User Guide

Wi- Fi Module

Module： EWN -8822CUN3 GA，TOPT-8822CUCG01

SPECIFICATION V1.3

IEEE 802.11b/g/n/a/ac Wireless+ Bluetooth 2.1/3.0/5.0

With USB2.0 Interface Combo Module

APPROVAL
L Y K
2022/03/31

Contents

1 General Specifications

The module provides a complete solution for a high-performance integrated wireless and Bluetooth device. It support 2-stream 802.11ac solutions with Multi-user MIMO (Multiple-Input, Multiple-Output) with Wireless LAN(WLAN) USB2.0 network interface controller. It provides USB2.0 multi-function interface for Wi-Fi and Bluetooth. The module complies with IEEE 802.11 a/b/g/n/ac 2T2R MIMO standard, and Maximum PHY data rate up to 173.3 Mbps using 20 MHz bandwidth, 400 Mbps using 40 MHz bandwidth, and 866.7 Mbps using 80 MHz bandwidth.

The module MAC supports 802.11e for multimedia applications, 802.11i and WAPI for security, and 802.11n/802.11ac for enhanced MAC protocol efficiency.

2 Features

2.1 WLAN

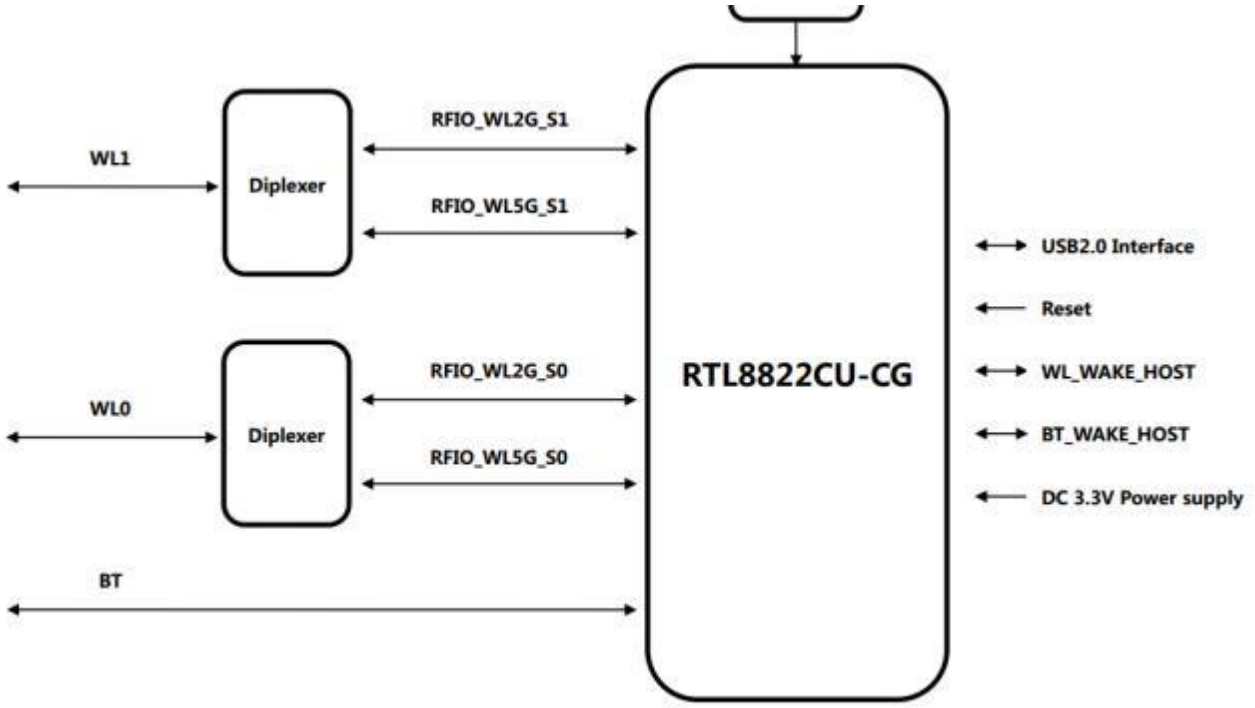
- Supports 802.11ac 2x2, Wave-2 compliant with MU-MIMO
- Completes 802.11n MIMO solution for 2.4GHz and 5GHz band
- Maximum PHY data rate up to 173.3Mbps using 20MHz bandwidth, 400Mbps using 40 MHz bandwidth, and 866.7Mbps using 80MHz bandwidth
- Backward compatible with 802.11a/b/g devices while operating at 802.11n data rates
- Backward compatible with 802.11a/n devices while operating at 802.11ac data rates
- Complies with USB2.0 for WLAN and BT controller
- USB Multi-Function for both BT (USB function 0) and WLAN (USB function 1)
- USB Selective Suspend supported
- IEEE 802.11a/b/g/n/ac compatible WLAN
- IEEE 802.11e QoS Enhancement(WMM)
- IEEE 802.11i (WPA, WPA2). Open, shared key and pair-wise key authentication services
- IEEE 802.11h DFS, TPC, Spectrum Measurement
- IEEE 802.11k Radio Resource Measurement
- WAPI (Wireless Authentication Privacy Infrastructure) certified
- Channel management and co-existence
- Wi-Fi Direct supports wireless peer to peer
- Support Wake-On-WLAN via Magic Packet and wake-up frame

- CCA on secondary through RTS/CTS handshake
- Supports TCP/UDP/IP checksum offload
- Two Transmit and Two Receive paths
- 20MHz/40MHz/80MHz bandwidth transmission
- Supports 2.4GHz and 5GHz band channels
- Short Guard Interval(400ns)
- Sounding packet

2.2 Bluetooth

- Compatible with Bluetooth v2.1 Systems
- Supports Bluetooth 5.0 system
- Supports all packet types in basic rate and enhanced data rate
- Supports multiple Low Energy states
- Supports Secure Simple Pairing
- Integrated MCU to execute Bluetooth protocol stack
- Supports Bluetooth Low Energy
- Enhanced BT/Wi-Fi Coexistence Control to improve transmission quality in different profiles
- Dual Mode support: Simultaneous LE and BR/EDR

3 System Block Diagram



4 Sticker Content Description

TOPT-8822CUCG01：	Customer module model
QR code：	Wi-Fi MAC QR code
0：	Eardatek version
220217：	production date (2022-02-17)
000019：	Production serial number
MAC:5477878B043F：	Wi-Fi MAC

5 PHY Specification

5.1 Wi-Fi Specification

Table 1 EWN-8822CUN3GA Wi-Fi RF Parameters

Protocol	IEEE 802.11b/g/n/a/ac
Interface	USB 2.0
Frequency	2.4GHz band CH1~CH11 5GHz Band CH36~CH48/5150-5250MHz CH149~CH165/5725-5850MHz 2.4G&5G Band Refer to Channel Plan Domain Code
Bandwidth	20/40/80 MHz
PHY Rate	Maximum PHY data rate up to 173.3 Mbps using 20MHz bandwidth; Maximum PHY data rate up to 400 Mbps using 40MHz bandwidth; Maximum PHY data rate up to 866.7 Mbps using 80MHz bandwidth .
2.4G Transmit Power	802.11b (2.4G 11M): 16±2dBm @ EVM <-10dB; 802.11g (2.4G 54M): 15±2dBm @ EVM <-25dB; 802.11n (2.4G HT20 MCS7): 14±2dBm @ EVM <-28dB; 802.11n (2.4G HT40 MCS7): 14±2dBm @ EVM <-28dB.
5G Transmit Power	802.11a (5G 54M): 14±2dBm @ EVM <-25dB; 802.11n (5G HT20 MCS7): 14±2dBm @ EVM <-28dB; 802.11n (5G HT40 MCS7): 14±2dBm @ EVM <-28dB; 802.11ac (5G VHT20 MCS8): 13±2dBm @ EVM <-32dB; 802.11ac (5G VHT40 MCS9): 12±2dBm @ EVM <-32dB; 802.11ac (5G VHT80 MCS9): 12±2dBm @ EVM <-32dB.
Frequency Error	<±10ppm/802.11b/g/n/a/ac
Mask	-20dB/±11MHz/OFDM; -28dB/±20MHz/OFDM; -30dB/±11MHz/DSSS, CCK; -50dB/±20MHz/DSSS, CCK.
2.4G Receive Sensitivity @ PER<10%	802.11b (2.4G 1M): -95dBm, typical; 802.11b (2.4G 11M): -85dBm, typical; 802.11g (2.4G 6M): -92dBm, typical; 802.11g (2.4G 54M): -74dBm, typical; 802.11n (2.4G HT20 MCS0): -90dBm, typical; 802.11n (2.4G HT20 MCS7): -72dBm, typical; 802.11n (2.4G HT40 MCS0): -88dBm, typical; 802.11n (2.4G HT40 MCS7): -69dBm, typical.

5G Receive Sensitivity @ PER<10%	802.11g (5G 6M):	-92dBm, typical;
	802.11g (5G 54M):	-74dBm, typical;
	802.11n (5G HT20 MCS0):	-90dBm, typical;
	802.11n (5G HT20 MCS7):	-72dBm, typical;
	802.11n (5G HT40 MCS0):	-88dBm, typical;
	802.11n (5G HT40 MCS7):	-69dBm, typical;
	802.11ac (5G VHT20 MCS0):	-89dBm, typical;
	802.11ac (5G VHT20 MCS8):	-67dBm, typical;
	802.11ac (5G VHT40 MCS0):	-87dBm, typical;
	802.11ac (5G VHT40 MCS9):	-64dBm, typical;
	802.11ac (5G VHT80 MCS0):	-85dBm, typical;
	802.11ac (5G VHT80 MCS9):	-58dBm, typical.

5.2 BT Specification

Table 2 EWN-8822CUN3GA Bluetooth RF Parameters

Protocol	BTv2.1+EDR/BTv3.0/BTv3.0+HS/BT v5.0
Interface	USB2.0
Frequency	2400 MHz ~ 2483.5 MHz (79 channels)
Modulation	GFSK, π/4-DQPSK, 8-DPSK
PHY Rate	1Mbps for Basic Rate; 2、3 Mbps for Enhanced Data Rate; 1、2 Mbps for BLE
Transmit Power	6dBm, typical
Receive Sensitivity	<-89dBm @ BER=0.1% for GFSK (1Mbps); <-86dBm @ BER=0.01% for π/4-DQPSK (2Mbps); <-83dBm @ BER=0.01% for 8-DPSK (3Mbps); <-90dBm @ PER=30.8% for BLE

6 Other Specifications

Table 3 Other Specifications

Ambient Operating Temperature	0℃~+70℃
Storage Temperature	Module: -20℃~+125℃ Package: -20℃~+70℃
Operating Humidity	RH 95%(Non-Condensing)
Storage Humidity	RH 95%(Non-Condensing)
Humidity level	Level 3
Security	WEP 64/128bit,WPA,WPA2,TKIP,AES,WAPI
Other characteristics:	QoS-WMM, WMM-PS
Operation System	Windows XP/Win7/Linux/Android
ESD	±4kV(Contact) @ RF Port

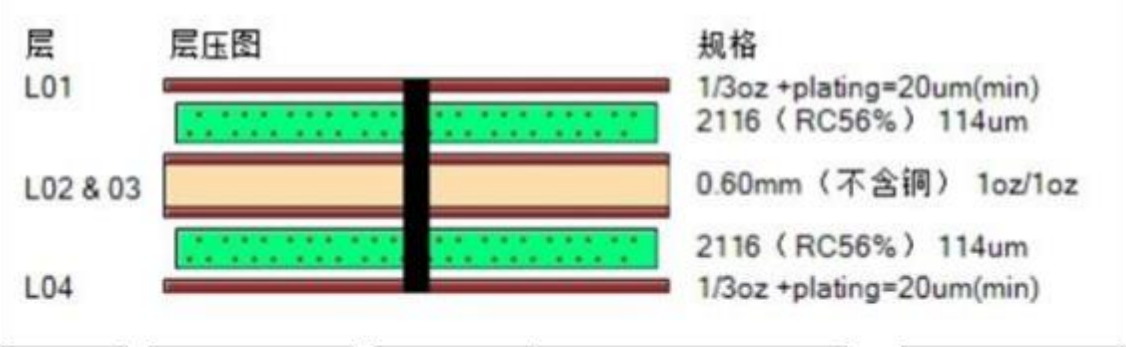
7 DC Characteristics

Table 4 Power Supply Characteristics

Symbol	Parameter	Min.	Typical	Max.	Unit
VDD_3.3V	3.3V Supply Voltage	3.0	3.3	3.6	V
IDD_3.3V	3.3V Rating Current	-	-	1000	mA

8 Module configurations

PCB Dimension:



	CONDUCTOR (面铜)		BASE CU (基铜)		BASEMENT (基材)		SOLDER MASK (油墨) SURFACE (线面)		SOLDER MASK (油墨) CORNER (线角)	
	SPEC (标准)	实测值	SPEC (标准)	实测值	SPEC (标准)	实测值	SPEC (标准)	实测值	SPEC (标准)	实测值
1	20-45	36.00	TOZ+plating	36.00	10-50	33.00	10-30	18.00	10-30	15.00
2			1OZ	30.00						
3			1OZ	30.00						
4	20-45	37.00	TOZ+plating	37.00	10-50	32.00	10-30	18.00	10-30	16.00

DIELECTRIC （介电层） （UNIT (单位)：mm）		
REQUIREMENT (要求)		实测值
L1-2	0.114+/-0.0114	0.120
L2-3	0.6+/-0.06	0.614
L3-4	0.114+/-0.0114	0.115

FIG 2 EWN-8822CUN3GA PCB Stack Up

Module Dimension (unit : mm)： 23.0mm (±0.3) *21.8mm (±0.3) *2.5mm (±0.3) 。

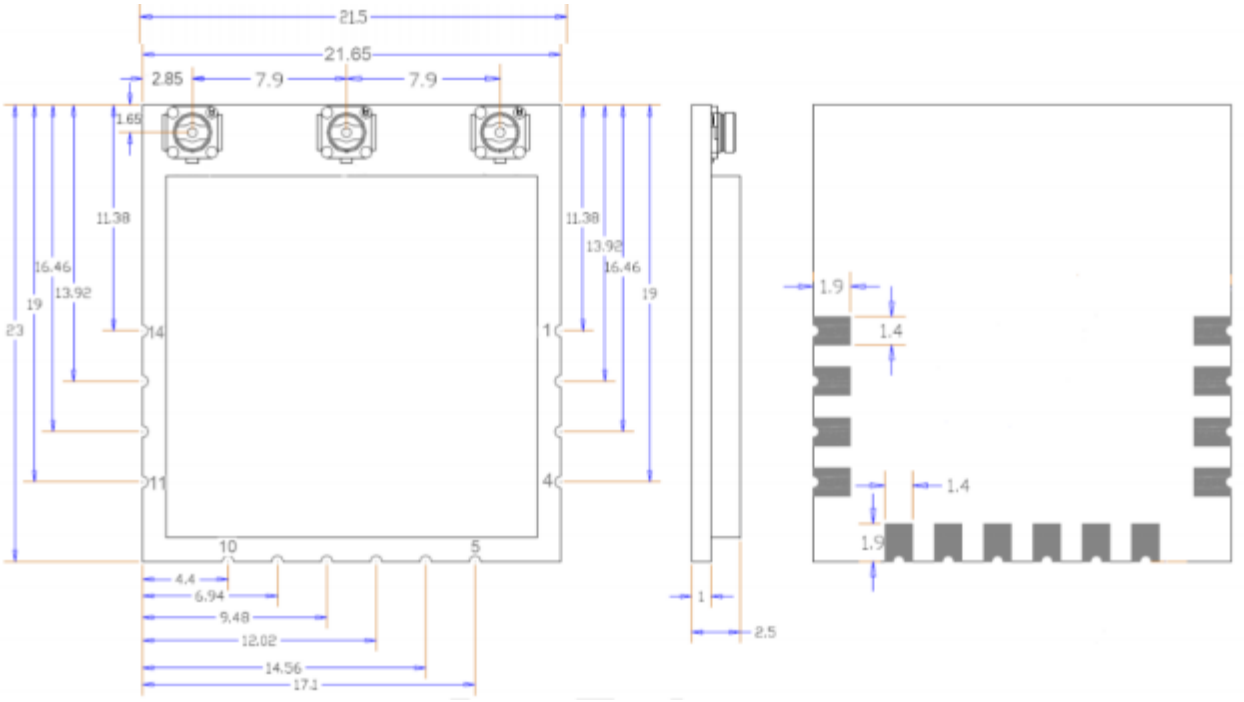


FIG 3 EWN-8822CUN3GA Module Dimension

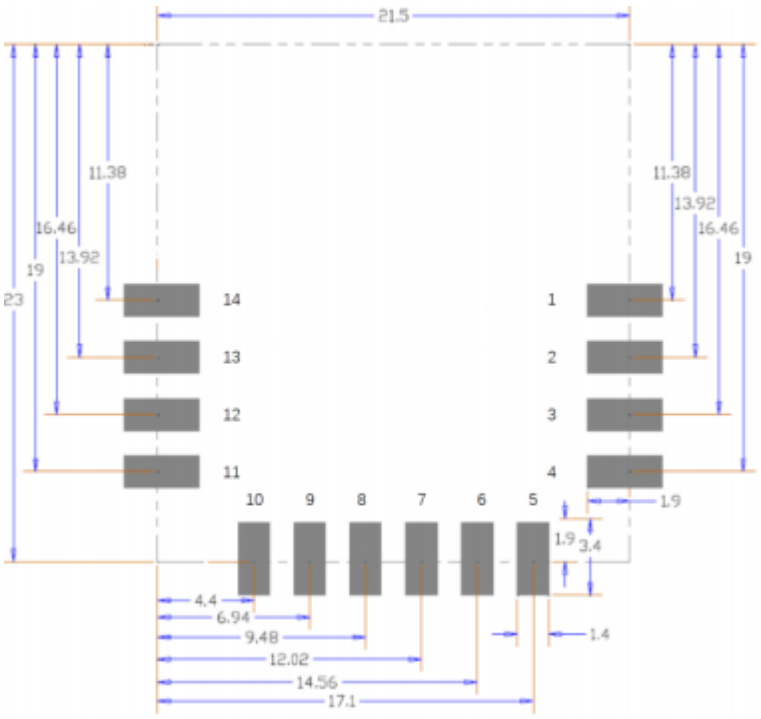


FIG 4 Mainboard PCB Layout

9 Pin Definition

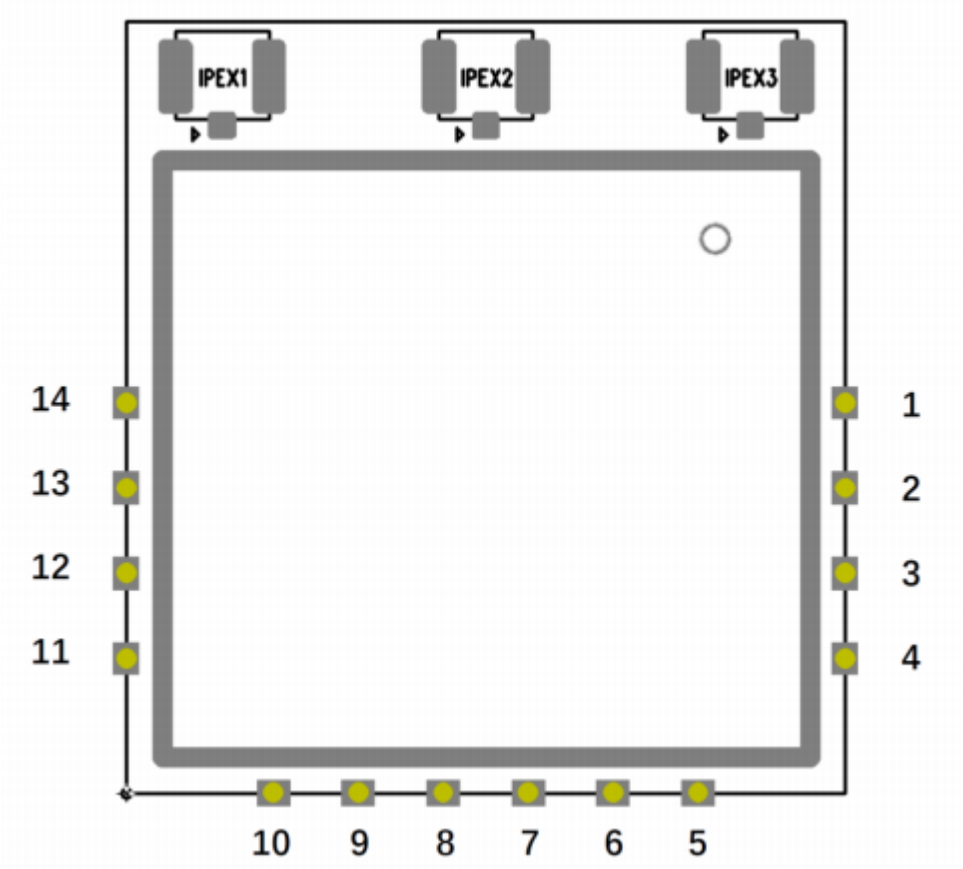


FIG 5 Pin Definition

See table 5 for the module hardware pin definition.

Table 5 EWN-8822CUN3GA Pin Description

Pin	Definition	Description	Power Supply	Power level
IPEX1	WL0	Wi-Fi Path 0 ANT Port	-	-
IPEX2	WL1	Wi-Fi Path 1 ANT Port	-	-
IPEX3	BT	Bluetooth ANT port	-	-
1	GND	Ground	-	-
2	GND	Ground	-	-
3	VDD33	Main power voltage source input (DC 3.3V±0.3V)	Main Power	3.3V
4				
5	USB_D-	USB 2.0 Transceiver pair	-	-
6	USB_D+	USB 2.0 Transceiver pair	-	-
7	GND	Ground	-	-

Pin	Definition	Description	Power Supply	Power level
8	RESET	Pull Low to Reset , Active Low	Main Power	3.3V
9	WL_WAKE_HOST	WLAN to wake-up the host	Main Power	3.3V
10	GND	Ground	-	-
11	BT_WAKE_HOST	Bluetooth to wake-up the host	Main Power	3.3V
12	GND	Ground	-	-
13	GND	Ground	-	-
14	GND	Ground	-	-

11 Key material list

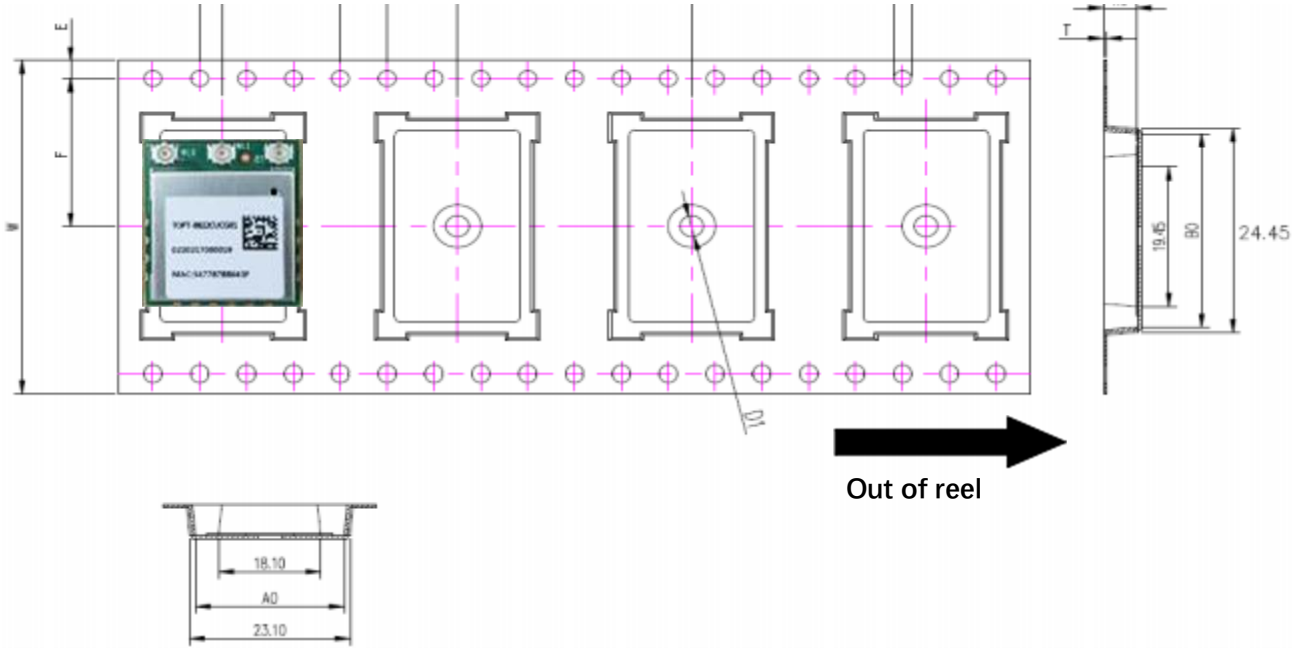
Table 6 EWN-8822CUN3GA Key material list

Type	Model	Footprint	QTY.
Diplexers	LD1 8 D2 4 5 0 LAN - D4 0 / M	DPX1 6 0 8	2 PCS
	RFDIP1607L132A8D1T	DPX1608	2 PCS
IC	RTL8822CU -CG	QFN56	1 PCS
Crystal	40MHz (CX)	X3225	1 PCS

1 2　Package Information

Carrier dimension:　(Unit : mm)

规格	22.10±0.1	23.45±0.1	2.90±0.1	4.0±0.1	32.0±0.1	2.0±0.1
符号	W	T	E	F	D0	D1
规格	44.0±0.3	0.3±0.05	1.75±0.1	20.2±0.1	$\phi 1.5^{+0.1}_{-0}$	$\phi 2.0^{+0.1}_{-0}$



Reel dimension :　D=38cm　8 0 0 PCS Modules Per Reel

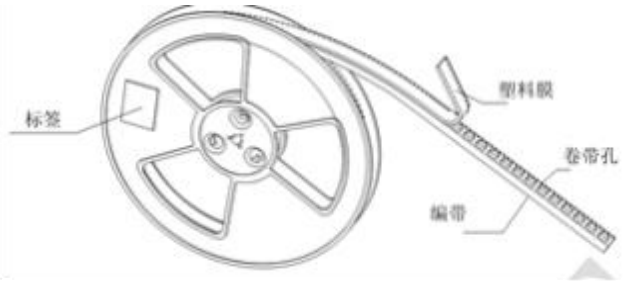


FIG 9　Reel

FIG 1 0　Reel figure

13 Reference design

13.1 Power supply requirement

The module power supply voltage is DC+3.3V, and the maximum module current is 1000mA. The power supply design needs to consider the output current and power interference. To avoid the +3.3V power supply from interfering with other circuits on the motherboard, it is recommended to supply to the module using the regulator circuit alone. the recommended DC-DC circuit structure shown in the figure below. A 4.7uF~10uF capacitor is connected in parallel at 3_3VD output to filter out the interference. A bead is connected in series at 3_3VD output. The bead and capacitor must be placed as close to the module as possible. If you need to share +3.3V with other circuits, consider whether the current of the shared power supply is sufficient.

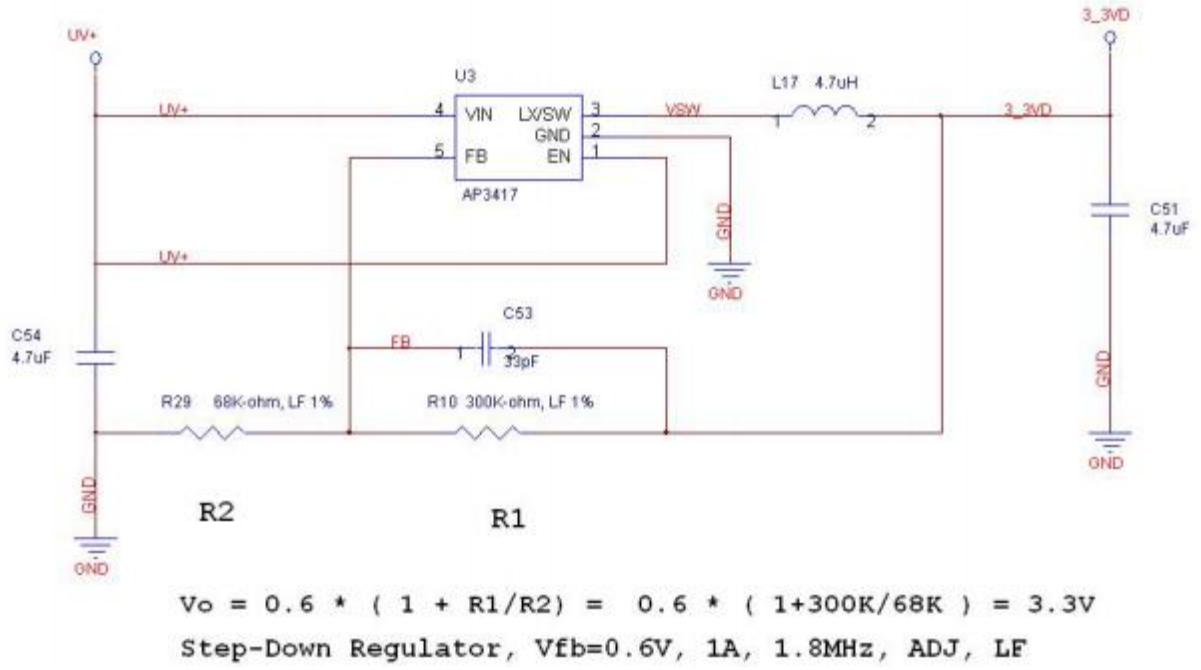


FIG 11 Power supply Circuit schematic

13.2 USB Interface

The USB interface must be designed as 90 Ohm difference line and Surround the data line with ground copper.

13.3 RF circuit

If using the SMD package, the RF port impedance must be offset after the module is soldered to the motherboard. In order to achieve the best performance,, it is recommended to add a PI-type matching network to the motherboard, as shown below (C11, R21,C6). The value of the PI type matching network needs to be debugged according to the actual motherboard to match RF port impedance to 50 Ohm.

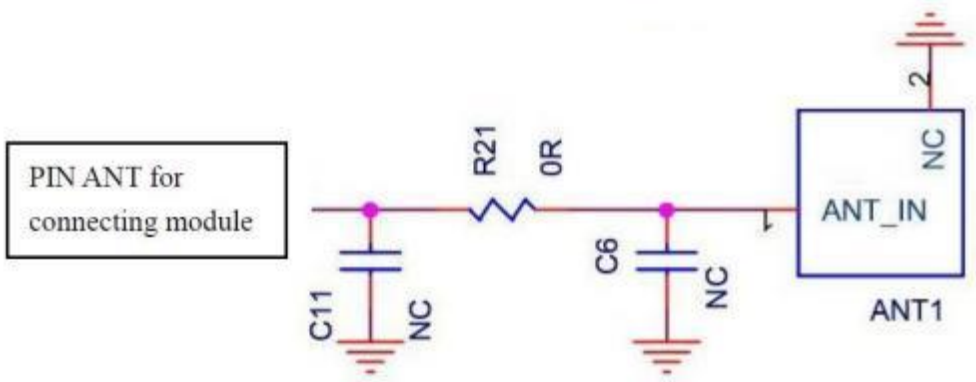


FIG 12 Connect 50 Ohm matching antenna reference circuit

The antenna ANT1 in the figure above must be 50 Ohm. If the antenna is not matched, it is recommended to add a set of PI type matching network at the front of the antenna to match the antenna. Generally, the antenna manufacturers will give Suggestions on matching parameters.

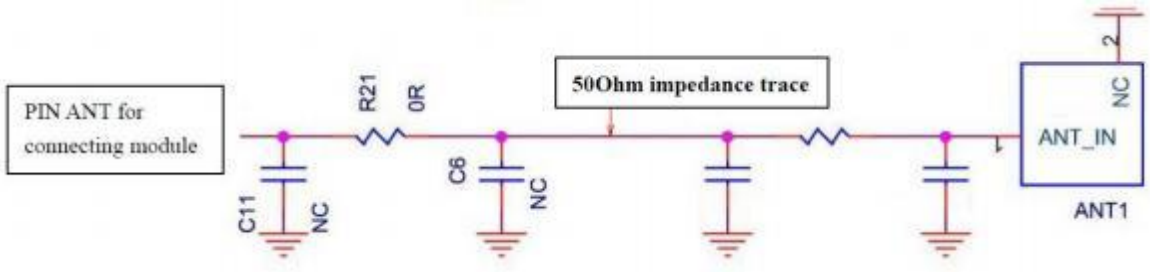


FIG 13 Connect the unmatched antenna reference circuit

The RF line layout should be matched according to 50ohm. The line impedance is related to the plate, plate thickness, line width and copper spacing. Professional software can be used to calculate the line width. Note: for multilayer plates, the plate thickness should calculate the distance from RF routing layer to GND of the next layer. There are RF lines Layout principles :

1. RF line layout needs to match 50 ohms. The line width can be calculated by professional software. (Note: If it is a multi-layer board, The board thickness should calculate the distance from the RF trace layer to the next ground layer.)

2. The RF line must be surrounded by ground copper and ground holes.

3. The PI-type matching circuit for adjusting the impedance of the module is placed close to the module. The PI type matching circuit for matching the antenna is placed close to the antenna.

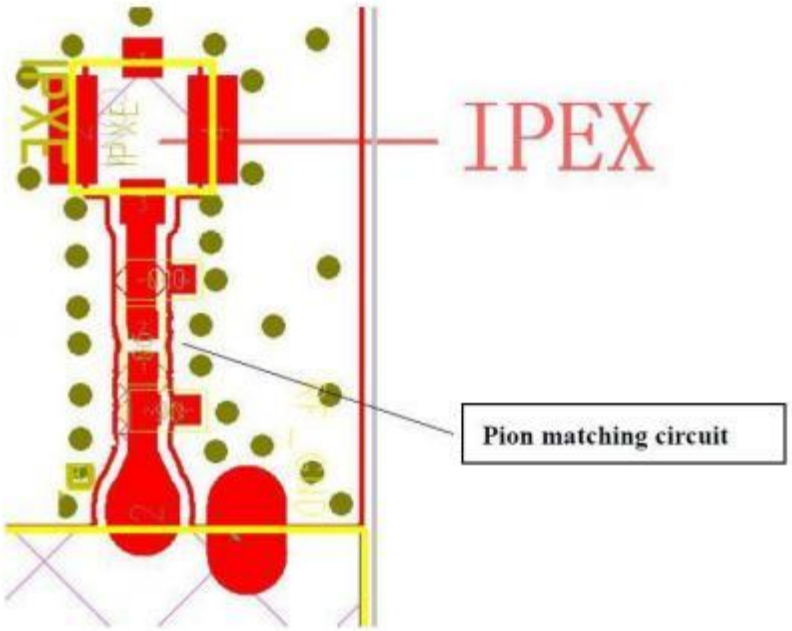


FIG 14 The PI type matching circuit Layout

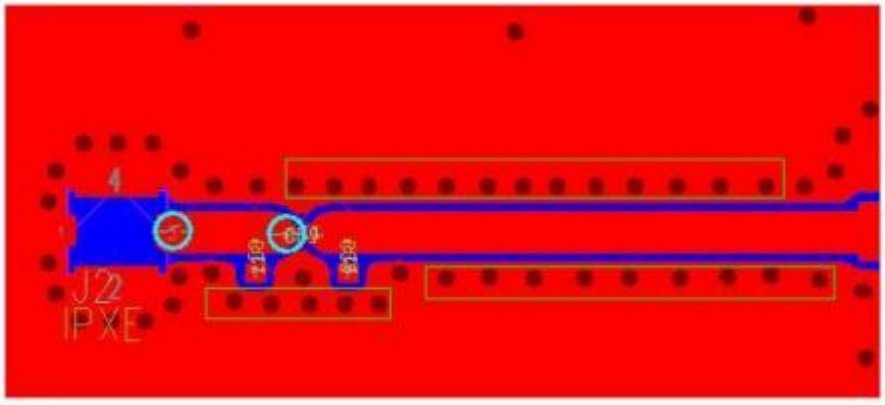


FIG 15 The RF line Layout

13.4 Motherboard interference avoidance

Motherboard interference comes from: high-speed data interface (HDMI), the Operating frequency of main chip, DDR, DC-DC power supply. The method of avoiding interference according to the characteristics of various signals is also different. The main methods of interference avoidance include :

1. keeping away from the source of interference;

2. Adding shields to avoid interference leakage;

3. Reasonable layout to eliminate interference.

13.4.1 Interface interference

When HDMI uses the 74.2MHz frequency, its 33x frequency is in the 2.4G band of Wi-Fi, which will seriously interfere with the Wi-Fi signal. If the HDMI frequency is 148.5MHz, although the 16x frequency is not in the Wi-Fi band, the isolation of the frequency is not good, and the Wi-Fi signal will be interfered to some extent. If the distance between the HDMI interface and the Wi-Fi module on the PCB is less than 5cm, the HDMI output display will interfere with the Wi-Fi signal, resulting in problems such as Wi-Fi connection failure and throughput drop. Therefore, keep the location of the Wi-Fi module away from the HDMI port on the hardware layout to avoid interference.

At the same time, if the Wi-Fi antenna is built-in the motherboard, its placement must also be carefully considered to be far from the interface interference. If the antenna is placed in an incorrect position, even if the module is shielded, the interference signal is coupled through the antenna, which will eventually result in a lower Wi-Fi throughput. (Note: In addition to interference, the placement of the internal antenna should also evaluate the effect of the metal interface, motherboard, and housing material on the antenna impedance.)

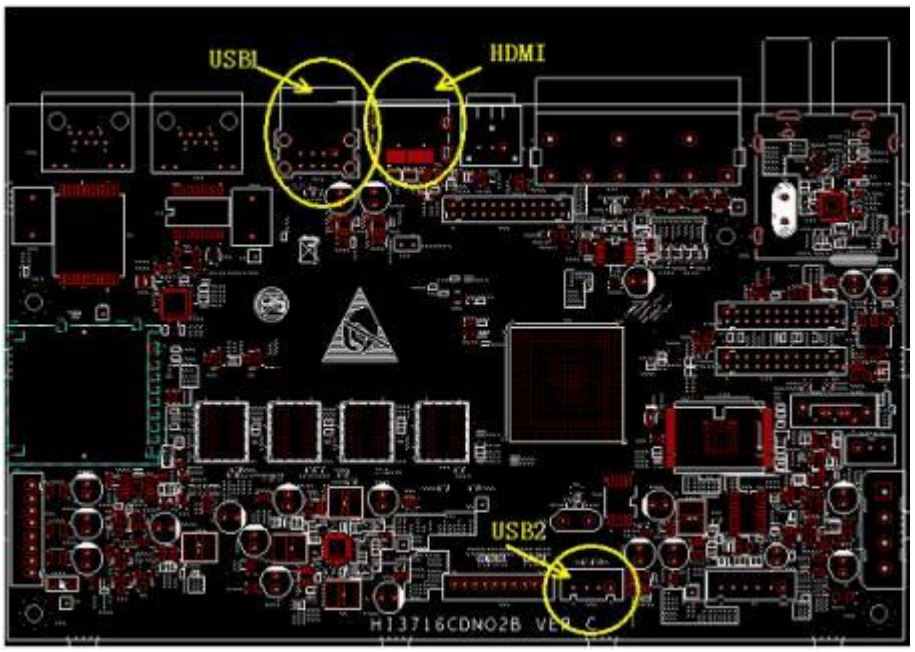


FIG 16 HDMI and USB interference

13.4.2 The main chip interferes with DDR

Because the main chips operate at about 800MHz or DDR2 operate at 667MHz, 3x frequency of 800MHz and 4x frequency of 667MHz are near 2.4GHz band. It must to place Wi-Fi modules and antennas far away from the main chip and DDR. It is strongly recommended that the main chip be isolated from the DDR by a shield. As shown in the figure below.

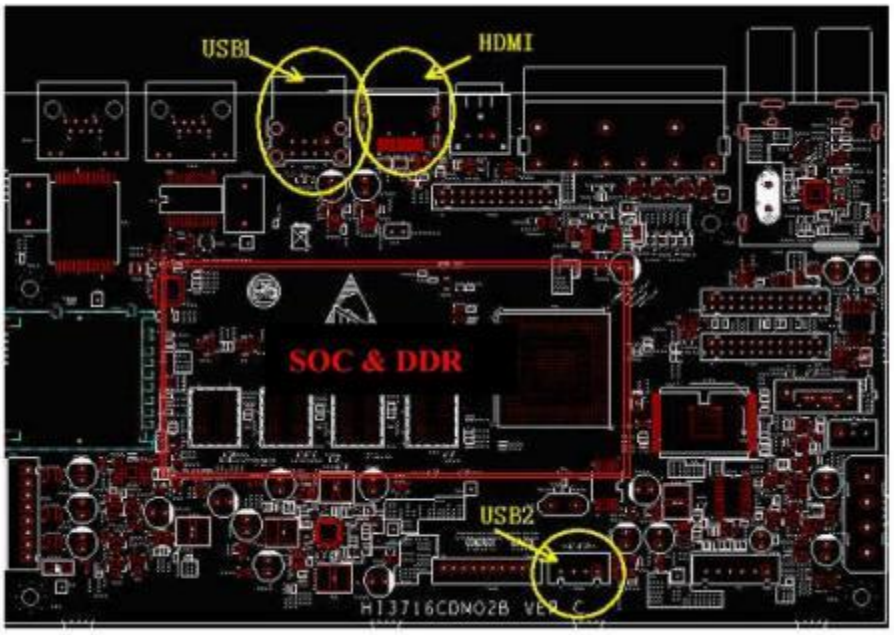


FIG 17 Main chip and DDR interference

13.5 Recommended secondary reflux temperature curve

The number of reflux shall not exceed 2 times, and the tin feeding height of the half hole of the module shall be no less than 1/4.

The lead-free reflux curve requirements of Wi-Fi module products are shown in figure18 :

Stage	Note	Pb-free assembly
Average ramp-up rate	T_L to Tp	3 ℃/ second max.
Preheat	Temperature min (T_{smin})	150℃
	Temperature max (Tsmax)	200℃
	Time (t_{smin} to t_{smax})	60 – 120 seconds
Time maintained above	Temperature(T_L)	217℃
	Time (t_L)	60 – 150 seconds
Peak package body temperature (Tp)		Tp must not exceed the specified classification temp(Tc=245℃).
Time(tp) within 5℃ of the specified classification temperature (Tc)		30 seconds
Ramp-down rate (Tp to T_L)		6 ℃ / seconds max.
Time 25℃ to peak temperature		8 minutes max.

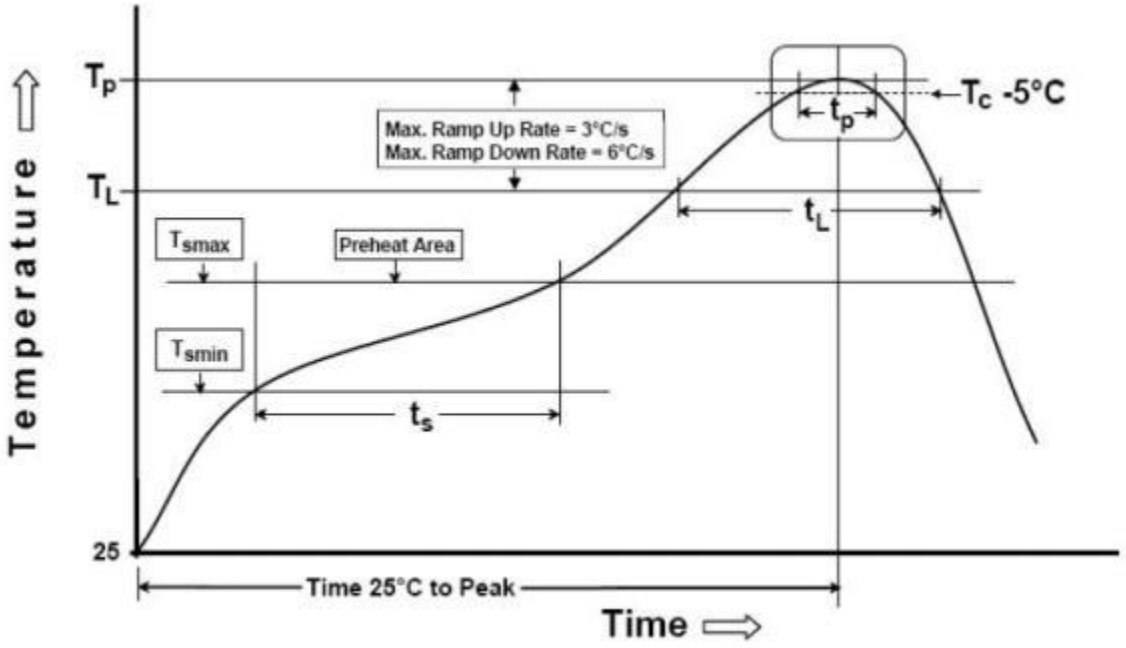


FIG 18 Furnace temperature curve

NOTE:

1.The maximum furnace temperature of the module is 260℃, don't exceed this temperature.

2.The gold plating thickness of the module pad is 2u".

14 Appendix Notices

FCC Statement

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 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.

FCC Modular Usage Statement

The requirement for KDB 996369 D03:

2.2 List of applicable FCC rules
FCC CFR Title 47 Part 15 Subpart C Section 15.247
2.3 Summarize the specific operational use conditions
The module has been certified for Fix, Mobile, Portable applications. This transmitter must not be co- located or operating in conjunction with any other antenna or transmitter.
2.4 Limited module procedures
Not applicable
2.5 Trace antenna designs
Not applicable
2.6 RF exposure considerations
This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This modular must be installed and operated with a minimum distance of 20 cm between the radiator and user body.
2.7 Antennas
Integral antenna with antenna gain 1.89dBi(for Bluetooth), 1.82dBi(for WIFI 2.4G), 1.93dBi(for WIFI 5.2G), 1.63dBi(for WIFI 5.8G), The antenna is permanently attached, can't be replaced.
2.8 Label and compliance information
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.
Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable

protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

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: 2AV3428644 Or Contains FCC ID: 2AV3428644 ”

2.9 Information on test modes and additional testing requirements

The modular transmitter is only FCC authorized for the specific rule parts (FCC Part 15.247) list on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed when contains digital circuity.

2.10 Additional testing, Part 15 Subpart B disclaimer

When testing host product, the host manufacture should follow FCC KDB Publication 996369 D04 Module Integration Guide for testing the host products. The host manufacturer may operate their product during the measurements.