-	1.425	1.5	1.575	kΩ
Internal pull-down resistor	D= to GND, D- to GND	14.3	15	24.8	kΩ
High-Z state output impedance	0 V < VDD < 3.6 V; measured at D+ and D- pins to GND	300	-	-	kΩ
Termination voltage	An internal supply voltage, VTRM	3.0	3.3	3.6	Volt
Driver characteristics – full speed					
Transition time:					
Rise time	CL = 50 to 125 pF	4	-	20	ns
Fall time	CL – 50 to 125 pF	4	-	20	ns
Rise/fall time matching		90	-	111	%
Series output resistance	D+, D-	28	33	44	Ω
Driver characteristics – low speed					
Transition time:					
Rise time	CL = 50 to 600 pF	75	-	300	ns
Fall time	CL – 50 to 600 F	75	-	30	ns
Rise/fall time matching		80	-	125	%

5 LTE910XF TECHNICAL SPECIFICATIONS continued
 5.2 Mechanical Specification

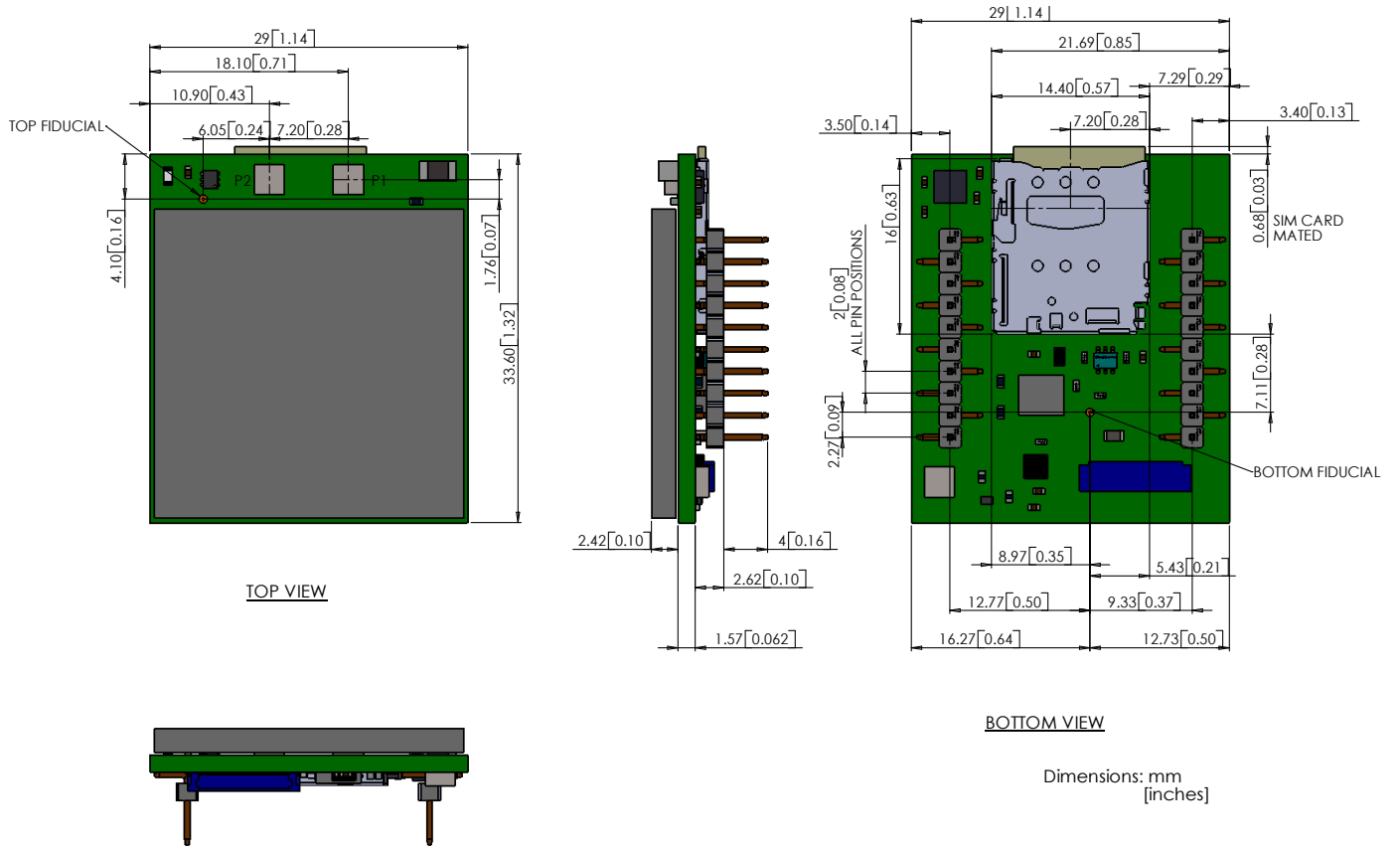


Figure 7 LTE910XF Mechanical Dimensions

6 Operation

6.1 Powering ON/OFF

6.1.1 Powering ON

Power the Modem ON by pulling the ON_OFF signal (Pin 19) to ground for at least five (5) seconds, then release.

6.1.2 Powering OFF

There are two methods to turn OFF the Modem under normal circumstances:

- Use the AT shutdown command (AT#SHDN)
- Pull ON_OFF signal (Pin 19) to ground for at least three (3) seconds, then release.

The normal shutdown procedure can take many seconds to complete. For power sensitive applications, consider using a 'fast shutdown' method to reduce the shutdown time. See the Telit AT Command Guide and the Telit Hardware Design Guide for more information.

Under abnormal circumstances, the modem can be shut down using the RESET input (pin 20).

6.2. Communicating with the Modem

The default configuration of the modem has AT command ports available on the UART interface and the USB interface.

6.2.1 UART Interface

The UART port operates at the following default parameters:

- Baud Rate: 115.2 kbps
- Bits: 8
- Stop Bits: 1
- Parity: None
- Hardware Handshaking

6.2.2 USB Interface

The USB port instantiates two serial modem connections as AT command ports by default. USB drivers are available from Telit or Janus.

6.3 Testing Communications

- The cellular module should always respond to the attention command with 'OK'. Send:

```
AT<cr>1
```

Note 1. "<cr>" designates a carriage return character.

The module will respond with 'OK'.

- Verify the module model. Send:

```
AT+CGMM<cr>
```

The response should be the Telit module model number.

- Verify the firmware version. Send:

```
AT+CGMR<cr>
```

The response will be the Telit module's current firmware.

6.4 Cellular Network Communications

6.4.1 SIM Card

All LTE modems require a SIM card. The LTE910XF v20.00 supports a 3FF 'micro' size SIM card.

6 Operation continued

6.4 Cellular Network Communications continued

6.4.3 Signal Strength

Signal channel can be checked as follows. Enter:

```
AT+CSQ<cr>
```

The default response format will contain two numbers:

```
+CSQ: 17,0
```

The first number is the rssi (received signal strength indication) and the second is ber (bit error rate).

The rssi can be interpreted as follows:

10-14 Okay

15-20 Good

20+ Excellent.

Anything below 10 would be considered marginal.

A response of 99 indicates no signal.

6.4.4 Registration

Network registration can be checked as follows. Enter:

```
AT+CEREG?<cr>
```

A response of +CEREG:0,1 or +CEREG: 0,5 indicates the device is registered to the home network or roaming, respectively.

If response is different than this, please refer to the Telit AT command reference document for more information

6.5 Data Communications

The modem incorporates a TCP/IP stack that can be used to directly send data using AT commands. Alternatively, an external host can be used to make a PPP connection.

See the Telit M/NB-IoT Quick Start Guide for further information

6.5.1 Data Communications - Using the Internal Stack

To send data using the internal stack, a data context must be activated.

Activate the context as follows:

AT&T centric (FWSWITCH=0):

Enter:

```
AT#SGACT=1,1<cr>
```

Verizon (FWSWITCH=1):

Enter:

```
AT#SGACT=3,1<cr>
```

If successful, the modem will respond with an IP address assigned by the carrier. Data can be sent to a host with a socket dial command. Enter:

```
AT#SD=<connid>,0,80,<IPaddr>
```

where <connid> is the user data context and <IPaddr> is a text string (in quotes) containing a dotted IP address or a DNS resolvable host name.

The modem will respond with CONNECT and any data entered thereafter will be sent to the connected host.

Enter the escape sequence:

```
+++
```

to suspend the connection.

See the Telit IP Easy User Guide and the Telit AT Commands Guide for more information.

6 Operation continued

6.5 Data Communications continued

6.5.2 PPP Dialing

In a hosted system (e.g. Linux) the host TCP/IP stack can be used. A PPP connection is initiated using the ATD dialing command. Depending on the script or application performing the PPP connection, you may have to change the numeric digit in the PPP AT dialing command that designates the context to use.

The dialing string for the AT&T centric (#FWSWITCH=0) would be:

```
ATD*99***1#<cr>
```

Where the '1' digit selects the #1 data context set with the +CDGCONT command.

Similarly the dialing string for the Verizon (#FWSWITCH=1) would be:

```
ATD*99***3#<cr>
```

Where the '3' digit selects the #3 data context set with the +CDGCONT command.

6.6 SMS

SMS availability on Cat.M1 networks may be different than what has been experienced on other 4G or 3G network plans. Some may not allow SMS to be sent from a device, or may restrict SMS to operation to other Cat. M1 devices or from portals only. Check with your carrier for specifics.

SMS allows you to send a text message (max 160 characters) to a SMS capable unit.

- Set the SMS mode to text. This setting is not persistent; it must be entered every power cycle.

```
AT+CMGF=1<cr>
```

- To enter the receiving subscriber unit phone number and message enter:

```
AT+CMGS="8885551234"<cr>
```

Wait for response ">" then enter message text .

Enter

```
<ctrl-z>
```

to end the message text and send it.

6.7 GNSS

The GNSS system on the Telit module includes support for stand-alone operation with GPS, GLONASS, BeiDou, Galileo, and QZSS. The GPS and WWAN (cellular) systems share resources in the cellular module. The WWAN system has priority by default. See the Telit MEx10G1/ML865G1 GNSS Application Note for further information.

A simple example of stand-alone GPS operation follows.

Turn on the GNSS system:

```
AT$GPSP=1<cr>
```

After allowing enough time for a GPS fix to be obtained, the current location information can be read using:

```
AT$GPSACP<cr>
```

NMEA data can be continuously streamed. Enter:

```
AT$GPSNMUN=3,1,1,1,1,1,1,1<cr>
```

This enables multiple NMEA data messages and they will be continuously streamed to the AT command port until an escape sequence ("+++") is entered.

6 Operation continued

6.8 Firmware Selection

The LTE910XF v20.00 uses the Telit ME910G1-WW module which has firmware to support multiple carriers. The firmware load can be changed by issuing the command:

```
AT#FWSWITCH=<image_number>,1
```

where <image_number> is

- 0 for AT&T centric
- 1 for Verizon
- 2 for Worldwide
- 3 for Telstra Australia

The module will automatically reboot with the new firmware image. Current firmware status can be checked by issuing the command:

```
AT#FWSWITCH?
```

The response will be #FWSWITCH: <image_number>,n where <image_number> is as described above.

Note that 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.

7 Design Considerations

7.1 Minimum Required Module Pin Connects

Pin	Signal	Function
1	VCC	Power Supply
4,10,11,15	GND	Ground
2	RESET	Reset Control
20	ON_OFF	-Off Control

Additionally, you must implement either the UART or USB port to communicate with the modem. The UART port requires at a minimum:

Pin	Signal	Function
2	RXD	UART Received Data
3	TXD	UART Transmitted Data
14	VL	Interface Voltage Reference
16	RTS	UART Ready to Send

If not used the RTS signal must be connected to GND.

The USB port requires the following signals:

Pin	Signal	Function
6	USB_VBUS	USB Supply Detect
7	USB_D+	USB Differential Data (+)
8	USB_D-	USB Differential Data (-)

If not used, the USB port should still be made available for troubleshooting.

7.2 Software debug

You can get more verbose responses to some error conditions by issuing the command:

```
AT+CMEE=2
```

7.3 Hardware debug

To test and debug the modem it is recommended to incorporate test pads on the host PCB. This will allow verification of the connection between the modem and the host application. This is especially true of the USB port which provides access for flashing firmware and running diagnostic traces. Depending on the customer application, these pads include, but are not limited to the following signals:

- VCC
- RESET
- GND
- USB D+
- TXD
- USB D-
- RXD
- USB V_BUS
- ON/OFF

APPENDICES

Approvals

LTE910XF v20.00

FCC: RI7ME910G1WW

PTCRB, AT&T, Verizon

RED (Radio Equipment Directive) compliant

Note: Further certification may be necessary if additional radio equipment is being integrated with this product.

Antenna Care and Replacement

Do not use the Modem with a damaged antenna.

Buy the antenna from an approved suppliers list. Using unauthorized antennas, modifications, or attachments could damage the Modem and may violate local RF emission regulations or invalidate type approval.

Abbreviations

3GPP	3rd Generation Partnership Project	HSPA	High Speed Packet Access
AC	Alternating Current	LTE	Long Term Evolution
ADC	Analog To Digital Converter	IoT	Internet of Things
APN	Access Point Name	LED	Light Emitting Diode
BER	Bit Error Rate	M2M	Machine To Machine
CD	Carrier Detect	RF	Radio Frequency
CDMA	Code Division Multiple Access	RI	Ring Indicator
CTS	Clear To Send	RSSI	Received Signal Strength Indication
DB	Decibel	RTS	Request To Send
DC	Direct Current	RxD	Received Data
DCE	Data Communications Equipment	SMS	Short Message Service
DSR	Data Set Ready	TTFF	Time To First Fix
DTMF	Dual-tone multi-frequency	TxD	Transmitted Data
DTR	DTE Ready	UICC	Universal Integrated Circuit Card
GNSS	Global Navigation Satellite System	UMTS	Universal Mobile Telecommunications System
GPIO	General Purpose Input Output	USIM	Universal Subscriber Identity Module
GPRS	General Packet Radio Service	VSWR	Voltage Standing Wave Ratio
GSM	Global System Mobile	WCDMA	Wideband Code Division Multiplexing Access

LTE910XF CAT-M1/NB-IOT Embedded Cellular Modem Manual



Ordering Information

Ordering Information	Description
LTE910XF v20.00	LTE Cat-M1/NB-IOT Modem - GNSS Enabled - AT&T, Verizon, Worldwide

Revision History

Revision	Revision Date	Note
00	03/04/21	New LTE910XF v20.00 CAT-M1/NB-IOT User Manual
01	03/16/21	Updated 5.1.5 Antenna Specifications and Mechanical Drawing
02	06/04/21	Updates to Mechanical Drawing, Specifications
03	01/18/24	Updated Pin Descriptions and added Design Considerations

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