

PRODUCT SPECIFICATION

6233B-UUB

Wi-Fi Dual-band 1T1R 802.11a/b/g/n + Bluetooth 5.2

Combo Module

Version:v1.0

Customer: _____

Customer P/N: _____

Signature: _____

Date: _____

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6233B-UUB Module Datasheet

Ordering Information	Part NO.	Description
	FG6233BUUB-00	RTL8733BU-CG/802.11a/b/g/n/ WiFi+BT5.2, 1T1R, 13*15 ,USB, two-ANT, with shielding

Target Power:

2.4G: 17/15/14

5.8G: 15/14

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Revision History

[illegible]

1. General Description

1.1 Introduction

6233BUUB is a highly integrated module with Realtek 8733BU-CG single-chip 802.11a/b/g/n 1T1R WLAN, and an integrated Bluetooth 5.2 combo chip with USB 2.0 multi-function. The highly integrated module makes the possibilities of web browsing, VoIP, video stream applications. With seamless roaming capabilities and advanced security, also could interact with different vendors' 802.11a/b/g/n 1x1 Access Points in the wireless LAN.

The wireless module complies with IEEE 802.11 a/b/g/n standard and it can achieve up to a speed of 150Mbps when using 40MHz bandwidth. The integrated module provides USB2.0 interface for Wi-Fi.

1.2 Description

Model Name	6233BUUB
Product Description	Support Wi-Fi/Bluetooth functionalities
Dimension	L x W x H: 13 x 15 x2.3 (typical) mm
Wi-Fi Interface	Support USB 2.0
BT Interface	USB2.0
Operating temperature	-20 ℃ to 70 ℃
Storage temperature	-40 ℃ to 85 ℃

2. Features

General

- 802.11a/b/g/n 1T1R WLAN and Bluetooth 5.2 combo chip
- Complete 802.11n solution for both 2.4GHz and 5GHz band
- 72.2Mbps receive PHY rate and 72.2Mbps transmit PHY rate using 20MHz bandwidth
- 150Mbps receive PHY rate and 150Mbps transmit PHY rate using 40MHz bandwidth
- Maximum data rate 54Mbps in 802.11g; and 150Mbps in 802.11n

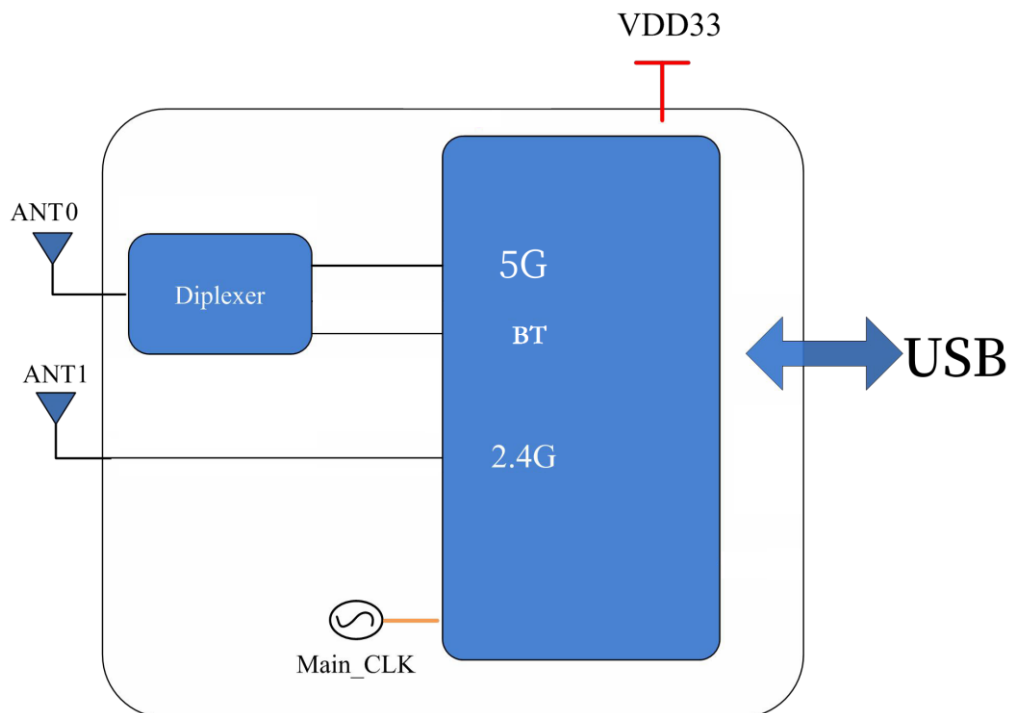
Host Interface

- USB Multi-Function for both BT (USB function 0) and WLAN (USB function 1)

Bluetooth Features

- Supports Bluetooth multiple Low Energy states
- Bluetooth 5.2 Dual Mode support: Simultaneous LE and BR/EDR
- Small SMT package

3. Block Diagram



4. General Specification

4.1 WI-FI 2.4GHz RF Specification

Feature	Description	
WLAN Standard	IEEE 802.11 b/g/n Wi-Fi compliant	
Frequency Range	2.400 GHz ~ 2.4835 GHz (2.4 GHz ISM Band)	
Number of Channels	2.4GHz: Ch1 ~ Ch14	
Test Items	Typical Value	EVM
Output Power	802.11b /11Mbps : 17dBm $\pm$ 2 dB	EVM $\leq$ -9dB
	802.11g /54Mbps : 15dBm $\pm$ 2 dB	EVM $\leq$ -25dB
	802.11n /MCS7 : 14dBm $\pm$ 2 dB	EVM $\leq$ -28dB
Spectrum Mask	Meet with IEEE standard	
Freq. Tolerance	$\pm$ 20ppm	
Test Items	TYP Test Value	Standard Value
SISO Receive Sensitivity (11b,20MHz) @8% PER	- 11Mbps PER @ -85 dBm	$\leq$ -81
SISO Receive Sensitivity (11g,20MHz) @10% PER	- 54Mbps PER @ -71 dBm	$\leq$ -67
SISO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=7 PER @ -68 dBm	$\leq$ -65
SISO Receive Sensitivity (11n,40MHz) @10% PER	- MCS=7, PER @ -65 dBm	$\leq$ -62
Maximum Input Level	802.11b : -10 dBm	
	802.11g/n : -20 dBm	

Note: Other data rates transmit power are controlled by Power-by-Rate function of the driver.

4.2 WI-FI 5GHz RF Specification

Feature	Description	
WLAN Standard	IEEE 802.11 a/n Wi-Fi compliant	
Frequency Range	5.150 GHz ~ 5.850 GHz (5.0 GHz Band)	
Number of Channels	5.0GHz: Please see the following table1	
Test Items	Typical Value	EVM
Output Power	802.11a /54Mbps : 15dBm $\pm$ 2 dB	EVM $\leq$ -25dB
	802.11n /MCS7 : 14dBm $\pm$ 2 dB	EVM $\leq$ -28dB
Spectrum Mask	Meet with IEEE standard	

Freq. Tolerance	$\pm 20\text{ppm}$	
Test Items	TYP Test Value	Standard Value
SISO Receive Sensitivity (11a,20MHz) @10% PER	- 54Mbps PER @ -71 dBm	≤ -68
SISO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=7 PER @ -68 dBm	≤ -65
SISO Receive Sensitivity (11n,40MHz) @10% PER	- MCS=7, PER @ -65 dBm	≤ -62
Maximum Input Level	802.11a/n : -10 dBm	
Antenna Reference	Small antennas with 0~2 dBi peak gain	

Note: Other data rates transmit power are controlled by Power-by-Rate function of the driver.

¹5GHz(20MHz) Channel table

Band range	Operating Channel Numbers	Channel center frequencies(MHz)
5180MHz~5240MHz	36	5180
	40	5200
	44	5220
	48	5240
5260MHz~5320MHz	52	5260
	56	5280
	60	5300
	64	5320
5550MHz~5700MHz	100	5500
	104	5520
	108	5540
	112	5560
	116	5580
	120	5600
	124	5620
	128	5640
	132	5660
	136	5680
5745MHz~5825MHz	140	5700
	149	5745
	153	5765
	157	5785

	161	5805
	165	5825

4.3 Bluetooth Specification

Feature	Description		
General Specification			
Bluetooth Standard	Bluetooth V5.2		
Host Interface	USB		
Antenna Reference	Small antennas with 0~2 dBi peak gain		
Frequency Band	2402 MHz ~ 2480 MHz		
Number of Channels	79 channels		
Modulation	GFSK, $\pi/4$ -DQPSK, 8-DPSK		
RF Specification			
	Min(dBm)	Typical(dBm)	Max(dBm)
Output Power (Class 1)	2	8	10
Sensitivity @ BER=0.1% for GFSK (1Mbps)			-70
Sensitivity @ BER=0.01% for $\pi/4$ -DQPSK (2Mbps)			-70
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)			-70
Maximum Input Level	GFSK (1Mbps):-20dBm		
	$\pi/4$ -DQPSK (2Mbps) :-20dBm		
	8DPSK (3Mbps) :-20dBm		

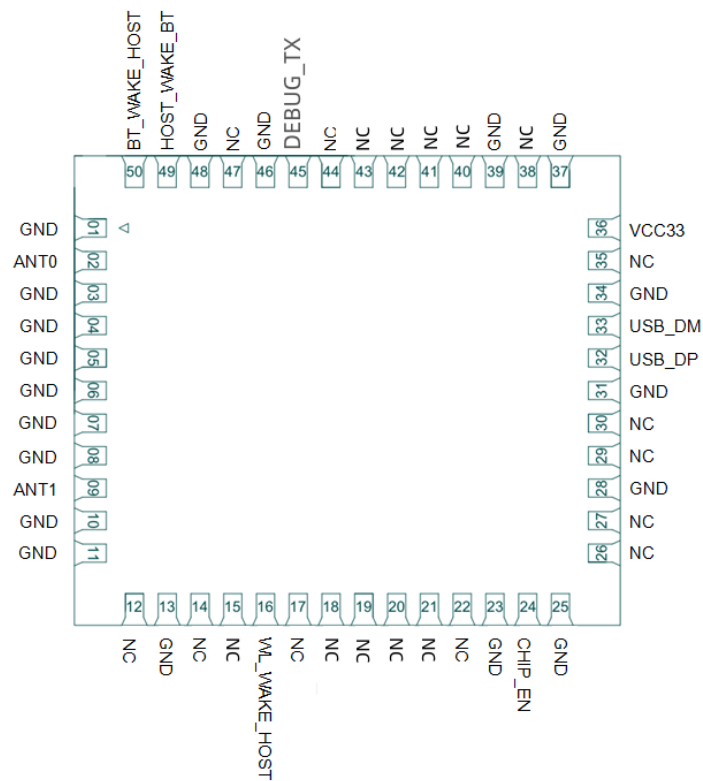
5. ID setting information

WI-FI

Vendor ID	-
Product ID	-

6. Pin Definition

6.1 Pin Outline



6.2 Pin Definition details

PIN	Name	Type	Description	Voltage
1	GND	—	Ground connections	
2	ANT0	I/O	RF I/O BT&5G WIFI	
3~8	GND	—	Ground connections	
9	ANT1	I/O	RF I/O 2.4G WIFI	
10~11	GND	—	Ground connections	
12	NC	—	Not connected	

13	GND	—	Ground connections	
14	NC	—	Not connected	
15	NC	—	Not connected	
16	WL_WAKE_HOST	O	WLAN to wake-up HOST	
17~22	NC	—	Not connected	
23	GND	—	Ground connections	
24	CHIP_EN	I	Enable pin for chipset. Pull low to enable	3.3V
25	GND	—	Ground connections	
26~27	NC	—	Not connected	
28	GND	—	Ground connections	
29~30	NC	—	Not connected	
31	GND	—	Ground connections	
32	USB_DP	I/O	USB2.0 differential pair D+ for WLAN and Bluetooth	
33	USB_DM	I/O	USB2.0 differential pair D- for WLAN and Bluetooth	
34	GND	—	Ground connections	
35	NC	—	Not connected	
36	VCC33	P	Main power input 3.3V	3.3V
37	GND	—	Ground connections	
38	NC	—	Not connected	
39	GND	—	Ground connections	
40~44	NC	—	Not connected	
45	DEBUG_TX	O	Debug UART TXD	
46	GND	—	Ground connections	
47	NC	I	Not connected	
48	GND	—	Ground connections	
49	HOST_WAKE_BT	I	HOST to wake-up Bluetooth device	
50	BT_WAKE_HOST	O	Bluetooth device to wake-up HOST	

P:POWER I:INPUT O:OUTPUT

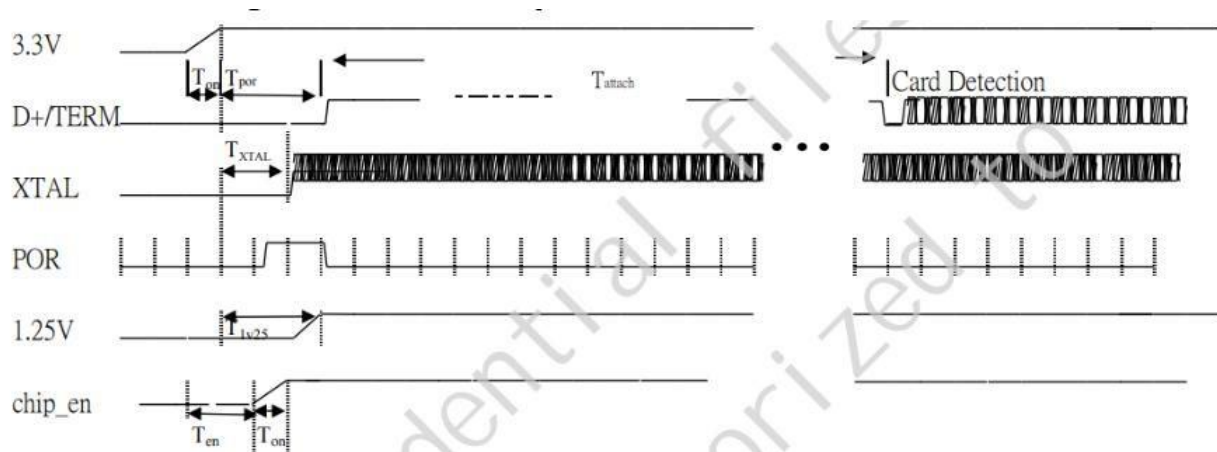
7. Electrical Specifications

7.1 Power Supply DC Characteristics

	Min.	Typ.	Max.	Unit
Operating Temperature	0	25	70	deg.C
VCC33	3.15	3.3	3.45	V

7.2 Interface Circuit time series

7.2.1 USB Bus Timing during Power On Sequence



T_{on}: The main power ramp up duration

T_{en}: Interval between the rising point of 3.3V and chip_en

T_{gate}: Interval of 3.3V to be gated when chip_en voltage level < 2V

T_{attach}: USB attach state. The duration from resistor attached to USB host starting card detection procedure

T_{xtal}: XTAL starts

The power on flow Description:

The power on flow description : After main 3.3V ramp up, the internal power on reset is released by power ready detection circuit and the power management unit will be enabled. The power management unit enables the internal regulator and clock circuits.

The power management unit also enables the USB circuits.

USB analog circuits attach resistors to indicate the insertion of the USB device.

	Unit	Min	Typical	Max
T _{on}	ms	0.2	1.5	5

Tpor	ms	--	2	10
Txtal	ms	--	1.5	8
Tattach	ms	100	250	-
T1v25	ms	0	0	5

7.2.2 Power off by 3.3V power sequence

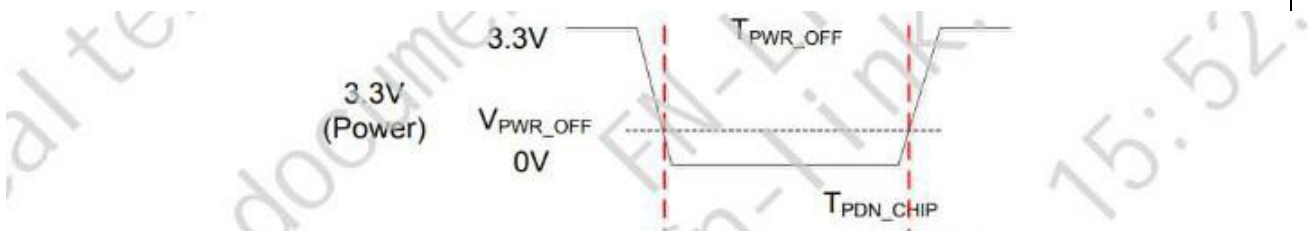


Figure 6. RTL8731BU-CG Power Off by 3.3V power Sequence

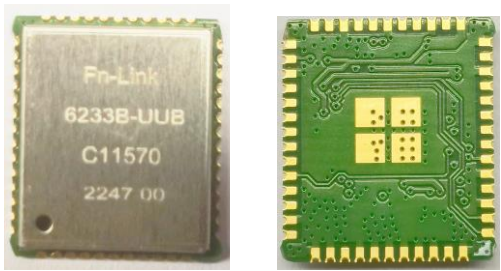
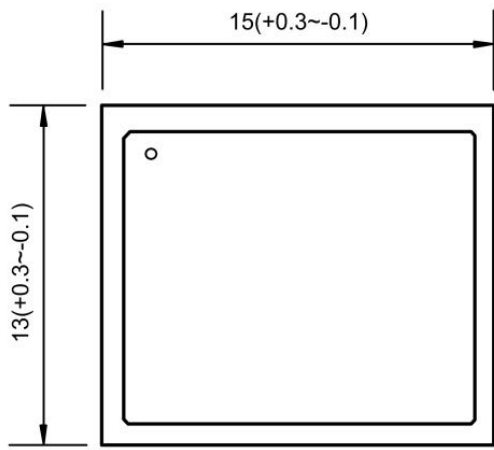
Table 14. RTL8731BU-CG Power Off by 3.3V power Timing Parameters

	Min	Typical	Max	Unit	Description
T_{PWR_OFF}	100	200	--	ms	3.3V power off time
V_{PWR_OFF}	--	--	0.7	V	3.3V power off voltage

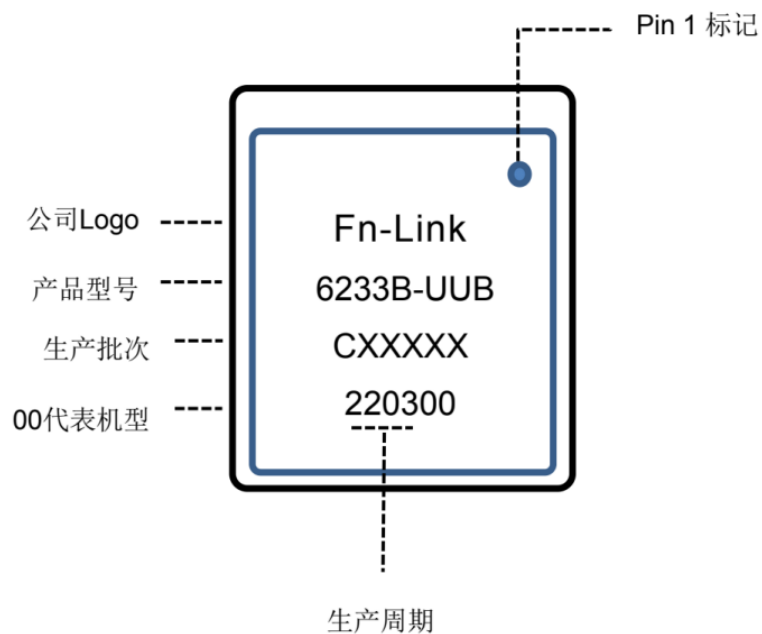
When 3.3V power off and on afterward, the voltage of 3.3V power must keep lower than V_{PWR_OFF}, and the 3.3V power keeping off duration must be more than T_{PWR_OFF}

8. Size reference

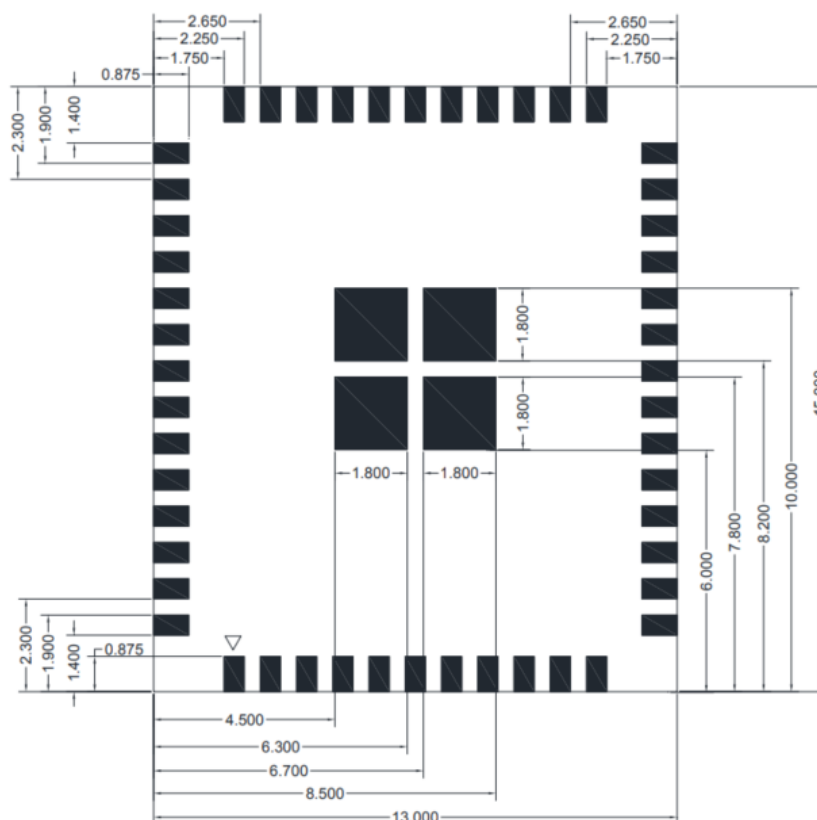
8.1 Module Picture

L x W : 13 x 15 (+0.3/-0.1) mm 	
H: 2.3 (±0.2) mm	
Weight	0.85g

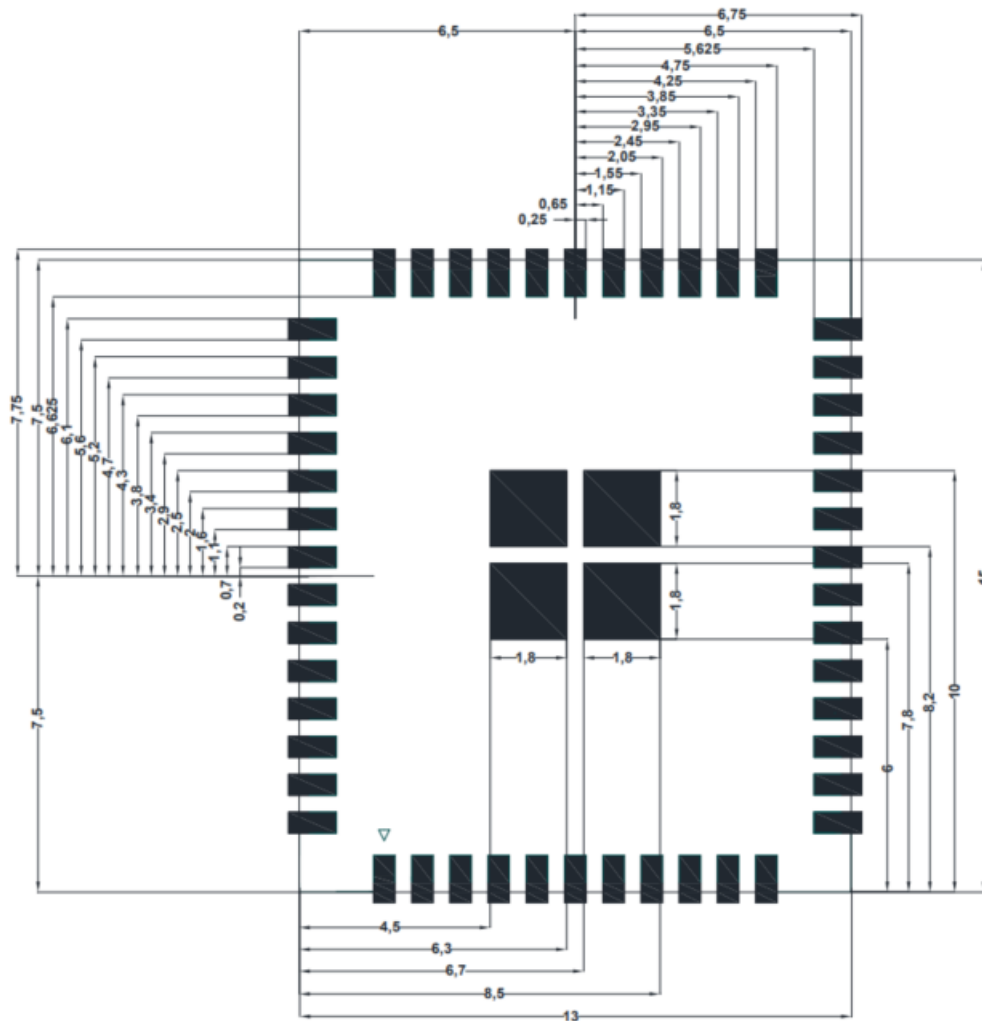
< TOP VIEW >



<TOP View>



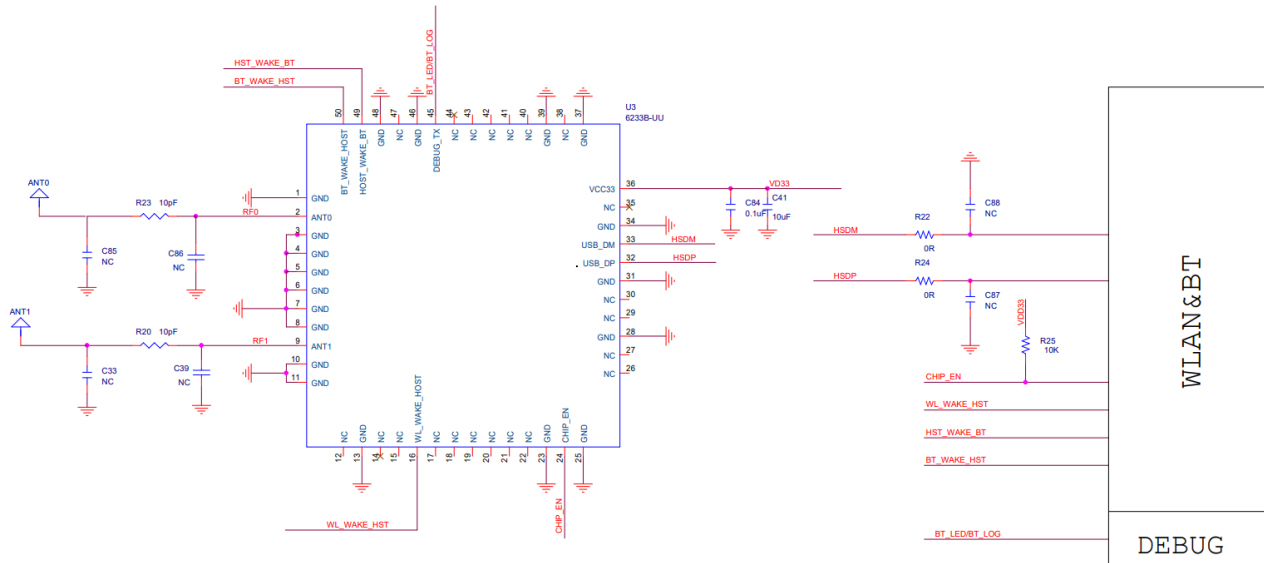
8.4 Layout Recommendation



9. The Key Material List

Item	Part Name	Description	Manufacturer
1	Inductor	2016,2.2uH, ±20%,DCR 0.264Ω,耐流 1.1A	Sunlord,Ceaiya,cenker,TAIYO,Chilisin,INPAQ
2	Diplexer	1608 Dual-band, dual-mode 2.4GHz/5GHz WLAN	Glead, Walsin, ACX, Murata, MAG.LAYERS,TDK,FTR
3	Crystal	2016 40MHz 10ppm 12PF -20-85° C	ECEC, TKD, Hosonic, JWT, TXC
4	Chipset	RTL8733BU-CG,QFN40	Realtek
5	PCB	6233BUUB V2.0PCB green,4layer,FR4,13X15X0.8mm	XY-PCB,GDKX,Sunlord, SL-PCB,TRULY
6	Shielding	6221B-UUC-V1.0,shielding,13.65x11.65x1.55mm,T=0.15mm	信太, 精力通, 卓益

10. Reference Design

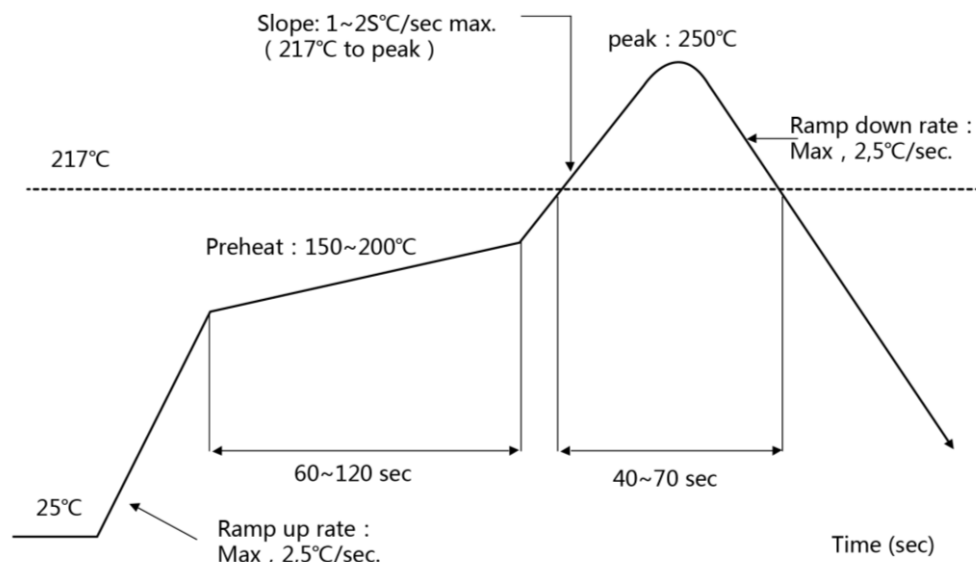


11. Recommended Reflow Profile

Referred to IPC/JEDEC standard.

Peak Temperature : <250°C

Number of Times : ≤2 times



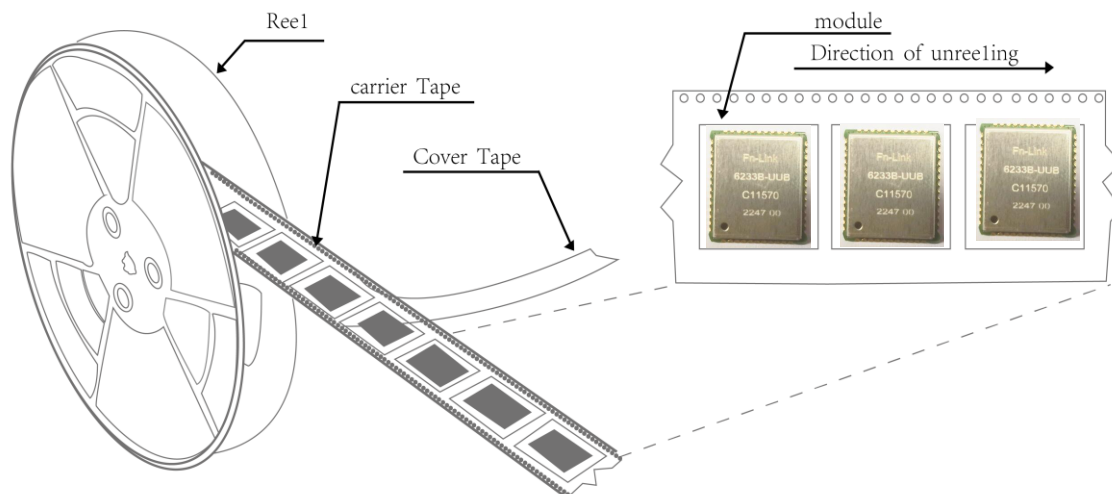
12. RoHS compliance

All hardware components are fully compliant with EU RoHS directive

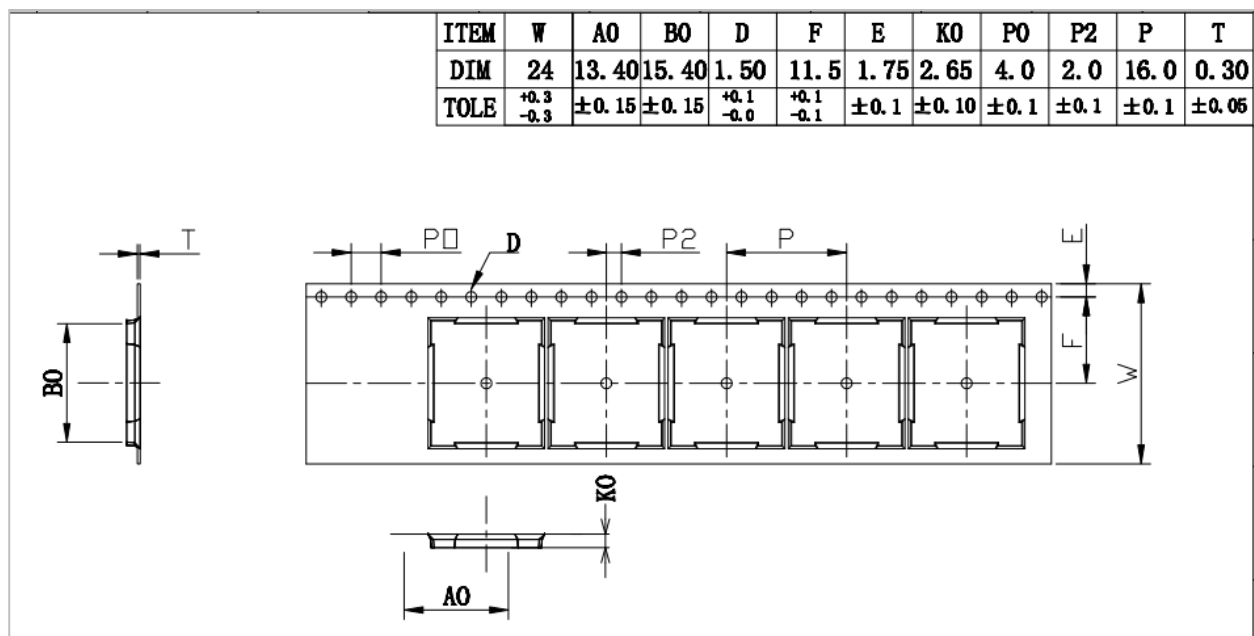
13. Package

13.1 Reel

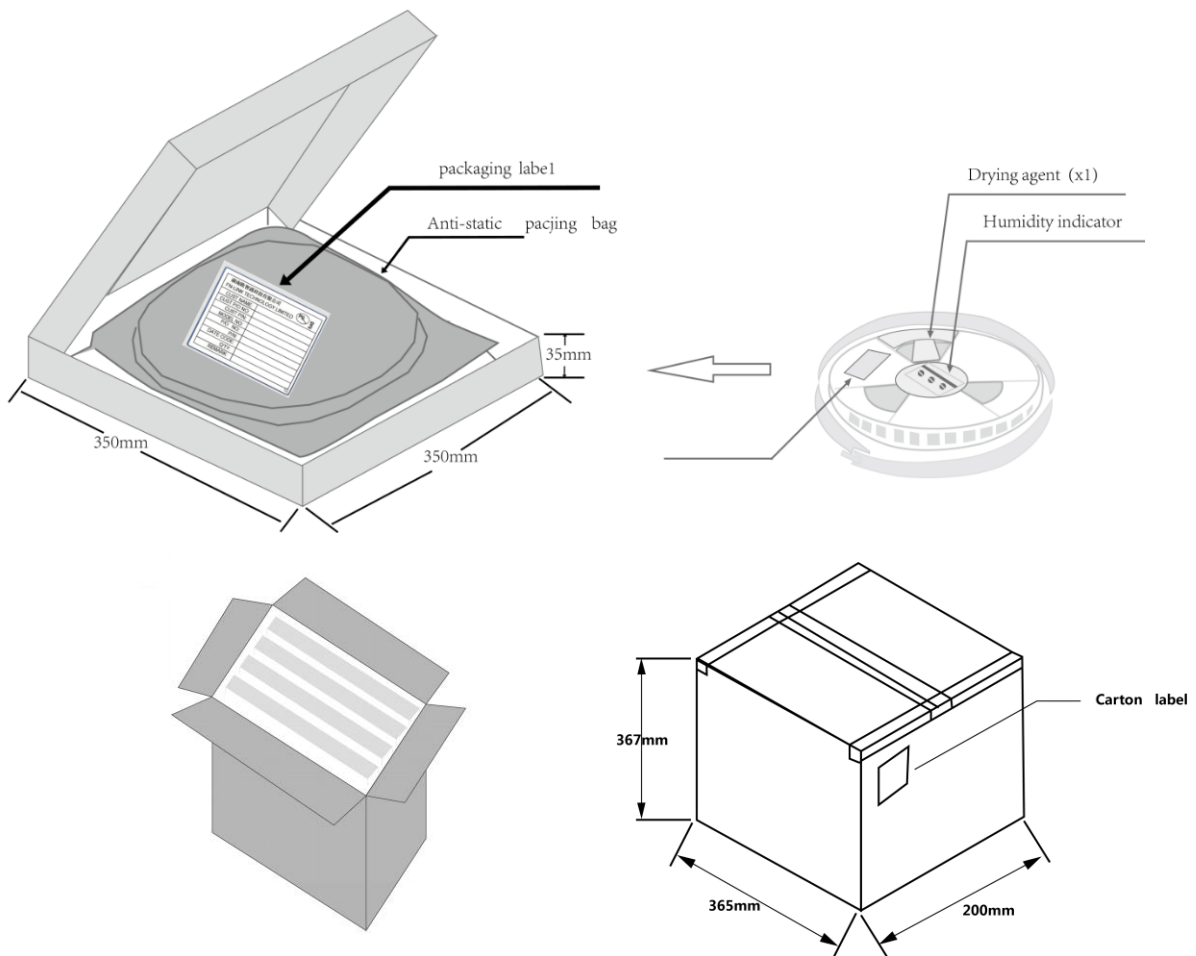
A roll of 1500pcs



13.2 Carrier Tape Detail



13.3 Packaging Detail



14. Moisture sensitivity

The Modules is a Moisture Sensitive Device level 3, in according with standard IPC/JEDEC J-STD-020, take care

all the relatives requirements for using this kind of components.

Moreover, the customer has to take care of the following conditions:

- Calculated shelf life in sealed bag: 12 months at $<40^{\circ}\text{C}$ and $<90\%$ relative humidity (RH)
- Environmental condition during the production: 30°C / 60% RH according to IPC/JEDEC J-STD-033A paragraph 5
- The maximum time between the opening of the sealed bag and the reflow process must be 168 hours if condition
- “IPC/JEDEC J-STD-033A paragraph 5.2” is respected
- Baking is required if conditions b) or c) are not respected
- Baking is required if the humidity indicator inside the bag indicates 10% RH or more

Warning & Statement

This module meets the requirements of Part 15 Subpart B, FCC CFR Title 47 Part 15 Subpart C, FCC CFR Title 47 Part 15 Subpart E.

Integration is strictly limited to fixed categorized end-products where a separation distance of at least 20 cm between the radiating part and any human body can be assured during normal operating conditions.

This module only allows connection antenna in the instruction manual. If other antennas are used, re-evaluation is required.

This module is test stand-alone, if more another modules work together with this module, please evaluation the multiple RF exposure.

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 party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses 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.

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: 2AATL-6233BUUB or Contains FCC ID: 2AATL-6233BUUB".

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

This equipment must be installed and operated with minimum distance 20cm between radiator & your body

Integration instructions for host product manufacturers according to KDB 996369 D03 OEMManual v01

Conditions on using FN-LINK TECHNOLOGY LIMITED regulatory approvals:

- A. Customer must ensure that its product (The "CUSTOMER Product") is electrically identical to FN-LINK TECHNOLOGY LIMITED reference designs. Customer acknowledges that any modifications to FN-LINK TECHNOLOGY LIMITED reference designs may invalidate regulatory approvals in relation to the CUSTOMER Product, or may necessitate notifications to the relevant regulatory authorities.
- B. Customer is responsible for ensuring that antennas used with the product are of the same type, with same or lower gains as approved and providing antenna reports to FN-LINK TECHNOLOGY LIMITED.
- C. Customer is responsible for regression testing to accommodate changes to FN-LINK TECHNOLOGY LIMITED reference designs, new antennas, and portable RF exposure safety testing/approvals.
- D. Appropriate labels must be affixed to the CUSTOMER Product that comply with applicable regulations in all respects.
- E. A user's manual or instruction manual must be included with the customer product that contains the text as required by applicable law. Without limitation of the foregoing, an example (for illustration purposes only) of possible text to include is set forth below:

2.2 List of applicable FCC rules

FCC Part 15 Subpart C 15.247 & 15.207 & 15.209& 15.205

FCC Part 15 Subpart E 15.407

2.3 Specific operational use conditions

Radio Technology : Bluetooth V5.2 EDR

Operation

frequency : 2402-2480MHz

Channel No. : 79 Channels

Channel spacing : 1MHz

Modulation type : GFSK, $\pi/4$ DQPSK, 8DPSK

Antenna Type : Rob Antenna, max gain 3.35dBi

Radio Technology : Bluetooth V5.2 BLE

Operation

frequency : 2402-2480MHz

Channel No. : 40 Channels

Channel spacing : 2MHz

Rate : 1Mbps, 2Mbps

Modulation type : GFSK

Antenna Type : Rob Antenna, max gain 3.35dBi

Radio Technology : 2.4G WIF

2412MHz-2462MHz for IEEE 802.11 b, g, n/HT20

2422MHz~2452MHz for IEEE802.11n/HT40

802.11b/802.11g /802.11n(HT20): 11CH

802.11(HT40): 7CH

IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK)

IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK)

IEEE 802.11n:OFDM(64QAM, 16QAM, QPSK, BPSK)

Rob Antenna, max gain 3.35dBi

Radio Technology : 5G WIFI

Operation Frequency : 802.11a/n(HT20): 5180~5240MHz; 5260-5320MHz; 5500-5700MHz; 5745~5825MHz

802.11n(HT40): 5190~5230MHz; 5260-5320MHz; 5510-5670MHz;

5755~5795MHz

Channel separation : 20MHz for 802.11a/ 802.11ac(VHT20)/ 802.11n(HT20)

40MHz for802.11n(HT40)

Modulation technology : IEEE 802.11n/a: OFDM (64QAM, 16QAM, QPSK, BPSK)

Antenna Type : Rob Antenna, max gain 4.56dBi.

The module can be used for mobile or portable applications with a maximum 4.56dBi antenna. The host manufacturer installing this module into their product must ensure that the final composit product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter

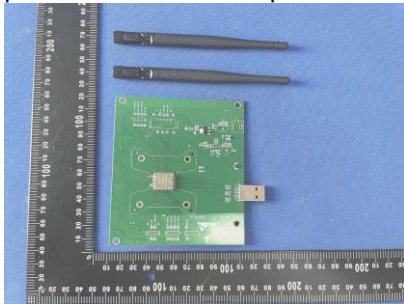
operation. The host manufacturer has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as shown in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

2.4 Limited module procedures

Not applicable. The module is a Single module and complies with the requirement of FCC Part 15.212.

2.5 Trace antenna designs

Not applicable. The module has its own antenna, and doesn't need a host's printed board microstrip trace antenna etc.



2.6 RF exposure considerations

The device can be used in portable exposure condition without restriction and if RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

2.7 Antennas

Antenna Specification are as follows:

Antenna Type: Rob antenna

Antenna Gain(Peak):4.56 dBi (Provided by customer)

This device is intended only for host manufacturers under the following conditions:

The transmitter module may not be co-located with any other transmitter or antenna;

The module shall be only used with the External antenna(s) that has been originally tested and certified with this module. The antenna must be either permanently attached or employ a 'unique' antenna coupler.

As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

2.8 Label and compliance information

Host product manufacturers need to provide a physical or e-label stating "Contains FCC ID 2AATL-6233BUUB" With their finished product.

2.9 Information on test modes and additional testing requirements

Radio Technology : Bluetooth V5.2 EDR

Operation

frequency : 2402-2480MHz

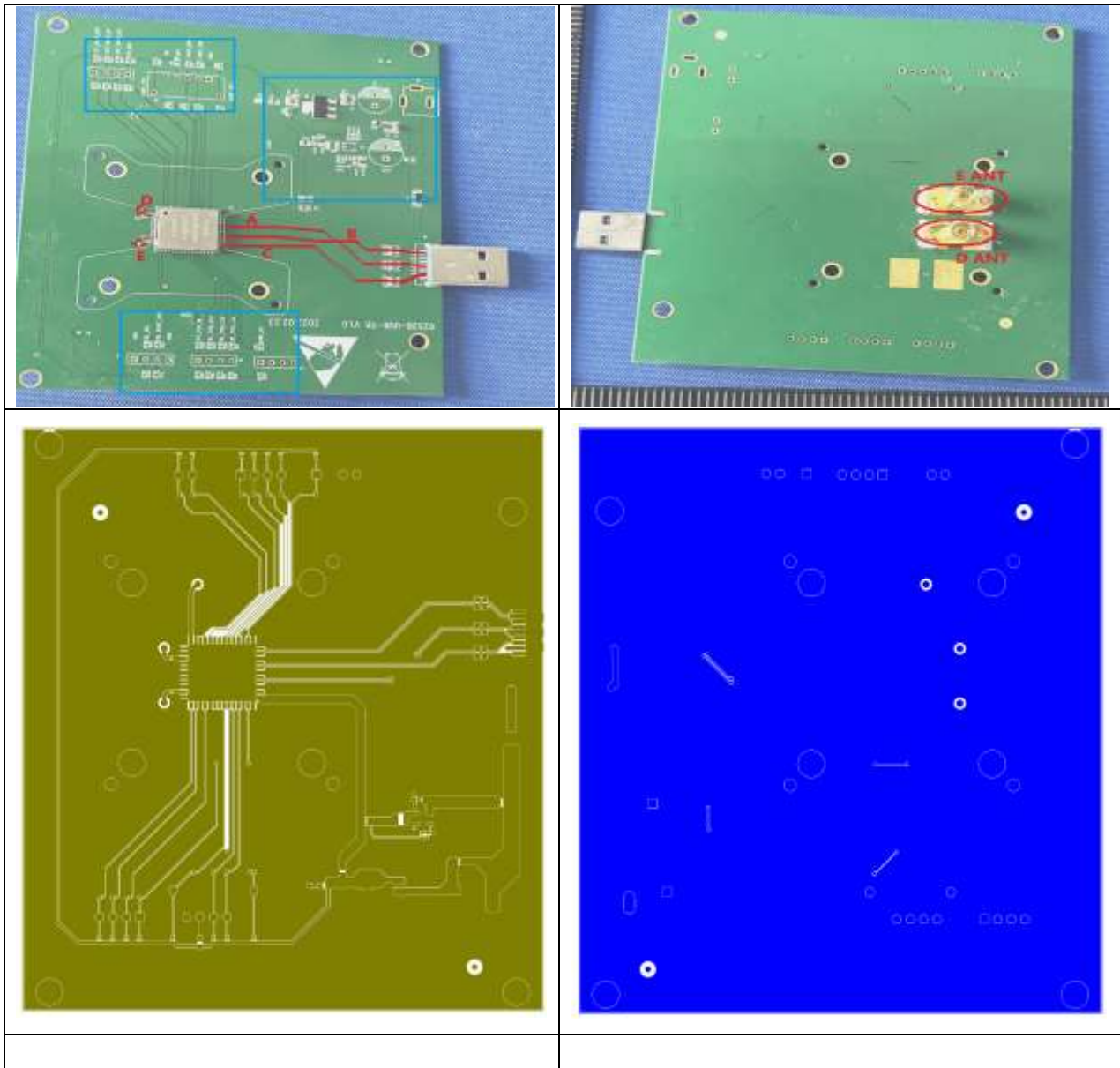
Channel No. : 79 Channels

Channel spacing : 1MHz
Modulation type : GFSK, $\pi/4$ DQPSK, 8DPSK
Antenna Type : Rob Antenna, max gain 3.35dBi
Radio Technology : Bluetooth V5.2 BLE
Operation
frequency : 2402-2480MHz
Channel No. : 40 Channels
Channel spacing : 2MHz
Rate : 1Mbps, 2Mbps
Modulation type : GFSK
Antenna Type : Rob Antenna, max gain 3.35dBi

Radio Technology : 2.4G WIF
2412MHz-2462MHz for IEEE 802.11 b, g, n/HT20
2422MHz~2452MHz for IEEE802.11n/HT40
802.11b/802.11g /802.11n(HT20): 11CH
802.11(HT40): 7CH
IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK)
IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK)
IEEE 802.11n:OFDM(64QAM, 16QAM, QPSK, BPSK)
Rob Antenna, max gain 3.35dBi
Radio Technology : 5G WIFI
Operation Frequency : 802.11a/n(HT20): 5180~5240MHz; 5260-5320MHz; 5500-5700MHz; 5745~5825MHz
802.11n(HT40): 5190~5230MHz; 5260-5320MHz; 5510-5670MHz;
5755~5795MHz
Channel separation : 20MHz for 802.11a/ 802.11ac(VHT20)/ 802.11n(HT20)
40MHz for802.11n(HT40)
Modulation technology : IEEE 802.11n/a: OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna Type : Rob Antenna, max gain 4.56dBi.
Host manufacturer must perform test of radiated & conducted emission and spurious emission, etc according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.
Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for FCC Part 15 Subpart C 15.247 & 15.207 & 15.209 & 15.205 and FCC Part 15 Subpart E 15.407 that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.



As shown in the diagram, the module is only controlled and powered by ABC representing a three way USB circuit. Normally, it can be replaced with a separate cable. D and E represent the exit of the antenna. But for the convenience of frequency setting and testing, it is fixed on the public board. That is to say, the module can work independently from the public board, and the blue box in the table is suspended and not working. This cable method is the final installation method of the module.