

# HF-LPB200

## Low Power WiFi Module User Manual

V 1.0



### Overview of Characteristic

- ✧ **Support IEEE802.11b/g/n Wireless Standards**
- ✧ **Marvell Solutions for Smart Energy and Home/Building Automation**
- ✧ **Low-Power Applications with Excellent Power Save Scheme**
- ✧ **Support UART/SPI/USB/PWM/ADC/GPIO Data Communication Interface**
- ✧ **Support Work As STA/AP/AP+STA/Wi-Fi Direct Mode**
- ✧ **Support Smart Link™ Function (APP for smart configuration)**
- ✧ **Support Wireless (OTA) and Remote Firmware Upgrade Function**
- ✧ **Support Wakeup-on-Wireless and Wakeup Local**
- ✧ **Support FTTPS/TLS and mDNS Application**
- ✧ **Single +3.3V Power Supply**
- ✧ **Smallest Size: 23.1mm x 32.8mm x2.7mm**
- ✧ **FCC/CE Certificated**

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**HISTORY**

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# 1. PRODUCT OVERVIEW

## 1.1. General Description

The HF-LPB200 is a fully self-contained small form-factor, single stream, 802.11b/g/n Wi-Fi module, which provide a wireless interface to any equipment with a Serial/SPI/USB/GPIO interface for data transfer. HF-LPB200 integrate MAC, baseband processor, RF transceiver with power amplifier in hardware and all Wi-Fi protocol and configuration functionality and networking stack, in embedded firmware to make a fully self-contained 802.11b/g/n Wi-Fi solution for a variety of applications.

HF-LPB200 support AP+STA wireless networking and support Wi-Fi Direct mode. HF-LPB200 also provides wireless and remote firmware upgrade, which satisfied all kinds of application requirement. HF-LPB200 support wakeup-on-wireless feature which make it a very suitable solution for battery applications with excellent power save scheme.

The HF-LPB200 employs the world's lowest power consumption embedded architecture. It has been optimized for all kinds of client applications in the home automation, smart grid, handheld device, personal medical application and industrial control that have lower data rates, and transmit or receive data on an infrequent basis.

The HF-LPB200 integrates all Wi-Fi functionality into a low-profile, 23.1x32.8x 2.7mm SMT module package that can be easily mounted on main PCB with application specific circuits. Also, module provides built-in antenna, external antenna option.

### 1.1.1 Device Features

- Single stream Wi-Fi @ 2.4 GHz with support for WEP security mode as well as WPA/WPA2
- Fully self-contained serial-to-wireless functionality.
- Support IEEE802.11b/g/n Wireless Standards
- Ultra-Low-Power for Battery Applications with Excellent Power Save Scheme
- Support UART/SPI/USB/PWM/ADC/GPIO Data Communication Interface
- Support Work As STA/AP/AP+STA/Wi-Fi Direct Mode
- Support Smart Link™ Function (APP for smart configuration)
- Support Wireless (OTA) and Remote Firmware Upgrade Function
- Support Wakeup-on-Wireless and Wakeup Local
- Support TLS/SSL and mDNS Protocol
- Reserve More Than 512KB Flash and 128KB SRAM For User Defined Application
- Single +3.3V Power Supply
- Smallest Size: 23.1mm x 32.8mm x 2.7mm
- FCC/CE Certificated

### 1.1.2 Device Parameters

Table 1 HF-LPB200 Module Technical Specifications

Class	Item	Parameters
Wireless Parameters	Certification	FCC/CE
	Wireless standard	802.11 b/g/n
	Frequency range	2.412GHz-2.484GHz
	Transmit Power	802.11b: +16 +/-2dBm (@11Mbps)
		802.11g: +14 +/-2dBm (@54Mbps)
		802.11n: +13 +/-2dBm (@HT20, MCS7)
		802.11n: +12 +/-2dBm (@HT40, MCS7)
	Receiver Sensitivity	802.11b: -93 dBm (@11Mbps ,CCK)
802.11g: -85 dBm (@54Mbps, OFDM)		
802.11n: -82 dBm (@HT20, MCS7)		
Internal:On-board PCB antenna		
Hardware Parameters	Data Interface	UART
		SPI, PWM, GPIO...
		Others: USB, ADC, RTC...
	Operating Voltage	3.1~3.6V
	Operating Current	Peak [Continuous TX]: ~240mA Normal [WiFi ON/OFF, DTIM=100ms]: AP Associate: ~21mA; No-AP Associate:~26mA Wakeup-on-Wireless Mode: ~10mA; Deep Sleep: <100uA
	Operating Temp.	0°C - 70°C
	Storage Temp.	-45°C - 125°C
Dimensions and Size	23.1mm × 32.8mm × 2.7mm	
Software Parameters	Network Type	STA /AP/STA+AP/Wi-Fi Direct
	Security Mechanisms	WEP/WPA-PSK/WPA2-PSK
	Encryption	WEP64/WEP128/TKIP/AES
	Update Firmware	Local Wireless (OTA), Remote
	Customization	Web Page Upgrade Provide SDK for application develop
	Reserved Resource	Flash: >200KB; SRAM:>100KB
	Network Protocol	IPv4,TCP/UDP/FTP/HTTP, HTTPS,TLS,mDNS
	User Configuration	AT+instruction set, Web page/ Android/ iOS Smart Link APP tools

### 1.1.3 Key Application

- Remote equipment monitoring
- Smart Home/Energy
- Industrial sensors and controls
- Home automation
- Medical/Healthcare devices



## 1.2. Hardware Introduction



Figure 1. HF-LPB200 Demo

### 1.2.1. Pins Definition

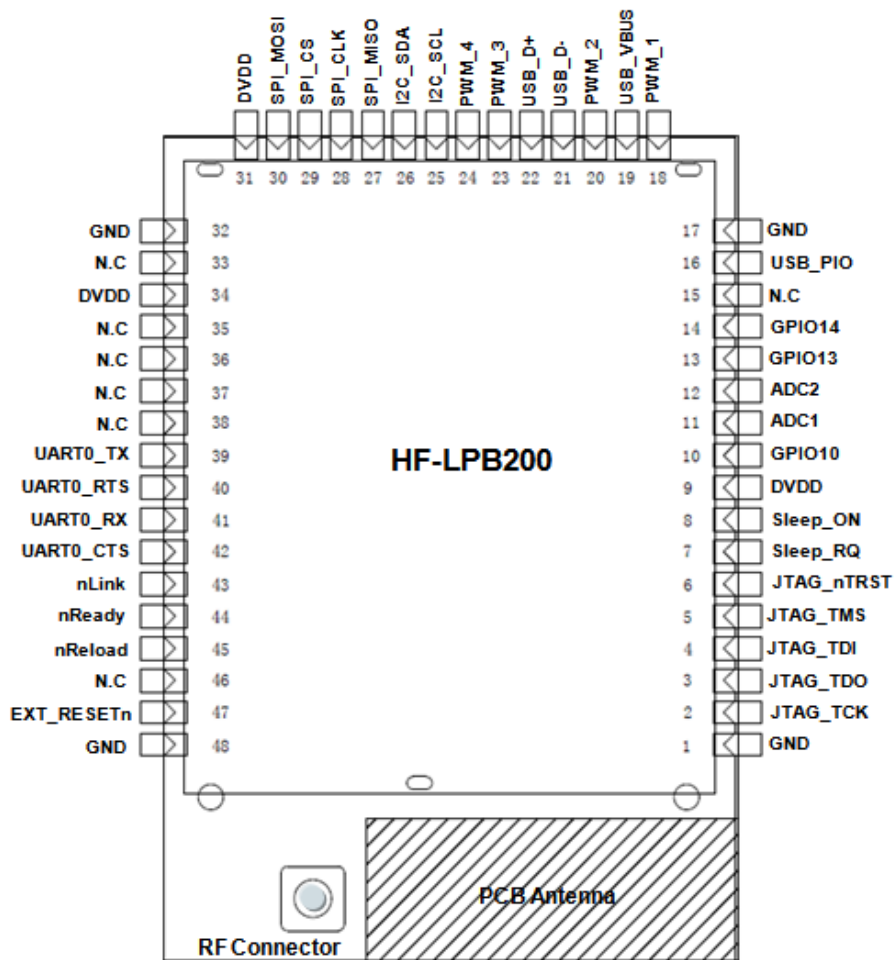


Figure 2. HF-LPB200 Pins Map

Table 2 HF-LPB200 Pins Definition

Pin	Description	Net Name	Signal Type	Comments
1,17,32,48	Ground	GND	Power	
2	JTAG Function	JTAG_TCK	I, PU	JTAG/Debug functional pin, No connect if not use. No connect
3	JTAG Function	JTAG_TDO	O	
4	JTAG Function	JTAG_TDI	I,PU	
5	JTAG Function	JTAG_TMS	I,PU	
6	JTAG Function	JTAG_nTRST	I,PU	
7	Sleep Control	Sleep_RQ	I,PU	GPIO7, No connect if not use.
8	Sleep Control	Sleep_ON	O	GPIO8, No connect if not use.
9	+3.3V Power	DVDD	Power	
10	GPIO	GPIO10	I/O,PU	GPIO10, No connect if not use.
11	A/D Input 1	ADC1	I/O	GPIO11, No connect if not use.
12	A/D Input 2	ADC2	I/O	GPIO12, No connect if not use.
13	GPIO	GPIO13	I/O	GPIO13, No connect if not use.
14	GPIO	GPIO14	I/O	GPIO14, No connect if not use.
15		N.C		No connect (Must Float)
16	USB Interface	USB_PIO	I/O	USB dedicated interface.
18	PWM Output 1	PWM_1	I/O	GPIO18, No connect if not use.
19	USB Interface	USB_VBUS	I	USB dedicated interface.
20	PWM Output 2	PWM_2	I/O	GPIO20, No connect if not use.
21	USB Interface	USB-	I/O	90 ohm Diff. Line
22	USB Interface	USB+	I/O	90 ohm Diff. Line
23	PWM Output 3	PWM_3	I/O	GPIO23, No connect if not use.
24	PWM Output 4	PWM_4	I/O	GPIO24, No connect if not use.
25	I2C Interface	I2C_SCL	I/O	GPIO25, No connect if not use.
26	I2C Interface	I2C_SDA	I/O	GPIO26, No connect if not use.
27	SPI Data In	SPI_MISO	I	GPIO27, No connect if not use.
28	SPI Interface	SPI_CLK	I/O	GPIO28, No connect if not use.
29	SPI Interface	SPI_CS	I/O	GPIO29, No connect if not use.
30	SPI Data Out	SPI_MOSI	O	GPIO30, No connect if not use.
31	+3.3V Power	DVDD	Power	
33		N.C		No connect
34	+3.3 Power	DVDD	Power	
35		N.C		No connect
36		N.C		No connect
37		N.C		No connect
38		N.C		No connect
39	UART0	UART0_TX	O	UART Communication Pin
40	UART0	UART0_RTS	I/O	UART Pin (Or RS485 Control)
41	UART0	UART0_RX	I	UART Communication Pin
42	UART0	UART0_CTS	I/O	UART Communication Pin
43	Wi-Fi Status	nLink	O	"0"- Wi-Fi Linked "1"- No WIFI Linked No connect if not use.
44	Module Boot Up	nReady	O	"0" – Boot-up OK;

	Indicator			“1” – Boot-up No OK; Also used as hardware watch dog trigger signal. No connect if not use.;
45	Restore Configuration	nReload	I,PU	Module will restore factory default after set this pin “0” more than 1s, then set “1”.
46		N.C		No connect
47	Module Reset	EXT_RESETn	I,PU	“Low” effective reset input.

**Notes:**

- Detailed GPIO functional application refers to Chapter 2 “GPIO Function” Section.
- For customer which plan migrate from HF-LPB to HF-LPB200, please pay attention Pin 35, Pin 46 is NC for HF-LPB200;

## 2.1.1. Electrical Characteristics

Absolute Maximum Ratings:

Parameter	Condition	Min.	Typ.	Max.	Unit
Storage temperature range		-45		125	°C
Maximum soldering temperature	IPC/JEDEC J-STD-020			260	°C
Supply voltage		0		3.8	V
Voltage on any I/O pin		0		3.3	V
ESD (Human Body Model HBM)	TAMB=25°C			2	KV
ESD (Charged Device Model, CDM)	TAMB=25°C			500	V

Power Supply &amp; Power Consumption:

Parameter	Condition	Min.	Typ.	Max.	Unit
Operating Supply voltage		2.97	3.3	3.63	V
Supply current, peak	Continuous Tx		200	250	mA
Supply current, IEEE PS	DTIM=100ms		21		mA
Input high voltage		VDD*70%		VDD+0.4	V
Input low voltage		-.04		VDD*30%	V
Input leakage current		VDD On		2	uA
Input capacitance				5	pF
Pullup strength		10		50	uA
Pulldown strength		10		50	uA
Analog input range		0		3	V
Analog output range		0		3	V

## 2.1.2. Mechanical Size

HF-LPB200 modules physical size (Unit: mm) as follows:

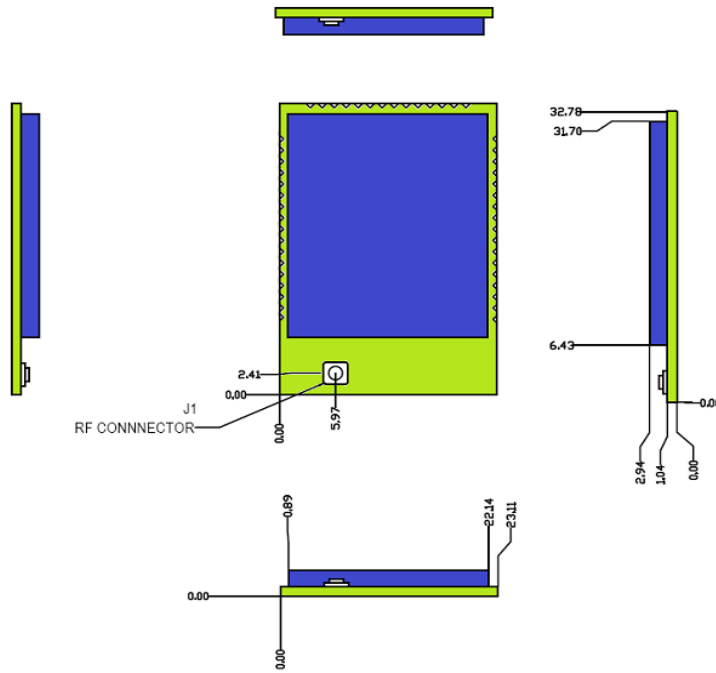


Figure 3. HF-LPB200 Mechanical Dimension

HF-LPB200 Module PCB symbol size (mm) as follows:

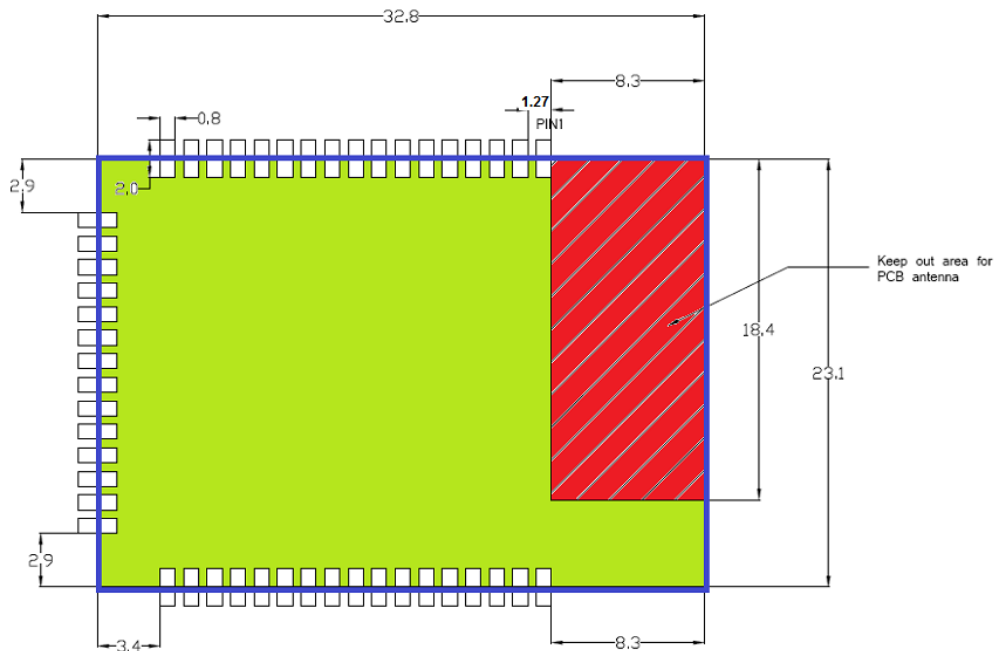


Figure 4. HF-LPB200 PCB Symbol Size

### 2.1.3. On-board Chip Antenna

HF-LPB200 module support internal on-board chip antenna option. When customer select internal antenna, you shall comply with following antenna design rules and module location suggestions:

- For customer PCB, RED color region (8.3x18.4mm) can't put componet or paste GND net;

- Antenna must away from metal or high components at least 10mm;
- Antenna can't be shielded by any meal enclosure; All cover, include plastic, shall away from antenna at least 10mm;

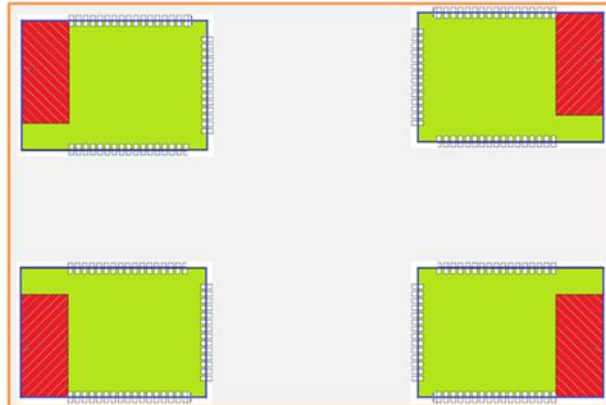


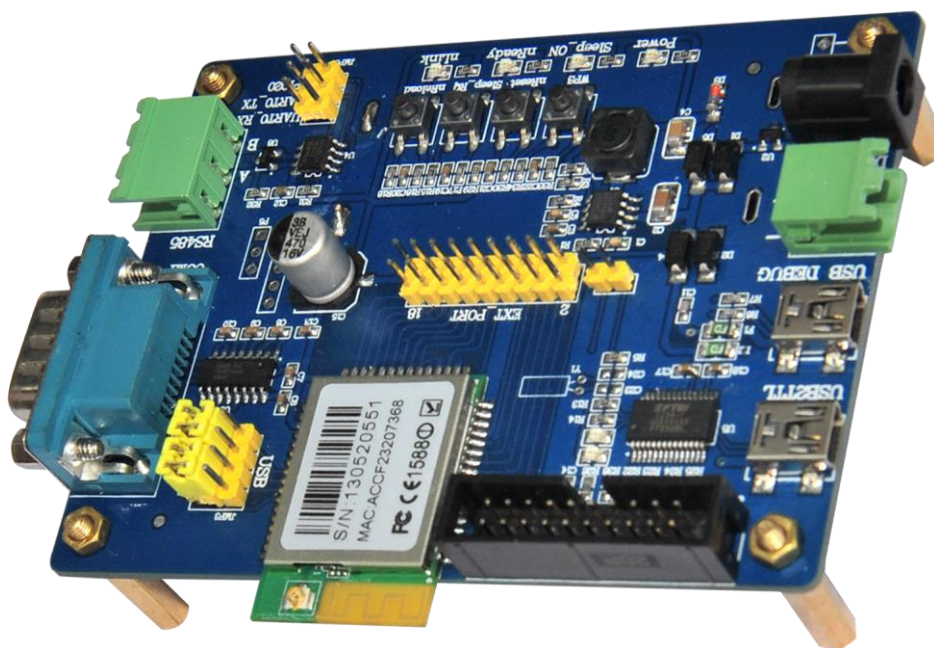
Figure 5. Suggested Module Placement Region

High-Flying suggest HF-LPB200 module better locate in following region at customer board, which to reduce the effect to antenna and wireless signal, and better consult High-Flying technical people when you structure your module placement and PCB layout.

#### 2.1.4. Evaluation Kit

High-Flying provides the evaluation kit to promote user to familiar the product and develop the detailed application. The evaluation kit shown as below, user can connect to HF-LPB200 module with the RS-232 UART, RS485, USB (Internal UART-USB convetor) or Wireless port to configure the parameters, manage the module or do some functional tests.

Detailed EVK applicarion pls refer to HF-LPB200 SDK user guide.



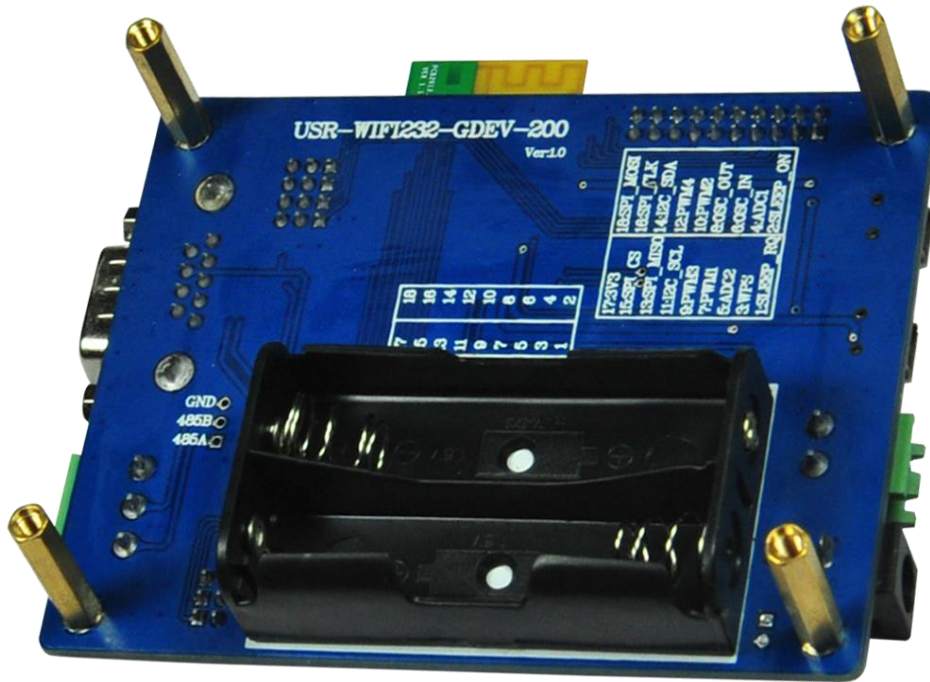


Figure 6. HF-LPB200 Evaluation Kit

**Notes:** User may needs download USB - UART port driver from High-Flying web or contact with technical support people for more detail.

The external interface description for evaluation kit as follows:

Table 4 HF-LPB200 Evaluation Kit Interface Description

Function	Name	Description
External Interface	COM1	Main data/command RS-232 interface
	RS485	Main data/command RS-485 interface
	JTAG	JTAG/JLink debug interface
	USB2TTL	UART to USB debug interface. (For PC without RS232, need load driver). Can be power input.
	USB DEBUG	HF-LPB200 USB2.0 data interface (Reserved for future use)
	DC Jack	DC jack for power in, 5~18V input.
	DC5-18V	DC jack for power in, 5~18V input.
	BAT	2 Li-Battery Power Supply.
	EXT PORT	HF-LPB200 GPIO function extend interface connector
	JMP2	Boot up option. Add jumper when download image through UART.
	JMP3	4Pin USB or RS232 Jumper. Left jump when select USB.
	JMP6	3Pin RS485 Jumper. No jump when selects RS232.
LED	Power	3.3V Power Indicator
	nLink	nLink -WiFi LINK Indicator
	nReady	nReady – Module Bootup Ready Indicator On (“low”)- Module bootup OK; Off (“high”)- Module bootup failed; <b>Twinkle- Remote Upgrade Ongoing;</b>
	Sleep_ON	Sleep_ON-Module asleep or awake Indicator On (“low”)- Module in shutdown(deep sleep) status; Off (“high”)- Module in normal status; <b>Twinkle- Bootloader Upgrade Ongoing;</b>
Button	nReset	Used to reset the module.
	nReload	Restore factory configuration after push this pin more than 3s.
	WPS	WPS Button
	Sleep_RQ	Pin Sleep Control, more than 1s to put module in standby mode.

2.1.5. Order Information

Base on customer detailed requirement, HF-LPB200 series modules provide different variants and physical type for detailed application.

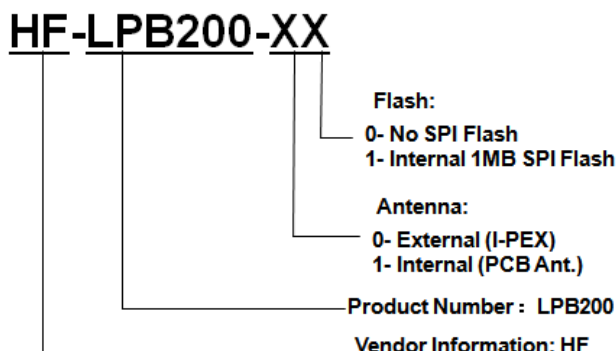


Figure 7. HF-LPB200 Order Information

## 2.2. Typical Application

### 2.2.1. Hardware Typical Application

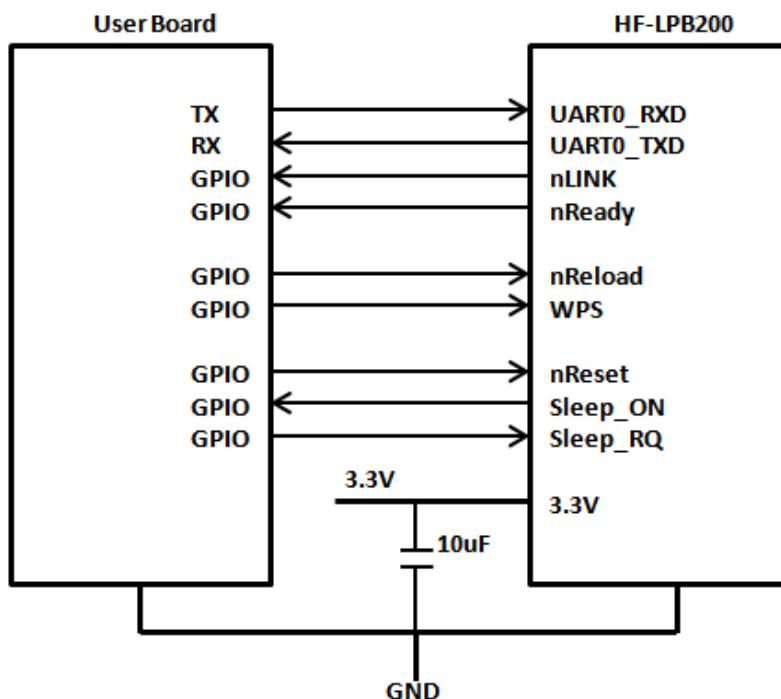


Figure 8. HF-LPB200 Hardware Typical Application

#### Notes:

**nReset-** Module hardware reset signal. Input. Logics “0” effective.

There is pull-up resistor internal and no external pull-up required. When module power up or some issue happened, MCU need assert nRST signal “0” at least 10ms, then set “1” to keep module fully reset.

**nLink-** Module WiFi connection status indication. Output.

When module connects to AP (AP associated), this pin will output “0”. This signal used to judge if module already at WiFi connection status. There is pull-up resistor internal and no external pull-up required. If nLink function not required, can leave this pin open.

**nReady-** Module boot up ready signal. Output. Logics “0” effective.

The module will output “0” after normal boot up. This signal used to judge if module finish boot up and ready for application or working at normal mode. If nReady function not required, can leave this pin open.

**nReload-** Module restore to factory default configuration. Input. Logics “0” effective.

User can de-assert nReload signal “0” more than 3s through button or MCU pin, then release, module will restore to factory default configuration and re-start boot up process.



**Sleep-RQ-** Module Pin Sleep Control. Input.

The user should de-assert this pin low “0”, after 1’s assert to high ”1” to put the module to sleep status. Also at the deep sleep/standby mode, user can de-assert this pin low “0”, after 1’s assert to high ”1” to put the module to wake up the module.

**Sleep-ON-** Module Pin Sleep Indicator. Output.

This pin is used to indicate that the module is asleep (Module output “0”) or awake (Module output “1”) status. If user doesn't use pin sleep function, can leave this pin open.

**UART0\_TXD/RXD-** UART port data transmit and receive signal.

2.2.2. Internal MCU Hardware Feature

MCU and hardware Key Features as following for customized application:

- ARM Cortex - M3 Core, Up to 200Mhz;
- 1MB in-package QSPI Flash, 512KB SRAM;
- SPI Extend 1MB flash available;
- Multiple power down mode w/ SRAM Retention;
- Configurable GPIO function (Module output);
  - ✓ ADC 16 bit, 2 channel;
  - ✓ PWM, 4 channel;
  - ✓ One I2C interface;
  - ✓ One SPI/I2S/UART interface;
  - ✓ One USB OTG FS2.0 interface;
  - ✓ RTC extend interface;

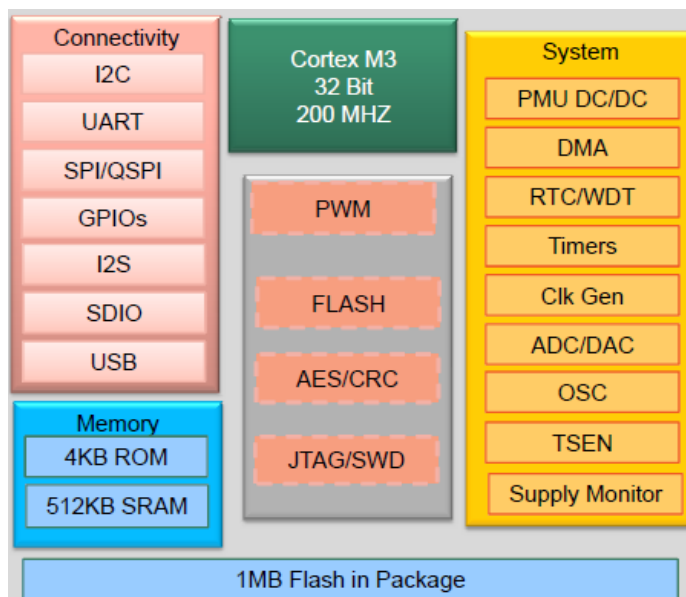


Figure 9. HF-LPB200 Internal MCU Hardware Architecture

2.2.3. Software SDK Architecture

HF-LPB software platform as following picture and High-Flying will provide full SDK for customer application development.

Detailed SDK introduction refer to SDK API interface and user guide document.

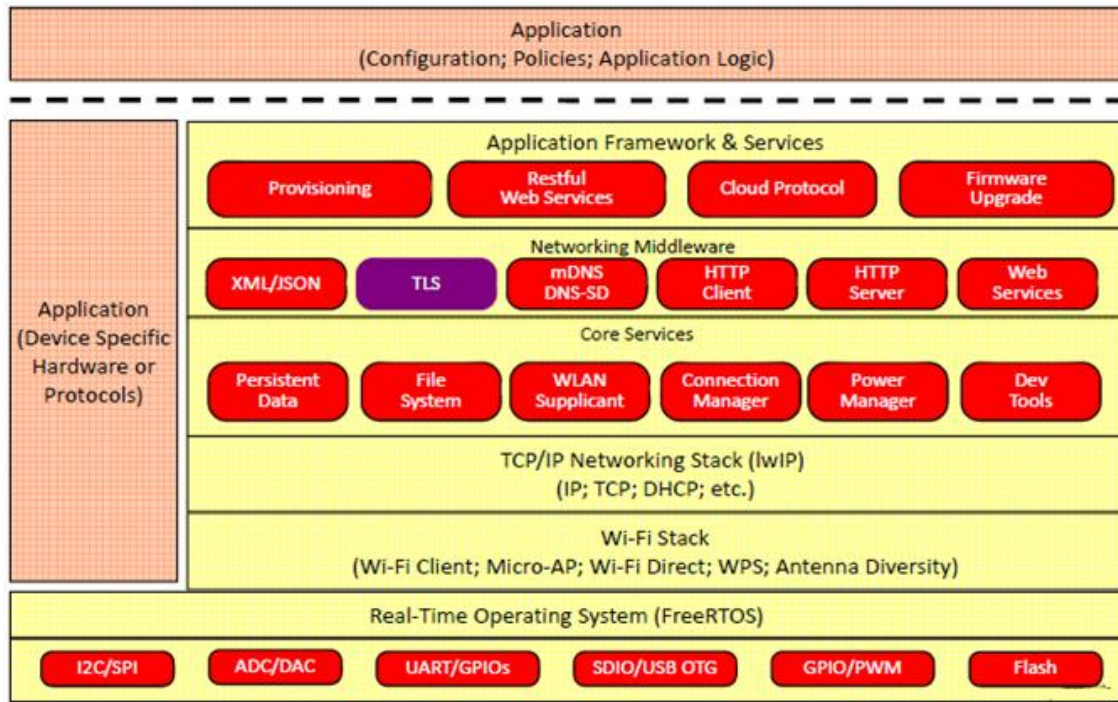


Figure 10. HF-LPB200 Software SDK Architecture

## 3. FUNCTIONAL DESCRIPTION

### 3.1. Wireless Networking

HF-LPB200 module can be configured as both wireless STA and AP base on network type. Logically there are two interfaces in HF-LPB200. One is for STA, and another is for AP. When HF-LPB200 works as AP, other STA equipments are able to connect to wireless LAN via HF-LPB200 module. Wireless Networking with HF-LPB200 is very flexible.

#### Notes:

**AP:** that is the wireless Access Point, the founder of a wireless network and the centre of the network nodes. The wireless router we use at home or in office may be an AP.

**STA:** short for Station, each terminal connects to a wireless network (such as laptops, PDA and other networking devices) can be called with a STA device.

#### 3.1.1. Basic Wireless Network Based On AP (Infrastructure)

Infrastructure: it's also called basic network. It built by AP and many STAs which join in.

The characters of network of this type are that AP is the centre, and all communication between STAs is transmitted through the AP. The figure following shows such type of networking.



Figure 11. HF-LPB200 Basic Wireless Network Structure

#### 3.1.2. Wireless Network Based On AP+STA

HF-LPB200 module support AP+STA network mode, means module support one AP interface and one STA interface at the same time, as following figure,

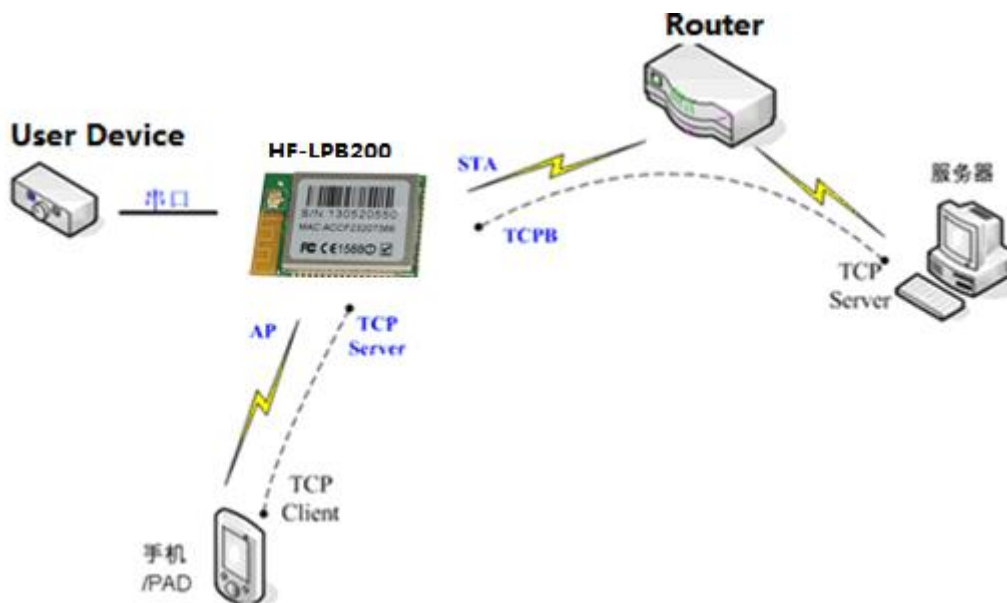


Figure 12. HF-A11 AP+STA Network Structure

When module enables AP+STA function, Module’s STA interface can connect with router and connect to TCP server in the network. At the same time, module’s AP interface is also active and permit phone/PAD to connect through TCPB, then phone/PAD can control user device and and setting the module parameters,

The advantage of AP+STA mode is:

- Users can easily setting and track user device through Phone/PAD and not change the original network setting.
- Users can easily setting module’s parameters through WiFi when module works as STA mode.

### 3.1.3. Wi-Fi Direct Network

Wi-Fi Direct standard permits the wireless connection without AP router. Like blue tooth, this standard use point to point interconnection and all devices connect each other and transmit data without router.

HF-LPB200 module support following Wi-Fi Direct networking:

- 1:1 P2P Networking;
- 1:N P2P Networking (TBD);



Figure 13. HF-LPB200 1:1 P2P Networking

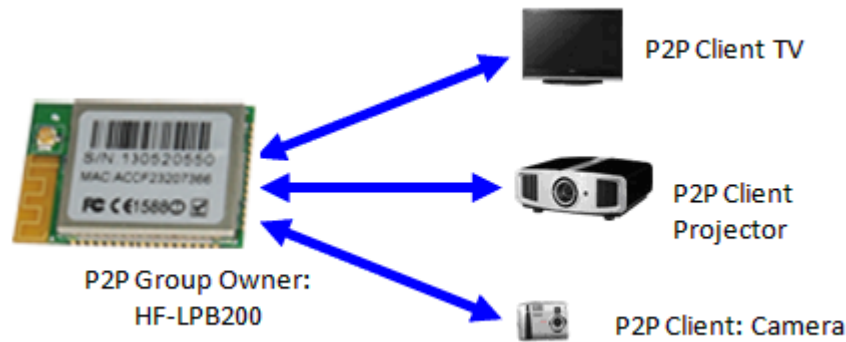


Figure 14. HF-LPB200 1:N P2P Networking

### 3.2. Work Mode : Transparent Transmission Mode

HF-LPB200 module support serial interface transparent transmission mode. The benefit of this mode is achieves a plug and play serial data port, and reduces user complexity furthest. In this mode, user should only configure the necessary parameters. After power on, module can automatically connect to the default wireless network and server.

As in this mode, the module's serial port always work in the transparent transmission mode, so users only need to think of it as a virtual serial cable, and send and receive data as using a simple serial. In other words, the serial cable of users' original serial devices is directly replaced with the module; user devices can be easy for wireless data transmission without any changes.

The transparent transmission mode can fully compatible with user's original software platform and reduce the software development effort for integrate wireless data transmission.

The parameters which need to configure include:

- **Wireless Network Parameters**
  - Wireless Network Name (SSID)
  - Security Mode
  - Encryption Key
- **TCP/UDP Linking Parameters**
  - Protocol Type
  - Link Type (Server or Client)
  - Target Port ID Number
  - Target Port IP Address
- **Serial Port Parameters**
  - Baud Rate
  - Data Bit
  - Parity (Check) Bit
  - Stop Bit
  - Hardware Flow Control

### 3.3. UART Frame Scheme

HF-LPB200 support UART free-frame function. Module will check the intervals between any two bytes when reciving UART data. If this interval time exceeds defined value (50ms default), HF-LPB200 will think it as the end of one frame and transfer this free-frame to WiFi port, or HF-LPB200 will receive UART data untill 1400 bytes, then transfer 1400 bytes frame to WiFi port.

HF-LPB200's default interval time is 50ms. User can also set this interval to fast (10ms) through AT command. But user have to consider if user MCU can send UART data with 10ms interval ,or the UART data may be divide as fragment.

Through AT command: AT+UARTTE=fash/normal, user can set the interval time: fast (10ms) and normal (50ms).

### 3.4. Encryption

Encryption is a method of scrambling a message that makes it unreadable to unwanted parties, adding a degree of secure communications. There are different protocols for providing encryption, and the HF-LPB200 module supports following:

- ◆ WEP
- ◆ WPA-PSK/TKIP
- ◆ WPA-PSK/AES
- ◆ WPA2-PSK/TKIP
- ◆ WPA2-PSK/AES

### 3.5. Multi-TCP Link Connection

When HF-LPB200 module configured as TCP Server, it supports Multi-TCP link connection, and maximum eight TCP clients permit to connect to HF-LPB200 module. User can realize multi-TCP link connection at each work mode.

Multi-TCP link connection will work as following structure:

#### **Upstream:**

All dates from different TCP connection or client will be transmitted to the serial port as a sequence.

#### **Downstream:**

All data from serial port (user) will be duplicate and broadcast to every TCP connection or client.

Detailed multi-TCP link data transmission structure as following figure:

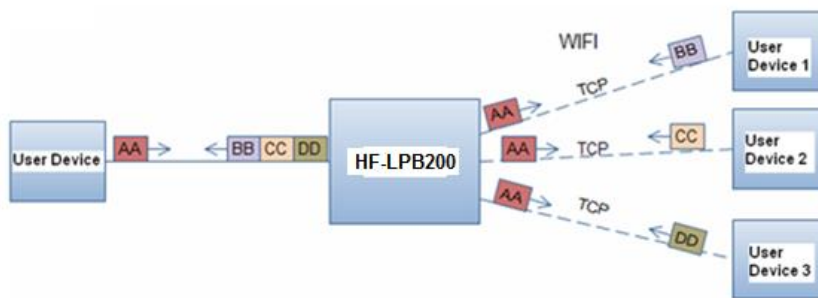


Figure 15. Multi-TCP Link Data Transmission Structure

### 3.6. Power Save Scheme

HF-LPB200 module can work at three modes based on different power save scheme:

- **Normal Mode (Active/Sleep)** - AP Associated, Wi-Fi ON/OFF based on internal control
- **Wi-Fi Wakeup Mode (Standby)** - AP Associated, MCU OFF, Wi-Fi wakeup
- **Deep Sleep Mode (Shutdown)** - Non AP Associated, Wi-Fi Shut down, MCU Sleep Pin/Timer Wakeup

**Normal Mode (Active/Sleep)** Normal mode means Wi-Fi circuitry works at IEEE PS mode and MCU circuitry work at normal mode. That's the default working mode for HF-LPB200 to communication with outside and no data transceiving latency.

**Wi-Fi Wakeup Mode (Standby)** allows the MCU circuitry to be powered down and still keep Wi-Fi AP associated, which save more power compared with normal mode and module can be wake up through Wi-Fi at network server side.

**Deep Sleep Mode (Shutdown)** allows the Wi-Fi circuitry and MCU circuitry to be powered down, which results in the lowest sleep current, but at the expense of longer wake up times. This is due to the module associating with the access point every time when it wakes up. The intent of this option is to allow for longer sleep times. Deep sleep mode can trigger "Sleep\_RQ" pin to go in.

The Difference between Wi-Fi Wakeup and Deep Sleep mode as follows:

Table 6 Difference between Wi-Fi Wakeup Mode and Standb Deep Sleep Mode

	Module Status				Wake Up Method			
	Wi-Fi	MCU	Current	UART	GPIO	Timeout	AT Com.	Wi-Fi
Wi-Fi Wakeup	ON	OFF	<10mA	OFF	Yes	Yes	No	Yes
Deep Sleep	OFF	OFF	1mA	OFF	Yes	Yes	No	No

Following typical measurement parameters can be used for select suitable power save scheme based on the real application case:

Table 7 Power Consumption with Different Power Save Mode

WiFi Mode	Condition	Average Current	Peak Current
Deep Sleep	Wi-Fi/MCU Shutdown	< 100uA	< 100uA
Wi-Fi Wakeup	MCU Shutdown	~10mA	< 200mA
Normal (Active/Sleep)	WiFi ON - AP Associated DTIM = 100ms, No Data	~21mA	< 250mA
Normal (Active/Sleep)	WiFi ON - AP No-Associated DTIM = 100ms, No Data	~27mA	< 250mA
Normal (Active/Sleep)	WiFi ON – AP Connected DTIM = 100ms, Data:1KB/s	~50mA	< 250mA

In addition, for Wi-Fi Wakeup/Deep Sleep mode, module provides three wakes up options, user can select one or whole as the module wake up option. Refer to AT Instruction (Power Management Instruction Set) for more detailed setting.

- Pin (Sleep\_RQ) Wake Up
- Timeout Wake Up
- Wi-Fi Wake Up

**Pin Wake Up Option** allows an external microcontroller to determine when HF-LPB200 should sleep and when it should wake by controlling the “Sleep\_RQ” and “Sleep\_ON” pin. at the Wi-Fi wakeup mode/Deep Sleep mode, user can de-assert this pin low “0”, after 1’s assert to high “1” to put the module to wake up the module. If user doesn’t use pin sleep function, can leave this pin open.

**Timeout Wake Up Option** allows the sleep timeout period to be configured through the use of AT Instruction. In this option, the module will exit sleep based on the <Timeout> AT Instruction parameters

**Wi-Fi Wake Up Option** only applicable for Wi-Fi Wakeup mode, which provide the flexibility for network server or user to control and manage the Wi-Fi device to go into power save mode, but still keep the Wi-Fi link associated, Refer to AT Instruction to know more about the WiFi wakeup command.

### 3.7. Parameters Configuration

HF-LPB200 module supports two methods to configuration parameters: **Web Accessing** and **AT+instruction set**.

Web accessing means users can configure parameters through Web browser. When HF-LPB200 module connected to wireless network, parameters configuration is done on a PC connected to the same wireless network.

AT+instruction set configuration means user configure parameters through serial interface command. Refer to “AT+instruction set” chapter for more detail.

### 3.8. Firmware Update

HF-LPB200 module supports two on-line upgrade methods:

- Webpage Wi-Fi Upgrade
- Remote Upgrade

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www.hi-flying.com



Webpaged based Wi-Fi upgrade, please refer to 3.1.8 firmware upgrade page, user can upload firmware file from PC to HF-LPB200.

HF-LPB200 module also support upgrade from remote HTTP server, keep module connects to AP router before excuate remote HTTP upgrade. Remote upgrade have two methods: **Direct Download and Upgrade, Configure File Based Upgrade.**

#### ◆ **Configure File Based Upgrade**

AT+UPURL command to set the remote directory which the configuration file located, such as AT+UPURL=http://www.hi-flying.com!/admin/down/

Notes: The last '/' can't be remove

AT+UPFILE command to set the configuration file name, such as AT+UPFILE=config.txt

AT+UPST command to start remote upgrade. After excuate this command, the module will firstly download configuration file ("config.txt"), then download the upgrade file base on the URL address listed in the configure file.

General "config.txt" file format as following example:

[URL]="http://www.hi-flying.com!/admin/down/20133181764087523.zip"

#### ◆ **Direct Download and Upgrade**

AT+UPURL command to set the remote directory and file name, such as:

AT+UPURL=http://www.hi-flying.com!/admin/down/lpb.bin

After excuate this command, the module will directly download the "lpb.bin" file from remote directory and start upgrade.

**Notes:** please contact with high-flying technical people before upgrade firmware, or maybe damage the module and can't work again.

### 3.9. GPIO Function

HF-LPB200 module can provide maximum 17 GPIO pins, which include following configurable interface application:

- **Two A/D** analog input pins, dual channel, 16-bit ADC with sample rate upto 250KHz;
- **Four PWM** ouput pins (4 channel);
- 32.768KHz Crystal input for **RTC** function support;
- **Two Pin sleep** control pins for low power application;
- **One WPS** functional pin;
- **One I2C** interace;
- One General Serial Communication Port, which can configured as
  - **Master/Slave SPI** Interface;
  - **UART2 Interface** with flow control;
  - **I2S** audio interface;

HF-LPB200 GPIO pin map as following table:

Table 7 HF-LPB200 GPIO Pin Mapping Table

GPIO	Function 1	Function 2	Default Setting	Description
GPIO7	Sleep_RQ	GPIO	Sleep_RQ	Sleep Control Function Pins
GPIO8	Sleep_ON	GPIO	Sleep_ON	
GPIO10	WPS	GPIO	WPS	WPS functional pin
GPIO11	A/D Input 1	GPIO	GPIO11	16-Bits ADC input pins Dual ADC input
GPIO12	A/D Input 2	GPIO	GPIO12	
GPIO13	OSC32K_IN	GPIO	GPIO13	External 32.768KHz RTC clock input option
GPIO14	OSC32K_OUT	GPIO	GPIO14	
GPIO18	PWM 1	ADC2 Vfef	GPIO18	PWM functiona pins output.
GPIO20	PWM 2	GPIO	GPIO20	
GPIO23	PWM 3	GPIO	GPIO23	
GPIO24	PWM 4	GPIO	GPIO24	
GPIO25	I2C_SCL	GPIO	GPIO25	I2C Bus Interface
GPIO26	I2C_SDA	GPIO	GPIO26	
GPIO27	SPI_MISO	UART2_TXD	GPIO27	Three Functions: <1> SPI Master/Slave <2> UART w flow ctl <3> I2S Interface
GPIO28	SPI_CLK	UART2_CTS	GPIO28	
GPIO29	SPI_CS	UART2_RTS	GPIO29	
GPIO30	SPI_MOSI	UART2_RXD	GPIO30	

User need get HF-LPB200 SDK to configure these GPIOs to different functions. Please contact high-flying technical people to acquire more information.

When module works at GPIO mode, PC and other equipts can setup connection (TCP/UDP) through Wi-Fi, then read/write GPIO information through command.

- GPIO n IN, Set GPIO n as input, Response GPIO OK or GPIO NOK;
- GPIO n OUT 0, Set GPIO n as output and output '0', Response GPIO OK or GPIO NOK;
- GPIO n OUT 1, Set GPIO n as output and output '1', Response GPIO OK or GPIO NOK;
- GPIO n SW, Set GPIO n as output and switch the output status, Response GPIO OK or GPIO NOK;
- GPIO n PWM m1 m2, Set GPIO n output a wave: m1 is 'high' duration and m2 is 'low' duration (Time unit is 'ms' and minimal is 10ms), Response GPIO OK or GPIO NOK;
- GPIO n GET, Read GPIO n status, Response I0,I1,O0,O1, means"input low","input high","output low","output high"

**Notes:** Some SW version may not include these GPIO command set, please contact with high-flying technical people.

### 3.10. Analog Digital Converter (ADC) Function

HF-LPB200 integrate two identical ADCs (ADC0 and ADC1) which be programmed separately. The ADC is a second order sigma-delta converter with up to 16-bit resolution. The conversion results can be written to memory through DMA. Several modes of operation are available for the ADC.

The main features of ADC are follows:

- Selectable decimation rates with also set the effective resolution 9 to 16 bits);

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- Throughput rate as fast as 4uS(250KHz);
- PGA setting support: 2x, 1x, and 0.5x;
- Reference voltage (Vref): interface reference 1.2V;
- Offset and gain calibration;
- Embedded temperature sensor with internal or external diode options;
- Interrupt generation and/or DMA request;
- GPIO n OUT 0, Set GPIO n as output and output '0', Response GPIO OK or GPIO NOK;

## 4. OPERATION GUIDELINE

### 4.1. Configuration via Web Accessing

When first use HF-LPB200 modules, user may need some configuration. User can connect to HF-LPB200 module’s wireless interface with following default setting information and configure the module through laptop.

Table 8 HF-LPB200 Web Access Default Setting

Parameters	Default Setting
SSID	HF-LPB200
IP Address	10.10.100.254
Subnet Mask	255.255.255.0
User Name	Admin
Password	Admin

#### 4.1.1. Open Web Management Interface

- Step 1: Connect laptop to SSID “HF-LPB200” of HF-LPB200 module via wireless LAN card;
- Step 2: After wireless connection OK. Open Wen browser and access “<http://10.10.100.254>”;
- Step 3: Then input user name and password in the page as following and click “OK” button.



Figure 16. Open Web Management page

The HF-LPB200 web management page support English and Chinese language. User can select language environment at the top right corner and click “Apply” button.

The main menu include nine pages: “System”, “Work Mode”, “STA Setting”, “AP Setting”, “Other Setting”, “Account”, “Upgrade SW”, “Restart”, “Restore”.

#### 4.1.2. System Page

At this page, user can check current device’s important information and status such as: device ID (MID), software version, wireless work mode and related Wi-Fi parameters.

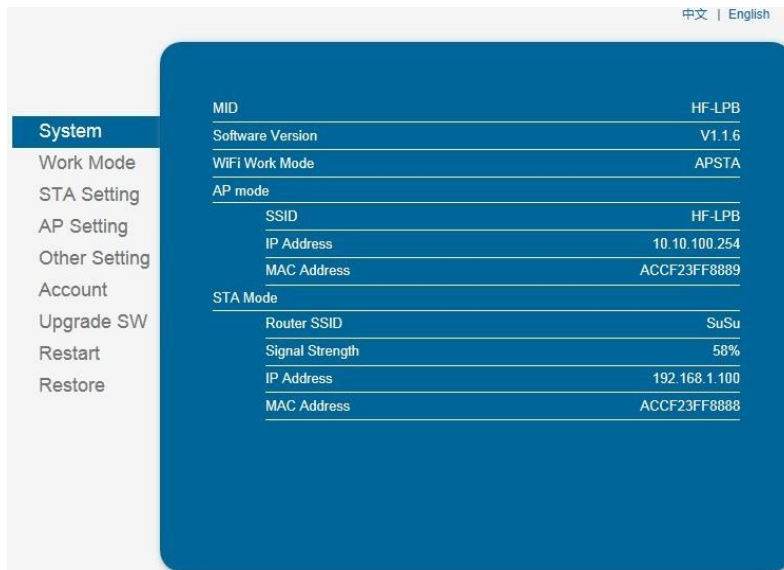


Figure 17. System Web Page

#### 4.1.3. Work Mode Page

HF-LPB200 module can work at AP mode to simplify user's configuration, can also work at STA to connect remote server through AP router. Also, it can configure at AP+STA mode which provide very flexible application for customers.

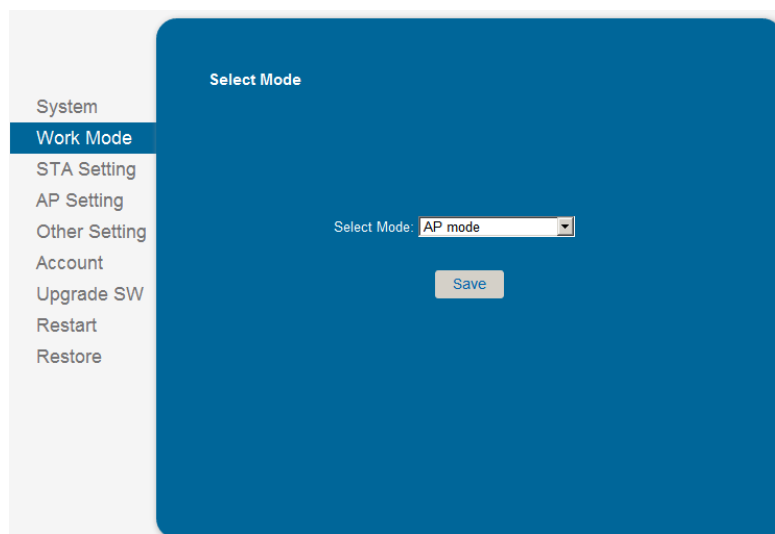


Figure 18. Work Mode Page

#### 4.1.4. STA Setting Page

User can push "Scan" button to auto search Wi-Fi AP router nearby, and can connect with associate AP through some settings. Please note the encryption information input here must be fully same with Wi-Fi AP router's configuration, and then it can link with AP correctly.



Figure 19. STA Setting Page

#### 4.1.5. AP Setting Page

When user select module works at AP and AP+STA mode, then need setting this page and provide wireless and network parameters. Most of the system support DHCP to achieve IP address, so we suggest to “Enable” DHCP server in most applications.

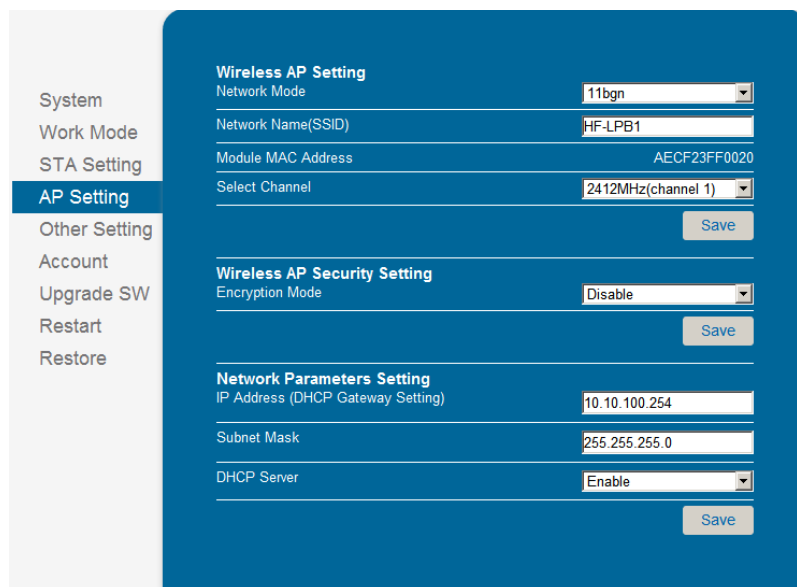


Figure 20. AP Setting Page

#### 4.1.6. Other Setting Page

HF-LPB200 usually works at data transparent transmission mode. At this mode, the user device which connected with HF-LPB200 will connect and communicate with remote PC or server. At this page, user need setting serial port communication parameters and defines TCP related protocol parameters.

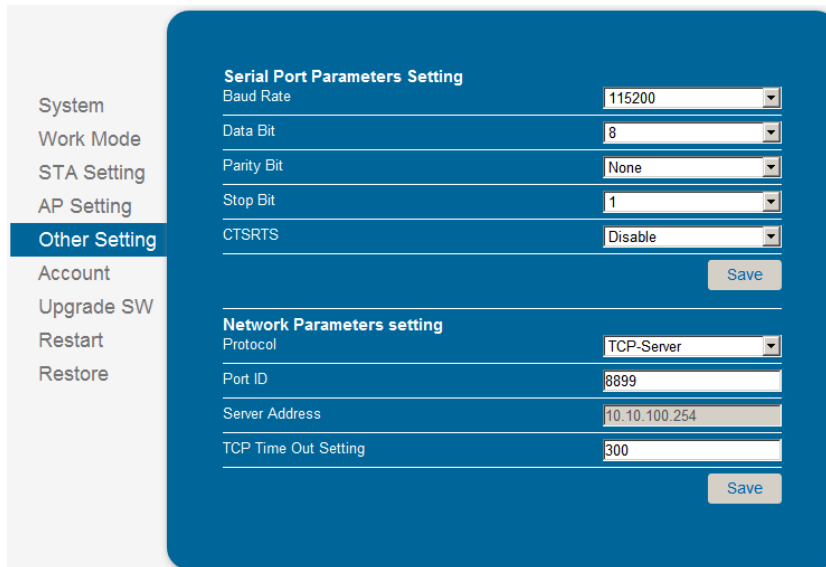


Figure 21. Other Setting Page

#### 4.1.7. Account Management Page

This page set web server's user name and password.

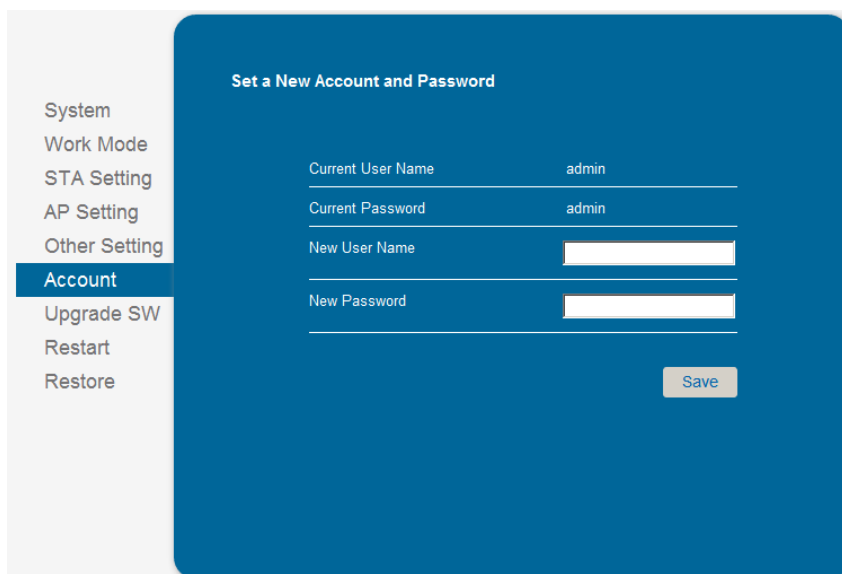


Figure 22. Account Page

#### 4.1.8. Upgrade Software Page

User can upgrade new software (firmware) version through Wi-Fi.

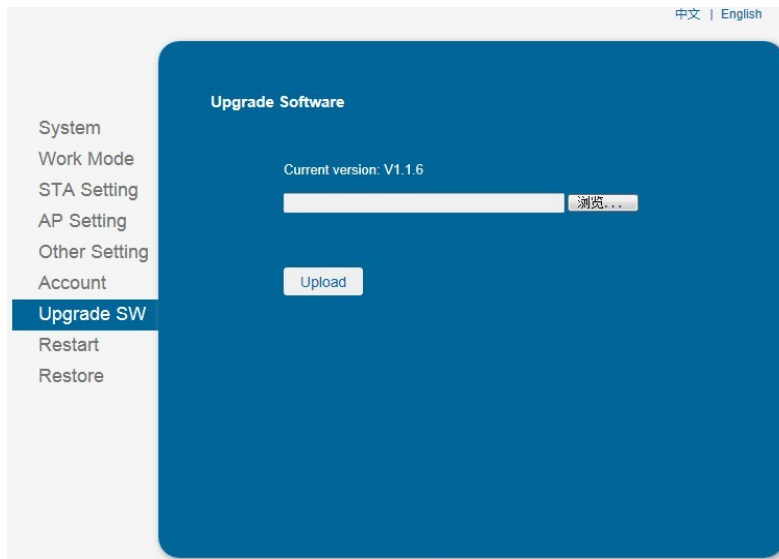


Figure 23. Upgrade SW page

#### 4.1.9. Restart Page

Most of the setting and configuration can only effective after system restart. User shall restart after finish all setting.

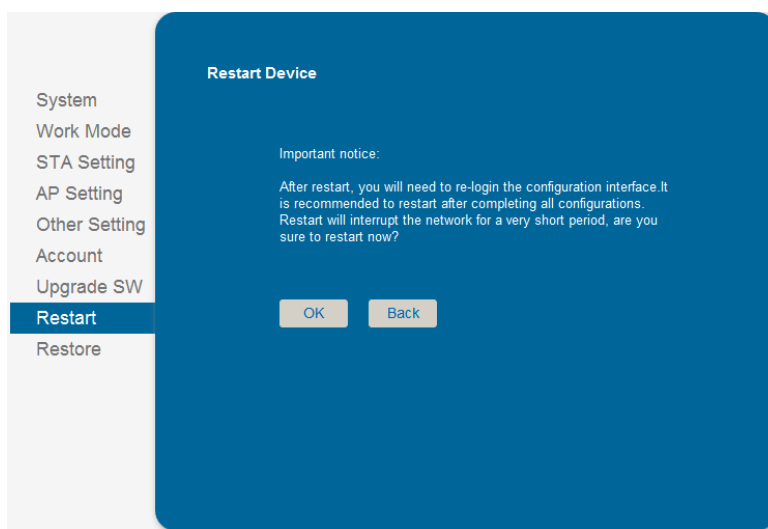


Figure 24. Restart Page

#### 4.1.10. Restore Page

After module restore factory default setting, all user configuration profile will lose.



User can access <http://10.10.100.254> to set again, and user name and password is “admin”. HF-LPB200 will restore to AP mode for factory default setting.

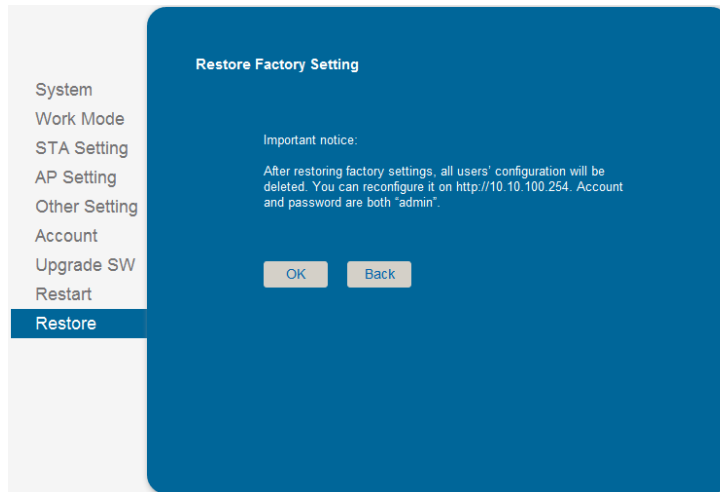




Figure 25. Restore Page

## 4.2. HF-LPB200 Usage Introduction

### 4.2.1. Software Debug Tools

High-Flying use two common software tools debugging and applying HF-LPB200 module. (User can also select other tools used to debug serial port).

- Serial Debugging Software: ComTools  ComTools.exe
- Ethernet Debugging Software: TCPUDPDbg  TCPUDPDbg.exe

### 4.2.2. Network Connection

User can select two methods to connect HF-LPB200 module base on dedicated application.

- **Use HF-LPB200 STA interface.** HF-LPB200 and debug PC2 connect to a wireless AP, another PC1 (or user device) connect to HF-LPB200 module with serial port:



Figure 26. STA Interface Debug Connection

- **Use HF-LPB200 AP interface.** Debug PC2 connect to HF-LPB200 through wireless connection, another PC1 (or user device) connect to HF-LPB200 module with serial port.



Figure 27. AP Interface Debug Connection

#### 4.2.3. Default Parameter Setting

- Default SSID: HF-LPB200;
- Deault security mode: open,none;
- User UART parameter setting:115200,8,1,None;
- Default network parameter setting:TCP,Server,8899,10.10.100.254;
- Module IP address: dhcp,0.0.0.0,0.0.0.0,0.0.0.0;

#### 4.2.4. Module Debug

PC1 open “CommTools” program, setting the same serial port parameters with HF-LPB200 module and open serial port connection.

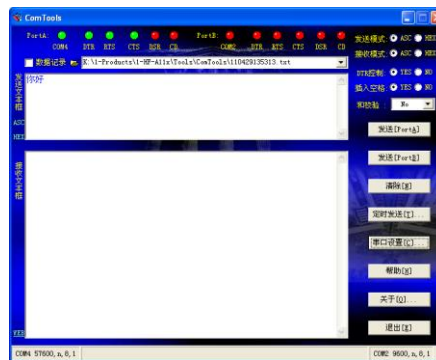


Figure 28. “CommTools” Serial Debug Tools

PC2 open “TCPUDPDbg” program, and create a new connection. If HF-LPB200 configured as Server mode, “TCPUDPDbg” Tools shall create “Client “mode connection. Or otherwise, create a “Server” mode connection.

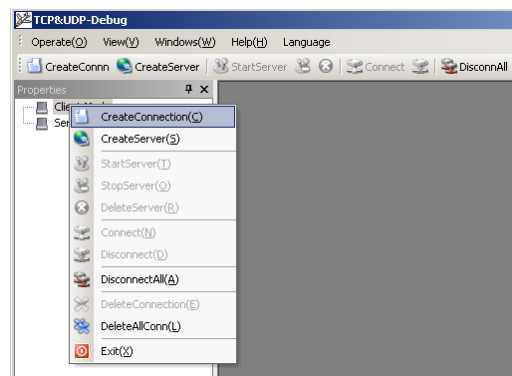


Figure 29. “TCPUDPDbg” Tools Create Connection

Then setting the TCP/UDP connection parameters. Default as following:

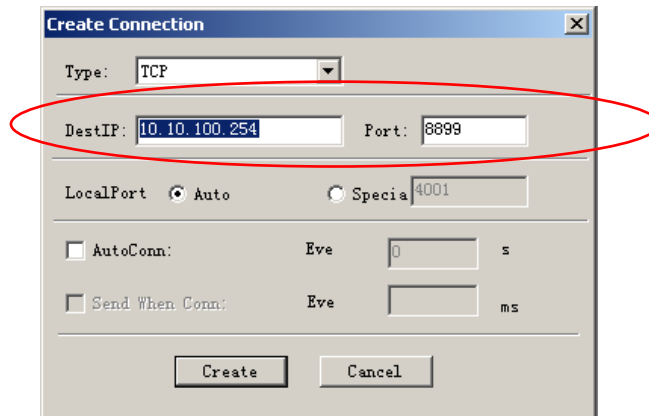


Figure 30. “TCPUDPDbg” Tools Setting

Then, click “Create” button to create a connection.

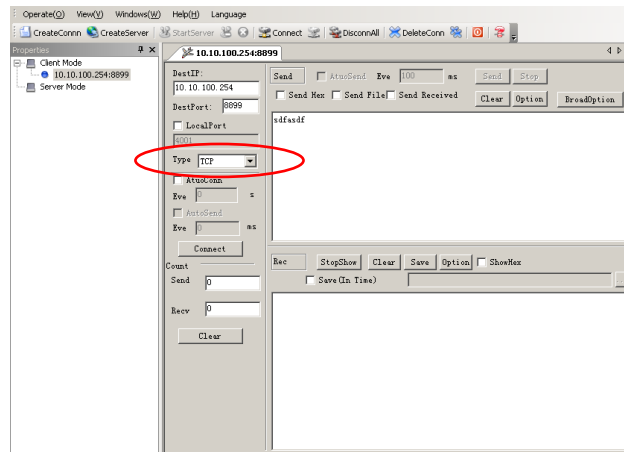


Figure 31. “TCPUDPDbg” Tools Connection

Now, in transparent transmission mode, data can be transferred from “CommTools” program to “TCPUDPDbg” program, or in reverse. You can see data in receiver side will keep same as in sender side.

### 4.3. Typical Application Examples

#### 4.3.1. Wireless Control Application



Figure 32. Wireless Control Application

For this wireless control application, HF-LPB200 works as Ad-Hoc mode. Module's serial port connects to user device. So, control agent (Smart phone for this example) can manage and control the user device through the wireless connection with HF-LPB200 module.

#### 4.3.2. Remote Management Application

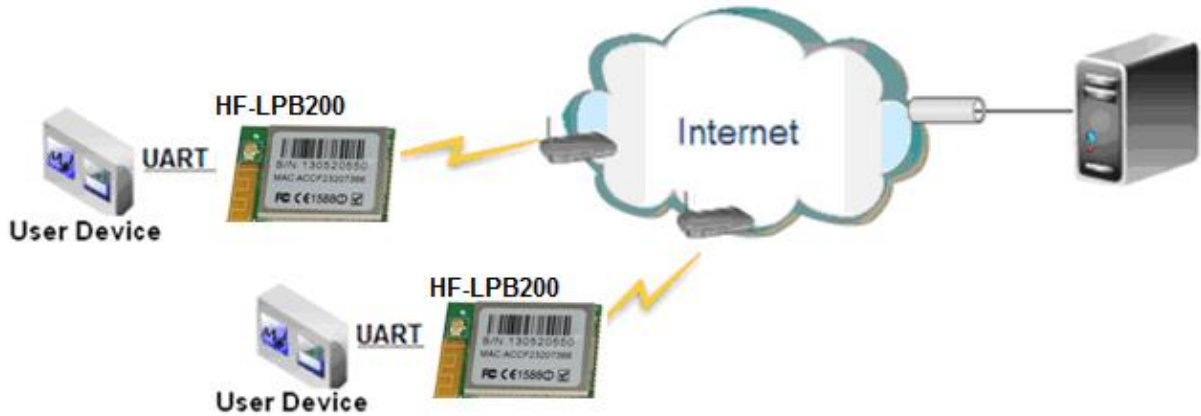


Figure 33. Remote Management Application

For this remote management application, HF-LPB200 works as STA mode and connects to Internet through wireless AP. Module configured as TCP Client and communicates with remote TCP server at Internet. Module's serial port connects to user device.

So, user device's data or sampling information can send to remote TCP server for storage or processing. Also remote TCP server can send command to control and manage the user device through the wireless network.

#### 4.3.3. Transparent Serial Port Application

For this transparent serial port application, two HF-LPB200 modules connect as below figures to build up a transparent serial port connection. HF-LPB200 works as Ad-Hoc mode to connect each other.



Figure 34. Transparent Serial Port Application

## 5. AT+INSTRUCTION INTRODUCTION

### 5.1. Configuration Mode

When HF-LPB200 power up, it will default works as transparent transmission mode, then user can switch to configuration mode by serial port command. HF-LPB200 UART default parameters setting as below figure,

Uart Setting	
Baudrate	115200
Data Bits	8
Parity	None
Stop	1
CTSRTS	Disable

Figure 35. HF-LPB200 Default UART Port Parameters

In configuration mode, user can setting the module through AT+ instruction set, which cover all web page setting function.

#### 5.1.1. Switch to Configuration Mode

Two steps to finish switching from transparent transmission mode to configuration mode.

- **UART input “+++”, after module receive “+++”, and feedback “a” as confirmation.**
- **UART input “a”, after module receive “a” and feedback “+ok” to go into AT+ instruction set configuration mode.**

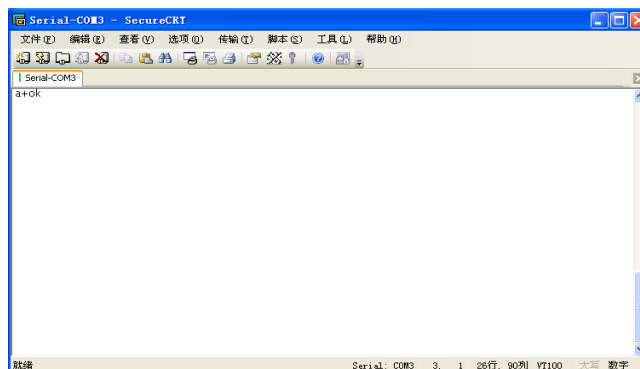


Figure 36. Switch to Configuration Mode

#### **Notes:**

1. When user input “+++” (No “Enter” key required), the UART port will display feedback information “a”, and not display input information “+++” as above UART display.
2. Any other input or wrong step to UART port will cause the module still works as original mode (transparent transmission).

## 5.2. AT+ Instruction Set Overview

User can input AT+ Instruction through hyper terminal or other serial debug terminal, also can program the AT+ Instruction to script. User can also input “AT+H” to list all AT+ Instruction and description to start.

```

AT+H
+ok

AT+: NONE command, reply "+ok".
AT+ASWD: Set/Query WiFi configuration code.
AT+E: Echo ON/off, to turn on/off command line echo function.
AT+ENTM: Goto Through Mode.
AT+NETP: Set/Get the Net Protocol Parameters.
AT+UART: Set/Get the UART Parameters.
AT+UARTF: Enable/disable UART AutoFrame function.
AT+UARTFT: Set/Get time of UART AutoFrame.
AT+UARTFL: Set/Get frame length of UART AutoFrame.
AT+UARTTE: Set/Query UART free-frame triggerf time between two byte.
AT+PING: General PING command.
AT+WAP: Set/Get the AP parameters.
AT+WKEY: Set/Get the Security Parameters of WIFI AP Mode.
AT+WMODE: Set/Get the WIFI operation Mode (AP or STA).
AT+WSKEY: Set/Get the Security Parameters of WIFI STA Mode.
AT+WSSID: Set/Get the AP's SSID of WIFI STA Mode.
AT+WSLK: Get Link Status of the Module (Only for STA Mode).
AT+WSLQ: Get Link Quality of the Module (Only for STA Mode).
AT+WSCAN: Get The AP site Survey (only for STA Mode).
AT+WEBU: Set/Get the Login Parameters of WEB page.
AT+TCPK: Get The state of TCP link.
AT+TCPTO: Set/Get TCP time out.
AT+TCPDIS: Connect/Dis-connect the TCP client link
AT+RECV: Recv data from UART
AT+SEND: Send data to UART
AT+WANN: Set/Get The WAN setting if in STA mode.
AT+LANN: Set/Get The LAN setting if in ADHOC mode.
AT+RELD: Reload the default setting and reboot.
AT+RLDEN: Put on/off the GPIO12.
AT+Z: Reset the Module.
AT+MID: Get The Module ID.
AT+VER: Get application version.
AT+H: Help.

```

Figure 37. "AT+H" Instruction for Help

### 5.2.1. Instruction Syntax Format

AT+Instruction protocol is based on the instruction of ASCII command style, the description of syntax format as follow.

- **Format Description**
  - <>: Means the parts must be included
  - []: Means the optional part

- **Command Message**

**AT+<CMD>[op][para-1,para-2,para-3,para-4...]<CR>**

- AT+: Prefix of command message;
- CMD: Command string;
- [op]: Symbol of command operator,
  - ◆ “=”: The command requires parameters input;
  - ◆ “NULL”: Query the current command parameters setting;
- [para-n]: Parameters input for setting if required;
- <CR>: "Enter" Key, it's 0x0a or 0x0d in ASCII;

**Notes:** When input AT+Instruction, “AT+<CMD>” character will display capital letter automatic and other\_parts will not change as you input.

➤ **Response Message**

**+<RSP>[op] [para-1,para-2,para-3,para-4...]<CR><LF><CR><LF>**

- +: Prefix of response message;
- RSP: Response string;
  - ◆ “ok” : Success
  - ◆ “ERR”: Failure
- [op] : =
- [para-n]: Parameters if query command or Error code when error happened;
- <CR>: ASCII 0x0d;
- <LF>: ASCII 0x0a;

➤ **Error Code**

Table 9 Error Code Description

Error Code	Description
-1	Invalid Command Format
-2	Invalid Command
-3	Invalid Operation Symbol
-4	Invalid Parameter
-5	Operation Not Permitted

5.2.2. AT+ Instruction Set

Table 10 AT+ Instruction Set List

Instruction	Description
<null>	NULL
<b>Managment Instruction Set</b>	
E	Open/Close show back function
WMODE	Set/Query Wi-Fi work mode (AP/STA/APSTA)
ENTM	Set module into transparent transition mode
TMODE	Set/Query module data transfer mode
MID	Query module ID information
VER	Query module software version information
RELD	Restore to factory default setting
Z	Re-start module
H	Help
<b>Configure Parameters Instruction Set</b>	
CFGRD	Batch Read User Configure Parameters
CFGWR	Batch Write Configure Parameters
CFGFR	Batch Read Factory Default Configure Parameters
CFGTF	Copy User Parameters to Factory Default Parameters

<b>UART Instruction Set</b>	
UART	Set/Query serial port parameters
UARTTE	Set/Query UART free-frame triggerf time between two bytes
<b>Command Mode Set</b>	
SEND	Send Data at Command Mode
RECV	Receive Data at Command Mode
<b>Network Instruction Set</b>	
PING	Network "Ping" Instruction
NETP	Set/Query network protocol parameters
TCPLK	Query if TCP link already build-up
TCPTO	Set/Query TCP timeout
TCPDIS	Open/Close TCP link
<b>Wi-Fi STA Instruction Set (Effective when module works as STA)</b>	
WSKEY	Set/Query STA security parameters
WSSID	Set/Query associated AP SSID parameters
WANN	Set/Query STA's network parameters
WSMAC	Query STA's MAC address
WSLK	Query STA Wi-Fi link status
WSLQ	Query STA Wi-Fi signal strength
WSCAN	Scan AP
WSDNS	Set/Query STA's Static DNS server address
<b>Wi-Fi AP Instruction Set (Effective when module works as AP)</b>	
LANN	Set/Query AP's network parameters
WAP	Set/Query AP Wi-Fi parameters
WAKEY	Set/Query AP security parameters
WAMAC	Set/Query AP MAC address
WADHCP	Set/Query AP DHCP Server status
WADMN	Set/Query AP webpage domain name
<b>Webpage Management Instruction Set</b>	
WEBSWITCH	Set Webpage Option
PLANG	Set/Query Webpage Language Option
WEBU	Set/Query Webpage User name and Code
<b>Remote Upgrade Instruction Set</b>	
UPURL	Set/Query remote upgrade URL address
UPFILE	Set/Query remote upgrade configure file name
UPST	Start remote upgrade
<b>Power Management Instruction Set</b>	
MSLP	Set power save mode parameters
<b>Others Instruction Set</b>	
WRMID	Set module ID
ASWD	Set/Query WiFi configuration code

#### 5.2.2.1. AT+E

- Function: Open/Close show back function;
- Format:

**AT+E<CR>**

**+ok<CR>< LF ><CR>< LF >**



When HF-LPB200 module firstly switch from transparent transmission to configuration mode, show back status is open, input “AT+E” to close show back function, input“AT+E” again to open show back function.

#### 5.2.2.2. AT+WMODE

- Function: Set/Query WIFI work mode;

- Format:

- ◆ Query Operation

**AT+WMODE<CR>**

**+ok=<mode><CR>< LF ><CR>< LF >**

- ◆ Set Operation

**AT+ WMODE=<mode><CR>**

**+ok<CR>< LF ><CR>< LF >**

- Parameters:

- ◆ mode:Wi-Fi work mode

- ◇ AP
- ◇ STA
- ◇ APSTA

#### 5.2.2.3. AT+ENTM

- Function: Set module into transparent transmission mode;

- Format:

**AT+ENTM<CR>**

**+ok<CR>< LF ><CR>< LF >**

When operate this command, module switch from configuration mode to transparent transmission mode.

#### 5.2.2.4. AT+TMODE

- Function: Set/Query module data transfer mode.

- Format:

- ◆ Query Operation

**AT+TMODE<CR>**

**+ok=<tmode><CR>< LF ><CR>< LF >**

- ◆ Set Operation

**AT+TMODE=<tmode><CR>**

**+ok<CR>< LF ><CR>< LF >**

- Parameters:

- ◆ tmode: data transfer mode, include:

- ◇ throughput
- ◇ cmd

#### 5.2.2.5. AT+MID

- Function: Query module ID information;

- Format:

- ◆ Query Operation

**AT+MID<CR>**

**+ok=<module\_id><CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ module\_id: Module ID information;
    - ✧ HF-LPB200;

Notes: User can set this parameter through AT+WRMID.

#### 5.2.2.6. AT+VER

- Function: Query module software version information;
- Format:
  - ◆ Query Operation

**AT+VER<CR>**

**+ok=<ver><CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ ver: Module software version information;

#### 5.2.2.7. AT+RELD

- Function: module restore to factory default setting;
- Format:
  - ◆ Set Operation

**AT+ RELD<CR>**

**+ok=rebooting...<CR>< LF ><CR>< LF >**

When operate this command, module will restore to factory default setting and reboot.

#### 5.2.2.8. AT+Z

- Function: Re-start module;
- Format:

**AT+ Z<CR>**

#### 5.2.2.9. AT+H

- Function: Help;
- Format:
  - ◆ Query Operation

**AT+H<CR>**

**+ok=<command help><CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ command help: command introduction;

#### 5.2.2.10. AT+CFGRD

- Function: Batch Read User Configure Parameters;
- Format:
  - ◆ Query Operation

**AT+CFGRD<CR>**

**+ok=<config><CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ config: the first two bytes means the length of configuration parameters;

#### 5.2.2.11. AT+CFGWR

- Function: Batch Write User Configure Parameters;
- Format:
  - ◆ Set Operation

**AT+CFGWR=<config><CR>**

**+ok<CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ config: the first two bytes means the length of configuration parameters;

#### 5.2.2.12. AT+CFGFR

- Function: Batch Read Factory Default Configure Parameters;
- Format:
  - ◆ Query Operation

**AT+CFGFR<CR>**

**+ok=<config><CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ config: the first two bytes means the length of configuration parameters;

#### 5.2.2.13. AT+CFGTF

- Function: Copy User Parameters to Factory Default Parameters;
- Format:
  - ◆ Query Operation

**AT+CFGTF<CR>**

**+ok=<status><CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ status: feedback operation status;

#### 5.2.2.14. AT+UART

- Function: Set/Query serial port parameters;
- Format:
  - ◆ Query Operation

**AT+UART<CR>**

**+ok=<baudrate,data\_bits,stop\_bit,parity><CR>< LF ><CR>< LF >**

- ◆ Set Operation

**AT+UART=<baudrate,data\_bits,stop\_bit,parity><CR>**

**+ok<CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ baudrate:
    - ◇ 300,600,1200,1800,2400,4800,9600,19200,38400,57600,115200.
  - ◆ data\_bits:

- ◇ 8
- ◆ stop\_bits:
  - ◇ 1,2
- ◆ parity:
  - ◇ NONE
  - ◇ EVEN
  - ◇ ODD
- ◆ Flowctrl: (CTSRTS)
  - ◇ NFC: No hardware flow control
  - ◇ FC: hardware flow control

#### 5.2.2.15. AT+ UARTTE

- Function: Set/Query UART free-frame trigger time between two bytes;
- Format:

- ◆ Query Operation

**AT+ UARTTE<CR>**

**+ok=<mode><CR>< LF ><CR>< LF >**

- ◆ Set Operation

**AT+ UARTTE=<mode><CR>**

**+ok<CR>< LF ><CR>< LF >**

- Parameters:

- ◆ mode:
  - ◇ fast: free-frame trigger time between two bytes is 10ms;
  - ◇ normal: free-frame trigger time between two bytes is 50ms;

#### 5.2.2.16. AT+ SEND

- Function: Send Data at Command Mode.
- Format:

**AT+SEND=<data\_lenth, data\_content><CR>**

**+ok<CR>< LF ><CR>< LF >**

- Parameters:

- ◆ data\_lenth: Lenth of send data. Range: 0~1000 Byte
- ◆ data\_content: contents of send data.

When two parameters conflict, select smaller value to send data.

#### 5.2.2.17. AT+ RECV

- Function: Receive Data at Command Mode.
- Format:

**AT+RECV=<data\_lenth><CR>**

**+ok=< data\_lenth, data\_content><CR>< LF ><CR>< LF >**

- Parameters:

- ◆ data\_lenth: Lenth of receive data. Range: 0~1000 Byte
- ◆ data\_content: contents of receive data.

If not receive any data in 3 second, then feedback +ok=0.

## 5.2.2.18. AT+ PING

- Function: Network “PING” Instruction.
- Format:
  - ◆ Set Operation

**AT+ PING=<IP\_address ><CR>**

**+ok=<sta><CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ sta: feedback result
    - ◇ Success
    - ◇ Timeout
    - ◇ Unknown host

## 5.2.2.19. AT+NETP

- Function: Set/Query network protocol parameters;
- Format:
  - ◆ Query Operation

**AT+NETP<CR>**

**+ok=<protocol,CS,port,IP><CR>< LF ><CR>< LF >**

- ◆ Set Operation

**AT+NETP=<protocol,CS,port,IP><CR>**

**+ok<CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ protocol:
    - ◇ TCP
    - ◇ UDP
  - ◆ CS: Network mode:
    - ◇ SERVER
    - ◇ CLIENT
  - ◆ Port: protocol port ID: Decimal digit and less than 65535
  - ◆ IP: Server’s IP address when module set as client

## 5.2.2.20. AT+ TCPLK

- Function: Query if TCP link already build-up;
- Format:

**AT+ TCPLK<CR>**

**+ok=<sta><CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ sta.: if module already setup TCP link;
    - ◇ on: TCP link setup;
    - ◇ off: TCP link not setup;

## 5.2.2.21. AT+ TCPTO

- Function: Set/Query TCP timeout;

- Format:
  - ◆ Query Operation
 

```
AT+ TCPTO<CR>
```

```
+ok=<time><CR>< LF ><CR>< LF >
```
  - ◆ Set Operation
 

```
AT+ TCPTO=<time ><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```
- Parameters:
  - ◆ time: TCP timeout time.
    - ◇ ≤ 600, (600s);
    - ◇ ≥ 0, (0 means no timeout);
    - ◇ Default, 300s;

#### 5.2.2.22. AT+TCPDIS

- Function: Open/Close TCP link;
- Format:
  - ◆ Query Opera
 

```
AT+TCPDIS<CR>
```

```
+ok=<sta><CR>< LF ><CR>< LF >
```
  - ◆ Set Operation
 

```
AT+ TCPDIS =<on/off><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```

- Parameters:

When query, sta.: Feedback if TCP Client can be link,

- ◇ On, TCP link close
- ◇ off, TCP link on

When setting, “off” means close TCP link. After finish this command, module disconnect TCP link and not connect again. “On” means open TCP link. After finish this command, module re-connect TCP server right away.

#### 5.2.2.23. AT+WSSSID

- Function: Set/Query Wi-Fi associated AP SSID parameters.
- Format:
  - ◆ Query Operation
 

```
AT+WSSSID<CR>
```

```
+ok=<ap's ssid><CR>< LF ><CR>< LF >
```
  - ◆ Set Operation
 

```
AT+ WSSSID=<ap's ssid ><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```
- Parameters:
  - ◆ ap's ssid: AP's SSID (Within 32 character);

#### 5.2.2.24. AT+WSKEY

- Function: Set/Query STA security parameters;
- Shanghai High-Flying Electronics Technology Co., Ltd  
www.hi-flying.com

- Format:
  - ◆ Query Operation
- AT+WSKEY<CR>**
- +ok=<auth,key><CR>< LF ><CR>< LF >**
- ◆ Set Operation
- AT+ WSKEY=< auth,encry,key><CR>**
- +ok<CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ auth: Authentication mode
    - ◇ OPEN
    - ◇ SHARED
    - ◇ WPAPSK
    - ◇ WPA2PSK
  - ◆ encry:Encryption algorithm
    - ◇ NONE: When “auth=OPEN”, effective
    - ◇ WEP: When “auth=OPEN” or “SHARED”, effective
    - ◇ TKIP: When “auth= WPAPSK” or “WPA2PSK”, effective
    - ◇ AES: When “auth= WPAPSK” “WPA2PSK”, effective
  - ◆ key: password, ASCII code, shall less than 64 bit and greater than 8bit

#### 5.2.2.25. AT+ WANN

- Function: Set/Query STA network setting;
- Format:
  - ◆ Query Operation
- AT+WANN<CR>**
- +ok=<mode,address,mask,gateway><CR>< LF ><CR>< LF >**
- ◆ Set Operation
- AT+ WANN=< mode,address,mask,gateway ><CR>**
- +ok<CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ mode: STA's IP network setting
    - ◇ static: Static IP
    - ◇ DHCP: Dynamic IP
  - ◆ address: STA IP address;
  - ◆ mask: STA subnet mask;
  - ◆ gateway: STA gateway address;

#### 5.2.2.26. AT+ WSMAC

- Function: Query STA MAC address parameters;
- Format:
  - ◆ Query Operation
- AT+WSMAC<CR>**
- +ok=<mac\_address><CR>< LF ><CR>< LF >**
- Parameters:

- ◆ code: security code
  - ◇ 8888 (default value)
- ◆ Mac\_address: STA MAC address, such as ACCF23FF1234

#### 5.2.2.27. AT+ WSLK

- Function: Query STA WiFi link status
- Format:
  - ◆ Query Operation
 

```
AT+ WSLK<CR>
```

```
+ok=<ret><CR>< LF ><CR>< LF >
```
- Parameters:
  - ◆ ret
    - ◇ "Disconnected", if no WiFi connection;
    - ◇ "AP' SSID (AP's MAC" ) , if WiFi connection available;
    - ◇ "RF Off", if WiFi OFF;

#### 5.2.2.28. AT+ WSLQ

- Function: Query STA WiFi signal strength;
- Format:
  - ◆ Query Operation
 

```
AT+ WSLQ<CR>
```

```
+ok=<ret><CR>< LF ><CR>< LF >
```
- Parameters:
  - ◆ ret
    - ◇ "Disconnected", if no WiFi connection;
    - ◇ "AP's WiFi signal strength" , if WiFi connection available;

#### 5.2.2.29. AT+WSCAN

- Function: Scan AP;
- Format:
 

```
AT+ WSCAN<CR>
```

```
+ok=<ap_site><CR>< LF ><CR>< LF >
```
- Parameters:
  - ◆ ap\_site: AP searched;

#### 5.2.2.30. AT+ WSDNS

- Function: Set/Query STA static DNS server address;
- Format:
  - ◆ Query Operation
 

```
AT+WSDNS<CR>
```

```
+ok=<address><CR>< LF ><CR>< LF >
```
  - ◆ Set Operation
 

```
AT+ WSDNS =<address><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```



- Parameters:
  - ◆ address: STA's DNS server address; Effective right away.

#### 5.2.2.31. AT+ LANN

- Function: Set/Query AP's network parameters;
- Format:
  - ◆ Query Operation

**AT+LANN<CR>**

**+ok=<ipaddress,mask><CR>< LF ><CR>< LF >**

- ◆ Set Operation

**AT+ LANN=< ipaddress,mask><CR>**

**+ok<CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ ipaddress: AP's IP address;
  - ◆ mask: AP's net mask;

#### 5.2.2.32. AT+WAP

- Function: Set/Query AP Wi-Fi parameters;
- Format:
  - ◆ Query Operation

**AT+WAP<CR>**

**+ok=<wifi\_mode,ssid,channel><CR>< LF ><CR>< LF >**

- ◆ Set Operation

**AT+ WAP =<wifi\_mode,ssid,channel><CR>**

**+ok<CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ wifi\_mode: Wi-Fi mode, include:
    - ◇ 11BGN (Default Value)
  - ◆ ssid: SSID at AP mode
  - ◆ channel: Wi-Fi channel selection:
    - ◇ AUTO
    - ◇ CH1~CH11; (Default CH1)

#### 5.2.2.33. AT+WKEY

- Function: Set/Query AP Wi-Fi security parameters;
- Format:
  - ◆ Query Operation

**AT+WKEY<CR>**

**+ok=<auth,key><CR>< LF ><CR>< LF >**

- ◆ Set Operation

**AT+ WKEY=< auth,encry,key><CR>**

**+ok<CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ auth: include

- ✧ OPEN
- ✧ WPA2PSK
- ◆ Encry: include
  - ✧ NONE: When “auth=OPEN” available;
  - ✧ AES: When “auth=WPA2PSK” available;
- ◆ key: security code, ASCII code, smaller than 64bit and bigger than 8 bit;

#### 5.2.2.34. AT+WAMAC

- Function: Query AP MAC address parameters;
- Format:
  - ◆ Query Operation

**AT+WAMAC<CR>**

**+ok=<mac\_address><CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ mac\_address: AP’s MAC address;

Note: Module AP mode’s MAC address is related to STA mode’s MAC address. If user need changeto others, please contact with high-flying technical people.

#### 5.2.2.35. AT+WADHCP

- Function: Set/Query AP DHCP server status;
- Format:
  - ◆ Query Operation

**AT+WADHCP<CR>**

**+ok=<status><CR>< LF ><CR>< LF >**

- ◆ Set Operation

**AT+ WADHCP=<status><CR>**

**+ok<CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ status: AP’s DHCP server function status:
    - ✧ on: DHCP Server Open;
    - ✧ off: DHCP Server Close;

#### 5.2.2.36. AT+WADMN

- Function: Set/Query AP webpage domain name;
- Format:
  - ◆ Query Operation

**AT+WADMN<CR>**

**+ok=<domain\_name><CR>< LF ><CR>< LF >**

- ◆ Set Operation

**AT+ WADMN =<domain\_name><CR>**

**+ok<CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ Domain\_name: Webpage domain name (within 20 characters, can’t all numbers).

## 5.2.2.37. AT+PLANG

- Function: Set/ Query webpage language option;

- Format:

- ◆ Query Operation

**AT+ PLANG<CR>**

**+ok=<language> <CR>< LF ><CR>< LF >**

- ◆ Set Operation

**AT+ PLANG=<language> <CR>**

**+ok<CR>< LF ><CR>< LF >**

- Parameters:

- ◆ language: webpage's language
  - ◇ CN: Chinese Version (Default);
  - ◇ EN: English Version;

## 5.2.2.38. AT+UPURL

- Function: Set/ Query remote upgrade URL address;

- Format:

- ◆ Query Operation

**AT+ UPURL<CR>**

**+ok=<url> <CR>< LF ><CR>< LF >**

- ◆ Set Operation

**AT+ UPURL=<url,filename> <CR>**

**+ok<CR>< LF ><CR>< LF >**

- Parameters:

- ◆ url: the upgrade file url address; the last charter shall be "/" (within 20 characters).
- ◆ filename: the upgrade file name, it's optional and not saved parameter. If provide this file name here, the module will start upgrade right away;

## 5.2.2.39. AT+UPFILE

- Function: Set/ Query remote upgrade configure file name;

- Format:

- ◆ Query Operation

**AT+ UPFILE<CR>**

**+ok=<filename> <CR>< LF ><CR>< LF >**

- ◆ Set Operation

**AT+ UPFILE=<filename> <CR>**

**+ok<CR>< LF ><CR>< LF >**

- Parameters:

- ◆ filename: the upgrade configure file name (within 20 characters).

## 5.2.2.40. AT+UPST

- Function: Start remote upgrade;

- Format:

- ◆ Query Operation

**AT+ UPST<CR>**

**+ok=<log> <CR>< LF ><CR>< LF >**

- Parameters:

- ◆ log: feedback the status of remote upgrade;

**Note:** After execute this command, the HF-LPB200 will automatic start upgrade base on the setting of UPURL, UPFILE command contents;

#### 5.2.2.41. AT+WEBU

- Function: Set/ Query webpage user name and password;

- Format:

- ◆ Query Operation

**AT+ WEBU<CR>**

**+ok=<username,password> <CR>< LF ><CR>< LF >**

- ◆ Set Operation

**AT+ WEBU=<username,password><CR>**

**+ok<CR>< LF ><CR>< LF >**

- Parameters:

- ◆ username: User Name, within 15 characters, not support empty.
- ◆ password: password, within 15 characters, support empty.

#### 5.2.2.42. AT+MSLP

- Function: Set power save mode (Wi-Fi wake up and deep sleep) parameters;

- Format:

- ◆ Set Operation

**AT+ MSLP=<mode, mask, timeout><CR>< LF ><CR>< LF >**

- Parameters:

- ◆ mode, power save mode
  - ◇ standby: Wi-Fi wakeup mode;
  - ◇ dslp: Deep Sleep Mode;
- ◆ mask (only available at standby mode): Wi-Fi wake up condition.  
This is multiple-choice option, "1111" mean select all wake up condition.
  - ◇ 0001: broadcast;
  - ◇ 0010: unicast;
  - ◇ 0100: mac event;
  - ◇ 1000: multicast;
- ◆ timeout: timer wakeup parameters, after this time, module will wake up.  
Unit: second.
  - ◇ 0: wake up trigger no related to timer;
  - ◇ >1s:

#### 5.2.2.43. AT+WRMID

- Function: Set module ID;

- Format:

- ◆ Set Operation

**AT+ WRMID=<wrmid> <CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ wrmid: set module's ID (within 20 characters).

#### 5.2.2.44. AT+ASWD

- Function: Set/Query WiFi Configuration Password;

- Format:

- ◆ Query Operation

**AT+ ASWD<CR>**

**+ok=<aswd> <CR>< LF ><CR>< LF >**

- ◆ Set Operation

**AT+ ASWD=<aswd> <CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ aswd: WiFi Configuration Password (within 20 characters).

## 6. PACKAGE INFORMATION

### 6.1. Recommended Reflow Profile

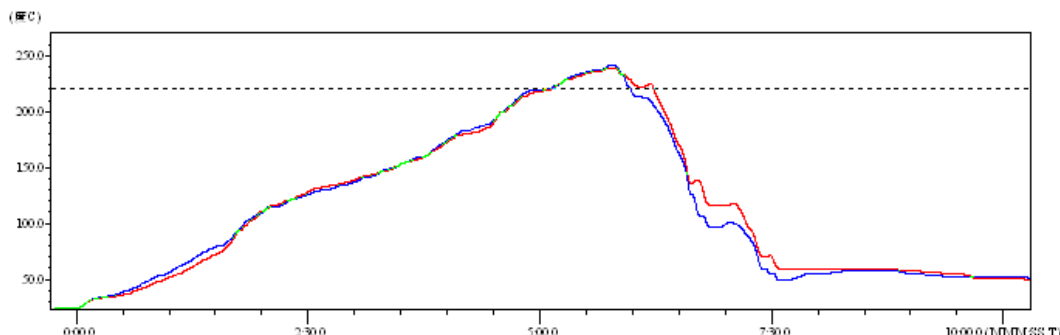


Figure 38. Reflow Soldering Profile

Table 11 Reflow Soldering Parameter

NO.	Item	Temperature (Degree)	Time(Sec)
1	Reflow Time	Time of above 220	35~55 sec
2	Peak-Temp	260 max	

- Note:** 1. Recommend to supply N2 for reflow oven.  
 2. N2 atmosphere during reflow (O2<300ppm)

### 6.2. Device Handling Instruction (Module IC SMT Preparation)

- Shelf life in sealed bag: 12 months, at <30°C and <60% relative humidity (RH)
- After bag is opened, devices that will be re-baked required after last baked with window time 168 hours.
- Recommend to oven bake with N2 supplied
- Recommend end to reflow oven with N2 supplied
- Baked required with 24 hours at 125+5°C before rework process for two modules, one is new module and two is board with module
- Recommend to store at ≤ 10% RH with vacuum packing
- If SMT process needs twice reflow:
  - Top side SMT and reflow
  - Bottom side SMT and reflow

Case 1: Wifi module mounted on top side. Need to bake when bottom side process over 168 hours window time, no need to bake within 168 hours

Case 2: Wifi module mounted on bottom side, follow normal bake rule before process

**Note:** Window time means from last bake end to next reflow start that has 168 hours space.

### 6.3. Shipping Information

#### TRAY

Size: 420\*245\*34 mm



#### BOX

Size: 422\*247\*72 mm (inside)



#### CARTON

Size: 440\*260\*320 mm (inside)



Figure 39. Shipping Information

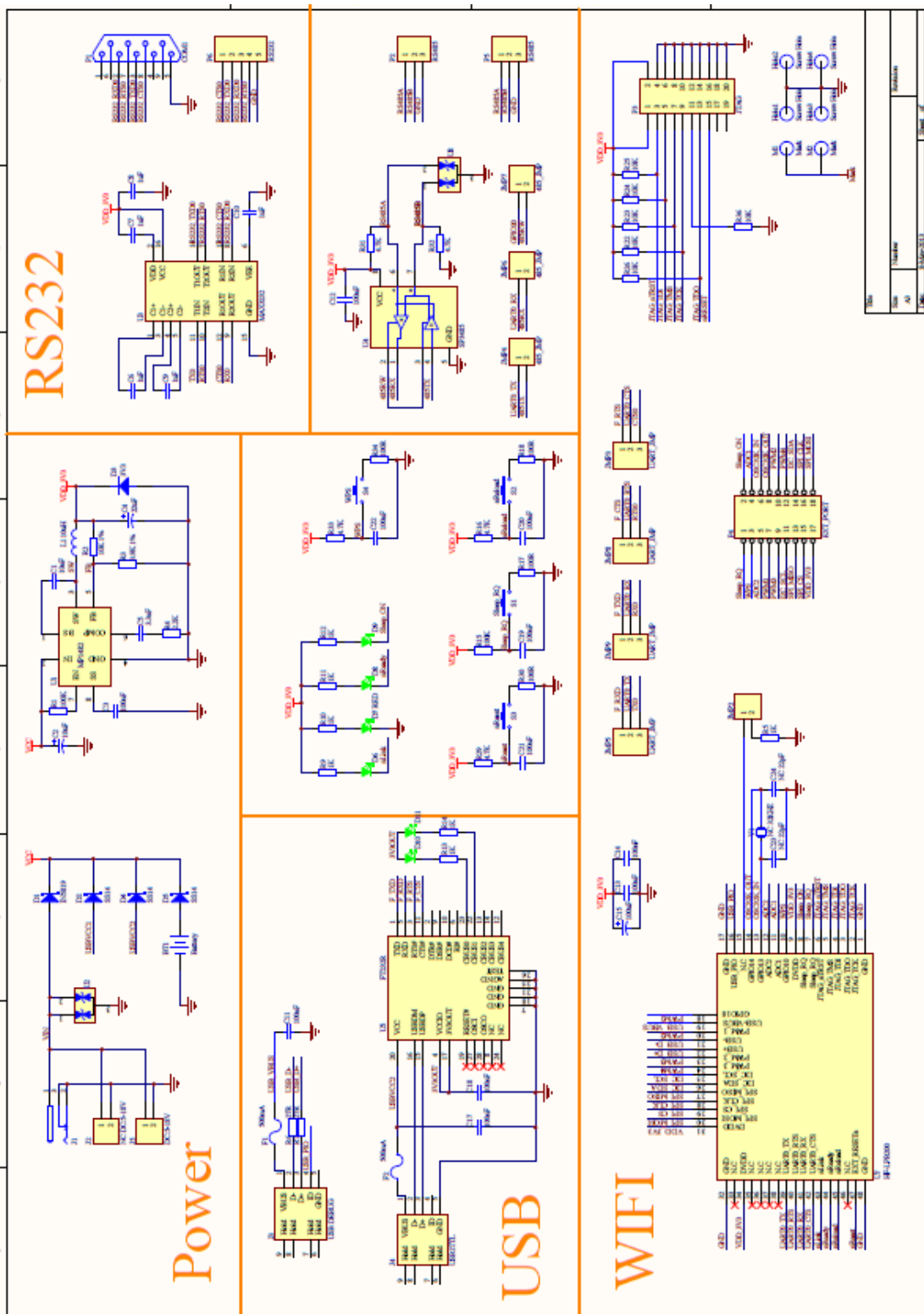
**Note:**

1 tray = 5\*20pcs = 100 pcs

1 box = 2 trays = 2 \* 100 pcs = 200pcs

1 carton = 4 boxes = 4 \* 200 pcs = 800pcs

# APPENDIX A: HW REFERENCE DESIGN



Detailed HF-LPB200 Evaluation Board design source files, pls access High-Flying web download page or contact with High-Flying technical support people to acquire.

Shanghai High-Flying Electronics Technology Co., Ltd  
www.hi-flying.com



## APPENDIX B: CONTACT INFORMATION

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**Address:** Room.511/510, Building 7, No.365, Chuanhong Road, Pudong New Area,  
Shanghai, China, 201202

**Web:** [www.hi-flying.com](http://www.hi-flying.com)

**Service Online:** 400-189-3108

**Sales Contact:** [sales@hi-flying.com](mailto:sales@hi-flying.com)

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For more information about High-Flying modules, applications, and solutions, please visit our web site  
<http://www.hi-flying.com/en/>

## END OF DOCUMENT

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[www.hi-flying.com](http://www.hi-flying.com)

## **FCC STATEMENT**

1. 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.

(2) This device must accept any interference received, including interference that may cause undesired operation.

2. 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 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.

## **FCC Radiation Exposure Statement**

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