

# FCMA62N Hardware Design

**Short Range Module Series**

Version: 1.0.0

Date: 2024-05-10

Status: Preliminary



At Quectel, our aim is to provide timely and comprehensive services to our customers. If you require any assistance, please contact our headquarters:

**Quectel Wireless Solutions Co., Ltd.**

Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China

Tel: +86 21 5108 6236

Email: [info@quectel.com](mailto:info@quectel.com)

**Or our local offices. For more information, please visit:**

<http://www.quectel.com/support/sales.htm>.

**For technical support, or to report documentation errors, please visit:**

<http://www.quectel.com/support/technical.htm>.

Or email us at: [support@quectel.com](mailto:support@quectel.com).

## Legal Notices

We offer information as a service to you. The provided information is based on your requirements and we make every effort to ensure its quality. You agree that you are responsible for using independent analysis and evaluation in designing intended products, and we provide reference designs for illustrative purposes only. Before using any hardware, software or service guided by this document, please read this notice carefully. Even though we employ commercially reasonable efforts to provide the best possible experience, you hereby acknowledge and agree that this document and related services hereunder are provided to you on an “as available” basis. We may revise or restate this document from time to time at our sole discretion without any prior notice to you.

## Use and Disclosure Restrictions

### License Agreements

Documents and information provided by us shall be kept confidential, unless specific permission is granted. They shall not be accessed or used for any purpose except as expressly provided herein.

### Copyright

Our and third-party products hereunder may contain copyrighted material. Such copyrighted material shall not be copied, reproduced, distributed, merged, published, translated, or modified without prior written consent. We and the third party have exclusive rights over copyrighted material. No license shall be granted or conveyed under any patents, copyrights, trademarks, or service mark rights. To avoid ambiguities, purchasing in any form cannot be deemed as granting a license other than the normal non-exclusive, royalty-free license to use the material. We reserve the right to take legal action for noncompliance with abovementioned requirements, unauthorized use, or other illegal or malicious use of the material.

## Trademarks

Except as otherwise set forth herein, nothing in this document shall be construed as conferring any rights to use any trademark, trade name or name, abbreviation, or counterfeit product thereof owned by Quectel or any third party in advertising, publicity, or other aspects.

## Third-Party Rights

This document may refer to hardware, software and/or documentation owned by one or more third parties ("third-party materials"). Use of such third-party materials shall be governed by all restrictions and obligations applicable thereto.

We make no warranty or representation, either express or implied, regarding the third-party materials, including but not limited to any implied or statutory, warranties of merchantability or fitness for a particular purpose, quiet enjoyment, system integration, information accuracy, and non-infringement of any third-party intellectual property rights with regard to the licensed technology or use thereof. Nothing herein constitutes a representation or warranty by us to either develop, enhance, modify, distribute, market, sell, offer for sale, or otherwise maintain production of any our products or any other hardware, software, device, tool, information, or product. We moreover disclaim any and all warranties arising from the course of dealing or usage of trade.

## Privacy Policy

To implement module functionality, certain device data are uploaded to Quectel's or third-party's servers, including carriers, chipset suppliers or customer-designated servers. Quectel, strictly abiding by the relevant laws and regulations, shall retain, use, disclose or otherwise process relevant data for the purpose of performing the service only or as permitted by applicable laws. Before data interaction with third parties, please be informed of their privacy and data security policy.

## Disclaimer

- a) We acknowledge no liability for any injury or damage arising from the reliance upon the information.
- b) We shall bear no liability resulting from any inaccuracies or omissions, or from the use of the information contained herein.
- c) While we have made every effort to ensure that the functions and features under development are free from errors, it is possible that they could contain errors, inaccuracies, and omissions. Unless otherwise provided by valid agreement, we make no warranties of any kind, either implied or express, and exclude all liability for any loss or damage suffered in connection with the use of features and functions under development, to the maximum extent permitted by law, regardless of whether such loss or damage may have been foreseeable.
- d) We are not responsible for the accessibility, safety, accuracy, availability, legality, or completeness of information, advertising, commercial offers, products, services, and materials on third-party websites and third-party resources.

**Copyright © Quectel Wireless Solutions Co., Ltd. 2024. All rights reserved.**

## Safety Information

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



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



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



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



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



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



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

# About the Document

## Revision History

Version	Date	Author	Description
-	2024-05-10	Lisa LI/Stephen LI	Creation of the document
1.0.0	2024-05-10	Lisa LI/Stephen LI	Preliminary

## Contents

<b>Safety Information.....</b>	<b>3</b>
<b>About the Document.....</b>	<b>4</b>
<b>Contents.....</b>	<b>5</b>
<b>Table Index.....</b>	<b>7</b>
<b>Figure Index.....</b>	<b>8</b>
<b>1 Introduction.....</b>	<b>9</b>
1.1. Special Mark .....	10
<b>2 Product Overview .....</b>	<b>11</b>
2.1. Key Features.....	12
<b>3 Application Interfaces .....</b>	<b>13</b>
3.1. Pin Assignment .....	13
3.2. Pin Definitions .....	14
3.3. GPIO Multiplexing .....	16
3.4. Interface Definition .....	17
3.4.1. UART Interfaces .....	17
3.4.2. SWD Interface .....	19
3.4.3. SPI Interface* .....	20
3.4.4. I2C Interfaces* .....	20
3.4.5. I2S Interface* .....	21
3.4.6. PWM Interfaces* .....	22
<b>4 Operating Characteristics.....</b>	<b>23</b>
4.1. Power Supply .....	23
4.1.1. Reference Design for Power Supply .....	23
4.2. Turn-on.....	24
4.3. Reset.....	24
<b>5 RF Performances.....</b>	<b>26</b>
5.1. Wi-Fi Performances .....	26
5.2. Bluetooth Performances .....	27
5.3. Antenna/Antenna Interface .....	28
5.3.1. PCB Antenna .....	28
5.3.2. RF Coaxial Connector .....	31
5.3.2.1. Antenna Connector Specifications.....	31
5.3.2.2. Recommended RF Connector Installation.....	33
5.3.2.3. Recommended Manufacturers of RF Connector and Cable .....	34
5.4. Wire to Board Wafer .....	35
5.4.1. Recommended Wire to Board Wafer .....	35

<b>6 Electrical Characteristics and Reliability.....</b>	<b>36</b>
6.1. Absolute Maximum Ratings .....	36
6.2. Power Supply Ratings.....	36
6.3. Power Consumption.....	37
6.3.1. Wi-Fi Power Consumption.....	37
6.3.2. Bluetooth Power Consumption .....	38
6.4. Digital I/O Characteristics .....	38
6.5. ESD Protection .....	38
6.6. Thermal Dissipation .....	39
<b>7 Mechanical Information .....</b>	<b>41</b>
7.1. Mechanical Dimensions .....	41
7.2. Recommended Footprint .....	43
7.3. Top and Bottom Views.....	44
<b>8 Storage, Manufacturing and Packaging.....</b>	<b>46</b>
8.1. Storage Conditions .....	46
8.2. Manufacturing and Soldering.....	47
8.3. Packaging Specification.....	49
8.3.1. Carrier Tape.....	49
8.3.2. Plastic Reel.....	50
8.3.3. Mounting Direction.....	50
8.3.4. Packaging Process.....	51
<b>9 Appendix References.....</b>	<b>52</b>

## Table Index

Table 1 : Special Mark .....	10
Table 2 : Basic Information .....	11
Table 3 : Key Features .....	12
Table 4 : Parameter Definition .....	14
Table 5 : Pin Description.....	14
Table 6 : GPIO Multiplexing.....	16
Table 7 : Pin Description of UART Interfaces.....	17
Table 8 : Pin Description of SWD Interface.....	19
Table 9 : Pin Description of SPI Interface.....	20
Table 10 : Pin Description of I2C Interfaces .....	21
Table 11 : Pin Description of I2S Interface .....	21
Table 12 : Pin Description of PWM Interfaces.....	22
Table 13 : Pin Definition of Power Supplies and GND Pins .....	23
Table 14 : Pin Definition of CHIP_EN.....	24
Table 15 : Pin Definition of CHIP_EN.....	24
Table 16 : Wi-Fi Performances.....	26
Table 17 : Bluetooth Performances .....	27
Table 18 : Requirements for PCB Antenna .....	28
Table 19 : Major Specifications of the RF Connector .....	31
Table 20 : Absolute Maximum Ratings (Unit: V) .....	36
Table 21 : Module Power Supply Ratings (Unit: V) .....	36
Table 22 : Wi-Fi Power Consumption in Non-signaling Mode (Unit: mA) .....	37
Table 23 : Bluetooth Power Consumption in Non-signaling Mode (Unit: mA).....	38
Table 24 : VBAT I/O Requirements (Unit: V).....	38
Table 25 : ESD Characteristics (Unit: kV) .....	39
Table 26 : Recommended Thermal Profile Parameters .....	48
Table 27 : Carrier Tape Dimension Table (Unit: mm) .....	49
Table 28 : Plastic Reel Dimension Table (Unit: mm).....	50
Table 29 : Reference Documents.....	52
Table 30 : Terms and Abbreviations.....	52



## Figure Index

Figure 2 : Pin Assignment (Top View) .....	13
Figure 3 : UART0 Interface Connection .....	18
Figure 4 : UART1 Interface Connection .....	18
Figure 5 : UART2 Interface Connection .....	18
Figure 6 : Reference Design of UART3 Interface.....	19
Figure 7 : SWD Interface Connection.....	19
Figure 8 : SPI Connection.....	20
Figure 9 : Reference Design of Power Supply .....	23
Figure 10 : Turn-on Timing .....	24
Figure 11 : Reset Timing .....	25
Figure 12 : Keepout Area on Motherboard.....	29
Figure 13 : Prohibited Area for Routing .....	30
Figure 14 : Dimensions of the Receptacle (Unit: mm).....	31
Figure 15 : Plug specifications matching the antenna base (unit: mm).....	32
Figure 16 : Installation diagram of RF connector (unit: mm) .....	32
Figure 17 : Plug in a Coaxial Cable Plug.....	33
Figure 18 : Pull out a Coaxial Cable Plug.....	33
Figure 19 : Install the Coaxial Cable Plug with Jig .....	34
Figure 20 : Pitch Wire to Board Wafer (Unit: mm).....	35
Figure 21 : Placement and Fixing of the Heatsink.....	40
Figure 22 : Top and Side Dimensions .....	41
Figure 23 : Bottom Dimensions (Bottom View) .....	42
Figure 24 : Recommended Footprint.....	43
Figure 25 : Top and Bottom Views (PCB Antenna) .....	44
Figure 26 : Top and Bottom Views (RF Coaxial Connector) .....	44
Figure 27 : Recommended Reflow Soldering Thermal Profile .....	47
Figure 28 : Carrier Tape Dimension Drawing (Unit: mm) .....	49
Figure 29 : Plastic Reel Dimension Drawing .....	50
Figure 30 : Mounting Direction .....	50
Figure 31 : Packaging Process.....	51

# 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 the FCMA62N and describes its hardware interfaces and air interfaces which are connected with your applications. With this document, you can quickly understand module interface specifications, RF performances, electrical and mechanical details, as well as other related information of the module.

Hereby, Quectel Wireless Solutions Co., Ltd. declares that the radio equipment type FCMA62N is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at the following internet address:  
<http://www.quectel.com/support/technical.htm>


## Disposal of old electrical appliances



The European directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE), requires that old household electrical appliances must not be disposed of in the normal unsorted municipal waste stream. Old appliances must be collected separately in order to optimize the recovery and recycling of the materials they contain, and reduce the impact on human health and the environment.

The crossed out “wheeled bin” symbol on the product reminds you of your obligation, that when you dispose of the appliance, it must be separately collected.

Consumers should contact their local authority or retailer for information concerning the correct disposal of their old appliance.

	AT	BE	BG	HR	CY	CZ	DK
	EE	FI	FR	DE	EL	HU	IE
	IT	LV	LT	LU	MT	NL	PL
	PT	RO	SK	SI	ES	SE	UK(NI)

This equipment should be installed and operated with minimum distance 20cm between the radiator and your body. The device is restricted to indoor use only when operating in the 5150 to 5350 MHz frequency range.

## 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.

## 2 Product Overview

FCMA62N is a low-power, cost-effective MCU Wi-Fi 6 and Bluetooth module supporting IEEE 802.11a/b/g/n/ac/ax and BLE 5.3 protocols. The module has multiple interfaces including UART, SWD, SPI\*, I2C\*, I2S\* and PWM\* for various applications.

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

- 260 MHz Cortex-M33 processor
- Built-in 1.2 MB SRAM and 8 MB flash
- Support for secondary development

**Table 2: Basic Information**

FCMA62N	
Packaging type	LCC
Pin counts	18
Dimensions	(38.3 ±0.2) mm × (21.6 ±0.2) mm × (4.75 ±0.2) mm
Weight	Approx. 3.6 g

## 2.1. Key Features

Table 3: Key Features

Basic Information	
Protocols and Standard	<ul style="list-style-type: none"> <li>● Wi-Fi Protocols: IEEE 802.11a/b/g/n/ac/ax</li> <li>● Bluetooth protocol: BLE 5.3</li> <li>● All hardware components are fully compliant with EU RoHS directive</li> </ul>
Power Supply	<b>VBAT Power Supply:</b> <ul style="list-style-type: none"> <li>● 4.5–5.5 V</li> <li>● Typ.: 5.0 V</li> </ul>
Temperature Ranges	<ul style="list-style-type: none"> <li>● Operating temperature <sup>1</sup>: -40 °C to +85 °C</li> <li>● Storage temperature: -45 °C to +95 °C</li> </ul>
TE-B Kit	FCMA62N-TE-B <sup>2</sup>
Antenna/Antenna Interface	
Antenna/Antenna Interface <sup>3</sup>	<ul style="list-style-type: none"> <li>● PCB antenna</li> <li>● RF coaxial connector</li> <li>● 50 Ω characteristic impedance</li> </ul>
Application Interface <sup>4</sup>	
Application Interfaces	UART, SWD, SPI*, I2C*, I2S*, PWM*

<sup>1</sup> Within the operating temperature range, the module's related performance meets IEEE and Bluetooth specifications.

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

<sup>3</sup> The module is provided with one of the two antenna/antenna interface designs. For more details, please contact Quectel Technical Support.

<sup>4</sup> For more details about the interfaces, see **Chapter 3.3** and **Chapter 3.4**.

# 3 Application Interfaces

## 3.1. Pin Assignment

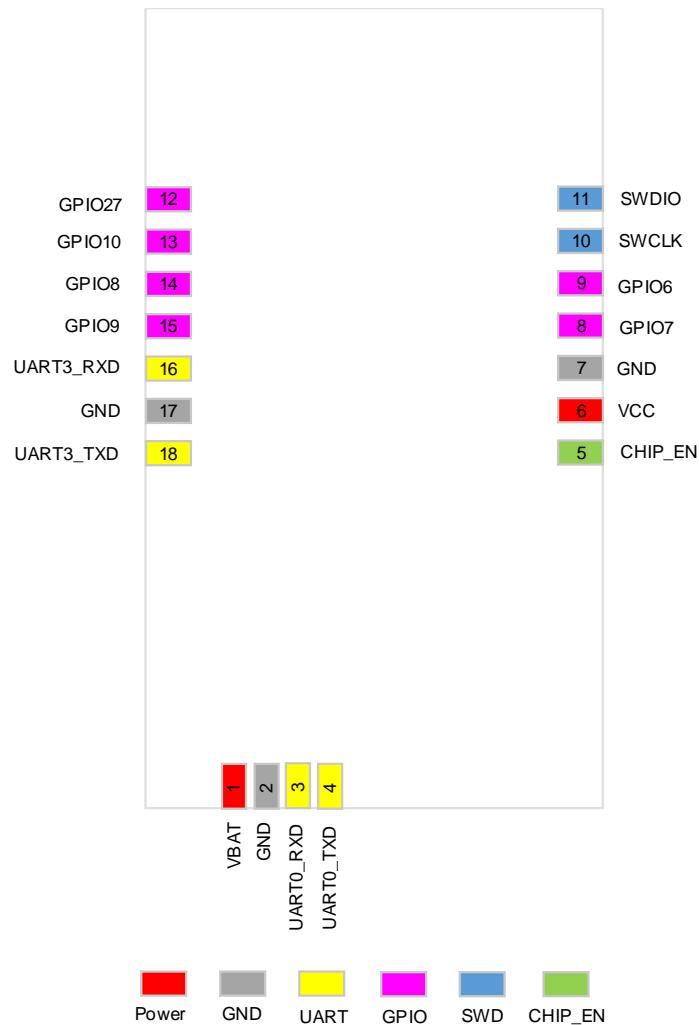


Figure 1: Pin Assignment (Top View)

### NOTE

1. All GND pins should be connected to ground.
2. The module has UART, SWD, and 6 GPIO interfaces by default. In the case of multiplexing, it supports interfaces including SPI\*, I2C\*, I2S\*, and PWM\*. For more details, see **Chapter 3.3** and **Chapter 3.4**.

## 3.2. Pin Definitions

Table 4: Parameter Definition

Parameter	Description
DI	Digital Input
DO	Digital Output
DIO	Digital Input/Output
PI	Power Input
PO	Power Output
PU	Pull Up
PD	Pull Down
Hi-Z	High Impedance

DC characteristics include power domain and rated current.

Table 5: Pin Description

Power Supplies and GND Pins						
Pin Name	Pin No.	I/O	Status after Rest	Description	DC Characteristics	Comment
VBAT	1	PI	-	Power supply for the module	Vmax = 5.5 V Vmin = 4.5 V Vnom = 5.0 V	It must be provided with sufficient current of at least 0.8 A.
VCC	6	PO	-	3.3 V output	Vmax = 3.6 V Vmin = 3.0 V Vnom = 3.3 V	For debugging, maximum current 0.3 A.
GND	2, 7, 17					
Turn on/off						
Pin Name	Pin No.	I/O	Status after Rest	Description	DC Characteristics	Comment
CHIP_EN	5	DI	PU	Turn on/off the	3.3 V	Internally pulled up

module

Reset the  
module

to 3.3 V with a  
51 kΩ resistor.  
Active high.

### UART Interfaces

Pin Name	Pin No.	I/O	Status after Rest	Description	DC Characteristics	Comment
UART0_RXD	3	DI	PU	UART0 receive	VBAT	
UART0_TXD	4	DO	PU	UART0 transmit		
UART3_RXD	16	DI	PU	UART3 receive		
UART3_TXD	18	DO	PU	UART3 transmit		

### SWD Interface

Pin Name	Pin No.	I/O	Status after Rest	Description	DC Characteristics	Comment
SWCLK	10	DI	PU	Serial data clock	VCC	
SWDIO	11	DIO	PU	Serial data input/output		

### GPIO Interfaces

Pin Name	Pin No.	I/O	Status after Rest	Description	DC Characteristics	Comment
GPIO7	8	DIO	Hi-Z	General-purpose input/output	VCC	
GPIO6	9	DIO	Hi-Z	General-purpose input/output		
GPIO27	12	DIO	Hi-Z	General-purpose input/output		
GPIO10	13	DIO	Hi-Z	General-purpose input/output		
GPIO8	14	DIO	Hi-Z	General-purpose input/output		
GPIO9	15	DIO	Hi-Z	General-purpose input/output		



### 3.3. GPIO Multiplexing

The module has UART, SWD, and 6 GPIO interfaces by default. 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
UART0_RXD	3	GPIO2	-	I2C0_SDA	-	-
UART0_TXD	4	GPIO3	PWM0	-	I2C0_SCL	-
GPIO7	8	GPIO7	UART1_SCK	SPI_SCK	I2S_SCK	-
GPIO6	9	GPIO6	UART1_CTS	SPI_CS	-	-
SWCLK	10	GPIO13	UART2_RXD	I2C2_SDA	-	-
SWDIO	11	GPIO14	UART2_TXD	I2C2_SCL	-	-
GPIO27	12	GPIO27	PWM5	-	-	-
GPIO10	13	GPIO10	UART1_RTS	-	-	-
GPIO8	14	GPIO8	UART1_TXD	SPI_MISO	I2C1_SCL	I2S_WS
GPIO9	15	GPIO9	UART1_RXD	SPI_MOSI	I2C1_SDA	I2S_DATA
UART3_RXD	16	GPIO24	-	I2C3_SDA	-	-
UART3_TXD	18	GPIO26	PWM4	-	I2C3_SCL	-

#### NOTE

1. After the module is powered off, all of its GPIOs must input low. Current leakage may make the module to be in an abnormal state.
2. 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

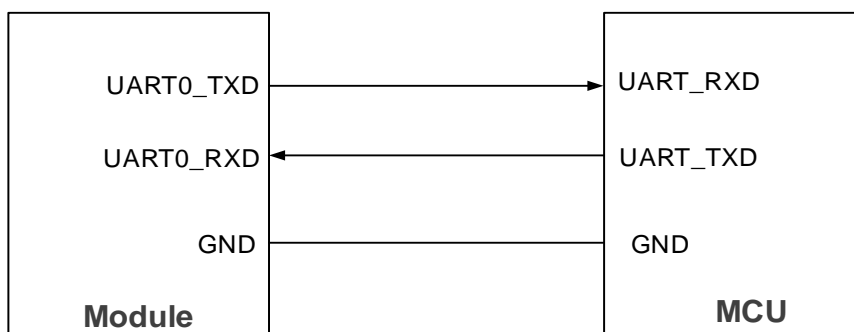
The module supports 2 UART interfaces (UART0 and UART 3) by default. In the case of multiplexing, it can support up to 4 UART interfaces (UART0, UART1, UART2 and UART3).

**Table 7: Pin Description of UART Interfaces**

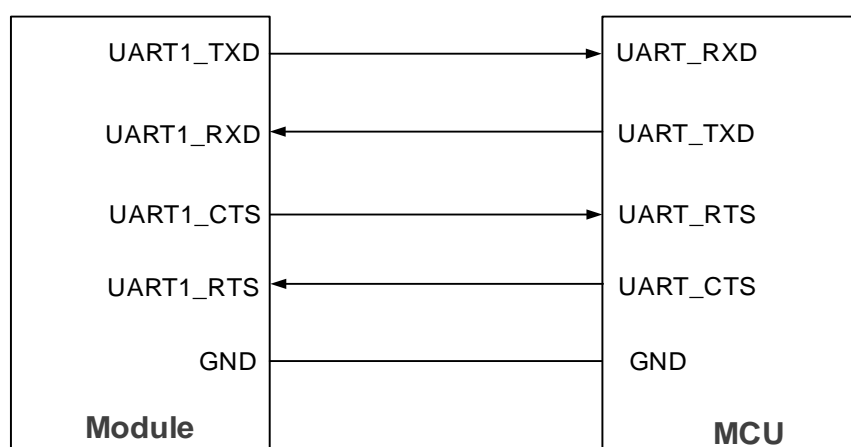
Pin Name	Pin No.	Alternate Function	I/O	Description
UART0_TXD	4	-	DO	UART0 transmit
UART0_RXD	3	-	DI	UART0 receive
GPIO8	14	UART1_TXD	DO	UART1 transmit
GPIO9	15	UART1_RXD	DI	UART1 receive
GPIO6	9	UART1_CTS	DO	Clear to send signal to the module
GPIO10	13	UART1_RTS	DI	Request to send signal from the module
SWDIO	11	UART2_TXD	DO	UART2 transmit
SWCLK	10	UART2_RXD	DI	UART2 receive
UART3_TXD	18	-	DO	UART3 transmit
UART3_RXD	16	-	DI	UART3 receive

UART0, UART1 and UART2 can be used for AT command communication and data transmission. The default baud rate is 115200 bps, and the maximum baud rate can reach 6 Mbps.

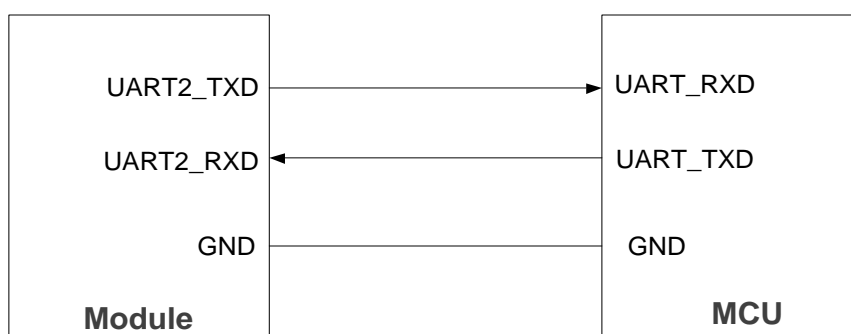
The UART interfaces connection between the module and the MCU are shown below:



**Figure 2: UART0 Interface Connection**

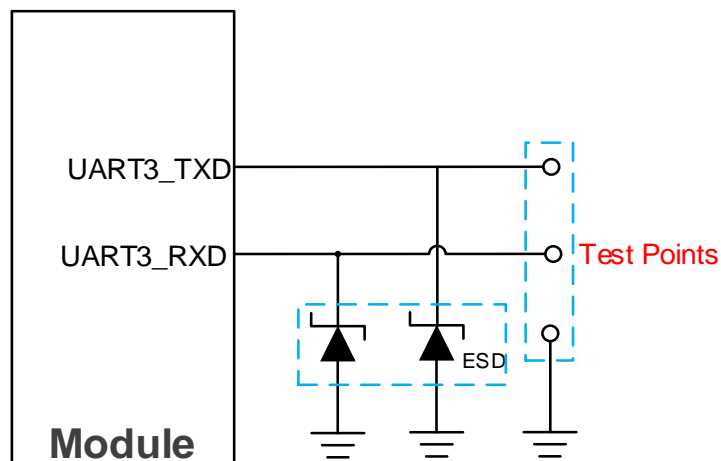


**Figure 3: UART1 Interface Connection**



**Figure 4: UART2 Interface Connection**

The debug UART3 supports 115200 bps baud rate by default, and is used for outputting partial logs with debugging tools. The following is a reference design of debug UART3.



**Figure 5: Reference Design of UART3 Interface**

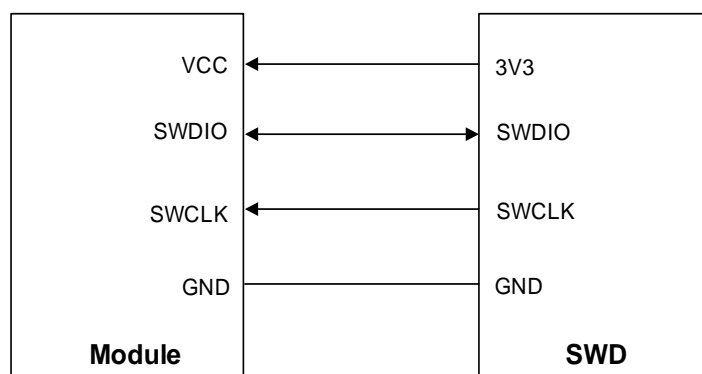
### 3.4.2. SWD Interface

The module supports 2-line Serial Wire Debug interface (SWD).

### Table 8: Pin Description of SWD Interface

Pin Name	Pin No.	Alternate Function	I/O	Description
SWCLK	10	UART2_RXD	DI	Serial data clock
SWDIO	11	UART2_TXD	DO	Serial data input/output

The SWD interface connection between the module and the host is shown below:



### Figure 6: SWD Interface Connection

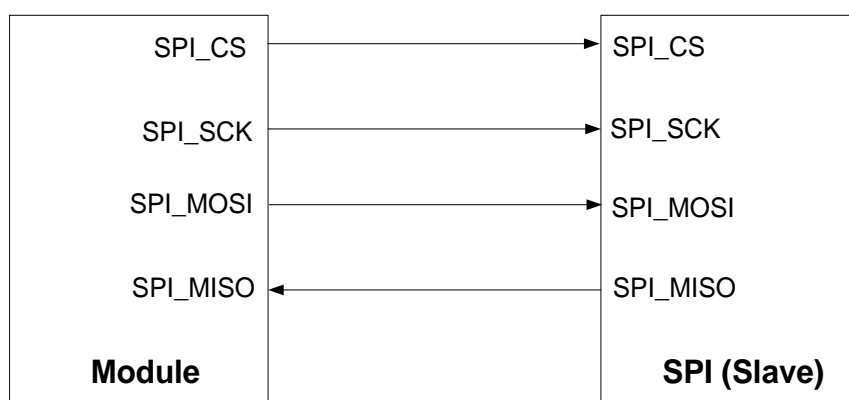
### 3.4.3. SPI Interface\*

In the case of multiplexing, the module provides 1 SPI which only supports master mode with a maximum clock frequency of up to 30 MHz.

**Table 9: Pin Description of SPI Interface**

Pin Name	Pin No.	Alternate Function	I/O	Description
GPIO6	9	SPI_CS	DO	SPI chip select
GPIO7	8	SPI_SCK	DO	SPI clock
GPIO8	14	SPI_MISO	DI	SPI master-in slave-out
GPIO9	15	SPI_MOSI	DO	SPI master-out slave-in

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



**Figure 7: SPI Connection**

### 3.4.4. I2C Interfaces\*

In the case of multiplexing, the module provides up to 4 I2C interfaces that support master mode only. It supports:

- AMBA 2.0 APB bus protocol
- Standard-speed mode (100 kbps), high-speed mood (400 kbps) and fast-speed mode (3400 kbps) protocols
- Programmable master mode
- 7-bit and 10-bit addressing modes
- Programmable clock and data timing

- DMA
- Universal call address

**Table 10: Pin Description of I2C Interfaces**

Pin Name	Pin No.	Alternate Function	I/O	Description
UART0_TXD	4	I2C0_SCL	OD	I2C0 serial clock
UART0_RXD	3	I2C0_SDA	OD	I2C0 serial data
GPIO8	14	I2C1_SCL	OD	I2C1 serial clock
GPIO9	15	I2C1_SDA	OD	I2C1 serial data
SWDIO	11	I2C2_SCL	OD	I2C2 serial clock
SWCLK	10	I2C2_SDA	OD	I2C2 serial data
UART3_TXD	18	I2C3_SCL	OD	I2C3 serial clock
UART3_RXD	16	I2C3_SDA	OD	I2C3 serial data

### 3.4.5. I2S Interface\*

In the case of multiplexing, the module provides one I2S interface which supports both master and slave modes with sampling rates from 8 kHz to 384 kHz.

**Table 11: Pin Description of I2S Interface**

Pin Name	Pin No.	Alternate Function	I/O	Description
GPIO8	14	I2S_WS	DO	I2S channel select
GPIO7	8	I2S_SCK	DO	I2S bit clock
GPIO9	15	I2S_DATA	DI	I2S data input

### 3.4.6. PWM Interfaces\*

In the case of multiplexing, the module supports up to 3 PWM channels.

**Table 12: Pin Description of PWM Interfaces**

Pin Name	Pin No.	Alternate Function	I/O	Description	Comment
UART0_TXD	4	PWM0	DO	PWM out	The power domain of PWM0 is 5 V; the power domain of PWM4 and PWM5 is 3.3 V.
UART3_TXD	18	PWM4	DO	PWM out	
GPIO27	12	PWM5	DO	PWM out	

# 4 Operating Characteristics

## 4.1. Power Supply

Table 13: Pin Definition of Power Supplies and GND Pins

Pin Name	Pin No.	I/O	Description	Min.	Typ.	Max.	Unit
VBAT	1	PI	Power supply for the module	4.5	5.0	5.5	V
VCC	6	PO	3.3 V output	3.0	3.3	3.6	V
GND	2, 7, 17						

### 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 with sufficient current of at least 0.8 A. For better power supply performance, it is recommended to parallel a 22  $\mu$ F decoupling capacitor, and two filter capacitors (1  $\mu$ F and 100 nF) near the module's VBAT pin. And 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:

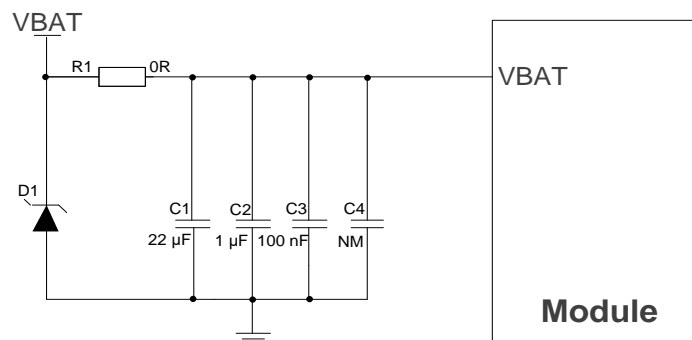


Figure 8: Reference Design of Power Supply



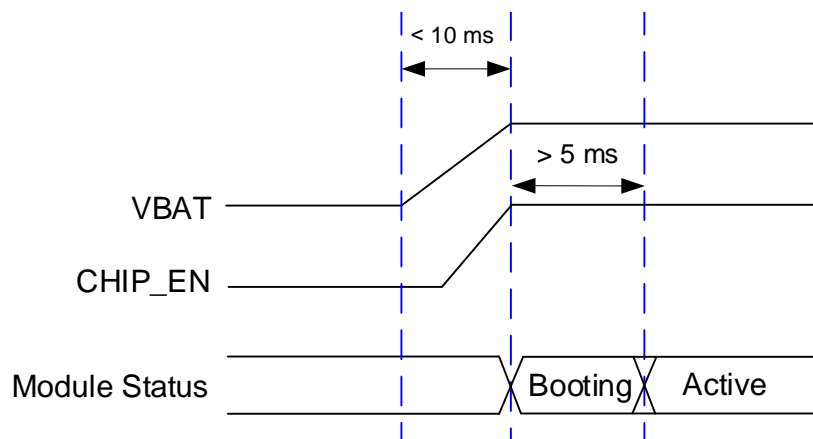
## 4.2. Turn-on

After the module VBAT is powered on, keep the CHIP\_EN at high level for more than 5 ms 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	5	DI	Turn on/off the module	Internally pulled up to 3.3 V with a 51 kΩ resistor. Active high.

The turn-on timing is shown below:



**Figure 9: Turn-on Timing**

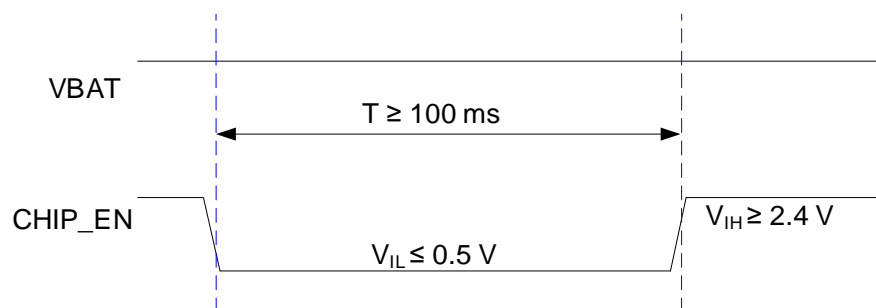
## 4.3. Reset

Drive CHIP\_EN low for at least 100 ms and then release it to reset the module.

**Table 15: Pin Definition of CHIP\_EN**

Pin Name	Pin No.	I/O	Description	Comment
CHIP_EN	5	DI	Reset the module	Internally pulled up with a 51 kΩ resistor. Active high.

The module reset timing is illustrated in the following figure.



**Figure 10: Reset Timing**

# 5 RF Performances

## 5.1. Wi-Fi Performances

Table 16: Wi-Fi Performances

Operating Frequency			
<ul style="list-style-type: none"> <li>● <b>2.4 GHz:</b> 2.400–2.4835 GHz</li> <li>● <b>5 GHz:</b> 5.150–5.850 GHz</li> </ul>			
Modulation			
DSSS, OFDM, DBPSK, DQPSK, CCK, BPSK, QPSK, 16QAM, 64QAM, 256QAM			
Encryption Mode			
WEP, WPA, WPA2, WPA3			
Operating Mode			
<ul style="list-style-type: none"> <li>● AP</li> <li>● STA</li> </ul>			
Transmission Data Rate			
<ul style="list-style-type: none"> <li>● 802.11b: 1 Mbps, 2 Mbps, 5.5 Mbps, 11 Mbps</li> <li>● 802.11a/g: 6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps, 54 Mbps</li> <li>● 802.11n: HT20 (MCS 0–7)</li> <li>● 802.11ac: VHT20 (MCS 0–8)</li> <li>● 802.11ax: HE20 (MCS 0–9)</li> </ul>			
Condition (VBAT = 5.0 V; Temp.: 25 °C)	EVM	Typ.; Unit: dBm; Tolerance: ±2 dB	
		Transmitting Power	Receiver Sensitivity
2.4 GHz	≤ 35 %	802.11b @ 1 Mbps	18
		802.11b @ 11 Mbps	-94
	≤ -5 dB	802.11g @ 6 Mbps	18
			-87
			-89

5 GHz	802.11g @ 54 Mbps	≤ -25 dB	17	-73
	802.11n, HT20 @ MCS 0	≤ -5 dB	18	-89
	802.11n, HT20 @ MCS 7	≤ -27 dB	16	-70
	802.11ax, HE20 @ MCS 0	≤ -5 dB	18	-86
	802.11ax, HE20 @ MCS 9	≤ -32 dB	15	-60
	802.11a @ 6 Mbps	≤ -5 dB	17	-89
	802.11a @ 54 Mbps	≤ -25 dB	16	-72
	802.11n, HT20 @ MCS 0	≤ -5 dB	18	-89
	802.11n, HT20 @ MCS 7	≤ -27 dB	15	-70
	802.11ac, VHT20 @ MCS 0	≤ -5 dB	18	-89
	802.11ac, VHT20 @ MCS 8	≤ -30 dB	13	-66
	802.11ax, HE20 @ MCS 0	≤ -5 dB	18	-86
	802.11ax, HE20 @ MCS 9	≤ -32 dB	13	-60

## 5.2. Bluetooth Performances

Table 17: Bluetooth Performances

Operating Frequency		
2.400–2.4835 GHz		
Modulation		
GFSK		
Operating Mode		
Bluetooth Low Energy (BLE)		
Condition (VBAT = 5.0 V; Temp.: 25 °C)	Typ.; Unit: dBm; Tolerance: ±2 dB	
	Transmitting Power	Receiver Sensitivity
BLE (1 Mbps)	8	-94

BLE (2 Mbps)	8	-92
BLE Long Range (S = 8) 125 kbps	8	-102
BLE Long Range (S = 2) 500 kbps	8	-96

### 5.3. Antenna/Antenna Interface <sup>5</sup>

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 two antenna/antenna interface designs: PCB antenna and RF coaxial connector. The RF coaxial connector is not soldered when the module is designed with PCB antenna. The impedance of antenna port is 50  $\Omega$ .

#### 5.3.1. PCB Antenna

**Table 18: Requirements for PCB Antenna**

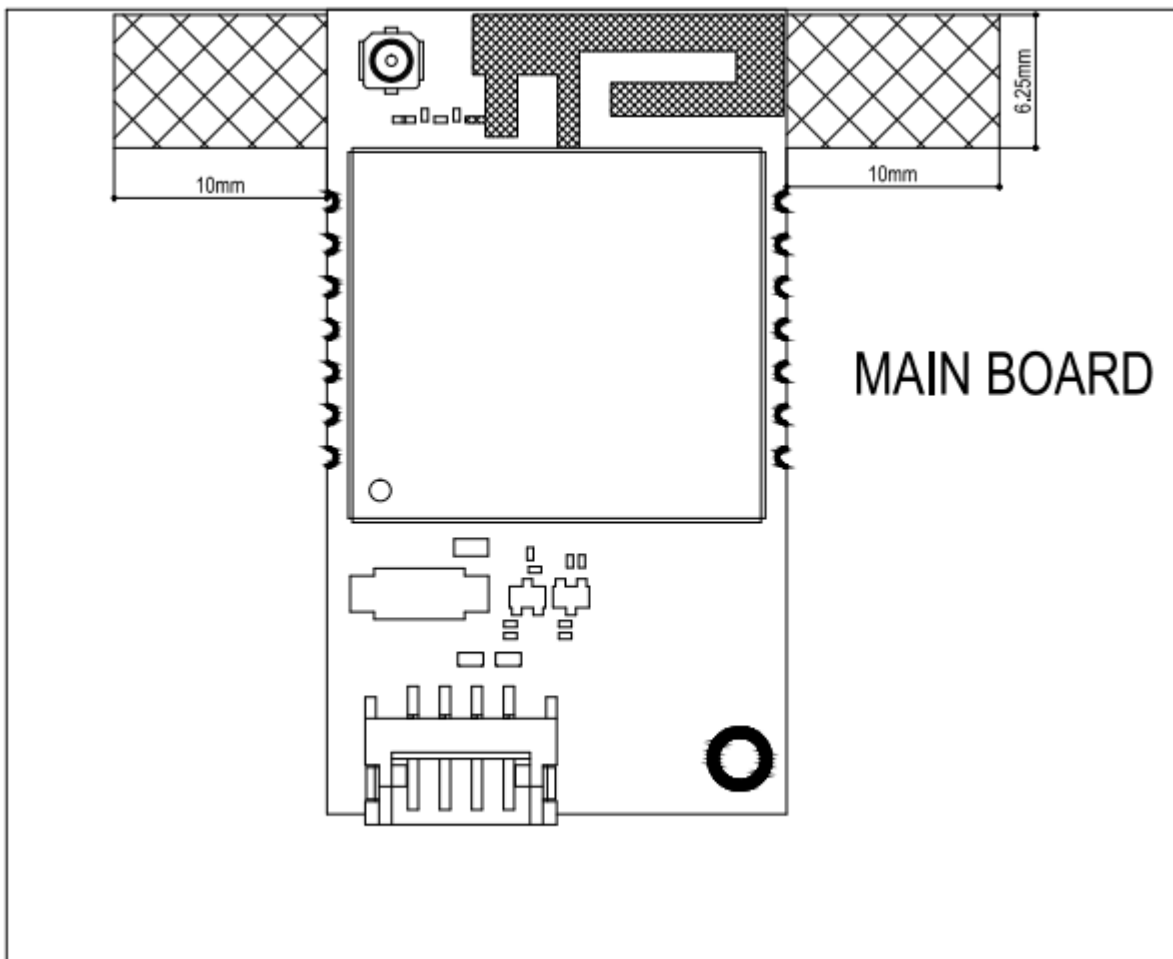
Parameter	Requirement
Frequency Range (GHz)	<ul style="list-style-type: none"> <li>2.4 GHz: 2.400–2.500</li> <li>5 GHz: 5.150–5.850</li> </ul>
Input Impedance ( $\Omega$ )	50
VSWR	TBD
Gain (dBi)	TBD
Efficiency	TBD

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:

1. The module should be placed on the edge of the motherboard.

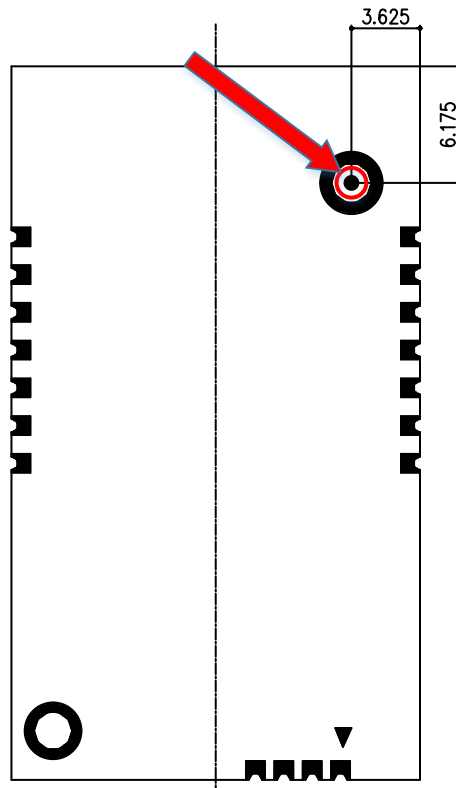
<sup>5</sup> The module is provided with one of the two antenna/antenna interface designs. For more details, please contact Quectel Technical Support.

2. 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.
3. The PCB antenna should be at least 16 mm away from power connectors, ethernet ports, USB ports and any other big size components on the motherboard.
4. Plastic case should be at least 10 mm away from PCB antenna. If it's metal case, it's recommended to use external antenna.
5. If the above principles are difficult to guarantee, it's recommended to use an external antenna by selecting the RF coaxial connector version of the module. Quectel antenna team can help design and provide the external antenna. Please contact Quectel Technical Support if needed.



**Figure 11: Keepout Area on Motherboard**

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

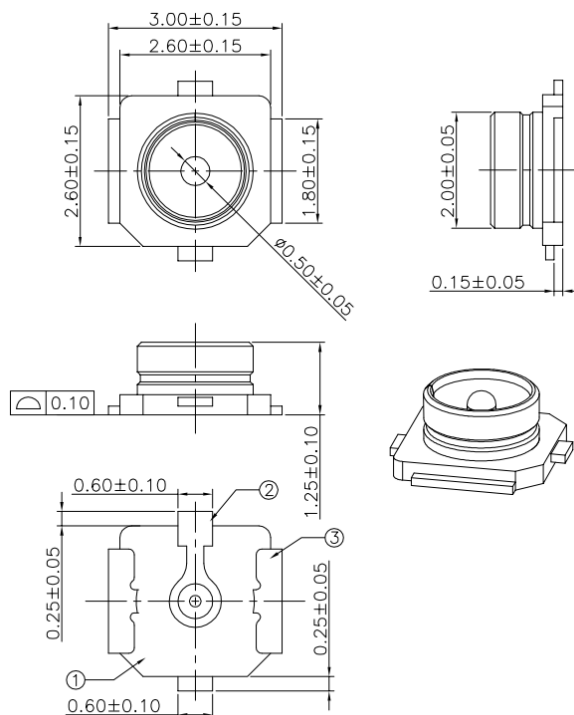


**Figure 12: Prohibited Area for Routing**

### 5.3.2. RF Coaxial Connector

#### 5.3.2.1. Antenna Connector Specifications

The mechanical dimensions are as follows.



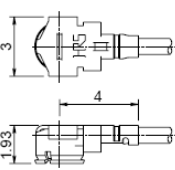
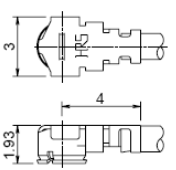
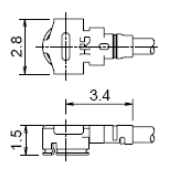
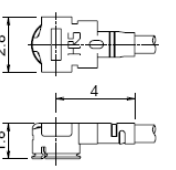
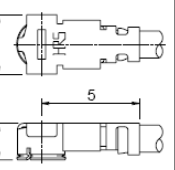
**Figure 13: Dimensions of the Receptacle (Unit: mm)**

**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 +85 °C
Voltage Standing Wave Ratio (VSWR)	Meet the requirements of: Max. 1.3 (DC–3 GHz) Max. 1.45 (3–6 GHz)

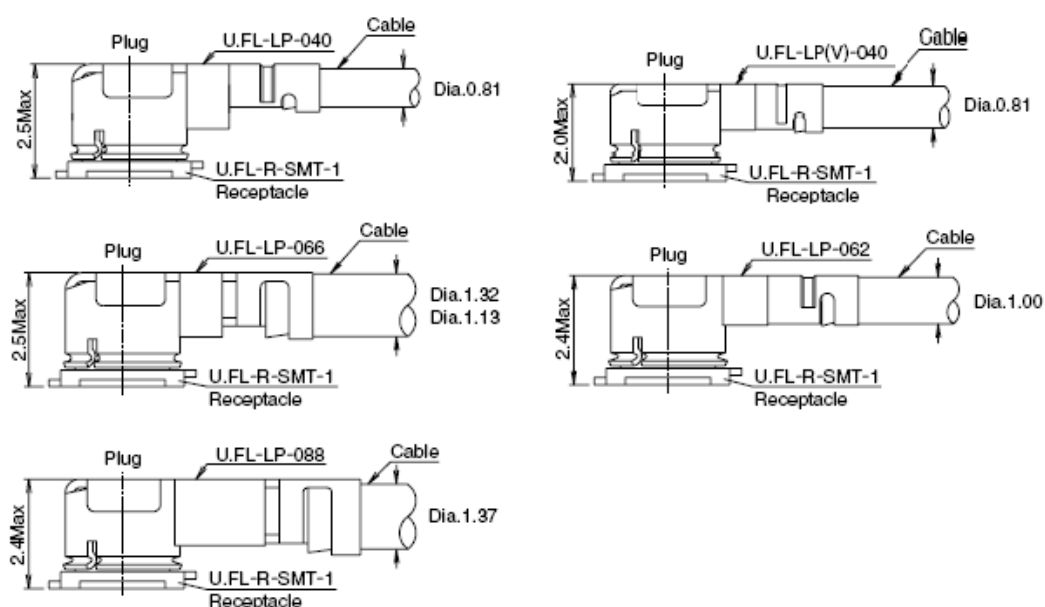
The RF plug matched with the module antenna base supports the following types and specifications:



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 14: Plug specifications matching the antenna base (unit: mm)**

The following figure shows the dimensions of the antenna base and plug after assembly:



**Figure 15: Installation diagram of RF connector (unit: mm)**

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

### 5.3.2.2. Recommended RF Connector Installation

The pictures for plugging in a coaxial cable plug is shown below,  $\theta = 90^\circ$  is acceptable, while  $\theta \neq 90^\circ$  is not.

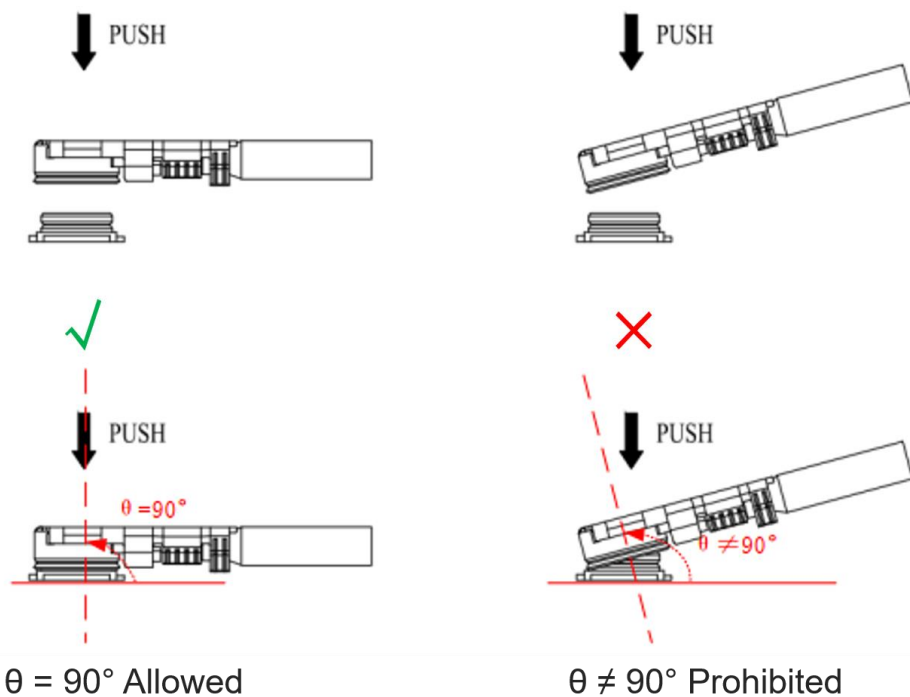


Figure 16: Plug in a Coaxial Cable Plug

The pictures of pulling out the coaxial cable plug is shown below,  $\theta = 90^\circ$  is acceptable, while  $\theta \neq 90^\circ$  is not.

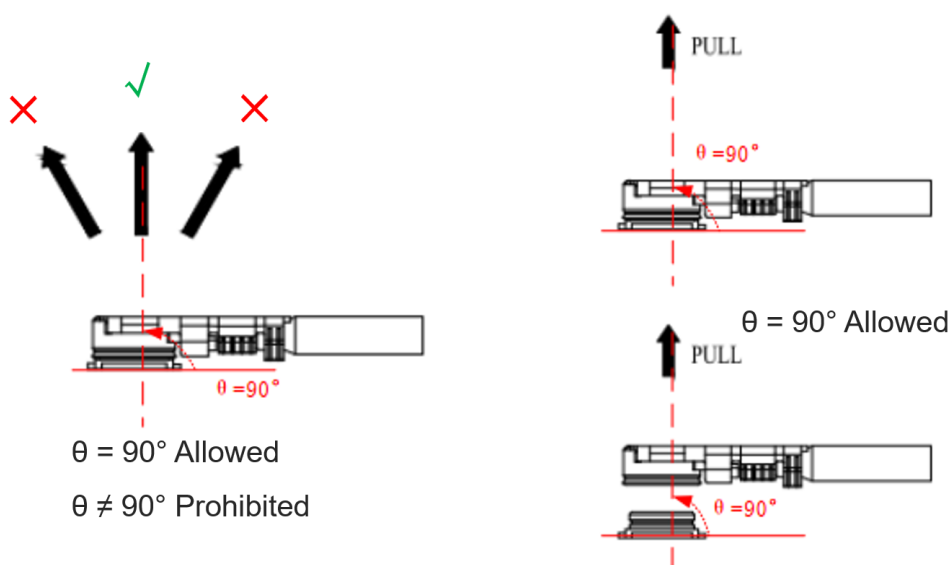
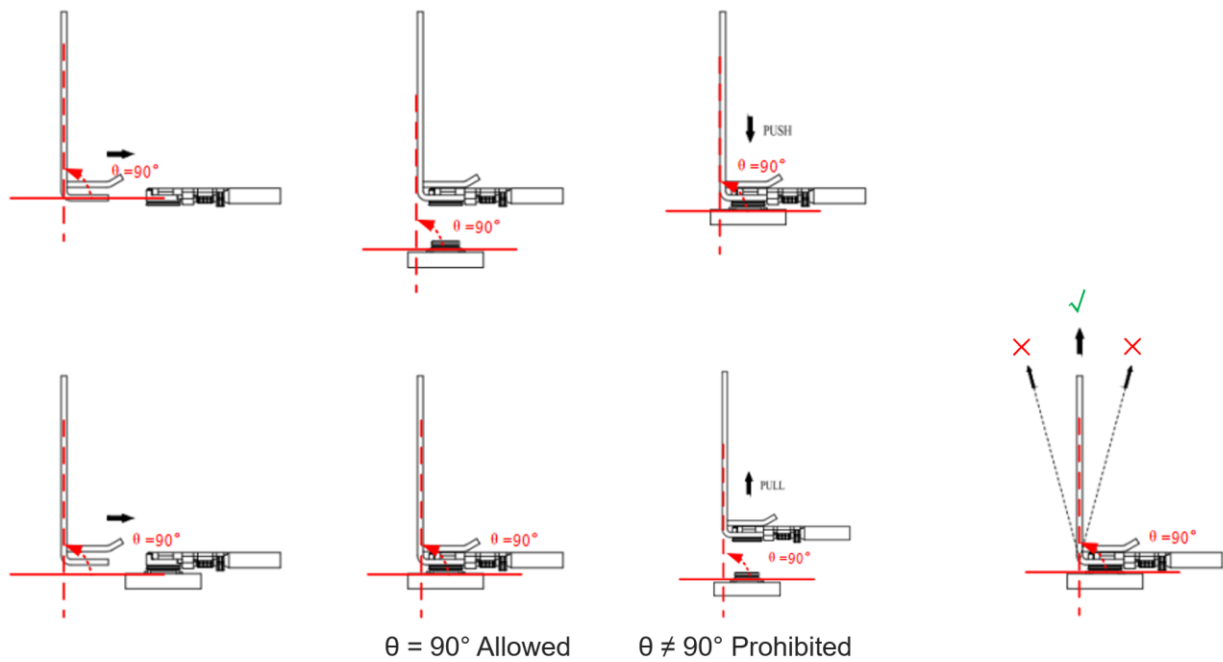


Figure 17: Pull out a Coaxial Cable Plug

The pictures of installing the coaxial cable plug with a jig is shown below,  $\theta = 90^\circ$  is acceptable, while  $\theta \neq 90^\circ$  is not.



**Figure 18: Install the Coaxial Cable Plug with Jig**

### 5.3.2.3. 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>.

## 5.4. Wire to Board Wafer

### 5.4.1. Recommended Wire to Board Wafer

The model is S4B-ZR-SM4A-TF(LF)(SN) The mechanical dimensions are as follows.

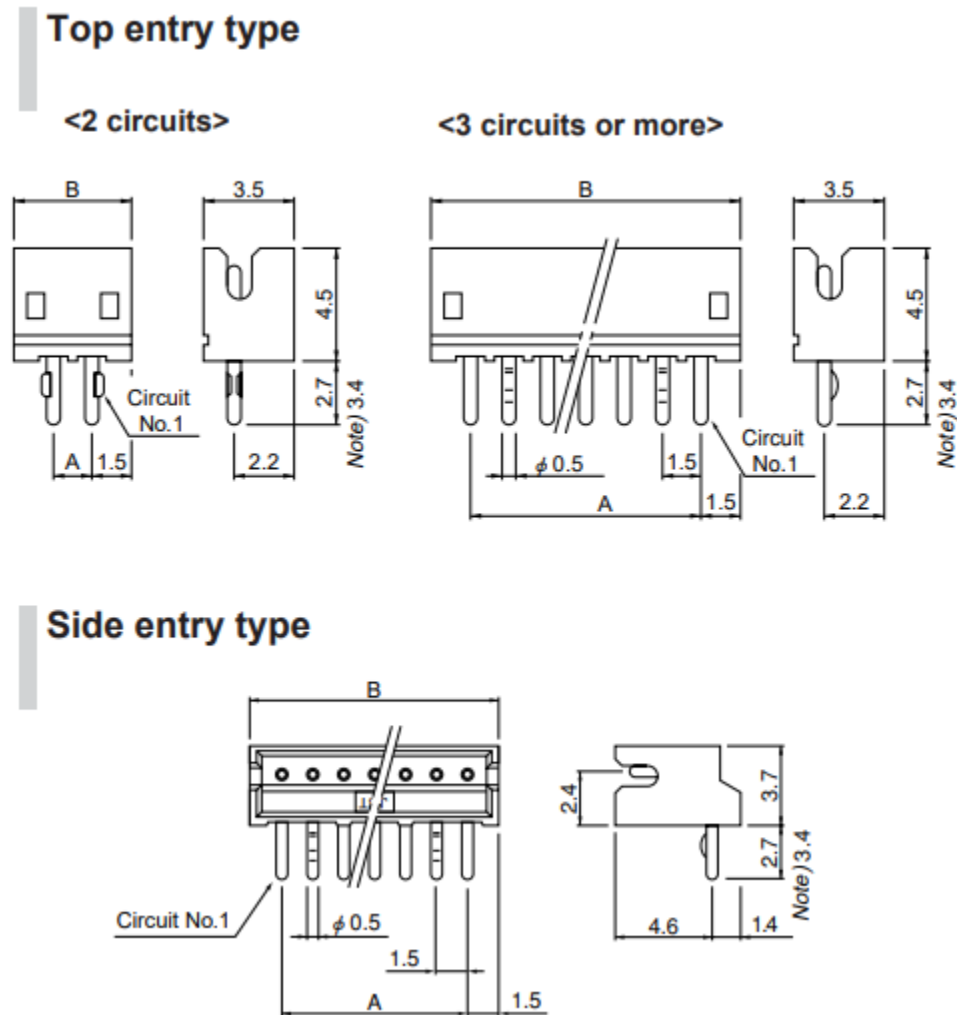


Figure 19: Pitch Wire to Board Wafer (Unit: mm)

# 6 Electrical Characteristics and Reliability

## 6.1. Absolute Maximum Ratings

Table 20: Absolute Maximum Ratings (Unit: V)

Parameter	Min.	Max.
VBAT	-0.3	5.5
Voltage at Digital Pins	-0.3	3.96

## 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.	4.5	5.0	5.5

## 6.3. Power Consumption

### 6.3.1. Wi-Fi Power Consumption

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

Condition			I <sub>VBAT</sub>
2.4 GHz	802.11b	Tx @ 1 Mbps	TBD
		Tx @ 11 Mbps	TBD
	802.11g	Tx @ 6 Mbps	TBD
		Tx @ 54 Mbps	TBD
	802.11n	Tx HT20 @ MCS 0	TBD
		Tx HT20 @ MCS 7	TBD
	802.11ax	Tx HE20 @ MCS 0	TBD
		Tx HE20 @ MCS 9	TBD
5 GHz	802.11a	Tx @ 6 Mbps	TBD
		Tx @ 54 Mbps	TBD
	802.11n	Tx HT20 @ MCS 0	TBD
		Tx HT20 @ MCS 7	TBD
	802.11ac	Tx VHT20 @ MCS 0	TBD
		Tx VHT20 @ MCS 8	TBD
	802.11ax	Tx HE20 @ MCS 0	TBD
		Tx HE20 @ MCS 9	TBD

### 6.3.2. Bluetooth Power Consumption

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

Condition	I <sub>VBAT</sub>
BLE (1 Mbps) @ TBD dBm	TBD
BLE (2 Mbps) @ TBD dBm	TBD
BLE Long Range (S = 8) 125 kbps @ TBD dBm	TBD
BLE Long Range (S = 2) 500 kbps @ TBD dBm	TBD

## 6.4. Digital I/O Characteristics

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

Parameter	Description	Min.	Max.
V <sub>IH</sub>	High-level Input Voltage	0.7 × VBAT	VBAT
V <sub>IL</sub>	Low-level Input Voltage	0	0.3 × VBAT
V <sub>OH</sub>	High-level Output Voltage	0.9 × VBAT	VBAT
V <sub>OL</sub>	Low-level Output Voltage	0	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.

Table 25: ESD Characteristics (Unit: kV)

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

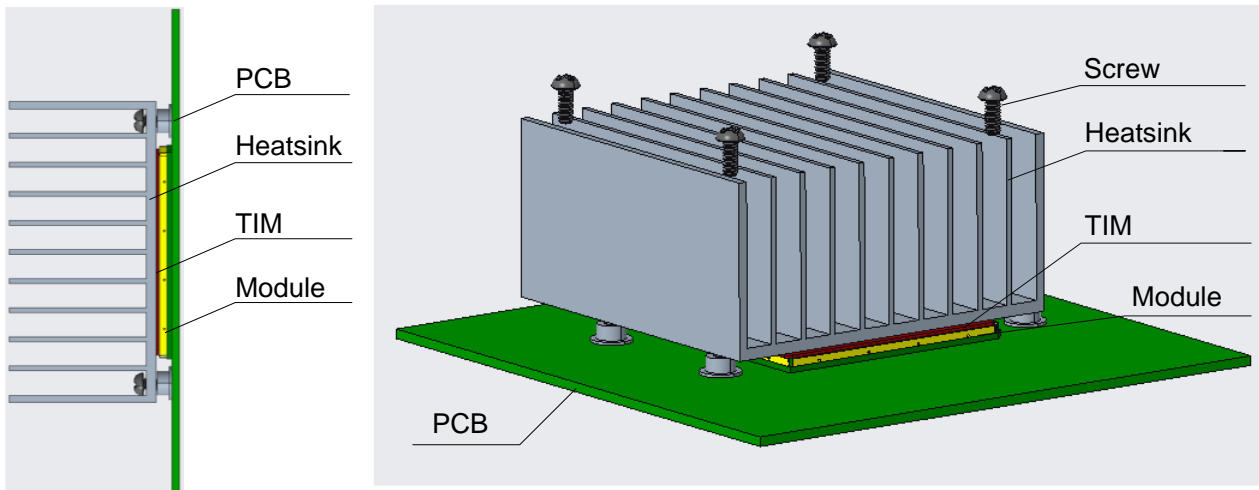
## 6.6. Thermal Dissipation

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

The following principles for thermal consideration are provided for reference:

- Keep the module away from heat sources on your PCB, especially high-power components such as processor, power amplifier, and power supply.
- Maintain the integrity of the PCB copper layer and drill as many thermal vias as possible.
- Follow the principles below when the heatsink is necessary:
  - Do not place large size components in the area where the module is mounted on your PCB to reserve enough place for heatsink installation.
  - Attach the heatsink to the shielding cover of the module; In general, the base plate area of the heatsink should be larger than the module area to cover the module completely;
  - Choose the heatsink with adequate fins to dissipate heat;
  - Choose a TIM (Thermal Interface Material) with high thermal conductivity, good softness and good wettability and place it between the heatsink and the module;
  - Fasten the heatsink with four screws to ensure that it is in close contact with the module to prevent the heatsink from falling off during the drop, vibration test, or transportation.



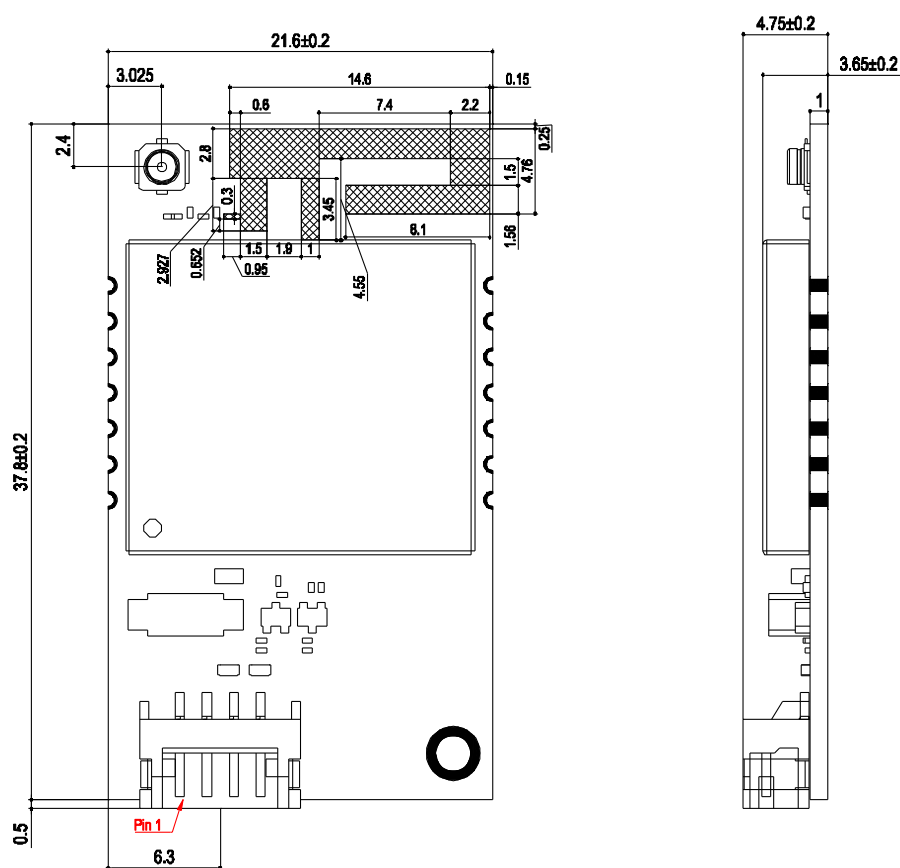


**Figure 20: Placement and Fixing of the Heatsink**

## 7 Mechanical Information

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

## 7.1. Mechanical Dimensions



### Figure 21: Top and Side Dimensions

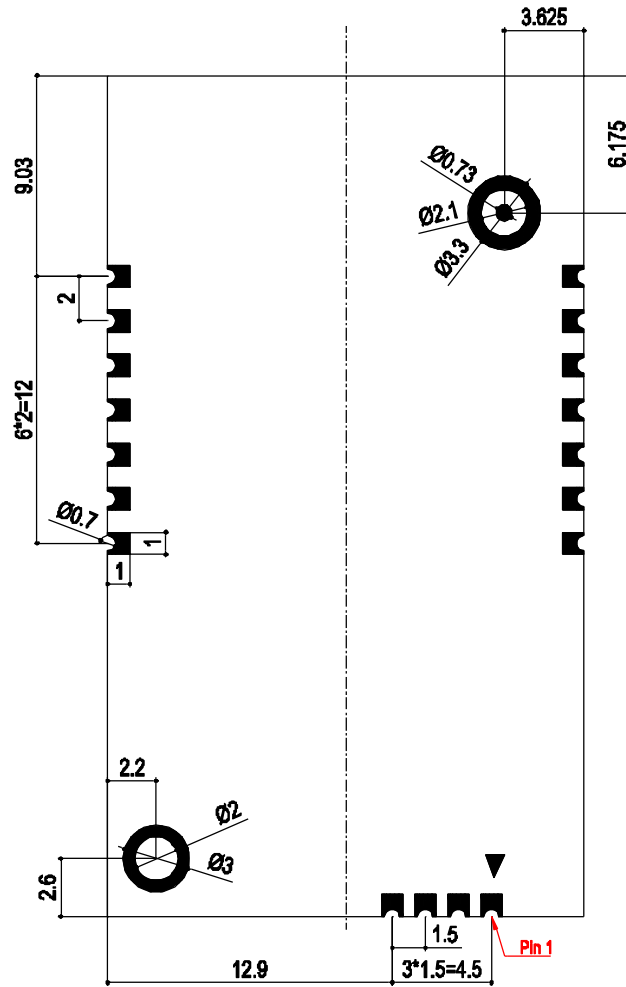
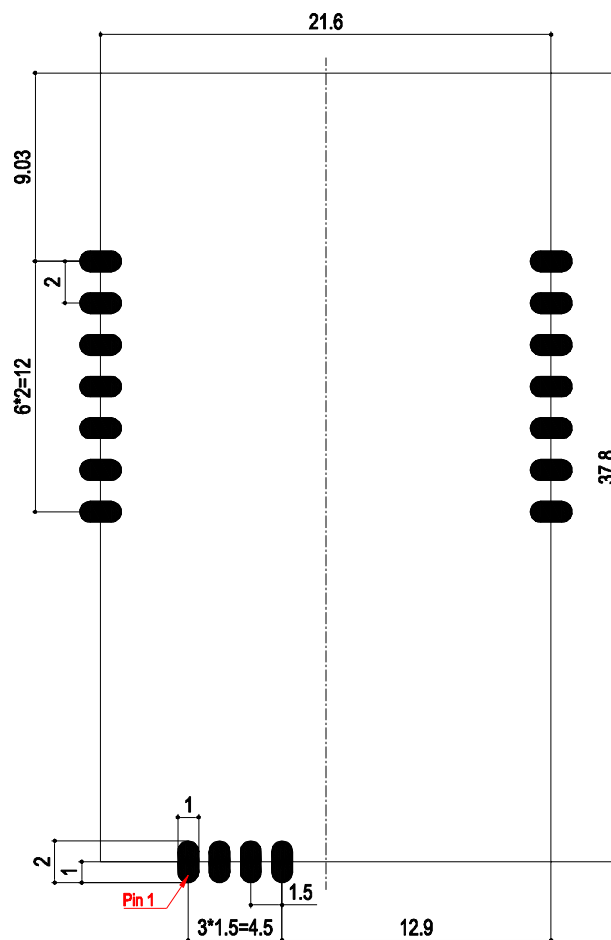


Figure 22: Bottom Dimensions (Bottom View)

**NOTE**

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

## 7.2. Recommended Footprint



### Figure 23: 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

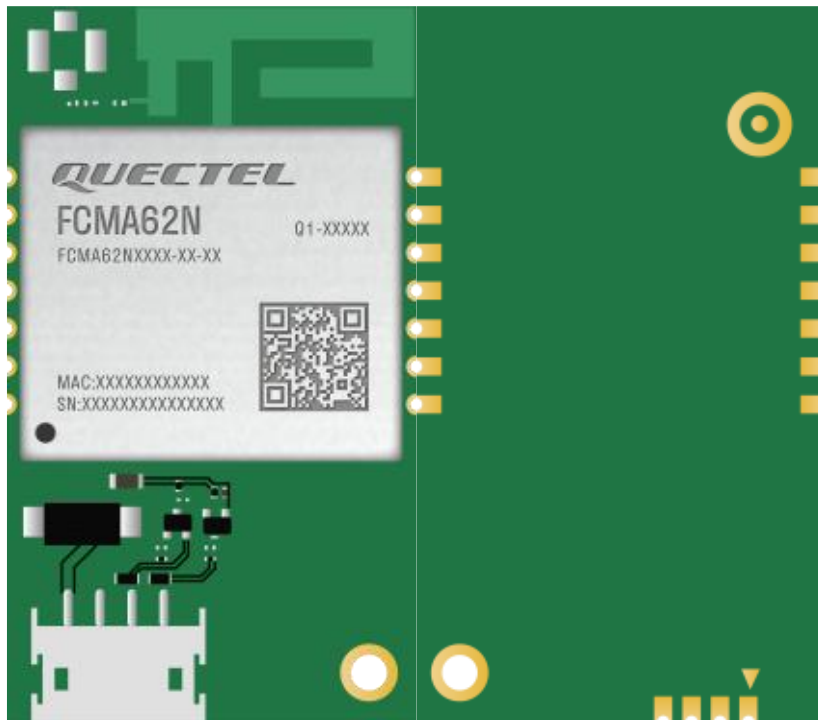


Figure 24: Top and Bottom Views (PCB Antenna)

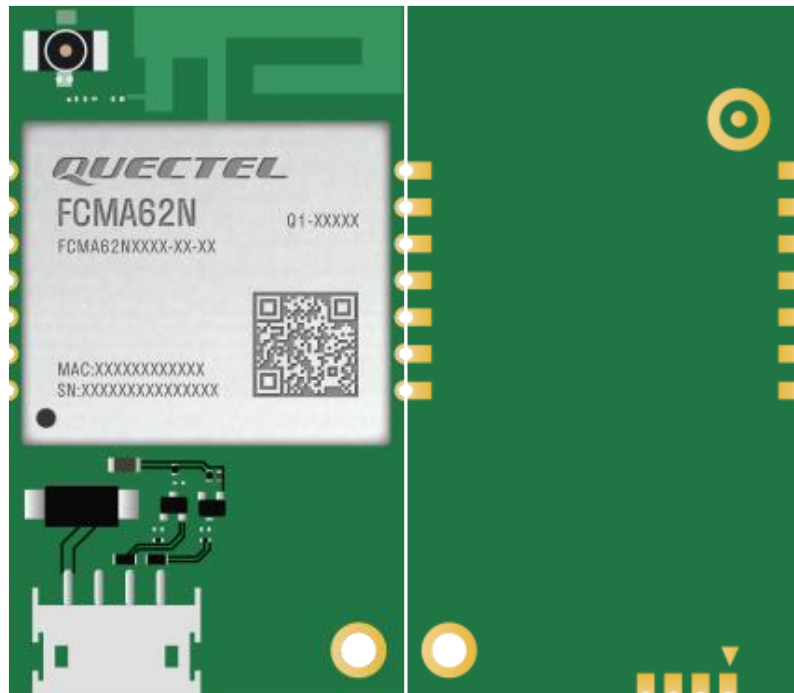


Figure 25: Top and Bottom Views (RF Coaxial Connector)

**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 soldered when the module is designed with PCB antenna.

# 8 Storage, Manufacturing and 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  $23 \pm 5$  °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 <sup>6</sup> in a factory where the temperature is  $23 \pm 5$  °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  $120 \pm 5$  °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.

---

<sup>6</sup> 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 0.15–0.18 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.

Temp. (°C)

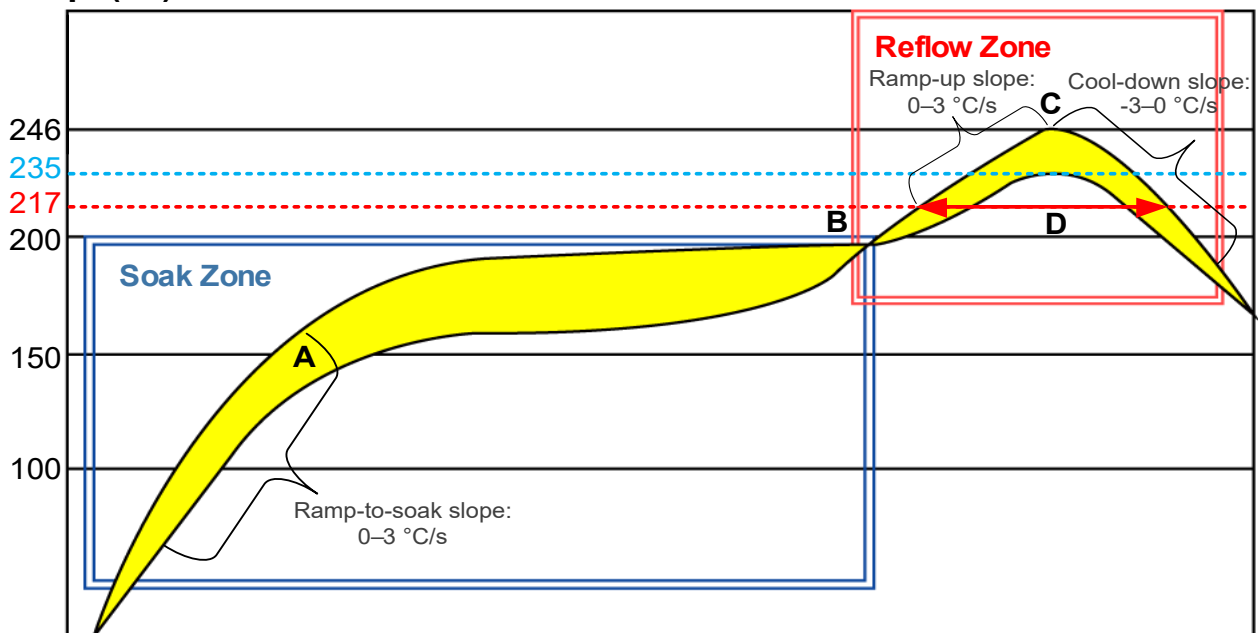


Figure 26: Recommended Reflow Soldering Thermal Profile



Table 26: Recommended Thermal Profile Parameters

Factor	Recommended Value
<b>Soak Zone</b>	
Ramp-to-soak Slope	0–3 °C/s
Soak time (between A and B: 150 °C and 200 °C)	70–120 s
<b>Reflow Zone</b>	
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
<b>Reflow Cycle</b>	
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. 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]**.

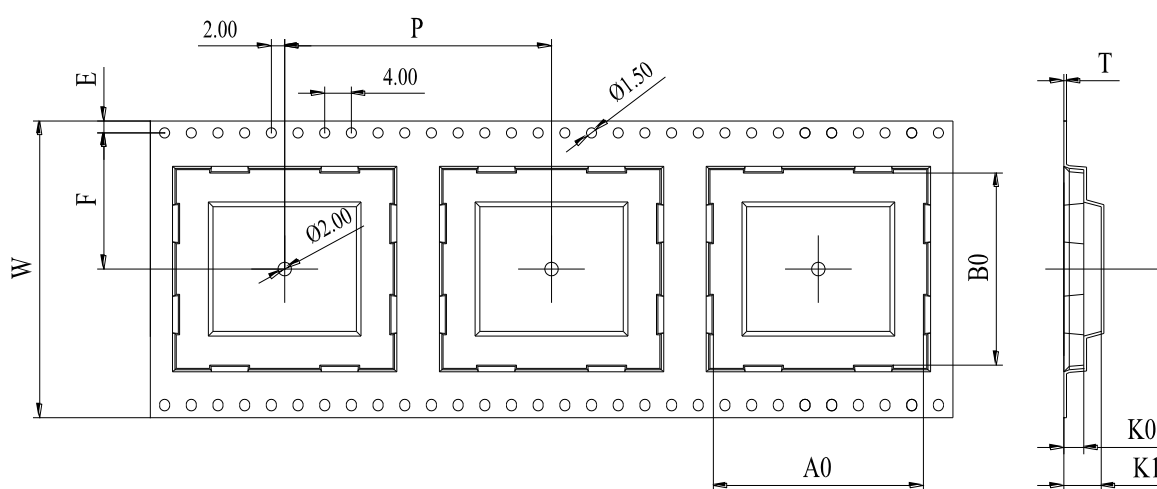
## 8.3. Packaging Specification

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:



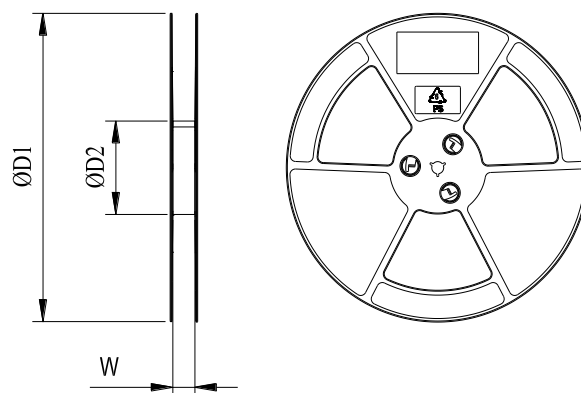
**Figure 27: Carrier Tape Dimension Drawing (Unit: mm)**

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

W	P	T	A0	B0	K0	K1	F	E
56	32	0.4	22.1	38.3	5.45	6.8	26.2	1.75

### 8.3.2. Plastic Reel

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

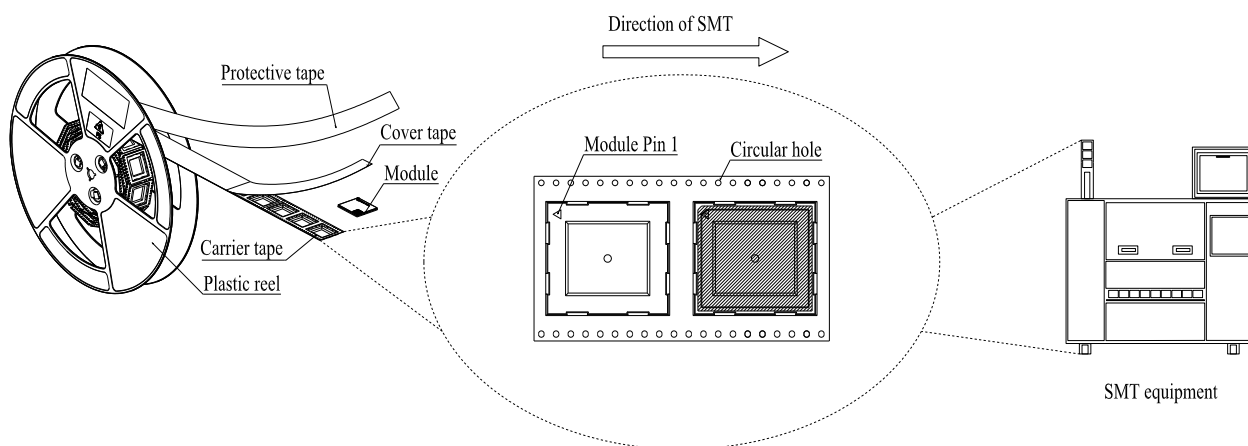


**Figure 28: Plastic Reel Dimension Drawing**

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

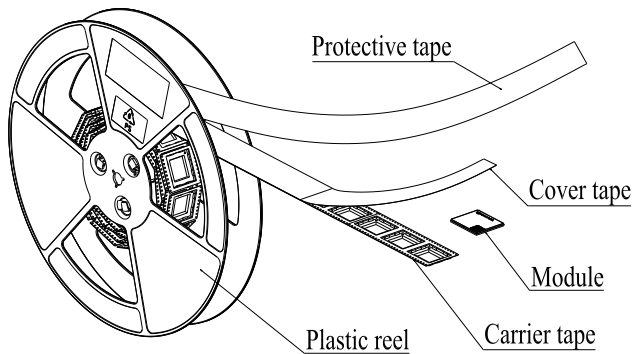
ØD1	ØD2	W
330	100	56.5

### 8.3.3. Mounting Direction



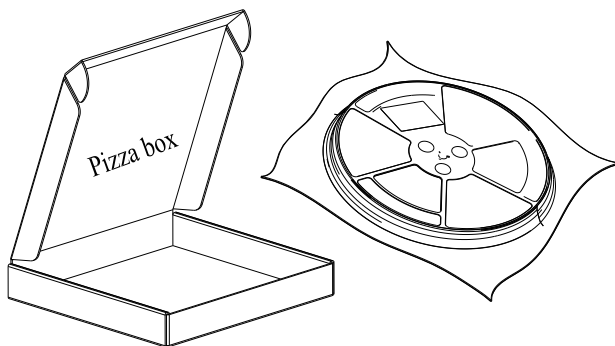
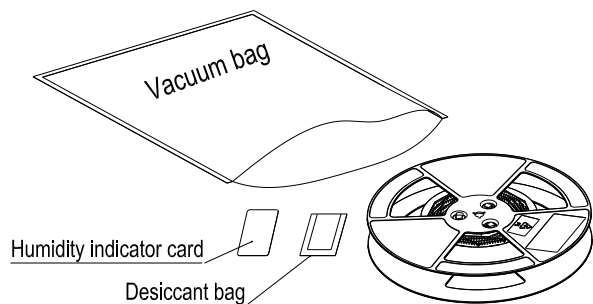
**Figure 29: Mounting Direction**

### 8.3.4. Packaging Process



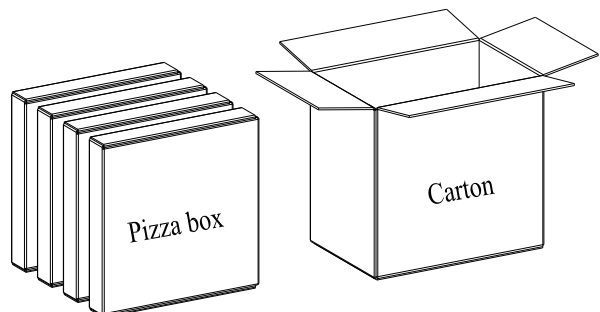
Place the modules onto the carrier tape cavity and cover them securely with cover tape. Wind the heat-sealed carrier tape onto a plastic reel and apply a protective tape for additional protection. 1 plastic reel can pack 250 modules.

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 1000 modules.



**Figure 30: Packaging Process**

# 9 Appendix References

**Table 29: Reference Documents**

Document Name
[1] Quectel_FCMA62N_TE-B_User_Guide
[2] Quectel_RF_Layout_Application_Note
[3] Quectel_Module_Stencil_Design_Requirements
[4] Quectel_Module_SMT_Application_Note

**Table 30: Terms and Abbreviations**

Abbreviation	Description
AMBA	Advanced Microcontroller Bus Architecture
AP	Access Point
APB	Advanced Peripheral Bus
BLE	Bluetooth Low Energy
BPSK	Binary Phase Shift Keying
CCK	Complementary Code Keying
CDM	Charged Device Model
DMA	Direct Memory Access
DQPSK	Differential Quadrature Reference 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
HBM	Human Body Model
HE	High Efficiency
HT	High Throughput
I/O	Input/Output
I2C	Inter-Integrated Circuit
I2S	Inter-IC Sound
IEEE	Institute of Electrical and Electronics Engineers
kbps	Kilobits Per Second
LCC	Leadless Chip Carrier (package)
Mbps	Million Bits Per Second
MCU	Microcontroller Unit
OFDM	Orthogonal Frequency Division Multiplex
OTA	Over The Air
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PWM	Pulse Width Modulation
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
RoHS	Restriction of Hazardous Substances
SAE	Simultaneous Authentication of Equals
SMD	Surface Mount Device
SPI	Serial Peripheral Interface
SRAM	Static Random Access Memory

STA	Station
SWD	Serial Wire Debug
TBD	To Be Determined
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
(U)SIM	(Universal) Subscriber Identity Module
VHT	Very High Throughput
$V_{IH}$	High-level Input Voltage
$V_{IL}$	Low-level Input Voltage
$V_{max}$	Maximum Voltage
$V_{min}$	Minimum Voltage
$V_{nom}$	Normal Voltage Value
$V_{OH}$	High-level Output Voltage
$V_{OL}$	Low-level Output Voltage
VSWR	Voltage Standing Wave Ratio
WEP	Wired Equivalent Privacy
Wi-Fi	Wireless Fidelity
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 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 users' 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: External Antenna

Gain: 2.4G:-1.2dBi; 5G:1.14dBi;

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: XMR2024FCMA62N" 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 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: XMR2024FCMA62N**"

**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.

## 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.