RM255C-GL

Hardware Design

5G Module Series

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Quectel Wireless Solutions Co., Ltd.
Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China
Tel: +86 21 5108 6236
Email: info@quectel.com

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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 terminal or mobile incorporating the module. Manufacturers of the 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 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.

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 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 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 terminals. Areas with explosive or potentially explosive atmospheres include fueling 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
-	2024-12-10	Iyukee SHEN/ Hebe BAO/ Sherlock ZHAO	Creation of the document
1.0.0	2024-12-10	Iyukee SHEN/ Hebe BAO/ Sherlock ZHAO	Preliminary

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1 Introduction

1.1. Introduction

The document introduces RM255C-GL module and describes its air interface and hardware interfaces which are connected to your applications.

This document helps you quickly understand the interface specifications, RF characteristics, electrical and mechanical details, as well as other related information of the module. To facilitate its application in different fields, reference design is also provided for reference. Associated with application notes and user guides, you can use the module to design and set up mobile applications easily.

1.2. Reference Standards

The module complies with the following standards:

- *PCI Express M.2 Specification Revision 4.0, Version 1.1*
- *PCI Express Base Specification Revision 4.0*
- *Universal Serial Bus 3.1 Specification*
- *ISO/IEC 7816-3*
- *MIPI Alliance Specification for RF Front-End Control Interface version 2.0*
- *3GPP TS 27.007* and *3GPP TS 27.005*

1.3. Special Mark

Table 1: Special Mark

Mark	Definition
*	Unless otherwise specified, an asterisk (*) after a function, feature, interface, pin name, command, argument, and so on indicates that it is under development and currently not supported; and the asterisk (*) after a model indicates that the model sample is currently unavailable.

2 Product Overview

2.1. Frequency Bands and Functions

RM255C-GL is a 5G NR/LTE wireless communication module with receiving diversity. It provides data connectivity on 5G NR SA, LTE-FDD, and LTE-TDD networks. It is a standard M.2 Key-B WWAN module. For more details, see *PCI Express M.2 Specification Revision 4.0, Version 1.1*.

The module supports embedded operating systems such as Windows, Linux and Android, and also provides GNSS and voice* functions to meet specific application demands.

RM255C-GL is an industrial-grade module for industrial and commercial applications only.

The following table shows the frequency bands, MIMO and GNSS systems supported by the module.

Table 2: Frequency Bands & MIMO & GNSS Systems

Mode	Frequency Band
5G NR SA	n1/n2/n3/n5/n7/n8/n12/n13/n14/n18/n20/n25/n26/n28/n30/n38/n40/n41/n48/n66/n70/n71/n77/n78 **DL 2 × 2 MIMO**: n1/n2/n3/n5/n7/n8/n12/n13/n14/n18/n20/n25/n26/n28/n30/n38/n40/n41/n48/n66/n70/n71/n77/n78
LTE	**FDD:** B1/B2/B3/B4/B5/B7/B8/B12/B13/B14/B17/B18/B19/B20/B25/B26/B28/B30/B66/B71 **TDD:** B34/B38/B39/B40/B41/B42/B43/B48 **DL 2 × 2 MIMO**: B1/B2/B3/B4/B5/B7/B8/B12/B13/B14/B17/B18/B19/B20/B25/B26/B28/B30/B66/B71/B34/B38/B39/B40/B41/B42/B43/B48
GNSS	GPS/GLONASS/BDS/Galileo/NavIC

2.2. Key Features

Table 3: Key Features

Feature	Details
Function Interface	PCI Express M.2 Interface
Power Supply	● Supply voltage: 3.135–4.4 V ● Typical supply voltage: 3.7 V
(U)SIM Interfaces	● Compliant with *ISO/IEC 7816-3*, ETSI and IMT-2000 ● Supported (U)SIM cards: Class B (3.0 V) and Class C (1.8 V) ● (U)SIM1 and (U)SIM2 interfaces ● Dual SIM Single Standby
eSIM	Optional eSIM function
USB Interface	● Compliant with USB 2.0 specification ● Maximum transmission rate: 480 Mbps ● Used for AT command communication, data transmission, firmware upgrade, software debugging, GNSS NMEA sentence output and voice over USB* ● Supported USB serial drivers: - Windows 8.1/10/11 - Linux 2.6–6.7 - Android 4.x–13.x
PCIe Interface	● Compliant with PCIe Gen 2 ● PCIe × 1 lane, supporting up to 5 Gbps ● Used for AT command communication, data transmission, firmware upgrade, software debugging, GNSS NMEA sentence output ● Supports endpoint (EP) mode and root complex (RC) mode
Transmitting Power	● 5G NR bands: Class 3 (23 dBm ±2 dB) [1] ● 5G NR HPUE [2] bands (n38/n40/n41/n77/n78): Class 2 (26 dBm +2/-3 dB) ● LTE bands: Class 3 (23 dBm ±2 dB) [3] ● LTE HPUE [2] bands (B38/B40/B41/B42/B43): Class 2 (26 dBm ±2 dB)
5G NR Features	● Supports 3GPP Rel-17 Redcap. 5G NR sub-6 ● Supported modulations: - Uplink: QPSK, 16QAM, 64QAM and 256QAM

[1] The transmitting power of n30 is Class 3 (22 dBm +2 dB).
[2] HPUE is only for single carrier.
[3] The transmitting power of B30 is Class 3 (22 dBm +2 dB).

	- Downlink: QPSK, 16QAM, 64QAM and 256QAM ● Supports SCS 15 kHz [4] and 30 kHz [4] ● Supports SA on all the 5G bands ● Supports Option 2 ● Max. transmission data rates [5]: - SA: 223 Mbps (DL), 123 Mbps (UL) ● SRS: - SA: 1T2R (n38/n40/n41/n77/n78)
LTE Features	● Supports 3GPP Rel-16 ● LTE Category: DL Cat 4/UL Cat 4 ● Supported modulations: - Uplink: QPSK, 16QAM, 64QAM and 256QAM - Downlink: QPSK, 16QAM, 64QAM and 256QAM ● Supports 1.4/3/5/10/15/20 MHz RF bandwidth ● Max. transmission data rates [5]: 195 Mbps (DL), 105 Mbps (UL)
Rx-diversity	Supports 5G NR/LTE Rx-diversity
GNSS Features	● Protocol: NMEA 0183 ● Data Update Rate: 1 Hz ● Supports AGNSS. For more details, see ***document [4]***.
Antenna Interfaces	● ANT1_MAIN ● ANT4_DRX ● ANT5_GNSS L1&L5
AT Commands	● Compliant with *3GPP TS 27.007* and *3GPP TS 27.005* ● Quectel enhanced AT commands
Internet Protocol Features	Supports TCP/UDP/PING/SSL/TLS/FTP(S)/HTTP(S)/MQTT(S)/SMTP(S)/NTP/ NITZ/LwM2M protocols
USB Tethering	RmNet, RNDIS, ECM, DUN, MBIM
Firmware Upgrade	● USB 2.0 interface ● PCIe interface ● FOTA
SMS	● Only supports SGs, IMS and NAS SMS ● Text and PDU modes

[4] 5G NR FDD bands only support 15 kHz SCS, and NR TDD bands only support 30 kHz SCS.
[5] The maximum rates are theoretical and the actual values refer to the network configuration.

	● Point-to-point MO and MT ● SMS cell broadcast ● SMS storage: ME by default
Physical Characteristics	● M.2 Key-B ● Size: 30.0 mm × 42.0 mm × 2.3 mm ● Weight: approx. 6.0 g
Temperature Ranges	● Operating temperature range: -30 °C to +75 °C [6] ● Extended temperature range: -40 °C to +85 °C [7] ● Storage temperature range: -40 °C to +90°C
RoHS	All hardware components are fully compliant with EU RoHS directive.

2.3. EVB Kit

Quectel supplies an evaluation board (5G-M2 EVB) with accessories to develop and test the module. For more details, see ***document [1]***.

[6] To meet the normal operating temperature range requirements, it is necessary to ensure effective thermal dissipation, e.g., by adding passive or active heatsinks, heat pipes, vapor chambers. Within this range, the module's indicators comply with 3GPP specification requirements.

[7] To meet the extended operating temperature range requirements, it is necessary to ensure effective thermal dissipation, e.g., by adding passive or active heatsinks, heat pipes, vapor chambers. Within this range, the module retains the ability to establish and maintain functions such as voice*, SMS, data transmission and emergency call*, without any unrecoverable malfunction. Radio spectrum and radio network remain uninfluenced, whereas the value of one or more parameters, such as P_{out}, may decrease and fall below the range of the 3GPP specified tolerances. When the temperature returns to the normal operating temperature range, the module's indicators will comply with 3GPP specification requirements again.

2.4. Functional Diagram

The following figure shows a block diagram of RM255C-GL.

- Power management
- Baseband
- LPDDR2 SDRAM + NAND Flash
- Radio frequency
- M.2 Key-B interface

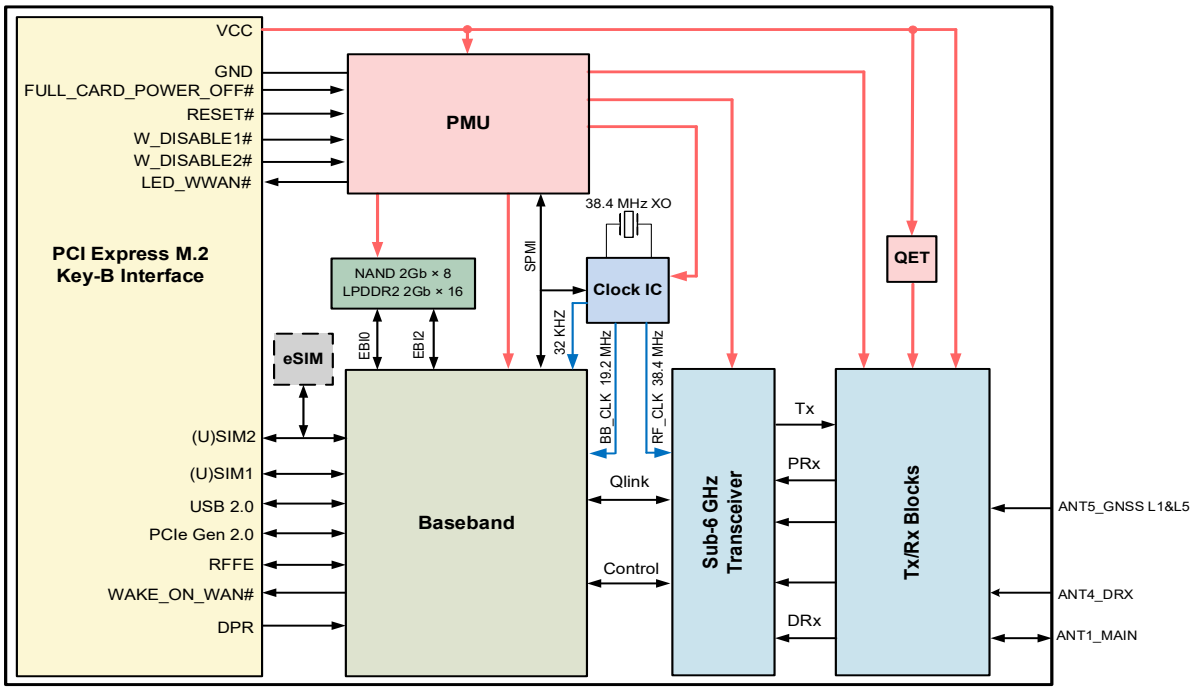


Figure 1: Functional Diagram

2.5. Pin Assignment

The following figure shows the pin assignment of the RM255C-GL.

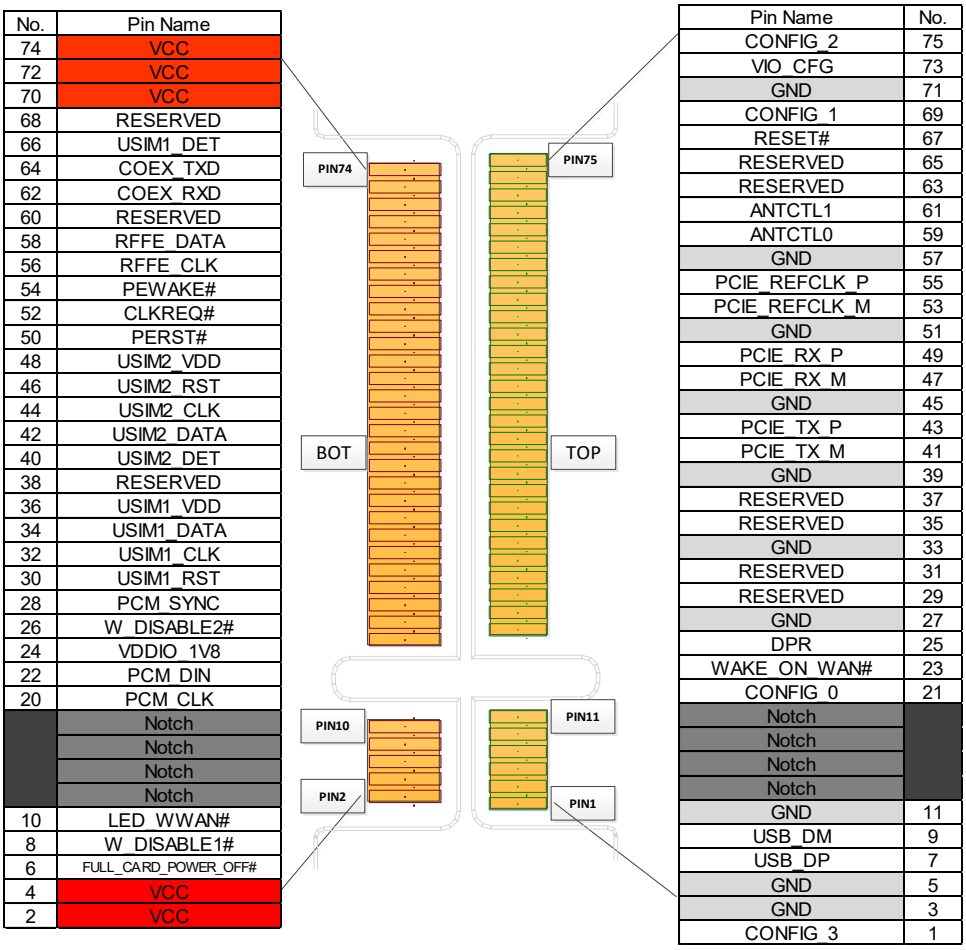


Figure 2: Pin Assignment

NOTE

Before the module turns on, ensure the pins DPR and USIM_DET are not pulled high to avoid current sink damaging the module. For more details, contact Quectel Technical Support.

2.6. Pin Definitions

Table 4: Parameter Definition

Parameter	Description
AI	Analog Input
AO	Analog Output
AIO	Analog Input/Output
DI	Digital Input
DO	Digital Output
DIO	Digital Input/Output
OD	Open Drain
PI	Power Input
PO	Power Output

DC characteristics include power domain and rated current.

Table 5: Pin Description

Pin No.	Pin Name	I/O	Description	DC Characteristics	Comment
1	CONFIG_3	DO	Not connected internally		
2	VCC	PI	Power supply for the module	Vmin = 3.135 V Vnom = 3.7 V Vmax = 4.4 V	
3	GND		Ground		
4	VCC	PI	Power supply for the module	Refer to pin 2	
5	GND		Ground		
6	FULL_CARD_ POWER_OFF#	DI	Turn on/off the module	V_{IH}max = 3.6 V V_{IH}min = 1.19 V V_{IL}max = 0.2 V	High level: Turns on. Low level: Turns off. Internally pulled down with a 100 kΩ

					resistor.
7	USB_DP	AIO	USB 2.0 differential data (+)		Requires differential impedance of 90 Ω. A test point must be reserved.
8	W_DISABLE1#	DI	Airplane mode control	1.8/3.3 V	Active LOW.
9	USB_DM	AIO	USB 2.0 differential data (-)		Requires differential impedance of 90 Ω. A test point must be reserved.
10	LED_WWAN#*	OD	RF status LED indicator	VCC	Active LOW.
11	GND		Ground		
12	Notch		Notch		
13	Notch		Notch		
14	Notch		Notch		
15	Notch		Notch		
16	Notch		Notch		
17	Notch		Notch		
18	Notch		Notch		
19	Notch		Notch		
20	PCM_CLK	DIO	PCM clock	1.8 V	
21	CONFIG_0	DO	Not connected internally		
22	PCM_DIN	DI	PCM data input	1.8 V	
23	WAKE_ON_WAN#*	OD	Wake up the host	1.8/3.3 V	Active LOW.
24	VDDIO_1V8	PO	Provide 1.8 V for external circuit	1.8 V	Maximum output current: 50 mA. This pin is defined as VDDIO_1V8 by default and can also be used as PCM_DOUT.

25	DPR*	DI	Dynamic power reduction	1.8 V	
26	W_DISABLE2#*	DI	GNSS control	1.8/3.3 V	Active LOW.
27	GND		Ground		
28	PCM_SYNC	DIO	PCM data frame sync	1.8 V	
29	RESERVED		Reserved		
30	USIM1_RST	DO	(U)SIM1 card reset	USIM1_VDD	
31	RESERVED		Reserved		
32	USIM1_CLK	DO	(U)SIM1 card clock	USIM1_VDD	
33	GND		Ground		
34	USIM1_DATA	DIO	(U)SIM1 card data	USIM1_VDD	
35	RESERVED		Reserved		
36	USIM1_VDD	PO	(U)SIM1 card power supply	**High-voltage:** Vmin = 2.7 V Vnom = 2.85 V Vmax = 3.05 V **Low-voltage:** Vmin = 1.65 V Vnom = 1.8 V Vmax = 1.95 V	
37	RESERVED		Reserved		
38	RESERVED		Reserved		
39	GND		Ground		
40	USIM2_DET	DI	(U)SIM2 card hot-plug detect	1.8 V	
41	PCIE_TX_M	AO	PCIe transmit (-)		Requires differential impedance of 85 Ω.
42	USIM2_DATA	DIO	(U)SIM2 card data	USIM2_VDD	
43	PCIE_TX_P	AO	PCIe transmit (+)		Requires differential impedance of 85 Ω.
44	USIM2_CLK	DO	(U)SIM2 card clock	USIM2_VDD	

45	GND		Ground		
46	USIM2_RST	DO	(U)SIM2 card reset	USIM2_VDD	
47	PCIE_RX_M	AI	PCIe receive (-)		Requires differential impedance of 85 Ω.
48	USIM2_VDD	PO	(U)SIM2 card power supply	**High-voltage:** Vmin = 2.7 V Vnom = 2.85 V Vmax = 3.05 V **Low-voltage:** Vmin = 1.65 V Vnom = 1.8 V Vmax = 1.95 V	
49	PCIE_RX_P	AI	PCIe receive (+)		Requires differential impedance of 85 Ω.
50	PERST#	DI [8]	PCIe reset	1.8/3.3 V	Active LOW.
51	GND		Ground		
52	CLKREQ#	OD [8]	PCIe clock request	1.8/3.3 V	Active LOW.
53	PCIE_REFCLK_M	AIO	PCIe reference clock (-)		Clock frequency: 100 MHz. Requires differential impedance of 85 Ω.
54	PEWAKE#	OD [8]	PCIe wake up	1.8/3.3 V	Active LOW.
55	PCIE_REFCLK_P	AIO	PCIe reference clock (+)		Clock frequency: 100 MHz. Requires differential impedance of 85 Ω.
56	RFFE_CLK* [9]	DO	Used for external MIPI IC control	1.8 V	
57	GND		Ground		
58	RFFE_DATA* [9]	DIO	Used for external MIPI IC control	1.8 V	
59	ANTCTL0	DO	Antenna control 0	1.8 V	

[8] PERST# behaves as DI in PCIe EP mode, and as OD in PCIe RC mode. CLKREQ# and PEWAKE# behave as OD in PCIe EP mode, and as DI in PCIe RC mode. PCIe EP mode is the default.
[9] If this function is required, contact Quectel Technical Support for more details.

60	RESERVED		Reserved		
61	ANTCTL1	DO	Antenna control 1	1.8 V	
62	COEX_RXD* [10]	DI	5G/LTE and WLAN coexistence receive	1.8 V	
63	RESERVED		Reserved		
64	COEX_TXD* [10]	DO	5G/LTE and WLAN coexistence transmit	1.8 V	
65	RESERVED		Reserved		
66	USIM1_DET	DI	(U)SIM1 card hot-plug detect	1.8 V	
67	RESET#	DI	Reset the module	1.8 V	Internally pulled up to 1.8 V. A test point is recommended to be reserved if unused. Active LOW.
68	RESERVED		Reserved		
69	CONFIG_1	DO	Connected to GND internally		
70	VCC	PI	Power supply for the module	Refer to pin 2	
71	GND		Ground		
72	VCC	PI	Power supply for the module	Refer to pin 2	
73	VIO_CFG		Configuration of PCIe sideband signals [11] power domain. NC: supports 1.8/3.3 V; GND: supports 3.3 V		The default state is NC (Not Connected).
74	VCC	PI	Power supply for the module	Refer to pin 2	
75	CONFIG_2	DO	Connected to GND internally		

[10] Note that COEX_RXD and COEX_TXD cannot be used as general UART ports.
[11] PCIe sideband signals include PERST#, CLKREQ# and PEWAKE#.

NOTE

1. Keep all RESERVED and unused pins unconnected.
2. All GND pins should be connected to ground.

3 Operating Characteristics

3.1. Operating Modes

The table below briefly summarizes the various operating modes of the module.

Table 6: Overview of Operating Modes

Mode	Details	
Full Functionality Mode	Idle	Software is active. The module has registered on the network, and it is ready to send and receive data.
	Voice*/Data	Network is connected. In this mode, the power consumption is determined by network setting and data transmission rate.
Minimum Functionality Mode	**AT+CFUN=0** sets the module to a minimum functionality mode without removing the power supply. In this mode, both RF function and (U)SIM cards are invalid.	
Airplane Mode	**AT+CFUN=4** or driving W_DISABLE1# pin LOW will set the module to airplane mode. In this mode, the RF function is invalid.	
Sleep Mode	When **AT+QSCLK=1** is executed and the host's USB enters suspended mode, the module will enter sleep mode. The module keeps receiving paging messages, SMS, voice calls* and TCP/UDP data from the network with its power consumption reducing to an ultra-low level.	
Power Down Mode	In this mode, the power management unit shuts down the power supply. Software is inactive, all application interfaces are inaccessible, and the operating voltage (connected to VCC) remains applied.	

3.1.1. Sleep Mode

With DRX technology, power consumption of the module will be reduced to an ultra-low level. The figure below shows the relationship between the DRX run time and the power consumption in sleep mode. The longer the DRX runs, the lower the power consumption is.

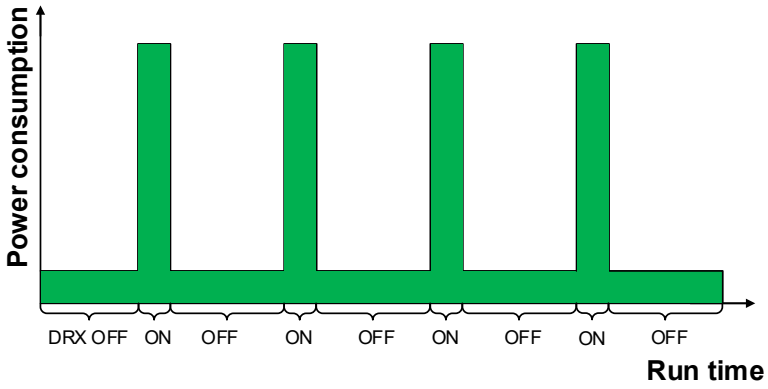


Figure 3: Module Power Consumption in Sleep Mode

NOTE

DRX cycle values are transmitted over the wireless network.

The following part of this section presents the power saving procedure and sleep mode of the module.

If the host supports USB Suspend/Resume and remote wakeup function, the following two conditions must be met to set the module to sleep mode.

- Execute **AT+QSCLK=1**.
- The module's USB interface enters Suspend mode.

The following figure shows the connection between the module and the host.

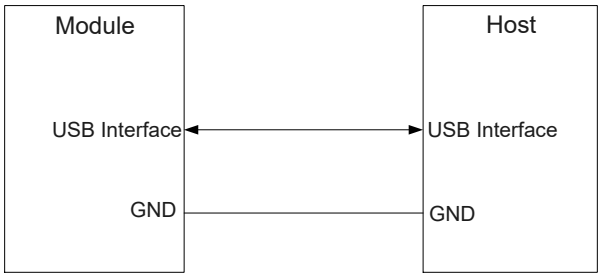


Figure 4: Sleep Mode Application with USB Remote Wakeup

The module and the host will be waked up in the following conditions:

- Sending data to the module through USB will wake up the module.
- When the module has a URC to report, it will send remote wake-up signals via USB to wake up the host.

3.1.2. Airplane Mode

The module provides a W_DISABLE1# pin to disable or enable airplane mode through hardware operation. See ***Chapter 4.4.1*** for more details.

3.2. Communication Interface with a Host

The module supports to communicate through both USB and PCIe interfaces, respectively referring to the USB mode and the PCIe mode as described below:

USB Mode

- Supports all USB 2.0 features.
- Supports MBIM/QMI/QRTR/AT over USB interface.
- Communication can be switched to PCIe mode by **AT+QCFG="data_interface",1.**

USB is the default communication interface between the module and the host. If you want to use the PCIe interface for communication, an AT command under USB mode can also be sent through the PCIe interface. For more details about the AT command, see ***document [3]***.

It is suggested that USB 2.0 interface be reserved for firmware upgrade.

USB-AT-based PCIe Mode

- Supports MBIM/QMI/QRTR/AT over PCIe interface.
- Supports AT over USB interface.
- Communication can be switched back to USB mode by **AT+QCFG="data_interface",0.**

When the module works at the USB-AT-based PCIe mode (switched from USB mode by AT command), it can be switched back to USB mode by **AT+QCFG="data_interface",0,0**.

For USB-AT-based PCIe mode, the firmware upgrade via PCIe interface is not supported, so USB 2.0 interface must be reserved for the firmware upgrade.

eFuse-based PCIe Mode

- Supports MBIM/QMI/QRTR/AT over PCIe interface.
- Supports Non-X86 system and X86 system (supports BIOS PCIe early initialization).

For eFuse-based PCIe mode, the firmware upgrade via PCIe interface is supported. The module can also be reprogrammed to PCIe mode based on eFuse. If switched to PCIe mode by burnt eFuse, the communication cannot be switched back to USB mode.

Note that if the host does not support firmware upgrade through PCIe, the firmware can be upgraded by the 5G-M2 EVB, which could be connected to PC with a USB cable. For more details, see ***document [1]***.

3.3. Power Supply

The following table shows pin definition of VCC pins and ground pins.

Table 7: Pin Definition of VCC and GND Pins

Pin	Pin Name	I/O	Description	Comment
2, 4, 70, 72, 74	VCC	PI	Power supply for the module	Vmin = 3.135 V Vnom = 3.7 V Vmax = 4.4 V
3, 5, 11, 27, 33, 39, 45, 51, 57, 71	GND	-	Ground	-

3.3.1. Voltage Stability Requirements

The power supply range of the module is from 3.135 V to 4.4 V. Ensure that the input voltage will never drop below 3.135 V, otherwise the module will turn off automatically. The voltage ripple of the input power supply should be less than 100 mV. The figure below shows the power supply limits during burst transmission when 3.3 V power supply is applied.

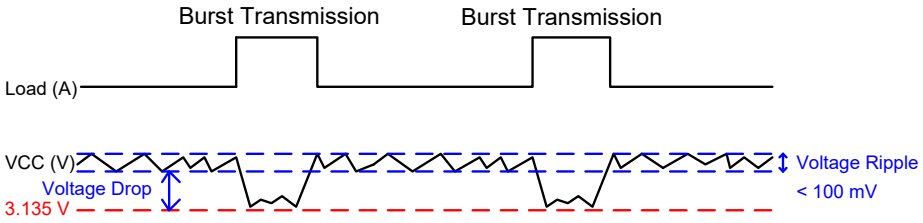


Figure 5: Power Supply Limits during Burst Transmission

To decrease the voltage drop, two bypass capacitors of 220 µF with low ESR should be used, and a multi-layer ceramic chip capacitor (MLCC) array should also be used due to its ultra-low ESR. It is recommended to use ceramic capacitors (100 nF, 6.8 nF, 220 pF, 68 pF, 15 pF, 9.1 pF, 4.7 pF) for composing the MLCC array, and place these capacitors close to VCC pins. The width of VCC trace should be not less than 3 mm. In principle, the longer the VCC trace is, the wider it should be.

In addition, to guarantee stability of the power supply, it is recommended to use a TVS with working peak reverse voltage of 5.0 V.

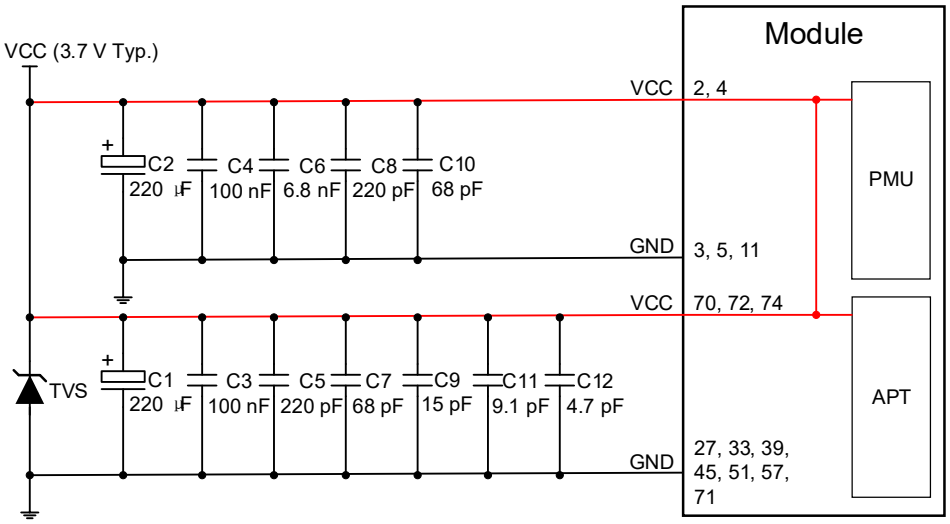


Figure 6: Reference Circuit for VCC

3.3.2. Reference Design for Power Supply

The power source is critical to the module's performance. The continuous current of the power supply should be 3.0 A at least and the peak current should be 4.0 A at least.

The following figure shows a reference design for 5.0 V input power supply. The designed output of the power supply is about 3.7 V.

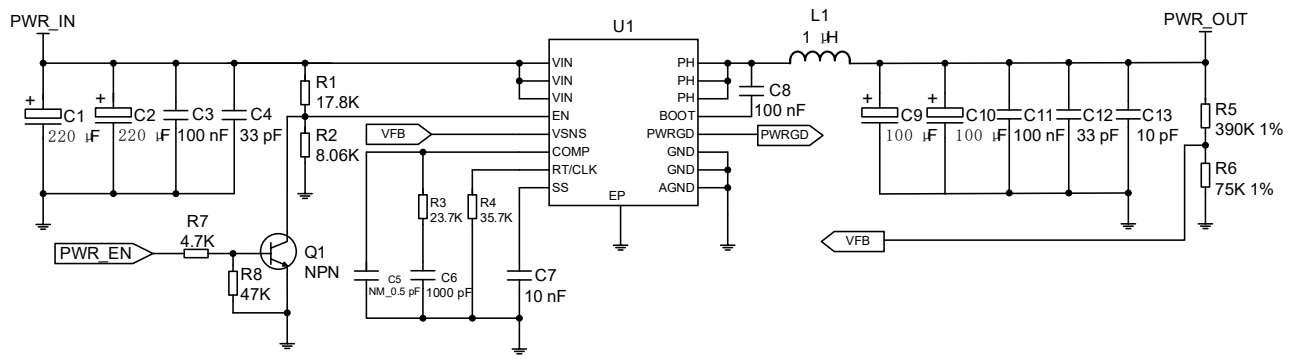


Figure 7: Reference Circuit for Power Supply

3.3.3. Power Supply Monitoring

AT+CBC can be used to monitor the voltage value of VCC. For more details about the AT command, see ***document [3]***.

3.4. Turn On

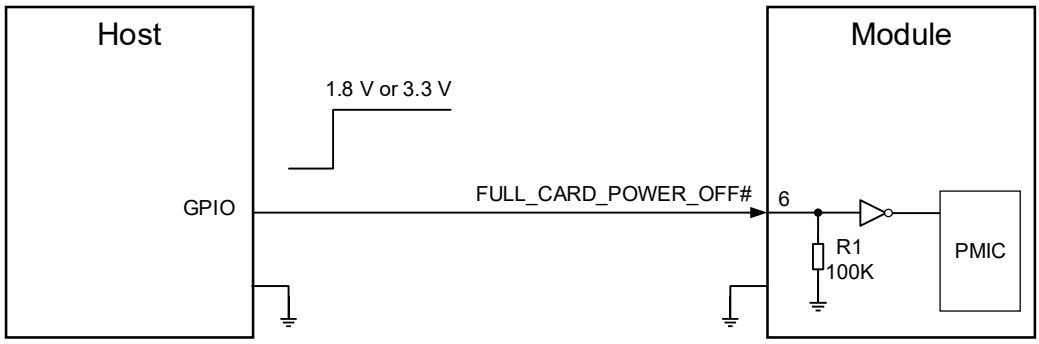
FULL_CARD_POWER_OFF# is used to turn on/off the module. This input signal can be driven by either 1.8 V or 3.3 V GPIO.

When FULL_CARD_POWER_OFF# is driven HIGH (≥ 1.19 V), the module will turn on.

Table 8: Pin Definition of FULL_CARD_POWER_OFF#

Pin No.	Pin Name	I/O	Description	Comment
6	FULL_CARD_ POWER_OFF#	DI	Turn on/off the module.	High level: Turns on. Low level: Turns off. Internally pulled down with a 100 kΩ resistor.

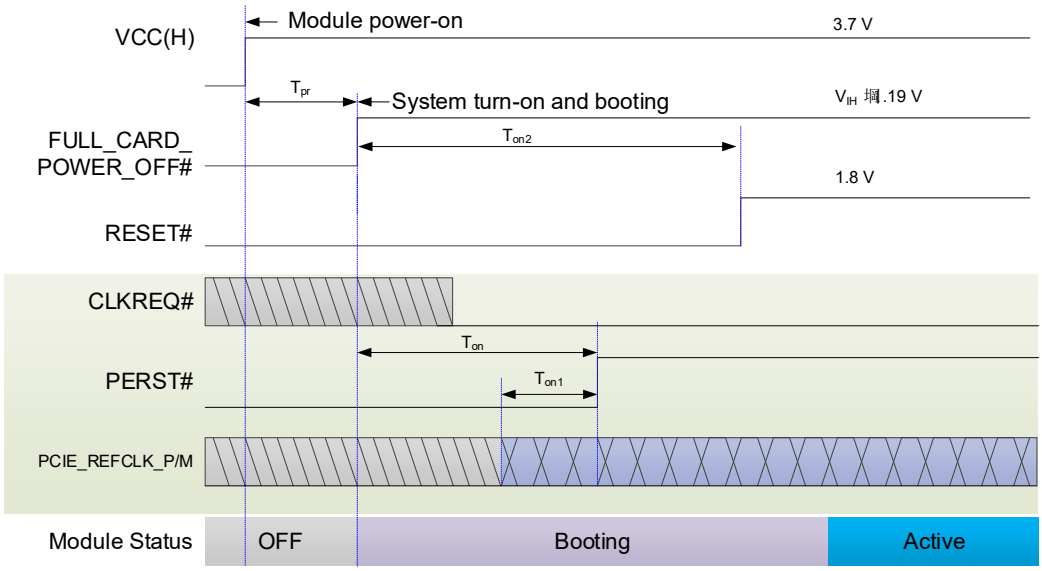
It is recommended to use a host GPIO to control FULL_CARD_POWER_OFF#. A simple reference circuit is illustrated by the following figure.



NOTE: The voltage of pin 6 should be not less than 1.19 V when it is at HIGH level.

Figure 8: Turn on the Module with a Host GPIO

The timing of turn-on scenario is illustrated in the following figure.



NOTE: When the module is in USB mode, ignore the PCIe related signals and their timing parameters in the figure.

Figure 9: Turn-on Timing of the Module

Table 9: Turn-on Timing of the Module

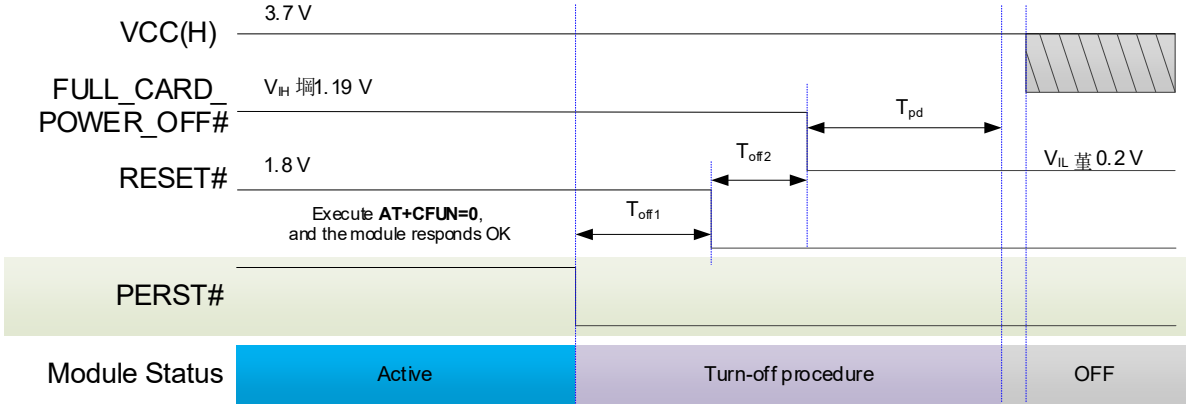
Symbol	Min.	Typ.	Max.	Comment
T_{pr}	100 ms	-	-	The variation of the module's power-up time before system turn-on and booting depends on the host.
T_{on}	TBD	-	-	The period when the host GPIO controls the module to exit the PCIe reset state. 1. For eFuse-based PCIe mode, Min. T_{on} is TBD. 2. For USB-AT-based PCIe mode, Typ. T_{on} is TBD.
	-	TBD	-	

T_{on1}	TBD	-	-	The period during which PCIE_REFCLK_P/M is stable before PERST# is driven high.
T_{on2} [12]	TBD	-	-	The period from the host pulling up FULL_CARD_POWER_OFF# to the module pulling up RESET# internally and automatically. The module will pull up RESET# internally and automatically after FULL_CARD_POWER_OFF# is driven high.

3.5. Turn Off

For the design that turns on the module with a host GPIO, when the power is supplied to VCC, driving FULL_CARD_POWER_OFF# pin LOW (≤ 0.2 V) or tri-stating the pin will turn off the module.

The timing of turn-off scenario is illustrated by the following figure.



NOTE:
When the module is in USB mode, please ignore the PCIe related signals and their timing parameters in the figure.

Figure 10: Turn-off Timing through FULL_CARD_POWER_OFF#

Table 10: Turn-off Timing of the Module through FULL_CARD_POWER_OFF#

Symbol	Min.	Typ.	Max.	Comment
T_{off1}	-	TBD	-	The period from the host pulling down PERST# to it pulling down FULL_CARD_POWER_OFF#.
T_{off2}	TBD	TBD	-	The period from the host pulling down RESET# to it pulling down FULL_CARD_POWER_OFF#.

[12] At booting stage, the host must not drive RESET# low after FULL_CARD_POWER_OFF# is at high level.

T_{pd}	900 ms	-	-	The period from the host pulling down FULL_CARD_POWER_OFF# to the module turning off. It is recommended to cut off VCC when the module has been turned off completely.

3.6. Reset

RESET# is an active LOW signal (1.8 V logic level). When this pin is at low level , the module will immediately enter reset condition.
Note that triggering the RESET# signal will lead to loss of all data in the module and removal of system drivers. It will also disconnect the modem from the network.

Table 11: Pin Definition of RESET# Pin

Pin No.	Pin Name	I/O	Description	Comment
67	RESET#	DI	Reset the module	Internally pulled up to 1.8 V. A test point is recommended to be reserved if unused. Active LOW.

The module can be reset by pulling down the RESET#. An open collector/drain driver or a button can be used to control RESET#.

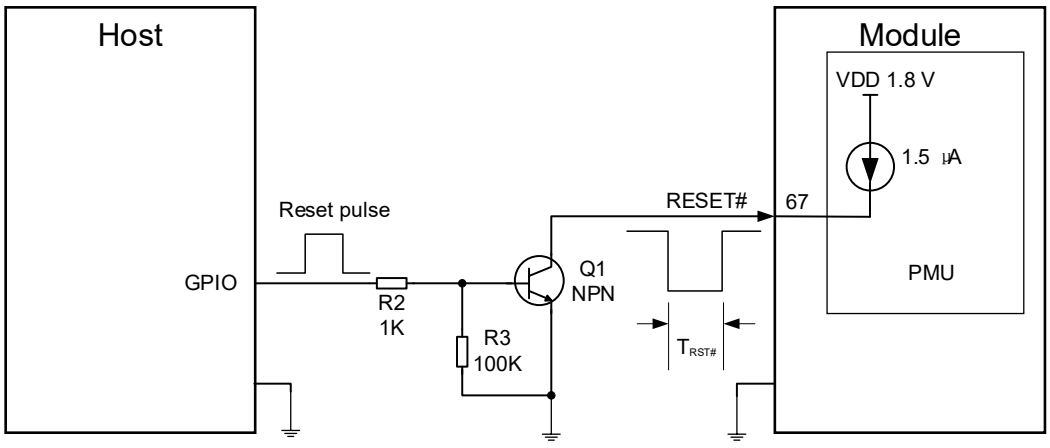
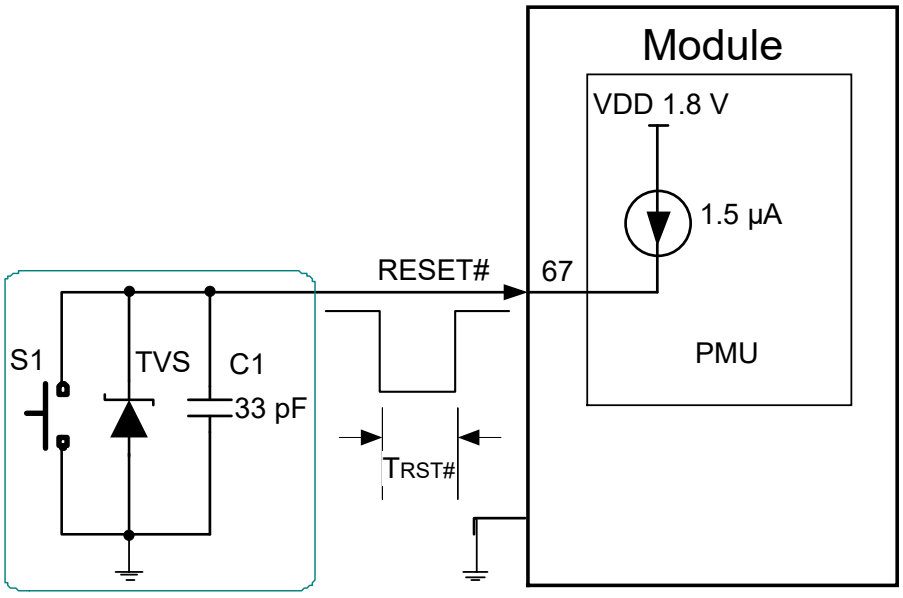


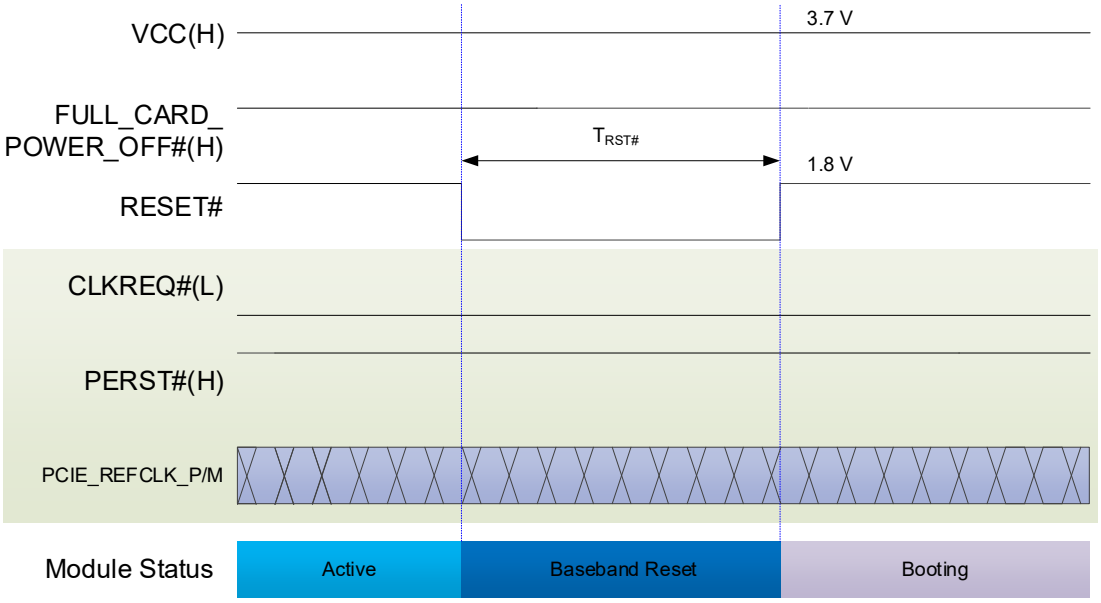
Figure 11: Reference Circuit for RESET# with NPN Driver Circuit



NOTE: The capacitor C1 is recommended to be less than 47 pF.

Figure 12: Reference Circuit for RESET# with a Button

For a warm reset when only the reset signal is pulled LOW, see the timing illustrated by the figure below. In this reset mode, the power of the module will not be turned off. This timing sequence is recommended for scenarios where the module is reset with a button.



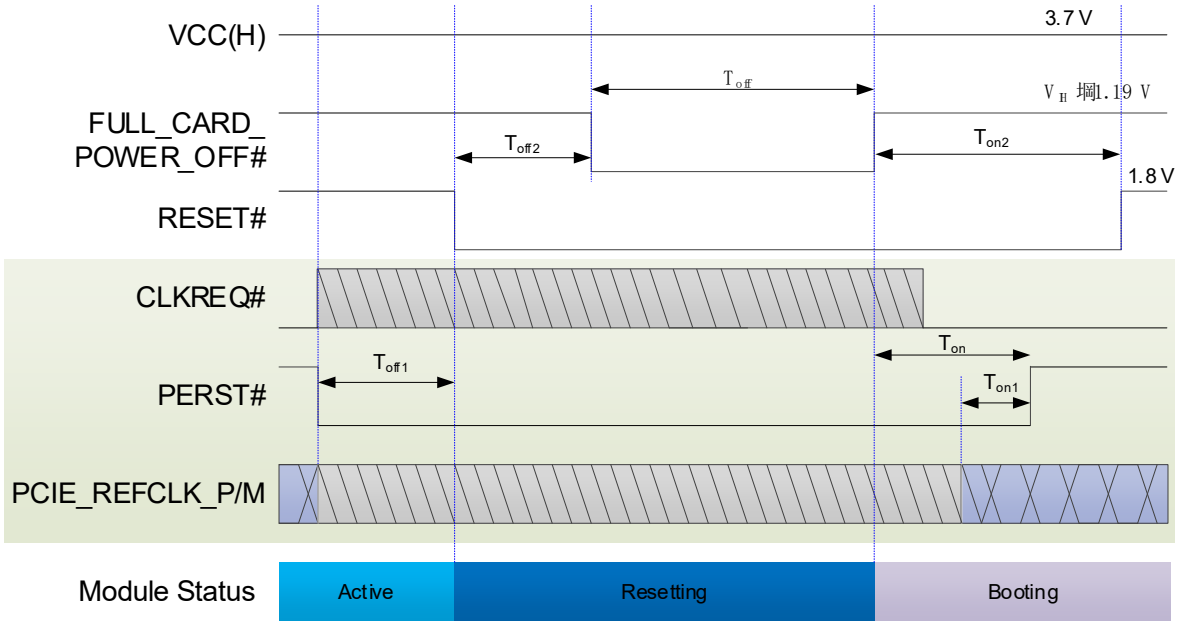
NOTE:
When the module is in USB mode, ignore the PCIe related signals and their timing parameters in the figure.

Figure 13: Reset Timing of the Module's Warm Reset

Table 12: Reset Timing of the Module's Warm Reset

Symbol	Min.	Typ.	Max.	Comment
$T_{RST\#}$	TBD	TBD	-	Reset baseband chip IC only.

For a hard reset, see the timing illustrated by the figure below. This timing sequence is recommended for scenarios where the module is reset with NPN driver circuit.



NOTE:
1. The timing parameters after the host pulls up FULL_CARD_POWER_OFF# refer to the boot timing of the PCIe mode module.
2. When the module is in USB mode, please ignore the PCIe related signals and their timing parameters in the figure.

Figure 14: Reset Timing of the Module's Hard Reset

Table 13: Reset Timing of the Module's Hard Reset

Symbol	Min.	Typ.	Max.	Comment
T_{off1}	-	TBD	-	The period from the host pulling down PERST# to it pulling down RESET#.
T_{off2}	TBD	TBD	-	The period from the host pulling down RESET# to it pulling down FULL_CARD_POWER_OFF#.
T_{off}	900 ms	-	-	Module hard reset. Ensure that the module has been turned off completely.

T_{on}	TBD	-	-	The period when the host GPIO controls the module to exit the PCIe reset state. 1. For eFuse-based PCIe mode, Min. T_{on} is TBD. 2. For USB-AT-based PCIe mode, Typ. T_{on} is TBD.
	-	TBD	-	
T_{on1}	TBD	-	-	The period during which PCIE_REFCLK_P/M is stable before PERST# is driven high.
T_{on2} [12]	TBD	-	-	The period from the host pulling up FULL_CARD_POWER_OFF# to the module pulling up RESET# internally and automatically. The module will pull up RESET# internally and automatically after FULL_CARD_POWER_OFF# is driven high.

4 Application Interfaces

The physical connections and signal levels of the module comply with the PCI Express M.2 specification. This chapter mainly describes the definition and application of the following interfaces/pins of the module:

- (U)SIM interfaces
- USB interface
- PCIe interface
- Control and indication interfaces*
- Cellular/WLAN COEX interface*
- Antenna tuner control interface
- Configuration pins
- PCM interface

4.1. (U)SIM Interfaces

The (U)SIM interface circuitry meets *ISO/IEC 7816-3,* ETSI and IMT-2000 requirements. Both Class B (3.0 V) and Class C (1.8 V) (U)SIM cards are supported.

4.1.1. Pin Definition of (U)SIM Interfaces

The module has two (U)SIM interfaces, and supports Dual SIM Single Standby.

Table 14: Pin Definition of (U)SIM Interfaces

Pin No.	Pin Name	I/O	Description
36	USIM1_VDD	PO	(U)SIM1 card power supply
34	USIM1_DATA	DIO	(U)SIM1 card data
32	USIM1_CLK	DO	(U)SIM1 card clock
30	USIM1_RST	DO	(U)SIM1 card reset
66	USIM1_DET	DI	(U)SIM1 card hot-plug detect

48	USIM2_VDD	PO	(U)SIM2 card power supply
42	USIM2_DATA	DIO	(U)SIM2 card data
44	USIM2_CLK	DO	(U)SIM2 card clock
46	USIM2_RST	DO	(U)SIM2 card reset
40	USIM2_DET	DI	(U)SIM2 card hot-plug detect

4.1.2. (U)SIM Hot-Plug

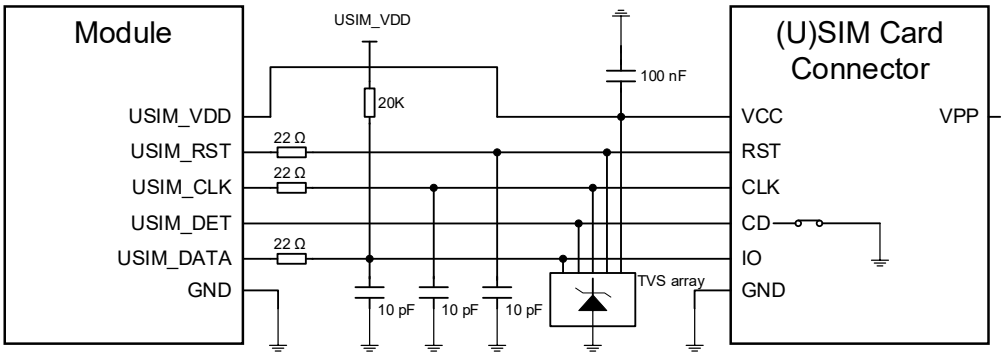
The module supports (U)SIM card hot-plug via the (U)SIM card hot-plug detect pins (USIM1_DET and USIM2_DET), which is disabled by default. (U)SIM card is detected by USIM_DET interrupt. (U)SIM card insertion is detected by high/low level.

4.1.3. Normally Closed (U)SIM Card Connector

With a normally closed (U)SIM card connector, USIM_DET pin is shorted to ground when there is no (U)SIM card inserted. (U)SIM card detection by high level is applicable to this type of connector. Once (U)SIM hot-plug is enabled by executing **AT+QSIMDET=1,1**, a (U)SIM card insertion will drive USIM_DET from low to high level, and the removal of it will drive USIM_DET from high to low level.

- When the (U)SIM card is absent, CD is shorted to ground and USIM_DET is at low level.
- When the (U)SIM card is present, CD is open from ground and USIM_DET is at high level.

The following figure shows a reference design for (U)SIM interface with a normally closed (U)SIM card connector.



NOTE: All these resistors, capacitors and TVS should be close to (U)SIM card connector in PCB layout.

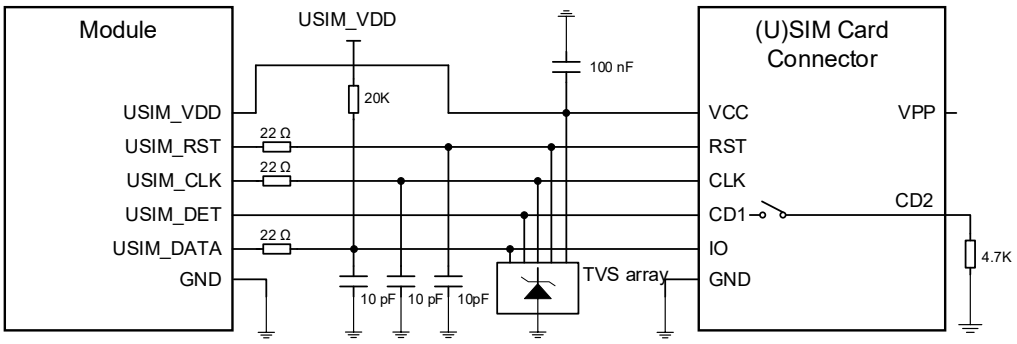
Figure 15: Reference Circuit for Normally Closed (U)SIM Card Connector

4.1.4. Normally Open (U)SIM Card Connector

With a normally open (U)SIM card connector, CD1 and CD2 of the connector are disconnected when there is no (U)SIM card inserted. (U)SIM card detection by low level is applicable to this type of connector. Once (U)SIM hot-plug is enabled by executing **AT+QSIMDET=1,0**, a (U)SIM card insertion will drive USIM_DET from high to low level, and the removal of it will drive USIM_DET from low to high level.

- When the (U)SIM card is absent, CD1 is open from CD2 and USIM_DET is at high level.
- When the (U)SIM card is present, CD1 is pulled down to ground and USIM_DET is at low level.

The following figure shows a reference design for (U)SIM interface with a normally open (U)SIM card connector.

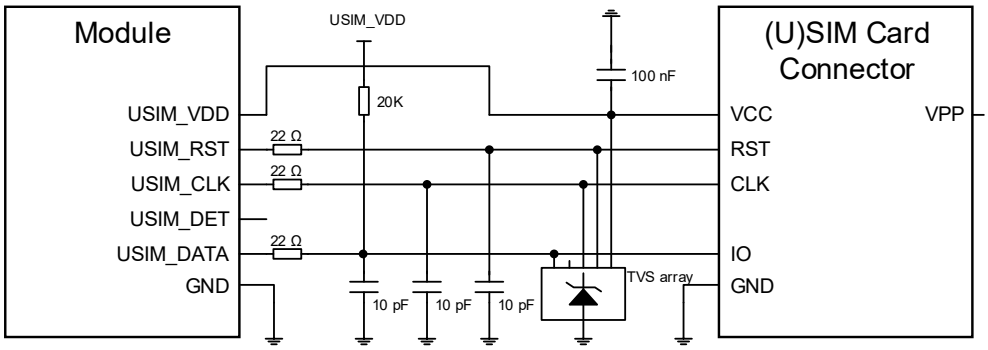


NOTE: All these resistors, capacitors and TVS should be close to (U)SIM card connector in PCB layout.

Figure 16: Reference Circuit for Normally Open (U)SIM Card Connector

4.1.5. (U)SIM Card Connector Without Hot-Plug

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



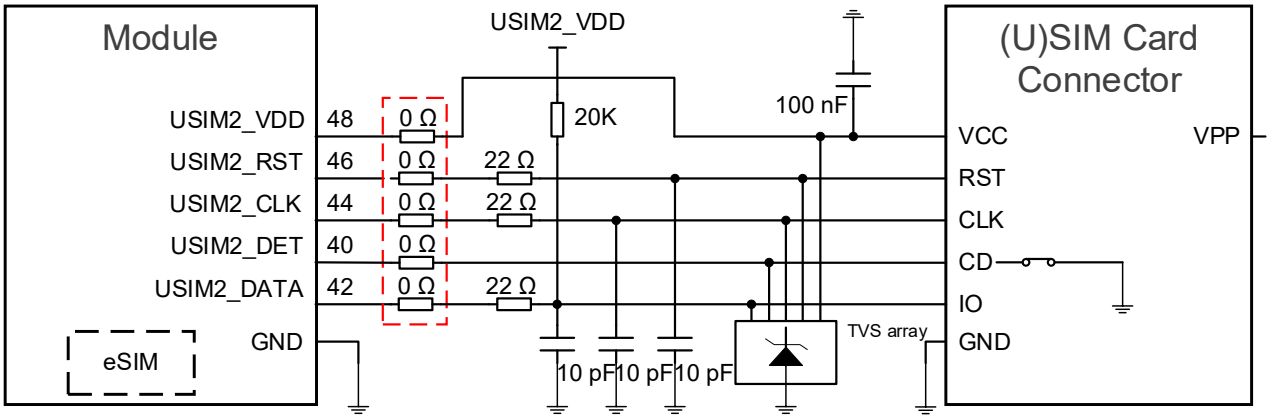
NOTE: All these resistors, capacitors and TVS should be close to (U)SIM card connector in PCB layout.

Figure 17: Reference Circuit for a 6-Pin (U)SIM Card Connector

4.1.6. (U)SIM2 Card Compatible Design

It should be noted that when the (U)SIM2 interface is used for an external (U)SIM card, the circuits are the same as those of (U)SIM1 interface. When the (U)SIM2 interface is used for the optional internal eSIM card, pins 40, 42, 44, 46 and 48 of the module must be kept open.

A recommended compatible design for the (U)SIM2 interface is shown below.



NOTE:
The five 0 Ω resistors must be placed close to the module, and all other components should be placed close to (U)SIM card connector in PCB layout.

Figure 18: Recommended Compatible Design for (U)SIM2 Interface

4.1.7. (U)SIM Design Notices

To enhance the reliability and availability of the (U)SIM card in applications, follow the criteria below in (U)SIM circuit design.

- Place the (U)SIM card connector as close to the module as possible, (U)SIM card related resistors and capacitors and ESD protection components should be placed close to the card connector. Keep the trace length as short as possible, at most 200 mm.
- Keep (U)SIM card signals away from RF and VCC traces.
- Ensure the ground between the module and the (U)SIM card connector is short and wide. Keep the trace width of ground and USIM_VDD not less than 0.5 mm to maintain the same electric potential.
- To avoid cross-talk between USIM_DATA and USIM_CLK, keep them away from each other and shield them with surrounded ground.
- To offer better ESD protection, add a TVS array of which the parasitic capacitance should be not higher than 10 pF. Add 22 Ω resistors in series between the module and the (U)SIM card connector to suppress EMI. The 10 pF capacitors are used to filter out RF interference.
- For USIM_DATA, it is optional to add a 20 kΩ pull-up resistor near the (U)SIM card connector.

4.2. USB Interface

The module provides one integrated Universal Serial Bus (USB) interface which complies with the USB 2.0 specification and supports high-speed (480 Mbps) and full-speed (12 Mbps) modes on USB 2.0. The USB interface is used for AT command communication, data transmission, GNSS NMEA sentence output, software debugging, firmware upgrade and voice over USB*.

Table 15: Pin Definition of USB Interface

Pin No.	Pin Name	I/O	Description	Comment
7	USB_DP	AIO	USB 2.0 differential data (+)	Require differential impedance of 90 Ω. Test points must be reserved.
9	USB_DM	AIO	USB 2.0 differential data (-)	

For more details about the USB 2.0 specification, visit http://www.usb.org/home.

The USB 2.0 interface is recommended to be reserved for firmware upgrade in designs. The following figure shows a reference circuit of USB interface.

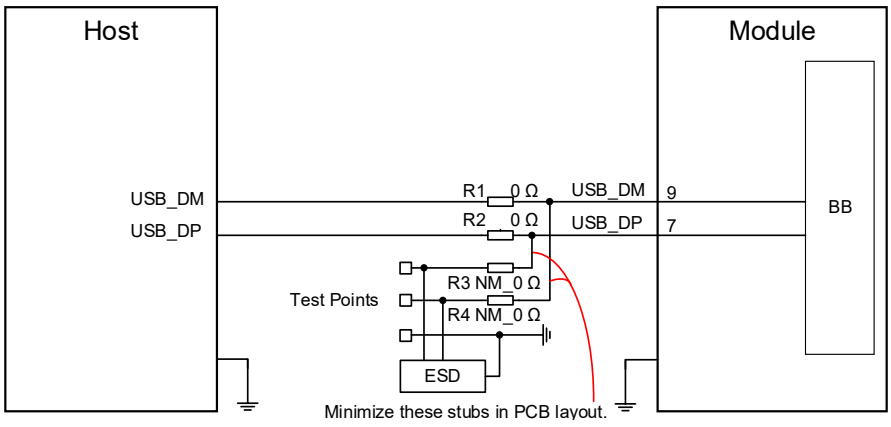


Figure 19: Reference Circuit of USB 2.0 Interface

To ensure the signal integrity of USB 2.0 data traces, R1, R2, R3 and R4 must be placed close to the module, and the stubs must be minimized in PCB layout.

You should follow the principles below when designing for the USB interface to meet USB specifications.

- Route the USB signal traces as differential pairs with ground surrounded. The impedance of USB 2.0 differential trace of is 90 Ω.
- For USB 2.0 signal traces, the trace length should be less than 225 mm, and the intra-pair length matching (P/M) should be less than 2 mm.

- Do not route signal traces under crystals, oscillators, magnetic devices, PCIe and RF signal traces. Route the USB differential traces in inner-layer of the PCB, and surround the traces with ground on that layer and with ground planes above and below.
- Junction capacitance of the ESD protection component might cause influences on USB data traces, so you should pay attention to the selection of the component. Typically, the stray capacitance should be less than 1.0 pF for USB 2.0.
- Keep the ESD protection components as close to the USB connector as possible.
- If possible, reserve 0 Ω resistors on USB_DP and USB_DM traces respectively.

4.3. PCIe Interface

The module provides one integrated PCIe (Peripheral Component Interconnect Express) interface.

- *PCI Express Base Specification Revision 4.0* compliant.
- Data rate up to 5 Gbps.
- Supports endpoint (EP) mode and root complex (RC) mode, and EP mode is the default. In EP mode, the module operates as a PCIe EP device, while in RC mode, as a PCIe root complex device.

4.3.1. Pin Definition of PCIe Interface

The following table shows the pin definition of PCIe interface.

Table 16: Pin Definition of PCIe Interface

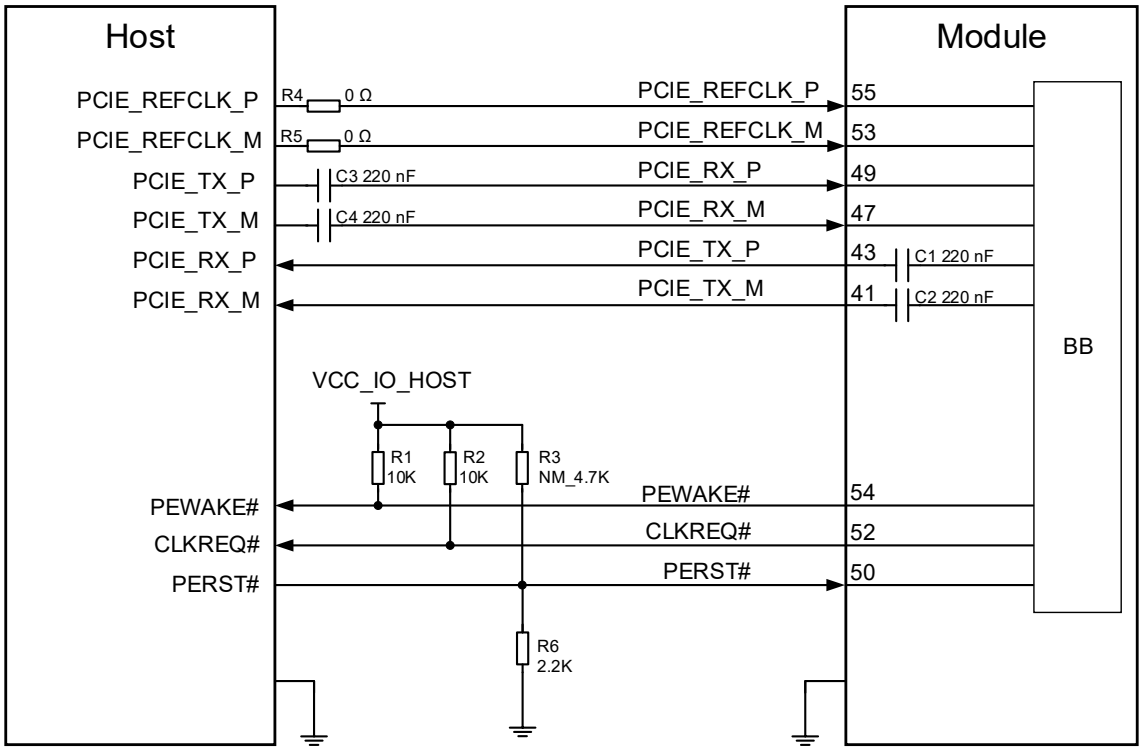
Pin No.	Pin Name	I/O	Description	Comment
55	PCIE_REFCLK_P	AIO	PCIe reference clock (+)	Clock frequency: 100 MHz. Require differential impedance of 85 Ω.
53	PCIE_REFCLK_M	AIO	PCIe reference clock (-)	
49	PCIE_RX_P	AI	PCIe receive (+)	Require differential impedance of 85 Ω.
47	PCIE_RX_M	AI	PCIe receive (-)	
43	PCIE_TX_P	AO	PCIe transmit (+)	Require differential impedance of 85 Ω.
41	PCIE_TX_M	AO	PCIe transmit (-)	
50	PERST#	DI [13]	PCIe reset	1.8/3.3 V. Active LOW.

[13] PERST# behaves as DI in PCIe EP mode, and as OD in PCIe RC mode. CLKREQ# and PEWAKE# behave as OD in PCIe EP mode, and as DI in PCIe RC mode. PCIe EP mode is the default.

52	CLKREQ#	OD [13]	PCIe clock request	1.8/3.3 V. Active LOW
54	PEWAKE#	OD [13]	PCIe wake up	1.8/3.3 V. Active LOW

4.3.2. Reference Design for PCIe Interface

The following figure shows a reference circuit for the PCIe interface.



NOTE: The HOST must use a push-pull GPIO to control PERST#.

Figure 20: PCIe Interface Reference Circuit

To ensure the signal integrity of PCIe interface, AC coupling capacitors C3 and C4 should be placed close to the host on PCB. C1 and C2 have been integrated inside the module, so do not place these two capacitors on your schematic and PCB.

The following principles of PCIe interface design should be complied with to meet PCIe specification.

- Keep the PCIe data and control signals away from sensitive circuits and signals, such as RF, audio, crystal, and oscillator signals.
- Add a capacitor in series on Tx/Rx traces to prevent any DC bias.

- Keep the maximum trace length not more than 200 mm.
- Keep the intra-pair length matching of each differential data pair (P/M) less than 0.7 mm.
- Keep the differential impedance of PCIe data trace as 85 Ω ±10 %.
- You must not route PCIe data traces under components or cross them with other traces.
- It is recommended to use a push-pull GPIO to output a low level that approaches to 0 V rather than using a pull-down resistor to get a low level. Otherwise, voltage division may be formed with the pull-up resistor inside the module, resulting in an uncertain 0 V voltage that could further lead to unpredictable problems.

NOTE

1. When the Host control pin is push-pull output, it is recommended to use the pull-down resistor on PERST#;
2. When the Host control pin is not push-pull output, it is recommended to reserved the pull-up and pull-down resistors on PERST#. And adjust the resistance according to the actual debugging situation.

4.4. Control and Indication Interfaces*

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

Table 17: Pin Definition of Control and Indication Interfaces

Pin No.	Pin Name	I/O	Description	Comment
8	W_DISABLE1#	DI	Airplane mode control	1.8/3.3 V. Active LOW.
26	W_DISABLE2#	DI	GNSS control	
10	LED_WWAN#	OD	RF status LED indicator	VCC. Active LOW.
23	WAKE_ON_WAN#	OD	Wake up the host	1.8/3.3 V. Active LOW.
25	DPR	DI	Dynamic power reduction	1.8 V.

4.4.1. W_DISABLE1#

The module provides a W_DISABLE1# pin to disable or enable airplane mode through hardware operation. W_DISABLE1# is pulled up by default. Driving it LOW will set the module to airplane mode. In airplane mode, the RF function will be disabled.

The RF function can also be enabled or disabled through AT commands. The following table shows the AT command and corresponding RF function status of the module.

Table 18: RF Function Status

W_DISABLE1# Logic Level	AT Command	RF Function Status	Operating Mode
HIGH	**AT+CFUN=1**	Enabled	Full functionality mode
	AT+CFUN=0	Disabled	Minimum functionality mode
	AT+CFUN=4		Airplane mode
LOW	**AT+CFUN=0** **AT+CFUN=1** **AT+CFUN=4**	Disabled	Airplane mode

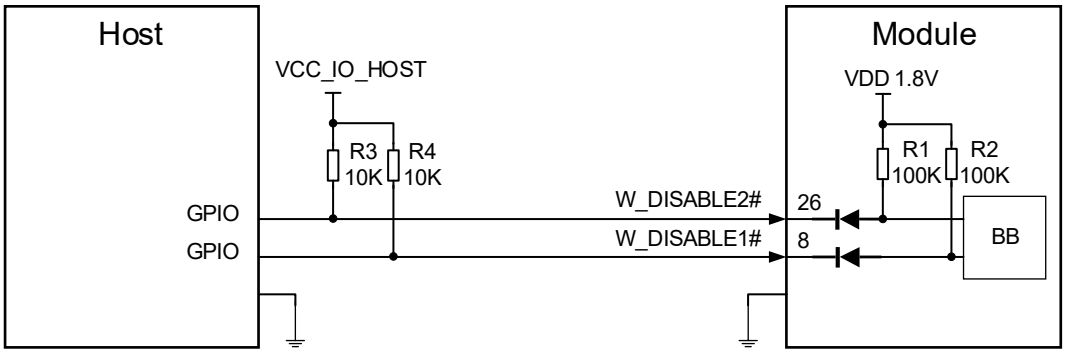
4.4.2. W_DISABLE2#

The module provides a W_DISABLE2# pin to disable or enable the GNSS function. The W_DISABLE2# pin is pulled up by default. Driving it LOW will disable the GNSS function. The combination of W_DISABLE2# pin and AT commands can control the GNSS function. For more details about the AT command, see ***document [4].***

Table 19: GNSS Function Status

W_DISABLE2# Logic Level	AT Command	GNSS Function Status
HIGH	**AT+QGPS=1**	Enabled
HIGH	**AT+QGPSEND**	Disabled
LOW	**AT+QGPS=1**	Disabled
LOW	**AT+QGPSEND**	

W_DISABLE1# and W_DISABLE2# are active LOW signals, and a reference circuit is shown as below.



NOTE: The voltage level of VCC_IO_HOST could be 1.8 V or 3.3 V typically.

Figure 21: W_DISABLE1# and W_DISABLE2# Reference Circuit

4.4.3. LED_WWAN#

LED_WWAN# is used to indicate the RF status of the module, and its typical power consumption is up to 10 mA.

To reduce power consumption of the LED, a current-limited resistor must be placed in series with the LED, as illustrated in the figure below. The LED is ON when the LED_WWAN# signal is at low level.

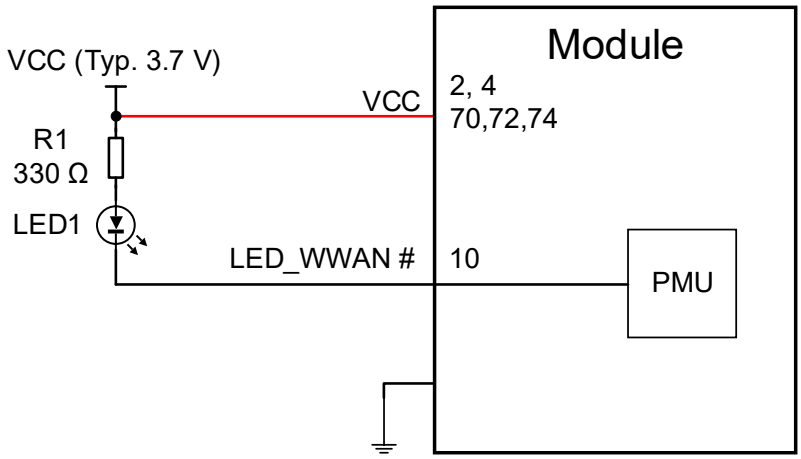


Figure 22: LED_WWAN# Reference Circuit

Table 20: Network Status Indications of LED_WWAN#

LED_WWAN# Logic Level	Description
LOW (LED on)	RF function is turned on.

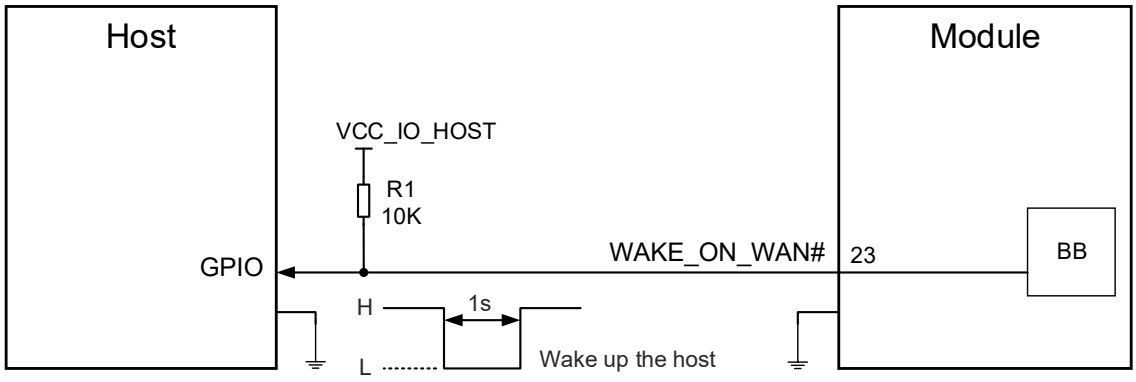
HIGH (LED off)	RF function is turned off if any of the following occurs: ● The (U)SIM card is not powered. ● W_DISABLE1# is at low level (airplane mode enabled). ● **AT+CFUN=4** (RF function disabled).

4.4.4. WAKE_ON_WAN#

When a URC returns, a one-second low level pulse signal will be outputted to wake up the host.

Table 21: State of the WAKE_ON_WAN#

WAKE_ON_WAN# State	Module Operation Status
Outputs a one-second pulse signal at low level	Call/SMS/Data is incoming (to wake up the host)
Always at high level	Idle/Sleep



NOTE:
The voltage level on VCC_IO_HOST depends on the host side due to the open drain in pin 23.

Figure 23: WAKE_ON_WAN# Signal Reference Circuit

4.4.5. DPR

The module provides the DPR (Dynamic Power Reduction) pin for body SAR (Specific Absorption Rate) detection. The signal is sent from the proximity sensor of the host system to the module to provide an input trigger, which will reduce the output power in radio transmission.

Table 22: Function of the DPR Signal

DPR Level	Function
HIGH/Floating	NO maximum transmitting power backoff
LOW	Maximum transmitting power backoff by **AT+QSAR**

A reference circuit is shown as below.

Figure 24: DPR Reference Circuit

NOTE

See ***document [3]*** for more details about **AT+QSAR**.

4.5. Cellular/WLAN COEX Interface*

The module provides the cellular/WLAN COEX interface, and the following table shows the pin definition of this interface.

Table 23: Pin Definition of COEX Interface

Pin No.	Pin Name	I/O	Description	Comment
62	COEX_RXD	DI	5G/LTE and WLAN coexistence receive	

64	COEX_TXD	DO	5G/LTE and WLAN coexistence transmit

4.6. Antenna Tuner Control Interface

The module provides ANTCTL[0:1] and RFFE interface used for antenna tuner control and should be routed to an appropriate antenna control circuit.

Table 24: Pin Definition of Antenna Tuner Control Interface

Pin No.	Pin Name	I/O	Description	Comment
56	RFFE_CLK*	DO	Used for external MIPI IC control	1.8 V.
58	RFFE_DATA*	DIO		1.8 V.
24	VDDIO_1V8	PO	Provide 1.8 V for external circuit	1.8 V. Max output current: 50 mA. This pin is defined as VDDIO_1V8 by default and can also be used as PCM_DOUT.
59	ANTCTL0	DO	Antenna control 0	1.8 V.
61	ANTCTL1	DO	Antenna control 1	1.8 V.

NOTE

If RFFE function is required, contact Quectel Technical Support for more details.

4.7. Configuration Pins

Configuration pins are used to assist the host to identify the presence of the module in the socket and identify module type. The module provides four configuration pins, which are defined as below.

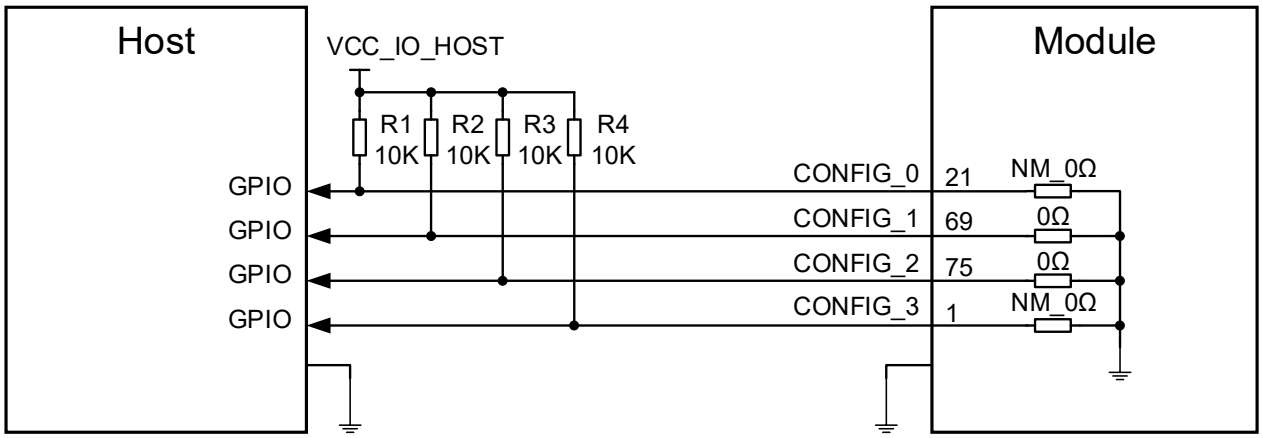
Table 25: Configuration Pins List of M.2 Specification

CONFIG_0 (Pin 21)	CONFIG_1 (Pin 69)	CONFIG_2 (Pin 75)	CONFIG_3 (Pin 1)	Module Type and Main Host Interface	Port Configuration
NC	GND	GND	NC	WWAN-PCIe	2 (Quectel defined)

Table 26: Configuration Pins of the Module

Pin No.	Pin Name	I/O	Description
21	CONFIG_0	DO	Not connected internally
69	CONFIG_1	DO	Connected to GND internally
75	CONFIG_2	DO	Connected to GND internally
1	CONFIG_3	DO	Not connected internally

The following figure shows a reference circuit of these four pins.



NOTE: The voltage level of VCC_IO_HOST depends on the host side and could be 1.8 V or 3.3 V.

Figure 25: Recommended Circuit for Configuration Pins

4.8. PCM Interface

RM255C-GL module supports audio communication via Pulse Code Modulation (PCM) digital interface.

Table 27: Pin Definition of PCM Interface

Pin No.	Pin Name	I/O	Description	Comment
20	PCM_CLK	DIO	PCM clock	
22	PCM_DIN	DI	PCM data input	
24	PCM_DOUT	DO	PCM data output	This pin is defined as VDDIO_1V8 by default and can also be used as PCM_DOUT.
28	PCM_SYNC	DIO	PCM data frame sync	

The PCM interface supports the following modes:

- Short frame mode: the module works as both the slave and the master device.
- Long frame mode: the module works as the master device only.

The module supports 16-bit linear encoding format. The following figures are the short frame mode timing diagram (PCM_SYNC = 8 kHz, PCM_CLK = 2048 kHz) and the long frame mode timing diagram (PCM_SYNC = 8 kHz, PCM_CLK = 256 kHz).

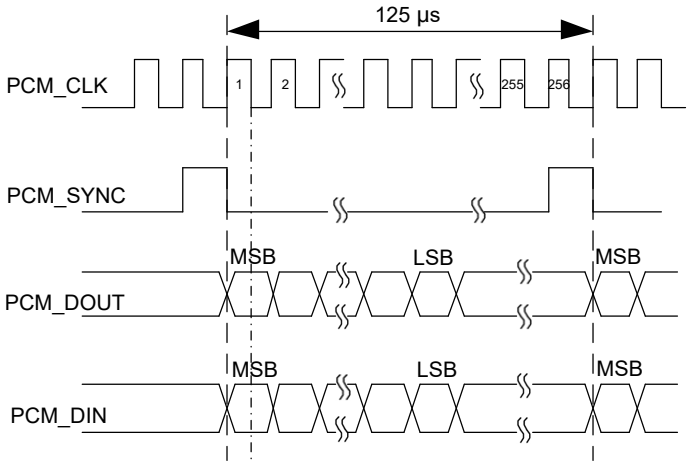


Figure 26: Timing of Short Frame Mode

In short frame mode, data is sampled on the falling edge of PCM_CLK and transmitted on the rising edge. The PCM_SYNC falling edge represents the MSB. In this mode, PCM_CLK supports 256 kHz, 512 kHz, 1024 kHz and 2048 kHz when PCM_SYNC operates at 8 kHz, and also supports 4096 kHz when PCM_SYNC operates at 16 kHz.

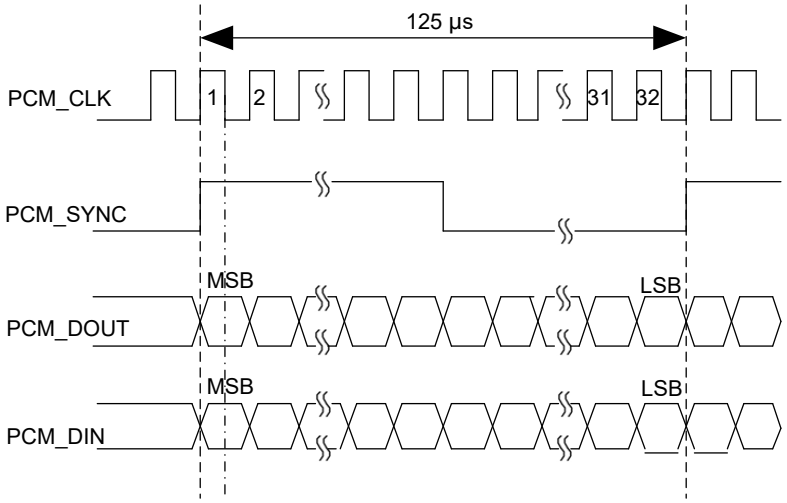


Figure 27: Timing of Long Frame Mode

In long frame mode, data is also sampled on the falling edge of the PCM_CLK and transmitted on the rising edge. But in this mode, the PCM_SYNC rising edge represents the MSB. PCM_CLK supports 256 kHz, 512 kHz, 1024 kHz and 2048 kHz when PCM_SYNC reaches 8 kHz with a 50 % duty cycle.

5 RF Characteristics

This chapter mainly describes RF characteristics of the module.

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. Antenna Interfaces

5.1.1. Pin Definition

The pin definition of antenna interfaces is shown below.

Table 28: Pin Definition of Antenna Interfaces

Antenna Connector	I/O	Description	Comment
ANT1_MAIN	AIO	Antenna 1 interface: **5G NR:** LB/MHB/UHB TRX **LTE:** LB/MHB/UHB TRX	LB: 617–960 MHz MHB: 1695–2690 MHz UHB: 3300–4200 MHz
ANT4_DRX	AI	Antenna 4 interface: **5G NR:** LB/MHB/UHB DRX **LTE:** LB/MHB/UHB DRX	
ANT5_GNSS L1&L5	AI	Antenna 5 interface: **GNSS:** L1&L5	

5.1.2. Cellular Network

5.1.2.1. Receiving Sensitivity

Table 29: Conducted Receiving Sensitivity (Unit: dBm)

Mode	Frequency	Primary	Diversity	SIMO [14]	3GPP (SIMO)
LTE	LTE-FDD B1 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-FDD B2 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-FDD B3 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-FDD B4 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-FDD B5 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-FDD B7 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-FDD B8 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-FDD B12 (B17) (10 MHz)	TBD	TBD	TBD	TBD
	LTE-FDD B13 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-FDD B14 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-FDD B18 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-FDD B19 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-FDD B20 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-FDD B25 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-FDD B26 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-FDD B28 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-FDD B30 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-TDD B34 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-TDD B38 (10 MHz)	TBD	TBD	TBD	TBD

[14] SIMO is a smart antenna technology that uses a single antenna at the transmitter side and two antennas at the receiver side, which improves Rx performance.

	LTE-TDD B39 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-TDD B40 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-TDD B41 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-TDD B42 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-TDD B43 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-TDD B48 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-FDD B66 (10 MHz)	TBD	TBD	TBD	TBD
	LTE-FDD B71 (10 MHz)	TBD	TBD	TBD	TBD
5G NR	5G NR-FDD n1 (20 MHz)	TBD	TBD	TBD	TBD
	5G NR-FDD n2 (20 MHz)	TBD	TBD	TBD	TBD
	5G NR-FDD n3 (20 MHz)	TBD	TBD	TBD	TBD
	5G NR-FDD n5 (20 MHz)	TBD	TBD	TBD	TBD
	5G NR-FDD n7 (20 MHz)	TBD	TBD	TBD	TBD
	5G NR-FDD n8 (20 MHz)	TBD	TBD	TBD	TBD
	5G NR-FDD n12 (15 MHz)	TBD	TBD	TBD	TBD
	5G NR-FDD n13 (10 MHz)	TBD	TBD	TBD	TBD
	5G NR-FDD n14 (10 MHz)	TBD	TBD	TBD	TBD
	5G NR-FDD n18 (15 MHz)	TBD	TBD	TBD	TBD
	5G NR-FDD n20 (20 MHz)	TBD	TBD	TBD	TBD
	5G NR-FDD n25 (20 MHz)	TBD	TBD	TBD	TBD
	5G NR-FDD n26 (20 MHz)	TBD	TBD	TBD	TBD
	5G NR-FDD n28 (20 MHz)	TBD	TBD	TBD	TBD
	5G NR-FDD n30 (10 MHz)	TBD	TBD	TBD	TBD
	5G NR-TDD n38 (20 MHz)	TBD	TBD	TBD	TBD
	5G NR-TDD n40 (20 MHz)	TBD	TBD	TBD	TBD

5G NR-TDD n41 (20MHz)	TBD	TBD	TBD	TBD
5G NR-TDD n48 (20 MHz)	TBD	TBD	TBD	TBD
5G NR-FDD n66 (20 MHz)	TBD	TBD	TBD	TBD
5G NR-FDD n70 (20 MHz)	TBD	TBD	TBD	TBD
5G NR-FDD n71 (20 MHz)	TBD	TBD	TBD	TBD
5G NR-TDD n77 (20 MHz)	TBD	TBD	TBD	TBD
5G NR-TDD n78 (20 MHz)	TBD	TBD	TBD	TBD

5.1.2.2. Transmitting Power

The following table shows the RF output power of the module.

Table 30: Cellular Output Power

Mode	Frequency	Max.	Min.
LTE	LTE bands [15]	23 dBm ±2 dB (Class 3)	< -40 dBm
	LTE HPUE [16] bands (B38/B40/B41/B42/B43)	26 dBm ±2 dB (Class 2)	< -40 dBm
5G NR	5G NR bands [17]	23 dBm ±2 dB (Class 3)	< -40 dBm [18]
	5G NR HPUE [16] bands (n38/n40/n41/n77/n78)	26 dBm +2/-3 dB (Class 2)	< -40 dBm [18]

[15] The transmitting power of B30 is Class 3 (22 dBm +2 dB).
[16] HPUE is only for single carrier.
[17] The transmitting power of n30 is Class 3 (22 dBm +2 dB).
[18] For 5G NR TDD bands, the normative reference for this requirement is *TS 38.101-1 clause 6.3.1.*

5.1.3. GNSS

The module includes a fully integrated global navigation satellite system solution (GPS、GLONASS、BDS、Galileo、NavIC).

The module supports standard NMEA 0183 protocol, and outputs NMEA sentences at 1 Hz data update rate via USB interface by default.

The GNSS engine is switched off by default. It has to be switched on via **AT+QGPS**.

5.1.3.1. GNSS Frequency

Table 31: GNSS Frequency

Bands	Type	Frequency	Unit
L1	GPS	1575.42 ±1.023 (L1)	MHz
	Galileo	1575.42 ±2.046 (E1)	MHz
	GLONASS	1597.5–1605.8	MHz
	BDS	1561.098 ±2.046	MHz
L5	GPS/Galileo/NavIC	1176.45 ±10.23 (L5)	MHz

5.1.3.2. GNSS Performance

The following table shows GNSS performance of the module.

Table 32: GNSS Performance

Parameter	Description	Conditions	Typ.	Unit
Sensitivity	Acquisition	Autonomous	TBD	dBm
	Reacquisition	Autonomous	TBD	dBm
	Tracking	Autonomous	TBD	dBm
TTFF	Cold start	Autonomous	TBD	s

	@ open sky	AGNSS start	TBD	s
	Warm start @ open sky	Autonomous	TBD	s
		AGNSS start	TBD	s
	Hot start @ open sky	Autonomous	TBD	s
		AGNSS start	TBD	s
Accuracy	CEP-50	Autonomous @ open sky	TBD	m

NOTE

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

5.2. Antenna Connectors

5.2.1. Antenna Connector Specifications

The module is mounted with standard 2 mm × 2 mm receptacle antenna connectors for convenient antenna connection. The antenna connector dimensions are illustrated as below:

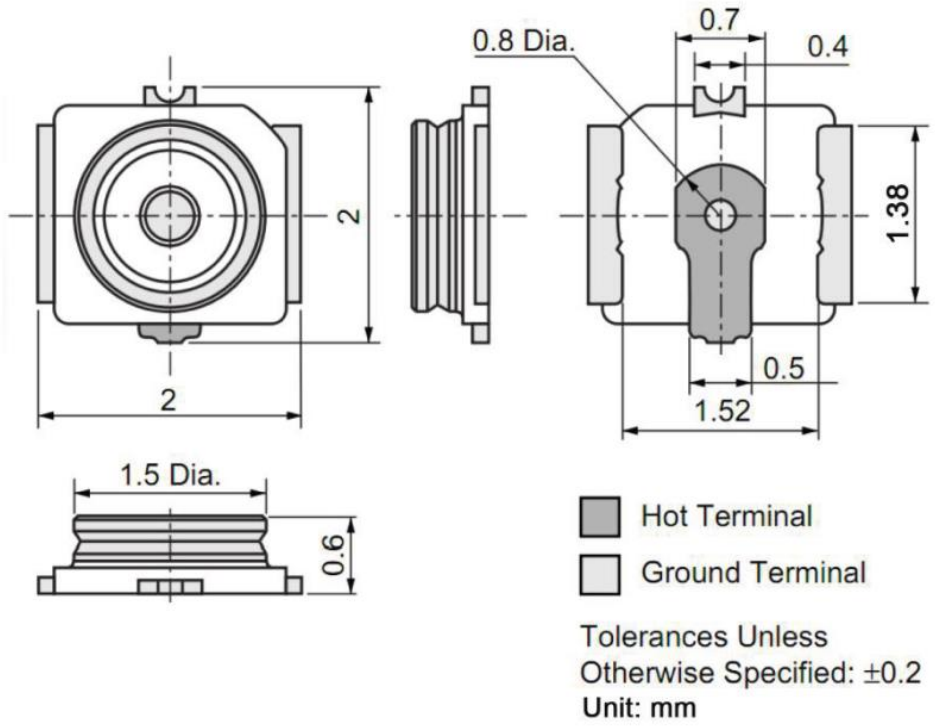


Figure 28: Dimensions of the Receptacle

Table 33: Major Specifications of the RF Connector

Item	Specification
Nominal Frequency Range	DC to 6 GHz
Nominal Impedance	50 Ω
Temperature Rating	-40 °C to +85 °C
Voltage Standing Wave Ratio (VSWR)	Meet the requirements of: Max 1.3 (DC–3 GHz) Max 1.4 (3–6 GHz)

5.2.2. Antenna Connector Location

RM255C-GL has three antenna connectors: ANT1_MAIN, ANT4_DRX and ANT5_GNSS L1&L5, which are shown as below.

Figure 29: RM255C-GL Antenna Connectors

NOTE

It is recommended that the straight-line distance between the antenna and the module be greater than 15 mm to achieve better wireless performance of the whole device.

5.2.3. Antenna Connector Installation

The receptacle RF connector used in conjunction with the module will accept two types of mating plugs that will meet a maximum height of 1.2 mm using a Ø 0.81 mm coaxial cable or a maximum height of 1.45 mm utilizing a Ø 1.13 mm coaxial cable.

The following figure shows the specifications of mated plugs using Ø 0.81 mm coaxial cables.

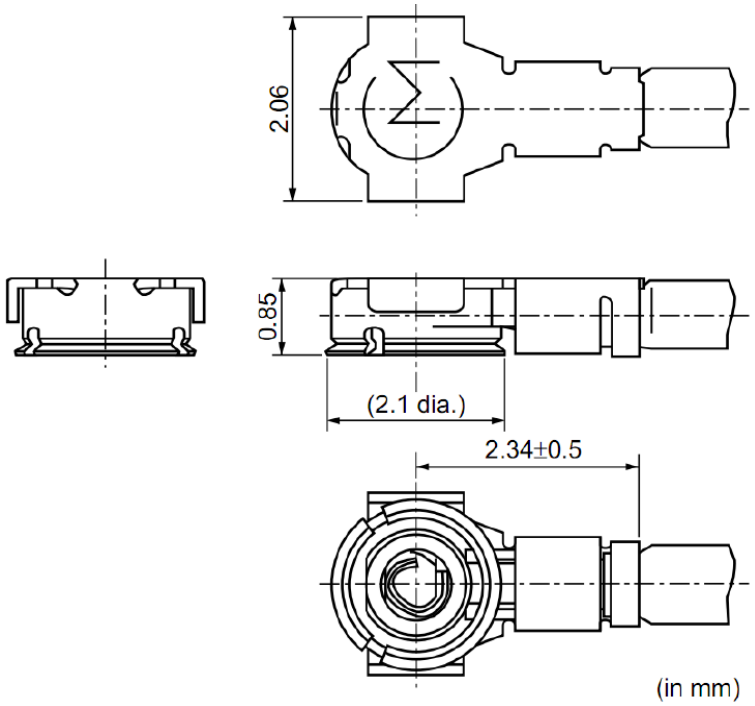


Figure 30: Dimensions of Mated Plugs (Ø 0.81 mm Coaxial Cables)

The following figure illustrates the connection between the receptacle RF connector on the module and the mated plug using a Ø 0.81 mm coaxial cable.

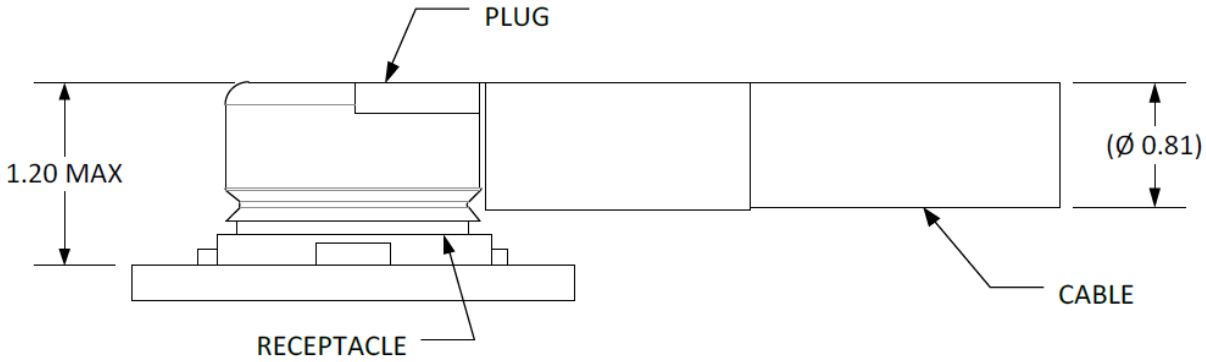


Figure 31: Space Factor of Mated Connectors (Ø 0.81 mm Coaxial Cables) (Unit: mm)

The following figure illustrates the connection between the receptacle RF connector on the module and the mated plug using a Ø 1.13 mm coaxial cable.

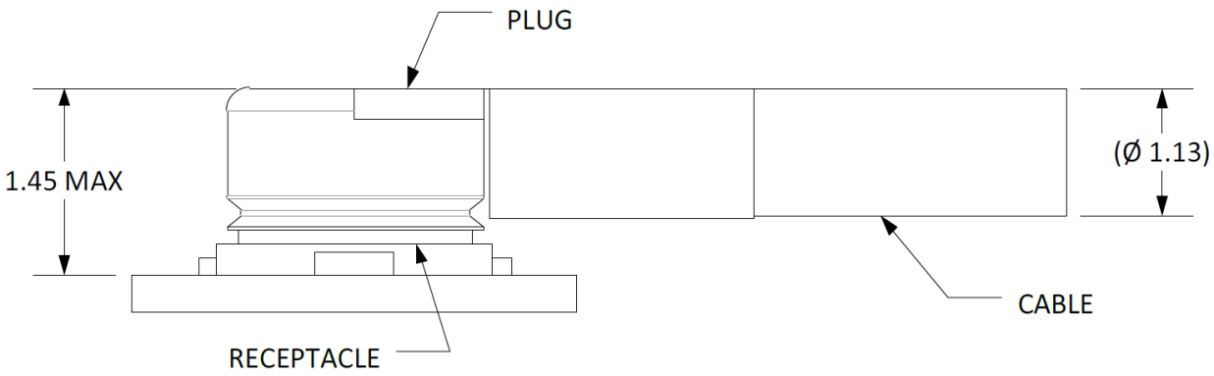


Figure 32: Space Factor of Mated Connectors (Ø 1.13 mm Coaxial Cables) (Unit: mm)

5.2.4. RF Connector Installation

5.2.4.1. Assemble Coaxial Cable Plug Manually

The illustration for plugging in a coaxial cable plug is shown below, θ = 90° is acceptable, while θ ≠ 90° is not.

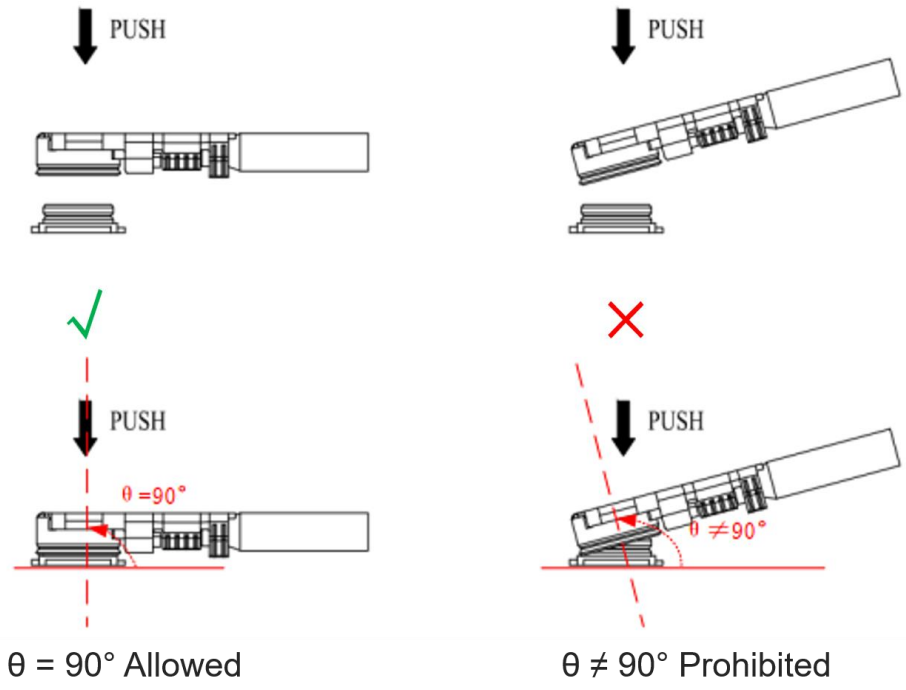


Figure 33: Plug in a Coaxial Cable Plug

The illustration of pulling out the coaxial cable plug is shown below, θ = 90° is acceptable, while θ ≠ 90° is not.

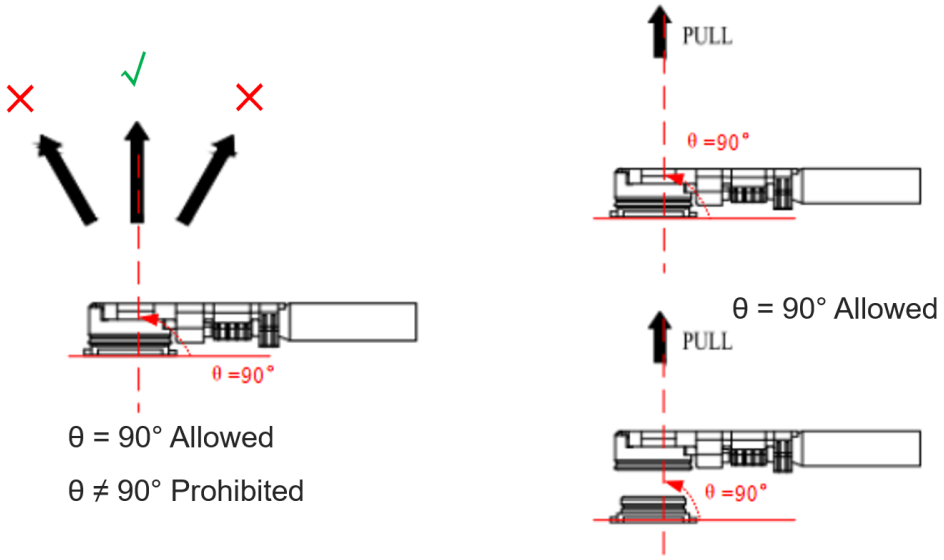


Figure 34: Pull out a Coaxial Cable Plug

5.2.4.2. Assemble Coaxial Cable Plug with Jig

The pictures of installing the coaxial cable plug with a jig is shown below, θ = 90° is acceptable, while θ ≠ 90° is not.

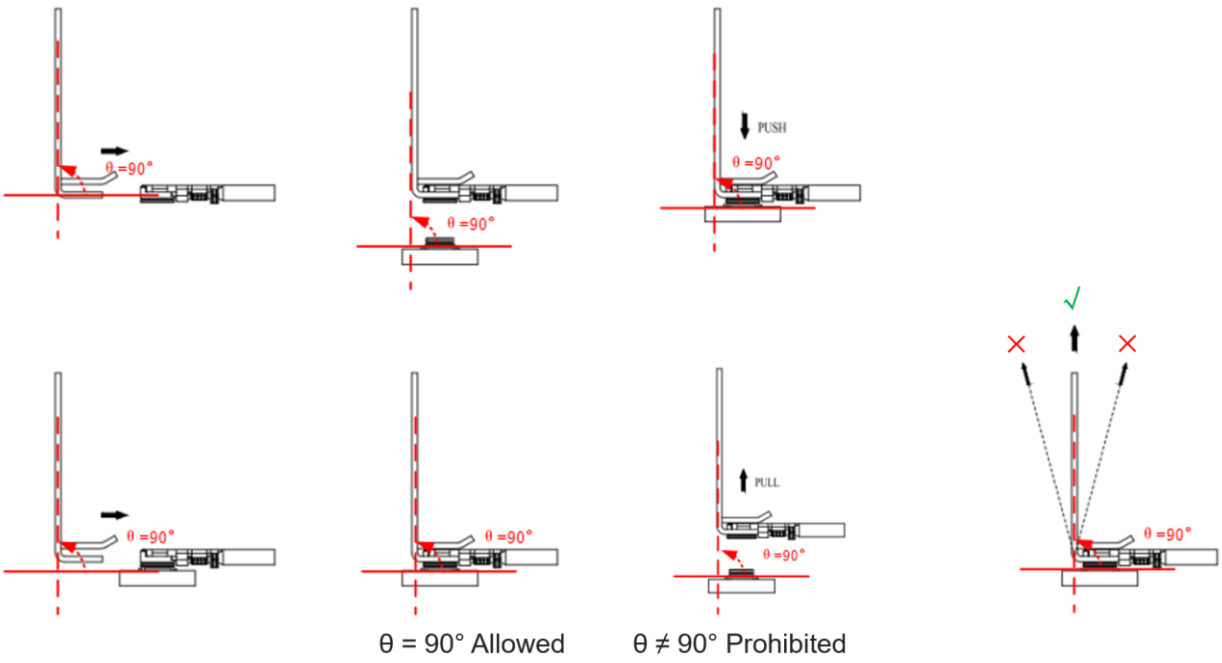


Figure 35: Install the Coaxial Cable Plug with Jig

5.2.5. Recommended Manufacturers of RF Connector and Cable

RF connectors and cables by I-PEX2 are recommended. For more details, visit https://www.i-pex.com.

5.3. Antenna Requirements

The following table shows the requirements on LTE, 5G NR antenna and GNSS antennas.

Table 34: Antenna Requirements

Type	Requirements
Cellular	● VSWR: ≤ 2 ● Efficiency: > 30 % ● Input Impedance: 50 Ω ● Cable insertion loss: - < 1 dB: LB (<1 GHz) - < 1.5 dB: MB (1–2.3 GHz) - < 2 dB: HB (> 2.3 GHz)
GNSS	● Frequency range: - L1: 1559–1609 MHz - L5: 1166–1187 MHz ● Polarization: RHCP or linear ● VSWR: ≤ 2 (Typ.)
	For passive antenna usage: Passive antenna gain: > 0 dBi
	For active antenna usage: Active antenna noise figure: < 1.5 dB (Typ.) Active antenna embedded LNA gain: < 17 dB (Typ.)

NOTE

It is recommended to use a passive GNSS antenna when LTE B13 or B14 is supported, as the use of active antenna may generate harmonics which will affect the GNSS performance.

6 Electrical Characteristics and Reliability

6.1. Absolute Maximum Ratings

Absolute maximum ratings for power supply and voltage on digital pins of the module are listed in the following table.

Table 35: Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
VCC	-0.3	4.7	V
Voltage at 1.8 V Digital Pins	-0.3	2.3	V
Voltage at 3.3 V Digital Pins	-0.3	3.6	V

6.2. Power Supply Requirements

The typical input voltage of the module is 3.7 V, the following table shows the power supply requirements of the module.

Table 36: Power Supply Requirements

Parameter	Description	Min.	Typ.	Max.	Unit
VCC	Power Supply for the module	3.135	3.7	4.4	V
Voltage Ripple	-	-	30	100	mV

6.3. Power Consumption

Table 37: Averaged Power consumption

Mode	Condition	Band/Combination	Typ.	Unit
Turn off	Power off	-	TBD	μA
Sleep State	**AT+CFUN=0** (USB 2.0 Suspend)	-	TBD	mA
	AT+CFUN=4 (USB 2.0 Suspend)	-	TBD	mA
	SA FDD PF = 64 (USB 2.0 Suspend)	-	TBD	mA
Idle State	SA PF = 64 (USB 2.0 active)	-	TBD	mA
LTE	LTE LB @ 23 dBm	TBD	TBD	mA
	LTE MB @ 23 dBm	TBD	TBD	mA
	LTE HB @ 23 dBm	TBD	TBD	mA
5G SA (1 Tx)	5G NR LB @ 23 dBm	TBD	TBD	mA
	5G NR MB @ 23 dBm	TBD	TBD	mA
	5G NR HB @ 23 dBm	TBD	TBD	mA
	5G NR UHB @ 26 dBm	TBD	TBD	mA

NOTE

1. The power consumption test is performed with EVB at room temperature without any thermal dissipation measure.
2. The power consumption above is for reference only, contact Quectel Technical Support for detailed power consumption test report of the module.

6.4. Digital I/O Characteristic

Table 38: Logic Levels of 1.8 V Digital I/O

Parameter	Description	Min.	Max.	Unit
VDDIO_1V8	Supply voltage	1.7	1.94	V
V_{IH}	High-level input voltage	0.65 × VDDIO_1V8	VDDIO_1V8 + 0.3	V
V_{IL}	Low-level input voltage	-0.3	0.35 × VDDIO_1V8	V
V_{OH}	High-level output voltage	VDDIO_1V8 - 0.45	-	V
V_{OL}	Low-level output voltage	-	0.45	V

Table 39: Logic Levels of 3.3 V Digital I/O

Parameter	Description	Min.	Max.	Unit
3.3 V	Supply voltage	3.135	3.465	V
V_{IH}	High-level input voltage	2.0	3.6	V
V_{IL}	Low-level input voltage	-0.5	0.8	V

Table 40: (U)SIM High/Low-voltage I/O Requirements

Parameter	Description	Min.	Max.	Unit
V_{IH}	High-level input voltage	0.7 × USIM_VDD	USIM_VDD + 0.3	V
V_{IL}	Low-level input voltage	-0.3	0.2 × USIM_VDD	V
V_{OH}	High-level output voltage	0.8 × USIM_VDD	-	V
V_{OL}	Low-level output voltage	-	0.4	V

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.

Table 41: Electrostatic Discharge Characteristics (Temperature: 25–30 ºC, Humidity: 40 ±5 %)

Tested Interfaces	Contact Discharge	Air Discharge	Unit
VCC, GND	TBD	TBD	kV
Antenna Interfaces	TBD	TBD	kV
Other Interfaces	TBD	TBD	kV

6.6. Operating and Storage Temperatures

Table 42: Operating and Storage Temperatures

Parameter	Min.	Typ.	Max.	Unit
Operating Temperature Range [19]	-30	+25	+75	ºC
Extended Temperature Range [20]	-40	-	+85	ºC
Storage temperature Range	-40	-	+90	ºC

[19] To meet the normal operating temperature range requirements, it is necessary to ensure effective thermal dissipation, e.g., by adding passive or active heatsinks, heat pipes, vapor chambers. Within this range, the module's indicators comply with 3GPP specification requirements.

[20] To meet the extended operating temperature range requirements, it is necessary to ensure effective thermal dissipation, e.g., by adding passive or active heatsinks, heat pipes, vapor chambers. Within this range, the module retains the ability to establish and maintain functions such as voice*, SMS, data transmission and emergency call*, without any unrecoverable malfunction. Radio spectrum and radio network remain uninfluenced, whereas the value of one or more parameters, such as P_{out}, may decrease and fall below the range of the 3GPP specified tolerances. When the temperature returns to the normal operating temperature range, the module's indicators will comply with 3GPP specification requirements again.

6.7. Thermal Dissipation

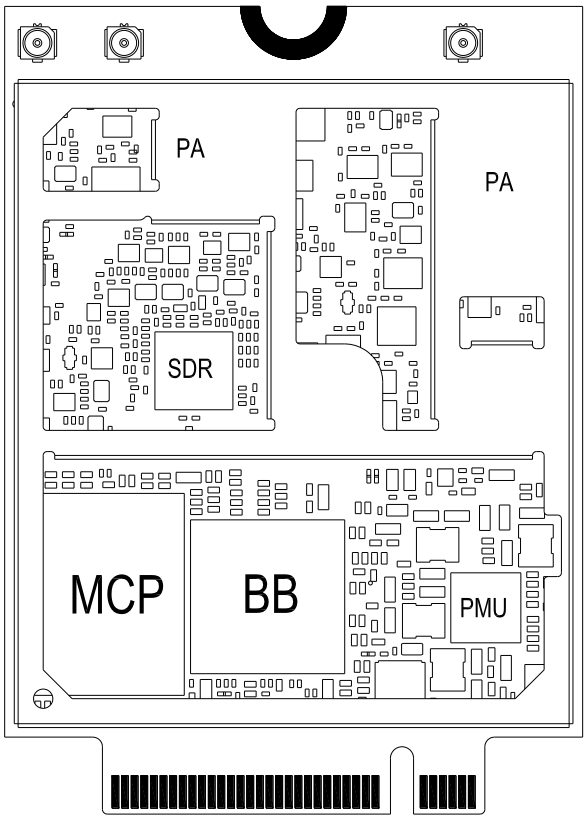


Figure 36: Thermal Dissipation Area of the Module

The module offers the best performance when all internal IC chips are working within their operating temperatures. When the IC chip reaches or exceeds the maximum junction temperature, the module may still work but the performance and function (such as RF output power and data rate) will be affected to a certain extent. Therefore, the thermal design should be maximally optimized to ensure all internal IC chips always work within the recommended operating temperature range.

The following principles for thermal consideration are provided for reference:

- Keep the module away from heat sources on your PCB, especially high-power components such as processor, power amplifier, and power supply.
- Maintain the integrity of the PCB copper layer and drill as many thermal vias as possible.
- Expose the copper in the PCB area where module is mounted.
- Apply a soft thermal pad with appropriate thickness and high thermal conductivity between the module and the PCB to conduct heat.
- Follow the principles below when the heatsink is necessary:

- Do not place large size components in the area where the module is mounted on your PCB to reserve enough place for heatsink installation.
- Attach the heatsink to the shielding cover of the module; In general, the base plate area of the heatsink should be larger than the module area to cover the module completely.
- Choose the heatsink with adequate fins to dissipate heat.
- Choose a TIM (Thermal Interface Material) with high thermal conductivity, good softness and good wettability and place it between the heatsink and the module.
- Fasten the heatsink with four screws to ensure that it is in close contact with the module to prevent the heatsink from falling off during the drop, vibration test, or transportation.

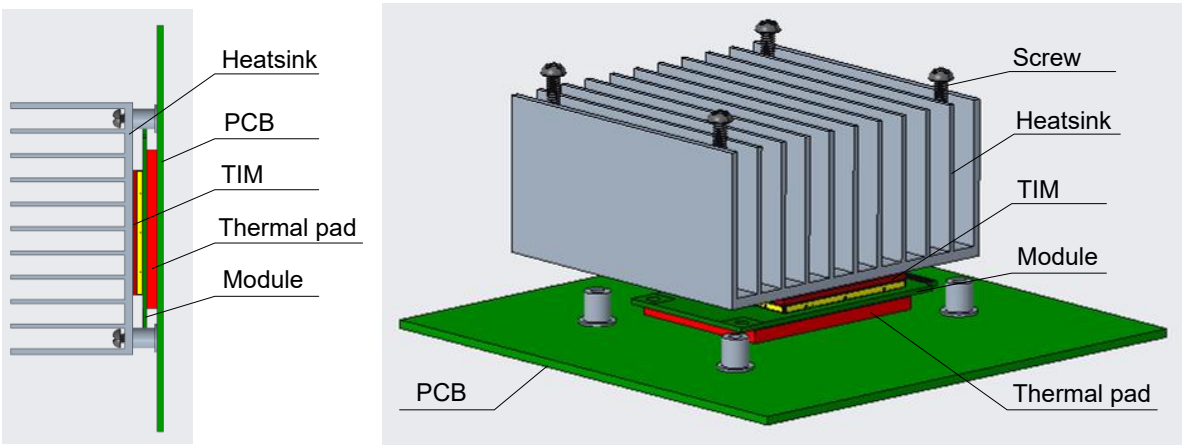


Figure 37: Placement and Fixing of the Heatsink

7 Mechanical Dimensions

This chapter mainly describes mechanical dimensions and packaging specifications of RM255C-GL module. All dimensions are measured in mm, and the dimensional tolerances are ±0.15 mm unless otherwise specified.

7.1. Mechanical Dimensions

Figure 38: Mechanical Dimensions of the Module (Unit: mm)

7.2. Top and Bottom Views

Top View

Bottom View

Figure 39: Top and Bottom Views of the Module

NOTE

Images above are for illustration purpose only and may differ from the actual module. For authentic appearance and label, please refer to the module received from Quectel.

7.3. M.2 Connector

The module adopts a standard PCI Express M.2 connector which compiles with the directives and standards listed in the PCI Express M.2 Specification.

8 Storage and Packaging

8.1. Storage Conditions

The storage requirements are shown below.

1. Recommended Storage Condition: the temperature should be 23 ±5 °C and the relative humidity should be 35–60 %.

2. Shelf life: 12 months in Recommended Storage Condition.

NOTE

Pay attention to ESD protection, such as wearing anti-static gloves, when touching the modules.

8.2. Notification

Please follow the principles below in module application.

8.2.1. 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

8.2.2. Cleaning

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

8.2.3. Installing

Fix the module firmly to avoid poor contact caused by shaking. It is recommended to install the module on the socket with a screw as shown below.

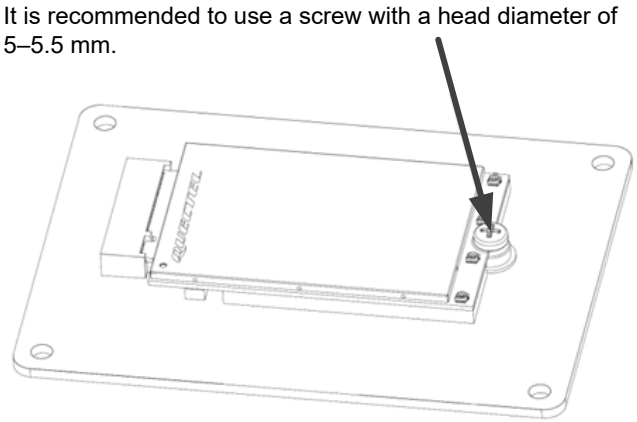


Figure 40: Installation Schematic

8.3. Packaging Specifications

This chapter outlines the key packaging parameters and processes. All figures below are for reference purposes only, as the actual appearance and structure of packaging materials may vary in delivery.

The modules are packed in a blister tray packaging as specified in the sub-chapters below.

8.3.1. Blister Tray

Blister tray dimensions are illustrated in the following figure:

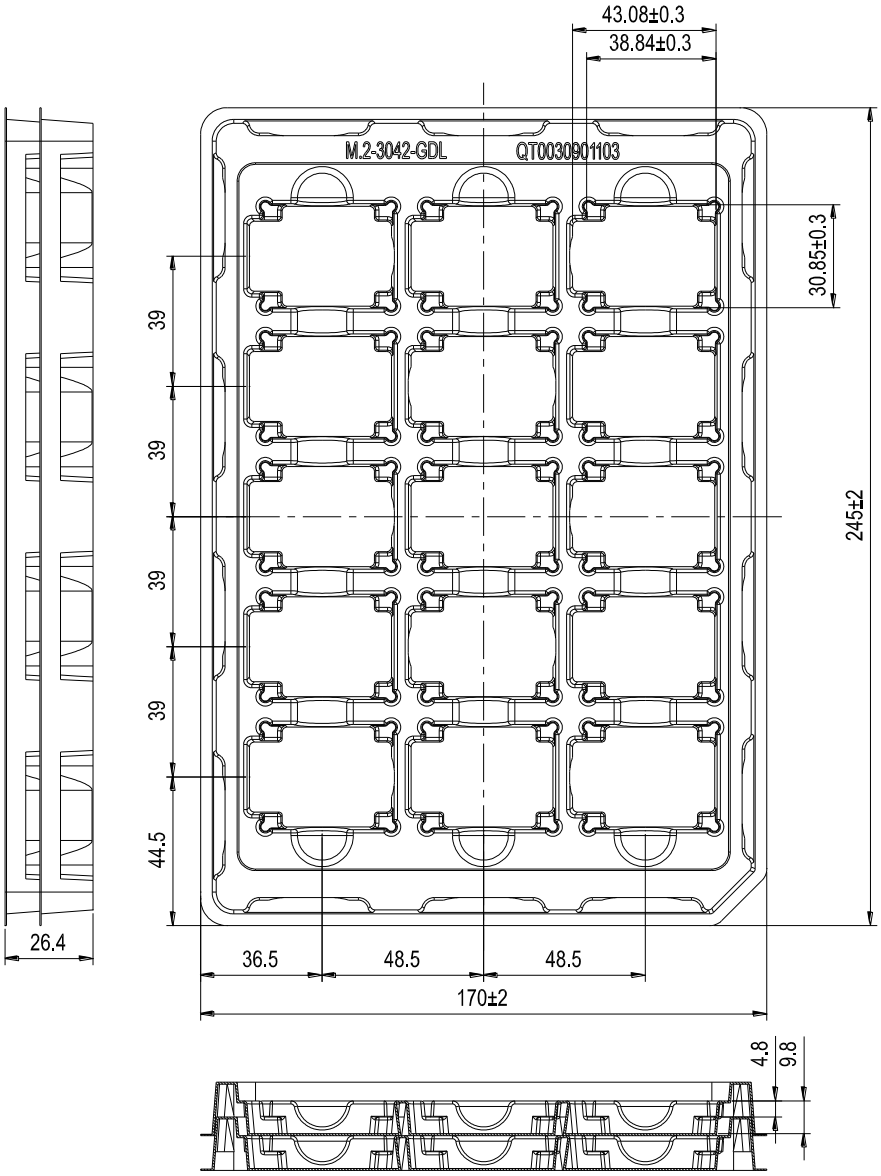
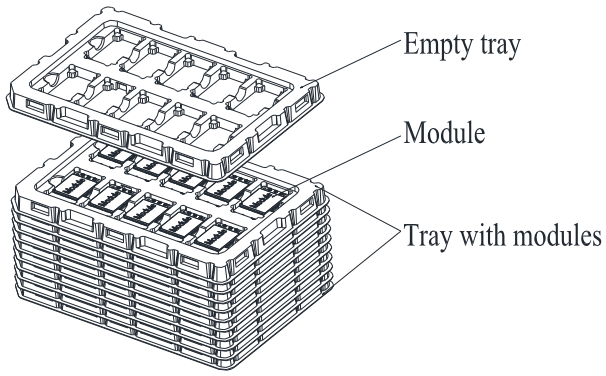


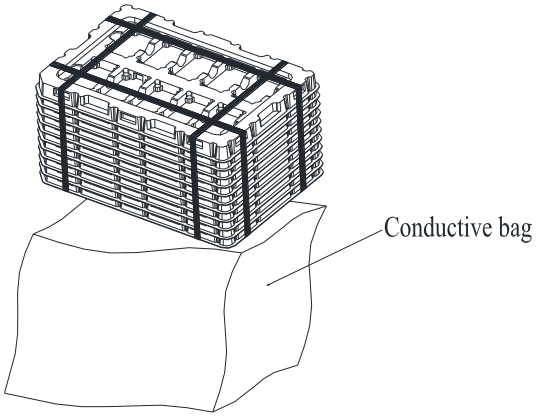
Figure 41: Blister Tray Dimension Drawing (Unit: mm)

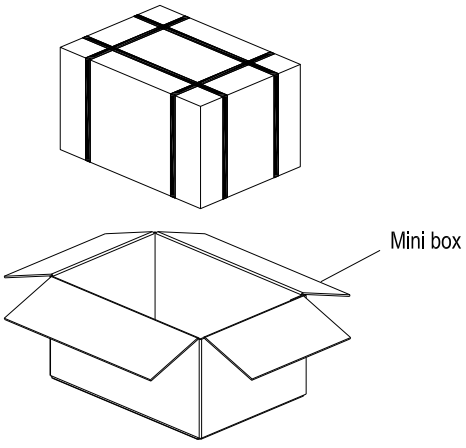
8.3.2. Packaging Process



Each blister tray packs 15 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 150 modules.

Place the 4 packaged mini boxes into 1 carton and seal it. 1 carton can pack 600 modules.

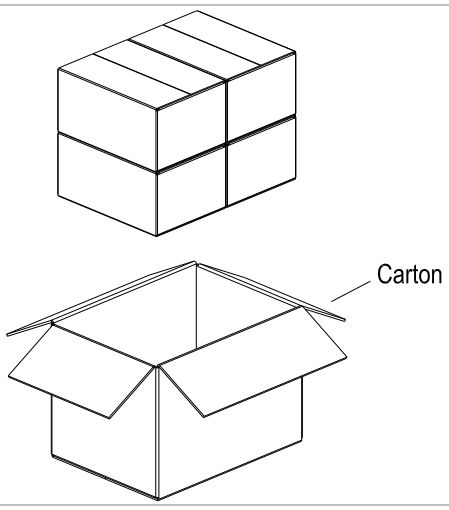


Figure 42: Packaging Process

9 Appendix A References

Table 43: Related Documents

Document Name
[1] Quectel_5G-M2_EVB_User_Guide
[2] Quectel_RG255C_Series&RM255C-GL_RF_Application_Note
[3] Quectel_RG255C_Series&RM255C-GL_AT_Commands_Manual
[4] Quectel_RG255C_Series&RM255C-GL_GNSS_Application_Note

Table 44: Terms and Abbreviations

Abbreviation	Description
3GPP	3rd Generation Partnership Project
BDS	BeiDou Navigation Satellite System
BIOS	Basic Input Output System
bps	Bit Per Second
CHAP	Challenge-Handshake Authentication Protocol
COEX	Coexistence
CPE	Customer Premise Equipment
DC-DC	Direct Current to Direct Current
FOTA	Firmware Over-The-Air
DL	Downlink
DPR	Dynamic Power Reduction
DUN	Dial-up Networking

DRX	Discontinuous Reception (***Chapter 3.1.1***) Diversity Reception (***Chapter 5***)
ECM	Ethernet Networking Control Model
EP	End Point
ESD	Electrostatic Discharge
ET	Envelope Tracking
E-UTRA	Evolved Universal Terrestrial Radio Access
FDD	Frequency Division Duplexing
GLONASS	Global Navigation Satellite System (Russia)
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GSM	Global System for Mobile Communications
HB	High Band
HPUE	High Power User Equipment
IC	Integrated Circuit
IMS	IP Multimedia Subsystem
IPQ	Qualcomm Internet Processor
kbps	Kilo Bits Per Second
LAA	License Assisted Access
LED	Light Emitting Diode
LTE	Long Term Evolution
MB	Middle Band
MBIM	Mobile Broadband Interface Model
Mbps	Mega Bits Per Second
ME	Mobile Equipment
MIMO	Multiple-Input Multiple-Output
MLCC	Multilayer Ceramic Chip Capacitor

MO	Mobile Originated
MSB	Most Significant Bit
MT	Mobile Terminated
NAS	Non-access Stratum
NDIS	Network Driver Interface Specification
NR	New Radio
PAP	Password Authentication Protocol
PCB	Printed Circuit Board
PCIe	Peripheral Component Interconnect Express
PDU	Protocol Data Unit
PPP	Point-to-Point Protocol
PRX	Primary Receive
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RC	Root Complex
RF	Radio Frequency
RHCP	Right Hand Circularly Polarized
RFFE	RF Front-End
RmNet	Remote Network
RNDIS	Remote Network Driver Interface Specification
Rx	Receive
SAR	Specific Absorption Rate
SCS	Sub-Carrier Spacing
SIMO	Single Input Multiple Output
SMS	Short Message Service
TCP	Transmission Control Protocol
TDD	Time Division Duplexing

TTFF	Time to First Fix
Tx	Transmit
UART	Universal Asynchronous Receiver & Transmitter
UDP	User Datagram Protocol
UHB	Ultra High Band
UL	Uplink
URC	Unsolicited Result Code
USB	Universal Serial Bus
(U)SIM	(Universal) Subscriber Identity Module
V_{IH}	High-level input voltage
V_{IL}	Low-level input voltage
V_{OH}	High-level output voltage
V_{OL}	Low-level output voltage
VSWR	Voltage Standing Wave Ratio
WLAN	Wireless Local Area Network
WWAN	Wireless Wide Area Network

10 Appendix B Operating Frequency

Table 45: Operating Frequencies (5G)

5G	Duplex Mode	Uplink Operating Band	Downlink Operating Band	Unit
n1	FDD	1920–1980	2110–2170	MHz
n2	FDD	1850–1910	1930–1990	MHz
n3	FDD	1710–1785	1805–1880	MHz
n5	FDD	824–849	869–894	MHz
n7	FDD	2500–2570	2620–2690	MHz
n8	FDD	880–915	925–960	MHz
n12	FDD	699–716	729–746	MHz
n13	FDD	777–787	746–756	MHz
n14	FDD	788–798	758–768	MHz
n18	FDD	815–830	860–875	MHz
n20	FDD	832–862	791–821	MHz
n24	FDD	1626.5–1660.5	1525–1559	MHz
n25	FDD	1850–1915	1930–1995	MHz
n26	FDD	814–849	859–894	MHz
n28	FDD	703–748	758–803	MHz
n29	SDL	-	717–728	MHz
n30	FDD	2305–2315	2350–2360	MHz
n34	TDD	2010–2025	2010–2025	MHz
n38	TDD	2570–2620	2570–2620	MHz

n39	TDD	1880–1920	1880–1920	MHz
n40	TDD	2300–2400	2300–2400	MHz
n41	TDD	2496–2690	2496–2690	MHz
n46	TDD	5150–5925	5150–5925	MHz
n47	TDD	5855–5925	5855–5925	MHz
n48	TDD	3550–3700	3550–3700	MHz
n50	TDD	1432–1517	1432–1517	MHz
n51	TDD	1427–1432	1427–1432	MHz
n53	TDD	2483.5–2495	2483.5–2495	MHz
n65	FDD	1920–2010	2110–2200	MHz
n66	FDD	1710–1780	2110–2200	MHz
n67	SDL	-	738–758	MHz
n70	FDD	1695–1710	1995–2020	MHz
n71	FDD	663–698	617–652	MHz
n74	FDD	1427–1470	1475–1518	MHz
n75	SDL	-	1432–1517	MHz
n76	SDL	-	1427–1432	MHz
n77	TDD	3300–4200	3300–4200	MHz
n78	TDD	3300–3800	3300–3800	MHz
n79	TDD	4400–5000	4400–5000	MHz
n80	SUL	1710–1785	-	MHz
n81	SUL	880–915	-	MHz
n82	SUL	832–862	-	MHz
n83	SUL	703–748	-	MHz
n84	SUL	1920–1980	-	MHz
n85	FDD	698–716	728–746	MHz

n86	SUL	1710–1780	-	MHz
n89	SUL	824–849	-	MHz
n90	TDD	2496–2690	2496–2690	MHz
n91	FDD	832–862	1427–1432	MHz
n92	FDD	832–862	1432–1517	MHz
n93	FDD	880–915	1427–1432	MHz
n94	FDD	880–915	1432–1517	MHz
n95	SUL	2010–2025	-	MHz
n96	TDD	5925–7125	5925–7125	MHz
n97	SUL	2300–2400	-	MHz
n98	SUL	1880–1920	-	MHz
n99	SUL	1626.5–1660.5	-	MHz

Table 46: Operating Frequencies (2G + 3G + 4G)

2G	3G	4G	Duplex Mode	Uplink	Downlink	Unit
-	B1	B1	FDD	1920–1980	2110–2170	MHz
PCS1900	B2/BC1	B2	FDD	1850–1910	1930–1990	MHz
DCS1800	B3	B3	FDD	1710–1785	1805–1880	MHz
-	B4	B4	FDD	1710–1755	2110–2155	MHz
GSM850	B5/BC0	B5	FDD	824–849	869–894	MHz
-	B6	-	FDD	830–840	875–885	MHz
-	B7	B7	FDD	2500–2570	2620–2690	MHz
EGSM900	B8	B8	FDD	880–915	925–960	MHz
-	B9	B9	FDD	1749.9–1784.9	1844.9–1879.9	MHz
-	B10	B10	FDD	1710–1770	2110–2170	MHz
-	B11	B11	FDD	1427.9–1447.9	1475.9–1495.9	MHz

-	B12	B12	FDD	699–716	729–746	MHz
-	B13	B13	FDD	777–787	746–756	MHz
-	B14	B14	FDD	788–798	758–768	MHz
-	-	B17	FDD	704–716	734–746	MHz
-	-	B18	FDD	815–830	860–875	MHz
-	B19	B19	FDD	830–845	875–890	MHz
-	B20	B20	FDD	832–862	791–821	MHz
-	B21	B21	FDD	1447.9–1462.9	1495.9–1510.9	MHz
-	B22	B22	FDD	3410–3490	3510–3590	MHz
-	-	B24	FDD	1626.5–1660.5	1525–1559	MHz
-	B25	B25	FDD	1850–1915	1930–1995	MHz
-	B26	B26	FDD	814–849	859–894	MHz
-	-	B27	FDD	807–824	852–869	MHz
-	-	B28	FDD	703–748	758–803	MHz
-	-	B29	FDD [21]	-	717–728	MHz
-	-	B30	FDD	2305–2315	2350–2360	MHz
-	-	B31	FDD	452.5–457.5	462.5–467.5	MHz
-	-	B32	FDD [21]	-	1452–1496	MHz
-	B33	B33	TDD	1900–1920	1900–1920	MHz
-	B34	B34	TDD	2010–2025	2010–2025	MHz
-	B35	B35	TDD	1850–1910	1850–1910	MHz
-	B36	B36	TDD	1930–1990	1930–1990	MHz
	B37	B37	TDD	1910–1930	1910–1930	MHz
-	B38	B38	TDD	2570–2620	2570–2620	MHz
-	B39	B39	TDD	1880–1920	1880–1920	MHz

[21] Restricted to E-UTRA operation when carrier aggregation is configured. The downlink operating band is paired with the uplink operating band (external) of the carrier aggregation configuration that is supporting the configured Pcell.

-	B40	B40	TDD	2300–2400	2300–2400	MHz
-	-	B41	TDD	2496–2690	2496–2690	MHz
-	-	B42	TDD	3400–3600	3400–3600	MHz
-	-	B43	TDD	3600–3800	3600–3800	MHz
-	-	B44	TDD	703–803	703–803	MHz
-	-	B45	TDD	1447–1467	1447–1467	MHz
-	-	B46	TDD	5150–5925	5150–5925	MHz
-	-	B47	TDD	5855–5925	5855–5925	MHz
-	-	B48	TDD	3550–3700	3550–3700	MHz
-	-	B50	TDD	1432–1517	1432–1517	MHz
-	-	B51	TDD	1427–1432	1427–1432	MHz
-	-	B52	TDD	3300–3400	3300–3400	MHz
-	-	B65	FDD	1920–2010	2110–2200	MHz
-	-	B66	FDD [22]	1710–1780	2110–2200	MHz
-	-	B67	FDD [21]	-	738–758	MHz
-	-	B68	FDD	698–728	753–783	MHz
-	-	B69	FDD [21]	-	2570–2620	MHz
-	-	B70	FDD [23]	1695–1710	1995–2020	MHz
-	-	B71	FDD	663–698	617–652	MHz
-	-	B72	FDD	451–456	461–466	MHz
-	-	B73	FDD	450–455	460–465	MHz
-	-	B74	FDD	1427–1470	1475–1518	MHz
-	-	B75	FDD [21]	-	1432–1517	MHz

[22] The range 2180–2200 MHz of the DL operating band is restricted to E-UTRA operation when carrier aggregation is configured.
[23] The range 2010–2020 MHz of the DL operating band is restricted to E-UTRA operation when carrier aggregation is configured and TX-RX separation is 300 MHz. The range 2005–2020 MHz of the DL operating band is restricted to E-UTRA operation when carrier aggregation is configured and TX-RX separation is 295 MHz.

-	-	B76	FDD [21]	-	1427–1432	MHz
-	-	B85	FDD	698–716	728–746	MHz
-	-	B87	FDD	410–415	420–425	MHz
-	-	B88	FDD	412–417	422–427	MHz

FCC ID: XMR2025RM255CGL

OEM/Integrators Installation Manual

Important Notice to OEM integrators

1. This module is limited to OEM installation ONLY.
2. This module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).
3. The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations
4. For FCC Part 15.31 (h) and (k): The host manufacturer is responsible for additional testing to verify compliance as a composite system. When testing the host device for compliance with Part 15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions). The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are complaint with the transmitter(s) rule(s).
The Grantee will provide guidance to the host manufacturer for Part 15 B requirements if needed.

Important Note

notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify to Quectel that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the USI, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

End Product Labeling

When the module is installed in the host device, the FCC/IC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text:
“Contains FCC ID: XMR2025RM255CGL”
“Contains IC: 10224A-025RM255CGL”
The FCC ID/IC ID can be used only when all FCC/IC compliance requirements are met.

Antenna Installation

(1) The antenna must be installed such that 20cm is maintained between the antenna and users,
(2) The transmitter module may not be co-located with any other transmitter or antenna.

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC/IC authorization is no longer considered valid and the FCC ID/IC

ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC/IC authorization.

Antenna Type	Max Gain
External	**LTE** B2:8.00dBi; B4:5.00dBi; B5:11.56dBi; B7:8.00dBi; B12:10.85dBi; B13:11.31dBi; B14:11.38dBi; B17:10.89dBi; B25:8.00dBi; B26:11.51dBi; B30:-1.02dBi; B38:5.00dBi; B41:5.00dBi; B42:2.00dBi; B42/43/48(CBRS):-2.00dBi; B66:5.00dBi; B71:10.63dBi;
	NR n2:8.00dBi; n5:11.57dBi; n7:8.00dBi; n12:10.86dBi; n13:11.31dBi; n14:11.38dBi; n25:8.00dBi; n26:11.52dBi; n30:-1.02dBi; n38/41/66/70:5.00dBi; n71:10.63dBi; n77/78:2dBi

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.

Federal Communication Commission Interference Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

List of applicable FCC rules

This module has been tested and found to comply with part 22, part 24, part 27, part 90, and part 96 requirements for Modular Approval.
The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other

FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

This device is intended only for OEM integrators under the following conditions: (For module device use)

1) The antenna must be installed such that 20cm is maintained between the antenna and users, and
2) The transmitter module may not be co-located with any other transmitter or antenna.
As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

IC: 10224A-025RM255CGL PMN: QUECTEL RM255C-GL, RM255C-GL

Industry Canada Statement

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.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:
(1) l'appareil ne doit pas produire de brouillage, et
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement."

Radiation Exposure Statement

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Déclaration d'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition aux rayonnements ISED établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20cm de distance entre la source de rayonnement et votre corps.

This device is intended only for OEM integrators under the following conditions: (For module device use)

1) The antenna must be installed such that 20cm is maintained between the antenna and users, and
2) The transmitter module may not be co-located with any other transmitter or antenna.
As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes: (Pour utilisation de dispositif module)

1) L'antenne doit être installée de telle sorte qu'une distance de 20cm est respectée entre l'antenne et les utilisateurs, et

2) Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.
Tant que les 2 conditions ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

IMPORTANT NOTE:

In the event that these conditions cannot be met (for example certain laptop configurations or colocation with another transmitter), then the Canada authorization is no longer considered valid and the IC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

NOTE IMPORTANTE:

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: “Contains IC: 10224A-025RM255CGL”.

Plaque signalétique du produit final

Ce module émetteur est autorisé uniquement pour une utilisation dans un dispositif où l'antenne peut être installée de telle sorte qu'une distance de 20cm peut être maintenue entre l'antenne et les utilisateurs. Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: 10224A-025RM255CGL".

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.

Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.
Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

Hereby, [Quectel Wireless Solutions Co., Ltd.] declares that the radio equipment type [RM255C-GL] is in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available at the following internet address: http://www.quectel.com/support/technical.htm

The device could be used with a separation distance of 20cm to the human body.