PB-02 Specifications

Version V1.0

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Document development / revision / revocation resume

Version	Date	Development/revision	Development	Approval
V1.0	2020.05.29	Initial development	Xie Yiji	

Contents

1、Product Overview

PB-02 is a BLE 5.0 low-power Bluetooth module based on PHY6212 chip; supports SIGMesh.. PHY6212 is equipped with ARM® Cortex™ -M0 32-bit processor, 138KB SRAM, ultra-low power consumption,high performance and wireless multi-mode characteristics,, supports BLE functions of security, applications and wireless updates.

PB-02 module has the function of Bluetooth mesh networking; the communication between devices through peer-to-peer network, using Bluetooth broadcast for communication, can ensure timely response in the case of multiple devices. It is mainly used in intelligent lamp control, wearable smart device, retail payment and other Internet of things fields; it can meet the requirements of low power consumption, low delay, low cost wireless data communication.

Characteristics

- 1.1 mm spacing SMD-20 package
- 6 channels PWM output
- The antenna adopts PCB onboard antenna; at the same time, half hole pad and antenna hole are reserved. The half-hole pad can guide the antenna to the motherboard, and the antenna hole can be directly welded to the spring antenna.
- Brightness (duty cycle) adjustment range 5%-100%
- Factory default cool and warm color 50%
- PWM output frequency 1KHz
- Features with Nightlight
- Switching Color Temperature with Wall Switching

Main parameters

Table 1 main parameter descriptions

Model	PB-02
Dimensions	12.2*18.6*2.3(±0.2) MM
Package	SMD-20
Wireless Standards	Bluetooth 5.0
Frequency range	2400~2483.5 MHz
Maximum transmit power	Maximum dBm 10
Receiving sensitivity	-93±2 dBm
Interface	GPIO/PWM/SPI/ADC
Operating temperature	-40℃ ~ 85 ℃
Storage environment	-40℃~125℃,<90%
Powersupply range	Supply voltage 2.7 V ~3.6 V, supply current ≥50 mA
Power consumption	Deep sleep mode :0.7 uA (IO wake-up)
	Dormancy mode :2 uA (RTC wake-up)
	RX mode :7 mA
	TX (10dBm):25mA

2、Electrical parameters

Electrical characteristics

PB-02 module is electrostatic sensitive equipment, when handling need to take special precautions

Absolute maximum rating

Any more than the following absolute maximum values can cause module damage

Name	Minimum value	Typical values	Maximum value	Units
Supply voltage	2.7	3.3	3.6	V
I/O supply voltage (VCCIO)	−0.3	−	3.6	V
Operating temperature	−40	−	+85	℃
Storage temperature	−40	−	+125	℃

Power consumption

Name	Typical values	Units
Emission power consumption (10 dBm)	25	mA
Receiving Power	7	mA
Light Sleep	2	uA
Deep Sleep	0.7	uA

RF parameters

Transmission power

Name	Minimum value	Typical values	Maximum value	Units
Average power	-	8.5	10	dBm

Receiving sensitivity

Name	Minimum value	Typical values	Maximum value	Units
Receiving sensitivity	-95	-93	-	dBm

3、Appearance dimensions
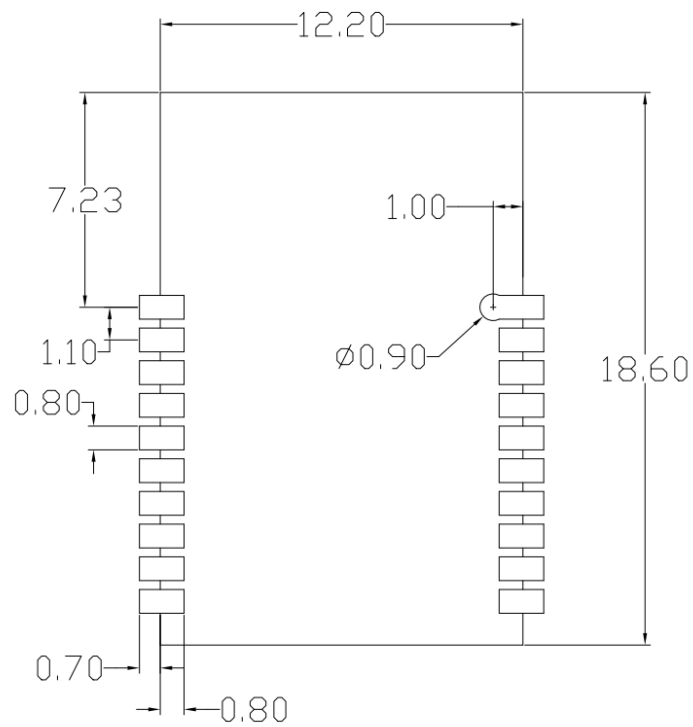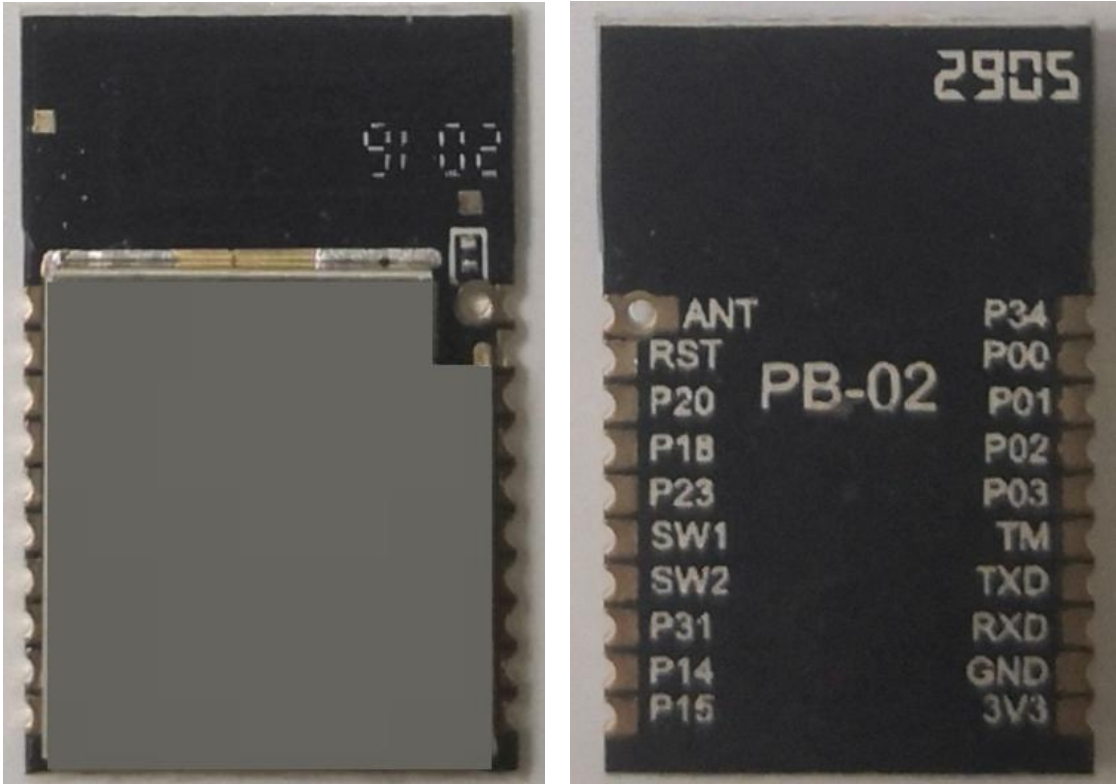
4、Definition of pins
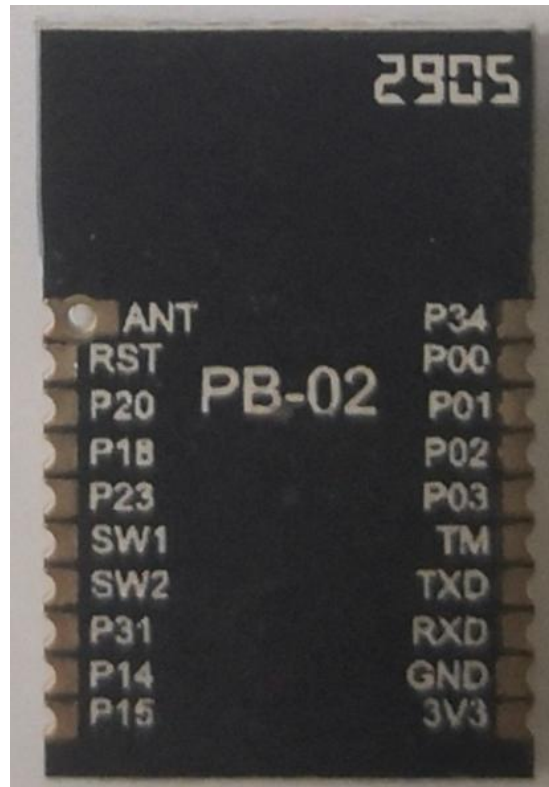
PB-02 Foot Schemes

The PB-02 module has a total of 20 interfaces. As shown in the pin diagram, the pin function definition table is the interface definition.

Foot function definition table

| No.	Name	Functional Description
1	P34	GPIO34, all features are configurable *Note: Interrupt and ADC functions are not supported
2	P00	GPIO00, all functions are configurable/ JTAG_TDO *Note: ADC functionality not supported
3	P01	GPIO01, all functions are configurable/ JTAG_TDI *Note: ADC functionality not supported
4	P02	GPIO02, all functions are configurable/ JTAG_TMS *Note: ADC functionality not supported
5	P03	GPIO03, all functions are configurable/ JTAG_TCK *Note: ADC functionality not supported
6	TM	Flash mode selection, this pin pull-up to high level , boot start into flash mode

| 7	TXD	Serial URAT_TXD
8	RXD	Serial URAT_RXD
9	GND	Ground
10	3V3	Power supply, typical value 3.3 V
11	P15	GPIO15, all features configurable/ AIO <4>
12	P14	GPIO14, all features are configurable/ AIO <3>
13	P31	GPIO31, all features are configurable *Note: Interrupt and ADC functions are not supported
14	SW2	GPIO25, all functions configurable/test mode start configuration [1], this pin pull-up to high level , boot start into test mode
15	SW1	GPIO24, all features configurable/test mode start configuration [0]
16	P23	GPIO23, all features are configurable *Note: Interrupt and ADC functions are not supported
17	P18	GPIO18, all functions are configurable/ AIO <7>/ PGA differential positive input *Note: Interrupt functionality not supported
18	P20	GPIO20, all functions are configurable/ AIO <9>/ microphone bias output *Note: Interrupt functionality not supported
19	RST	Reset pin
20	ANT	Antenna interface

5、 Schematic diagrams
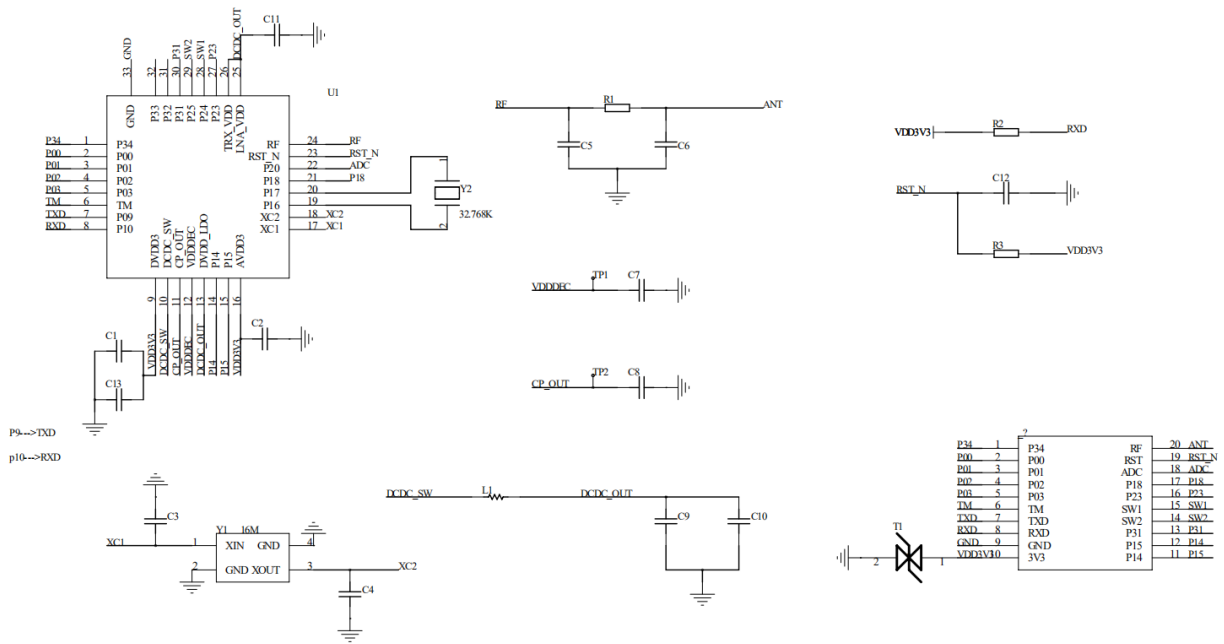
6、Design guidance

1、Application circuit
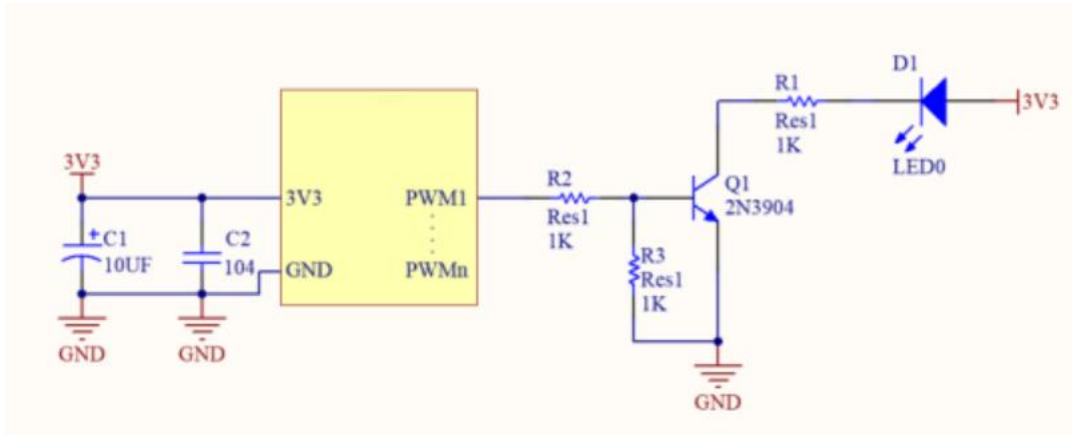
2. recommended module package design dimensions
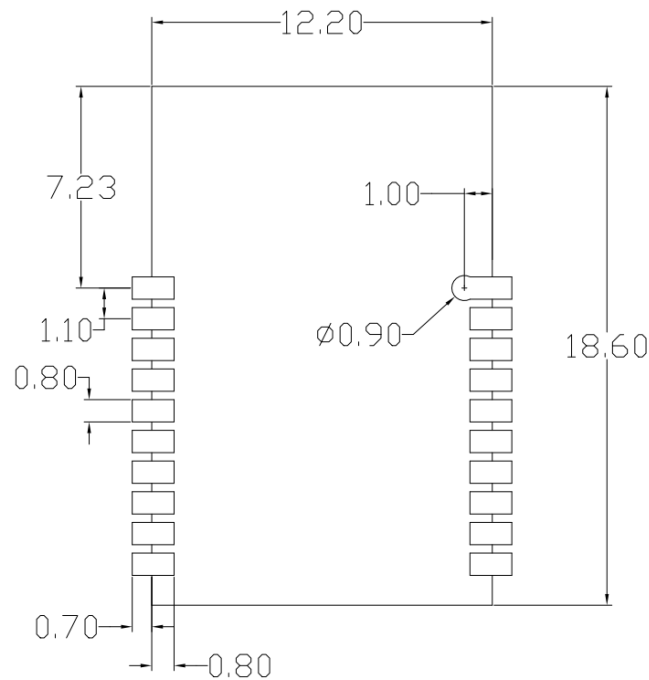
Note: This is the PB-02 module package diagram, It is recommended to design the PCB board according to this diagram, so that the module can work normally on the PCB board; and when designing the pads, please pay attention to the design of the pads on the PCB. The pad is retracted and offset, and the PCB pad is expanded from the module pad do not affect the use of the module.

3. antenna layout requirements

（1）、For the installation position on the motherboard, the following two methods are recommended:

（2）Solution 1: Put the module on the edge of the motherboard, and the antenna area extends out of the edge of the motherboard.

（3）Solution 2: Put the module on the edge of the motherboard, and hollow out an area at the antenna position on the edge of the motherboard.

（4）In order to meet the performance of the onboard antenna, it is forbidden to place metal parts around the antenna, away from high-frequency components.

4. power supply

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

(2)、 It is recommended to use LDO for power supply; if DC-DC is used, the ripple is recommended to be controlled within 30mV.

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

(4),It is recommended to add ESD devices to the 3.3V power interface
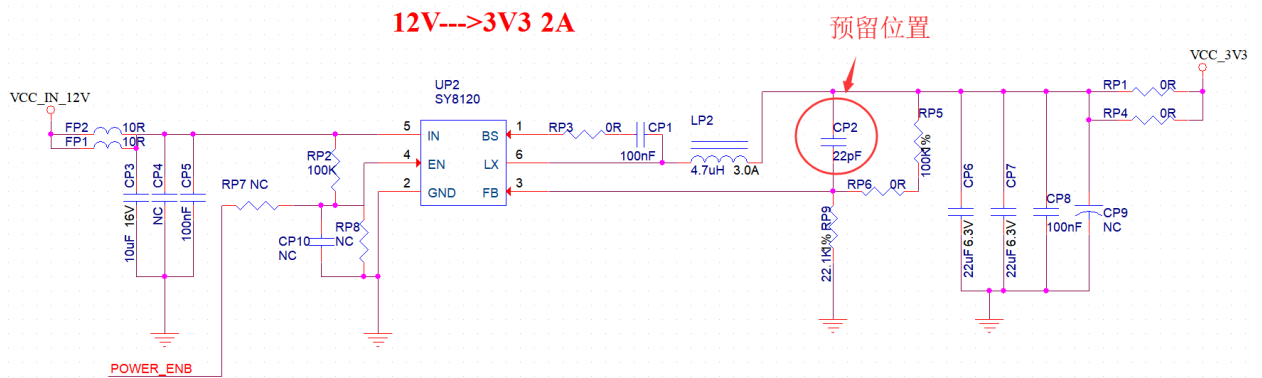
5. Design description of PWM dimming scheme

For lamps that require dimming function, only require to connect the PWM pin of the corresponding color to the control end of the subsequent drive circuit; PWM independent output is a digital signal with 100 levels of adjustable duty cycle, and the subsequent circuit can be voltage drive type or a current drive type.
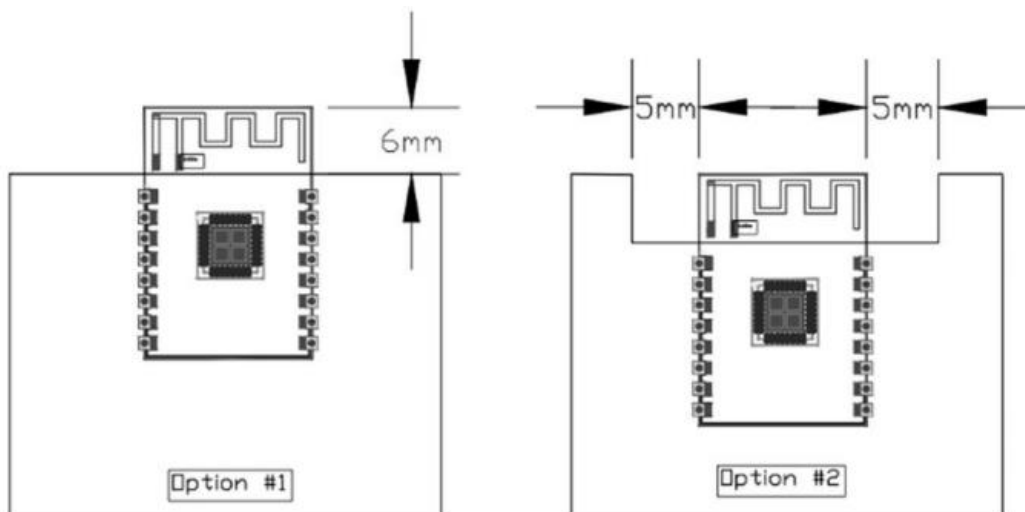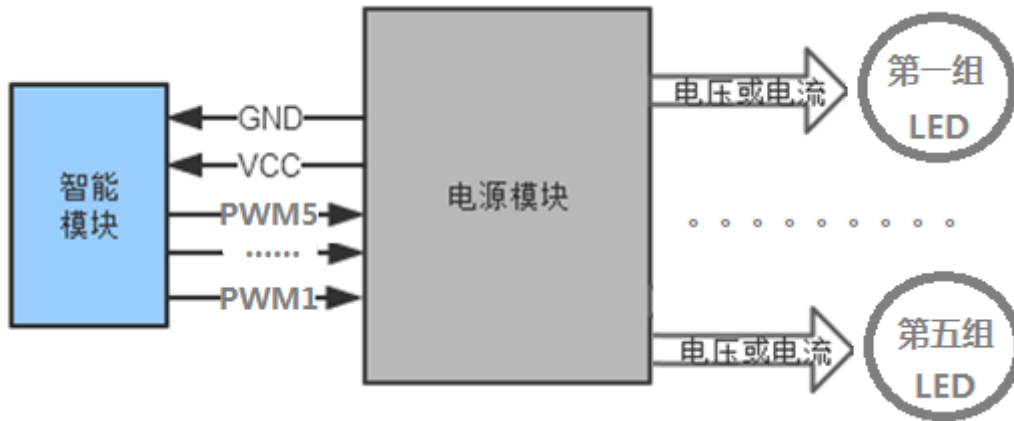

Diagram of connection

6.LED Drive Reference Design

The PB-02 module application only requires 3.3V power supply and a simple drive circuit to realize smart light control. Take the MOS tube driving a positive white light as an example. The design refers to the following figure; CW_I is the PWM output pin of the positive white light of the module , Q1 is a MOS tube, WW is an LED lamp bead, and the design method of the other 4-way lamp driving circuit is the same as this way.
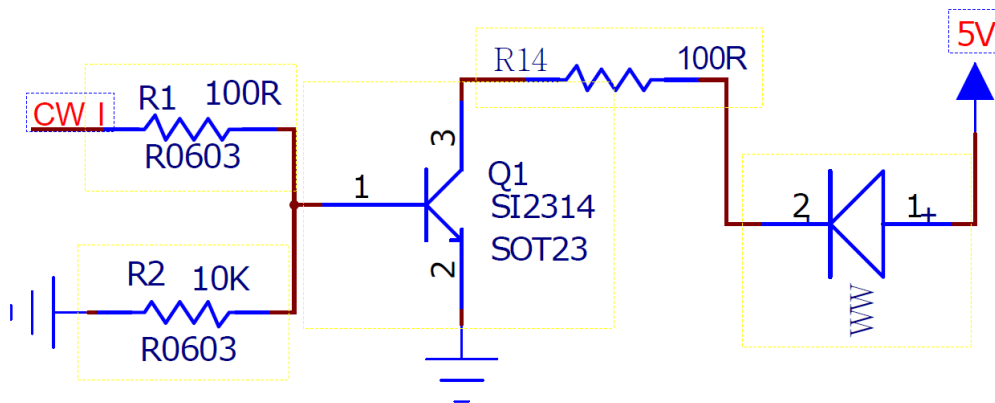
7、Packaging information

as shown below, the PB-02 packing is tape packing.

8、 Contact us

Official website: https://www.ai-thinker.com

Development DOCS : http s : //d ocs.ai-thinker.com

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

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

Business cooperation: sales@aithinker.com

Technical support: support@aithinker.com

Company Address: Building C, Huafeng Intelligent Innovation Port, Xixiang, Baoan District,

Shenzhen

Tel :0755-29162996

OEM/Integrators Installation Manual
Important Notice to OEM integrators
INTEGRATION INSTRUCTIONS
FCC rules
The PB-02 is an BT Module Module with frequency hopping. It operates on the 2400 ~2500 MHz band and, therefore, is within U.S. FCC part 15.247 standard.
Modular installation instruction
1,PB-02 Integrates high-speed GPIO and peripheral interface. Please pay attention to the installation direction (pin direction).
2,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.
3,When the module needs to output 10dBm or more power, it needs a voltage supply of 3.6V or more to achieve the expected output power.
4,When working at full load, it is recommended that the entire bottom surface of the module be attached to the housing or heat dissipation plate, and it is not recommended to conduct heat dissipation through air or screw column heat conduction.
5,UART1 and UART2 are serial ports with the same priority. The port which receives commands returns information.
Trace antenna designs
Not Applicable
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.
Antennas
The PB-02 is an BT Module beams signals and communicates with its antenna, which is PCB Antenna . The PCB Antenna gain is 1.5dBi
LABEL OF THE END PRODUCT
The final end product must be labeled in a visible area with the following:
Host must Contains FCC ID: 2ATPO-PB01-02. 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.

Information on test modes and additional testing requirements5
Data transfer module demo board can control the EUT work in RF test mode at
specified test channel.

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: 2400 ~2500MHz

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.

PB-02 has its own onboard antenna, PB-01 his used with external antenna, to maintain compliance with FCC's RF Exposure guidelines, This equipment should be installed with only the supplied antenna.