



## Product Specification

|                               |  |                    |                   |
|-------------------------------|--|--------------------|-------------------|
| <b>Revision</b>               | V1.1   |                    |                   |
| <b>Date</b>                   | 2019-07-15   |                    |                   |
| <b>Model Name</b>             | BL-M8821CU1  |                    |                   |
| <b>Product Name</b>           | IEEE 802.11a/b/g/n/ac(1T1R) USB WIFI+BT Combo Module |                    |                   |
| <b>Bilian Approve Field</b>   |  |                    |                   |
| <b>Engineer</b>               | <b>QC</b>  | <b>Sales</b>       |                   |
| Can Zhang                     |  |                    |                   |
| <b>Customer Approve Field</b> |  |                    |                   |
| <b>Engineer</b>               | <b>QC</b>  | <b>Manufactory</b> | <b>Purchasing</b> |
|                               |  |                    |                   |

Shenzhen Bilian Electronic Co., Ltd

Address: 10-11F, Building A1, Huaqiang idea park, Guangming district, Shenzhen.Guangdong, China

Homepage: [www.b-link.net.cn](http://www.b-link.net.cn)

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## Revision History

| Date       | Document Revision | Product Revision | Description   |
|------------|-------------------|------------------|---|
| 2017/04/06 | 0.1               | V0.1             | Preliminary release                                       |
| 2017/09/26 | 1.0               | V1.0             | Update the product pictures                               |
| 2019/06/18 | 1.1               | V1.1             | Revise the descriptive error and the dimension of product |

## 1. Introduction

### 1.1 General Description

BL-M8821CU1 is the module designed by a highly integrated IEEE 802.11a/b/g/n/ac MAC/Baseband/RF WLAN and Bluetooth Baseband/RF single chip. It combines a WLAN MAC, a 1T1R capable WLAN baseband, BT Protocol (LM, LL and LE), BT Baseband, modem, and WLAN/BT RF in a single chip. The module provides a complete solution for a high-performance wireless LAN and Bluetooth device. The BT controller supports BT 4.2 system and compatibles Bluetooth 2.1+EDR.

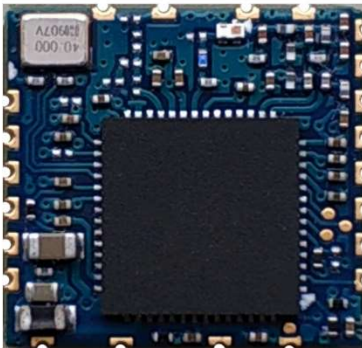


Figure 1 Top View



Figure 2 Bottom View

**Note:** The above pictures are for reference only

### 1.2 Features

- Operating Frequencies :  
BT:2.402~2.48GHz(BT)  
2.4GWIFI:2.412~2.472GHz(USA 11Channels, Europe and others 13 channels)  
B5GWIFI:5.18~5.24GHz/5.745~5.825GHz
- Host Interface is USB 2.0 for WLAN and BT controller
- IEEE Standards : IEEE 802.11a/b/g/n/ac
- Wireless data rate can reach up to 433.3Mbps
- Bluetooth Low Energy Support
- Connect to external antenna through the half hole
- Power Supply:3.3V±0.2V

### 1.3 Applications

- MID
- IP Camera
- STB
- Smart TV
- E-book
- Other devices which need to be supported by wireless network

## 2. Functional Block Diagram

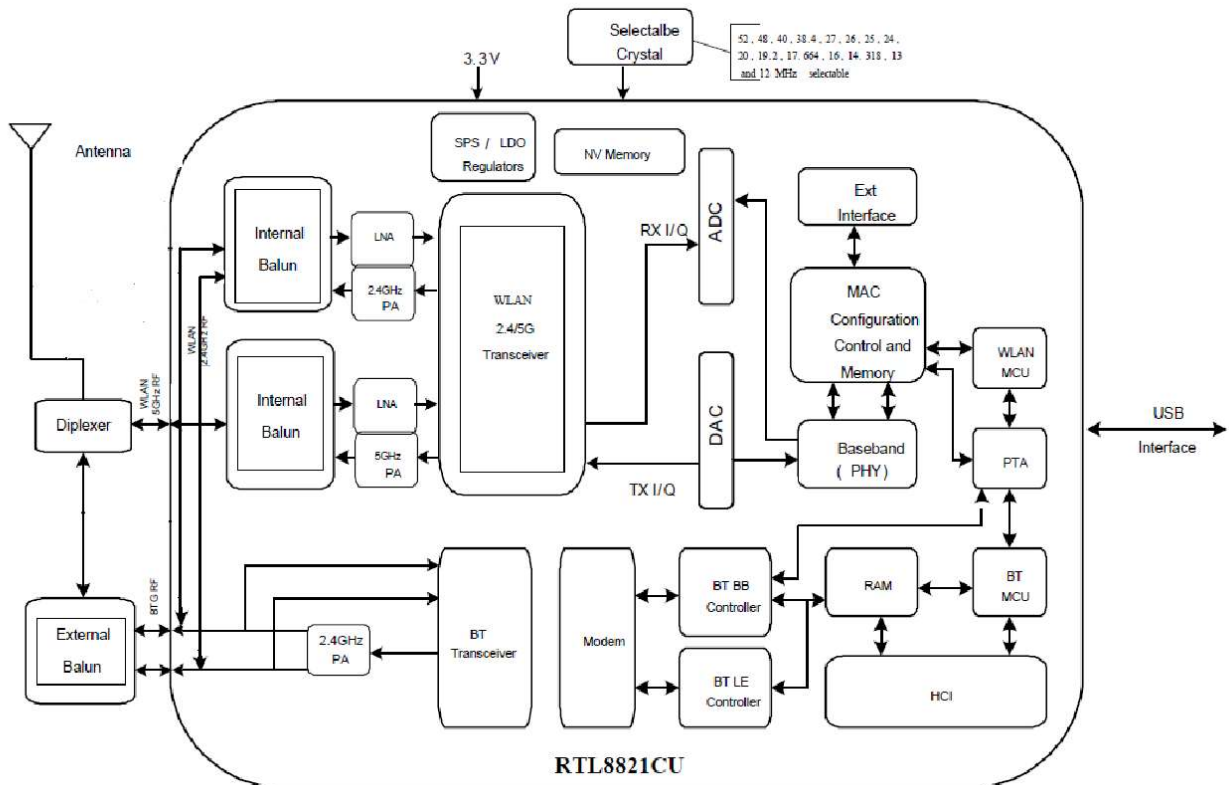


Figure 3 BL-M8821CU1 block diagram

## 3. Product Technical Specifications

### 3.1 General Specifications

| Item                  | Description   |
|-----------------------|---|
| Product Name          | BL-M8821CU1   |
| Main Chip             | RTL8821CU-CG  |
| Host Interface        | USB 2.0   |
| IEEE Standards        | IEEE 802.11a/b/g/n/ac   |
| Operating Frequencies | BT:2.402~2.48GHz(BT)<br>2.4GWIFI:2.412~2.472GHz(USA 11Channels, Europe and others 13 channels)<br>BSGWIFI:5.18~5.24GHz/5.745~5.825GHz |

|                     |  |
|---------------------|--|
| Modulation          | WiFi:<br>802.11b: CCK, DQPSK, DBPSK<br>802.11a/g: 64-QAM, 16-QAM, QPSK, BPSK<br>802.11n: 64-QAM, 16-QAM, QPSK, BPSK<br>802.11ac: 256-QAM, 64-QAM, 16-QAM, QPSK, BPSK<br>BT:<br>8DPSK, $\pi/4$ DQPSK, GFSK  |
| Working Mode        | Infrastructure, Ad-Hoc   |
| Wireless Data Rate  | WiFi:<br>802.11b: 1, 2, 5.5, 11Mbps<br>802.11a/g: 6, 9, 12, 18, 24, 36, 48, 54Mbps<br>802.11n: HT20 reach up to 72.2Mbps, HT40 reach up to 150Mbps<br>802.11ac: MCS0~8, VHT20 reach up to 173.3Mbps, VHT40 reach up to 239Mbps,<br>MCS0~9, VHT80 reach up to 433.3Mbps<br>BT:<br>1Mbps for Basic Rate<br>2,3 Mbps for Enhanced Data Rate |
| Rx Sensitivity      | -96dBm (Min)   |
| Antenna Type        | Connect to external antenna through the half hole  |
| Dimension(L*W*H)    | 13.0*12.2*1.5mm (L*W*H) , Tolerance: $\pm 0.15$ mm   |
| Power Supply        | 3.3V $\pm 0.2$ V   |
| Power Consumption   | Standby 82mA@3.3V (Max)<br>TX mode 420 mA@3.3V (Max)   |
| Clock Source        | 40MHz  |
| Working Temperature | -10° C to +50° C   |
| Storage Temperature | -40° C to +70° C   |

**ESD CAUTION:** Although this module is designed to be as robust as possible, Electrostatic Discharge (ESD) can damage this module. It must be protected from ESD at all times and handled under the protection of ESD.

### 3.2 DC Power Consumption

|                                |       |      |        |      |
|--------------------------------|-------|------|--------|------|
| Vcc=3.3V, Ta = 25 °C, unit: mA |       |      |        |      |
| Supply current                 | Typ.  |      | Max    |      |
| Standby (RF disabled)          | 95    |      | 105    |      |
| <b>802.11b</b>                 |       |      |        |      |
|                                | 1Mbps |      | 11Mbps |      |
| Supply current                 | Typ.  | Max. | Typ.   | Max. |
| TX mode                        | 341   | 368  | 331    | 381  |
| Rx mode                        | 93    | 126  | 92     | 128  |

| 802.11g          | 6Mbps |      | 54Mbps |      |
|------------------|-------|------|--------|------|
| Supply current   | Typ.  | Max. | Typ.   | Max. |
| TX mode          | 325   | 388  | 240    | 376  |
| Rx mode          | 85    | 112  | 86     | 116  |
| 802.11n HT20     | MCS0  |      | MCS7   |      |
| Supply current   | Typ.  | Max. | Typ.   | Max. |
| TX mode          | 320   | 380  | 239    | 372  |
| Rx mode          | 87    | 112  | 88     | 116  |
| 802.11n HT40     | MCS0  |      | MCS7   |      |
| Supply current   | Typ.  | Max. | Typ.   | Max. |
| TX mode          | 286   | 352  | 215    | 360  |
| Rx mode          | 89    | 116  | 90     | 120  |
| 802.11a          | 6Mbps |      | 54Mbps |      |
| Supply current   | Typ.  | Max. | Typ.   | Max. |
| TX mode          | 340   | 420  | 270    | 380  |
| Rx mode          | 90    | 120  | 91     | 124  |
| 802.11n HT40(5G) | MCS0  |      | MCS7   |      |
| Supply current   | Typ.  | Max. | Typ.   | Max. |
| TX mode          | 320   | 392  | 240    | 384  |
| Rx mode          | 92    | 124  | 93     | 128  |
| 802.11ac         | MCS0  |      | MCS9   |      |
| Supply current   | Typ.  | Max. | Typ.   | Max. |
| TX mode          | 281   | 352  | 254    | 368  |
| Rx mode          | 111   | 144  | 110    | 150  |

### 3.3 RF Specifications

|                             |  |
|-----------------------------|--|
| TX Power                    | 2.4GWIFI:15.95dBm(Max.)<br>5.2GWIFI:12.88dBm(Max.)<br>5.8GWIFI:10.95dBm(Max.)<br>2.4GBT:4.93dBm(Max.)<br>2.4GBLE:3.84dBm(Max.) |
| TX Constellation Error(EVM) | 2.4G:<br>802.11b: <-22dB@11Mbps<br>802.11g: <-28dB@54Mbps  |

|  |   |
|--|---|
|  | 802.11n-HT20: <-28dB@72.2Mbps<br>802.11n-HT40:< -28dB@150Mbps<br>5G:<br>802.11a: <-28dB@54Mbps<br>802.11n-HT20: <-28dB@72.2Mbps<br>802.11n-HT40: <-28dB@150Mbps<br>802.11ac-VHT80:< -32dB@433Mbps |
| Receiver Minimum Input Sensitivity@PER | 1Mbps: -96dBm@PER<8%;<br>11Mbps:-90dBm@PER<8%;<br>54Mbps:-72dBm@PER<10%;<br>150Mbps:-69dBm@PER<10%;<br>433Mbps:-59dBm@PER<10%;  |

## 4. Pin Assignments

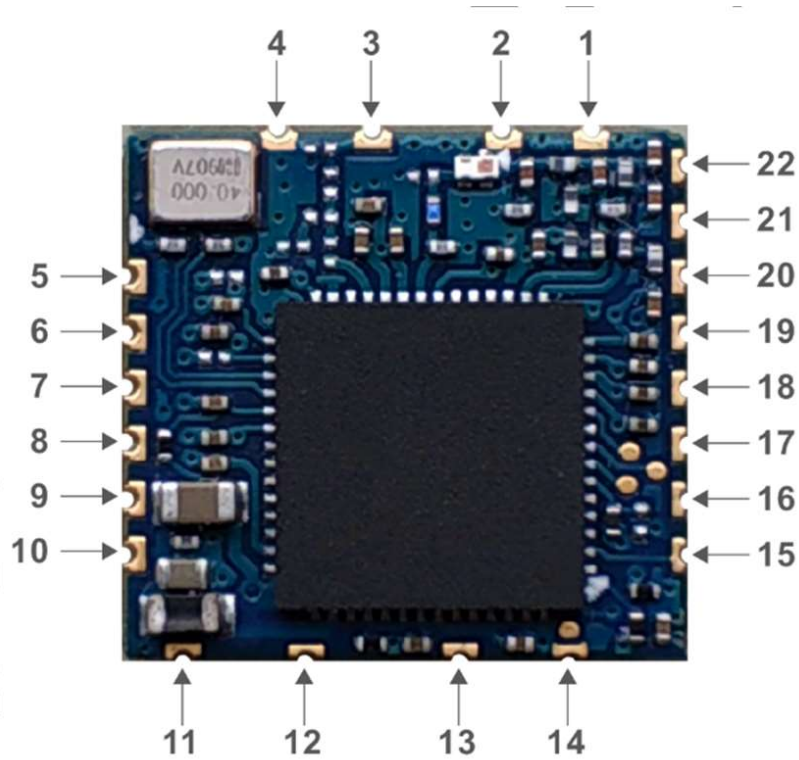


Figure 4 Pin Assignments (Top view)

The following signal type codes are used in the tables:

I:Input

O:Output

O/D: Open Drain

P:Power Pin

| Pin No: | Pin Name | Type | Description           |
|---------|----------|------|-----------------------|
| 1       | GND      | P    | Ground                |
| 2       | RF_0     | I/O  | 2G&5G WIFI and BT ANT |
| 3       | NC       | /    | /                     |
| 4       | GND      | P    | Ground                |

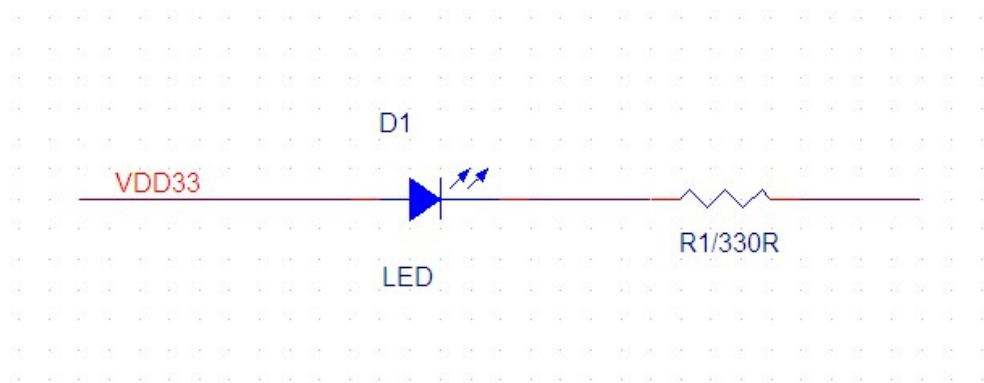


|         |              |     |   |
|---------|--------------|-----|---|
| 5、6、7、8 | NC           | /   | Floating(Don't connected to ground)         |
| 9       | BT_WAKE_HOST | O   | Bluetooth device to wake up HOST            |
| 10      | HOST_WAKE_BT | I   | HOST to wake up Bluetooth device            |
| 11      | VIN          | P   | VDD 3.3V Power Supply                       |
| 12      | USB_DM       | I/O | USB Transmitter/Receiver Differential Pair  |
| 13      | USB_DP       | I/O | USB Transmitter/Receiver Differential Pair  |
| 14      | GND          | P   | ground                                      |
| 15      | 3DD_SYNC     | I/O | PCM_OUT/GPIO1                               |
| 16      | WL_DIS       | I   | WIFI DISABLE (Low potential)                |
| 17      | BT_DIS       | I   | BT DISABLE (Low potential)                  |
| 18      | CHIP_EN      | I   | High asserting for use/ Low asserting reset |
| 19      | HST_WAKE_WL  | I   | HOST to wake up WIFI                        |
| 20      | WL_WAKE_HST  | O   | WIFI to wake up HOST                        |
| 21      | WPS          | I/O | WPS Switch (GPIO)                           |
| 22      | LED          | I/O | External LED Control(GPIO)                  |

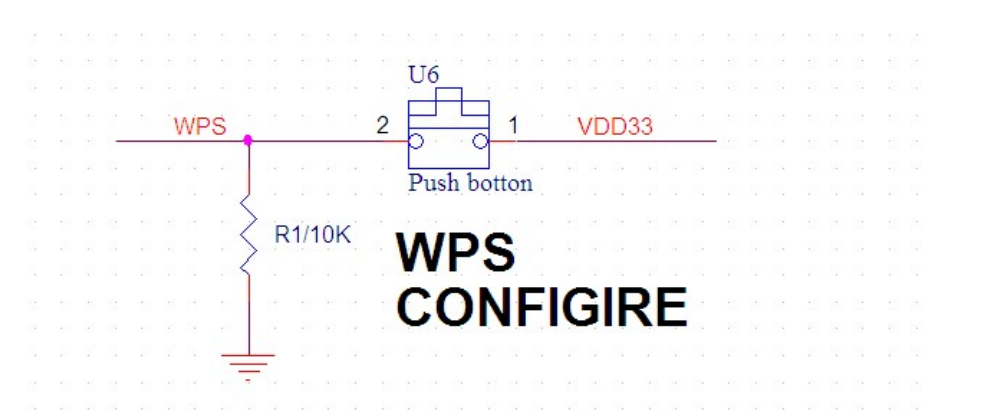
## 5. Application Information

### 5.1 Typical Application Circuit

#### LED Circuit



#### WPS Circuit



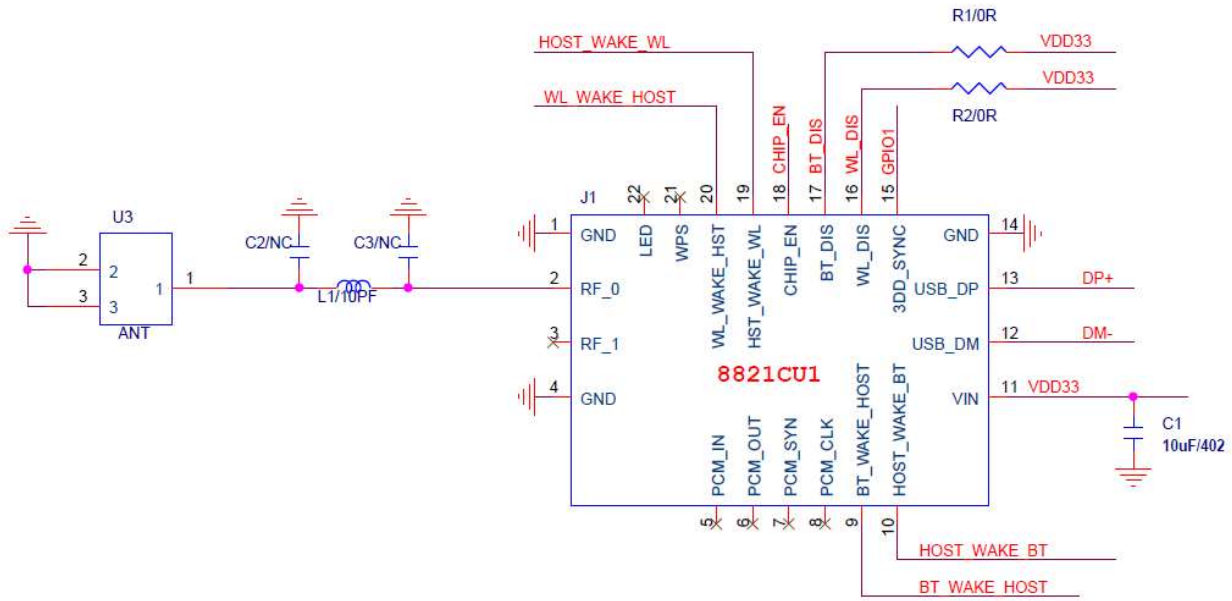


Figure 5 Typical application circuit

### NOTE:

- 1、RF trace need to keep 50 ohm impedance.
- 2、USB differential pair need to keep 90ohm impedance.
- 3、C1 10uF closed to Module pin 11
- 4、Reserved 0R between Module pin 16 pin 17 and Host
- 5、LED active low.

### Recommended alternatives or upgrades

If you just use WiFi (only connect the pin 1/2/11/12/13/14), you can replace it with the following solution:

BL-R7601MU2 / BL-R8188EU1 / BL-R8801MU2

Details please refer to : [www.b-link.net.cn](http://www.b-link.net.cn)

## 6. Mechanical Specifications

Module dimension: Typical ( L\*W \* H): 13.0mm\*12.2mm\*1.50mm Tolerance : +/-0.15mm

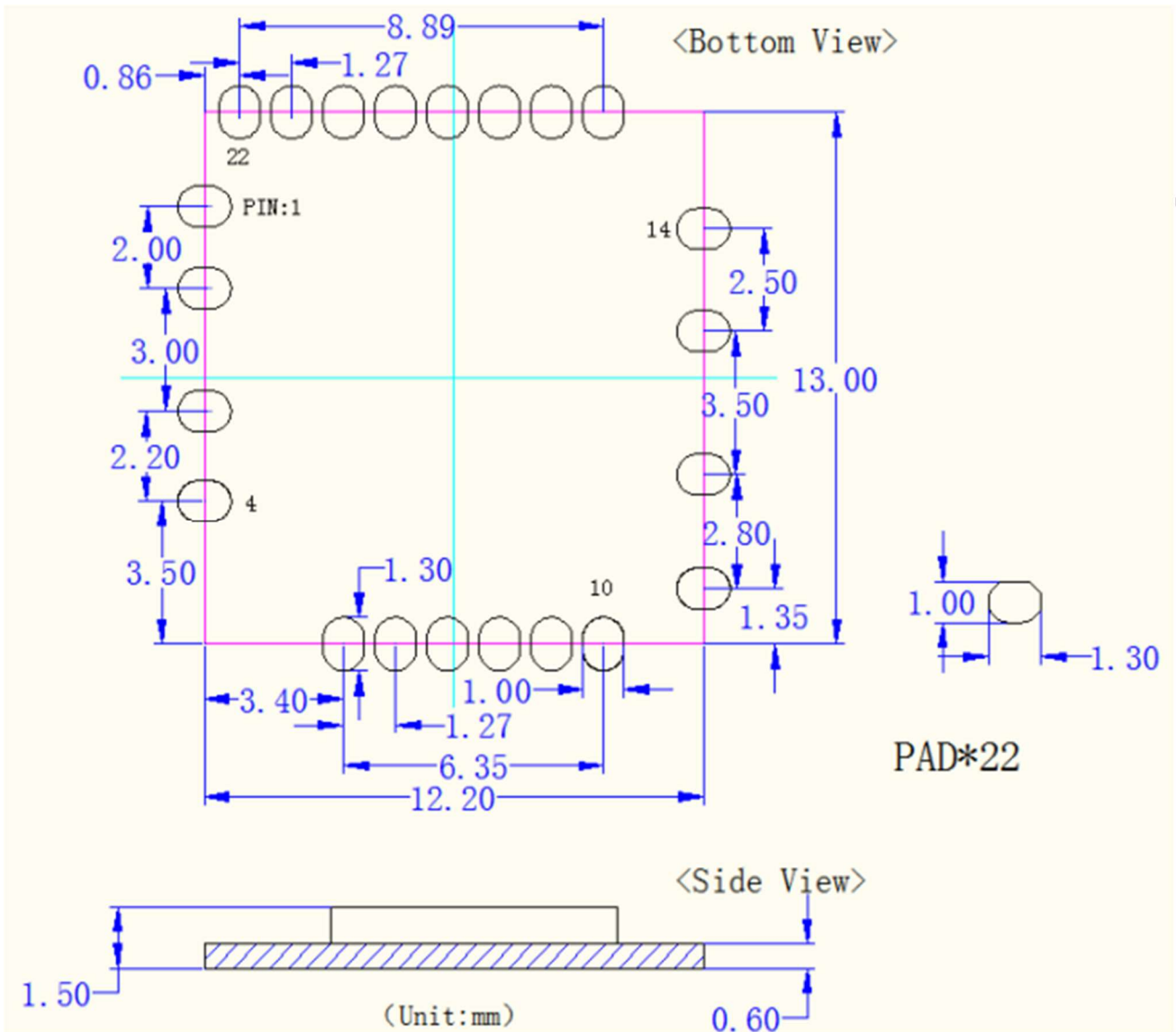


Figure 6 Module dimension

## 7. Others

### 7.1 Package Information



Figure 7 Package Information

## 7.2 Storage Temperature and Humidity

1. Storage Condition: Moisture barrier bag must be stored under 30°C, humidity under 85% RH.  
The calculated shelf life for the dry packed product shall be a 12 months from the bag seal date.  
Humidity indicator cards must be blue, <30%.
2. Products require baking before mounting if humidity indicator cards reads > 30% temp < 30°C, humidity < 70% RH, over 96 hours.  
Baking condition: 125°C, 12 hours.  
Baking times: 1 time.

## 7.3 Recommended Reflow Profile

Reflow soldering shall be done according to the solder reflow profile, Typical Solder Reflow Profile is illustrated in Figures 8. The peak temperature is 245°C.

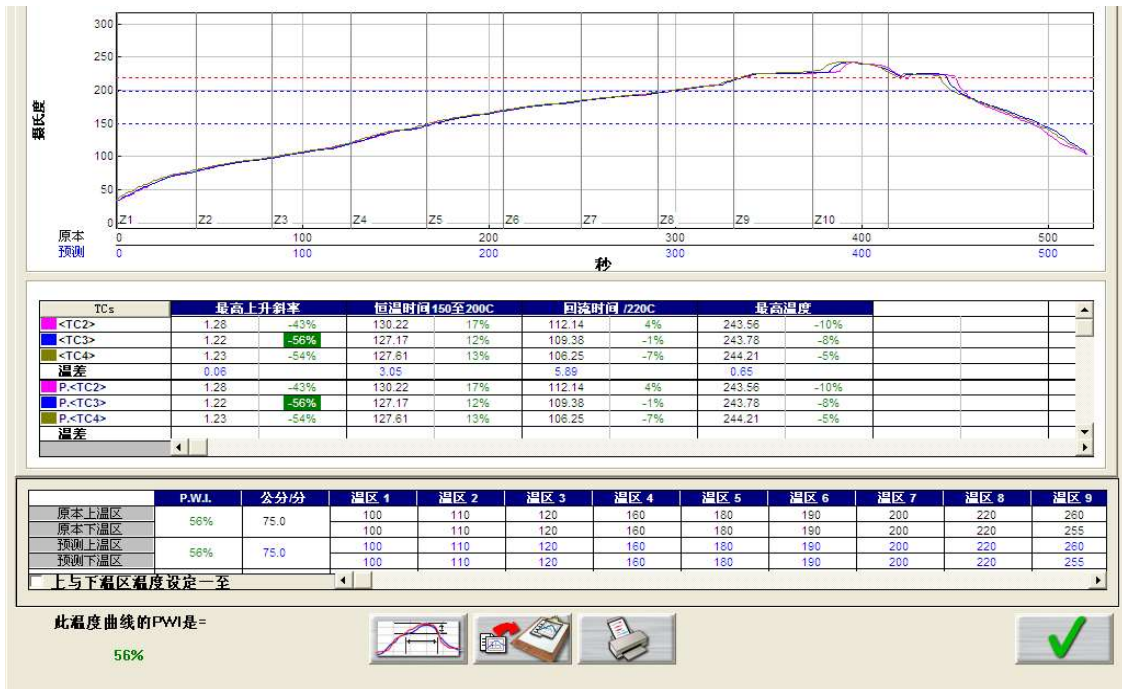


Figure 8 Typical Solder Reflow Profile

### **FCC Statement**

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 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 important announcement

Important Note:

### **Radiation Exposure Statement**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 0cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Country Code selection feature to be disabled for products marketed to the US/Canada.

This device is intended only for OEM integrators under the following conditions:

1. The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2. The transmitter module may not be co-located with any other transmitter or antenna,
3. For all products market in US, OEM has to limit the operation channels in CH1 to CH11 for 2.4G band by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change. (if modular only test Channel 1-11)

As long as the three conditions above are met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

### **Important Note:**

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

### **End Product Labeling**

The final end product must be labeled in a visible area with the following" Contains FCC ID: **2AL6KBL-M8821CU1** "

### **Manual Information to the End User**

The OEM integrator 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 show in this manual.

# Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

## 2.2 List of applicable FCC rules

CFR 47 FCC PART 15 SUBPART C has been investigated. It is applicable to the modular transmitter

## 2.3 Specific operational use conditions

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

## 2.4 Limited module procedures

This module is Limited single modular without shielding, host manufacturer have to consult with module manufacturer for the module limiting conditions when integrate the module in the host. module manufacturer should reviews detailed test data or host designs prior to giving the host manufacturer approval.

## 2.5 Trace antenna designs

Not applicable

## 2.6 RF exposure considerations

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

## 2.7 Antennas

This radio transmitter **2AL6KBL-M8821CU1** has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

| Model           | Type            | Connector | Peak gain ( dBi ) |               |               |               |               |
|-----------------|-----------------|-----------|-------------------|---------------|---------------|---------------|---------------|
|                 |                 |           | 2400-2483.5 MHz   | 5150-5250 MHz | 5250-5350 MHz | 5470-5725 MHz | 5725-5850 MHz |
| 2400-2483.5 MHz | PIFA/<br>Dipole | /         | 2.0dBi            | /             | /             | /             | /             |
| 2.4GWIFI        | PIFA/<br>Dipole | /         | 2.0dBi            | /             | /             | /             | /             |
| 5GWIFI          | PIFA/<br>Dipole | /         | /                 | 2.0dBi        | /             | /             | 2.0dBi        |

## 2.8 Label and compliance information

The final end product must be labeled in a visible area with the following" Contains FCC ID:2AL6KBL-M8821CU1".

## 2.9 Information on test modes and additional testing requirements

Host Host manufacturer which install this modular with limit modular approval should perform the test of radiated emission and spurious emission according to FCC part 15C:15.247&FCC part 15E:15.407 and 15.209 requirement, only if the test result comply with FCC part 15.247&FCC part 15E:15.407 and 15.209 requirement, then the host can be sold legally.

## 2.10 Additional testing, Part 15 Subpart B disclaimer

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B.