FGM840R Series
Hardware Design

Short-Range Module Series

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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.
SOS	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
-	2024-11-15	Joy dai	Creation of the document
1.0	2024-11-15	Joy dai	Released

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1 Introduction

QuecOpen® is a solution where the module acts as the main processor. Constant transition and evolution of both the communication technology and the market highlight its merits. It can help you to:

- Realize embedded applications' quick development and shorten product R&D cycle
- Simplify circuit and hardware structure design to reduce engineering costs
- Miniaturize products
- Reduce product power consumption
- Apply OTA technology
- Enhance product competitiveness and price-performance ratio

This document defines FGM840R series in QuecOpen® solution and describes its air interfaces and hardware interfaces, which are connected with your applications. The document provides a quick insight into interface specifications, RF performance, electrical and mechanical specifications, as well as other related information of the module.

NOTE

For conciseness purposes, FGM840R and FGM842D-P will hereinafter be referred to collectively as "the module/modules" in parts hereof applicable to both models, and individually as "FGM842D" and "FGM842D-P" in parts hereof referring to the differences between them.

1.1. Special Mark

Table 1: Special Mark

Mark	Definition
[…]	Brackets ([…]) used after a pin enclosing a range of numbers indicate all pins of the same type. For example, SDIO_DATA[0:3] refers to all four SDIO pins: SDIO_DATA0, SDIO_DATA1, SDIO_DATA2, and SDIO_DATA3.

2 Product Overview

FGM840R series are high performance MCU Wi-Fi 4 and Bluetooth modules supporting IEEE 802.11b/g/n and BLE 5.0 protocols. It provides multiple interfaces including UART, GPIO, SPI, I2C, PWM ,SDIO and ADC for various applications.

It is an SMD module with compact packaging. It includes:

- Cortex-M33 and Cortex-M23 MCU processors,200MHZ Real-M300 KM4 and 20MHZ Real-M200 KM0
- Built-in 512 KB RAM RAM and 4 MB Flash
- Support for secondary development

Table 2: Basic Information

FGM842D Series	
Packaging type	LGA
Pin counts	61
Dimensions	(12.5 ±0.2) mm × (13.2 ±0.2) mm × (2.05 ±0.2) mm
Weight	TBD

2.1. Key Features

Table 3: Key Features

Basic Information	
Protocols and Standard	● Wi-Fi Protocols: IEEE 802.11b/g/n ● Bluetooth protocol: BLE 5.0 ● All hardware components are fully compliant with EU RoHS directive
Power Supply	**VBAT Power Supply:** ● 3.0–3.6 V ● Typ.: 3.3 V

Temperature Ranges [1]	● **Design Solution 1:**
	  − Operating temperature: -40 to +85 °C
	  − Storage temperature: -45 to +95 °C

TE-B Kit	FGM840R-TE-B
Antenna/Antenna Interface	
Antenna/Antenna Interfaces	● Pin antenna interface (ANT_WIFI/BT) or RF coaxial connector ● 50 Ω characteristic impedance
Application Interface [4]	
Application Interfaces	UART/ SPI/ I2C/ PWM/ ADC/ SDIO/ USB, etc.

.
[4] For more details about the interfaces, see *Chapter 3.3* and *Chapter 3.4*

3 Application Interfaces

3.1. Pin Assignment
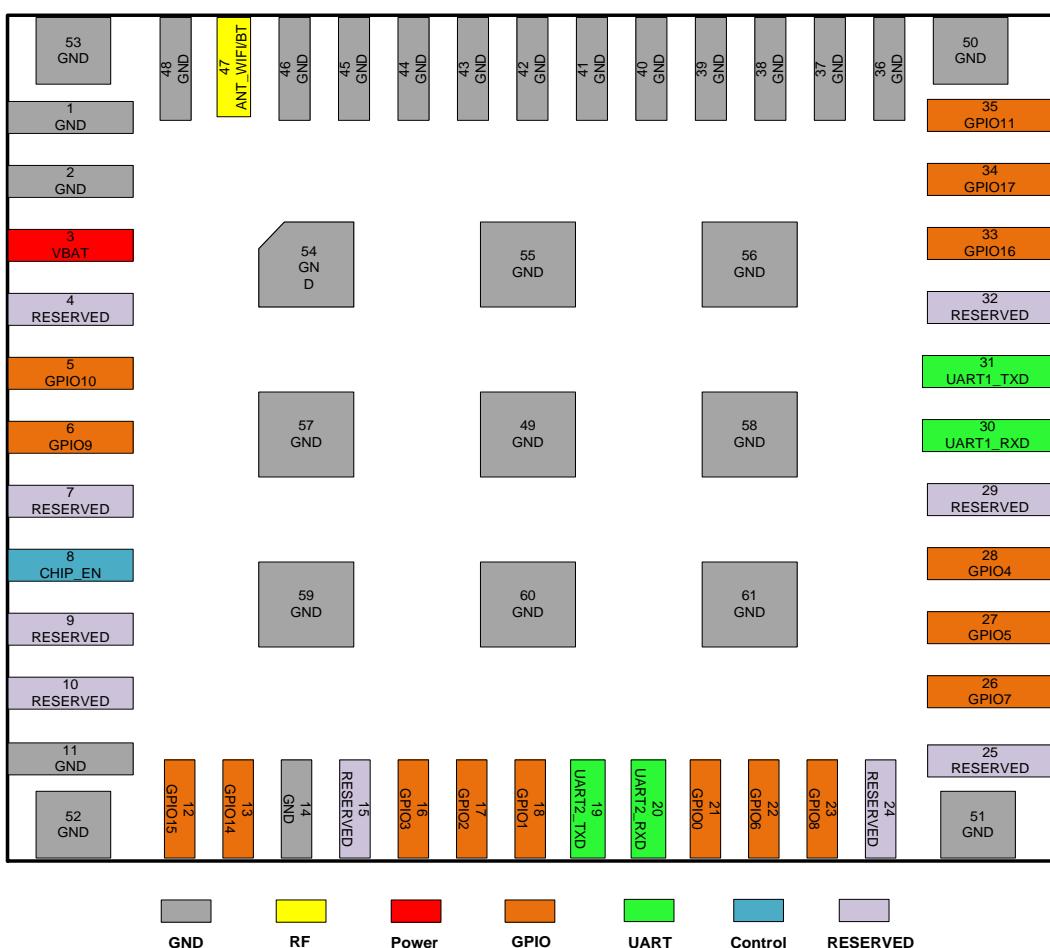
Figure 1:FGM840R Pin Assignment (Top View)

NOTE

1. Keep all RESERVED and unused pins unconnected.
2. All GND pins should be connected to ground.
3. The module provides 1 UART ,1 debug UART and 16 GPIO interfaces by default. In the case of multiplexing, it can support interfaces including SPI, I2C, PWM , ADC,SDIO and USB, etc. . For more details, see *Chapter 3.3* and *3.4*.

3.2. Pin Description

Table 4: Parameter Description

Parameter	Description
AIO	Analog Input/Output
DI	Digital Input
DO	Digital Output
DIO	Digital Input/Output
PI	Power Input

DC characteristics include power domain and rated current.

Table 5: Pin Description

Power Supply					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
VBAT	3	PI	Power supply for the module	Vmax = 3.6 V Vmin = 3.0 V Vnom = 3.3 V	It must be provided with sufficient current of at least 0.8 A.
GND	1, 2, 11, 14, 36–46, 48–61				
Control Signal					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
CHIP_EN	8	DI	Enable the module	VBAT	Hardware enable.；

| | | | | | Internally pulled up to 3.3 V. Active high. |

UARTs

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
UART1_TXD	31	DO	UART1 transmit		
UART1_RXD	30	DI	UART1 receive	VBAT	
UART2_TXD	19	DO	UART2 transmit		
UART2_RXD	20	DI	UART2 receive		

GPIO Interfaces

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
GPIO10	5	DIO	General-purpose input/output		
GPIO9	6	DIO	General-purpose input/output		
GPIO15	12	DIO	General-purpose input/output		
GPIO14	13	DIO	General-purpose input/output		
GPIO3	16	DIO	General-purpose input/output		
GPIO2	17	DIO	General-purpose input/output		
GPIO1	18	DIO	General-purpose input/output	VBAT	Wakeup.
GPIO0	21	DIO	General-purpose input/output		
GPIO6	22	DIO	General-purpose input/output		
GPIO8	23	DIO	General-purpose input/output		
GPIO7	26	DIO	General-purpose input/output		
GPIO5	27	DIO	General-purpose input/output		
GPIO4	28	DIO	General-purpose input/output		

GPIO16	33	DIO	General-purpose input/output		
GPIO17	34	DIO	General-purpose input/output		
GPIO11	35	DIO	General-purpose input/output		

FGM8420R RF Antenna Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
ANT_WIFI/BT	47	AIO	Wi-Fi/Bluetooth antenna interface		50 Ω characteristic impedance.

RESERVED Pins

Pin Name	Pin No.				Comment
RESERVED	4, 7, 9, 10, 15, 24, 25, 29,32				Keep them open.

3.3. GPIO Multiplexing

The module provides 16 GPIO interfaces by default, and can support up to 18 GPIO interfaces in the case of multiplexing. Pins are defined as follows:

Table 6: GPIO Multiplexing

Pin Name	Pin No.	Alternate Function 0 (GPIO No.)	Alternate Function 1	Alternate Function 2	Alternate Function 3	Alternate Function 4
UART2_TX	19	PA7	UART_LOG_TXD	-	-	-
UART2_RX	20	PA8	UART_LOG_RXD	-	-	-
GPIO0	21	PA12	SPI_MOSI	-	-	-
GPIO1	18	PA13	SPI_MISO		-	-
GPIO2	17	PA14	SPI_CLK		-	-
GPIO3	16	PA15	SPI_CS		-	-
GPIO4	28	PA25	USB_DM	-	-	-

GPIO5	27	PA26	USB_DP	-		-
GPIO6	22	PA27	-	-	-	-
GPIO7	26	PA28	RREF	-		-
GPIO8	23	PA30	-	-	-	-
GPIO9	6	PB1	ADC4	-	-	-
GPIO10	5	PB2	ADC5	-	-	-
GPIO11	35	PB3	ADC6	-	-	-
UART1_RX	30	PB18	SWD_CLK	-		
UART1_TX	31	PB19	SWD_DATA	-	-	-
GPIO14	13	PB20	I2C_SCL	PWM0	-	-
GPIO15	12	PB21	I2C_SDA	PWM1		
GPIO16	33	PB22	PWM2	-		-
GPIO17	34	PB23	PWM3			

NOTE

1. All GPIO can be used as sleep interrupt to wake up the module which will immediately enter the operating state after being awakened.
2. The maximum number of each application interface multiplexed with GPIOs is not available simultaneously. For more details, see *Chapter 3.4*.
3. After the module is powered off, all its GPIOs must input low. Once GPIO leaks electricity, the module may be in an abnormal state.

3.4. Application Interfaces

3.4.1. UARTs

The module provides 2 UARTs by default which can all support full-duplex asynchronous serial communication at a baud rate up to 6 Mbps.

Table 7: Pin Definition of UARTs

Pin Name	Pin No.	I/O	Description
UART1_TXD	31	DO	UART1 transmit
UART1_RXD	30	DI	UART1 receive
UART2_TXD	19	DO	UART2 transmit
UART2_RXD	20	DI	UART2 receive

The UART1 can be used for downloading, debugging and AT command communication with the default baud rate of 115200 bps. The UART1 connection between the module and the MCU is illustrated below.
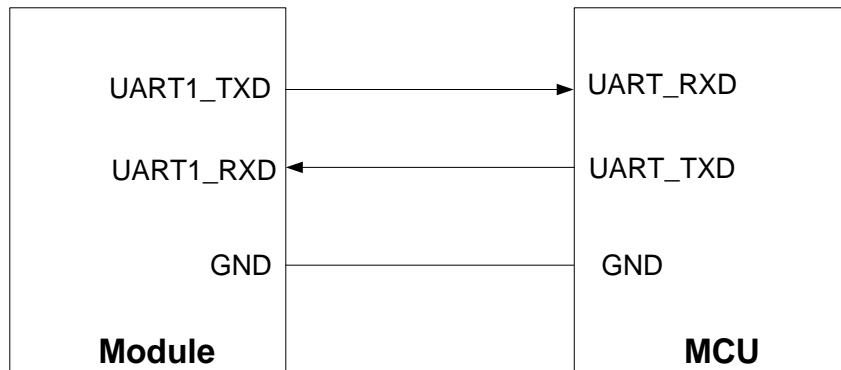
Figure 3: UART1 Connection

UART2 can be used as a debugging UART with a debugging tool, which is used for downloading, debugging, and AT command communication, supporting the commissioning command input of the chip manufacturer and some AT command applications, and supporting log printout.. The following is reference design of UART2.
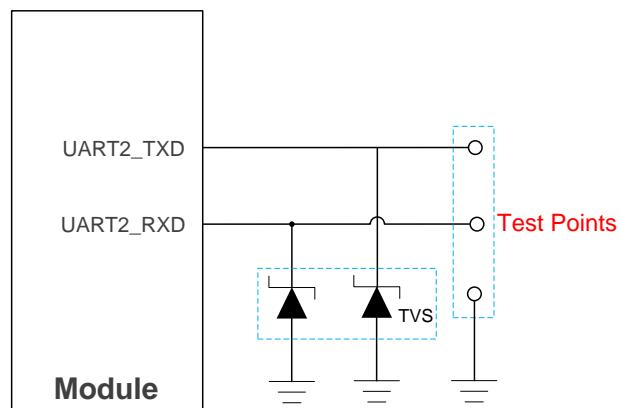
Figure 4: UART2 Reference Design

3.4.2. SPI

In the case of multiplexing, the module provides 1 SPI that supports both master and slave modes. The maximum clock frequency of the interface can reach 25 MHz in master mode.

Table 8: Pin Definition of SP

Pin Name	Pin No.	Alternate Function	I/O	Description	Comment
GPIO3	16	SPI_CS	DIO	SPI chip select	In master mode, it is an output signal; In slave mode, it is an input signal.
GPIO2	17	SPI_CLK	DIO	SPI clock	In master mode, it is an output signal; In slave mode, it is an input signal.
GPIO1	18	SPI_MISO	DIO	SPI master-in slave-out	
GPIO0	21	SPI_MOSI	DIO	SPI master-out slave-in	

The following figure shows the SPI connection between the host and the slave:
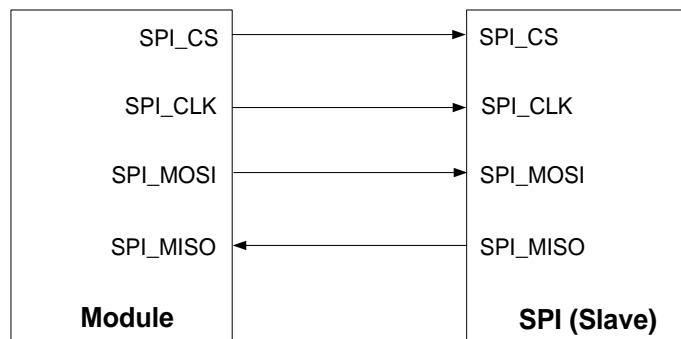
Figure 5: SPI Connection (Master Mode)
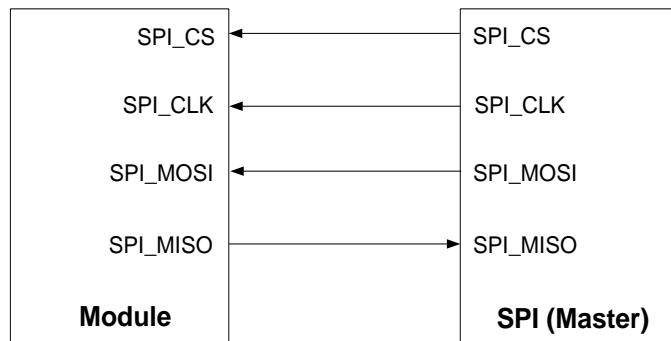
Figure 6: SPI Connection (Slave Mode)

3.4.3. I2C Interface

In the case of multiplexing, the module provides 2 I2C interfaces which supports the master and slave modes. The interface supports standard (up to 100 kbps) and fast (up to 400 kbps) modes with 7-bit addressing.

Table 9: Pin Definition of I2C Interface

Pin Name	Pin No.	Alternate Function	I/O	Description
GPIO4	28	I2C1_SCL	DO	I2C1 serial clock
GPIO5	27	I2C1_SDA	DIO	I2C1 serial data
GPIO14	13	I2C2_SCL	DO	I2C2 serial clock
GPIO15	12	I2C2_SDA	DIO	I2C2 serial data

NOTE

Reserve 1–10 kΩ pull-up resistors to VBAT when I2C interface is connected to an external equipment.

3.4.4. PWM Interfaces

In the case of multiplexing, the module supports up to 4 PWM interfaces.

Table 10: Pin Definition of PWM Interfaces

Pin Name	Pin No.	Alternate Function	I/O	Description
GPIO14	13	PWM4	DO	PWM4 out
GPIO15	12	PWM5	DO	PWM5 out
GPIO16	33	PWM0	DO	PWM0 out
GPIO17	34	PWM1	DO	PWM1 out

3.4.5. ADC Interfaces

In the case of multiplexing, the module supports up to 3 12-bit ADC interfaces, whose voltage range is 0~3.3 V. To improve ADC accuracy, surround ADC traces with ground.

Table 11: Pin Definition of ADC Interfaces

Pin Name	Pin No.	Alternate Function	I/O	Description
GPIO9	1	ADC4	AI	General-purpose ADC interface
GPIO10	2	ADC5	AI	General-purpose ADC interface
GPIO11	3	ADC6	AI	General-purpose ADC interface

Table 12: ADC Features

Parameter	Min.	Typ.	Max.	Unit
ADC Voltage Range	0	-	3.3	V
ADC Resolution	-	12	-	bit

4 Operating Characteristics

4.1. Power Supply

Power supply pin and ground pins of the module are defined in the following table.

Table 13: Pin Definition of Power Supply and GND Pins

Pin Name	Pin No.	I/O	Description	Min.	Typ.	Max.	Unit
VBAT	3	PI	Power supply for the module	3.0	3.3	3.6	V
GND	1, 2, 11, 14, 36–46, 48–61						

4.1.1. Reference Design for Power Supply

The module is powered by VBAT, and it is recommended to use a power supply chip that can provide at least 0.8 A output current. For better power supply performance, it is recommended to parallel a 22 μF decoupling capacitor, and two filter capacitors (1 μF and 100 nF) near the module's VBAT pin. C4 is reserved for debugging and not mounted by default. In addition, it is recommended to add a TVS near the VBAT to improve the surge voltage bearing capacity of the module. In principle, the longer the VBAT trace is, the wider it should be.

VBAT reference circuit is shown below:
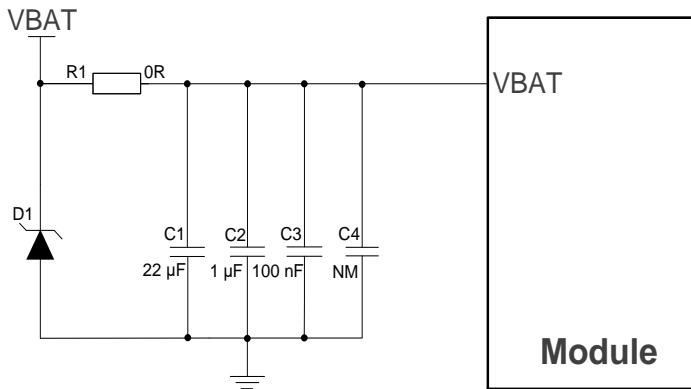
Figure 7: Reference Circuit of Power Supply

4.2. Turn On

After the module VBAT is powered on, it can be automatically powered on, and the power-on time is less than 1 ms.keep the CHIP_EN at high level to realize the automatic startup of the module.

Table 14: Pin Definition of CHIP_EN

Pin Name	Pin No.	I/O	Description	Comment
CHIP_EN	8	DI	Enable the module	Hardware enable. Internally pulled up to 3.3 V. Active high.

The turn-on timing is shown below:
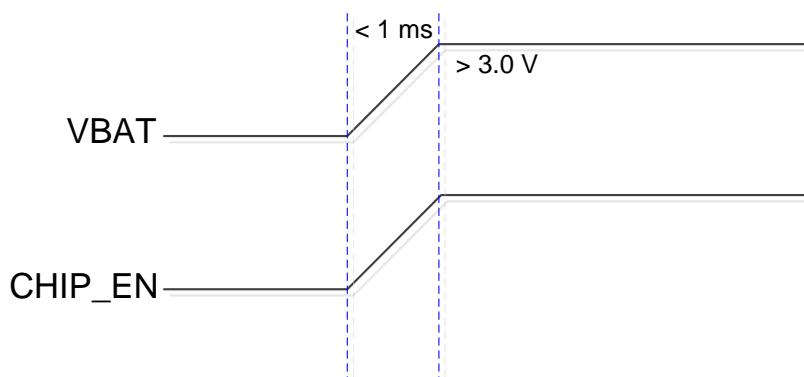
Figure 8: Turn-on Timing

4.3. Reset

pull the voltage CHIP_EN down to 0.2 0f VBAT for at least 1 ms, the module can be reset. The reference design for hardware resetting of the module are shown below. An open collector driving circuit can be used to control the CHIP_EN pin.
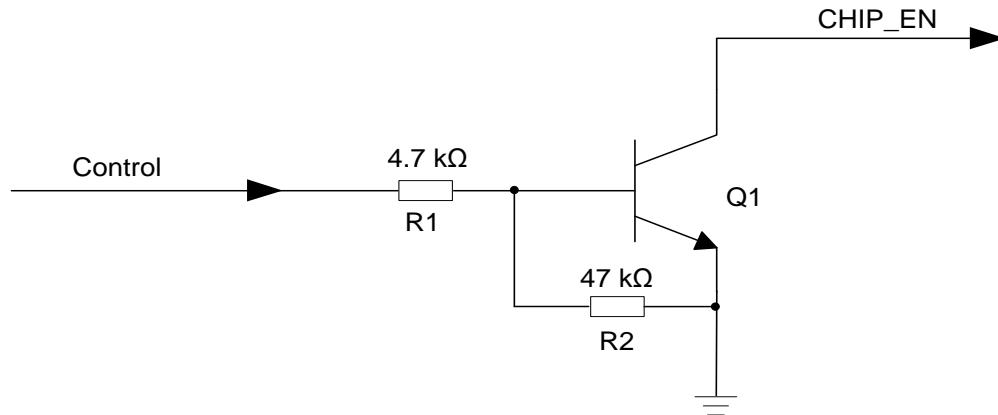
Figure 9: Reference Circuit of CHIP_EN by Using a Driving Circuit

Another way to control the CHIP_EN is by using a button directly. When pressing the button, an electrostatic strike may generate from finger. Therefore, a TVS component shall be placed near the button for ESD protection.
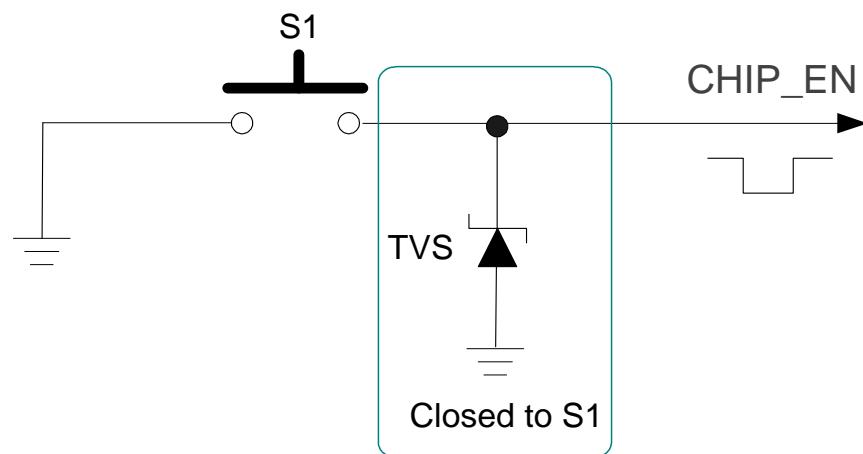

Figure 10: Reference Circuit of RESET with a Button

The module reset timing is illustrated in the following figure.
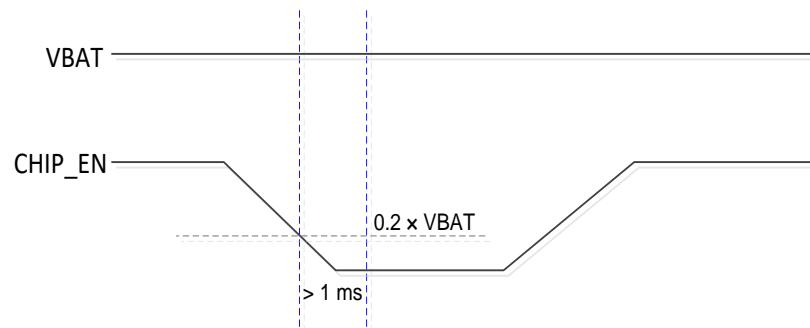
Figure 11: Reset Timing

4.4. Download mode

if the module has   already been downloaded firmware,.we want to download the firmware again, we just need to wait for the module to powered on, then the firmware can be downloaded directly through the debugging UART.

if the module was   not been downloaded firmware, we want to download the firmware, we just need to wait for the module to powered on, The CHIP_EN and DBG_TXD pins need to be pulled down for at least 1 ms,, Then release the CHIP_EN and then the DBG_TXD pins, the module   will go into download mode, he firmware can be downloaded through the debugging UART.

When   the   Module   which was never been downloaded firmware   goes into download mode,,the signal timing   is shown in the following figure .
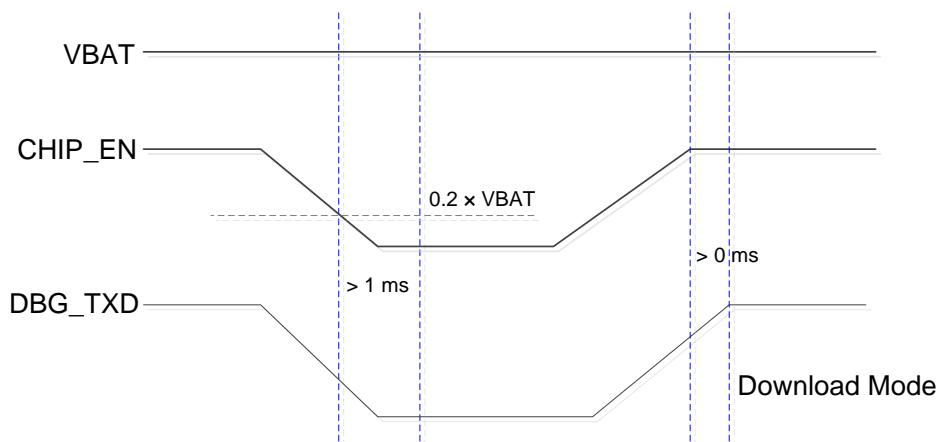
Figure 12: signal timing   figure   of   the module which was never been downloaded   is be downloading

5 RF Performances

5.1. Wi-Fi Performances

Table 15: Wi-Fi Performances

Operating Frequency

**1.4 GHz:** 2.400–2.4835 GHz

5 Ghz: 5.150~5.850 GHz

Modulation

DBPSK、DQPSK、CCK、BPSK、QPSK、16QAM、64QAM

Operating Mode

- AP
- STA

Encryption Mode

AES、DES、SHA

Transmission Data Rate

- 802.11b: 1 Mbps, 2 Mbps, 5.5 Mbps, 11 Mbps
- 802.11a/g: 6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps, 54 Mbps
- 802.11n: HT20 (MCS 0–MCS 7)、HT40（MCS 0~7）

Condition (VBAT = 3.3 V; Temp.: 25 °C)		EVM	Typ.; Unit: dBm, Tolerance: ±2 dB	
			Transmitting Power	Receiver Sensitivity
2.4 GHz	802.11b @ 1 Mbps	≤ 35 %	18	-99
	802.11b @ 11 Mbps		18	-90.5
	802.11g @ 6 Mbps	≤ -5 dB	18	-94.5
	802.11g @ 54 Mbps	≤ -25 dB	17	-77.5
	802.11n, HT20 @ MCS 0	≤ -5 dB	18	-94.5
	802.11n, HT20 @ MCS 7	≤ -27 dB	16	-75.5
	802.11n, HT40 @ MCS 0	≤ -5 dB	18	-92.5
	802.11n, HT40 @ MCS 7	≤ -27 dB	16	-72.5
5 GHz	802.11a @ 6 Mbps	≤ -5 dB	16	-94.5
	802.11a @ 54 Mbps	≤ -25 dB	14	-77
	802.11n, HT20 @ MCS 0	≤ -5 dB	16	-94.5
	802.11n, HT20 @ MCS 7	≤ -27 dB	13	-75
	802.11n, HT40 @ MCS 0	≤ -5 dB	14	-92
	802.11n, HT40 @ MCS 7	≤ -27 dB	11	-72

5.2. Bluetooth Performances

Table 16: Bluetooth Performances

Operating Frequency		
2.400–2.4835 GHz		
Modulation		
GFSK		
Operating Mode		
BLE		
Condition (VBAT = 3.3 V; Temp.: 25 °C)	Typ.; Unit: dBm, Tolerance: ±2 dB	
	Transmitting Power	**Receiver Sensitivity**
BLE (1 Mbps)	4.5	-100.5
BLE (2 Mbps)	4.5	-97.5

5.3. Antenna/Antenna Interfaces

FGM840R is provided with one of the two antenna interface designs: pin antenna interface (ANT_WIFI/BT) or RF coaxial connector. The RF coaxial connector is not available when the module is designed with ANT_WIFI/BT antenna interface，The impedance of antenna port is 50 Ω.

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

5.3.1. FGM840R Pin Antenna Interface (ANT_WIFI/BT) [5]

Table 17: ANT_WIFI/BT Pin Definition

Pin Name	Pin No.	I/O	Description	Comment
ANT_WIFI/BT	47	AIO	Wi-Fi/Bluetooth antenna interface	50 Ω characteristic impedance.

5.3.1.1. Reference Design

A circuit of the RF antenna interface is shown below. For better RF performance, it is necessary to reserve a π matching circuit and add ESD protection components. Reserved matching components such as R1, C1, C2, and D1 should be placed as close to the antenna as possible. C1, C2, and D1 are not mounted by default. The parasitic capacitance of TVS should be less than 0.05 pF and R1 is recommended to be 0 Ω.
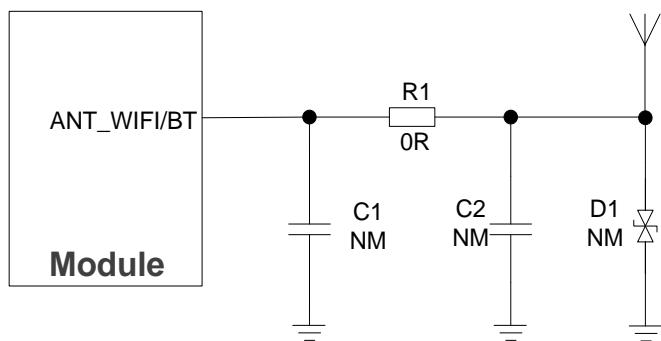
Figure 2: RF Antenna Reference Design

5.3.1.2. Antenna Design Requirements

Table 18: Antenna Design Requirements

Parameter	Requirement
Frequency Range (GHz)	2.4 GHz：2.400–2.4835 5 GHz：5.150~5.850
Cable Insertion Loss (dB)	< 1
VSWR	≤ 2 (Typ.)

---

[5] FGM8420R is provided with one of the two antenna interface designs. For more details, please contact Quectel Technical Support.

Gain (dBi)	1 (Typ.)
Max. input power (W)	50
Input impedance (Ω)	50
Polarization type	Vertical

5.3.1.3. RF Routing Guidelines

For user's PCB, the characteristic impedance of all RF traces should be controlled to 50 Ω. The impedance of the RF traces is usually determined by the trace width (W), the materials' dielectric constant, the height from the reference ground to the signal layer (H), and the spacing between RF traces and grounds (S). Microstrip or coplanar waveguide is typically used in RF layout to control characteristic impedance. The following are reference designs of microstrip or coplanar waveguide with different PCB structures.
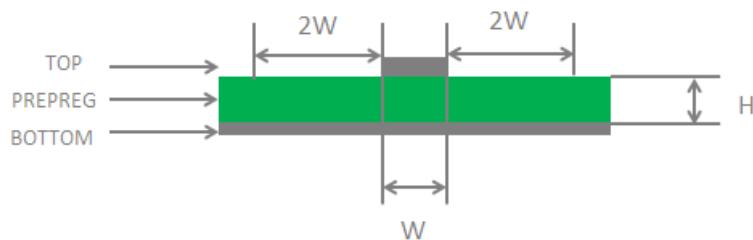

**Figure 3: Microstrip Design on a 2-layer PCB**
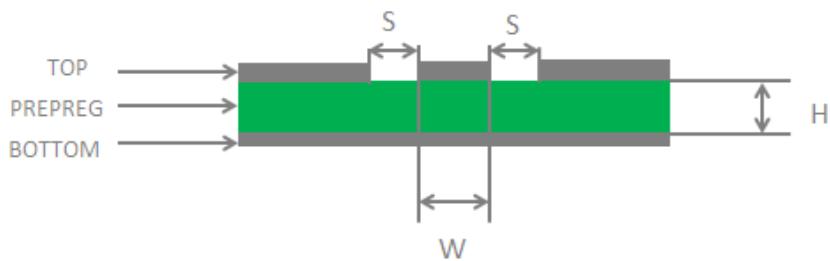
**Figure 4: Coplanar Waveguide Design on a 2-layer PCB**
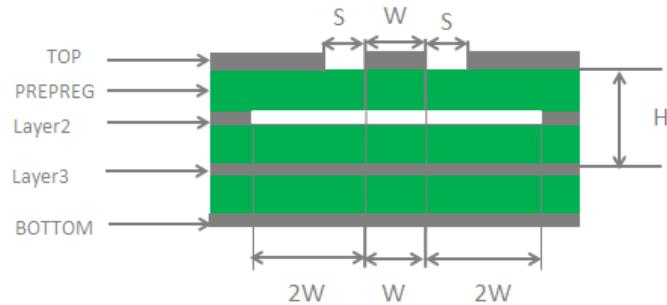
Figure 5: Coplanar Waveguide Design on a 4-layer PCB (Layer 3 as Reference Ground)
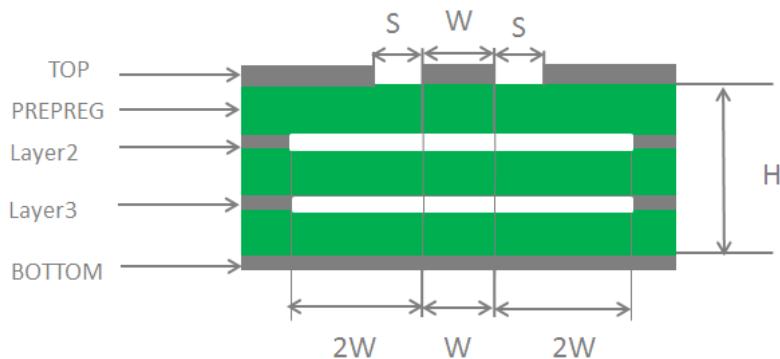

Figure 6: Coplanar Waveguide Design on a 4-layer PCB (Layer 4 as Reference Ground)

To ensure RF performance and reliability, follow the principles below in RF layout design:

● Use an impedance simulation tool to control the characteristic impedance of RF traces to 50 Ω.
● GND pins adjacent to RF pins should not be designed as thermal relief pads, and should be fully connected to the ground.
● The distance between the RF pins and the RF connector should be as short as possible and all right-angle traces should be changed to curved ones. The recommended trace angle is 135°.
● There should be clearance under the signal pin of the antenna connector or solder joint.
● The reference ground of RF traces should be complete. In addition, adding some ground vias around RF traces and the reference ground could help to improve RF performance. The distance between the ground vias and RF traces should be at least twice the width of RF signal traces (2 × W).
● Keep RF traces away from interference sources, and avoid intersection and paralleling between traces on adjacent layers.

For more details about RF layout, see *document [2]*.

5.3.2. FGM840R RF Coaxial Connector [6]

5.3.2.1. Receptacle Specifications

The mechanical dimensions of the receptacle supported by the module are as follows.
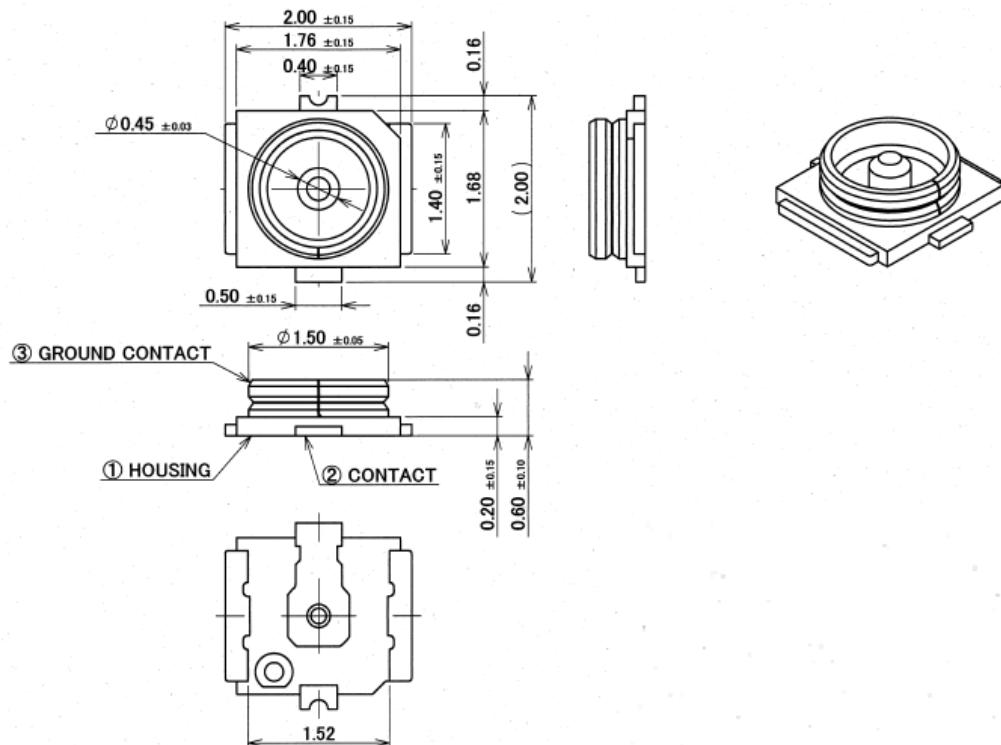
Figure 7: Dimensions of the Receptacle (Unit: mm)

Table 19: Major Specifications of the RF Connector

Item	Specification
Nominal Frequency Range	DC to 6 GHz
Nominal Impedance	50 Ω
Temperature Rating	-40 °C to +105 °C
Voltage Standing Wave Ratio (VSWR)	Meet the requirements of: Max. 1.3 (DC–3 GHz) Max. 1.45 (3–6 GHz)

---

[6] FGM842D is provided with one of the three antenna interface designs. For more details, please contact Quectel Technical Support.

5.3.2.2. Antenna Connector Installation

The mated plug listed in the following figure can be used to match the connector.
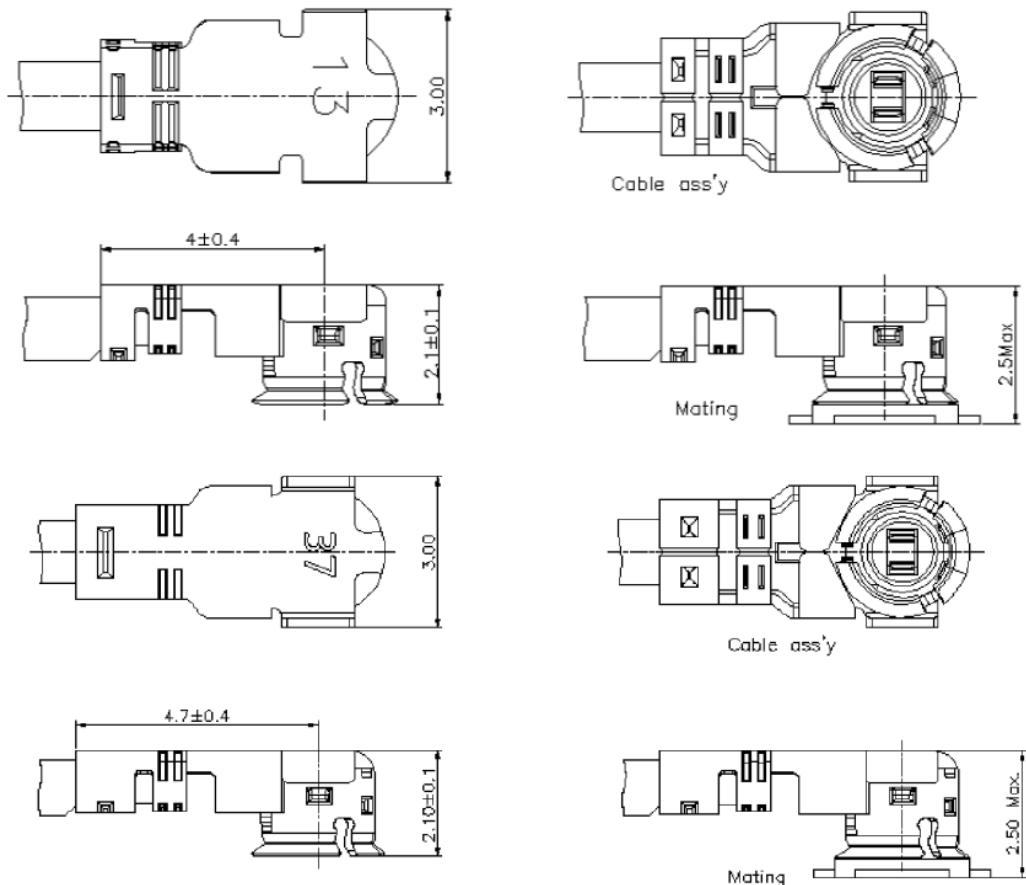
Figure 8: Space Factor of the Mated Connectors (Unit: mm)

5.3.2.3. Recommended RF Connector Installation

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

θ = 90° Allowed   θ ≠ 90° Prohibited
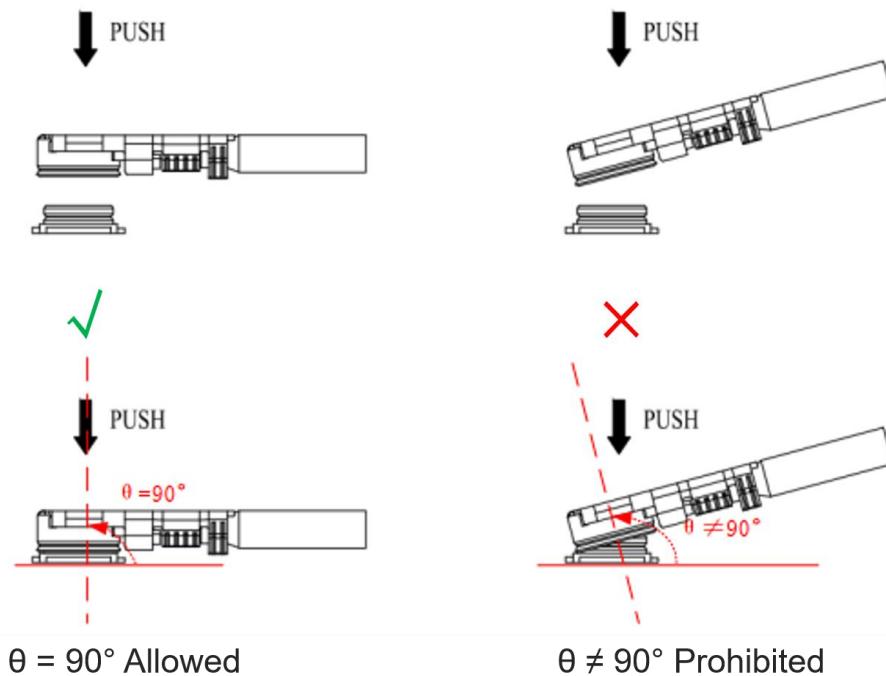
Figure 9: Plug in a Coaxial Cable Plug

The pictures of pulling out the coaxial cable plug is shown below, θ = 90° is acceptable, while θ ≠ 90° is not.
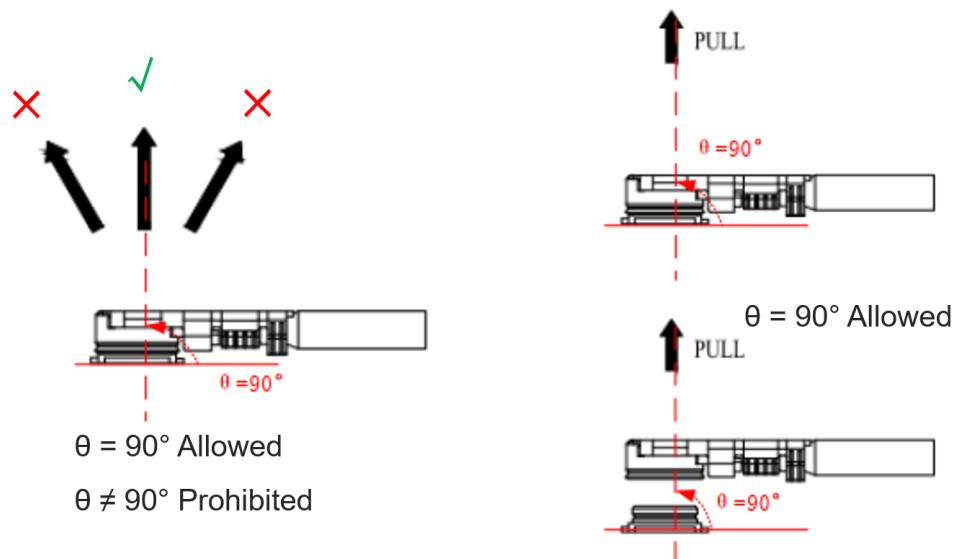
Figure 10: Pull out a Coaxial Cable Plug

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

θ = 90° Allowed   θ ≠ 90° Prohibited
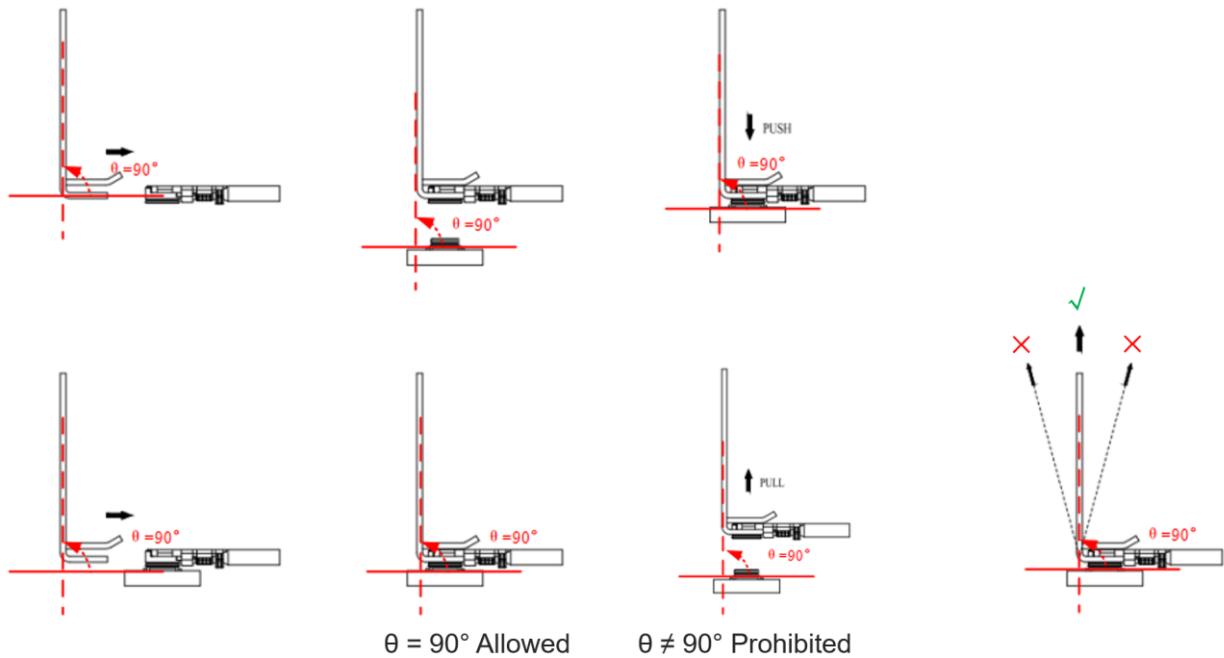
Figure 11: Install the Coaxial Cable Plug with Jig

5.3.2.4.   Recommended Manufacturers of RF Connector and Cable

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

6

6 Electrical Characteristics & Reliability

6.1. Absolute Maximum Ratings

Table 20: Absolute Maximum Ratings (Unit: V)

Parameter	Min.	Max.

VBAT	-0.3	3.6
Voltage at Digital Pins	-0.3	3.6
Voltage at ADC[1:6]	0	3.6

6.2. Power Supply Ratings

Table 21: Module Power Supply Ratings (Unit: V)

Parameter	Description	Condition	Min.	Typ.	Max.
VBAT	Power supply for the module	The actual input voltages must be kept between the minimum and maximum values.	3.0	3.3	3.6

6.3. Power Consumption

6.3.1. Wi-Fi Power Consumption

Table 22: Power Consumption in Non-signaling Mode (Unit: mA)

Condition			I_{VBAT} (Typ.)
2.4 GHz	802.11b	Tx 1 Mbps @　TBD	TBD
		Tx 11 Mbps @　TBD	TBD
	802.11g	Tx 6 Mbps @　TBD	TBD
		Tx 54 Mbps @　TBD	TBD
	802.11n	Tx HT20 MCS 0 @　TBD	TBD

		Tx HT20 MCS 7 @ TBD	TBD
		Tx HT40 MCS 0 @ TBD	TBD
		Tx HT40 MCS 7 @ TBD	TBD
5 GHz	802.11a	Tx 6 Mbps @ TBD	TBD
		Tx 54 Mbps @ TBD	TBD
	802.11n	Tx HT20 MCS 0 @ TBD	TBD
		Tx HT20 MCS 7 @ TBD	TBD
		Tx HT40 MCS 0 @ TBD	TBD
		Tx HT40 MCS 7 @ TBD	TBD

6.3.2. Bluetooth Power Consumption

Table 23: Power Consumption in Non-signaling Mode (Unit: mA)

Condition	I_{VBAT} (Typ.)
BLE (1 Mbps)	TBD
BLE (2 Mbps)	TBD

6.4. Digital I/O Characteristics

Table 24: VBAT I/O Requirements (Unit: V)

Parameter	Description	Min.	Max.

V_{IH}	High-level input voltage	$0.7 \times VBAT$	VBAT
V_{IL}	Low-level input voltage	0	$0.3 \times VBAT$
V_{OH}	High-level output voltage	$0.9 \times VBAT$	-
V_{OL}	Low-level output voltage	-	$0.1 \times VBAT$

6.5. ESD Protection

Static electricity occurs naturally and 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 25: ESD Characteristics (Unit: kV)

Model	Test Result	Standard
Human Body Model (HBM)	±2	*ANSI/ESDA/JEDEC JS-001-2017*
Charged Device Model (CDM)	±0.5	*ANSI/ESDA/JEDEC JS-002-2018*

7 Mechanical Information

This chapter describes the mechanical dimensions of the module. All dimensions are measured in millimeters (mm), and the dimensional tolerances are ±0.2 mm unless otherwise specified.

7.1. Mechanical Dimensions
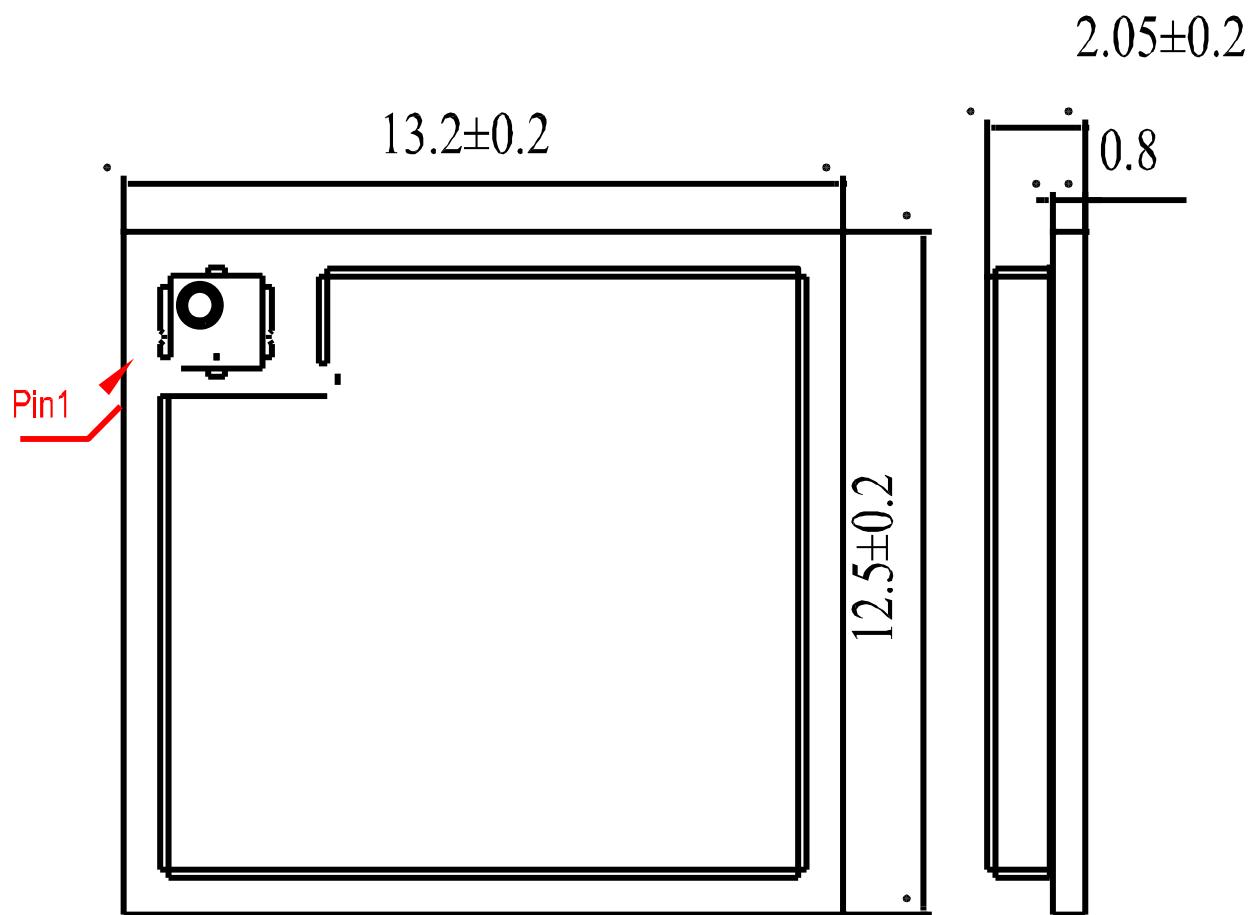
Figure 23:FGM840R Top and Side Dimensions
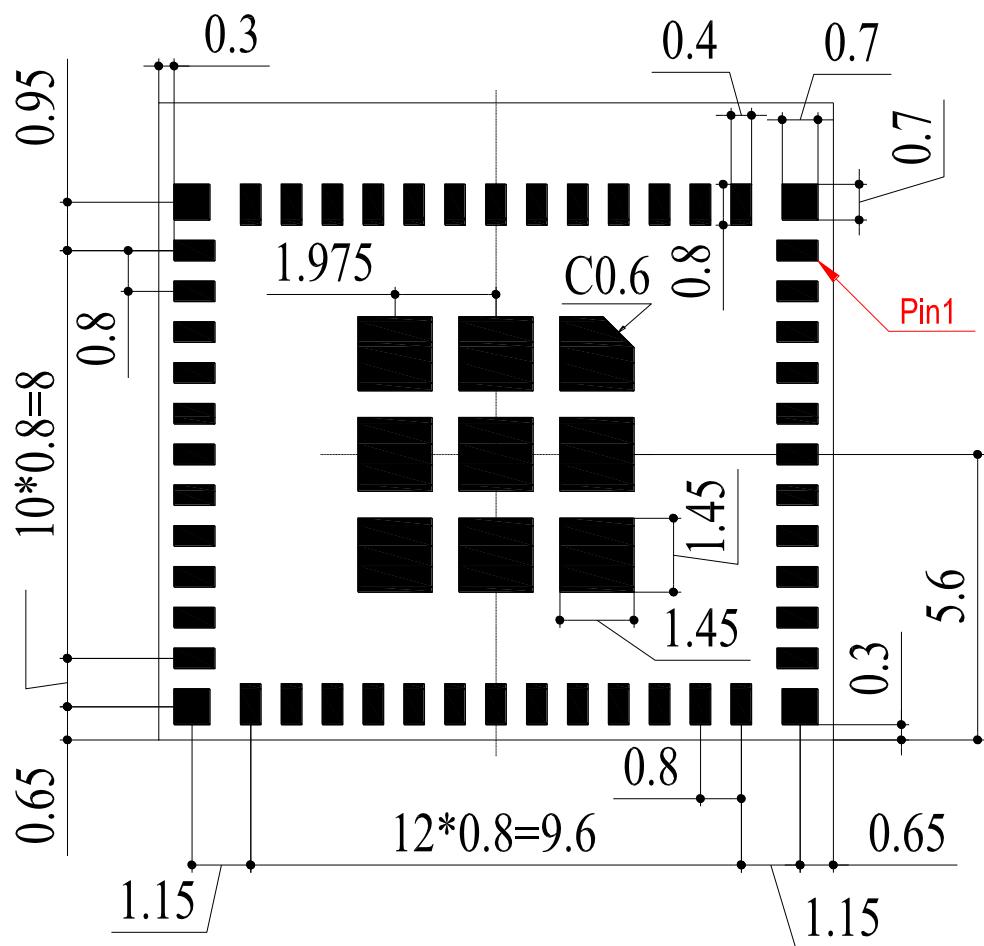
Figure 24:FGM842D Bottom Dimensions (Bottom View)

NOTE

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

7.2. Top and Bottom Views
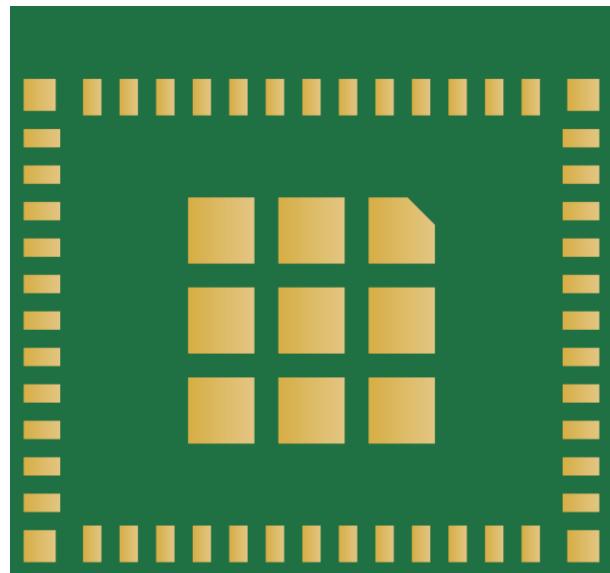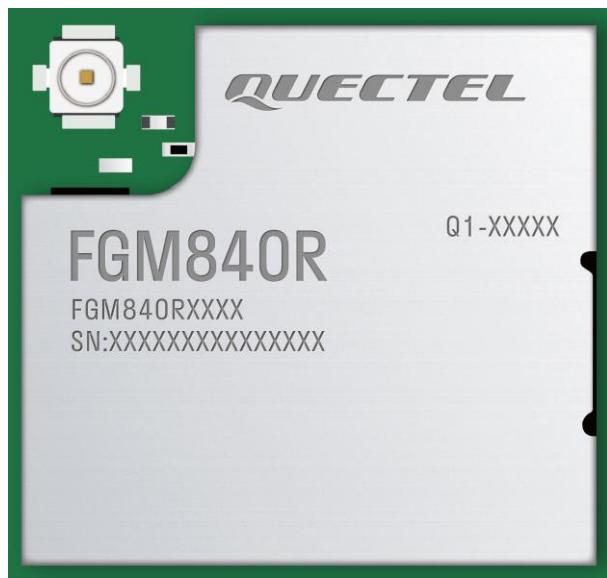
Figure 25: FGM840R Top and Bottom Views (RF Coaxial Connector)

> **NOTE**
>
> 1. Images above are for illustrative purposes only and may differ from the actual module. For authentic appearance and label, please refer to the module received from Quectel.
> 2. The RF coaxial connector is not mounted on the FGM840R when using pin antenna interface (ANT_WIFI/BT).

8 Storage, Manufacturing & Packaging

8.1. Storage Conditions

The module is provided with vacuum-sealed packaging. MSL of the module is rated as 3. 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 (in a vacuum-sealed packaging): 12 months in Recommended Storage Condition.

3. Floor life: 168 hours [7] in a factory where the temperature is 23 ±5 °C and relative humidity is below 60 %. After the vacuum-sealed packaging is removed, the module must be processed in reflow soldering or other high-temperature operations within 168 hours. Otherwise, the module should be stored in an environment where the relative humidity is less than 10 % (e.g., a dry cabinet).

4. The module should be pre-baked to avoid blistering, cracks and inner-layer separation in PCB under the following circumstances:

   ● The module is not stored in Recommended Storage Condition;
   ● Violation of the third requirement mentioned above;
   ● Vacuum-sealed packaging is broken, or the packaging has been removed for over 24 hours;
   ● Before module repairing.

5. If needed, the pre-baking should follow the requirements below:

   ● The module should be baked for 8 hours at 120 ±5 °C;
   ● The module must be soldered to PCB within 24 hours after the baking, otherwise it should be put in a dry environment such as in a dry cabinet.

---

[7] This floor life is only applicable when the environment conforms to *IPC/JEDEC J-STD-033*. It is recommended to start the solder reflow process within 24 hours after the package is removed if the temperature and moisture do not conform to, or are not sure to conform to *IPC/JEDEC J-STD-033*. Do not unpack the modules in large quantities until they are ready for soldering.

1. To avoid blistering, layer separation and other soldering issues, extended exposure of the module to the air is forbidden.
2. Take out the module from the package and put it on high-temperature-resistant fixtures before baking. If shorter baking time is desired, see *IPC/JEDEC J-STD-033* for the baking procedure.
3. Pay attention to ESD protection, such as wearing anti-static gloves, when touching the modules.

8.2. Manufacturing and Soldering

Push the squeegee to apply the solder paste on the surface of stencil, thus making the paste fill the stencil openings and then penetrate to the PCB. Apply proper force on the squeegee to produce a clean stencil surface on a single pass. To guarantee module soldering quality, the thickness of stencil for the module is recommended to be TBD mm. For more details, see **document [3]**.

The recommended peak reflow temperature should be 235–246 ℃, with 246 ℃ as the absolute maximum reflow temperature. To avoid damage to the module caused by repeated heating, it is recommended that the module should be mounted only after reflow soldering for the other side of PCB has been completed. The recommended reflow soldering thermal profile (lead-free reflow soldering) and related parameters are shown below.
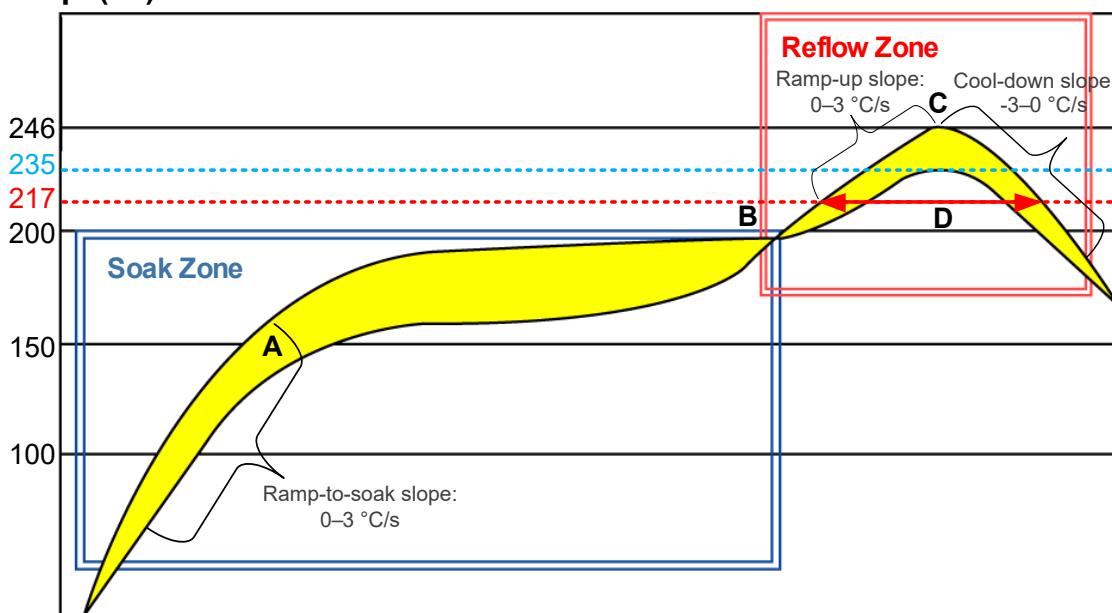

Figure 26: Recommended Reflow Soldering Thermal Profile

Table 26: Recommended Thermal Profile Parameters

Factor	Recommended Value
Soak Zone	
Ramp-to-soak slope	0–3 °C/s
Soak time (between A and B: 150 °C and 200 °C)	70–120 s
Reflow Zone	
Ramp-up slope	0–3 °C/s
Reflow time (D: over 217 °C)	40–70 s
Max. temperature	235–246 °C
Cool-down slope	-3–0 °C/s
Reflow Cycle	
Max. reflow cycle	1

NOTE

1. The above profile parameter requirements are for the measured temperature of solder joints. Both the hottest and coldest spots of solder joints on the PCB should meet the above requirements.
2. During manufacturing and soldering, or any other processes that may contact the module directly, NEVER wipe the module's shielding can with organic solvents, such as acetone, ethyl alcohol, isopropyl alcohol, trichloroethylene, etc. Otherwise, the shielding can may become rusted.
3. The shielding can for the module is made of Cupro-Nickel base material. It is tested that after 12 hours' Neutral Salt Spray test, the laser engraved label information on the shielding can is still clearly identifiable and the QR code is still readable, although white rust may be found.
4. 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.
5. Avoid using ultrasonic technology for module cleaning since it can damage crystals inside the module.
6. Due to the complexity of the SMT process, please contact Quectel Technical Support in advance for any situation that you are not sure about, or any process (e.g. selective soldering, ultrasonic soldering) that is not mentioned in *document [3]*.

8.3. Packaging Specification

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 tape and reel packaging as specified in the sub-chapters below.

8.3.1. Carrier Tape

Carrier tape dimensions are illustrated in the following figure and table:
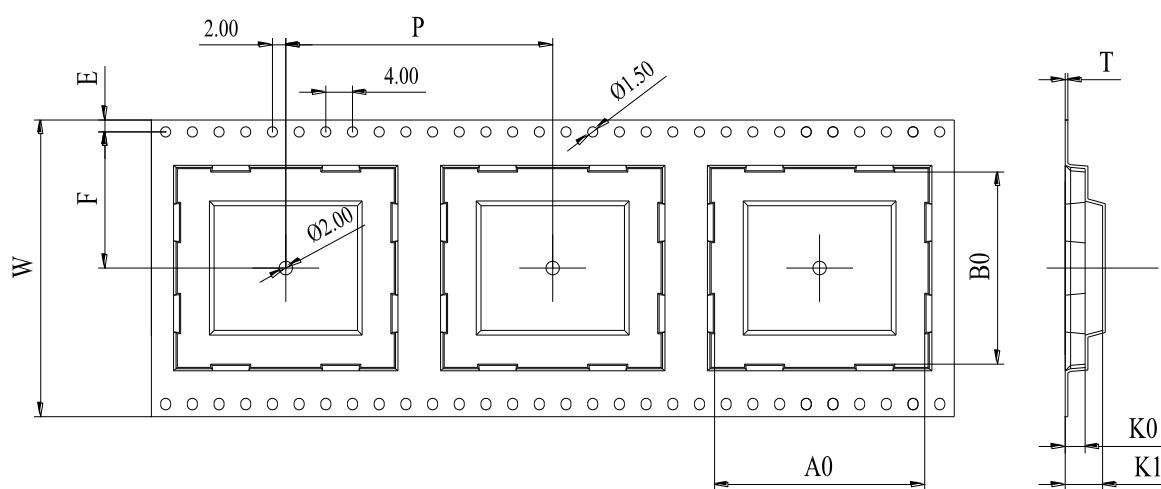
Figure 27: Carrier Tape Dimension Drawing (Unit: mm)

Table 27: FGM840R Carrier Tape Dimension Table (Unit: mm)

W	P	T	A0	B0	K0	K1	F	E
32	24	0.4	13.6	12.6	2.3	3.2	14.2	1.75

8.3.2. Plastic Reel

Plastic reel dimensions are illustrated in the following figure and table:
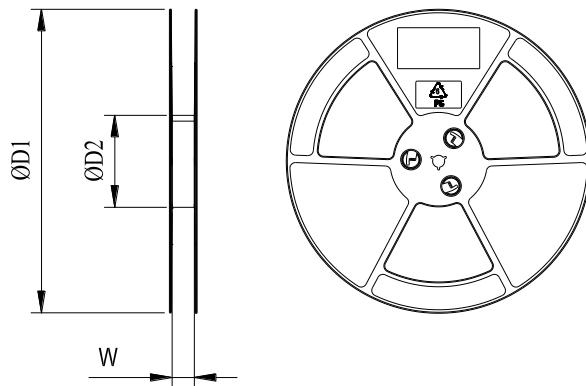
Figure 28: Plastic Reel Dimension Drawing

Table 28: Plastic Reel Dimension Table (Unit: mm)

øD1	øD2	W
380	100	32.5

8.3.3. Mounting Direction
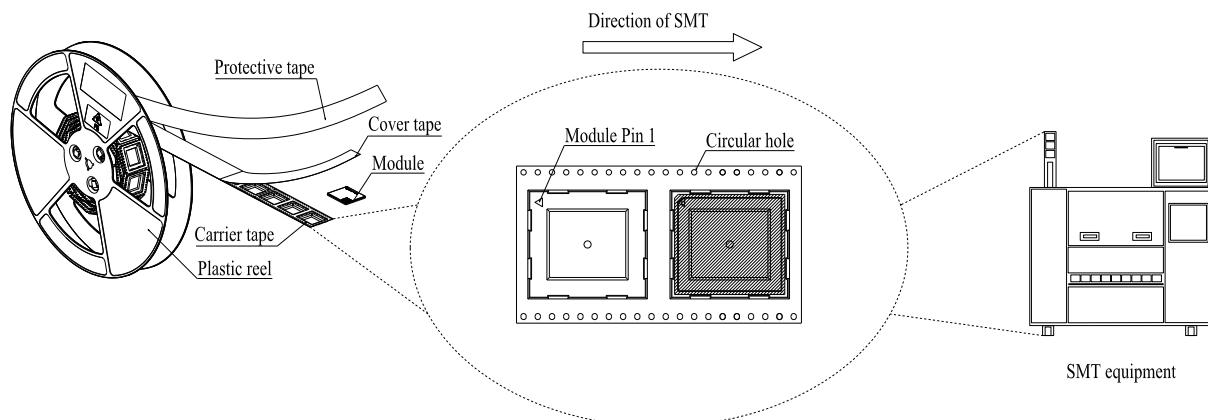
Figure 29: Mounting Direction

8.3.4. Packaging Process
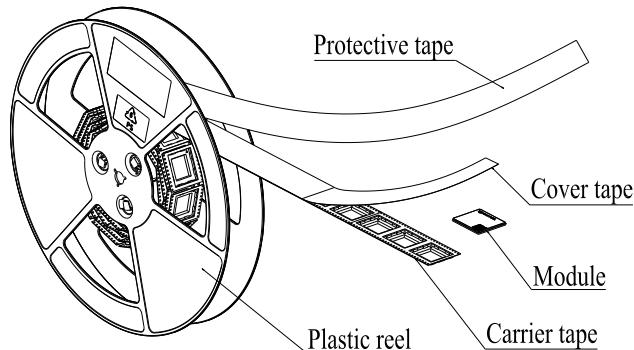
Place the modules onto the carrier tape cavity and cover them securely with cover tape. Wind the heat-sealed carrier tape onto a plastic reel and apply a protective tape for additional protection. 1 plastic reel can pack 1000 modules.

Place the packaged plastic reel, humidity indicator card and desiccant bag into a vacuum bag, and vacuumize it.
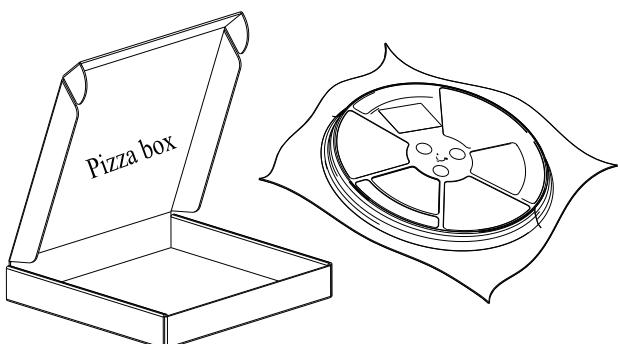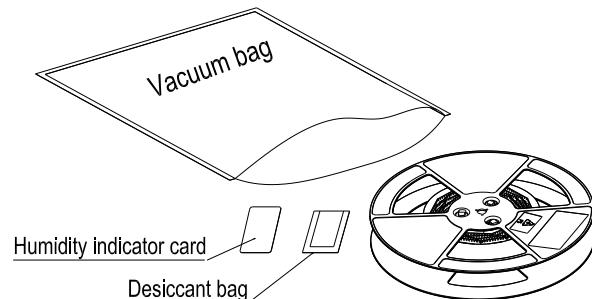
Place the vacuum-packed plastic reel into a pizza box.

Place the 4 packaged pizza boxes into 1 carton and seal it. 1 carton can pack 4000 modules.
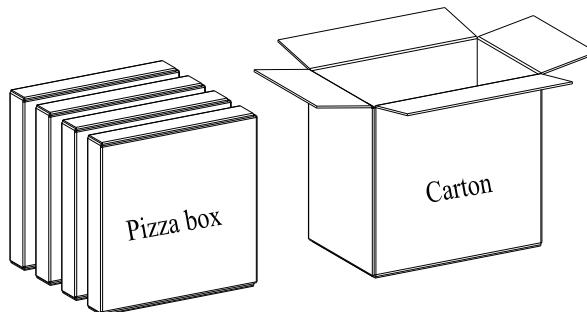
Figure30: Packaging Process

9 Appendix References

Table 29: Reference Documents

Document Name
[1] Quectel_FGM842R_TE-B_User_Guide
[2] Quectel_RF_Layout_Application_Note
[3] Quectel_Module_SMT_Application_Note

Table 30: Terms and Abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
AES	Advanced Encryption Standard
AP	Access Point
BLE	Bluetooth Low Energy
BPSK	Binary Phase Shift Keying
CCK	Complementary Code Keying
DPSK	Differential Phase Shift Keying
DSSS	Direct Sequence Spread Spectrum
ESD	Electrostatic Discharge
EVM	Error Vector Magnitude
GFSK	Gauss frequency Shift Keying
GND	Ground
GPIO	General-Purpose Input/Output

HT	High Throughput
I/O	Input/Output
I2C	Inter-Integrated Circuit
IEEE	Institute of Electrical and Electronics Engineers
JTAG	Joint Test Action Group
LCC	Leadless Chip Carrier (package)
Mbps	Million Bits Per Second
MCU	Microcontroller Unit
MISO	Master In Slave Out
MOSI	Master Out Slave In
PCB	Printed Circuit Board
PSK	Pre-Shared Key
PWM	Pulse Width Modulation
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RAM	Random Access Memory
RF	Radio Frequency
RoHS	Restriction of Hazardous Substances
SAE	Simultaneous Authentication of Equals
SMT	Surface Mount Technology
SPI	Serial Peripheral Interface
STA	Station
TBD	To Be Determined
TRNG	True Random Number Generator
TVS	Transient Voltage Suppressor
Tx	Transmit
UART	Universal Asynchronous Receiver/Transmitter

(U)SIM	(Universal) Subscriber Identity Module
V_{IH}	High-level Input Voltage
V_{IL}	Low-level Input Voltage
Vmax	Maximum Voltage
Vmin	Minimum Voltage
Vnom	Nominal Voltage Value
V_{OH}	High-level Output Voltage
V_{OL}	Low-level Output Voltage
VSWR	Voltage Standing Wave Ratio
WPA	Wi-Fi Protected Access

FCC Statement

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help

The device must not be co-located or operating in conjunction with any other antenna or transmitter. 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.

FCC Radiation Exposure Statement
This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

Does not comply with the use restrictions of the product:
Portable devices used close with human's body (within 20cm), Like Cell phone, Notebook etc.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

2.2 List of applicable FCC rules
FCC Part 15 Subpart C 15.247 & 15.209 &15.407.
2.3 Specific operational use conditions
The module can be used for mobile applications with a maximum 0.2dBi antenna. The host manufacturer installing this module into their product must ensure that the final compos it product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules,

including the transmitter operation. The host manufacturer 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.

2.4 Limited module procedures

Not applicable The module is a Single module and complies with the requirement of FCC Part 15 212.

2.5 Trace antenna designs

Not applicable The module has its own antenna, and doesn't need a hosts printed board micro strip trace antenna etc.

2.6 RF exposure considerations

The module must be installed in the host equipment such that at least 20cm is maintained between the antenna and users" body; and if RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application The FCC ID of the module cannot be used on the final product In these circumstances, the host manufacturer will be responsible for reevaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

2.7 Antennas

Antenna Specification are as follows:

Type: External Antenna

Gain: 2.4G:2.1dBi;5G:3.3dBi;

This device is intended only for host manufacturers under the following conditions: The transmitter module may not be co-located with any other transmitter or antenna; The module shall be only used with the internal antenna(s) that has been originally tested and certified with this module. The antenna must be either permanently attached or employ a "unique" antenna coupler.

As long as the conditions above are met, further transmitter test will not be required However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc).

2.8 Label and compliance information

Host product manufacturers need to provide a physical or e-label stating "Contains FCC ID: XMR2024FGM840R" with their finished product.

2.9 Information on test modes and additional testing requirements

Host manufacturer must perform test of radiated & conducted emission and spurious emission, e.t.c according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product. Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for FCC Part 15 Subpart C 15.247 & 15 209 &15.407 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.

Federal Communication Commission Statement (FCC, U S)

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

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.

FCC Caution:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

IMPORTANT NOTES

Co-location warning:

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

OEM integration instructions:

This device is intended only for OEM integrators under the following conditions:

The transmitter module may not be co-located with any other transmitter or antenna The module shall be only used with the external antenna(s) that has been originally tested and certified with this module.

As long as the 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 (for example, digital device emissions, PC peripheral requirements, etc.).

Validity of using the module certification:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module 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 authorization.

End product labeling:

The final end product must be labeled in a visible area with the following: "Contains Transmitter Module **FCC ID: XMR2024FGM840R**"

Information that must be placed in the end user manual:

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

IC Statement

This device complies with Industry Canada license-exempt RSS standard(s). 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. The device is compliance with RF field strength limits, users can obtain Canadian information on RF exposure and compliance.

IC 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 IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

The user manual for local area network devices shall contain instructions related to the restrictions

mentioned in the above sections, namely that:

(i) the device for operation in the band 5150-5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems;

(ii) the maximum antenna gain permitted for devices in the bands 5250-5350 MHz and 5470-5725 MHz shall comply with the e.i.r.p. limit; and

(iii) the maximum antenna gain permitted for devices in the band 5725-5825 MHz shall comply with the e.i.r.p. limits specified for point-to-point and non point-to-point operation as appropriate.

(i)Les dispositifs fonctionnant dans la bande 5150-5250 MHz sont réservés uniquement pour une utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux.

(ii) le gain d'antenne maximal autorisé pour les appareils dans les bandes 5250-5350 MHz et 5470-5725 MHz doivent respecter le pire limiter; et

(iii) le gain d'antenne maximal autorisé pour les appareils dans la bande 5725-5825 MHz doivent respecter le pire limites spécifiées pour le point-à-point et l'exploitation non point à point, le cas échéant.

Users should also be advised that high-power radars are allocated as primary users (i.e. priority users) of the bands 5250-5350 MHz and 5650-5850 MHz and that these radars could cause interference and/or damage to LE-LAN devices.

Les utilisateurs de radars de haute puissance sont désignés utilisateurs principaux (c.-à-d., qu'ils ont la priorité) pour les bandes 5250-5350 MHz et 5650-5850 MHz et que ces radars pourraient causer du brouillage et/ou des dommages aux dispositifs LAN-EL.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that20 cm may be maintained between the antenna and users. The final end product must belabeled in a visible area with the following: "Contains IC:10224A-2024FGM840R".

Étiquetage du produit final

Ce module émetteur n'est autorisé que pour une utilisation dans un dispositif où l'antenne peut être installée de telle sorte que 20 cm puissent être maintenus entre l'antenne et les utilisateurs. Le produit final doit être étiqueté dans une zone visible avec la mention suivante: "contient IC:10224A-2024FGM840R".