

# HF-LPB

## Low Power WiFi Module User Manual

V 1.1



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Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

If the FCC ID of the module cannot be seen when it is installed, then the host label must include the text: Contains FCC ID: AZY-HF-LPB



## Overview of Characteristic

- ✧ **Support IEEE802.11b/g/n Wireless Standards**
- ✧ **Fully Self-Contained Serial-to-Wireless Functionality**
- ✧ **Ultra-Low-Power for Battery Applications with Excellent Power Save Scheme**
- ✧ **Support UART/SPI/USB/PWM/GPIO Data Communication Interface**
- ✧ **Support Work As STA/AP/AP+STA Mode**
- ✧ **Support Wi-Fi Direct**
- ✧ **Support WPS Function**
- ✧ **Support Wireless and Remote Firmware Upgrade Function**
- ✧ **Support User-Defined Web Page Upload**
- ✧ **Single +3.3V Power Supply**
- ✧ **Smallest Size: 23mm x 32.5mm x2.7mm**
- ✧ **FCC/CE Certificated**

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**HISTORY**

**Ed. V1.0** Created on 1-29-2013.

**Ed. V1.1** 02-24-2013. Update AT command contents.

# 1. PRODUCT OVERVIEW

## 1.1. General Description

The HF-LPB 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 interface for data transfer. HF-LPB 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-LPB support AP+STA wireless networking and support Wi-Fi Direct. HF-LPB also provides wireless and remote firmware upgrade, which satisfied all kinds of application requirement. HF-LPB support user defined Web page and can revise the data communication protocol, which reduce much customer's software development and customization work.

The HF-LPB 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-LPB integrates all Wi-Fi functionality into a low-profile, 23x32.5x 2.7mm SMT module package that can be easily mounted on main PCB with application specific circuits.

### 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.
- Ultra-low-power operation with all kinds of power-save modes.
- Includes all the protocol and configuration functions for Wi-Fi connectivity.
- Support STA/AP/AP+STA Mode
- Support Wi-Fi Direct Mode
- Support WPS
- Support Wireless and Remote Firmware Upgrade Function
- Support User-Defined Web Page Upload
- Integrated chip antenna options.
- Compact surface mount module 23mm x 32.5mm x 2.7mm.
- Full IPv4 and IPv6 stack.
- Low power RTOS and drivers.
- FCC Certified.
- RoHS and CE compliant.
- Single supply – 3.3V operation.



### 1.1.2 Device Parameters

Table 1 HF-LPB Module Technical Specifications

Class	Item	Parameters
Wireless Parameters	Certification	FCC/CE
	Wireless standard	802.11 b/g/n
	US Frequency range	2.412GHz-2.462GHz
	EU Frequency range	2.412GHz-2.472GHz
	Transmit Power	802.11b: +18dBm (Max.)
		802.11g: +14dBm (Max.)
		802.11n: +11dBm (Max.)
		Configurable
Receiver Sensitivity	802.11b: -93 dBm (@11Mbps ,CCK)	
	802.11g: -85 dBm (@54Mbps, OFDM)	
	802.11n: -82 dBm (@HT20, MCS7)	
Antenna Option	Internal:On-board PCB antenna	
Hardware Parameters	Data Interface	UART
		USB, SPI, PWM...
		Others: GPIO, ADC/DAC, RTC...
	Operating Voltage	3.1~3.6V
	Operating Current	Peak [Continuous TX]: ~200mA Normal [WiFi ON/OFF, DTIM=100ms]: Average. ~5mA, Peak: 200mA Deep Sleep: [WiFi OFF]: ~2mA Standby [WiFi Shutdown]: <2uA
	Operating Temp.	-40°C- 85°C
	Storage Temp.	-45°C- 125°C
Dimensions and Size	23mm×32.5mm×2.7mm	
Software Parameters	Network Type	STA /AP/STA+AP/Wi-Fi Direct
	Security Mechanisms	WEP/WPA-PSK/WPA2-PSK/WPS
	Encryption	WEP64/WEP128/TKIP/AES
	Update Firmware	Local Wireless, Remote
	Customization	Web Page Upgrade
		Support SDK for application develop
	Serial command	AT+instruction set
	Network Protocol	IPv4, IPv6,TCP/UDP/FTP/HTTP
User Configuration	AT+instruction set. Android/ iOS	

### 1.1.3 Key Application

- Remote equipment monitoring
- Asset tracking and telemetry
- Security
- Industrial sensors and controls
- Home automation
- Medical devices

## 1.2. Hardware Introduction

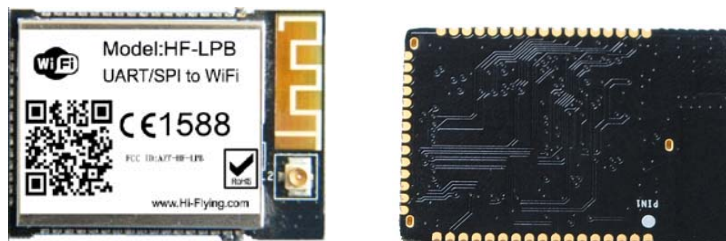


Figure 1. HF-LPB Demo

### 1.2.1. Pins Definition

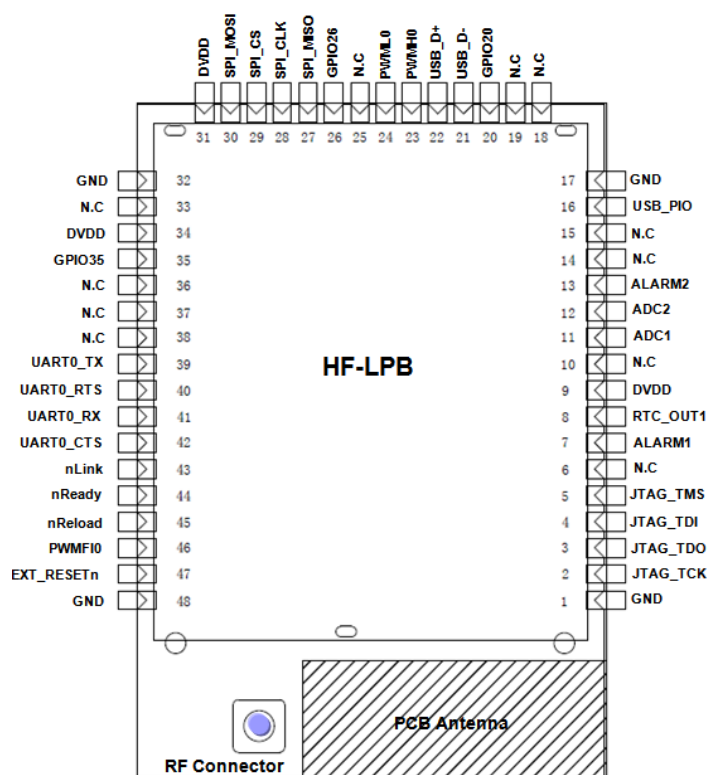


Figure 2. HF-LPB Pins Map

Table 2 HF-LPB 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.
3	JTAG Function	JTAG_TDO	O	
4	JTAG Function	JTAG_TDI	I,PU	
5	JTAG Function	JTAG_TMS	I,PU	

6		N.C		No connect
7	RTC Input 1	ALARM1	I,PD	GPIO7, Sleep_RQ Pin
8	RTC Output 1	RTC_OUT1	O	GPIO8, Sleep_ON Pin
9	+3.3V Power	DVDD	Power	
10		N.C		No connect
11	A/D Input 1	ADC1	I/O,PD	GPIO11, No connect if not use.
12	A/D Input 2	ADC2	I/O,PD	GPIO12, No connect if not use.
13	RTC Input 2	ALARM2	I,PD	GPIO13, No connect if not use.
14		N.C		No connect
15		N.C		No connect
16	USB 5V Detect	USB_PIO	I/O	GPIO16, No connect if not use.
18		N.C		No connect
19		N.C		No connect
20	GPIO	GPIO20	I/O,PD	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 Output0+	PWMH0	O	GPIO23, No connect if not use.
24	PWM Output0-	PWML0	O	GPIO24, No connect if not use.
25		N.C		No connect
26	GPIO	GPIO26	I/O,PD	GPIO26, No connect if not use.
27	SPI Interface	SPI_MISO	I/O, PU	No connect if not use.
28	SPI Interface	SPI_CLK	I/O, PU	No connect if not use.
29	SPI Interface	SPI_CS	I/O,PU	No connect if not use.
30	SPI Interface	SPI_MOSI	I/O,PD	No connect if not use.
31	+3.3V Power	DVDD	Power	
33		N.C		No connect
34	+3.3 Power	DVDD	Power	
35	GPIO	GPIO35	I/O,PD	GPIO35, WPS functional pin
36		N.C		No connect
37		N.C		No connect
38		N.C		No connect
39	UART0	UART0_TX	O, PD	UART Communication Pin
40	UART0	UART0_RTS	I/O,PD	UART Communication Pin
41	UART0	UART0_RX	I,PD	UART Communication Pin
42	UART0	UART0_CTS	I/O, PD	UART Communication Pin
43	Wi-Fi Status	nLink	O,PU	“0”- Wi-Fi Linked “1”- No WIFI Linked No connect if not use.
44	Module Boot Up Indicator	nReady	O,PU	“0” – Boot-up OK; “1” – Boot-up No OK; 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”. No connect if not use;
46	PWM Fault Input0	PWMFIO		GPIO46, No connect if not use.
47	Module Reset	EXT_RESETh	I,PU	“Low” effective reset input.

1.2.2. 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			1	KV

Power Supply & Power Consumption:

Parameter	Condition	Min.	Typ.	Max.	Unit
Operating Supply voltage		3.1	3.3	3.8	V
Supply current, peak	Continuous Tx		200		mA
Supply current, IEEE PS	DTIM=100ms		5		mA
Output high voltage	Sourcing 6mA	2.8			V
Output low voltage	Sinking 6mA			0.2	V
Input high voltage		2.2			V
Input low voltage				0.8	V
Input leakage current				+/-25	nA
Analog input range		0		3	V
Analog output range		0		3	V

1.2.3. Mechanical Size

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

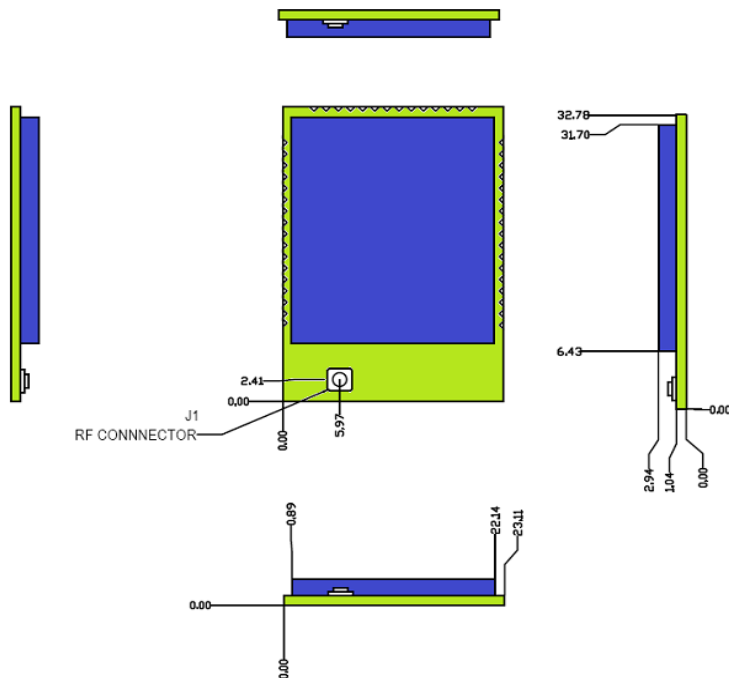


Figure 3. HF-LPB Mechanical Dimension

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

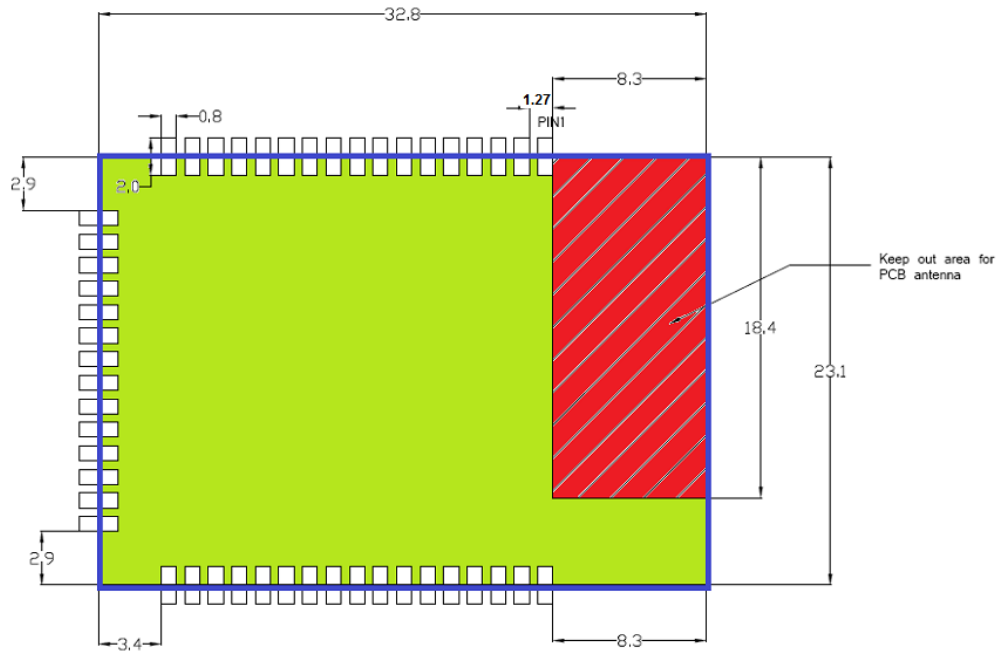


Figure 4. HF-LPB PCB Symbol Size

1.2.4. On-board Chip Antenna

HF-LPB 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 shieldedby any meal enclosure; All cover, include plastic, shall away from antenna at least 10mm;

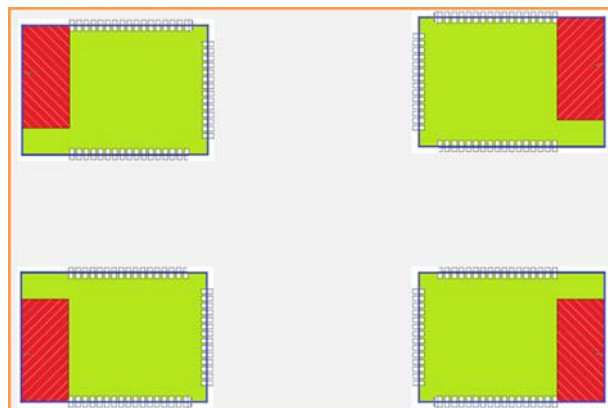


Figure 5. Suggested Module Placement Region

High-Flying suggest HF-LPB 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.

### 1.2.5. 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-LPB module with the RS-232 UART, RS485, USB (Internal UART-USB convertor) or Wireless port to configure the parameters, manage the module or do the some functional tests.

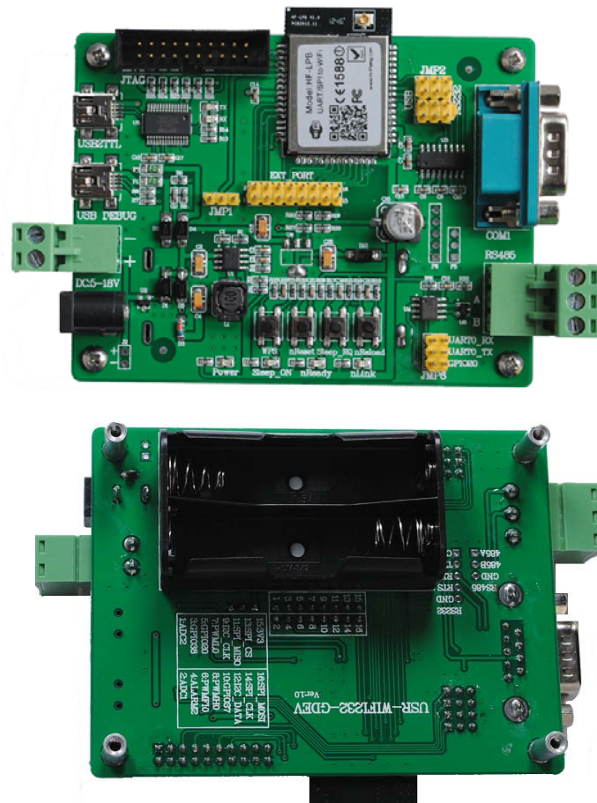


Figure 6. HF-LPB Evaluation Kit

**Notes:** User need 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-LPB 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 data debug interface (Not for user use)
	USB2TTL	UART to USB debug interface. (For PC without RS232, need load driver). Can be Power input.
	USB DEBUG	USB2.0 data interface.
	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-LPB GPIO function extend interface connector
	JMP1,JMP2	Reserved, No Jumper required.
	JMP3	4Pin USB or RS232 Jumper. Left jump select USB.
	JMP6	3Pin RS485 Jumper. No jump selects RS232.
LED	Power	3.3V Power Indicator
	nLink	nLink -WiFi LINK Indicator
	nReady	nReady – Module Bootup Ready Indicator
	Sleep_ON	Sleep_ON-Module asleep or awake Indicator
Button	nReset	Used to reset the module.
	nReload	Restore factory default configuration after push this pin more than 3s.
	WPS	WPS Button
	Sleep_RQ	Pin Sleep Control button, more than 1s to put module in standby mode.

1.2.6. Order Information

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

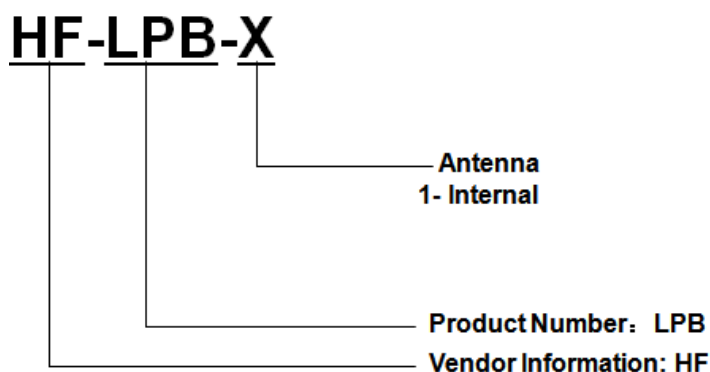


Figure 7. HF-LPB Order Information

### 1.3. Typical Application

#### 1.3.1. Hardware Typical Application

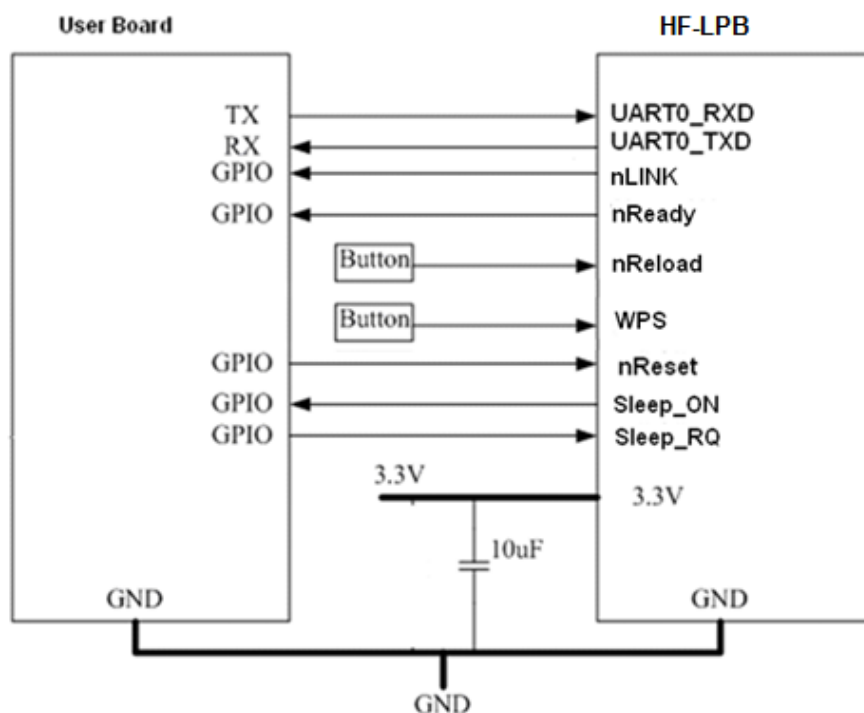


Figure 8. HF-LPB Hardware Typical Application

**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 n Link 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.

**WPS** – module auto-negotiation with AP and acquire password and build link  
 User can de-asser this pin low “0”, after 500ms, then asser this pin high “1” to enable the auto negotiation.if AP also push its WPS button, then Module and AP will start auto-negotiation and



module acquire password and build link. Next time, module will link with same AP without auto-negotiation required. User can use “AT+WSSSID” and “AT+WSKEY” command to query SSID and password.

**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. There is pull-up resistor internal and no external pull-up required. If nReload function not required, can leave this pin open.

**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. If user doesn’t use pin sleep function, can leave this pin open.

**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. FUNCTIONAL DESCRIPTION

### 2.1. Wireless Networking

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

#### 2.1.1. 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.

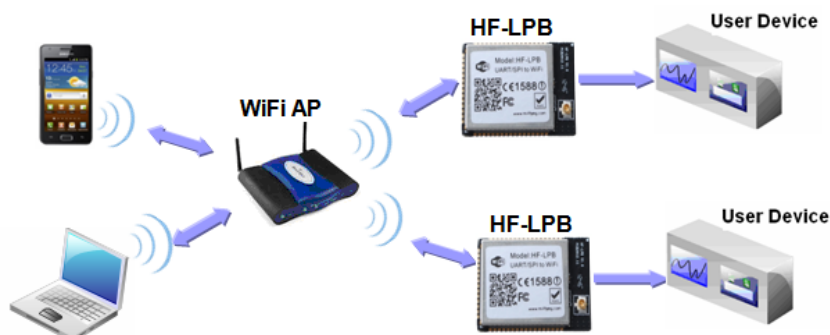


Figure 9. HF-LPB Basic Wireless Network Structure

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

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

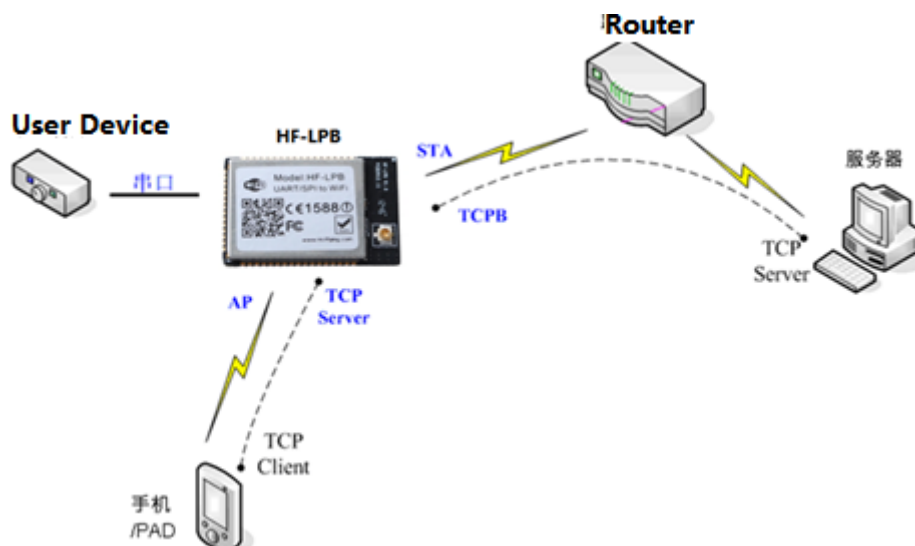


Figure 10. HF-A11 AP+STA Network Structure

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 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.

### 2.1.3. 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-LPB module support following Wi-Fi Direct networking:

- 1:1 P2P Networking;
- 1:N P2P Networking;
- Concurrent Operation Networking;



Figure 11. HF-LPB 1:1 P2P Networking

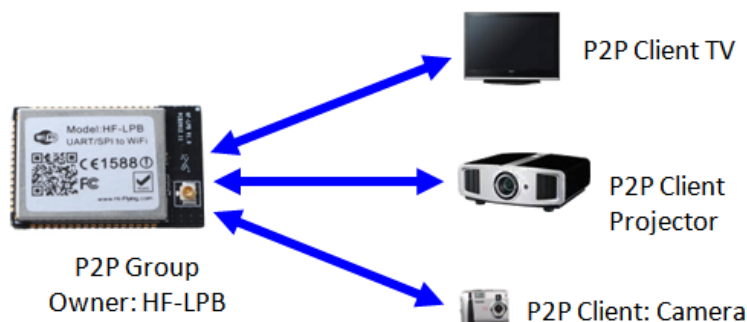


Figure 12. HF-LPB 1:N P2P Networking

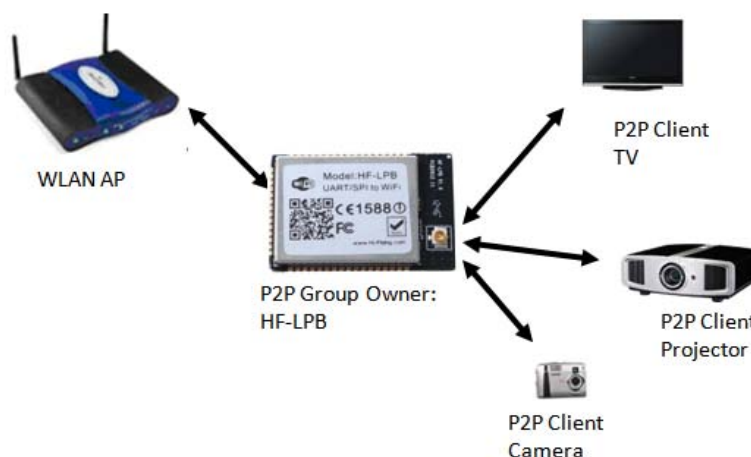


Figure 13. HF-LPB Concurrent Operation Networking

## 2.2. Work Mode : Transparent Transmission Mode

HF-LPB 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

## 2.3. UART Frame Scheme

### 2.3.1. UART Free-Frame

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

HF-LPB'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).

### 2.3.2. UART Auto-Frame

HF-LPB support UART auto-frame function. If user select open this function and setting auto-frame trigger length and auto-frame trigger time parameters, then module will auto framing the data which received from UART port and transmitting to the network as pre-defined data structure.

- **Auto-frame trigger length:** The fixed data length that module used to transmitting to the network.
- **Auto-frame trigger time:** After the trigger time, if UART port received data can't reach auto-frame trigger length, then module will transmitting available data to the network and bypass the auto-frame trigger length condition.

Detailed UART auto-frame function can refer to AT+ instruction set "UARTF/UARTFT/UARTFL" introduction.

## 2.4. 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-LPB module supports following:

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

## 2.5. Network Protocol

HF-LPB includes a fully IPv4 and IPv6 capable stack supporting TCP and UDP connection. Following table shows the key features of the HF-LPB module IP stack, which including support for DHCP, multicast, and ARP.

The Frame size limits are (including IP headers):

- Transmit
  - ✓ TCP/UDP/ICMP (v4): 1576
  - ✓ ICMP (v6): 1576
  - ✓ UCP/UDP (v6): 1220
- Receive
  - ✓ TCP/UDP (v4): 1516
  - ✓ TCP/UDP (v6): 1496
  - ✓ ICMPv4 and ICMPv6: 5000

Table 5 HF-LPB IP Stack Features

Feature	Support
ARP	Supported
Forwarding	Supported
Fragmentation/Reassembly	Planned
IPv4/v6 Header Processing	Supported
UDP/TCP Socket Support	Supported
DHCP v4	Supported
Neighbor Discovery	Supported
Broadcast/Multicast	Supported
Path MTU Discovery	Supported
Address Auto-Configuration	Supported
Multicast	Planned
TCP Zero Copy Feature	Supported

## 2.6. Multi-TCP Link Connection

When HF-LPB module configured as TCP Server, it supports Multi-TCP link connection, and maximum eight TCP clients permit to connect to HF-LPB 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:

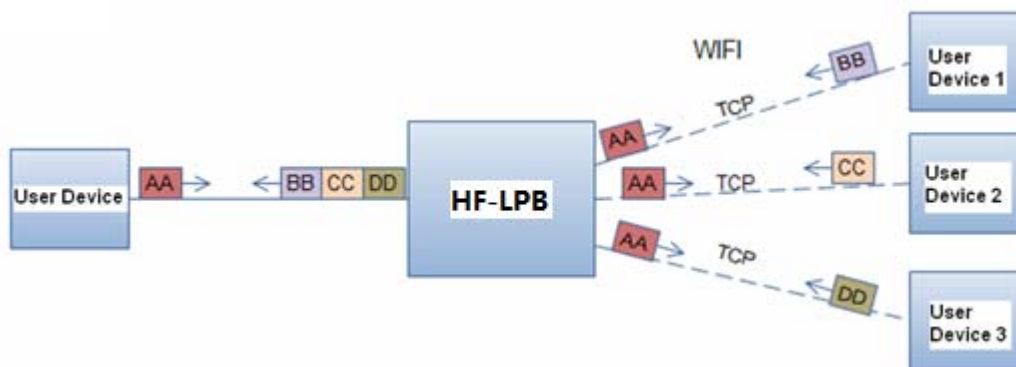


Figure 14. Multi-TCP Link Data Transmission Structure

## 2.7. Power Save Scheme

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

- **Normal (Active/Sleep) Mode** - AP Associated, WiFi ON/OFF based on internal control
- **Deep Sleep Mode** - Non AP Associated, WiFi OFF
- **Standby Mode** - Non AP Associated, WiFi Shut down

**Normal (Active/Sleep) Mode** Normal mode support two work option: One is no DTIM related (Default mode), module will monitor the interval to Active/Sleep. The other is DTIM related mode, which allows the module to sync up with beacons sent from the AP which contains the DTIM (Delivery Traffic Indication Message). The DTIM indicates when broadcast and multicast data will be sent on the network. This property is configured on the AP (Default value is 1, which means DTIM= 100ms) and is typically configured as the number of beacons between each beacon with DTIM.

**Deep Sleep/Standby Mode** allows the WiFi circuitry to be “OFF” status or powered down, which results in the lower/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.

The Difference between deep sleep and standby mode as follows:

Table 6 Difference Between Deep Sleep And Standby Mode

	Status				Wake Up Method		
	Wi-Fi	MCU	Current	UART	GPIO	Timeout	AT Command
Deep Sleep	OFF	ON	~2mA	ON	Yes	Yes	Yes
Standby	OFF	OFF	<2uA	OFF	Yes	Yes	No

Notes: For GPIO wake up, if trigger time <1s, then only wake up MCU.

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
Standby	WiFi Shutdown	~2uA	< 10uA
Deep Sleep	WiFi OFF	~2mA	< 10mA
Normal (Active/Sleep)	WiFi ON - AP Connected DTIM = 100ms	5.5~7mA	< 220mA
Normal (Active/Sleep)	WiFi ON – AP Connected DTIM = 500ms	3.5mA	< 220mA
Normal (Active/Sleep)	WiFi ON – AP Connected DTIM = 1000ms	2.8mA	< 220mA

In addition, for deep sleep/standby 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 Wake Up
- UART Wake Up
- Timeout Wake Up

**Pin Wake Up Option** allows an external microcontroller to determine when HF-LPB should sleep and when it should wake by controlling the “Sleep\_RQ” and “Sleep\_ON” pin. 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. If user doesn’t use pin sleep function, can leave this pin open.

**UART Wake Up Option.** HF-LPB can use AT command to put module into normal/sleep mode. When module works at deep sleep or standby mode, user can use “AT+MSLP =normal” to wake up module.

**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



## 2.8. Parameters Configuration

HF-LPB 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-LPB 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.

## 2.9. Firmware Update

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

- Webpage Wi-Fi Upgrade
- Remote Upgrade

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

Remote upgrade: TBD

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

## 2.10. GPIO Function

HF-LPB module can provide maximum 12 GPIO pins, which include 2 A/D analog input pins, 3 PWM control pins, 2 Pin sleep control pins, 1 WPS pin, 1 RTC pin, 1 USB 5V control pin, and 2 general GPIO pin. All these pins can be customized as GPIO pins if these functions are not required. As GPIO functional pin, user devices can read/write GPIO pins status through AT+instruction set.

Table 8 HF-LPB GPIO Pin Mapping Table

GPIO	Configured Function	Description	Default Setting	Type
GPIO7	Sleep_RQ	Wakeup/Sleep	Sleep_RQ	I,PD
GPIO8	Sleep_ON		Sleep_ON	O
GPIO11	A/D Input 1	A/D	GPIO11	I/O,PD
GPIO12	A/D Input 2		GPIO12	I/O,PD
GPIO13	RTC Input 2	RTC	GPIO13	I,PD
GPIO16	USB 5V Track	USB	GPIO16	I/O
GPIO20	GPIO	GPIO	GPIO20	I/O
GPIO23	PWM Dif. Out+	PWM	GPIO23	O
GPIO24	PWM Dif. Out-		GPIO24	O
GPIO26	GPIO	GPIO	GPIO26	I/O
GPIO35	WPS Input	WPS	GPIO35	I/O,PD
GPIO46	PWM Fault Input	PWM	GPIO46	I/O

When module works at GPIO mode, PC and other equipments can setup connection (TCP/UDP) through WiFi, 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"

### 3. OPERATION GUIDELINE

#### 3.1. Configuration via Web Accessing

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

Table 9 HF-LPB Web Access Default Setting

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

##### 3.1.1. Open Web Management Interface

- Step 1: Connect laptop to SSID “HF-LPB” of HF-LPB 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 15. Open Web Management page

The HF-LPB 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”.

##### 3.1.2. 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.

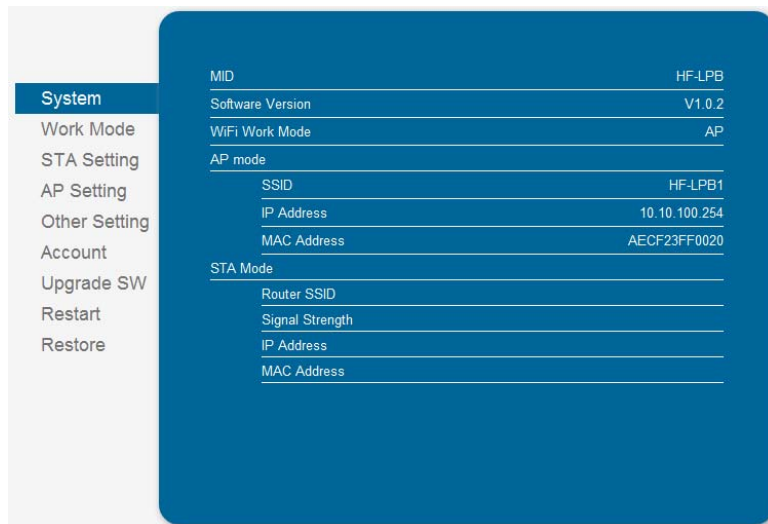


Figure 16. System Web Page

### 3.1.3. Work Mode Page

HF-LPB 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 provides very flexible application for customers.

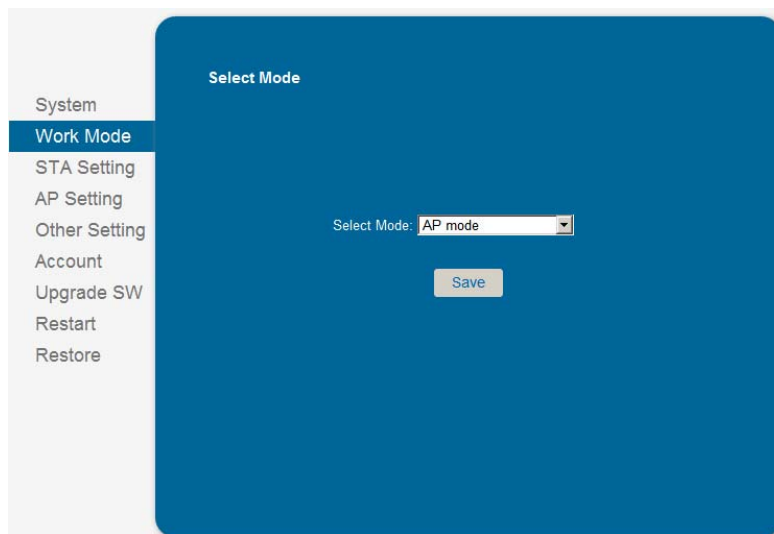


Figure 17. Work Mode Page

### 3.1.4. STA Setting Page

User can push "Scan" button to auto search Wi-Fi AP router nearby, and can connect with associated 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.

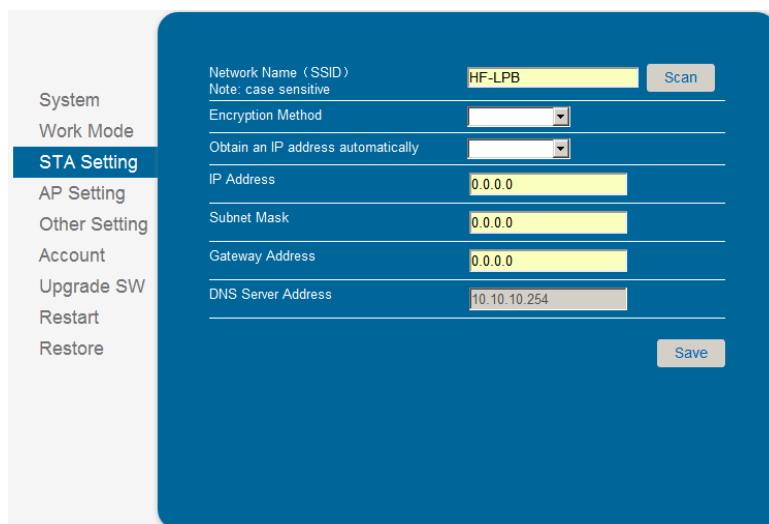


Figure 18. STA Setting Page

### 3.1.5. 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.

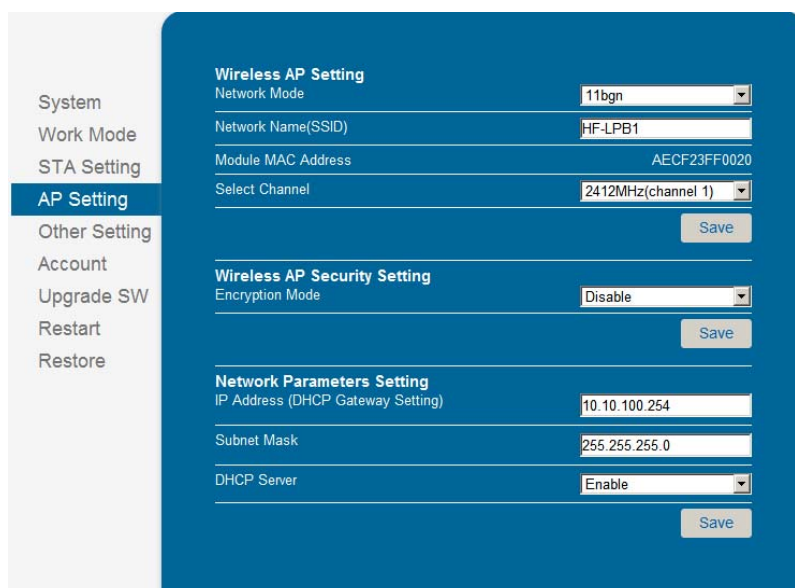


Figure 19. AP Setting Page

### 3.1.6. Other Setting Page

HF-LPB usually works at data transparent transmission mode. At this mode, the user device which connected with HF-LPB 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.

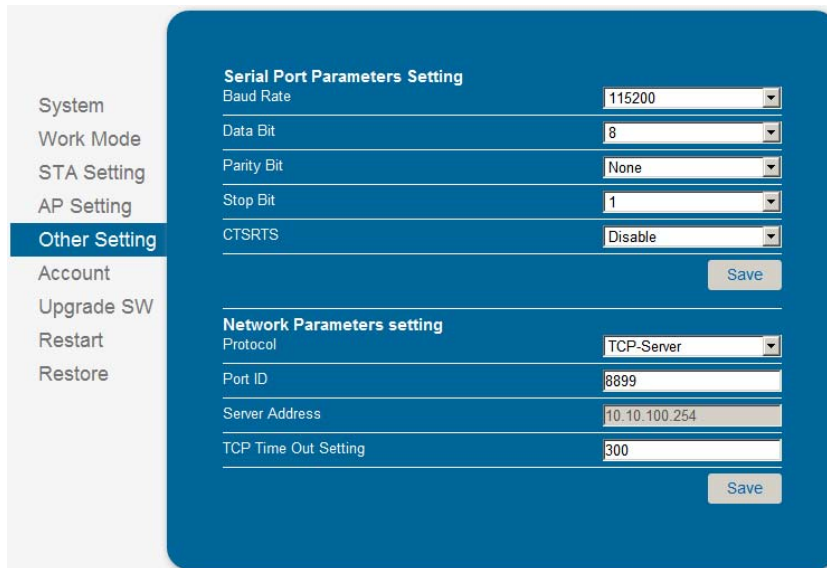


Figure 20. Other Setting Page

### 3.1.7. Account Management Page

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

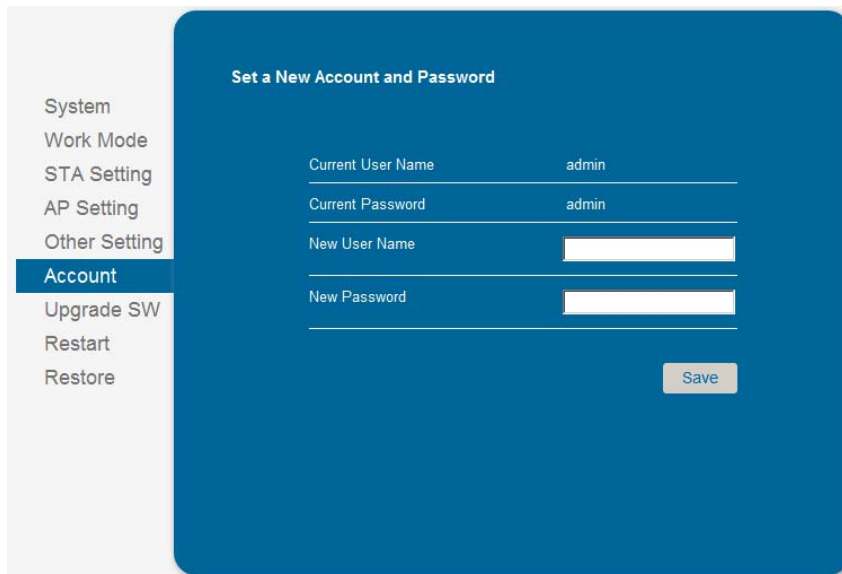


Figure 21. Account Page

### 3.1.8. Upgrade Software Page

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

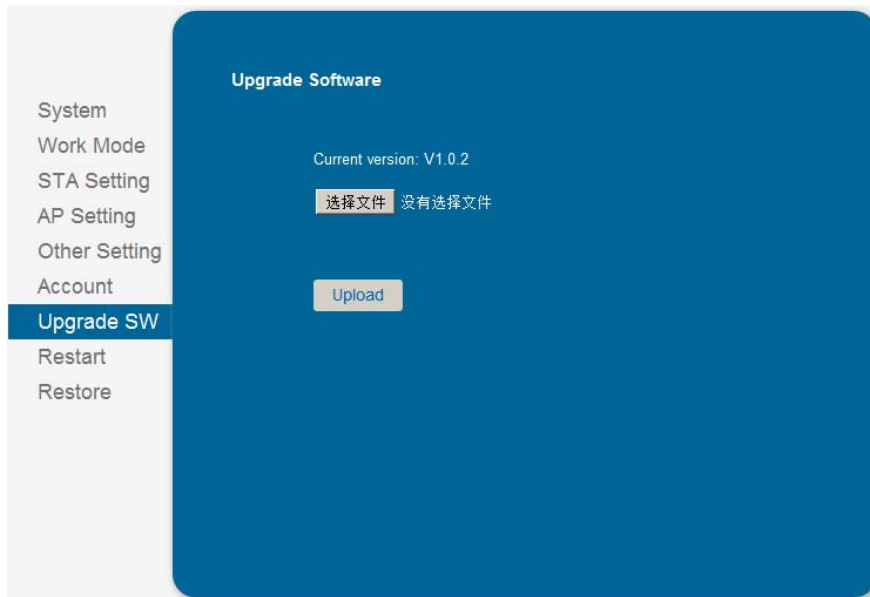


Figure 22. Upgrade SW page

### 3.1.9. Restart Page

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

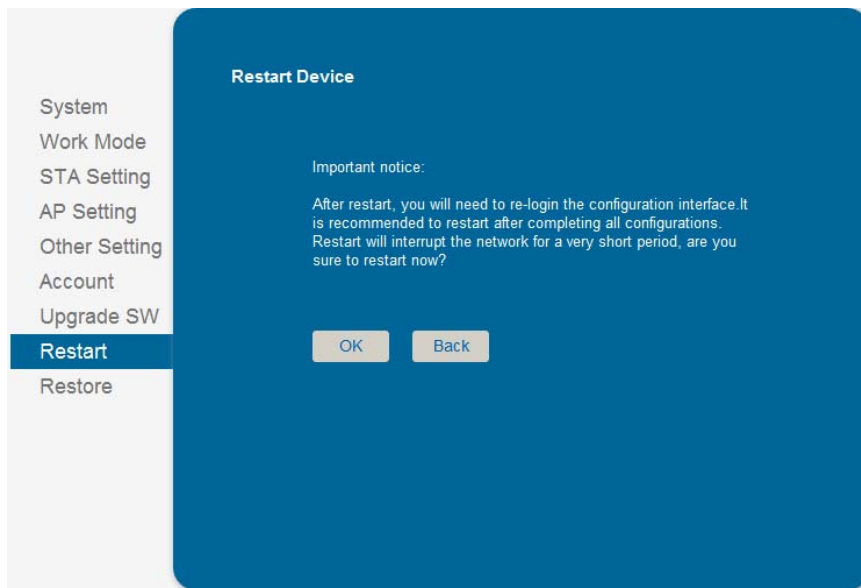


Figure 23. Restart Page

### 3.1.10. 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-LPB will restore to AP mode for factory default setting.

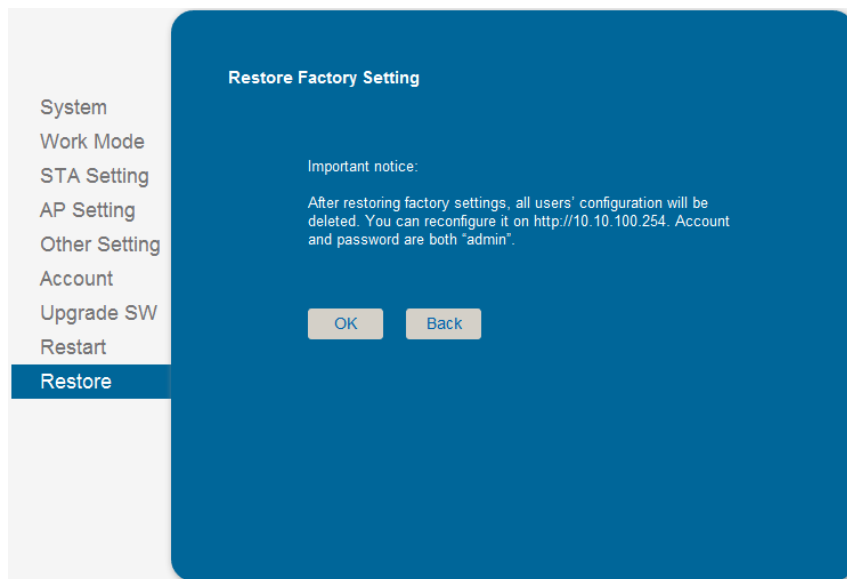


Figure 24. Restore Page

### 3.2. HF-LPB Usage Introduction

#### 3.2.1. Software Debug Tools

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

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

#### 3.2.2. Network Connection

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

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



Figure 25. STA Interface Debug Connection

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





Figure 26. AP Interface Debug Connection

### 3.2.3. Default Parameter Setting

- Default SSID: HF-LPB;
- 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;

### 3.2.4. Module Debug

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

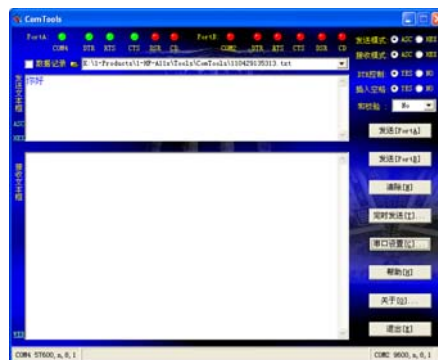


Figure 27. “CommTools” Serial Debug Tools

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

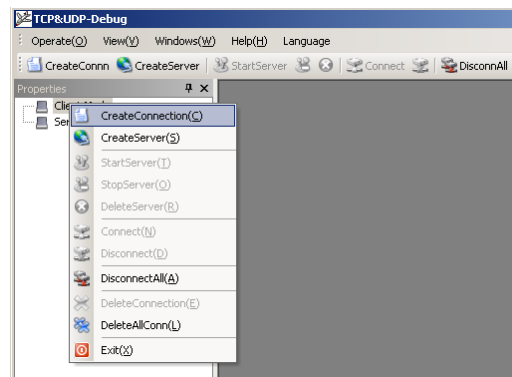


Figure 28. “TCPUDPDbg” Tools Create Connection

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

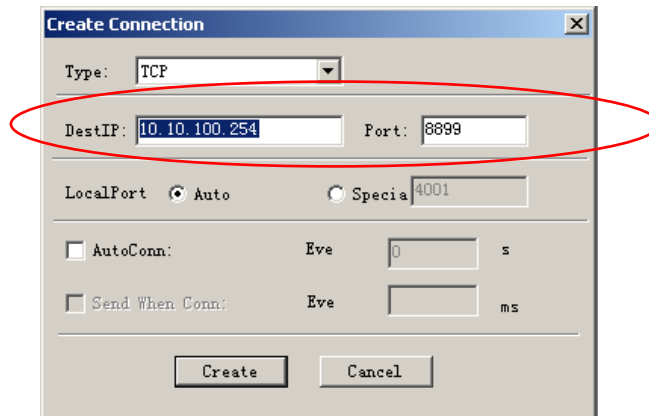


Figure 29. “TCPUDPDbg” Tools Setting

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

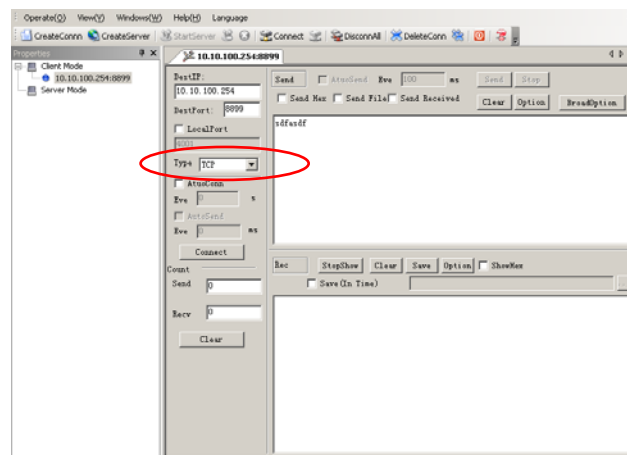


Figure 30. “TCPUDPDbg” Tools Connection

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.

### 3.3. Typical Application Examples

#### 3.3.1. Wireless Control Application



Figure 31. Wireless Control Application

For this wireless control application, HF-LPB 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-LPB module.

### 3.3.2. Remote Management Application

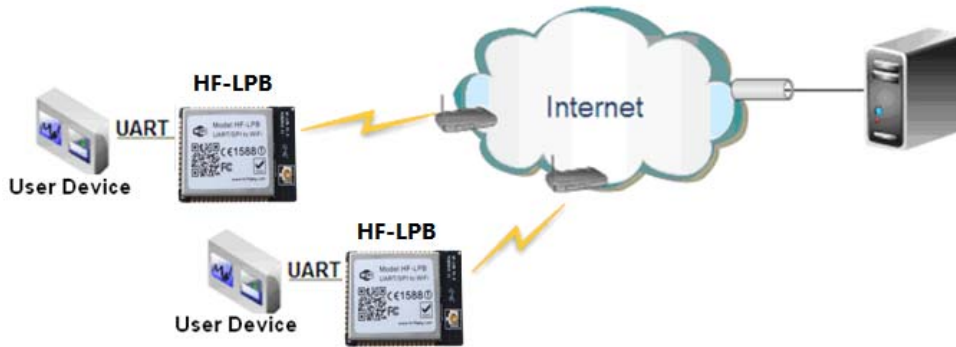


Figure 32. Remote Management Application

For this remote management application, HF-LPB 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.

### 3.3.3. Transparent Serial Port Application

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



Figure 33. Transparent Serial Port Application

## 4. AT+INSTRUCTION INTRODUCTION

### 4.1. Configuration Mode

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

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

Figure 34. HF-LPB Default UART Port Parameters

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

#### 4.1.1. 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.**

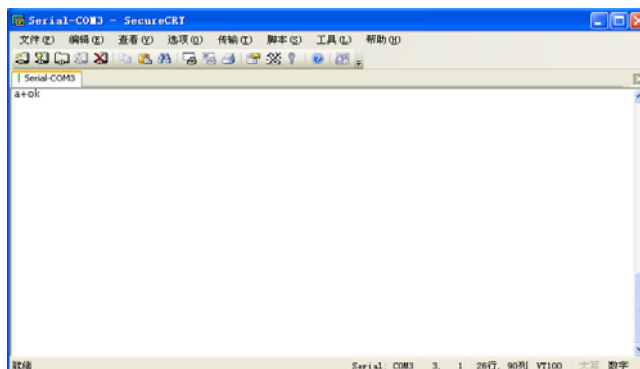


Figure 35. Switch to Configuration Mode

#### **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).

## 4.2. 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 36. "AT+H" Instruction for Help

### 4.2.1. 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 10 Error Code Description

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

4.2.2. AT+ Instruction Set

Table 11 AT+ Instruction Set List

Instruction	Description
<null>	NULL
<b>Management 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>UART Instruction Set</b>	
UART	Set/Query serial port parameters
UARTF	Open/Close UART auto-frame function
UARTFT	Set/Query UART auto-frame trigger time

UARTFL	Set/Query UART auto-frame trigger length
UARTTE	Set/Query UART free-frame trigger 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	Set/Query STA's MAC address
WSLK	Query STA Wi-Fi link status
WSLQ	Query STA Wi-Fi signal strength
WSCAN	Scan AP
<b>WiFi 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
<b>Webpage Management Instruction Set</b>	
WEBSWITCH	Set Webpage Option
<b>Power Management Instruction Set</b>	
PSPAR	Set/Query power save parameters at NORMAL mode
MSOPT	Set/Query wake up option parameters
MSLP	Set/Query deep sleep/standby mode parameters
TSPAR	Set/Query timeout wake up parameters
<b>Others Instruction Set</b>	
WRMID	Set module ID
ASWD	Set/Query WiFi configuration code

**<Notes>:**

- All Power Management Instruction Set NOT support in this version.

## 4.2.2.1. AT+E

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

**AT+E<CR>****+ok<CR>< LF ><CR>< LF >**

When HF-LPB 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.

## 4.2.2.2. 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

## 4.2.2.3. 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.

## 4.2.2.4. 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

## 4.2.2.5. 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-LPB;

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

#### 4.2.2.6. 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;

#### 4.2.2.7. 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.

#### 4.2.2.8. AT+Z

- Function: Re-start module;
- Format:

**AT+ Z<CR>**

#### 4.2.2.9. AT+H

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

**AT+H<CR>**

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

- Parameters:
  - ◆ command help: command introduction;

#### 4.2.2.10. 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:
    - ◇ 300,600,1200,1800,2400,4800,9600,19200,38400,57600,115200,230400,380400,460800.
  - ◆ data\_bits:
    - ◇ 8
  - ◆ stop\_bits:
    - ◇ 1,2
  - ◆ parity:
    - ◇ NONE
    - ◇ EVEN
    - ◇ ODD
  - ◆ Flowctrl: (CTSRTS)
    - ◇ NFC: No hardware flow control
    - ◇ FC: hardware flow control

#### 4.2.2.11. AT+ UARTF

- Function: Open/Close UART auto-frame function;
- Format:
  - ◆ Query Operation

**AT+ UARTF<CR>**

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

- ◆ Set Operation

**AT+ UARTF=<para ><CR>**

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

- Parameters:
  - ◆ para:
    - ◇ disable - Close auto-frame function;
    - ◇ enable - Open auto-frame function;

#### 4.2.2.12. AT+ UARTFT

- Function: Set/Query UART auto-frame trigger time;
- Format:
  - ◆ Query Operation

**AT+ UARTFT<CR>**

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

- ◆ Set Operation

**AT+ UARTFT=<time ><CR>**

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

- Parameters:
  - ◆ time: Range 100 ~10000; Unit: ms. Auto-frame trigger time

## 4.2.2.13. AT+ UARTFL

- Function: Set/Query UART auto-frame trigger length;
- Format:
  - ◆ Query Operation
 

```
AT+ UARTFL<CR>
```

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

```
AT+ UARTFL=<len ><CR>
```

```
+ok<CR>< LF ><CR>< LF >
```
- Parameters:
  - ◆ len: Range 16 ~1400; Unit: Byte. Auto-frame trigger length;

## 4.2.2.14. 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;

## 4.2.2.15. 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.

## 4.2.2.16. 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.

#### 4.2.2.17. 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

#### 4.2.2.18. 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

#### 4.2.2.19. 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;

## 4.2.2.20. 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;

## 4.2.2.21. 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.

## 4.2.2.22. 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);

## 4.2.2.23. AT+WSKEY

- Function: Set/Query STA security parameters;
- Format:

- ◆ Query Operation

**AT+WSKEY<CR>**

**+ok=<auth, encry, 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

## 4.2.2.24. 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;

## 4.2.2.25. AT+ WSMAC

- Function: Set/Query STA MAC address parameters;
- Format:
  - ◆ Query Operation

**AT+WSMAC<CR>**

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

- ◆ Set Operation

**AT+ WSMAC=<code,mac\_address><CR>**

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

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

#### 4.2.2.26. 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;

#### 4.2.2.27. 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;

#### 4.2.2.28. AT+WSCAN

- Function: Scan AP;
- Format:

**AT+ WSCAN<CR>**

**+ok=<ap\_site><CR>< LF ><CR>< LF >**

- Parameters:
  - ◆ ap\_site: AP searched;

#### 4.2.2.29. 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;

#### 4.2.2.30. 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:
  - ◇ 11B
  - ◇ 11BG
  - ◇ 11BGN (Default Value)
- ◆ ssid: SSID at AP mode
- ◆ channel: Wi-Fi channel selection:
  - ◇ AUTO
  - ◇ CH1~CH11; (Default CH1)

#### 4.2.2.31. AT+WKEY

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

- Format:

- ◆ Query Operation

**AT+WKEY<CR>**

**+ok=<auth,encry,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;

#### 4.2.2.32. 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 change to others, please contact with high-flying technical people.

#### 4.2.2.33. 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;

#### 4.2.2.34. AT+WEBSWITCH

- Function: Set Web page display option;
- Format:
  - ◆ Set Operation

**AT+ WEBSWITCH=<web><CR>**

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

- Parameters:
  - ◆ web: module’s web page option:
    - ◇ iw: select internal reduced version web page as default web page;
    - ◇ ew: select full version web page as default web page;

**Note:** “iw” web page only used to upgrade and upload customized web page; “ew” web page provide more configuration option.

#### 4.2.2.35. AT+PSPAR

- Function: Set/ Query power save parameters at Normal mode;
- Format:

- ◆ Query Operation

**AT+ PSPAR<CR>**

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

- ◆ Set Operation

**AT+ PSPAR=<mode> <CR>< LF ><CR>< LF >**

- Parameters:

- ◆ mode:

- ◇ pf: Continuous TX Mode (NO WiFi OFF)
- ◇ ps1: Normal Mode, Disable DTIM (**Default, 100ms interval**)
- ◇ ps2: Normal Mode, Enable DTIM

#### 4.2.2.36. AT+MSLP

- Function: Set/Query deep sleep/standby mode parameters;

- Format:

- ◆ Query Operation

**AT+ MSLP<CR>**

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

- ◆ Set Operation

**AT+ MSLP=<mode><CR>< LF ><CR>< LF >**

- Parameters:

- ◆ ret:

- ◇ normal: normal mode (ps1: 100ms interval)
- ◇ deep sleep: deep sleep mode [WiFi OFF]
- ◇ standby: WiFi shut down mode

- ◆ mode:

- ◇ normal: normal mode (ps1: 100ms interval)
- ◇ dslp: deep sleep mode [WiFi OFF]
- ◇ standby: WiFi shut down mode

**Note:** AT MSLP command can only be applied one time in every 10 second;

#### 4.2.2.37. AT+MSOPT

- Function: Set/Query wake up option parameters;

- Format:

- ◆ Query Operation

**AT+ MSOPT<CR>**

**+ok=<wakeup\_mode> <CR>< LF ><CR>< LF >**

- ◆ Set Operation

**AT+ MSOPT=<wakeup\_mode> <CR>< LF ><CR>< LF >**

- Parameters:

- ◆ Wakeup\_mode:

- ◇ 0b0001: UART Wake up
- ◇ 0b0010: Pin Wake up
- ◇ 0b0100: Timeout Wake up

**Note:** These 3 options can multi-selection, such as 0b0111 means all three wakes up option enabled.  
Shanghai High-Flying Electronics Technology Co., Ltd  
www.hi-flying.com

## 4.2.2.38. AT+TSPAR

- Function: Set/Query timeout wake up parameters;
- Format:
  - ◆ Query Operation
  - AT+ TSPAR<CR>**
  - +ok=<timeout> <CR>< LF ><CR>< LF >**
  - ◆ Set Operation
  - AT+ TSPAR=<timeout> <CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ timeout: set timeout time, unit: second.

## 4.2.2.39. 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).

## 4.2.2.40. 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).

## 5. PACKAGE INFORMATION

### 5.1. Recommended Reflow Profile

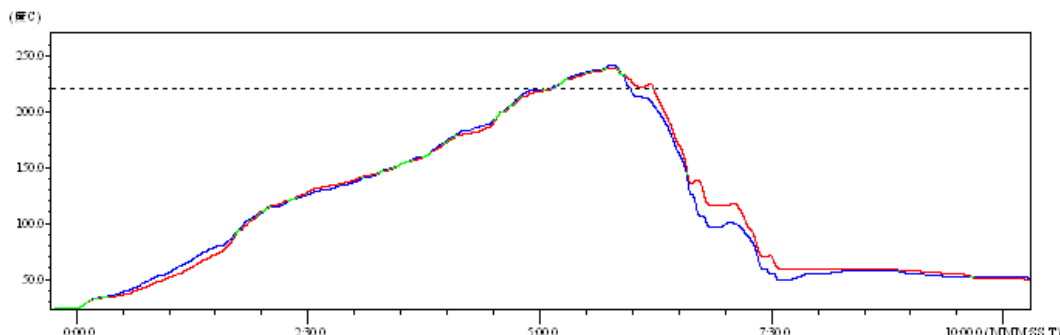


Figure 37. Reflow Soldering Profile

Table 12 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)

### 5.2. 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.

### 5.3. Shipping Information

#### TRAY

Size: 420\*245\*34 mm



#### BOX

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



#### CARTON

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



Figure 38. Shipping Information

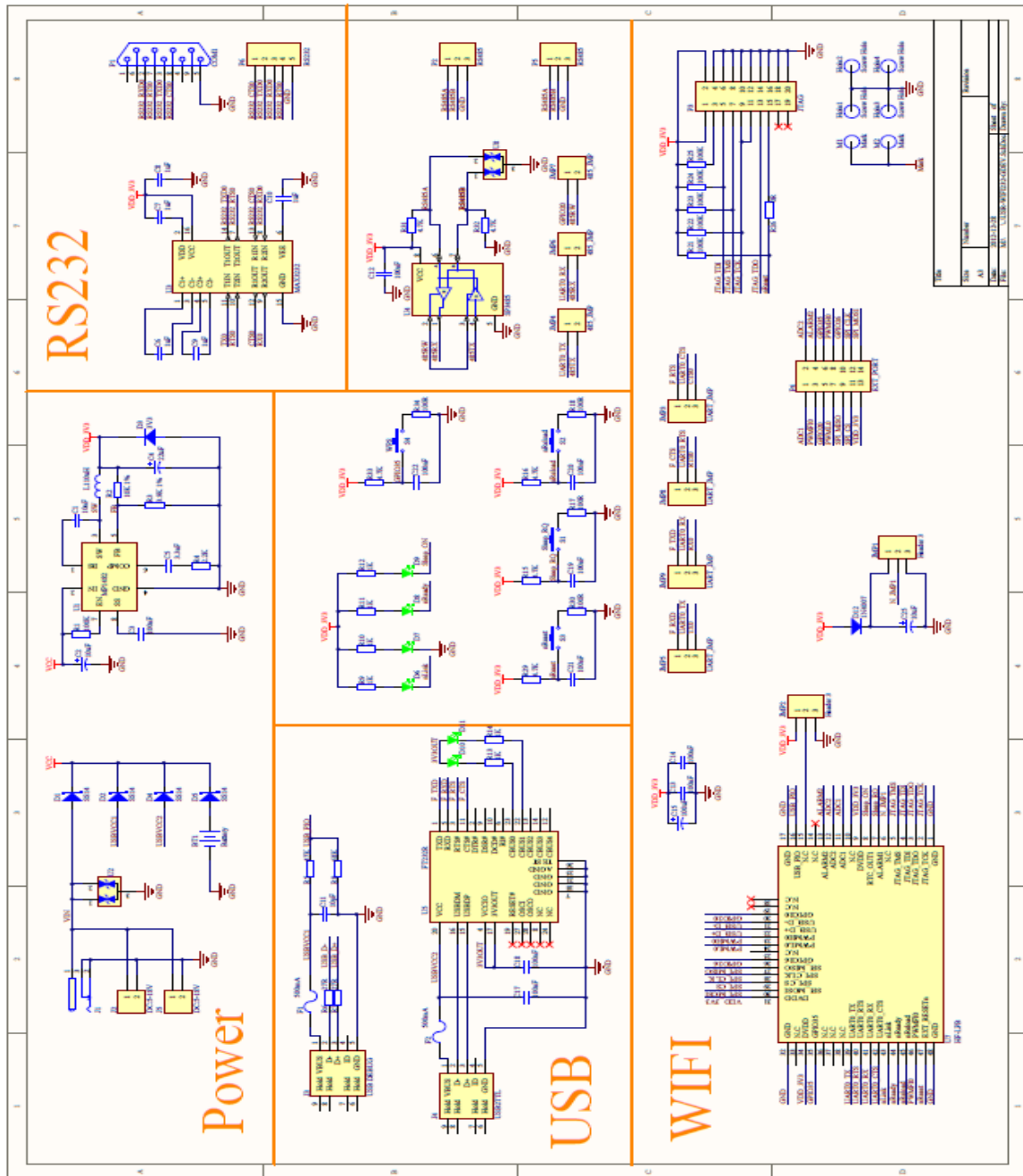
**Note:**

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

## APPENDIX B: CONTACT INFORMATION

---

**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/>

## FCC RF EXPOSURE REQUIREMENTS

### 1 STANDARDS AND REGULATORY COMPLIANCE

#### 1.2 Standards and certification

The EUT conforms to the following standards and certification requirements:

802.11 b/g/n

FCC

- 47 CFR Part 1 - RF radiation exposure limits
- 47 CFR Part 2 - Equipment authorization
- 47 CFR Part C - WIFI

#### 1.3 FCC certification requirements.

According to the definition of mobile and fixed device is described in Part 2.1091(b), this device is a mobile device.

And the following conditions must be met:

1. The EUT is a mobile device; maintain at least a 20 cm separation between the EUT and the user's body and must not transmit simultaneously with any other antenna or transmitter.
2. The device is only for fixed operation mode. (A Class II Change would be required for near-body Host applications.)
3. A label with the following statements must be attached to the host end product: This device contains Tx FCC ID: AZY-HF-LPB.
4. To comply with FCC regulations limiting both maximum RF output power and human exposure to RF radiation, maximum antenna gain (including cable loss) must not exceed:

- 802.11b band < 0.8 dBi



- 802.11g band <0.8 dBi
- 802.11n band <0.8 dBi

5. This module must not transmit simultaneously with any other antenna or transmitter
6. The host end product must include a user manual that clearly defines operating requirements and conditions that must be observed to ensure compliance with current FCC RF exposure guidelines.

For portable devices, in addition to the conditions 3 through 6 described above, a separate approval is required to satisfy the SAR requirements of FCC Part 2.1093

If the device is used for other equipment that separate approval is required for all other operating configurations, including portable configurations with respect to 2.1093 and different antenna configurations.

For this device, OEM integrators must be provided with labeling instructions of finished products. Please refer to KDB784748 D01 v07, section 8. Page 6/7 last two paragraphs:

A certified modular has the option to use a permanently affixed label, or an electronic label. For a permanently affixed label, the module must be labelled with an FCC ID - Section 2.926 (see 2.2 Certification (labelling requirements) above). The OEM manual must provide clear instructions explaining to the OEM the labelling requirements, options and OEM user manual instructions that are required (see next paragraph).

For a host using a certified modular with a standard fixed label, if (1) the module's FCC ID is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straightforward commonly used methods for access to remove the module so that the FCC ID of the module is visible; then an additional permanent label referring to the enclosed module: "Contains Transmitter Module FCC ID: AZY-HF-LPB" or "Contains FCC ID: AZY-HF-LPB" must be used. The host OEM user manual must also contain clear instructions on how end users can find and/or access the module and the FCC ID.

The user manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the Internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

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.

Caution: Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

#### 1.4 FCC RF exposure requirements

1. Radiated transmit power must be equal to or lower than that specified in the FCC Grant of Equipment Authorization for FCC ID: AZY-HF-LPB.
2. To comply with FCC regulations limiting both maximum RF output power and human exposure to RF radiation, maximum antenna gain (including cable loss) must not exceed:
  - 802.11b band < 0.8 dBi
  - 802.11g band < 0.8 dBi
  - 802.11n band <0.8 dBi
3. This module must not transmit simultaneously with any other antenna or transmitter.
4. To ensure compliance with all non-transmitter functions the host manufacturer is responsible for ensuring compliance with the module(s) installed and fully operational. For example, if a host was previously authorized as an unintentional radiator under the Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that the after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements.



## NATIONAL RESTRICTIONS-CE

<b>Annex 3 Band A</b> <b>Wideband Data</b> <b>Transmission</b> <b>systems</b> <b>2400.0-2483.5 MHz</b>	France	Limited implementation	The outdoor use is limited to 10 mW e.i.r.p. within the band 2454-2483.5 MHz. Military Radiolocation use. Refarming of the 2.4 GHz has been ongoing in recent years to allow current relaxed regulation. Full implementation planned 2012
	Italy		For private use, a general authorisation is required if WAS/RLAN's are used outside own premises. For public use, a general authorisation is required
	Norway	Implemented	This subsection does not apply for the geographical area within a radius of 20 km from the centre of Ny-Ålesund
	Russian Federation	Limited implementation	<b>1. SRD with FHSS modulation</b> 1.1. Maximum 2.5 mW e.i.r.p. 1.2. Maximum 100 mW e.i.r.p. Permitted for use SRD for outdoor applications without restriction on installation height only for purposes of gathering telemetry information for automated monitoring and resources accounting systems. Permitted to use SRD for other purposes for outdoor applications only when the installation height is not exceeding 10 m above the ground surface. 1.3. Maximum 100 mW e.i.r.p. Indoor applications  <b>2. SRD with DSSS and other than FHSS wideband modulation</b> 2.1. Maximum mean e.i.r.p. density is 2 mW/MHz. Maximum 100 mW e.i.r.p. 2.2. Maximum mean e.i.r.p. density is 20 mW/MHz. Maximum 100 mW e.i.r.p. It is permitted to use SRD for outdoor applications only for purposes of gathering telemetry information for automated monitoring and resources accounting systems or security systems. 2.3. Maximum mean e.i.r.p. density is 10 mW/MHz. Maximum 100 mW e.i.r.p. Indoor applications
	Ukraine	Limited implementation	e.i.r.p. ≤100 mW with built-in antenna with amplification factor up to 6 dBi

**END OF DOCUMENT**

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