

1 Product Overview

WR3N is a low-power embedded Wi-Fi module that Tuya has developed. It consists of a highly integrated RF chip (RTL8710BN) and an external flash chip, with an embedded Wi-Fi network protocol stack and robust library functions. WR3N also contains a low-power Arm Cortex-M4F microcontroller unit (MCU), WLAN MAC protocol, 1T1R WLAN module, 256 KB static random-access memory (SRAM), 2 MB flash memory, and extensive peripherals. WR3N also contains N32S032 security chip, embedded with hardware algorithm co-processor to provide excellent performance DES / 3DES, AES, SHA, RSA, ECC and national commercial passwords SM1 / SM2 / SM3 / SM4 and other security algorithm modules. WR3N 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: 125 MHz
- ✧ Working voltage: 3.0 V to 3.6 V
- ✧ Peripherals: 7×GPIOs, 2×UART, 1×ADC
- ✧ Wi-Fi connectivity
 - 802.11b/g/n20/n40
 - Channels 1 to 14 at 2.4 GHz
 - WPA and WPA2 security modes
 - Up to +20 dBm output power in 802.11b mode
 - STA, AP, and STA+AP working modes

- Smart and AP network configuration modes for Android and iOS devices
- Onboard PCB antenna
- Working temperature: -20°C to +85°C

1.2 Applications

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

Change History

No.	Date	Change Description	Version After Change
1	2019-12-28	This is the first release.	1.0.0
2	2020-03-19	Update RF Current Consumption	1.0.1

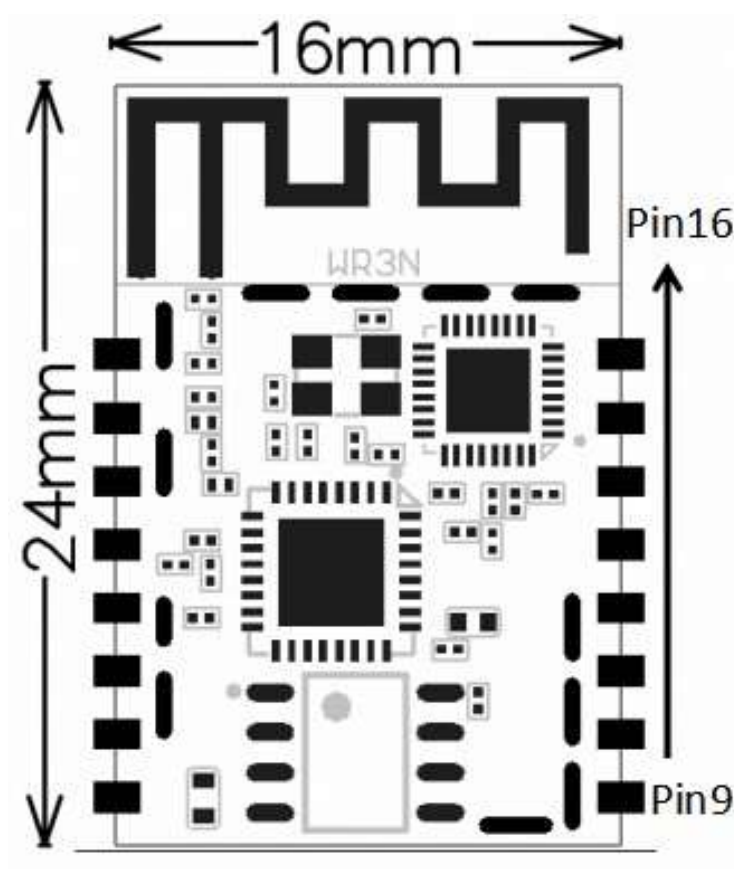
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2 Module Interfaces

2.1 Dimensions and Footprint

WR3N has two rows of pins (2 x 8) with a 2 mm pin spacing. The WR3N dimensions (W x D x H) are 16 ± 0.35 mm x 24 ± 0.35 mm x 2.9 ± 0.15 mm. The PCB thickness is 0.8 ± 0.1 mm. The shield cover height is 2.0 ± 0.05 mm.



2.2 Interface Pin Definition

Table 2-1 WR3N interface pins

Pin No.	Symbol	I/O Type	Function
1	RST	/	Reset
2	ADC	AI	ADC pin with the maximum output voltage of 5 V
3	CHIP_EN	I/O	Function has been disabled by software, users can disconnect it

Pin No.	Symbol	I/O Type	Function
4	GPIOA_29	I/O	UART_Log_RXD, which is used for printing the module internal information and can be configured as a common GPIO (The pin has been pulled up and cannot be set to be triggered at a high level.)
5	GPIOA_14	I/O	GPIOA_14, hardware PWM pin, which is connected to pin 13 on the internal IC
6	GPIOA_15	I/O	GPIOA_15, hardware PWM pin, which is connected to pin 14 on the internal IC
7	GPIOA_0	I/O	GPIOA_0, hardware PWM pin, which is connected to pin 16 on the internal IC (The pin cannot be pulled up during power-on and can be configured after power-on.
8	VCC	P	Power supply pin (3.3 V)
9	GND	P	Power supply reference ground pin
10	NC	/	NC
11	TX0	I/O	UART_Log_TXD, which is used for printing the module internal information and can be configured as a common GPIO
12	NC	/	NC
13	GPIOA_5	I/O	GPIOA_5, hardware PWM pin, which is connected to pin 28 on the internal IC
14	GPIOA_12	I/O	GPIOA_12, hardware PWM pin, which is connected to pin 17 on the internal IC
15	RXD	I/O	UART0_RXD, which is used as a user-side serial interface pin
16	TXD	I/O	UART0_TXD, which is used as a user-side serial interface pin

Note:

P indicates power supply pins

I/O indicates input/output pins

AI indicates analog input pins.

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
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

Table 3-2 Normal electrical 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
VIL	I/O low-level input	−0.3	N/A	3V3*0.25	V
VIH	I/O high-level input	3V3*0.75	N/A	3.6	V
VoL	I/O low-level output	N/A	N/A	3V3*0.1	V
VoH	I/O high-level output	3V3*0.8	N/A	3V3	V
I _{max}	I/O drive current	N/A	N/A	12	mA
C _{pad}	IO input pin capacitance	N/A	2	N/A	pF

3.3 RF Current Consumption

Table 3-3 Power consumption during constant transmission and receiving

Working Status	Parameter			Typical Value	Unit
	Mode	Rate	TX Power/Receiving		
TX	802.11b	11 Mbit/s	+17.5 dBm	350	mA
	802.11g	54 Mbit/s	+14.5 dBm	320	mA
	802.11n	MCS0	+13.5 dBm	350	mA
	802.11n	MCS7	+13.5 dBm	300	mA
RX	802.11b	11 Mbit/s	Constant receiving	137	mA
	802.11g	54 Mbit/s	Constant receiving	137	mA
	802.11n	MCS7	Constant receiving	137	mA

3.4 Working Current

Table 3-4 WR3N 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.	177	418	mA
AP	The module is in AP mode, and the Wi-Fi indicator blinks slowly.	168	434	mA
Network connect without operation	The internet is connected, and the Wi-Fi indicator always blinks.	155	430	mA
Network connect with operation	The internet is connected, and the Wi-Fi indicator always blinks.	154	430	mA

Working Mode	Working Status (Ta = 25°C)	Typical Value	Peak Value*	Unit
Network disconnect	The internet is disconnected, and the Wi-Fi indicator not blink.	155	414	mA

4 RF Features

4.1 Basic RF Features

Table 4-1 Basic RF features

Parameter	Description
Frequency band	2.412 GHz to 2.4835 GHz
Wi-Fi standard	IEEE 802.11b/g/n (channels 1 to 14)
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	Onboard 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			-16		dB
EVM under 802.11g OFDM, 54 Mbit/s, 15.0 dBm			-30		dB
EVM under 802.11n OFDM, MCS7, 14.0 dBm			-31		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

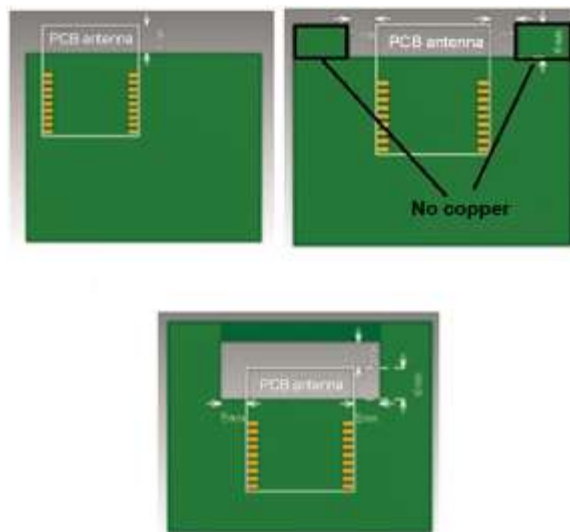
5.1 Antenna Type

WR3N uses an onboard PCB antenna(default way).

5.2 Antenna Interference Reduction

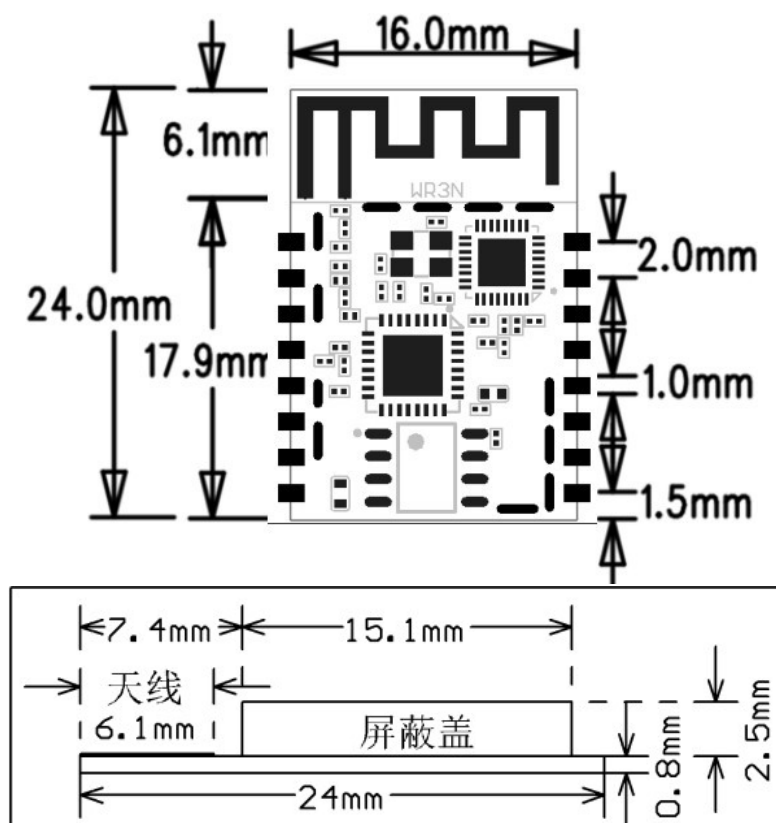
To ensure optimal Wi-Fi performance when the Wi-Fi module uses an onboard PCB antenna, it is recommended that the antenna be at least 15 mm away from other metal parts.

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.

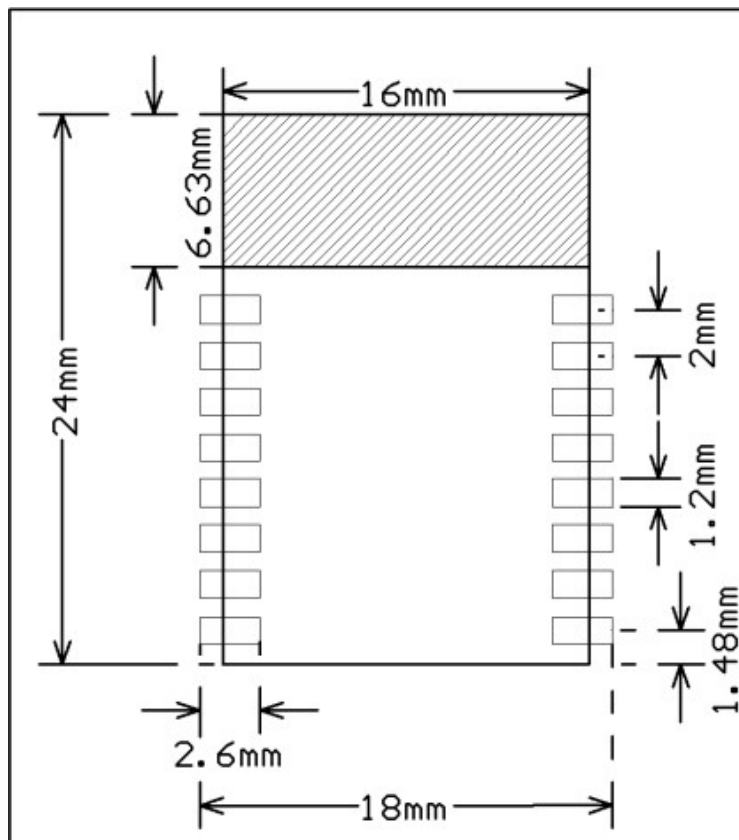
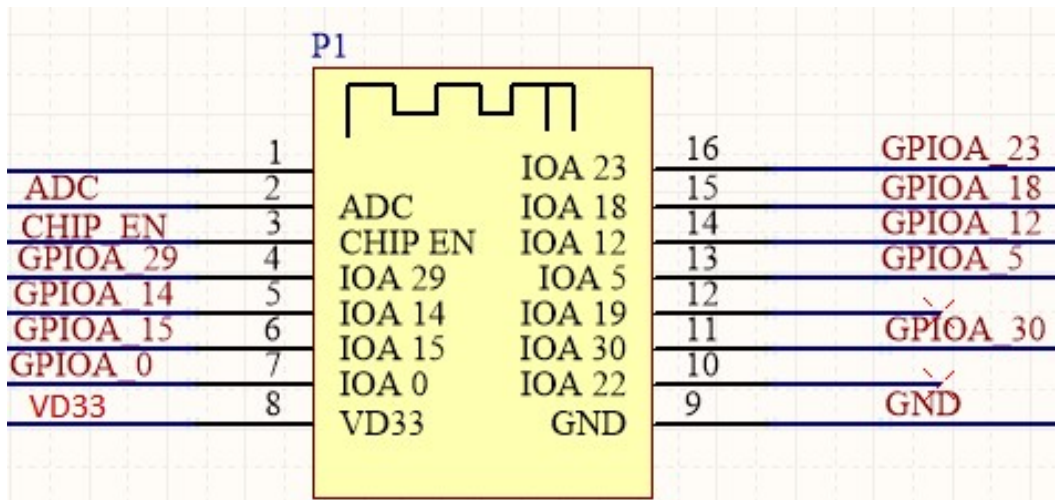


6 Packaging Information and Production Instructions

6.1 Mechanical Dimensions

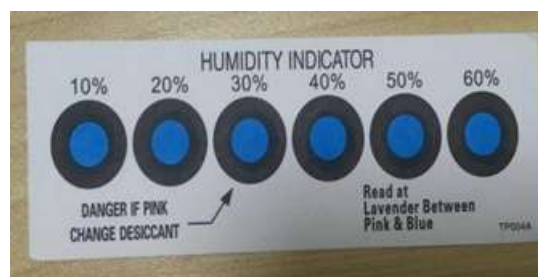


6.2 Recommended PCB Layout



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 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).



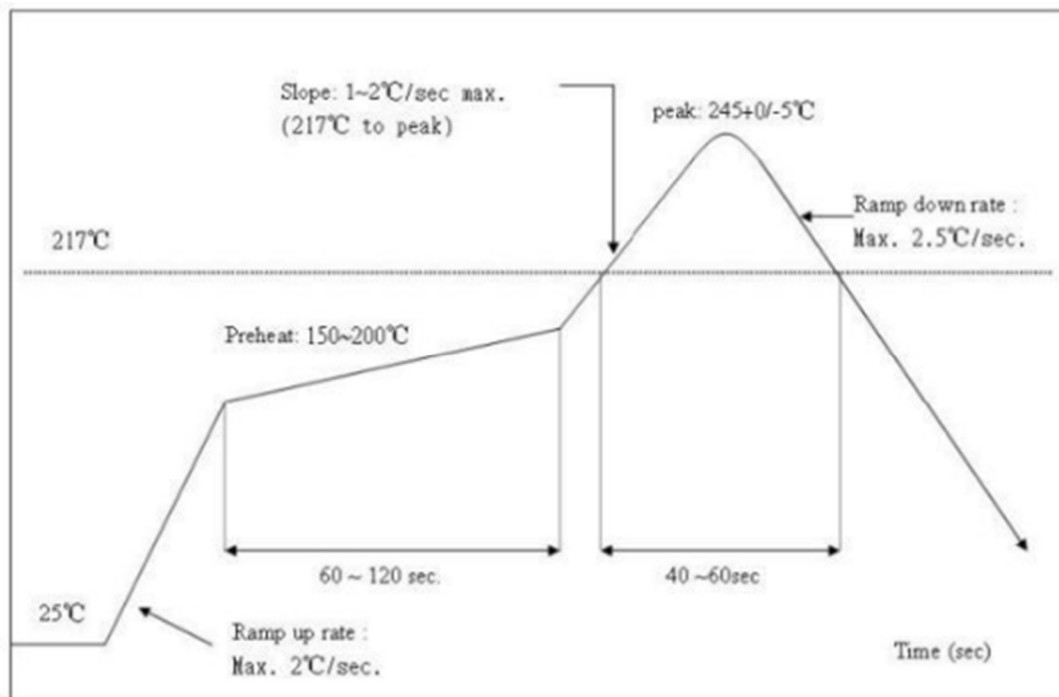
3. Bake a module based on HIC status as follows when you unpack the module package:
 - (1) If the 30%, 40%, and 50% circles are blue, bake the module for 2 consecutive hours.
 - (2) If the 30% circle is pink, bake the module for 4 consecutive hours.

- (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: $125 \pm 5^{\circ}\text{C}$
 - (2) Alarm temperature: 130°C
 - (3) SMT placement ready temperature after natural cooling: $< 36^{\circ}\text{C}$
 - (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.



6.5 Storage Conditions

	CAUTION This bag contains MOISTURE-SENSITIVE DEVICES	LEVEL <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 3 </div>
	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: <u>260</u> °C <small>If Blank, see adjacent bar code label</small>		
3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must		
a) Mounted within: <u>168</u> hrs. of factory conditions <small>If Blank, see adjacent bar code label</small>		
≤ 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: _____ <small>If Blank, see adjacent bar code label</small>		
Note: Level and body temperature defined by IPC/JEDEC J-STD-020		

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-WR3N. The final end product must be labeled in a visible area with the following: "Contains Transmitter Module FCC ID:2ANDL-WR3N"

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.