QUECTEL

FCE863R

Hardware Design

Short-Range Module Series

Version: 1.0.0

Date: 2024-02-26

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

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.

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

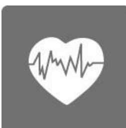
The following safety precautions must be observed during all phases of operation, such as usage, service or repair of any terminal or mobile incorporating the module. Manufacturers of the terminal should notify users and operating personnel of the following safety information by incorporating these guidelines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

Full attention must be given 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 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 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 cellular 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
-	2024-01-11	Jason YI/Tara KONG/ Elijah ZHOU	Creation of the document
1.0.0	2024-01-11	Jason YI/Tara KONG/ Elijah ZHOU	Preliminary

Contents

Safety Information 3

About the Document 4

Contents 5

Table Index 7

Figure Index 8

1 Introduction 9

2 Product Overview 10

2.1. Key Features 11

3 RF Performances 12

3.1. Wi-Fi Performances 12

3.2. Bluetooth Performances 12

4 Application Interfaces 14

4.1. Pin Assignment 14

4.2. Pin Description 15

4.3. Power Supply 17

4.4. Wi-Fi Application Interfaces 18

4.4.1. PCIe Interface 19

The module provides the PCIe 1.1 interface to implement the Wi-Fi application functions. The PCIe interface connection between the module and the host machine is provided as follows: 19

4.5. Bluetooth Application Interfaces 20

4.5.1. Bluetooth UART 20

4.6. RF Antenna Interfaces 21

4.6.1. Reference Design 21

4.6.2. Antenna Design Requirements 22

4.6.3. RF Routing Guidelines 23

4.6.4. RF Connector Recommendation 25

5 Electrical Characteristics & Reliability 27

5.1. Absolute Maximum Ratings 27

5.2. Power Supply Ratings 27

5.3. Power Consumption 28

5.4. Digital I/O Characteristics 30

5.5. ESD Protection 30

5.6. Thermal Dissipation 30

6 Mechanical Information 32

6.1. Mechanical Dimensions 32

6.2. Recommended Footprint 34
6.3. Top and Bottom Views 35

7 Storage, Manufacturing & Packaging 36
7.1. Storage Conditions 36
7.2. Manufacturing and Soldering 37
7.3. Packaging Specification 39
7.3.1. Carrier Tape 39
7.3.2. Plastic Reel 40
7.3.3. Mounting Direction 40
7.3.4. Packaging Process 41

8 Appendix References 42

Table Index

Table 2 : Basic Information 10
Table 3 : Key Features 11
Table 4 : Wi-Fi Performances 12
Table 5 : Bluetooth Performances 12
Table 6 : Parameter Definition 15
Table 7 : Pin Description 15
Table 12 : Antenna Design Requirements 22
Table 13 : Absolute Maximum Ratings (Unit: V) 27
Table 14 : Module Power Supply Ratings (Unit: V) 27
Table 15 : Wi-Fi Power Consumption in Non-signalling Mode (Typ.) 28
Table 16 : Bluetooth Power Consumption in Non-signalling Modes (Typ.) 29
Table 17 : 3.3V IO DC Characteristics (Unit: V) 30
Table 18 : 1.8V IO DC Characteristics (Unit: V) 30
Table 19 : Recommended Thermal Profile Parameters 38
Table 20 : Carrier Tape Dimension Table (Unit: mm) 39
Table 21 : Plastic Reel Dimension Table (Unit: mm) 40
Table 22 : Related Documents 42
Table 23 : Terms and Abbreviations 42

Figure Index

Figure 2 : Pin Assignment (Top View) 14
Figure 3 : Reference Design of Power Supply 18
Figure 4 : Power-up Timing 18
Figure 5 : Wi-Fi Application Interface Connection 19
图 6 ： PCIe Interface connection 19
Figure 7 : Bluetooth Application Interface Connection 20
Figure 12 : Reference Design for RF Antenna Interface 22
Figure 13 : Microstrip Design on a 2-layer PCB 23
Figure 14 : Coplanar Waveguide Design on a 2-layer PCB 23
Figure 15 : Coplanar Waveguide Design on a 4-layer PCB (Layer 3 as Reference Ground) 23
Figure 16 : Coplanar Waveguide Design on a 4-layer PCB (Layer 4 as Reference Ground) 24
Figure 17 : Dimensions of the Receptacle (Unit: mm) 25
Figure 18 : Specifications of Mated Plugs 25
Figure 19 : Space Factor of Mated Connectors (Unit: mm) 26
Figure 20 : Placement and Fixing of the Heatsink 31
Figure 21 : Top and Side Dimensions 32
Figure 22 : Bottom Dimension (Bottom View) 33
Figure 23 : Recommended Footprint 34
Figure 24 : Top and Bottom Views 35
Figure 25 : Recommended Reflow Soldering Thermal Profile 37
Figure 26 : Carrier Tape Dimension Drawing (Unit: mm) 39
Figure 27 : Plastic Reel Dimension Drawing 40
Figure 28 : Mounting Direction 40
Figure 29 : Packaging Process 41

1 Introduction

This document defines the FCE863R and describes its air interfaces and hardware interfaces which are connected with your applications. The document provides a quickly insight into interface specifications, RF performance, 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 FCE863R 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.

The device is restricted to indoor use only when operating in the 5250 to 5350 MHz frequency range.
The device could be used with a separation distance of 20cm to the human body.

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)

2 Product Overview

The module is a low-power and high-performance IEEE 802.11a/b/g/n/ac/ax Wi-Fi 6 and Bluetooth 5.2 module. It supports 2.4 GHz and 5 GHz Wi-Fi bands and 2T2R mode with maximum transmission rate up to 1201 Mbps. It provides SDIO 3.0 interface for Wi-Fi applications; UART and PCM interfaces for Bluetooth applications.

It is an SMD module with compact packaging. Related information is listed in the table below:

Table 1: Basic Information

FCS866R	
Packaging type	LCC
Pin counts	50
Dimensions	(15.0 ±0.15) mm × (13.0 ±0.15) mm × (2.2 ±0.2) mm
Weight	Approx. 0.92 g

2.1. Key Features

Table 2: Key Features

Basic Information	
Protocols and Standard	● Wi-Fi protocols: IEEE 802.11a/b/g/n/ac/ax ● Bluetooth protocol: Bluetooth 5.2 ● All hardware components are fully compliant with EU RoHS directive
Power Supplies	**VBAT Power Supply:** ● 3.0–3.6 V ● Typ.: 3.3 V **VDD_IO Power Supply:** ● 1.7–3.6 V ● Typ.: 1.8/3.3 V
Temperature Ranges	● Normal operating temperature [1]: -20 °C to +70 °C ● Storage temperature: -55 °C to +125 °C
EVB Kit	FCE863R-M.2, RK3568-WF EVB [2]
RF Antenna Interface	
Wi-Fi Antenna Interfaces	● ANT_WIFI0 ● ANT_WIFI1/BT ● 50 Ω characteristic impedance
Bluetooth Antenna Interface [3]	● Two-antenna solution: ANT_WIFI1/BT ● Three-antenna solution: ANT_BT ● 50 Ω characteristic impedance
Application Interface	
Wi-Fi Application Interface	PCIe 1.1
Bluetooth Application Interfaces	UART, PCM

[1] To meet the normal operating temperature range requirements, it is necessary to ensure effective thermal dissipation, e.g., by adding passive or active heatsinks, heat pipes, vapor chambers, etc. Within this range, the module's indicators comply with IEEE and Bluetooth specification requirements.
[2] Quectel supplies evaluation boards (FCE863R-M.2 and RK3568-WF EVB) with accessories to develop and test the module. For more details about the EVB, see ***document [1]***.
[3] The module supports two-antenna and three-antenna solutions. ANT_WIFI1/BT serves as Wi-Fi and Bluetooth shared antenna and ANT_BT is kept unconnected in two-antenna solution. Exclusive Bluetooth antenna is supported in three-antenna solution with ANT_WIFI1/BT only served as Wi-Fi antenna. For more details, please contact Quectel Technical Support.

3 RF Performances

3.1. Wi-Fi Performances

Table 3: Wi-Fi Performances

Operating Frequency
2.4 GHz: 2.400–2.4835 GHz **5 GHz:** 5.150–5.850 GHz
Modulation
DBPSK, DQPSK, CCK, BPSK, QPSK, 16QAM, 64QAM, 256QAM,1024QAM
Encryption Mode
WPA3
Operating Mode
● STA
Transmission Data Rate
● 802.11b: 1 Mbps, 2 Mbps, 5.5 Mbps, 11 Mbps ● 802.11a/g: 6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps, 54 Mbps ● 802.11n: HT20 (MCS 0–MCS 7), HT40 (MCS 0–MCS 7) ● 802.11ac: VHT20 (MCS 0–MCS 8), VHT40 (MCS 0–MCS 9), VHT80 (MCS 0–MCS 9) ● 802.11ax: HE20 (MCS 0–MCS 11), HE40 (MCS 0–MCS 11), HE80 (MCS 0–MCS 11)

3.2. Bluetooth Performances

Table 4: Bluetooth Performances

Operating Frequency

2.400–2.4835 GHz
Modulation
GFSK, π/4-DQPSK, 8-DPSK
Operating Mode
● Classic Bluetooth (BR + EDR) ● Bluetooth Low Energy (BLE)

4 Application Interfaces

4.1. Pin Assignment

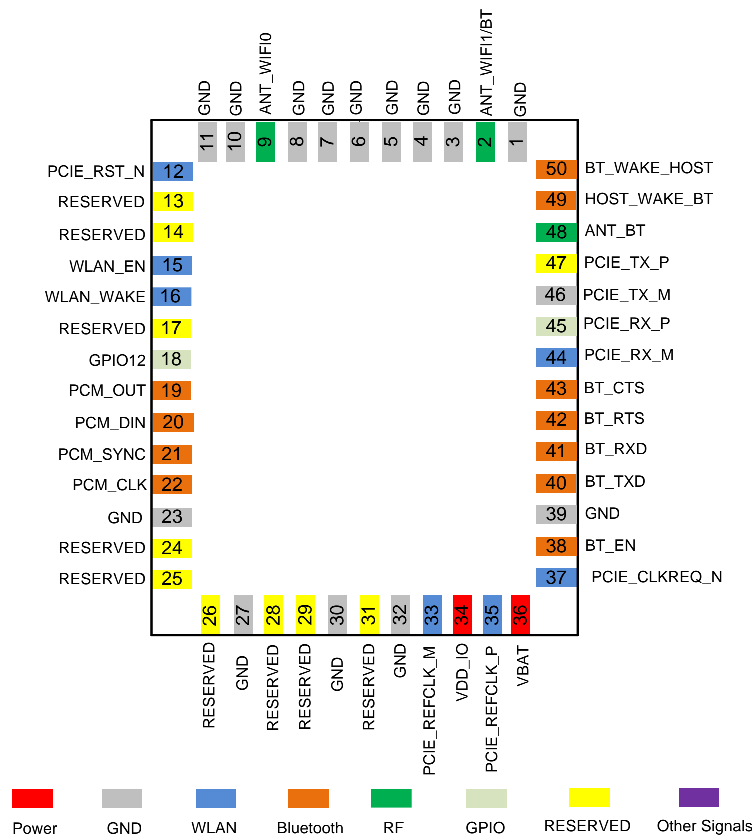


Figure 1: Pin Assignment (Top View)

NOTE

1. Keep all RESERVED and unused pins unconnected.
2. All GND pins should be connected to ground.
3. Pin 48 (ANT_BT) is kept unconnected for two-antenna solution.

4.2. Pin Description

Table 5: Parameter Definition

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

DC characteristics include power domain and rated current.

Table 6: Pin Description

Power Supply					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristic**	**Comment**
VBAT	36	PI	Main power supply for the module	Vmin = 3.0 V Vnom = 3.3 V Vmax = 3.6 V	It must be provided with sufficient current of at least 2 A.
VDD_IO	34	PI	Power supply for the module's I/O pins	Vmin = 1.7 V Vnom = 1.8/3.3 V Vmax = 3.6 V	
GND	1、3~8、10、11、23、27、30、32、39、46				
Wi-Fi Application Interfaces					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristic**	**Comment**
PCIE_RST_N	12	DI	PCIE reset		Active low
WLAN_EN	15	DI	Wi-Fi function enable control	VDD_IO	Active high. It is recommended to

					reserve a resistor to pull it up to VDD_IO when used.
PCIE_REFCLK_M	16	DO	PCIe Differential Reference Clock Source (-)		Active high.
PCIE_REFCLK_P	44	DI	PCIe Differential Reference Clock Source (-)		Active low.
PCIE_CLKREQ_N	17	DIO	PCIe Reference Clock Request		
PCIE_RX_M	18	DI	PCIe Receive Differential pair(-)		
PCIE_RX_P	19	DIO	PCIe Receive Differential pair(+)		
PCIE_TX_M	20	DIO	PCIe Transmit Differential pair(-)		
PCIE_TX_P	21	DIO	PCIe Transmit Differential pair(+)		
Bluetooth Application Interfaces					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristic**	**Comment**
PCM_SYNC	21	DO	PCM data frame sync		
PCM_DIN	20	DI	PCM data input		If unused, keep them open.
PCM_DOUT	19	DO	PCM data output		
PCM_CLK	22	DIO	PCM clock		
BT_EN	38	DI	Bluetooth enable control	VDD_IO	Active high. It is recommended to reserve a resistor to pull it up to VDD_IO.
BT_TXD	40	DO	Bluetooth UART transmit		
BT_RXD	41	DI	Bluetooth UART receive		
BT_RTS	42	DO	Request to send signal from the module		It is recommended to add 0 Ω series resistors.
BT_CTS	43	DI	Clear to send signal to the module		

HOST_WAKE_BT	49	DI	Host wake up Bluetooth		Active high.
BT_WAKE_HOST	50	DO	Bluetooth wake up host		
RF Antenna Interfaces					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristic**	**Comment**
ANT_WIFI1/BT	2	AIO	Wi-Fi 1/Bluetooth antenna interface		50 Ω characteristic impedance.
ANT_WIFI0	9	AIO	Wi-Fi 0 antenna interface		
ANT_BT [4]	12	AIO	Bluetooth antenna interface		
GPIO Interfaces					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristic**	**Comment**
GPIO12	18	DIO	General-purpose input/output	VDD_IO	Need to be open or pulled down during the module power-up.
RESERVED Pins					
Pin Name	**Pin No.**				**Comment**
RESERVED	24–26, 33, 35, 37, 47				Keep them open.

4.3. Power Supply

The module is powered by VBAT. It is recommended to use a power supply chip that can provide sufficient current of at least 2 A. For better power supply performance, it is recommended to parallel a 47 μF decoupling capacitor, and two filter capacitors (1 μF and 100 nF) near the module's VBAT pin. C4 is reserved for debugging and not mounted by default. In addition, it is recommended to add a TVS near the VBAT to improve the surge protection capacity of the module. In theory, the longer the VBAT trace is, the wider it should be.

VBAT reference design is shown below.

[4] Pin 12 (ANT_BT) is kept unconnected for two-antenna solution.

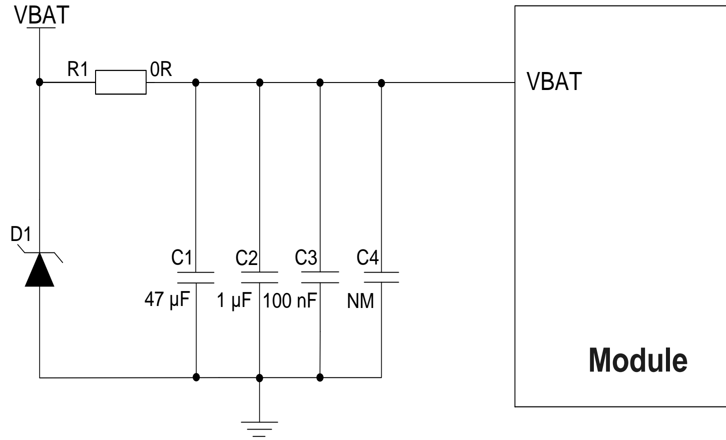


Figure 2: Reference Design of Power Supply

The power-up timing of the module is shown below.

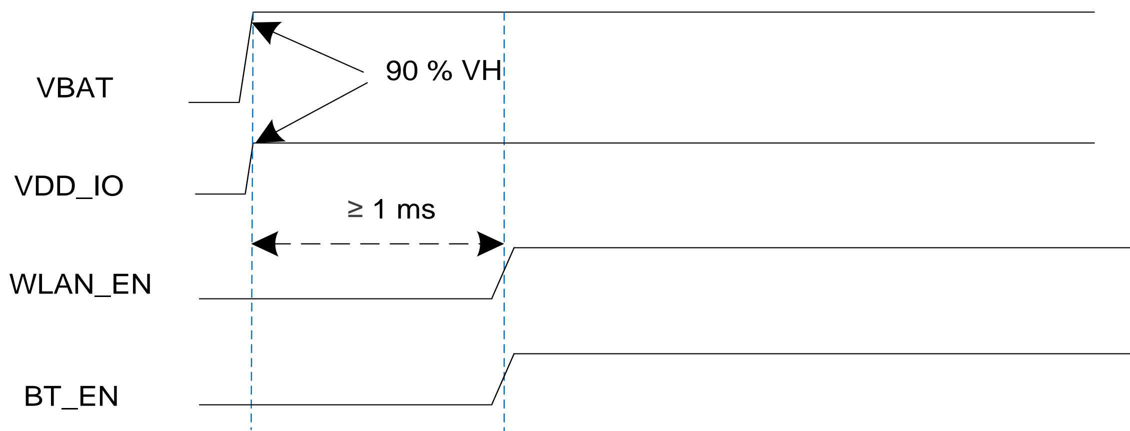


Figure 3: Power-up Timing

4.4. Wi-Fi Application Interfaces

Wi-Fi application interface connection between the module and the host is illustrated in the figure below.

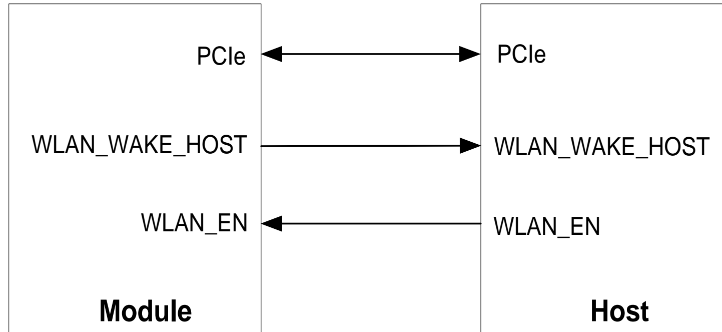


Figure 4: Wi-Fi Application Interface Connection

4.4.1. PCIe Interface

The module provides the PCIe 1.1 interface to implement the Wi-Fi application functions. The PCIe interface connection between the module and the host machine is provided as follows:

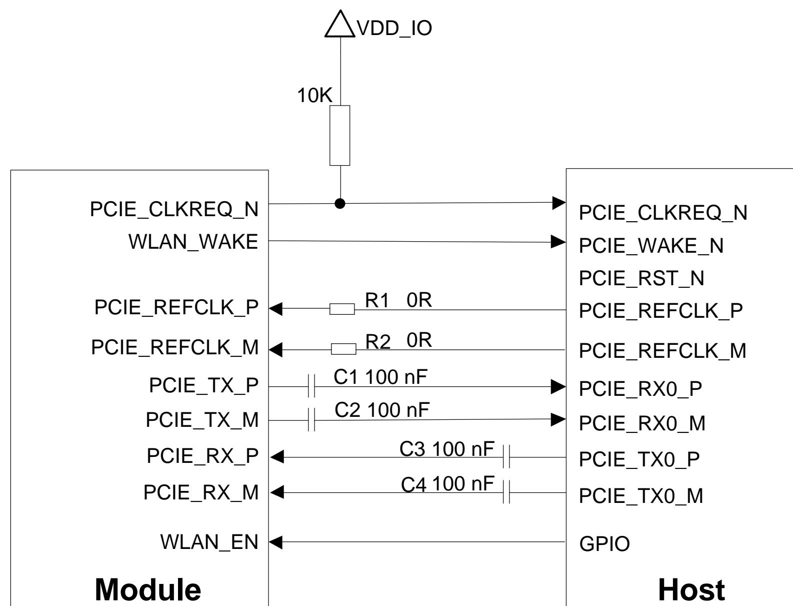


图 5：PCIe Interface connection

- In order to ensure the integrity of the PCIe interface signal quality, C1 and C2 need to be placed close to the modules, C3 and C4 need to be placed close to the host equipment, and the wiring should be as short as possible.
- The PCIe interface circuit shall be designed with the following principles:

- PCIe Tx / Rx / REFCLK shall be wired by differential impedance 85 Ω ± 10%, and solid solid.
- The spacing between Tx and Rx signal lines should be greater than 3 times the line width, and the spacing between Tx / Rx signal lines and other signal lines should be greater than 4 times the line width.
- PCIe Signal routing should be far away from crystal, crystal vibration, magnetic device and radio frequency signal routing and other interference sources, PCIe differential signal inner routing.。

4.5. Bluetooth Application Interfaces

Bluetooth application interface connection between the module and the host is illustrated in the figure below.

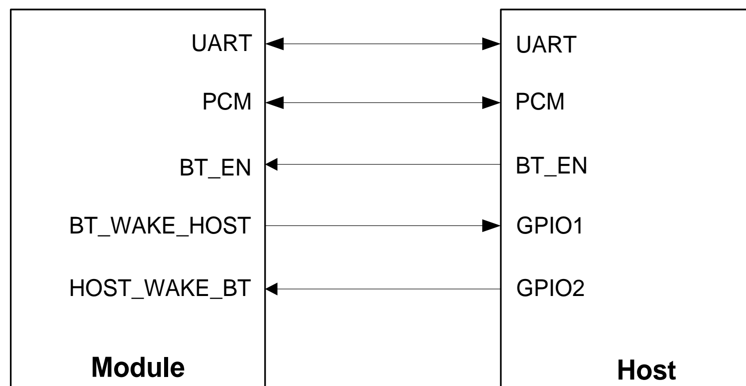


Figure 6: Bluetooth Application Interface Connection

4.5.1. Bluetooth UART

The module provides an HCI UART defined by Bluetooth 5.2 protocol. It supports hardware flow control(RXD/TXD/CTS) and can be used for data transmission with the host. The default baud rate is 115200 bps, and the maximum baud rate is 4 Mbps.

HCI UART interface timing is shown below：

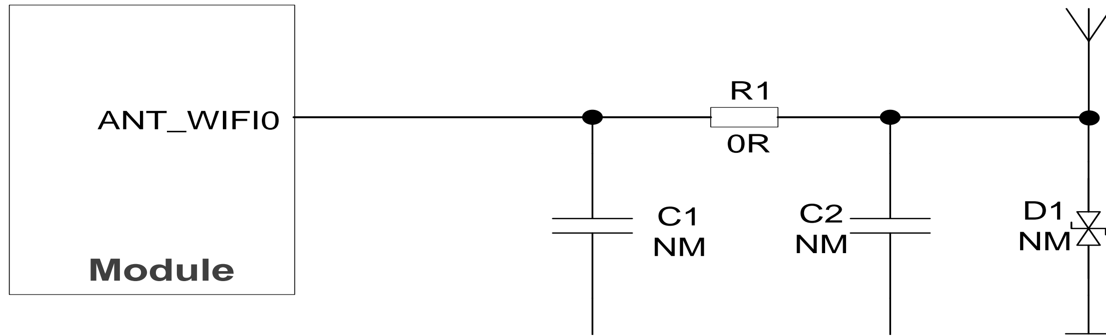


Table 8: PIN Discrption

Parameter	Description	Min.	Typ.	Max.	Unit
Baud Rate		64	-	512	kHz
Baud rate accuracy(per)	Transmit/Receive	-3	-	3	%
CTS low to TX_Data on	Hardware flow	0	2	-	ns
CTS high to TX_Data off		-	-	1	byte
CTS High plus width		1	-	-	bit

4.6. RF Antenna Interfaces

The module provides three antenna pins (ANT_WIFI0, ANT_WIFI1/BT and ANT_BT) and supports two-antenna and three-antenna solutions. ANT_WIFI1/BT serves as Wi-Fi and Bluetooth shared antenna and ANT_BT is kept unconnected in two-antenna solution. Exclusive Bluetooth antenna is supported in three-antenna solution with ANT_WIFI1/BT only served as Wi-Fi antenna. For more details, please contact Quectel Technical Support. The impedance of antenna port is 50 Ω.

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

4.6.1. Reference Design

A reference circuit for the RF antenna interface is shown below. It is recommended to reserve a π-type matching circuit and add ESD protection components for better RF performance. Matching components

such as R1, C1, C2, and the protection component D1 should be placed as close to the antenna as possible. R1 is recommended to be 0 Ω. C1, C2 and D1 are not mounted by default. The parasitic capacitance of TVS should be less than 0.05 pF.

The following reference design is based on ANT_WIFI0 as an example, the reference designs of other RF antenna interfaces are the same.

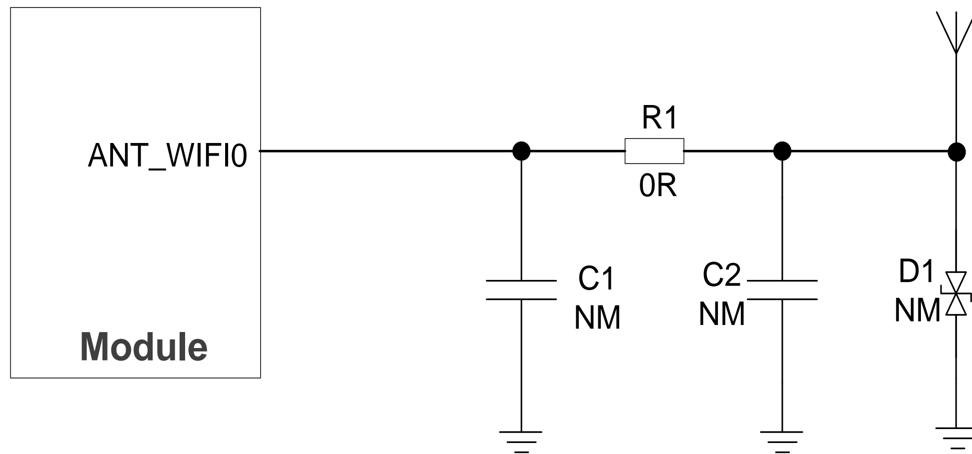


Figure 7: Reference Design for RF Antenna Interface

4.6.2. Antenna Design Requirements

Table 7: Antenna Design Requirements

Parameter	Requirement [5]
Frequency Ranges (GHz)	● 2.4 GHz: 2.400–2.4835 ● 5 GHz: 5.150–5.850
Cable Insertion Loss (dB)	< 1
VSWR	≤ 2 (Typ.)
Gain (dBi)	0.2 (max)
Max Input Power (W)	50
Input Impedance (Ω)	50
Polarization Type	Vertical

[5] For more details about the RF performances, see ***Chapter 3***.

4.6.3. RF Routing Guidelines

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

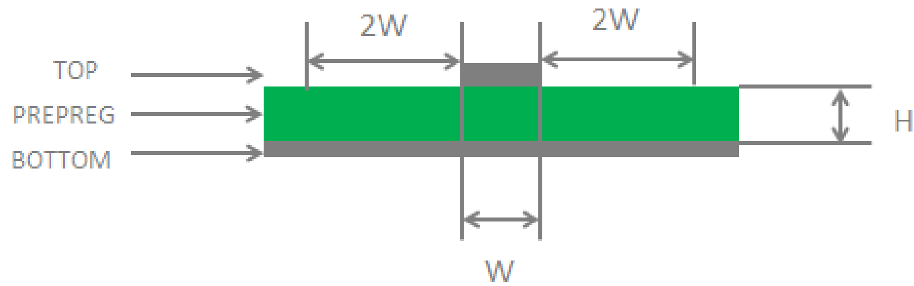


Figure 8: Microstrip Design on a 2-layer PCB

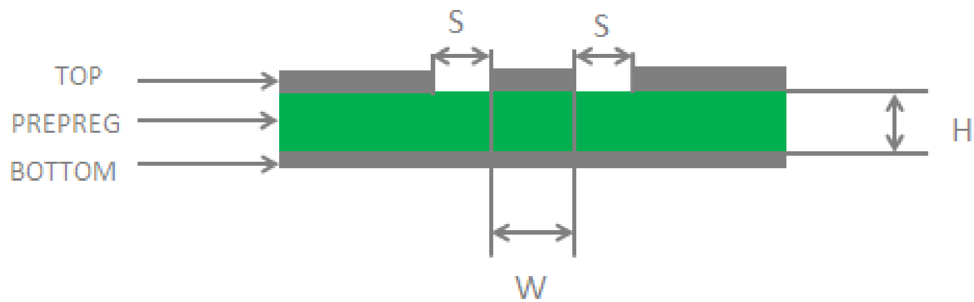


Figure 9: Coplanar Waveguide Design on a 2-layer PCB

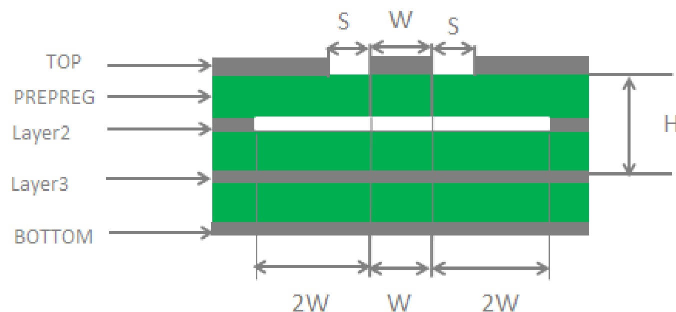


Figure 10: Coplanar Waveguide Design on a 4-layer PCB (Layer 3 as Reference Ground)

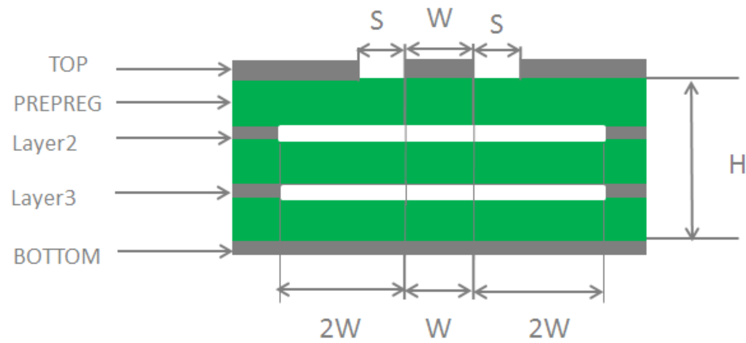


Figure 11: Coplanar Waveguide Design on a 4-layer PCB (Layer 4 as Reference Ground)

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

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

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

4.6.4. RF Connector Recommendation

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

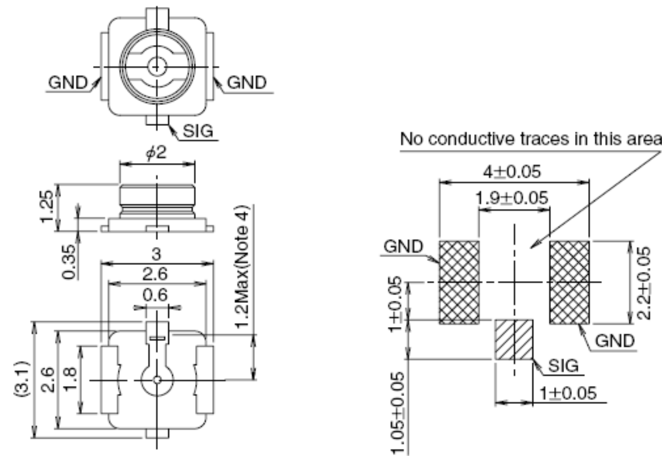


Figure 12: Dimensions of the Receptacle (Unit: mm)

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

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 13: Specifications of Mated Plugs

The following figure describes the space factor of mated connectors:

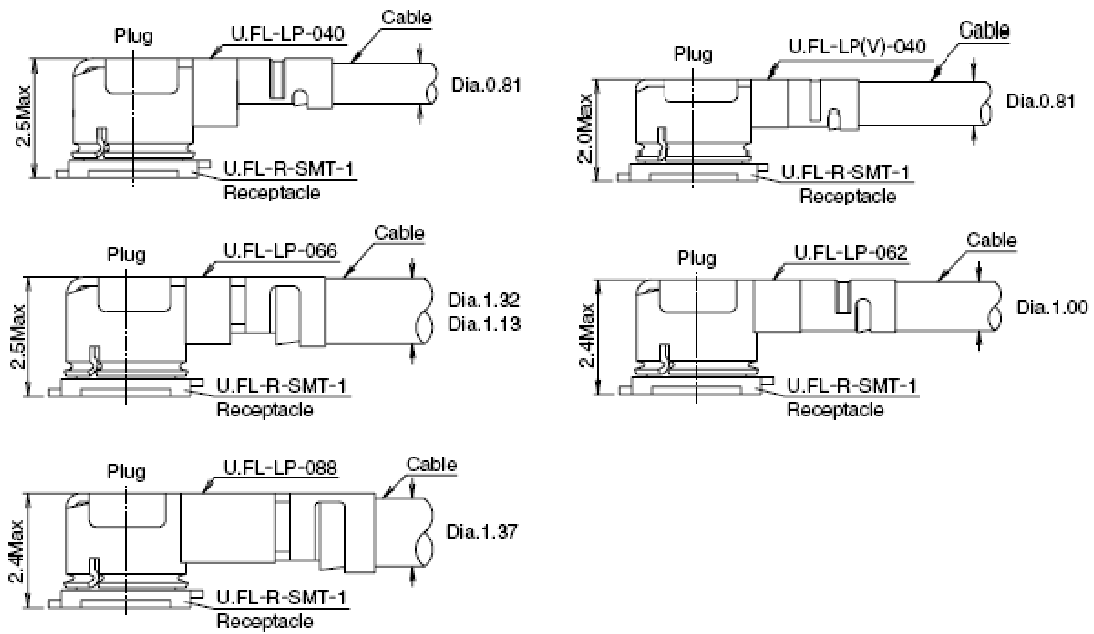


Figure 14: Space Factor of Mated Connectors (Unit: mm)

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

5 Electrical Characteristics & Reliability

5.1. Absolute Maximum Ratings

Table 8: Absolute Maximum Ratings (Unit: V)

Parameter	Min.	Max.
VBAT	-0.3	3.6
VDD_IO	-0.3	3.6

5.2. Power Supply Ratings

Table 9: Module Power Supply Ratings (Unit: V)

Parameter	Description	Condition	Min.	Typ.	Max.
VBAT	Main power supply for the module	The actual input voltages must be kept between the minimum and maximum values.	3.0	3.3	3.6
VDD_IO	Power supply for the module's I/O pins	-	1.7	1.8/3.3	3.6

5.3. Power Consumption

Table 10: Wi-Fi Power Consumption in Non-signalling Mode (Typ.)

Condition			I_{VDD_IO} (μA)		I_{VBAT} (mA)	
			ANT_WIFI0	ANT_WIFI1/BT	ANT_WIFI0	ANT_WIFI1/BT
2.4 GHz	802.11b	Tx @ 1 Mbps	393.82	393.61	406.92	395.67
		Tx @ 11 Mbps	393.41	393.28	230.90	224.45
	802.11g	Tx @ 6 Mbps	380.06	376.69	258.12	255.11
		Tx @ 54 Mbps	384.69	382.71	162.02	158.16
	802.11n 2 × 2 MIMO	Tx HT20 @ MCS 0	380.32	377.02	252.74	249.80
		Tx HT20 @ MCS 7	384.71	382.73	160.38	156.30
		Tx HT40 @ MCS 0	380.29	379.61	208.09	204.50
		Tx HT40 @ MCS 7	383.42	383.09	154.47	150.82
	802.11ac 2 × 2 MIMO	Tx VHT20 @ MCS 0	377.16	376.91	252.95	250.06
		Tx VHT20 @ MCS 8	382.78	382.82	157.99	154.14
		Tx VHT40 @ MCS 0	379.45	379.78	208.32	201.80
		Tx VHT40 @ MCS 9	382.93	383.14	153.83	149.91
	802.11ax 2 × 2 MIMO	Tx HE20 @ MCS 0	377.62	378.01	233.71	230.06
		Tx HE20 @ MCS 11	382.68	383.04	154.65	150.58
		Tx HE40 @ MCS 0	379.86	380.21	199.16	195.52
		Tx HE40 @ MCS 11	382.86	383.20	152.75	148.75
5 GHz	802.11a	Tx @ 6 Mbps	375.13	375.44	279.78	272.96
		Tx @ 54 Mbps	382.20	382.60	162.08	158.44
	802.11n 2 × 2 MIMO	Tx HT20 @ MCS 0	375.91	375.89	273.84	267.20
		Tx HT20 @ MCS 7	382.86	382.73	160.17	156.31

	Tx HT40 @ MCS 0	379.27	379.07	217.74	213.89
	Tx HT40 @ MCS 7	383.27	383.16	152.81	149.46
802.11ac 2 × 2 MIMO	Tx VHT20 @ MCS 0	376.21	375.93	274.09	267.47
	Tx VHT20 @ MCS 8	383.06	382.91	156.71	153.65
	Tx VHT40 @ MCS 0	379.29	379.05	217.93	214.19
	Tx VHT40 @ MCS 9	383.36	383.27	151.21	148.26
	Tx VHT80 @ MCS 0	380.77	380.71	193.58	189.00
	Tx VHT80 @ MCS 9	382.95	382.95	158.54	154.45
802.11ax 2 × 2 MIMO	Tx HE20 @ MCS 0	377.45	377.26	252.17	246.19
	Tx HE20 @ MCS 11	383.26	393.18	152.35	148.77
	Tx HE40 @ MCS 0	379.94	379.80	206.95	202.78
	Tx HE40 @ MCS 11	383.47	383.39	149.93	146.70
	Tx HE80 @ MCS 0	381.03	381.01	189.52	184.73
	Tx HE80 @ MCS 11	382.99	382.89	158.86	155.04

Table 11: Bluetooth Power Consumption in Non-signalling Modes (Typ.)

Mode	Transmitting Power (dBm)	I_{VDD_IO} (μA)	I_{VBAT} (mA)
BR	/	209.22	38.01
EDR (π/4-DQPSK)	/	209.21	38.03
EDR (8-DPSK)	/	209.22	38.07
BLE (1 Mbps)	/	209.46	35.33
BLE (2 Mbps)	/	210.15	56.89
BLE (S = 2)	/	208.94	37.84
BLE (S = 8)	/	208.81	36.54

5.4. Digital I/O Characteristics

Table 12: 3.3V IO DC Characteristics (Unit: V)

Parameter	Description	Min.	Typ.	Max.	Unit
V_{IH}	High-level input voltage	2	3.3	3.6	V
V_{IL}	Low-level input voltage	-	0	0.9	V
V_{OH}	High-level output voltage	2.97	-	3.3	V
V_{OL}	Low-level output voltage	0	-	0.33	V

Table 13: 1.8V IO DC Characteristics (Unit: V)

Parameter	Description	Min.	Typ.	Max.	Unit
V_{IH}	High-level input voltage	1.7	1.8	3.6	V
V_{IL}	Low-level input voltage	-	0	0.8	V
V_{OH}	High-level output voltage	1.62	-	1.8	V
V_{OL}	Low-level output voltage	0	-	0.18	V

5.5. ESD Protection

Static electricity occurs naturally and it may damage the module. Therefore, applying proper ESD countermeasures and handling methods is imperative. For example, wear anti-static gloves during the development, production, assembly and testing of the module; add ESD protection components to the ESD sensitive interfaces and points in the product design.

5.6. 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, etc.) 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.

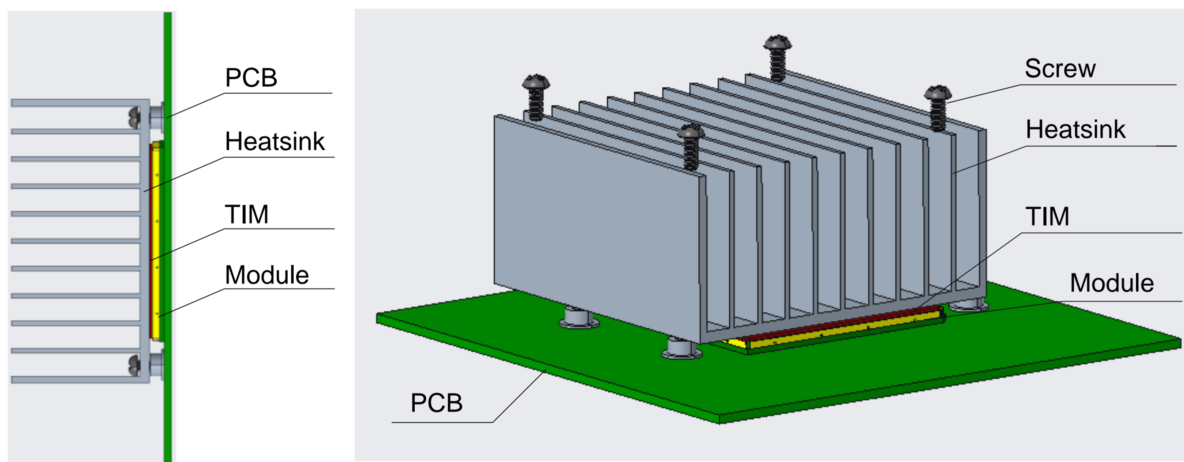


Figure 15: Placement and Fixing of the Heatsink

6 Mechanical Information

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

6.1. Mechanical Dimensions

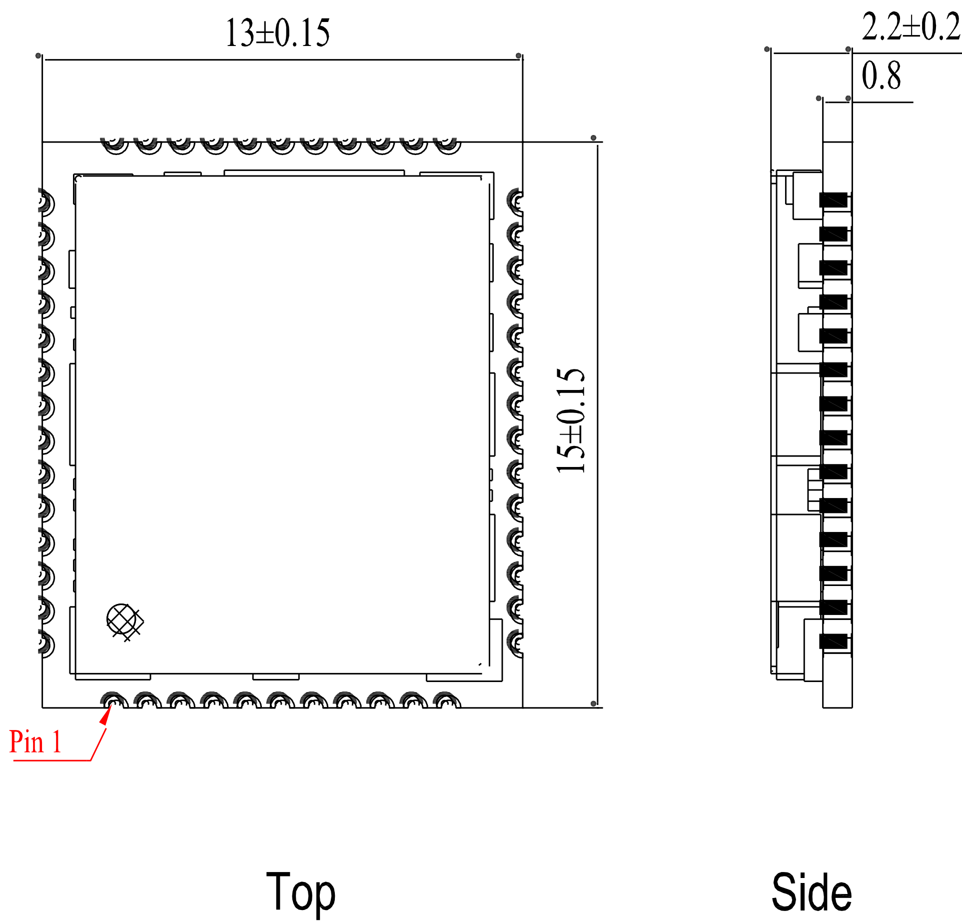


Figure 16: Top and Side Dimensions

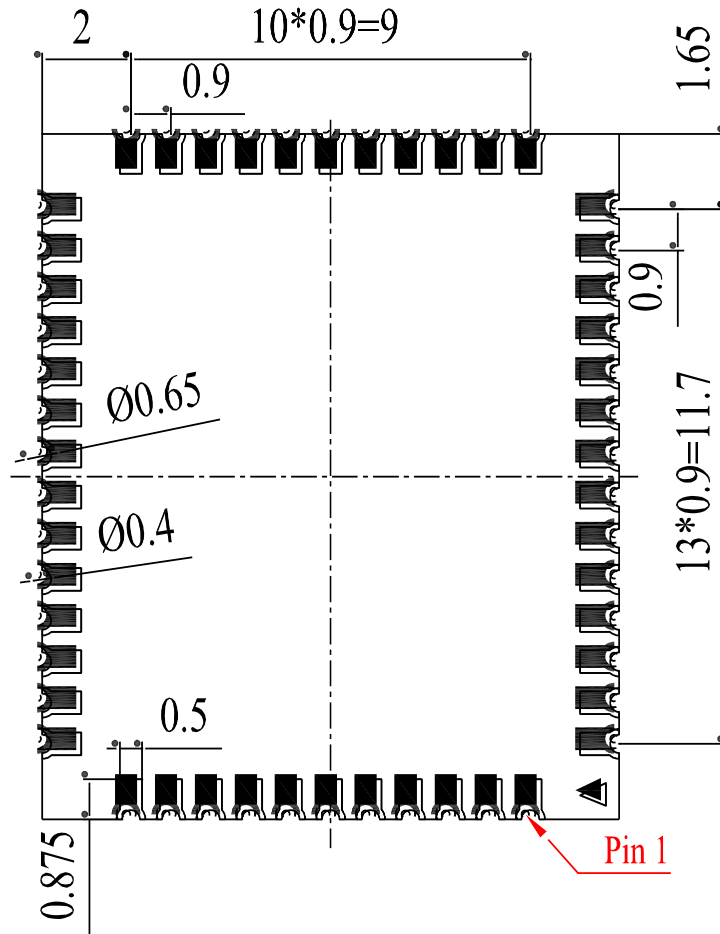


Figure 17: Bottom Dimension (Bottom View)

NOTE

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

6.2. Recommended Footprint

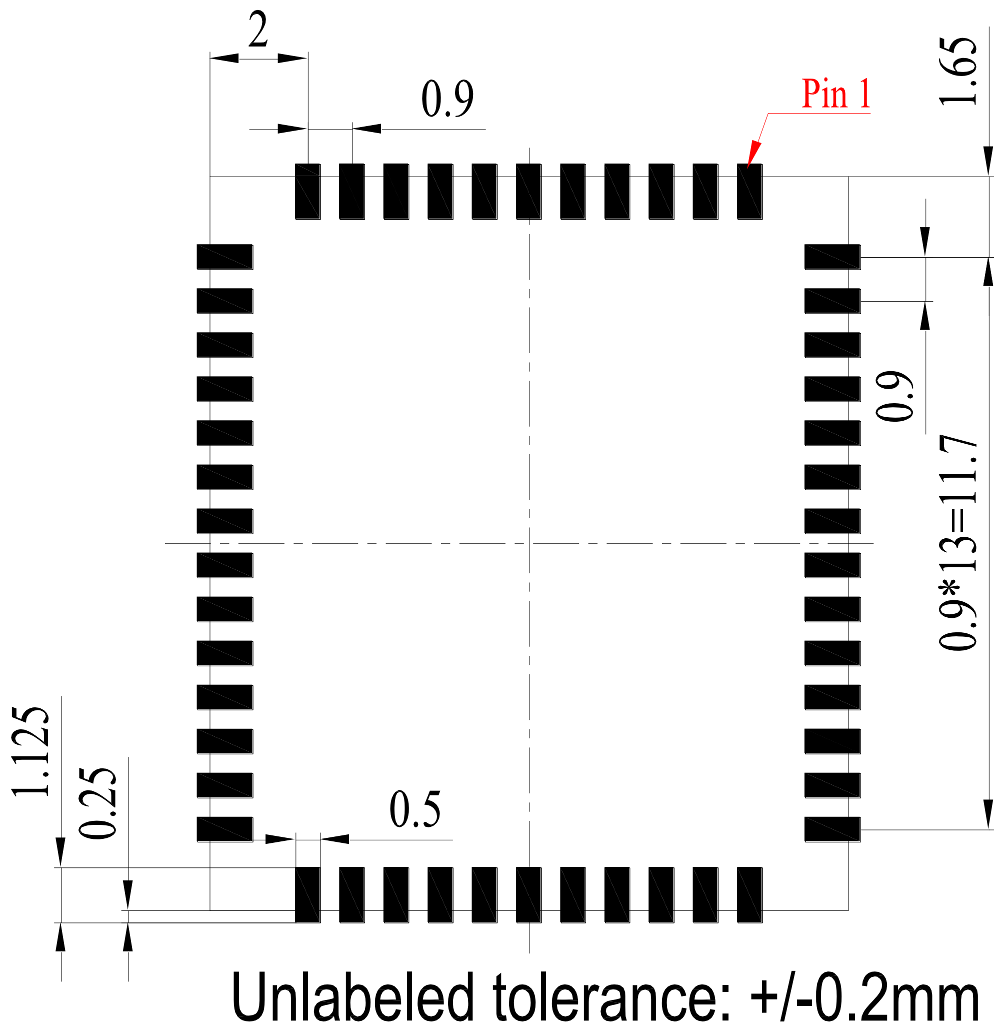


Figure 18: Recommended Footprint

NOTE

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

6.3. Top and Bottom Views

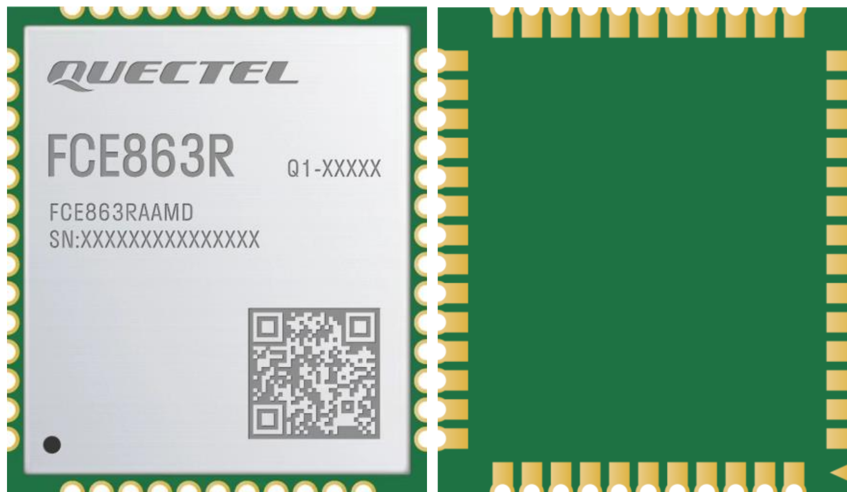


Figure 19: Top and Bottom Views

NOTE

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.

7 Storage, Manufacturing & Packaging

7.1. 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*. 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.

7.2. 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 0.1–0.12 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.

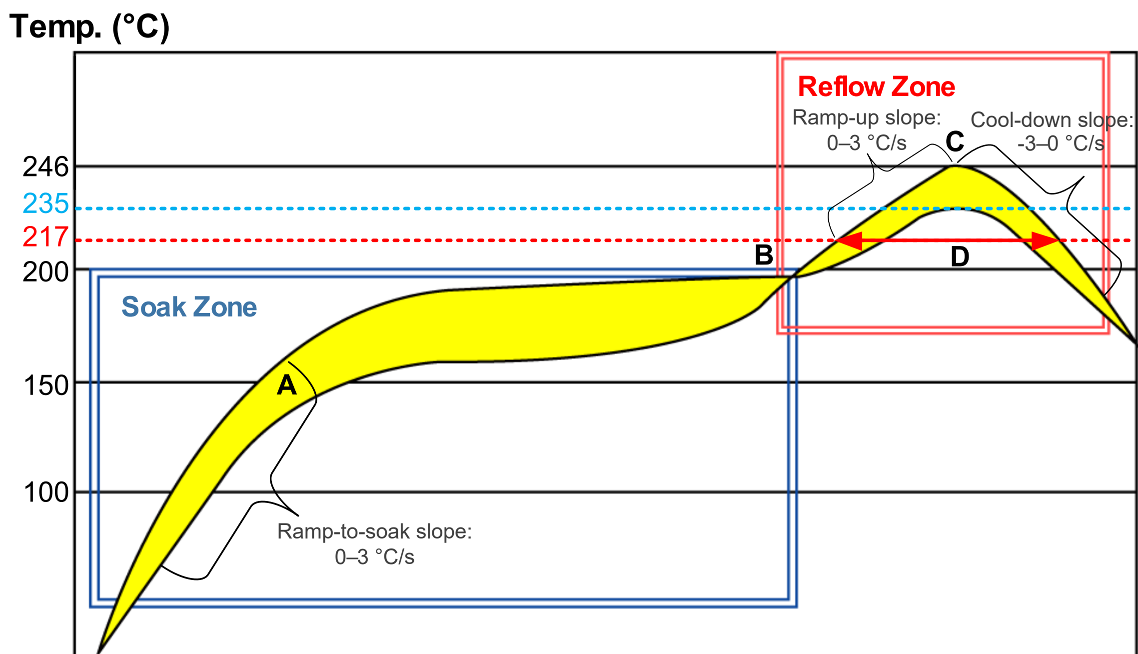


Figure 20: Recommended Reflow Soldering Thermal Profile

Table 14: 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 the 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 [3]***.

7.3. 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.

7.3.1. Carrier Tape

Carrier tape dimensions are illustrated in the following figure and table:

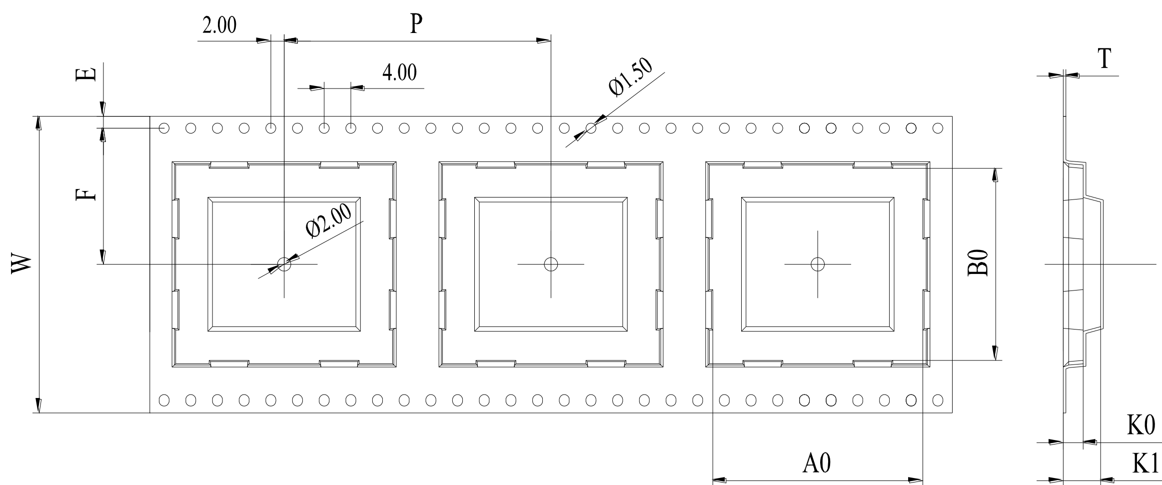


Figure 21: Carrier Tape Dimension Drawing (Unit: mm)

Table 15: Carrier Tape Dimension Table (Unit: mm)

W	P	T	A0	B0	K0	K1	F	E
32	24	0.4	15.4	13.4	2.7	3.2	14.2	1.75

7.3.2. Plastic Reel

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

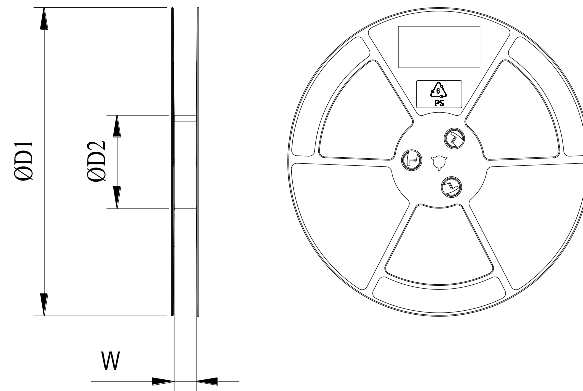


Figure 22: Plastic Reel Dimension Drawing

Table 16: Plastic Reel Dimension Table (Unit: mm)

øD1	øD2	W
380	100	32.5

7.3.3. Mounting Direction

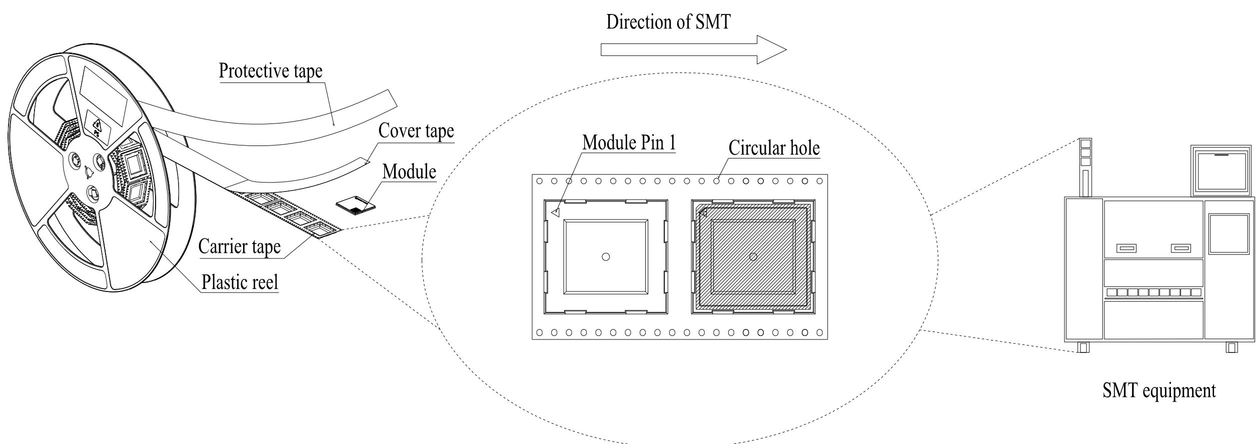
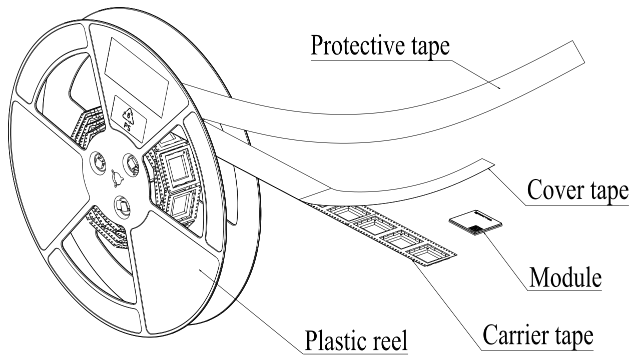


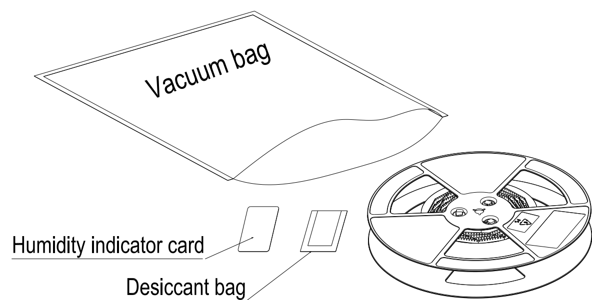
Figure 23: Mounting Direction

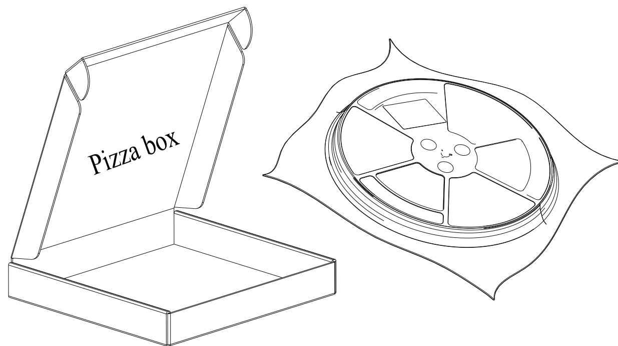
7.3.4. Packaging Process



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 load 1000 modules.

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





Place the vacuum-packed plastic reel into a pizza box.

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

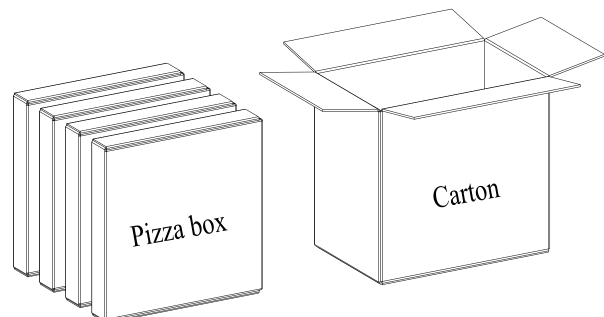


Figure 24: Packaging Process

8 Appendix References

Table 17: Related Documents

Document Name
[1] Quectel_RK3568-WF_EVB_User_Guide
[2] Quectel_RF_Layout_Application_Note
[3] Quectel_Module_SMT_Application_Note

Table 18: Terms and Abbreviations

Abbreviation	Description
2T2R	Two Transmit Two Receive
AP	Access Point
BLE	Bluetooth Low Energy
BPSK	Binary Phase Shift Keying
BR	Basic Rate
CCK	Complementary Code Keying
CTS	Clear To Send
DBPSK	Differential Binary Phase Shift Keying
DDR	Double Data Rate
DPSK	Differential Phase Shift Keying
DQPSK	Differential Quadrature Phase Shift Keying
EDR	Enhanced Data Rate

eSCO	Extended Synchronous Connection-Oriented
ESD	Electrostatic Discharge
EVB	Evaluation Board
EVM	Error Vector Magnitude
GFSK	Gauss Frequency Shift Keying
GND	Ground
GPIO	General-Purpose Input/Output
HCI	Host Controller Interface
HE	High Efficiency
HT	High Throughput
IEEE	Institute of Electrical and Electronics Engineers
I/O	Input/Output
LCC	Leadless Chip Carrier (package)
LSB	Least Significant Bit
Mbps	Million Bits Per Second
MCS	Modulation and Coding Scheme
MIMO	Multiple Input Multiple Output
MSB	Most Significant Bit
NM	Not Mounted
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
RoHS	Restriction of Hazardous Substances

RTS	Request to Send
Rx	Receive
SCO	Synchronous Connection-Oriented
SDIO	Secure Digital Input/Output
SDR	Single Data Rate
SMD	Surface Mount Device
SMT	Surface Mount Technology
STA	Station
TBD	To Be Determined
TVS	Transient Voltage Suppressor
Tx	Transmit
UART	Universal Asynchronous Receiver/Transmitter
(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	Nominal Voltage
V_{OH}	High-level Output Voltage
V_{OL}	Low-level Output Voltage
VSWR	Voltage Standing Wave Ratio
WPA	Wi-Fi Protected Access

Important Notice to OEM integrators

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

Important Note

notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify to Quectel that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the USI, or the host manufacturer can take responsibility through the change in FCC ID (XMR2024FCE863R) procedure followed by a Class II permissive change application.

End Product Labeling

When the module is installed in the host device, the FCC/IC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text: “Contains FCC ID: XMR2024FCE863R”
“Contains IC: 10224A-2024FCE863R“
The FCC ID/IC ID can be used only when all FCC/IC compliance requirements are met.

Antenna Installation

(1) The antenna must be installed such that 20 cm is maintained between the antenna and users,
(2) The transmitter module may not be co-located with any other transmitter or antenna.
(3) Only antennas of the same type and with equal or less gains as shown below may be used with this module. Other types of antennas and/or higher gain antennas may require additional authorization for operation.

Antenna type	2.4GHz band Peak Gain	5.2GHz band Peak Gain	5.3GHz band Peak Gain	5.5GHz band Peak Gain	5.8GHz band Peak Gain

	(dBi)	(dBi)	(dBi)	(dBi)	(dBi)
Dipole	0.2	-0.7	-0.8	-1.2	-1.5

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

Manual Information to the End User

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

Federal Communication Commission Interference Statement

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

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

List of applicable FCC rules

This module has been tested and found to comply with 15.247 and 15.407 requirements for Modular Approval.
The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to

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

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

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

Radiation Exposure Statement

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

IC

Industry Canada Statement

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:
(1) This device may not cause interference; and
(2) This device must accept any interference, including interference that may cause undesired operation of the device.

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

Radiation Exposure Statement

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

Déclaration d'exposition aux radiations:

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

RSS-247 Section 6.4 (5) (6) (for local area network devices, 5GHz)

The device could automatically discontinue transmission in case of absence of information to transmit, or operational failure. Note that this is not intended to prohibit transmission of control or signaling information or the use of repetitive codes where required by the technology.

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;
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
The maximum antenna gain permitted for devices in the band 5725–5850 MHz shall comply with the e.i.r.p. limits specified for point-to-point and non point-to-point operation as appropriate.

L'appareil peut interrompre automatiquement la transmission en cas d'absence d'informations à transmettre ou de panne opérationnelle. Notez que ceci n'est pas destiné à interdire la transmission d'informations de contrôle ou de signalisation ou l'utilisation de codes répétitifs lorsque cela est requis par

la technologie.

Le dispositif utilisé dans la bande 5150-5250 MHz est réservé à une utilisation en intérieur afin de réduire le risque de brouillage préjudiciable aux systèmes mobiles par satellite dans le même canal;
Le gain d'antenne maximal autorisé pour les dispositifs dans les bandes 5250-5350 MHz et 5470-5725 MHz doit être conforme à la norme e.r.p. limite; et
Le gain d'antenne maximal autorisé pour les appareils de la bande 5725-5850 MHz doit être conforme à la norme e.i.r.p. les limites spécifiées pour un fonctionnement point à point et non point à point, selon le cas.

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

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

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

1) L'antenne doit être installée de telle sorte qu'une distance de 20 cm est respectée entre l'antenne et les utilisateurs, et
2) Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

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

IMPORTANT NOTE:

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

NOTE IMPORTANTE:

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

ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains IC:10224A-2024FCE863R".

Plaque signalétique du produit final

Ce module émetteur est autorisé uniquement pour une utilisation dans un dispositif où l'antenne peut être installée de telle sorte qu'une distance de 20cm peut être maintenue entre l'antenne et les utilisateurs. Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: 10224A-2024FCE863R".

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

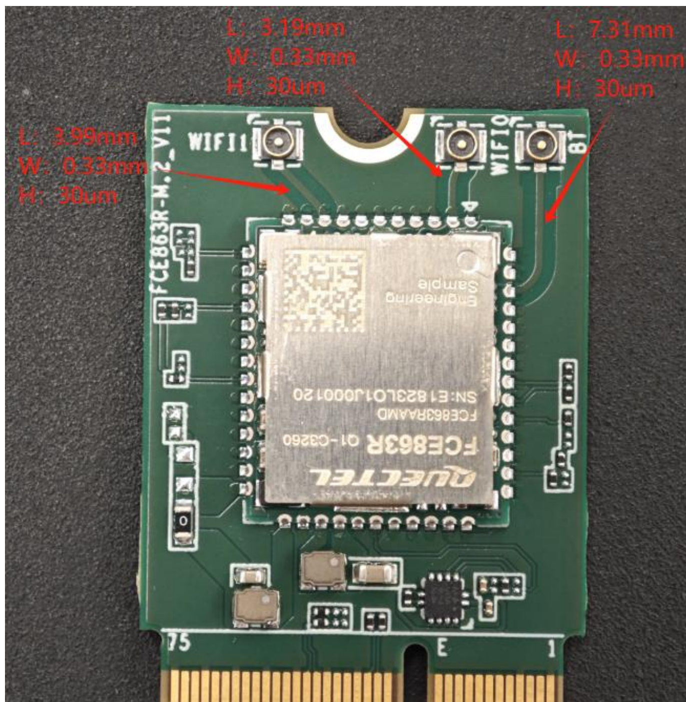
The end user manual shall include all required regulatory information/warning as show in this manual.

Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

Trace design



Dielectric constant，and Impedance

Stack-up

材料	IT150G	板厚0.8mm			
Layer	Mother Board	Tolerance（um）	Typical layer thickness	Dielectric Constant	Df
	Solder Mask		20	3.5	NA
L1	copper+plating	+/-5	30	NA	NA
	Prepreg	+/-7.5	50	3.5	0.0141
L2	copper+plating	+/-5	23	NA	NA
	Prepreg	+/-10%	116	4.1	0.0114
L3	Copper	Hoz	16	NA	NA
	Core	+/-38	300	4.2	0.0107
L4	Copper	Hoz	16	NA	NA
	Prepreg	+/-10%	116	4.1	0.0114
L5	copper+plating	+/-5	23	NA	NA
	Prepreg	+/-7.5	50	3.5	0.0141
L6	copper+plating	+/-5	30	NA	NA
	Solder Mask		20	3.5	NA
	Total thickness	0.8+/-0.08mm	810		