# FCMA62N Hardware Design

**Short Range Module Series**

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Status: Preliminary

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| | |
|---|---|
|  | 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 |

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# 1 Introduction

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

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

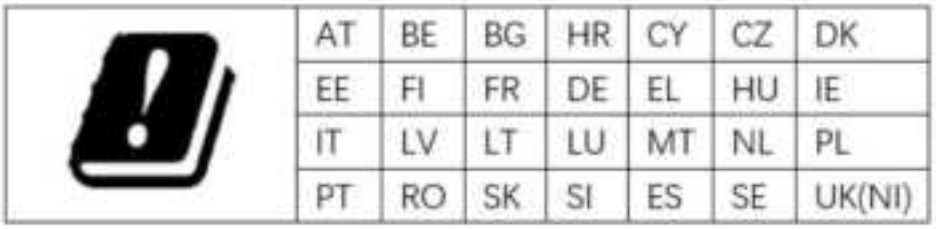
This document defines the FCMA62N and describes its hardware interfaces and air interfaces which are connected with your applications. With this document, you can quickly understand module interface specifications, RF performances, electrical and mechanical details, as well as other related information 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 | ● Wi-Fi Protocols: IEEE 802.11a/b/g/n/ac/ax<br>● Bluetooth protocol: BLE 5.3<br>● All hardware components are fully compliant with EU RoHS directive |
| Power Supply | **VBAT Power Supply:**<br>● 4.5–5.5 V<br>● Typ.: 5.0 V |
| Temperature Ranges | ● Operating temperature [1]: -40 °C to +85 °C<br>● Storage temperature: -45 °C to +95 °C |
| TE-B Kit | FCMA62N-TE-B [2] |
| **Antenna/Antenna Interface** | |
| Antenna/Antenna Interface [3] | ● PCB antenna<br>● RF coaxial connector<br>● 50 Ω characteristic impedance |
| **Application Interface [4]** | |
| Application Interfaces | UART, SWD, SPI*, I2C*, I2S*, PWM* |

[1] Within the operating temperature range, the module's related performance meets IEEE and Bluetooth specifications.
[2] For more details about the TE-B, see ***document [1]***.
[3] The module is provided with one of the two antenna/antenna interface designs. For more details, please contact Quectel Technical Support.
[4] For more details about the interfaces, see ***Chapter 3.3*** and ***Chapter 3.4***.

# 3 Application Interfaces

## 3.1. Pin Assignment

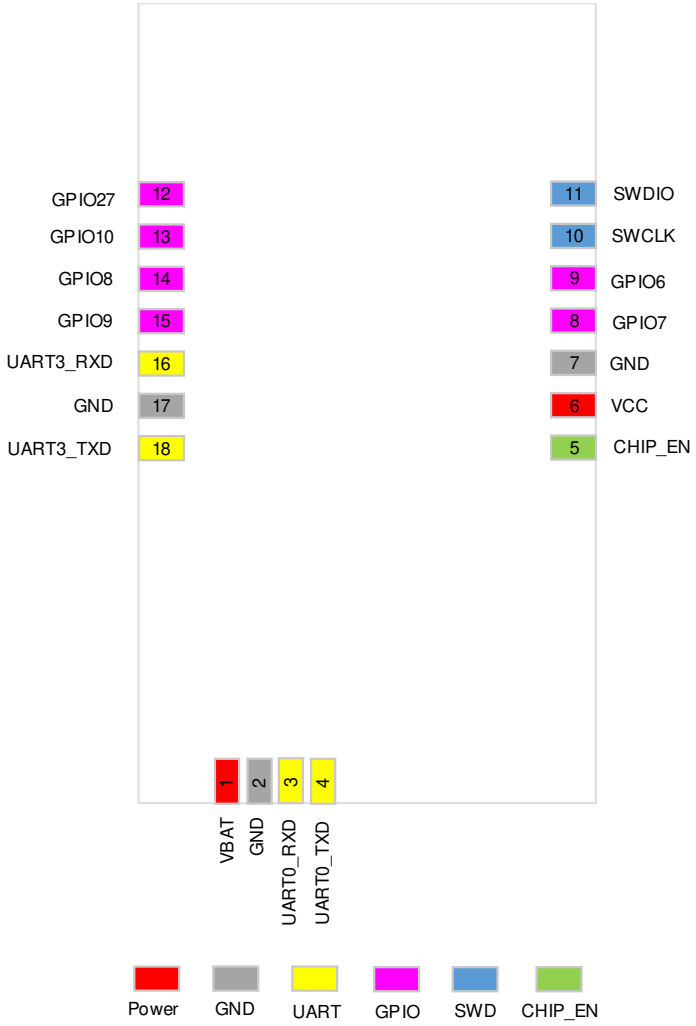



**Figure 1: Pin Assignment (Top View)**

**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<br>Vmin = 4.5 V<br>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<br>Vmin = 3.0 V<br>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 | | to 3.3 V with a 51 kΩ resistor. Active high. |
| | | | | Reset the module | | |
| **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:

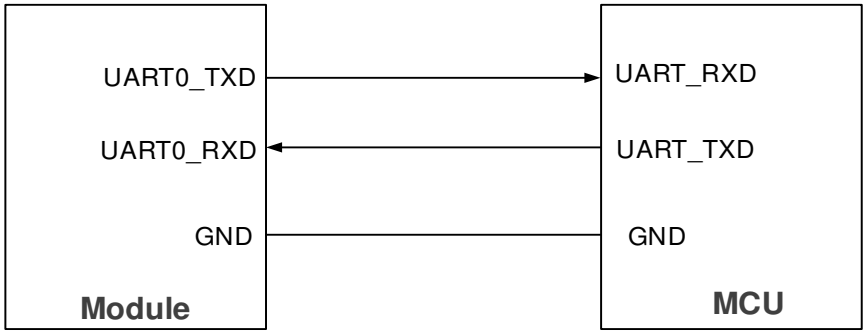



**Figure 2: UART0 Interface Connection**

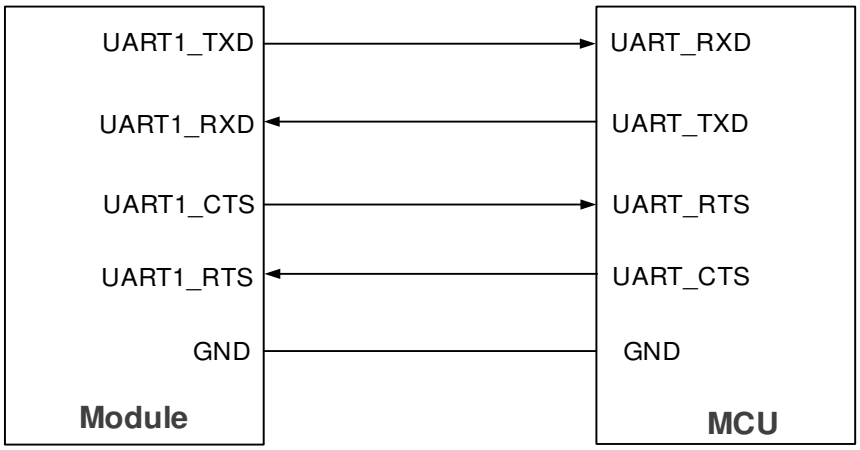



**Figure 3: UART1 Interface Connection**

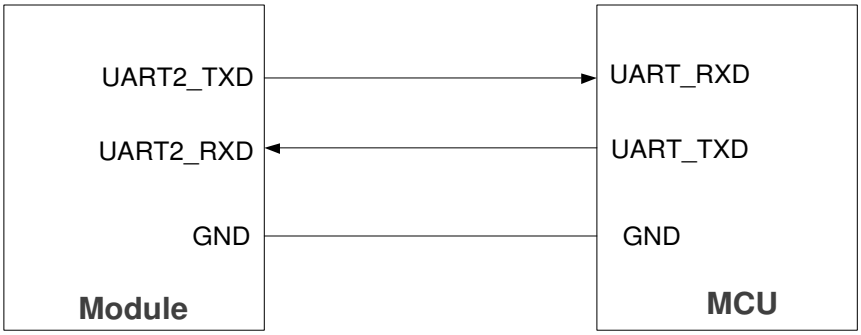



**Figure 4: UART2 Interface Connection**

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.

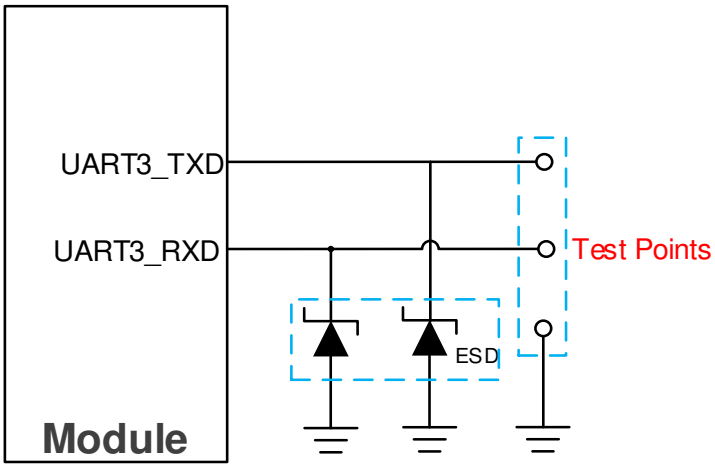



**Figure 5: Reference Design of UART3 Interface**

### 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:

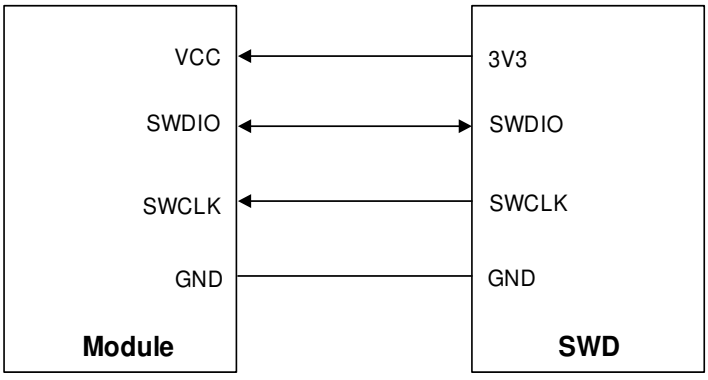



**Figure 6: SWD Interface Connection**

### 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:

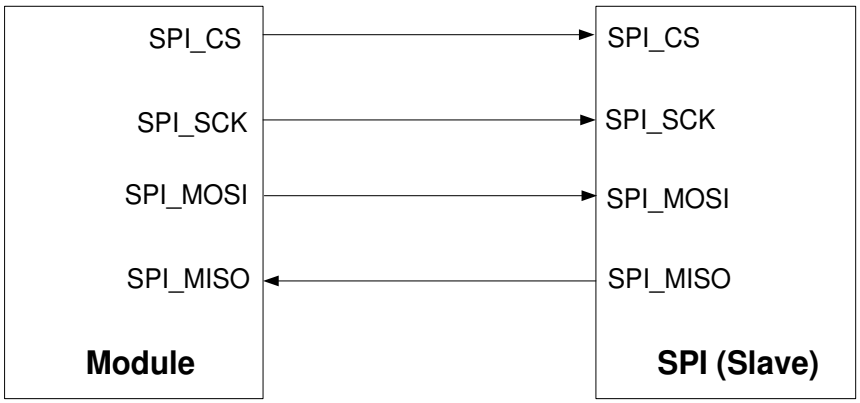



**Figure 7: SPI Connection**

### 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 µF decoupling capacitor, and two filter capacitors (1 µF 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:

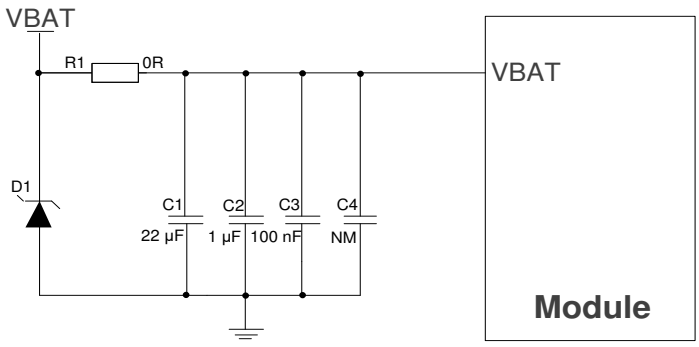



**Figure 8: Reference Design of Power Supply**

## 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.<br>Active high. |

The turn-on timing is shown below:

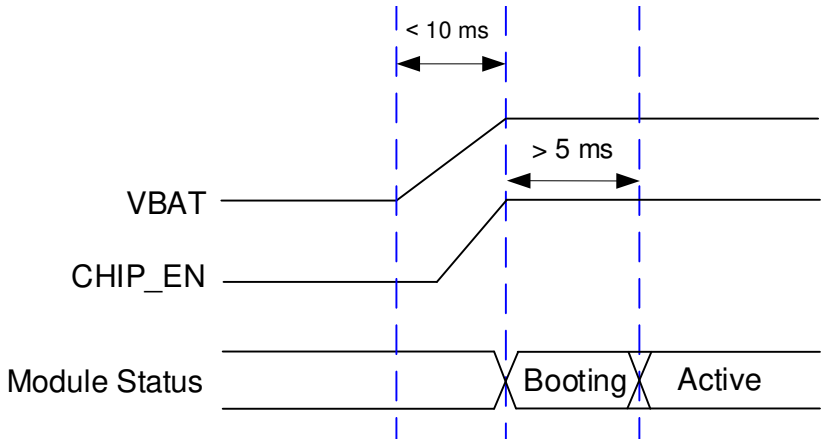



**Figure 9: Turn-on Timing**

## 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.<br>Active high. |

The module reset timing is illustrated in the following figure.

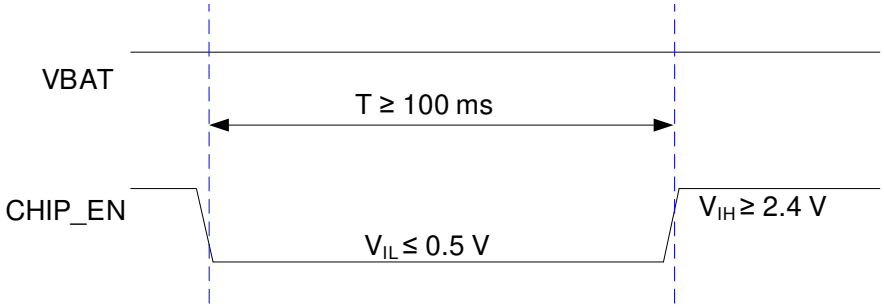



**Figure 10: Reset Timing**

# 5 RF Performances

## 5.1. Wi-Fi Performances

**Table 16: Wi-Fi Performances**

| | | | | |
|---|---|---|---|---|
| **Operating Frequency** | | | | |
| ● **2.4 GHz:** 2.400–2.4835 GHz<br>● **5 GHz:** 5.150–5.850 GHz | | | | |
| **Modulation** | | | | |
| DSSS, OFDM, DBPSK, DQPSK, CCK, BPSK, QPSK, 16QAM, 64QAM, 256QAM | | | | |
| **Encryption Mode** | | | | |
| WEP, WPA, WPA2, WPA3 | | | | |
| **Operating Mode** | | | | |
| ● AP<br>● STA | | | | |
| **Transmission Data Rate** | | | | |
| ● 802.11b: 1 Mbps, 2 Mbps, 5.5 Mbps, 11 Mbps<br>● 802.11a/g: 6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps, 54 Mbps<br>● 802.11n: HT20 (MCS 0–7)<br>● 802.11ac: VHT20 (MCS 0–8)<br>● 802.11ax: HE20 (MCS 0–9) | | | | |
| **Condition (VBAT = 5.0 V; Temp.: 25 °C)** | | **EVM** | **Typ.; Unit: dBm; Tolerance: ±2 dB** | |
| | | | **Transmitting Power** | **Receiver Sensitivity** |
| 2.4 GHz | 802.11b @ 1 Mbps | ≤ 35 % | 18 | -94 |
| | 802.11b @ 11 Mbps | | 18 | -87 |
| | 802.11g @ 6 Mbps | ≤ -5 dB | 18 | -89 |

| | | | | |
|---|---|---|---|---|
| | 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 |
| 5 GHz | 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 [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 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 Ω.

### 5.3.1. PCB Antenna

**Table 18: Requirements for PCB Antenna**

| Parameter | Requirement |
|---|---|
| Frequency Range (GHz) | ● 2.4 GHz: 2.400–2.500<br>● 5 GHz: 5.150–5.850 |
| Input Impedance (Ω) | 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.

[5] 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.

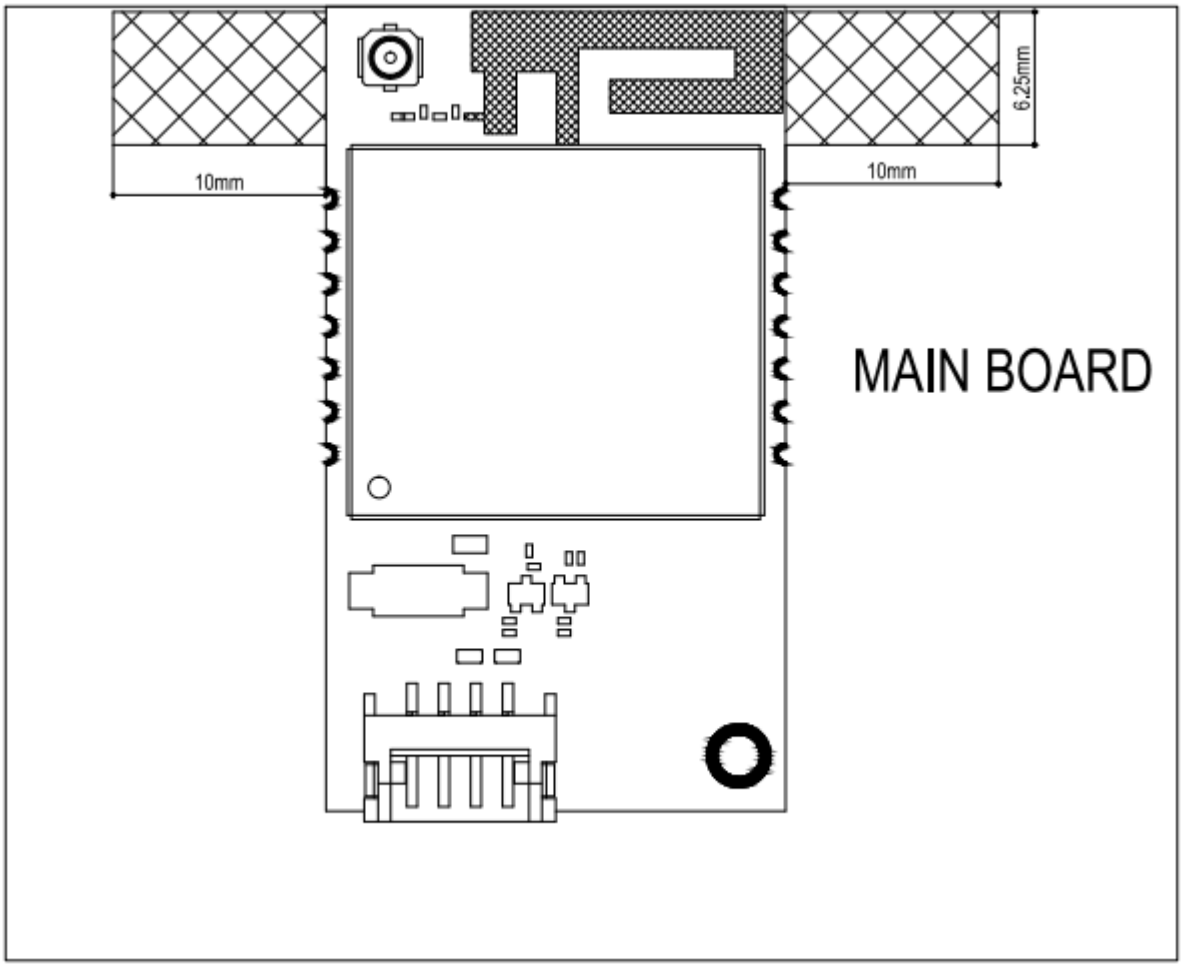



**Figure 11: Keepout Area on Motherboard**

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:

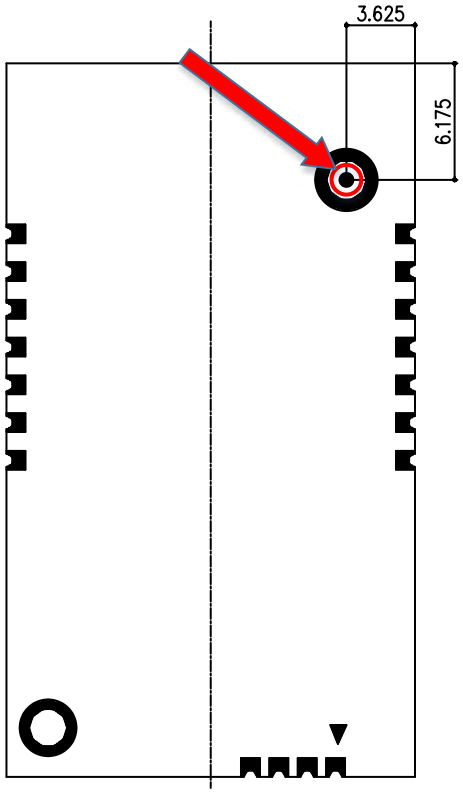



**Figure 12: Prohibited Area for Routing**

### 5.3.2. RF Coaxial Connector

#### 5.3.2.1. Antenna Connector Specifications

The mechanical dimensions are as follows.

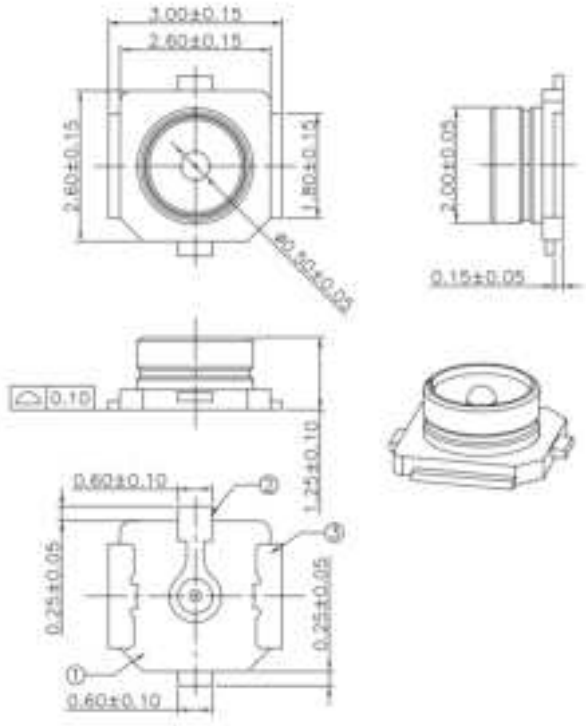



**Figure 13: Dimensions of the Receptacle (Unit: mm)**

**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:<br>Max. 1.3 (DC–3 GHz)<br>Max. 1.45 (3–6 GHz) |

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

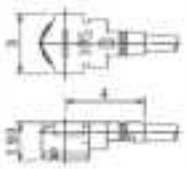
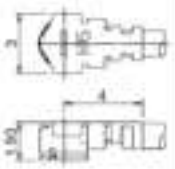
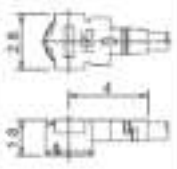
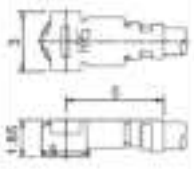
| Part No. | U.FL-LP-040 | U.FL-LP-066 | U.FL-LP(V)-040 | U.FL-LP-062 | U.FL-LP-088 |
|---|---|---|---|---|---|
| |  |  |  |  |  |
| Mated Height | 2.5mm Max. (2.4mm Nom.) | 2.5mm Max. (2.4mm Nom.) | 2.0mm Max. (1.9mm Nom.) | 2.4mm Max. (2.3mm Nom.) | 2.4mm Max. (2.3mm Nom.) |
| Applicable cable | Dia. 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:

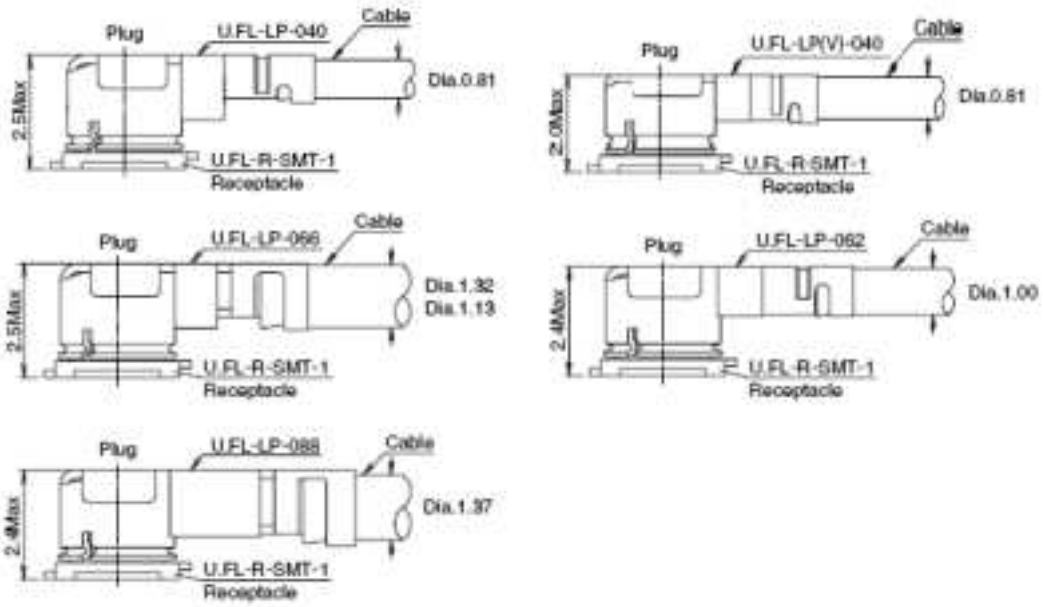



**Figure 15: Installation diagram of RF connector (unit: mm)**

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, θ = 90° is acceptable, while θ ≠ 90° is not.

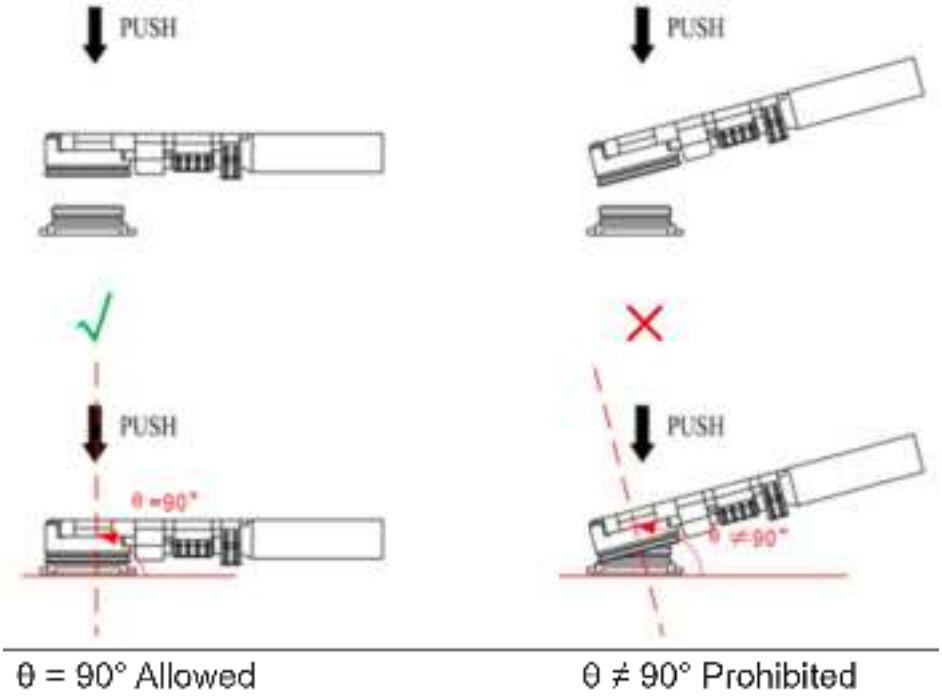



**Figure 16: Plug in a Coaxial Cable Plug**

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

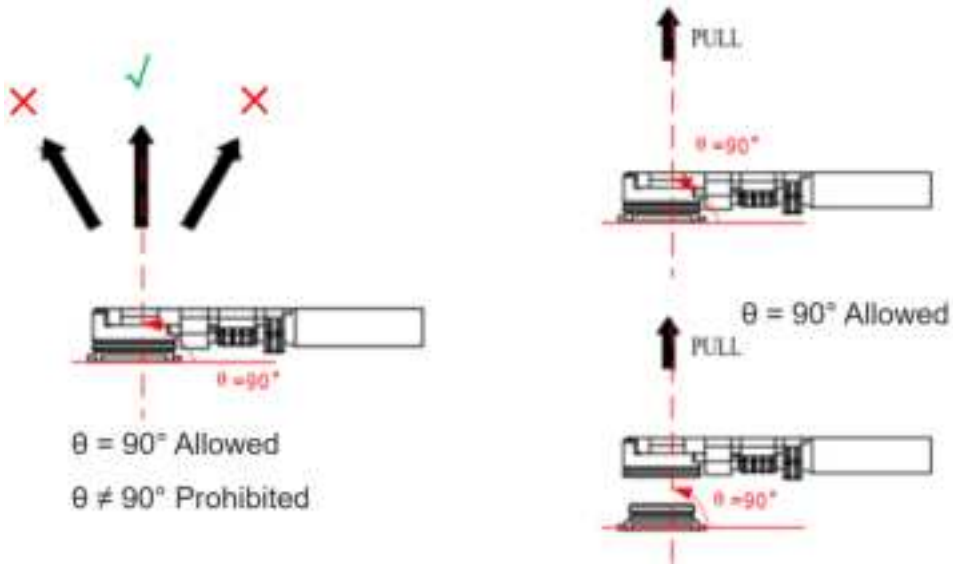



**Figure 17: Pull out a Coaxial Cable Plug**

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

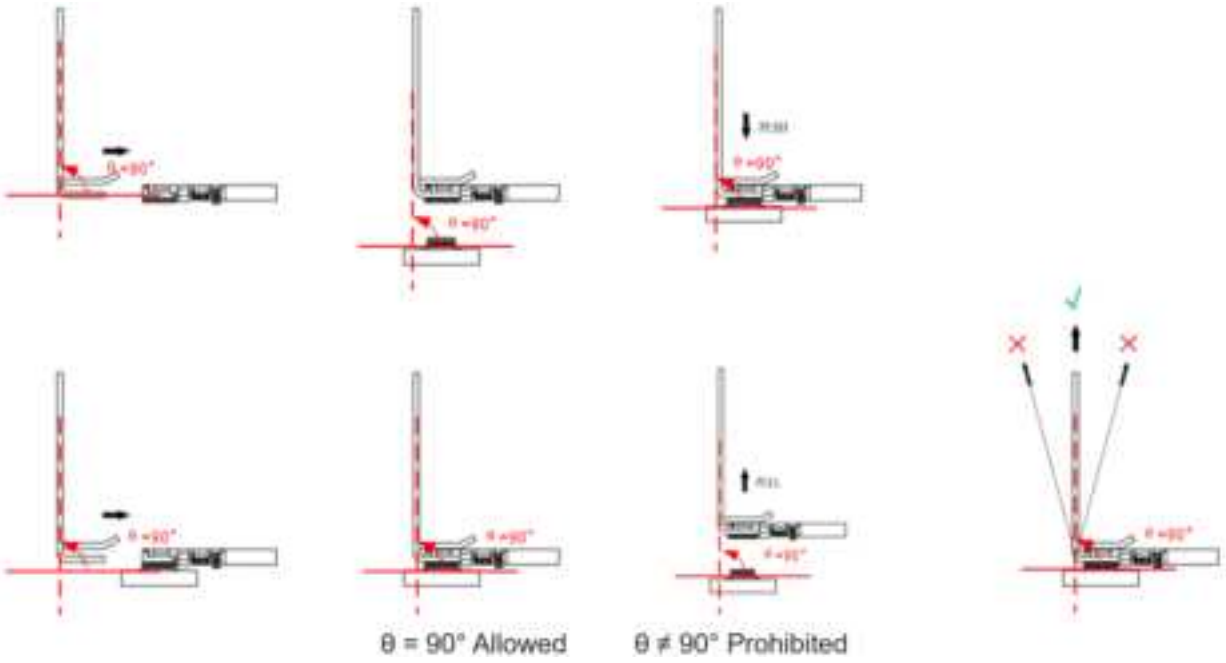



**Figure 18: Install the Coaxial Cable Plug with Jig**

#### 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.

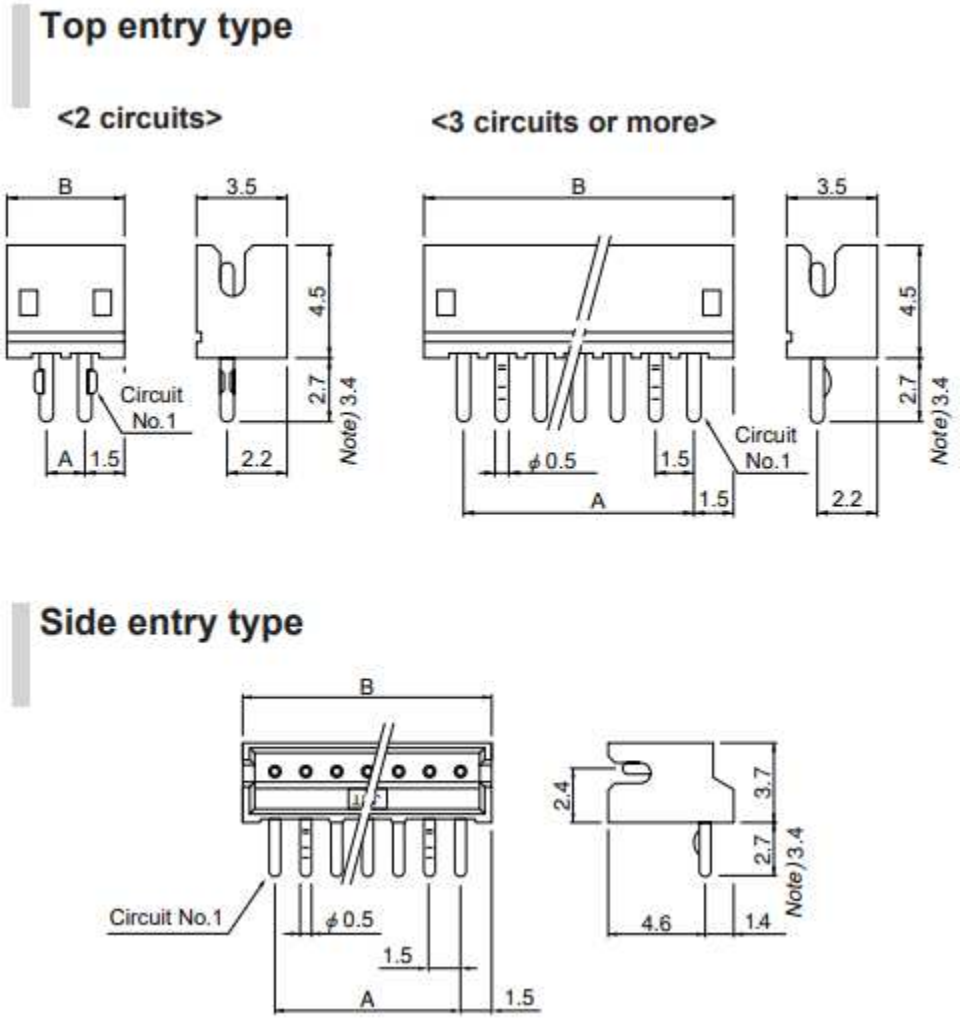



**Figure 19: Pitch Wire to Board Wafer (Unit: mm)**

# 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 | | | $I_{VBAT}$ |
|---|---|---|---|
| 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 | $I_{VBAT}$ |
|---|---|
| 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. |
|---|---|---|---|
| $V_{IH}$ | High-level Input Voltage | 0.7 × VBAT | VBAT |
| $V_{IL}$ | Low-level Input Voltage | 0 | 0.3 × VBAT |
| $V_{OH}$ | High-level Output Voltage | 0.9 × VBAT | VBAT |
| $V_{OL}$ | 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) | ±2 | *ANSI/ESDA/JEDEC JS-001-2017* |
| Charged Device Model (CDM) | ±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.

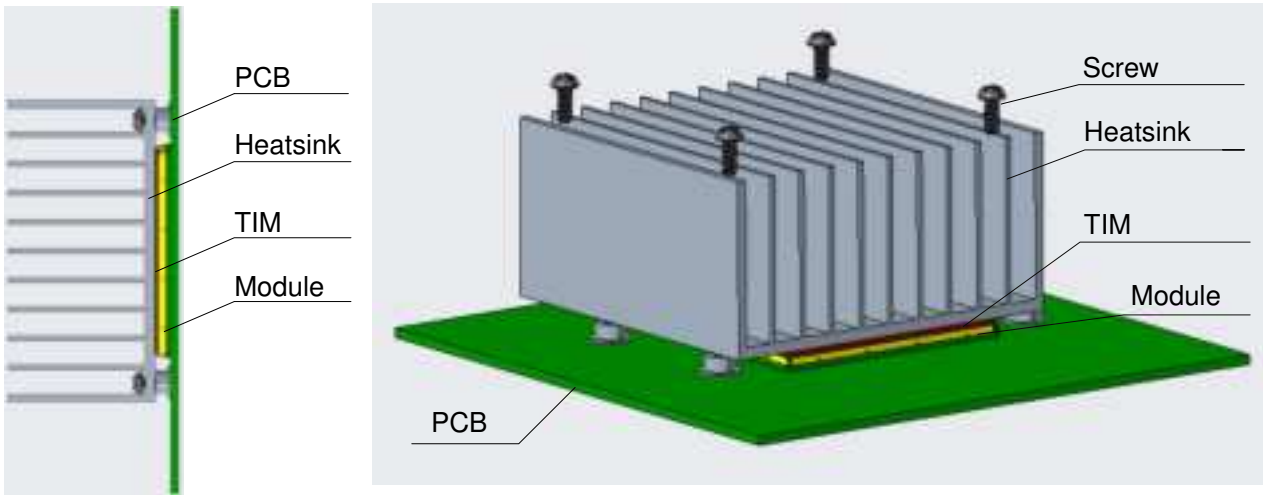



**Figure 20: Placement and Fixing of the Heatsink**

# 7 Mechanical Information

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

## 7.1. Mechanical Dimensions

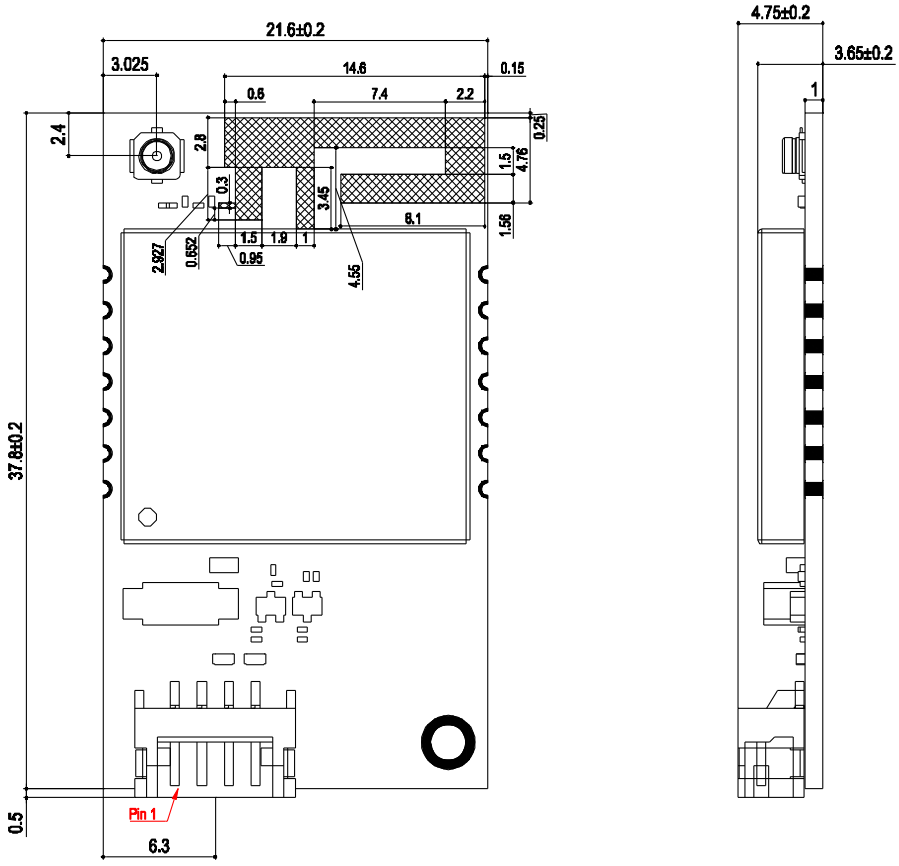



**Figure 21: Top and Side Dimensions**

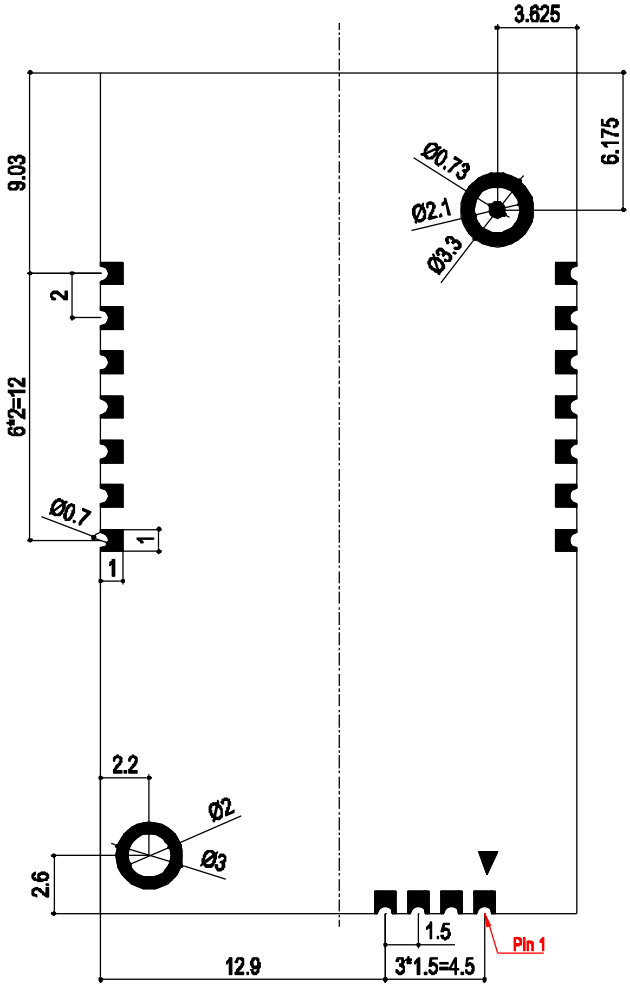



**Figure 22: Bottom Dimensions (Bottom View)**

**NOTE**

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

## 7.2. Recommended Footprint

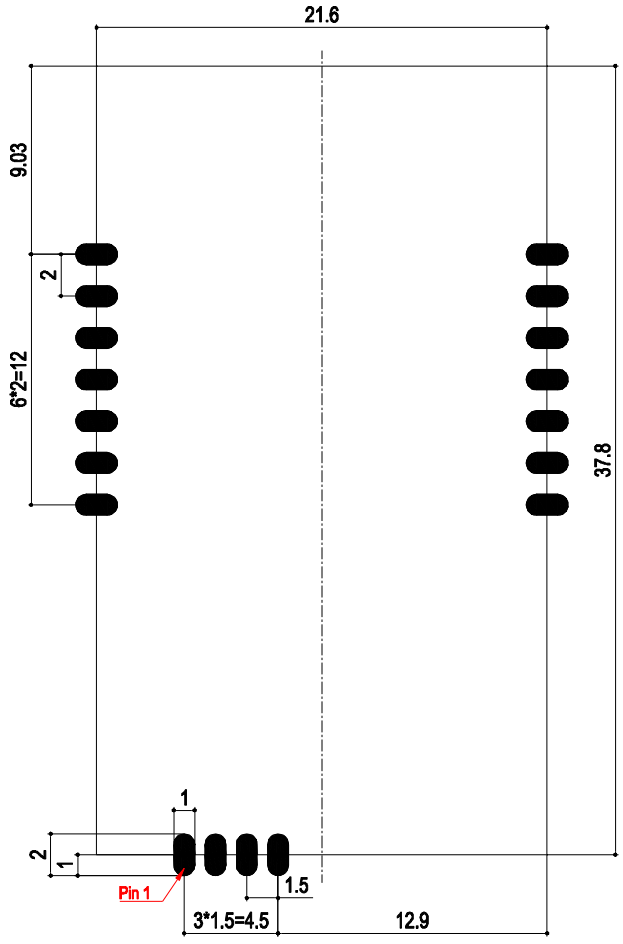



**Figure 23: Recommended Footprint**

**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

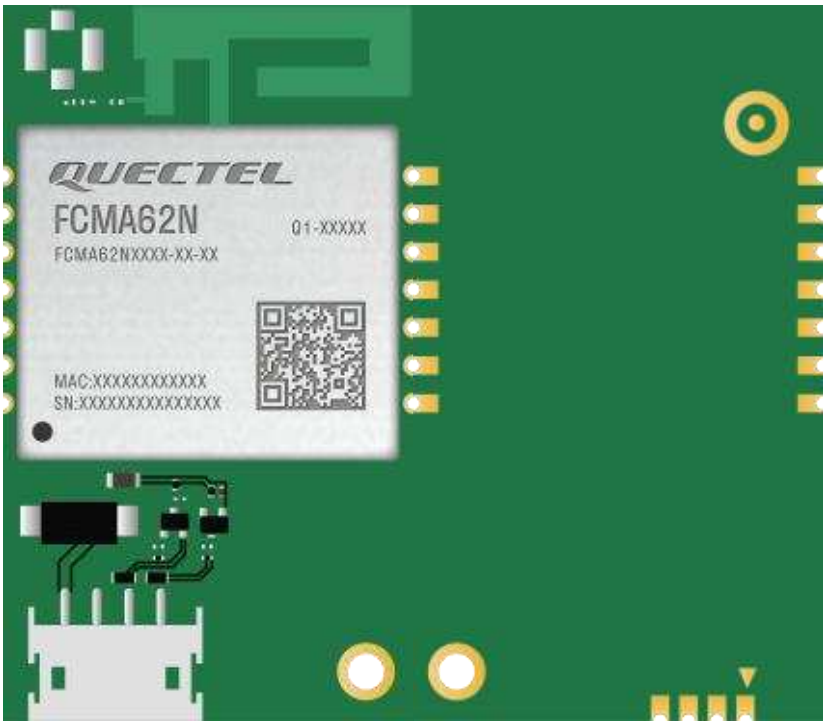



**Figure 24: Top and Bottom Views (PCB Antenna)**

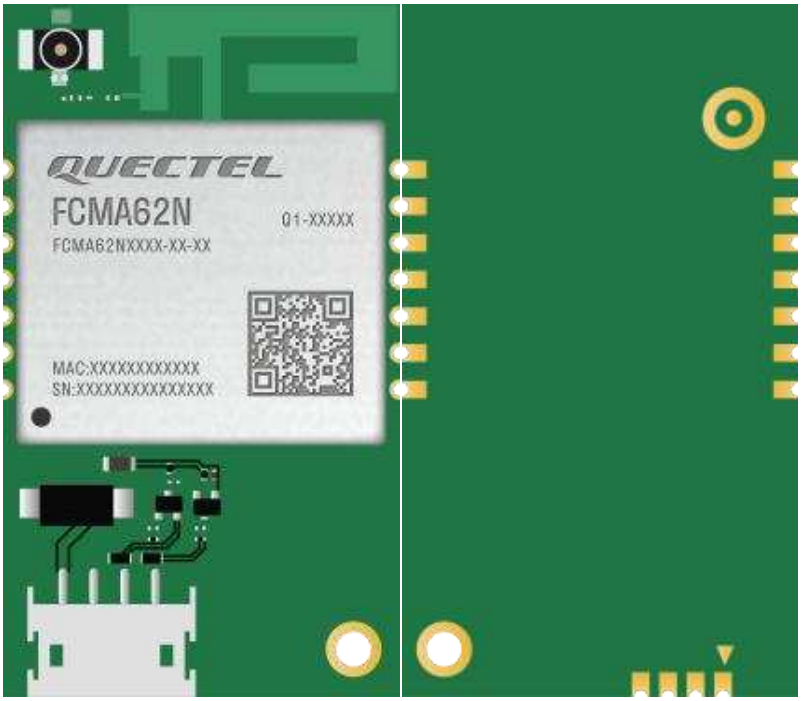



**Figure 25: Top and Bottom Views (RF Coaxial Connector)**

**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 ±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 [6] in a factory where the temperature is 23 ±5 °C and relative humidity is below 60 %. After the vacuum-sealed packaging is removed, the module must be processed in reflow soldering or other high-temperature operations within 168 hours. Otherwise, the module should be stored in an environment where the relative humidity is less than 10 % (e.g., a dry cabinet).

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

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

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

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

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

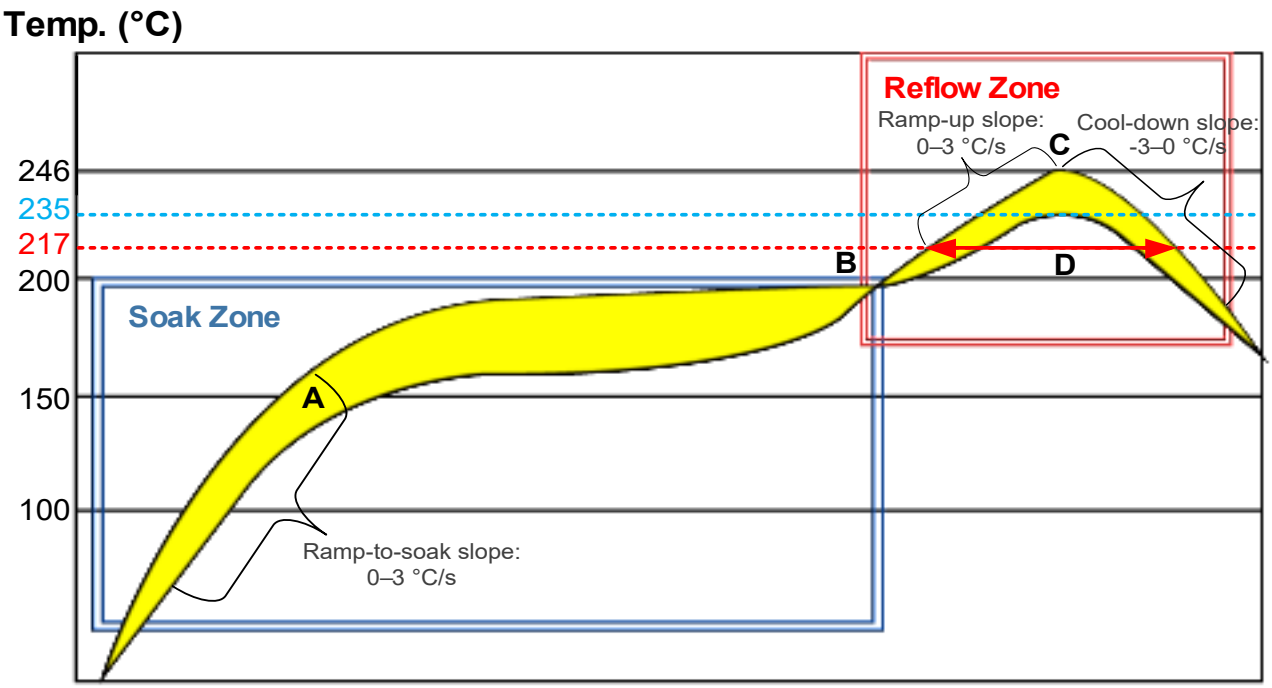



**Figure 26: Recommended Reflow Soldering Thermal Profile**

**Table 26: Recommended Thermal Profile Parameters**

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

**NOTE**

1. The above profile parameter requirements are for the measured temperature of solder joints. Both the hottest and coldest spots of solder joints on the PCB should meet the above requirements.
2. During manufacturing and soldering, or any other processes that may contact the module directly, NEVER wipe the module's shielding can with organic solvents, such as acetone, ethyl alcohol, isopropyl alcohol, trichloroethylene, etc. Otherwise, the shielding can may become rusted.
3. The shielding can for the module is made of Cupro-Nickel base material. It is tested that after 12 hours' Neutral Salt Spray test, the laser engraved label information on the shielding can is still clearly identifiable and the QR code is still readable, although white rust may be found.
4. If a conformal coating is necessary for the module, do NOT use any coating material that may chemically react with the PCB or shielding cover, and prevent the coating material from flowing into the module.
5. Avoid using ultrasonic technology for module cleaning since it can damage crystals inside the module.
6. 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:

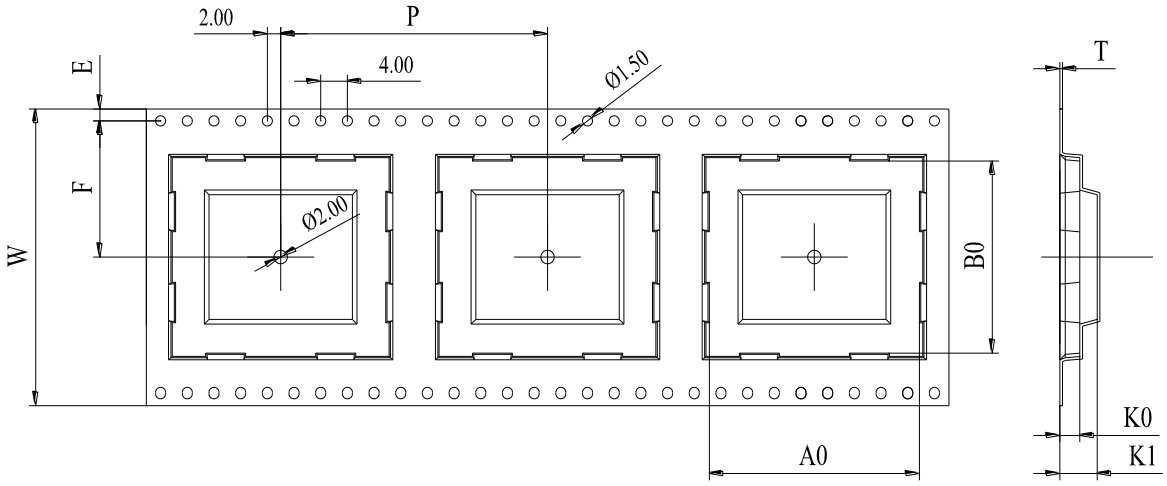



**Figure 27: Carrier Tape Dimension Drawing (Unit: mm)**

**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:

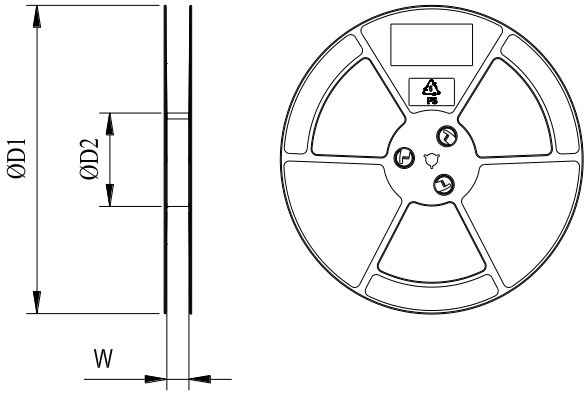



**Figure 28: Plastic Reel Dimension Drawing**

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

| øD1 | øD2 | W |
|---|---|---|
| 330 | 100 | 56.5 |

### 8.3.3. Mounting Direction

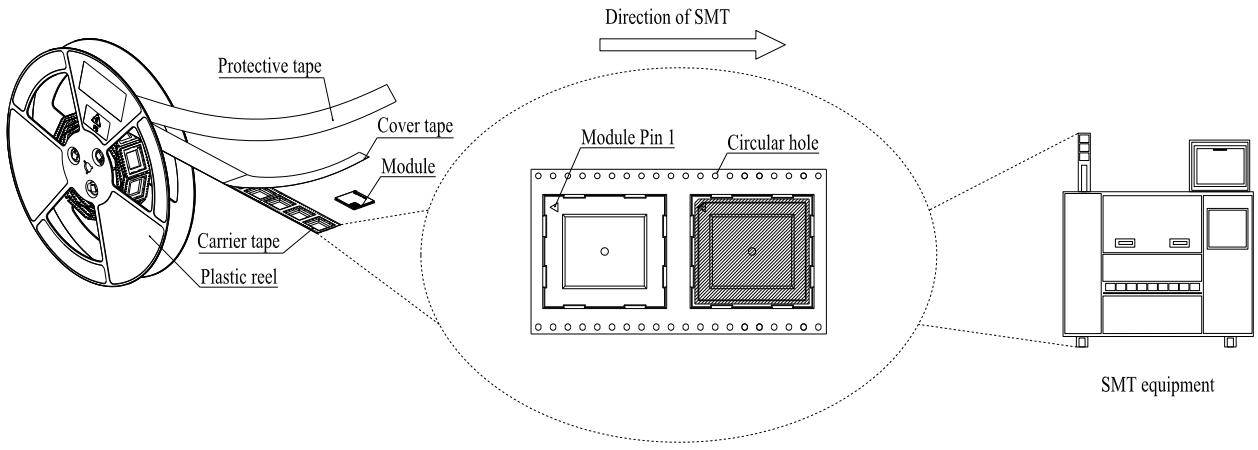
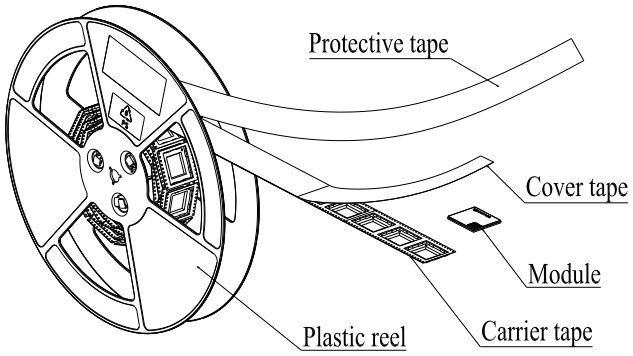


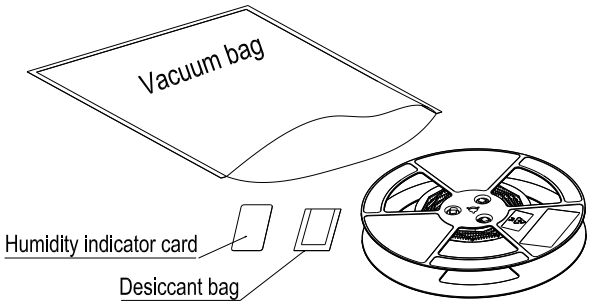

**Figure 29: Mounting Direction**

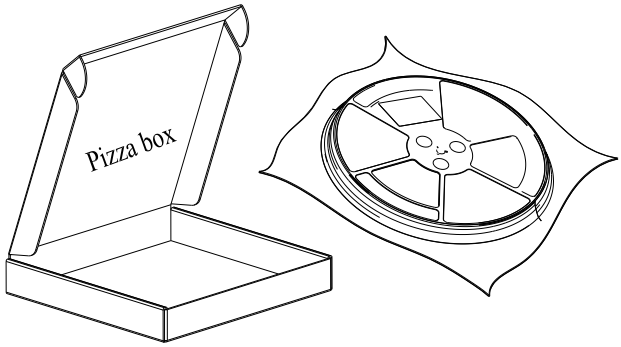
### 8.3.4. Packaging Process




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.

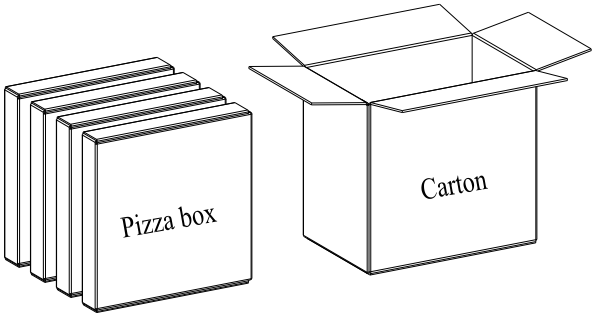



**Figure 30: Packaging Process**

# 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 |
| Vmax | Maximum Voltage |
| Vmin | Minimum Voltage |
| Vnom | 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 compos it product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules,

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

**2.4 Limited module procedures**

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

**2.5 Trace antenna designs**

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

**2.6 RF exposure considerations**

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

**2.7 Antennas**

Antenna Specification are as follows:

Type: External Antenna

Gain: 2.4G:-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, e.t.c according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product. Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

**2.10 Additional testing, Part 15 Subpart B disclaimer**

The modular transmitter is only FCC authorized for FCC Part 15 Subpart C 15.247 & 15 209 &15.407 and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

**Federal Communication Commission Statement (FCC, U S)**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules These limits are designed to provide reasonable protection against harmful interference in a residential installation This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications However, there is no guarantee that interference will not occur in a particular installation If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

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

This device complies with Part 15 of the FCC Rules Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

**FCC Caution:**

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

**IMPORTANT NOTES**

**Co-location warning:**

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

**OEM integration instructions:**

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

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

As long as the conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance

requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

**Validity of using the module certification:**

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot be used on the final product In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

**End product labeling**:

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

## IC Statement

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.
Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :(1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.
The device is compliance with RF field strength limits, users can obtain Canadian information on RF exposure and compliance.

IC Radiation Exposure Statement

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

Déclaration d'exposition aux radiations:

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

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

mentioned in the above sections, namely that:
(i) the device for operation in the band 5150-5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems;
(ii) the maximum antenna gain permitted for devices in the bands 5250-5350 MHz and 5470-5725 MHz shall comply with the e.i.r.p. limit; and
(iii) the maximum antenna gain permitted for devices in the band 5725-5825 MHz shall comply with the e.i.r.p. limits specified for point-to-point and non point-to-point operation as appropriate.

(i)Les dispositifs fonctionnant dans la bande 5150-5250 MHz sont réservés uniquement pour une utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux.
(ii) le gain d'antenne maximal autorisé pour les appareils dans les bandes 5250-5350 MHz et 5470-5725 MHz doivent respecter le pire limiter; et
(iii) le gain d'antenne maximal autorisé pour les appareils dans la bande 5725-5825 MHz doivent respecter le pire limites spécifiées pour le point-à-point et l'exploitation non point à point, le cas échéant.

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

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