



# WBRG1 Module Datasheet

Device Development > Cloud Module > Wi-Fi & BLE Dual Mode

Module

Version: 20201104

[Online Version](#)

## Contents

|          |  |           |
|----------|--|-----------|
| <b>1</b> | <b>Product overview</b>                                  | <b>1</b>  |
| 1.1      | Features . . . . .                                       | 1         |
| 1.2      | Applications . . . . .                                   | 1         |
| 1.3      | Change history . . . . .                                 | 2         |
| <b>2</b> | <b>Module interfaces</b>                                 | <b>2</b>  |
| 2.1      | Dimensions and package . . . . .                         | 2         |
| 2.2      | Pin definition . . . . .                                 | 4         |
| <b>3</b> | <b>Electrical parameters</b>                             | <b>9</b>  |
| 3.1      | Absolute electrical parameters . . . . .                 | 9         |
| 3.2      | Normal working conditions . . . . .                      | 9         |
| 3.3      | TX power consumption . . . . .                           | 10        |
| 3.4      | RX power consumption . . . . .                           | 11        |
| 3.5      | Power consumption in working mode . . . . .              | 11        |
| <b>4</b> | <b>RF parameters</b>                                     | <b>14</b> |
| 4.1      | Basic RF features . . . . .                              | 14        |
| 4.2      | TX performance . . . . .                                 | 14        |
| 4.3      | RX performance . . . . .                                 | 15        |
| <b>5</b> | <b>Antenna</b>   | <b>17</b> |
| 5.1      | Antenna type . . . . .                                   | 17        |
| 5.2      | Antenna interference reduction . . . . .                 | 17        |
| 5.3      | U.FL RF connector . . . . .                              | 19        |
| <b>6</b> | <b>Packaging information and production instructions</b> | <b>21</b> |
| 6.1      | Mechanical dimensions . . . . .                          | 21        |
| 6.2      | The diagram of PCB packaging . . . . .                   | 22        |
| 6.3      | Mounting requirements . . . . .                          | 22        |
| 6.4      | Storage conditions . . . . .                             | 23        |
| 6.5      | Baking requirements . . . . .                            | 24        |
| 6.6      | Baking settings . . . . .                                | 24        |
| 6.7      | Recommended oven temperature curve . . . . .             | 25        |



|   |           |
|---|-----------|
| 6.8 Storage conditions . . . . .  | 26        |
| <b>7 MOQ and packaging information</b>                                  | <b>27</b> |
| <b>8 Appendix: Statement</b>  | <b>27</b> |
| 8.1 Federal Communications Commission (FCC) Declaration of Conformity . | 27        |
| 8.2 Declaration of Conformity European notice . . . . .                 | 29        |

## 1 Product overview

WBRG1 is a low-power embedded Wi-Fi module that Tuya has developed. It consists of a highly integrated wireless RF chip (RTL8721CSM) and an external flash chip, with an embedded Wi-Fi network protocol stack and varied library functions. With the maximum CPU clock rate of 200 MHz, WBRG1 also contains a KM4 microcontroller unit (MCU), a low-power KM0 MCU, a WLAN MAC, a 1T1R WLAN module, a 4-MB pseudo-static random-access memory (PSRAM), 8-MB flash memory, and rich extensive peripherals.

WBRG1 is an RTOS platform that integrates all function libraries of the Wi-Fi MAC and TCP/IP. You can develop embedded Wi-Fi products as required.

### 1.1 Features

- Embedded low-power 32-bit Cortex-M33 CPU, which can also function as an application processor
- The maximum clock rate: 200 MHz
- Working voltage: 3.0V to 3.6V
- Peripherals: 6 pulse width modulations (PWM), 3 universal asynchronous receiver/transmitters (UART), 1 inter-IC sound (I2S), 1 packet traffic arbitration (PTA), and 1 audio
- Wi-Fi/BT connectivity
  - 802.11 b/g/n20/n40
  - Channels 1 to [14@2.4](#) GHz (CH 1 to 11 for US/CA, and CH 1 to 13 for EU/CN)
  - Support WEP, WPA, WPA2, and WPA2 PSK (AES) security modes
  - Support BLE (Bluetooth Low Energy) 5.0
  - Up to + 20dBm output power in 802.11b mode
  - Support SmartConfig and AP network configuration modes for Android and IOS devices
  - Onboard PC antenna and external antenna IPEX connector
  - Working temperature: -20°C to 85°C

### 1.2 Applications

- Intelligent building

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

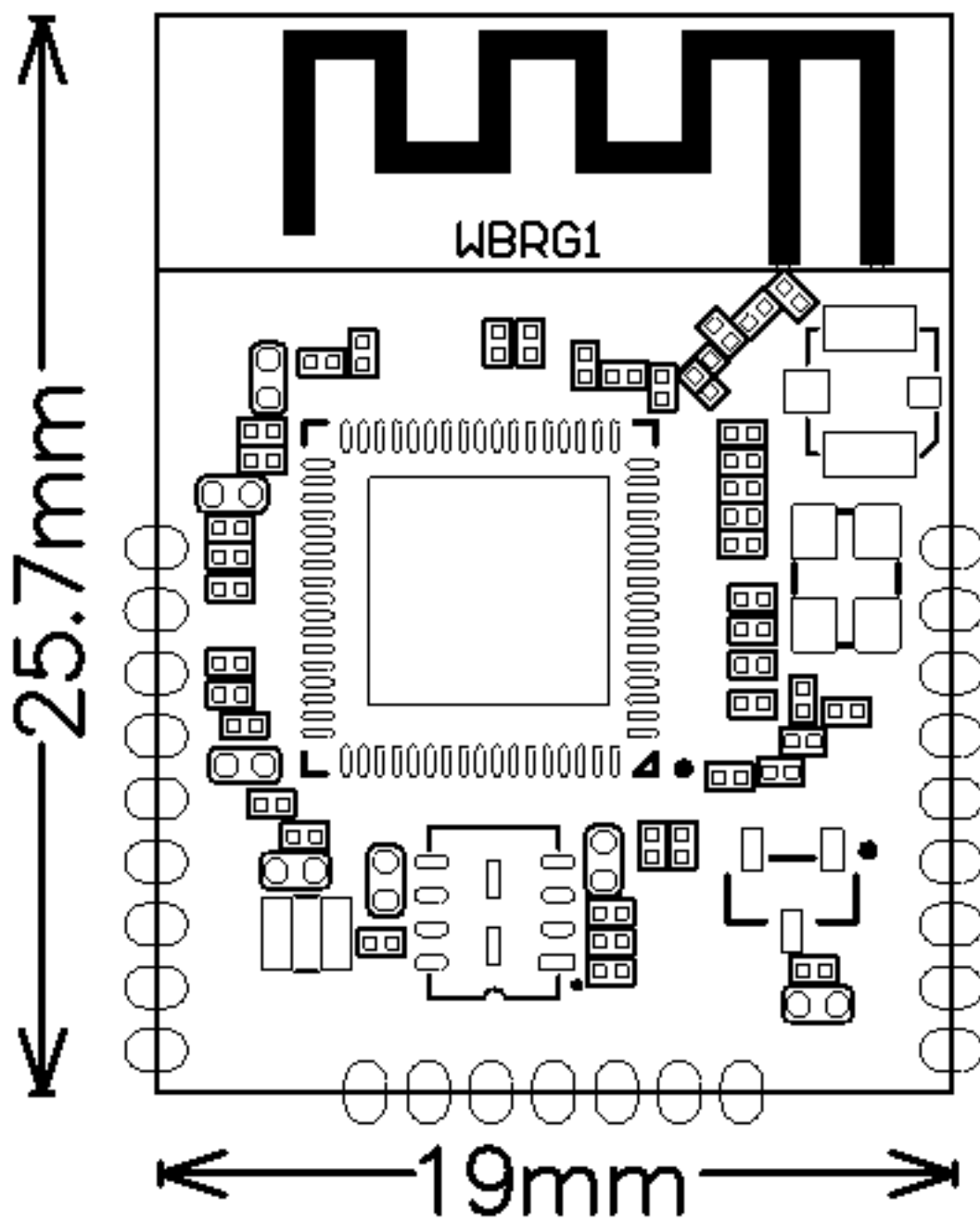
### 1.3 Change history

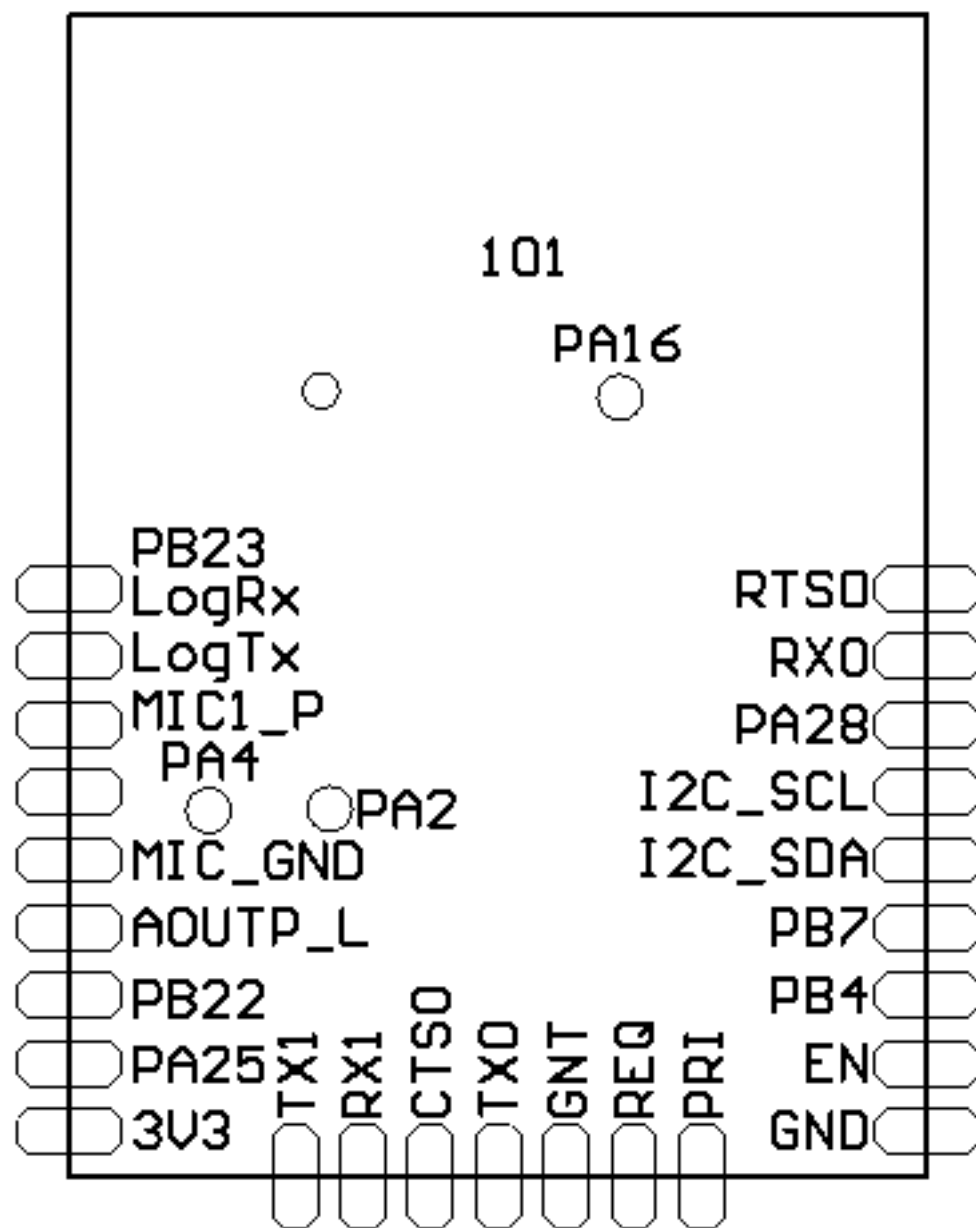
| Update date | Updated content    | Version after update |
|-------------|--------------------|----------------------|
| 10/10/2020  | The first release. | V1.0.0               |

## 2 Module interfaces

### 2.1 Dimensions and package

WBRG1 has 3 rows of pins with a 1.5 mm pin spacing. As shown in the following figures, the dimensions of WBRG1 are  $19\pm0.35$  mm (W)  $\times$   $25.7\pm0.35$  mm (L)  $\times$   $2.9\pm0.1$  mm (H). The thickness of the PCB is  $0.8\pm0.1$  mm.





## 2.2 Pin definition

| Symbol  | I/O type | Function   |
|---------|----------|--|
| RTS0    | I/O      | PA 16, which corresponds to Pin 29 and is a serial port Uart0 flow control request-to-send pin |
| RX0     | I/O      | PA 19, which corresponds to Pin 32 and Uart0_RX and is the docking serial port of a user's MCU |
| PA28    | I/O      | PA 28, which corresponds to Pin 38, is a hardware PWM and can be configured as a GPIO          |
| I2C_SCL | I/O      | PB 5, which corresponds to Pin 45 and can be configured as an I2C or GPIO                      |
| I2C_SDA | I/O      | PB 6, which corresponds to Pin 46 and can be configured as an I2C or GPIO                      |
| PB7     | I/O      | PB7, which corresponds to Pin 47, is a hardware PWM and can be configured as a GPIO            |
| PB4     | I/O      | PB4, which corresponds to Pin 44, is a hardware PWM and can be configured as a GPIO            |



| Symbol | I/O type | Function  |
|--------|----------|---|
| EN     | P        | Enabling pin, which works at the voltage of 3.3V and is pulled up                             |
| GND    | P        | Power supply reference ground   |
| PRI    | I/O      | PB1, which corresponds to Pin 41 and has the PTA_PRI function                                 |
| REQ    | I/O      | PA26, which corresponds to Pin 39 and has the PTA_REQ function                                |
| GNT    | I/O      | PA27, which corresponds to Pin 33 and has the PTA_GNT function                                |
| TX0    | I/O      | PA18, which corresponds to Pin 31 and Uart0_TX and is the docking serial port of a user's MCU |
| CTS0   | I/O      | PA17, which corresponds to Pin 30 and is a serial port Uart0 flow control clear-to-send pin   |
| RX1    | I/O      | PA13, which corresponds to Pin 26 and Uart1_RX and is the docking serial port of a user's MCU |
| TX1    | I/O      | PA12, which corresponds to Pin 25 and Uart1_TX and is the docking serial port of a user's MCU |
| 3V3    | P        | Power supply pin (3.3V)   |

| Symbol  | I/O type | Function   |
|---------|----------|--|
| PA25    | I/O      | PA 25, which corresponds to Pin 40, is a hardware PWM and can be configured as a GPIO      |
| PB22    | I/O      | PB 22, which corresponds to Pin 60, is a hardware PWM and can be configured as a GPIO      |
| AOUTP_L | I/O      | PB31, which corresponds to Pin 65, audio's analog output positive electrode (left channel) |
| MIC GND | I/O      | MIC_GND  |
| MIC1_P  | I/O      | PA4, which corresponds to Pin 3, the input positive electrode of MIC1, main MIC            |
| Log TX  | I/O      | PA7, which corresponds to Pin 7 and is used to print system logs                           |
| Log Rx  | I/O      | PA8, which corresponds to Pin8 and is used to print system logs                            |
| PB23    | I/O      | PB23, which corresponds to Pin 61, is a hardware PWM and can be configured as a GPIO       |



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

### 3 Electrical parameters

#### 3.1 Absolute electrical parameters

| Parameter   | Description          | Minimum value | Maximum value | Unit |
|---|----------------------|---------------|---------------|------|
| Ts  | Storage temperature  | -40           | 105           | °C   |
| VBAT  | Power supply voltage | -0.3          | 3.6           | V    |
| Static electricity discharge voltage (human body model) | TAMB-25°C            | -             | 2             | KV   |
| Static electricity discharge voltage (machine model)    | TAMB-25°C            | -             | 0.5           | KV   |

#### 3.2 Normal working conditions

| Parameter | Description          | Minimum value | Typical value | Maximum value | Unit |
|-----------|----------------------|---------------|---------------|---------------|------|
| Ta        | Working temperature  | -20           | -             | 85            | °C   |
| VCC       | Power supply voltage | 3.0           | 3.3           | 3.6           | V    |

| Parameter | Description           | Minimum value | Typical value | Maximum value | Unit  |
|-----------|-----------------------|---------------|---------------|---------------|-------|
| $V_{IL}$  | I/O low level input   | -             | -             | -             | 0.8 V |
| $V_{IH}$  | I/O high-level input  | 2.0           | -             | -             | V     |
| $V_{OL}$  | I/O low level output  | -             | -             | 0.4           | V     |
| $V_{OH}$  | I/O high level output | 2.4           | -             | -             | V     |
| $I_{max}$ | I/O drive current     | -             | -             | 16            | mA    |
| $C_{pad}$ | Input pin capacitance | -             | 2             | -             | mA    |

### 3.3 TX power consumption

| Symbol | Mode       | Power    | Average value | Peak value (Typical value) | Unit |
|--------|------------|----------|---------------|----------------------------|------|
| IRF    | 11b 11Mbps | 17 dBm   | 247           | 272                        | mA   |
| IRF    | 11b 11Mbps | 18 dBm   | 252           | 285                        | mA   |
| IRF    | 11g 54Mbps | 15 dBm   | 177           | 238                        | mA   |
| IRF    | 11g 54Mbps | 17.5 dBm | 202           | 280                        | mA   |

| Symbol | Mode          | Power    | Average value | Peak value (Typical value) | Unit |
|--------|---------------|----------|---------------|----------------------------|------|
| IRF    | 11n BW20 MCS7 | 13 dBm   | 165           | 240                        | mA   |
| IRF    | 11n BW20 MCS7 | 16.5 dBm | 192           | 269                        | mA   |
| IRF    | 11n BW40 MCS7 | 13 dBm   | 144           | 236                        | mA   |
| IRF    | 11n BW40 MCS7 | 16.5 dBm | 166           | 266                        | mA   |

### 3.4 RX power consumption

| Symbol | Mode          | Average Value | Peak Value (Typical Value) | Unit |
|--------|---------------|---------------|----------------------------|------|
| IRF    | 11B 11M       | 61            | 77                         | mA   |
| IRF    | 11G 54M       | 61            | 75                         | mA   |
| IRF    | 11N HT20 MCS7 | 61            | 77                         | mA   |

### 3.5 Power consumption in working mode

| Working mode                                | Working status, TA = 25°C   | Average value | Peak value (Typical value) | Unit |
|---|---|---------------|----------------------------|------|
| Quick network connection state (Bluetooth ) | The module is in the fast network connection state and the Wi-Fi indicator flashes fast   | 57            | 284                        | mA   |
| Quick network connection state (AP)         | The module is in the fast network connection state and the Wi-Fi indicator flashes slowly | 203           | 392                        | mA   |
| Quick network connection state (EZ)         | The module is in the fast network connection state and the Wi-Fi indicator flashes fast   | 55            | 298                        | mA   |
| Idle state                                  | The module is connected to the network and the indicator is always on                     | 53            | 259                        | mA   |

| Working mode       | Working status, TA = 25°C  | Average value | Peak value (Typical value) | Unit |
|--------------------|--|---------------|----------------------------|------|
| Operation state    | The module is connected to the network and the WiFi indicator is always on | 56            | 293                        | mA   |
| Disconnected state | The module is disconnected   | 58            | 287                        | mA   |

**Note:** The above parameters vary with firmware functions.



## 4 RF parameters

### 4.1 Basic RF features

| Parameter              | Description                                  |
|------------------------|--|
| Frequency range        | 2.400 to 2.4835 GHz                          |
| Wi-Fi standard         | IEEE 802.11b/g/n (channels 1 to 14)          |
| BLE standard           | BLE 5.0                                      |
| Data transmission rate | 11b: 1, 2, 5.5, and 11 (Mbps)                |
| Data transmission rate | 11g: 6, 9, 12, 18, 24, 36, 48, and 54 (Mbps) |
| Data transmission rate | 11n: HT20 MCS 0 to 7                         |
| Data transmission rate | 11n: HT40 MCS 0 to 7                         |
| Antenna type           | PCB antenna with a gain of 1.05 dBi          |

### 4.2 TX performance

#### TX performance

| Parameter                                      | Minimum value | Typical value | Maximum value | Unit |
|--|---------------|---------------|---------------|------|
| Average RF output power, 802.11b CCK Mode 11M  | -             | 17.5          | -             | dBm  |
| Average RF output power, 802.11g OFDM Mode 54M | -             | 14.5          | -             | dBm  |

| Parameter                                       | Minimum value | Typical value | Maximum value | Unit |
|---|---------------|---------------|---------------|------|
| Average RF output power, 802.11n HT20 Mode MCS7 | -             | 13.5          | -             | dBm  |
| Average RF output power, 802.11n HT40 Mode MCS7 | -             | 13.5          | -             | dBm  |
| Average RF output power, BLE5.0                 | -             | 6.5           | -             | dBm  |
| Frequency error                                 | -20           | -             | 20            | ppm  |
| EVM@802.11b CCK 11 Mbps Mode 17.5 dBm           | -             | -             | -10           | dB   |
| EVM@802.11g OFDM 54 Mbps Mode 14.5 dBm          | -             | -             | -29           | dB   |
| EVM@802.11n OFDM MCS7 Mode 13.5 dBm             | -             | -             | -30           | dB   |

### 4.3 RX performance

RX sensitivity

| Parameter                                       | Minimum value | Typical value | Maximum value | Unit |
|---|---------------|---------------|---------------|------|
| PER<8%, RX sensitivity, 802.11b DSSS Mode 1M    | -             | -92           | -             | dBm  |
| PER<10%, RX sensitivity, 802.11g OFDM Mode 54M  | -             | -76           | -             | dBm  |
| PER<10%, RX sensitivity, 802.11n OFDM Mode MCS7 | -             | -73           | -             | dBm  |

## 5 Antenna

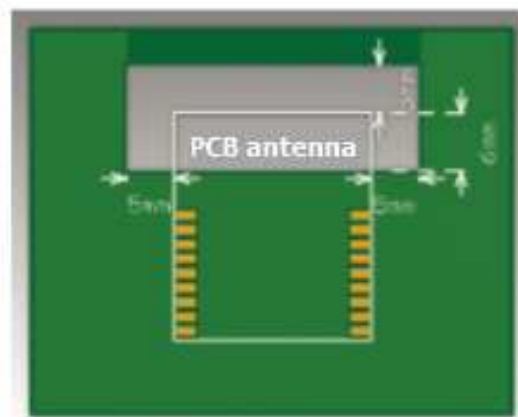
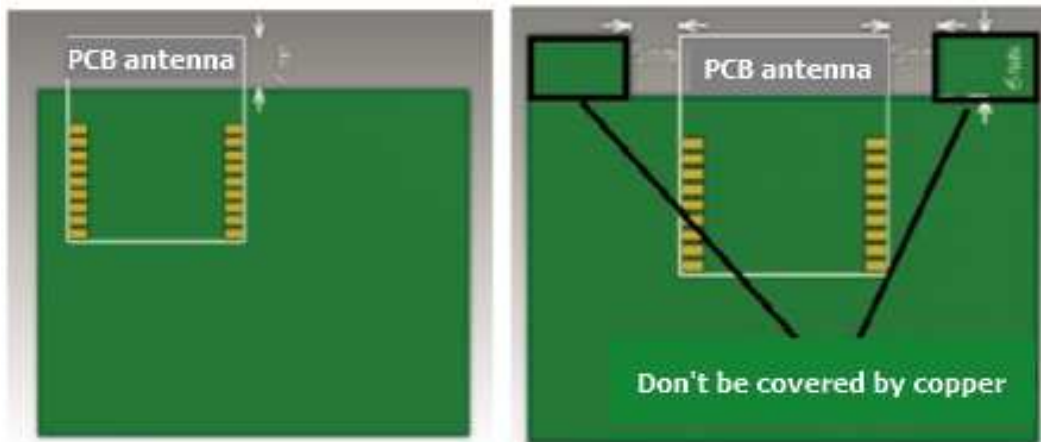
### 5.1 Antenna type

WBRG1 supports two types of antennas: onboard PCB antenna and external antenna. By default, the onboard PCB antenna is preferred.

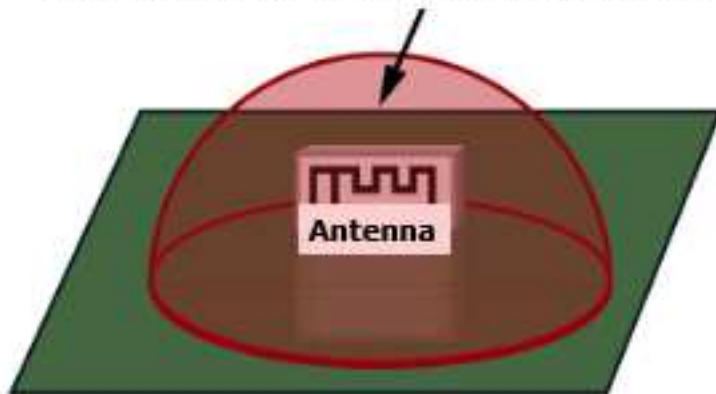
### 5.2 Antenna interference reduction

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

To prevent an adverse impact on the antenna radiation performance, avoid copper or traces along the antenna area on the PCB.

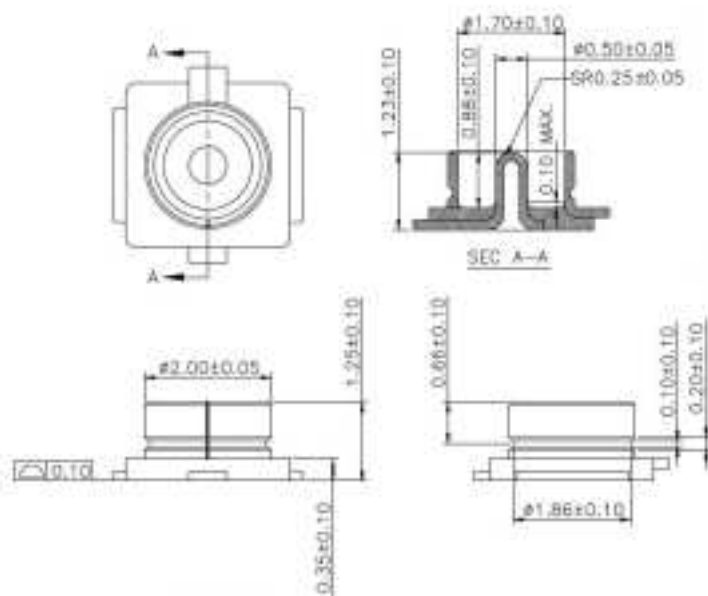


Do not place any metal in the red area above the antenna.  
The recommended diameter of the circular arc is greater than 3 cm.



### 5.3 U.FL RF connector

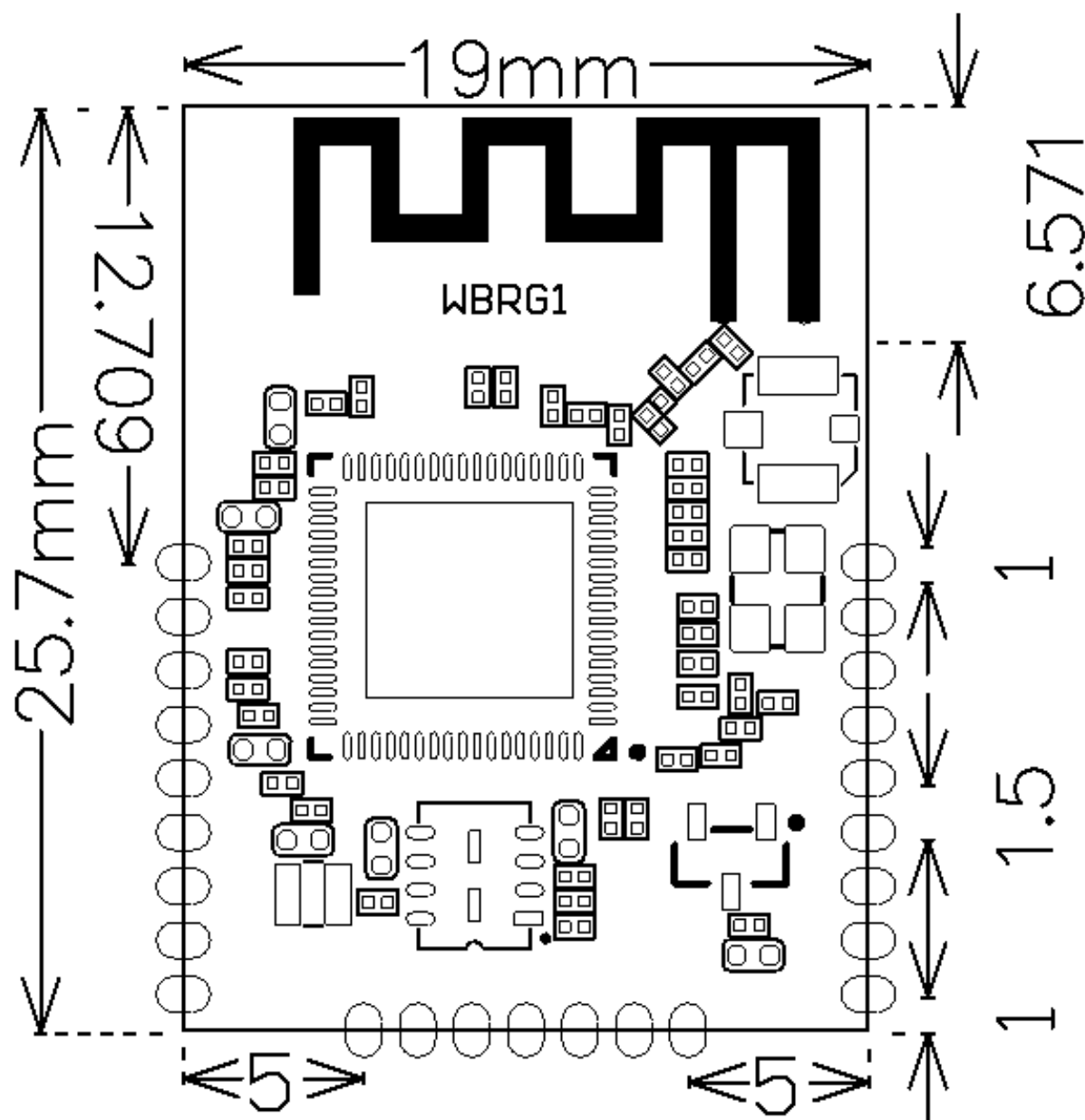
Parameters of the U.FL RF connector are as below:



## 6 Packaging information and production instructions

### 6.1 Mechanical dimensions

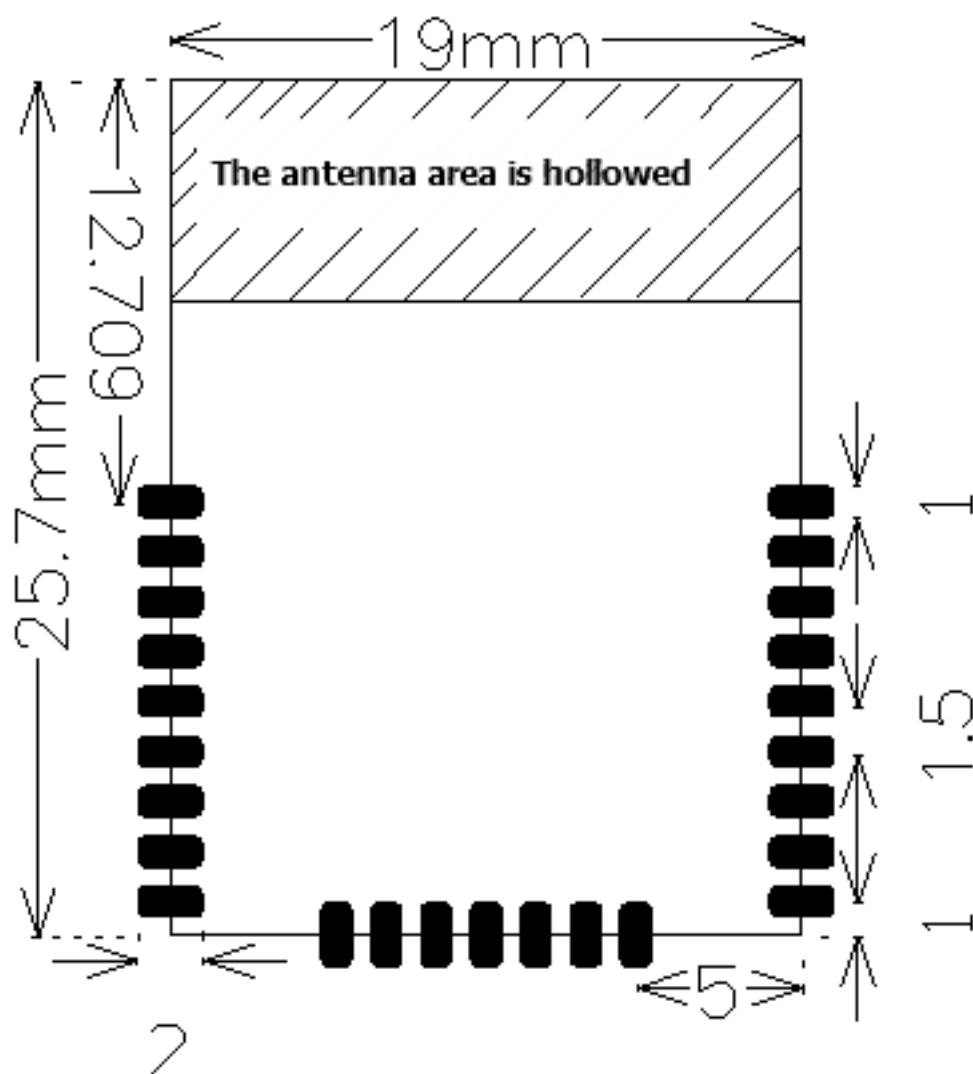
The PCB dimensions are  $19 \pm 0.35$  mm (W)  $\times$   $25.7 \pm 0.35$  mm (L)  $\times$   $0.8 \pm 0.15$  mm (H).



**Note:** For the PCB frame, the dimensional tolerance is  $\pm 0.35$  mm, and for the thickness of the PCB, the dimensional tolerance is  $\pm 0.1$  mm.



## 6.2 The diagram of PCB packaging

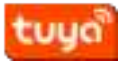


## 6.3 Mounting requirements

Use an SMT machine to mount components to the stamp hole module that Tuya produces within 24 hours after the module is unpacked and the firmware is burned. If not, pack the module again in a vacuum.

### Note:

Bake the module before mounting components to the module.



Before using SMT, take electrostatic discharge (ESD) protective measures.

Do not use SMT to process modules that have been unpacked for more than 3 months, unless they will be seriously oxidized because electroless nickel/immersion gold (ENIG) is used for PCBs. SMT is very likely to cause pseudo and missing soldering. Tuya is not liable for such problems and consequences.

To reduce the reflow defect rate, draw 10% of the products for visual inspection and AOI before the first mounting, to determine the rationality of oven temperature control and component attachment and placement manners. Draw 5 to 10 modules from subsequent batches each hour for visual inspection and AOI.

The following equipment or instrument is required:

| Instrument/device | Description                                  |
|-------------------|--|
| SMT machine       | Reflow soldering machine                     |
|                   | Automated optical inspection (AOI) equipment |
|                   | Nozzle with a 6 to 8 mm diameter             |
| Baking devices    | Cabinet oven                                 |
|                   | Anti-static heat-resistant trays             |
|                   | Anti-static heat-resistant gloves            |

### 6.4 Storage conditions

Storage conditions for a delivered module are as follows:

- The moisture-proof bag must be placed in an environment where the temperature is below 30°C and the relative humidity is lower than 70%.
- The shelf life of a dry-packaged product is 6 months from the date when the product is packaged and sealed.
- The package contains a humidity indicator card (HIC).



### 6.5 Baking requirements

Bake a module based on HIC status as follows when you unpack the module package:

| Value read from the HIC | Color circle color   | Operation                                |
|-------------------------|----------------------|--|
| 30%, 40%, and 50%       | All circles are blue | Bake the module for 2 consecutive hours  |
| 30%                     | Pink                 | Bake the module for 4 consecutive hours  |
| 30% and 40%             | All circles are pink | Bake the module for 6 consecutive hours  |
| 30%, 40%, and 50%       | All circles are pink | Bake the module for 12 consecutive hours |

### 6.6 Baking settings

| Parameter          | Description |
|--------------------|-------------|
| Baking temperature | 125±5°C     |

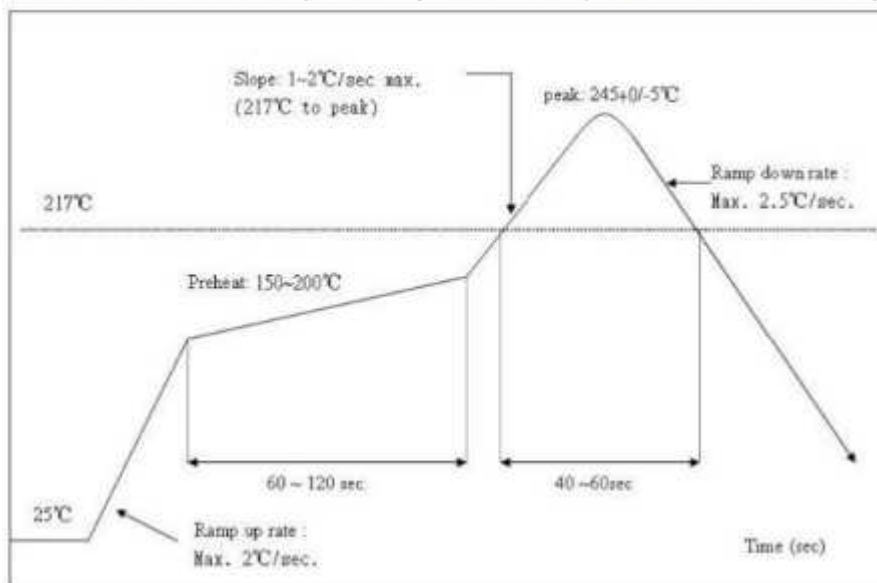
| Parameter                  | Description                           |
|----------------------------|---------------------------------------|
| Alarm temperature          | 130°C                                 |
| SMT ready temperature      | Naturally cooling temperature: < 36°C |
| The number of drying times | 1                                     |

**Note:** If the module is not soldered within 12 hours after being baked, you need to bake it again.

## 6.7 Recommended oven temperature curve

Perform SMT based on the following reflow oven temperature curve. The highest temperature is 245°C. The reflow oven temperature curve is as below:

Refer to IPC/JEDEC standard; Peak Temperature: <245°C; Number of Times: ≤2 times;



## 6.8 Storage conditions

|   |  |  |
|---|--|--|
|    | <p><b>CAUTION</b></p> <p><b>This bag contains</b></p> <p><b>MOISTURE-SENSITIVE DEVICES</b></p> | <p><b>LEVEL</b></p> <div style="border: 1px solid black; padding: 5px; display: inline-block;"> <p><b>3</b></p> </div> <p><small>If Blank, see adjacent bar code label</small></p> |
| <p>1. Calculated shelf life in sealed bag: 12 months at &lt; 40°C and &lt; 90% relative humidity (RH)</p>   |  |  |
| <p>2. Peak package body temperature: <u>260</u> °C<br/><small>If Blank, see adjacent bar code label</small></p>   |  |  |
| <p>3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must</p>   |  |  |
| <p>a) Mounted within: <u>168</u> hrs. of factory conditions<br/><small>If Blank, see adjacent bar code label</small></p>                                      |  |  |
| <p>≤ 30°C/60%RH, OR</p>   |  |  |
| <p>b) Stored at &lt;10% RH</p>  |  |  |
| <p>4. Devices require bake, before mounting, if:</p>  |  |  |
| <p>a) Humidity Indicator Card is &gt; 10% when read at 23 ± 5°C</p>   |  |  |
| <p>b) 3a or 3b not met.</p>   |  |  |
| <p>5. If baking is required, devices may be baked for 48 hrs. at 125 ± 5°C</p>  |  |  |
| <p>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</p> |  |  |
| <p>Bag Seal Date: _____<br/><small>If Blank, see adjacent bar code label</small></p>  |  |  |
| <p>Note: Level and body temperature defined by IPC/JEDEC J-STD-020</p>  |  |  |

## 7 MOQ and packaging information

| Product Number | MOQ (pcs) | Shipping packaging method | The number of modules per reel | The number of reels per carton |
|----------------|-----------|---------------------------|--------------------------------|--------------------------------|
| WBRG1          | 3600      | Tape reel                 | 900                            | 4                              |

## 8 Appendix: Statement

### 8.1 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 a minimum distance of 20cm between the radiator and your body.

**Important Note**

This radio module must not be installed to co-locate and operating simultaneously with other radios in the host system except in accordance with FCC multi-transmitter product procedures. Additional testing and equipment authorization may be required to operate 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 with 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 has got an FCC ID: 2ANDL-WBRG1. The final end product must be labeled in a visible area with the following: "Contains Transmitter Module FCC ID: 2ANDL-WBRG1.

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 the 2 conditions above are met, further transmitter tests 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.

## 8.2 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.

The device could be used with a separation distance of 20cm to the human body.