

WiFi module**Model Number: WXT0AR2101****(Reolink Part Number:
48.01.001.0069A)****(REALTEK: RTL8832BU-VF1-CG)**

Custom Approval Section		
Customer Name		
Department		
Approval		Date:

DESIGN	CHECK	APPROVAL
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2023.08.04	2023.08.04	2023.08.04

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Document revision history

[illegible]

1. General Description

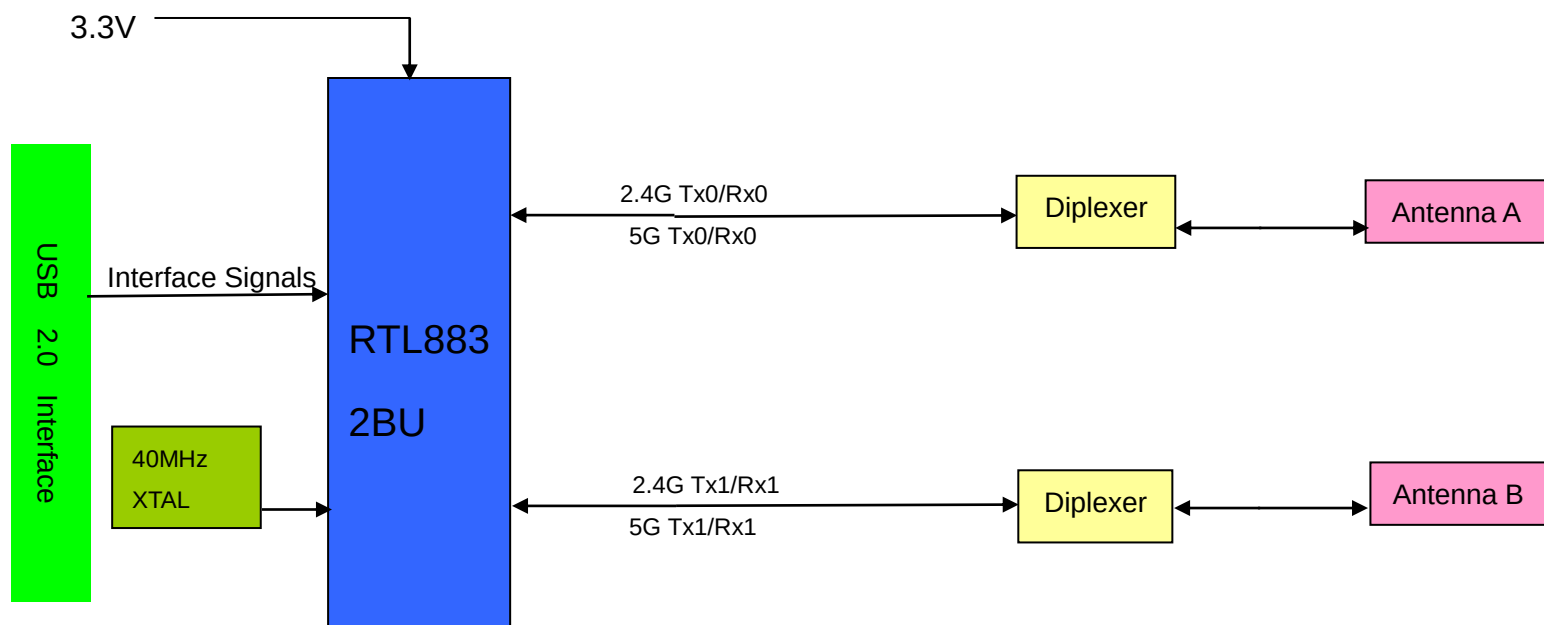
The Realtek RTL8832BU-CG is a highly integrated single-chip that support 2-stream 802.11ax solutions with Multi-user MIMO (Multiple-Input, Multiple-Output) with Wireless LAN (WLAN) USB network interface controller. It combines a WLAN MAC, a 2T2R capable WLAN baseband, and RF in a single chip. The RTL8832BU-CG provides a complete solution for a high-performance wireless device.

2. Features

- Compatible with IEEE 802.11a standard, providing wireless data rate up to 54Mbps.
- Compatible with IEEE 802.11b standard, providing wireless data rate up to 11Mbps.
- Compatible with IEEE 802.11g standard, providing wireless data rate up to 54Mbps.
- Compatible with IEEE 802.11n standard, providing wireless data rate up to 300Mbps.
- Compatible with IEEE 802.11ac standard, providing wireless data rate up to 866.7Mbps.
- Compatible with IEEE 802.11ax standard to provide wireless 573.5Mbps data rate in 2.4GHz band.
- Compatible with IEEE 802.11ax standard to provide wireless 1201Mbps data rate in 5GHz band.
- Support 20MHz, 40MHz bandwidth in 2.4GHz band
- Support 20MHz, 40MHz, 80Mhz bandwidth in 5GHz band
- Support STBC, LDPC
- Support QoS Enhancement (WMM)
- Security support for WPA/WPA2/WPA3
- Operation at 2.4~2.5GHz and 5.15~5.825GHz frequency band to meet worldwide regulations
- High speed USB 2.0 interface
- HSF compliant

3. Application Diagrams

3.1 Functional Block Diagram



3.2 General Requirements

3.2.1 IEEE 802.11b Section

	Feature	Detailed Description
3.2.1.1	Standard	IEEE 802.11b
3.2.1.2	Radio and Modulation Schemes	DQPSK , DBPSK , DSSS , and CCK
3.2.1.3	Operating Frequency	2412 ~ 2462MHz ISM band
3.2.1.4	Channel Numbers	11 channels for WorldWide
3.2.1.5	Data Rate	at most 11Mbps
3.2.1.6	Media Access Protocol	CSMA/CA with ACK
3.2.1.7	Transmitter Output Power at Antenna Connector	- Typical RF Output Power (tolerance$\pm$2dB) at each RF chain, Data Rate and at room Temp. 25 degree C 16$\pm$2 dBm at 11Mbps
3.2.1.8	Receiver Sensitivity at Antenna Connector	- Typical Sensitivity at Which Frame(1000-byte PDUs)Error Rate=8% at room Temp 25°C -83 dBm at 11Mbps

3.2.2 IEEE 802.11g Section

	Feature	Detailed Description
3.2.2.1	Standard	IEEE 802.11g
3.2.2.2	Radio and Modulation Type	QPSK , BPSK , 16QAM ,64QAM with OFDM
3.2.2.3	Operating Frequency	2412-2462MHz ISM band
3.2.2.4	Channel Numbers	11 channels for WorldWide
3.2.2.5	Data Rate	at most 54Mbps
3.2.2.6	Media Access Protocol	CSMA/CA with ACK
3.2.2.7	Transmitter Output Power at Antenna Connector	- Typical RF Output Power(tolerance$\pm$2dB) at each RF chain, Data Rate and at room Temp. 25degree C 15$\pm$2 dBm at 54Mbps
3.2.2.8	Receiver Sensitivity at Antenna Connector	- Typical Sensitivity at each RF chain. Frame(1000-byte PDUs)Error Rate<10% at room Temp 25 degree C -71 dBm at 54Mbps

3.2.3 IEEE 802.11a Section

	Feature	Detailed Description
3.2.3.1	Standard	IEEE 802.11a
3.2.3.2	Radio and Modulation Type	QPSK, BPSK, 16QAM ,64QAM with OFDM
3.2.3.3	Operating Frequency	5.15~5.25GHz 5.25~5.35GHz 5.47~5.725GHz 5.725~5.825GHz
3.2.3.4	Data Rate	at most 54 Mbps
3.2.3.5	Media Access Protocol	CSMA/CA with ACK
3.2.3.6	Transmitter Output Power at Antenna Connector	- Typical RF Output Power(tolerance$\pm$2dB) at each RF chain, Data Rate and at room Temp. 25degree C 15$\pm$2 dBm at 54Mbps
3.2.3.7	Receiver Sensitivity at Antenna Connector	- Typical Sensitivity at each RF chain. Frame (1000-byte PDUs) Error Rate<10% at room Temp 25 degree C -71 dBm at 54Mbps

3.2.4 IEEE 802.11n Section

	Feature	Detailed Description	
3.2.4.1	Standard	IEEE 802.11n	
3.2.4.2	Radio and Modulation Type	BPSK , QPSK , 16QAM ,64QAM with OFDM	
3.2.4.3	Operating Frequency	2.4GHz band:2412-2462MHz 5GHz : 5.15~5.25GHz; 5.25~5.35GHz 5.47~5.725GHz; 5.725~5.825GHz;	
3.2.4.4	Data Rate	at most 300 Mbps	
3.2.4.5	Media Access Protocol	CSMA/CA with ACK	
3.2.4.6	Transmitter Output Power at Antenna Connector	Typical RF Output Power (tolerance$\pm$2dB) at each RF chain, Data Rate and at room Temp. 25 degree C	
		2.4GHz Band/HT20	2.4GHz Band/HT40
		15$\pm$2 dBm at MCS7	15$\pm$2 dBm at MCS7
3.2.4.7	Receiver Sensitivity at Antenna Connector	Typical Sensitivity at each RF chain at Which Frame(1000-byte PDUs)Error Rate=10% and at room Temp.25 degree C	
		2.4GHz Band/HT20	2.4GHz Band/HT40
		-68 dBm at MCS7	-66 dBm at MCS7
		5GHz Band/HT20	5GHz Band/HT40
		-68 dBm at MCS7	-66 dBm at MCS7

3.2.5 IEEE 802.11ac Section

	Feature	Detailed Description
3.2.5.1	Standard	IEEE 802.11ac
3.2.5.2	Radio and	QPSK , BPSK , 16QAM ,64QAM,256QAM with OFDM

	Modulation Type		
3.2.5.3	Operating Frequency	5GHz : 5.15~5.25GHz; 5.25~5.35GHz; 5.47~5.725GHz; 5.725~5.825GHz;	
3.2.5.4	Data Rate	at most 866.7 Mbps	
3.2.5.5	Media Access Protocol	CSMA/CA with ACK	
3.2.5.6	Transmitter Output Power at Antenna Connector	Typical RF Output Power(tolerance± 2dB) at each RF chain, Data Rate and at room Temp. 25degree C	
		5GHz Band/VHT20 14± 2 dBm at MCS8	5GHz Band/VHT40 13± 2 dBm at MCS9
		5GHz Band/VHT80 13± 2 dBm at MCS9	
3.2.5.7	Receiver Sensitivity at Antenna Connector	Typical Sensitivity at each RF chain. Frame(1000-byte PDUs)Error Rate<10% at room Temp 25 degree C	
		5GHz Band / VHT20 -64dBm at MCS8	5GHz Band / VHT40 -58dBm at MCS9
		5GHz Band / VHT80 -55dBm at MCS9	

3.2.6 IEEE 802.11ax Section

	Feature	Detailed Description	
3.2.6.1	Standard	● IEEE 802.11ax	
3.2.6.2	Radio and Modulation Type	● QPSK , BPSK , 16QAM ,64QAM,256QAM, 1024QAM with OFDMA	
3.2.6.3	Operating Frequency	● 2.4GHz band:2412-2462MHz ● 5GHz : 5.15~5.25GHz; 5.25~5.35GHz 5.47~5.725GHz; 5.725~5.825GHz;	
3.2.6.4	Data Rate	● 2G: at most 573.5Mbps ● 5G: at most 1201Mbps	
3.2.6.5	Media Access Protocol	● CSMA/CA with ACK	
3.2.6.6	Transmitter Output Power at Antenna Connector	● Typical RF Output Power(tolerance±2dB) at each RF chain, Data Rate and at room Temp. 25degree C	
		2.4GHz Band/HE20 ● 11±2 dBm at MCS11	2.4GHz Band/HE40 ● 11±2 dBm at MCS11
		5GHz Band/HE20 ● 11±2 dBm at MCS11	5GHz Band/HE40 ● 11±2 dBm at MCS11
		5GHz Band/HE80 ● 11±2 dBm at MCS11	
3.2.6.7	Receiver Sensitivity at Antenna Connector	● Typical Sensitivity at each RF chain. Frame(1000-byte PDUs)Error Rate<10% at room Temp 25 degree C	
		2.4GHz Band / HE20 ● -57dBm at MCS8	2.4GHz Band / HE40 ● -55dBm at MCS9
		5GHz Band / HE20 ● -57dBm at MCS8	5GHz Band / HE40 ● -55dBm at MCS9
		5GHz Band / HE80 ● -53dBm at MCS9	

4. Electrical and Thermal Characteristics

4.1 Environmental Requirements

Parameter	Minimum	Maximum	Units
Storage Temperature	-40	+80	°C
Ambient Operating Temperature	0	70	°C
Junction Temperature	0	125	°C

4.2 General Section

	Feature	Detailed Description
4.2.1	Antenna Type	I-PEX connector (WIFI)
4.2.2	Operating Voltage	3.3 V±10%
4.2.3	Current Consumption	<2000mA
4.2.4	Form Factor and Interface	High Speed USB2.0 Interface

4.3 Software

Driver	Windows
Security	WPA ,WPA2,WPA3

4.4 Mechanical Dimensions

	Feature	Detailed Description
4.4.1	Length	27.15mm
4.4.2	Width	17.56mm
4.4.3	Height	MAX 2.7mm(PCB 0.8mm)

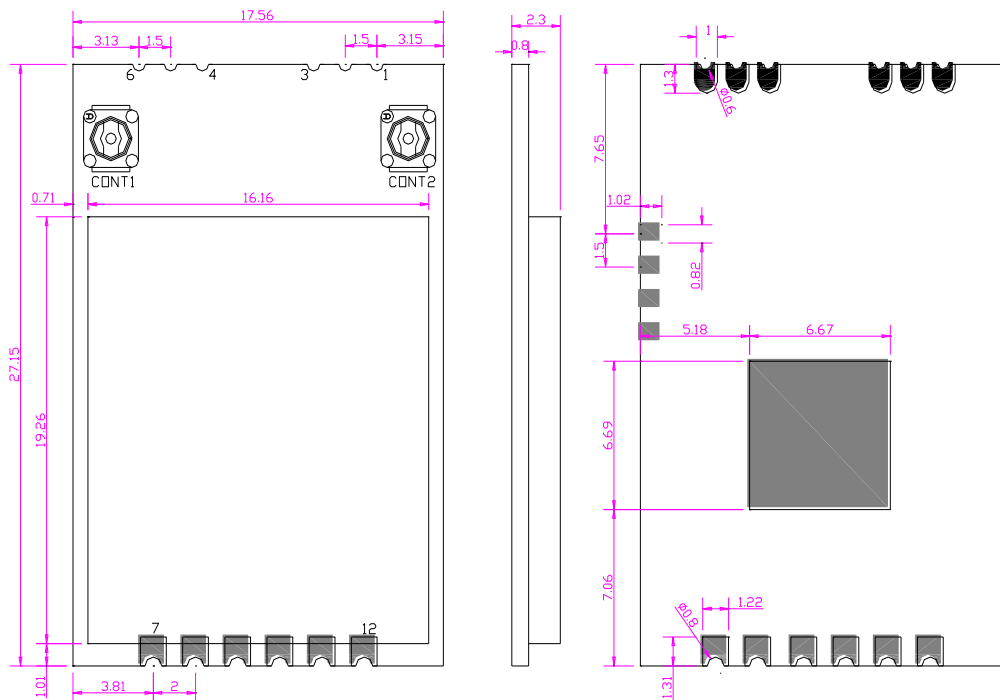
5. PIN Description

PIN	SYMBOL	DESCRIPTION	TYPE
1	CHIP_EN	Shutdown CHIP (Internal 47K Ω pull up to 3.3V, low level active)	I
2	VDD33	3.3V	/
3	WL_USB_DN	USB D-	I/O
4	WL_USB_DP	USB D+	I/O
5	GND	GND	/
6	WLAN_WAKE_HOST	WLAN CHIP WAKES UP HOST	O
7	GND	GND	/
8	NC	Not Connect	/
9	GND	GND	/
10	GND	GND	/
11	NC	Not Connect	/
12	GND	GND	/
13	GND	GND	/
14	NC	Not Connect	/
15	GND	GND	/
16	NC	NC	/

CONT1: TX0/RX0(WIFI)

CONT2: TX1/RX1(WIFI)

6 Mechanical Dimensions

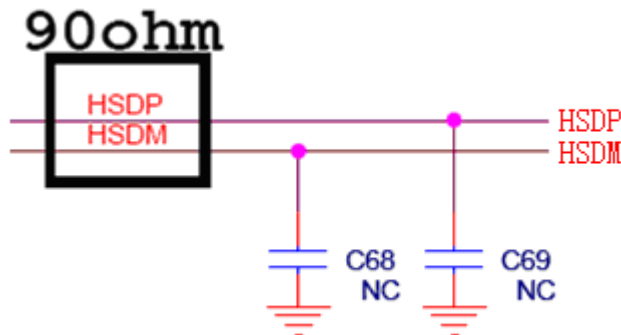


Note: Tolerance table

DIM (MM)	Tolerance (MM)
0-5	± 0.15
5-10	± 0.20
10-50	± 0.30

7 Note

7.1 USB interface electrical characteristics



Note: USB D+/D-differential line impedance control 90 OHM; Please reserve C68 and C69 in advance and adjust according to the actual situation.

7.1 ESD

Can't get the wifi module bare hands when needs, must we wear the gloves and static ring.

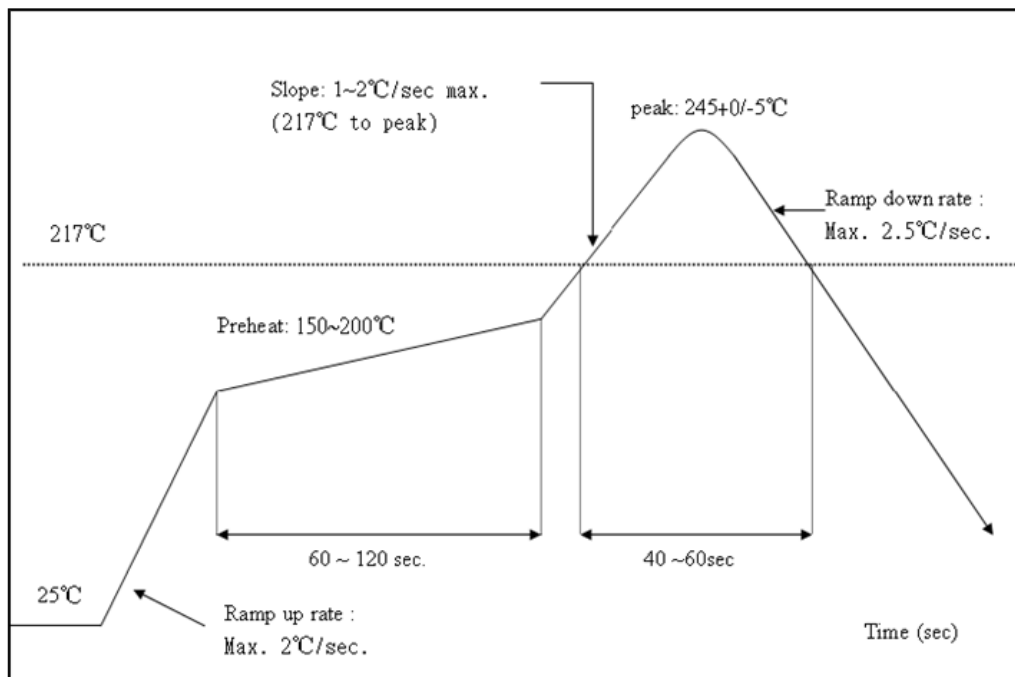
7.2 MSL

Moisture Sensitivity Level (MSL) : JEDEC L3

		Soak Requirements (濕度環境要求)				
		Floor Life (車間時間)		Standard (標準)		Accelerated (加速)
Level	Time	Cond °C/%RH	Time (hrs)	Cond °C/%RH	Time (hrs)	Cond °C/%RH
1	unlimited	≤30/85%	168+5/-0	85/85	n/a	n/a
2	1 year	≤30/60%	168+5/-0	85/60	n/a	n/a
2a	4 weeks	≤30/60%	696+5/-0	30/60	120+1/-0	60/60
3	168 hours	≤30/60%	192+5/-0	30/60	40+1/-0	60/60
4	72 hours	≤30/60%	96+2/-0	30/60	20+0.5/-0	60/60
5	48 hours	≤30/60%	72+2/-0	30/60	15+0.5/-0	60/60
5a	24 hours	≤30/60%	48+2/-0	30/60	10+0.5/-0	60/60
6	TOL	≤30/60%	TOL	30/60	n/a	60/60

Check the humidity card :stored at ≤20%RH.If :30%~40%(pink)or greater than 40%(red).Labeling module has moisture absorption.

7.3 Recommended Reflow Profile



Referred to IPC/JEDEC standard. Peak Temperature : $245 \pm 5^{\circ} \text{C}$ Times : $\leq 2 \text{ s}$

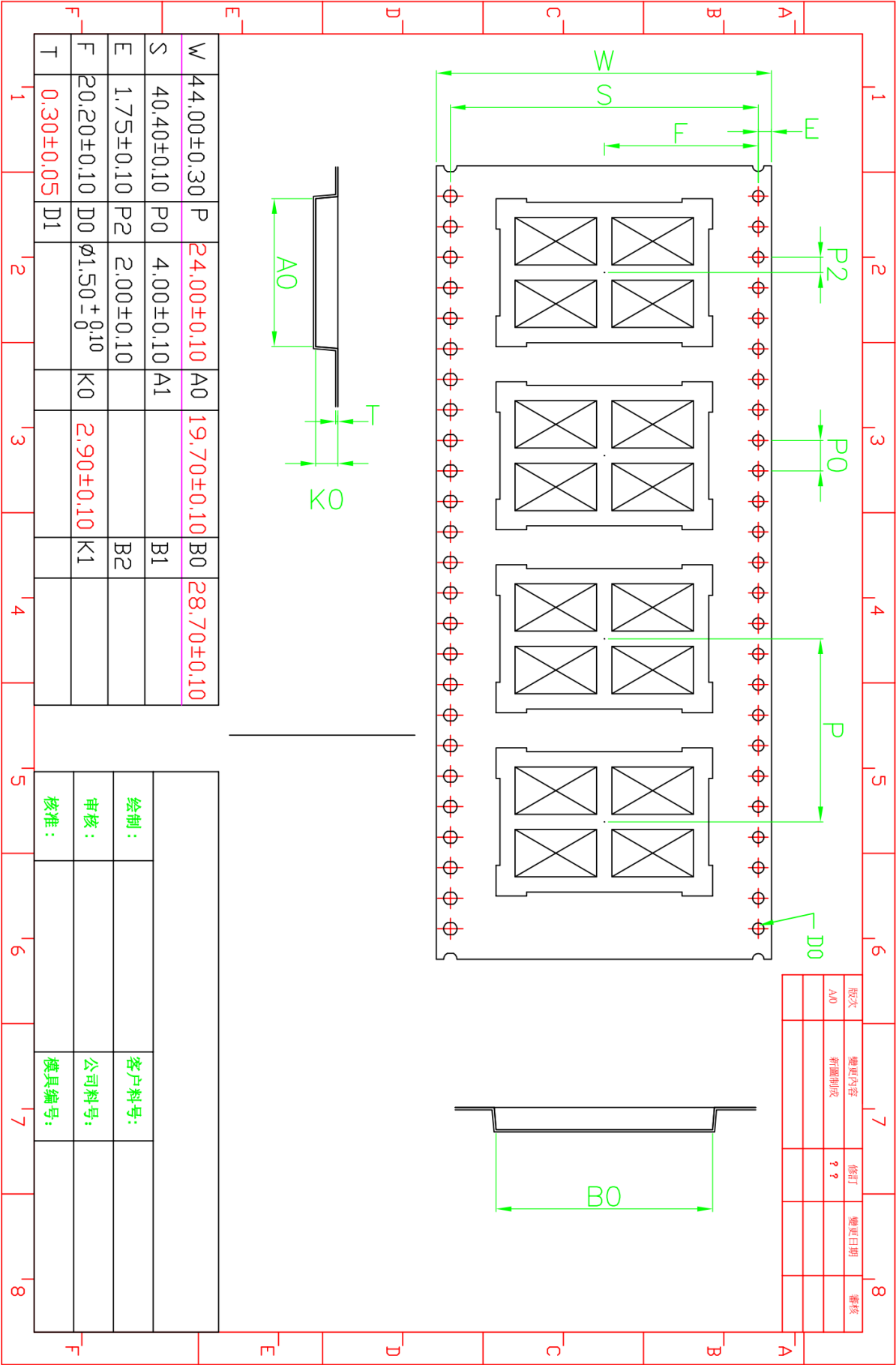
8. Product picture

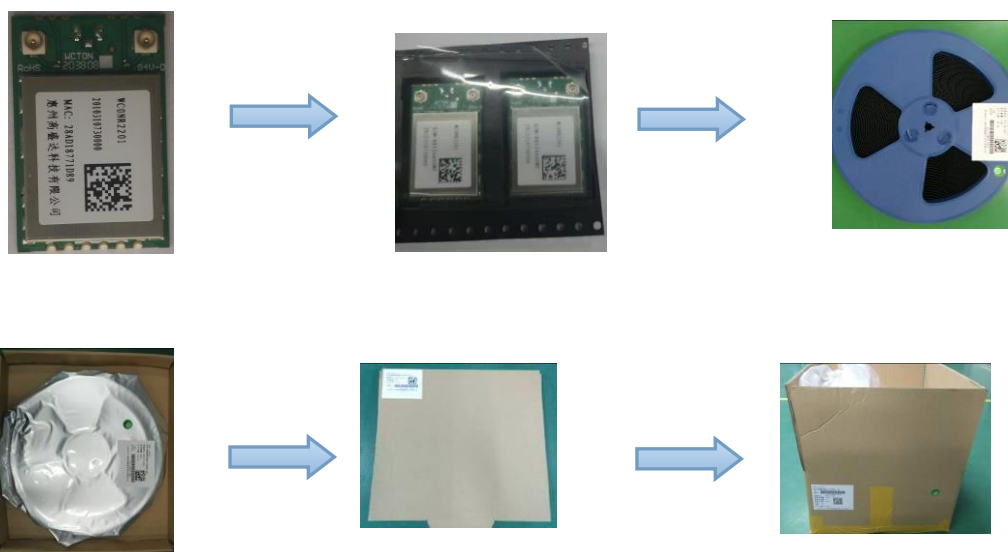


9. label

TD

10. Package





outer box: 426*378*300mm

inner box: 411*365*54mm

Anti-static vacuum bag: 450X500mm

Packing quantity: 4000PCS per box (5 boxes, 800PCS per box)

11 Wireless module before the SMT note:

1. When customers Open stencil advice sure the hole bigger to the Wireless module plate, please press 1 to 1 and 0.7 mm is widened to open outward, the thickness of 0.12 mm.
2. Can't get the wifi module bare hands when needs, must we wear the gloves and static ring.
3. The furnace temperature according to the size of the customer the mainboard, generally like to stick on a tablet standard temperature of 250 + - 5

Storage and use Wifi module control should pay attention to the following matters:

• Module of the storage life of vacuum packaging:

1-1. Storage life : 12 months. Storage conditions: <40℃. Relative humidity: <90%R.H.

1-2. After this bag is opened, devices that will be subjected to infrared reflow, vapor-phase reflow, or equivalent processing must be :

1-3. Check the humidity card : stored at $\leq 20\%RH$. If : 30%~40%(pink) or greater than 40%(red). Labeling module has moisture absorption.

① Mounted within 168 hours at factory conditions of: $t \leq 30^\circ C$, $\leq 60\%RH$.

② Once opened, the workshop the preservation of life for 168 hours.

1-4. If baking is required, devices may be baked for:

① Modules must be to remove module moisture problem.

② Baking temperature: 125 °C, 8 hours.

③ After baking, put proper amount of desiccant to seal packages.

1-5. The actual number of module vacuum packing which is based on the actual number of packages to the customer requirements, vacuum packing of picture<1>

2. Module reel packaging items as follows.

2-1. Storage life : 12 months. Storage conditions: <40℃. Relative humidity: <90%R.H.

2-2. Module apart packing after 168 hours, To launch patch need to bake, to remove the module hygroscopic, baking temperature conditions: 125℃, 8hours.

2-3. The actual number of module reel packing which is based on the actual number of packages to the customer requirements, Reel packing of picture<2>

3. Module pallet packaging items as follows:

3-1. Storage life: 3 months. Storage conditions: <40℃. Relative humidity: <90%R.H.

3-2. Module if not used within 48 hours, before launch the need for baking, baking temperature: 125 °C, 8 hours.

3-3. Pallet packaging each plate is 100 PCS. The actual number of module pallet packing which is based on the actual number of packages to the customer requirements.

FCC WARNING

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

15.105 Information to the user.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

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.

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

Radiation Exposure Statement:

This equipment complies with FCC 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.

The availability of some specific channels and/or operational frequency bands are country dependent and are firmware programmed at the factory to match the intended destination.

The firmware setting is not accessible by the end user.

The final end product must be labelled in a visible area with the following:

“Contains Transmitter Module FCC ID:2AYHE-2403E”

Requirement per KDB996369 D03

2.2 List of applicable FCC rules

List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies. DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.³

Explanation: This module meets the requirements of FCC part 15C(15.247).FCC Part 15.407

2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain.

Explanation: The EUT only have two External antenna, Yes, the module contains a permanently attached antenna, The antenna gain is 2.4G: 2.77dBi, 5G antenna 3.83dBi, The use condition of the prototype is mobile.

2.4 Limited module procedures

If a modular transmitter is approved as a "limited module," then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited

module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.

Explanation: The module is a single module.

2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects: layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.

- a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s), dielectric constant, and impedance as applicable for each type of antenna);
- b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency, the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered);
- c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;
- d) Appropriate parts by manufacturer and specifications;
- e) Test procedures for design verification; and
- f) Production test procedures for ensuring compliance.

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

Explanation: No, The module has no tracking antenna design, is External antenna.

2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person's body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).

Explanation: This module complies with FCC RF radiation exposure limits set forth for an uncontrolled environment, This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body." This module is designed to comply with the FCC statement,
FCC ID: 2AYHE-2403E

2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an “omni-directional antenna” is not considered to be a specific “antenna type”)).

For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

Explanation: The EUT only have two FPC antenna, Yes, the module contains a permanently attached antenna, The antenna gain is 2.4G: 2.77dBi, 5G antenna 3.83dBi,

2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This

includes advising host product manufacturers that they need to provide a physical or e-label stating “Contains FCC ID” with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

Explanation: The host system using this module, should have label in a visible area indicated the following texts: "Contains FCC ID: 2AYHE-2403E

2.9 Information on test modes and additional testing requirements

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer's determination that a module as installed in a host complies with FCC requirements.

Explanation: Can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

2.10 Additional testing, Part 15 Subpart B disclaimer

The grantee should include a statement that the modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules

that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15

Subpart B compliant (when it also contains unintentional-radiator digital 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.

Explanation: The host should be evaluated by the FCC Subpart B.

This product uses External antenna ,The antenna gain is 2.4G: 2.77dBi, 5G antenna 3.83dBi,