

FCMF66D

Hardware Design

Short-Range Products

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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

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-	2025-07-30	Joy Dai/ Tina Wu/ Neil Cheng	Creation of the document
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1 Introduction

This document defines FCMF66D in open solution and describes its hardware interfaces and air interface, 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.

1.1. 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.
[...]	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

FCMF66D is a high-performance, low-power MCU Wi-Fi 6 and Bluetooth module supporting IEEE 802.11b/g/n/ax and BLE 5.4 protocols. The module provides multiple interfaces including UART, SPI, I2C, PWM, ADC*, SDIO* and TOUCH* for various applications.

It is an SMD module with compact packaging. The general features of the module are as follows:

- ARMv8-M Star-MC1 MCU processor, with a main frequency of up to 240 MHz
- Built in 4 MB or 8 MB Flash

Table 2: Basic Information

FCMF66D	
Packaging type	LCC
Pin counts	27
Dimensions	(22.5 +0.2) mm × (13.5 +0.2) mm × (2.4 ±0.2) mm
Weight	Approx. 1.12 g

2.1. Key Features

Table 3: Key Features

Basic Information	
Protocols and Standard	● Wi-Fi protocol: IEEE 802.11 b/g/n/ax ● Bluetooth protocol: BLE 5.4 ● All hardware components are fully compliant with EU RoHS directive
Power Supply	VBAT Power Supply: ● 2.0–4.35 V ● Typ.: 3.3 V
Temperature Ranges	● Normal operating temperature ¹: -40 to +105 °C ● Storage temperature: -45 to +115 °C
TE-B Kit	FCMF66D-TE-B ²
Antenna/Antenna Interface ³	
Antenna/Antenna Interface	● Pin antenna interface (ANT_WIFI/BT) ● PCB antenna ● RF coaxial connector ● 50 Ω characteristic impedance
Application Interface ⁴	
Application Interfaces	UART, SPI, I2C, PWM, ADC*, SDIO*, TOUCH*

¹ Within this range, the module's indicators comply with IEEE and Bluetooth specification requirements. Optimum RF performance is guaranteed only in the temperature range from -40 °C to 85 °C.

² For more details about the TE-B, see **document [1]**.

³ The module is provided with one of the three antenna/antenna interface designs. For more details, contact Quectel Technical Support.

⁴ For more details about the interfaces, see **Chapters 3.3** and **3.4**.

3 Application Interfaces

3.1. Pin Assignment

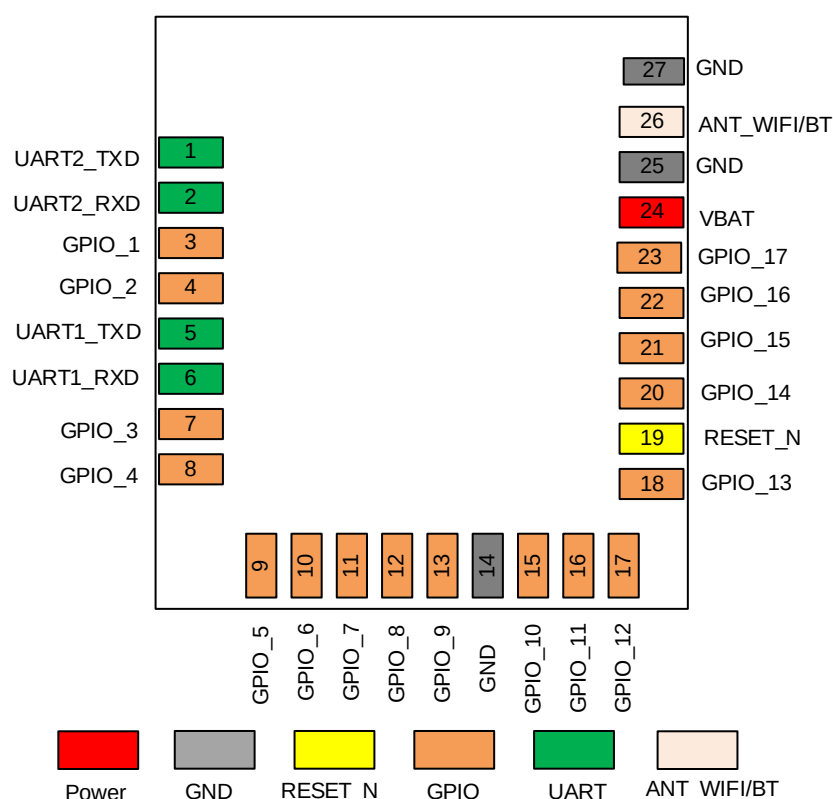


Figure 1: Pin Assignment (Top View)

NOTE

1. Keep all unused pins unconnected.
2. All GND pins should be connected to ground.
3. Ensure that there is no current sink on the module's pins before the module turns on.
4. The module provides 2 UART interfaces and 17 GPIO interfaces by default. In the case of multiplexing, it can support interfaces including SPI, I2C, PWM, ADC*, SDIO*, TOUCH*. For more details, see **Chapters 3.3** and **3.4**.

3.2. Pin Descriptions

Table 4: Parameter Definition

Parameter	Description
AIO	Analog Input/Output
DI	Digital Input
DO	Digital Output
DIO	Digital Input/Output
PI	Power Input
PU	Pull Up
Hi-Z	High Impedance

DC characteristics include power domain and rated current.

Table 5: Pin Description

Power Supply and GND Pins						
Pin Name	Pin No.	I/O	Status After Reset	Description	DC Characteristics	Comment
VBAT	24	PI	-	Main power supply for the module	Vmax = 4.35 V Vmin = 2.0 V Vnom = 3.3 V	It is recommended to provide with sufficient current of at least 0.8 A.
GND	14、25、27					
Control Signal						
Pin Name	Pin No.	I/O	Status After Reset	Description	DC Characteristics	Comment
RESET_N	19	DI	PU	Enable the module (by default)	VBAT	Hardware enable. Internally pulled up to 3.3 V. Active high.

				Reset the module	Internally pulled up to 3.3 V. Active low.	
UART Interfaces						
Pin Name	Pin No.	I/O	Status After Reset	Description	DC Characteristics	Comment
UART1_TXD	5	DO	DO	UART1 transmit	VBAT	
UART1_RXD	6	DI	DI	UART1 receive		
UART2_TXD	1	DO	DO	UART2 transmit		
UART2_RXD	2	DI	DI	UART2 receive		
GPIO Interfaces						
Pin Name	Pin No.	I/O	Status After Reset	Description	DC Characteristics	Comment
GPIO_1	3	DIO	Hi-Z	General-purpose input/output	VBAT	Interrupt wake-up.
GPIO_2	4	DIO	Hi-Z	General-purpose input/output		
GPIO_3	7	DIO	Hi-Z	General-purpose input/output		
GPIO_4	8	DIO	Hi-Z	General-purpose input/output		
GPIO_5	9	DIO	Hi-Z	General-purpose input/output		
GPIO_6	10	DIO	Hi-Z	General-purpose input/output		
GPIO_7	11	DIO	Hi-Z	General-purpose input/output		
GPIO_8	12	DIO	Hi-Z	General-purpose input/output		
GPIO_9	13	DIO	-	General-purpose input/output		
GPIO_10	15	DIO	Hi-Z	General-purpose input/output		
GPIO_11	16	DIO	Hi-Z	General-purpose input/output		
GPIO_12	17	DIO	Hi-Z	General-purpose		

				input/output		
GPIO_13	18	DIO	Hi-Z	General-purpose input/output		
GPIO_14	20	DIO	Hi-Z	General-purpose input/output		
GPIO_15	21	DIO	Hi-Z	General-purpose input/output		
GPIO_16	22	DIO	Hi-Z	General-purpose input/output		
GPIO_17	23	DIO	Hi-Z	General-purpose input/output		
RF Antenna Interface						
Pin Name	Pin No.	I/O	Status After Reset	Description	DC Characteristics	Comment
ANT_WIFI/BT	26	AIO	-	Wi-Fi/Bluetooth antenna interface	-	50 Ω characteristic impedance.

NOTE

To reduce the probability of module damage and extend module service life, do not power up and down frequently.

3.3. GPIO Multiplexing

The module provides 17 GPIO interfaces by default, and can support up to 21 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_TXD	1	P11	SDIO_DATA3	-	-	-
UART2_RXD	2	P10	SDIO_DATA2	-	-	-
GPIO_1	3	P16	SDIO_DATA0	SPI0_MOSI	-	-

GPIO_2	4	P17	SDIO_DATA1	SPI0_MISO	-	-
UART1_TXD	5	P41	UART2_TX	-	-	-
UART1_RXD	6	P40	UART2_RX	-	-	-
GPIO_3	7	P15	SDIO_CMD	SPI0_CS	I2C1_SDA	-
GPIO_4	8	P18	SDIO_DATA2	PWMG0_PWM0	-	-
GPIO_5	9	P12	-	ADC14	TOUCH0	-
GPIO_6	10	P13	-	ADC15	TOUCH1	-
GPIO_7	11	P0	UART1_TX	I2C1_SCL	SWCLK	ADC12
GPIO_8	12	P1	UART1_RX	I2C1_SDA	SWDIO	ADC13
GPIO_9	13	P48				-
GPIO_10	15	P28	ADC4		TOUCH2	-
GPIO_11	16	P36	PWMG1_PWM4	SPI0_MISO	TOUCH10	-
GPIO_12	17	P34	PWMG1_PWM2	SPI0_CS	TOUCH8	-
GPIO_13	18	P19	SDIO_DATA3	PWMG0_PWM1		
GPIO_14	20	P24	PWMG0_PWM4	ADC2		
GPIO_15	21	P25	PWMG0_PWM5	ADC1		
GPIO_16	22	P32	PWMG1_PWM0		TOUCH6	
GPIO_17	23	P14	SDIO_CLK	SPI0_CLK	I2C1_SCL	

NOTE

1. All GPIOs support interrupt wake-up.
2. After the module is powered off, all GPIOs must input low-level. Current leakage may cause the module to be in an abnormal state.
3. The maximum number of each application interface multiplexed with GPIOs is not available simultaneously. For more details, see **Chapter 3.4**.

3.4. Interface Definition

3.4.1. UART Interfaces

The module supports two UART interfaces by default. The pin definitions are shown in the table below.

Table 7: Pin Description of UART Interfaces

Pin Name	Pin No.	I/O	Description
UART1_TXD	5	DO	UART1 transmit
UART1_RXD	6	DI	UART1 receive
UART2_TXD	1	DO	UART2 transmit
UART2_RXD	2	DI	UART2 receive

UART1 interface is mainly used for communication with MCU, supporting AT command communication and data transmission. The default baud rate is 115200 bps.

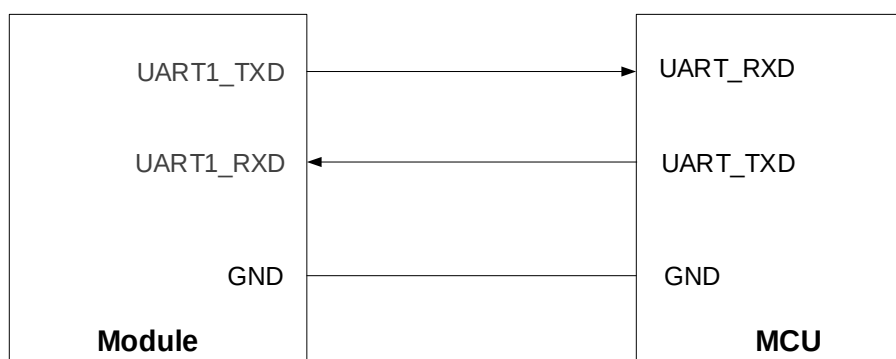


Figure 2: Reference Design of UART1 Interface

UART2 interfaces can be used as debug UART with the debugging tool, which supports download, debugging, AT command communication and log printing output. The default baud rate is 115200 bps.

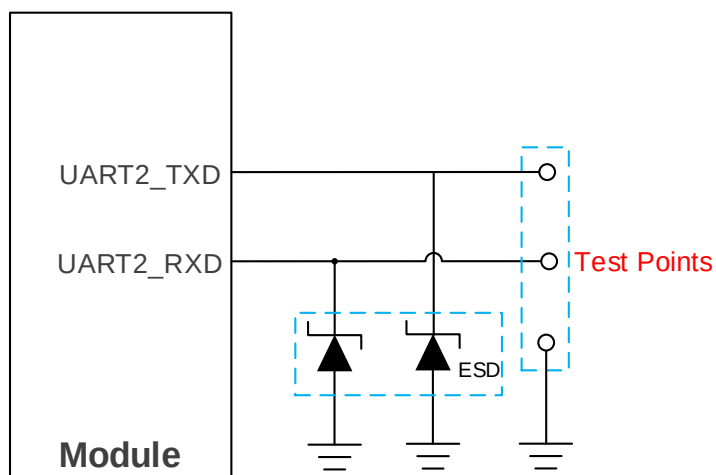


Figure 3: Reference Design of UART2 Interface

3.4.2. SPI Interface

In the case of multiplexing, the module provides one SPI interface, which supports both master and slave modes. The maximum clock frequency is up to 40 MHz.

Table 8: Pin Description of SPI Interface

Pin Name	Pin No.	Alternate Function	I/O	Description	Comment
GPIO_3	7	SPI0_CS	DIO	SPI chip select	In master mode, it is an output signal.
GPIO_17	23	SPI0_CLK	DIO	SPI clock	In slave mode, it is an input signal.
GPIO_2	4	SPI0_MISO	DIO	SPI master-in slave-out	
GPIO_1	3	SPI0_MOSI	DIO	SPI master-out slave-in	

The following figure shows the SPI connection between the host and the SPI:

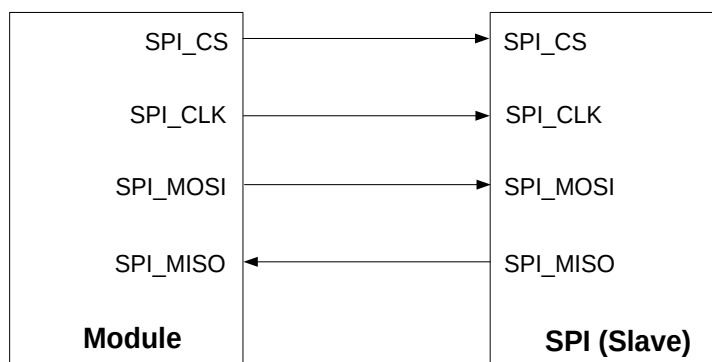


Figure 4: SPI Interface Connection (Master Mode)

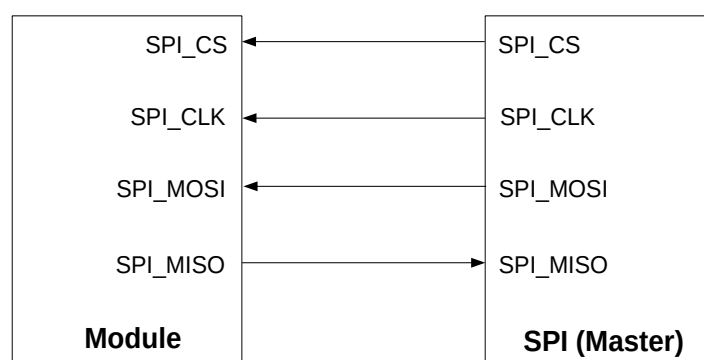


Figure 5: SPI Interface Connection (Slave Mode)

3.4.3. I2C Interface

In the case of multiplexing, the module provides one I2C interface, which supports both master and slave modes. The interface supports standard (100 kbps) and fast (400 kbps) modes with 7-bit and 10-bit addressing.

Table 9: Pin Description of I2C Interface

Pin Name	Pin No.	Alternate Function	I/O	Description
GPIO_7	11	I2C1_SCL	OD	I2C1 serial clock
GPIO_8	12	I2C1_SDA	OD	I2C1 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 two sets of advanced PWM control groups (PWMG). Each PWMG can contain up to three independent 32-bit channels, each equipped with an auto-reload counter driven by a programmable prescaler. The PWMG can be used to generate pulse width modulation signals, supporting various application scenarios including input capture, pulse edge counting, and output waveform generation (achieved through output compare functionality).

Table 10: Pin Description of PWM Interfaces

Pin Name	Pin No.	Alternate Function	I/O	Description
GPIO_4	8	PWMG0_PWM0	DO	PWMG0 channel; PWM0 output
GPIO_13	18	PWMG0_PWM1	DO	PWMG0 channel; PWM1 output
GPIO_14	20	PWMG0_PWM4	DO	PWMG0 channel; PWM4 output
GPIO_15	21	PWMG0_PWM5	DO	PWMG0 channel; PWM5 output
GPIO_16	22	PWMG1_PWM0	DO	PWMG1 channel; PWM0 output
GPIO_12	17	PWMG1_PWM2	DO	PWMG1 channel; PWM2 output
GPIO_11	16	PWMG1_PWM4	DO	PWMG1 channel; PWM4 output

3.4.5. ADC Interfaces*

In the case of multiplexing, it supports up to seven 12-bit ADC interfaces, of which the input voltage range is 0–3.3 V. Route the ADC signal traces with ground surrounded to improve the ADC voltage's accuracy. AUX ADC features multiple external analog input channels and internal dedicated channels, supporting A/D conversion execution in single-shot, software-triggered, or continuous modes.

Table 11: Pin Description of ADC Interfaces

Pin Name	Pin No.	Alternate Function	I/O	Description
GPIO_7	11	ADC12	AI	General-purpose ADC interface
GPIO_8	12	ADC13	AI	General-purpose ADC interface
GPIO_5	9	ADC14	AI	General-purpose ADC interface
GPIO_6	10	ADC15	AI	General-purpose ADC interface
GPIO_14	20	ADC2	AI	General-purpose ADC interface
GPIO_15	21	ADC1	AI	General-purpose ADC interface
GPIO_10	15	ADC4	AI	General-purpose ADC interface

Table 12: ADC Features

Parameter	Min.	Typ.	Max.	Unit
ADC Input Voltage Range	0	1.1	-	V
ADC Input Resistance	10	-	-	MΩ
ADC Resolution	-	12	-	bit

NOTE

The input voltage of each ADC interface should not exceed its corresponding voltage range.

3.4.6. SDIO Interface*

In the case of multiplexing, the module supports one SDIO interface.

Table 13: Pin Description of SDIO Interface

Pin Name	Pin No.	Alternate Function	I/O	Description
GPIO_17	23	SDIO_CLK	DI	SDIO clock
GPIO_3	7	SDIO_CMD	DIO	SDIO command

GPIO_1	3	SDIO_DATA0	DIO	SDIO data bit 0
GPIO_2	4	SDIO_DATA1	DIO	SDIO data bit 1
GPIO_4	8	SDIO_DATA2	DIO	SDIO data bit 2
GPIO_13	18	SDIO_DATA3	DIO	SDIO data bit 3

The connection between the module and the host is as below:

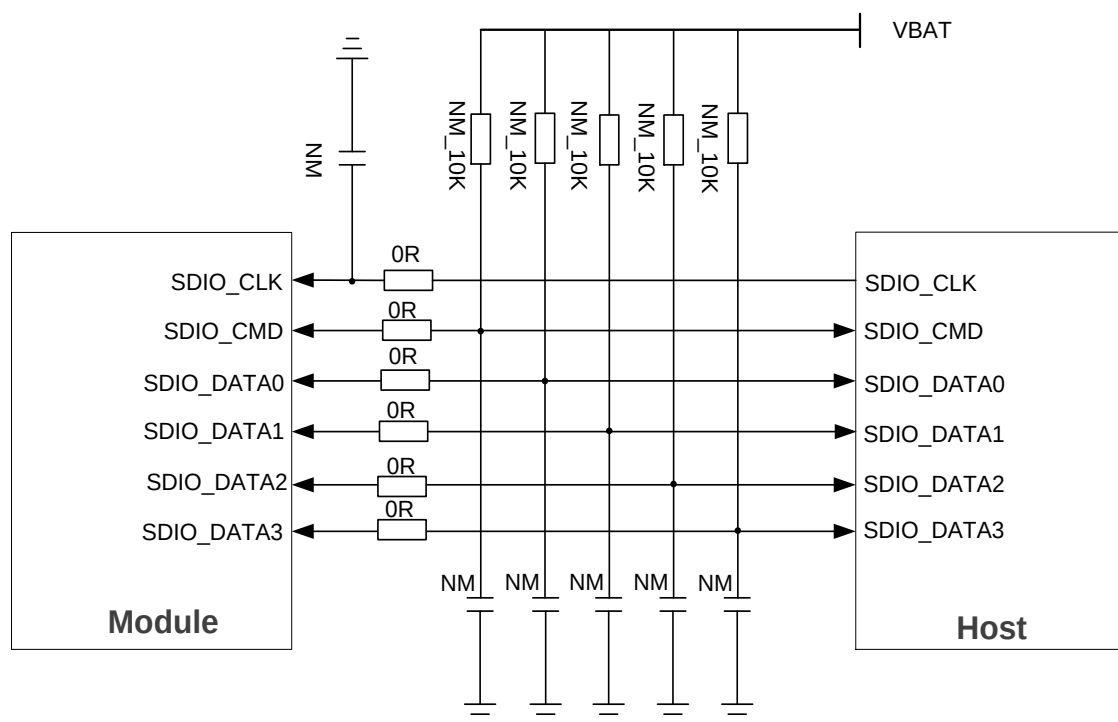


Figure 6: Reference Design of SDIO Interface

To ensure communication performance, the following conditions should be taken into considerations when designing SDIO interface:

- To avoid jitter of bus, reserve pull-up resistors with value of 10–100 kΩ (recommended value is 10 kΩ) on the SDIO_CMD, SDIO_DATA[0:3], and SDIO_CLK signal traces, and pull them up to VBAT of the module.
- Route SDIO signal traces at the inner-layer of the PCB, and surround the traces with ground on the same layer and with ground planes above and below. The impedance of SDIO signal trace is 50 Ω ±10 %. And the SDIO_CLK signal trace should be routed with ground surrounded separately.
- Keep SDIO signal traces far away from power supply traces, crystal-oscillators, magnetic devices, sensitive signals such as RF signals, analog signals, and noise signals generated by clock and DC-DC.
- SDIO_CLK, SDIO_DATA[0:3], and SDIO_CMD signal traces need to be of equal length (the distance

between the traces should be less than 2.52 mm). Route SDIO traces in parallel on the same layer whenever possible, ensuring that there are enough ground vias around the SDIO traces and connecting them to a ground plane.

- The spacing between SDIO signals and other signals should be greater than twice the trace width, and the bus load capacitance must be less than 15 pF.

3.4.7. TOUCH Interfaces*

In the case of multiplexing, the module supports 6 TOUCH interfaces.

Table 14: Pin Description of Touch Interfaces

Pin Name	Pin No.	Alternate Function	I/O	Description
GPIO_5	9	TOUCH0	AI	Touch sensitive interface 0
GPIO_6	10	TOUCH1	AI	Touch sensitive interface 1
GPIO_10	15	TOUCH2	AI	Touch sensitive interface 2
GPIO_16	22	TOUCH6	AI	Touch sensitive interface 6
GPIO_12	17	TOUCH8	AI	Touch sensitive interface 8
GPIO_11	16	TOUCH10	AI	Touch sensitive interface 10

4 Operating Characteristics

4.1. Power Supply Interface

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

Table 15: Pin Description of Power Supply and GND Pins

Pin Name	Pin No.	I/O	Description	Min.	Typ.	Max.	Unit
VBAT	24	PI	Main power supply for the module	2.0	3.3	4.35	V
GND	14, 25, 27						

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 provides at least 0.8 A to ensure sufficient current. For better power supply performance, it is recommended to parallel a 22 μ F decoupling capacitor, and two filter capacitors (1 μ F 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:

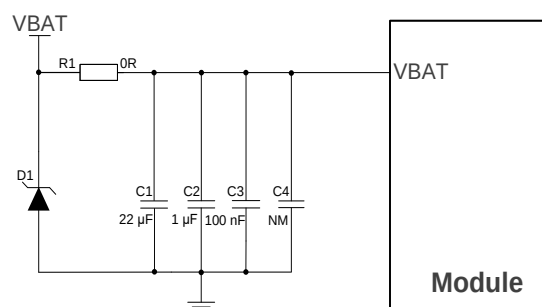


Figure 8: Reference Design of Power Supply

4.2. Turn On

After VBAT is powered on, keep RESET_N at a high level for at least 200 us to enable the module to automatically power on.

Table 16: Pin Description of RESET_N

Pin Name	Pin No.	I/O	Description	Comment
RESET_N	18	DI	Enable the module	Hardware enable. Internally pulled up to 3.3 V. Active high.

The turn-on timing is shown below:

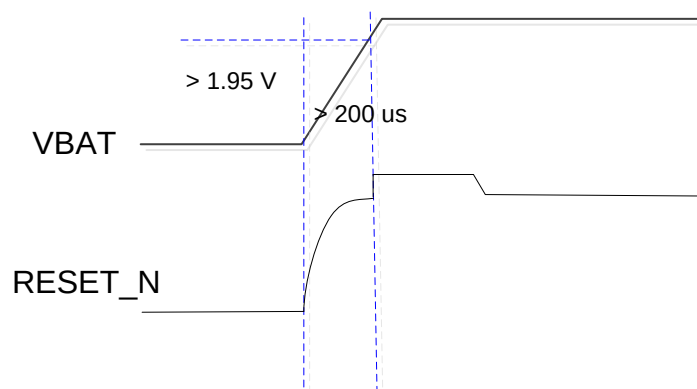


Figure 7: Turn-on Timing

4.3. Reset

Pull the RESET_N pin low for at least 1 ms or until the voltage drops below 0.3 V to achieve module reset.

Table 17: Pin Description of Reset RESET_N

Pin Name	Pin No.	I/O	Description	Comment
RESET_N	18	DI	Reset the module	Internally pulled up to 3.3 V; Active low.

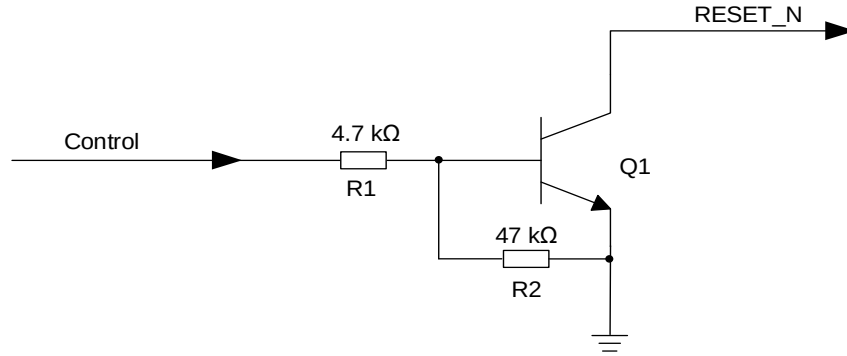


Figure 8: Reference Circuit of RESET_N by Using a Driving Circuit

Another way to control the RESET_N is the button. When pressing the button, static electricity may be generated by the fingers. Therefore, a TVS component shall be placed near the button for ESD protection. The reference design is shown below:

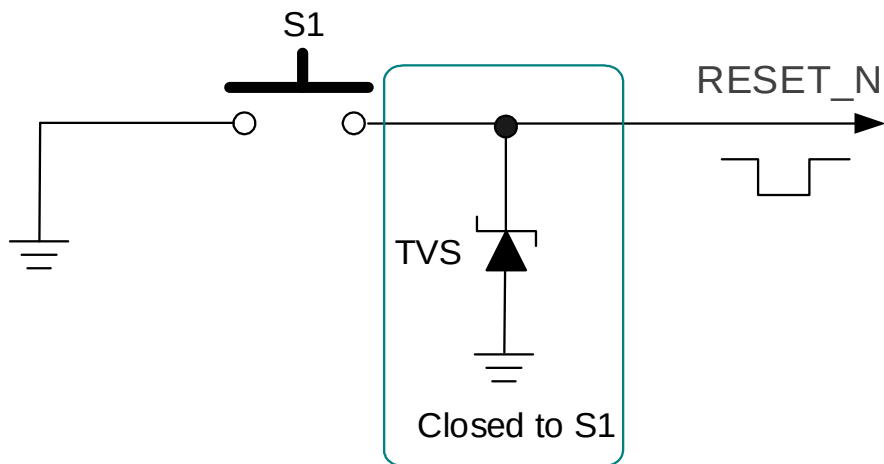


Figure 9: Reference Circuit of RESET_EN with the Button

The reset timing of the module is shown below:

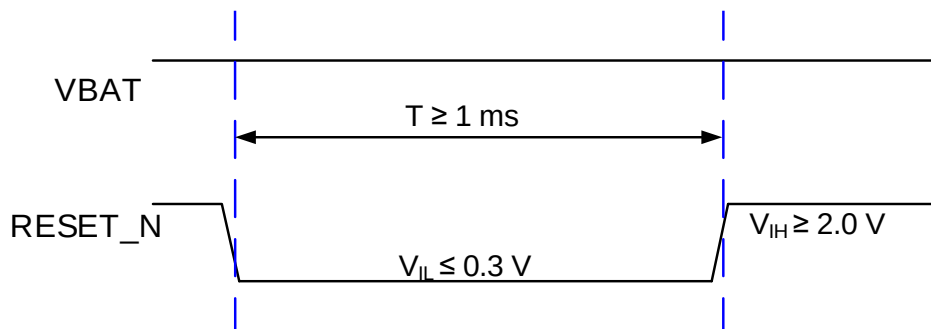


Figure 10: Reset Timing

5 RF Performances

5.1. Wi-Fi Performances

Table 18: Wi-Fi Performances

Operating Frequency			
2.4 GHz: 2.400–2.4835 GHz			
Modulation			
DBPSK, DQPSK, CCK, BPSK, QPSK, 16QAM, 64QAM, 256QAM			
Encryption Mode			
WPA/ WPA2/ WPA3-Personal/ AES/ RSA/ ECC/ TRNG			
Operating Mode			
- AP - STA			
Transmission Data Rate			
802.11b: 1 Mbps、2 Mbps、5.5 Mbps、11 Mbps 802.11g: 6 Mbps、9 Mbps、12 Mbps、18 Mbps、24 Mbps、36 Mbps、48 Mbps、54 Mbps 802.11n: HT20 (MCS 0~7)、HT40 (MCS 0~7) 802.11ax: HE20 (MCS 0~7)、HT40 (MCS 0~7)			
Condition (VBAT = 3.3 V; Temp.: 25 °C)	EVM	Typ.; Unit: dBm; Tolerance: ±2 dB	
		Transmit Power	Receiver Sensitivity
2.4 GHz	≤ 35 %	802.11b @ 1 Mbps	18
		802.11b @ 11 Mbps	-97
	≤ -5 dB	802.11g @ 6 Mbps	19
		802.11g @ 54 Mbps	-88
	≤ -25 dB	15	-93
		14	-75

802.11n, HT20 @ MCS 0, BPSK	≤ -5 dB	15	-92
802.11n, HT20 @ MCS 7, 64QAM	≤ -27 dB	14	-73
802.11n, HT40 @ MCS 0, BPSK	≤ -5 dB	13	-89
802.11n, HT40 @ MCS 7, 64QAM	≤ -27 dB	13	-71
802.11ax, HE20 @ MCS 0, BPSK	≤ -5 dB	14	-93
802.11ax, HE20 @ MCS 7, 1024QAM	≤ -35 dB	13	-75
802.11ax, HE40 @ MCS 0, BPSK	≤ -5 dB	13	-90
802.11ax, HE40 @ MCS 11, 1024QAM	≤ -35 dB	13	-72

NOTE

The module supports the above frequency bands in hardware, but actual applications may be subject to local regulations.

5.2. Bluetooth Performances

Table 19: Bluetooth Performances

Operating Frequency		
2.400–2.4835 GHz		
Modulation		
GFSK		
Operating Mode		
Bluetooth Low Energy (BLE)		
Condition (VBAT = 3.3 V; Temp.: 25 °C)	Typ.; Unit: dBm; Tolerance: ±3 dB	
	Transmit Power	Receiver Sensitivity
BLE (1 Mbps)	6.5	-96
BLE (2 Mbps)	6.5	-94

BLE (S = 2)	6.5	-102
BLE (S = 8)	6.5	-99

5.3. Antenna/Antenna Interfaces ⁵

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.

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

5.3.1. Pin Antenna Interface (ANT_WIFI/BT)

Table 20: Pin Description of ANT_WIFI/BT

Pin Name	Pin No.	I/O	Description	Comment
ANT_WIFI/BT	26	AIO	Wi-Fi/Bluetooth antenna interface	50 Ω characteristic impedance.

5.3.1.1. Reference Design

A circuit of the pin antenna interface is shown below. For better RF performance, it is necessary to reserve a dual L-type circuit and add an ESD protection component. Reserved matching components R1, C1, C2, and D1 should be placed as close to the antenna as possible and should be mounted or not based on the actual situation. By default, C1, C2, and D1 are not mounted, and only a 0 Ω resistor is mounted at R1. The parasitic capacitance of TVS should be less than 0.05 pF.

⁵ The module is provided with one of the three antenna/antenna interface designs. For more details, contact Quectel Technical Support.

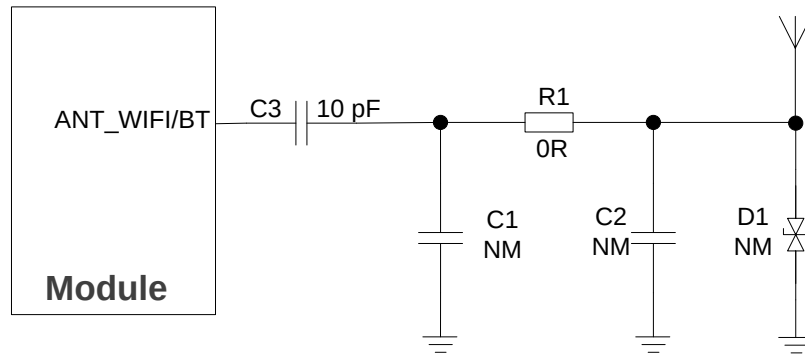


Figure 11: Reference Design of ANT_WIFI/BT

NOTE

- 1) If there is DC power at the antenna ports, place capacitor on C3 to prevent short circuit to ground. The capacitance value is recommended to be 10 pF, which can be adjusted according to the debugging results.
- 2) If there is no DC power in the peripheral design:
 - a) Do not reserve C3.
 - b) If C3 has already been reserved, it should be mounted with components, and it is recommended to use a 0 Ω resistor. You can also match the components according to the debugging results.

5.3.1.2. 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.

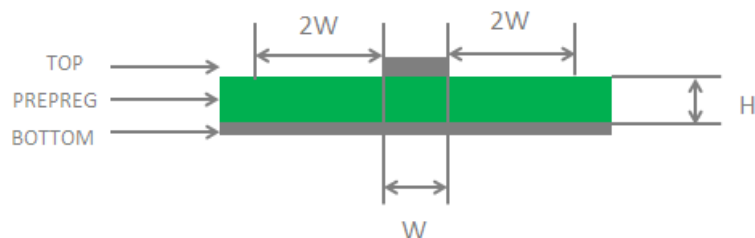


Figure 12: Microstrip Design on a 2-layer PCB

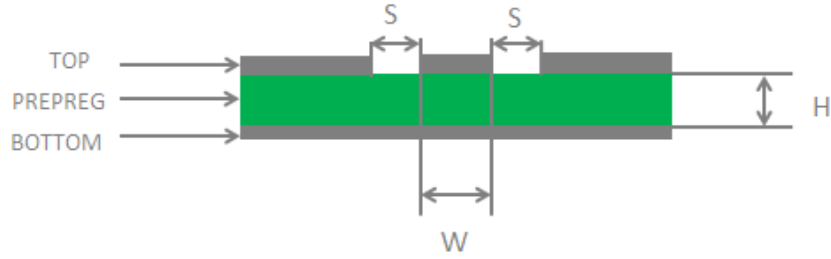


Figure 13: Coplanar Waveguide Design on a 2-layer PCB

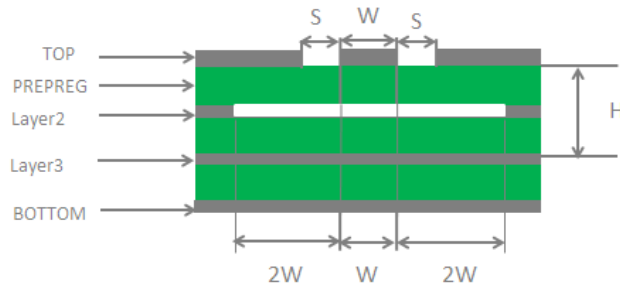


Figure 14: Coplanar Waveguide Design on a 4-layer PCB (Layer 3 as Reference Ground)

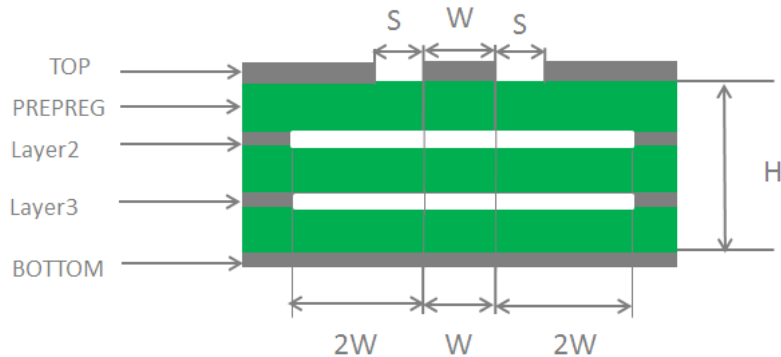


Figure 15: Coplanar Waveguide Design on a 4-layer PCB (Layer 4 as Reference Ground)

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

- Use an impedance simulation tool to accurately 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. Meanwhile, 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 ($2 \times W$).
- Keep RF traces away from interference sources (such as DC-DC, (U)SIM/USB/SDIO high frequency digital signals, display signals, and clock signals), and avoid intersection and paralleling between traces on adjacent layers.

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

5.3.1.3. RF Connector Recommendation

If RF connector is used for antenna connection, it is recommended to use U.FL-R-SMT connector provided by Hirose.

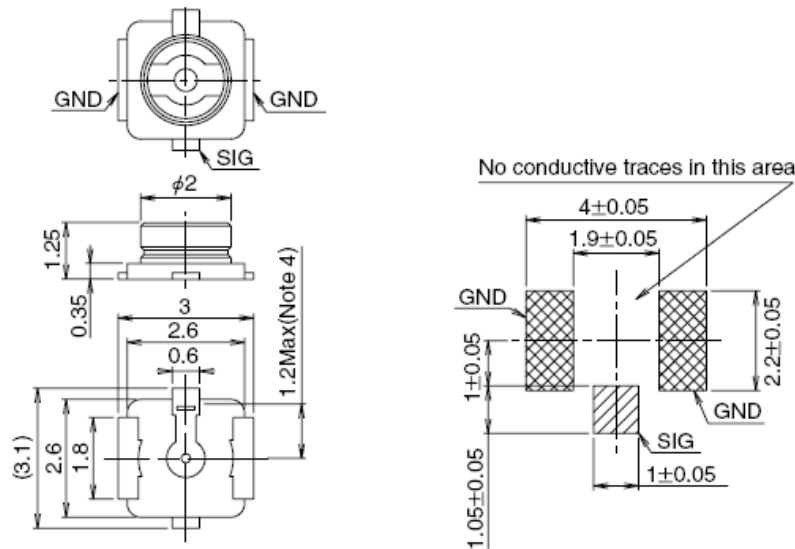


Figure 16: Dimensions of the Receptacle (Unit: mm)

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

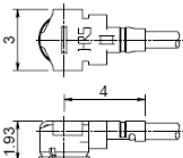
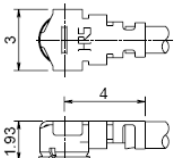
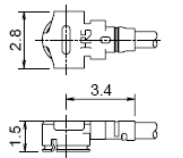
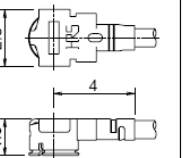
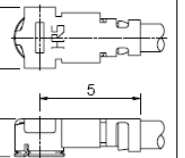
Part No.	U.FL-LP-040	U.FL-LP-066	U.FL-LP(V)-040	U.FL-LP-062	U.FL-LP-088
					
Mated Height	2.5mm Max. (2.4mm Nom.)	2.5mm Max. (2.4mm Nom.)	2.0mm Max. (1.9mm Nom.)	2.4mm Max. (2.3mm Nom.)	2.4mm Max. (2.3mm Nom.)
Applicable cable	Dia. 0.81mm Coaxial cable	Dia. 1.13mm and Dia. 1.32mm Coaxial cable	Dia.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

Figure 17: Specifications of Mated Plugs

The following figure describes the space factor of mated connectors.

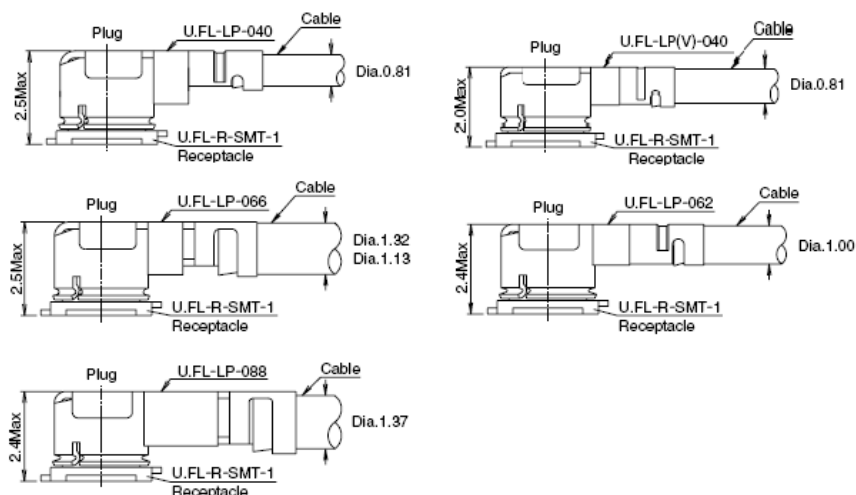


Figure 18: Space Factor of Mated Connectors (Unit: mm)

For more details, please visit <http://hirose.com>.

5.3.2. PCB Antenna

Table 21: Requirements for PCB Antenna

Parameter	Requirements
Frequency Range (GHz)	2.400–2.4835
Input Impedance (Ω)	50
VSWR	≤ 3
Gain (dBi)	-0.2 (Typ.)
Efficiency	35 % (Avg.)

The performance of the PCB antenna depends on the entire product, including the motherboard, case, other RF signals, etc., and it is recommended to verify it at the early stage of design. To ensure the performance and reliability when designed with PCB antenna, follow the basic principles below for module's placement and layout:

- The module should be placed on the edge of the motherboard.
- On the motherboard, all PCB layers under the PCB antenna and within at least 10 mm to the left and right should be designed as keepout areas.
- On the motherboard, ensure a minimum clearance of 16 mm between the PCB antenna and power connectors, Ethernet ports, USB ports, and other large form-factor components (if any).
- If using a plastic case, ensure a minimum clearance of 10 mm between the PCB antenna and the plastic case. If using a metal case, it is recommended to use an external antenna.

NOTE

If any of the above principles cannot be guaranteed, it is advisable to explore alternative antenna solutions for the module or seek assistance from the Quectel Antenna Team, who can offer design assistance and recommend suitable external antennas. Please feel free to contact Quectel Technical Support if necessary.

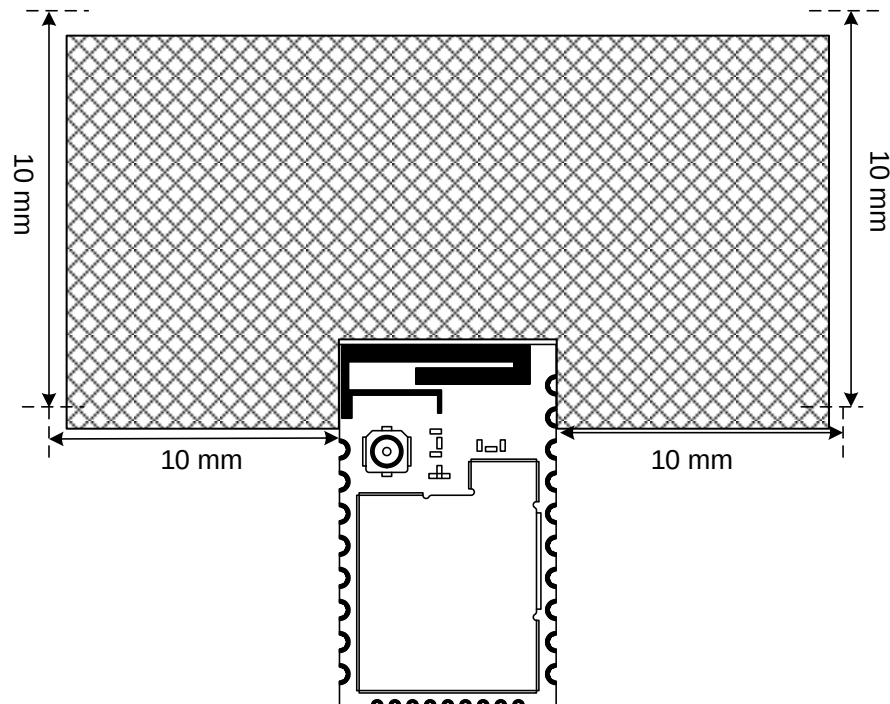


Figure 19: Keepout Area on Motherboard

To ensure module performance, do not route at the RF test point at the bottom of the module during PCB design. The prohibited area during routing is shown in the red box below:

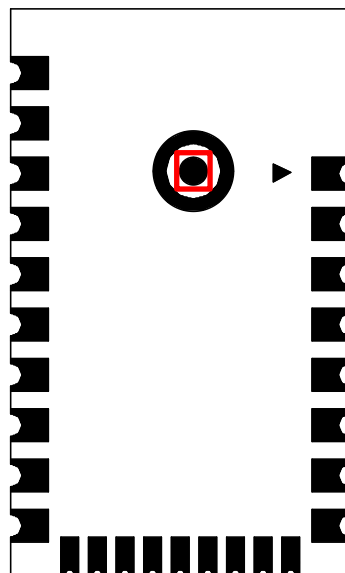


Figure 20: Prohibited Area During Routing (Bottom Side)

5.3.3. RF Coaxial Connector

5.3.3.1. Antenna Connector Specifications

The mechanical dimensions of the receptacle supported by the module are as follows.

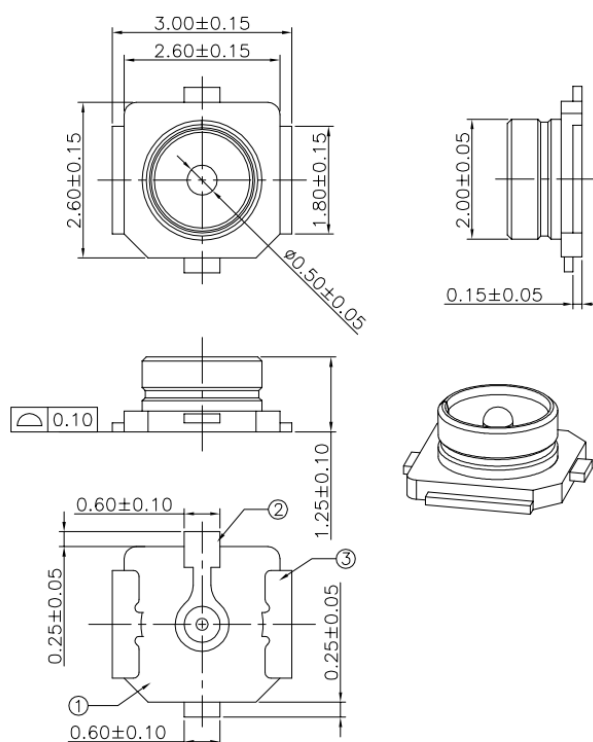


Figure 21: Dimensions of the Receptacle (Unit: mm)

Table 22: 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. 1.45 (3–6 GHz)

5.3.3.2. Antenna Connector Installation

The receptacle mounted on the module accepts two types of mated plugs that will meet a maximum height of 2.0 mm using a $\varnothing$ 0.81 mm coaxial cable or a maximum height of 2.2 mm utilizing a $\varnothing$ 1.13 mm coaxial cable.

The following figure shows the dimensions of mated plugs using $\varnothing$ 0.81 mm/ $\varnothing$ 1.13 mm coaxial cables.

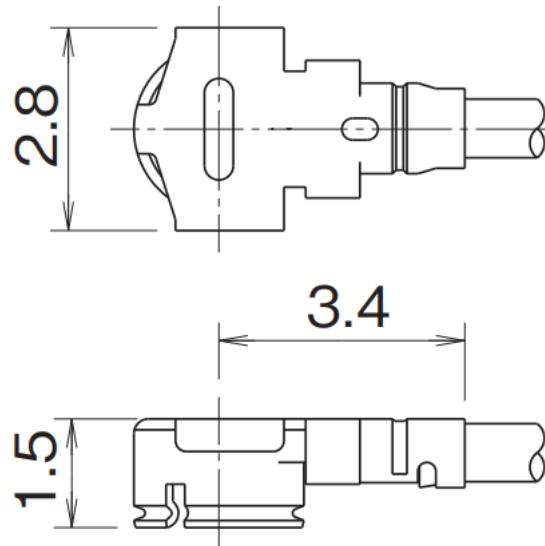


Figure 22: Dimensions of Mated Plugs ($\varnothing$ 0.81 mm/ $\varnothing$ 1.13 mm Coaxial Cables; Unit: mm)

The following figure illustrates the connection between the receptacle on the module and the mated plug using a $\varnothing$ 0.81 mm coaxial cable.

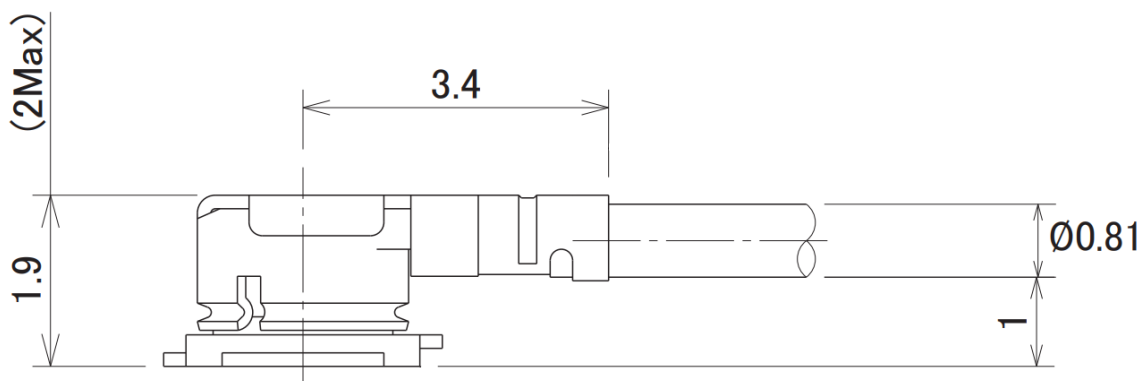


Figure 23: Space Factor of Mated Connectors ($\varnothing$ 0.81 mm Coaxial Cables; Unit: mm)

The following figure illustrates the connection between the receptacle mounted on the module and the mated plug using a $\varnothing$ 1.13 mm coaxial cable.

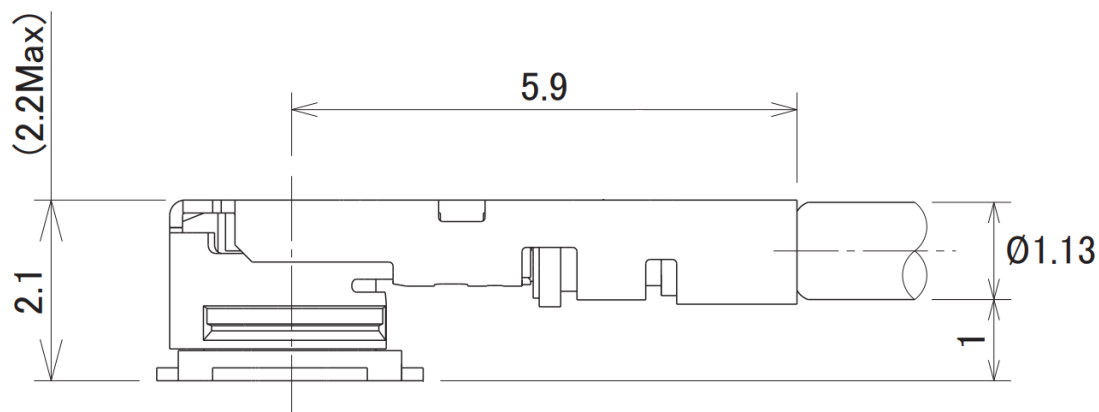


Figure 24: Space Factor of Mated Connectors (Ø 1.13 mm Coaxial Cables; Unit: mm)

5.3.3.3. 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>.

5.3.4. Requirements for Antenna Design

Table 23: Requirements for Antenna Design

Parameter	Requirements
Frequency Range (GHz)	● 2.4 GHz: 2.400–2.4835
	● 5 GHz: 5.150–5.850
Pin Antenna Interface/ RF Coaxial Connector	● VSWR: ≤ 2 (Typ.)
	● Gain: 1 dBi (Typ.)
	● Max. Input Power: 50 W
	● Input Impedance: 50 Ω
	● Vertical polarization
	● Cable Insertion Loss: < 1 dB

6 Electrical Characteristics & Reliability

6.1. Absolute Maximum Ratings

Table 24: Absolute Maximum Ratings (Unit: V)

Parameter	Min.	Max.
VBAT	-0.3	3.6
Voltage at Digital Pins	-0.3	3.6
Input Voltage at ADC	0	3.6

NOTE

Exceeding the conditions of use as shown above may cause permanent damage to the module.

6.2. Power Supply Ratings

Table 25: Module's Power Supply Ratings (Unit: V)

Parameter	Description	Condition	Min.	Typ.	Max.
VBAT	Main power supply for the module	The actual input voltages must be kept between the minimum and maximum values.	2.0	3.3	4.35

6.3. Power Consumption

Test conditions for module power consumption are as follows:

- Ambient temperature 25 °C
- Typical power domain
- 50 Ω impedance

The above power consumption data are the typical values for your reference only. Actual values may vary among different modules due to differences in internal components, software versions and test ambient temperatures. For more details, please contact Quectel Technical Support.

6.3.1. Wi-Fi Power Consumption ⁶

Table 26: Wi-Fi Power Consumption in Non-signaling Mode (Unit: mA)

Condition (Duty cycle: 99 %)			I _{VBAT} (Typ.)
2.4 GHz	802.11b	Tx @ 1 Mbps	227
		Tx @ 11 Mbps	227
	802.11g	Tx @ 6 Mbps	190
		Tx @ 54 Mbps	169
	802.11n	Tx HT20 @ MCS 0	176
		Tx HT20 @ MCS 7	166
		Tx HT40 @ MCS 0	162
		Tx HT40 @ MCS 7	163
	802.11ax	Tx HE20 @ MCS 0	171
		Tx HT20 @ MCS 7	163
		Tx HT40 @ MCS 0	158
		Tx HT40 @ MCS 7	158

⁶ The Bluetooth function is disabled when the Wi-Fi power consumption is tested.

6.3.2. Bluetooth Power Consumption ⁷

Table 27: Bluetooth Power Consumption in Non-signaling Mode (Unit: mA)

Condition	I _{VBAT} (Typ.)
BLE (1 Mbps) @ 6 dBm	78
BLE (2 Mbps) @ 6 dBm	55
BLE (S = 2) @ 6 dBm	71
BLE (S = 8) @ 6 dBm	91

6.4. Digital I/O Characteristics

Table 28: VBAT I/O Requirements (Unit: V)

Parameter	Description	Min.	Max.
V _{IH}	High-level input voltage	0.7 × VBAT	VBAT + 0.3
V _{IL}	Low-level input voltage	-0.3	0.3 × VBAT
V _{OH}	High-level output voltage	0.9 × VBAT	-
V _{OL}	Low-level output voltage	-	0.1 × 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.

⁷ The Wi-Fi function is disabled when the Bluetooth power consumption is tested.

Table 29: Electrostatic Discharge 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

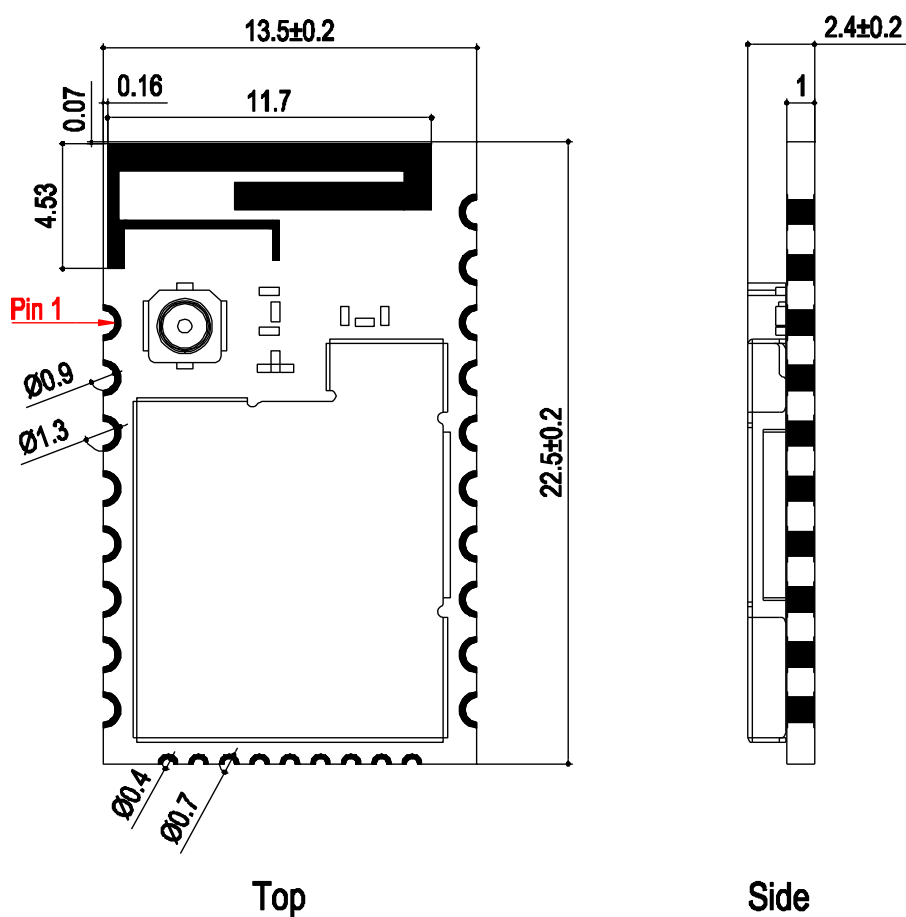


Figure 25: Top and Side Dimensions

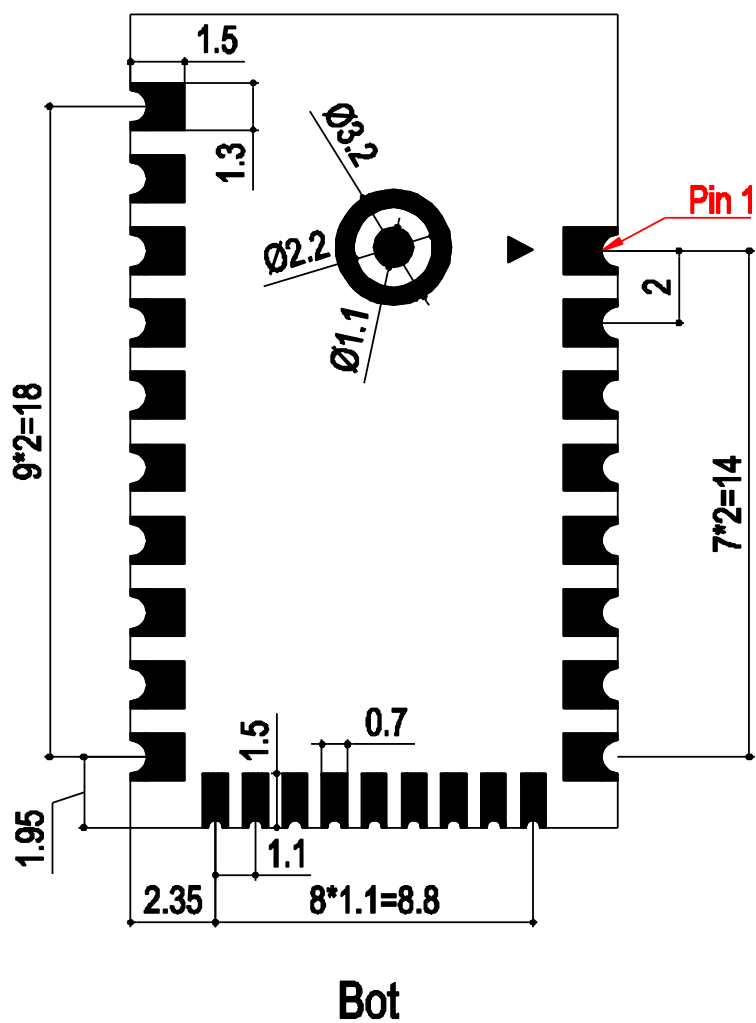


Figure 26: Bottom Dimensions (Bottom View)

NOTE

The module's coplanarity standard: ≤ 0.13 mm.

7.2. Recommended Footprint

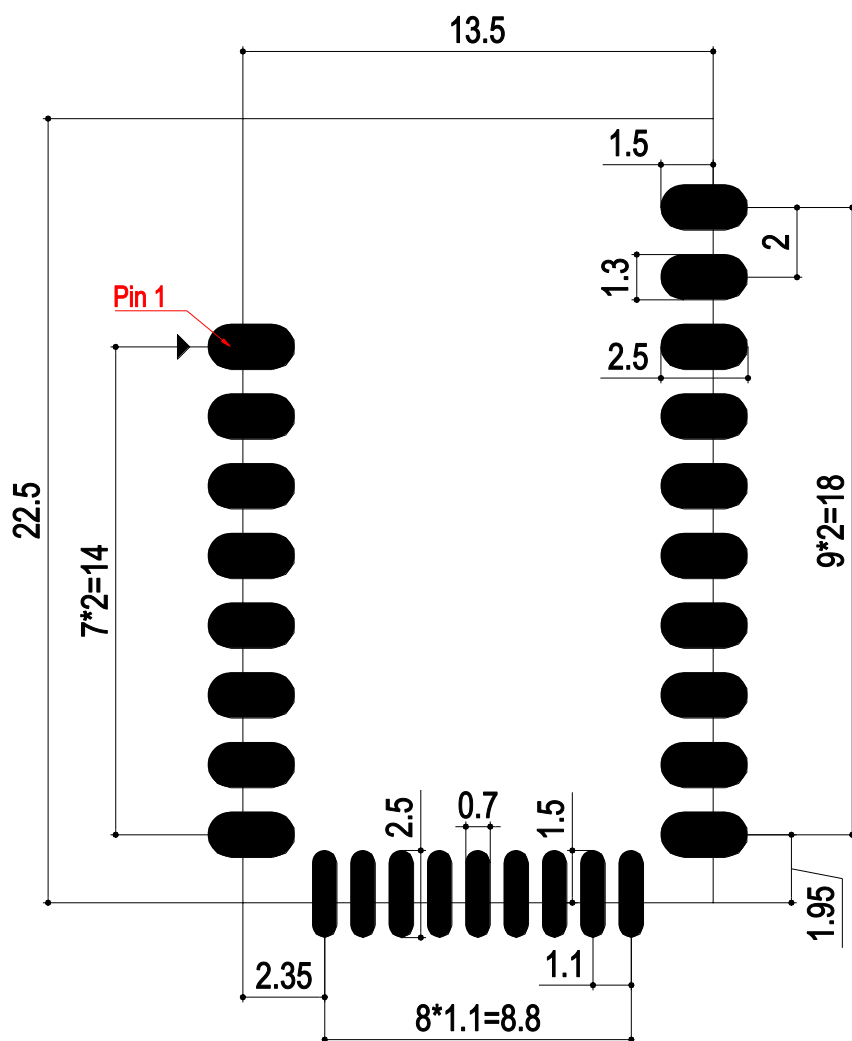


Figure 27: Recommended Footprint

NOTE

Keep at least 3 mm between the module and other components on the motherboard to improve soldering quality and maintenance convenience.

7.3. Top and Bottom Views

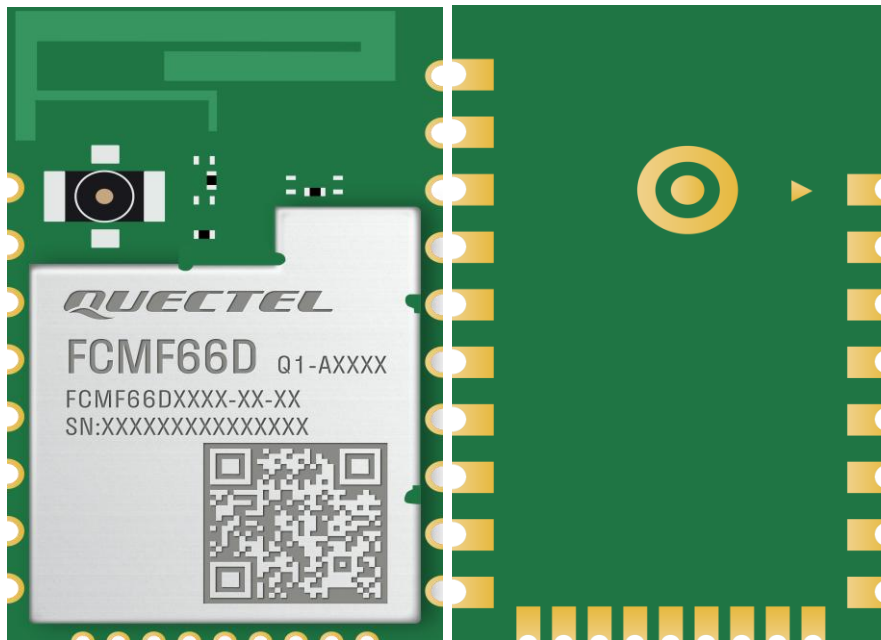


Figure 28: Top and Bottom Views (RF Coaxial Connector)

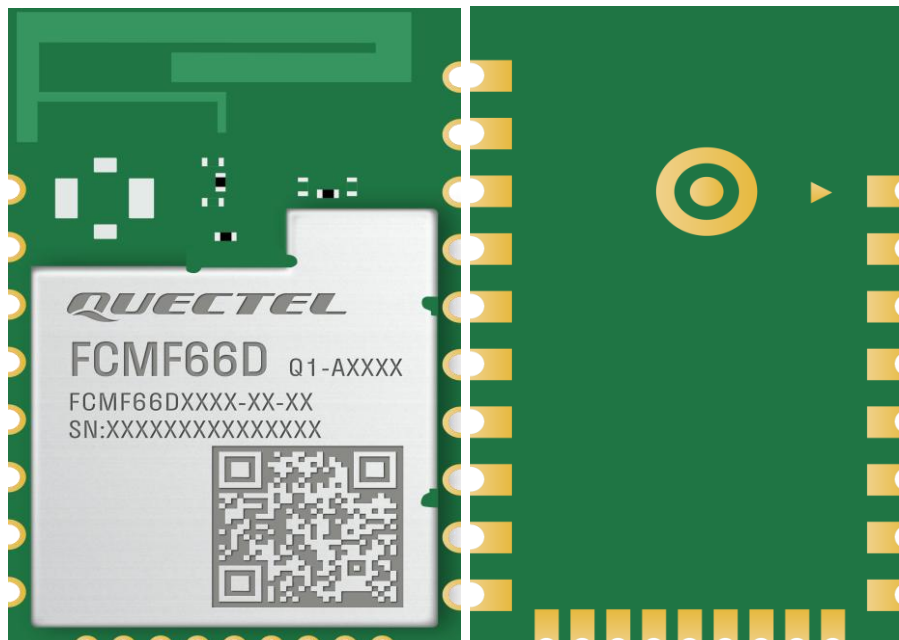


Figure 29: Top and Bottom Views (Pin Antenna Interface)

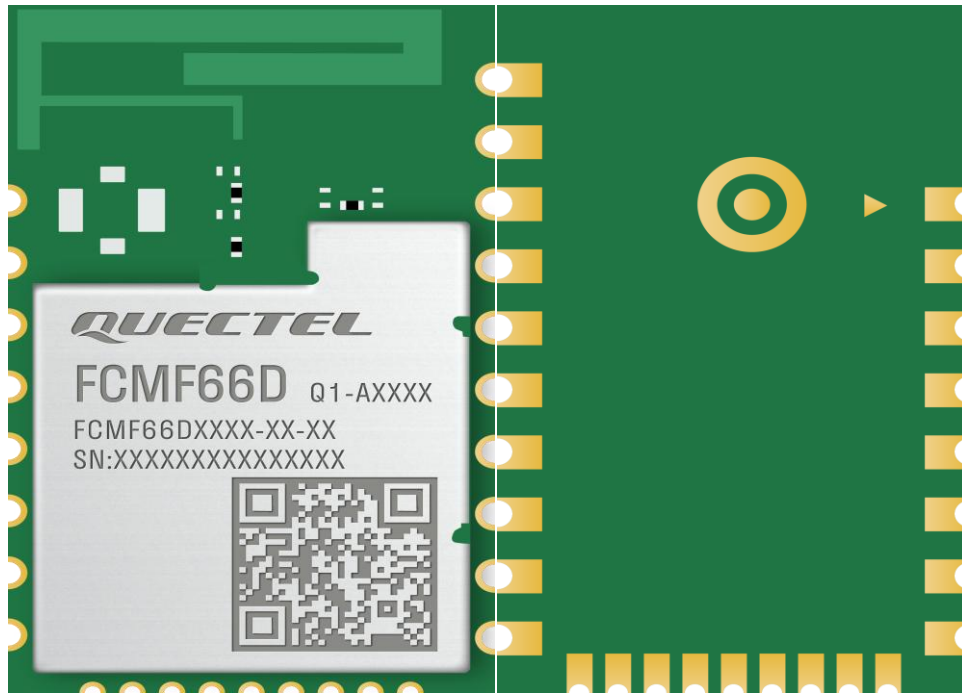


Figure 30: Top and Bottom Views (PCB Antenna)

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 soldered on the module when using pin antenna interface (ANT_WIFI/BT) or PCB antenna.

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 ⁸ 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 24 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.

⁸ 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*. And do not unpack the modules in large quantities until they are ready for soldering.

NOTE

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 0.08–0.12 mm. For more details, see **document [3]**.

The recommended peak reflow temperature should be 235–246 °C, with 246 °C 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.

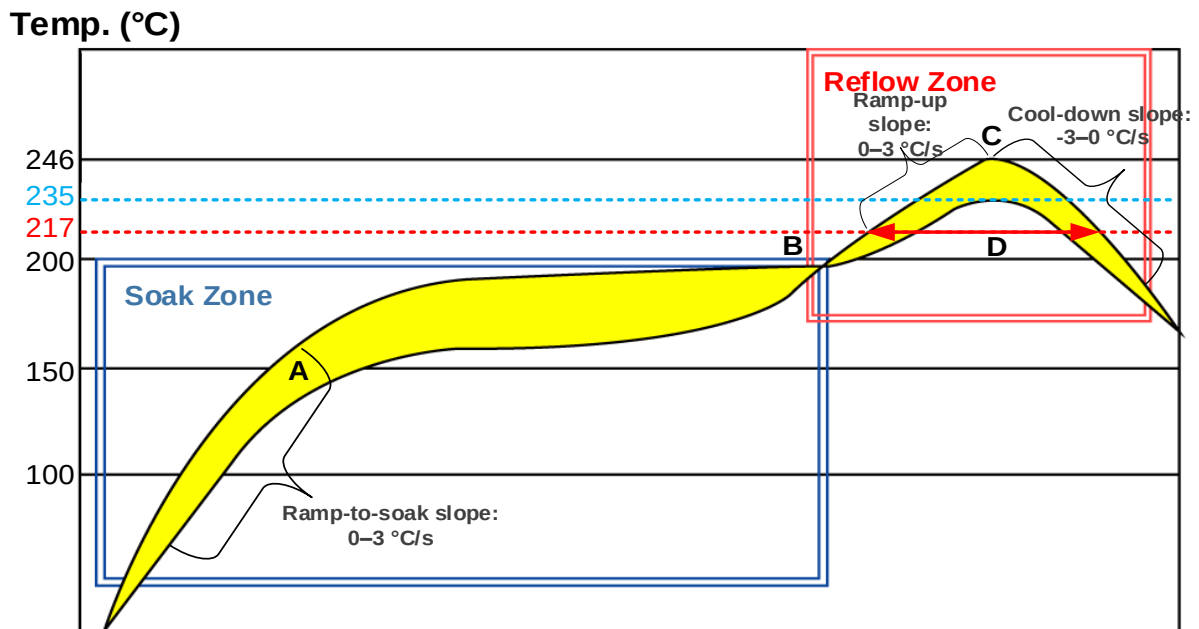


Figure 31: Recommended Reflow Soldering Thermal Profile

Table 30: 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. Avoid using materials that contain mercury (Hg), such as adhesives, for module processing, even if the materials are RoHS compliant and their mercury content is below 1000 ppm (0.1 %).
7. Corrosive gases may corrode the electronic components inside the module, affecting their reliability and performance, and potentially leading to a shortened service life that fails to meet the designed lifespan. Therefore, do not store or use unprotected modules in environments containing corrosive gases such as hydrogen sulfide, sulfur dioxide, chlorine, and ammonia.
8. 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 [4]**.

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:

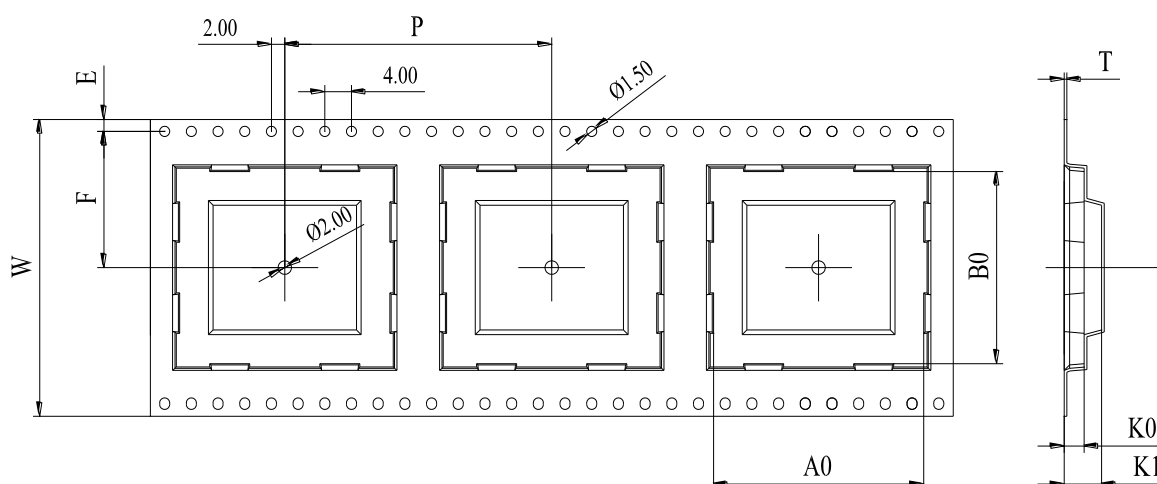


Figure 32: Carrier Tape Dimension Drawing (Unit: mm)

Table 31: Carrier Tape Dimension Table (Unit: mm)

W	P	T	A0	B0	K0	K1	F	E
32	24	0.4	13.6	12.9	2.3	3.2	14.2	1.75

8.3.2. Plastic Reel

Plastic reel dimensions are illustrated in the following figure and table:

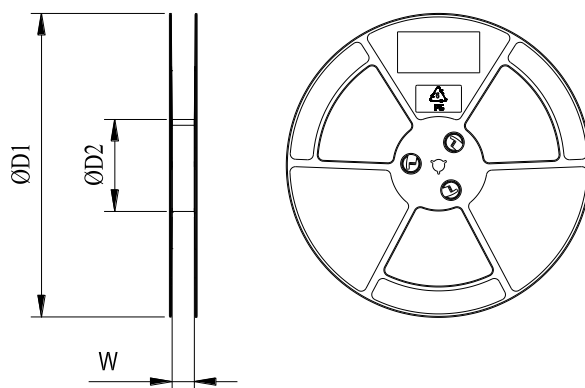


Figure 33: Plastic Reel Dimension Drawing

Table 32: Plastic Reel Dimension Table (Unit: mm)

ØD1	ØD2	W
380	100	32.5

8.3.3. Mounting Direction

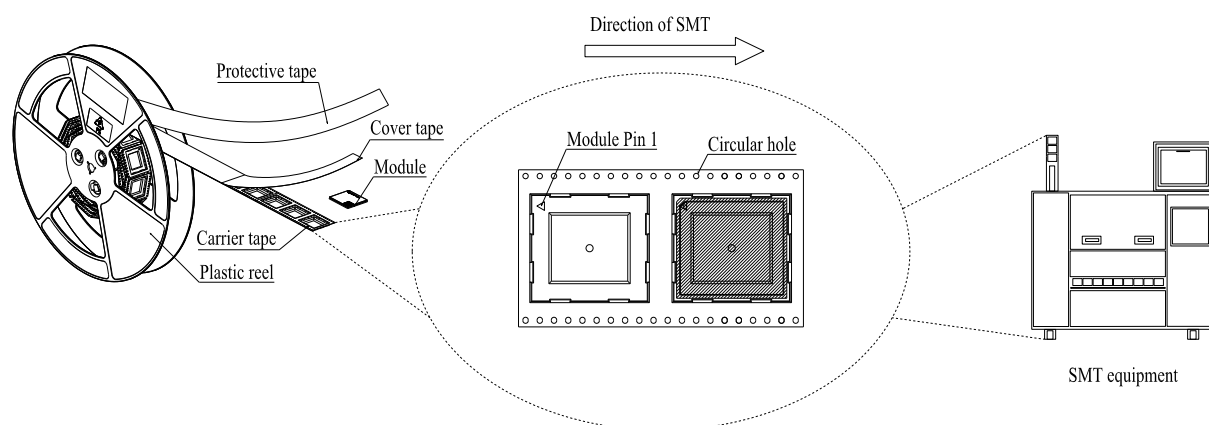
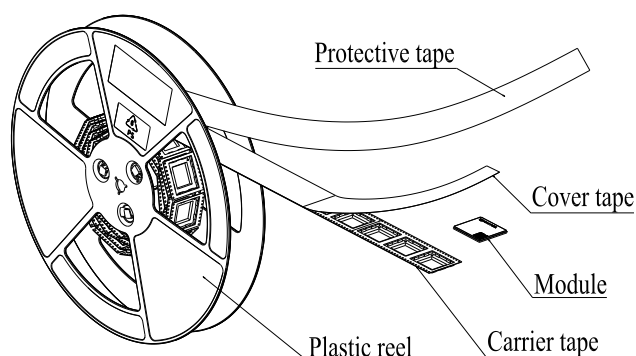


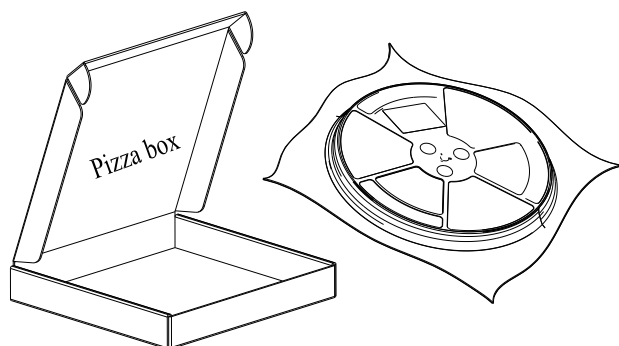
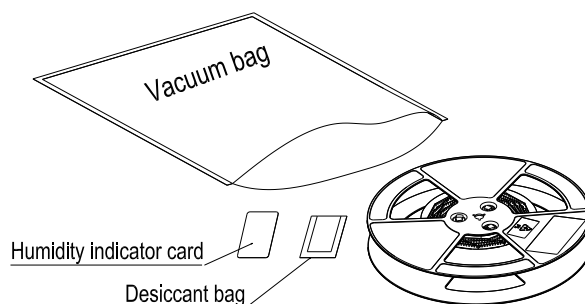
Figure 34: Mounting Direction

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.

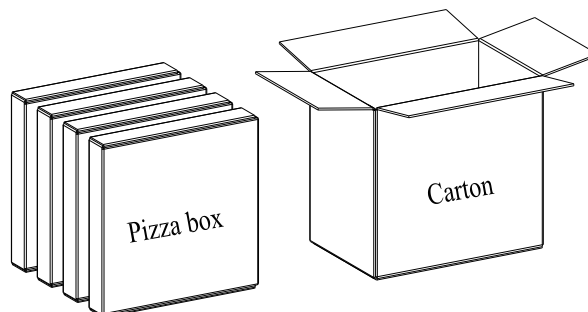


Figure 35: Packaging Process

9 Appendix References

Table 33: Related Documents

Document Name
[1] Quectel_FCMF66D_TE-B_User_Guide
[2] Quectel_RF_Layout_Application_Note
[3] Quectel_Module_Stencil_Design_Requirements
[4] Quectel_Module_SMT_Application_Note

Table 34: 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
CBC	Cipher Block Chaining
CCK	Complementary Code Keying
DBPSK	Differential Binary Phase Shift Keying
DC	Direct Current
DQPSK	Differential Quadrature Phase Shift Keying
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
LCC	Leadless Chip Carrier
MAC	Medium Access Control
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/Phase Shift Keying
PWM	Pulse Width Modulation
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RoHS	Restriction of Hazardous Substances
SAE	Simultaneous Authentication of Equals
SDIO	Secure Digital Input/Output
SHA	Secure Hash Algorithm
SMT	Surface Mount Technology
SPI	Serial Peripheral Interface
STA	Station
TVS	Transient Voltage Suppressor
Tx	Transmit

UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
(U)SIM	(Universal) Subscriber Identity Module
VBAT	Voltage at Battery
V_{IH}	High-level Input Voltage
V_{IL}	Low-level Input Voltage
V_{max}	Maximum Voltage
V_{min}	Minimum Voltage
V_{nom}	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

2.3 Specific operational use conditions

The module can be used for mobile applications with a maximum -0.5dBi antenna. The host manufacturer installing this module into their product must ensure that the final 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 shown 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 host's 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 user's body; and if RF exposure statement or module layout is changed, then the host product manufacturer is 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: PCB Antenna

Gain: 2.4G:-0.5dBi;

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: XMR2025FCMF66D" 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, etc. 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 circuitry), 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 PCB 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: XMR2025FCMF66D**"

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 shown in this manual.