FC21 Hardware Design

Wi-Fi&BT Module Series

Version: 1.0

Date: 2020-08-13

Status: Preliminary

Our aim is to provide customers with timely and comprehensive service. For any assistance, please contact our company 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 office. 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 to support@quectel.com.

GENERAL NOTES

QUECTEL OFFERS THE INFORMATION AS A SERVICE TO ITS CUSTOMERS. THE INFORMATION PROVIDED IS BASED UPON CUSTOMERS' REQUIREMENTS. QUECTEL MAKES EVERY EFFORT TO ENSURE THE QUALITY OF THE INFORMATION IT MAKES AVAILABLE. QUECTEL DOES NOT MAKE ANY WARRANTY AS TO THE INFORMATION CONTAINED HEREIN, AND DOES NOT ACCEPT ANY LIABILITY FOR ANY INJURY, LOSS OR DAMAGE OF ANY KIND INCURRED BY USE OF OR RELIANCE UPON THE INFORMATION. ALL INFORMATION SUPPLIED HEREIN IS SUBJECT TO CHANGE WITHOUT PRIOR NOTICE.

DISCLAIMER

WHILE QUECTEL HAS MADE EFFORTS TO ENSURE THAT THE FUNCTIONS AND FEATURES UNDER DEVELOPMENT ARE FREE FROM ERRORS, IT IS POSSIBLE THAT THESE FUNCTIONS AND FEATURES COULD CONTAIN ERRORS, INACCURACIES AND OMISSIONS. UNLESS OTHERWISE PROVIDED BY VALID AGREEMENT, QUECTEL MAKES NO WARRANTIES OF ANY KIND, IMPLIED OR EXPRESS, WITH RESPECT TO THE USE OF FEATURES AND FUNCTIONS UNDER DEVELOPMENT. TO THE MAXIMUM EXTENT PERMITTED BY LAW, QUECTEL EXCLUDES ALL LIABILITY FOR ANY LOSS OR DAMAGE SUFFERED IN CONNECTION WITH THE USE OF THE FUNCTIONS AND FEATURES UNDER DEVELOPMENT, REGARDLESS OF WHETHER SUCH LOSS OR DAMAGE MAY HAVE BEEN FORESEEABLE.

COPYRIGHT

About the Document

Revision History

Version	Date	Author	Description
1.0	2020-08-13	Power JIN/Kris ZHANG	Initial

Contents

Table Index

Figure Index

1 Introduction

This document defines the FC21 module and describes its air interface and hardware interfaces which are connected to the customers' applications.

The document can help customers quickly understand module interface specifications, electrical and mechanical details, as well as other related information of the module. In combination with Quectel EC2x&EG2X-G[1)] modules, FC21 module can help customers to design and set up LTE+Wi-Fi/BT applications easily.

Table 1: FC21 Module

Module	Wi-Fi	BT
FC21	2.4GHz and 5GHz	BT 4.2

NOTE

[1)] In this document, EC2x refers to Quectel EC25, EC21 and EC20 R2.1 modules and EG2x-G refers to Quectel EG21-G and EG25-G modules.

1.1. 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 FC21 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 paid to driving at all times in order to reduce the risk of an accident. Using a mobile while driving (even with a handsfree kit) causes distraction and can lead to an accident. Please comply with laws and regulations restricting the use of wireless devices while driving.
	Switch off the 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 emergent 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.

2 Product Concept

2.1 General Description

FC21 is a low-power cost-effective Wi-Fi/BT module based on QCA1023. FC21 supports 1×1 IEEE 802.11a/b/g/n/ac WLAN standards and BT 4.2 (BLE and SPP) and provides a low-power SDIO 3.0 interface for Wi-Fi and UART&PCM interfaces for BT*, and also supports LTE/WLAN coexistence.

FC21 module is a SMT module, with 38 LCC pins and 14 LGA pins. The module package is compact and the size is only 16.6mm × 13mm × 2.1mm.

NOTES

1. "*" means under development.
2. BLE function of FC21 module is available.

批注 [RL1]: 这里面不要加上 FC21 模块为贴片式模块，共有 38 个 LCC 引脚和 14 个 LGA 引脚；模块封装紧凑，尺寸仅为 16.6 mm × 13 mm × 2.1 mm。

批注 [RL2]: 中文这里没加星号，中文是否要加上

批注 [RL3]: 中文这里没有这一条，中文是否要加上

2.2 Key Features

The following table describes the detailed features of FC21 module.

Table 2: Key Features

Features	Description
Power Supply	**VDD_3V3 Power Supply:** Voltage Range: 3.14V~3.46V Typical voltage: 3.3V **I/O supply voltage:** Voltage Range: 1.71V~3.46V Typical voltage: 1.8V
Wi-Fi Data Rates	● 802.11b: 1Mbps, 2Mbps, 5.5Mbps, 11Mbps ● 802.11g: 6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps, 54Mbps

	● 802.11n (20MHz): 7.2Mbps, 14.2Mbps, 21.7Mbps, 28.9Mbps, 43.3Mbps, 57.8Mbps, 65Mbps, 72.2Mbps ● 802.11n (40MHz): 15Mbps, 30Mbps, 45Mbps, 60Mbps, 90Mbps, 120Mbps, 150Mbps ● 802.11a: 6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps, 54Mbps ● 802.11ac: VHT20 (MCS0~MCS8), VHT40 (MCS0~MCS9), VHT80 (MCS0~MCS9)
Wi-Fi Transmitting Power	● TBD
Wi-Fi Protocol Features	● IEEE 802.11a/b/g/n/ac
Wi-Fi Modulation	● BPSK, QPSK, CCK, 16QAM, 64QAM, 256QAM
Wi-Fi Operation Modes	● AP ● STA
BT Protocol Features	● GATT* ● SPP*
BT Operation Modes	● BT* BLE
BT Modulation	● GFSK, 8-DPSK,π/4-DQPSK
Wireless Connectivity Interfaces	● Wi-Fi：SDIO 3.0 ● BT：UART and PCM
Antenna Interface	Wi-Fi/BT antenna interface, 50Ω impedance
Physical Characteristics	Dimensions: (16.6 ±0.15) mm × (13.0 ±0.15) mm × (2.1±0.2) mm Package: LCC Weight: TBD
Temperature Ranges	Extended temperature range: -40 to +85°C[1)] Storage temperature range: -45 to +95°C
RoHS	All hardware components are fully compliant with EU RoHS directive

批注 [RL4]: 中文里没有这个，中文是否要加上

NOTES

1. [1)] Within extended temperature range, the module remains the ability for data transmission. There is no unrecoverable malfunction. There are also no effects on radio spectrum and no harm to radio network. Only one or more parameters like P_{out} might reduce in their value and exceed the specified tolerances. When the temperature returns to the normal operating temperature levels, the module will meet IEEE compliant again.
2. "*" means under development.

2.3 Functional Diagram

The following figure shows a block diagram of FC21 module and illustrates the major functional parts:

- Power supply
- Wireless Connectivity Interfaces
  - Wi-Fi interface
  - BT interface
  - Coexistence interface
- Antenna interface
- Other interfaces
  - DBG_TXD
  - 32KHz_IN interface

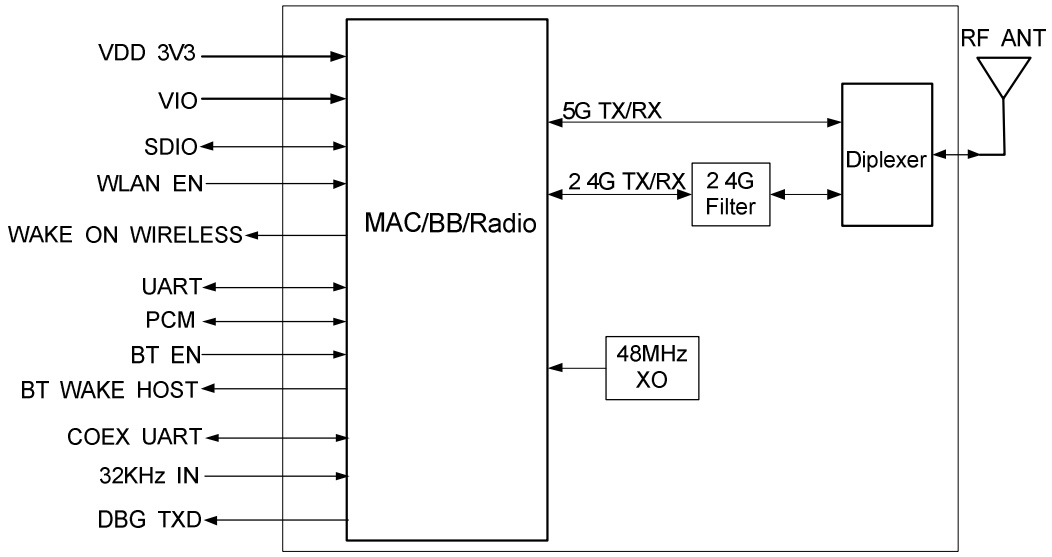


Figure 1: Functional Diagram of FC21 Module

批注 [RL5]:
FC21_SA 版本带 2.4G Filter，FC21_SD版本不带2.4G Filter.

要不要加这个备注

NOTE

FC21_SA version has 2.4G Filter, FC21_SD version does not have 2.4G Filter.

批注 [RL6R5]:

2.4 Evaluation Board

In order to help customers to develop applications with FC21 module, Quectel supplies an evaluation board (UMTS&LTE EVB), an RS-232 to USB converter cable, a USB data cable, a power adapter, 4 antennas and other peripherals to control or test the module. For details, please refer to ***document [1]***.

3 Application Interfaces

3.1. General Description

FC21 module is equipped with 38 LCC pads and 14 LGA pads that can be connected to cellular application platform. The subsequent chapters will provide detailed descriptions of the following interfaces:

- Power supply
- Wireless Connectivity Interfaces
  - Wi-Fi interface
  - BT interface
  - Coexistence interface
- Other interfaces
  - DBG_TXD interface
  - 32KHz_IN interface
- Antenna interface

3.2. Pin Assignment

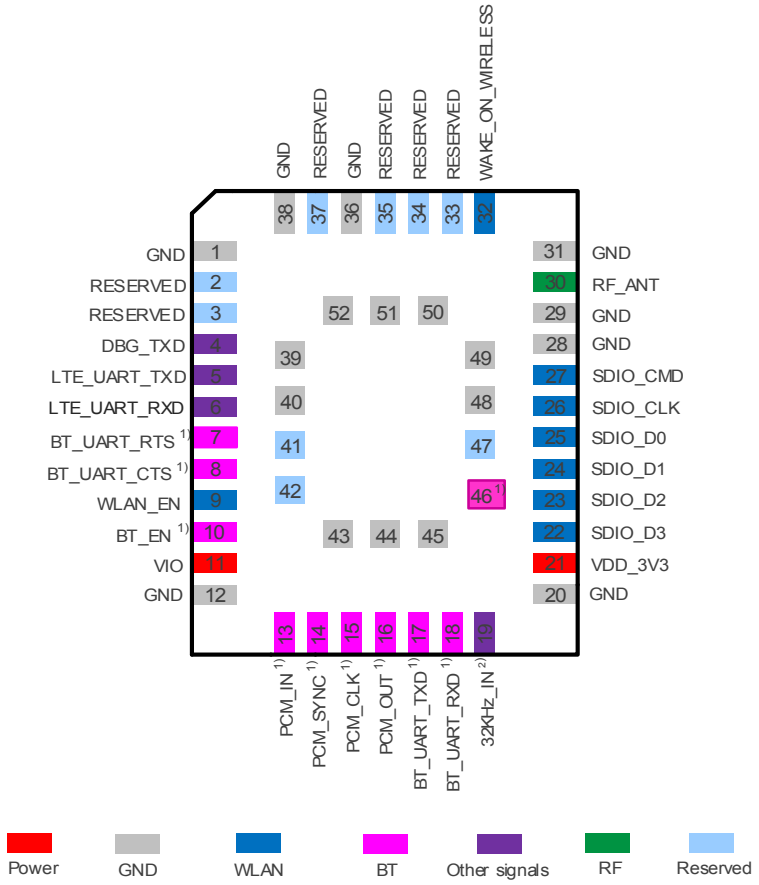


Figure 2: Pin Assignment of FC21 Module

NOTES

1. Please keep all RESERVED pins open.
2. [1)] indicates that pins 7, 8, 10, 13~18 and 46 are BT function pins. BT function is under development.
3. [2)] indicates that 32KHz_IN is reserved on FC21 module since the sleep function is under development.

3.3. Pin Description

The following tables show the pin definition of FC21 module.

Table 3: I/O Parameters Definition

Type	Description
DI	Digital input
DO	Digital output
IO	Bidirectional
PI	Power input

Table 4: Pin Description of FC21 Module

Power Supply					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
VDD_3V3	21	PI	Main power supply for module	Vmax=3.46V Vmin=3.14V Vnorm=3.3V	It must be provided with sufficient current up to 0.6A.
VIO	11	PI	Power supply for module's I/O pins	Vmax=3.46V Vmin=1.71V Vnorm=1.8V	It is suggested to be powered by EC2x&EG2x-G module.
GND	1, 12, 20, 28, 29, 31, 36, 38~40, 43~45, 48~52		Ground		
Wi-Fi Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
WAKE_ON_WIRELESS	32	OD	Wi-Fi wake up the host	V_{OL}max=0.18V V_{OH}min=1.62V	1.8V power domain. Active low. Require external pull-up to 1.8V. If unused, keep this

					pin open.
WLAN_EN	9	DI	Wi-Fi function control	V_{IL}min=-0.3V V_{IL}max=0.54V V_{IH}min=1.26V V_{IH}max=2.0V	1.8V power domain. Active high.
SDIO_D3	22	IO	SDIO data bus D3	V_{OL}max=0.18V V_{OH}min=1.62V V_{IL}min=-0.3V V_{IL}max=0.54V V_{IH}min=1.26V V_{IH}max=2.0V	1.8V power domain
SDIO_D2 [1)]	23	IO	SDIO data bus D2	V_{OL}max=0.18V V_{OH}min=1.62V V_{IL}min=-0.3V V_{IL}max=0.54V V_{IH}min=1.26V V_{IH}max=2.0V	1.8V power domain. Require external pull-up to 1.8V.
SDIO_D1	24	IO	SDIO data bus D1	V_{OL}max=0.18V V_{OH}min=1.62V V_{IL}min=-0.3V V_{IL}max=0.54V V_{IH}min=1.26V V_{IH}max=2.0V	1.8V power domain
SDIO_D0	25	IO	SDIO data bus D0	V_{OL}max=0.18V V_{OH}min=1.62V V_{IL}min=-0.3V V_{IL}max=0.54V V_{IH}min=1.26V V_{IH}max=2.0V	1.8V power domain
SDIO_CLK	26	DI	SDIO bus clock	V_{IL}min=-0.3V V_{IL}max=0.54V V_{IH}min=1.26V V_{IH}max=2.0V	1.8V power domain
SDIO_CMD	27	IO	SDIO bus command	V_{OL}max=0.18V V_{OH}min=1.62V V_{IL}min=-0.3V V_{IL}max=0.54V V_{IH}min=1.26V V_{IH}max=2.0V	1.8V power domain
BT Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**

BT_EN	10	DI	BT function control	V_{IL}min=-0.3V V_{IL}max=0.54V V_{IH}min=1.26V V_{IH}max=2.0V	1.8V power domain. Active high. If unused, keep this pin open.
BT_WAKE_HOST	46	OD	BT wake up the host	V_{OL}max=0.18V V_{OH}min=1.62V	1.8V power domain. Active low. Pulled up internally. If unused, keep this pin open.
PCM_IN	13	DI	BT PCM data input	V_{IL}min=-0.3V V_{IL}max=0.54V V_{IH}min=1.26V V_{IH}max=2.0V	1.8V power domain. If unused, keep this pin open.
PCM_SYNC	14	DI	BT PCM data frame synchronization signal	V_{IL}min=-0.3V V_{IL}max=0.54V V_{IH}min=1.26V V_{IH}max=2.0V	1.8V power domain. If unused, keep this pin open.
PCM_CLK	15	DI	BT PCM data bit clock	V_{IL}min=-0.3V V_{IL}max=0.54V V_{IH}min=1.26V V_{IH}max=2.0V	1.8V power domain. If unused, keep this pin open.
PCM_OUT	16	DO	BT PCM data output	V_{OL}max=0.18V V_{OH}min=1.62V	1.8V power domain. If unused, keep this pin open.
BT_UART_RTS	7	DO	BT UART request to send	V_{OL}max=0.18V V_{OH}min=1.62V	1.8V power domain. If unused, keep this pin open.
BT_UART_CTS	8	DI	BT UART clear to send	V_{IL}min=-0.3V V_{IL}max=0.54V V_{IH}min=1.26V V_{IH}max=2.0V	1.8V power domain. If unused, keep this pin open.
BT_UART_TXD	17	DO	BT UART transmit data	V_{OL}max=0.18V V_{OH}min=1.62V	1.8V power domain. If unused, keep this pin open.
BT_UART_RXD	18	DI	BT UART receive data	V_{IL}min=-0.3V V_{IL}max=0.54V V_{IH}min=1.26V V_{IH}max=2.0V	1.8V power domain. If unused, keep this pin open.
Coexistence Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
LTE_UART_TXD	5	DO	LTE/Wi-Fi&BT coexistence signal	V_{OL}max=0.18V V_{OH}min=1.62V	1.8V power domain. If unused, keep this

					pin open.
LTE_UART_RXD	6	DI	LTE/Wi-Fi&BT coexistence signal	V_{IL}min=-0.3V V_{IL}max=0.54V V_{IH}min=1.26V V_{IH}max=2.0V	1.8V power domain. If unused, keep this pin open.
RF Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
RF_ANT	30	IO	Wi-Fi/BT antenna interface		50Ω impedance.
Other Interfaces					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
DBG_TXD	4	OD	Used for software debugging	V_{OL}max=0.18V V_{OH}min=1.62V	1.8V power domain. Require external pull-up to 1.8V. If unused, keep this pin open.
32KHz_IN [2)]	19	DI	Low power. External 32.768kHz clock input.	V_{IL}min=-0.3V V_{IL}max=0.54V V_{IH}min=1.26V V_{IH}max=2.0V	1.8V power domain. If unused, keep this pin open.
RESERVED Pins					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
RESERVED	2, 3, 33~35, 37, 41, 42, 47		Reserved		Keep these pins open.

NOTES

1. [1)] indicates that SDIO_D2 is a boot strap signal, which must be kept at high level for normal operation during power on.
2. [2)] indicates that 32KHz_IN is reserved on FC21 module since the sleep function is still to be developed.

3.4. Power Supply

批注 [RL7]: 中文下面有个单独的 3.4.1 引脚介绍，是否要加上

▪ 3.4.1. 引脚介绍

下表为 FC21 模块的

3.4.1. Pin Introduction

The following table shows the power supply pins and the ground pins of FC21. The VIO power supply is recommended to be powered by VDD_EXT of EC2x&EG2x-G modules.

Table 5: Power Supply Pins and GND Pins

Pin Name	Pin No.	Description	Min.	Typ.	Max.	Unit
VDD_3V3	21	Main power supply for the module	3.14	3.3	3.46	V
VIO	11	Power supply for the module's I/O pins	1.71	1.8	3.46	V
GND	1, 12, 20, 28, 29, 31, 36, 38~40, 43~45, 48~52	Ground				

FC21 is powered by VDD_3V3, and it is recommended to use a power supply chip with maximum output current more than 0.6A.

The following figure shows a reference design for VDD_3V3. Pulling PM_ENABLE to a high voltage level will enable VDD_3V3 power output. And this pin should be connected to pin 127 of EC2x&EG2x-G. For more details, please refer to ***document [2]***, ***[3]***, ***[4]***, ***[5]*** or ***[6]***.

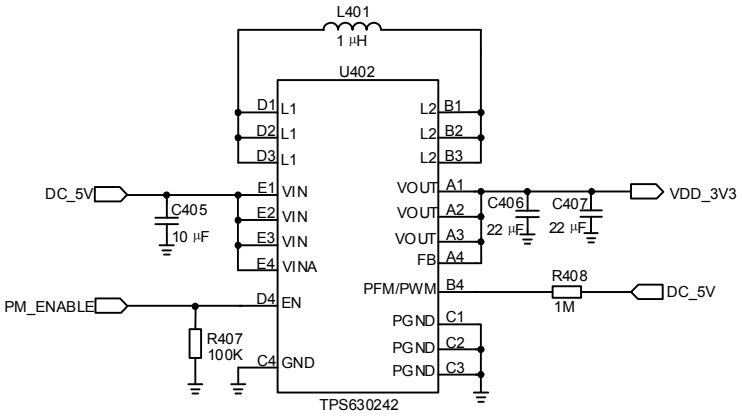


Figure 3: Reference Circuit for VDD_3V3

The following figure shows the recommended power on/off sequences for FC21 module.

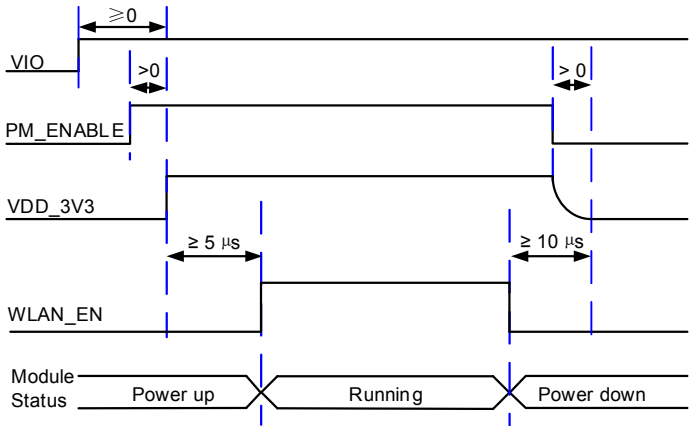


Figure 4: Timing of Turning on/off FC21 Module

3.5. Wireless Connectivity Interfaces

FC21 support a low-power SDIO 3.0 interface for WLAN, and UART&PCM interfaces for BT function.

3.5.1. Wi-Fi Interface

The following figure shows the WLAN interface connection between FC21 and EC2x&EG2x-G.

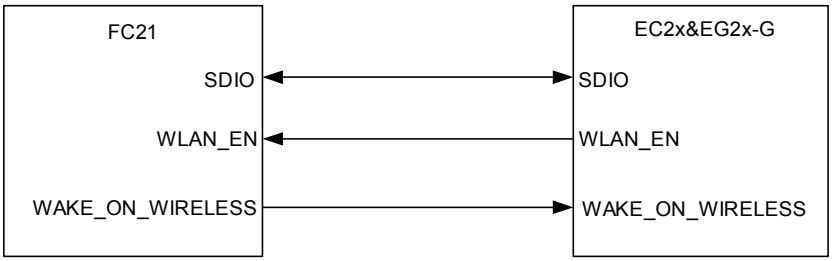


Figure 5: Wi-Fi Interface Connection

3.5.1.1. WAKE_ON_WIRELESS

WAKE_ON_WIRELESS is used to wake up the EC2x&EG2x-G module. When the pin is pulled down, EC2x&EG2x-G can be woken up.

Table 6: Pin Definition of WAKE_ON_WIRELESS

Pin Name	Pin No.	I/O	Description	Comment
WAKE_ON_WIRELESS	32	OD	Wi-Fi wake up the host	1.8V power domain. Active low. Require external pull-up to 1.8V. If unused, keep this pin open.

3.5.1.2. WAKE_EN

WLAN_EN is used to control the WLAN function of FC21. When WLAN_EN is at high level voltage, Wi-Fi function will be enabled.

Table 7: Pin Definition of WLAN_EN

Pin Name	Pin No.	I/O	Description	Comment
WLAN_EN	9	DI	Wi-Fi function control	1.8V power domain. Active high.

NOTE

WLAN_EN is a sensitive signal, and therefore, WLAN_EN should be ground-shielded and routed as close as possible to FC21 module.

3.5.1.3. SDIO Interface

The following table shows the pin definition of SDIO interface.

Table 8: Pin Definition of SDIO Interface

Pin Name	Pin No.	I/O	Description	Comment
SDIO_D3	22	IO	SDIO data bus D3	1.8V power domain.
SDIO_D2	23	IO	SDIO data bus D2	1.8V power domain. Require external pull-up to 1.8V.
SDIO_D1	24	IO	SDIO data bus D1	1.8V power domain.
SDIO_D0	25	IO	SDIO data bus D0	1.8V power domain.
SDIO_CLK	26	DI	SDIO bus clock	1.8V power domain.
SDIO_CMD	27	IO	SDIO bus command	1.8V power domain.

The following figure shows the SDIO interface connection between FC21 and EC2x&EG2x-G.

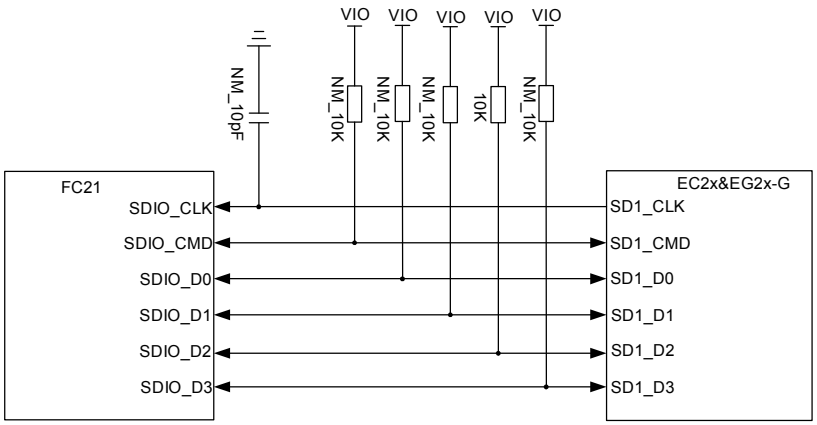


Figure 6: SDIO Interface Connection

In order to ensure the performance of SDIO, please comply with the following principles:

- SDIO signals are very high-speed signals. Please prevent crosstalk among them and other sensitive signals.
- Keep SDIO traces as parallel as possible in the same layer. Make sure SDIO lines are guarded by ground vias and not crossed.

- Do not route SDIO signal traces under crystals, oscillators, magnetic devices and RF signal traces.
- SDIO_D2 is a boot strap signal, which must be kept at high level for normal operation during power on. The pull-up resistor on SDIO_D2 line must be mounted.
- Keep SDIO traces as short as possible with equal length, and impedance control as 50Ω.
- The spacing to all other signals is greater than 2 times of the trace width.

3.5.2. BT Interface*

批注 [RL8]: 中文这里没有加星号，中文是否要加上

The following figure shows the block diagram of BT interface connection between FC21 and EC2x&EG2x-G.

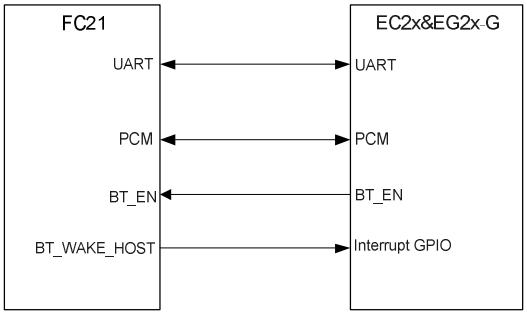


Figure 7: Block Diagram of BT Interface Connection

NOTES

1. "*" means under development.
2. PIN3 of EC2x / EG2x-G can be used as an interrupt GPIO.

3.5.2.1. BT_EN

BT_EN is used to control the BT function of FC21. When BT_EN is at high level voltage, BT function will be enabled.

Table 9: Pin Definition of BT_EN

Pin Name	Pin No.	I/O	Description	Comment
BT_EN	10	DI	BT function control	1.8V power domain. Active high. If unused, keep this pin open.

3.5.2.2. BT_WAKE_HOST

BT_WAKE_HOST is used to wake up the EC2x&EG2x-G module. When the pin is pulled down, EC2x&EG2x-G can be woken up.

Table 10: Pin Definition of BT_WAKE_HOST

Pin Name	Pin No.	I/O	Description	Comment
BT_WAKE_HOST	46	OD	BT wake up the host	1.8V power domain. Active Low. Pulled up internally. If unused, keep this pin open.

3.5.2.3. PCM Interface

FC21 provides a PCM interface for BT application. The following table shows the pin definition of PCM interface. The PCM interface is not needed when a BLE function is used.

Table 11: Pin Definition of PCM Interface

Pin Name	Pin No.	I/O	Description	Comment
PCM_IN	13	DI	BT PCM data input	1.8V power domain. If unused, keep these pins open.
PCM_SYNC	14	DI	BT PCM data frame synchronization signal	
PCM_CLK	15	DI	BT PCM data bit clock	
PCM_OUT	16	DO	BT PCM data output	

The following figure shows a reference design for PCM interface connection between FC21 and EC2x&EG2x-G.

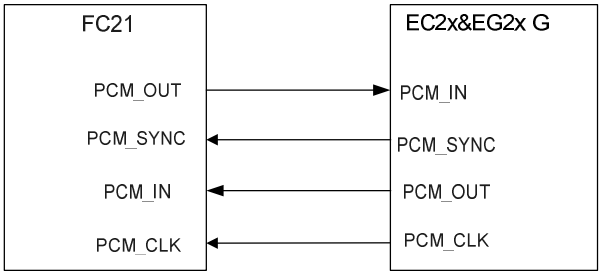


Figure 8: Reference Design for PCM Interface

3.5.2.4. BT_UART Interface

批注 [RL9]: 中文是BT_UART，这里是否需要改为一致

批注 [RL10R9]:

FC21 provides a dedicated UART interface for BT application. The following table shows the pin definition of UART interface.

Table 12: Pin Definition of UART Interface

Pin Name	Pin No.	I/O	Description	Comment
BT_UART_RTS	7	DO	BT UART request to send	1.8V power domain. If unused, keep these pins open.
BT_UART_CTS	8	DI	BT UART clear to send	
BT_UART_TXD	17	DO	BT UART transmit data	
BT_UART_RXD	18	DI	BT UART receive data	

The following figure shows a reference design for UART interface connection between FC21 and EC2x&EG2x-G.

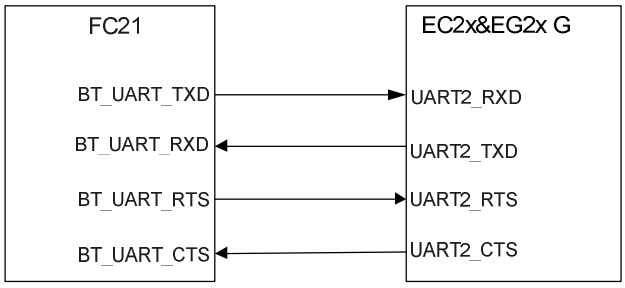


Figure 9: Reference Design for UART Interface Connection

3.5.3. Coexistence Interface

The following table shows the pin definition of coexistence interface [1)].

Table 13: Pin Definition of Coexistence Interface

Pin Name	Pin No.	I/O	Description	Comment
LTE_UART_TXD	5	DO	LTE/Wi-Fi&BT coexistence signal	1.8V power domain. If unused, keep these pins open.
LTE_UART_RXD	6	DI	LTE/Wi-Fi&BT coexistence signal	

The following figure shows the coexistence interface connection between FC21 and EC2x&EG2x-G.

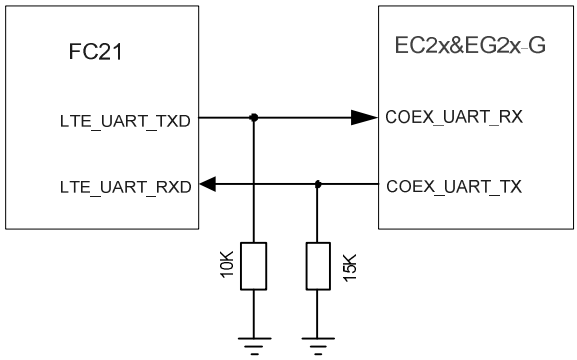


Figure 10: Coexistence Interface Connection

3.6. Other Interfaces

3.6.1. DBG_TXD Interface

DBG_TXD interface can be used for log output.

Table 14: Pin Definition of DBG_TXD Interface

Pin Name	Pin No.	I/O	Description	Comment
DBG_TXD	4	OD	Used for software debugging	1.8V power domain. Require external pull-up to 1.8V. If unused, keep this pin open.

3.6.2. 32KHz_IN Interface

The 32KHz clock is used in low power mode such as IEEE power saving mode and sleep mode. It serves as a timer to determine when to wake up FC21 module to receive beacons in various power saving schemes, and to maintain basic logic operations in sleep mode.

Table 15: Pin Definition of 32KHz_IN Interface

Pin Name	Pin No.	I/O	Description	Comment
32KHz_IN	19	DI	Low power. External 32.768kHz clock input.	1.8V power domain. If unused, keep this pin open.

批注 [RL11]: 休眠时钟，默认由 EC2x 和 EG2x-G 模块提供。中文里的引脚描述章节是这样表述的。要以哪个为准

NOTE

32KHz_IN pin is reserved on FC21 module since the sleep function is still to be developed.

3.7. Antenna Interface

批注 [RL12]: 中文里有这个射频天线 Layout 参考指导章节，是否需要添加

Pin 30 is the RF antenna pad. And the RF port has an impedance of 50Ω.

3.7.1. Pin Definition of RF Antenna Interface

Table 16: Pin Definition of RF Antenna Interface

Pin Name	Pin No.	I/O	Description	Comment
GND	28		Ground	
GND	29		Ground	
RF_ANT	30	IO	Wi-Fi/BT antenna pad	50Ω impedance
GND	31		Ground	

批注 [RL13R12]: ▪ 3.7.4.

对
材料的
的控制
时微带

3.7.2. Operating Frequency

Operating frequency is as bellow.

Table 17: Operating Frequency

Feature	Frequency	Unit
2.4GHz WLAN	2.412~2.472	GHz
5GHz WLAN	5.180~5.825	GHz
BT 4.2	2.402~2.48	GHz

3.7.3. Reference Designs

FC21 module provides an RF antenna pad for Wi-Fi/BT antenna connection. The RF trace in host PCB connected to the module's RF antenna pad should be microstrip line or other types of RF trace, with characteristic impendence close to 50Ω. FC21 module comes with grounding pads which are next to the antenna pad in order to give a better grounding.
A reference circuit for the RF antenna interface is shown below. It is recommended to reserve a π-type matching circuit for better RF performance. The capacitors are not mounted by default.

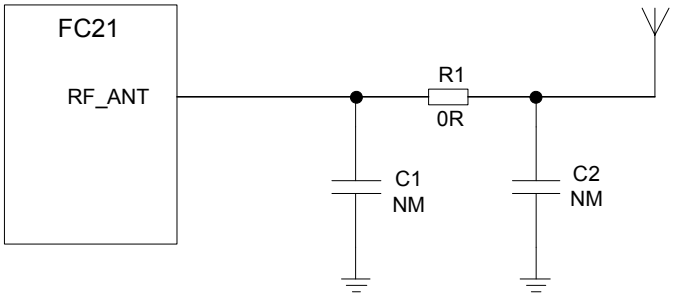


Figure 11: Reference Circuit for RF Antenna Interface

Another type of reference circuit for the RF antenna interface is shown below. It is designed for vehicle applications. It is recommended to reserve two notch filter circuits and a π-type matching circuit for better RF performance. C2/L1 and L3/C3 comprise two notch filter circuits for filtering out interference caused by a particular frequency. When L3/C2/L1/C3 is NC, C1/L2/C4 comprise a π-type matching circuit. Capacitors C1/C2/C3/C4 and inductors L1/L3 are not mounted by default, and L2 is 0Ω by default.

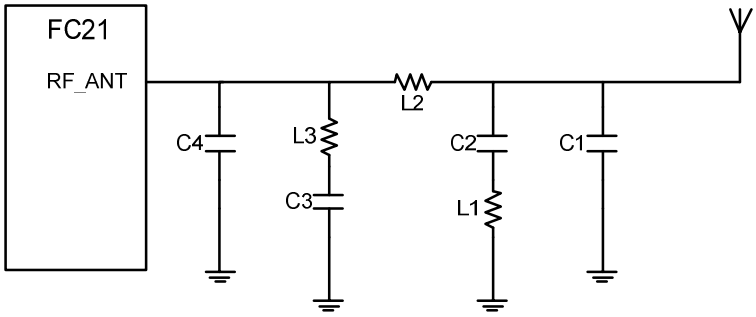


Figure 12: Reference Circuit for RF Antenna Interface (Vehicle Applications)

3.7.4. Reference Design of RF Layout

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.

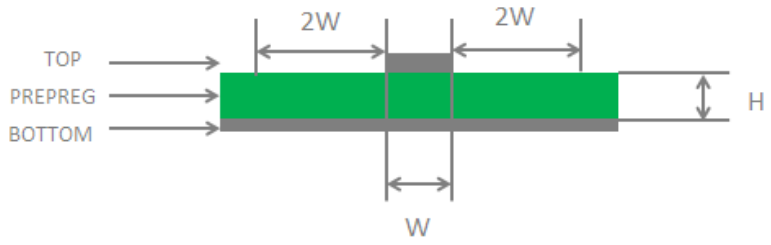


Figure 13: Microstrip Design on a 2-layer PCB

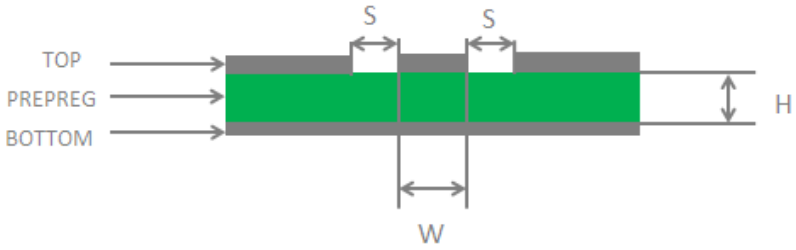


Figure 14: Coplanar Waveguide Design on a 2-layer PCB

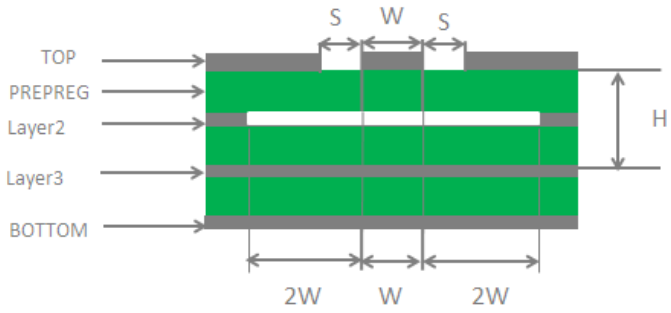


Figure 15: Coplanar Waveguide Design on a 4-layer PCB (Layer 3 as Reference Ground)

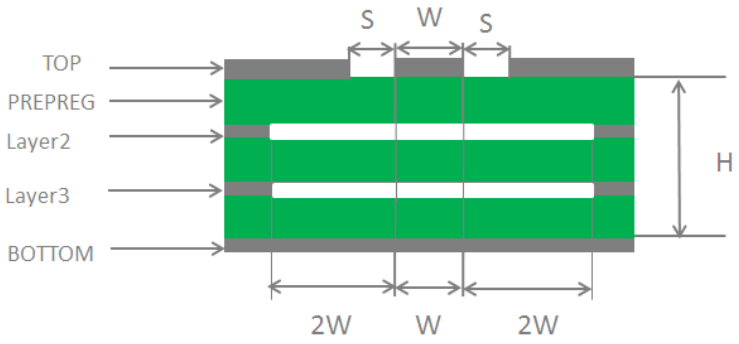


Figure 16: Coplanar Waveguide Design on a 4-layer PCB (Layer 4 as Reference Ground)

In order to ensure RF performance and reliability, the following principles should be complied with 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 no less than two times the width of RF signal traces (2 x 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 [7]***.

3.7.5. Antenna Requirements

The following table shows the requirements on RF antenna.

Table 18: Antenna Cable Requirements

Type	Requirements
2.412GHz~2.472GHz	Cable insertion loss <1dB
5.180GHz~5.825GHz	Cable insertion loss <1dB

Table 19: Antenna Requirements

Type	Requirements
Frequency Range	2.412GHz~2.472GHz 5.180GHz~5.825GHz
VSWR	< 2:1 recommended
Gain (dBi)	Typically 1
Max Input Power (W)	50
Input Impedance (Ω)	50
Polarization Type	Vertical

3.7.6. Recommended RF Connector for Antenna Installation

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

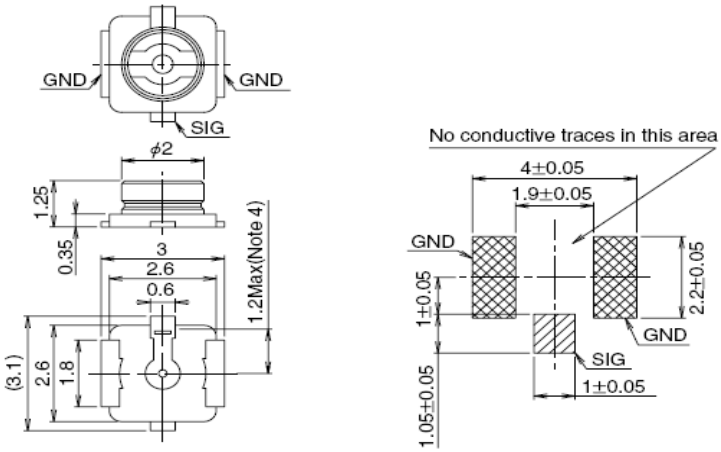


Figure 17: Dimensions of the U.FL-R-SMT Connector (Unit: mm)

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

批注 [RL14]: 这个是连接器吧，中文里写的是连接线，要不要改为连接器

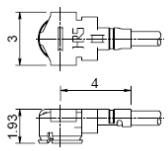
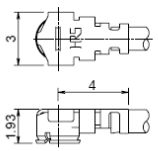
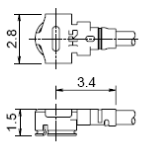
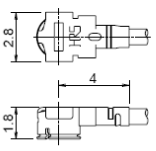
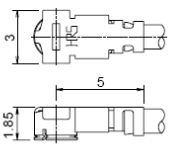
Part No.	U.FL-LP-040	U.FL-LP-066	U.FL-LP(V)-040	U.FL-LP-062	U.FL-LP-088
					
Mated Height	2.5mm Max. (2.4mm Nom.)	2.5mm Max. (2.4mm Nom.)	2.0mm Max. (1.9mm Nom.)	2.4mm Max. (2.3mm Nom.)	2.4mm Max. (2.3mm Nom.)
Applicable cable	Dia. 0.81mm Coaxial cable	Dia. 1.13mm and Dia. 1.32mm Coaxial cable	Dia. 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 18: Mechanicals of U.FL-LP Connectors

The following figure describes the space factor of mated connector.

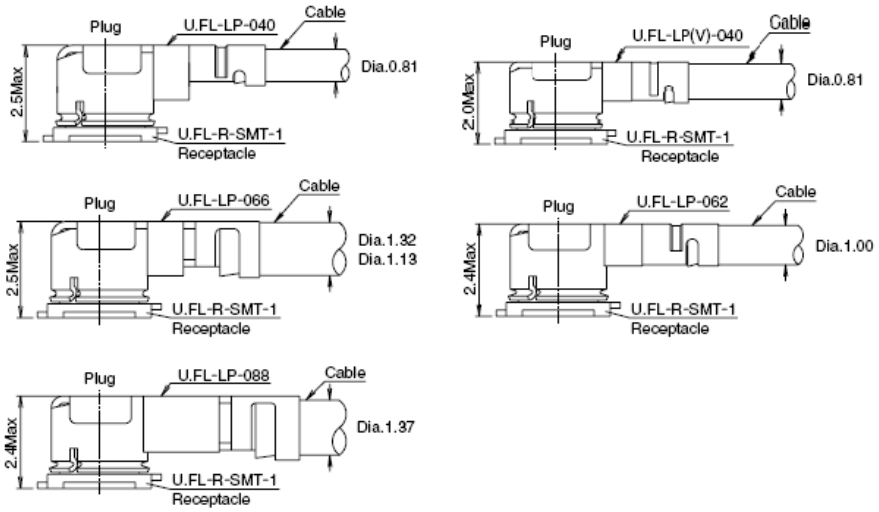


Figure 19: Space Factor of Mated Connector (Unit: mm)

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

4 Electrical, Reliability and Radio Characteristics

4.1. General Description

This chapter mainly introduces the electrical and the radio frequency characteristics of FC21 module, which are listed in detail in the following chapters:

- Electrical characteristics
- I/O interface characteristics
- Current consumption
- RF performance
- Electrostatic discharge

4.2. Electrical Characteristics

The following table shows the absolute maximum ratings.

Table 20: Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
VDD_3V3	-0.3	3.46	V
VIO	-0.3	3.46	V
Digital I/O input voltage	-0.3	VIO+0.2	V

The following table shows the recommended operating conditions for FC21 module.

Table 21: Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Unit
VDD_3V3	3.14	3.3	3.46	V
VIO	1.71	1.8	3.46	V

4.3. I/O Interface Characteristics

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

Table 22: General DC Electrical Characteristics

Symbol	Parameter	Min.	Max.	Unit
V_{IH}	High Level Input Voltage	0.7 x VIO	VIO+0.2	V
V_{IL}	Low Level Input Voltage	-0.3	0.3 x VIO	V
V_{OH}	High Level Output Voltage	0.9 x VIO	VIO	V
V_{OL}	Low Level Output Voltage	0	0.1 x VIO	V
I_{IL}	Input Leakage Current	-5	5	μA

4.4. Current Consumption

4.4.1. Wi-Fi Current Consumption

Table 23: Wi-Fi Current Consumption

Description	Condition	$I_{WLAN3V3}$	I_{VIO}	Unit
OFF state [1)]	**AT+QWIFI=0**	0	TBD	μA
Idel state [2)]	**AT+QWIFI=1**	TBD	TBD	mA
802.11b	TX 1 Mbps	TBD	TBD	mA

	TX 11 Mbps	TBD	TBD	mA
	RX 1 Mbps	TBD	TBD	mA
	RX 11 Mbps	TBD	TBD	mA
802.11g	TX 6 Mbps	TBD	TBD	mA
	TX 54 Mbps	TBD	TBD	mA
	RX 6 Mbps	TBD	TBD	mA
	RX 54 Mbps	TBD	TBD	mA
802.11n	TX HT20-MCS0	TBD	TBD	mA
	TX HT20-MCS7	TBD	TBD	mA
	TX HT40-MCS0	TBD	TBD	mA
	TX HT40-MCS7	TBD	TBD	mA
	RX HT20-MCS0	TBD	TBD	mA
	RX HT20-MCS7	TBD	TBD	mA
	RX HT40-MCS0	TBD	TBD	mA
	RX HT40-MCS7	TBD	TBD	mA
802.11a	TX HT20 MCS0	TBD	TBD	mA
	TX HT20 MCS7	TBD	TBD	mA
	RX HT20 MCS0	TBD	TBD	mA
	RX HT20 MCS7	TBD	TBD	mA
802.11ac	TX VHT20 MCS0	TBD	TBD	mA
	TX VHT20 MCS8	TBD	TBD	mA
	TX VHT40 MCS0	TBD	TBD	mA
	TX VHT40 MCS9	TBD	TBD	mA
	TX VHT80 MCS0	TBD	TBD	mA
	TX VHT80 MCS9	TBD	TBD	mA

	RX VHT20 MCS0	TBD	TBD	mA
	RX VHT20 MCS8	TBD	TBD	mA
	RX VHT40 MCS0	TBD	TBD	mA
	RX VHT40 MCS9	TBD	TBD	mA
	RX VHT80 MCS8	TBD	TBD	mA
	RX VHT80 MCS9	TBD	TBD	mA

NOTES

1. [1] OFF state: Executing **AT+QWIFI=0** command will make the module enter this state. Under the state, the sleep clock is disabled and no data is saved.
2. [2] Idle state: Wi-Fi function enabled via **AT+QWIFI=1**, but without any device connected to the AP.

4.4.2. BLE Current Consumption

Table 24: BLE Current Consumption During Non-signaling

Description	Power	Power Supply	Consumed Current	Unit
Non-signaling	-2±2.5dBm	3.3V	22.0	mA
		1.8V	3.0	

4.5. RF Performance

4.5.1. Wi-Fi Performance

The following tables summarize the transmitter and receiver characteristics of FC20 series.

Table 25: Conducted RF Output Power at 2.4GHz

Standard	Data Rate	Typ.	Unit
802.11b	1Mbps	TBD	dBm
802.11b	11Mbps	TBD	dBm

802.11g	6Mbps	TBD	dBm
802.11g	54Mbps	TBD	dBm
802.11n, HT20	MCS0	TBD	dBm
802.11n, HT20	MCS7	TBD	dBm
802.11n, HT40	MCS0	TBD	dBm
802.11n, HT40	MCS7	TBD	dBm

Table 26: Conducted RF Output Power at 5GHz

Standard	Data Rate	Typ.	Unit
802.11a	6 Mbps	TBD	dBm
802.11a	54 Mbps	TBD	dBm
802.11n，HT20	MCS0	TBD	dBm
802.11n，HT20	MCS7	TBD	dBm
802.11n，HT40	MCS0	TBD	dBm
802.11n，HT40	MCS7	TBD	dBm
802.11ac，VHT20	MCS0	TBD	dBm
802.11ac，VHT20	MCS8	TBD	dBm
802.11ac，VHT40	MCS0	TBD	dBm
802.11ac，VHT40	MCS9	TBD	dBm
802.11ac，VHT80	MCS0	TBD	dBm
802.11ac，VHT80	MCS9	TBD	dBm

Table 27: Conducted RF Receiving Sensitivity at 2.4GHz

Standard	Data Rate	Typ.	Unit
802.11b	1Mbps	TBD	dBm
802.11b	11Mbps	TBD	dBm

802.11g	6Mbps	TBD	dBm
802.11g	54Mbps	TBD	dBm
802.11n, HT20	MCS0	TBD	dBm
802.11n, HT20	MCS7	TBD	dBm
802.11n, HT40	MCS0	TBD	dBm
802.11n, HT40	MCS7	TBD	dBm

Table 28: Conducted RF Receiving Sensitivity at 5GHz

Standard	Data Rate	Typ.	Unit
802.11a	6 Mbps	TBD	dBm
802.11a	54 Mbps	TBD	dBm
802.11n，HT20	MCS0	TBD	dBm
802.11n，HT20	MCS7	TBD	dBm
802.11n，HT40	MCS0	TBD	dBm
802.11n，HT40	MCS7	TBD	dBm
802.11ac，VHT20	MCS0	TBD	dBm
802.11ac，VHT20	MCS8	TBD	dBm
802.11ac，VHT40	MCS0	TBD	dBm
802.11ac，VHT40	MCS9	TBD	dBm

4.5.2. BLE Performance

The following table shows the BLE transmitting and receiving performance of FC21 module.

Table 29: BLE Transmitting and Receiving Performance

Channel	Transmitting Power	Receiving Sensitivity
0	TBD	TBD

19	TBD	TBD
39	TBD	TBD

4.6. Electrostatic Discharge

The module is not protected against Electrostatic Discharge (ESD) in general. Consequently, it is subject to ESD handling precautions that typically apply to ESD sensitive components. Proper ESD handling and packaging procedures must be followed throughout the processing, handling and operation of any application that involves the module.

The following table shows the module's electrostatic discharge characteristics.

Table 30: Electrostatic Discharge Characteristics (25ºC, 45% Relative Humidity)

Tested Interfaces	Contact Discharge	Air Discharge	Unit
VDD_3V3	TBD	TBD	kV
GND	TBD	TBD	kV
RF	TBD	TBD	kV

5 Mechanical Dimensions

This chapter describes the mechanical dimensions of FC21 module. All dimensions are measured in millimeter (mm), and the dimensional tolerances are ±0.05mm unless otherwise specified.

5.1. Mechanical Dimensions of the Module

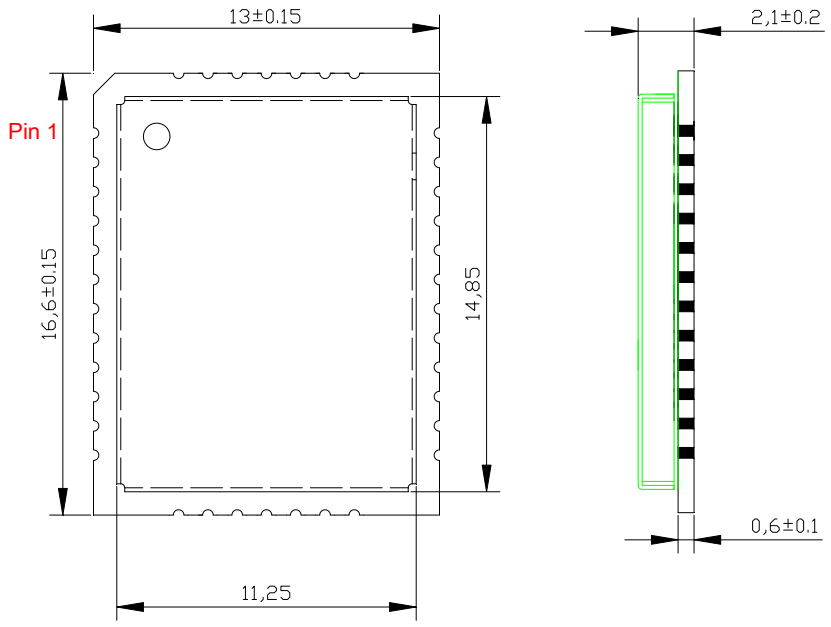


Figure 20: Top and Side Dimensions

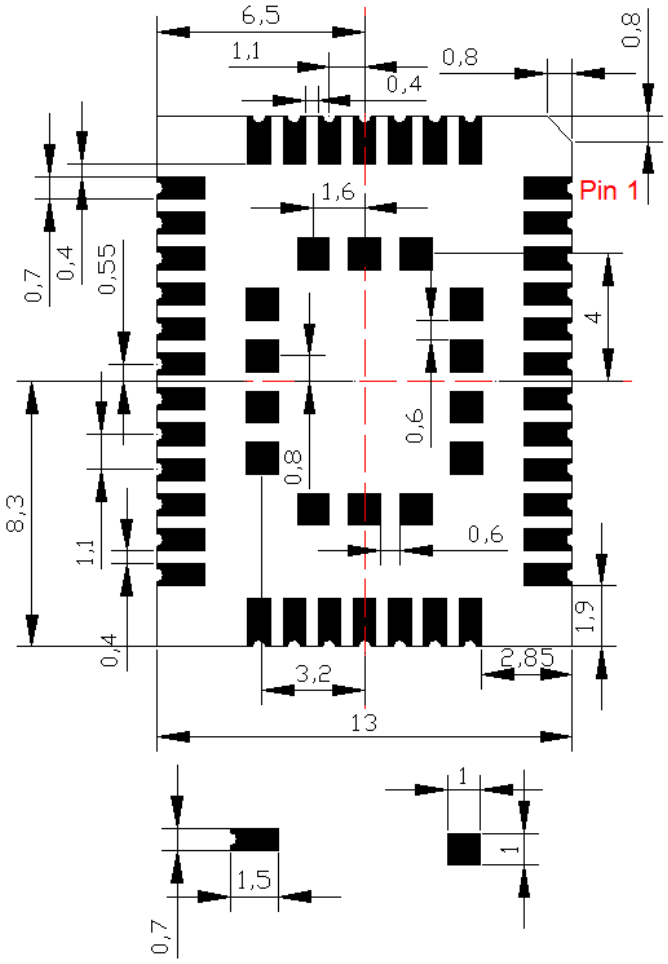


Figure 21: Bottom Dimensions

NOTE

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

5.2. Recommended Footprint and Stencil Design

批注 [RL15]: 中文分开的两章结，是否需要分开

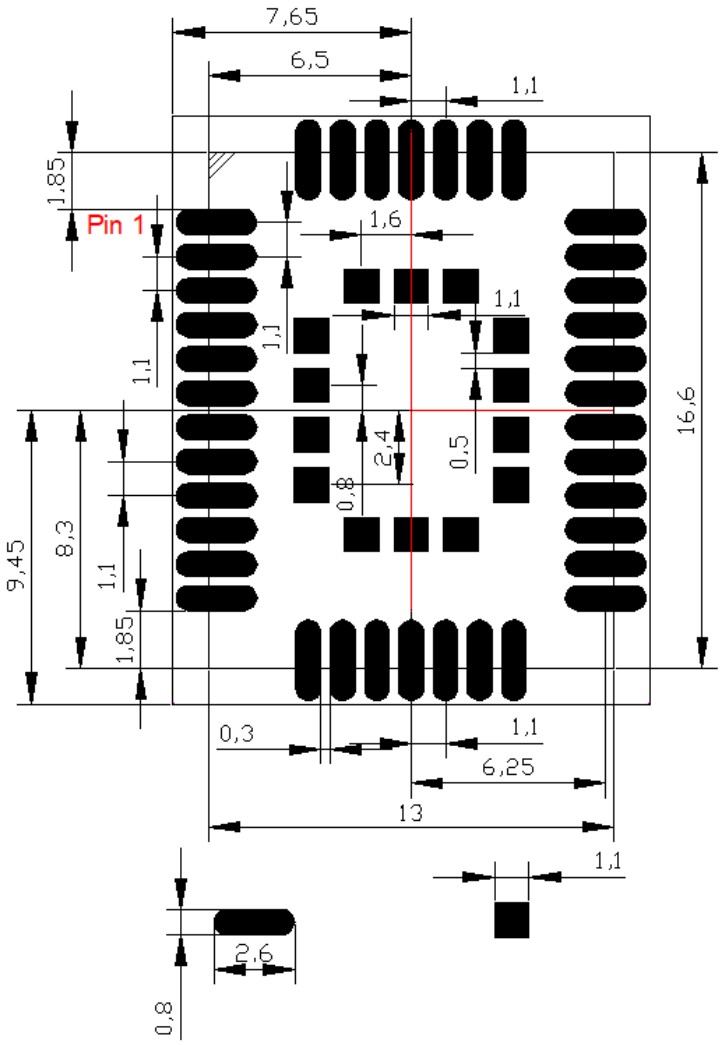


Figure 22: Recommended Footprint

The recommended stencil design for FC21 is shown below. To ensure the module soldering quality, the thickness of stencil for the module is recommended to be 0.18mm.

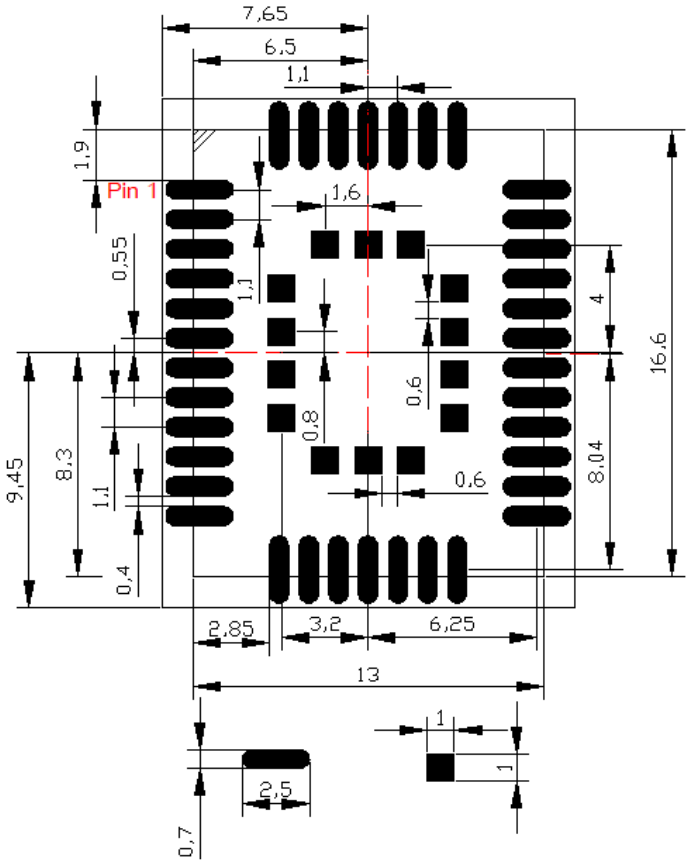


Figure 23: Recommended Stencil Design

NOTE

For easy maintenance of the module, please keep about 3mm between the module and other components on host PCB.

5.3. Top and Bottom Views of the Module

Figure 24: Top View of the Module

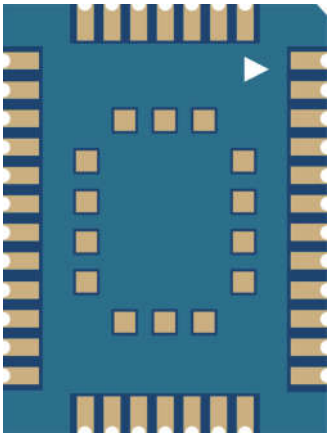


Figure 25: Bottom View of the Module

NOTE

These are renderings of FC21 modules. For authentic appearance, please refer to the module provided by Quectel.

6 Storage, Manufacturing and Packaging

6.1. Storage

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 [1)] 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 168 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.

NOTES

1. [1)] This floor life is only applicable when the environment conforms to *IPC/JEDEC J-STD-033*.
2. To avoid blistering, layer separation and other soldering issues, it is forbidden to expose the modules to the air for a long time. If the temperature and moisture do not conform to *IPC/JEDEC J-STD-033* or the relative moisture is over 60%, It is recommended to start the solder reflow process within 24 hours after the package is removed. And do not remove the packages of tremendous modules if they are not ready for soldering.
3. Please take the module out of the packaging and put it on high-temperature resistant fixtures before the baking. If shorter baking time is desired, please refer to *IPC/JEDEC J-STD-033* for baking procedure.

6.2. 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. The force on the squeegee should be adjusted properly so as 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 0.15–0.18 mm. For more details, please refer to ***document [8]***.

It is suggested that the peak reflow temperature is 238–246 ºC, and the absolute maximum reflow temperature is 246 ºC. To avoid damage to the module caused by repeated heating, it is strongly recommended that the module should be mounted after reflow soldering for the other side of PCB has been completed. The recommended reflow soldering thermal profile (lead-free reflow soldering) and related parameters are shown below.

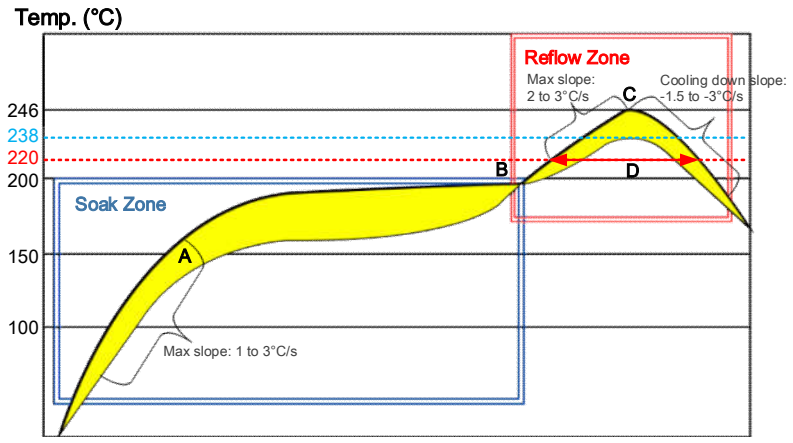


Figure 26: Recommended Reflow Soldering Thermal Profile

Table 31: 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 220°C)	45–70 s
Max temperature	238 °C to 246 °C
Cooling down slope	-1.5 to -3 °C/s
Reflow Cycle	
Max reflow cycle	1

NOTE

During manufacturing and soldering, or any other processes that may contact the module directly, NEVER wipe the module label with organic solvents, such as acetone, ethyl alcohol, isopropyl alcohol, trichloroethylene, etc. Otherwise, the label information may become unclear.

6.3. Packaging

FC21 module is packaged in a vacuum-sealed bag which is ESD protected. The bag should not be opened until the devices are ready to be soldered onto the application.

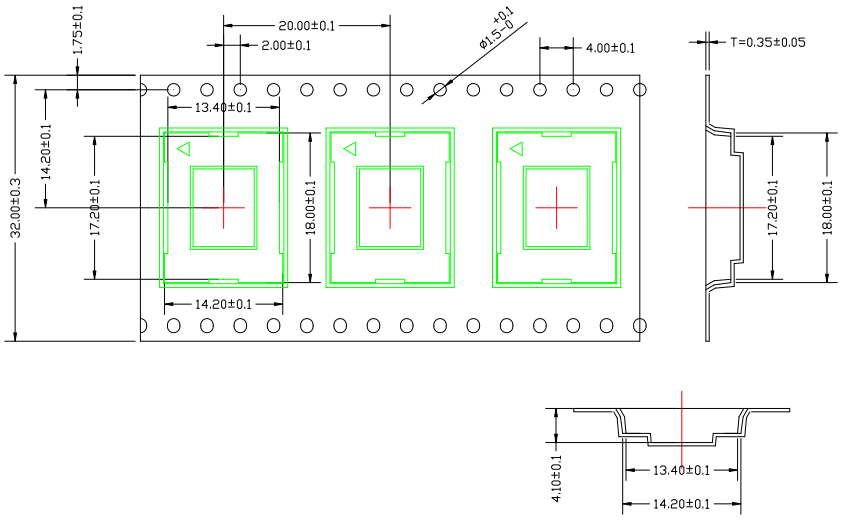


Figure 27: Tape Dimensions

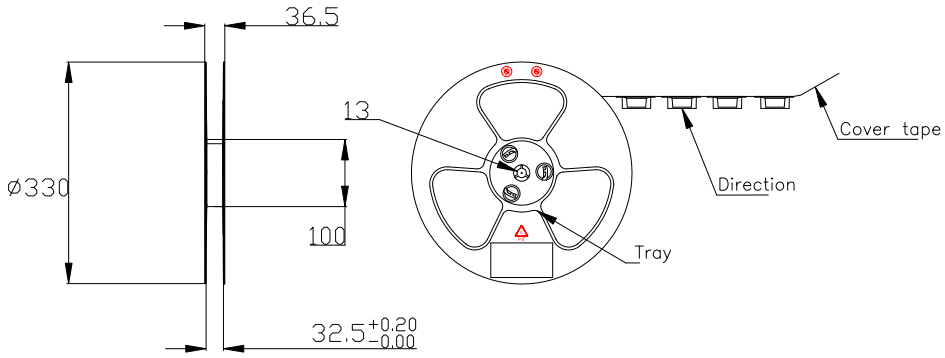


Figure 28: Reel Dimensions

7 Appendix A References

Table 32: Related Documents

SN	Document Name	Remark
[1]	Quectel_UMTS&LTE_EVB_User_Guide	UMTS&LTE EVB user guide
[2]	Quectel_EC25_Reference_Design	EC25 reference design
[3]	Quectel_EC21_Reference_Design	EC21 reference design
[4]	Quectel_EC20_R2.1_Reference_Design	EC20 R2.1 reference design
[5]	Quectel_EG25-G_Reference_Design	EC25-G reference design
[6]	Quectel_EG21-G_Reference_Design	EC21-G reference design
[7]	Quectel_RF_Layout_Application_Note	RF layout application note
[8]	Quectel_Module_Secondary_SMT_User_Guide	Module secondary SMT user guide

Table 33: Terms and Abbreviations

Abbreviation	Description
AP	Access Point
BPSK	Binary Phase Shift Keying
BLE	Bluetooth Low Energy
BT	Bluetooth
CCK	Complementary Code Keying
ESD	Electrostatic Discharge
GND	Ground
HT	High Throughput

I/O	Input/Output
IEEE	Institute of Electrical and Electronics Engineers
I_{IL}	Input Leakage Current
LTE	Long Term Evolution
Mbps	Million Bits Per Second
MCS	Modulation and Coding Scheme
MOQ	Minimum Order Quantity
MP	Manufacture Product
PCB	Printed Circuit Board
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
RH	Relative Humidity
RoHS	Restriction of Hazardous Substances
RX	Receive Direction
SDIO	Secure Digital Input and Output Card
STA	Station
TX	Transmitting Direction
USB	Universal Serial Bus
VDD	Voltage Power for Digital Device
VHT	Very High Throughput
V_{IH}max	Maximum Input High Level Voltage Value
V_{IH}min	Minimum Input High Level Voltage Value
V_{IL}max	Maximum Input Low Level Voltage Value
V_{IL}min	Minimum Input Low Level Voltage Value

VIO	Voltage for Input/Output Port
V_{OH}min	Minimum Output High Level Voltage Value
V_{OL}max	Maximum Output Low Level Voltage Value
VSWR	Voltage Standing Wave Ratio
WLAN	Wireless Local Area Network

Hereby, [Quectel Wireless Solutions Co., Ltd.] declares that the radio equipment type [FC21] 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.

The device could be used with a separation distance of 20cm to the human body.

Frequency bands	Maximum output power
Bluetooth/ LE	15 dbm(rate conducted power)
WIFI 2.4G	19 dbm(rate conducted power)
WIFI 5G	17 dbm(rate conducted power)

External antenna gain :

Band		Antenna Gain (dBi)
Wi-Fi 2.4G	802.11b	5.16
	802.11g	5.16
	802.11n HT20	5.16
	802.11n HT40	5.16
Wi-Fi 5G U-NII-1	802.11a	4.48
	802.11n HT20	4.48
	802.11n HT40	4.48
	802.11ac HT20	4.48
	802.11ac HT40	4.48
	802.11ac HT80	4.48
Wi-Fi 5G U-NII-2A	802.11a	4.48
	802.11n HT20	4.48
	802.11n HT40	4.48
	802.11ac HT20	4.48
	802.11ac HT40	4.48
	802.11ac HT80	4.48
Wi-Fi 5G U-NII-2C	802.11a	5.05
	802.11n HT20	5.05
	802.11n HT40	5.05

	802.11ac HT20	5.05
	802.11ac HT40	5.05
	802.11ac HT80	5.05
Wi-Fi 5G U-NII-3	802.11a	4.54
	802.11n HT20	4.54
	802.11n HT40	4.54
	802.11ac HT20	4.54
	802.11ac HT40	4.54
	802.11ac HT80	4.54
Bluetooth		3.00

The use for 5GHz WLAN band is restricted to indoor use. This restriction will be applied to all Member States of European Union listed in the label.

FCC Certification Requirements.

According to the definition of mobile and fixed device is described in Part 2.1091(b), this device is a mobile device.

And the following conditions must be met:

1. This Modular Approval is limited to OEM installation for mobile and fixed applications only. The antenna installation and operating configurations of this transmitter, including any applicable source-based timeaveraging duty factor, antenna gain and cable loss must satisfy MPE categorical Exclusion Requirements of 2.1091.
2. The EUT is a mobile device; maintain at least a 20 cm separation between the EUT and the user's body and must not transmit simultaneously with any other antenna or transmitter.
3. A label with the following statements must be attached to the host end product: This device contains FCC ID: XMR202102FC21
4. This module must not transmit simultaneously with any other antenna or transmitter
5. The host end product must include a user manual that clearly defines operating requirements and conditions that must be observed to ensure compliance with current FCC RF exposure guidelines.

For portable devices, in addition to the conditions 3 through 6 described above, a separate approval is required to satisfy the SAR requirements of FCC Part 2.1093

If the device is used for other equipment that separate approval is required for all other operating configurations, including portable configurations with respect to 2.1093 and different antenna configurations.

For this device, OEM integrators must be provided with labeling instructions of finished products.

Please refer to KDB784748 D01 v07, section 8. Page 6/7 last two paragraphs:

A certified modular has the option to use a permanently affixed label, or an electronic label. For a permanently

affixed label, the module must be labeled with an FCC ID - Section 2.926 (see 2.2 Certification (labeling requirements) above). The OEM manual must provide clear instructions explaining to the OEM the labeling requirements, options and OEM user manual instructions that are required (see next paragraph).

For a host using a certified modular with a standard fixed label, if (1) the module's FCC ID is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straightforward commonly used methods for access to remove the module so that the FCC ID of the module is visible; then an additional permanent label referring to the enclosed module: "Contains Transmitter Module FCC ID: XMR202102FC21 " or "Contains FCC ID: XMR202102FC21 " must be used. The host OEM user manual must also contain clear instructions on how end users can find and/or access the module and the FCC ID.

The final host / module combination may also need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device.

The user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the Internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

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.

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

To ensure compliance with all non-transmitter functions the host manufacturer is responsible for ensuring compliance with the module(s) installed and fully operational. For example, if a host was previously authorized as an unintentional radiator under the Supplier's Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that the after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements.

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.

Wireless Access Systems including Radio Local Area Networks (WAS/RLANs) frequency range 5150 – 5350 MHz is Restricted to indoor use in EU, this device contains 5150-5250 MHz.