

# **RAK473/476 Use Guidance**

## **Cautions to the Design of Hardware**

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## 1. Overview

The document lists the notes in all the stages when the customer uses 473 and 476 WiFi modules to design the products. Customers should read the document carefully at first and take consideration of the potential problems in the hard ware design stage in advance. And try to avoid them, so as to achieve the rapid and massive production. Take the RAK473 module for example for instruction here.

### 1.1 Available module type

RAK473&476 series

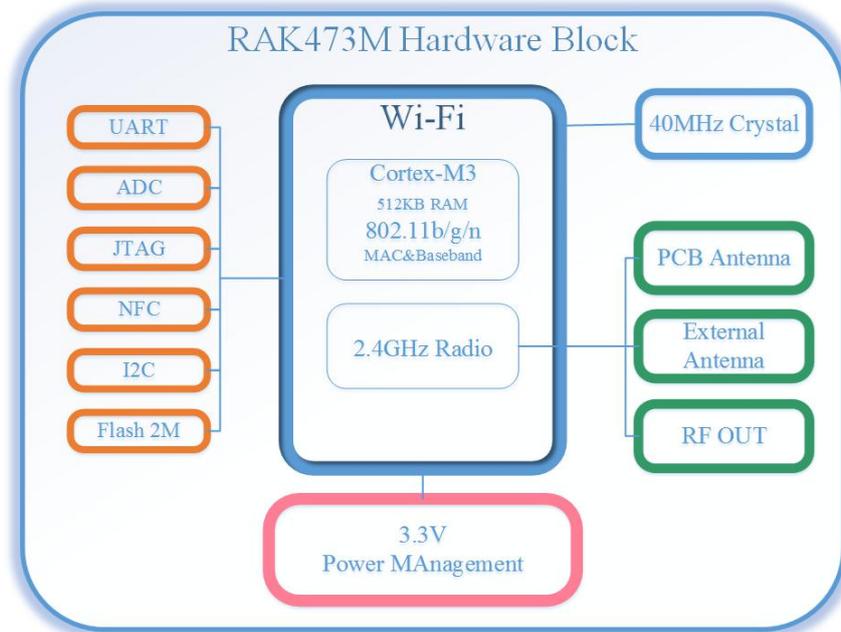
Table 1-1: 473 type list

Series	Model	Antenna	Communication Interface	Remarks
RAK473	473MA	Board PCB antenna	UART	
	473MB	External IPEX interface antenna	UART	
	473MC	RF PUT direct output	UART	The customers draw out the antenna by themselves, and match with 50 ohm impedances
RAK476	476MA	Board PCB antenna	UART	
	476MB	External IPEX interface antenna	UART	
	476MC	RF PUT direct output	UART	The customers draw out the antenna by themselves, and match with 50 ohm impedances

### 1.2 The fundamental features of the module

- Each module has the globally unique MAC ID
- Three kinds of antenna types: PCB antenna, external antenna and directly drawn out antenna
- When carrying out SMT, the module is subjected to 2rd reflow
- Average current 80mA@3.3V
- The module brings OTA mode with itself in delivery

### 1.3 The module brings OTA mode with itself in delivery



## 2. Cautions to the design of hardware

### 2.1 Module figure



Figure 2-1 Front view



Figure 2-2 Back view

### 2.2 Reference packaging design

Figure 2-3 is the recommended packaging dimension drawings of the module in designing the base plate PCB. The resistance welding window and bonding pad are uniform in size.

Tips: There are several test points on the back of our modules. The test points should not contact with the bonding pad or metal objects in designing the base plate PCB.

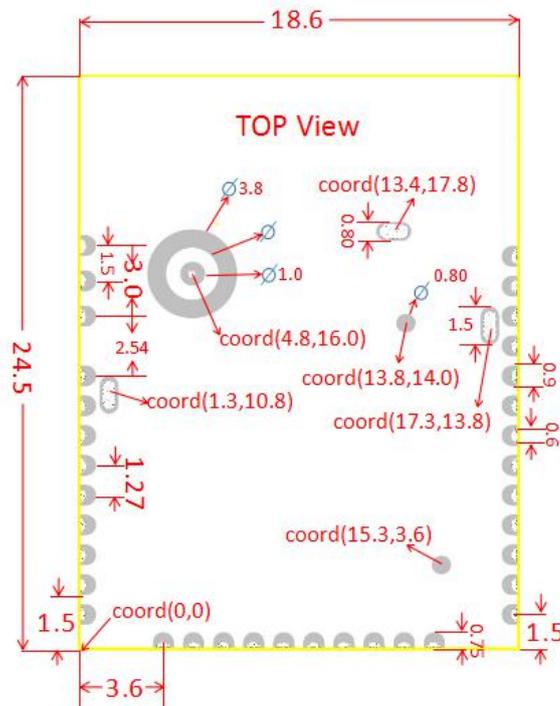


Figure 2-3 Packaging dimension drawing

## 2.3 RF design

In case of using the module of board PCB antenna, you should consider reducing the intervene of external factors on the module signal as far as possible in designing the hard ware.

### 2.3.1 Two methods for reducing the intervene for PCB antenna signal

1. If possible, we can cut the base plate in PCB antenna area, thus being able to reduce the influences of the base plate on the PCB antenna performances as far as possible.
2. If the first method is restricted and cannot be used, please ensure that the module shall not be packed by any metal shell, the PCB antenna area and expanded 15mm areas of the module shall be cleared (copper, routing, and components are strictly prohibited), the schematic diagram is as shown in Figure 2-4.

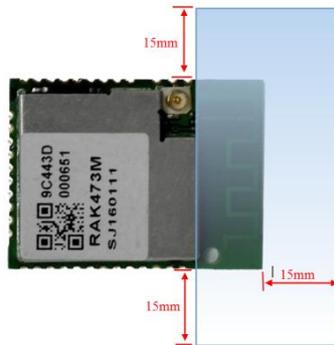


Figure 2-4. Clearance schematic diagram of PCB antenna area

### 2.3.2 The recommended location instruction of the module on the base plate

We recommend the customer to put the module on the following areas of the base plate so as to reduce the influences on the PCB antenna and wireless signal.

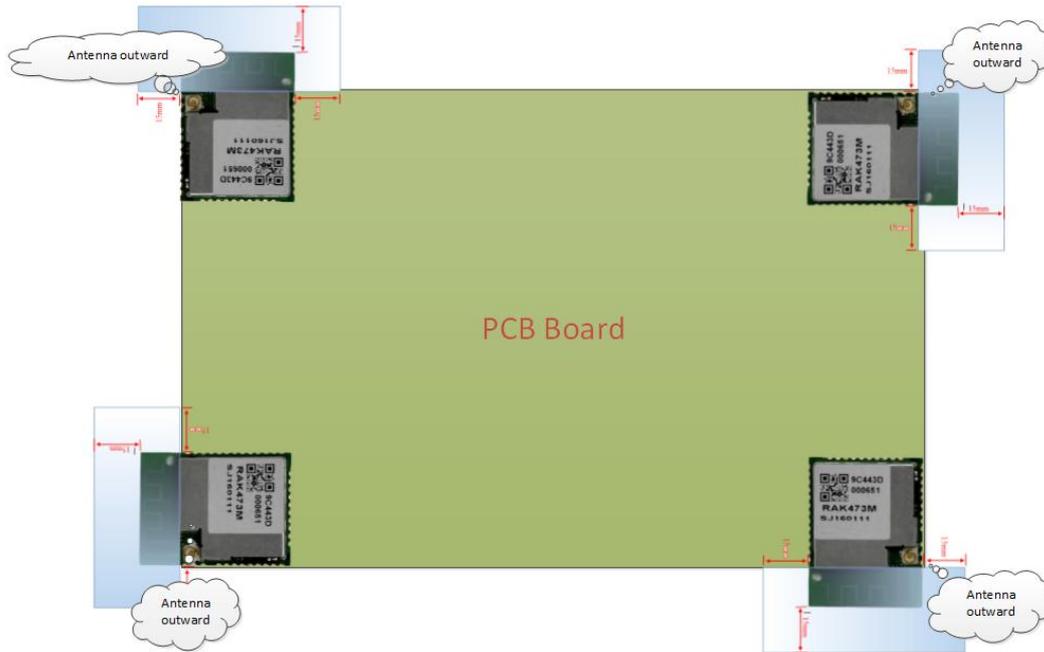


Figure 2-5 Schematic diagram of the module position

### 2.3.3 Antenna connector selection for external antenna module

Figure 2-6 is the size of the module IPEX's antenna connector, when selecting the connectors, you should confirm the connector's coincidence with the suppliers.

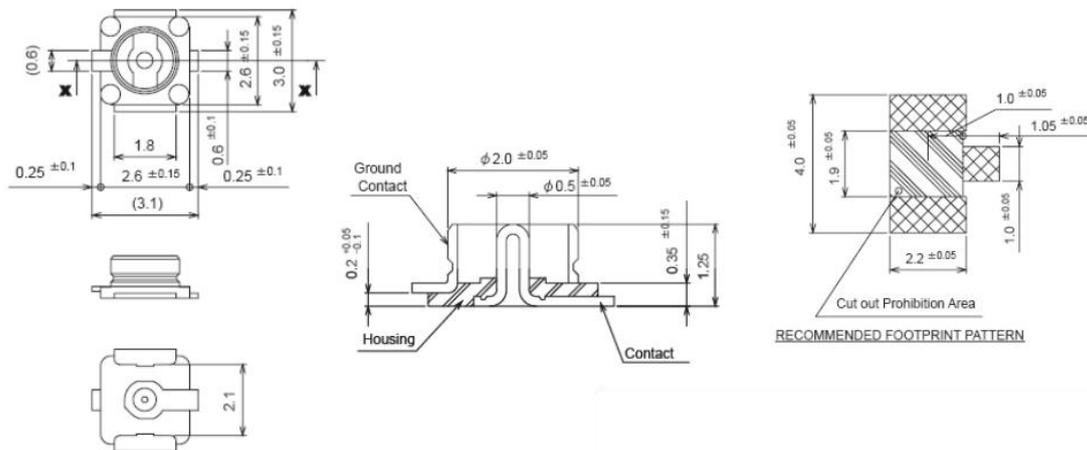


Figure 2-6 Dimensions of the IPEX antenna connector

## 2.4 Design of DC power supply

In order to reduce the probability of problems in the final product, the design of the power supply needs to consider the following issues:

1. Module's peak current is 320mA or so, and we recommend using the DC/DC power chip with maximum output current of over 600mA. Compared to LDO, DC/DC shows the advantages of the module's low power consumption more easily.
2. When using DC/DC, pay attention to wiring; the device shall be compact as far as possible;

the ground for the input and output requires a good connection; the feedback signal should be far away from the inductor and Schottky diode. Please refer to corresponding DC/DC power chip's Datasheets for specific requirements.

3. When using LDO, pay attention to the maximum output current and heat radiation. For example, from 5V to 3.3V, the pressure drop is 1.7V. If the current is 320mA, then the power consumption of LDO converted to heat is:  $1.7V \times 320mA = 544mW$ . Parameters on the LDO Datasheet, namely, Power Dissipation, must be greater than 544mW (the other input voltages are calculated according to this method).

## **2.5 ESD design**

ESD grade of the module: ESD grade of human body model (HBM) is 2000V, the one of the charged device model (CDM) is 500V.

### **2.5.1 The module is directly welded to the board**

If the product has a higher ESD requirement, you should pay special attention to all possible pins contacting with the outside world. If the module is connected to the USB seat, SD card slot and other locations which are to be connected to the plugs, the location of ESD protection devices should be reserved.

### **2.5.2 The module is not directly welded to the board**

If the module is working through the fly line, you should pay attention to the EMI problem. The shielded wires should be used to connect, or position should be reserved for common mode choke coil on the board.

### 3. Cautions for SMT

#### 3.1 Cautions for making steel mesh

- Recommended thickness of the steel mesh: 0.12mm (0.1~0.15mm); use the laser to polish and make holes
- Recommended solder paste: SAC305 lead-free solder paste

#### 3.2 The temperature curve of the reflow flux

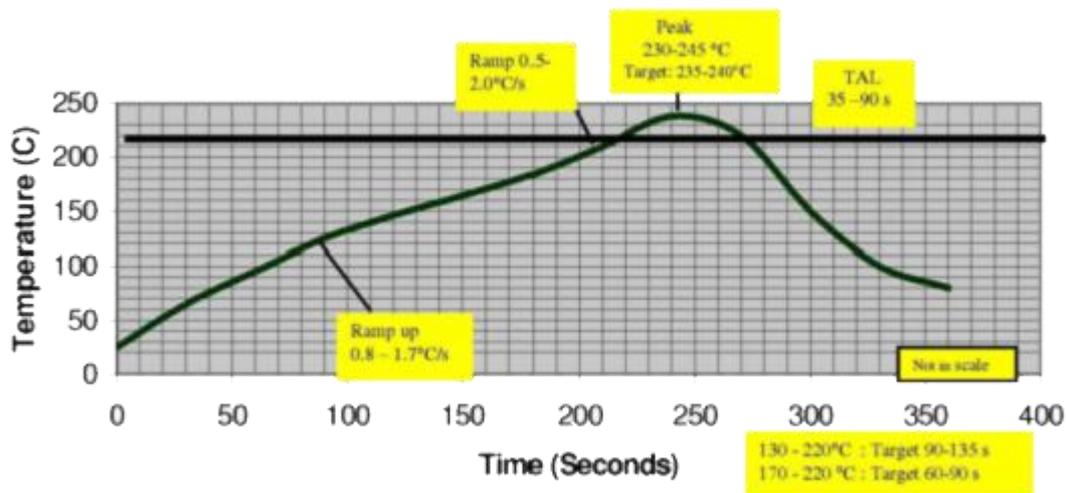


Figure 3-1 Temperature curve of the reflow flux

Remarks:

Figure 3-1 is based on SAC305 lead-free solder paste (3% of silver, 0.5% of copper). The reflow temperature curve of Alfa OM-338 lead-free disposable flux is recommended. The chart is mainly used for reference; the time of whole reflow operation process is based on the bonding pad numbers and device intensity of the assembling plate.

## 4. Version

Version	Author	Date	Content modification
V1.0	Lianbo Wang	2016/02/01	Create a document