tuya | **Global Intelligent Platform**

Product Manual

Tuya TYWRD1S Wi-Fi Module

Version: 3.0.0   **Date: 2019-10-12**   **No.: 0000000004**

1. Product Overview

TYWRD1S is a low-power embedded Wi-Fi module that Tuya has developed. It consists of a highly integrated RF chip (RDA5981B) and several peripheral components, with an embedded Wi-Fi network protocol stack and robust library functions. TYWRD1S is embedded with a low-power 32-bit CPU, 2 MB flash memory, and 448 KB static random-access memory (SRAM), and has extensive peripherals.

TYWRD1S 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: 160 MHz

✧ Working voltage: 3.0 V to 3.6 V

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

✧ Wi-Fi connectivity

● 802.11b/g/n

● 2.4GHz WiFi

● WPA and WPA2 security modes

● Up to +20±2 dBm output power

- STA, AP, and STA+AP working modes

- Smart and AP network configuration modes for Android and iOS devices

- Onboard PCB antenna with a gain of 1.0 dBi

- 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

Change History

No.	Date	Change Description	Version After Change
1	2019-06-20	This is the first release.	1.0.0
2	2019-07-26	Revised the document.	2.0.0
3	2019-10-12	Revised the document.	3.0.0

Contents

Tables

Figures

2 Module Interfaces

2.1 Dimensions and Footprint

TYWRD1S has two rows of pins with a 1.5±0.1 mm pin spacing.

The TYWRD1S dimensions (H x W x D) are 3.3±0.1 mm x 18±0.35 mm x 23.5±0.35 mm. Figure 1-1 shows the TYWRD1S dimensions.
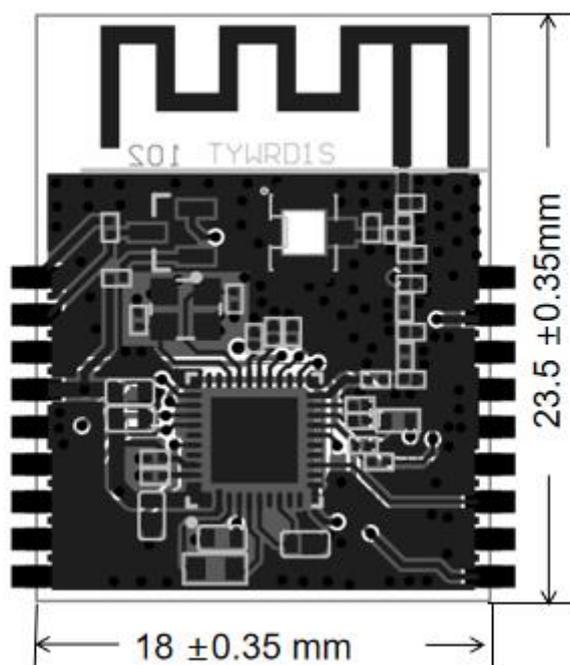
**Figure 2-1 TYWRD1S dimensions**

2.2 Interface Pin Definition

Table 2-1 TYWRD1S interface pins

Pin No.	Symbol	I/O Type	Function
1	VCC	P	Power input pin for the internal level conversion

Pin No.	Symbol	I/O Type	Function
			circuit (3.3 V or 5 V)
2	UART-TX	I/O	UART0_TXD (See the following Note 3.)
3	UART-RX	I/O	UART0_RXD (See the following Note 3.)
4	3.3 V	P	Power supply pin (3.3 V)
5	GND	P	Power supply reference ground pin
6	GPIO23	I/O	Hardware PWM pin, which is connected to GPIO23 (pin 33) on the internal IC
7	GPIO22	I/O	Hardware PWM pin, which is connected to GPIO22 (pin 34) on the internal IC
8	GPIO25	I/O	Hardware PWM pin, which is connected to GPIO25 (pin 31) on the IC
9	GPIO0	I/O	Common GPIO, which is connected to GPIO0 (pin 36) on the IC
10	GPIO24	I/O	Hardware PWM pin, which is connected to GPIO24 (pin 32) on the internal IC
11	GPIO1	I/O	Common GPIO, which is connected to GPIO1 (pin 21) on the internal IC
12	GPIO8	I/O	Common GPIO, which is connected to GPIO8 (pin 13) on the internal IC
13	GPIO3	I/O	Hardware PWM pin, which is connected to GPIO3 (pin 23) on the internal IC
14	GND	P	Power supply reference ground pin
15	GND	P	Power supply reference ground pin
16	nRST	I/O	Hardware reset pin (The module has an internal pull-up resistor, and the reset pin is active at a low level.)
17	ADC	AI	10-bit SAR ADC (See the following Note 2.)
18	GND	P	Power supply reference ground pin

Note:

1. **P** indicates power supply pins, **I/O** indicates input/output pins, and **AI** indicates analog input pins. nRST is only a hardware reset pin and cannot clear the Wi-Fi network configuration.

2. This pin can only function as an ADC input and not a common I/O. If this pin is not used, it must be disconnected. When this pin is used as an ADC input, the input voltage range is 0 V to 1.0 V.

3. UART0 is a user-side serial interface, which generates information when the module is powered on and starts.

2.3 Test Pin Definition

Table 2-2 TYWRD1S test pins

Pin No.	Symbol	I/O Type	Function
N/A	TEST	Input	Used for the module production test

Note:

 Test pins are not recommended.

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
VBAT	Power supply voltage	3.0	3.6	V
Static electricity voltage (human body model)	Tamb = 25°C	N/A	2	kV

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

3.2 Electrical Conditions

Table 3-2 Normal electrical conditions

Parameter	Description	Minimum Value	Typical Value	Maximum Value	Unit
Ta	Working temperature	−20	N/A	85	°C
VBAT	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
VOH	I/O high-level output	VCC x 0.8	N/A	VCC	V
Imax	I/O drive current	N/A	N/A	12	mA

3.3 Working Current

Table 3-4 TYWRD1S working current

Working Mode	Working Status (Ta = 25°C)	Average Value	Unit
EZ	The module is in EZ mode, and the Wi-Fi indicator blinks quickly.	70	mA
AP	The module is in AP mode, and the Wi-Fi indicator blinks slowly.	80	mA
Connected	The module is connected to the network, and the Wi-Fi indicator is steady on.	70	mA

4 RF Features

4.1 Basic RF Features

Table 4-1 Basic RF features

Parameter	Description
Frequency band	2.4GHz
Wi-Fi standard	IEEE 802.11b/g/n
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 with a gain of 1.0 dBi

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	11 Mbit/s	N/A	17	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	12.5	N/A	dBm
Frequency error		−10	N/A	+10	ppm

4.3 RX Performance

Table 4-3 RX sensitivity

Parameter		Minimum Value	Typical Value	Maximum Value	Unit
PER < 8%, 802.11b CCK mode	11 Mbit/s	N/A	−90	N/A	dBm
PER < 10%, 802.11g OFDM mode	54 Mbit/s	N/A	−73	N/A	dBm
PER < 10%, 802.11n OFDM mode	MCS7	N/A	−70	N/A	dBm

5 Antenna Information

5.1 Antenna Type

TYWRD1S supports an onboard PCB antenna or external antenna. By default, TYWRD1S 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.

For details about the onboard PCB antenna area on TYWRD1S, see Figure 6-1.

5.3 Antenna Connector Specifications

Figure 5-1 shows the U.FL RF connector parameters.
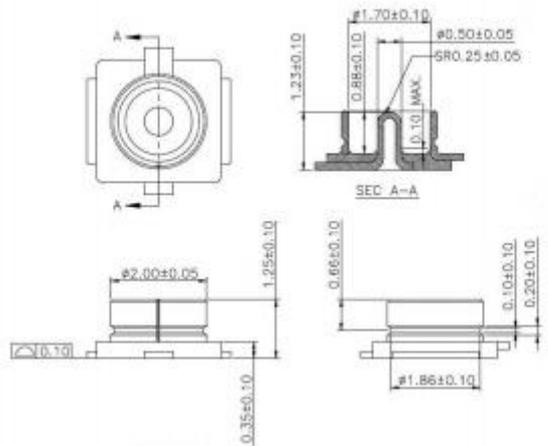
Figure 5-1 U.FL RF connector parameters

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 18±0.35 mm x 23.5±0.35 mm.
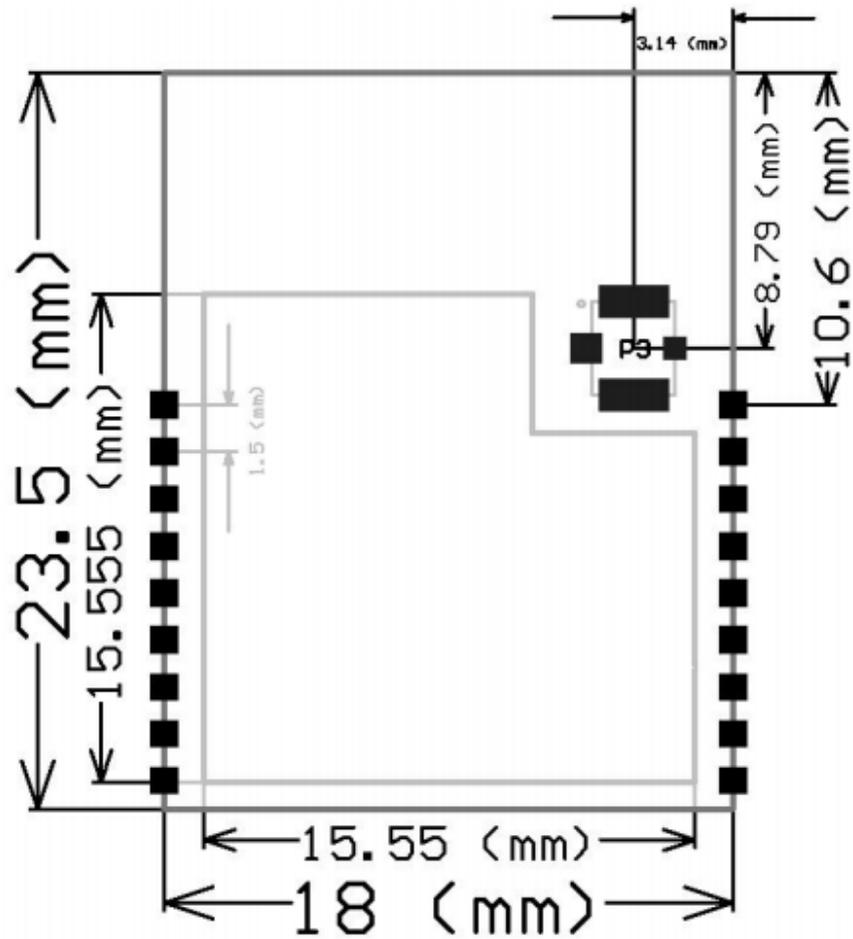
**Figure 6-1 TYWRD1S mechanical dimensions**
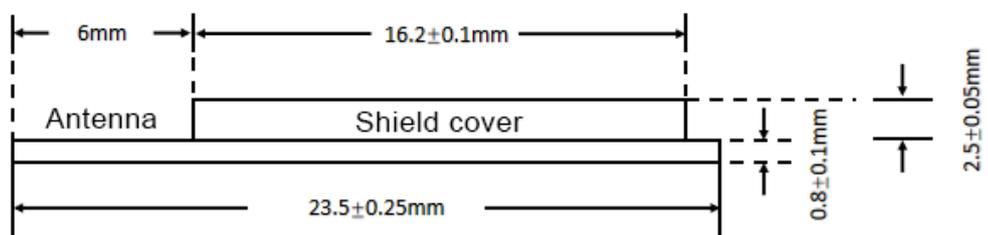
Figure 6-2 Side view

6.2 Recommended PCB Layout
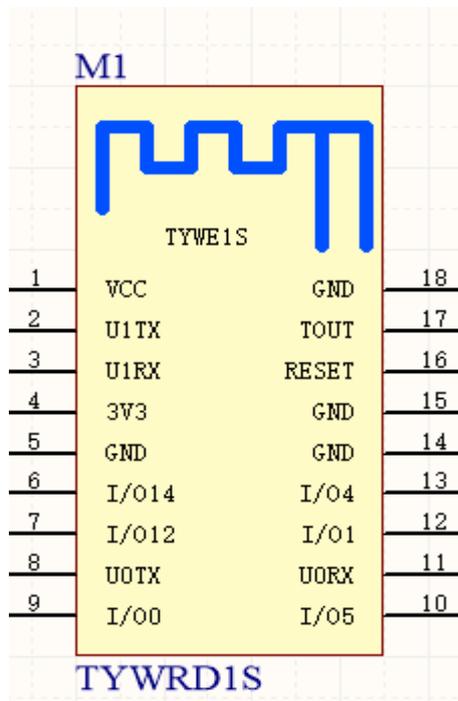
Figure 6-3 TYWRD1S pins
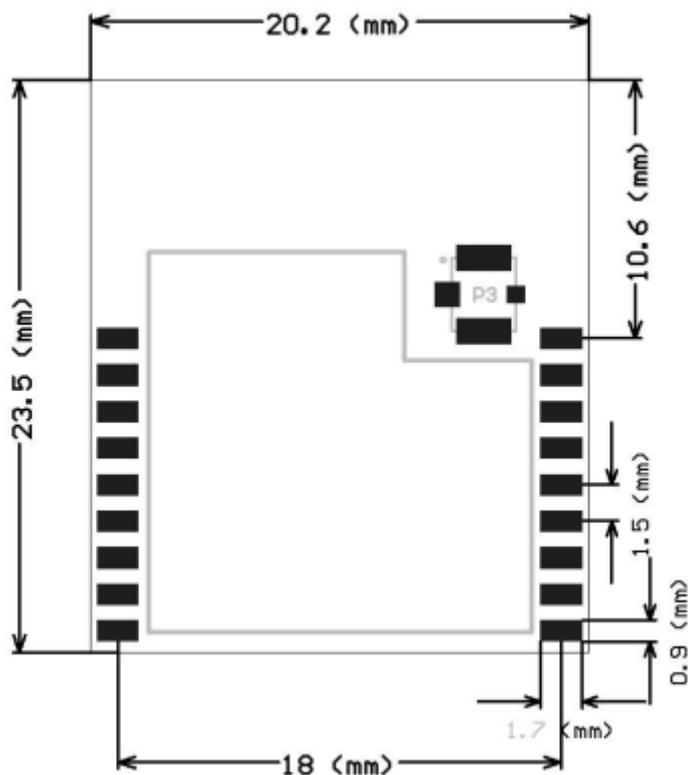
Figure 6-4 Layout of the PCB to which TYWRD1S applies

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. iAutomated 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 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 humidity indicator card (HIC).
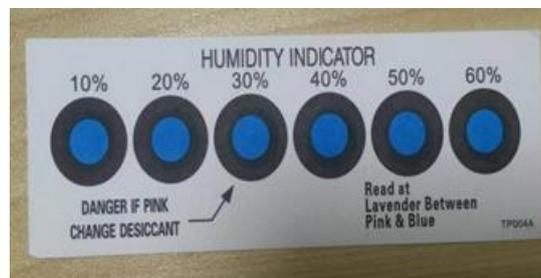
Figure 6-5 HIC for TYWRD1S

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.
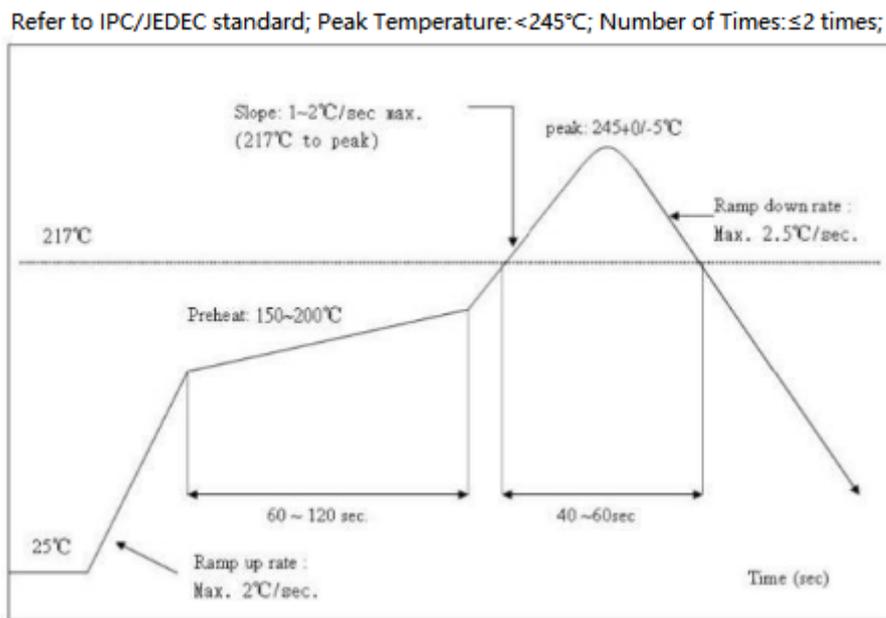
Figure 6-6 Oven temperature curve

6.5 Storage Conditions

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

MOQ and packing information				
Product Model	MOQ	Packing Method	Number of Modules in Each Reel Pack	Number of Reel Packs in Each Box
TYWRD1S	4000	Carrier tape and reel packing	1000	4

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.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

15.105 Information to the user.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

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.

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

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

The availability of some specific channels and/or operational frequency bands is country dependent and firmware programmed at the factory to match the intended destination.

The firmware setting is not accessible by the end user.

The final end product must be labeled in a visible area with the following:

"Contains Transmitter Module 2ANDL-TYWRD1S"

This radio module must not be installed to co-locate and operating simultaneously with other radios in host system, additional testing and equipment authorization may be required to operating simultaneously with other radio.

Declaration of Conformity European notice

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

EN 300 328 V2.1.1

EN 301 489-1 V2.1.1; EN 301 489-17 V3.1.1

EN 62311:2008

EN 60950-1:2006+A11:2009+A1:2010+A12:2011+A2:2013