HF-BL500

Bluetooth Module

User Manual

V 1.1

Overview of Characteristic

- ✧ **Support BLE5.0 Standard. Max 2Mbps Data Rate**
- ✧ **Integrate RISC MCU, 48MHz CPU, 48KB RAM, 512KB Flash**
- ✧ **Support Wireless OTA Upgrade**
- ✧ **UART Transparent Transmit Module**
- ✧ **Support SIG Mesh**
- ✧ **Supper Low Sleep Mode, 6.1uA. Excellence Power Save Scheme Suitable for Battery-Powered Applications**
- ✧ **Support Internal Antenna**
- ✧ **Size: 22.5mm x 13.5mm x 3mm**

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HISTORY

V 0.1 08-10-2020. First Version

V 0.2 09-02-2020. Update Pin Description

V 1.0 10-19-2020. Add and update AT command(AT:WAC, AT:TPL, AT:ADV)

V 1.1 01-13-2021. Add AT+UIDNW, AT+UIDIW, AT+UIDIR, AT+UIDNR Command

1. PRODUCT OVERVIEW

1.1. General Description

HF-BL500 Bluetooth Low Energy module is a high performance IOT module designed by High Flying. It provide a solution for connecting things to Bluetooth wireless network and data transmitting via UART interface. With the feature of low power, small size, high anti-interference performance, the module integrates PCB antenna and use open stamp type interface which enable customer have more flexibility on software and product structure , and solve the RF hardware design and debug issue.

The HF-BL500 SOC chip block diagram is as following.

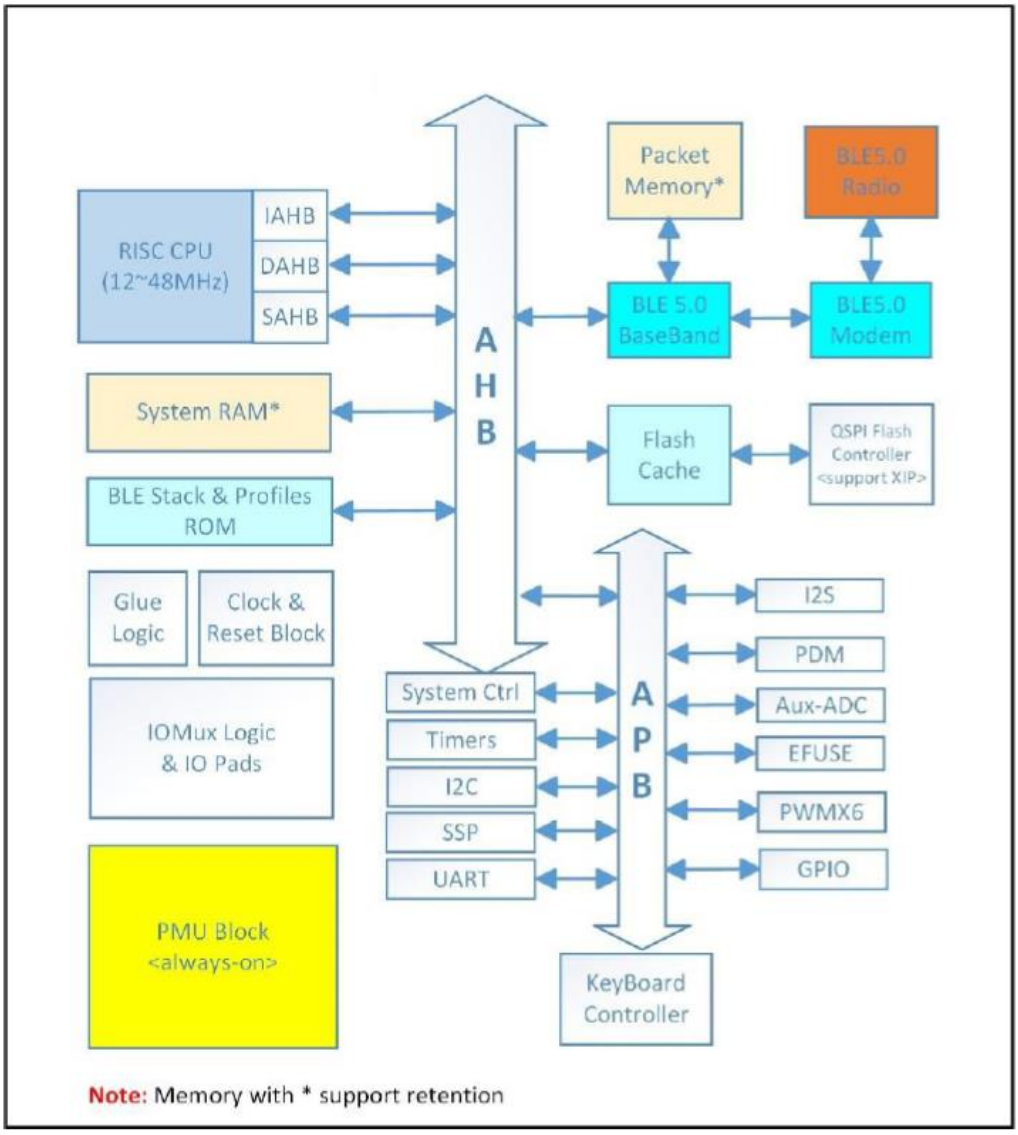

Figure 1. HF-BL500 SOC Block Diagram

1.2. Key Application

- Smart LED lighting
- Smart toy
- Electronic Scale
- Smart Cup
- Smart Home Appliance
- OBD
- IOT, Smart Home Automation
- Sports, fitness, customer electronics products
- Smart instrument, data acquisition sensor
- PC, Tablet peripheral interface

1.3. Device Parameter

Table1. HF-BL500 Module Technique Specification

Class	Item	Condition	Parameter
Wireless parameter	Certificate		TBD
	Wireless standard		802.15.1
	Frequency range		2.402GHz-2.480GHz
	Data rate		2Mbps@2.4GHz
	Tx power Max		3.41 dBm
	Rx sensitivity		-93 dBm
Hardware parameter	Data interface		UART PWM ADC
	Operating voltage		DC 3.3V
	Power consumption	Sleep	6.1uA
	Average power consumption	20ms broadcast	3.2mA
	Distance	Indoor	30 meters
	Work temperature		-40℃- 125℃
	Storage temperature		-45℃- 125℃
	Size		22.5mm x 13.5mm x 3mm

1.4. Module Appearance

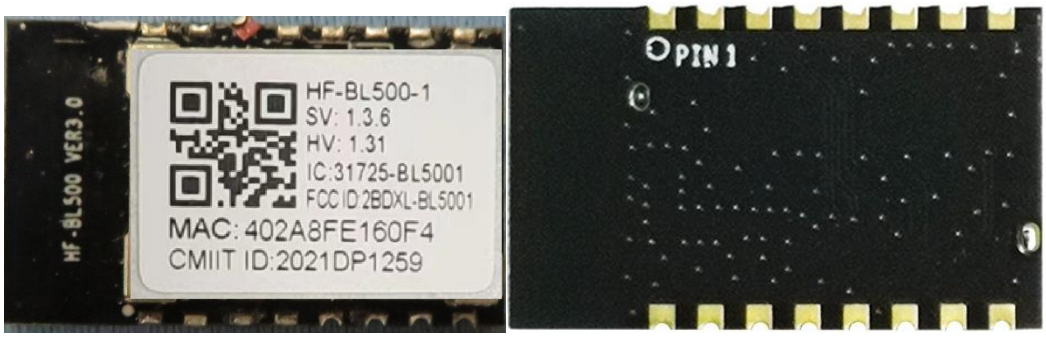

Figure 2. HF-BL500 Appearance

2. HARDWARE INTRODUCTION

2.1. Pin Definition

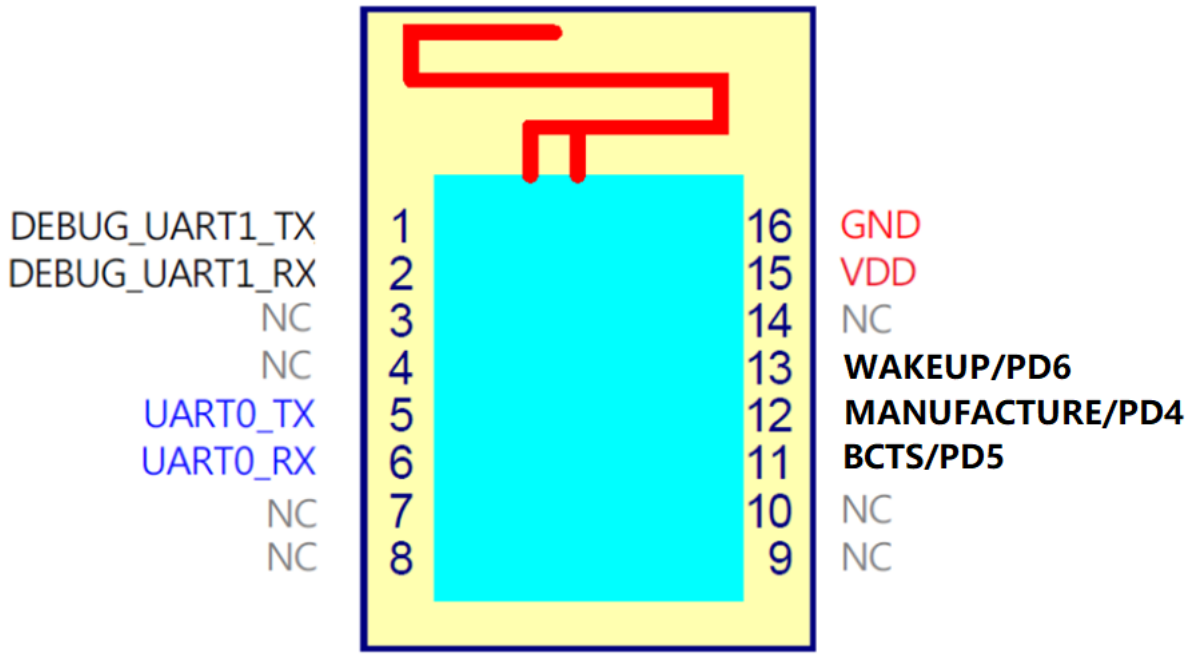

Figure 3. HF-BL500 Pin Definition

Table2. HF-BL500 Pin Function Definition

Pin	Describtion	Net Name	Signal Type	Comments
1	UART1_TX	DEBUG_UART1_TX	O	3.3V TTL Debug UART1 Output PORTA3, PWM3
2	UART1_RX	DEBUG_UART1_RX	I	3.3V TTL Debug UART1 Input PORTA2, PWM2
3		NC		
4		NC		
5	UART0_TX	UART0_TX	O	3.3V TTL UART0 Output PORTC7
6	UART0_RX	UART0_RX	I	3.3V TTL UART0 Input PORTC6
7, 8 9, 10		NC		
11		BCTS	IO	The default output low, high data output is sent, used to wake up the MCU, the data is sent after the output low PORTD5, PWM4/ADC1
12		MANUFACTURE	I/O	Pull Low for more than 5 seconds to restore the factory settings, leave it open if not

				use(internal has low pull-up) PORTD4, PWM5/ADC0
13		WAKEUP	IO	Pull low to wake up module, if does not need power save, direct connect this pin to GND PORTD6, PWM1/ADC2
14		NC		
15	**+3.3V 电源**	**DVDD**	**Power**	
16	**Ground**	**GND**	**Power**	

<Notes>

I — Input；O — Output

PU—Internal Resistor Pull Up； I/O: Digital I/O； Power—Power Supply

PWM function:

PWM1~PWM5 is for LED Mesh application, it direct output PWM, control the LED duty cycle, add transistor or MOSFET to amplify.

2.2. Electrical Specification

Table3. Limited Specification

Parameter	Description	Min Value	Typ. Value	Max value	Unit
VPIN	Pin voltage limit	-0.1	-	VCC	V
T_VRISE	Power up time	5	-	100	mS
ESD_HBM				4000	V
ESD_MM				100	V
ESD_CDM				500	V
Storage temperature range		-50		150	°C

Table4. RF Specification

Parameter	**Min value**	**Typ. Value**	**Max value**	**Unit**
Receiving sensitivity		-93		dBm
Operating frequency range	2400		2483	MHz
Frequency deviation	225	250	275	KHz
Output Power	-20		4	dBm
Frequency tolerance		±50		Ppm
Signal strength accuracy		±5		dBm
Signal accuracy		1		dBm

2.3. Mechanical size

HF-BL500 physical size （unit: mm）as below:

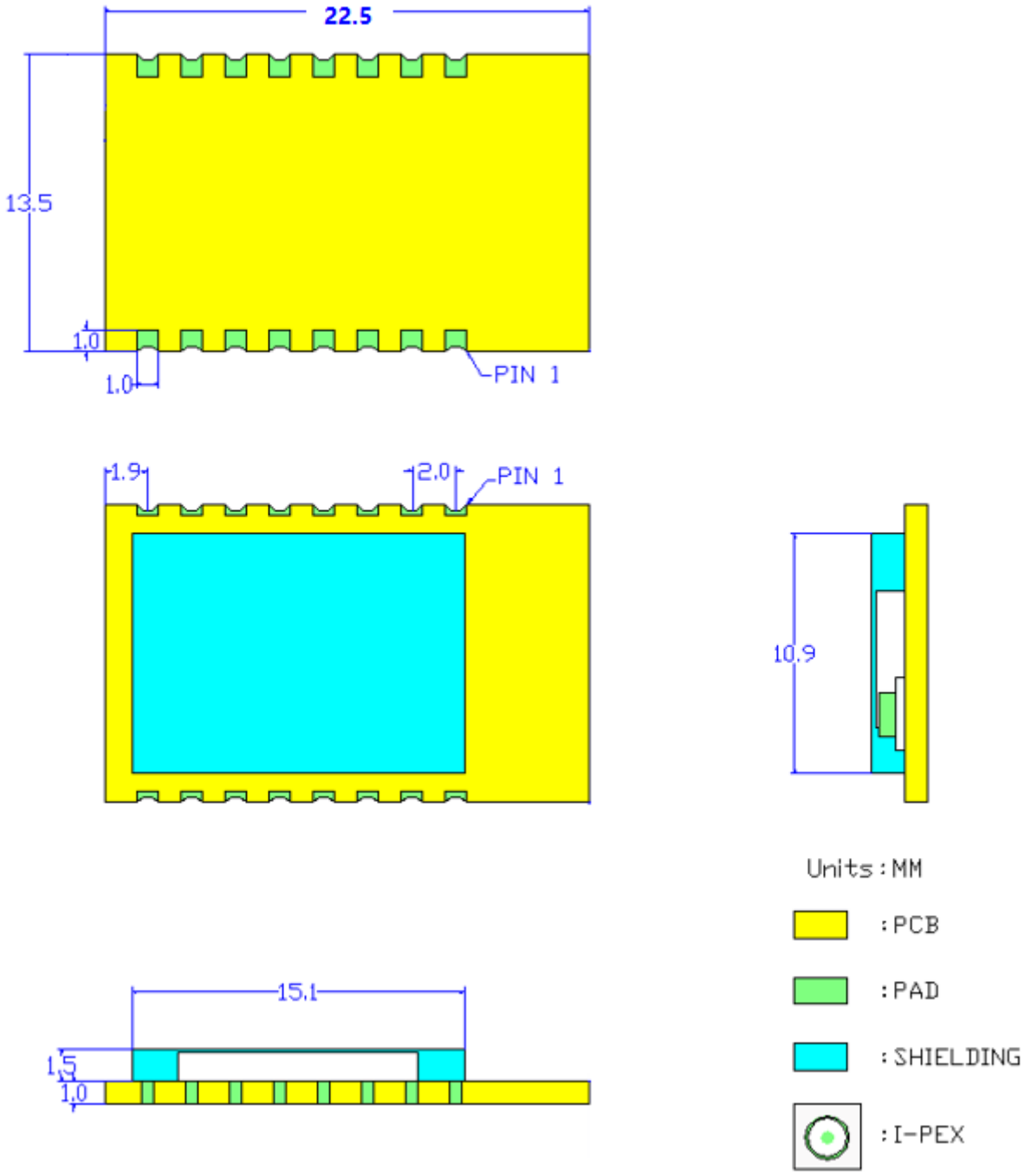

Figure 4. HF-BL500 Mechanical size

2.4. Antenna Layout

HF-BL500 supports internal antenna. Customers need to obey following antenna design rules and module location suggestions:

- For user PCB, place module on the edge area of the PCB as possible, or suspend the antenna area.

- Module antenna correspondent area can't put components or paste GND, the surrounding components or GND should be as far as possible from antenna place.
- Antenna must be away from high components at least 10mm.
- Antenna can't be shielded by any metal enclosure.

High Flying suggests to locate HF-BL500 as following picture to reduce the influence to antenna and wireless signal as much as possible, or contact High Flying technique people for support

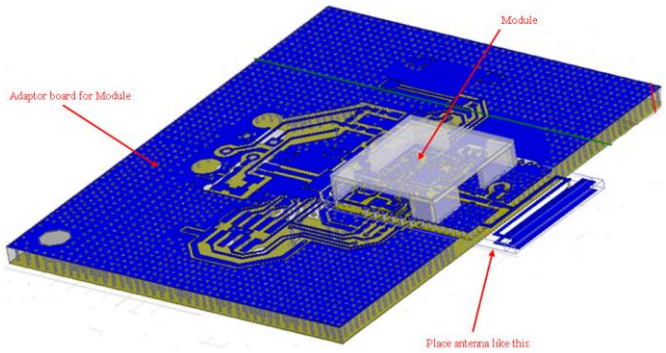

Figure 5. HF-BL500 Module Reference Placement

3. PACKAGE INFORMATION

3.1. Reflow Soldering Profile

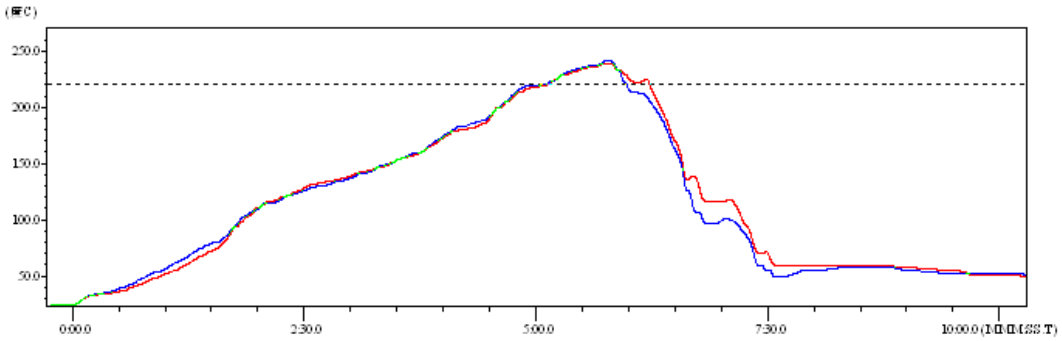

Figure 6. Reflow Soldering Profile

Table5. Reflow Soldering Specification

Number	Item	Temp (℃)	Time(s)
1	Reflow time	220 ℃ above	35~55 s
2	Peak temp	Max 260℃	

Remark: 1. Recommend to supply N2 for reflow oven
2. O2 content lower than 300ppm；

3.2. Handling Instruction

1. Shelf life in sealed bag: 12 months at <30℃, <60% humidity。
2. After bag opened, device need to be re-baked if window time over 168 hours
3. Recommended to over bake with N2 supplied
4. Recommended to reflow oven with N2 supplied
5. Bake required with 24 hours at 125+-5℃,
6. Recommended to store at ≦10% RH with vacuum packing
7. If SMT process needs twice reflow
   (1) TOP side (2) BOT side

Case 1: BLE module mounted on PCB TOP, need to bake TOP side after BOT side processed 168 hours (window time)

Case 2: BLE module mounted on PCB BOT side ,follow normal bake rule.

Remark: window time means it is been 168 hours since last bake to next flow.

APPENDIX A: UART TRANSPARENT TRANSMIT TYPICAL APPLICATION

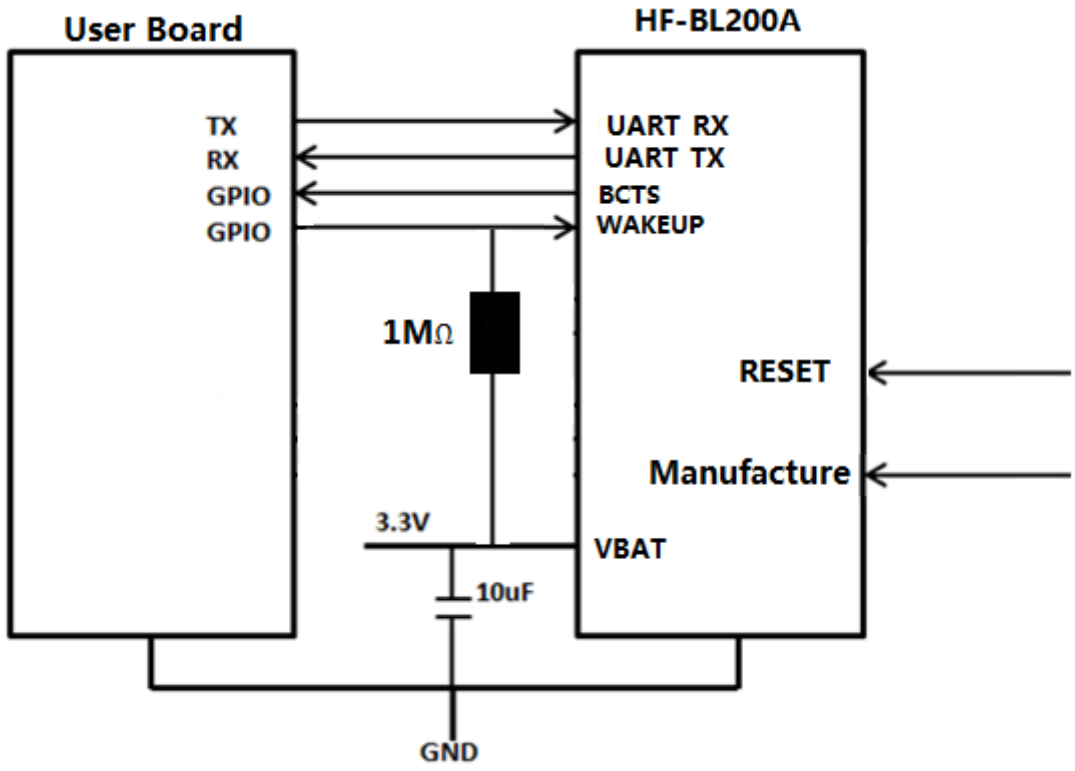

Figure 7. UART Transparent Transmit Typical Application

BCTS------ Module UART output notify signal, output （wakeup external MCU, remind MCU there is data output）

Module will pull down BCTS, and delay Xms before output data; X set by external MCU via At command, in default there is no latency. After sending data, BCTS pull-up, if there is new data sending BCTS will pull-up after sending all the new data. .

WAKEUP------ UART wakeup enable, Stop Mode Wakeup,(recommend to add external Pull-up resistor)

Pin Mode: WAKEUP pin is high resistor input. Can't be suspended, can be controller by pull-up or pull down or external MCU

UART Wakeup Enable: when WAKEUP is pull-up, all system enter into DEEPSLEEP ; when WAKEUP is pull-down, system enter into SLEEP mode. When sending data from external MCU to module, need to pull-down WAKEUP pin, after sending finished, pull-up WAKEUP to lower the power.

There must be a latency from WAKEUP pull-down to MCU sending data, the time is no less 拉低 than 2ms。

Stop Mode Wakeup:WAKEUP pull-down, AT command send out Stop command, when system enter into STOP mode, can be wakeup through pull-up WAKEUP.

UART_TX/RX------UART data send/receive signal。
Manufacture------restore factory setting via hardware method: keep low level at least 5 second when power on or restore

1.1 List of applicable FCC rules:
The module complies with FCC Part 15.247

1.2 Summarize the specific operational use conditions:
The module has been certified for mobile application(20 cm separation). This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

1.3 Limited module procedures:
Not applicable.

1.4 Trace antenna designs:
Not applicable.

1.5 RF exposure considerations:
This equipment complies with FCC's RF radiation exposure limits set forth for an uncontrolled environment. The antenna(s) used for this transmitter must not be collocated or operating in conjunction with any other antenna or transmitter.
Any deviation in conditions or host configuration will require approval and FCC filing by the Grantee in accordance with KDB 447498.

1.6 Antennas:

Type	Gain	Impedance	Application	Min Separation
PCB Antenna	0.75 dBi	50Ω	Fixed	

The antenna is permanently attached, can't be replaced.

1.7 Label and compliance information:
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: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications or changes to this equipment. Such modifications or changes could void the user's authority to operate the equipment.

Warning: Changes or modifications to this unit 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 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 a minimum distance of 20cm between the radiator & your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

The system integrator must place an exterior label on the outside of the final product housing the HF-BL500-1 Module. Below are the contents that must be included on this label.

OEM Labeling Requirements:

NOTICE: The OEM must make sure that FCC labeling requirements are met. This includes a clearly visible exterior label on the outside of the final product housing that displays the contents shown in below:

Model : HF-BL500-1 Contains FCC ID: 2BDXL-BL5001

1.8 Information on test modes and additional testing requirements:

When testing host product, the host manufacture should follow FCC KDB Publication 996369 D04 Module Integration Guide for testing the host products. The host manufacturer may operate their product during the measurements. In setting up the configurations, if the pairing and call box options for testing does not work, then the host product manufacturer should coordinate with the module manufacturer for access to test mode software.

1.9 Additional testing, Part 15 Subpart B disclaimer:

The modular transmitter is only FCC authorized for the specific rule parts (FCC Part 15.247) list on the grant, and that 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 when contains digital circuity.

2.0 Note EMI Considerations

The host responsible party integrator must perform EMC tests on the module during synchronous transfer operations when integrating on the host. If there are no emissions of increased magnitude and/or different frequencies compared to the data reported in the module authorization, there is no need to submit the results of these simultaneous transmission test data.
KDB publication 996369 D02 and D04 for guidance on module integration and best practices.
Co-launching with other modules can refer to KDB publication 996369 D02 and D04, while allowing the host manufacturer to confirm compliance

2.1 How to make changes

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

APPENDIX B: CONTACT INFORMATION

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