Product Specifications

IEEE802. 11a/b/g/n/ac/bt 1T1R 2.4G/5G Dual

with Integrated Bluetooth V4.2

Project Name	RTL8821CE Combo Module
Main Model	WD_RTL8821CE_V10 (Wi-Fi PCIE /BT:USB2.0)
Version number	V1.0
Customer's Part NO	
Customer	

Approved	RD	quality	Drafted
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Contents

1. General Description

The Realtek RTL8821CE is a highly integrated single-chip that support 1-stream 802.11ac solutions with Multi-user MIMO (Multiple-Input , Multiple-Output) STA mode with Wireless LAN (WLAN) PCIExpress network interface controller with integrated Bluetooth 2.1/4.2 USB interface controller. Itcombines a WLAN MAC, a 1T1R capable WLAN baseband, and RF in s single chip. The RTL8821CE provides a complete solution for a high-performance integrated wireless and Bluetooth device.

The RTL8821CE baseband implements Multi-user Multiple Input, Multiple Output (MU MIMO)Orthogonal Frequency Division Multiplexing (OFDM) STA mode with one transmit and one receive paths(1T1R). Features include one spatial stream transmissions, short Guard Interval (GI) of 400ns, spatial spreading, and support for variant channel bandwidth. Moreover, RTL8821CE provides one spatial stream space-time block code (STBC), Transmit Beamforming (TxBF) and Low Density Parity Check (LDPC) to extend the range of transmission. As the recipient, the RTL8821CE also supports explicit sounding packet feedback that helps senders with beamforming capability.

For legacy compatibility, Direct Sequence Spread Spectrum (DSSS), Complementary Code Keying (CCK)and OFDM baseband processing are included to support all IEEE 802.11b, 802.11g and 802.11a data rates.Differential phase shift keying modulation schemes, DBPSK and DQPSK with data scrambling capability are available, and CCK provides support for legacy data rates, with long or short preamble. The high speed FFT/IFFT paths, combined with BPSK, QPSK, 16QAM, 64QAM and 256QAM modulation of the individual subcarriers, and rate compatible coding rate of 1/2, 2/3, 3/4, and 5/6, provide up to 433.3Mbps for IEEE 802.11ac MIMO OFDM.

The RTL8821CE builds in an enhanced signal detector, an adaptive frequency domain equalizer, and a soft-decision Viterbi decoder to alleviate severe multi-path effects and mutual interference in the reception of multiple streams. Robust interference detection and suppression are provided to protect against Bluetooth, cordless phone, and microwave oven interference.

Receive vector diversity for multi-stream application is implemented for efficient utilization of the MIMO channel. Efficient IQ-imbalance, DC offset, phase noise, frequency offset, and timing offset compensations are provided for the radio frequency front-end.

The RTL8821CE supports fast receiver Automatic Gain Control (AGC) with synchronous and asynchronous control loops among antennas, antenna diversity functions, and adaptive transmit power control functions to obtain better performance in the analog portions of the transceiver.

The RTL8821CE MAC supports 802.11e for multimedia applications, 802.11i and WAPI (Wireless Authentication Privacy Infrastructure) for security, and 802.11n/802.11ac for enhanced MAC protocol efficiency. Using packet aggregation techniques such as A-MPDU with BA and A-MSDU, protocol efficiency is significantly improved. Power saving mechanisms such as Legacy Power Save, U-APSD, and MIMO power saving reduce the power wasted during idle time, and compensate for the extra power required to transmit MIMO OFDM. The RTL8821CE provides simple legacy, 20MHz/40MHz/80MHz co-existence mechanisms to ensure backward and network compatibility.

2.Features

General Information

- CMOS MAC, Baseband PHY and RF in a single chip for IEEE 802.11a/b/g/n/ac compatible WLAN
- Support 802.11ac 1x1,Wave-2 compliant with MU-MIMO STA mode
- Complete 802.11n MIMO solution for 2.4GHz and 5Ghz band
- Maximum PHY data rate up to 86.7Mbps using 20MHz bandwidth, 200Mbps using 40MHz bandwidth, and 433.3Mbps 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.

Host Interface

- Complies with PCI Express Base Specification Revision 2.1
- Complies with USB2.0 FS-mode Specification for Bluetooth
- PCIe LTR / L1.OFF state supported
- USB Selective Suspend supported

Standards 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.
- Cisco Compatible Extensions (CCX) for WLAN devices

MAC Features

- Frame aggregation for increased MAC efficiency (A-MSDU, A-MPDU)
- Low latency immediate Block Acknowledgement (BA)
- Long NAV for media reservation with CF-End for NAV release
- Transmit Opportunity (TXOP) Short Inter-Frame Space (SIFS) bursting for higher multimedia bandwidth
- WiFi Direct supports wireless peer to peer applications.
- WiFi NAN (Neighborhood Area Network) support
- PHY-level spoofing to enhance legacy compatibility
- Channel management and co-existence
- Multiple BSSID feature allows the RTL8821CU-CG to assume multiple MAC identities when used as a wireless bridge
- WiFi FTM (Fine Time Measurement) supported
- WiFi TDLS (Tunneled Direct Link Setup) Supported

Other Features

- Supports Wake-On-WLAN via Magic
- Support Network List Offload

Packet and Wake-up frame
- Transmit Beamforming
- Support S3/S4 AES/TKIP group key update
- CCA on secondary through RTS/CTS handshake.
- Support TCP/UDP/IP checksum offload

Peripheral Interfaces

- Up to 15 General Purpose Input/Output pins
- Three configurable LED pins (mux with GPIO pins)
- Generates 40MHz clock for peripheral chip.
- Single external power source 3.3V only

PHY Features

- IEEE 802.11ac OFDM
- IEEE 802.11n OFDM
- One Transmit and One Receive path
- 5MHz / 10MHz / 20MHz / 40MHz / 80MHz bandwidth transmission
- Support 2.4GHz and 5GHz band channels
- Short Guard Interval (400ns)
- Sounding packet.
- DSSS with DBPSK and DQPSK, CCK modulation with long and short preamble
- OFDM with BPSK, QPSK, 16QAM, 64QAM and 256QAM modulation. Convolutional Coding Rate: 1/2, 2/3, 3/4, and 5/6
- Maximum data rate 54Mbps in 802.11g, 150Mbps in 802.11n and 433.3bps in 802.11ac.
- Switch diversity used for DSSS/CCK
- Support STBC Receiving
- Support LDPC Transmitting
- Hardware antenna diversity
- Fast receiver Automatic Gain Control (AGC)
- On-chip ADC and DAC
- Build-in both 2.4GHz and 5GHz PA
- Build-in both 2.4GHz and 5GHz LNA

Bluetooth Controller

- Compatible with Bluetooth 2.1+EDR
- Support Bluetooth 4.2 system
- Integrated MCU to execute Bluetooth protocol stack
- Supports all packet types in basic rate and enhanced data rate
- Supports piconets in a scatternet
- Supports Secure Simple Pairing

Bluetooth Transceiver

- Fast AGC control to improve receiving dynamic range
- Supports AFH to dynamically detect channel quality to improve transmission quality
- Integrated internal Class 1, Class 2, and Class 3 PA
- Supports Low Power Mode (Sniff/Sniff Sub-rating)
- Enhanced BT/WIFI Coexistence Control to improve transmission quality in different profiles
- Bluetooth 4.0 Dual Mode support: Simultaneous LE and BR/EDR
- Supports multiple Low Energy states
- Supports Enhanced Power Control
- Supports Bluetooth Low Energy
- Integrated 32K oscillator for power management

Figure 1. Dual-Band MIMO 1x1 Solution(11ac 1x1 MAC/BB/RF + PA) and Integrated Bluetooth Controller Solution with Antenna Diversity --- RTL8821CE

4.General Specification

Model	WD_RTL8821CE_V10
Product Name	802.11a/b/g/n/ac PCIE module
Major Chipset	Realtek RTL8821CE-VL-CG
Standard	WIFI: 802.11a/b/g/n/ac/e/i/h BT : V2.1+ EDR and V4.2, For BR/EDR,V4.0BLE
Bus Interface	WiFi：PCIE BT: USB2.0
Modulation Method	DSSS,DBPSK, DQPSK, CCK and OFDM (BPSK, QPSK, 16QAM, 64QAM and 256-QAM)
Frequency Band	2.4GHz ~ 2.472GHz 4.9GHz ~ 6.0GHz
Operating Channel	WiFi 2.4GHz: 11: (Ch. 1-11) – United States 13: (Ch. 1-13) – Europe

	BT 2.4GHz: Ch. 0 ~78
OS Support	Linux/Android/Windows32,64
Security	WMM, WPA, WPA2
Operating Temperature	0 ~ +60° C ambient temperature
Storage Temperature	-20 ~ 70°C ambient temperature
Humidity	5 to 90 % maximum (non-condensing)
Dimension	L16.0x*W12,.0 * H1.6mm(±0.2MM)

5.DC Characteristics

1 ） Power Supply Characteristics

Symbol	**Parameter**	**Minimum**	**Typical**	**Maximum**	**Units**
VDD33	3.3V I/O Supply Voltage	3.0	3.3	3.6	V
VD10	1.05V Core Supply Voltage	0.945	1.05	1.155	V

6.Electrical Specifications

1)RF Characteristics for IEEE802.11b （ 11Mbps mode unless otherwise specified)

Items	Contents			
Specification	IEEE802.11b			
Mode	CCK 11 Mbps			
Channel frequency	2412 ~ 2462 MHz for FCC use Only			
RX (per≤85 dBm@8%)	-85 dBm			
TX Characteristics	Min.	Typ.	Max.	Unit
Power Level (±1.5 dBm)		17		dBm
EVM (≤-18)		-18		dB

2) RF Characteristics for IEEE802.11g （ 54Mbps mode unless otherwise specified)

Items	Contents
Specification	IEEE802.11g

Mode	OFDM 54 Mbps			
Channel frequency	2412 ~ 2462 MHz			
RX (per≤70 dBm@10%)	-70 dBm			
TX Characteristics	Min.	Typ.	Max.	Unit
Power Level (±1.5dBm)		14		dBm
EVM (≤-28)		-28		dB

3) RF Characteristics for IEEE802.11n (BW20_MCS7)

Items	Contents			
Specification	IEEE802.11n (BW20_MCS7)			
Mode	OFDM 65 Mbps			
Channel frequency	2412 ~ 2462 MHz			
RX (per≤65 dBm@10%)	-65 dBm			
TX Characteristics	Min.	Typ.	Max.	Unit
Power Level (±1.5 dBm)		13		dBm
EVM (≤-28)		-30		dB

4) RF Characteristics for IEEE802.11n (BW40_MCS7)

Items	Contents			
Specification	IEEE802.11n (BW40_MCS7)			
Mode	OFDM 135 Mbps			
Channel frequency	2422 ~ 2452 MHz			
RX (per≤65 dBm@10%)	-65 dBm			
TX Characteristics	Min.	Typ.	Max.	Unit
Power Level (±1.5dBm)		13		dBm
EVM (≤-28)		-30		dB

5) RF Characteristics for IEEE802.11A (54 Mbps)

Items	Contents			
Specification	IEEE802.11A (54 Mbps)			
Channel frequency	5.15GHz ~ 5.25GHz			
RX (per≤68 dBm@10%)	-70 dBm			
Freq.Error(±10ppm)	±10ppm			
TX Characteristics	Min.	Typ.	Max.	Unit
Power Level (±2 dBm)		13		dBm
EVM (≤-28)		-30		dB

6) RF Characteristics for IEEE802.11N (BW20_MCS7)

Items	Contents			
Specification	IEEE802.11n (BW20_MCS7)			
Channel frequency	5.18GHz ~ 5.24GHz			
RX (per≤63 dBm@10%)	-65 dBm			
Freq.Error(±10ppm)	±10ppm			
TX Characteristics	Min.	Typ.	Max.	Unit
Power Level (±2 dBm)		12		dBm
EVM (≤-30)		-30		dB

7) RF Characteristics for IEEE802.11n (BW40_MCS7)

s	Contents			
Specification	IEEE802.11n (BW40_MCS7)			
Channel frequency	5.19GHz ~ 5.23GHz			
RX (per≤63 dBm@10%)	-63dBm			
Freq.Error(±10ppm)	±10ppm			
TX Characteristics	Min.	Typ.	Max.	Unit
Power Level (±2 dBm)		12		dBm
EVM (≤-30)		-30		dB

8) RF Characteristics for IEEE802.11ac (BW80_MCS9)

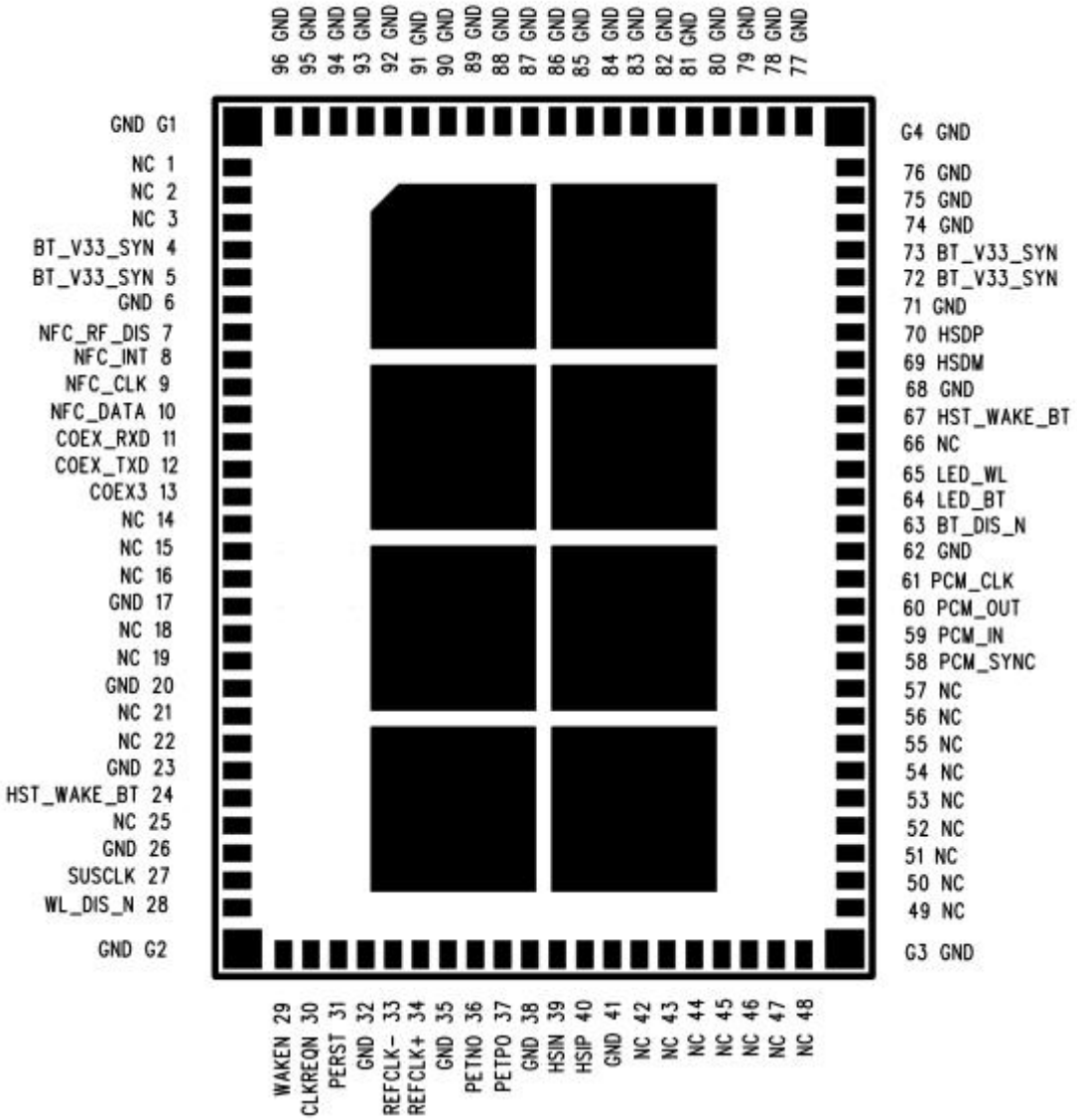
Items	Contents			
Specification	IEEE802.11ac (BW80_MCS9)			
Channel frequency	5210GHz			
RX (per≤56dBm@10%)	-57 dBm			
Freq.Error(±10ppm)	±10ppm			
TX Characteristics	Min.	Typ.	Max.	Unit
Power Level (±2 dBm)		11		dBm
EVM (≤-32)		-32		dB

7.Bluetooth Specification

Feature	Description		
General Specification			
Bluetooth Standard	Bluetooth V4.2 of 1, 2 and 3 Mbps.		
Host Interface	USB 2.0		
Antenna Reference	Small antennas with 0~2 dBi peak gain		
Frequency Band	2.402 GHz ~ 2480 GHz		
Number of Channels	79 channels		
Modulation	FHSS, GFSK, DPSK, DQPSK		
RF Specification			
	Min	Typical	Max
Output Power (Class 1.5)	-6	8	10
Output Power (Class 2)		2	
Sensitivity @ BER=0.1% for GFSK (1Mbps)		-89	
Sensitivity @ BER=0.01% for π/4-DQPSK (2Mbps)		-85	
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)		-83	

Maximum Input Level	GFSK (1Mbps):-20dBm
	π/4-DQPSK (2Mbps) :-20dBm
	8DPSK (3Mbps) :-20dBm

8. Pin Definition



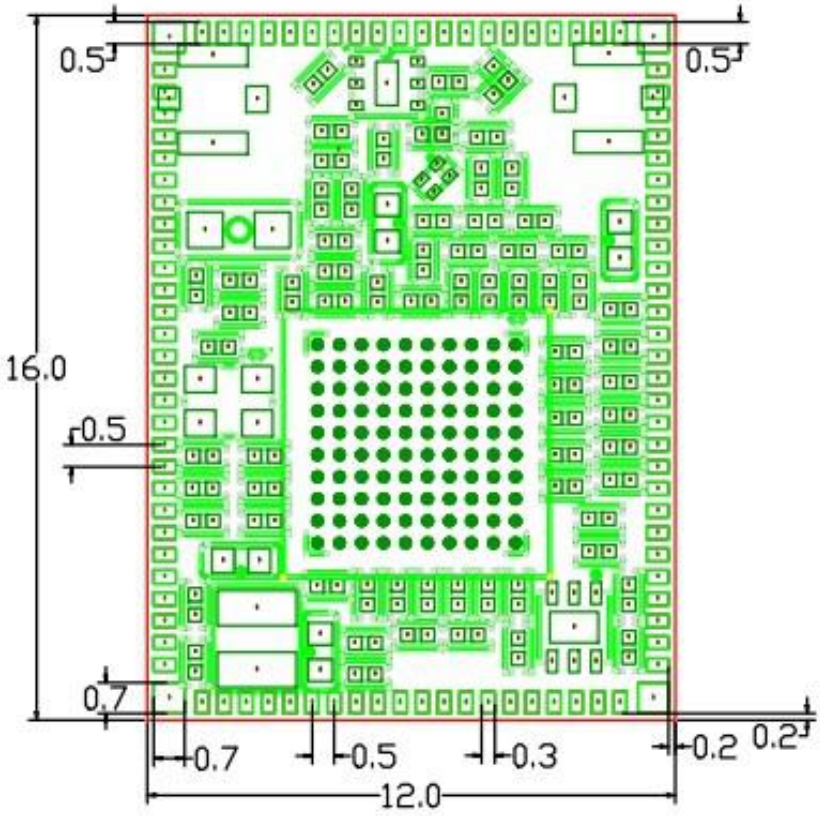
Pin	Definition	Description
G1	GND	Ground
1	NC	NC
2~3	NC	NC
4	VDD33	3.3V

5	VDD33	3.3V
6	GND	Ground
7	NFC_RF_DIS	NC
8	NFC_INT	NC
9	NFC_CLK	NC
10	NFC_DATA	NC
11	COEX_RXD	GPIO6
12	COEX_TXD	GPIO12
13	COEX3	GPIO7
14~16	NC	NC
17	GND	Ground
18~19	NC	NC
20	GND	Ground
21~22	NC	NC
23	GND	Ground
24	HST_WAKE_DEV	GPIO13
25	NC	NC
26	GND	Ground
27	SUSCLK	Shared with EECS. External 32K or RTC clock input
28	WL_DIS_N	GPIO9
G2	GND	Ground
29	WAKE_N	WAKE_N
30	CLKREQ	CLKREQ
31	PERSTB	PCI Express Reset Signal: active low. When the PERST# is asserted at power-on state, the RTL8821CE returns to a pre-defined reset state and is ready for initialization and configuration after the de-assertion of the PERST#.
32	GND	Ground
33	REFCLK_N	PCI Express Differential Reference Clock Source: 100MHz±300ppm
34	REFCLK_P	PCI Express Differential Reference Clock Source: 100MHz±300ppm

35	GND	Ground
36	HSON	PCI Express Transmit Differential Pair
37	HSOP	PCI Express Transmit Differential Pair
38	GND	Ground
39	HSIN	PCI Express Receive Differential Pair
40	HSIP	PCI Express Receive Differential Pair
41	GND	Ground
42~48	NC	NC
G3	GND	Ground
49~56	NC	NC
57	GND	Ground
58	PCM_SYNC	GPIO2
59	PCM_IN	GPIO0
60	PCM_OUT	GPIO1
61	PCM_CLK	GPIO3
62	GND	Ground
63	BT_DIS	GPIO11
64	BT_LED	LED1
65	WL_LED	LED2
66	NC	NC
67	HOST_WAKE_BT	GPIO13
68	GND	Ground
69	HSDM	High-Speed USB D- Signal
70	HSDP	High-Speed USB D+ Signal
71	GND	Ground
72	VDD33	3.3V
73	VDD33	3.3V
74~76	GND	Ground
G4	GND	Ground

	77~96	GND	Ground	

9. Size reference

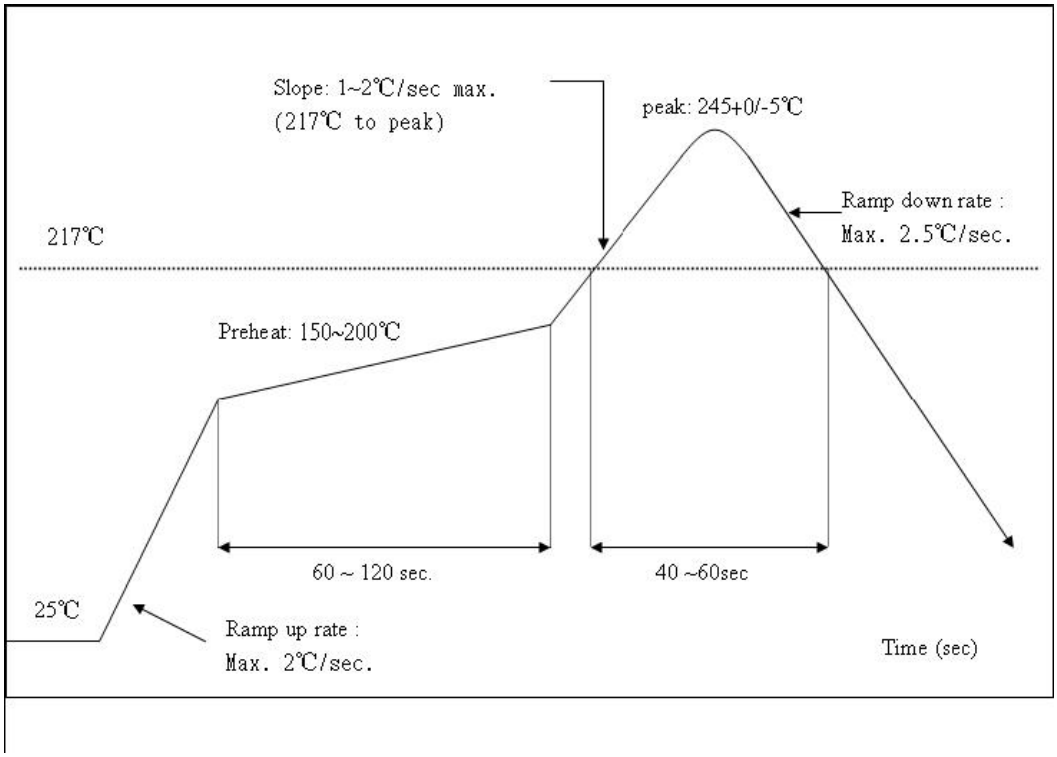


The PCB tolerances within + / -0.2 or so

	Length	Width	Height
Dimensions (mm)	16.0	12.0	1.75
	(Tolerance:±0.2mm)	**(Tolerance:±0.2mm)**	**(Tolerance:±0.2mm)**

10.Recommended Reflow Profile

Referred to IPC/JEDEC standard.
Peak Temperature : <250°C
Number of Times : ≤2 times



ENVIRONMENTAL

Operating

Operating Temperature: 0°C to +60 °C
Relative Humidity: 5-90% (non-condensing)

Storage

Temperature: -20°C to +70°C (non-operating)
Relevant Humidity: 5-95% (non-condensing)

Patch WIFI modules installed before the notice:

WIFI module installed note:

1. Please press 1 : 1 and then expand outward proportion to 0.7 mm, 0.12 mm thickness When open a stencil
2. Take and use the WIFI module, please insure the electrostatic protective measures.
3. Reflow soldering temperature should be according to the customer the main size of the products, such as the temperature set at 250 + 5 ℃ for the MID motherboard.

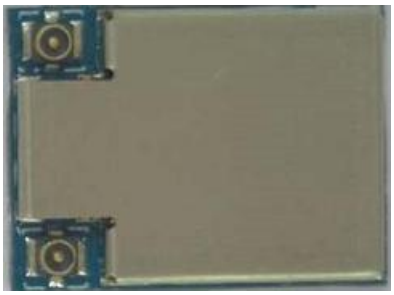
About the module packaging, storage and use of matters needing attention are as follows:

1. The module of the reel and storage life of vacuum packing: 1). Shelf life: 8 months,

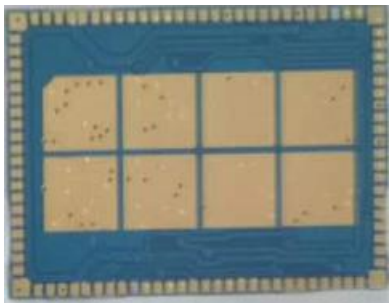
storage environment conditions: temperature in: < 40 ℃, relative humidity: < 90% r.h.
2. The module vacuum packing once opened, time limit of the assembly:
Card: 1) check the humidity display value should be less than 30% (in blue), such as: 30% ~ 40% (pink), or greater than 40% (red) the module have been moisture absorption.
2.) factory environmental temperature humidity control: ≦ 30 ℃, ≦ 60% r.h..
3). Once opened, the workshop the preservation of life for 168 hours.
3. Once opened, such as when not used up within 168 hours:
1). The module must be again to remove the module moisture absorption.
2). The baking temperature: 125 ℃, 8 hours.
3.) After baking, put the right amount of desiccant to seal packages.

11. PACKING INFORMATION

TOP



BOTTOM



A piece of 64 PCS

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Federal Communications Commission (FCC) Declaration of Conformity

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. (15.247 & §15.407)
Operation is subject to the fol-lowing 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 lo-cation 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 encour-aged 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 is country dependent and 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 labeled in a visible area with the following: "Con-tains Transmitter Module2AXHEWDRTL8821CE" This radio module must not be installed to co-locate and operating simultaneously with other radios in host system, additional testing and equipment authorization may be required to operating simultaneously with other radio.

This LMA have RF shielding and is tested and approved as standalone configuration, additional evaluation may be required for any system integrated this radio module.
External Antenna Type, with the maximum 0dBi indicated.

THE END