# HF-LPB130

# User Manual

**V 1.3**



## Overview of Characteristic

✧ **Support IEEE802.11b/g/n Wireless Standards**

✧ **Based on Cortex-M4 SOC, 160MHz CPU, 352KB RAM for 1MB Flash Version, 448KB RAM for 4MB Flash Version**

✧ **Support UART Data Communication Interface**

✧ **Support Work As STA/AP/AP+STA Mode**

✧ **Support Smart Link Function (APP program provide)**

✧ **Support WeChat Airkiss 2.0**

✧ **Support Wireless and Remote Firmware Upgrade Function**

✧ **HF-LPB130：PCB Antenna**
✧ **Single +3.3V Power Supply**

✧ **Small Size:**
■ **HF-LPB130：23.1mm x 32.8mm x 3.5mm,SMT34 package**

✧ **FCC/CE/SRRC/RoHS Certificated**

## TABLE OF CONTENTS

## LIST OF FIGURES

# LIST OF TABLES

## HISTORY

**Ed. V0.2**  07-25-2017     Internal Version.

**Ed. V0.2**  08-22-2017     Release Version

**Ed. V1.1**  13-10-2017     Add HF-LPT130A type module

**Ed. V1.2**  10-11-2017     Add HF-LPB130 type module

**Ed. V1.3**  03-01-2018     Update HF-LPT230 Pin，webpage config.

# 1. PRODUCT OVERVIEW

## 1.1. General Description

The HF-LPB130 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 interface for data transfer.HF-LPB130 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.

The HF-LPB130 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.

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

### 1.1.2 Device Paremeters

Table1.  HF-LPB130 Module Technical Specifications

| Class | Item | Parameters |
|---|---|---|
| **Wireless Parameters** | Certification | FCC/CE/SRRC/RoHS |
| | Wireless standard | 802.11 b/g/n |
| | Frequency range | 2.412GHz-2.462GHz |
| | RF Power | 802.11b: +16 +/-2dBm (@11Mbps) |
| | | 802.11g: +15 +/-2dBm (@54Mbps) |
| | | 802.11n: +15 +/-2dBm (@HT20, MCS7) |
| | Antenna Option | PCB antenna |
| **Hardware Parameters** | Data Interface | UART |
| | | GPIO,SPI |
| | Operating Voltage | 2.9~3.6V |
| | Operating Current | Peak (Continuous TX): 260Ma<br>Average(STA, No data): 27mA<br>Average(STA, Continuous TX): 35mA<br>Average(AP): 80mA |
| | Operating Temp. | -25℃- 85℃ |
| | Storage Temp. | -40℃- 125℃ |
| | Dimensions and Size | 23.1mm x 32.8mm x 3.5mm |
| **Software Parameters** | Network Type | STA/AP/AP+STA |
| | Security Mechanisms | WEP/WPA-PSK/WPA2-PSK |
| | Encryption | WEP64/WEP128/TKIP/AES |
| | Update Firmware | Local Wireless, Remote OTA |
| | Customization | Support SDK for application develop |
| | Network Protocol | IPv4, TCP/UDP/HTTP/TLS(SDK) |
| | User Configuration | AT+instruction set. Android/ iOS Smart Link APP tools |

## 1.2.  Hardware Introduction

HF-LPB130 Wi-Fi module appearance is as following.



Figure 1.     HF-LPB130 Appearance

### 1.2.1.  HF-LPB130 Pins Definition



| | | | | |
|---|---|---|---|---|
| GND | 1 | | 34 | GND |
| NC | 2 | | 33 | RESET |
| NC | 3 | | 32 | NC |
| GPIO21 | 4 | | 31 | nReload/GPIO25 |
| GPIO5 | 5 | | 30 | nReady/GPIO24 |
| GPIO4 | 6 | | 29 | nLink/GPIO8 |
| ADC | 7 | | 28 | UART0_CTS/GPIO22 |
| NC | 8 | | 27 | UART0_RX |
| VCC | 9 | | 26 | UART0_RTS/GPIO23 |
| NC | 10 | | 25 | UART0_TX |
| GPIO3 | 11 | | 24 | NC |
| GPIO7 | 12 | | 23 | USB_DP |
| GPIO13 | 13 | | 22 | USB_DN |
| GPIO12 | 14 | | 21 | UART1_TX |
| GPIO0 | 15 | | 20 | VCC |
| GPIO9 | 16 | | 19 | UART1_RX |
| GND | 17 | | 18 | GND |
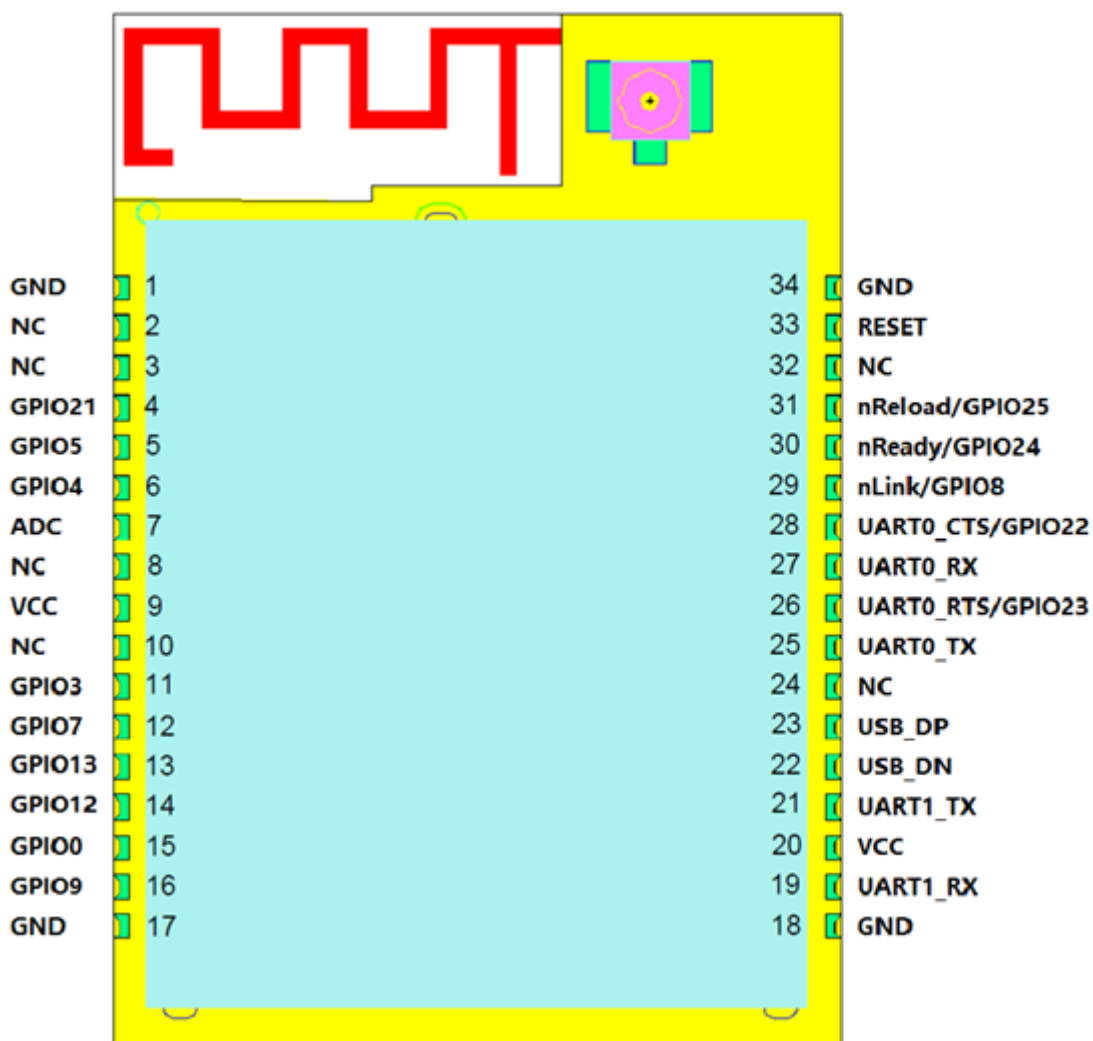
Figure 2.    HF-LPB130 Pins Map

Table2.    HF-LPB130 Pins Definition

| Pin | Describtion | Net Name | Signal Type | Comments |
|---|---|---|---|---|
| 1,17,18,34 | Ground | GND | Power | |
| 2 | | N.C | | |
| 3 | | N.C | | |
| 4 | GPIO21 | GPIO21 | I/O | Output Low when boot |
| 5 | GPIO5 | GPIO5 | IPD/O | Can be used as SPI_CS |
| 6 | GPIO4 | GPIO4 | IPD/O | Can be used as SPI_CLK |
| 7 | ADC | ADC | IPD/O | GPADC0,ADC Function |
| 8 | | N.C | | |
| 9,20 | +3.3V Power | DVDD | Power | |
| 10 | | N.C | | |
| 11 | GPIO3 | GPIO3 | IPU/O | There will be 2ms output low when bootup, after then it works as input pull high.<br>Can be used as PWM4 |
| 12 | GPIO7 | GPIO7 | IPD/O | Can be used as SPI_MISO |
| 13 | GPIO13 | GPIO13 | I/O | |
| 14 | GPIO12 | GPIO12 | IPD/O | Can be used as SPI_MOSI |
| 15 | GPIO0 | GPIO0 | I/O | |
| 16 | GPIO9 | GPIO9 | I/O | |
| 19 | UART1_RXD | UART0_CTS | I | 3.3V UART1 Debug Input GPIO26, Leave it  if not use Detailed functions see <Notes> |
| 21 | UART1_TXD | UART0_RTS | O | 3.3V UART1 Debug Output GPIO27, Leave it  if not use Detailed functions see <Notes> |
| 22 | USB_DN | USB_DN | | |
| 23 | USB_DP | USB_DP | | |
| 24 | | N.C | | |
| 25 | UART0 | UART0_TX | O | 3.3V UART0 Communication Output GPIO2 |
| 26 | UART0_RTS | UART0_RTS | IPU/O | GPIO23, PWM1 |
| 27 | UART0 | UART0_RX | I | 3.3V UART0 Communication Input GPIO1 |
| 28 | UART0_CTS | UART0_CTS | IPU/O | GPIO22, PWM0 |
| 29 | Wi-Fi Status | nLink | IPD/O | "0" – Wi-Fi connect to router "1" – Wi-Fi unconncted; **Detailed functions see <Notes>** GPIO8 |
| 30 | Module Boot Up Indicator | nReady | IPU/O | "0" – Boot-up OK; "1" – Boot-up No OK; GPIO24, PWM2 |

| Pin | Describtion | Net Name | Signal Type | Comments |
|-----|-------------|----------|-------------|----------|
| 31 | Multi-Function | nReload | IPU/O | **Detailed functions see <Notes>** GPIO25, PWM3 |
| 32 | | N.C | | |
| 33 | Module Reset | EXT_RESETn | I,PU | **"Low" effective reset input. There is RC reset circuit internally. External pull-up resistor is not allowed.** |

**<Notes>**

**I — Input；O — Output**

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

**Supply nReload Pin (Button) function：**

1. **When this pin is set to "low" during module boot up, the module will enter wireless firmware and config upgrade mode. This mode is used for customer manufacture. (See Appendix to download software tools for customer batch configuration and upgrade firmware during mass production)**

2. **After module is powered up, short press this button ( "Low" < 2s ) and loose to make the module go into "Smart Link " config mode, waiting for APP to set password and other information. (See Appendix to download SmartLink APP)**

3. **After module is powered up, long press this button ( "Low" > 4s ) and loose to make the module recover to factory setting.**

**High-Flying strongly suggest customer fan out this pin to connector or button for "Manufacture" and " Smart Link" application.**

**nReady Pin (LED) function(Low effective)：**

1. **OS initial finished indicator. Only after this pin output low, can the UART function be used.**

**nLink Pin (LED) function(Low effective)：**

1. **At wireless firmware and config upgrade mode , this LED used to indicate configure and upgrade status.**

2. **At "Smart Link " config mode, this LED used to indicate APP to finish setting.**

3. **At normal mode, it's Wi-Fi link status indicator**

**High-Flying strongly suggest customer fan out this pin to LED.**

**PWM function：**

**PWM0~PWM3 support 1～100% duty, 5us～256speriod, PWM4 support 1～100% duty, 5us～4s period.**

**UART1 Debug ：**

1. **Is used for debug log or firmware program.**

2. **Can be used for communication in SDK.**

### 1.2.2.  Electrical Characteristics

Table3.　Absolute Maximum Ratings:

| Parameter | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Storage temperature range | | -40 | | 125 | °C |
| Maximum soldering temperature | IPC/JEDEC J-STD-020 | | | 260 | °C |
| Supply voltage | | 0 | | 3.6 | V |
| Voltage on any I/O pin | | 0 | | 3.6 | V |
| ESD (Human Body Model HBM) | TAMB=25°C | | | 2.5 | KV |
| ESD (MM) | TAMB=25°C | | | 0.25 | KV |

Table4.　Power Supply & Power Consumption:

| Parameter | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Operating Supply voltage | | 2.9 | 3.3 | 3.6 | V |
| Supply current, peak | Continuous Tx | | 260 | | mA |
| Supply current, | STA No data transfer | | 27 | | mA |
| Supply current, | STA Continuous data transfer | | 35 | | mA |
| Supply current, | AP | | 80 | | mA |

### 1.2.3.  HF-LPB130 Mechanical Size

HF-LPB130 modules physical size （Unit: mm） as follows:
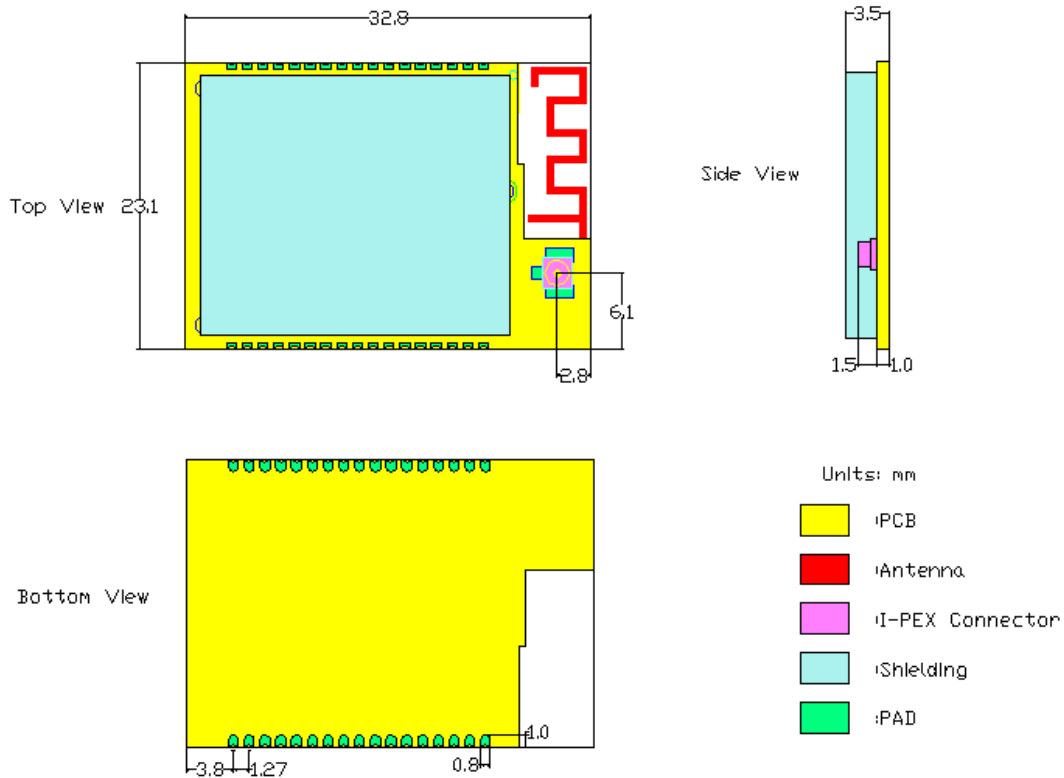


Figure 3.　HF-LPB130 Mechanical Dimension

1.2.4.  HF-LPB130 On-board PCB Antenna

HF-LPB130 module support internal on-board PCB 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 metal enclosure;
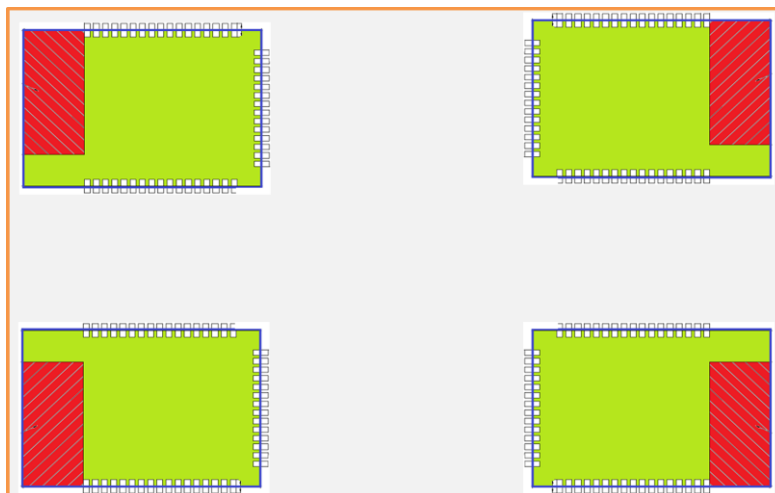


Figure 4.    Suggested Module Placement Region

High-Flying suggest HF-LPB130 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.  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-LPB130 series module with the RS-232 UART, USB (Internal USB to UART convetor) or Wireless interface to configure the parameters, manage the module or do the some functional tests.
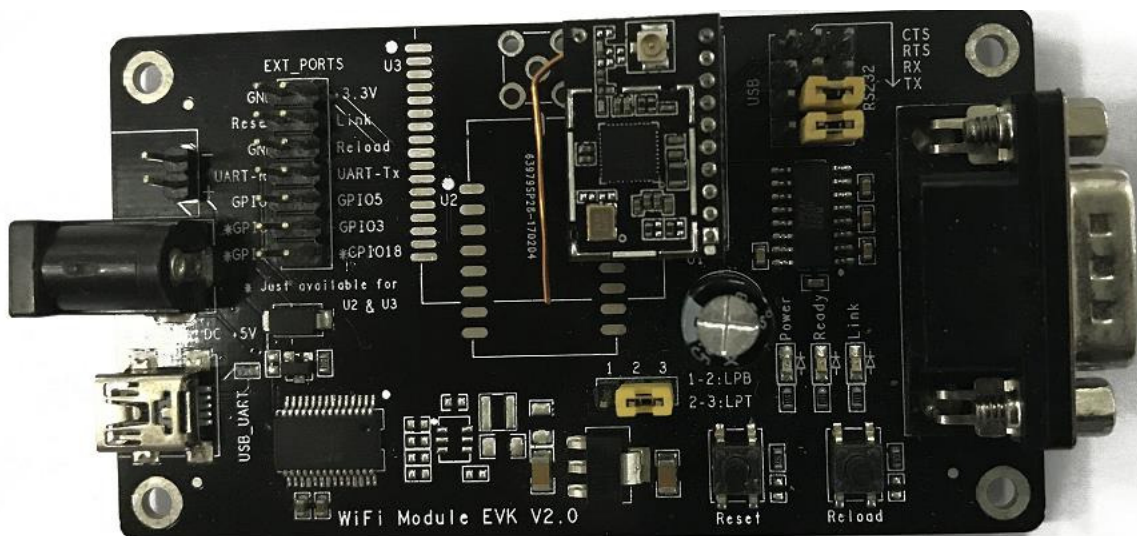
Figure 5.    HF-LPT130 EVK

Notes: User need download USB to 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:

Table6.    HF-LPB130 Evaluation Kit Interface Description

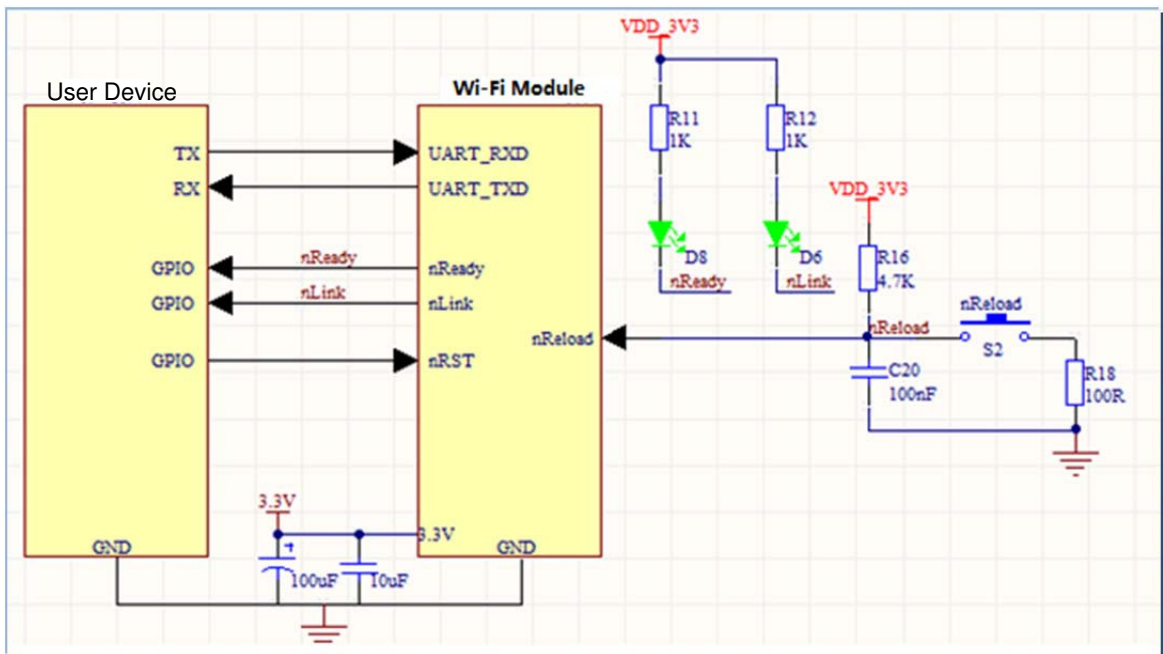| Function | Name | Description |
|---|---|---|
| External Interface | RS232 | Main data/command RS-232 interface |
| | USB | USB to UART interface |
| | DC5V | DC jack for power in, 5V input. |
| LED | Power | Power LED |
| | Ready | nReady LED |
| | Link | nLink LED |
| Button | nReload | Restore factory default configuration after push this pin more than 4s. **See 1.2.1** |

1.2.7. Hardware Typical Application



Figure 8. HF-LPB130 Hardware Typical Application

**Notes:**

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

There is pull-up resister 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.
**(This pin is recommend to connect to LED, indicate status when the module in wireless upgrade mode)**
When module connects to AP (AP associated), this pin will output "0". This signal used to judge if module already at WiFi connection status. Thers is pull-up resister 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 4s through button or MCU pin, then release, module will restore to factory default configuration and re-start boot up process.. If nReload function not required, can leave this pin open.

**UART0_TXD/RXD**- UART port data transmit and receive signal.

# 2. FUNCTIONAL DESCRIPTION

## 2.1. Wireless Networking

HF-LPB130 module can be configured as both wireless STA and AP base on network type. Logically there are two interfaces in HF-LPB130. One is for STA, and another is for AP. When HF-LPB130 works as AP, other STA equipments are able to connect to HF-LPB130 module directly. Wireless Networking with HF-LPB130 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: 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.
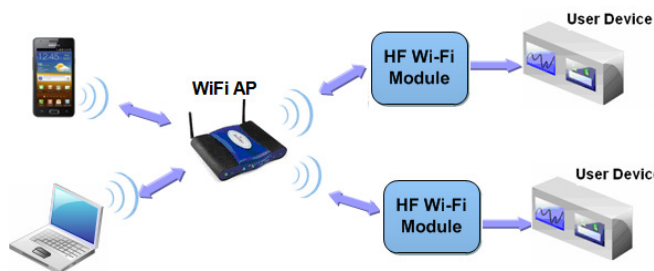


Figure 9.    HF-LPB130 Basic Wireless Network Structure

### 2.1.2. Wireless Network Based On STA

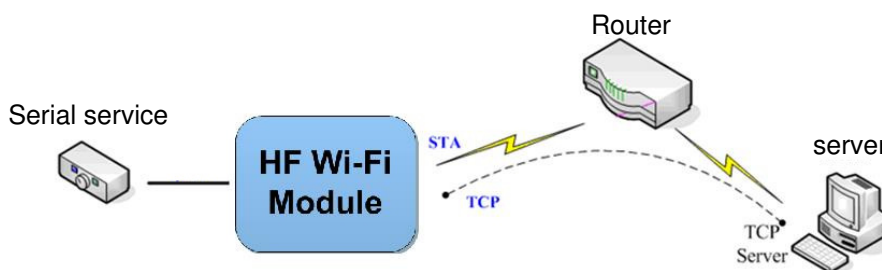HF-LPB130 module support STA network mode.



Figure 10.   HF-LPB130 STA Network Structure

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## 2.2. Work Mode : Transparent Transmission Mode

HF-LPB130 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. 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-LPB130 module supports following:

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

## 2.4. Parameters Configuration

HF-LPB130 module supports two methods to configuration parameters**: AT+instruction set.**

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

## 2.5. Firmware Update

HF-LPB130 module supports multiple upgrade methods:

- UART upgrade
- Local Network upgrade

## 2.6. SOCKET B Function

HF-LPB130 support double socket communication, the socket B function is disabled by default.
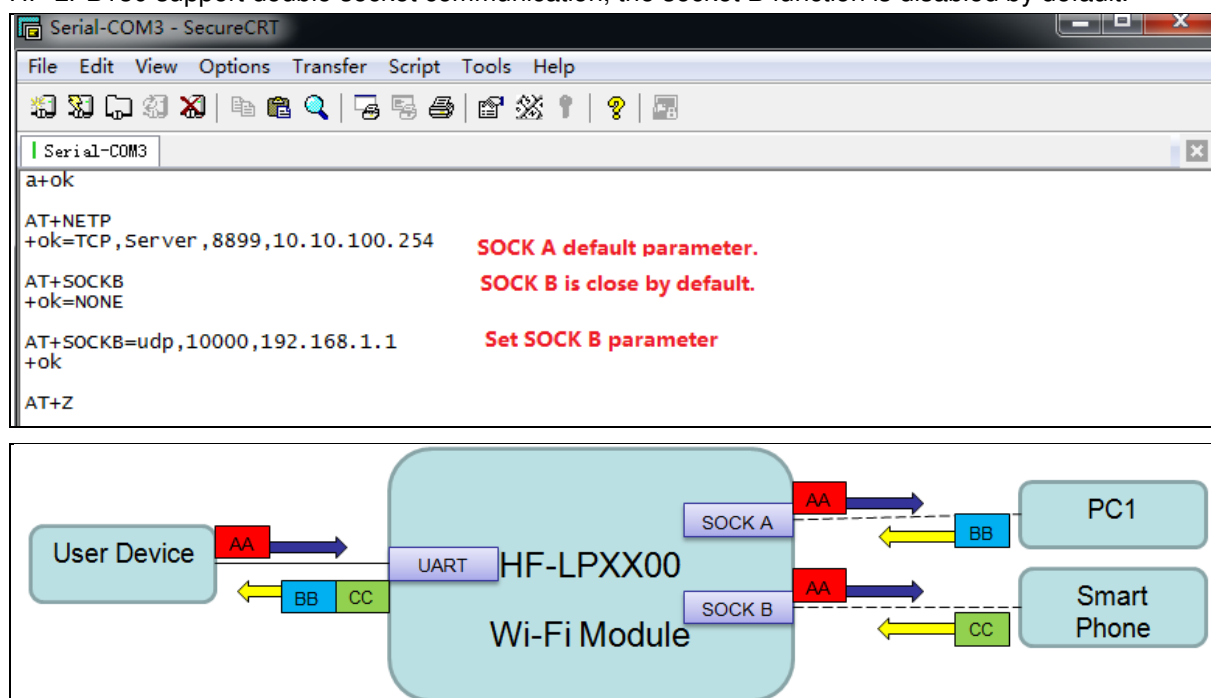




Figure 11.   Socket B function demo

## 2.7. Multi-TCP Link Connection

When HF-LPB130 module SOCK A configured as TCP Server, it supports Multi-TCP link connection, and maximum 5 TCP clients permitted to connect to HF-LPB130 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 replicate and broadcast to every TCP connection or client.

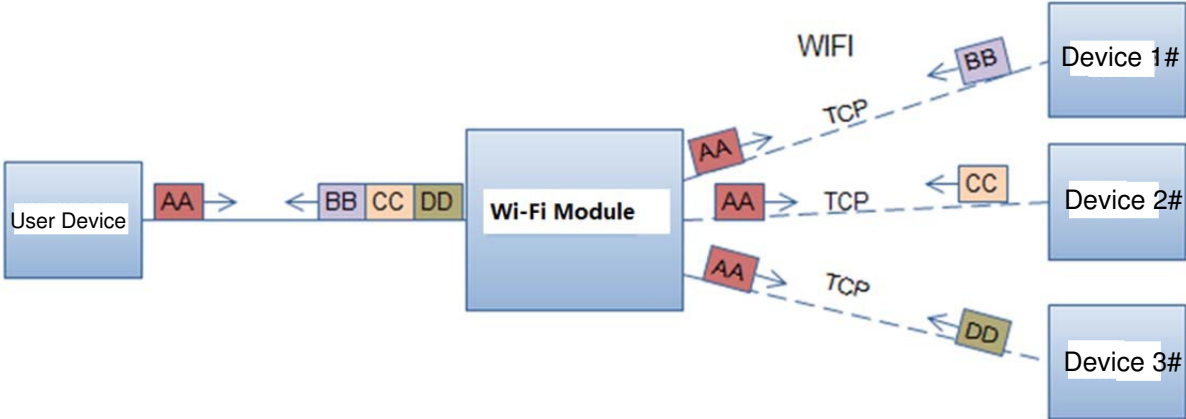Detailed multi-TCP link data transmission structure as following figure:

Figure 12.　Multi-TCP Link Data Transmition Structure

# 3. OPERATION GUIDELINE

## 3.1. Configuration

When first use HF-LPB130 series modules, user may need some configuration. User can connect to HF-LPB130 module's wireless interface with following default setting information and configure the module through laptop.

Table7.　HF-LPB130 Web Access Default Setting

| Parameters | Default Setting |
|---|---|
| SSID | HF-LPB130<br>HF-LPT230<br>HF-LPT130A |
| IP Address | 10.10.100.254 |
| Subnet Mask | 255.255.255.0 |
| Account | admin |
| Password | admin |

### 3.1.1. Open Web Management Interface

There is internal webpage and external webpage in modules. The external webpage is for web management. The internal webpage is only for upgrading. 1MB Flash external webpage is different from 4MB Flash version, but the internal webpage is the same.

Step 1: Connect laptop to SSID "HF-LPT230" of HF-LPT230 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 13.　Open Web Management page

The 1MB Flash version has the simple config page while the 4MB Flash version has the full config page. 1MB Flash version webpage is as following(By default is Chinese language, upgrade via internal webpage to upgrade English language).
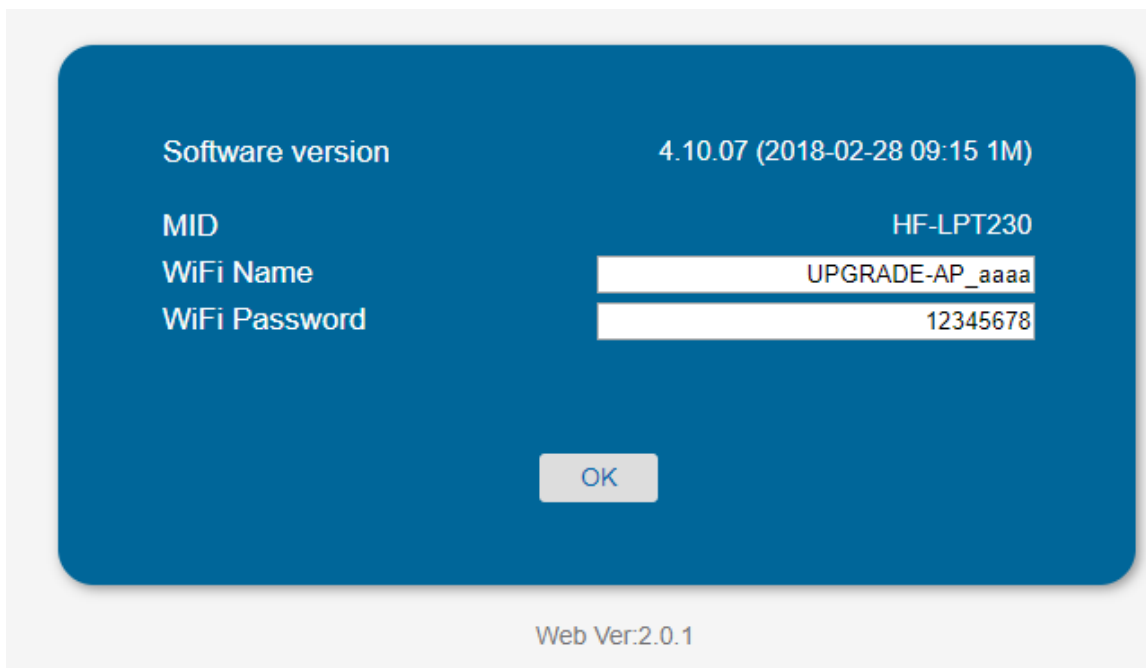
Figure 14.  1MB Flash Version webpage

The HF-LPB130 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 15.  System Web Page

### 3.1.3. Work Mode Page

HF-LPB130 module can works at AP mode to simplify user's configuration, can also works at STA to connect remote server through AP router.
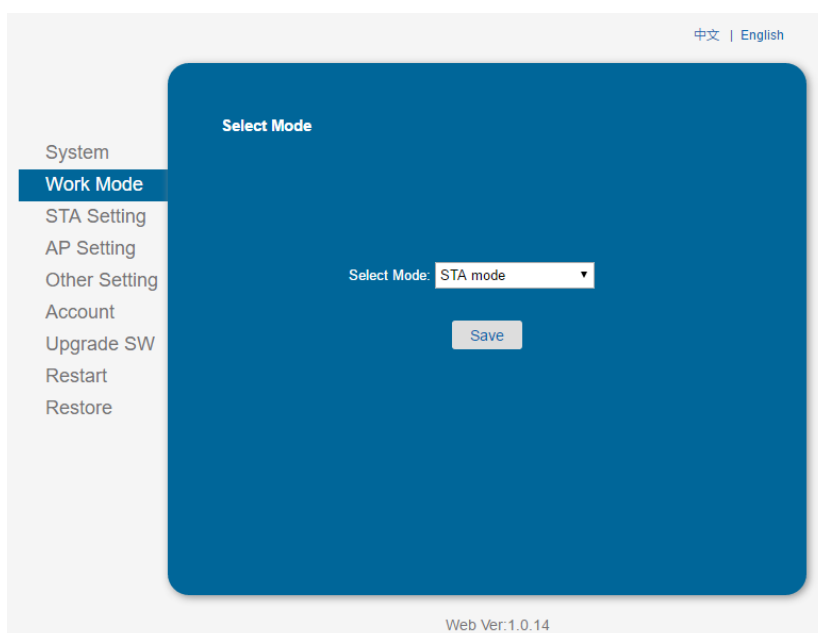


Figure 16. Work Mode Page

### 3.1.4. STA Setting Page

User can push "Scan" button to auto search Wi-Fi AP router nearby, and can connect with associate AP through some settings. Please note the encryption information input here must be fully same with Wi-Fi AP router's configration, and then it can link with AP correctly.
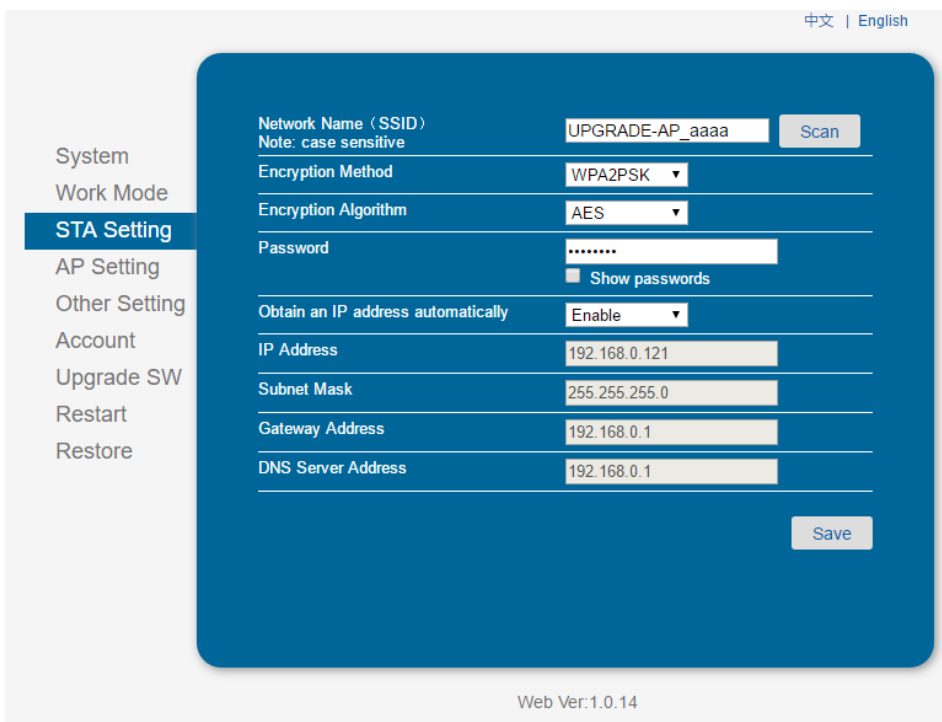
Figure 17.   STA Setting Page
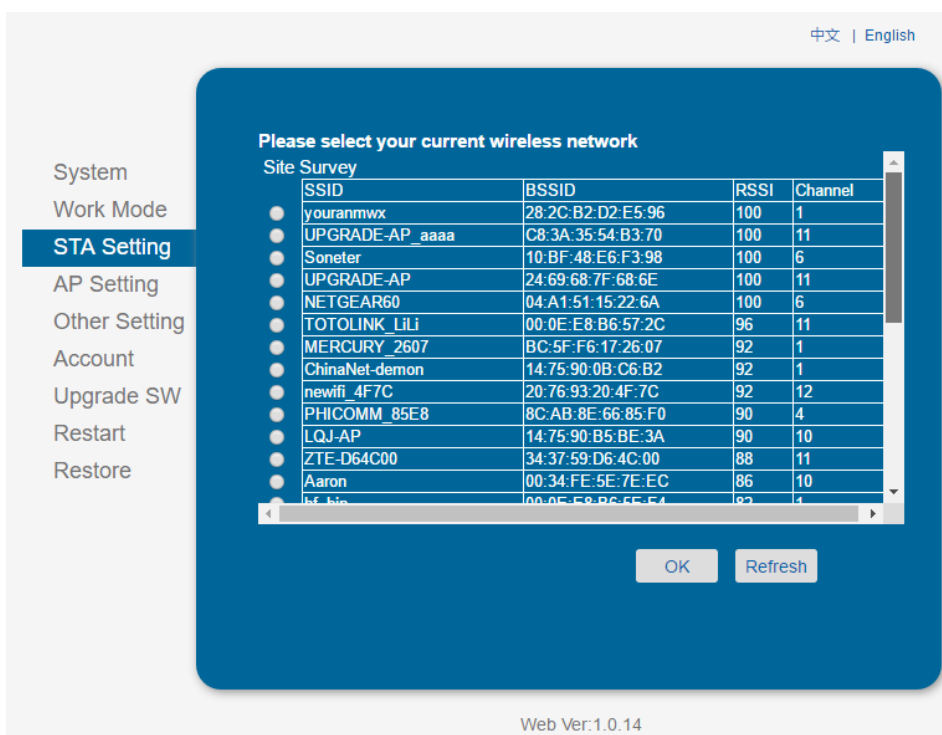


Figure 18.   STA Scan Page

### 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.
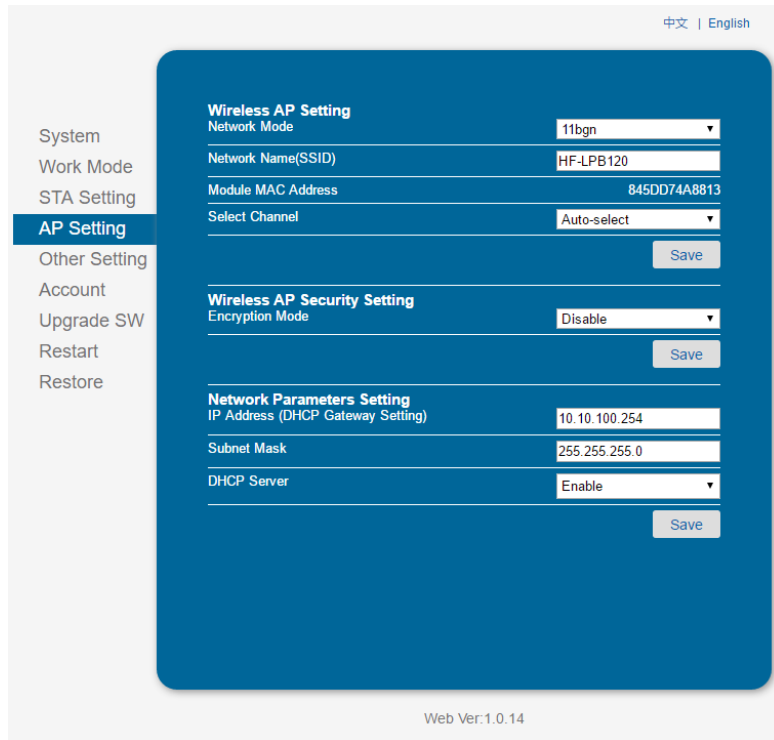


Figure 19. AP Setting Page

### 3.1.6. Other Setting Page

HF-LPB130 usually works at data transparent transmission mode. At this mode, the user device which connected with HF-LPB130 will connect and communicate with remote PC or server. At this page, user need setting serial port communication parameters and defines TCP related protocal parameters.
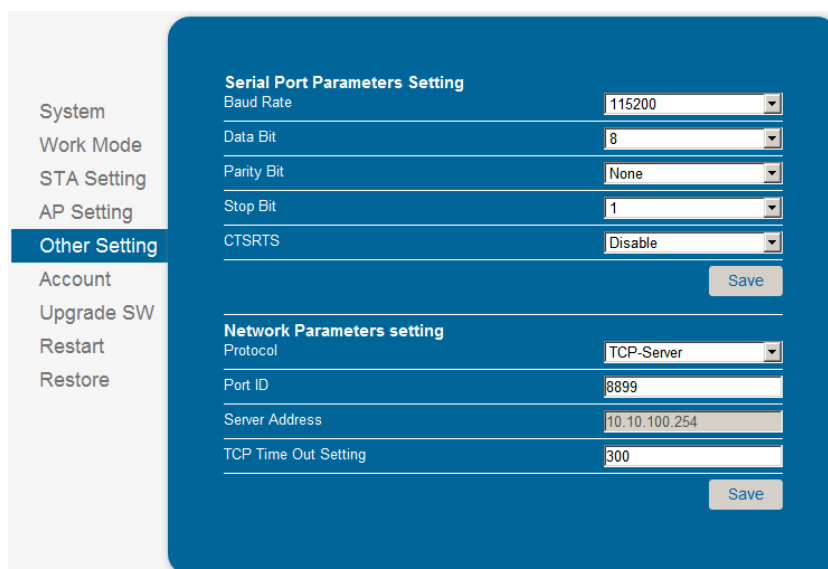


Figure 20. Other Setting Page

### 3.1.7. Account Management Page

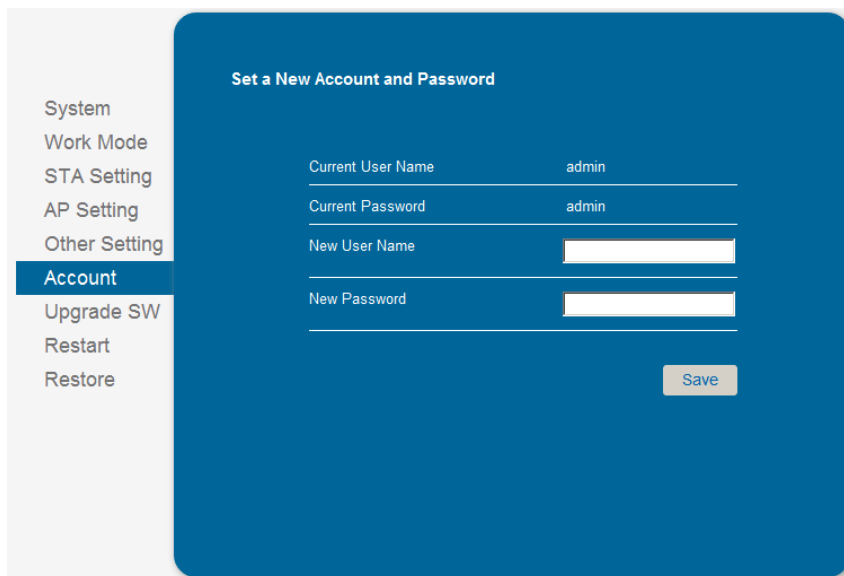This page set web server's user name and password.



Figure 21.  Account Page

### 3.1.8. Upgrade Software Page

User can upgrade new software (firmware) version through Wi-Fi. After upgrade success, need reboot it manually before new firmware valid.
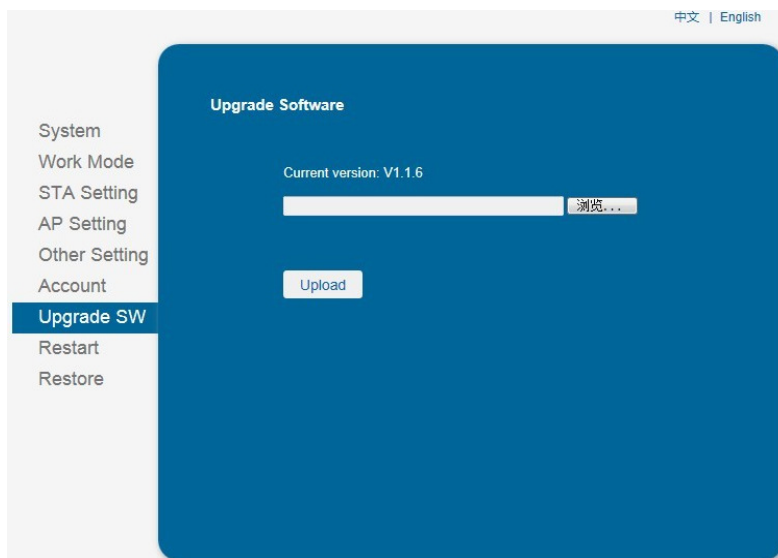


Figure 22.  Upgrade SW page

### 3.1.9. Restart Page

Most of the settting and configuration can only effective after system restart. User shall restart after finish all setting.
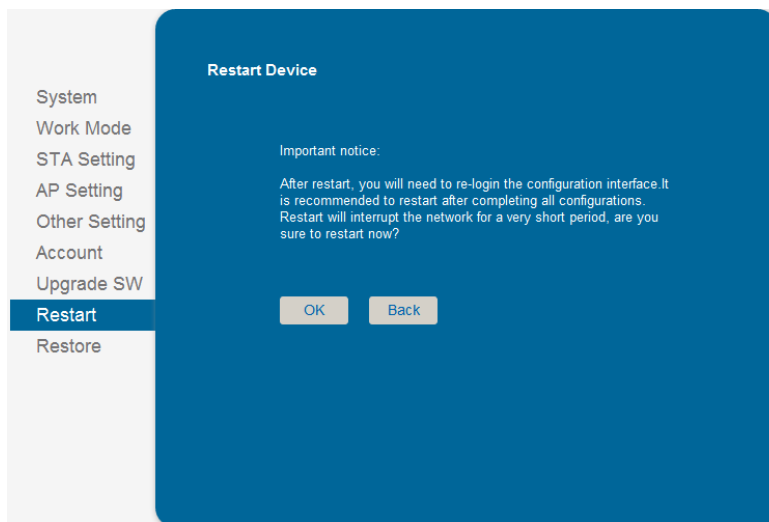
Figure 23.    Restart Page

### 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-LPB130 will restore to AP mode for factory default setting.
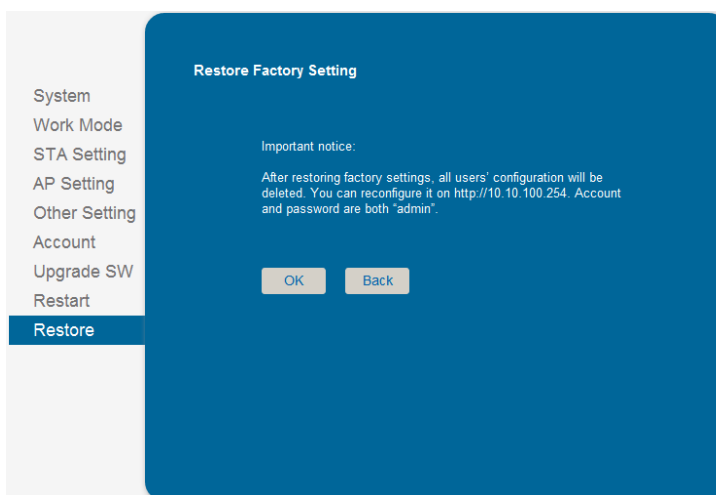


Figure 24.    Restore Page

### 3.1.11.  Internal Webpage

After wireless connection is OK. Open Wen browser and access "**http://10.10.100.254/iweb.html**"; It is for upgrading application and external webpage..

Figure 25.　Internal Webpage

## 3.2. Usage Introduction

### 3.2.1. Software Debug Tools

High-Flying use two common software tools debugging and applying HF-LPB130 module. (User can also select other tools used to debug serial port).

- Serial Debugging Software: ComTools    

- Ethernet Debugging Software: TCPUDPDbg    

### 3.2.2. Network Connection

User can select two methods to connect HF-LPB130 module base on dedicated application.

➢ **Use HF-LPB130 STA interface.** HF-LPB130 and debug PC2 connect to a wireless AP, another PC1 (or user device) connect to HF-LPB130 module with serial port:



Figure 26.　STA Interface Debug Connection

➢ **Use HF-LPB130 AP interface.** Debug PC2 connect to HF-LPB130 through wireless connection, another PC1 (or user device) connect to HF-LPB130 module with serial port.



Figure 27.　AP Interface Debug Connection

### 3.2.3. Default Parameter Setting

- Default SSID: HF-LPB130;

- 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-LPB130 module and open serial port connection.
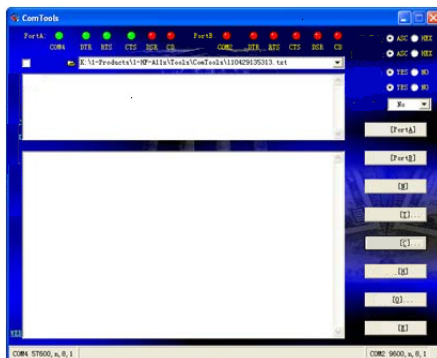


Figure 28.   "CommTools" Serial Debug Tools

PC2 open "TCPUDPDbg" program, and create a new connection. If HF-LPB130 configured as Server mode, "TCPUDPDbg" Tools shall create "Client "mode connection. Or otherwise, create a "Server" mode connection.
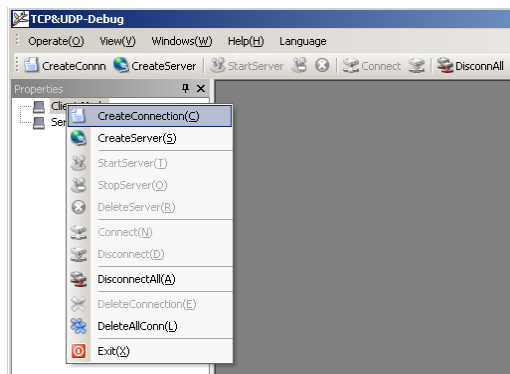


Figure 29.    "TCPUDPDbg" Tools Create Connection

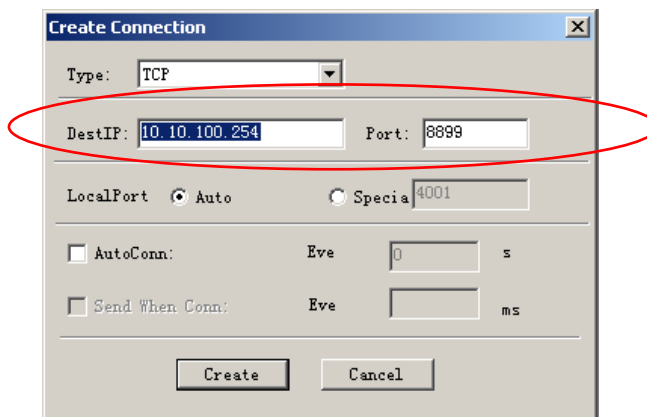Then setting the TCP/UDP connection parameters. Default as following:

Figure 30. "TCPUDPDbg" Tools Setting

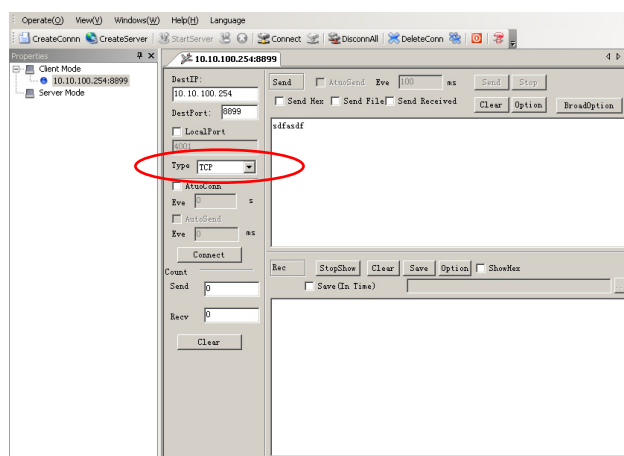Then, click "Create" button to create a connection.



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.

## 3.3. Typical Application Examples

3.3.1. Wireless Control Application



Figure 32. Wireless Control Application

For this wireless control application, HF-LPB130 works as AP 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-LPB130 module.
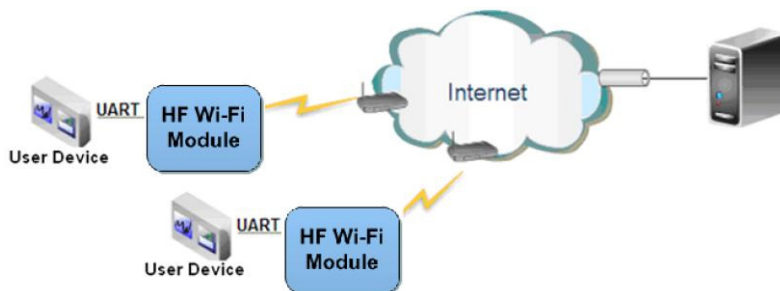
### 3.3.2. Remote Management Application



Figure 33.    Remote Management Application

For this remote management application, HF-LPB130 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-LPB130 modules connect as below figures to build up a transparent serial port connection. One HF-LPB130 works as AP mode, another HF-LPB130 works as STA mode. Make the STA device  connects to AP.



Figure 34.    Transparent Serial Port Application

FCC Statement

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

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.

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 20 cm between the radiator & your body.

**FCC Label Instructions**

The outside of final products that contains this module device must display a label

referring to the enclosed module. This exterior label can use wording such as: "Contains

Transmitter Module FCC ID: 2ACSV-HF-LPB130,or "Contains FCC ID: 2ACSV-HF-

LPB130, Any similar wording that expresses the same meaning may be used.