



# **WB2S Module Datasheet**

Version: 20220729

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WB2S is a low-power embedded Wi-Fi+Bluetooth LE Dual protocol module that Tuya has developed. It consists of a highly integrated RF chip (BK7231T) and several peripheral components, with an embedded Wi-Fi network protocol stack and robust library functions.

## 1 Overview

WB2S 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: nine GPIOs, one universal asynchronous receiver/transmitter (UART), and one analog-to-digital converter (ADC)
- Wi-Fi connectivity
- 802.11b/g/n
- Channels 1 to 14 at 2.4 GHz
- Support WEP, WPA/WPA2, WPA/WPA2 PSK (AES) ,WPA3 security modes
- Up to +16 dBm output power in 802.11b mode
- EZ net pairing mode for Android and iOS devices
- On-board PCB antenna with a gain of -1.0dBi
- Working temperature: -40°C to +85°C
- Bluetooth LE
  - Support Bluetooth (V4.2)
  - Maximum output power + 6dBm
  - Onboard PCB antenna

### 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

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Date	Change Description	Version After Change
2019-11-22	This is the first release.	1.0.0

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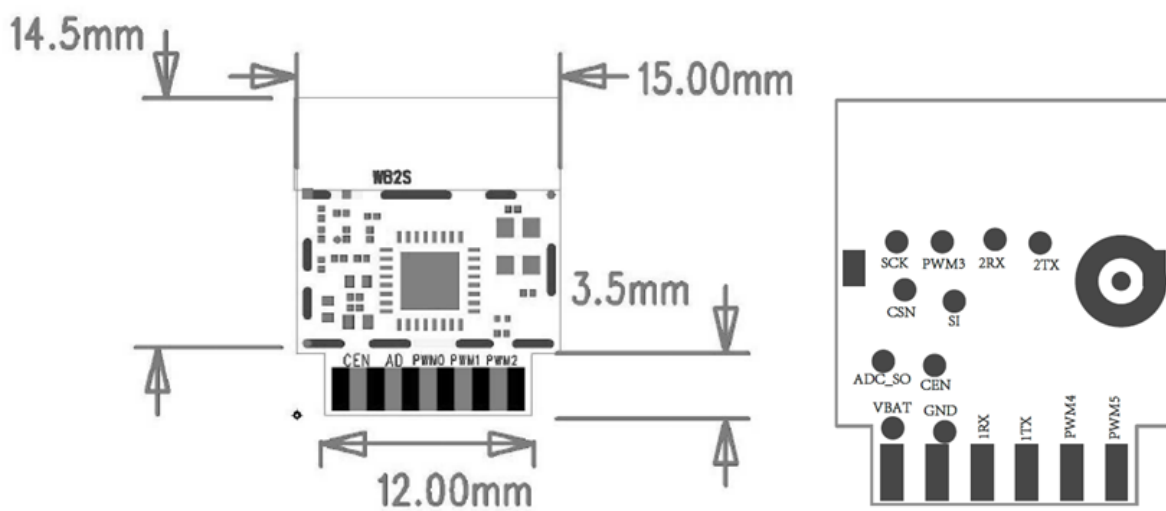
## 2 Module interfaces

### 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 2.8 mm x 15 mm x 18 mm.

**Note:** The default dimensional tolerance is  $\pm 0.35$  mm. If a customer has other requirements, clearly specify them in the datasheet after communication.



### 2.2 Interface pin definition

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

Pin No.	Symbol	I/O type	Function
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
5	1RX	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	1TX	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



Pin No.	Symbol	I/O type	Function
10	CEN	I	Low-level reset, high-level active (internally pulled high) Docking IC-CEN
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.

### 2.3 Test pin definition

Pin No.	Symbol	I/O type	Function
1	SO	I/O	Data output pin when data is downloaded from the flash memory, which is used for module production and firmware burning and is connected to the P23 or ADC3 pin on the internal IC

Pin No.	Symbol	I/O type	Function
2	SI	I/O	Data input pin when data is downloaded from the flash memory, which is used for module production and firmware burning and is connected to the P22 pin on the internal IC
3	CS	I/O	Chip selection pin when data is downloaded from the flash memory, which is used for module production and firmware burning and is connected to the P21 pin on the internal IC
4	SCK	I/O	Clock pin when data is downloaded from the flash memory, which is used for module production and firmware burning and is connected to the P20 pin on the internal IC

**Note:** Test pins are not recommended.

### 3 Electrical parameters

#### 3.1 Absolute electrical parameters

Parameter	Description	Minimum value	Maximum value	Unit
Ts	Storage temperature	-40	150	°C
VCC	Power supply voltage	-0.3	3.6	V
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 Electrical conditions

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
Ta	Working temperature	-40	N/A	85	°C
VCC	Power supply voltage	3.0	3.3	3.6	V
V <sub>IL</sub>	I/O low-level input	-0.3	N/A	VCC x 0.25	V

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
$V_{IH}$	I/O high-level input	$VCC \times 0.75$	N/A	3.6	V
$V_{OL}$	I/O low-level output	N/A	N/A	$VCC \times 0.1$	V
$V_{oH}$	I/O high-level output	$VCC \times 0.8$	N/A	VCC	V
$I_{max}$	I/O drive current	N/A	6	15	mA

### 3.3 RF Current consumption

Working Status	Mode	Rate	TX Power / Receiving	Typical value	Unit
TX	802.11b	11 Mbit/s	+16 dBm	235	mA
	802.11g	54 Mbit/s	+14 dBm	200	mA
	802.11n	MCS7	+12 dBm	185	mA
RX	802.11b	11 Mbit/s	Constant receiving	98	mA
	802.11g	54 Mbit/s	Constant receiving	98	mA
	802.11n	MCS7	Constant receiving	98	mA

### 3.4 Working current

Working mode	Working status (Ta = 25°C)	Average value	Peak value <sup>^^</sup> (Typical value)	Unit
Quick connection network status (Bluetooth network)	The module is in the fast network configuration state, and the WIFI indicator flashes quickly	110	310	mA
Fast connection network status (AP network configuration)	The module is in the fast connection network configuration state, the WIFI indicator flashes slowly	80	430	mA
Quick Connect Network Status (EZ Network)	The module is in the fast network configuration state, and the WIFI indicator flashes quickly	80	320	mA
Network connection idle state	The module is connected to the network and the WiFi indicator is always on	50	300	mA

Working mode	Working status (Ta = 25°C)	Average value	Peak value <sup>^^</sup> (Typical value)	Unit
Network connection operation status	The module is connected to the network and the WiFi indicator is always on	50	315	mA
Disconnected status	Module is offline	105	315	mA

## 4 RF features

### 4.1 Basic RF features

Parameter	Description
Frequency band	2.412 GHz to 2.484 GHz
Wi-Fi standard	IEEE 802.11b/g/n (channels 1 to 14)
Bluetooth LE standard	Bluetooth LE 4.2
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	Onboard PCB antenna with a gain of -1.0 dBi

### 4.2 TX performance

Parameter	Minimum value	Typical value	Maximum value	Unit
Average RF output power, 802.11b CCK mode 11 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



Parameter	Minimum value	Typical value	Maximum value	Unit
Average RF output power, 802.11n OFDM mode MCS7	N/A	13	N/A	dBm
Frequency error	-2	N/A	+2	ppm
EVM under 802.11b CCK, 11 Mbit/s 16 dBm	NA	-18	NA	dB
EVM under 802.11g OFDM, 54 Mbit/s, 14 dBm	-26	-27	-29	dB
EVM under 802.11n OFDM, MCS7, 13 dBm	-26	-27	-28	dB

### 4.3 RX performance

Parameter	Minimum value	Typical value	Maximum value	Unit
PER < 8%, 802.11b CCK mode 1 Mbit/s	N/A	-85	N/A	dBm
PER < 10%, 802.11g OFDM mode 54 Mbit/s	N/A	-72	N/A	dBm

Parameter	Minimum value	Typical value	Maximum value	Unit
PER < 10%, 802.11n OFDM mode MCS7	N/A	-68	N/A	dBm
PER < 10%,Bluetooth LE 1M	NA	-95	NA	dBm

## **5 Antenna**

### **5.1 Antenna type**

WB2S uses an onboard PCB antenna.

### **5.2 Antenna interference reduction**

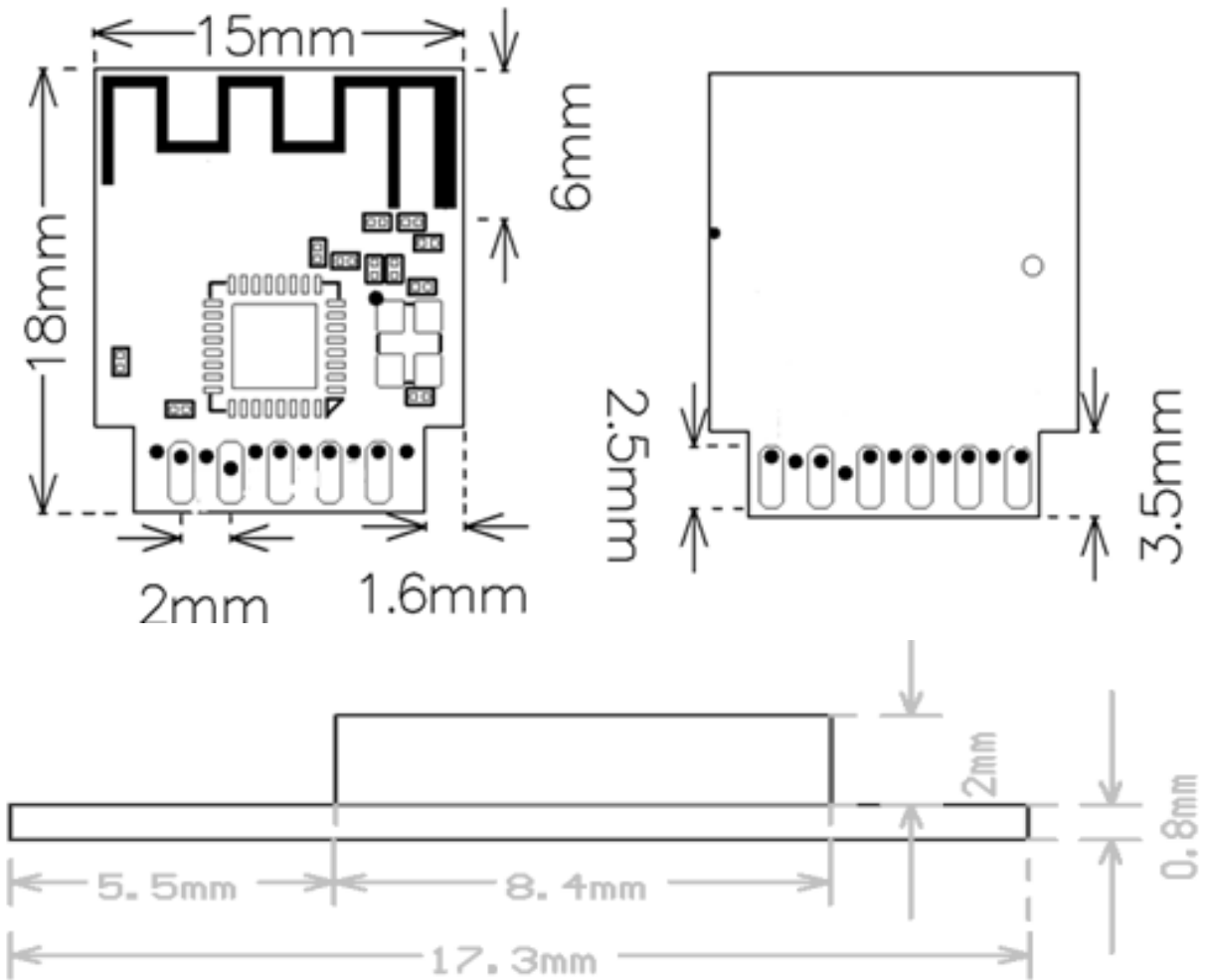
To ensure optimal Wi-Fi performance when the Wi-Fi module uses an onboard PCB antenna, it is recommended that the antenna be at least 15 mm away from other metal parts. To prevent an adverse impact on the antenna radiation performance, avoid copper or traces along the antenna area on the PCB. Deploy the antenna based on the antenna placement solutions.

### **5.3 Antenna connector specifications**

WB2S does not use an antenna connector.

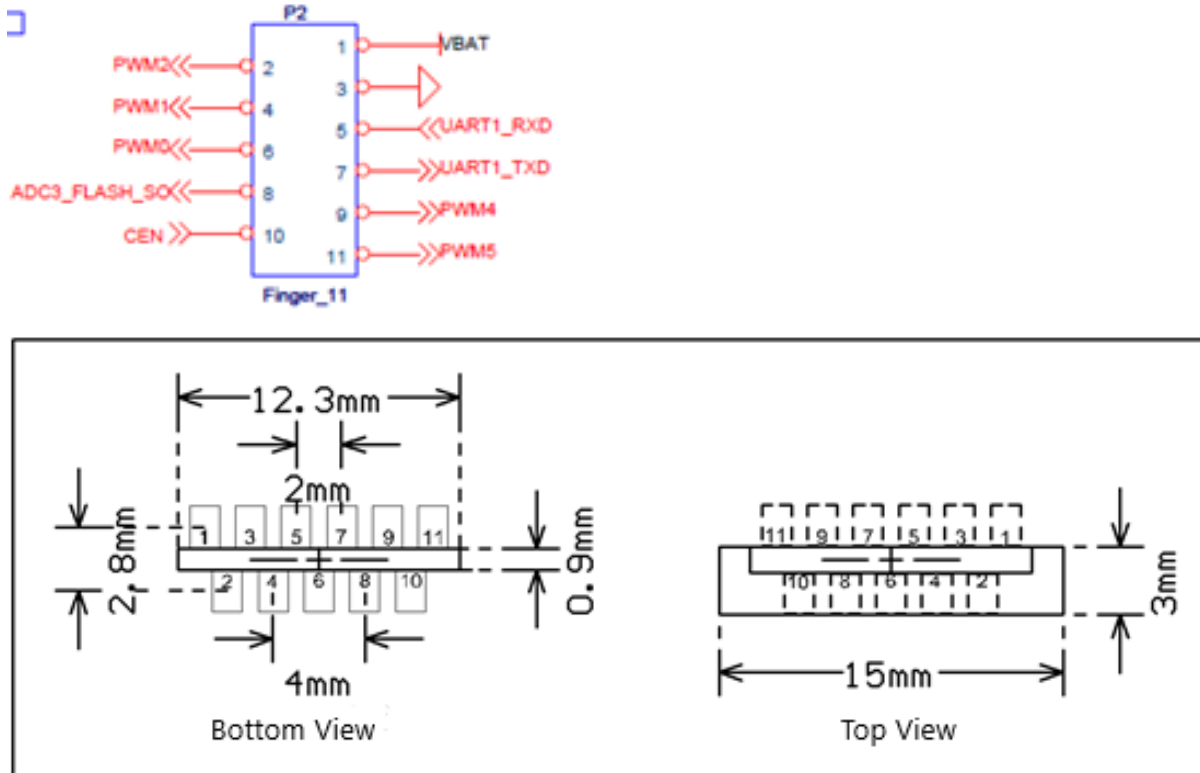
## 6 Packaging information and production instructions

### 6.1 Mechanical dimensions



**Note:** The default dimensional tolerance is  $\pm 0.35$  mm. If a customer has other requirements, clearly specify them in the datasheet after communication.

## 6.2 Recommended PCB layout



**Note:** The default dimensional tolerance is  $\pm 0.35$  mm. If a customer has other requirements, clearly specify them in the datasheet after communication.

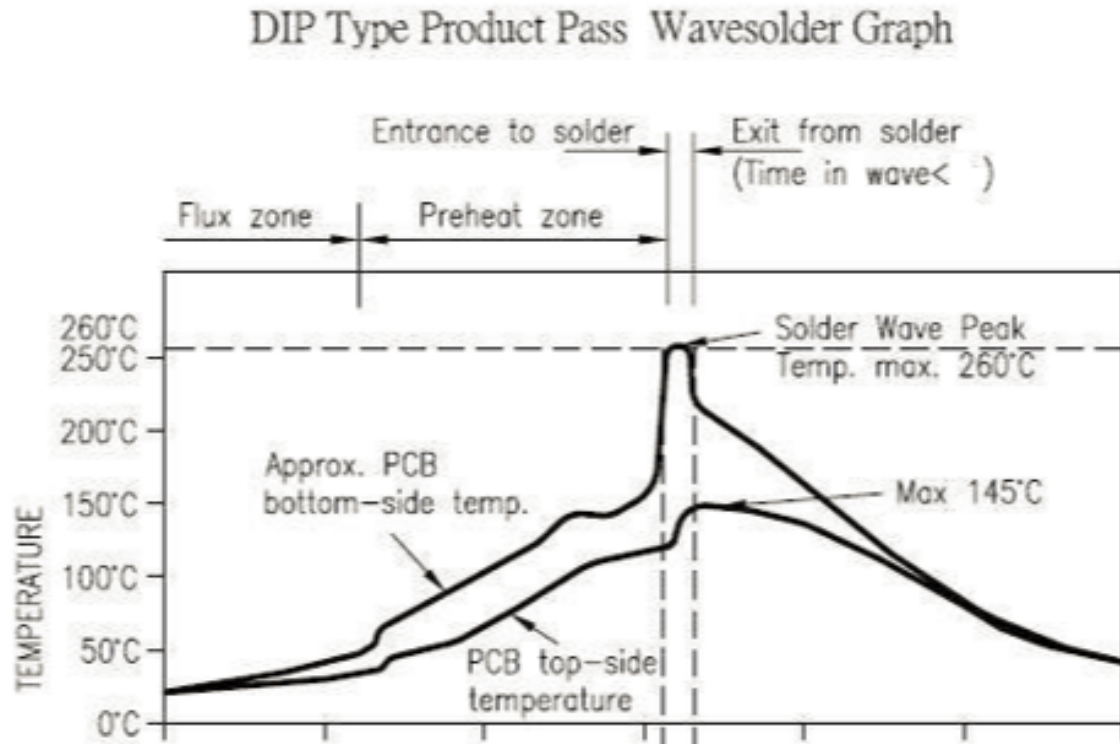
## 6.3 Production instructions

- For the Tuya in-line module, wave soldering is most preferred and manual soldering is less preferred. After being unpacked, the module must be soldered within 24 hours. Otherwise, it must be put into the drying cupboard where the RH is not greater than 10%; or it needs to be packaged under vacuum again and record the exposure time (the total exposure time cannot exceed 168 hours).
- Wave soldering devices and materials:
  - Wave soldering equipment
  - Wave soldering fixture
  - Constant-temperature soldering iron
  - Tin bar, tin wire, and flux

- Thermal profiler
3. Baking devices:
    - Cabinet oven
    - Anti-electrostatic and heat-resistant trays
    - Anti-electrostatic and heat-resistant gloves
  4. The module needs to be baked in the following cases:
    - The packaging bag is damaged before unpacking.
    - There is no humidity indicator card (HIC) in the packaging bag.
    - After unpacking, circles of 10% and above on the HIC become pink.
    - The total exposure time has lasted for over 168 hours since unpacking.
    - More than 12 months have passed since the sealing of the bag.
  5. Baking settings:
    - Temperature: 40°C and ≤ 5% RH for reel package and 125°C and ≤5% RH for tray package (please use the heat-resistant tray rather than plastic container)
    - Time: 168 hours for reel package and 12 hours for tray package
    - Alarm temperature: 50°C for reel package and 135°C for tray package
    - Production-ready temperature after natural cooling: < 36°C
    - Re-baking situation: If a module remains unused for over 168 hours after being baked, it needs to be baked again.
    - If a batch of modules is not baked within 168 hours, do not use the wave soldering to solder them. Because these modules are Level-3 moisture-sensitive devices, they are very likely to get damp when exposed beyond the allowable time. In this case, if they are soldered at high temperatures, it may result in device failure or poor soldering.
  6. In the whole production process, take electrostatic discharge (ESD) protective measures.
  7. To guarantee the quality of products, you must pay attention to the following items: The amount of soldering flux, the height of the wave peak, whether the tin slag and copper content in the wave soldering tank exceed standards, whether the window and thickness of the wave soldering fixture are appropriate, and whether the wave soldering oven temperature curve is appropriate.

### 6.4 Recommended oven temperature curve and temperature

Set oven temperatures according to the following temperature curve of wave soldering. The peak temperature is  $260^{\circ}\text{C} \pm 5^{\circ}\text{C}$ .



Recommended soldering temperature:

Suggestions on oven temperature curve of wave soldering

Suggestions on manual soldering temperature

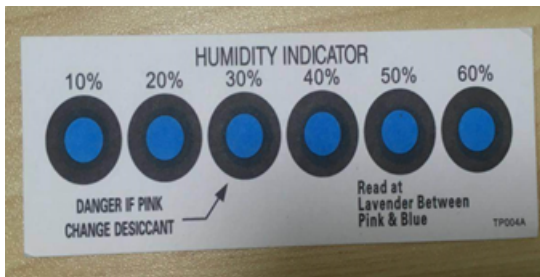
Preheat temperature	80 to 130 °C	Soldering temperature	$360 \pm 20^{\circ}\text{C}$
Preheat time	75 to 100s	Soldering time	$< 3\text{s}/\text{point}$
Peak contact time	3 to 5s	NA	NA
Temperature of tin cylinder	$260 \pm 5^{\circ}\text{C}$	NA	NA
Ramp-up slope	$\leq 2^{\circ}\text{C}/\text{s}$	NA	NA

Suggestions on oven temperature curve of wave soldering	Suggestions on manual soldering temperature
Ramp-down slope $\leq 6^{\circ}\text{C/s}$	NA

### 6.5 Storage conditions

Storage conditions for a delivered module:

- The moisture-proof bag is placed in an environment where the temperature is below  $40^{\circ}\text{C}$  and the relative humidity is lower than 90%.
- The shelf life of a dry-packaged product is 12 months from the date when the product is packaged and sealed.
- There is a humidity indicator card (HIC) in the packaging bag.







## 7 MOQ and packaging information

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Product number	MOQ (pcs)	Shipping packaging method	Modules per reel	Packaging reels per box
WB2S	4400	Tape reel	1100	4

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## 8 Appendix: Statement

**FCC Caution:** Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this device.

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 device has been tested and found to comply with the limits for a Class B digital device, according to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This device generates, uses, and can radiate radio frequency energy and, if not installed and used following 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 device does cause harmful interference to radio or television reception, which can be determined by turning the device 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 device and receiver.
- Connect the device 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 device complies with FCC radiation exposure limits set forth for an uncontrolled rolled environment. This device 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 following FCC multi-transmitter product procedures. Additional testing and device authorization may be required to operate simultaneously with other radios.

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/warnings 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-WB2S. The 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:

The antenna must be installed such that 20cm is maintained between the antenna and users, and 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.

#### **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 the 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.