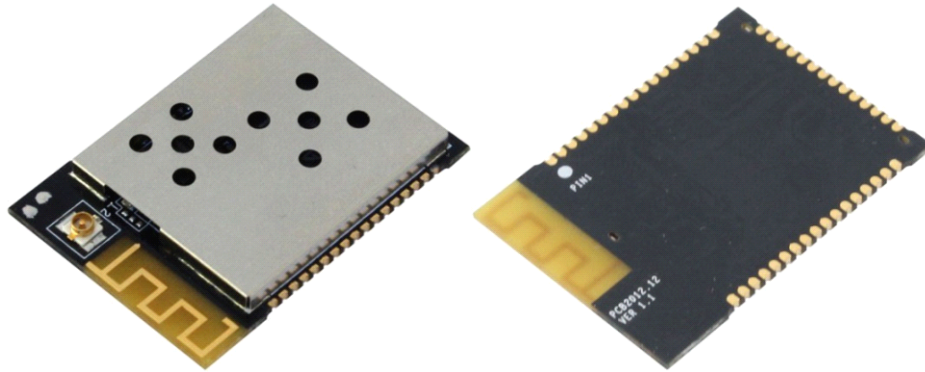


# tiLow Power WiFi Module User Manual

**(USR-WIFI232-G) V 1.3**



## Overview of Characteristic

- ✧ Support IEEE802.11b/g/n Wireless Standards
- ✧ Fully Self-Contained Serial-to-Wireless Functionality
- ✧ Ultra-Low-Power for Battery Applications with Excellent Power Save Scheme
- ✧ Support UART/SPI/USB/PWM/GPIO Data Communication Interface
- ✧ Support Work As STA/AP/AP+STA Mode
- ✧ Support Smart Link Function (APP program provide)
- ✧ Support Wireless and Remote Firmware Upgrade Function
- ✧ Support User-Defined Web Page Upload
- ✧ Support DNS to Open Webpage
- ✧ Support Internal/External Antenna Option
- ✧ Single +3.3V Power Supply
- ✧ Smallest Size: 23.1mm x 32.8mm x 2.7mm
- ✧ FCC/CE Certificated

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## HISTORY

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

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

**Ed. V1.2** 03-28-2013. Update AT command contents.

# 1. PRODUCT OVERVIEW

## 1.1. General Description

The USR-WIFI232-G is a fully self-contained small form-factor, single stream, 802.11b/g/n Wi-Fi module, which provide a wireless interface to any equipment with a Serial/SPI/USB interface for data transfer. USR-WIFI232-G 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.

USR-WIFI232-G support AP+STA wireless networking and support Wi-Fi Direct. USR-WIFI232-G also provides wireless and remote firmware upgrade, which satisfied all kinds of application requirement. USR-WIFI232-G support user defined Web page and can revise the data communication protocol, which reduce much customer's software development and customization work.

The USR-WIFI232-G employs the world's lowest power consumption embedded architecture. It has been optimized for all kinds of client applications in the home automation, smart grid, handheld device, personal medical application and industrial control that have lower data rates, and transmit or receive data on an infrequent basis.

The USR-WIFI232-G integrates all Wi-Fi functionality into a low-profile, 23.1x32.8x 2.7mm SMT module package that can be easily mounted on main PCB with application specific circuits. Also, module provides built-in antenna, external antenna option.

### 1.1.1 Device Features

- Single stream Wi-Fi @ 2.4 GHz with support for WEP security mode as well as WPA/WPA2
- Fully self-contained serial-to-wireless functionality.
- Ultra-low-power operation with all kinds of power-save modes.
- Includes all the protocol and configuration functions for Wi-Fi connectivity.
- Support STA/AP/AP+STA Mode
- Support Smart Link Function
- Support Wireless and Remote Firmware Upgrade Function
- Support User-Defined Web Page Upload
- Integrated chip antenna, antenna connector options.
- Compact surface mount module 23.1mm x 32.8mm x 2.7mm.
- Full IPv4 and IPv6 stack.
- Low power RTOS and drivers.
- FCC Certified.
- RoHS and CE compliant.
- Single supply - 3.3V operation.

### 1.1.2 Device Parameters

Table 1 USR-WIFI232-G Module Technical Specifications

| Class                      | Item                 | Parameters  |
|----------------------------|----------------------|---|
| <b>Wireless Parameters</b> | Certification        | FCC/CE  |
|                            | Wireless standard    | 802.11 b/g/n  |
|                            | Frequency range      | 2.412GHz-2.484GHz   |
|                            | Transmit Power       | 802.11b: +17.5 dBm (@11Mbps)  |
|                            |                      | 802.11g: +16 dBm (@54Mbps) for CE   |
|                            |                      | 802.11g: +13 dBm (@54Mbps) for FCC  |
|                            |                      | 802.11n: +16 dBm (@HT20, MCS7) for CE   |
|                            |                      | 802.11n: +12 dBm (@HT20, MCS7) for FCC  |
| <b>Hardware Parameters</b> | Data Interface       | 802.11b: -93 dBm (@11Mbps ,CCK)   |
|                            |                      | 802.11g: -85 dBm (@54Mbps, OFDM)  |
|                            |                      | 802.11n: -82 dBm (@HT20, MCS7)  |
|                            | Receiver Sensitivity | 802.11b: -93 dBm (@11Mbps ,CCK)   |
|                            | Antenna Option       | 802.11g: -85 dBm (@54Mbps, OFDM)  |
|                            |                      | 802.11n: -82 dBm (@HT20, MCS7)  |
|                            | Antenna Option       | External:I-PEX Connector  |
|                            |                      | Internal:On-board PCB antenna   |
| <b>Software Parameters</b> | Data Interface       | UART  |
|                            |                      | USB, SPI, PWM...  |
|                            |                      | Others: GPIO, ADC/DAC, RTC...   |
|                            | Operating Voltage    | 3.1~3.6V  |
|                            | Operating Current    | Peak [Continuous TX]: ~200mA<br>Normal [WiFi ON/OFF, DTIM=100ms]:<br>Average. ~8mA, Peak: 200mA<br>Standby [WiFi Shutdown]: <80uA |
|                            | Operating Temp.      | -40℃- 85℃   |
|                            | Storage Temp.        | -45℃- 125℃  |
| <b>Software Parameters</b> | Dimensions and Size  | 23.1mm×32.8mm×2.7mm   |
|                            | Network Type         | STA /AP/STA+AP  |
|                            | Security Mechanisms  | WEP/WPA-PSK/WPA2-PSK  |
|                            | Encryption           | WEP64/WEP128/TKIP/AES   |
|                            | Update Firmware      | Local Wireless, Remote  |
|                            | Customization        | Web Page Upgrade<br>Support SDK for application develop   |
|                            | Serial command       | AT+instruction set  |
|                            | Network Protocol     | IPv4, IPv6, TCP/UDP/FTP/HTTP  |
| <b>Software Parameters</b> | User Configuration   | AT+instruction set. Android/ iOS<br>Smart Link APP tools  |

### 1.1.3 Key Application

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



## 1.2. Hardware Introduction

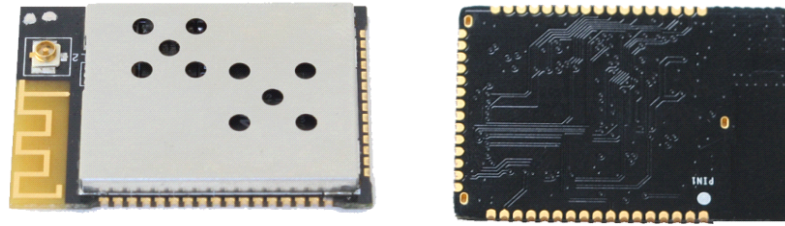


Figure 1. USR-WIFI232-G Demo

### 1.2.1. Pins Definition

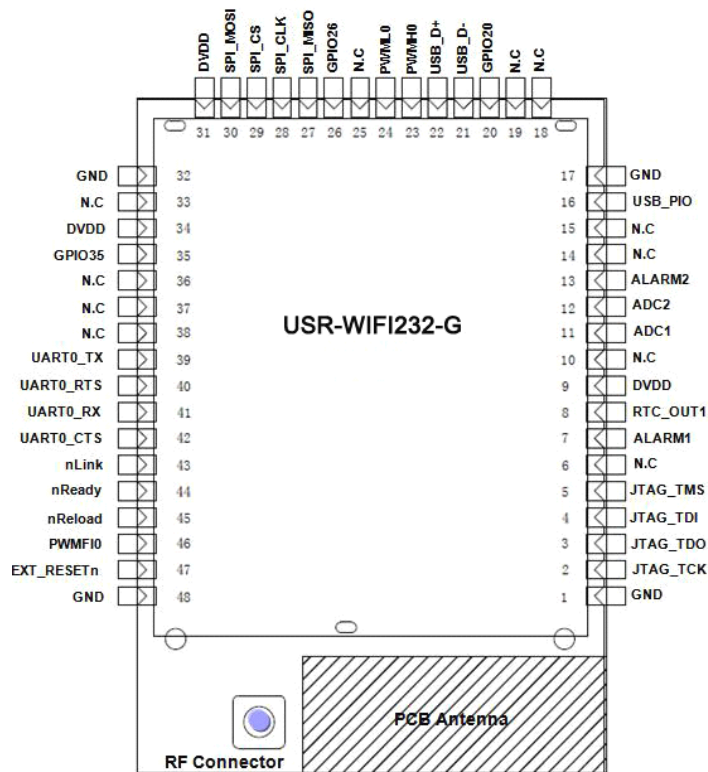


Figure 2. USR-WIFI232-G Pins Map

Table 2 USR-WIFI232-G Pins Definition

| Pin        | Description   | Net Name | Signal Type | Comments   |
|------------|---------------|----------|-------------|--|
| 1,17,32,48 | Ground        | GND      | Power       |  |
| 2          | JTAG Function | JTAG_TCK | I, PU       | JTAG/Debug functional pin,<br>No connect if not use. |
| 3          | JTAG Function | JTAG_TDO | O           |  |
| 4          | JTAG Function | JTAG_TDI | I,PU        |  |
| 5          | JTAG Function | JTAG_TMS | I,PU        |  |
| 6          |               | N.C      |             | No connect   |
| 7          | RTC Input 1   | ALARM1   | I.PD        | GPIO7, Sleep_RQ Pin                                  |

|    |                          |            |         |   |
|----|--------------------------|------------|---------|---|
|    |                          |            |         | (Suggest 50K ohm Pull up even not use this function.)   |
| 8  | RTC Output 1             | RTC_OUT1   | O       | GPIO8, Sleep_ON Pin   |
| 9  | +3.3V Power              | DVDD       | Power   |   |
| 10 |                          | N.C        |         | No connect  |
| 11 | A/D Input 1              | ADC1       | I/O,PD  | GPIO11, No connect if not use.  |
| 12 | A/D Input 2              | ADC2       | I/O,PD  | GPIO12, No connect if not use.  |
| 13 | RTC Input 2              | ALARM2     | I,PD    | GPIO13, No connect if not use.  |
| 14 |                          | N.C        |         | No connect  |
| 15 |                          | N.C        |         | No connect  |
| 16 | USB 5V Detect            | USB_PIO    | I/O     | GPIO16, No connect if not use.  |
| 18 |                          | N.C        |         | No connect  |
| 19 |                          | N.C        |         | No connect  |
| 20 | GPIO                     | GPIO20     | I/O,PD  | GPIO20, No connect if not use.  |
| 21 | USB Interface            | USB-       | I/O     | 90 ohm Diff. Line   |
| 22 | USB Interface            | USB+       | I/O     | 90 ohm Diff. Line   |
| 23 | PWM Output0+             | PWMH0      | O       | GPIO23, No connect if not use.  |
| 24 | PWM Output0-             | PWML0      | O       | GPIO24, No connect if not use.  |
| 25 |                          | N.C        |         | No connect  |
| 26 | GPIO                     | GPIO26     | I/O,PD  | GPIO26, No connect if not use.  |
| 27 | SPI Interface            | SPI_MISO   | I/O, PU | No connect if not use.  |
| 28 | SPI Interface            | SPI_CLK    | I/O, PU | No connect if not use.  |
| 29 | SPI Interface            | SPI_CS     | I/O,PU  | No connect if not use.  |
| 30 | SPI Interface            | SPI_MOSI   | I/O.PD  | No connect if not use.  |
| 31 | +3.3V Power              | DVDD       | Power   |   |
| 33 |                          | N.C        |         | No connect  |
| 34 | +3.3 Power               | DVDD       | Power   |   |
| 35 | GPIO                     | GPIO35     | I/O,PD  | GPIO35, WPS functional pin  |
| 36 |                          | N.C        |         | No connect  |
| 37 |                          | N.C        |         | No connect  |
| 38 |                          | N.C        |         | No connect  |
| 39 | UART0                    | UART0_TX   | O, PD   | UART Communication Pin  |
| 40 | UART0                    | UART0_RTS  | I/O,PD  | UART Pin (Or RS485 Control)   |
| 41 | UART0                    | UART0_RX   | I,PD    | UART Communication Pin  |
| 42 | UART0                    | UART0_CTS  | I/O, PD | UART Communication Pin  |
| 43 | Wi-Fi Status             | nLink      | O,PU    | “0”- Wi-Fi Linked<br>“1”- No WIFI Linked<br>No connect if not use.  |
| 44 | Module Boot Up Indicator | nReady     | O,PU    | “0” - Boot-up OK;<br>“1” - Boot-up No OK;<br>No connect if not use.;  |
| 45 | Restore Configuration    | nReload    | I,PU    | Module will restore factory default after set this pin “0” more than 1s, then set “1”.<br>(Suggest 50K ohm Pull up even not use this function.) |
| 46 | PWM Fault Input0         | PWMFI0     |         | GPIO46, No connect if not use.  |
| 47 | Module Reset             | EXT_RESETn | I,PU    | “Low” effective reset input.  |

### 1.2.2. Electrical Characteristics

Absolute Maximum Ratings:

| Parameter                       | Condition           | Min. | Typ. | Max. | Unit |
|---------------------------------|---------------------|------|------|------|------|
| Storage temperature range       |                     | -45  |      | 125  | °C   |
| Maximum soldering temperature   | IPC/JEDEC J-STD-020 |      |      | 260  | °C   |
| Supply voltage                  |                     | 0    |      | 3.8  | V    |
| Voltage on any I/O pin          |                     | 0    |      | 3.3  | V    |
| ESD (Human Body Model HBM)      | TAMB=25°C           |      |      | 2    | KV   |
| ESD (Charged Device Model, CDM) | TAMB=25°C           |      |      | 1    | KV   |

Power Supply & Power Consumption:

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

### 1.2.3. Mechanical Size

USR-WIFI232-G modules physical size (Unit: mm) as follows:

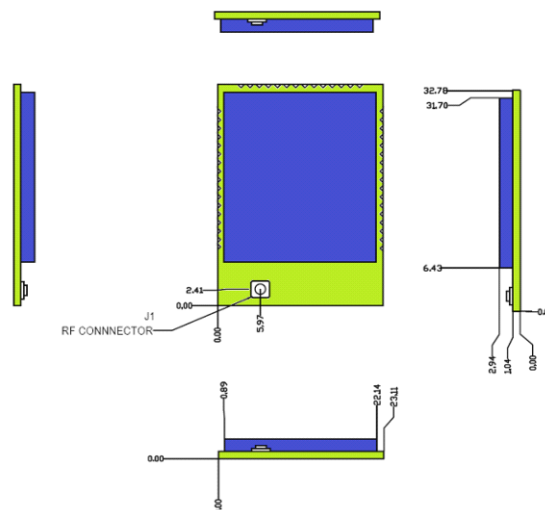


Figure 3. USR-WIFI232-G Mechanical Dimension

USR-WIFI232-G Module PCB symbol size (mm) as follows:

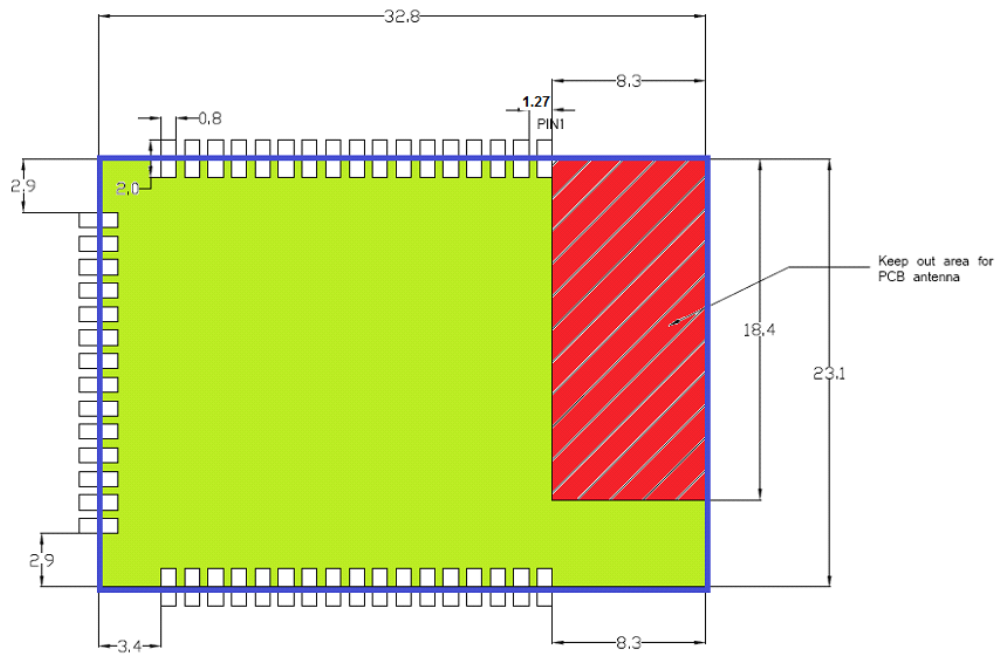


Figure 4. USR-WIFI232-G PCB Symbol Size

#### 1.2.4. On-board Chip Antenna

USR-WIFI232-G module support internal on-board chip antenna option. When customer select internal antenna, you shall comply with following antenna design rules and module location suggestions:

- For customer PCB, RED color region (8.3x18.4mm) can't put componet or paste GND net;
- Antenna must away from metal or high components at least 10mm;
- Antenna can't be shielded by any meal enclosure; All cover, include plastic, shall away from antenna at least 10mm;

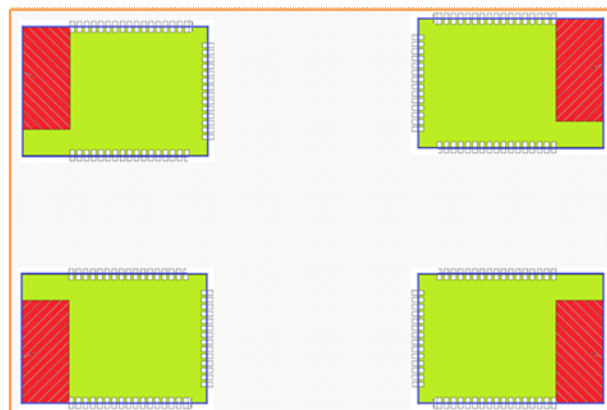


Figure 5. Suggested Module Placement Region

USR company suggest USR-WIFI232-G module better locate in following region at customer board, which to reduce the effect to antenna and wireless signal, and better consult USR company technical people when you structure your module placement and PCB layout.

### 1.2.5. External Antenna

USR-WIFI232-G module supports internal antenna and external antenna option for user dedicated application.

If user select external antenna, USR-WIFI232-G modules must be connected to the 2.4G antenna according to IEEE 802.11b/g/n standards.

The antenna parameters required as follows:

Table 3 USR-WIFI232-G External Antenna Parameters

| Item            | Parameters                 |
|-----------------|----------------------------|
| Frequency range | 2.4~2.5GHz                 |
| Impedance       | 50 Ohm                     |
| VSWR            | 2 (Max)                    |
| Return Loss     | -10dB (Max)                |
| Connector Type  | I-PEX or populate directly |

### 1.2.6. Evaluation Kit

USR company 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 USR-WIFI232-G module with the RS-232 UART, RS485, USB (Internal UART-USB convetor) or Wireless port to configure the parameters, manage the module or do the some functional tests.

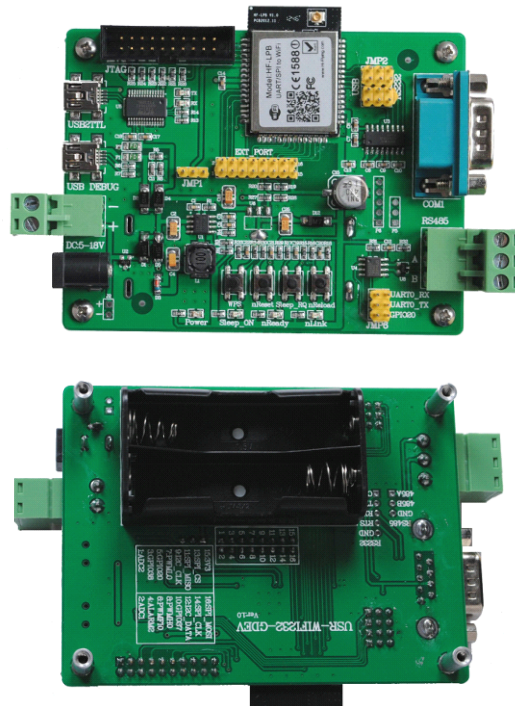


Figure 6. USR-WIFI232-G Evaluation Kit

**Notes:** User need download USB - UART port driver from USR company web or contact with technical support people for more detail.

The external interface description for evaluation kit as follows:

Table 4 USR-WIFI232-G Evaluation Kit Interface Description

| Function           | Name      | Description   |
|--------------------|-----------|---|
| External Interface | COM1      | Main data/command RS-232 interface  |
|                    | RS485     | Main data/command RS-485 interface  |
|                    | JTAG      | JTAG data debug interface (Not for user use)  |
|                    | USB2TTL   | UART to USB debug interface. (For PC without RS232, need load driver). Can be Power input.  |
|                    | USB DEBUG | USB2.0 data interface.  |
|                    | DC Jack   | DC jack for power in, 5~18V input.  |
|                    | DC5-18V   | DC jack for power in, 5~18V input.  |
|                    | BAT       | 2 Li-Battery Power Supply.  |
|                    | EXT PORT  | USR-WIFI232-G GPIO function extend interface connector  |
|                    | JMP1,JMP2 | Reserved, No Jumper required.   |
|                    | JMP3      | 4Pin USB or RS232 Jumper. Left jump select USB.   |
|                    | JMP6      | 3Pin RS485 Jumper. No jump selects RS232.   |
| LED                | Power     | 3.3V Power Indicator  |
|                    | nLink     | nLink -WiFi LINK Indicator  |
|                    | nReady    | nReady - Module Boot up Ready Indicator<br>On ("low")- Module boot up OK;<br>Off ("high")- Module bot up failed;<br><b>Twinkle- Remote Upgrade Ongoing;</b>                               |
|                    | Sleep_ON  | Sleep_ON-Module asleep or awake Indicator<br>On ("low")- Module in shundown(deep sleep) status;<br>Off ("high")- Module in normal status;<br><b>Twinkle- Boot loader Upgrade Ongoing;</b> |
| Button             | nReset    | Used to reset the module.   |
|                    | nReload   | Restore factory default configuration after push this pin more than 3s.   |
|                    | WPS       | WPS Button (Reserved, No Use)   |
|                    | Sleep_RQ  | Pin Sleep Control button, more than 1s to put module in standby mode.   |

### 1.2.7. Order Information

Base on customer detailed requirement, USR-WIFI232-G series modules provide different variants and physical type for detailed application.

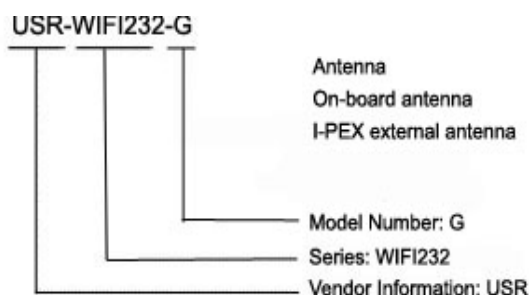


Figure 7. USR-WIFI232-G Order Information

## 1.3. Typical Application

### 1.3.1. Hardware Typical Application

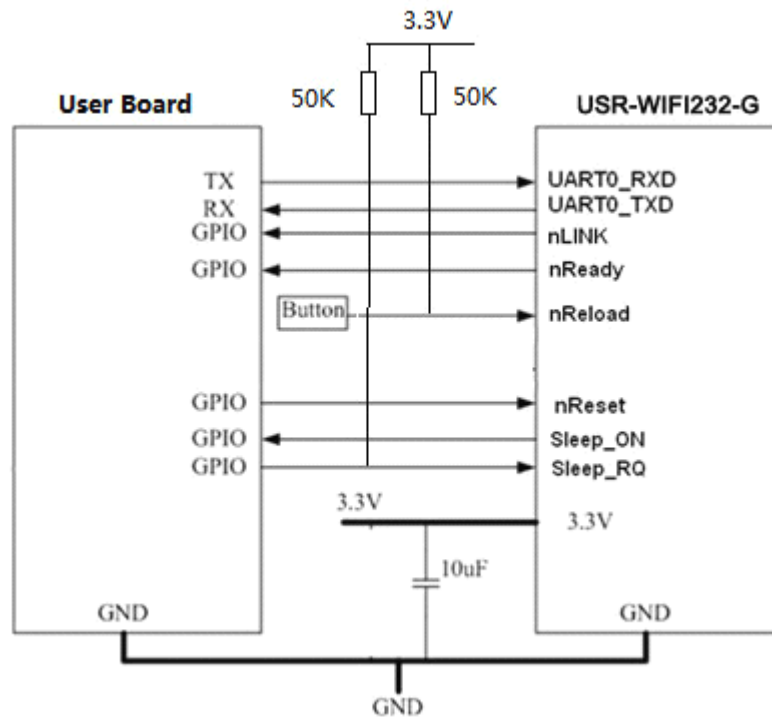


Figure 8. USR-WIFI232-G Hardware Typical Application

#### Notes:

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

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

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

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

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

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

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

User can de-assert nReload signal “0” more than 3s through button or MCU pin, then release, module will restore to factory default configuration and re-start boot up process.. [If nReload function not required, we still suggest 50K~100K ohm pull up added outside the module.](#)

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



The user should de-assert this pin low "0", after 1's assert to high "1" to put the module to sleep status. Also at the deep sleep/standby mode, user can de-assert this pin low "0", after 1's assert to high "1" to put the module to wake up the module. [If Sleep\\_RQ function not required, We still suggest 50K~100K ohm pull up added outside the module.](#)

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

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

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

## 2. FUNCTIONAL DESCRIPTION

### 2.1. Wireless Networking

USR-WIFI232-G module can be configured as both wireless STA and AP base on network type.

Logically there are two interfaces in USR-WIFI232-G. One is for STA, and another is for AP. When



USR-WIFI232-G works as AP, other STA equipments are able to connect to wireless LAN via USR-WIFI232-G module. Wireless Networking with USR-WIFI232-G is very flexible.

#### Notes:

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

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

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

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

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



Figure 9. USR-WIFI232-G Basic Wireless Network Structure

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

USR-WIFI232-G module support AP+STA network mode, means module support one AP interface and one STA interface at the same time, as following figure,

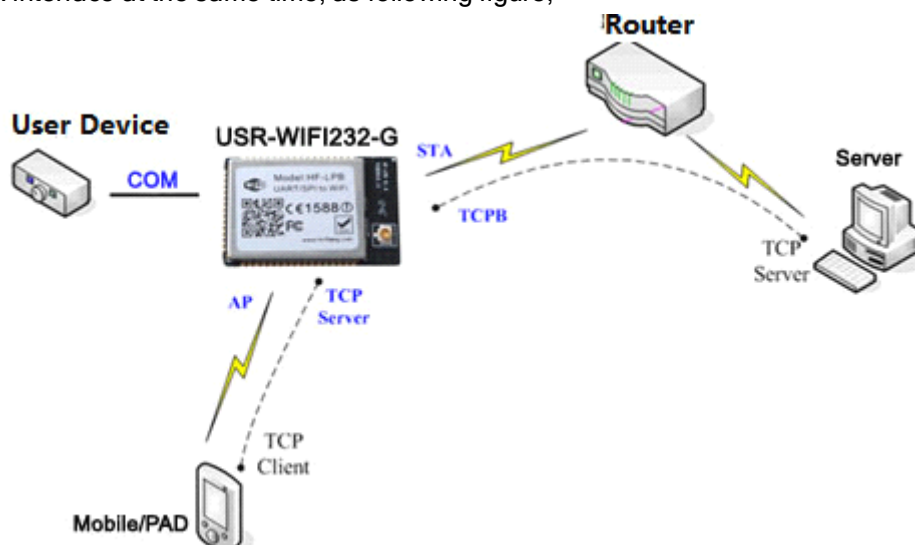


Figure 10.HF-A11 AP+STA Network Structure

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

The advantage of AP+STA mode is:

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

## 2.2. Work Mode : Transparent Transmission Mode

USR-WIFI232-G module support serial interface transparent transmission mode. The benefit of this mode is achieves a plug and play serial data port, and reduces user complexity furthest. In this mode, user should only configure the necessary parameters. After power on, module can automatically connect to the default wireless network and server.

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

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

The parameters which need to configure include:

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

## 2.3. UART Frame Scheme

### 2.3.1. UART Free-Frame

USR-WIFI232-G support UART free-frame function. If user select open this function, module will check the intervals between any two bytes when receiving UART data. If this interval time exceeds defined value (50ms default), USR-WIFI232-G will think it as the end of one frame and transfer this free-frame to WiFi port, or USR-WIFI232-G will receive UART data until 1400 bytes, then transfer 1400 bytes frame to WiFi port.

USR-WIFI232-G's default interval time is 50ms. User can also set this interval to fast (10ms) through AT command. But user have to consider if user MCU can send UART data with 10ms interval, or the UART data may be divide as fragment.

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

### 2.3.2. UART Auto-Frame

USR-WIFI232-G support UART auto-frame function. If user select open this function and setting auto-frame trigger length and auto-frame trigger time parameters, then module will auto framing the data which received from UART port and transmitting to the network as pre-defined data structure.

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

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

## 2.4. Encryption

Encryption is a method of scrambling a message that makes it unreadable to unwanted parties, adding a degree of secure communications. There are different protocols for providing encryption, and the USR-WIFI232-G module supports following:

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

## 2.5. Network Protocol

USR-WIFI232-G includes a fully IPv4 and IPv6 capable stack supporting TCP and UDP connection. Following table shows the key features of the USR-WIFI232-G module IP stack, which including support for DHCP, multicast, and ARP.

The Frame size limits are (including IP headers):

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

Table 5 USR-WIFI232-G IP Stack Features

## 2.6. Multi-Link

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

## TCP

### Connection

When USR-WIFI232-G module configured as TCP Server, it supports Multi-TCP link connection, and maximum eight TCP clients permit to connect to USR-WIFI232-G module. User can realize multi-TCP link connection at each work mode.

Multi-TCP link connection will work as following structure:

#### Upstream:

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

#### Downstream:

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

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



Figure 11.

Multi-TCP Link Data Transmission Structure

## 2.7. Power Save Scheme

USR-WIFI232-G module can work at two modes based on different power save scheme:

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

**Normal (Active/Sleep) Mode** Normal mode is no DTIM related (Default mode), module will monitor the interval to Active/Sleep.

**Standby Mode** allows the WiFi circuitry to be powered down, which results in the lowest sleep current, but at the expense of longer wake up times. This is due to the module associating with the access point every time when it wakes up. The intent of this option is to allow for longer sleep times. Standby mode can through AT+MSLP command or trigger "Sleep\_RQ" pin to go in.

The standby mode status and wakeup method as follows: For standby mode, module provides two wakes up options, user can select one or whole as the module wake up option. Refer to AT Instruction (Power Management Instruction Set) for more detailed setting.

- "Sleep\_RQ" Pin Wake Up
- "Reset" Pin Wake Up

Table 6 Standby Mode Status and Wake Up

|         | Status |     |         |      | Wake Up Method |         |            |           |
|---------|--------|-----|---------|------|----------------|---------|------------|-----------|
|         | Wi-Fi  | MCU | Current | UART | GPIO           | Timeout | AT Command | Reset Pin |
| Standby | OFF    | OFF | <80uA   | OFF  | Yes            | No      | No         | Yes       |

**Sleep\_RQ Pin Wake Up Option** allows an external microcontroller to determine when USR-WIFI232-G should sleep and when it should wake by controlling the "Sleep\_RQ" and "Sleep\_ON" pin. at the standby mode, user can de-assert this pin low "0", after 1's assert to high "1" to put the module to wake up the module. If user doesn't use pin sleep function, can leave this pin open.

**Sleep\_RQ Pin Wake Up Option** allows an external microcontroller to de-assert “Reset” pin to low “0” to reset the module.

## 2.8. Parameters Configuration

USR-WIFI232-G module supports two methods to configuration parameters: **Web Accessing** and **AT+instruction set**.

Web accessing means users can configure parameters through Web browser. When USR-WIFI232-G module connected to wireless network, parameters configuration is done on a PC connected to the same wireless network.

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

## 2.9. Firmware Update

USR-WIFI232-G module supports two on-line upgrade methods:

- Webpage Wi-Fi Upgrade
- Remote Upgrade

Webpaged based Wi-Fi upgrade, please refer to 3.1.8 firmware upgrade page, user can upload firmware file from PC to USR-WIFI232-G.

USR-WIFI232-G module also support upgrade from remote HTTP server, keep module connects to AP router before excuate remote HTTP upgrade. Remote upgrade have two methods: **Direct Download and Upgrade, Configure File Based Upgrade**.

### ◆ Configure File Based Upgrade

AT+UPURL command to set the remote directory which the configuration file located

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

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

### ◆ Direct Download and Upgrade

AT+UPURL command to set the remote directory and file name

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

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

## 2.10. GPIO Function

USR-WIFI232-G module can provide maximum 12 GPIO pins, which include 2 A/D analog input pins, 3 PWM control pins, 2 Pin sleep control pins, 1 WPS pin, 1 RTC pin, 1 USB 5V control pin, and 2

general GPIO pin. All these pins can be customized as GPIO pins if these functions are not required. As GPIO functional pin, user devices can read/write GPIO pins status through AT+instruction set.

Table 7 USR-WIFI232-G GPIO Pin Mapping Table

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

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

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

**Notes:** Some SW version may not include these GPIO command set. please contact with USR company technical people.

## 3. OPERATION GUIDELINE

### 3.1. Configuration via Web Accessing

When first use USR-WIFI232-G modules, user may need some configuration. User can connect to USR-WIFI232-G module's wireless interface with following default setting information and configure the module through laptop.

Table 8 USR-WIFI232-G Web Access Default Setting

| Parameters  | Default Setting |
|-------------|-----------------|
| SSID        | USR-WIFI232-G   |
| 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 "USR-WIFI232-G" of USR-WIFI232-G 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.





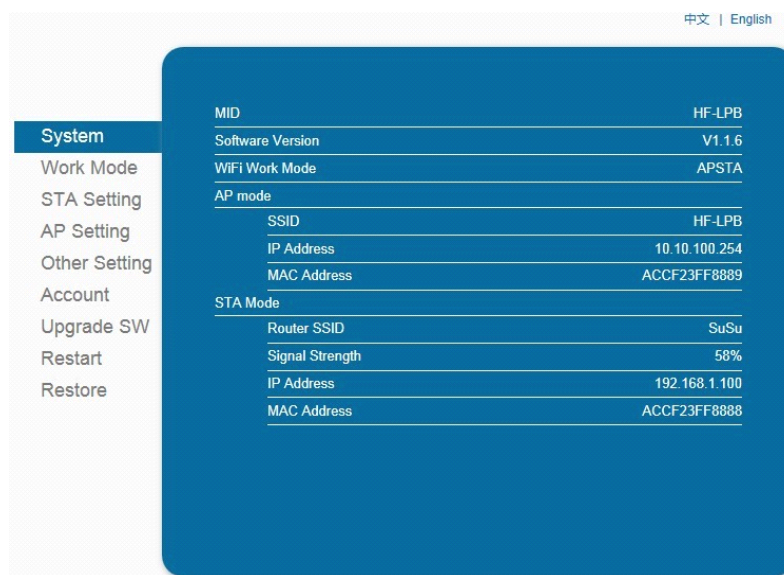
Figure 12.Open Web Management page

The USR-WIFI232-G 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.



|               |                          |
|---------------|--------------------------|
|               | 中文   English             |
| System        | MID HF-LPB               |
| Work Mode     | Software Version V1.1.6  |
| STA Setting   | WiFi Work Mode AP+STA    |
| AP Setting    | AP mode                  |
| Other Setting | SSID HF-LPB              |
| Account       | IP Address 10.10.100.254 |
| Upgrade SW    | MAC Address ACCF23FF8889 |
| Restart       | STA Mode                 |
| Restore       | Router SSID SuSu         |
|               | Signal Strength 58%      |
|               | IP Address 192.168.1.100 |
|               | MAC Address ACCF23FF8888 |

Figure 13.System Web Page

### 3.1.3. Work Mode Page

USR-WIFI232-G module can works at AP mode to simplify user’s configuration, can also works at STA to connect remote server through AP router. Also, it can configure at AP+STA mode which provide very flexible application for customers.

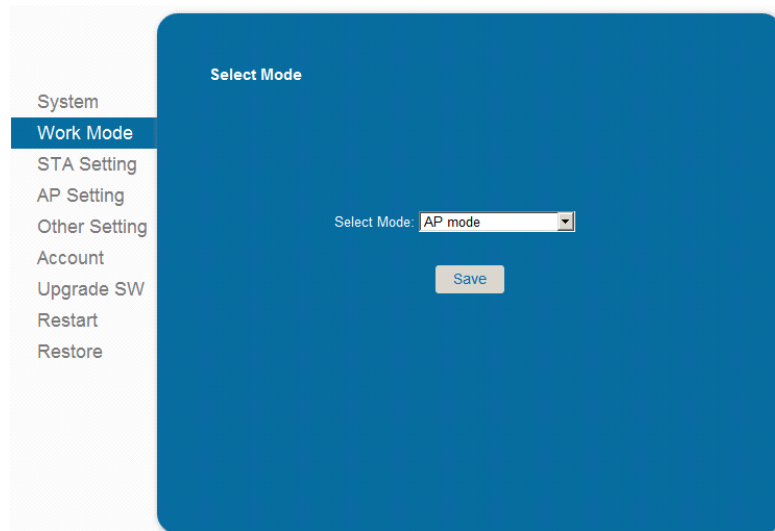


Figure 14.Work Mode Page

### 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 configuration, and then it can link with AP correctly.

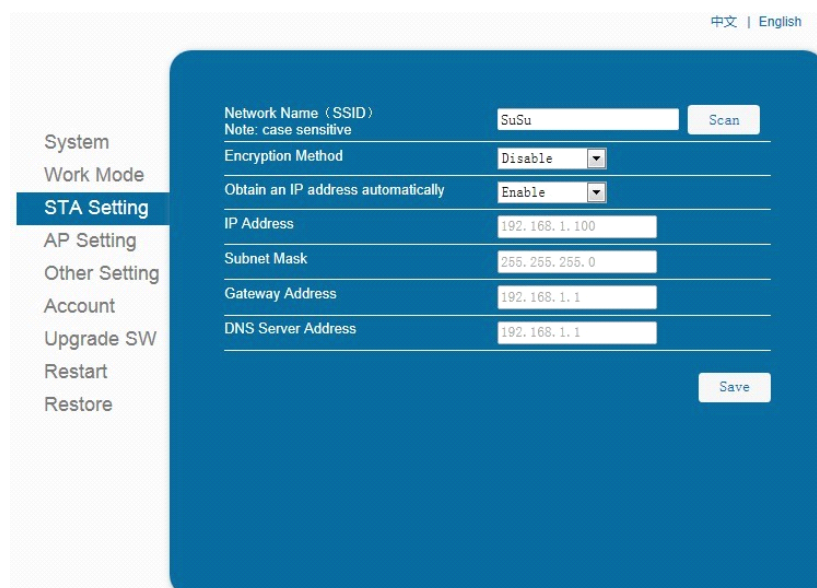


Figure 15.STA Setting Page

### 3.1.5. AP Setting Page

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

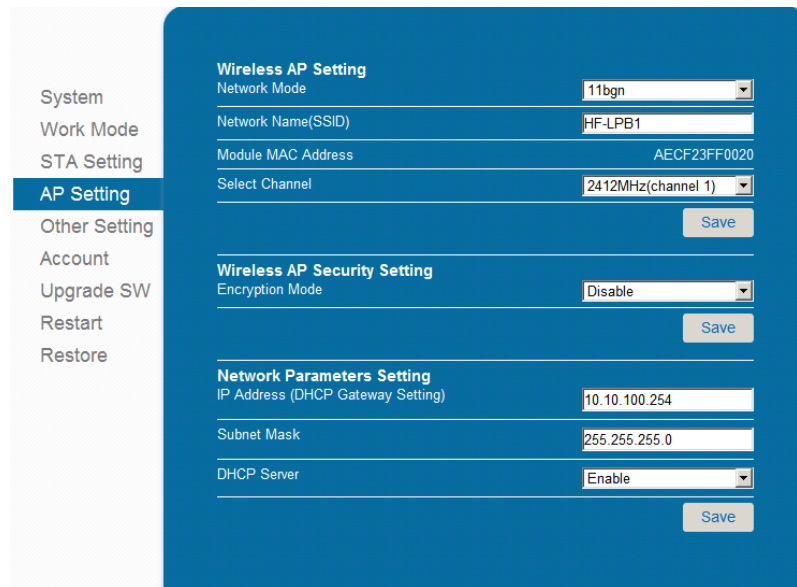


Figure 16.AP Setting Page

### 3.1.6. Other Setting Page

USR-WIFI232-G usually works at data transparent transmission mode. At this mode, the user device which connected with USR-WIFI232-G will connect and communicate with remote PC or server. At this page, user need setting serial port communication parameters and defines TCP related protocol parameters.

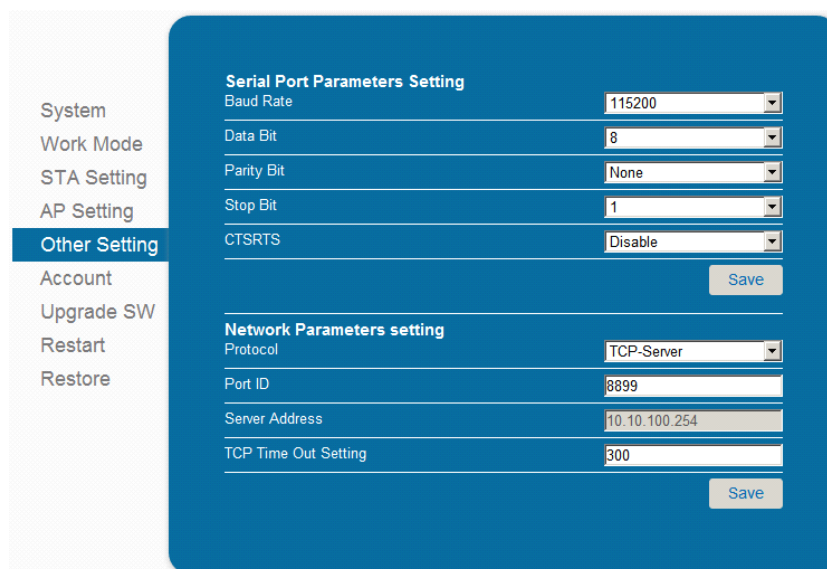


Figure 17.Other Setting Page

### 3.1.7. Account Management Page

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

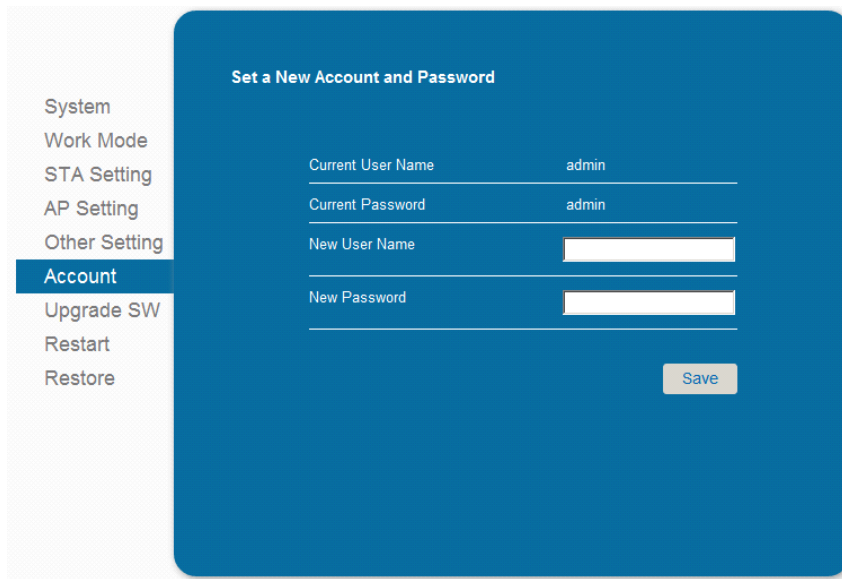


Figure 18.Account Page

### 3.1.8. Upgrade Software Page

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

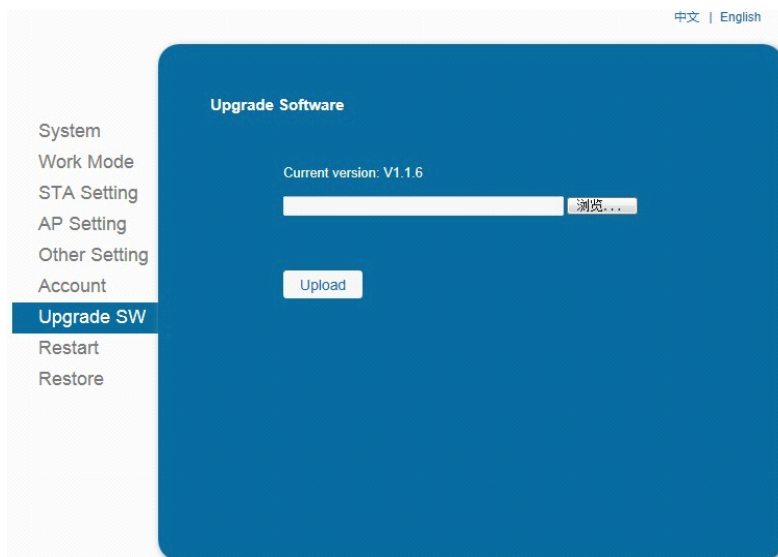


Figure 19.Upgrade SW page

### 3.1.9. Restart Page

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

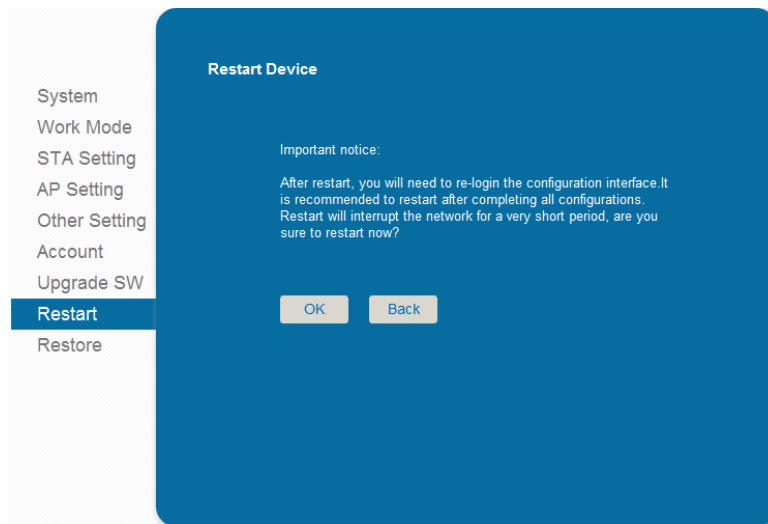


Figure 20.Restart Page

### 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". USR-WIFI232-G will restore to AP mode for factory default setting.

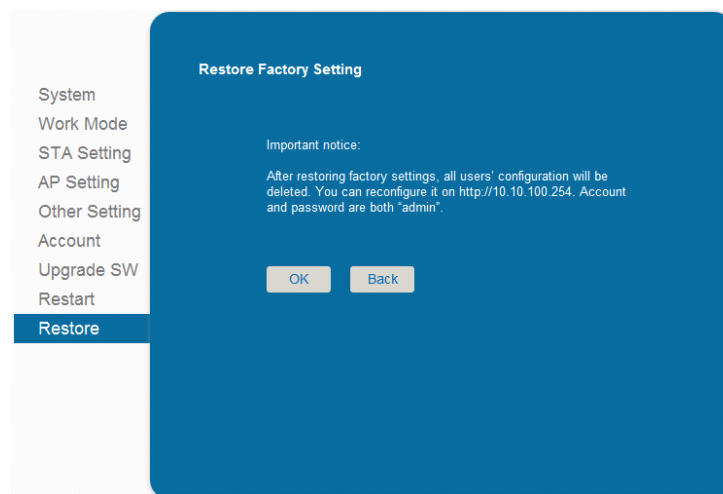


Figure 21.Restore Page

## 3.2. USR-WIFI232-G Usage Introduction

### 3.2.1. Software Debug Tools

USR company use the software tools debugging and applying USR-WIFI232-G module.  
(User can also select other tools used to debug serial port).

- Serial and Ethernet debugging tool  USR-TCP232-Test.exe

### 3.2.2. Network Connection

User can select two methods to connect USR-WIFI232-G module base on dedicated application.

- **Use USR-WIFI232-G STA interface.** USR-WIFI232-G and debug PC2 connect to a wireless AP, another PC1 (or user device) connect to USR-WIFI232-G module with serial port:



Figure 22.STA Interface Debug Connection

- **Use USR-WIFI232-G AP interface.** Debug PC2 connect to USR-WIFI232-G through wireless connection, another PC1 (or user device) connect to USR-WIFI232-G module with serial port.



Figure 23.AP Interface Debug Connection

### 3.2.3. Default Parameter Setting

- Default SSID: HF-LPB;
- Default 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 USR-WIFI232-G module and open serial port connection.

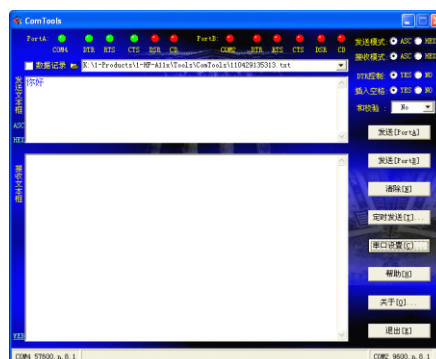


Figure 24. “CommTools” Serial Debug Tools

PC2 open “TCPUDPDbg” program, and create a new connection. If USR-WIFI232-G configured as Server mode, “TCPUDPDbg” Tools shall create “Client” mode connection. Or otherwise, create a “Server” mode connection.

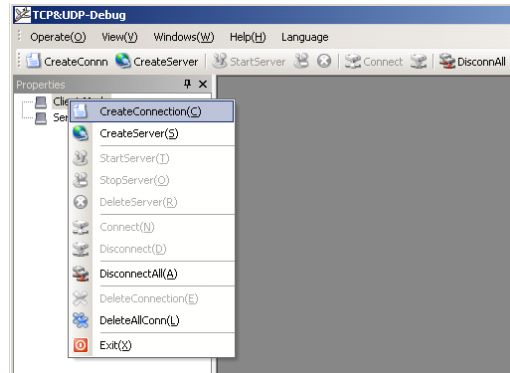


Figure 25. “TCPUDPDbg” Tools Create Connection

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

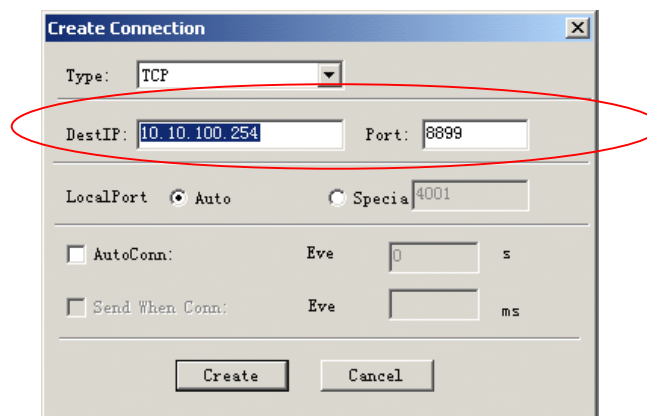


Figure 26. “TCPUDPDbg” Tools Setting

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

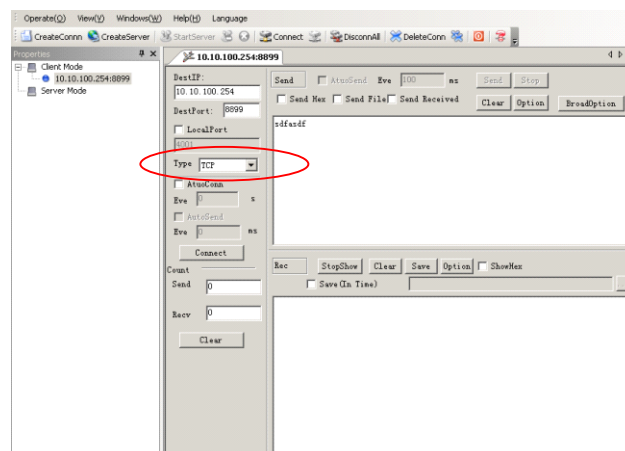


Figure 27. “TCPUDPDbg” Tools Connection



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 28. Wireless Control Application

For this wireless control application, USR-WIFI232-G works as Ad-Hoc mode. Module’s serial port connects to user device. So, control agent (Smart phone for this example) can manage and control the user device through the wireless connection with USR-WIFI232-G module.

#### 3.3.2. Remote Management Application

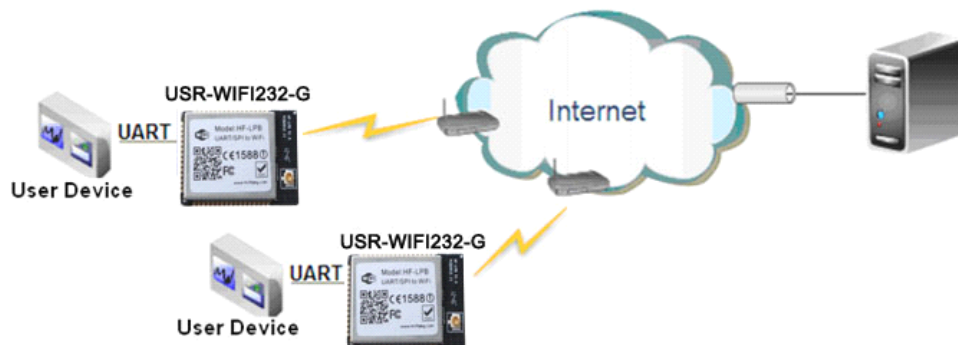


Figure 29. Remote Management Application

For this remote management application, USR-WIFI232-G 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 USR-WIFI232-G modules connect as below figures to build up a transparent serial port connection. USR-WIFI232-G works as Ad-Hoc mode to connect each other.



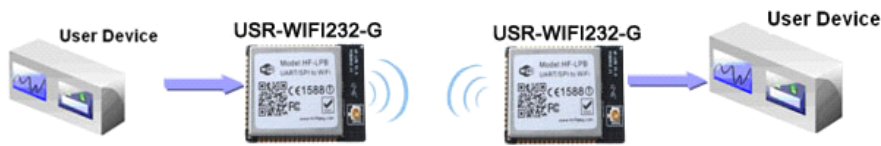


Figure 30.Transparent Serial Port Application

## 4. AT+INSTRUCTION INTRODUCTION

### 4.1. Configuration Mode

When USR-WIFI232-G power up, it will default works as transparent transmission mode, then user can switch to configuration mode by serial port command. USR-WIFI232-G UART default parameters setting as below figure,

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

Figure 31.USR-WIFI232-G 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.

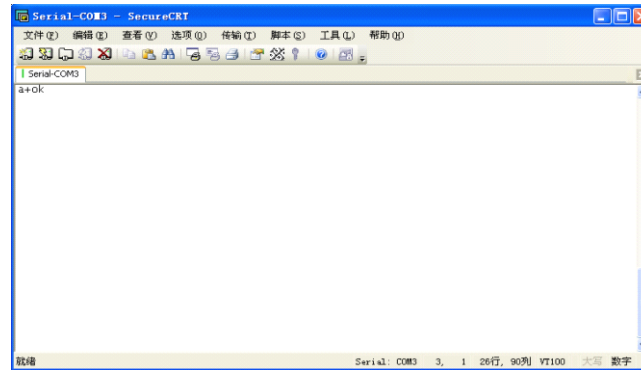


Figure 32. Switch to Configuration Mode

#### Notes:

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

## 4.2. AT+ Instruction Set Overview

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

```
AT+H
+ok
```

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

Figure 33. “AT+H” Instruction for Help

#### 4.2.1. Instruction Syntax Format

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

##### ➤ Format Description

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

##### ➤ Command Message

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

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

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

##### ➤ Response Message

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

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

##### ➤ Error Code

Table 9 Error Code Description

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

#### 4.2.2. AT+ Instruction Set

Table 10 AT+ Instruction Set List

| Instruction   | Description  |
|---|--|
| <null>  | NULL   |
| <b>Managment Instruction Set</b>                                      |  |
| E   | Open/Close show back function                            |
| WMODE   | Set/Query Wi-Fi work mode (AP/STA/APSTA)                 |
| ENTM  | Set module into transparent transition mode              |
| TMODE   | Set/Query module data transfer mode                      |
| MID   | Query module ID information                              |
| VER   | Query module software version information                |
| RELD  | Restore to factory default setting                       |
| Z   | Re-start module  |
| H   | Help   |
| <b>Configure Parameters Instruction Set</b>                           |  |
| CFGRD   | Batch Read User Configure Parameters                     |
| CFGWR   | Batch Write Configure Parameters                         |
| CFGFR   | Batch Read Factory Default Configure Parameters          |
| CGTTF   | Copy User Parameters to Factory Default Parameters       |
| <b>UART Instruction Set</b>   |  |
| UART  | Set/Query serial port parameters                         |
| UARTF   | Open/Close UART auto-frame function                      |
| UARTFT  | Set/Query UART auto-frame trigger time                   |
| UARTFL  | Set/Query UART auto-frame trigger length                 |
| UARTTE  | Set/Query UART free-frame trigger time between two bytes |
| <b>Command Mode Set</b>   |  |
| SEND  | Send Data at Command Mode                                |
| RECV  | Receive Data at Command Mode                             |
| <b>Network Instruction Set</b>  |  |
| PING  | Network "Ping" Instruction                               |
| NETP  | Set/Query network protocol parameters                    |
| TCPLK   | Query if TCP link already build-up                       |
| TCPTO   | Set/Query TCP timeout                                    |
| TCPDIS  | Open/Close TCP link                                      |
| <b>Wi-Fi STA Instruction Set (Effective when module works as STA)</b> |  |
| WSKEY   | Set/Query STA security parameters                        |
| WSSID   | Set/Query associated AP SSID parameters                  |
| WANN  | Set/Query STA's network parameters                       |
| WSMAC   | Set/Query STA's MAC address                              |
| WSLK  | Query STA Wi-Fi link status                              |
| WSLQ  | Query STA Wi-Fi signal strength                          |
| WSCAN   | Scan AP  |
| WSDNS   | Set/Query STA's Static DNS server address                |
| <b>Wi-Fi AP Instruction Set (Effective when module works as AP)</b>   |  |
| LANN  | Set/Query AP's network parameters                        |
| WAP   | Set/Query AP Wi-Fi parameters                            |
| WAKEY   | Set/Query AP security parameters                         |
| WAMAC   | Set/Query AP MAC address                                 |
| WADHCP  | Set/Query AP DHCP Server status                          |

|   |  |
|---|--|
| WADMN                                     | Set/Query AP webpage domain name             |
| <b>Webpage Management Instruction Set</b> |  |
| WEBSWITCH                                 | Set Webpage Option                           |
| PLANG                                     | Set/Query Webpage Language Option            |
| WEBU                                      | Set/Query Webpage User name and Code         |
| <b>Remote Upgrade Instruction Set</b>     |  |
| UPURL                                     | Set/Query remote upgrade URL address         |
| UPFILE                                    | Set/Query remote upgrade configure file name |
| UPST                                      | Start remote upgrade                         |
| <b>Power Management Instruction Set</b>   |  |
| MSLP                                      | Set/Query deep sleep/standby mode parameters |
| <b>Others Instruction Set</b>             |  |
| WRMID                                     | Set module ID                                |
| ASWD                                      | Set/Query WiFi configuration code            |

#### 4.2.2.1. AT+E

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

**AT+E<CR>**

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

When USR-WIFI232-G module firstly switch from transparent transmission to configuration mode, show back status is open, input “AT+E” to close show back function, input“AT+E” again to open show back function.

#### 4.2.2.2. AT+WMODE

- Function: Set/Query WIFI work mode;
- Format:

- ◆ Query Operation

**AT+WMODE<CR>**

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

- ◆ Set Operation

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

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

- Parameters:
  - ◆ mode:Wi-Fi work mode
    - ✧ AP
    - ✧ STA
    - ✧ APSTA

#### 4.2.2.3. AT+ENTM

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

**AT+ENTM<CR>**

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

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

## 4.2.2.4. AT+TMODE

- Function: Set/Query module data transfer mode.
- Format:

## ◆ Query Operation

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

## ◆ Set Operation

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

- Parameters:
  - ◆ tmode: data transfer mode, include:
    - ◇ throughput
    - ◇ cmd

## 4.2.2.5. AT+MID

- Function: Query module ID information;
- Format:

## ◆ Query Operation

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

- Parameters:
  - ◆ module\_id: Module ID information;
    - ◇ HF-LPB;

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

## 4.2.2.6. AT+VER

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

## ◆ Query Operation

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

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

## 4.2.2.7. AT+RELD

- Function: module restore to factory default setting;
- Format:

## ◆ Set Operation

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

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

## 4.2.2.8. AT+Z

- Function: Re-start module;

- Format:  
**AT+Z<CR>**

#### 4.2.2.9. AT+H

- Function: Help;
- Format:
  - ◆ Query Operation  
**AT+H<CR>**  
**+ok=<command help><CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ command help: command introduction;

#### 4.2.2.10. AT+CFGRD

- Function: Batch Read User Configure Parameters;
- Format:
  - ◆ Query Operation  
**AT+CFGRD<CR>**  
**+ok=<config><CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ config: the first two bytes means the length of configuration parameters;

#### 4.2.2.11. AT+CFGWR

- Function: Batch Write User Configure Parameters;
- Format:
  - ◆ Set Operation  
**AT+CFGWR=<config><CR>**  
**+ok<CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ config: the first two bytes means the length of configuration parameters;

#### 4.2.2.12. AT+CFGFR

- Function: Batch Read Factory Default Configure Parameters;
- Format:
  - ◆ Query Operation  
**AT+CFGFR<CR>**  
**+ok=<config><CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ config: the first two bytes means the length of configuration parameters;

#### 4.2.2.13. AT+CFGTF

- Function: Copy User Parameters to Factory Default Parameters;
- Format:
  - ◆ Query Operation  
**AT+CFGTF<CR>**

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

- Parameters:
  - ◆ status: feedback operation status;

#### 4.2.2.14. AT+UART

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

**AT+UART<CR>**

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

- ◆ Set Operation

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

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

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

#### 4.2.2.15. 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;



## 4.2.2.16. 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

## 4.2.2.17. AT+ UARTFL

- Function: Set/Query UART auto-frame trigger length;
- Format:
  - ◆ Query Operation  
**AT+ UARTFL<CR>**  
**+ok=<len><CR>< LF ><CR>< LF >**
  - ◆ Set Operation  
**AT+ UARTFL=<len ><CR>**  
**+ok<CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ len: Range 16 ~1400; Unit: Byte. Auto-frame trigger length;

## 4.2.2.18. AT+ UARTTE

- Function: Set/Query UART free-frame trigger time between two bytes;
- Format:
  - ◆ Query Operation  
**AT+ UARTTE<CR>**  
**+ok=<mode><CR>< LF ><CR>< LF >**
  - ◆ Set Operation  
**AT+ UARTTE=<mode><CR>**  
**+ok<CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ mode:
    - ◇ fast: free-frame trigger time between two bytes is 10ms;
    - ◇ normal: free-frame trigger time between two bytes is 50ms;

## 4.2.2.19. AT+ SEND

- Function: Send Data at Command Mode.
- Format:  
**AT+SEND=<data\_lenth, data\_content><CR>**  
**+ok<CR>< LF ><CR>< LF >**
- Parameters:

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

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

#### 4.2.2.20. AT+ RECV

- Function: Receive Data at Command Mode.
- Format:  
**AT+RECV=<data\_lenth><CR>**  
**+ok=< data\_lenth, data\_content><CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ data\_lenth: Lenth of receive data. Range: 0~1000 Byte
  - ◆ data\_content: contents of receive data.

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

#### 4.2.2.21. AT+ PING

- Function: Network “PING” Instruction.
- Format:
  - ◆ Set Operation  
**AT+ PING=<IP\_address ><CR>**  
**+ok=<sta><CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ sta: feedback result
    - ✧ Success
    - ✧ Timeout
    - ✧ Unknown host

#### 4.2.2.22. AT+NETP

- Function: Set/Query network protocol parameters;
- Format:
  - ◆ Query Operation  
**AT+NETP<CR>**  
**+ok=<protocol,CS,port,IP><CR>< LF ><CR>< LF >**
  - ◆ Set Operation  
**AT+NETP=<protocol,CS,port,IP><CR>**  
**+ok<CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ protocol:
    - ✧ TCP
    - ✧ UDP
  - ◆ CS: Network mode:
    - ✧ SERVER
    - ✧ CLIENT
  - ◆ Port: protocol port ID: Decimal digit and less than 65535
  - ◆ IP: Server's IP address when module set as client

## 4.2.2.23. 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;

## 4.2.2.24. 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;

## 4.2.2.25. AT+TCPDIS

- Function: Open/Close TCP link;
- Format:

- ◆ Query Opera

**AT+TCPDIS<CR>**

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

- ◆ Set Operation

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

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

- Parameters:

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

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

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

## 4.2.2.26. AT+WSSSID

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

- Format:
  - ◆ Query Operation  
**AT+WSSSID<CR>**  
**+ok=<ap's ssid><CR>< LF ><CR>< LF >**
  - ◆ Set Operation  
**AT+ WSSSID=<ap's ssid ><CR>**  
**+ok<CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ ap's ssid: AP's SSID (Within 32 character);

#### 4.2.2.27. AT+WSKEY

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

#### 4.2.2.28. AT+ WANN

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

✧ DHCP: Dynamic IP

- ◆ address: STA IP address;
- ◆ mask: STA subnet mask;
- ◆ gateway: STA gateway address;

#### 4.2.2.29. AT+WSMAC

- Function: Set/Query STA MAC address parameters;

- Format:

- ◆ Query Operation

**AT+WSMAC<CR>**

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

- ◆ Set Operation

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

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

- Parameters:

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

#### 4.2.2.30. AT+WSLK

- Function: Query STA WiFi link status

- Format:

- ◆ Query Operation

**AT+WSLK<CR>**

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

- Parameters:

- ◆ ret
  - ✧ "Disconnected", if no WiFi connection;
  - ✧ "AP' SSID (AP's MAC" ), if WiFi connection available;
  - ✧ "RF Off", if WiFi OFF;

#### 4.2.2.31. AT+WSLQ

- Function: Query STA WiFi signal strength;

- Format:

- ◆ Query Operation

**AT+WSLQ<CR>**

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

- Parameters:

- ◆ ret
  - ✧ "Disconnected", if no WiFi connection;
  - ✧ "AP's WiFi signal strength" , if WiFi connection available;

#### 4.2.2.32. AT+WSCAN

- Function: Scan AP;

- Format:  
**AT+ WSCAN<CR>**  
**+ok=<ap\_site><CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ ap\_site: AP searched;

#### 4.2.2.33. AT+ WSDNS

- Function: Set/Query STA static DNS server address;
- Format:
  - ◆ Query Operation  
**AT+WSDNS<CR>**  
**+ok=<address><CR>< LF ><CR>< LF >**
  - ◆ Set Operation  
**AT+ WSDNS =<address><CR>**  
**+ok<CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ address: STA's DNS server address; Effective right away.

#### 4.2.2.34. AT+ LANN

- Function: Set/Query AP's network parameters;
- Format:
  - ◆ Query Operation  
**AT+LANN<CR>**  
**+ok=<ipaddress,mask><CR>< LF ><CR>< LF >**
  - ◆ Set Operation  
**AT+ LANN=< ipaddress,mask><CR>**  
**+ok<CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ ipaddress: AP's IP address;
  - ◆ mask: AP's net mask;

#### 4.2.2.35. AT+WAP

- Function: Set/Query AP Wi-Fi parameters;
- Format:
  - ◆ Query Operation  
**AT+WAP<CR>**  
**+ok=<wifi\_mode,ssid,channel><CR>< LF ><CR>< LF >**
  - ◆ Set Operation  
**AT+ WAP =<wifi\_mode,ssid,channel><CR>**  
**+ok<CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ wifi\_mode: Wi-Fi mode, include:
    - ✧ 11B
    - ✧ 11BG

- ✧ 11BGN (Default Value)
- ◆ ssid: SSID at AP mode
- ◆ channel: Wi-Fi channel selection:
  - ✧ AUTO
  - ✧ CH1~CH11; (Default CH1)

#### 4.2.2.36. AT+WKEY

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

- ◆ Query Operation

**AT+WKEY<CR>**

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

- ◆ Set Operation

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

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

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

#### 4.2.2.37. AT+WAMAC

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

- ◆ Query Operation

**AT+WAMAC<CR>**

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

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

Note: Module AP mode's MAC address is related to STA mode's MAC address. If user need change to others, please contact with USR company technical people.

#### 4.2.2.38. AT+WADHCP

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

- ◆ Query Operation

**AT+WADHCP<CR>**

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

- ◆ Set Operation

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

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

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

#### 4.2.2.39. AT+WADMN

- Function: Set/Query AP webpage domain name;
- Format:
  - ◆ Query Operation  
**AT+WADMN<CR>**  
**+ok=<domain\_name><CR>< LF ><CR>< LF >**
  - ◆ Set Operation  
**AT+ WADMN =<domain\_name><CR>**  
**+ok<CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ Domain\_name: Webpage domain name (within 20 characters, can't all numbers).

#### 4.2.2.40. AT+WEBSWITCH

- Function: Set Web page display option;
  - Format:
    - ◆ Set Operation  
**AT+ WEBSWITCH=<web><CR>**  
**+ok<CR>< LF ><CR>< LF >**
  - Parameters:
    - ◆ web: module's web page option:
      - ✧ iw: select internal reduced version web page as default web page;
      - ✧ ew: select full version web page as default web page;
- Note:** "iw" web page only used to upgrade and upload customized web page; "ew" web page provide more configuration option.

#### 4.2.2.41. AT+PLANG

- Function: Set/ Query webpage language option;
- Format:
  - ◆ Query Operation  
**AT+ PLANG<CR>**  
**+ok=<language> <CR>< LF ><CR>< LF >**
  - ◆ Set Operation  
**AT+ PLANG=<language> <CR>**  
**+ok<CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ language: webpage's language
    - ✧ CN: Chinese Version (Default);
    - ✧ EN: English Version;



## 4.2.2.42. AT+UPURL

- Function: Set/ Query remote upgrade URL address;
- Format:
  - ◆ Query Operation  
**AT+ UPURL<CR>**  
**+ok=<url> <CR>< LF ><CR>< LF >**
  - ◆ Set Operation  
**AT+ UPURL=<url,filename> <CR>**  
**+ok<CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ url: the upgrade file url address; the last charter shall be "/" (within 20 characters).
  - ◆ filename: the upgrade file name, it's optional and not saved parameter. If provide this file name here, the module will start upgrade right away;

## 4.2.2.43. AT+UPFILE

- Function: Set/ Query remote upgrade configure file name;
- Format:
  - ◆ Query Operation  
**AT+ UPFILE<CR>**  
**+ok=<filename> <CR>< LF ><CR>< LF >**
  - ◆ Set Operation  
**AT+ UPFILE=<filename> <CR>**  
**+ok<CR>< LF ><CR>< LF >**
- Parameters:
  - ◆ filename: the upgrade configure file name (within 20 characters).

## 4.2.2.44. AT+UPST

- Function: Start remote upgrade;
  - Format:
    - ◆ Query Operation  
**AT+ UPST<CR>**  
**+ok=<log> <CR>< LF ><CR>< LF >**
  - Parameters:
    - ◆ log: feedback the status of remote upgrade;
- Note:** After execute this command, the USR-WIFI232-G will automatic start upgrade base on the setting of UPURL, UPFILE command contents;

## 4.2.2.45. AT+WEBU

- Function: Set/ Query webpage user name and password;
- Format:
  - ◆ Query Operation  
**AT+ WEBU<CR>**  
**+ok=<username,password> <CR>< LF ><CR>< LF >**

## ◆ Set Operation

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

## ■ Parameters:

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

## 4.2.2.46. AT+MSLP

## ■ Function: Set/Query deep sleep/standby mode parameters;

## ■ Format:

## ◆ Query Operation

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

## ◆ Set Operation

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

## ■ Parameters:

- ◆ ret:
  - ✧ normal: normal mode (100ms interval)
- ◆ mode:
  - ✧ normal: normal mode (100ms interval)
  - ✧ standby: WiFi shut down mode

## 4.2.2.47. AT+WRMID

## ■ Function: Set module ID;

## ■ Format:

## ◆ Set Operation

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

## ■ Parameters:

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

## 4.2.2.48. AT+ASWD

## ■ Function: Set/Query WiFi Configuration Password;

## ■ Format:

## ◆ Query Operation

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

## ◆ Set Operation

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

## ■ Parameters:

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

## 5. PACKAGE INFORMATION

### 5.1. Recommended Reflow Profile

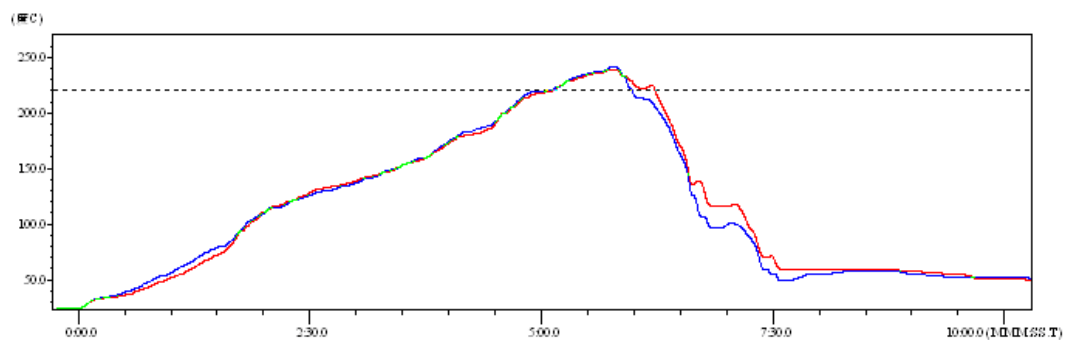


Figure 34. Reflow Soldering Profile

Table 11 Reflow Soldering Parameter

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

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

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

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

7. If SMT process needs twice reflow:

- (1) Top side SMT and reflow    (2) Bottom side SMT and reflow

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

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

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

### 5.3. Shipping Information

#### TRAY

Size: 420\*245\*34 mm

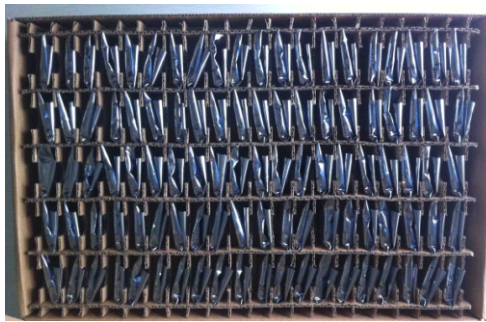


Figure 35. Shipping Information

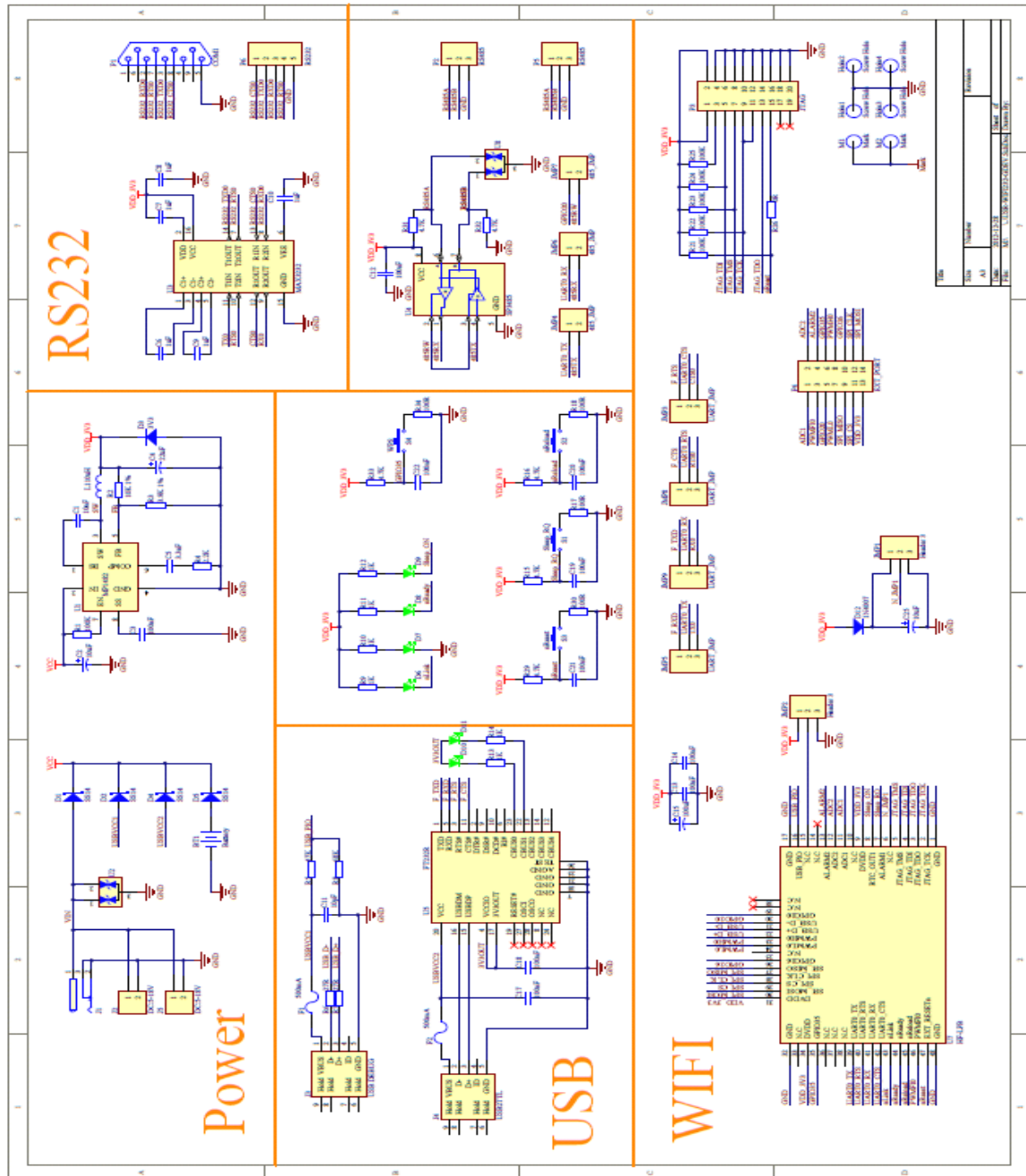
**Note:**

1 tray = 5\*20pcs = 100 pcs

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

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

# APPENDIX A: HW REFERENCE DESIGN



Detailed USR-WIFI232-G Evaluation Board design source files, pls access USR company web download page or contact with USR company technical support people to acquire.

## APPENDIX B: CONTACT INFORMATION

### Contact us:

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## END OF DOCUMENT