EG915Q-NA Mini PCIe

Hardware Design

LTE Standard Module Series

Version: 1.0

Date: 2024-07-05

Status: Released

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Safety Information

The following safety precautions must be observed during all phases of operation, such as usage, service or repair of any cellular terminal or mobile incorporating the module. Manufacturers of the cellular terminal should notify users and operating personnel of the following safety information by incorporating these guidelines into all manuals of the product. Otherwise, Quectel assumes no liability for customers' failure to comply with these precautions.

Full attention must be paid to driving at all times in order to reduce the risk of an accident. Using a mobile while driving (even with a handsfree kit) causes distraction and can lead to an accident. Please comply with laws and regulations restricting the use of wireless devices while driving.

Switch off the cellular terminal or mobile before boarding an aircraft. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communication systems. If there is an Airplane Mode, it should be enabled prior to boarding an aircraft. Please consult the airline staff for more restrictions on the use of wireless devices on an aircraft.

Wireless devices may cause interference on sensitive medical equipment, so please be aware of the restrictions on the use of wireless devices when in hospitals, clinics or other healthcare facilities.

Cellular terminals or mobiles operating over radio signal and cellular network cannot be guaranteed to connect in certain conditions, such as when the mobile bill is unpaid or the (U)SIM card is invalid. When emergency help is needed in such conditions, use emergency call if the device supports it. In order to make or receive a call, the cellular terminal or mobile must be switched on in a service area with adequate cellular signal strength. In an emergency, the device with emergency call function cannot be used as the only contact method considering network connection cannot be guaranteed under all circumstances.

The cellular terminal or mobile contains a transceiver. When it is ON, it receives and transmits radio frequency signals. RF interference can occur if it is used close to TV sets, radios, computers or other electric equipment.

In locations with explosive or potentially explosive atmospheres, obey all posted signs and turn off wireless devices such as mobile phone or other cellular terminals. Areas with explosive or potentially explosive atmospheres include fuelling areas, below decks on boats, fuel or chemical transfer or storage facilities, and areas where the air contains chemicals or particles such as grain, dust or metal powders.

About the Document

Revision History

Version	Date	Author	Description
-	2024-07-05	Len CHEN/ Barry DENG/ Sean FANG	Creation of the document
1.0	2024-07-05	Len CHEN/ Barry DENG/ Sean FANG	First official release

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1 Introduction

This document defines EG915Q-NA Mini PCIe module, and describes its air interfaces and hardware interfaces which are connected with your applications.

With this document, you can quickly understand module interface specifications, electrical and mechanical details, as well as other related information of the module. The document, coupled with application notes and user guides, makes it easy to design and set up wireless applications with the module.

2 Product Overview

EG915Q-NA Mini PCIe provides data connectivity on LTE-FDD networks with PCI Express Mini Card 1.2 standard interfaces. It supports embedded operating systems, such as Linux and Android, in addition to providing high-speed data transmission, and GNSS functionalities (Optional) to meet your specific application demands. EG915Q-NA Mini PCIe can be respectively applied in the following fields:

EG915Q-NA Mini PCIe:

- Smart metering
- Wearable devices
- Environmental monitoring
- Asset tracking
- Fleet management
- Security and alarm systems

2.1. Frequency Bands and Functions

Table 1: Frequency Bands and Functions

Mode	EG915Q-NA Mini PCIe
LTE-FDD (With Rx-diversity)	B2/B4/B5/B12/B13/B66
GNSS (Optional function)	GPS、GLONASS、BDS、Galileo、QZSS
Digital Audio (PCM)*	PCM function software development

NOTE

EG915Q-NA Mini PCIe GNSS function is optional.
If you need this function, please contact Quectel Technical Support.

2.2. Key Features

The following table describes the detailed features of EG915Q-NA Mini PCIe.

Table 2: Key Features

Feature	Description
Function Interface	PCI Express Mini Card 1.2 Standard Interface
Power Supply	● Supply voltage: 3.0–3.6 V ● Typical supply voltage: 3.3 V
Transmitting Power	● LTE-FDD：Class 3（23dBm±2dB）
LTE Features	● Supports compliance with 3GPP Rel-14 FDD ● Supports for Cat 1 bis ● Supports 1.4/3/5/10/20 MHz RF bandwidth ● Support uplink encoding format: QPSK、16QAM ● Support downlink encoding format: QPSK、16QAM、64QAM ● Max. transmission data rates: LTE-FDD: 10 Mbps (DL), 5 Mbps (UL)
Internet Protocol Features	● Supports TCP/UDP/PPP/FTP/FTPS/HTTP/HTTPS/NTP/PING/QMI/NITZ/SMTP/SSL/MQTT/CMUX/SMTPS/FILE/MMS* protocols ● Supports PAP and CHAP for PPP connections
SMS	● Text and PDU modes ● Point-to-point MO and MT ● SMS cell broadcast ● SMS storage: ME by default
UART Interface	Main Uart： ● Used for AT command communication and data transmission ● 115200 bps by default ● Supports RTS and CTS hardware flow control Debug Uart： ● Used to output some logs ● Baud rate: Up to 3 Mbps, 115200 bps by default
USB Interface	● Compliant with USB 2.0 specification (slave only) ● Data transfer rate: up to 480 Mbps ● Used for AT command communication, data transmission, firmware upgrade, software debugging and output some logs ● Supports USB serial drivers for: Windows 7/8/8.1/10/11, Linux 2.6–5.18, Android 4.x–12.x *, etc.

(U)SIM Interface	Supports USIM/SIM card: 1.8 V, 3.0 V
PCM Interface*	● One digital audio port: PCM port ● For audio, external Codec chip available
I2C Interface*	● One I2C port ● Complies with the I2C bus protocol specifications
AT Commands	● Compliant with *3GPP TS 27.007*, *3GPP TS 27.005* ● Quectel enhanced AT commands
Antenna Connectors	● Main antenna port（ANT_MAIN） ● GNSS antenna interfac（GNSS_MAIN,Optional） ● 50Ω characteristic impedance
Physical Characteristics	● Size: 30.0 mm × 51.0 mm × 4.9 mm ● Weight: approx. 7.1 g
Temperature Range	● Operating temperature range: -35 to +75 °C [1] ● Extended temperature range: -40 to +85 °C [2] ● Storage temperature range: -40 to +90 °C
Firmware Upgrade	USB 2.0 interface or DFOTA
RoHS	All hardware components are fully compliant with EU RoHS directive

[1] Within the operating temperature range, the module meets 3GPP specifications.

[2] Within the extended temperature range, the module remains the ability to establish and maintain functions such as voice, SMS, and data transmission, without any unrecoverable malfunction. Radio spectrum and radio network are not influenced, while one or more specifications, such as P_{out}, may exceed the specified tolerances of 3GPP. When the temperature returns to the operating temperature range, the module meets 3GPP specifications again.

2.3. Functional Diagram

The following figure shows the block diagram of EG91Q-NA Mini PCIe.

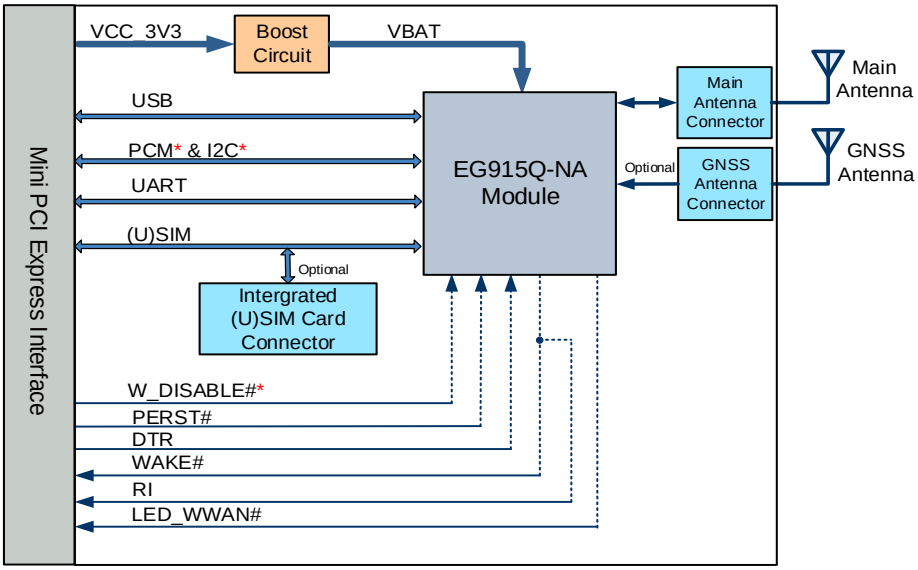


Figure 1: Functional Diagram

NOTE

1. The EG915Q-NA Mini PCIe provides a welded (U)SIM card (integrated (U)SIM card, optional).
2. The integrated (U)SIM card and the external (U)SIM card connected to the Mini PCI Express (U)SIM port share the same set of (U)SIM bus, but the hot swap signal cable is not drawn, so the hot swap detection function of the (U)SIM card is not supported. Integrated and external (U)SIM cards cannot be used at the same time.
3. If you need this function, please contact Quectel Technical Support.

2.4. EVB Kit

To help you develop applications with the module, Quectel supplies an evaluation board (Mini PCIe EVB) with accessories to control or test the module. For more details, see ***document [1]***.

3 Application Interfaces

This chapter mainly describes the following interfaces of the module:

- Power supply
- UART interface
- USB interface
- (U)SIM interface
- PCM* and I2C* interfaces
- Control and indication interfaces

3.1. Pin Assignment

The following figure shows the pin assignment of the module.
The top side contains EG915Q-NA module and antenna connectors.

引脚名	引脚号
WAKE#	1
NC	3
NC	5
NC	7
GND	9
UART_RXD	11
UART_TXD	13
GND	15
UART_RI	17
NC	19
GND	21
UART_CTS	23
UART_RTS	25
GND	27
GND	29
UART_DTR	31
UART_DCD*	33
GND	35
GND	37
VCC_3V3	39
VCC_3V3	41
GND	43
PCM_CLK*	45
PCM_DOUT*	47
PCM_DIN*	49
PCM_SYNC*	51

引脚号	引脚名
2	VCC_3V3
4	GND
6	NC
8	USIM_VDD
10	USIM_DATA
12	USIM_CLK
14	USIM_RST
16	NC
18	GND
20	W_DISABLE#*
22	PERST#
24	NC
26	GND
28	DBG_RXD
30	I2C_SCL*
32	I2C_SDA*
34	GND
36	USB_DM
38	USB_DP
40	GND
42	LED_WWAN#
44	USIM_PRESENCE
46	NC
48	DBG_TXD
50	GND
52	VCC_3V3

Figure 2: Pin Assignment

3.2. Pin Description

The following tables show the definition and description of the 52 pins on EG915Q-NA Mini PCIe.

Table 3: I/O Parameters Definition

Type	Description
AIO	Analog Input/Output
DI	Digital Input
DIO	Digital Input/Output
DO	Digital Output
OC	Open Collector
PI	Power Input
PO	Power Output

Table 4: Pin Description

Pin Number	Pin Name	I/O	Description	Comment
1	WAKE#	OC	Wake up the host	
2	VCC_3V3	PI	3.0–3.6 V, typ. 3.3 V DC supply	
3	NC	-	Not connected	
4	GND	-	Ground	
5	NC	-	Not connected	
6	NC		Not connectd	
7	NC	-	Not connected	
8	USIM_VDD	PO	(U)SIM card power supply	1.8/3.0 V power domain.
9	GND	-	Ground	
10	USIM_DATA	DIO	(U)SIM card data	1.8/3.0 V power

				domain.
11	UART_RXD	DI	UART receive	Connect to DTE's TXD. 3.3 V power domain.
12	USIM_CLK	DO	(U)SIM card clock	1.8/3.0 V power domain.
13	UART_TXD	DO	UART transmit	Connect to DTE's RXD. 3.3 V power domain.
14	USIM_RST	DO	(U)SIM card reset	1.8/3.0 V power domain.
15	GND	-	Ground	
16	NC	-	Not connected	
17	UART_RI	DO	Ring indication	3.3 V power domain.
18	GND	-	Ground	
19	NC	-	Not connected	
20	W_DISABLE#*	DI	Airplane mode control	3.3 V power domain. Pulled up by default. Active low.
21	GND	-	Ground	
22	PERST#	DI	Fundamental reset	3.3 V power domain. Pulled up by default. Active low. A test point is recommended to be reserved if the pin is unused.
23	UART_CTS	DI	DCE clear to send signal from DTE	Connects to DTE's RTS. 3.3 V power domain.
24	NC	-	Not connected	
25	UART_RTS	DO	DCE request to send signal from DTE	Connects to DTE's CTS. 3.3 V power domain.
26	GND	-	Ground	
27	GND	-	Ground	

28	DBG_RXD	DI	Debug receive	
29	GND	-	Ground	
30	I2C_SCL	OD	I2C serial clock	Requires external pull-up to 1.8 V.
31	UART_DTR	DI	Sleep mode control	3.3 V power domain.
32	I2C_SDA	OD	I2C serial data	Requires external pull-up to 1.8 V.
33	UART_DCD*	DO	Module output carrier detect	
34	GND	-	Ground	
35	GND	-	Ground	
36	USB_DM	AIO	USB differential data (-)	Requires differential impedance of 90 Ω. A test point must be reserved.
37	GND	-	Ground	
38	USB_DP	AIO	USB differential data (+)	Requires differential impedance of 90 Ω. A test point must be reserved.
39	VCC_3V3	PI	3.0–3.6 V, typ. 3.3 V DC supply	
40	GND	-	Ground	
41	VCC_3V3	PI	3.0–3.6 V, typ. 3.3 V DC supply	
42	LED_WWAN#	OC	LED signal for indicating the network status of the module	
43	GND	-	Ground	
44	USIM_PRESENCE	DI	(U)SIM card hot-plug detect	1.8 V power domain.
45	PCM_CLK *	DO	PCM clock	1.8 V power domain.
46	NC	--	Not connected	
47	PCM_DOUT *	DO	PCM data output	1.8 V power domain.
48	DBG_TXD	DO	Debug transmit	

49	PCM_DIN *	DI	PCM data input	1.8 V power domain.
50	GND	-	Ground	
51	PCM_SYNC*	DIO	PCM frame sync	1.8 V power domain.
52	VCC_3V3	PI	3.0–3.6 V, typ. 3.3 V DC supply	

NOTE

Keep all NC, RESERVED and unused pins unconnected and connect all GND pins to ground network.

3.3. Operating Modes

The following table briefly outlines the operating modes to be mentioned in the following chapters.

Table 5: Overview of Operating Modes

Mode	Details	
Full Functionality Mode	Idle	The module remains registered on the network, and is ready to send and receive data. In this mode, the software is active.
	Voice/Data	The module is connected to network. Its power consumption varies with the network setting and data transfer rate.
Airplane Mode	**AT+CFUN=4** or pulling W_DISABLE# pin down can set the module to airplane mode where the RF function is invalid.	
Minimum Functionality Mode	**AT+CFUN=0** can set the module to a minimum functionality mode without removing the power supply. In this mode, both RF function and (U)SIM card are invalid.	
Sleep Mode	The module remains the ability to receive paging message, SMS, voice call and TCP/UDP data from the network normally. In this mode, the power consumption is reduced to a very low level.	

NOTE

For more details about **AT+CFUN**, see ***document [2]***.

3.4. Power Saving

3.4.1. Sleep Mode

EG915Q-NA Mini PCIe is able to reduce its power consumption to a very low level in sleep mode. There are three preconditions that must be met to make the module enter sleep mode.

- Execute **AT+QSCLK=1** to enable sleep mode. See ***document [2]*** for details.
- Ensure the UART_DTR is kept at high level or open.
- Ensure the host's USB bus, which is connected with the module's USB interface, enters suspend state.

3.4.2. Airplane Mode

When the module enters airplane mode, the RF function will be disabled, and all AT commands related to it will be inaccessible. For more details, see ***Chapter 3.10.2***.

3.5. Power Supply

The following table shows the definition of VCC_3V3 and ground pins.

Table 6: Definition of VCC_3V3 and GND Pins

Pin Name	Pin No.	I/O	Description
VCC_3V3	2, 39, 41, 52	PI	3.0–3.6 V, Typ. 3.3 V DC supply
GND	4, 9, 15, 18, 21, 26, 27, 29, 34, 35, 37, 40, 43, 50		

The typical supply voltage of EG915Q-NA Mini PCIe is 3.3 V. Therefore, the power supply must be able to provide a rated output current of at least 2A. To reduce voltage drop, and a bypass capacitor (C3) of not less than 470 µF and with low ESR should be used to prevent the voltage from dropping. If a switching power supply is used to power the module, the power device and the routing traces of the switching power supply should avoid the antennas as much as possible to prevent EMI interference.
The following figure shows a reference design of power supply with an LDO where R2 and R3 are 1 % tolerance resistors and C3 is a 470 µF and low-ESR capacitor.

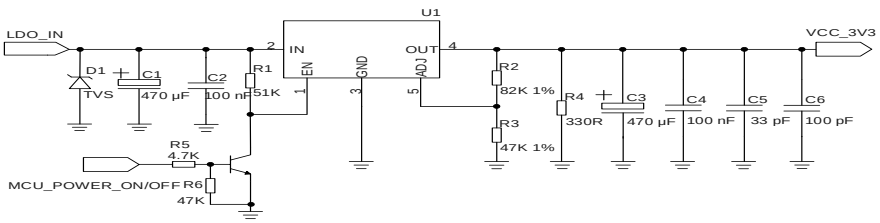


Figure 3: Reference Circuit of Power Supply

3.6. UART And Debug Interface

The module provides two serial ports.
The module is called Data Communication Equipment (DCE), according to the traditional DCE-DTE (Data Terminal Equipment).

EG915Q-NA Mini PCIe provides one UART interface that supports 9600 bps, 19200 bps, 38400 bps, 57600 bps, 115200 bps and 230400 bps baud rates, and the default is 115200 bps. It supports RTS and CTS hardware flow control, and can be used for AT command communication and data transmission.

EG915Q-NA Mini PCIe provides one Debug interface that supports 115200 bps, 3000000 bps, and the default is 115200 bps.

Table 7: Pin Definition of UART/Debug Interface

UART Interface				
Pin Name	**Pin No.**	**I/O**	**Description**	**Comment**
UART_RXD	11	DI	UART receive	Connect to DTE's TX. 3.3 V power domain.
UART_TXD	13	DO	UART transmit	Connect to DTE's RX. 3.3 V power domain.
UART_CTS	23	DI	DCE clear to send signal from DTE	Connects to DTE's RTS. 3.3 V power domain.
UART_RTS	25	DO	DCE request to send signal from DTE	Connects to DTE's CTS. 3.3 V power domain.
UART_RI	17	DO	Ring indication	3.3 V power domain.
UART_DTR	31	DI	Sleep mode control	3.3 V power domain.
UART_DCD*	33	DO	Module output carrier detect	
Debug Interface				
Pin Name	**Pin No.**	**I/O**	**Description**	**Comment**
DBG_RXD	28	DI	Debug receive	1.8 V power domain.
DBG_TXD	48	DO	Debug transmit	1.8V power domain.

The signal level of UART interface is 3.3 V. When connecting to the peripheral MCU/RAM, you need to

pay attention to the signal direction. The reference circuit is shown as below:

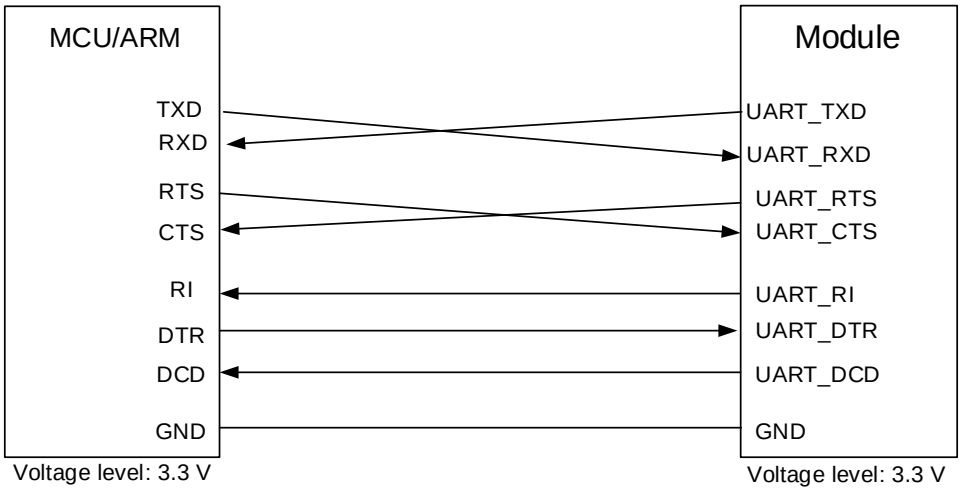


Figure 4: Reference Circuit of UART Connection

NOTE

1. Hardware flow control is disabled by default。**AT+IFC** can be used to set the hardware flow control. See ***document [2]*** for details.
2. **AT+IPR** can be used to set the baud rate of the UART interface, See ***document [2]*** for details.
3. Due to the transistor level conversion circuit inside the module, it is not suitable for applications with baud rates exceeding 460 kbps

3.7. USB Interface

EG915Q-NA Mini PCIe provides one integrated Universal Serial Bus (USB) interface which complies with USB 2.0 specification.
Meanwhile, it supports high-speed (480 Mbps) and full-speed (12 Mbps) modes.

The USB interface is used for AT command communication, data transmission, GNSS NMEA sentence output, software debugging and firmware upgrade.

The following table shows the pin definition of USB interface.

Table 8: Pin Definition of USB Interface

Pin Name	Pin No.	I/O	Description	Comment
USB_DM	36	AIO	USB differential data (-)	Requires differential impedance of 90 Ω.

USB_DP	38	AIO	USB differential data (+)	Test points must be reserved.

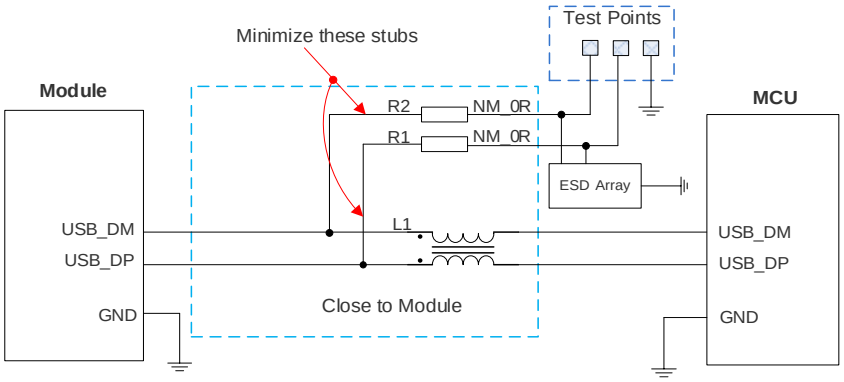


Figure 5: Reference Circuit of USB Interface

A common mode choke L1 is recommended to be added in series between the module and your MCU to suppress EMI spurious transmission. Meanwhile, the 0 Ω resistors (R1 and R2) should be added in series between the module and the test points to facilitate debugging, and the resistors are not mounted by default. In order to ensure the integrity of USB data trace signal, L1, R1, and R2 components must be placed close to the module, and these resistors should be placed close to each other. The extra stubs of trace must be as short as possible.

To meet USB 2.0 specification, the following principles should be complied with when designing the USB interface.

- Route the USB signal traces as differential pairs in inner-layer of the PCB with ground surrounded on that layer and with ground planes above and below. The impedance of USB differential trace is 90 Ω.
- Do not route signal traces under crystals, oscillators, magnetic devices and RF signal traces.
- Junction capacitance of the ESD protection devices might cause influences on USB signal traces, so you should pay attention to the selection of the device. Typically, the capacitance value should not exceed 2 pF.
- Keep the ESD protection devices as close to the USB connector as possible.

3.8. (U)SIM Interface

The (U)SIM interface circuitry meets ETSI and IMT-2000 requirements.
Either 1.8 V or 3.0 V (U)SIM card is supported.
The following table shows the pin definition of (U)SIM interface.

Table 9: Pin Definition of (U)SIM Interface

Pin Name	Pin No.	I/O	Description	Comment
USIM_VDD	8	PO	(U)SIM card power supply	1.8/3.0 V
USIM_DATA	10	DIO	(U)SIM card data	
USIM_CLK	12	DO	(U)SIM card clock	
USIM_RST	14	DO	(U)SIM card reset	
USIM_PRESENCE	44	DI	(U)SIM card hot-plug detect	1.8 V

The module supports (U)SIM card hot-plug via the USIM_PRESENCE pin and supports low-level and high-level detections. The function is disabled by default and can be configured via **AT+QSIMDET**. See ***document [2]*** for details about the command.

The following figure shows a reference design for (U)SIM interface with an 8-pin (U)SIM card connector.

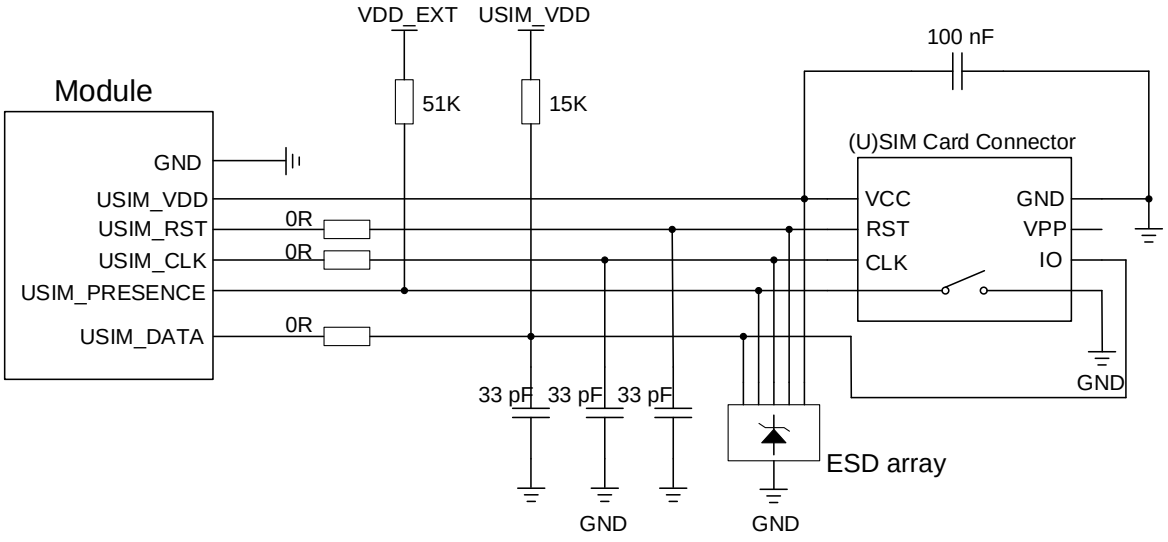


Figure 6: Reference Circuit of (U)SIM Interface with an 8-pin (U)SIM Card Connector

If (U)SIM card hot-plug detect is not needed, keep USIM_PRESENCE unconnected. A reference circuit for (U)SIM interface with a 6-pin (U)SIM card connector is illustrated in the following figure.

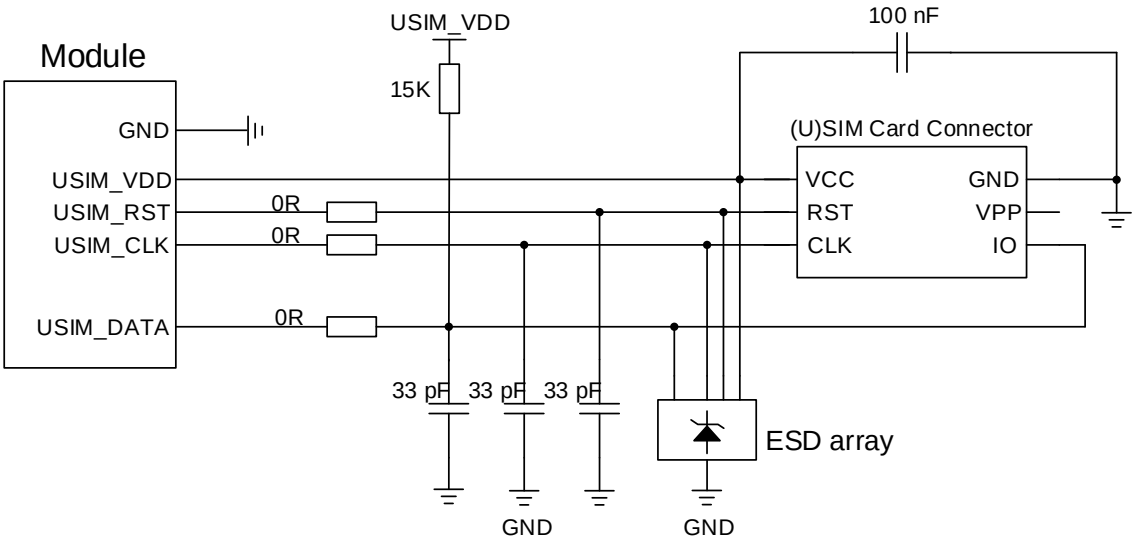


Figure 7: Reference Circuit of (U)SIM Interface with a 6-pin (U)SIM Card Connector

In order to enhance the reliability and availability of the (U)SIM card in your applications, please follow the criteria below in the (U)SIM circuit design:

- Place the (U)SIM card connector as close to the module as possible. Keep the trace length at most 200 mm.
- Keep (U)SIM card signals away from RF and power supply traces.
- To avoid cross-talk between USIM_DATA and USIM_CLK, keep them away from each other and shield them with surrounded ground.
- For better ESD protection, it is recommended to add an ESD device with parasitic capacitance not exceeding 15 pF.
- The 0 Ω resistors should be added in series between the module and the (U)SIM card connector to facilitate debugging. The 33 pF capacitors are used for filtering interference of EGSM900. Please note that the (U)SIM peripheral circuit should be close to the (U)SIM card connector.
- The pull-up resistor on USIM_DATA trace can improve anti-jamming capability when the layout trace is long, or the sensitive interference source is relatively close, and it should be placed close to the (U)SIM card connector.

NOTE

1. The EG915Q-NA Mini PCIe provides a welded (U)SIM card (integrated (U)SIM card, optional). To enable this function, contact Remote Communications technical support.
2. The integrated (U)SIM card and the external (U)SIM card connected to the Mini PCI Express (U)SIM port share the same set of (U)SIM bus, but the hot swap signal cable is not drawn, so the hot swap detection function of the (U)SIM card is not supported. Integrated and external (U)SIM cards cannot be used at the same time.
3. If you need this function, please contact Quectel Technical Support.

3.9. PCM* and I2C* Interfaces

EG915Q-NA Mini PCIe provides one Pulse Code Modulation (PCM) interface and one I2C interface. The following table shows the pin definition of PCM and I2C interfaces that can be applied in audio Codec design.

Table 10: Pin Definition of PCM and I2C Interfaces

Pin Name	Pin No.	I/O	Description	Comment
PCM_CLK *	45	DIO	PCM clock	1.8 V
PCM_DOUT *	47	DO	PCM data output	1.8 V
PCM_DIN *	49	DI	PCM data input	1.8 V
PCM_SYNC*	51	DIO	PCM frame sync	1.8 V
I2C_SCL*	30	OD	I2C serial clock (for external Codec)	Requires external pull-up to 1.8 V.
I2C_SDA*	32	OD	I2C serial data (for external Codec)	Requires external pull-up to 1.8 V.

The following figure shows a reference design of PCM and I2C interfaces with an external Codec IC.

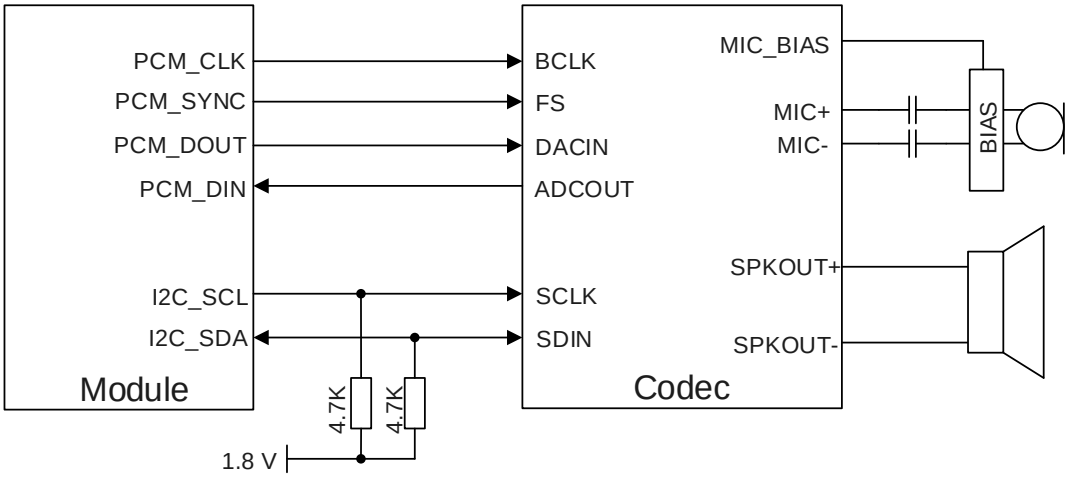


Figure 8: Reference Circuit of PCM and I2C Application with Audio Codec

NOTE

The EG915Q-NA Mini PCIe PCM software is still under development and does not support the PCM function. ,

3.10. Control and Indication Interfaces

The following table shows the pin definition of control and indication signals.

Table 11: Pin Definition of Control and Indication Interfaces

Pin Name	Pin No.	I/O	Description	Comment
UART_RI	17	OC	Ring indication	3.3 V power domain.
W_DISABLE#*	20	DI	Airplane mode control	3.3 V power domain. Pulled up by default. Active low.
UART_DTR	31	DI	Sleep mode control	3.3 V power domain.
PERST#	22	DI	Fundamental reset	3.3 V power domain. Pulled up by default. Active low. A test point is recommended to be reserved if the pin is unused.
LED_WWAN#	42	OC	LED signal for indicating the network status of the module	Active low.
WAKE#	1	OC	Wake up the host	

3.10.1. UART_RI

The RI signal can be used to wake up the host. When a URC returns, there will be the following behaviors on the RI pin after executing **AT+QCFG="risignaltype","physical"**. For more details, see ***document [3]***.

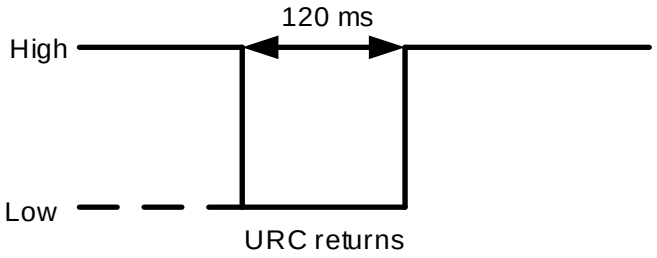


Figure 9: RI Behaviors

3.10.2. W_DISABLE#*

The module provides a W_DISABLE# signal to disable or enable the RF function (excluding GNSS). The W_DISABLE# pin is pulled up by default. Disabled in firmware by default, the W_DISABLE# control function for airplane mode can be enabled by **AT+QCFG="airplanecontrol",1**. Driving it low can make the module enter airplane mode. For more details, see ***document [3]***.

Table 12: Airplane Mode Controlled by Hardware Method

W_DISABLE#	RF Function Status	Module Operating Mode
High level	RF enabled	Full functionality mode
Low level	RF disabled	Airplane mode

The RF function can also be enabled or disabled through **AT+CFUN**, and the details are as follows.

Table 13: Airplane Mode Controlled by Software Method

AT+CFUN=?	RF Function Status	Module Operating Mode
0	RF and (U)SIM disabled	Minimum functionality mode
1	RF enabled	Full functionality mode
4	RF disabled	Airplane mode

NOTE

EG915Q-NA Mini PCIe for W_DISABLE# flight control function software development.
If you need this function, please contact Quectel Technical Support.

3.10.3. UART_DTR

The UART_DTR signal is used for sleep mode control. It is pulled up by default. When the module is in sleep mode, driving DTR low can wake up the module. For more details about the preconditions for the module to enter sleep mode, see ***Chapter 3.4.1***.

3.10.4. PERST#

The PERST# signal can be used to force a hardware reset. The module can be reset by driving the PERST# signal low for 150–460 ms and then releasing it. The PERST# signal is sensitive to interference. The traces should be as short as possible and be surrounded with ground.

The reset timing is illustrated in the following figure.

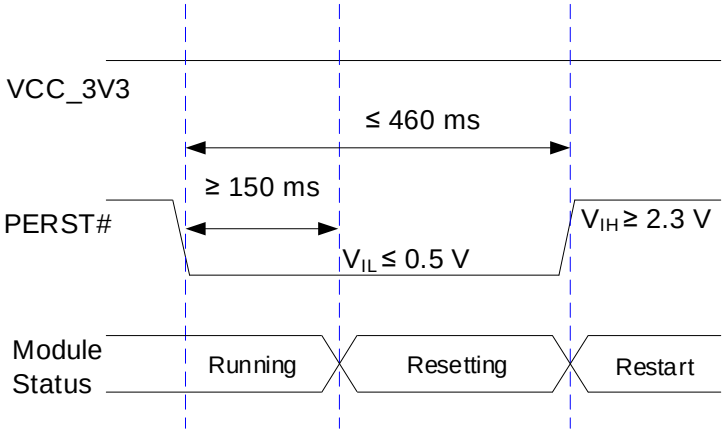


Figure 10: Reset Timing

3.10.5. LED_WWAN#

LED_WWAN# is an open collector output signal, and it is used to indicate the network status of the module, and its maximum input current can be up to 40 mA. A current-limiting resistor must be placed in series with the LED and its resistance can be determined by the LED brightness. The LED emits light when the LED_WWAN# output signal is at low level.

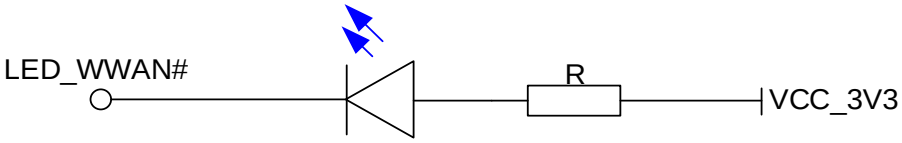


Figure 11: LED_WWAN# Signal Reference Circuit Diagram

There are two indication modes for LED_WWAN# signal to indicate network status, which can be switched through following AT commands:

- **AT+QCFG="ledmode",0** (default setting)
- **AT+QCFG="ledmode",2**

The following tables show the detailed network status indications of the LED_WWAN# signal.

Table 14: Indications of Network Status (AT+QCFG="ledmode",0, Default Setting)

Pin Status	Description
Flicker slowly (200 ms Low/1800 ms High)	Network searching
Flicker slowly (1800 ms Low/200 ms High)	Idle
Flicker quickly (125 ms Low/125 ms High)	Data transfer is ongoing

Table 15: Indications of Network Status (AT+QCFG="ledmode",2)

Pin Status	Description
Low Level (Light ON)	Registered on network successfully
High-impedance (Light OFF)	• No network covered or registered • W_DISABLE# signal is at low level. (RF Disabled.) • **AT+CFUN=0**, **AT+CFUN=4** executed

3.10.6. WAKE#

The WAKE# signal is an open collector signal, which is similar to RI signal, but a pull-up resistor and **AT+QCFG="risignaltype","physical"** are required to wake up the host. When a URC returns, a 120 ms low level pulse will be outputted. The state of WAKE# signal is shown as below.

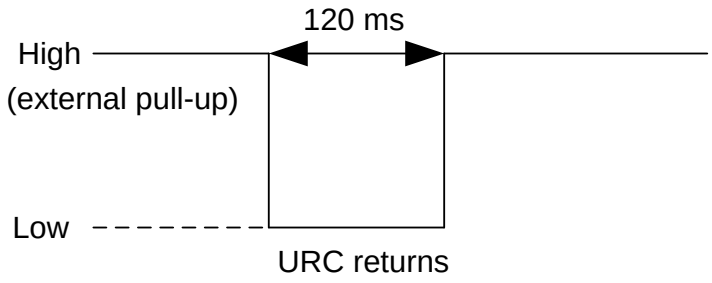


Figure 11: WAKE# Behaviors

4 GNSS

The GNSS function of the EG915Q-NA MINI PCIE is optional, and its application solution is All-in-one.

In **All-in-one** solution, LTE part and GNSS part can be worked as a whole unit. The GNSS part can be regarded as a peripheral of the LTE part. Without an external power supply, the LTE part can internally control the LDO to supply power to the GNSS. If the LTE part is disabled, the GNSS will not work.

EG915Q-NA Mini PCIe includes a fully integrated global navigation satellite system solution that supports GPS, GLONASS, BDS, Galileo and QZSS. Additionally, it supports standard NMEA 0183 protocol, and outputs NMEA sentences at 1 Hz data update rate via USB interface by default.

By default, the GNSS engine of the module is disabled and can only be enabled via AT command. For more details about GNSS engine technology and configurations, see ***document [4]***.

4.1. GNSS Performance

Table 16: GNSS Performance

Parameter	Description	Condition	Typ.	Unit
Sensitivity	Acquisition	Autonomous	TBD	dBm
	Reacquisition	Autonomous	TBD	
	Tracking	Autonomous	TBD	
TTFF	Cold start @ open sky	Autonomous	TBD	s
		AGPS enabled	TBD	
	Warm start @ open sky	Autonomous	TBD	
	Hot start @ open sky	Autonomous	TBD	
Accuracy	CEP-50	Autonomous @ open sky	TBD	m

NOTE

1. Tracking sensitivity: the minimum GNSS signal power at which the module can maintain lock (keep positioning for at least 3 minutes continuously).
2. Reacquisition sensitivity: the minimum GNSS signal power required for the module to maintain lock within 3 minutes after loss of lock.

3. Acquisition sensitivity: the minimum GNSS signal power at which the module can fix position successfully within 3 minutes after executing cold start command.

4.2. GNSS Frequency Bands

The following table shows the GNSS frequency bands of EG915Q-NA Mini PCIe.

Table 17: GNSS Frequency Bands (Unit: MHz)

Type	Frequency Band
GPS	1575.42 ±1.023 (L1)
GLONASS	1597.5~1605.8 (L1)
Galileo	1575.42 ±2.046 (E1)
BDS	1561.098 ±2.046 (B1I)
QZSS	1575.42 ±1.023 (L1)

5 Antenna Connection

5.1. Antenna Connectors

EG915Q-NA Mini PCIe is mounted with three antenna connectors for external antenna connection: a main antenna connector, a Rx-diversity antenna connector, and a GNSS antenna connector. And Rx-diversity function is enabled by default. The impedance of the antenna connectors is 50 Ω.

Appropriate antenna type and design should be used with matched antenna parameters according to specific application. It is required to perform a comprehensive functional test for the RF design before mass production of terminal products. The entire content of this chapter is provided for illustration only. Analysis, evaluation and determination are still necessary when designing target products.

5.1.1. Operating Frequency Bands

Table 18: Operating Frequency Bands (Unit: MHz)

3GPP Band	Transmit	Receive
LTE-FDD B2	1850~1910	1930~1990
LTE-FDD B4	1710~1755	2110~2155
LTE-FDD B5	824~849	869~894
LTE-FDD B12	699~716	729~746
LTE-FDD B13	777~787	746~756
LTE-FDD B66	1710~1780	2110~2180

5.2. Antenna Design Requirements

The following table shows the requirements on main antenna and GNSS antenna.

Table 19: Antenna Requirements

Type	Requirement
GNSS	● Frequency range: L1: 1559~1609 MHz ● Polarization: ● VSWR: < 2 (typ.) ● Passive antenna gain: > 0 dBi ● Active antenna noise figure: < 1.5 dB ● Active antenna gain: < 17 dB ● Active antenna embedded LNA gain: < 17 dB
LTE	● VSWR: ≤ 2 ● Efficiency: > 30% ● Max input power: 50 W ● Input impedance: 50 Ω ● Cable insertion loss: **< 1 dB :** LB (<1 GHz) **< 1.5 dB :** MB (1–2.3 GHz)

NOTE

1. It is recommended to use a passive GNSS antenna when LTE B13 is supported, as the use of active antenna may generate harmonics which will affect the GNSS performance.
2. Since the GNSS interface has a 2.85 V voltage output, a passive antenna that causes short to GND, such as PIFA antenna, is not recommended.

5.3. RF Connector

EG915Q-NA Mini PCIe is mounted with RF connectors (receptacles) for convenient antenna connection. The dimensions of the antenna connectors are shown as below.

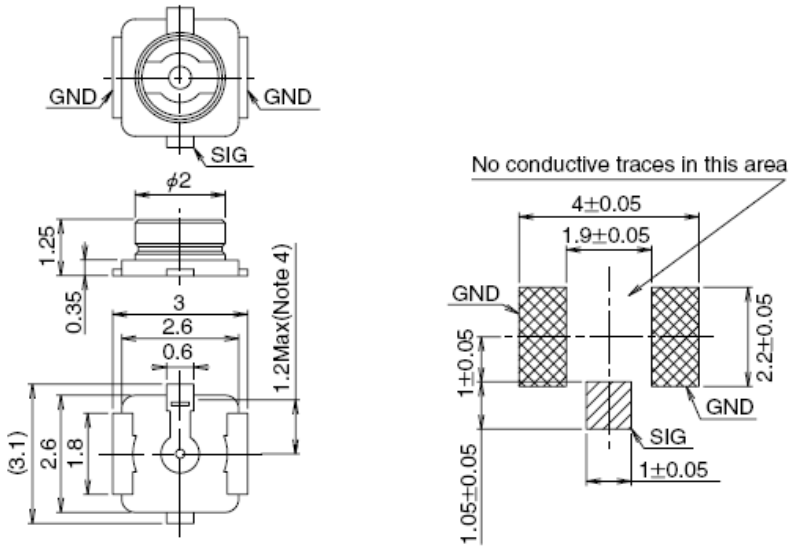


Figure 12: Dimensions of the Receptacle (Unit: mm)

U.FL-LP mated plugs listed in the following figure can be used to match the receptacles.

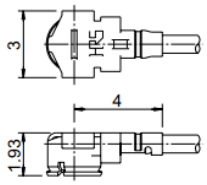
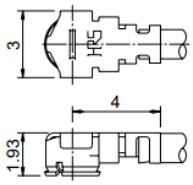
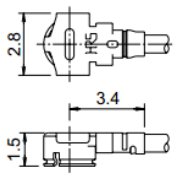
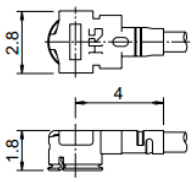
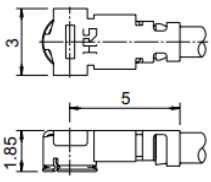
Part No.	U.FL-LP-040	U.FL-LP-066	U.FL-LP(V)-040	U.FL-LP-062	U.FL-LP-088
					
Mated Height	2.5mm Max. (2.4mm Nom.)	2.5mm Max. (2.4mm Nom.)	2.0mm Max. (1.9mm Nom.)	2.4mm Max. (2.3mm Nom.)	2.4mm Max. (2.3mm Nom.)
Applicable cable	Dia. 0.81mm Coaxial cable	Dia. 1.13mm and Dia. 1.32mm Coaxial cable	Dia. 0.81mm Coaxial cable	Dia. 1mm Coaxial cable	Dia. 1.37mm Coaxial cable
Weight (mg)	53.7	59.1	34.8	45.5	71.7
RoHS	YES				

Figure 13: Specifications of Mated Plugs

The following figure describes the space factor of mating connectors.

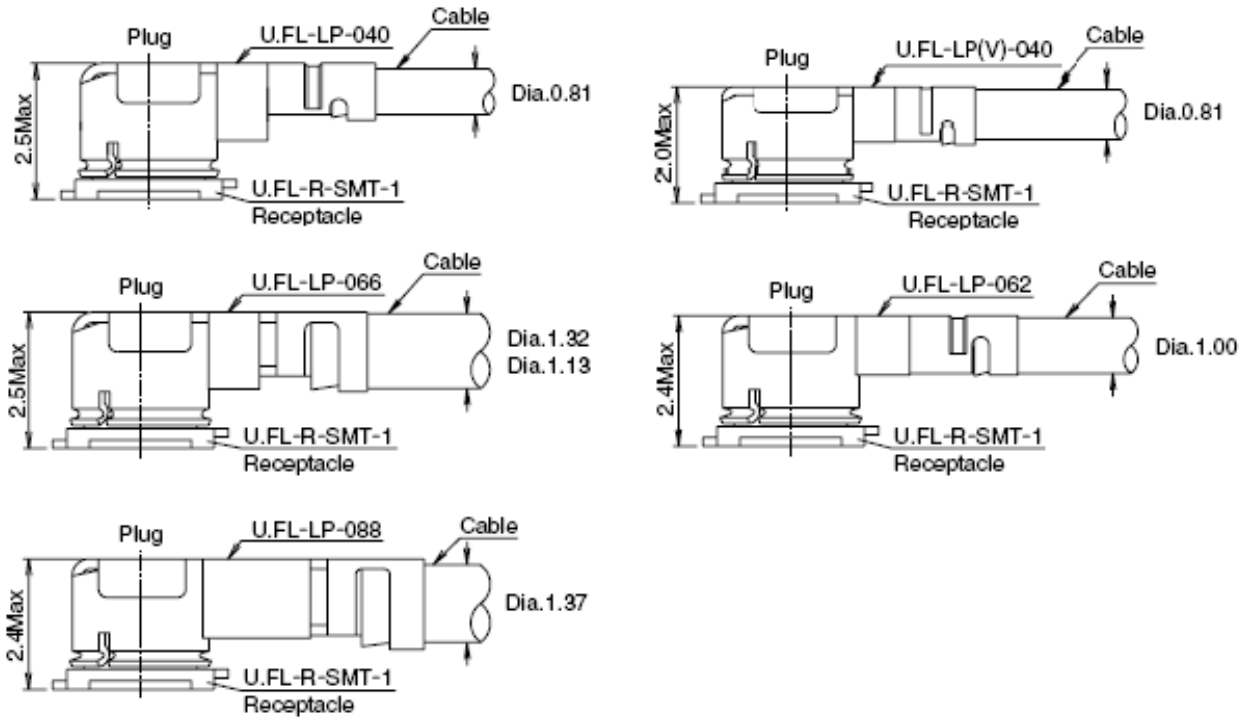


Figure 14: Space Factor of Mated Connectors (Unit: mm)

For more details, visit http://www.hirose.com.

6 Reliability, Radio and Electrical Characteristics

6.1. General Description

This chapter mainly describes the following electrical and radio characteristics of EG915Q-NA Mini PCIe:

- Power supply requirements
- Digital I/O characteristics
- RF performance
  - Tx power
  - Rx sensitivity
- ESD protection
- Power consumption

6.2. Power Supply Requirements

The input voltage of is 3.0–3.6 V, as specified by *PCI Express Mini Card Electromechanical Specification Revision 1.2*. The following table shows the power supply requirements of the module.

Table 20: Power Supply Requirements (Unit: V)

Parameter	Description	Min.	Typ.	Max.
VCC_3V3	Power supply	3.0	3.3	3.6

6.3. Digital I/O Characteristics

The following table shows the I/O requirements of EG915Q-NA Mini PCIe.

Table 21: I/O Requirements (Unit: V)

VDD_EXT I/O Requirements (Unit: V)			
Parameter	**Description**	**Min.**	**Max.**
V_{IH}	Input high voltage	1.2	2
V_{IL}	Input low voltage	-0.3	0.6
V_{OH}	Output high voltage	1.35	-
V_{OL}	Output low voltage	-	0.45
USIM LOW LEVEL I/O Requirements (Unit: V)			
Parameter	**Description**	**Min.**	**Max.**
V_{IH}	Input high voltage	1.2	-
V_{IL}	Input low voltage	-	0.6
V_{OH}	Output high voltage	1.35	-
V_{OL}	Output low voltage	-	0.45
USIM HIGH LEVEL I/O Requirements (Unit: V)			
Parameter	**Description**	**Min.**	**Max.**
V_{IH}	Input high voltage	1.95	-
V_{IL}	Input low voltage	-	1.0
V_{OH}	Output high voltage	2.55	-
V_{OL}	Output low voltage	-	0.45

6.4. RF Performance

6.4.1. Tx Power

The following tables show the conducted RF Tx power of EG915Q-NA Mini PCIe.

Table 22: Conducted RF Tx Power

Frequency Band	Max. Tx Power	Min. Tx Power
LTE bands	23 dBm ±2 dB	< -39 dBm

6.4.2. Rx Sensitivity

Table 23: Conducted RF Rx Sensitivity (Unit: dBm)

Frequency Band	RF Rx Sensitivity (Typ.)	3GPP (SIMO)
	Primary	
LTE-FDD B2 (10 MHz)	-97.5	-94.3 dBm
LTE-FDD B4 (10 MHz)	-98.5	-96.3 dBm
LTE-FDD B5 (10 MHz)	-99.5	-94.3 dBm
LTE-FDD B12 (10 MHz)	-99.0	-93.3 dBm
LTE-FDD B13 (10 MHz)	-98.0	-93.3 dBm
LTE-FDD B66 (10 MHz)	-98.5	-95.8 dBm

6.5. ESD Protection

Static electricity occurs naturally and it may damage the module. Therefore, applying proper ESD countermeasures and handling methods is imperative. For example, wear anti-static gloves during the development, production, assembly and testing of the module; add ESD protection components to the ESD sensitive interfaces and points in the product design.

The following table shows the ESD characteristics of EG915Q-NA Mini PCIe.

Table 24: ESD Characteristics (Temperature: 25–30 °C, Humidity: 40 ±5 %)

Tested Interface	Contact Discharge	Air Discharge	Unit
Power Supply and GND	±5	±10	kV
Antenna Interfaces	±4	±8	kV
USB Interface	TBD	TBD	kV
(U)SIM Interface	TBD	TBD	kV
Others	±0.5	±1	kV

6.6. Power Consumption

Table 25: Module Power Consumption Under Cellular Network

Description	Condition	Typ.	Unit
Power-off	Power down	887	μA
Sleep Mode	**AT+CFUN=0** (USB disconnected)	929	mA
	AT+CFUN=0 (USB suspended)	1155	mA
	AT+CFUN=4 (USB disconnected)	1045	mA
	AT+CFUN=4 (USB suspended)	1275	mA
	LTE-FDD @ PF = 32 (USB disconnected)	2.62	mA
	LTE-FDD @ PF = 64 (USB disconnected)	1.83	mA
	LTE-FDD @ PF = 64 (USB suspended)	2.08	mA
	LTE-FDD @ PF = 128 (USB disconnected)	1.44	mA
	LTE-FDD @ PF = 256 (USB disconnected)	1.28	mA
Idle State	LTE-FDD @ PF = 64 (USB disconnected)	8.09	mA
	LTE-FDD @ PF = 64 (USB connected)	34.91	mA

Lte Max Rates	LTE-FDD B2 20MHz @ 22.80dBm	780	mA
	LTE-FDD B4 20MHz @ 22.60 dBm	690	mA
	LTE-FDD B5 10MHz @ 23.30 dBm	630	mA
	LTE-FDD B12 10MHz @ 22.70 dBm	720	mA
	LTE-FDD B13 10MHz @ 22.78 dBm	780	mA
	LTE-FDD B66 20MHz @ 22.57 dBm	705	mA

Table 26: GNSS Power Consumption (Unit: mA)

Description	Condition	Typ.
Acquisition (**AT+CFUN=0**)	Cold start @ Passive antenna	73 mA
	Lost state @ Passive antenna	74 mA
Tracking (**AT+CFUN=0**)	Instrument environment	68 mA

6.7. Notification

Please follow the principles below in the module application.

6.7.1. Coating

If a conformal coating is necessary for the module, do NOT use any coating material that may chemically react with the PCB or shielding cover, and prevent the coating material from flowing into the module.

6.7.2. Cleaning

Avoid using ultrasonic technology for module cleaning since it can damage crystals inside the module.

6.7.3. Installing

It is recommended to fix the module firmly when the module is inserted into a socket.

7 Mechanical Information

This chapter mainly describes mechanical dimensions as well as packaging specification of EG915Q-NA Mini PCIe. All dimensions are measured in millimeter (mm), and the dimensional tolerances are ±0.15 mm unless otherwise specified.

7.1. Mechanical Dimensions

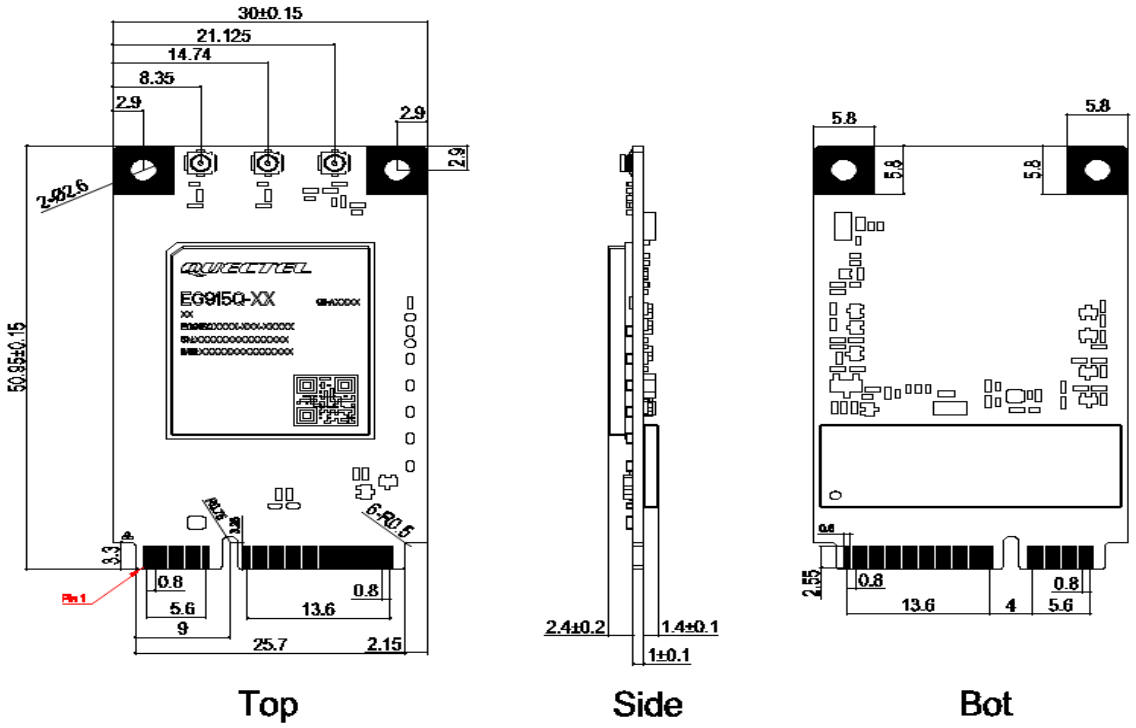


Figure 15: Mechanical Dimensions

NOTE

The package warpage level of the module conforms to the *JEITA ED-7306* standard.

7.2. Packaging Specifications

This chapter describes only the key parameters and process of packaging. All figures below are for reference only. The appearance and structure of the packaging materials are subject to the actual delivery.

The module adopts blister tray packaging and details are as follow:

7.2.1. Blister Tray

Dimension details are as follow:

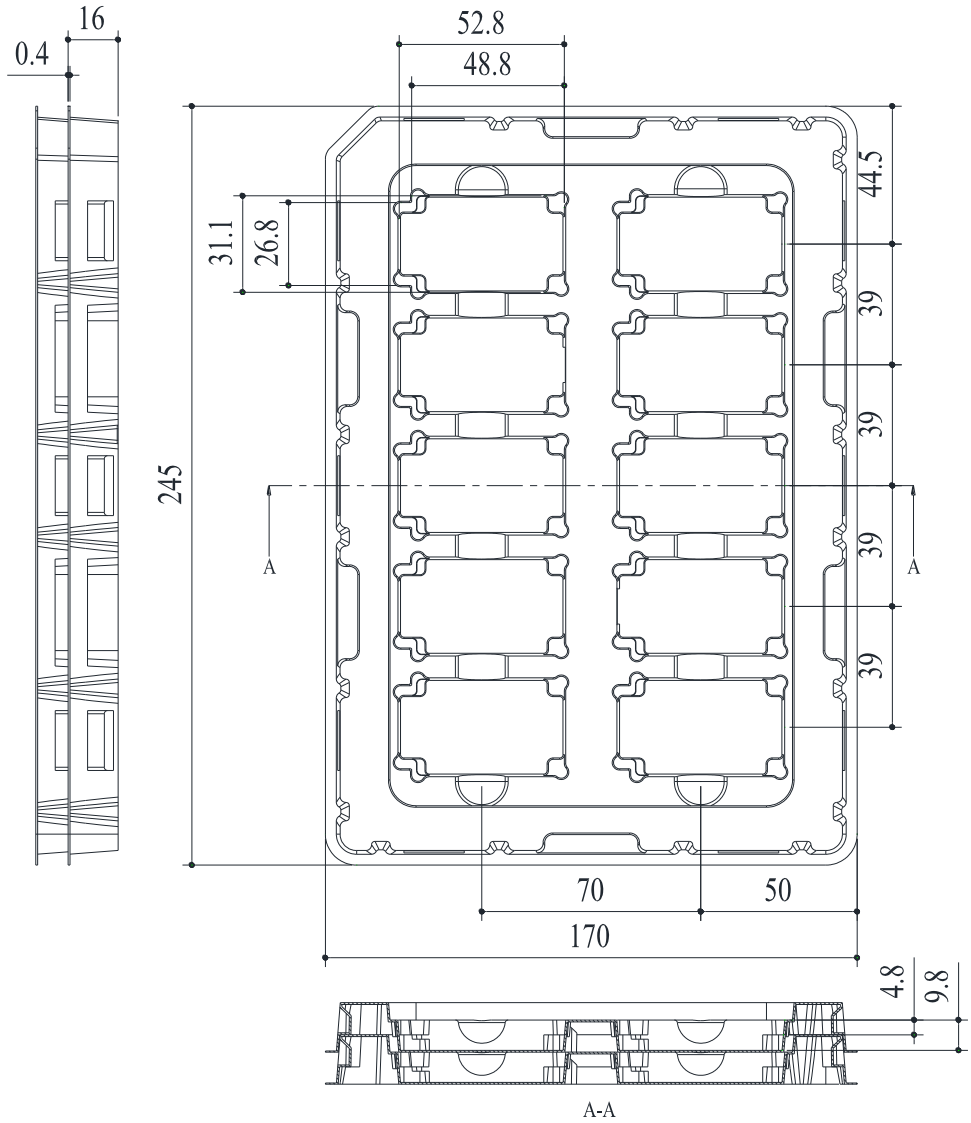
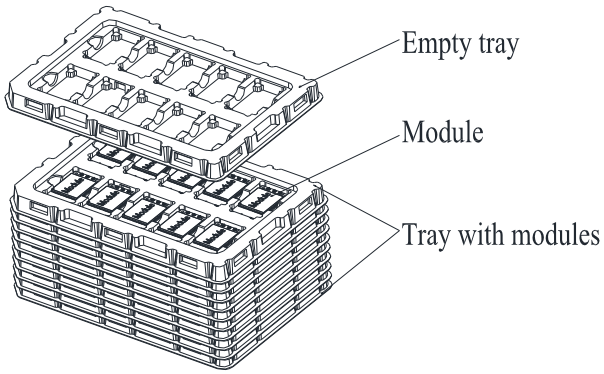


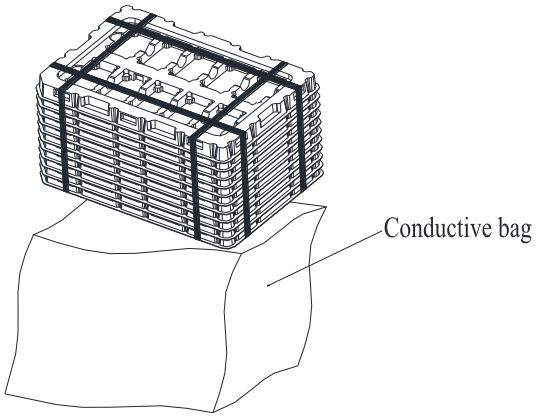
Figure 16: Blister Tray Dimension Drawing (Unit: mm)

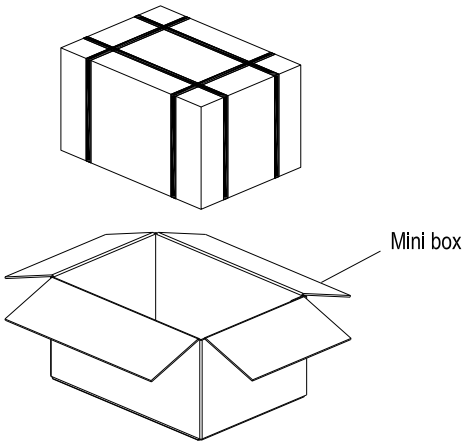
7.2.2. Packaging Process



Each blister tray packs 10 modules. Stack 10 trays with modules, and place 1 empty tray on top.

Fasten the 11 trays and place them into a conductive bag and fasten it.





Pack the conductive bag with blister trays into a mini box. 1 mini box can pack 100 modules.

Place the 4 packaged mini boxes into 1 carton and seal it. 1 carton can pack 400 modules.

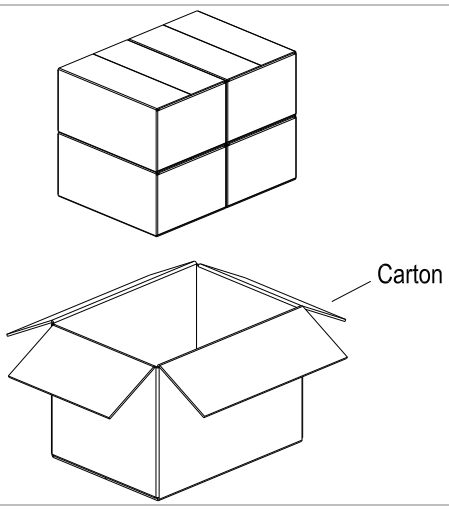


Figure 17: Packaging Process

8 Appendix References

Table 27: Related Documents

Document Name
[1] Quectel_Mini_PCIe_EVB_User_Guide
[2] Quectel_EC2x&EG2x-G(L)&EG9x&EM05_Series_AT_Commands_Manual
[3] Quectel_EC2x&EG2x&EG9x&EM05_Series_QCFG_AT_Commands_Manual
[4] Quectel_EC2x&EG2x&EG9x&EM05_Series_GNSS_Application_Note
[5] Quectel_EG915Q-NA_硬件设计手册_V1.0
[6] Quectel_EG2x-GL_Mini_PCIe_Hardware_Design_V1.0

Table 28: Terms and Abbreviations

Abbreviation	Description
3GPP	3rd Generation Partnership Project
AMR	Adaptive Multi-rate
BDS	BeiDou Navigation Satellite System
bps	Bits Per Second
CHAP	Challenge Handshake Authentication Protocol
CMUX	Connection Multiplexing
CS	Coding Scheme

CTS	Clear to Send
DCE	Data Communications Equipment
DC-HSDPA	Dual-carrier High Speed Downlink Packet Access
DCS	Digital Cellular System
DFOTA	Delta Firmware Upgrade Over-The-Air
DL	Downlink
DTE	Data Terminal Equipment
DTR	Data Terminal Ready
EFR	Enhanced Full Rate
EMI	Electro Magnetic Interference
ESD	Electrostatic Discharge
ESR	Equivalent Series Resistance
EVB	Evaluation Board
FDD	Frequency Division Duplexing
FR	Full Rate
FTP	File Transfer Protocol
FTPS	FTP over SSL
GLONASS	Russian Global Navigation Satellite System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HR	Half Rate
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
I/O	Input/Output
kbps	Kilo Bits Per Second

LDO	Low-dropout Regulator
LED	Light Emitting Diode
LTE	Long-Term Evolution
Mbps	Million Bits Per Second
MCS	Modulation and Coding Scheme
MCU	Micro Control Unit
ME	Mobile Equipment
MIMO	Multiple-Input Multiple-Output
MMS	Multimedia Messaging Service
MO	Mobile Originated
MQTT	Message Queuing Telemetry Transport
MT	Mobile Terminated
NITZ	Network Identity and Time Zone
NMEA	National Marine Electronics Association
NTP	Network Time Protocol
PA	Power amplifier
PAP	Password Authentication Protocol
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PCIe	Peripheral Component Interconnect Express
PCS	Personal Communications Service
PDA	Personal Digital Assistant
PDU	Protocol Data Unit
PIFA	Planar Inverted F Antenna
PING	Packet Internet Groper

POS	Point of Sale
PPP	Point-to-Point Protocol
PSK	Phase Shift Keying
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
QZSS	Quasi-Zenith Satellite System
RF	Radio Frequency
RHCP	Right Hand Circularly Polarized
RoHS	Restriction of Hazardous Substances
RTS	Ready To Send
Rx	Receive
SAW	Surface Acoustic Wave
SIM	Subscriber Identity Module
SIMO	Single Input Multiple Output
SMS	Short Message Service
SMTP	Simple Mail Transfer Protocol
SMTPS	Simple Mail Transfer Protocol Secure
SSL	Secure Sockets Layer
TCP	Transmission Control Protocol
TDD	Time Division Duplexing
Tx	Transmitting Direction
TVS	Transient Voltage Suppressor
UART	Universal Asynchronous Receiver & Transmitter
UDP	User Datagram Protocol
UL	Uplink

UMTS	Universal Mobile Telecommunications System
URC	Unsolicited Result Code
USB	Universal Serial Bus
(U)SIM	(Universal) Subscriber Identification Module
VSWR	Voltage Standing Wave Ratio

Product Marketing Name: Quectel EG915Q-NA MINIPCIE

FCC Certification Requirements.

According to the definition of mobile and fixed device is described in Part 2.1091(b), this device is a mobile device. And the following conditions must be met:

1. This Modular Approval is limited to OEM installation for mobile and fixed applications only. The antenna installation and operating configurations of this transmitter, including any applicable source-based timeaveraging duty factor, antenna gain and cable loss must satisfy MPE categorical Exclusion Requirements of 2.1091.
2. The EUT is a mobile device; maintain at least a 20 cm separation between the EUT and the user's body and must not transmit simultaneously with any other antenna or transmitter.
3. A label with the following statements must be attached to the host end product: This device contains FCC ID: XMR2023EG915QNA
4. To comply with FCC regulations limiting both maximum RF output power and human exposure to RF radiation, maximum antenna gain (including cable loss) must not exceed:

radiation, maximum antenna gain (including cable loss) must not exceed: Operating Band	FCC Max Antenna Gain dBi
LTE Band 2	8.00
LTE Band 4	5.00
LTE Band 5	9.41
LTE Band 12	8.70
LTE Band 13	9.16
LTE Band 14	9.23
LTE Band 66	5.00
LTE Band 71	8.48

5. This module must not transmit simultaneously with any other antenna or transmitter
6. The host end product must include a user manual that clearly defines operating requirements and conditions that must be observed to ensure compliance with current FCC RF exposure guidelines.

For portable devices, in addition to the conditions 3 through 6 described above, a separate approval is required to satisfy the SAR requirements of FCC Part 2.1093

If the device is used for other equipment that separate approval is required for all other operating configurations, including portable configurations with respect to 2.1093 and different antenna configurations.

For this device, OEM integrators must be provided with labeling instructions of finished products.

Please refer to KDB784748 D01 v07, section 8. Page 6/7 last two paragraphs:

A certified modular has the option to use a permanently affixed label, or an electronic label. For a permanently affixed label, the module must be labeled with an FCC ID - Section 2.926 (see 2.2 Certification (labeling requirements) above). The OEM manual must provide clear instructions explaining to the OEM the labeling requirements, options and OEM user manual instructions that are required (see next paragraph).

For a host using a certified modular with a standard fixed label, if (1) the module's FCC ID is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straightforward commonly used methods for access to remove the module so that the FCC ID of the module is visible; then an additional permanent label referring to the enclosed module: "Contains Transmitter Module FCC ID: XMR2023EG915QNA" or "Contains FCC ID: XMR2023EG915QNA" must be used. The host OEM user manual must also contain clear instructions on how end users can find and/or access the module and the FCC ID.

The final host / module combination may also need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device.

The user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the Internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

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.
Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.
To ensure compliance with all non-transmitter functions the host manufacturer is responsible for ensuring compliance with the module(s) installed and fully operational. For example, if a host was previously authorized as an unintentional radiator under the Supplier's Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that the after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

IC Statement

IRSS-GEN
"This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions: (1) This device may not cause interference; and (2) This device must accept any interference, including interference that may cause undesired operation of the device." or "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; 2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement."
Déclaration sur l'exposition aux rayonnements RF
L'autre utilisépour l'émetteur doit être installépour fournir une distance de séparation d'au moins 20 cm de toutes les personnes et ne doit pas être colocaliséou fonctionner conjointement avec une autre antenne ou un autre émetteur.
The host product shall be properly labeled to identify the modules within the host product.
The Innovation, Science and Economic Development Canada certification label of a module shall be clearly visible at all times when installed in the host product; otherwise, the host product must be labeled to display the Innovation, Science and Economic Development Canada certification number for the module, preceded by the word "Contains" or similar wording expressing the same meaning, as follows:
"Contains IC: 10224A-023EG915QNA" or "where: 10224A-023EG915QNA is the module's certification number".
Le produit hôte doit être correctement étiquetépour identifier les modules dans le produit hôte.
L'étiquette de certification d'Innovation, Sciences et Développement économique Canada d'un module doit être

clairement visible en tout temps lorsqu'il est installédans le produit hôte; sinon, le produit hôte doit porter une étiquette indiquant le numéro de certification d'Innovation, Sciences et Développement économique Canada pour le module, précédédu mot «Contient»ou d'un libellésemblable exprimant la même signification, comme suit:
"Contient IC: 10224A-023EG915QNA " ou "où: 10224A-023EG915QNA est le numéro de certification du module".

Antenna Requirements
The following antennae were approved with the prototype:
This radio transmitter [10224A-023EG915QNA has been approved by innovation, Science and development Economic Canada to operate with the types of antennas listed below, with the maximum allowable gain indicated. The types of antennas not included in this list that have a gain of any type lis ted are strictly prohibited for use with this device.
Les antennes suivantes ont été approuvées avec le prototype:
Cet émetteur radio [10224A-023EG915QNA] a été approuvé par innovation, Science et développement économique Canada pour fonctionner avec les types d'antennes énumérés ci-dessous, avec le gain maximal autorisé indiqué. Les types d'antennes non inclus dans cette liste qui ont un gain tout type lis ted sont strictement interdits pour une utilisation avec cet appareil.

Band	Description	MAX Gain (dBi)
LTE B2	External Antenna	1.43
LTE B4		1.54
LTE B5		2.21
LTE B12		2.00
LTE B13		2.10
LTE B66		1.68