HF-A11x

Embedded WiFi Module User Manual

V3.1

This module is limited to OEM installation only and must not be sold to end-users.

OEM integrators must be instructed to ensure that the end-user has no manual instructions to remove or install the device.

The end-user can not remove or install this module to any other devices.

Overview of Characteristic

- ✧ **Support IEEE802.11b/g/n Wireless Standards**
- ✧ **Support TCP/IP/UDP Network Protocols**
- ✧ **Support UART/GPIO/Ethernet Data Interface**
- ✧ **Support Work As STA/AP Mode**
- ✧ **Support Router/Bridge Mode Networking**
- ✧ **Support Internal Antenna Option**
- ✧ **Support Transparent/Agreement Transmission Mode**
- ✧ **Support AT+ Instruction Set for Configuration**
- ✧ **Support Friendly Web Configuration Page**
- ✧ **Support Palmodic Signal**
- ✧ **Support UART Port Auto-Frame Function**
- ✧ **Single +3.3V Power Supply**
- ✧ **Smallest Size: 25 x 40mm**
- ✧ **FCC/CE Certificated**
- ✧ **Flexible Software Platform with Linux OS**

FCC ID：AZYHF-A11X

CE1588

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HISTORY

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1. PRODUCT OVERVIEW

1.1. General Specification

Table 1 HF-A11x 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: +17.38 dBm (Max.)
		802.11g: +14.64 dBm (Max.)
		802.11n: +14.95 dBm (Max.)
		Configurable
	Receiver Sensitivity	802.11b: -89 dBm
		802.11g: -81dBm
		802.11n: -71dBm
	Antenna Option	Internal:On-board chip antenna
Hardware Parameters	Data Interface	UART: 1200bps - 230400bps
		GPIOs
		Ethernet: 100Mpbs
	Operating Voltage	3.3V (+/-5%)
	Operating Current	170mA~300mA
	Operating Temperature	-10℃- 70℃
	Storage Temperature	-40℃- 85℃
	Dimensions and Size	25×40×8mm (A111) 30×45×8mm (A112)
Software Parameters	Network Type	Station /AP mode
	Security Mechanisms	WEP/WAP-PSK/WAP2-PSK/WAPI
	Encryption	WEP64/WEP128/TKIP/AES
	Work Mode	Transparent Transmission and Agreement Transmission mode
	Serial command	AT+instruction set
	Network Protocol	TCP/UDP/ARP/ICMP/DHCP/DNS/HTTP
	Max. TCP Connection	32
	User Configuration	Web Server＋AT command config.
	User Application SW	Support customized application SW with Linux system.

Note: Limited by local law regulations, version for North America does not have region selection option.

1.2. Hardware Introduction

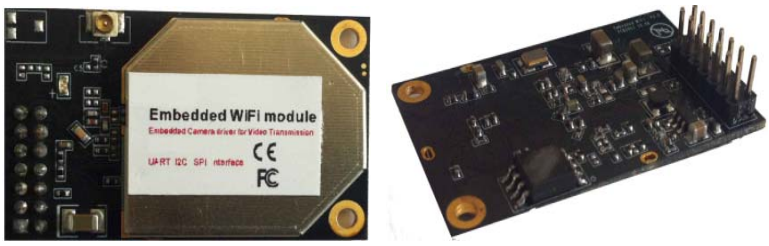


Figure 1. HF-A11x Demo

1.2.1. Pins Definition

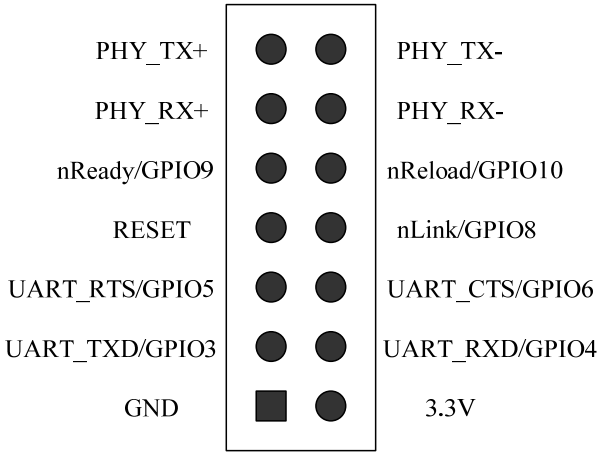


Figure 2. HF-A11x Pins Map

Table 2 HF-A11x Pins Definition

Pin	Description	Name	Direction	Note
1	Ground	GND	Power	
2	VCC	3.3V	Power	3.3V @ 350mA power input
3	UART Data Transmit	UART_TXD	O	If not use UART function，this 4 pins can be configured as GPIO pins, and can change GPIO pin status through AT command
	GPIO	GPIO3	I/O	
4	UART Data Receive	UART_RXD	I	
	GPIO	GPIO4	I/O	
5	UART sends request of data transmission	UART_RTS	O	
	GPIO	GPIO5	I/O	

6	UART receives data transmission permission	UART_CTS	I	
	GPIO	GPIO6	I/O	
7	Module reset signal	RESET	I	“Low (0)” effective reset input. The reset duration should be kept more than 300ms
8	WiFi status Indication	nLink	O	“1”- WIFI connection available, “0”- No WIFI connection Can be configured as GPIO.
	GPIO	GPIO8	I/O	
9	Indicate the module status of power on process	nReady	O	“0” or “Palmodic Signal” - Finish module boot up process; “1” - Module boot up not finish. Can be configured as GPIO.
	GPIO	GPIO9	I/O	
10	Restore configuration	nReload	I	Module will Restore factory default configuration after set this pin “0” more than 1s, then set “1”.
	GPIO	GPIO10	I/O	
11	Ethernet Interface	PHY_RX+	I	+1.8V Ethernet Data Interface Support transformer and direct connection (AC couple) mode.
12	Ethernet Interface	PHY_RX-	I	
13	Ethernet Interface	PHY_TX+	O	
14	Ethernet Interface	PHY_TX-	O	

1.2.2. Mechanical Size

HF-A11x series modules include HF-A111（25×40mm）and HF-A112（30×45mm）with different physical size as follows:

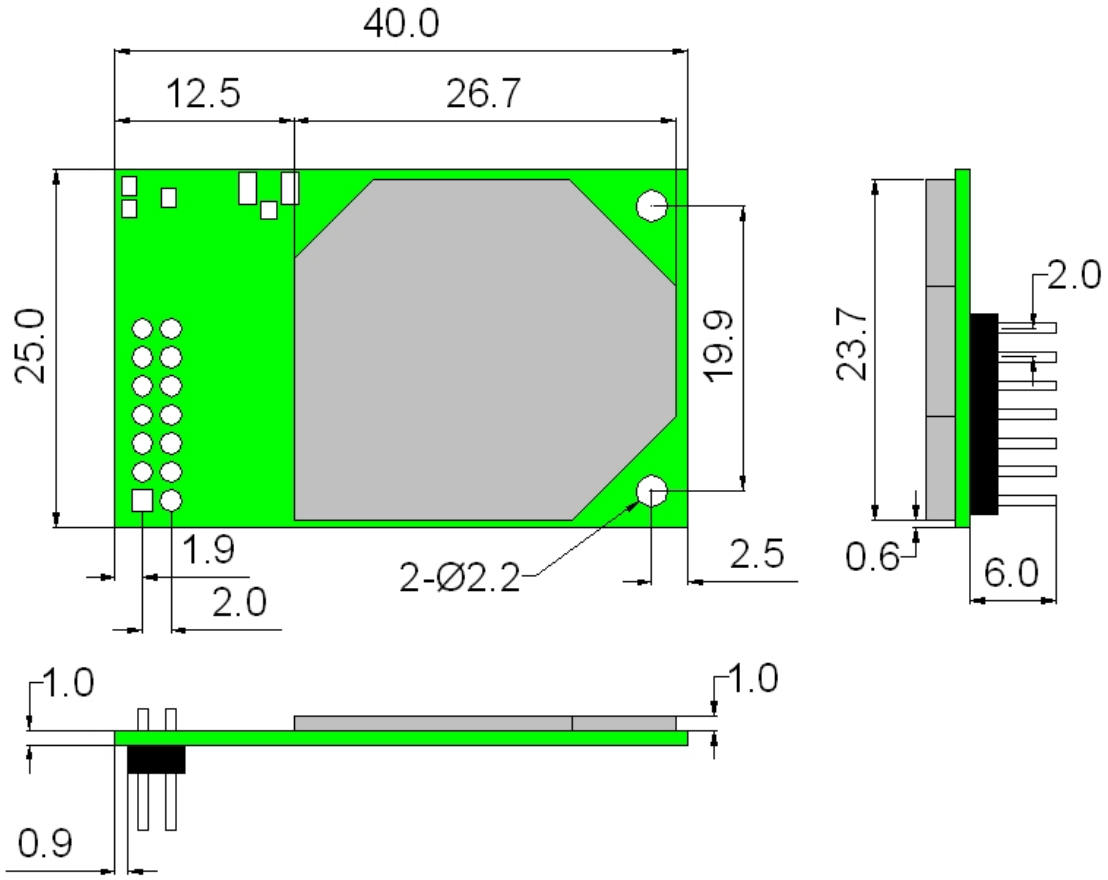


Figure 3. HF-A111 Mechanical Dimension

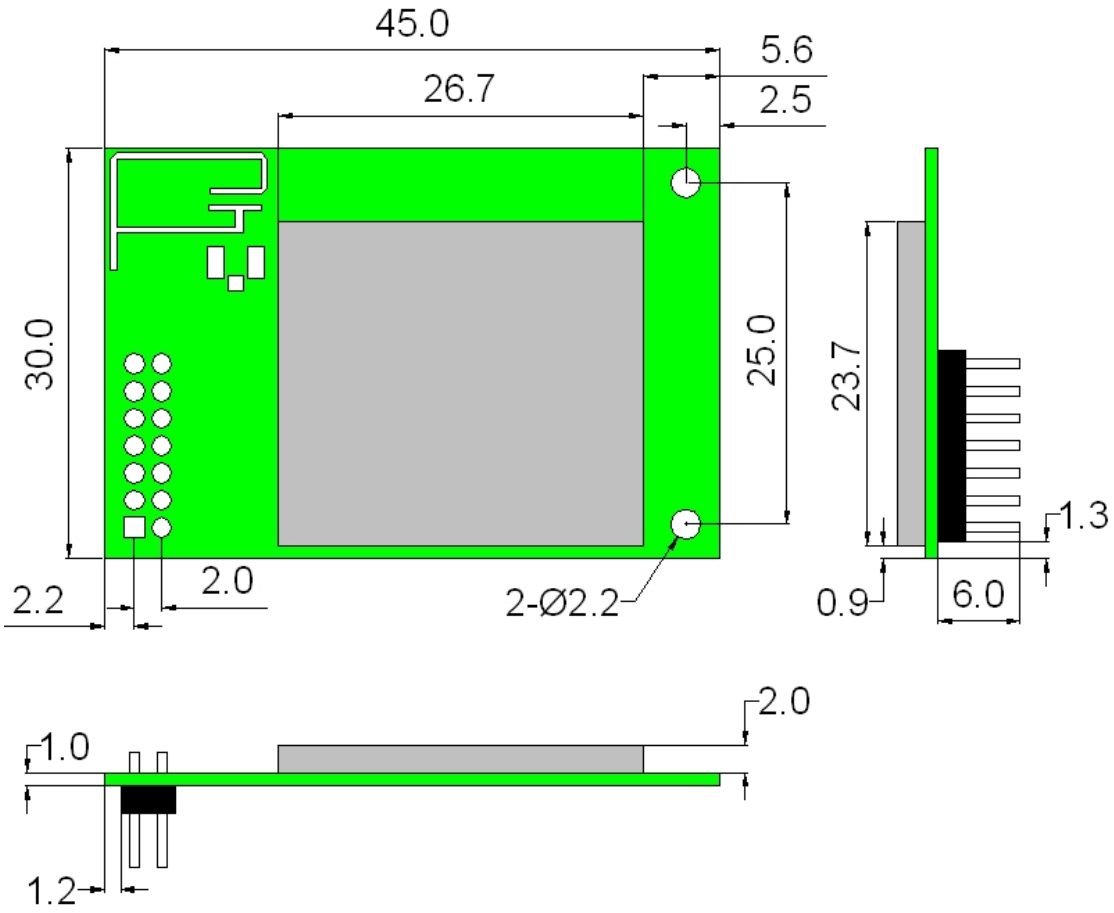


Figure 4. HF-A112 Mechanical Dimension

1.2.3. 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-A11x module with the RS-232 UART port, 100M Eth port or Wireless port to configure the parameters, manage the module or do the some functional tests.

Figure 5. HF-A11x Evaluation Kit

The external interface description for evaluation kit as follows:

Table 3 HF-A11x Evaluation Kit Interface Description

Function	Name	Description
External Interface	DB9	Male serial jack of 9-pin,and used to connect to PC
	RJ-45	100M Eth Interface
	Mini USB	B-type interface, work as 5V@1A input
	Module	2x7 2mm DIP connector
LED	Power (Red)	3.3V Power Indicator
	CTS	CTS/GPIO Indicator
	RTS	RTS/GPIO Indicator
	Reload	nReload/GPIO Indicator
	Ready	nReady/GPIO Indicator
	Link	nLink/GPIO Indicator
Button	Reset	Used to reset the module.
	Reload	Module restore to factory default configuration.

1.2.4. Order Information

Base on customer detailed requirement, HF-A11x series modules provide different variants and physical type for detailed application.

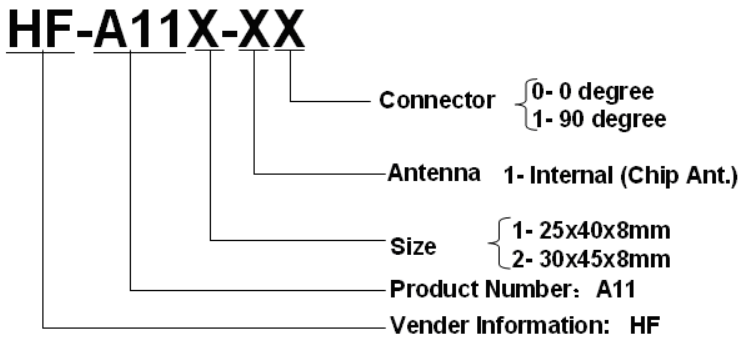


Figure 6. HF-A11x Order Information

1.3. Hardware Reference Design

1.3.1. Hardware Typical Application

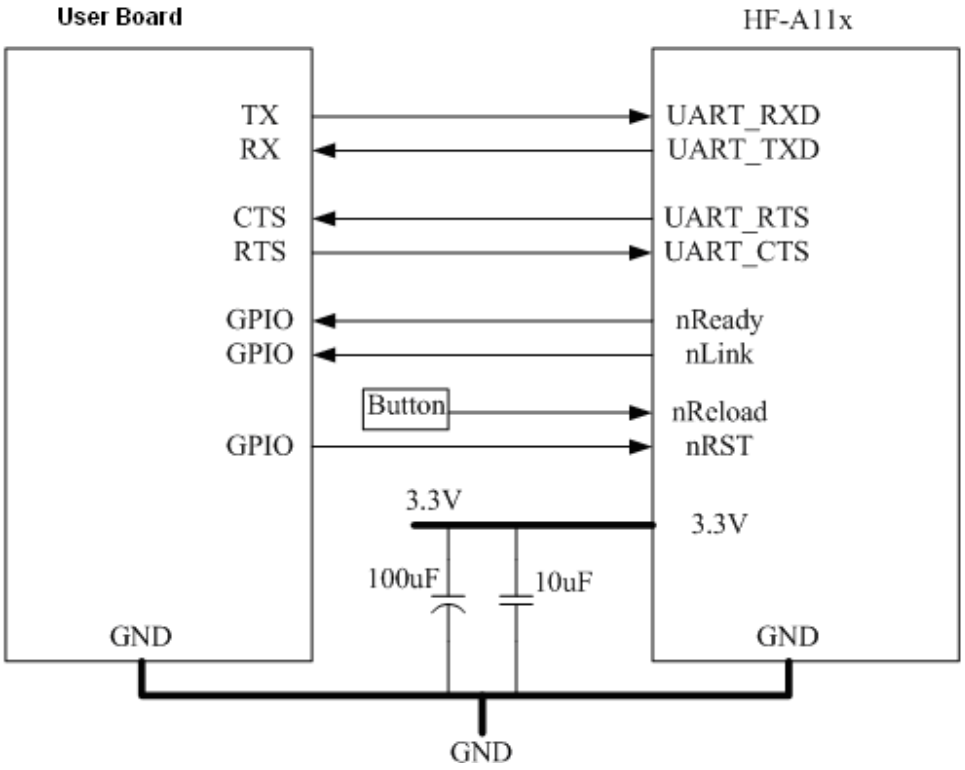


Figure 7. HF-A11x Hardware Typical Application

Notes：

nRST- Module hardware reset signal. Input. Logics “0” effective.
There is 100K Ohm pull-up resister internal. When module power up or some issue happened, MCU need assert nRST signal “0” at least 300ms, then set” 1” to keep module fully reset.

nReady- Module boot up ready signal. Output. Logics “0” effective.
There is 4.7K Ohm pull-up resister internal. The module will output “0” “or “Palmodic Signal” after normal boot up. This signal used to judge if module finish boot up and ready for application or working at normal mode.

nLink- Module WIFI connection indication. Output.
There is 4.7K Ohm pull-up resister internal. When module connect to AP (STA mode) or some WiFi STA connect to module (AP mode), the module will output “0”. This signal used to judge if module already at WiFi connection status.

nReload- Module restore to factory default configuration.Input. Logics “0” effective.
There is 4.7K Ohm pull-up resister internal. User can assert nReload signal “0” more than 1s through button or MCU pin, then release, module will restore to factory default configuration and re-start boot up process.

UART_TXD/RXD- UART port data transmit and receive signal.
There is 1K Ohm pull-down resister internal. User can’t add pull-up resister at these pins.

1.3.2. 10/100M Ethernet Interface

HF-A11x modules provide one 10/100M Ethernet PHY layer interface for data transition or user configuration. This Ethernet support with transformer and without transformer (PHY-to-PHY) 2 kinds of connection.

1.3.2.1. Ethernet Connection with Transformer

User board put Ethernet transformer and RJ-45 connector. This is a general 10/100M Ethernet phy layer connection. The reference design as following:

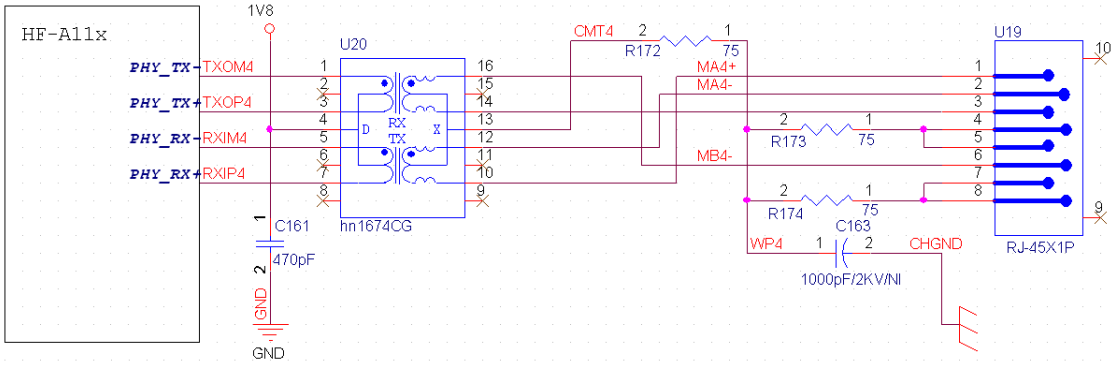


Figure 8. Ethernet Reference Design with Transformer

1.3.2.2. Ethernet Connection without Transformer

For this application, Ethernet will work as internal data transmition interface and save one transformer and RJ-45 connector. Ethernet PHY-to-PHY connection will use AC coupled connection. This is a space and cost optimized solution. Hardware reference design as following:
Note: VCC signal at reference design shall base on user board PHY chipset voltage level, such as 2.5V power supply for general Ethernet PHY chipset.

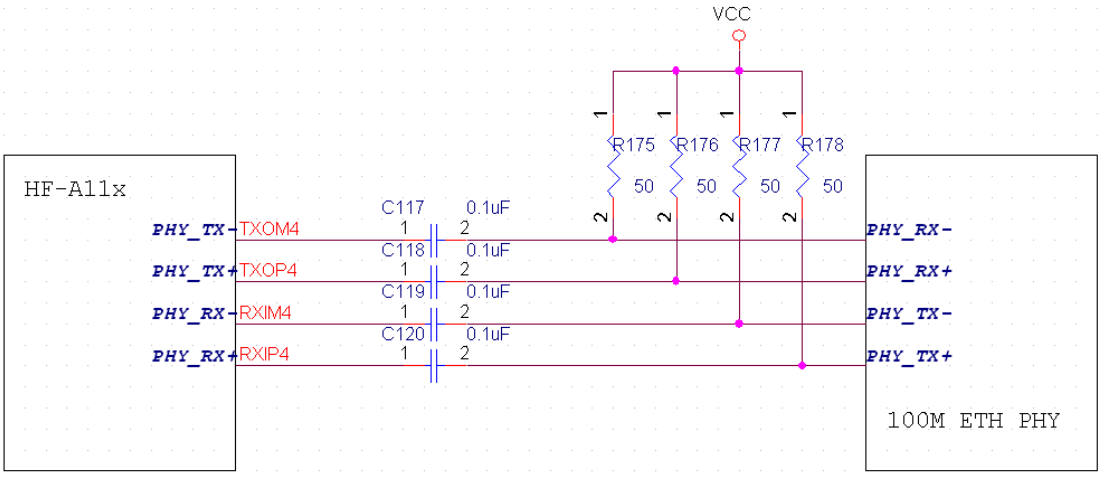


Figure 9. Ethernet Reference Design without Transformer

1.3.3. UART Interface

UART interface is the serial data transmition interface mainly used for HF-A11x modules.

User can add RS-232 chipset on user board and convert the signal to RS-232 voltage to communicate with outside equipment or sensors. HF-A11x modules UART interface include 4 general signals: TXD/RXD/RTS/CTS. The hardware reference design with RS-232 chipset as following:

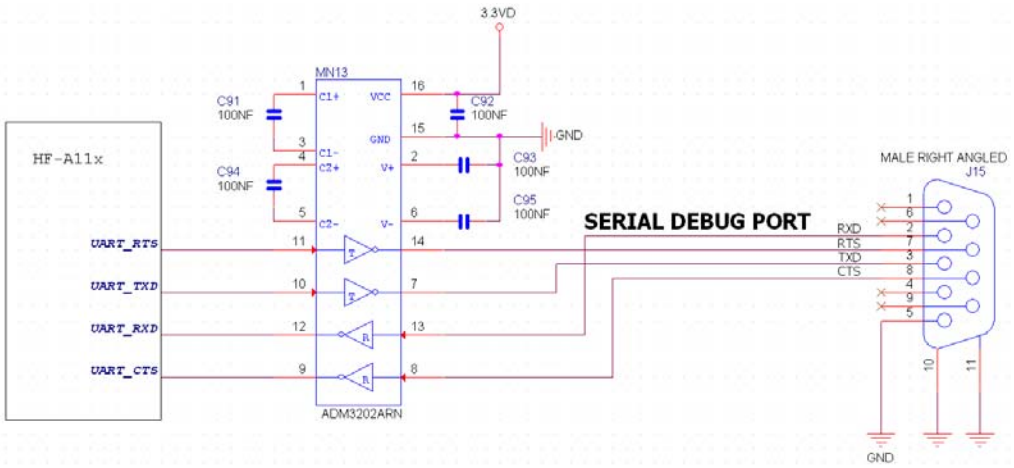


Figure 10. UART Interface Reference Design

Notes*:* TXD pin is also hardware configuration pin internal module. So this pin MUST pull-down during module power up. HF0A11x modules provide internal pull-down resister, user can't add pull-up/pull-down resister on user board, which may cause module can't work.

1.3.4. Power Interface

HF-A11x module support single +3.3V power supply. The peak current shall about 350mA and normal WiFi working current shall about 200mA. The power save (WiFi OFF) mode will about 100mA

Decoupling at power pin suggested, At least one 100uF and one 10uF capacitor required at user board and put near module power input pin will increase the reliability and performance.

1.4. Software Reference Design

When HF-A11x modules boot up phase, the general user board MCU software flow chart will as following:

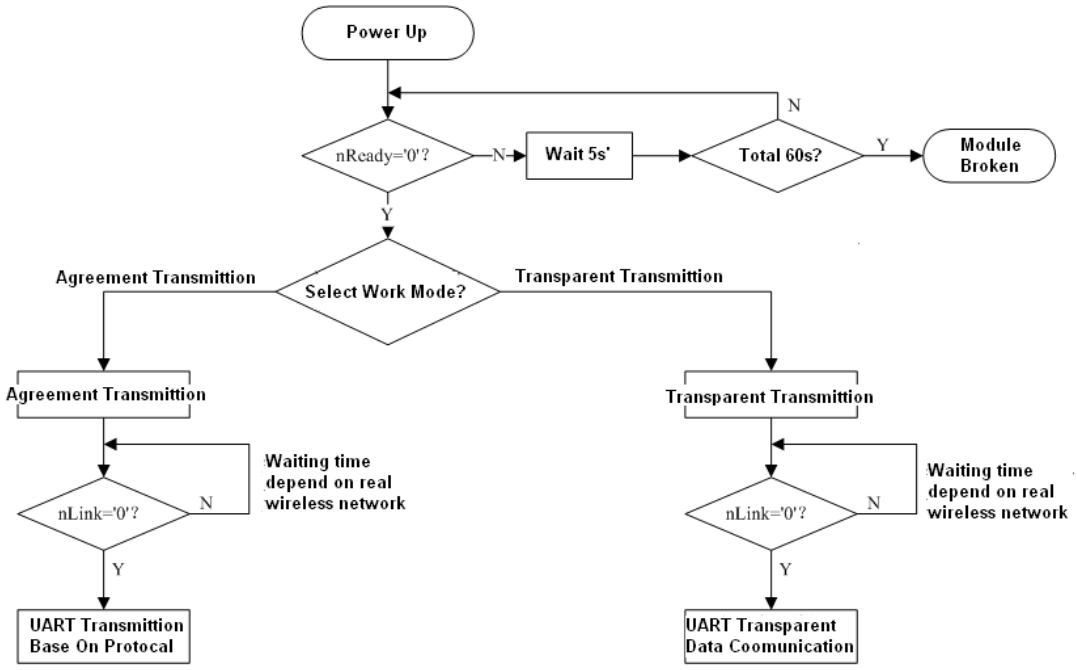


Figure 11. User MCU Software Flow Chart

HF-A11x modules provide two kinds of work mode and one configuration mode.
Work mode is **Transparent Transmission** and **Agreement Transmission.**
Configuration mode is through **AT+instruction set** to finish module setting and configuration.

When HF-A11x modules boot up, user can select one work mode base on the setting, and user can switch to the configuration mode at any kinds of work mode.

1.4.1. Transparent Transmission Mode

HF-A11x modules 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.

Notes: Transparent transmission mode as a low level phy layer data transmitting can't keep zero error rates by itself. User can enable UART port's hardware flow control CTS/RTS function or though higher layer protocol such as TCP to lower error rate and mange the data completeness.

High-Flying recommend when doing large amounts of data transmitting in transparent transmission mode, hardware flow control should be enabled, so as to fully ensure reliable data transmission. In the applications which doesn't need flow control, users can simply leave RTS / CTS pin vacant.

1.4.2. Agreement Transmission Mode

If user requires keep 100% accurate data transmitting (No error rate) or user board' MCU has limited data processing speed compared with wireless data transmitting rate, agreement transmission mode is suggested in this kinds of application.

Agreement transmission mode defines transmition data structure, verification mode, connection mode between both sides, which target to fully control and mange the data transmition on the serial port. These kinds of mode can keep accurate data transmitting.

In agreement transmission mode, user device (or MCU) send "SEND" instruction to HF-A11x modules, HF-A11x modules reply "SEND ACK" instruction to confirm. HF-A11x modules will not active transmit the serial port data to user device, it only can transmit the data after receive user device's data transmit request. HF-A11x module has 1M byte data FIFO to save data which need to be transmitting to the user device.

1.4.2.1. Agreement Transmission Data Structure

Agreement transmission mode's command data structure and **agreement** as following:

- The 1st Byte of each frame is command word;
- The 2nd Byte of each frame is serial number (SN).
  User device insert SN when it send command frame, the SN will increase one (SN+1) after one frame successful transmition. SN shall reset to 0x00 after arrive 0xFF as a cycle period.
- Data Length（Example: LLLL）, which is the net length of data part .
  Unit: Byte. Maximum: 1024 Bytes
- CRC Part（Example: CCCC）, which is the CRC result of whole frame.
- Serial transmition sequence for "LLLL" and "CCCC": Low byte first, then higher byte

➢ **Data Transmit Command（SEND）**

- User device use this command to send data to HF-A11x module
- "SEND" frame structure:

0	1	2 3	4 5	6 ... N+5	N+6 N+7
01	SS	0000	LLLL	DDDD……DDDD	CCCC

  - Command Word: 01
  - Serial Number: SS
  - Reserve Part: 0000（All reserve part shall set to "0"）
  - Data Length: LLLL（Data part" DDDD….DDDD" length）
  - Data Content: DDDD……..DDDD
  - CRC Check: CCCC

➢ **Data Transmit Acknowledge Command (SEND ACK)**

- HF-A11x module replies this command to acknowledge receive "SEND" frame data.
- "SEND ACK" frame structure:

0	1	2 3	4
01	SS	0000	XX

  - Command Word: 01
  - Serial Number: SS

（Serial Number need keep the same with “SEND” command’s serial number）
- Reserve Part: 0000（All reserve part shall set to “0”）
- Acknowledge Information: XX （”00” -- OK，”FF” or others --NOK）

➢ **Data Receive Request Command（RECV）**
- User device use this command to send data receive request to HF-A11x modules
- “RECV” frame structure:

0	1	2 3	4 5	6 7
02	SS	0000	LLLL	CCCC

- Command Word: 02
- Serial Number: SS
- Reserve Part: 0000（All reserve part shall set to “0”）
- Request Data Length: LLLL
- CRC Check: CCCC

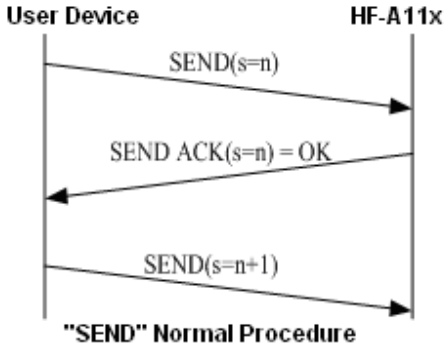
➢ **Data Receive Acknowledge Command (RECV ACK)**
- HF-A11x module reply this command to acknowledge receive “RECV” command and insert data (as user device request’s length or shorter) in the frame.
- “RECV ACK” frame structure:

0	1	2 3	4 5	6 ····· L+5	L+6 L+7
02	SS	0000	LLLL	DDDD……DDDD	CCCC

- Command Word: 02
- Serial Number: SS
  （Serial Number need keep the same with “RECV” command’s serial number）
- Reserve Part: 0000（All reserve part shall set to “0”）
- Data Length: LLLL (Length shall equal or shorter than request data length)
- Data Content: DDDD……..DDDD
- CRC Check: CCCC

1.4.2.2. Agreement Transmission Procedure

Agreement transmission mode procedure as following chart:
(This is a procedure user device hope to send data to HF-A11x module)



"SEND" Normal Procedure

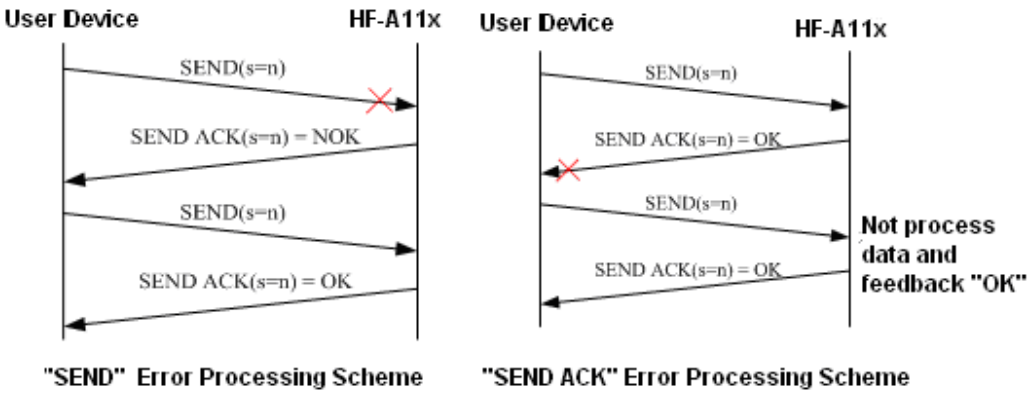


Figure 12. User Device Send Data to HF-A11x Module Procedure

Notes: For Error scheme 1, if HF-A11x receives wrong CRC information of “SEND” command, it will reply back “SEND ACK”=NOK. If HF-A11x not receives “SEND” command for the link issue, user device need decide to retry.

(This is a procedure HF-A11x module send data to user device procedure)

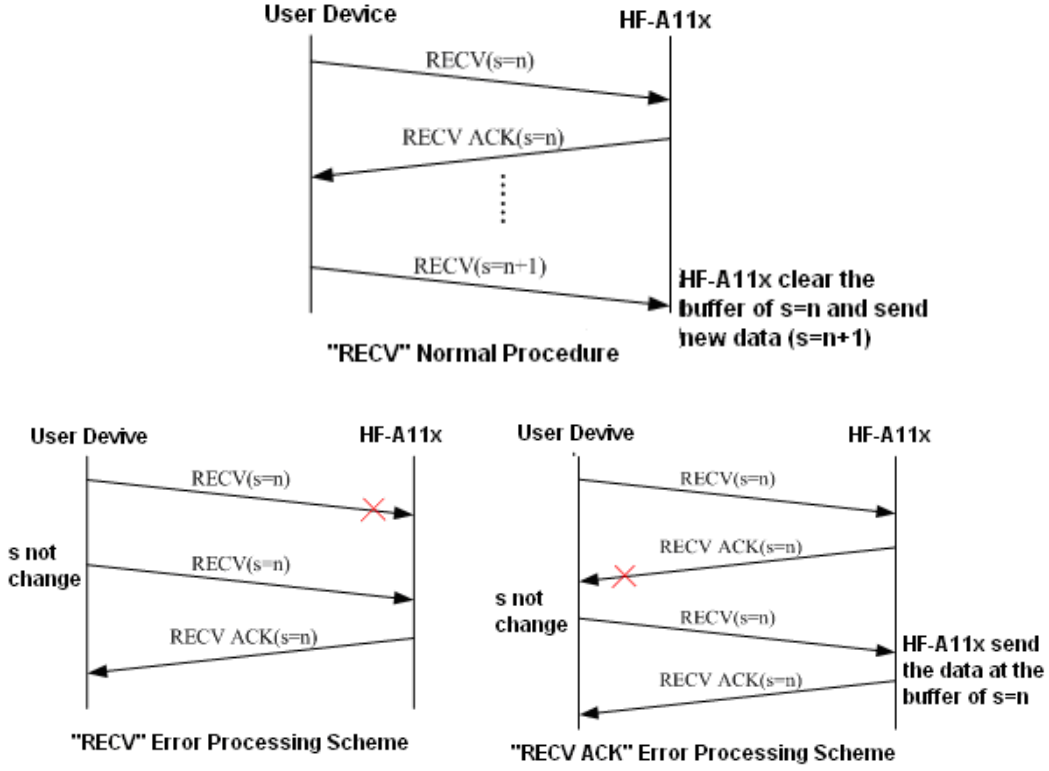


Figure 13. HF-A11x Module Send Data to User Device Procedure

1.4.2.3. Agreement Transmission CRC Arithmetic

CRC aarithmetic C language reference code as following:

```
u16 calc_sum(void *data, u32 len)
```

```
{
    u32 cksum=0;

    u16 *p=data;
    while (len > 1)
    {
        cksum += *p++;
        len -=2;
    }
    if (len)
    {
        cksum += *(u8 *)p;
    }
    cksum = (cksum >> 16) + (cksum & 0xffff);
    cksum += (cksum >>16);
    return ~cksum;
}
```

1.4.3. Configuration Mode

In configuration mode, user can finish HF-A11x module configuration management and parameters setting work. In work mode (Transparent Transmission or Agreement Transmission), user can switch to the configuration mode through AT+instruction, detailed switch operation refer to “AT+ instruction set” chapter.

1.4.4. Multi-TCP Link Connection

When HF-A11x module configured as TCP Server, it supports Multi-TCP link connection, and maximum 32 TCP clients permit to connect to HF-A11x 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 transmition structure as following figure:

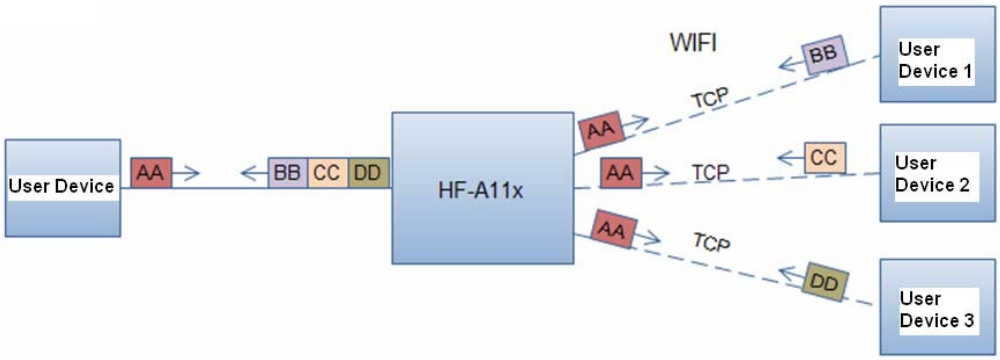


Figure 14. Multi-TCP Link Data Transmition Structure

1.4.5. Palmodic Signal

Base on selected factory default setting, nReady signal can have two output statuses:

- Status One: The module will output “0” after normal boot up. This signal used to judge if module finish boot up and ready for application.
- Status Two: The module will output “Palmodic Signal” after normal boot up.The palmodic signal is 0.5Hz square wave with dutyfactor 1:1. User can query this signal to judge if moduleis active “live” or need to re-boot. When module switches to command mode, it will output “0”, which used to distinguish work mode and command mode.

Notes:

This function is user selected factory setting and RELD instruction will not effective for this function. If user not requires this function, the default factory setting is Status One. Contact with Hi-flying for more detailed support.

2. FUNCTIONAL DESCRIPTION

2.1. Wireless Networking

HF-A11x module can be configured as both wireless STA and AP base on network type. Logically there are two interfaces in HF-A11x. One is for STA, and another is for AP. When HF-A11x works as AP, other STA equipments are able to connect to wireless LAN via HF-A11x module. Wireless Networking with HF-A11x is very flexible.
Following figure shows the functional architecture of HF-A11x module:

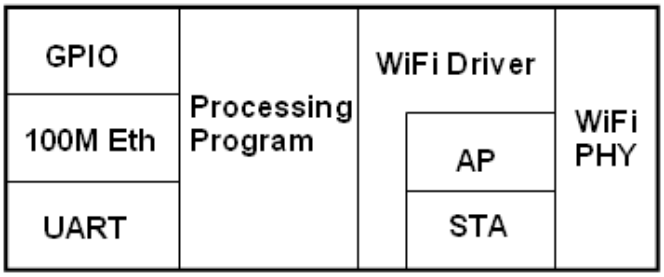


Figure 15. HF-A11x Functional Architecture

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.

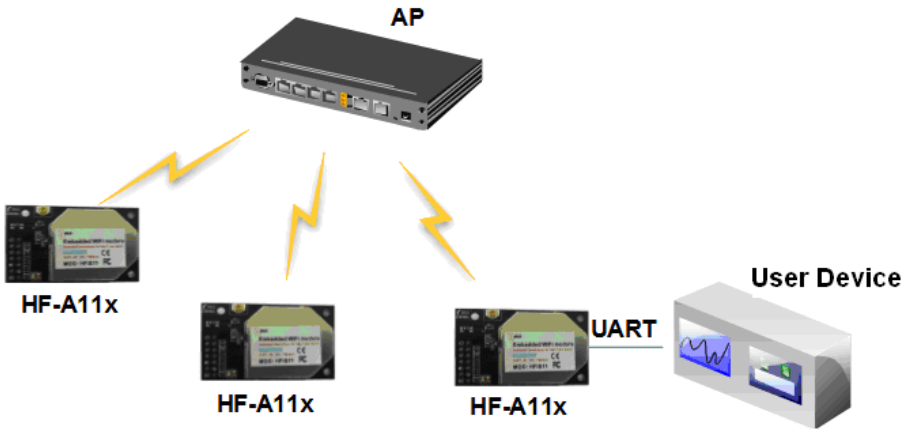


Figure 16. HF-A11x Basic Wireless Network Structure

2.1.2. Wireless Network Based On Adhoc Network (Adhoc)

Adhoc: It's also called independent basic service set, and it's built by two or more STAs without

AP, this type of network is a loose structure, all the STAs in the network can communicate directly.

As showing in the figure below, HF-A11x (1) can be treat as an AP, and HF-A11x (2), HF-A11x (3) and the laptop are STAs connected to HF-A11x (1). Meanwhile, all HF-A11x modules can connected to user device via UART interface. All HF-A11x modules can be operated and managed through the laptop. So it is convenient to O&M all HF-A11x modules. Moreover, in such Adhoc network structure, the whole coverage of a wireless network can be extended easily.

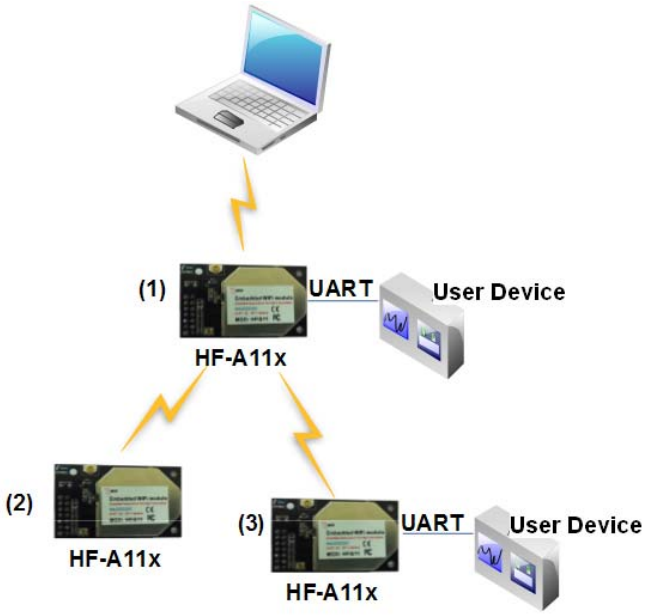


Figure 17. HF-A11x Adhoc Network Structure

2.2. Security

HF-A11x module supports multiple wireless encryption mechanisms, and enables to protect the security of user's data transmission, the mechanisms include:

- WEP
- WAP-PSK/TKIP
- WAP-PSK/AES
- WAP2-PSK/TKIP
- WPA2-PSK/AES

2.3. Multi-SSID with STA

HF-A11x support Multi-SSID when works at STA mode. Module can set maximum 3 AP's SSID. After modoule boot-up, it will auto search 1st SSID and try to connect with this AP. If 1st SSID can't link, it will search 2nd SSID, and then 3rd SSID, until successful connected with one AP.

Module will query link status every 5 second when try to connect to dedicate AP. For each SSID, user can set different encryption method.If this function is open, user can set different SSID through web page, "STA Interface Setting Page".

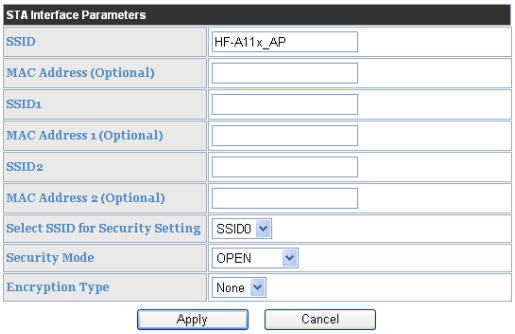


Figure 18. Multi-SSID with STA

Notes:
This function is user selected factory setting and RELD instruction will not effective for this function. If user not requires this function, the default factory setting is support one SSID when works at STA mode. Contact with Hi-flying for more detailed support.

2.4. UART Auto-Frame

HF-A11x 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.

2.5. Address Binding

HF-A11x module supports the feature of binding the BSSID address of target network. According to the provisions of 802.11 protocol, different wireless networks can have a same network name (i.e. SSID / ESSID), but must correspond to a unique BSSID address (i.e. MAC address). Illegal intruders can create a wireless network with the same SSID / ESSID, it will make STAs in the network to join to the illegal AP, thereby and then network leakage happen.

Users can prevent STA from joining to illegal network by binding the BSSID address, to improve wireless network security.

2.6. Ethernet Interface Communication

HF-A11x module provides one 10/100M Ethernet interface. With this Ethernet interface, user can easily realize the three interface (WiFi, UART, and Ethernet) intercommunication and networking. HF-A11x module can configured as **Bridge Mode** or **Router Mode** base on different networking technology.

Notes: For different networking requirement, HF-A11x may need different firmware to support this function (Such as "N-Ver" and "Z-Ver" as following, which need customized firmware as

customer detailed requirement). So, please contact with High-Flying technical support interface to know more about Ethernet interface networking application.

2.6.1. HF-A11x Ethernet Interface Networking (As AP)

Figure 19. HF-A11x Ethernet Interface Networking (As AP)

For above networking, HF-A11x module works as AP and also the centre of this network. All devices' IP address in this network shall use the same network segment with HF-A11x and they can intercommunication with this method.

2.6.2. HF-A11x Ethernet Interface Networking (As STA, N-Ver)

Figure 20. HF-A11x Ethernet Interface Networking (As STA, N-Ver)

For above networking, HF-A11x module works as STA（Firmware is N-Version）,and module configured as router mode. When module connect to AP, it will get wireless port IP address from AP（For example: 192.168.1.100）.At the same time, module also form a subnet（Default 10.10.100.254）and all devices connected to module Ethernet interface will get assigned IP address（For example: 10.10.100.101）.So for above networking, PC1 at internal subnet can initiate a connection to PC2 (For HF-A11x works as router mode), but PC2 can't active initiate a connection to PC1.

2.6.3. HF-A11x Ethernet Interface Networking (As STA, Z-Ver)

Figure 21. HF-A11x Ethernet Interface Networking (As STA, Z-Ver)

For above networking, HF-A11x module works as STA（Firmware is Z-Version）,and module configured as bridge mode. When module connect to AP, all devices connected to module Ethernet interface will get assigned IP address from AP (For example: 192.168.1.101).For module works as bridge mode, it can be treated as a transparent device and PC1, PC2 can communicate without any limit. But in this networking, HF-A11x module needs assign a static LAN IP address (For example: 192.168.1.10) if module also needs communication with AP or configuration through web page.

2.7. Work Mode

HF-A11x modules provide two kinds of work mode: Transparent transmission mode and Agreement Transmission mode. Transparent transmission mode achieves a plug and play serial data port, and reduces user complexity. Agreement Transmission mode can keep 100% accurate data transmitting. User can configure dedicated work mode base on actual requirement, and save the configuration information to the flash of HF-A11x, then module will go into the appointed work mode after power up.

For a module which already finished parameters setting, it will try to connect a wireless network and server with these parameters after power up, and serial interface is also active with pre-configured parameters. Then all the data is transferred directly between serial interface and Wifi interface without any interpreted.

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
- **Work Mode Selection**
  - Transparent transmission or Agreement Transmission mode

Transparent transmission demo as showing in the following figure, a HF-A11x module can be taken as a virtual serial line when UART interface working in transparent transmission mode. And user device will realize wireless data transmition almost without any changes.

Figure 22. HF-A11x Transparent Transmission Demo

2.8. Network Protocol

HF-A11x module supports TCP/UDP network protocol and the port parameters can be set via web accessing or AT+instruction set.

2.9. Parameters Configuration

HF-A11x 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-A11x 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.

Notes:

High-Flying can customized the parameters setting as customer request and ship HF-A11x modules with these parameters as factory default configuration. It will reduce user’s module configuration time for mass production. Also, if user need different parameters setting for every module, High-Flying can provide the **auto-configuration tool** to speed up the module conguration duration. Please contact High-Flying technical interface to acquire this tool if required.

2.10. Firmware Upgrade

HF-A11x module supports firmware upgrade online; User can upgrade firmware via web access.

2.11. GPIO Function

HF-A11x module can provide maximum 7 GPIO pins, Refer to “1.2.1 Pin Definition” charter, which include 4 UART pins and 3 general use 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.

3. OPERATION GUIDELINE

3.1. Configuration via Web Accessing

When first use HF-A11x modules, user may need some configuration. User can connect to HF-A11x module's wireless interface with following default setting information and configure the module through laptop.

Table 4 HF-A11x Web Access Default Setting

Parameters	Default Setting
SSID	HF-A11x_AP
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-A11_AP" of HF-A11x 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 23. Open Web Management page

The HF-A11x 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 five pages: "Mode Selection"," AP Interface Setting","STA Interface Setting","Application Setting", and "Device Management"

Notes:
Default, High-Flying suggests all Web management related operation shall execute at AP mode. (Even you need configure STA parameters and want module works as STA mode). If user selects STA mode and still want to configurate the module through Web browser, you have to access the module through another AP (and get the module IP address through this AP.)

3.1.2. Mode Selection Page

This page use to setting the module working mode (Transparent Transmission or Agreement Transmission) and wireless networking mode (AP and STA mode).

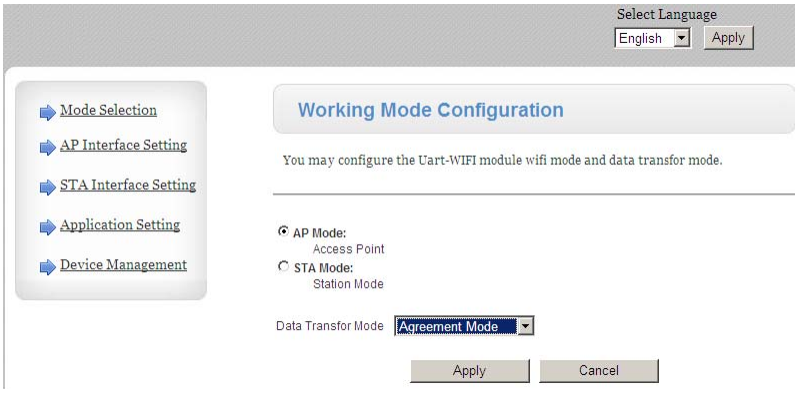


Figure 24. Mode Selection Page

3.1.3. AP Interface Setting Page

This page use to setting the parameters when HF-A11x module works as AP.

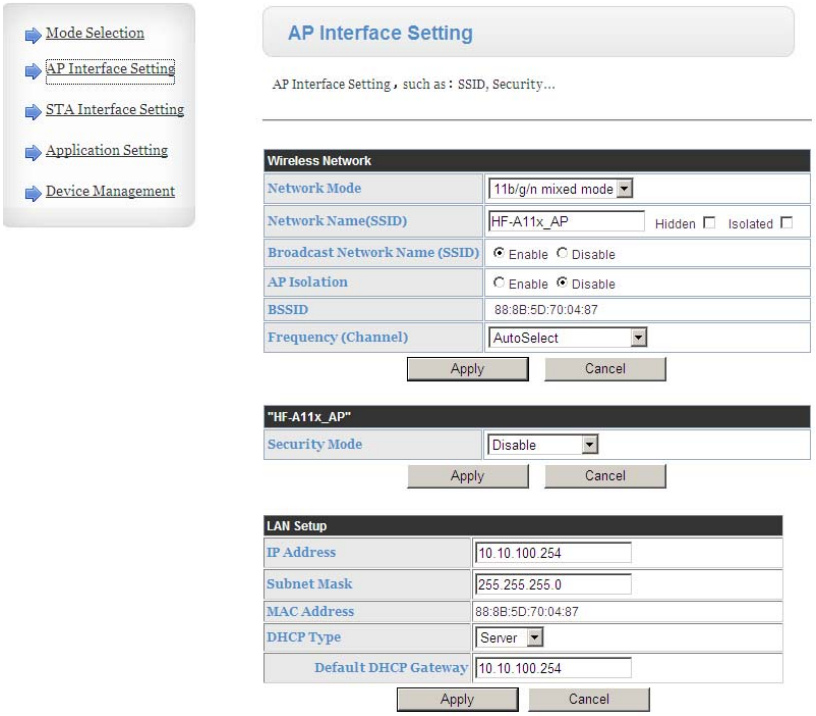


Figure 25. AP Interface Setting Page

3.1.4. STA Interface Setting Page

This page use to setting the parameters when HF-A11x module works as STA.
Such as SSID of AP which module need to connected, and also select the networking type: DHCP or static IP address.

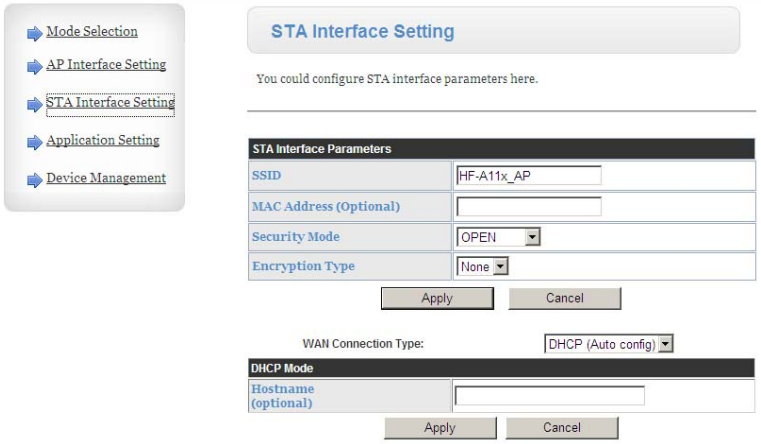


Figure 26. STA Interface Setting Page

3.1.5. Application Setting Page

This page use to setting the parameters of serial port communication, such as UART setting and high layer network protocol setting which used support serial communication.

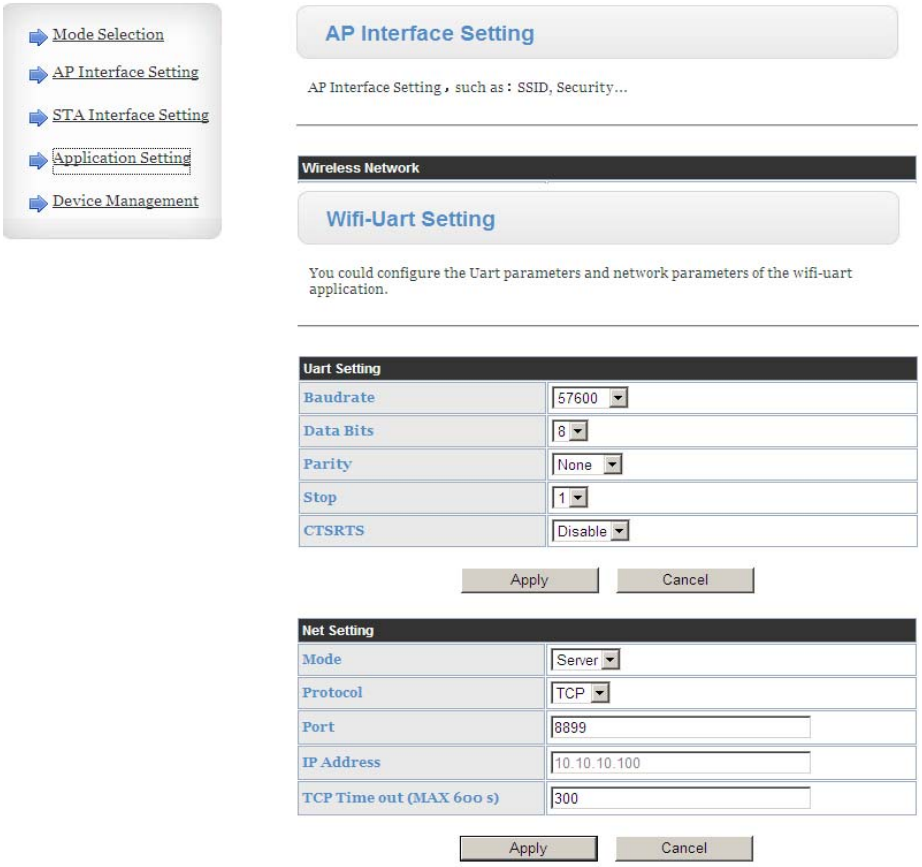


Figure 27. Application Setting Page

Notes:

Generally, Network protocols support three modes: **TCP Server**, **TCP Client**, **and UDP**. UDP has no server and client requirement according to standard.

Besides module working as TCP Server (IP address not required in this mode). User must set the IP address of the device which need communicate with HF-A11x module.

Also the Port ID between two sides of the communication devices must keep the same.

3.1.6. Device Management Page

This page use to manage HF-A11x module general setting, such as administrator setting, restart module button, restore factory default setting button, and update firmware through webpage.

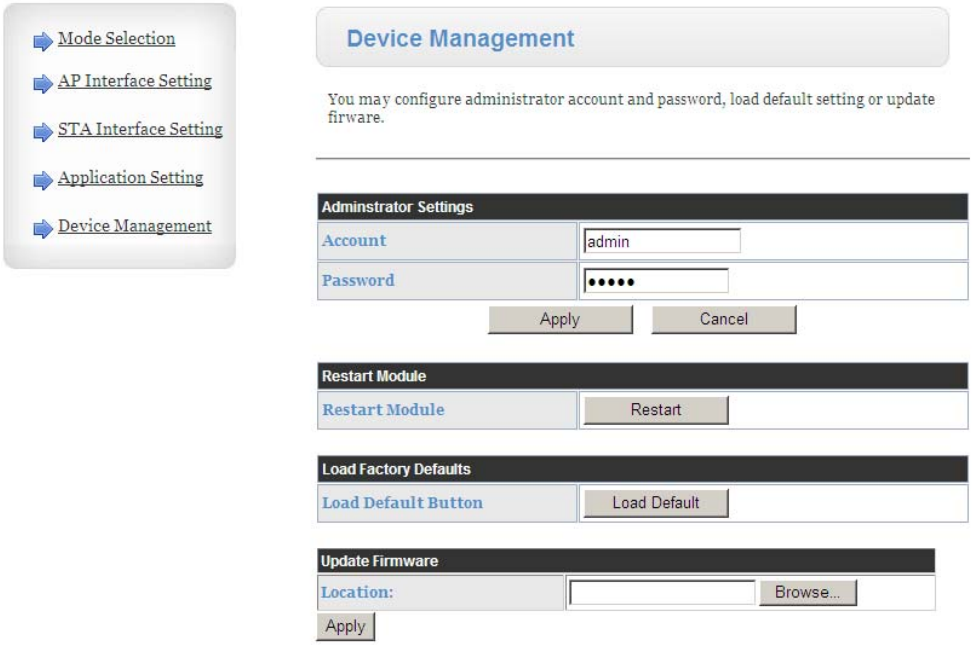


Figure 28. Device Management Page

Notes:

Restart module button: When you setting the parameters of different web pages, you will click “Apply” button to confirm the setting, but the setting take effect only after user click the “Restart” button here, the module will re-boot up and reflash the memory information with new changes.

3.2. HF-A11x Usage Introduction

3.2.1. Software Debug Tools

High-Flying use two common software tools debugging and applying HF-A11x modules. (User can also select other tools used to debug serial and Ethernet port).

- Serial Debugging Software: ComTools 

- Ethernet Debugging Software: TCPUDPDbg 

3.2.2. Network Connection

User can select two methods to connect HF-A11x module base on dedicated application.

- **Use HF-A11x STA interface**

HF-A11x and debug PC2 connect to a wireless AP, another PC1 (or user device) connect to HF-A11x module with serial port:

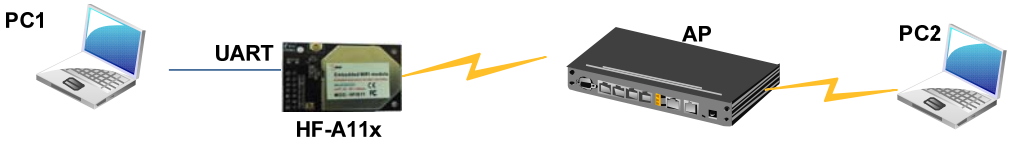


Figure 29. STA Interface Debug Connection

- **Use HF-A11x AP interface**

Debug PC2 connect to HF-A11x through wireless connection, another PC1 (or user device) connect to HF-A11x module with serial port.

Figure 30. AP Interface Debug Connection

3.2.3. Module Debug

PC1 open “CommTools” program, setting the same serial port parameters with HF-A11x module and open serial port connection.

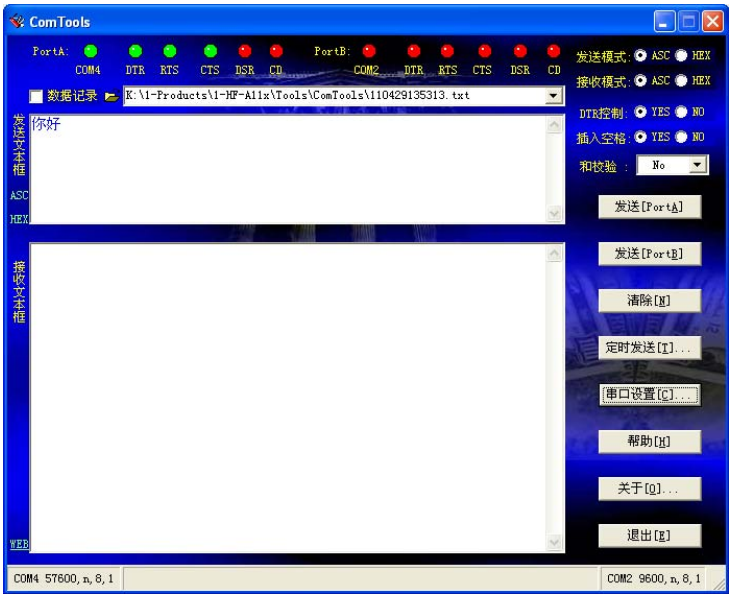


Figure 31. “CommTools” Serial Debug Tools

PC2 open “TCPUDPDbg” program, and create a new connection. If HF-A11x configured as Server mode, “TCPUDPDbg” Tools shall create “Client “mode connection. Or otherwise, create a “Server” mode connection.

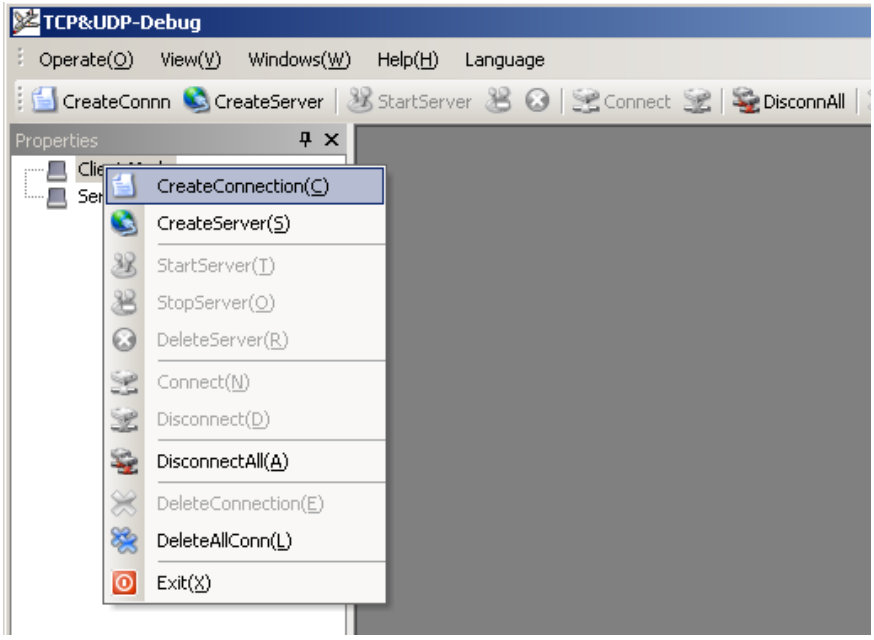


Figure 32. “TCPUDPDbg” Tools Create Connection

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

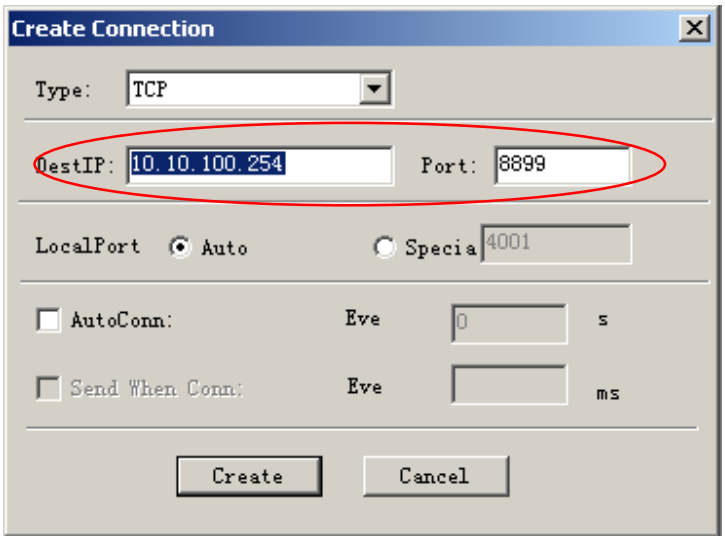


Figure 33. “TCPUDPDbg” Tools Setting

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

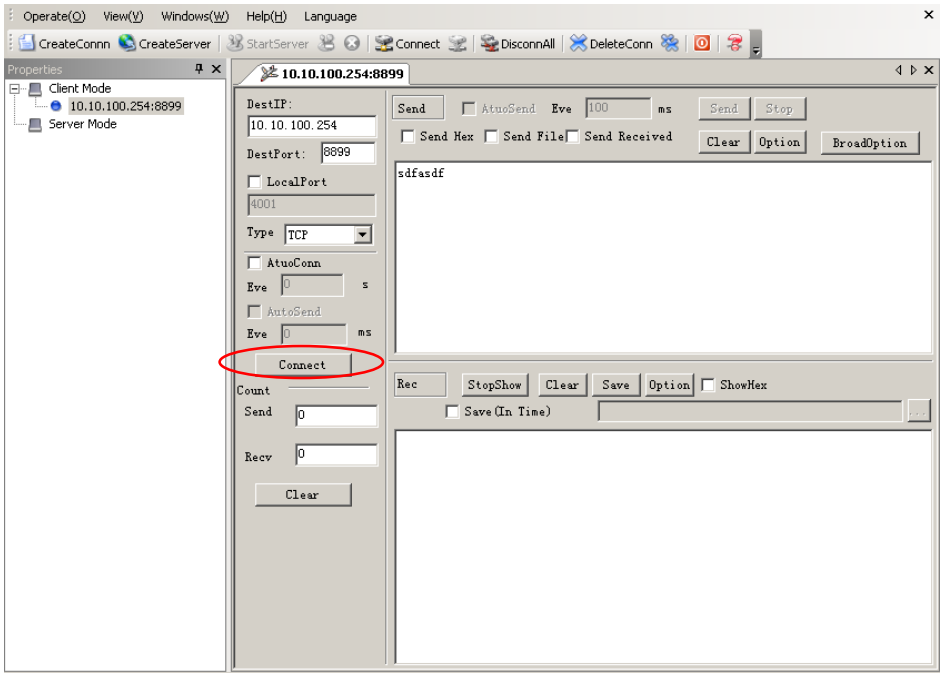


Figure 34. "TCPUDPDbg" Tools Connection

Now, in transparent transmission mode (HF-A11x default setting), 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 35. Wireless Control Application

For this wireless control application, HF-A11x 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-A11x module.

3.3.2. Remote Management Application

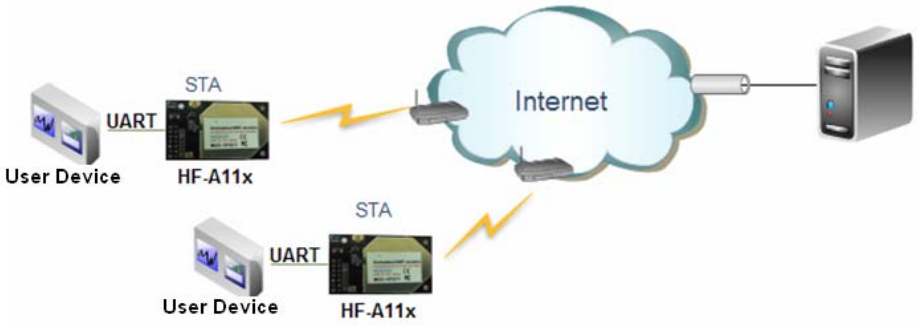


Figure 36. Remote Management Application

For this remote management application, HF-A11x 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-A11x modules connect as below figures to build up a transparent serial port connection.

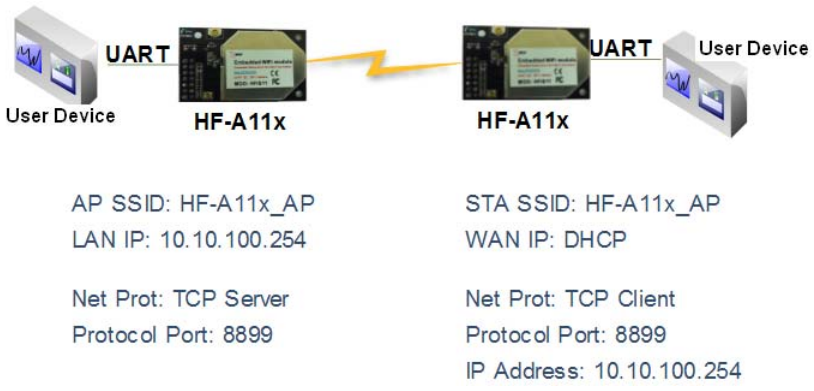


Figure 37. Transparent Serial Port Application

For left side HF-A11x module, configured as AP mode and use default SSID and IP address, network protocol configured as TCP/Server mode, and protocol port ID: 8899.

For right side HF-A11x module, configured as STA mode and setting the same SSID （"HF-A11x_AP" for this example）with left side HF-A11x module, enable DHCP network and network protocol configured as TCP/Client mode, protocol port ID: 8899. Target IP address part setting the same IP address with left side HF-A11x module ("10.10.100.254" for this example).

When right side HF-A11x boot up, it will find wireless AP (SSID：HF-A11x_AP for this example) and open TCP/Client network protocol to connect with left side module's TCP/Server. All these operation will be automatic and after finished, the two user devices connected to HF-A11x

module through serial port can communicate each other and think the connection between them is fully transparent.

3.3.4. Wireless Data Acquisition Card Application

For this wireless data acquisition card application, one PC works as data server and every data acquisition card connects with a HF-A11x module to support wireless connection function.

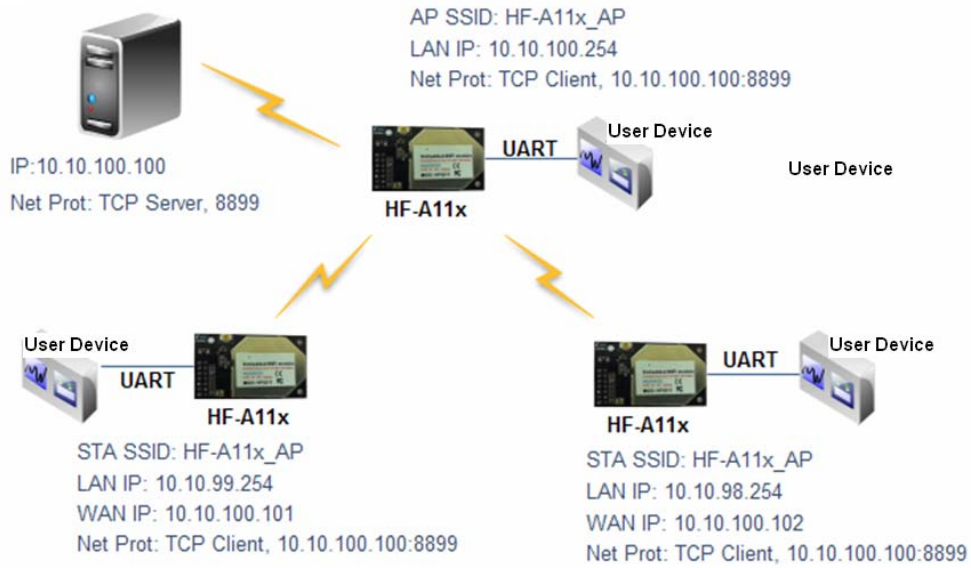


Figure 38. Wireless Data Acquisition Card Application

As above figure, one HF-A11x configured as AP mode and all others configured as STA mode. All HF-A11x which configured as STA and data server PC wireless connected to HF-A11x which configured as AP to make up a wires network.

Data server PC open TCP/Server protocol and all HF-A11x modules open TCP/Client protocol. All data acquisition cards' data and sampling information can be transmitted to data server PC for operation.

4. AT+INSTRUCTION INTRODUCTION

4.1. Configuration Mode

When HF-A11x power up, it will default works as transparent transmission mode, then user can switch to configuration mode by serial port command. HF-A11x UART default parameters setting as below figure,

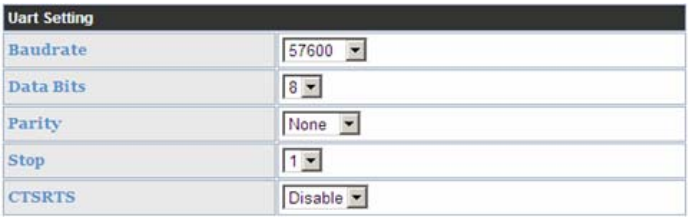


Figure 39. HF-A11x Default UART Port Parameters

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.**

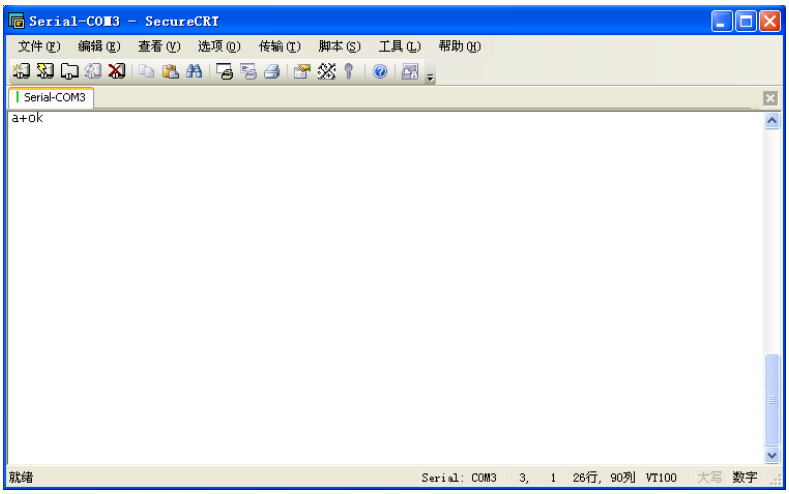


Figure 40. Switch to Configuration Mode

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.

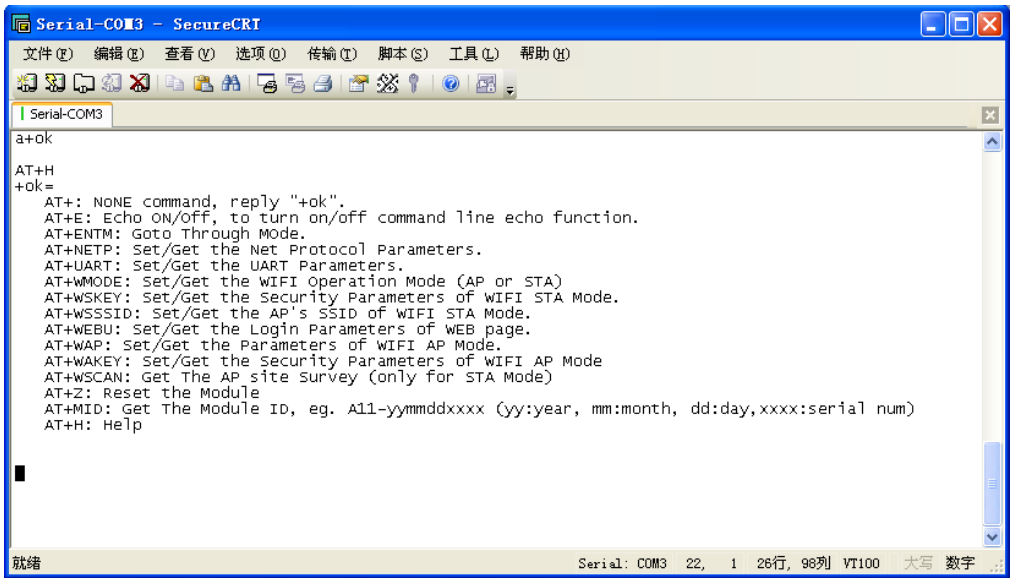


Figure 41. ”AT+H” Instruction for Help

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>: ASCIII 0x0a;

➢ **Error Code**

Table 5 Error Code DescribtionHF-A11x Web Access Default Setting

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 6 AT+ Instruction Set List

Instruction	Description
<null>	NULL
E	Open/Close show back function
ENTM	Set module into transparent transmition mode
NETP	Set/Query network protocol parameters
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
TMODE	Set/Query data transmition mode (transparent transmition or agreement transmition)
WMODE	Set/Query WIFI work mode (AP or STA)
WSKEY	Set/Query WIFI security parameters as STA
WSSSID	Set/Query WIFI target AP SSID parameters as STA
WSLK	Query WiFi link status as STA
WSLQ	Query WiFi signal strength as STA
WEBU	Set/Query WEB page login parameters (User Name and Password)
WAP	Set/Query WIFI parameters as AP
WAKEY	Set/Query WIFI security parameters as AP
MSLP	Set modules into power save mode.(Turn OFF WiFi)
WSCAN	Seek AP when module works as STA mode
TCPLK	Query if TCP link already build-up
WANN	Set/Query WAN setting, only effective as STA mode
LANN	Set/Query LAN setting, only effective as AP mode
DHCPGW	Set/Query DHCP gateway address
TCPTO	Set/Query TCP timeout

MAXSK	Set/Query maxima TCP connection
EPHY	Open/Close ETH interface
RELD	Restore to factory default setting
Z	Re-start module
MID	Query module ID information
VER	Query module software version information
H	Help

Notes: HF-A11x module can works as AP or STA, user have to use different AT+ Instruction to set WiFi parameters when module works as AP or STA mode.

4.2.2.1. AT+E

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

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

When HF-A11x 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+ENTM

- Function: Set module into transparent transmition mode;
- Format:

AT+ENTM<CR>
+ok<CR>< LF ><CR>< LF >

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

4.2.2.3. 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

After HF-A11x module boots up again, the setting will be effective.

4.2.2.4. AT+UART

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

AT+UART<CR>
+ok=<baudrate,data_bits,stop_bit,parity,flowctrl><CR>< LF ><CR>< LF >

  - Set Operation

AT+UART=<baudrate,data_bits,stop_bit,parity><CR>
+ok<CR>< LF ><CR>< LF >

- Parameters:
  - baudrate:
    - 50,75,110,134,150,200,300,600,1200,1800,2400,4800,9600,19200,38400,57600,115200
  - data_bits:
    - 5,6,7,8
  - stop_bits:
    - 1,2
  - parity:
    - NONE,EVEN,ODD,MARK,SPACE
  - flowctrl：hardware flow control (CTSRTS)
    - NFC: No flow control
    - FC: flow control

After HF-A11x module boots up again, the setting will be effective.

4.2.2.5. 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;

4.2.2.6. 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

4.2.2.7. 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 64 ~4096; Unit: byte. Auto-frame trigger length;

4.2.2.8. AT+TMODE

- Function: Set/Query data transmition 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 transmition mode
    - Through: Transparent transmition
    - Agreement: Agreement transmition

After HF-A11x module boots up again, the setting will be effective.

4.2.2.9. 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:WIFI work mode
    - AP
    - STA

After HF-A11x module boots up again, the setting will be effective.

4.2.2.10. AT+WSKEY

- Function: Set/Query WIFI security parameters as STA;
- 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
  - encry:Encryption algorithm

- ✧ NONE: When “auth=OPEN”, effective
- ✧ WEP: When “auth=OPEN” or “SHARED”, effective
- ✧ TKIP: When ”auth= WPAPSK”, effective
- ✧ AES: When “auth= WPAPSK”, effective

◆ key: password, ASCII code, shall less than 64 bit and greater than 8bit

This Instruction only effective for HF-A11x works as STA. After HF-A11x module boots up again, the setting will be effective. But user can set this command when module configured as AP.

4.2.2.11. AT+WSSSID

- Function: Set/Query WIFI target AP SSID parameters as STA.
- 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

This Instruction only effective for HF-A11x works as STA. After HF-A11x module boots up again, the setting will be effective. But user can set this command when module configured as AP.

4.2.2.12. AT+ WSLK

- Function: Query WiFi link status as STA
- 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;

This Instruction only effective for HF-A11x works as STA. After HF-A11x module boots up again, the setting will be effective. But user can set this command when module configured as AP.

4.2.2.13. AT+ WSLQ

- Function: Query WiFi signal strength as STA
- 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;

This Instruction only effective for HF-A11x works as STA. After HF-A11x module boots up again, the setting will be effective. But user can set this command when module configured as AP.

4.2.2.14. AT+WEBU

- Function: Set/Query WEB page login parameters;
- Format:
  - ◆ Query Operation

AT+WEBU<CR>
+ok=<usr,password><CR>< LF ><CR>< LF >

- Set Operation

AT+ WEBU=< usr,password ><CR>
+ok<CR>< LF ><CR>< LF >

- Parameters:
  - usr: User name for WEB page access;
  - password：Password for WEB page access;

4.2.2.15. AT+WAP

- Function: Set/Query WIFI parameters as AP;
- 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: WiFi protocols
    - 11BG
    - 11B
    - 11G
    - 11BGN
    - 11N
  - ssid: SSID when module works as AP;
  - channel: WIFI channel selection
    - AUTO
    - CH1~CH14

This Instruction only effective for HF-A11x works as AP. After HF-A11x module boots up again, the setting will be effective. But user can set this command when module configured as STA.

4.2.2.16. AT+WAKEY

- Function: Set/Query WIFI security parameters as AP;
- Format:
  - Query Operation

AT+WAKEY<CR>
+ok=<auth,encry,key><CR>< LF ><CR>< LF >

- Set Operation

AT+ WAKEY=< auth,encry,key><CR>
+ok<CR>< LF ><CR>< LF >

- Parameters:
  - auth: Authentication mode
    - OPEN
    - SHARED
    - WPAPSK
  - encry:Encryption algorithm
    - NONE: When “auth=OPEN”, effective;
    - WEP: When “auth=OPEN”, effective or “SHARED”, effective;
    - TKIP: When “auth=WPAPSK”, effective;
    - AES:When “auth=WPAPSK”, effective;
    - TKIPAES:When “auth=WPAPSK”, effective;
  - key: password, ASCII code, shall less than 64 bit and greater than 8bit;

This Instruction only effective for HF-A11x works as AP. After HF-A11x module boots up again, the setting will be effective. But user can set this command when module configured as STA.

4.2.2.17. AT+MSLP

- Function: Set modules into power save mode.(Turn OFF WiFi);
- Format:
  - Query Operation

AT+ MSLP <CR>
+ok=<sta.><CR>< LF ><CR>< LF >

  - Set Operation

AT+ MSLP=<on/off><CR>
+ok<CR>< LF ><CR>< LF >

- Parameters:
  - When Query,sta reply if the module in sleep mode;
    - On - Module not in sleep mode (WiFi ON);
    - Off - Module in sleep mode(WiFi OFF);
  - When Set,
    - Off - Set module to sleep mode (WiFi OFF);
    - On - Set module to normal mode (WiFi ON);

When module go into sleep mode, user can input “AT+MSLP=on” to re-start the module and module go into transparent transmission mode.

4.2.2.18. AT+WSCAN

- Function: Seek AP when module works as STA mode;
- Format:

AT+ WSCAN<CR>
+ok=<ap_site><CR>< LF ><CR>< LF >

- Parameters:
  - ap_site: AP searched;

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+ WANN

- Function: Set/Query WAN setting, only effective as STA mode;
- 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: IP setting for WAN port
    - static: Static IP
    - DHCP: Dynamic IP
  - address: WAN port IP address;

- mask: WAN port subnet mask;
- gateway: WAN port gateway address;

This Instruction only effective for HF-A11x works as STA. After HF-A11x module boots up again, the setting will be effective. But user can set this command when module configured as AP.

4.2.2.21. AT+ LANN

- Function: Set/Query LAN setting, only effective as AP mode;
- Format:
  - Query Operation

AT+LANN<CR>
+ok=<address,mask ><CR>< LF ><CR>< LF >

  - Set Operation

AT+ LANN=<address,mask ><CR>
+ok<CR>< LF ><CR>< LF >

- Parameters:
  - address: LAN port IP address;
  - mask: LAN port subnet mask;

This Instruction only effective for HF-A11x works as AP. After HF-A11x module boots up again, the setting will be effective. But user can set this command when module configured as STA.

4.2.2.22. AT+ DHCPGW

- Function: Set/Query DHCP gateway address;
- Format:
  - Query Operation

AT+ DHCPGW<CR>
+ok=<address><CR>< LF ><CR>< LF >

  - Set Operation

AT+ DHCPGW=<address ><CR>
+ok<CR>< LF ><CR>< LF >

- Parameters:
  - address: DHCP gate address;

4.2.2.23. 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;

4.2.2.24. AT+ MAXSK

- Function: Set/Query maxima TCP connection;
- Format:
  - Query Operation

AT+ MAXSK<CR>
+ok=<num><CR>< LF ><CR>< LF >

  - Set Operation

AT+ MAXSK =<num ><CR>
+ok<CR>< LF ><CR>< LF >

- Parameters:
  - num: 1~32, default 32. maxima TCP connection;

When configure as TCP/Server, HF-a11x support maxime 32 TCP connections. If not require so much connection, user can resetting this parameters.

4.2.2.25. AT+EPHY

- Function: Open/Close ETH interface;
- Format:
  - Set Operation

AT+ EPHY=<on/off><CR>
+ok<CR>< LF ><CR>< LF >

- Parameters:
  - On/off
    - Off: Close Ethernet port function;
    - On: Open Ethernet port function;

Close module's Ethernet port function can reduce the power consumption. The default setting for HF-A11x is close Ethernet port function.

4.2.2.26. AT+RELD

- Function: Restore to factory default setting;
- Format:

AT+ RELD<CR>
+ok=rebooting…<CR>< LF ><CR>< LF >

This command restores the module to factory default setting, and then re-starts the module.

4.2.2.27. AT+Z

- Function: Re-start module;
- Format:

AT+ Z<CR>

4.2.2.28. 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;
    - A11-yymmddnnnn "yymmdd" date; "nnnn" serial number;

4.2.2.29. 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;

4.2.2.30. AT+H

- Function: Help;
- Format:

- Query Operation

AT+H<CR>
+ok=<commod help><CR>< LF ><CR>< LF >

- Parameters:
  - commod help: command introduction;

APPENDIX A: QUESTIONS AND ANSWERS

Q1: How to configure transparent serial port application (TCP protocol) with two HF-A11x modules?

- Network structure as below figure:
  - Module 1# Setting:
    - Works as AP mode; *--See "Mode Selection Page"*
    - LAN IP address: 10.10.100.254; *--See "AP Interface Setting Page"*
    - Network Protocal:TCP/Server, Port ID: 8899; *-- See "Application Setting Page"* (Module default setting);
  - Module 2# Setting:
    - Works as STA mode; --See "Mode Selection Page"
    - WAN connection type: DHCP or Static IP (For this example:10.10.100.100) *--See "STA Interface Setting Page"*
    - Network Protocal:TCP/Client, Port ID: 8899; Application IP address: Module 1#'s LAN IP address (10.10.100.254); *-- See "Application Setting Page"*
    - **Notes:** When module 2# works as STA mode, module's WiFi interface works as WAN port. Module's WAN IP address and LAN IP address shall be setting different segment. So, module 2#'s LAN IP address must change to other segment; (For this sample, we change to 10.10.99.254); *--See "AP Interface Setting Page"*

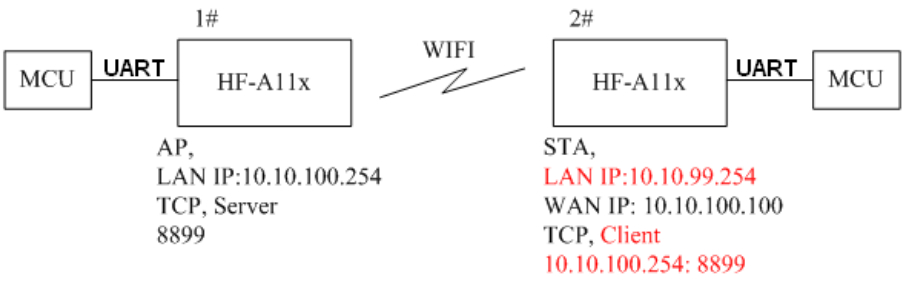


Figure 42. Configure Transparent Serial Port Connection (TCP)

Q2: Where to Set HF-A11x Module LAN IP and WAN IP through Web Page?

- HF-A11x Wireless LAN IP address setting see "AP Interface Setting Page" as below Figure,

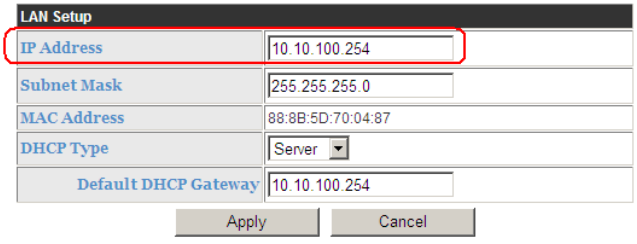


Figure 43. Module LAN IP Setting

- HF-A11x Wireless WAN IP address setting see "STA Interface Setting Page" as below Figure, User can set WAN connection type to DHCP and STATIC IP.

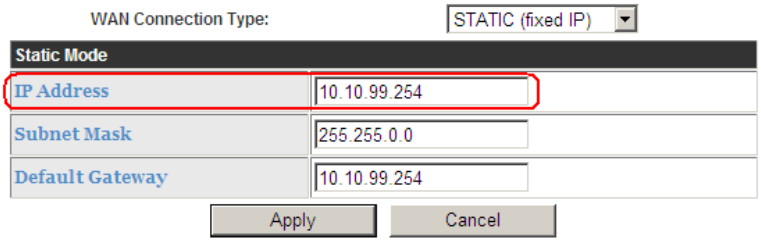


Figure 44. Module WAN IP Setting

Q3: How to configure transparent serial port application (UDP protocol) with two HF-A11x modules?

- Network structure as below figure:
  - Module 1# Setting:
    - Works as AP mode; *--See "Mode Selection Page"*
    - LAN IP address: 10.10.100.254; *--See "AP Interface Setting Page"*
    - Network Protocal:UDP, Port ID: 8899; Application IP address:10.10.100.100; *-- See "Application Setting Page"*
  - Module 2# Setting:
    - Works as STA mode; --See "Mode Selection Page"
    - WAN connection type: Static IP (10.10.100.100) *--See "STA Interface Setting Page"*
    - Network Protocal:UDP, Port ID: 8899; Application IP address: Module 1#'s LAN IP address (10.10.100.254); *-- See "Application Setting Page"*
    - LAN IP address: 10.10.99.254 (Different net segment with WAN port) *--See "AP Interface Setting Page"*

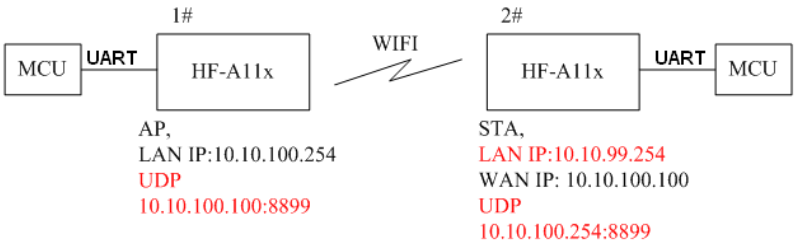


Figure 45. Configure Transparent Serial Port Connection (UDP)

Q4: Where to set HF-A11x module network protocol (TCP/UDP)?

- HF-A11x network protocol setting see "Application Setting Page" as below Figure,
  - Protocol: TCP Server
    - Only Port ID required: 8899 (Default)

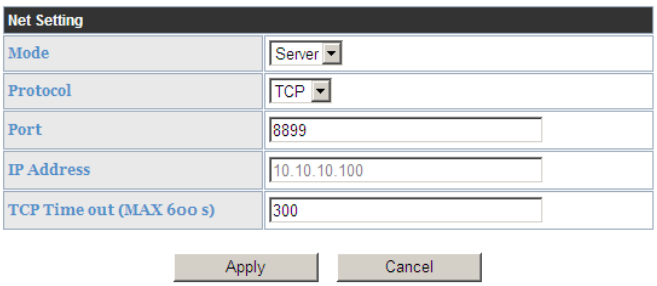


Figure 46. Module Network Protocols: TCP/Server

- Protocol: TCP Client
  - ✧ Application IP address required: it's target TCP server 's IP address;
  - ✧ Port ID required: 8899 (Default)

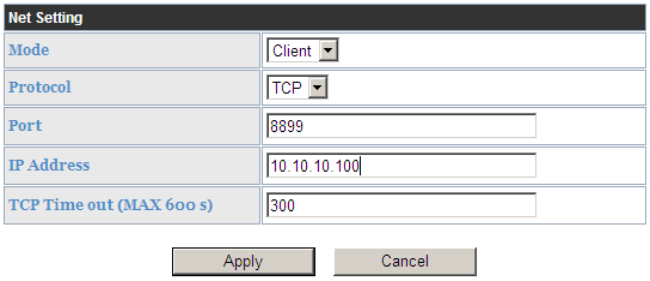


Figure 47. Module Network Protocol: TCP/Client

- Protocol: UDP
  - ✧ No Server/Client selection required;
  - ✧ Application IP address required: it's target device 's IP address;
  - ✧ Port ID required: 8899 (Default)

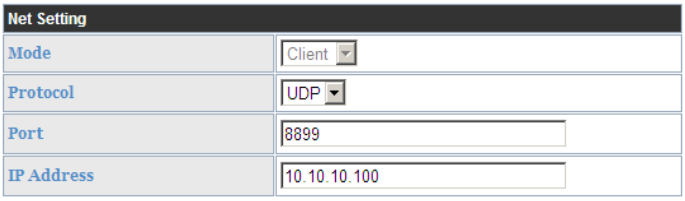


Figure 48. Module Network Protocol: UDP

Q5: How to configure transparent serial port application: Two HF-A11x modules all configured as STA and connection through AP?

- ➢ Network structure as below figure:
  - Module 1# Setting: (We use HF-A11x as AP for this example)
    - ✧ Works as AP mode and all default setting;
  - Module 2# Setting:
    - ✧ Works as STA mode; --See "Mode Selection Page"
    - ✧ WAN connection type: Static IP: 10.10.100.100; --*See "STA Interface Setting Page"*

- ✧ Network Protocal:TCP/Server, Port ID: 8899; -- *See "Application Setting Page"*
- ✧ LAN IP address: 10.10.99.254 (Different net segment with WAN port); *--See "AP Interface Setting Page"*

■ Module 3# Setting:
- ✧ Works as STA mode; --See "Mode Selection Page"
- ✧ WAN connection type: Static IP: 10.10.100.101; *--See "STA Interface Setting Page"*
- ✧ Network Protocal:TCP/Client, Port ID: 8899; Application IP address: Module 2#'s WAN IP address (10.10.100.100); *-- See "Application Setting Page"*
- ✧ LAN IP address: 10.10.98.254 (Different net segment with WAN port); *--See "AP Interface Setting Page"*

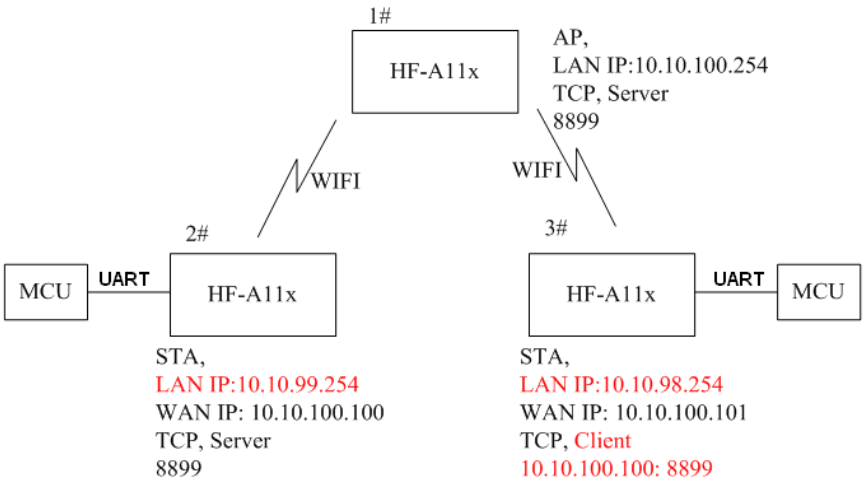


Figure 49. Two HF-A11x Modules Connection Through AP

Q6: How to avoid IP address confliction when apply HF-A11x module?

➢ The following address allocation method can avoid the IP address confliction for dynamic and static IP address mixed application.
- ■ Module dynamic IP address range from 100 to 200 for last IP address segment.
  - ✧ Such as default IP: 10.10.100.254. When module works as AP, the IP address module can allocate to STA is from 10.10.100.100 to 10.10.100.200;
- ■ So, if user needs to set static IP for dedicated STA internal network, the available IP address range can start from 10.10.100.1 to 10.10.100.99.

Q7: PC works as server, all HF-A11x modules works as data acquisition card and connect with PC, how to configure this application?

➢ Network structure as below figure: Three HF-A11x module setup 3 TCP links with PC server. Module 1# works as AP and all devices connect to module 1# through WiFi interface;
- ■ PC Setting:
  - ✧ IP address: 10.10.100.100;
  - ✧ Network Protocal:TCP/Server, Port ID: 8899;
- ■ Module 1# Setting:
  - ✧ Works as AP mode;
  - ✧ LAN IP address: 10.10.100.254;

- ✧ Network Protocal:TCP/Client, Port ID: 8899; Application IP address:10.10.100.100;

■ Module 2# Setting:
- ✧ Works as STA mode;
- ✧ WAN connection type: Static IP: 10.10.100.101;
- ✧ Network Protocal:TCP/Client, Port ID: 8899; Application IP address:10.10.100.100;
- ✧ LAN IP address: 10.10.99.254 (Different net segment with WAN port);

■ Module 3# Setting:
- ✧ Works as STA mode;
- ✧ WAN connection type: Static IP: 10.10.100.102;
- ✧ Network Protocal:TCP/Client, Port ID: 8899; Application IP address:10.10.100.100;
- ✧ LAN IP address: 10.10.98.254 (Different net segment with WAN port);

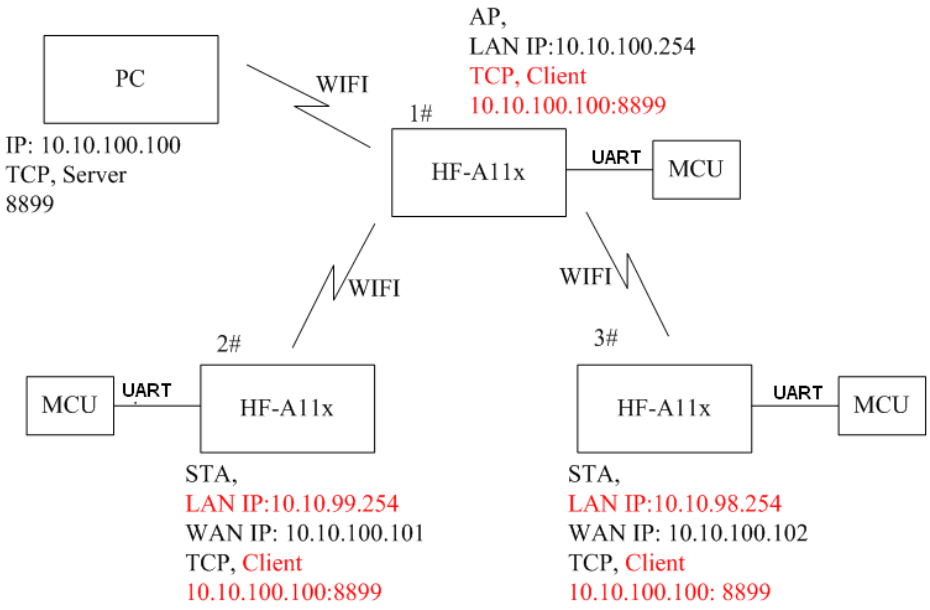


Figure 50. Wireless Data Acquisition Card Setting

APPENDIX B: USER DEVICE PSEUDO-CODE REFERENCE FOR AGREEMENT TRANSMITION MODE

```
#define MAX_DAT_BUF_LEN            1024
#define AGREE_HEAD_LEN              6
#define MAX_SEND_CMD_LEN MAX_ DAT_BUF_LEN+8
#define RECV_CMD_LEN AGREE_HEAD_LEN+2

// Define data structure
struct STRAGREE
{
    // SEND 命令
    unsigned char send_cmd[MAX_SEND_CMD_LEN];
    unsigned short send_len;
    unsigned char send_s;
    int waiting_4_send_ack;
    // RECV 命令
    unsigned char recv_cmd[RECV_CMD_LEN];
    unsigned short recv_len;
    unsigned char recv_s;
    int waiting_4_recv_ack;
} agree_data;


function do_send_ cmd()
    if (is_waiting_for_send_ack & is_timeout)
        send_cmd_out();
    else if (!is_waiting_for_send_ack)
{
        generate_new_send_cmd();
        send_cmd_out();
}
    else
        add waiting time;

function do_recv_cmd()
    if (is_waiting_for_recv_ack & is_timeout)
        recv_cmd_out();
    else if (!is_waiting_for_recv_ack)
{
        generate_new_recv_cmd();
        recv_cmd_out();
}
    else
        add waiting time;


function do_send_ack_cmd()
    if (receiv SEND ACK and check OK & is_waiting_for_send_ack)
    {
        agree_data.send_s++;
        agree_data. waiting_4_send_ack= 0;
}
```

```
else
        do nothing;

function do_recv_ack_cmd()
    if (receiv RECV ACK and check OK & is_waiting_for_recv_ack)
    {
        agree_data.recv_s++;
        agree_data. waiting_4_recv_ack= 0;
        to use the received data;
}
else
        do nothing;

function main()
……
char cmd;

init_agree_str();
init_pccom_port();
do
        if (read one byte from uart -> cmd)
        {
            if (cmd == 0x01)
                do_send_ack_cmd();
            else if (cmd == 0x02)
                do_recv_ack_cmd();
}
if (want_to_send_data | is_wait_for_send_ack)
            do_send_cmd();
if (want_to_recv_data | is_wait_for_recv_ack)
            do_recv_cmd();
while (…)
```

APPENDIX C: CONTACT INFORMATION

Address: No.456, B101, BiBo Road, PuDong, Shanghai, China, 201203
Web: www.hi-flying.com
Tel: 0086-21-33908861-8017, 0086-13916319365
Mail: sales@hi-flying.com, senxie@hi-flying.com

FCC RF EXPOSURE REQUIREMENTS

1 STANDARDS AND REGULATORY COMPLIANCE

1.1 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

1.2 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: AZYHF-A11X.

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: AZYHF-A11X" or "Contains FCC ID: AZYHF-A11X" 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.

1.3 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: AZYHF-A11X.

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.

1.4 **National Restrictions**

Annex 3 Band A **Wideband Data Transmission systems 2400.0-2483.5 MHz**	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	**1. SRD with FHSS modulation** 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 **2. SRD with DSSS and other than FHSS wideband modulation** 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