tuya | Global Intelligent Platform

Product Manual

Tuya WBR2 Wi-Fi and Bluetooth Module

Version: 2.0.0 **Date: 2019-10-28** **No.: 0000000001**

1. Product Overview

WBR2 is a low-power embedded Wi-Fi and Bluetooth module that Tuya has developed. It consists of a highly integrated RF chip (RTL8720CF) with an embedded Wi-Fi network protocol stack and robust library functions. WBR2 also contains a low-power KM4 microcontroller unit (MCU), a WLAN MAC, a 1T1R capable WLAN baseband, 256 KB static random-access memory (SRAM), 2 MB flash memory, and extensive peripherals.

WBR2 is an RTOS platform that integrates all function libraries of the Wi-Fi MAC and TCP/IP protocols. You can develop embedded Wi-Fi and Bluetooth products as required.

Figure 1-1 shows the WBR2 architecture.

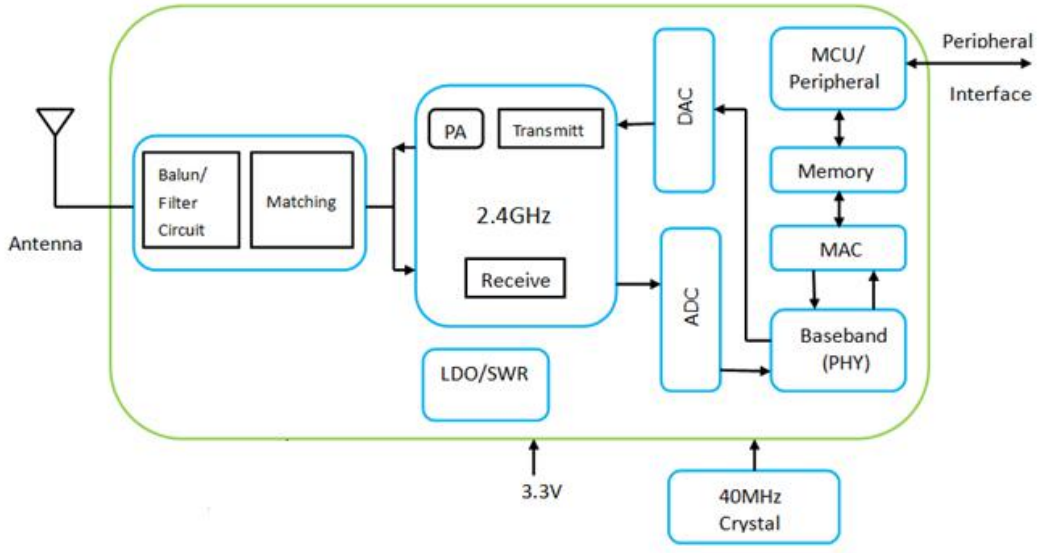

Figure 1-1 WBR2 architecture

1.1 Features

- Embedded low-power KM4 MCU, which can also function as an application processor
  - Clock rate: 100 MHz
- Working voltage: 3.0 V to 3.6 V
- Peripherals: six GPIOs and one universal asynchronous receiver/transmitter (UART)
- Wi-Fi connectivity
  - 802.11b/g/n20
  - Channels 1 to 14 at 2.4 GHz
  - Compatible with Bluetooth low energy (BLE) 4.2(Up to +9dBm EIPR output power)
  - WPA and WPA2 security modes
  - Up to +20 dBm EIRP output power in 802.11b mode
  - EZ net pairing mode for Android and iOS devices
  - Onboard PCB antenna
  - Certified by CE, FCC, and SRRC
  - Working temperature: –20°C to +85°C

1.2 Application Scenarios

- Intelligent building
- Smart household and home appliances
- Smart socket and light
- Industrial wireless control
- Baby monitor
- Network camera
- Intelligent bus

Change History

No.	Date	Change Description	Version After Change
1	2019-10-28	This is the first release.	2.0.0

Contents

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2. Module Interfaces

2.1 Dimensions and Footprint

WBR2 has two rows of pins with a 2 mm pin spacing.

The WBR2 dimensions (H x W x D) are 2.9±0.15 mm x 15±0.35 mm x 18±0.35 mm. Figure 2-1 shows the WBR2 front and rear views.

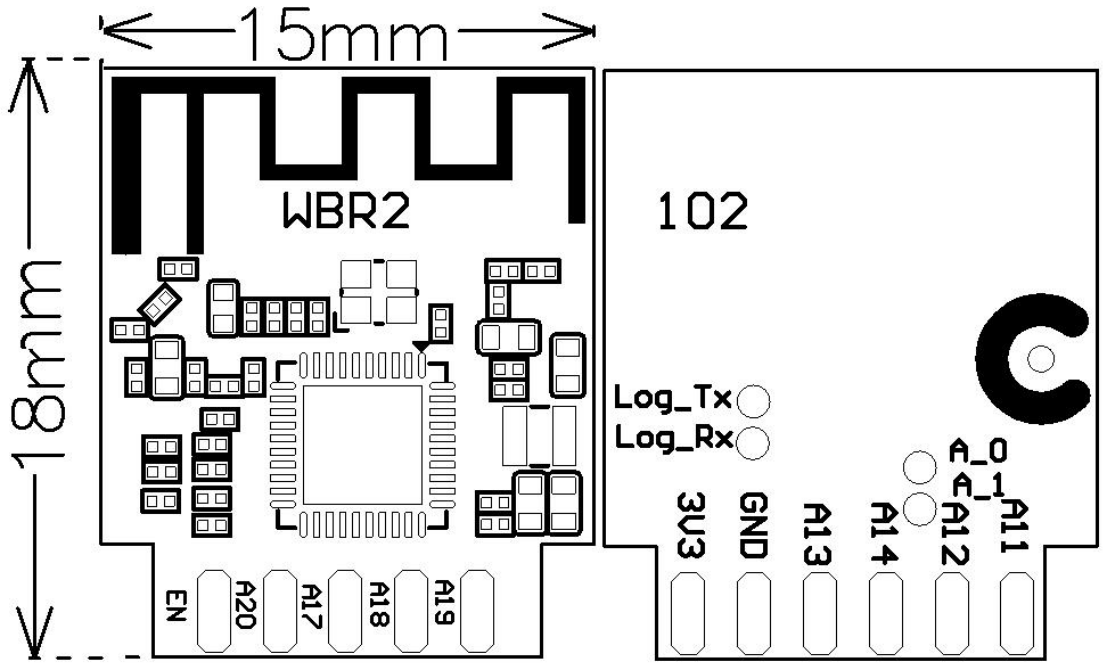

Figure 2-1 WBR2 front and rear views

2.2 Interface Pin Definition

Table 2-1 WBR2 interface pins

Pin No.	Symbol	I/O Type	Function
1	3V3	N/A	Power supply pin (3.3 V)
2	A19	I/O	GPIOA_19, hardware PWM pin, which is connected to pin 40 on the internal IC

Pin No.	Symbol	I/O Type	Function
3	GND	P	Power supply reference ground pin
4	A18	I/O	GPIOA_18, hardware PWM pin, which is connected to pin 39 on the internal IC
5	A13	I/O	GPIOA_13, user-side serial interface pin (UART0_RXD)
6	A17	I/O	GPIOA_17, hardware PWM pin, which is connected to pin 38 on the internal IC
7	A14	I/O	GPIOA_14, user-side serial interface pin (UART0_TXD)
8	A20	I/O	GPIOA_20, common GPIO, which is connected to pin 1 on the internal IC
9	A12	I/O	GPIOA_12, hardware PWM pin, which is connected to pin 26 on the internal IC
10	EN	I/O	Enable pin, which is active at a high level (The pin has been pulled up and is externally controllable.)
11	A11	I/O	GPIOA_11, hardware PWM pin, which is connected to pin 25 on the internal IC

Note:

P indicates a power supply pin, and **I/O** indicates an input/output pin.

3. Electrical Parameters

3.1 Absolute Electrical Parameters

Table 3-1 Absolute electrical parameters

Parameter	Description	Minimum Value	Maximum Value	Unit
Ts	Storage temperature	–40	105	°C
VDD	Power supply voltage	–0.3	3.6	V

Parameter	Description	Minimum Value	Maximum Value	Unit
Static electricity voltage (human body model)	Tamb = 25°C	N/A	2	kV
Static electricity voltage (machine model)	Tamb = 25°C	N/A	0.5	kV

3.2 Working Conditions

Table 3-2 Normal working conditions

Parameter	Description	Minimum Value	Typical Value	Maximum Value	Unit
Ta	Working temperature	–20	N/A	85	°C
VDD	Working voltage	3.0	N/A	3.6	V
V_{IL}	I/O low-level input	N/A	N/A	0.8	V
V_{IH}	I/O high-level input	2.0	N/A	N/A	V
V_{OL}	I/O low-level output	N/A	N/A	0.4	V
V_{OH}	I/O high-level output	2.4	N/A	N/A	V
Imax	I/O drive current	N/A	N/A	16	mA
C_{pad}	Input pin capacitance	N/A	2	N/A	pF

3.3 RF Current Consumption

Table 3-3 Current consumption during constant transmission

Symbol	Mode	Power	Typical Value	Peak Value	Unit
I_{RF}	802.11b 11 Mbit/s	17 dBm	217	268	mA
I_{RF}		18 dBm	231	283	mA
I_{RF}	802.11g	15 dBm	159	188	mA

Symbol	Mode	Power	Typical Value	Peak Value	Unit
I_{RF}	54 Mbit/s	17.5 dBm	177	213	mA
I_{RF}	802.11n BW20 MCS7	13 dBm	145	167	mA
I_{RF}		16.5 dBm	165	193	mA

Table 3-4 Current consumption during constant receiving

Symbol	Mode	Typical Value	Peak Value	Unit
IRF	802.11b 11 Mbit/s	63	65	mA
IRF	802.11g 54 Mbit/s	65	67	mA
IRF	802.11n HT20 MCS7	65	67	mA

3.4 Working Current

Table 3-5 Working current

Working Mode	Working Status (Ta = 25°C)	Typical Value	Peak Value	Unit
EZ	The module is in EZ mode, and the Wi-Fi indicator blinks quickly.	75	324	mA
Connected and idle	The module is connected to the network, and the Wi-Fi indicator is steady on.	64	314	mA
Connected and operating	The module is connected to the network, and the Wi-Fi indicator is steady on.	66	305	mA
Disconnected	The module is disconnected from the network, and the Wi-Fi indicator is steady off.	66	309	mA

4. RF Features

4.1 Basic RF Features

Table 4-1 Basic RF features

Parameter	Description
Frequency range	Bluetooth:2.400 GHz to 2.4835 GHz Wi-Fi:2.412 GHz to 2.484 GHz
Wi-Fi standard	IEEE 802.11b/g/n (channels 1 to 14,Ch1-11 for US/CA,Ch1-13 for EU/CN)
Data transmission rate	802.11b: 1, 2, 5.5, or 11 (Mbit/s) 802.11g: 6, 9, 12, 18, 24, 36, 48, or 54 (Mbit/s) 802.11n: HT20 MCS0 to MCS7;
Antenna type	PCB antenna

4.2 TX Performance

Table 4-2 Performance during constant transmission

Parameter		Minimum Value	Typical Value	Maximum Value	Unit
Average RF output power, 802.11b CCK mode	1 Mbit/s	N/A	17.5	N/A	dBm
Average RF output power, 802.11g OFDM mode	54 Mbit/s	N/A	14.5	N/A	dBm
Average RF output power, 802.11n OFDM mode	MCS7	N/A	13.5	N/A	dBm
Frequency error		–20	N/A	+20	ppm
EVM under 802.11b CCK, 11 Mbit/s, 17.5 dBm				–10	dB
EVM under 802.11g OFDM, 54 Mbit/s, 14.5 dBm				–29	dB
EVM under 802.11n OFDM, MCS7, 13.5 dBm				–30	dB

4.3 RX Performance

Table 4-3 RX sensitivity

Parameter		Minimum Value	Typical Value	Maximum Value	Unit
PER < 8%, 802.11b CCK mode	1 Mbit/s	N/A	–91	N/A	dBm
PER < 10%, 802.11g OFDM mode	54 Mbit/s	N/A	–75	N/A	dBm
PER < 10%, 802.11n OFDM mode	MCS7	N/A	–72	N/A	dBm

5. Antenna Information

5.1 Antenna Type

WBR2 uses an onboard PCB antenna with a gain of 2.5 dBi.

5.2 Antenna Interference Reduction

To ensure optimal Wi-Fi performance when the Wi-Fi and Bluetooth module uses an onboard PCB antenna, it is recommended that the antenna be at least 15 mm away from other metal parts.

6. Packaging Information and Production Instructions

6.1 Mechanical Dimensions

The PCB dimensions (H x W x D) are 0.8±0.1 mm x 15±0.35 mm x 18±0.35 mm, as shown in Figure 6-1.

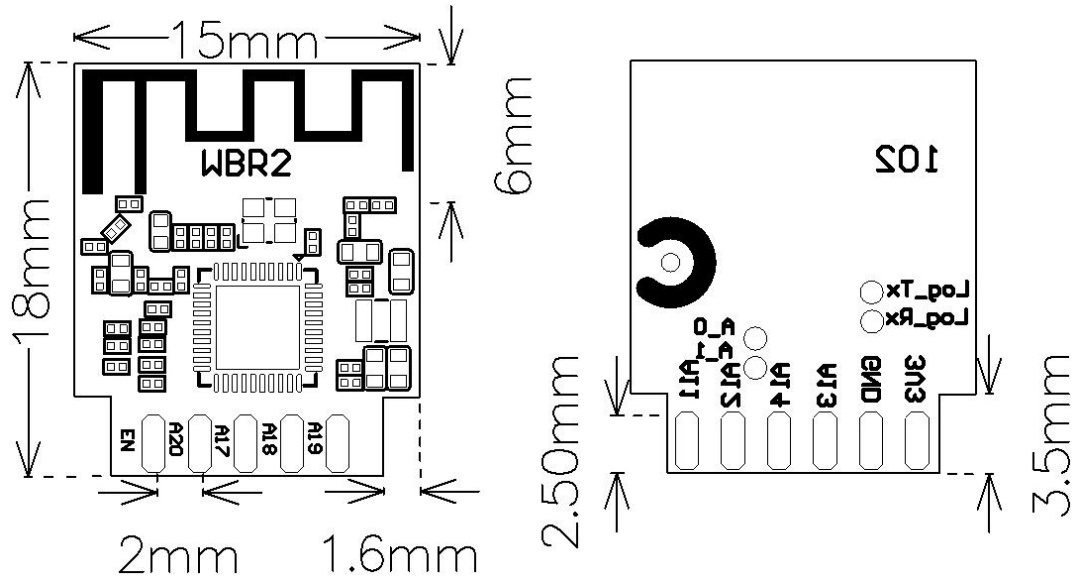

Figure 6-1 WBR2 mechanical dimensions

6.2 Recommended PCB Layout

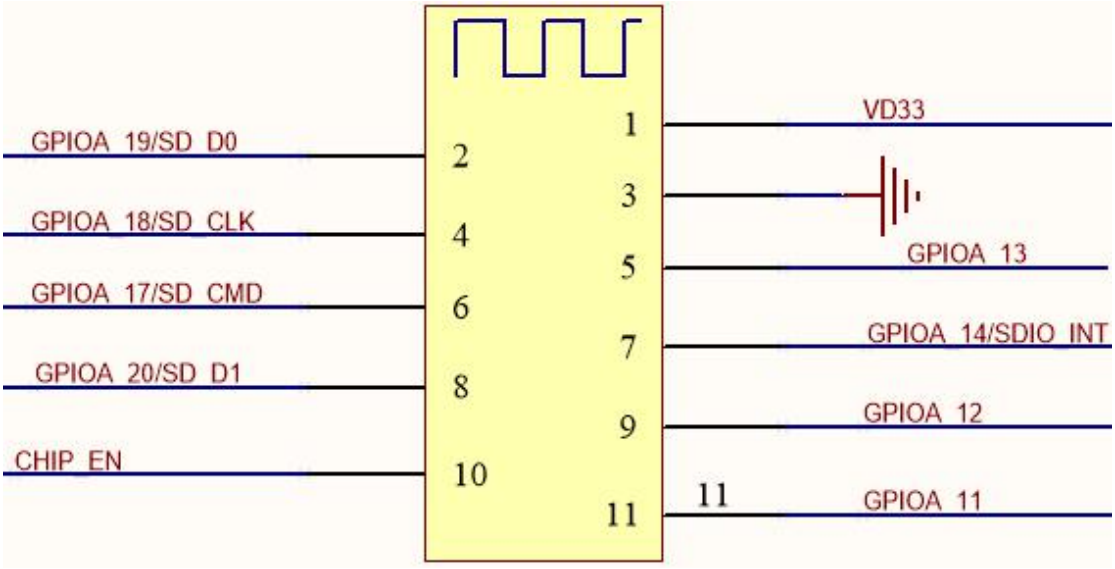

Figure 6-2 WBR2 pins

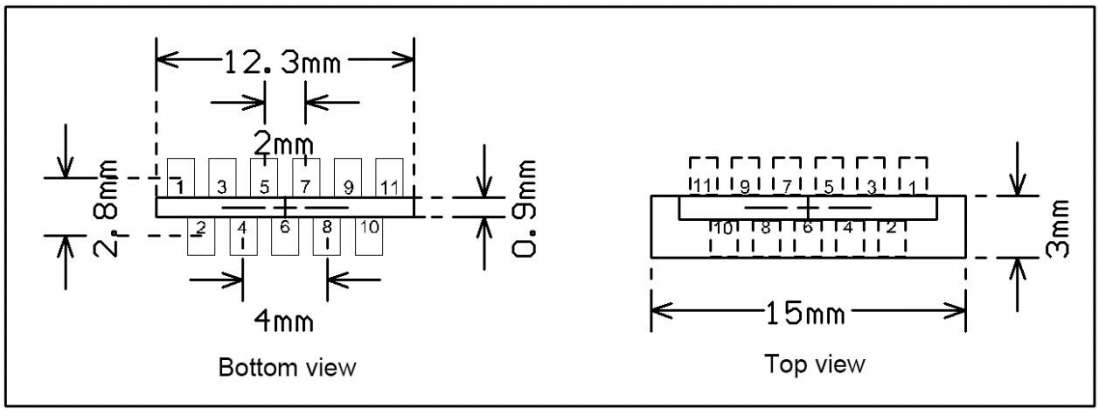

Figure 6-3 Top and bottom views of the PCB to which WBR2 applies

6.3 Production Instructions

1. Preferentially use the wave soldering machine to solder the module, which is recommended for Tuya-developed modules that are through-hole mounted onto PCBs. Use hand soldering only when there is no operational wave soldering machine. Complete soldering within 24 hours after the module is unpacked. If not, vacuum pack the module again.

   (1) Required materials for soldering:

   i. Wave soldering machine

   ii. Wave soldering fixture

   iii. Constant-temperature iron

   iv. Wave solder bar, wire, and flux

   v. Oven temperature tester

   (2) Baking equipment:

   i. Cabinet oven

   ii. Anti-static heat-resistant trays

   iii. Anti-static heat-resistant gloves

2. Bake the module if any of the following conditions is met:

   (1) The vacuum package is damaged before the module is unpacked.

   (2) The package does not contain a humidity indicator card (HIC).

(3) After the module is unpacked, the HIC shows that the 30% and higher rate circles are pink.

(4) Production is not completed within 72 hours after the module is unpacked.

(5) The module has been packed for more than six months.

3. Baking settings:

(1) Baking temperature: 65±5°C in reel pack mode and 125±5°C in tray pack mode

(2) Baking time: 48 hours in reel pack mode and 12 hours in tray pack mode

(3) Alarm temperature: 70°C in reel pack mode and 130°C in tray pack mode

(4) Production ready temperature after natural cooling: < 36°C

(5) Number of baking times: 1

(6) Rebaking condition: Production is not completed within 72 hours after baking.

4. Do not wave solder modules that have been unpacked for over three months. Electroless nickel immersion gold (ENIG) is used for the PCBs. If the solder pads are exposed to the air for over three months, they will be oxidized severely and dry joints or solder skips may occur. Tuya is not liable for such problems and consequences.

5. Throughout the production process, take electrostatic discharge (ESD) protective measures.

6. For a good product quality, ensure that the following items meet requirements:

(1) Flux amount

(2) Wave height

(3) Amount of tin dross and copper in the solder pot

(4) Wave soldering fixture window and thickness

(5) Oven temperature curve for wave soldering

6.4 Recommended Oven Temperature Curve and Soldering Temperature

Set the oven temperature to a value recommended for wave soldering. The peak temperature is 260±5°C. Figure 6-4 shows the oven temperature curve for wave soldering.

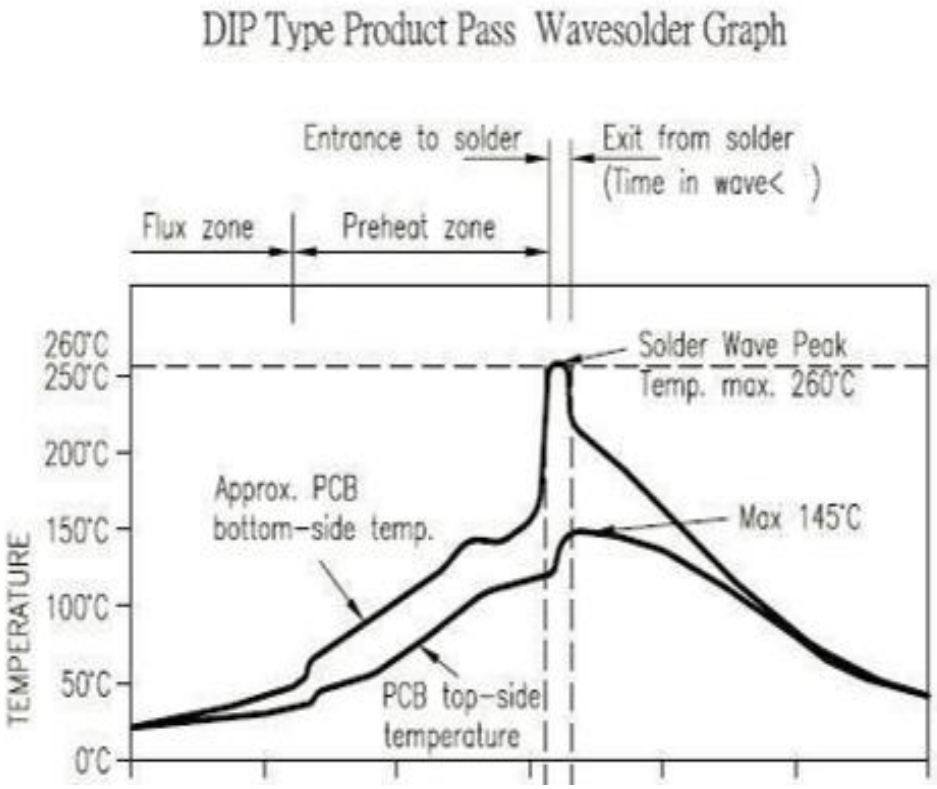

Figure 6-4 Oven temperature curve

Table 6-1 Recommended wave soldering temperature

Wave Soldering		Hand Soldering	
Preheat temperature	80°C to 130°C	Wave soldering temperature	360±20°C
Preheat time	75s to 100s	Soldering time	< 3s per point
Contact time	3s to 5s	N/A	N/A
Solder pot temperature	260±5°C	N/A	N/A
Temperature increase rate	≤ 2°C per second	N/A	N/A
Temperature drop rate	≤ 6°C per second	N/A	N/A

6.5 Storage Conditions

Storage conditions for a delivered module are as follows:

1. The moisture-proof bag is placed in an environment where the temperature is below 30°C and the relative humidity is lower than 70%.
2. The shelf life of a dry-packaged product is six months from the date when the product is packaged and sealed.
3. The package contains a HIC.

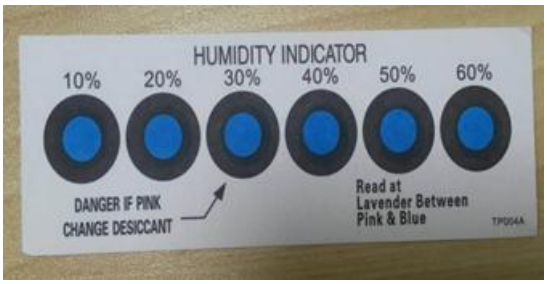

Figure 6-5 HIC for WBR2

CAUTION

This bag contains
MOISTURE-SENSITIVE DEVICES

LEVEL 3

If Blank, see adjacent bar code label

1. Calculated shelf life in sealed bag: 12 months at < 40°C and < 90% relative humidity (RH)

2. Peak package body temperature: 260 °C
   If Blank, see adjacent bar code label

3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must
   a) Mounted within: 168 hrs. of factory conditions
      If Blank, see adjacent bar code label
      ≤ 30°C/60%RH, OR
   b) Stored at <10% RH

4. Devices require bake, before mounting, if:
   a) Humidity Indicator Card is > 10% when read at 23 ± 5°C
   b) 3a or 3b not met.

5. If baking is required, devices may be baked for 48 hrs. at 125 ± 5°C

   Note: If device containers cannot be subjected to high temperature or shorter bake times are desired, reference IPC/JEDEC J-STD-033 for bake procedure

Bag Seal Date: _____
If Blank, see adjacent bar code label

Note: Level and body temperature defined by IPC/JEDEC J-STD-020

7. MOQ and Packing Information

8. Appendix: Statement

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.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.

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.

Radiation Exposure Statement

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

Important Note

This radio module must not installed to co-locate and operating simultaneously with other radios in host system except in accordance with FCC multi-transmitter product procedures. Additional testing and equipment authorization may be required to operating simultaneously with other radio.

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 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. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

The end user manual shall include all required regulatory information/warning as shown in this manual, including: This product must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

This device have got a FCC ID：2ANDL-WBR2.The final end product must be labeled in a visible area with the following: “Contains Transmitter Module FCC ID:2ANDL-WBR2”

This device is intended only for OEM integrators under the following conditions:
1) The antenna must be installed such that 20cm is maintained between the antenna and users, and
2) The transmitter module may not be co-located with any other transmitter or antenna.
As long as 2 conditions above are met, further transmitter test 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.

Declaration of Conformity European notice

Hereby, Hangzhou Tuya Information Technology Co., Ltd declares that this module product is in compliance with essential requirements and other relevant provisions of Directive 2014/53/EU,2011/65/EU.A copy of the Declaration of conformity can be found at https://www.tuya.com

This product must not be disposed of as normal household waste, in accordance with EU directive for waste electrical and electronic equipment (WEEE- 2012/19/EU). Instead， it should be disposed of by returning it to the point of sale, or to a municipal recycling collection point.