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Product Manual

Tuya WB2S Wi-Fi Module

Version: 1.0.0   **Date: 2019-11-23**   **No.: 0000000001**

1 Product Overview

WB2S is a low-power embedded Wi-Fi module that Tuya has developed. It consists of a highly integrated RF chip (BK7231D) and several peripheral components, with an embedded Wi-Fi network protocol stack and robust library functions. WB2S also contains a low-power Arm Cortex-M4 microcontroller unit (MCU), 1T1R WLAN module, 256 KB static random-access memory (SRAM), 2 MB flash memory, and extensive peripherals.

WB2S is an RTOS platform that integrates all function libraries of the Wi-Fi MAC and TCP/IP protocols. You can develop embedded Wi-Fi products as required.

1.1 Features

✧ Embedded low-power 32-bit CPU, which can also function as an application processor

● Clock rate: 120 MHz

✧ Working voltage: 3.0 V to 3.6 V

✧ Peripherals: five GPIOs, one universal asynchronous receiver/transmitter (UART), and one analog-to-digital converter (ADC)

✧ Wi-Fi connectivity

● 802.11b/g/n20/n40

● Channels 1 to 14 at 2.4 GHz

● WPA and WPA2 security modes

● Up to +16 dBm output power in 802.11b mode

● EZ net pairing mode for Android and iOS devices

● Onboard PCB antenna

- Certified by CE and FCC

- Working temperature: –20°C to +85°C

✧ BT

- Support Bluetooth (V4.0)

- Maximum output power + 7dBm EIRP

- Onboard PCB antenna with a gain of -1 dBi

1.2 Application Scenarios

✧ Intelligent building

✧ Smart household and home appliances

✧ Healthcare

✧ Industrial wireless control

✧ Baby monitor

✧ Network camera

✧ Intelligent bus

Change History

No.	Date	Change Description	Version After Change
1	2019-11-23	This is the first release.	1.0.0

Contents

Figures

Tables

2 Module Interfaces

2.1 Dimensions and Footprint

WB2S has two rows of pins with a 2 mm pin spacing.

The WB2S dimensions (H x W x D) are 3.3 mm x 15 mm x 18 mm. Figure 2-1 shows the WB2S front and rear views.
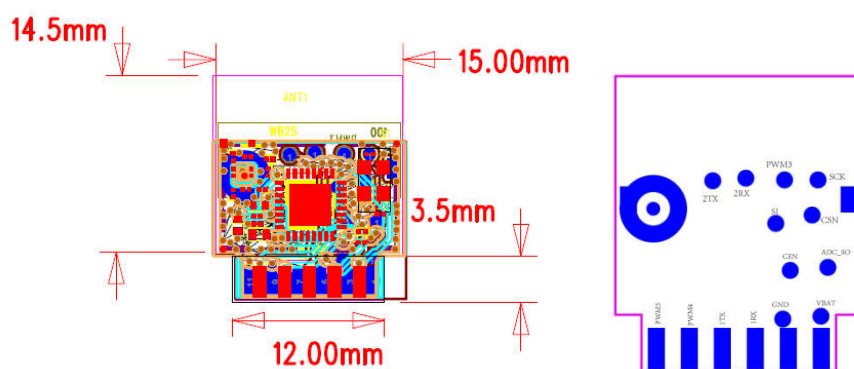
Figure 2-1 WB2S front and rear views

Note:

The default dimensional tolerance is ±0.35 mm, and the tolerance for some measurements is ±0.1 mm. The PCB thickness is 1.0±0.1 mm.

2.2 Interface Pin Definition

Table 2-1 WB2S interface pins

Pin No.	Symbol	I/O Type	Function
1	VBAT	P	Power supply pin (3.3 V), which is connected to the VBAT pin on the internal IC
2	PWM2	I/O	Common GPIO, which is connected to the P8 pin on the internal IC
3	GND	P	Power supply reference ground pin
4	PWM1	I/O	Common GPIO, which is connected to the P7 pin on the internal IC

Pin No.	Symbol	I/O Type	Function
5	RX	I/O	UART1_RXD, which is used as a user-side serial interface pin and is connected to the P10 pin on the internal IC
6	PWM0	I/O	Common GPIO, which is connected to the P6 pin on the internal IC
7	TX	I/O	UART1_TXD, which is used as a user-side serial interface pin and is connected to the P11 pin on the internal IC
8	AD	AI	ADC pin, which is connected to the P23 pin on the internal IC
9	PWM4	I/O	Common GPIO, which is connected to the P24 pin on the internal IC
10	CEN	I/O	External enabled reset pin, which is active at a low level and is connected to the CEN pin on the internal IC
11	PWM5	I/O	Common GPIO, which is connected to the P26 pin on the internal IC

Note:

P indicates a power supply pin, **I/O** indicates an input/output pin, and **AI** indicates an analog input 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	−20	85	°C
VCC	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
VCC	Power supply voltage	3.0	3.3	3.6	V
V_{IL}	I/O low-level input	−0.3	N/A	VCC x 0.25	V
V_{IH}	I/O high-level input	VCC x 0.75	N/A	VCC	V
V_{OL}	I/O low-level output	N/A	N/A	VCC x 0.1	V
V_{OH}	I/O high-level output	VCC x 0.8	N/A	VCC	V
Imax	I/O drive current	N/A	N/A	12	mA
C_{pad}	Input pin capacitance	N/A	2	N/A	pF

3.3 TX Current Consumption

Table 3-3 Current consumption during constant transmission

Symbol	Mode	Power	Typical Value	Unit
I_{RF}	802.11b	16 dBm	222	mA
I_{RF}	11 Mbit/s	15 dBm	215	mA
I_{RF}	802.11g	15 dBm	210	mA
I_{RF}	54 Mbit/s	14 dBm	195	mA
I_{RF}	802.11n BW20	13 dBm	200	mA
I_{RF}	MCS7	12 dBm	185	mA
I_{RF}	802.11n BW40	12 dBm	190	mA
I_{RF}	MCS7	11 dBm	190	mA

3.4 RX Current Consumption

Table 3-4 Current consumption during constant receiving

Symbol	Mode	Typical Value	Unit
I_{RF}	CPU sleep	50	mA
I_{RF}	CPU active	95	mA

3.5 Working Current

Table 3-5 WB2S working current

Working Mode	Working Status (Ta = 25°C)	Average Value	Maximum Value	Unit
EZ	The module is in EZ mode, and the Wi-Fi indicator blinks quickly.	100	170	mA
AP	The module is in AP mode, and	50	125	mA

Working Mode	Working Status (Ta = 25°C)	Average Value	Maximum Value	Unit
	the Wi-Fi indicator blinks slowly.			
Connected	The module is connected to the network, and the Wi-Fi indicator is steady on.	40	180	mA
Disconnected	The module is disconnected from the network, and the Wi-Fi indicator is steady off.	60	110	mA

4 RF Features

4.1 Basic RF Features

Table 4-1 Basic RF features

Parameter	Description
Frequency band	BT:2.400 GHz to 2.4835 GHz WIFI: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)
BT standard	BT 4.0
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 802.11n: HT40 MCS0 to MCS7
Antenna type	PCB antenna with a gain of -1.0 dBi

4.2 WB2S TX Power

Table 4-2 Power during constant transmission

Parameter		Minimum Value	Typical Value	Maximum Value	Unit
Average RF output power, 802.11b CCK mode	1 Mbit/s	N/A	16	N/A	dBm
Average RF output power, 802.11g OFDM mode	54 Mbit/s	N/A	14	N/A	dBm
Average RF output power, 802.11n OFDM mode	MCS7	N/A	12	N/A	dBm
Frequency error		−2	N/A	+2	ppm
EVM under 802.11b CCK, 11 Mbit/s, 16 dBm			−23		dB
EVM under 802.11g OFDM, 54 Mbit/s, 14.0 dBm			−27		dB
EVM under 802.11n OFDM, MCS7, 13 dBm			−28		dB

4.3 WB2S RX Sensitivity

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	MCS7	N/A	−68	N/A	dBm

OFDM mode					

5 Antenna Information

5.1 Antenna Type

WB2S uses an onboard PCB antenna.

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 adverse impact on the antenna radiation performance, avoid copper or traces along the antenna area on the PCB. Ensure that there are no substrate media above or below the antenna and that copper is at a certain distance away from the antenna to maximize the antenna radiation performance.
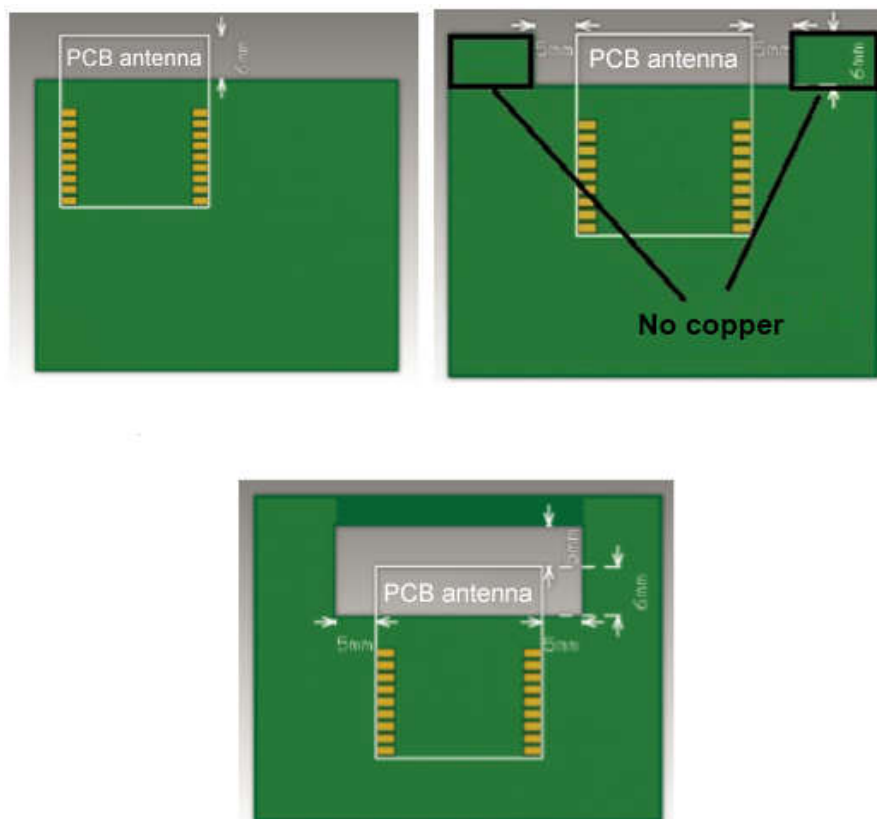
Figure 5-1 Antenna clearance part

For details about the onboard PCB antenna area on WB2S, see Figure 6-1.

Note:

The default dimensional tolerance is ±0.35 mm. If a customer has other requirements, clearly specify them in the datasheet after communication.

5.3 Antenna Connector Specifications

WB2S does not use an antenna connector.

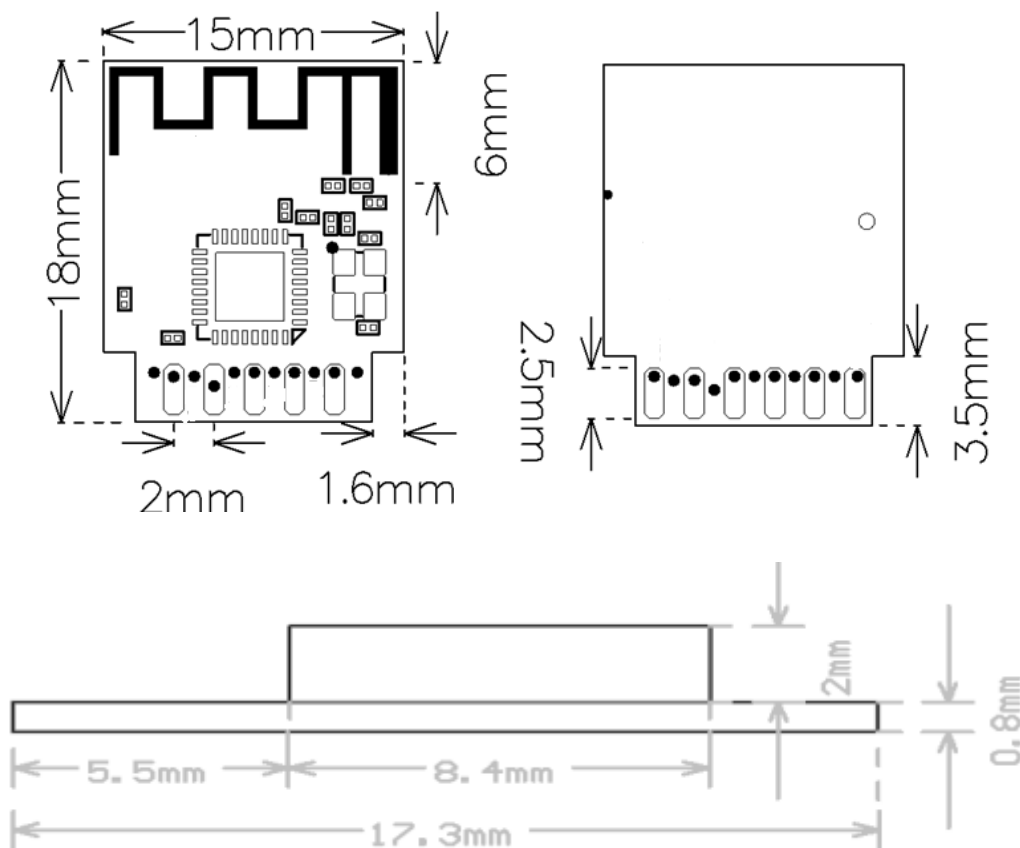# 6 Packaging Information and Production Instructions

6.1 Mechanical Dimensions

Figure 6-1 WB2S mechanical dimensions

Note:

The default dimensional tolerance is ±0.35 mm. If a customer has other requirements, clearly specify them in the datasheet after communication.
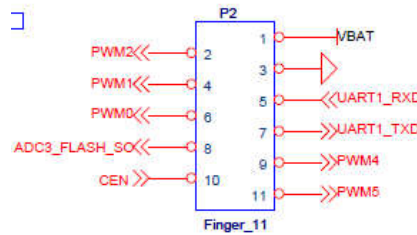
6.2 Recommended PCB Layout

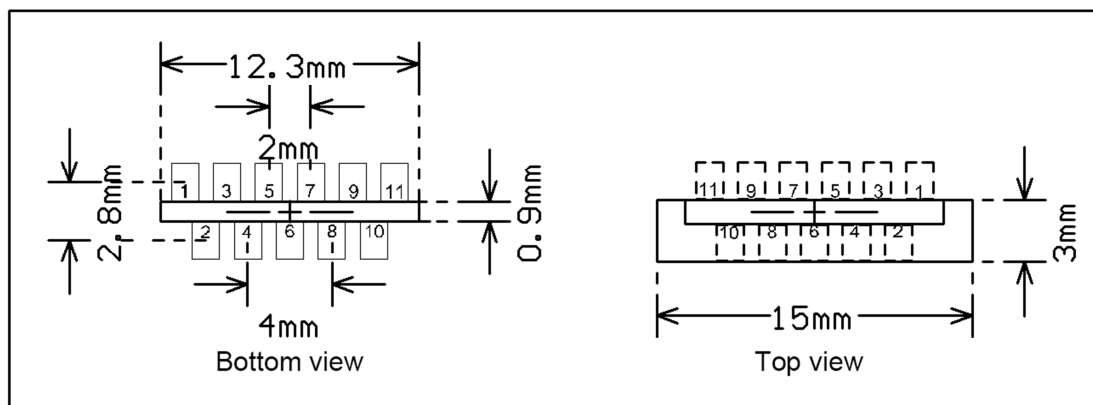
Figure 6-2 WB2S pins

Figure 6-3 Top and bottom views of the PCB to which WB2S applies

6.3 Production Instructions

1. Use an SMT placement machine to mount the stamp hole module that Tuya produces onto the PCB within 24 hours after the module is unpacked and the firmware is burned. If not, vacuum pack the module again. Bake the module before mounting it onto the PCB.

    (1) SMT placement equipment

        i.   Reflow soldering machine

      ii.   Automated optical inspection (AOI) equipment

      iii.   Nozzle with a 6 mm to 8 mm diameter

  (2) Baking equipment

      i.   Cabinet oven

      ii.   Anti-static heat-resistant trays

      iii.   Anti-static heat-resistant gloves

2. 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 85%.

  (2) The shelf life of a dry-packaged product is 12 months from the date when the product is packaged and sealed.

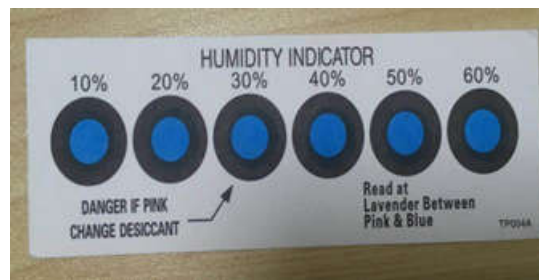 (3) The package contains a humidity indicator card (HIC).

Figure 6-4 HIC for WB2S

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

  (1) If the 30%, 40%, and 50% circles are blue, bake the module for 2 consecutive hours.

  (2) If the 30% circle is pink, bake the module for 4 consecutive hours.

  (3) If the 30% and 40% circles are pink, bake the module for 6 consecutive hours.

  (4) If the 30%, 40%, and 50% circles are pink, bake the module for 12 consecutive hours.

4. Baking settings:

  (1) Baking temperature: 125±5°C

  (2) Alarm temperature: 130°C

(3) SMT placement ready temperature after natural cooling: < 36°C

(4) Number of drying times: 1

(5) Rebaking condition: The module is not soldered within 12 hours after baking.

5. Do not use SMT to process 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.

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

7. To reduce the reflow defect rate, draw 10% of the products for visual inspection and AOI before first SMT placement to determine a proper oven temperature and component placement method. Draw 5 to 10 modules every hour from subsequent batches for visual inspection and AOI.

6.4 Recommended Oven Temperature Curve

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

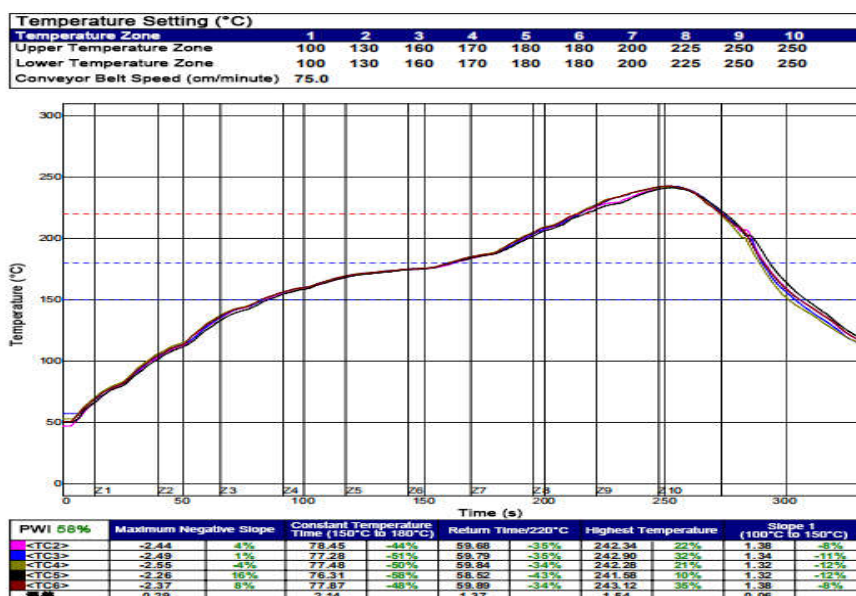Based on the IPC/JEDEC standard, perform reflow soldering on a module at most twice.

Figure 6-5 Oven temperature curve

6.5 Storage Conditions

7. Reference Circuit

7.1 Schematic Diagram

Figure 7-1 WB2S schematic diagram

8 MOQ and Packing Information

Table 8-1 Packing information

MOQ and packing information				
Product Model	**MOQ**	**Packing Method**	**Number of Modules in Each Reel Pack**	**Number of Reel Packs in Each Box**
WB2S	4000	Carrier tape and reel packing	1000	4

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-WB2S.The final end product must be labeled in a visible area with the following: "Contains Transmitter Module FCC ID:2ANDL-WB2S"

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.

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