

Product Specification

Module Name	RL-UM02WBS-8821CS-V1.2		
Module Description	IEEE 802.11 a/b/g/n/ac 1T1R Dual-band WiFi+BT4.2 Combo Module		
	USB Interface With LGA Package		
Reversion	V1.2		
Date			
Nater Approve Field			
Engineer	QC	Sales	
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Customer Approve Field			
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1. Introduction

HK NATER TECH Limited would like to announce a low-cost and low-power consumption module which has all of the Wi-Fi, Bluetooth functionalities. The highly integrated module makes the possibilities of web browsing, VoIP, Bluetooth headsets applications. With seamless roaming capabilities and advanced security, also could interact with different vendors' 802.11a/b/g/n/ac Access Points in the wireless LAN.

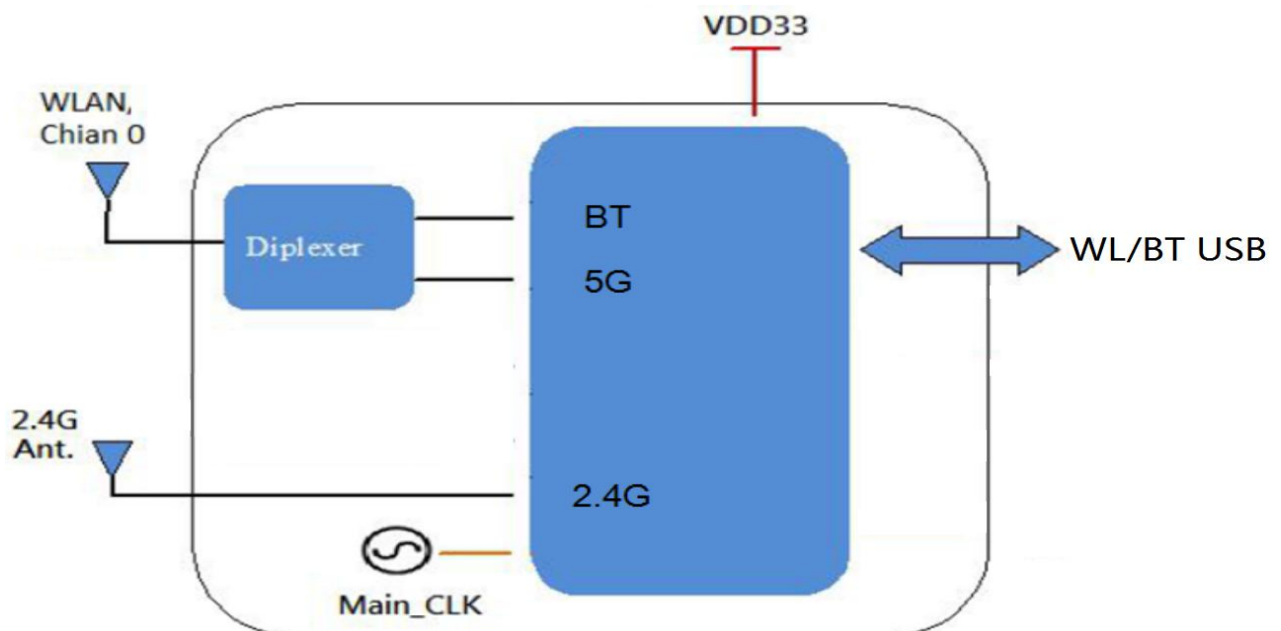
The wireless module complies with IEEE 802.11 a/b/g/n/ac standard and it can achieve up to a speed of 433.3Mbps with single stream in 802.11ac draft to connect to the wireless LAN. The integrated module provides USB interface for Wi-Fi and Bluetooth.

This compact module is a total solution for a combination of Wi-Fi + BT technologies. The module is specifically developed for Smart phones and Portable devices.

2. Features

- Highly integrated wireless local area network(WLAN) system-on-chip (SOC) for 5 GHZ 802.11ac, or 2.4G/5G 802.11n WLAN applications.
- Supports 20/40MHz at 2.4GHz and supports 20/40/80MHz at 5GHz
- Supports Bluetooth V4.1+HS, BLE and be backwards compatible with Bluetooth 1.2, 2.X+ enhance data rate.
- Supports WLAN-Bluetooth coexistence and ISM-LTE coexistence.
- Supports Bluetooth for class1 and class2 power level transmissions without requiring an external PA.

The block diagram of module is depicted in the figure below.



3. General Specification

3.1 General Specification

Model Name	RL-UM02WBS-8821CS-V1.2
Product Description	Support WiFi/Bluetooth functionalities
Dimension	L x W x H: 12 x 13 x 1.6 (typical) mm
WiFi Interface	USB 2.0
BT Interface	USB 2.0
Operating temperature	0°C to 70°C
Storage temperature	-40°C to 85°C

3.1.2 Recommended Operating Rating

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

4. WiFi RF Specification

4.1 2.4GHz RF Specification

Feature	Description
WLAN Standard	IEEE 802.11b/g/n/ac, WiFi compliant
Frequency Range	2.400 GHz ~ 2.497 GHz (2.4 GHz ISM Band)
Number of Channels	2.4GHz : Ch1 ~ Ch14
Output Power	802.11b /CCK : 16 dBm $\pm$ 1.5 dB @ EVM $\leq$ -9dB
	802.11g /64-QAM(R=3/4) : 15 dBm $\pm$ 1.5 dB @ EVM $\leq$ -25dB
	802.11n /64-QAM(R=5/6) : 14 dBm $\pm$ 1.5 dB @ EVM $\leq$ -28dB
Receive Sensitivity (11b) @8% PER	- 1Mbps PER @ -88 dBm, typical
	- 2Mbps PER @ -82 dBm, typical
	- 5.5Mbps PER @ -81 dBm, typical
	- 11Mbps PER @ -80 dBm, typical
Receive Sensitivity (11g) @10% PER	- 6Mbps PER @ -80 dBm, typical
	- 9Mbps PER @ -80 dBm, typical
	- 12Mbps PER @ -78 dBm, typical
	- 18Mbps PER @ -76 dBm, typical
	- 24Mbps PER @ -74 dBm, typical
	- 36Mbps PER @ -71 dBm, typical
	- 48Mbps PER @ -69 dBm, typical
	- 54Mbps PER @ -67 dBm, typical
Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -84 dBm, typical
	- MCS=1 PER @ -80 dBm, typical
	- MCS=2 PER @ -79 dBm, typical
	- MCS=3 PER @ -75 dBm, typical
	- MCS=4 PER @ -72 dBm, typical
	- MCS=5 PER @ -70 dBm, typical
	- MCS=6 PER @ -67 dBm, typical
	- MCS=7 PER @ -66 dBm, typical
Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 PER @ -84 dBm, typical
	- MCS=1 PER @ -80 dBm, typical
	- MCS=2 PER @ -79 dBm, typical
	- MCS=3 PER @ -75 dBm, typical
	- MCS=4 PER @ -71 dBm, typical
	- MCS=5 PER @ -67 dBm, typical
	- MCS=6 PER @ -65 dBm, typical

	- MCS=7 PER @ -64 dBm, typical
Receive Sensitivity (11ac,20MHz) @10% PER	- MCS=0 PER @ -86 dBm, typical
	- MCS=1 PER @ -83 dBm, typical
	- MCS=2 PER @ -82 dBm, typical
	- MCS=3 PER @ -78 dBm, typical
	- MCS=4 PER @ -75 dBm, typical
	- MCS=5 PER @ -71 dBm, typical
	- MCS=6 PER @ -69 dBm, typical
	- MCS=7 PER @ -68 dBm, typical
	- MCS=8 PER @ -63 dBm, typical
Receive Sensitivity (11ac,40MHz) @10% PER	- MCS=0 PER @ -84 dBm, typical
	- MCS=1 PER @ -81 dBm, typical
	- MCS=2 PER @ -79 dBm, typical
	- MCS=3 PER @ -76 dBm, typical
	- MCS=4 PER @ -73 dBm, typical
	- MCS=5 PER @ -68 dBm, typical
	- MCS=6 PER @ -67 dBm, typical
	- MCS=7 PER @ -65 dBm, typical
	- MCS=8 PER @ -61 dBm, typical
	- MCS=9 PER @ -60 dBm, typical

4.2 5GHz RF Specification

Feature	Description
WLAN Standard	IEEE 802.11a/b/g/n/ac, Wi-Fi compliant
Frequency Range	4.900 GHz ~ 5.845 GHz (5.0 GHz ISM Band)
Number of Channels	5.0GHz : Please see the table ¹
Modulation	802.11a/n : 64-QAM,16-QAM, QPSK, BPSK 802.11ac : 256-QAM, 64-QAM,16-QAM, QPSK, BPSK
Output Power	802.11a /64-QAM(R=3/4) : 14 dBm ± 1.5 dB @ EVM ≤ -25dB
	802.11n /64-QAM(R=5/6) : 13 dBm ± 1.5 dB @ EVM ≤ -28dB
	802.11ac/256-QAM(R=3/4) : 12 dBm ± 1.5 dB @ EVM ≤ -30dB
	802.11ac/256-QAM(R=5/6) : 10 dBm ± 1.5 dB @ EVM ≤ -32dB
Receive Sensitivity (11a, 20MHz) @10% PER	- 6Mbps PER @ -85 dBm, typical
	- 9Mbps PER @ -83 dBm, typical
	- 12Mbps PER @ -82 dBm, typical

	- 18Mbps PER @ -80 dBm, typical
	- 24Mbps PER @ -76 dBm, typical
	- 36Mbps PER @ -73 dBm, typical
	- 48Mbps PER @ -68 dBm, typical
	- 54Mbps PER @ -67 dBm, typical
Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -85 dBm, typical
	- MCS=1 PER @ -83 dBm, typical
	- MCS=2 PER @ -80 dBm, typical
	- MCS=3 PER @ -77 dBm, typical
	- MCS=4 PER @ -73 dBm, typical
	- MCS=5 PER @ -69 dBm, typical
	- MCS=6 PER @ -67 dBm, typical
	- MCS=7 PER @ -66 dBm, typical
Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 PER @ -83 dBm, typical
	- MCS=1 PER @ -80 dBm, typical
	- MCS=2 PER @ -78 dBm, typical
	- MCS=3 PER @ -75 dBm, typical
	- MCS=4 PER @ -72 dBm, typical
	- MCS=5 PER @ -67 dBm, typical
	- MCS=6 PER @ -66 dBm, typical
	- MCS=7 PER @ -64 dBm, typical
Receive Sensitivity (11ac,20MHz) @10% PER	- MCS=0 PER @ -86 dBm, typical
	- MCS=1 PER @ -84 dBm, typical
	- MCS=2 PER @ -81 dBm, typical
	- MCS=3 PER @ -77 dBm, typical
	- MCS=4 PER @ -74 dBm, typical
	- MCS=5 PER @ -70 dBm, typical
	- MCS=6 PER @ -68 dBm, typical
	- MCS=7 PER @ -67 dBm, typical
	- MCS=8 PER @ -63 dBm, typical
	- MCS=9 PER @ -62 dBm, typical
Receive Sensitivity (11ac,40MHz) @10% PER	- MCS=0 PER @ -83 dBm, typical
	- MCS=1 PER @ -79 dBm, typical
	- MCS=2 PER @ -77 dBm, typical
	- MCS=3 PER @ -74 dBm, typical
	- MCS=4 PER @ -71 dBm, typical
	- MCS=5 PER @ -66 dBm, typical
	- MCS=6 PER @ -64 dBm, typical

Receive Sensitivity (11ac,80MHz) @10% PER	- MCS=7	PER @ -62 dBm, typical
	- MCS=8	PER @ -60 dBm, typical
	- MCS=9	PER @ -59 dBm, typical
	- MCS=0	PER @ -80 dBm, typical
	- MCS=1	PER @ -77 dBm, typical
	- MCS=2	PER @ -75 dBm, typical
	- MCS=3	PER @ -71 dBm, typical
	- MCS=4	PER @ -68 dBm, typical
	- MCS=5	PER @ -66 dBm, typical
	- MCS=6	PER @ -62 dBm, typical
	- MCS=7	PER @ -60 dBm, typical
	- MCS=8	PER @ -57 dBm, typical
	- MCS=9	PER @ -56 dBm, typical

¹5GHz Channel table

Band (GHz)	Operating Channel Numbers	Channel center frequencies(MHz)
5.15GHz~5.25GHz	36	5180
	40	5200
	44	5220
	48	5240
5.25GHz~5.35GHz	52	5260
	56	5280
	60	5300
	64	5320
5.5GHz~5.7GHz	100	5500
	104	5520
	108	5540
	112	5560
	116	5580
	120	5600
	124	5620
	128	5640
	132	5660
	136	5680
5.725GHz~5.825GHz	140	5700
	149	5745
	153	5765
	157	5785
	161	5805
	165	5825

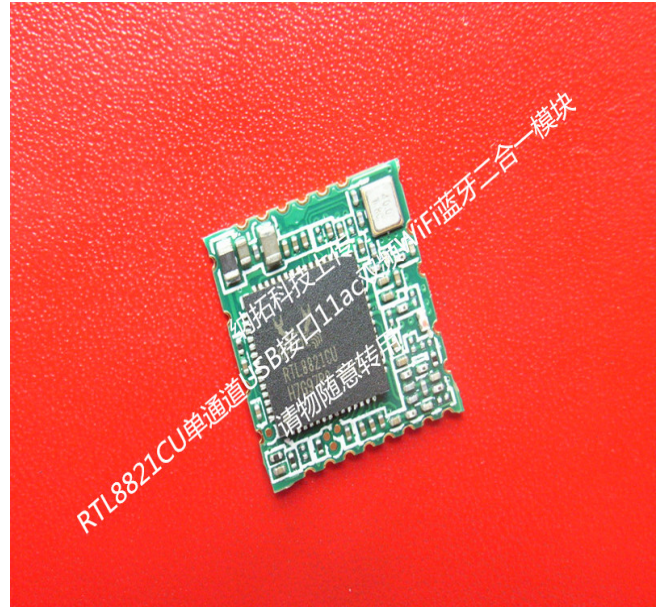
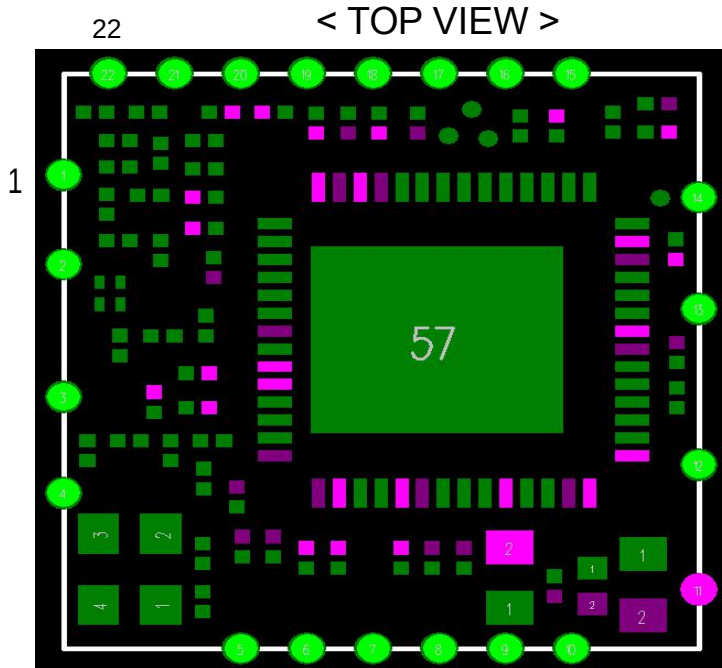
5. Bluetooth Specification

5.1 Bluetooth Specification

Feature	Description		
General Specification			
Bluetooth Standard	Bluetooth V4.1 of 1, 2 and 3 Mbps.		
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	FHSS, GFSK, DPSK, DQPSK		
RF Specification			
	Min.	Typical.	Max.
Output Power (Class 1.5)		8 dBm	
Sensitivity @ BER=0.1% for GFSK (1Mbps)		-88 dBm	
Sensitivity @ BER=0.01% for $\pi/4$ -DQPSK (2Mbps)		-88 dBm	
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)		-81 dBm	
Maximum Input Level	GFSK (1Mbps):-20dBm		
	$\pi/4$ -DQPSK (2Mbps) :-20dBm		
	8DPSK (3Mbps) :-20dBm		

6. Pin Assignments

6.1 Pin Outline



6.2 Pin Definition

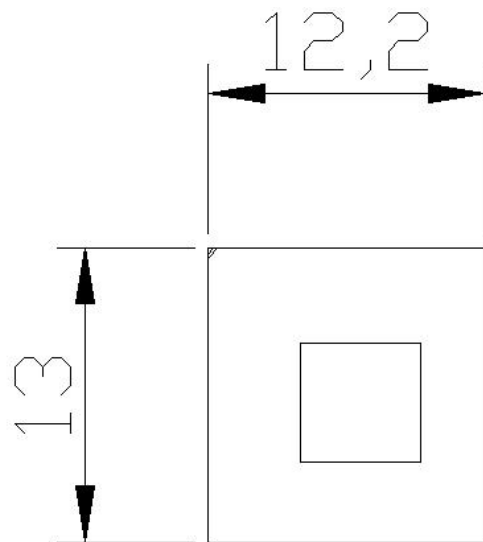
NO	Name	Description
1	GND	Ground connections
2	WL_BT_ANT	5G WIFI AND BT ANT
3	WL_ANT	2.4G WIFI ANT
4	GND	Ground connections
5	NC	Floating (Don't connected to ground)
6	NC	Floating (Don't connected to ground)
7	NC	Floating (Don't connected to ground)
8	NC	Floating (Don't connected to ground)
9	BT_WAKE_HOST	Bluetooth device to wake-up HOST
10	HOST_WAKE_BT	HOST to wake-up Bluetooth device
11	VDD33	3.3V POWER INPUT
12	D-	USB DATA DM
13	D+	USB DATA DP
14	GND	Ground connections
15	GPIO1	3DD_SYNC GPIO
16	WL_DIS	WIFI DISABLE
17	BT_DIS	Bluetooth DISABLE
18	CHIP_EN	CHIP ENABLE
19	HOST_WAKE_WL	HOST to wake-up WIFI device
20	WL_WAKE_HOST	WIFI device to wake-up HOST
21	GPIO2	WPS GPIO
22	GPIO8	LED GPIO

7. Dimensions

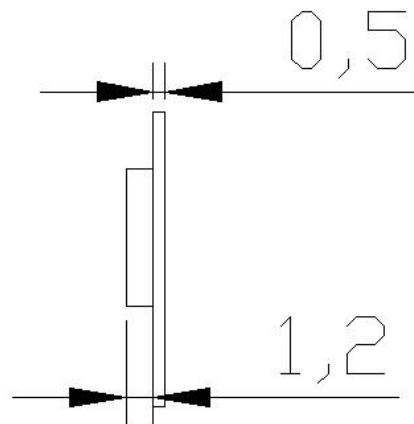
7.1 Physical Dimensions

(Unit: mm)

< TOP VIEW >



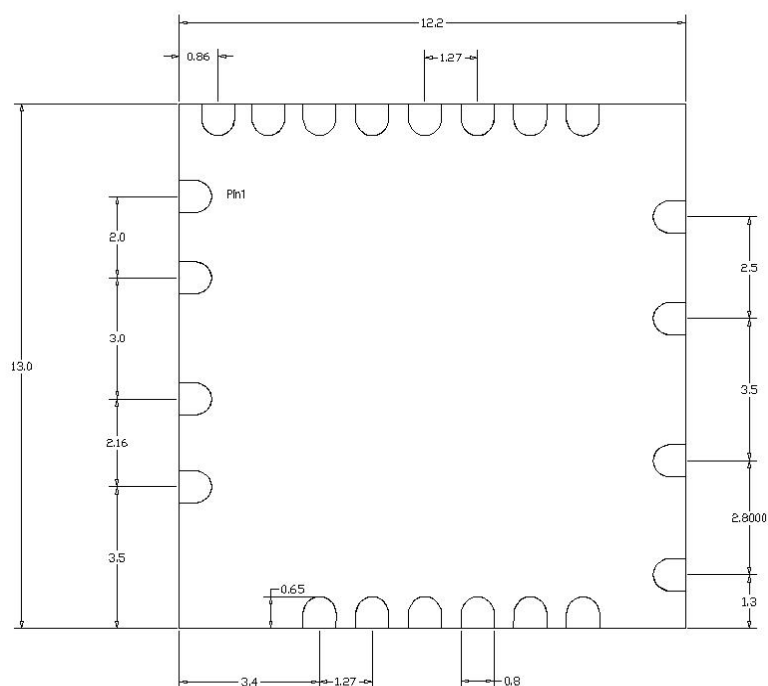
< Side View >



Module Physical Dimensions

(Unit: mm)

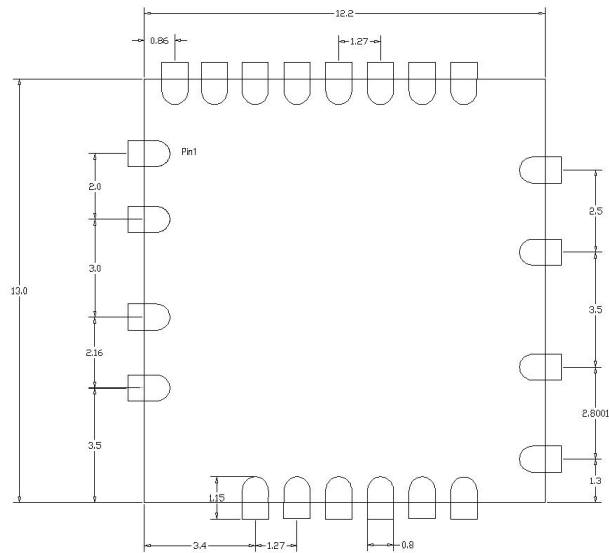
< TOP VIEW >



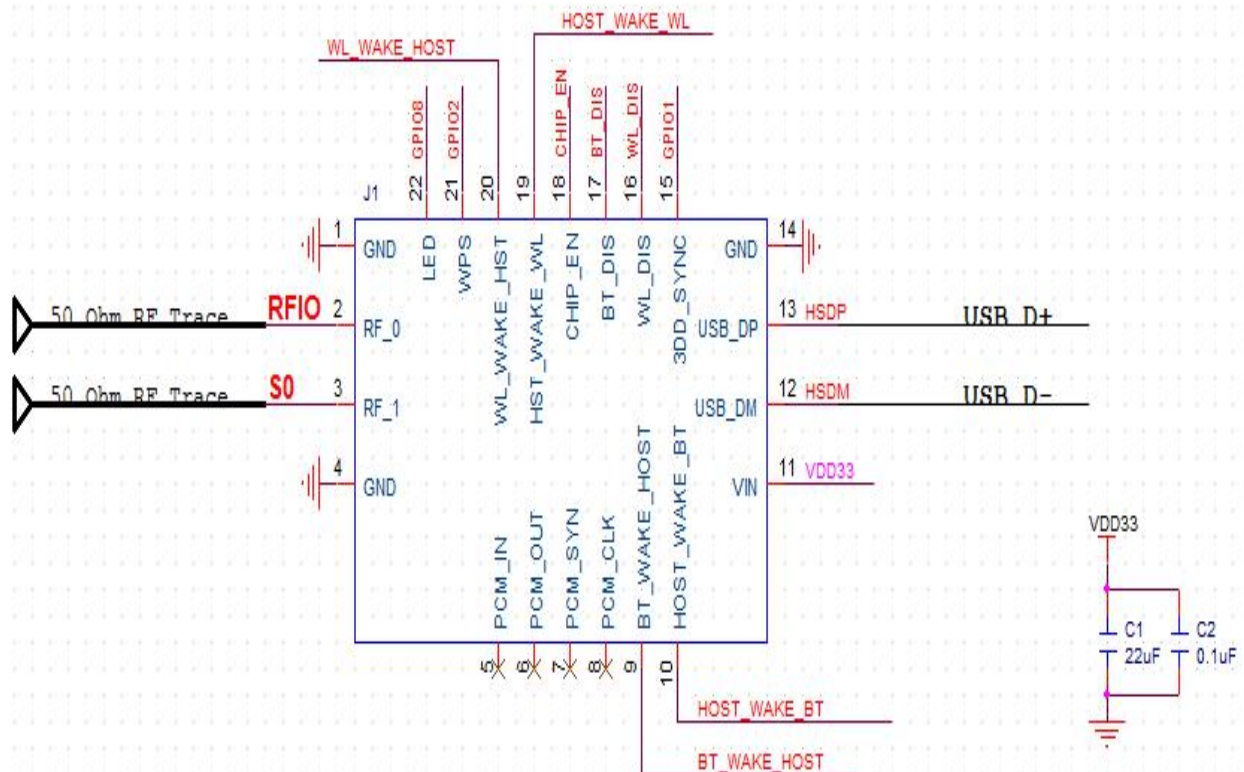
7.2 Layout Recommendation

(Unit: mm)

< TOP VIEW >



8. Reference Design



Environmental Requirements and Specifications TP Content

1 Temperature

1.1 Operating Temperature Conditions

The product shall be capable of continuous reliable operation when operating in ambient temperature of -10°C to +70°C.

1.2 Non-Operating Temperature Conditions

Neither subassemblies shall be damaged nor shall the operational performance be degraded when restored to the operating temperature when exposed to storage temperature in the range of -45°C to +135°C.

2 PCB Bending

The PCB bending spec shall be keep planeness under 0.1mm for both NATER and end assembly customer.

3 Handling environment

3.1. ESD

Symbol	Ratings	Max	Unit
V_{ESD} (HBM)	Electrostatic discharge voltage (human body model)	2000	V
V_{ESD} (CDM)	Electrostatic discharge voltage (charge device model)	500	

Please handle it under ESD protection environment.

3.2. Terminals

The product is mounted with motherboard through half hole. In order to prevent poor soldering, please do not touch the pad by hand.

3.3. Falling

It will cause damage on the mounted components when the product is falling or receiving drop shock. It may cause the product mal-function.

4 Storage Condition

4.1 Moisture barrier bag before opened

Moisture barrier bag must be stored under 30 degree C, humidity under 85% RH. The calculated shelf life for the dry packed product shall be a 12 months from the bag seal date.

4.2. Moisture barrier bag open

Humidity indicator cards must be blue, <30%.

5 Baking Condition

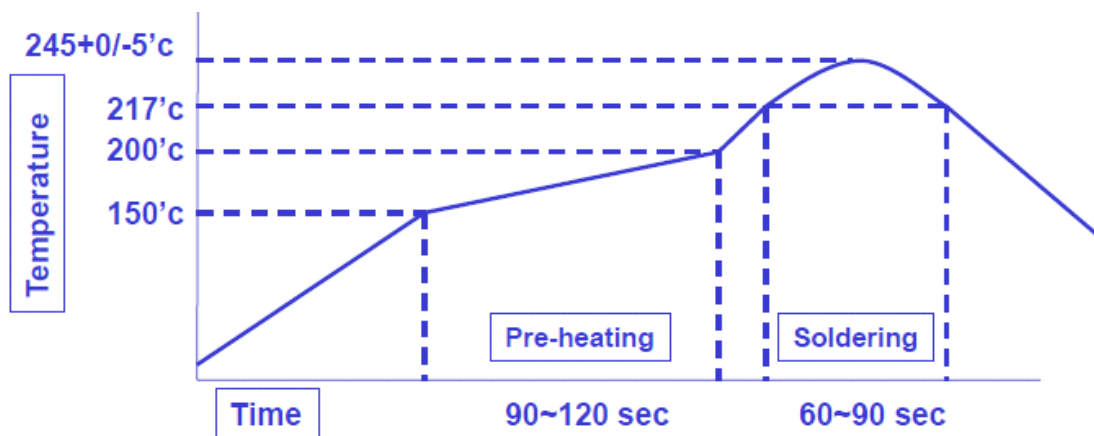
Products require baking before mounting if

- a) humidity indicator cards reads >30%
- b) temp <30 degree C, humidity < 70% RH, over 96 hours

Baking condition: 90 degree C, 12-24 hours

Baking times: 1 time

6 Soldering and reflow condition



- ◆ Follow the solder paste composition to set the reflow profile
- ◆ Lead free solder paste(SAC305, SAC387 or SAC405) reflow profile setting as above :
 - Ramp up rate (to Peak temp) : < 1.2°C/sec, typically
 - Time above Liquidus(217°C) : 60~90Sec
 - Peak Temp : 245+0/-5°C
 - Ramp-down rate (Peak to RT) : 1~3°C/sec, typically

模块化的设计，是为了集成设计，最主要是考虑多种硬件兼容设计，有利于产品的多样性，更为不同的用户、不同的行业应用提供了丰富的选择；

采用最经典的小尺寸 12.9*12.2mm，也就是通俗说成“拇指甲大小”！

可以对单独的 WiFi (1T1R/2T2R)、蓝牙 WiFi 二合一、11ac 标准 WiFi 蓝牙二合一做综合的硬件兼容设计。因为蓝牙部分还牵涉到 PCM 蓝牙语音对话功能，这部分是采用 PCM 接口，所以兼容设计仅仅是考虑其中的 USB 接口；

RTL8821CU 设计的模块 RL-UM02WBS-8821CU 有很好的兼容性，硬件上可以兼容以下同样封装尺寸的模块，只是各自功能同！

单频单通道的方案有：RTL8188CUS、RTL8188CTV、RTL8188EUS、RTL8188ETV、RTL8188FT V-VB、RTL8188FTV-VQ、AR9271、MT7601UN（其中 RTL8188CUS/CTV 很少用了）；符合 IEEE 802.11b/g/n 标准、1T1R、WiFi 最大数据传输速率 150Mbps、封装 LGA-6。

单频双通道的方案有：RTL8192EU；符合 IEEE 802.11b/g/n 标准、2T2R、WiFi 最大数据传输速率 300Mbps、封装 LGA-10。

单频蓝牙 WiFi 二合一的方案有：RTL8723BU (@BT4.0 / LGA-14)、RTL8723DU (@BT4.2 / LGA-20)；符合 IEEE 802.11b/g/n 标准、1T1R、WiFi 最大数据传输速率 150Mbps。

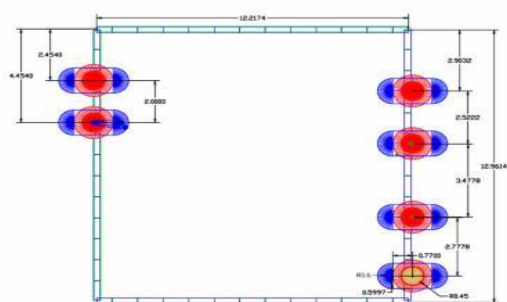
双频单通道的有：RTL8811CU；符合 IEEE 802.11a/b/g/n/ac 标准、1T1R、WiFi 最大数据传输速率 433Mbps、封装 LGA-22。

双频蓝牙 WiFi 二合一的方案有：RTL8821CU (@BT4.2) 符合 IEEE 802.11a/b/g/n/ac 标准、1T1R、WiFi 最大数据传输速率 433Mbps、封装 LGA-22。

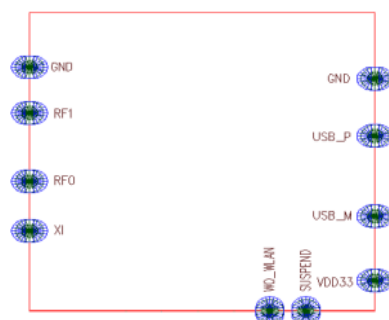
在前期调试时，还有直接 USB dongle 的方式可以选择，最终集成的时候采用模块化！

同一 PCB 封装，可以兼容下六款以上的模块，模块设计者的智慧，还是集成应用设计者的智慧，应该来说都有。集成本来就是为了方便使用，兼容性强的集成，那就方便了更多，希望这样的简单分析可以帮助一些初步设计这带来帮助，还有不明，可以及时沟通！

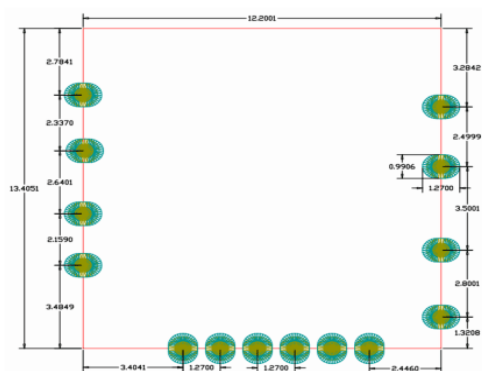
主要集成在平板、笔记本、广告机、智能电视 OTT/IPTV/DVB/机顶盒、运动DV、工控机、迷你行车记录仪、门铃、智能电视、智能投影仪、虚拟现实、无线存储、打印机、POS 机、电子称、车载前/后终端、无人机、机器人、智能网关、玩具、照明灯具、智能路灯、智能家电/家电、仪器仪表(水、电、气)智能城市及其他消费类电子产品！



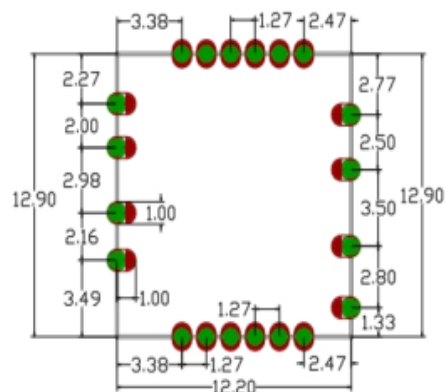
LGA-6 封装 RTL8188 系列



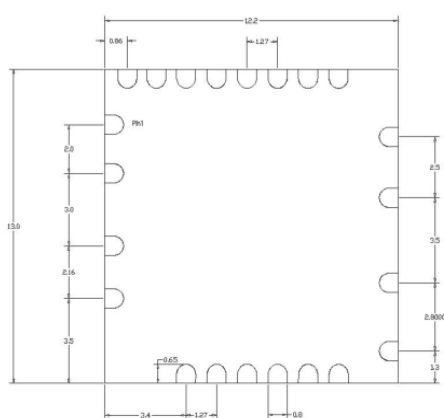
LGA-10 封装 RTL8192EU



LGA-14 封装 RTL8723BU



LGA-20 封装 RTL8723DU



LGA-22 封装 RTL8821CU/RTL8811CU



直接 Dongle 化的模块



所在这个系列的，也可以用万能转接板转成直接带 USB 的 Dongle