TB-02Specification

Version V1.0

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Document development/revision/revocation resume

Version	Date	Revised content	Maker	Approve
V1.0	2019.11.25	First developed	Yiji Xie	

CONTENT

1.INTRODUCTION

The TB-02 intelligent lighting module is a Bluetooth module based on the TLSR8253F512 chip and compatible with BT 5.0 low-power Tmall Genie Mesh. This module supports the Bluetooth module directly controlled by Tmall Genie and has a Bluetooth mesh networking function. Peer-to-peer network communication, using Bluetooth broadcast for communication, can ensure timely response in the case of multiple devices. It is mainly used in intelligent light control, which can meet the requirements of low power consumption, low latency, and short-range wireless data communication.

Features

- Can be directly controlled by Tmall Elf without a gateway
- 1.6mm pitch pin vertical solder DIP18 package
- 6 PWM outputs
- With on-board antenna, no need to design antenna
- Brightness (duty cycle) adjustment range 5% -100%
- Factory default 50% duty cycle for cool and warm colors
- PWM output power 1KHz
- With night light function
- With wall switch to switch color temperature function

LIST 1 Main Parameters

Model Name	TB-02
Size	18.0*18.0*2.8(±0.2)MM
Wireless Standard	Bluetooth V5.0
Frequency Range	2400 ~ 2483.5MHz
Output Power	10dBm
Max Sensitivity	-93.2dBm
Interface	GPIO/PWM/SPI/ADC
Work Temperature	-20℃ ~ 70 ℃
Store Temperature	-40 ℃ ~ 125 ℃ , < 90%RH
Voltage Range	Voltage 2.7V ~ 3.6V, Current≥50mA
Power	Deep Sleep Mode：0.8uA
	Sleep Mode：1.8uA
	TX：12.62mA
Transmission distance	80m ~ 150m

2.SPECIFICATION

Electrical characteristics

Absolute Maximum Rating

Any exceeding the following absolute maximum ratings may cause damage to TLSR8253F512

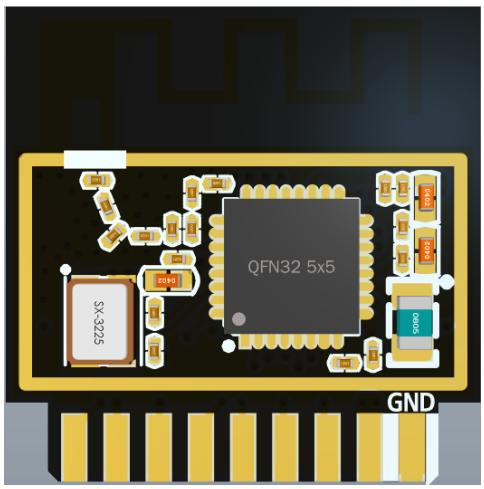
Item	Min	Typical	Max	Unit
Voltage	2.7	3.3	3.6	V
I/O Voltage (VCCIO)	-0.3	-	3.6	V
Work Temperature	-20	-	+70	℃
Store Temperature	-40	-	+125	℃

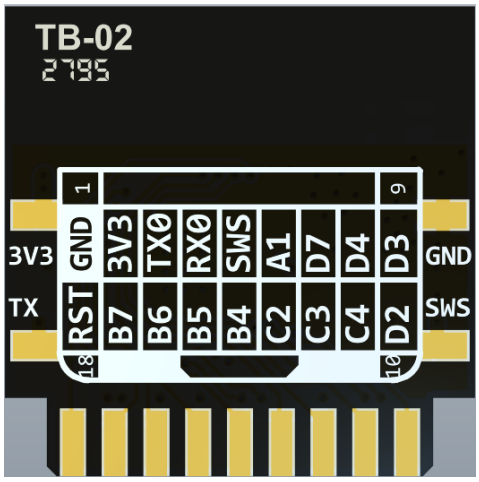
RF Specification

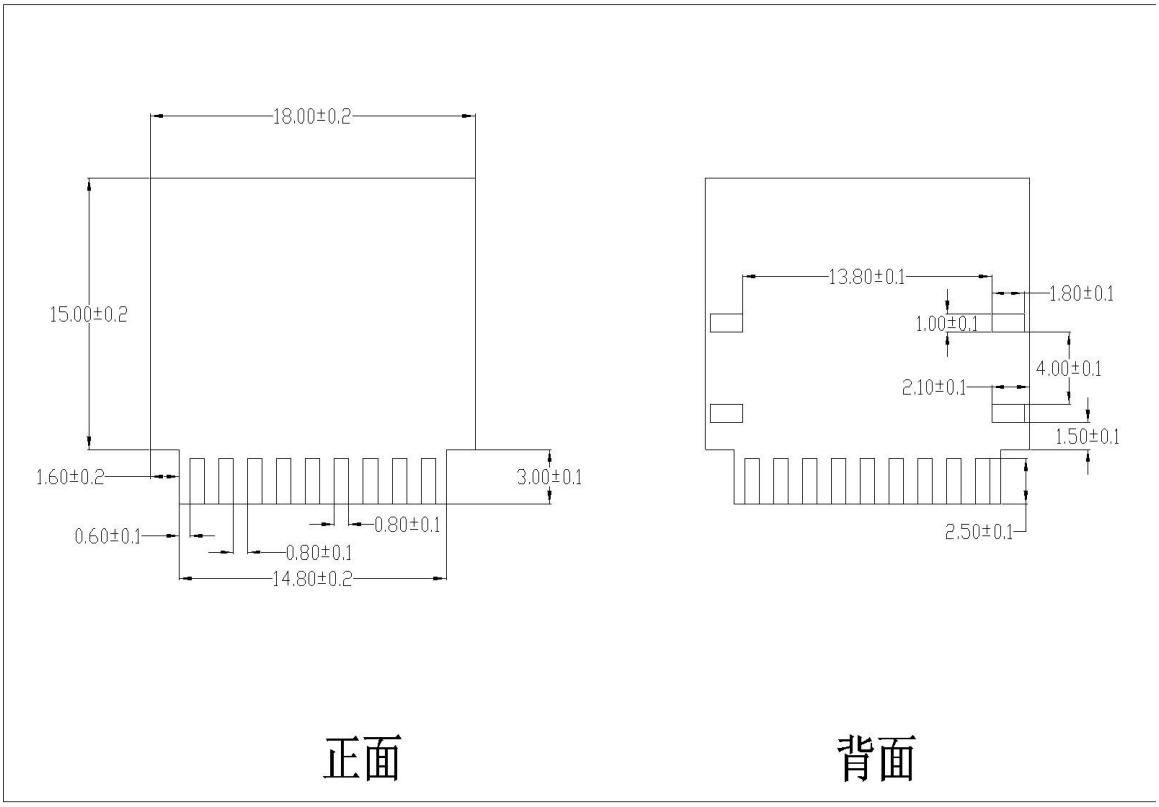
Sensitivity

Item	Min	Typical	Max	Unit
Sensitivity	-92dBm	-91dBm	-90dBm	dBm

3.DIMENSION

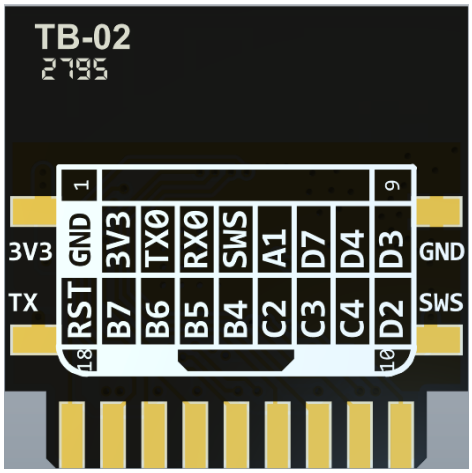






4.PIN DEFINITION

The TB-02 module has a total of 22 interfaces. For example, the pin diagram, the pin function definition table is the interface definition.



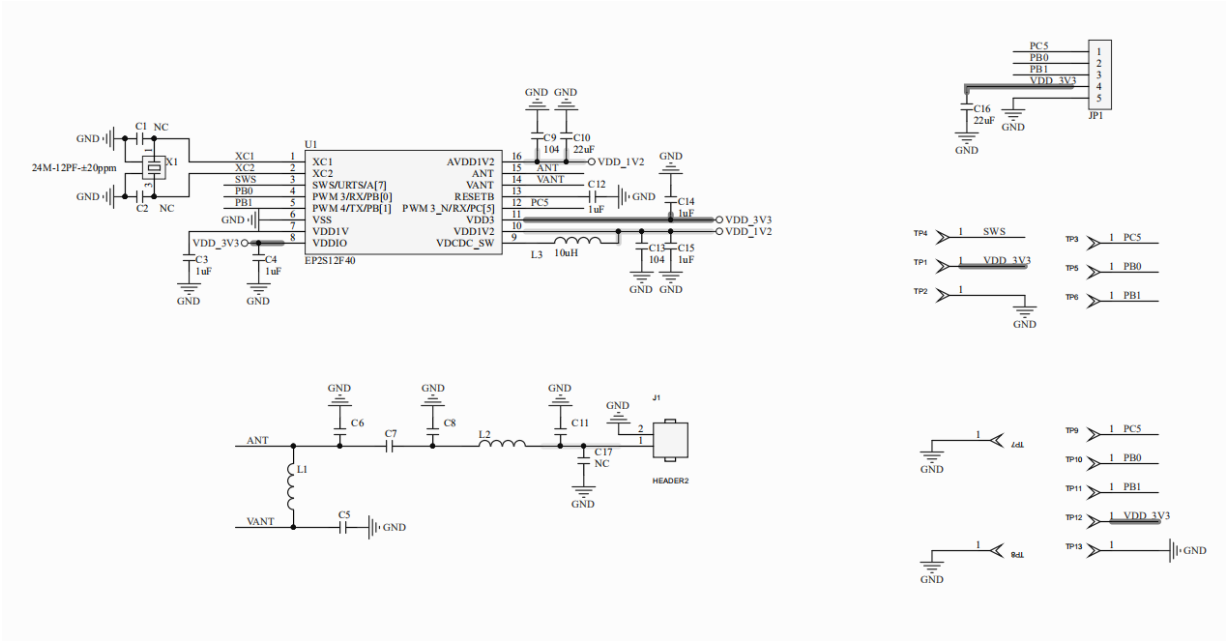
TB-02Pin diagram

PIN function definition sheet

No.	Item	Function Description
1	GND	Ground
2	3V3	Electricity supply
3	TX0	PWM4 output/UART_TX/SAR ADC input/GPIO PB1
4	RX0	PWM0 inverting output/UART_RX/GPIO PA0
5	SWS	Single wire slave/UART_RTS/GPIO PA7
6	A1	GPIO PA1
7	D7	GPIO PD7/SPI clock（I2C_SCK）
8	D4	GPIO PD4/Single wire master/PWM2 inverting output
9	D3	PWM1 inverting output/GPIO PD3
10	D2	SPI chip select（active low）/PWM3 output/GPIO PD2
11	C4	PWM2 output/UART_CTS/PWM0 inverting output /SAR ADC input/GPIO PC4
12	C3	PWM1 output/UART_RX/I2C serial clock/32kHz crystal input（optional）/GPIO PC3
13	C2	PWM0 output/I2C serial data/32kHz crystal output（optional）/GPIO PC2

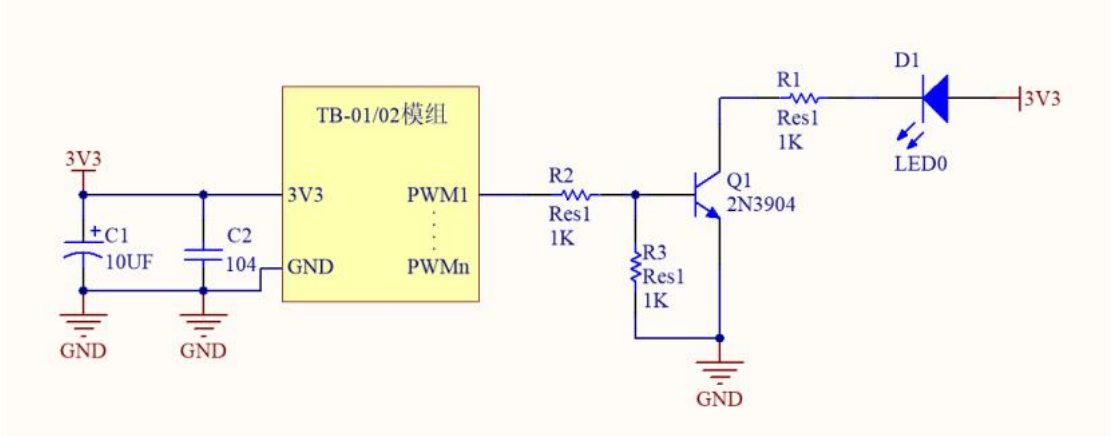
14	B4	PWM4 output/SAR ADC input/GPIO PB4
15	B5	PWM5 output/SAR ADC input/GPIO PB5
16	B6	SPI data input（I2C_SDA）/UART_RTS/SAR ADC input/GPIO PB6
17	B7	SPI data output/UART_RX/SAR ADC input/GPIO PB7
18	RST	RESET
19	3V3	Electricity supply
20	TX	UART_TX
21	GND	Ground
22	SWS	Single wire slave

5.SCHEMATIC



6.DESIGN GUIDE

1、Application circuit



2、Antenna layout requirements

(1) Place the module on the edge of the motherboard, and the antenna area extends beyond the edge of the motherboard.

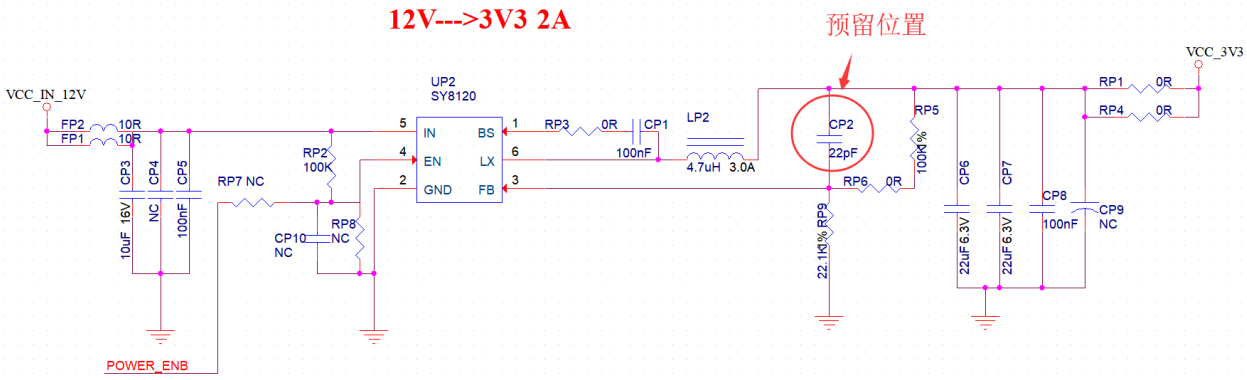
3、Electricity Supply

(1) Recommended 3.3V voltage, peak current above 50mA

(2) It is recommended to use LDO power supply; if using DC-DC, it is recommended to control the ripple within 30mV.

(3) The DC-DC power supply circuit is recommended to reserve the position of the dynamic response capacitor, which can optimize the output ripple when the load changes greatly.

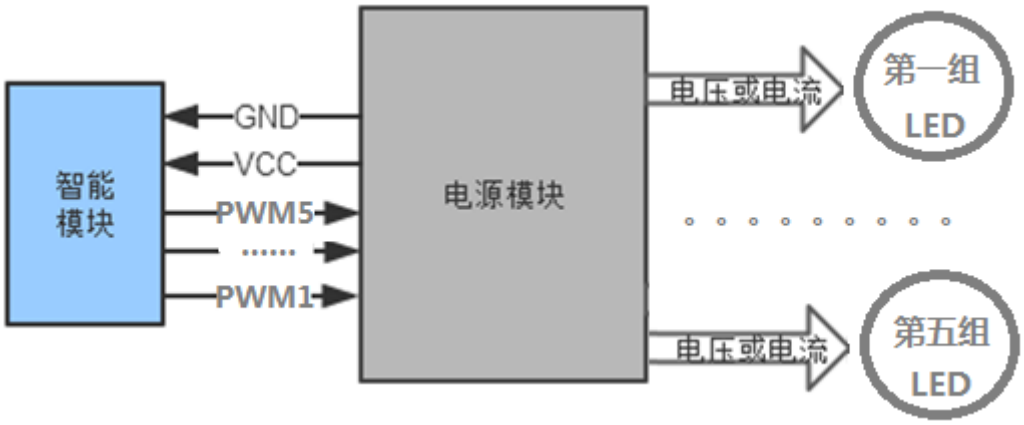
(4) 3.3V power interface is recommended to add ESD devices.



4、PWM Dimming Solution Design Instructions

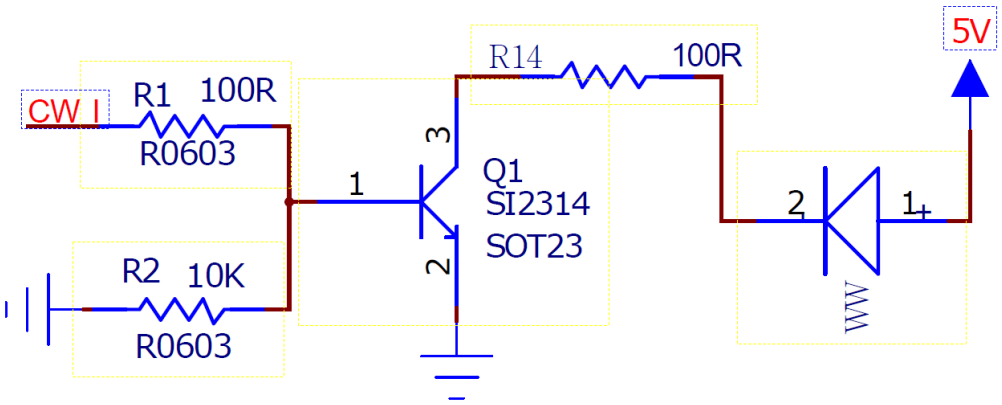
For lamps that require dimming, you only need to connect the PWM pins of the corresponding color to the control end of the subsequent stage drive circuit; the PWM independently outputs a 100-level adjustable digital signal, and the subsequent stage circuit can be voltage The driving type may be a current driving type.

Connection diagram



5、LED Drive Reference Design

TB-02 module application only needs 3.3V power supply and simple driving circuit to achieve intelligent light control. Take MOS tube to drive a channel of white light as an example, the design reference is as follows; CW_I is the module's positive white light PWM output , Q1 is MOS tube, WW is LED lamp beads, the other 4 road lamp driving circuit is the same as this road design method.



6、Secondary development

The TB-02 module supports users to write their own firmware programs to achieve customized functions.

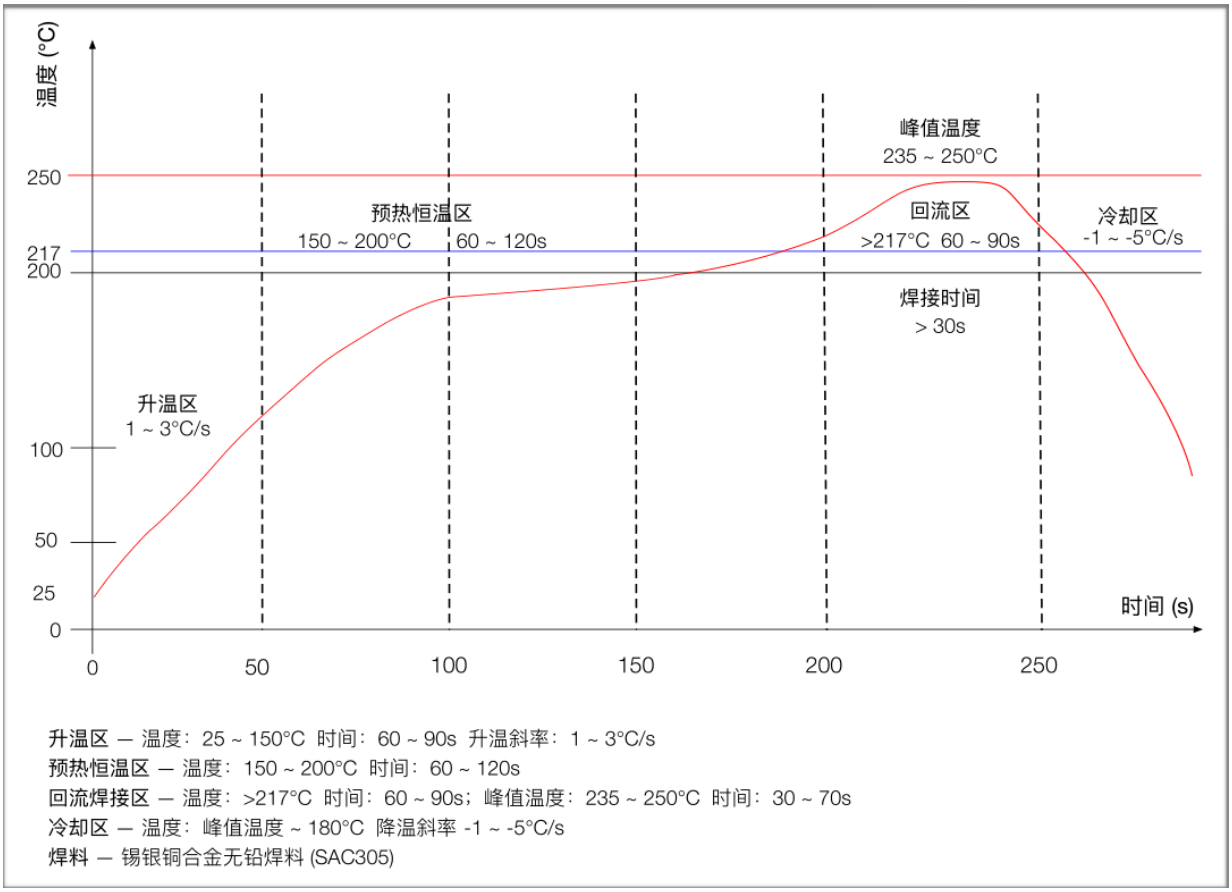
If you use a Linux machine to develop the firmware, you can refer to the SDK, documentation and source address of Anxin's collation:

https://github.com/Ai-Thinker-Open/Telink_825X_SDK.

If you use Windows development, you can refer to the original SDK provided by the chip manufacturer. Download address:

http://wiki.telink-semi.cn

7.REFLOW PROFILE



升温区 — 温度：25 ~ 150°C 时间：60 ~ 90s 升温斜率：1 ~ 3°C/s
预热恒温区 — 温度：150 ~ 200°C 时间：60 ~ 120s
回流焊接区 — 温度：>217°C 时间：60 ~ 90s；峰值温度：235 ~ 250°C 时间：30 ~ 70s
冷却区 — 温度：峰值温度 ~ 180°C 降温斜率 -1 ~ -5°C/s
焊料 — 锡银铜合金无铅焊料 (SAC305)

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

2.2 List of applicable FCC rules

The TB-02 is an BT Module with digitally modulated systems using an GFSK technology; modulation. It operates on the 2400-2483.5MHz band and, therefore, is within U.S. FCC part 15.247 standard

2.3 Specific operational use conditions

The EUT is a BT Module

Operation Frequency: 2402MHz~2480MHz

Modulation Type: GFSK

Number Of Channel: 40

TB-02 Type of antenna: PCB Antenna Gain：2dBi

TB-03F Type of antenna: PCB Antenna Gain：2dBi

TB-04 Type of antenna: FPCB Antenna Gain：2dBi

TB-02 is a BT Module developed by Shenzhen Anxin Ke Technology Co. The core processor TB-02 of this module is a highly integrated low-power BT system-on-chip (SoC) designed for the Internet of Things (IoT) , Mobile devices, wearable electronic devices, smart home and other applications. TB-02 has industry-leading low-power performance and RF performance, supports BLE, integrates BTMAC, BTRF and baseband, RF switch, RF Balun, power amplifier, low noise Amplifier, etc.

2.4 Limited module procedures

not applicable; Single Modular Approval Request

2.5 Trace antenna designs

Not applicable;

2.6 RF exposure considerations

To maintain compliance with FCC's RF Exposure guidelines, This equipment should be installed and operated with minimum distance between 20cm the radiator your body: Use only the supplied antenna.

2.7 Antennas

The TB-02 is an BT Module beams signals and communicates with its antenna, which is PCB Antenna. The PCB Antenna gain is 2.0dBi. Antenna could not be in no-load state when module is working. During debugging, it is suggested to add 50 ohms load to the antenna port to avoid damage or performance degradation of the module under long-time no-load condition. It needs to be declared. Only the antenna equipped with the package can be used, only antennas as in the filing are allowed.

2.8 Label and compliance information

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

Host must Contains FCC ID: 2ATPO-TB02. If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of 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.

2.9 Information on test modes and additional testing requirements

Data transfer module demo board can control the EUT work in RF test mode at specified test channel.

2.10 Additional testing, Part 15 Subpart B disclaimer

The module without unintentional-radiator digital circuit, so the module does not required an evaluation by FCC Part 15 Subpart B. The host should be evaluated by the FCC Subpart B.

ATTENTION

This device is intended only for OEM integrators under the following conditions:

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

2) This device and its antenna(s) must not be co‑located with any other transmitters except in accordance with FCC multi‑transmitter product procedures. Referring to the multi‑transmitter policy, multiple transmitter(s) and module(s) can be operated simultaneously without C2P.

3) For all products market in US, OEM has to limit the Operating Frequency: 2402-2480MHz by supplied firmware programming tool. OEM shall not supply any tool or info to the end‑user regarding to Regulatory Domain change.

USERS MANUAL OF THE END PRODUCT:

In the user manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio‑frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is required to be available in the users manual: This device complies with Part 15 of 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.

FCC WARNING

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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 generate, 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.

8.PACKAGING

As shown below, the packaging of TB-02 is taping packaging.

9.CONTACT US

Company Website：https://www.ai-thinker.com

Development DOCS：https://docs.ai-thinker.com

Official Forum：http://bbs.ai-thinker.com

Sample Purchase：https://anxinke.taobao.com

Business：sales@aithinker.com

Technical Support：support@aithinker.com

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