FC905A

User Manual

Wi-Fi&Bluetooth Module Series

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Safety Information

The following safety precautions must be observed during all phases of operation, such as usage, service or repair of any cellular terminal or mobile incorporating the module. Manufacturers of the cellular 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 cellular 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.
	Cellular 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 cellular 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 cellular 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 fuelling 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.

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1 Introduction

This document defines the FC905A and describes its air interfaces and hardware interfaces which are connected with your application.

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.

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20cm (8 inches) during normal operation.

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

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.

Important Notice to OEM integrators

1. This module is limited to OEM installation ONLY.
2. This module is limited to installation in 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 Wireless Solutions Co., Ltd 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 (new application) 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: XMR202208FC905A”

The FCC ID can be used only when all FCC 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.

(4) The max allowed antenna gain is WIFI 2.4G/BT 0.52dBi; WIFI 5G 0.66 dBi for external antenna.

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC 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.

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 device complies with ISED’s licence-exempt RSSs. 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.

Le présent appareil est conforme aux CNR d’ ISED applicables aux appareils radio exempts de licence. L’exploitation est autorisée aux deux conditions suivantes : (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

Radiation Exposure Statement:
This equipment complies with ISED 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 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.

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 co- location 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-2022FC905A”.

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-2022FC905A ".

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.

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.

Caution:

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) where applicable, antenna type(s), antenna models(s), and worst-case tilt angle(s) necessary to remain compliant with the e.i.r.p. elevation mask requirement set forth in section 6.2.2.3 shall be clearly indicated.

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.

Avertissement:

i) 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;

ii) lorsqu’il y a lieu, les types d’antennes (s’il y en a plusieurs), les numéros de modèle de l’antenne et les pires angles d’inclinaison nécessaires pour rester conforme à l’exigence de la

p.i.r.e. applicable au masque d’élévation, énoncée à la section 6.2.2.3, doivent être clairement indiqués.

i. for devices with detachable antenna(s), the maximum antenna gain permitted for devices in the bands 5250-5350 MHz and 5470-5725 MHz shall be such that the equipment still complies with the e.i.r.p. limit

ii. for devices with detachable antenna(s), the maximum antenna gain permitted for devices in the

band 5725-5850 MHz shall be such that the equipment still complies with the e.i.r.p. limits as appropriate; and

iii. where applicable, antenna type(s), antenna models(s), and worst-case tilt angle(s) necessary to remain compliant with the e.i.r.p. elevation mask requirement set forth in section 6.2.2.3 shall be clearly indicated.

1.1. Special Marks

Table 1: Special Marks

Mark	Definition
*	Unless otherwise specified, when an asterisk (*) is used after a function, feature, interface, pin name, AT command, or argument, it indicates that the function, feature, interface, pin, AT command, or argument is under development and currently not supported; and the asterisk (*) after a model indicates that the sample of such model is currently unavailable.
[…]	Brackets ([…]) used after a pin enclosing a range of numbers indicate all pins of the same type. For example, ANTCTL[0:3] refers to all four ANTCTL pins: ANTCTL0, ANTCTL1, ANTCTL2, and ANTCTL3.

2 Product Overview

2.1. General Description

FC905A is a Wi-Fi and Bluetooth module with low power consumption and high performance. It is a single-die WLAN (Wireless Local Area Network) and Bluetooth combo solution supporting IEEE 802.11a/b/g/n/ac WLAN standards and Bluetooth 5.0 standard which enables seamless integration of WLAN and Bluetooth low energy technologies.

With a SDIO 3.0 interface for WLAN, a UART and a PCM interface for Bluetooth, FC905A can provide WLAN and Bluetooth functions.

2.2. Key Features

The following table describes the key features of FC905A.

Table 2: Key Features

Features	Details
Power Supply	● **VBAT power supply:** Supply voltage range: 3.13–4.8 V Typical supply voltage: 3.6 V ● **VIO power supply:** Supply voltage range: 1.71–3.63 V Typical supply voltage: 1.8/3.3 V ● Module buck: VIN_LDO_OUT/VIN_LDO: typical voltage: 1.35 V
Operating Frequency	● 2.4 GHz Wi-Fi: 2.412–2.462 GHz ● 5 GHz Wi-Fi:5.18–5.825 GHz ● Bluetooth: 2.402–2.480 GHz
Wi-Fi Transmission Data Rates	**2.4 GHz:** ● 802.11b: 1 Mbps, 2 Mbps, 5.5 Mbps, 11 Mbps ● 802.11g: 6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 36 Mbps, 48 Mbps, 54 Mbps

	● 802.11n: HT20 (MCS0–MCS7) **5 GHz:** ● 802.11a: 6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps, 54 Mbps ● 802.11n: HT20 (MCS0–MCS7), HT40 (MCS0–MCS7) ● 802.11ac: VHT20 (MCS0–MCS8), VHT40 (MCS0–MCS9), VHT80 (MCS0–MCS9)
Wi-Fi Transmitting Power	**2.4 GHz:** ● 802.11b/11 Mbps: 18±1.5 dBm ● 802.11g/54 Mbps: 16±1.5 dBm ● 802.11n/HT20 MCS7: 15±1.5 dBm **5 GHz:** ● 802.11a/54 Mbps: 15±1.5 dBm ● 802.11n/HT20 MCS7: 15±1.5 dBm ● 802.11n/HT40 MCS7: 13±1.5 dBm ● 802.11ac/VHT20 MCS8: 14±1.5 dBm ● 802.11ac/VHT40 MCS9: 13±1.5 dBm ● 802.11ac/VHT80 MCS9: 12±1.5 dBm
Wi-Fi Protocol Feature	IEEE 802.11a/b/g/n/ac
Wi-Fi Modulation	DSSS, CCK, BPSK, QBPSK, DBPSK, 16QAM, 64QAM, 256QAM
Wi-Fi Operation Mode	● AP ● STA
Bluetooth Protocol Feature	GATT
Bluetooth Operation Mode	● BR + EDR ● BLE
Bluetooth Modulation	GFSK, π/4-DQPSK, 8-DPSK
WLAN Application Interface	SDIO 3.0
Bluetooth Application Interface	UART and PCM
RF Antenna Interfaces	● ANT_WIFI0/BT ● 50 Ω characteristic impedance
Physical Characteristics	● Package: LCC ● Weight: 0.6g
Temperature Range	● Operating temperature range: -30 °C to +75 °C [1] ● Storage temperature range: -40 °C to +95 °C
RoHS	All hardware components are fully compliant with EU RoHS directive

[1] Within operating temperature range, the module is IEEE compliant.

NOTE

FC905A supports internal crystal or external crystal.

2.3. EVB

To help customers to develop applications with FC905A, the evaluation board tools include EVB board (FC905A-M.2 and corresponding TE-A), USB 2.0 data cable, antenna and other external devices used to control and test the module. For details, see ***document [1]***.

3 Application Interfaces

3.1. General Description

FC905A is equipped with 44 LCC pins. The subsequent chapters will provide a detailed introduction to the following interfaces and pins of the module:

- Power supply
- WLAN application interface
- Bluetooth application interface
- RF antenna interfaces
- Other interfaces
  -WLAN_SLP_CLK
  -XTAL_IN/OUT
  -SDIO_VSEL
  -GPIOs

3.2. Pin Assignment

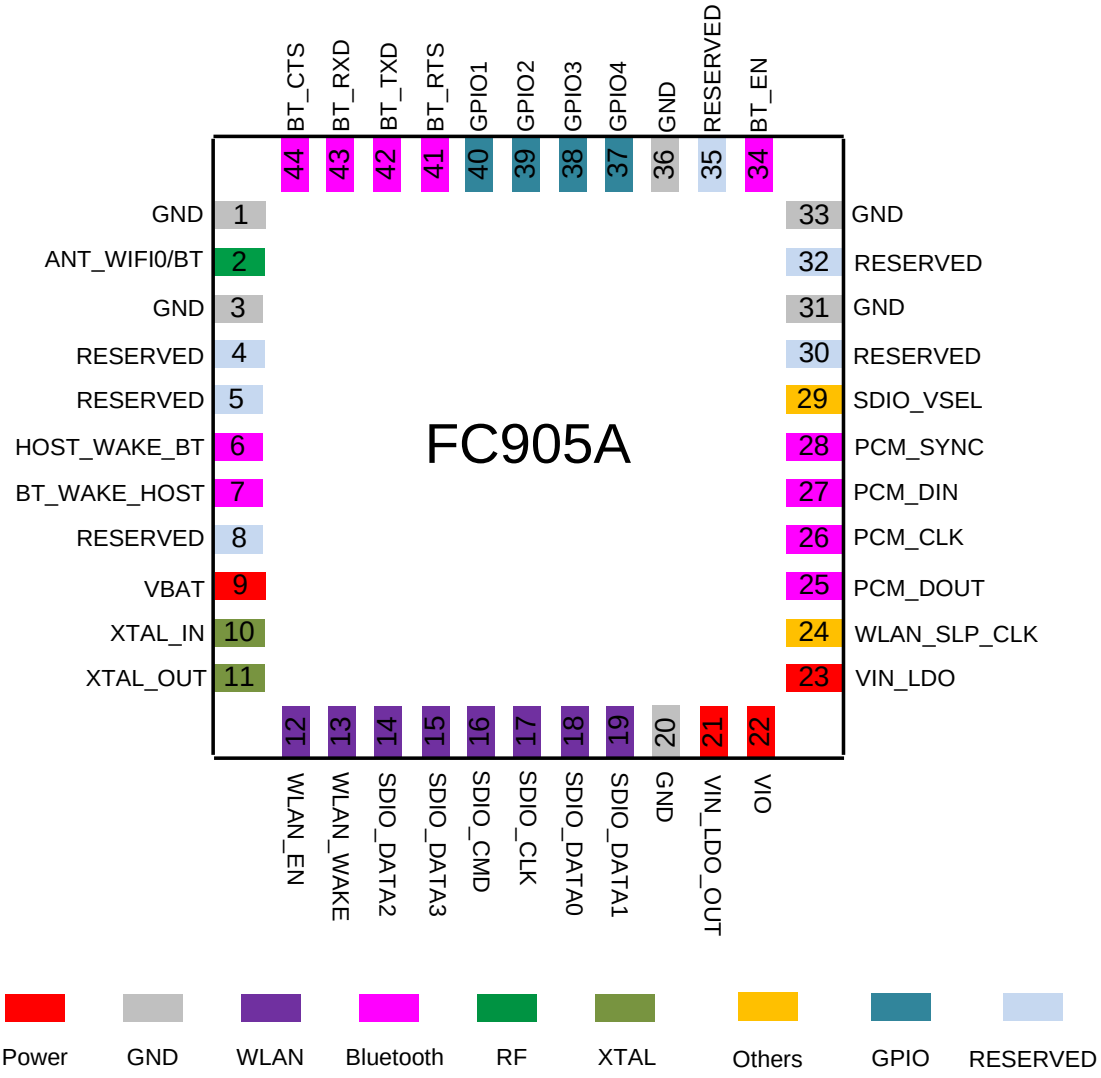


Figure 1: Pin Assignment (Top View)

NOTE

Keep all RESERVED pins open.

3.3. Pin Description

The following tables show the pin description of FC905A.

Table 3: I/O Parameters Definition

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

Table 4: Pin Description

Power Supply				
Pin Name	**Pin No.**	**I/O**	**Description**	**Comment**
VBAT	9	PI	Power supply for the module	
VIO	22	PI	Power supply for module's I/O pins	
VIN_LDO_OUT	21	PO	Internal buck output for the module	
VIN_LDO	23	PI	Internal buck input for the module	
GND	1, 3, 20, 31, 33, 36			
WLAN Application Interface				
Pin Name	**Pin No.**	**I/O**	**Description**	**Comment**
WLAN_EN	12	DI	WLAN function enable control	VIO power domain. Active high.
WLAN_WAKE	13	DO	Wake up the host by WLAN	

SDIO_DATA2	14	DIO	SDIO data bit 2/NC	VIO power domain. Supports 1-bit or 4-bit mode.
SDIO_DATA3	15	DIO	SDIO data bit 3/NC	
SDIO_CMD	16	DIO	SDIO command	
SDIO_CLK	17	DI	SDIO clock	
SDIO_DATA0	18	DIO	SDIO data bit 0	
SDIO_DATA1	19	DIO	SDIO data bit 1/IRQ	
Bluetooth Application Interface				
Pin Name	**Pin No.**	**I/O**	**Description**	**Comment**
BT_EN	34	DI	Bluetooth enable control	VIO power domain. Active high. If unused, pull it down.
HOST_WAKE_BT	6	DI	Host wakes up Bluetooth	VIO power domain. If unused, keep them open.
BT_WAKE_HOST	7	DO	Bluetooth wakes up host	
PCM_DOUT	25	DO	PCM data output	
PCM_CLK	26	DI	PCM clock	
PCM_DIN	27	DI	PCM data input	
PCM_SYNC	28	DI	PCM data frame sync	
BT_RTS	41	DO	Bluetooth UART request to send	
BT_TXD	42	DO	Bluetooth UART transmit	
BT_RXD	43	DI	Bluetooth UART receive	
BT_CTS	44	DI	Bluetooth UART clear to send	
RF Antenna Interfaces				
Pin Name	**Pin No.**	**I/O**	**Description**	**Comment**
ANT_WIFI0/BT	2	AIO	Wi-Fi0/Bluetooth antenna interface	50 Ω impedance.
Other Interfaces				
Pin Name	**Pin No.**	**I/O**	**Description**	**Comment**

WLAN_SLP_CLK	24	DI	External 32.768 kHz low power clock input	
XTAL_IN	10	DI	Crystal input	Optional.
XTAL_OUT	11	DO	Crystal output	
SDIO_VSEL	29	DI	SDIO mode selection 1.8 V: pull-up by default 3.3 V: pull-down and connect to GND through 10 kΩ resistor	
GPIO1 [2]	40	DIO	General-purpose input/output	VIO power domain. If unused, keep them open.
GPIO2	39	DIO		
GPIO3	38	DIO		
GPIO4	37	DIO		
RESERVED				
Pin Name	**Pin No.**			**Comment**
RESERVED	4, 5, 8, 30, 32, 35			Keep them open.

NOTE

The module supports external crystal or built-in crystal, so XTAL_IN and XTAL_OUT pins are optional pins.

3.4. Power Supply

3.4.1. Power Supply Pins Introduction

The following table shows the power supply pins and ground pins of FC905A.

[2] JTAG mode can be configured by configuring GPIO1/GPIO2. If you need, please contact the QUECTEL team.

Table 5: Definition of Power Supply and GND Pins

Pin Name	Pin No.	Description	Min.	Typ.	Max.	Unit
VBAT	9	Power supply for the module	3.0	3.6	4.8	V
VIO	22	Power supply for module's I/O pins	1.71	1.8/3.3	3.63	V
GND	1, 3, 20, 31, 33, 36	Ground				

The FC905A is powered by VBAT. It is recommended to use a power chip with a maximum output current of more than 0.5 A. To ensure better power supply performance, it is recommended to parallel 100 μF decoupling capacitors and 1 μF and 100 nF filter capacitors near the input of the module VBAT. Meanwhile, it is recommended to add a TVS near the VBAT input terminal to improve the surge voltage bearing capacity of the module. In principle, the longer the VBAT line, the wider the line.

The time sequence of FC905A power on and off is shown in the below:

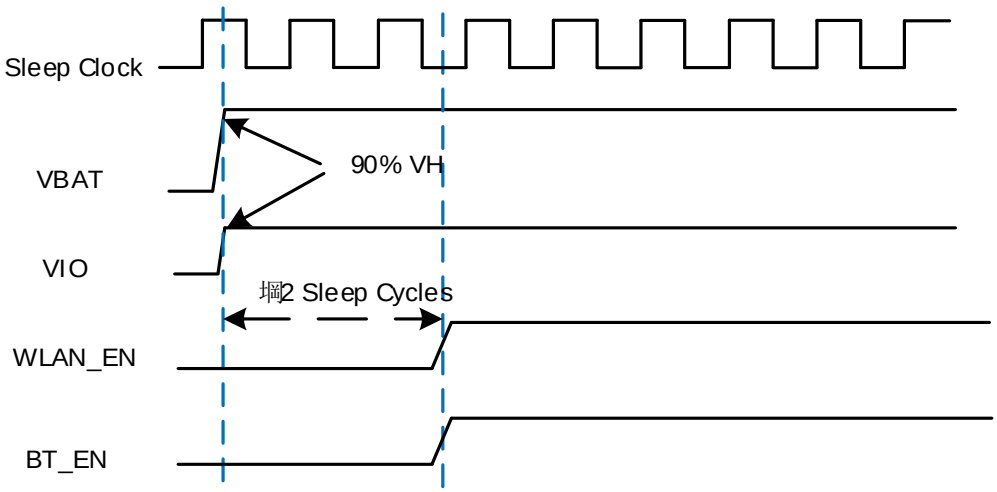


Figure 2: Power-up Timing

3.4.2. Buck Circuit Pins Introduction

The following table describes the pin definition of the internal buck circuit of the module:

Table 6: Definition of Buck Circuit Pins

Pin Name	Pin No.	Description	Min.	Typ.	Max.
VIN_LDO_OUT	21	Internal buck output for the module	-	-	-

VIN_LDO	23	Internal buck input for the module	-	1.35 V	-
GND	20	Buck circuit dedicated GND pin			

VIN_LDO_OUT/VIN_LDO is the output and input pins of the buck circuit inside the module, and pin 20 is the dedicated GND pin of the buck circuit. Because the buck circuit is prone to high-frequency noise, special attention should be paid to it. It is recommended to use 2.2 μH inductors such as TFM201610ALM-2R2MTAA (TDK) and 4.7 μF capacitors to ensure that the traces are as short as possible and the trace width should not be less than 0.4 mm. At the same time, it is recommended to route the wires away from sensitive signals.

Table 7: Recommended Inductance Parameters

Parameter	Recommend	Unit
Inductance	2.2	μH
Tolerance	±20 %	
DCR	< 0.2	Ω
Rated current (based on temperature rise)	1.15	A

3.5. WLAN Application Interface

The following figure shows the WLAN application interface connection between FC905A and the host.

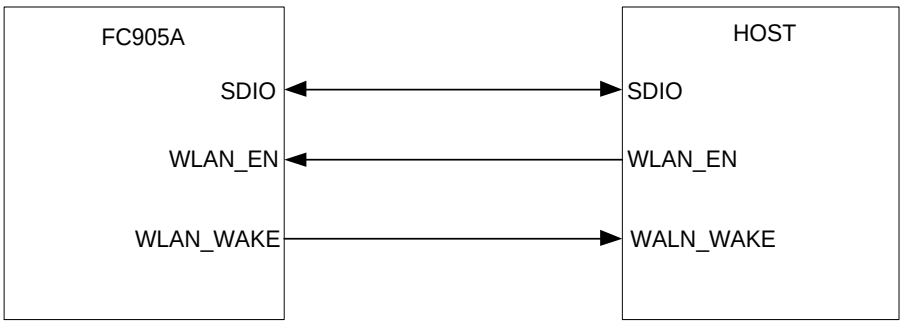


Figure 3: WLAN Application Interface Connection

3.5.1. SDIO Interface

FC905A is used for SDIO 3.0 interface, supports 1-bit mode or 4-bit mode (automatic detection when

SDIO link). SDIO interface definition is as follows:

Table 8: Pin Definition of SDIO Interface

Pin Name	Pin No.	1-bit Mode	4-bit Mode
SDIO_DATA2	14	NC	SDIO data bit 2
SDIO_DATA3	15	NC	SDIO data bit 3
SDIO_CMD	16	SDIO command	SDIO command
SDIO_CLK	17	SDIO clock	SDIO clock
SDIO_DATA0	18	SDIO data bit 0	SDIO data bit 0
SDIO_DATA1	19	IRQ	SDIO data bit 1

The following figure shows the SDIO interface connection between FC905A and host.

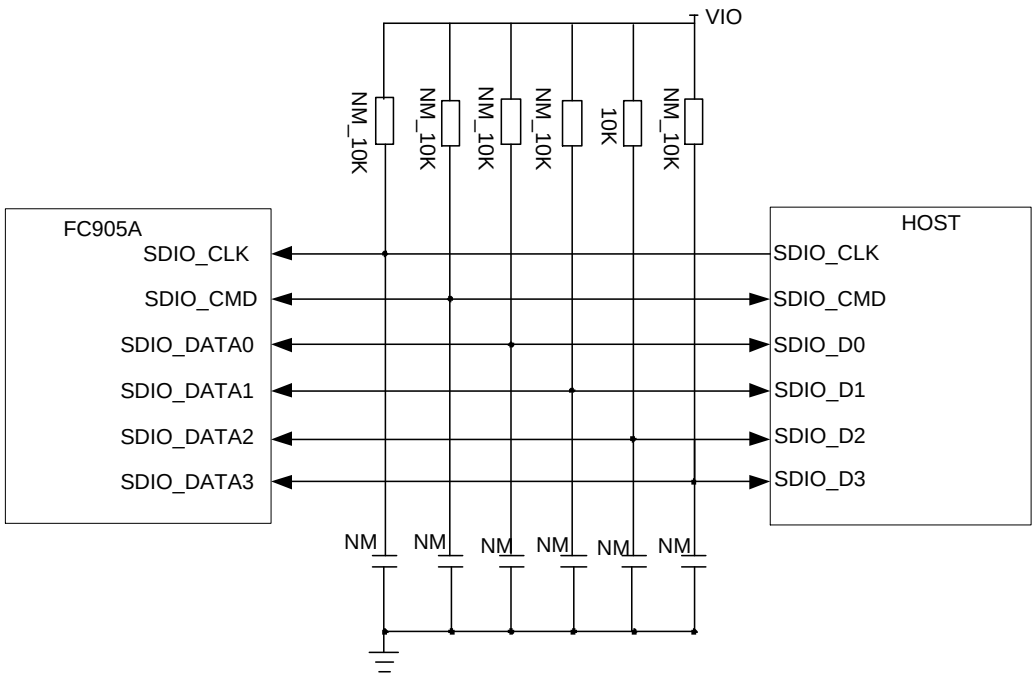


Figure 4: SDIO Interface Connection

To ensure that the interface design complies with the SDIO 3.0 specification, the following principles are recommended to be adopted:

- Route the SDIO traces in inner-layer of the PCB and the impedance is controlled at 50 Ω ±10 %.
- SDIO signals need to be keep away from sensitive signals, such as radio frequency, analog signals, clocks, and DC-DC noise signals.
- SDIO signal traces (SDIO_CLK and SDIO_DATA[0:3]/SDIO_CMD) need to be treated with equal length (the distance between the traces is less than 0.5 mm).
- The distance between SDIO signals and other signals must be greater than 2 times the trace width, and the busload capacitance must be less than 15 pF.
- The maximum length of the internal wiring of the SDIO module is 7.99 mm.

3.5.2. WLAN_EN

WLAN_EN is used to control the Wi-Fi function of the module. Wi-Fi function will be enabled when WLAN_EN is at high level.

Table 9: Pin Definition of WLAN_EN

Pin Name	Pin No.	I/O	Description	Comment
WLAN_EN	12	DI	Wi-Fi function enable control	VIO power domain. Active high.

NOTE

WLAN_EN is the Wi-Fi function enable signal. When wiring, keep it away from sensitive signals such as radio frequency, analog signal, clock, and DC-DC noise signals.

3.5.3. WLAN_WAKE

WLAN_WAKE is used to wake up the host.

Table 10: Pin Definition of WLAN_WAKE

Pin Name	Pin No.	I/O	Description	Comment
WLAN_WAKE	13	DO	Wake up the host by Wi-Fi	VIO power domain. If unused, keep it open.

3.6. Bluetooth Application Interface

The following figure shows the block diagram of Bluetooth application interface connection between FC905A and a host.

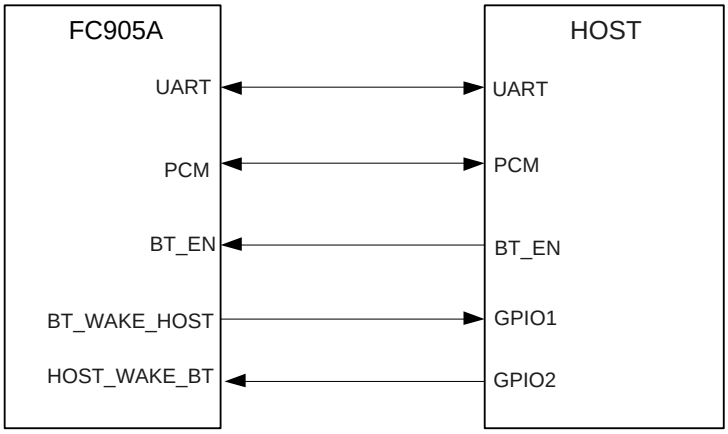


Figure 5: Block Diagram of Bluetooth Application Interface Connection

3.6.1. UART Interface

FC905A supports an HCI UART as defined in *Bluetooth Core Specification Version 5.1*. The UART supports hardware flow control, and it is used for data transmission with host. It supports up to 4.0 Mbps baud rates.

Table 11: Pin Definition of UART Interface

Pin Name	Pin No.	I/O	Description	Comment
BT_RTS	41	DO	Bluetooth UART request to send	VIO power domain. If unused, keep them open.
BT_TXD	42	DO	Bluetooth UART transmit	
BT_RXD	43	DI	Bluetooth UART receive	
BT_CTS	44	DI	Bluetooth UART clear to send	

The following figure shows a reference design for UART interface connection between FC905A and host.

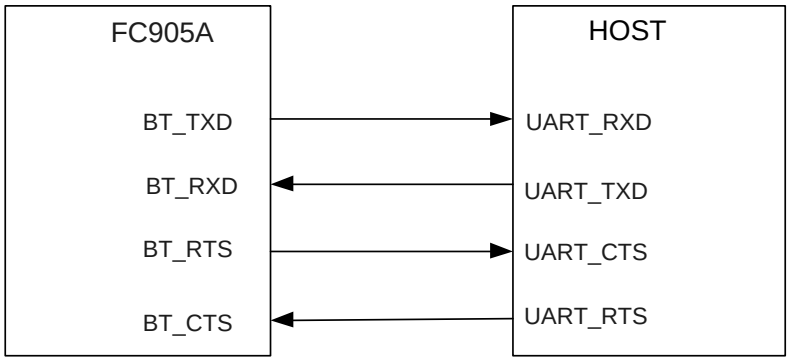


Figure 6: Reference Design for UART Interface Connection

NOTE

When paired with Quectel's LTE modules (EC21 series and EC25 series), it may be their own CTS connected to CTS and RTS connected to RTS. This depends on the input and output directions, so in principle, when connected, the input corresponds to the output.

3.6.2. BT_EN

BT_EN is used to control the Bluetooth function of FC905A. Bluetooth function will be enabled when BT_EN is at high level.

Table 12: Pin Definition of BT_EN

Pin Name	Pin No.	I/O	Description	Comment
BT_EN	34	DI	Bluetooth enable control	Active high. If unused, please pull it down. VIO power domain.

3.6.3. BT_WAKE_HOST and HOST_WAKE_BT

BT_WAKE_HOST and HOST_WAKE_BT are used to wake up Bluetooth function.

Table 13: Pin Definition of BT_WAKEUP_HOST and HOST_WAKEUP_BT

Pin Name	Pin No.	I/O	Description	Comment
HOST_WAKE_BT	6	DI	Host wakes up Bluetooth function	VIO power domain. If unused, keep them open.
BT_WAKE_HOST	7	DO	Bluetooth function wakes up host	

3.6.4. PCM Interface

PCM interface is used for audio over Bluetooth. The following table shows the pin definition of PCM interface.

Table 14: Pin Definition of PCM Interface

Pin Name	Pin No.	I/O	Description	Comment
PCM_DOUT	25	DO	PCM data output	VIO power domain. If unused, keep them open.
PCM_CLK	26	DI	PCM clock	
PCM_DIN	27	DI	PCM data input	
PCM_SYNC	28	DI	PCM data frame sync	

The following figure shows the PCM interface connection between FC905A and the host.

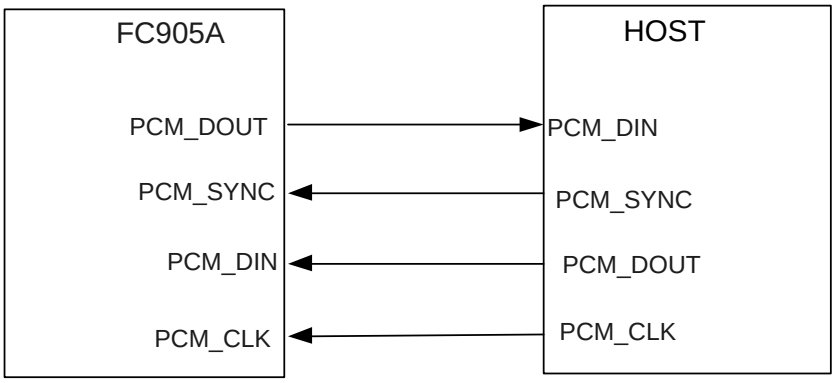


Figure 7: PCM Interface Connection

3.7. Other Interfaces

3.7.1. WLAN_SLP_CLK

The 32.768 kHz sleep clock is used in low power modes, such as IEEE power saving mode and sleep mode. It serves as a timer to determine when to wake up the FC905A to receive signals in various power saving schemes, and to maintain basic logic operations when the module is in sleep mode.

Table 15: Pin Definition of WLAN_SLP_CLK Interface

Pin Name	Pin No.	I/O	Description
WLAN_SLP_CLK	24	DI	External 32.768 kHz low power clock input.

The following are the recommended selection parameters for the recommended 32.768 kHz crystal:

Table 16: WLAN_SLP_CLK Parameter Recommendation

Parameter	Value	Unit
Frequency	32.768	kHz
Frequency accuracy	±200	ppm
Duty cycle	30–70	%
Input signal amplitude	200–3300	mV, p-p
Signal type	Square wave or sine wave	-
Input impedance	> 100	kΩ
Crystal load capacitance	< 5	pF
Clock jitter	< 10000	ppm

3.7.2. XTAL_IN/OUT

The XTAL_IN and XTAL_OUT pins are external crystal pins, and the recommended crystal frequency is 37.4 MHz. These pins are optional pins, and the crystal position has been reserved inside the module, and customers can choose according to their needs.

The following table is the recommended crystal parameters. It is recommended that customers select the crystal according to the following table:

Table 17: XO Parameter Definition

Parameter	Min	Typ.	Max	Unit
Frequency	-	37.4	-	MHz
load capacitance	-	16	-	pF
ESR	-	-	60	Ω
Drive level	200	-	-	μW
Frequency tolerance Initial + over temperature	-20	-	20	ppm

3.7.3. SDIO_VSEL

SDIO_VSEL is SDIO mode selection pin, the following table shows the pin definition of SDIO_VSEL.

Table 18: Pin Definition of SDIO_VSEL

Pin Name	Pin No.	I/O	Description
SDIO_VSEL	29	DI	SDIO mode selection 1.8 V: pull-up by default 3.3 V: pull-down and connect to GND through 10 kΩ resistor

3.7.4. GPIOs

GPIO1/GPIO2 are function configuration pins, which can be used to enter JTAG mode. Please contact QUECTEL if necessary. FC905A offers 4 GPIOs by default:

Table 19: Pin Definition of GPIOs

Pin Name	Pin No.	I/O	Description	Comment
GPIO1	40	DIO	General-purpose input/output	VIO power domain. If unused, keep them open.
GPIO2	39	DIO		
GPIO3	38	DIO		
GPIO4	37	DIO		

3.8. RF Antenna Interfaces

ANT_WIFI0/BT is the RF antenna pin, and the RF port requires 50 Ω characteristic impedance.

3.8.1. Operating Frequency

The operating frequency of FC905A is shown in the following.

Table 20: FC905A Operating Frequency

Feature	Frequency	Unit
2.4 GHz Wi-Fi	2.412–2.462	GHz
5 GHz Wi-Fi	5.180–5.825	GHz
Bluetooth 5.1	2.402–2.480	GHz

3.8.2. Pin Definition of RF Antenna Interface

Pin definitions of the antenna interface are shown in the following table:

Table 21: Pin Definition of RF Antenna Interfaces

Pin Name	Pin No.	I/O	Description	Comment
ANT_WIFI0/BT	2	AIO	Wi-Fi0/Bluetooth antenna interface	50 Ω impedance.

3.8.3. Reference Design

FC905Amodule provides an RF antenna pin for Wi-Fi/Bluetooth antenna connection. The RF trace in host PCB connected to the module's RF antenna pin should be microstrip line or other types of RF trace, with characteristic impendence close to 50 Ω. FC905A comes with grounding pins which are next to the antenna pin in order to give a better grounding.

A reference circuit for the RF antenna interface is shown below. It is recommended to reserve a LC and Π-type matching circuit for better RF performance. Matching components should be placed as close to the antenna as possible. The NM in the figure below is not attached by default.

When using the PCB antenna on the module, place the module near the PCB of the mainboard. Ensure that the distance between the PCB of the mainboard and other metal components, connectors, PCB via holes, cabling, and copper coating is at least 16 mm. Ensure that all layers of the PCB area of the mainboard under the PCB antenna are cleared.

3.8.4. Reference Design of RF Routing

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.

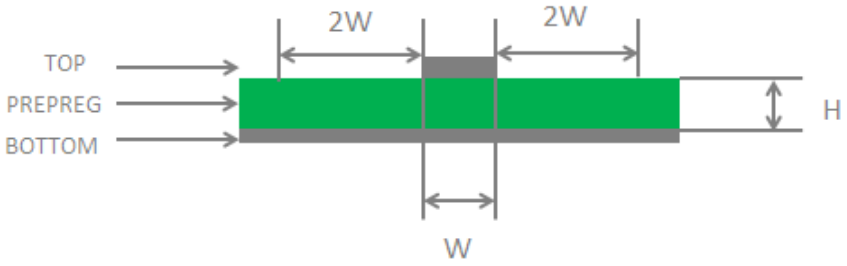


Figure 8: Microstrip Design on a 2-layer PCB

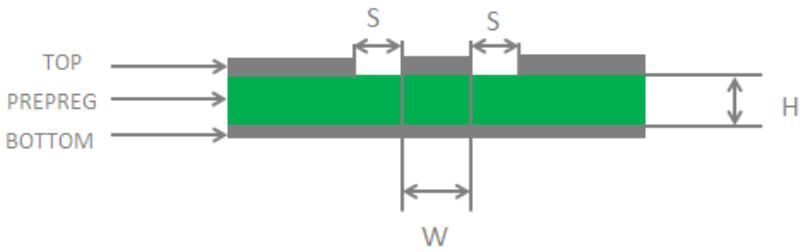


Figure 9: Coplanar Waveguide Design on a 2-layer PCB

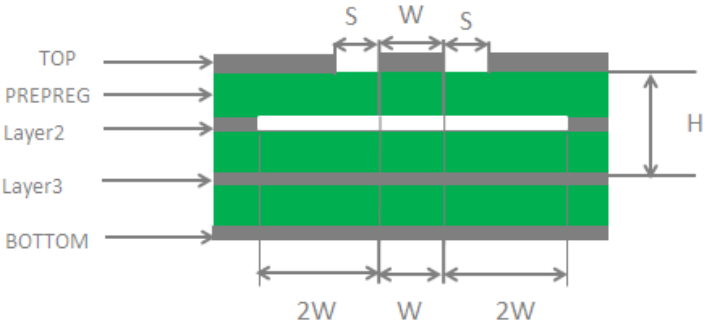


Figure 10: Coplanar Waveguide Design on a 4-layer PCB (Layer 3 as Reference Ground)

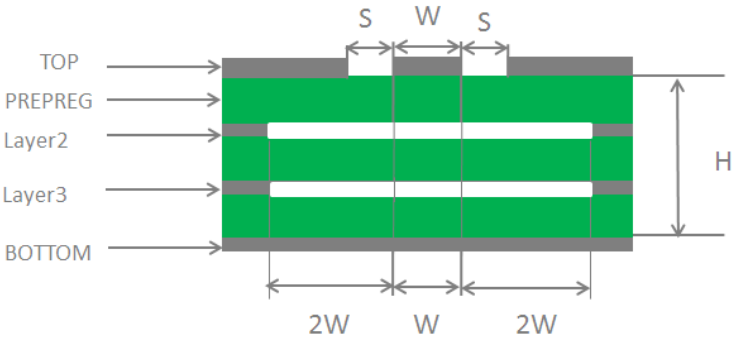


Figure 11: Coplanar Waveguide Design on a 4-layer PCB (Layer 4 as Reference Ground)

To ensure RF performance and reliability, the following principles should be complied with RF layout design:

- Use impedance simulation tool to control the characteristic impedance of RF traces to 50 Ω.
- The GND pins adjacent to RF pins should not be designed as thermal relief pins, 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 area 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 no less than two times 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]***.

3.8.5. Requirements for Antenna Design

The antenna design requirements are as follows:

Table 22: Antenna Cable Requirements

Type	Requirements
2.412–2.472 GHz	Cable insertion loss < 1 dB
5.150–5.875 GHz	

The antenna requirements are as follows:

Table 23: Antenna Requirements

Type	Requirements
Frequency Range	2.412–2.472 GHz 5.150–5.875 GHz
VSWR	< 2
Gain (dBi)	Typ. 1
Max Input Power (W)	50
Input Impedance (Ω)	50
Polarization Type	Vertical

3.8.6. 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*.

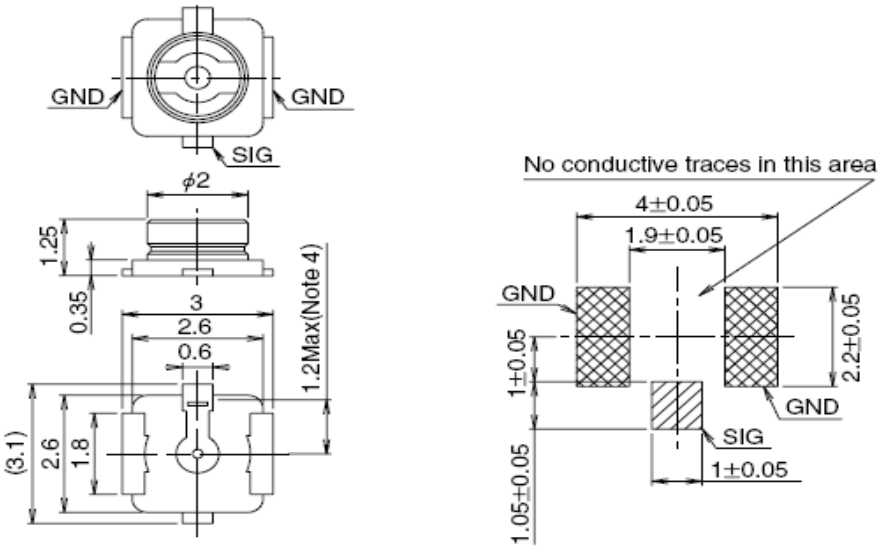


Figure 12: Dimensions of the U.FL-R-SMT Connector (Unit: mm)

U.FL-LP serial connectors listed in the following figure can be used to match the U.FL-R-SMT

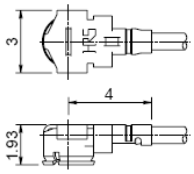
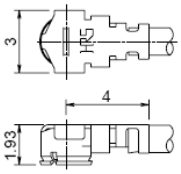
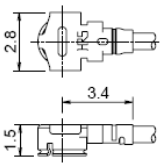
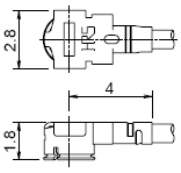
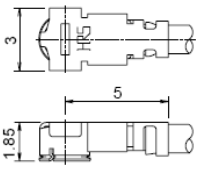
Part No.	U.FL-LP-040	U.FL-LP-066	U.FL-LP(V)-040	U.FL-LP-062	U.FL-LP-088
					
Mated Height	2.5mm Max. (2.4mm Nom.)	2.5mm Max. (2.4mm Nom.)	2.0mm Max. (1.9mm Nom.)	2.4mm Max. (2.3mm Nom.)	2.4mm Max. (2.3mm Nom.)
Applicable cable	Dia. 0.81mm Coaxial cable	Dia. 1.13mm and Dia. 1.32mm Coaxial cable	Dia.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

Figure 13: Mechanicals of U.FL-LP Connectors

The following figure describes the space factor of mated connector.

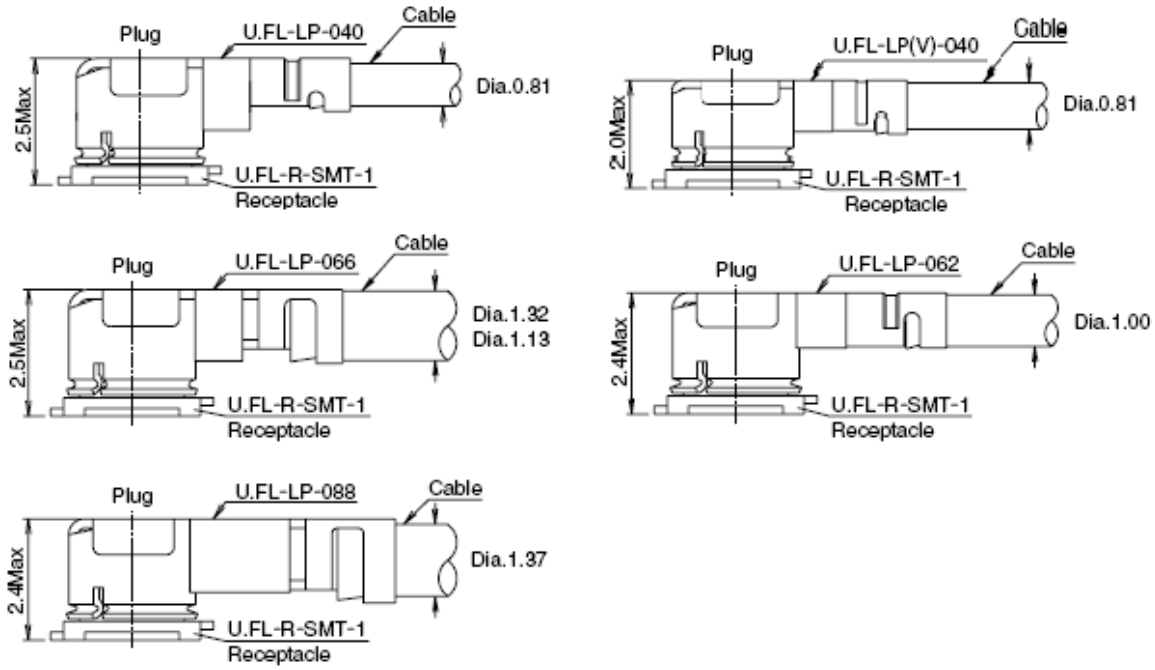


Figure 14: Space Factor of Mated Connector (Unit: mm)

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

4 Electrical Characteristics & Reliability

4.1. General Description

This chapter mainly introduces the electrical characteristics and radio frequency characteristics of FC905A, the specific content is as follows:

- Absolute maximum ratings & recommended operating conditions
- I/O interface characteristics
- Power consumption
- RF performance
- Electrostatic discharge

4.2. Absolute Maximum Ratings & Recommended Operating Conditions

The following table shows the absolute maximum ratings.

Table 24: Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
VBAT	-0.3	5.5	V
Digital I/O Input Voltage	-0.3	3.9	V

The following table shows the recommended operating conditions of the module.

Table 25: Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Unit
VBAT	3.13	3.6	4.8	V

VIO	1.71	1.8/3.3	3.63	V

4.3. I/O Interface Characteristics

The following table shows the general DC electrical characteristics over recommended operating conditions (unless otherwise specified).

Table 26: General DC Electrical Characteristics

Symbol	Parameter	Min.	Max.	Unit
V_{IH}	High-level Input Voltage	0.7 × VIO	VIO + 0.2	V
V_{IL}	Low-level Input Voltage	-0.3	0.3 × VIO	V
V_{OH}	High-level Output Voltage	0.9 × VIO	VIO	V
V_{OL}	Low-level Output Voltage	0	0.1 × VIO	V
I_{iL}	Input leakage current	-5	5	μA

4.4. Power Consumption

The values of power consumption are shown as below.

Table 27: Power Consumption of the Module

Parameters	Conditions	Typ.	Units
802.11b	TX (2.4 GHz) @ 1 Mbps	364	mA
	TX (2.4 GHz) @ 11 Mbps	339	mA
802.11g	TX (2.4 GHz) @ 6 Mbps	346	mA
	TX (2.4 GHz) @ 54 Mbps	230	mA
802.11n	TX (2.4 GHz) @ HT20 MCS0	335	mA

	TX (2.4 GHz) @ HT20 MCS7	216	mA
802.11a	TX (5 GHz) @ 6 Mbps	316	mA
	TX (5 GHz) @ 54 Mbps	222	mA
802.11n	TX (5 GHz) @ HT20 MCS0	309	mA
	TX (5 GHz) @ HT20 MCS7	217	mA
	TX (5 GHz) @ HT40 MCS0	303	mA
	TX (5 GHz) @ HT40 MCS7	199	mA
802.11ac	TX (5 GHz) @ VHT20 MCS0	307	mA
	TX (5 GHz) @ VHT20 MCS8	208	mA
	TX (5 GHz) @ VHT40 MCS0	304	mA
	TX (5 GHz) @ VHT40 MCS9	194	mA
	TX (5 GHz) @ VHT80 MCS0	299	mA
	TX (5 GHz) @ VHT80 MCS9	201	mA

4.5. Wi-Fi RF Performances

The following tables summarize the Wi-Fi transmitting and receiving performances of FC905A.

4.5.1. Conducted RF Output Power

Table 28: Conducted RF Output Power at 2.4 GHz

Description	Typ.	Unit	Accuracy
802.11b @ 1 Mbps	18	dBm	±1.5 dB
802.11b @ 11 Mbps	18	dBm	±1.5 dB
802.11g @ 6 Mbps	18	dBm	±1.5 dB
802.11g @ 54 Mbps	16	dBm	±1.5 dB

802.11n, HT20 @ MCS0	18	dBm	±1.5 dB
802.11n, HT20 @ MCS7	15	dBm	±1.5 dB

Table 29: Conducted RF Output Power at 5 GHz

Description	Typ.	Unit	Accuracy
802.11a @ 6 Mbps	17	dBm	±1.5 dB
802.11a @ 54 Mbps	15	dBm	±1.5 dB
802.11n, HT20 @ MCS0	17	dBm	±1.5 dB
802.11n, HT20 @ MCS7	15	dBm	±1.5 dB
802.11n, HT40 @ MCS0	16	dBm	±1.5 dB
802.11n, HT40 @ MCS7	13	dBm	±1.5 dB
802.11ac, VHT20 @ MCS0	17	dBm	±1.5 dB
802.11ac, VHT20 @ MCS8	14	dBm	±1.5 dB
802.11ac, VHT40 @ MCS0	16	dBm	±1.5 dB
802.11ac, VHT40 @ MCS9	13	dBm	±1.5 dB
802.11ac, VHT80 @ MCS0	15	dBm	±1.5 dB
802.11ac, VHT80 @ MCS9	12	dBm	±1.5 dB

4.5.2. Conducted RF Receiving Sensitivity

Table 30: Conducted RF Receiving Sensitivity at 2.4 GHz

Description	Typ.	Unit	Accuracy
802.11b @ 1 Mbps	-96	dBm	±1.5 dB
802.11b @ 11 Mbps	-87	dBm	±1.5 dB
802.11g @ 6 Mbps	-92	dBm	±1.5 dB

802.11g @ 54 Mbps	-76	dBm	±1.5 dB
802.11n, HT20 @ MCS0	-91	dBm	±1.5 dB
802.11n, HT20 @ MCS7	-74	dBm	±1.5 dB

Table 30: Conducted RF Receiving Sensitivity at 5 GHz

Description	Typ.	Unit	Accuracy
802.11a @ 6 Mbps	-92	dBm	±1.5 dB
802.11a @ 54 Mbps	-75	dBm	±1.5 dB
802.11n, HT20 @ MCS0	-92	dBm	±1.5 dB
802.11n, HT20 @ MCS7	-72	dBm	±1.5 dB
802.11n, HT40 @ MCS0	-88	dBm	±1.5 dB
802.11n, HT40 @ MCS7	-68	dBm	±1.5 dB
802.11ac, VHT20 @ MCS0	-92	dBm	±1.5 dB
802.11ac, VHT20 @ MCS8	-69	dBm	±1.5 dB
802.11ac, VHT40 @ MCS0	-88	dBm	±1.5 dB
802.11ac, VHT40 @ MCS9	-64	dBm	±1.5 dB
802.11ac, VHT80 @ MCS0	-85	dBm	±1.5 dB
802.11ac, VHT80 @ MCS9	-62	dBm	±1.5 dB

4.6. Bluetooth RF Performance

The following tables summarize the transmitting and receiving performances of FC905A.

4.6.1 Conducted RF Output Power

Table 31: Conducted RF Output Power

Description	Min.	Typ.	Unit
GFSK	7	9	dBm
π/4-DQPSK	4	6	dBm
8-DQPSK	4	6	dBm
BLE_1M	2	4	dBm

4.6.2 Conducted RF Receiving Sensitivity

Table 32: Conducted RF Receiving Sensitivity at 2.4 GHz

Description	Receiving Sensitivity (Typ.)
GFSK	-88 dBm
π/4-DQPSK	-92 dBm
8-DQPSK	-85 dBm
BLE_1M	-92 dBm

4.7. ESD

If the static electricity generated by various ways discharges to the module, the module maybe damaged to a certain extent. Thus, please take proper ESD countermeasures and handling methods. For example, wearing anti-static gloves during the development, production, assembly and testing of the module; adding ESD protective components to the ESD sensitive interfaces and points in the product design.

Table 33: Electrostatic Discharge Characteristics (25 ºC, 45 % Relative Humidity)

Tested Interfaces	Contact Discharge	Air Discharge	Unit
VBAT、GND	8	12	kV
ANT_WIFI0/BT	5	10	kV

5 Mechanical Information

This chapter describes the mechanical dimensions of FC905A. All dimensions are measured in millimeter (mm), and the dimensional tolerances are ±0.2 mm unless otherwise specified.

5.6 Mechanical Dimensions

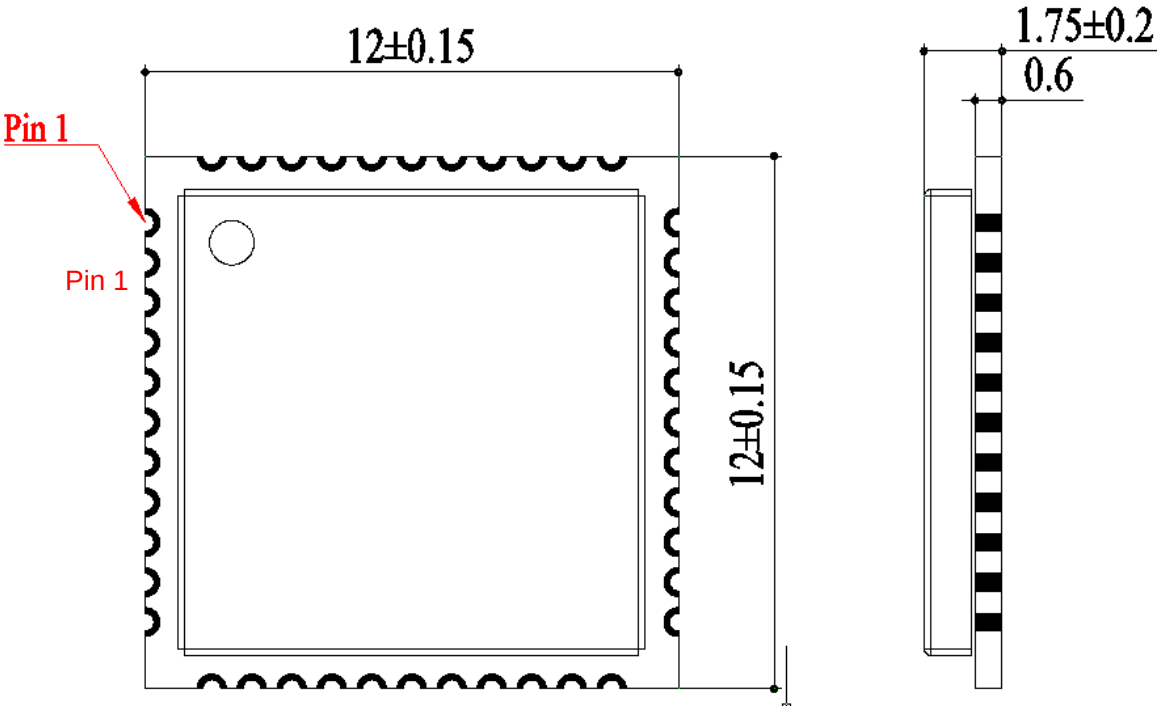


Figure 15: Top and Side Dimensions (Top and Side View)

5.7 Top and Bottom Views

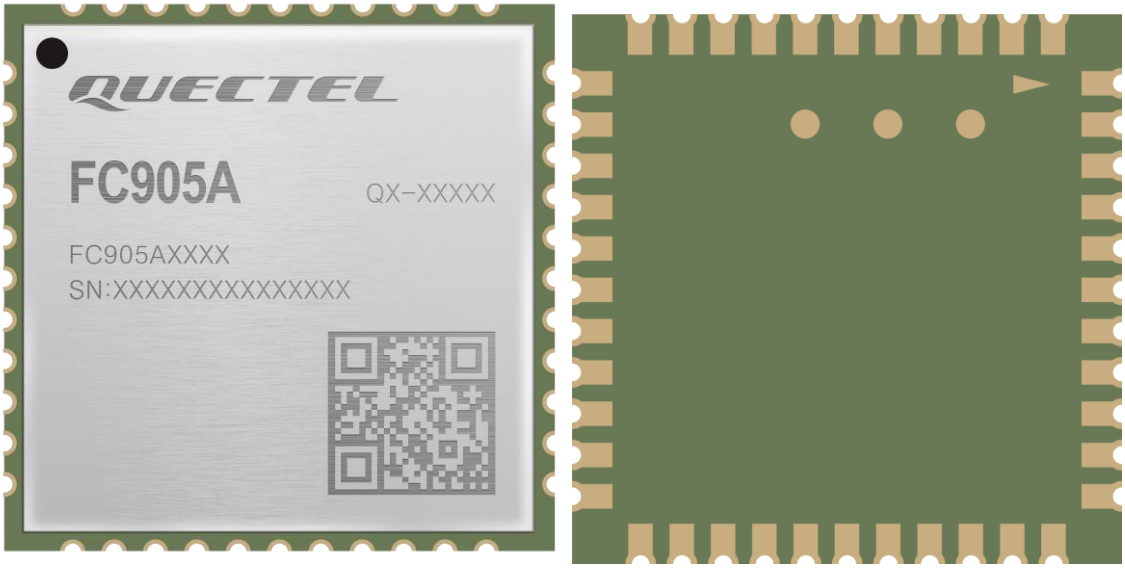


Figure 16: Top & Bottom View of FC905A

NOTE

Images above are for illustration purpose only and may differ from the actual module. For authentic appearance and label, please refer to the module received from Quectel.

6 Storage, Manufacturing & Packaging

6.6 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. The storage life (in vacuum-sealed packaging) is 12 months in Recommended Storage Condition.

3. The floor life of the module is 168 hours [3] in a plant 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 24 hours. Otherwise, the module should be stored in an environment where the relative humidity is less than 10 % (e.g. a drying 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 above occurs;
   - 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;
   - All modules must be soldered to PCB within 24 hours after the baking, otherwise they should be put in a dry environment such as in a drying oven.

[3] 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 remove the packages of tremendous modules if they are not 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. All modules must be soldered to PCB within 24 hours after the baking, otherwise put them in the drying oven. 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.

6.7 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. The force on the squeegee should be adjusted properly to produce a clean stencil surface on a single pass. To ensure the module soldering quality, the thickness of stencil for the module is recommended to be 0.15–0.18mm. For more details, see ***document [3]***.

The 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 strongly 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.

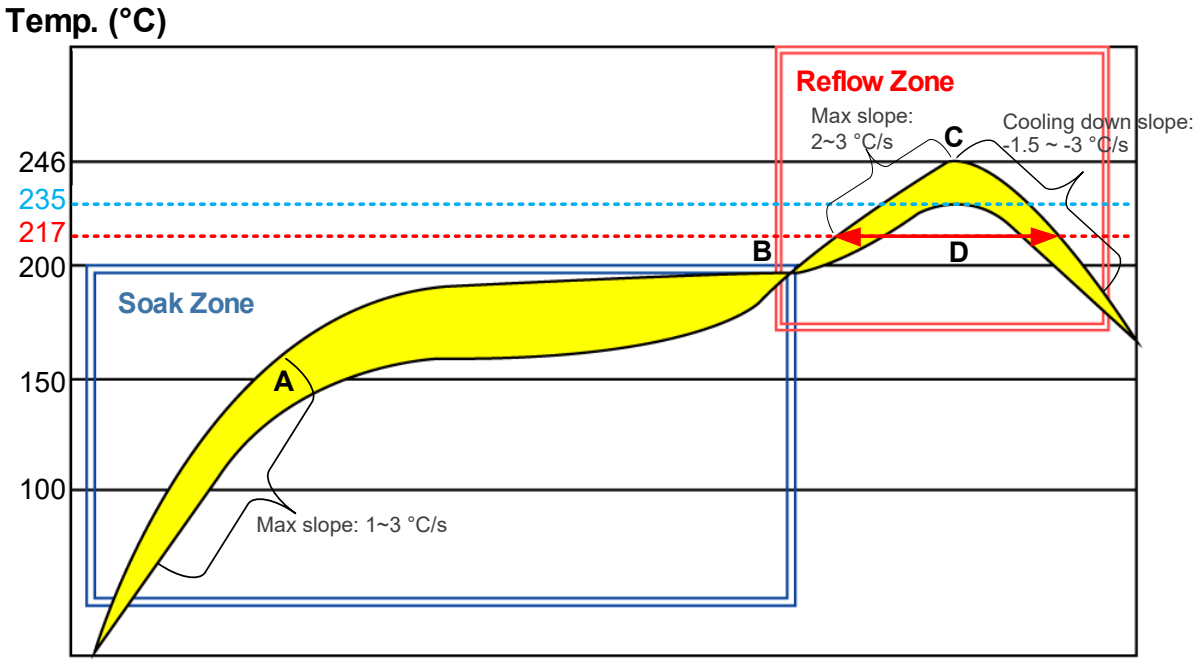


Figure 17: Recommended Reflow Soldering Thermal Profile

Table 34: Recommended Thermal Profile Parameters

Factor	Recommendation
Soak Zone	
Max slope	1–3 °C/s
Soak time (between A and B: 150 °C and 200 °C)	70–120 s
Reflow Zone	
Max slope	2–3 °C/s
Reflow time (D: over 217 °C)	40–70 s
Max temperature	235 °C to 246 °C
Cooling down slope	-1.5 to -3 °C/s
Reflow Cycle	
Max reflow cycle	1

NOTE

1. 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.
2. 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.
3. 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.
4. Avoid using ultrasonic technology for module cleaning since it can damage crystals inside the module.
5. Due to the complexity of the SMT process, please contact Quectel Technical Supports 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]***.

6.8 Packaging Specifications

The module adopts carrier tape packaging and details are as follow:

6.8.1 Carrier Tape

Dimension details are as follow:

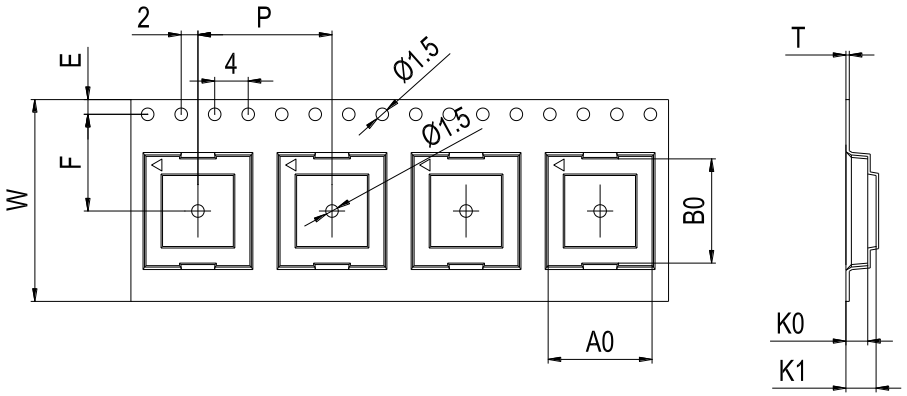


Figure 18: Carrier Tape Dimension Drawing

Table 35: Carrier Tape Dimension Table (Unit: mm)

W	P	T	A0	B0	K0	K1	F	E
24	16	0.35	12.4	12.4	2.6	3.6	11.5	1.75

6.8.2 Plastic Reel

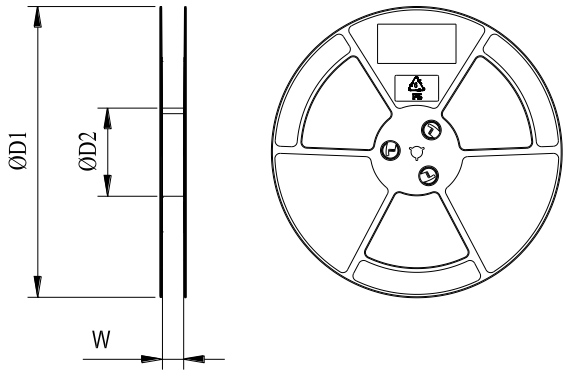
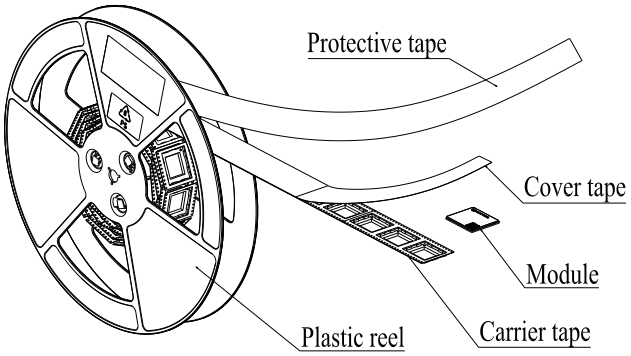


Figure 19: Plastic Reel Dimension Drawing

Table 36: Plastic Reel Dimension Table (Unit: mm)

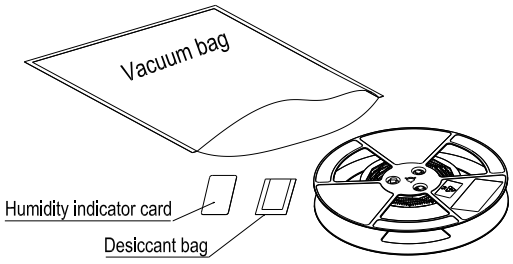
øD1	øD2	W
330	100	24.5

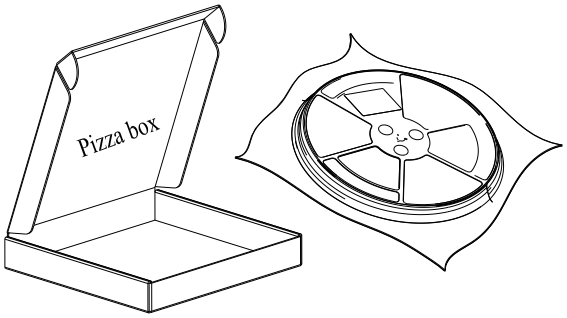
6.8.3 Packaging Process



Place the module into the carrier tape and use the cover tape to cover it; then wind the heat-sealed carrier tape to the plastic reel and use the protective tape for protection. 1 plastic reel can load 500 modules.

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





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

Put 4 packaged pizza boxes into 1 carton and seal it. 1 carton can pack 2000 modules.

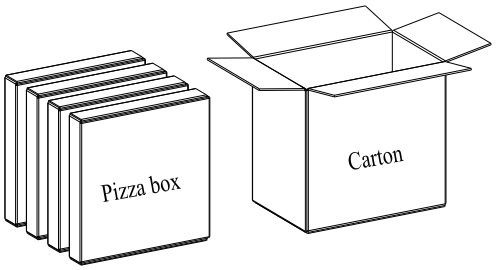


Figure 20: **Packaging Process**

7 Appendix References

Table 37: Related Documents

SN	Document Name
[1]	Quectel_UMTS&LTE_EVB_User_Guide
[2]	Quectel_RF_Layout_Application_Note
[3]	Quectel_Module_Secondary_SMT_Application_Note

Table 38: Terms and Abbreviations

Abbreviation	Description
AP	Access Point
BLE	Bluetooth Low Energy
BPSK	Binary Phase Shift Keying
BT	Bluetooth
CCK	Complementary Code Keying
CTS	Clear To Send
DQPSK	Differential Quadrature Reference Phase Shift Keying
GATT	Generic Attribute Profile
GND	Ground
HT	High Throughput
IEEE	Institute of Electrical and Electronics Engineers
I/O	Input/Output
Mbps	Million Bits Per Second

QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
RoHS	Restriction of Hazardous Substances
STA	Spike-triggered average
RTS	Request to Send
RXD	Receive Data
TBD	To Be Determined
TXD	Transmit Data
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
V_{IH}max	Maximum High-level Input Voltage
V_{IH}min	Minimum High-level Input Voltage
V_{IL}max	Maximum Low-level Input Voltage
V_{IL}min	Minimum Low-level Input Voltage
V_{OL}max	Maximum Low-level Output Voltage
V_{OH}min	Minimum High-level Output Voltage
Vnom	Normal Voltage
VSWR	Voltage Standing Wave Ratio