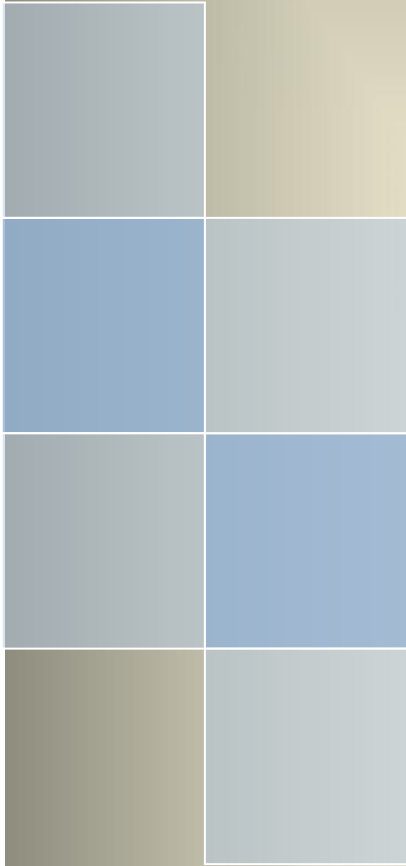


**WLINK**

# Quick Start

---Apply to WL-R220 Series OpenWrt Router



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# 1

## Product Introduction

### 1.1 Product overview

WL-R220 4G/3G OpenWrt industrial router is the internet of thing mobile broadband router and a machine to machine (M2M) industrial cellular router, which can optional works on 4G/3G cellular network to provide reliable, secure and high speed wireless connectivity. It is powerful and programmable industrial mobile router with high performance and harden casing design for remote management, telemetry, condition monitoring, CCTV, ATMs, vending machine and other M2M applications.

WLINK WL-R220 4G/3G OpenWrt industrial router is based on the OpenWrt trunk system, which is configured using a web interface (LuCI). Customers can be allowed to customize WL-R220 series router to fit any application from the selection and configuration by WLINK provided . It'll be used for anything that an embedded Linux system can be used for, including functions as SNMP, SSH, VPN, traffic-shaping system, and so on.

### 1.2 Model Introduction

WLINK industrial grade router OpenWrt Series have single module / single SIM card, single module / double SIM card, double module / double SIM card design, support multi-band frequency WCDMA, HSPA+,4G FDD/TDD etc., mobile wide-band, backward compatibility with GPRS、EDGE、CDMA 1x, etc., mobile narrow-band, optional built-in Wi-Fi module to build WLAN network, optional GPS module Expansion positioning function, to suit different requirement and different network environment of different operators, our OpenWrt Series router have many available models for option, please consult WLINK sales manager for details.

Partial Order Number List								
Model	4G	3G	Interface	Dual SIM	WiFi	GPS	DL	UL
WL-R220LH-d	FDD 800/850/900/1800 /1900/2100/2600MHz	DC-HSPA+/HSPA+/HSDPA 2100/1900/850/900MHz	2x LAN,1xWAN 1x RS232 3x I/O	✓	300Mbps		100M	50M
WL-R220LH-g	FDD 800/850/900/1800 /1900/2100/2600MHz	DC-HSPA+/HSPA+/HSDPA 2100/1900/850/900MHz	2x LAN,1xWAN 1x RS232 3x I/O	✓	300Mbps	✓	100M	50M
WL-R220LH2-d	FDD 700/850/1700/1900MHz	DC-HSPA/HSPA+/HSPA+ 850/AWS/1900MHz	2x LAN,1xWAN 1x RS232 3x I/O	✓	300Mbps		100M	50M
WL-R220LH2-g	FDD 700/850/1700/1900MHz	DC-HSPA/HSPA+/HSPA+ 850/AWS/1900MHz	2x LAN,1xWAN 1x RS232 3x I/O	✓	300Mbps	✓	100M	50M
WL-R220LF-d	FDD: 1800/2100/2600MHz TDD: 1900/2300/2600MHz	HSPA+/HSPA/HSDPA 2100/1900/850MHz	2x LAN,1xWAN 1x RS232 3x I/O	✓	300Mbps		100M	50M
WL-R220LF-g	FDD: 1800/2100/2600MHz TDD: 1900/2300/2600MHz	HSPA+/HSPA/HSDPA 2100/1900/850MHz	2x LAN,1xWAN 1x RS232 3x I/O	✓	300Mbps	✓	100M	50M
WL-R220H-d		HSPA+ 2100/1900/850MHz	2x LAN,1xWAN 1x RS232 3x I/O	✓	300Mbps		21M	5.76M
WL-R220H-g		HSPA+ 2100/1900/850MHz	2x LAN,1xWAN 1x RS232 3x I/O	✓	300Mbps	✓	21M	5.76M
WL-R220H1-d		HSPA+ 2100/1900/900/850MHz	2x LAN,1xWAN 1x RS232 3x I/O	✓	300Mbps		21M	5.76M
WL-R220H1-g		HSPA+ 2100/1900/900/850MHz	2x LAN,1xWAN 1x RS232 3x I/O	✓	300Mbps	✓	21M	5.76M
WL-R220H4-d		HSPA+ 900/2100 or 850/1900MHz	2x LAN,1xWAN 1x RS232 3x I/O	✓	300Mbps		21M	5.76M
WL-R220H4-g		HSPA+ 900/2100 or 850/1900MHz	2x LAN,1xWAN 1x RS232 3x I/O	✓	300Mbps	✓	21M	5.76M

## 1.3 Typical Application Diagram

WLINK 4G/3G Router are widely used in Telecom, economic, advertisement, traffic, environment protection business area.

For example, in economic area, WL-R220 OpenWrt Series Router connect server by IPSec & GRE to ensure data security, tiny design makes it easily installed into ATM machine. All these technology ensure safe and reliable data transmission, and minimize the probability of network disconnection, and maximize the usability of economic business like ATM, POS .etc.

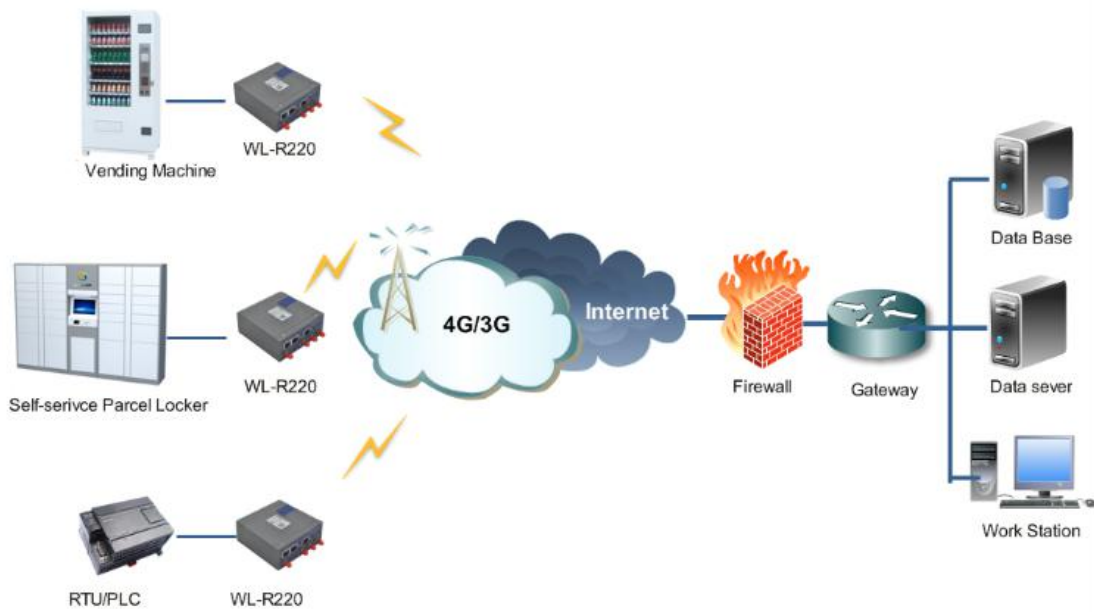


Figure 1-1 Network Topology

## 1.4 Hardware Features

- CPU: Atheros AR9344, 533MHz
- SPI Nor Flash - 16MB
- NAND Flash 128MB
- DDR2: 16Bit 64MB
- Mini PCIe Adapter USB2.0 3G/4G Module, 4G/HSPA+/WCDMA module

optional

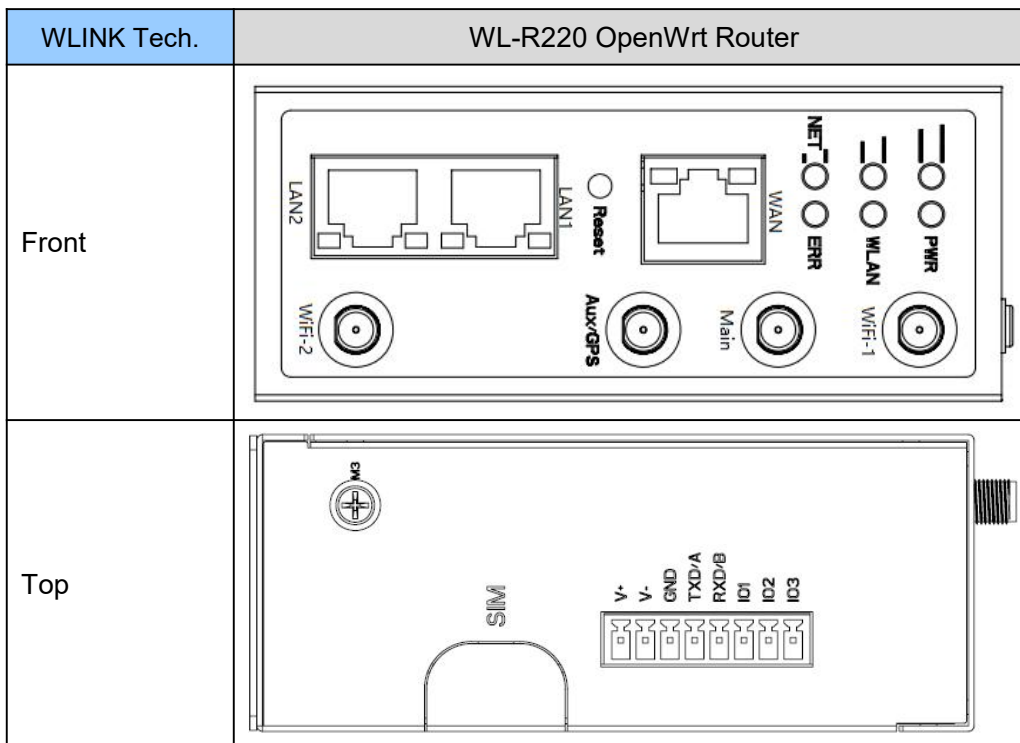
- 2\*USIM Slots
- 2\*LAN, 1\*WAN
- RS232/RS485 Optional
- Reset Button
- Embedded watchdog
- Wi-Fi: IEEE 802.11n 300Mbps
- 2\*DI, 1\*DO

# 2 Hardware Installation

This chapter is mainly for installation introduction, there would be some difference between the scheme and real object. But the difference won't have any influence to products performance.

## 2.1 Panel

Table 2-1 WL-R220 Structure



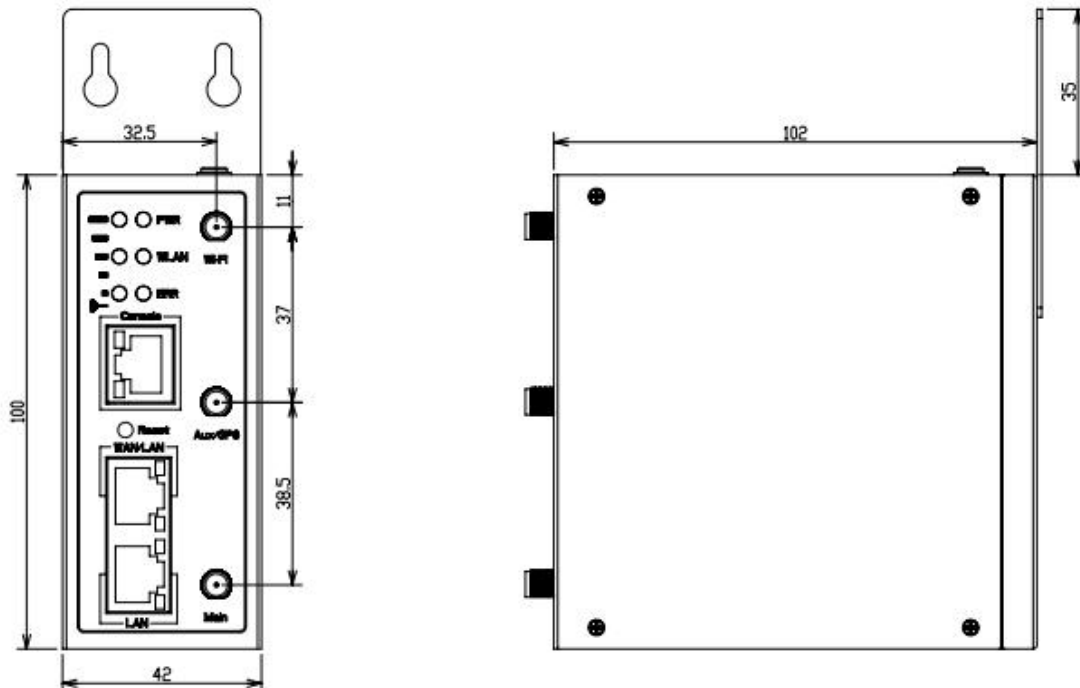
There are difference on Antenna interface and indicator light for the device with extended GPS features.



Table 2-2 Router Interface

Port	Instruction	Remark
USIM	Plug type SIM Slot, support 1.8/3V/5V automatic detection.	
Main	3G/LTE antenna, SMA connector, 50Ω.	
Aux/GPS	Optional for LTE MIMO antenna or GPS antenna ,SMA connector, 50Ω.	
Wi-Fi1	Wi-Fi antenna, SMA connector,	
Wi-Fi2	Wi-Fi antenna, SMA connector,	Wi-Fi MIMO
LAN1	10/100Base-TX, MDI/MDIX self-adaption.	
LAN2	10/100Base-TX, MDI/MDIX self-adaption.	
WAN	10/100Base-TX, MDI/MDIX self-adaption.	
Reset	Reset button,(press on button at least 5 seconds)	
PWR	Power connector	5~32V DC
I/O	I/O1 and I/O2 is digital input, and I/O3 is digital output.	

## 2.2 Dimension



## 2.3 How to Install

### 2.3.1 SIM/UIM card install

If use dual SIM/UIM card router, you need insert dual SIM before configure it. After inserting, please follow below steps to connect the router.



Before connecting, please disconnect any power resource of router

---

### 2.3.2 Ethernet Cable Connection

Use an Ethernet cable to connect the cellular Router with computer directly, or transit by a switch.

### 2.3.3 Serial Port Connection

If you want to connect the router via serial port to laptop or other devices, you should prepare a serial port or RJ45 cable, this cable is optional available from WLINK. One end connect to computer serial port, the other end connects to the console port of the router



Before connecting, please disconnect any power resource.

---

### 2.3.4 Power Supply

In order to get high reliability, WLINK OpenWrt Series Router power adapt supports wide voltage input range from +5V to +36VDC, support hot plug and complex application environment.

### 2.3.5 Review

After insert the SIM/UIM card and connect Ethernet cable and antenna, connect power supply adaptor or power cable.



Please connect the antenna before power on, otherwise the signal maybe poor because of impedance mismatching.

---

Notice:

- Step 1 Check the antenna connection.
- Step 2 Check SIM/UIM card, confirm SIM/UIM card is available.
- Step 3 Power on the industrial Router

----END

# 3 OpenWrt Instruction

## 3.1 GPIO and LED Indicators

GPIO	Indication	Description
GPIO_0	Output GPIO_0_out	Digit signal output
GPIO_1	Input GPIO_1_in	Digit signal input check: High level as default
GPIO_2	Input GPIO_2_in	Digit input check: High level as default
GPIO_3	Output SIM_Choose	SIM control: Low level for SIM1, and high level for SIM2. Low level as default for SIM available.
GPIO_4	Output Signal	Watchdog heartbeat check: 500ms pulse signal
GPIO_11	Output Error_LED	Error LED indication: Not find 3G/4G module or SIM card. LED on at low level and LED off at high level.
GPIO_12	Output module_PWR_Control	4G/3G module power control: Low level mode enable power for module. High level mode disable power for module. Note: reset module when module is abnormal.
GPIO_13	Output 2G_WLAN_LED	Wi-Fi LED indication. On at low level and off at high level.
GPIO_14	Output Net_1_LED	3G/4G signal strength indication(weak): On at low level and off at high level.
GPIO_15	Output Net_2_LED	3G/4G signal strength indication(Normal): On at

		low level and off at high level.
GPIO_16	Output Net_3_LED	3G/4G signal strength indication(good): On at low level and off at high level.
GPIO_17	Input Reset Button	WDS as default with high level as default. When GPIO17 detects constant low level more than 5sec, the router will reset to default setting.
GPIO_18	Output Internet_LED	WAN ACT LED. Light on for Low level and light off for high level.
GPIO_19	Output LED_LINK_1	LAN1 ACT LED. Light on for low level and light off for high level.
GPIO_20	Output LED_LINK_2	LAN2 ACT LED. Light on for low level and light off for high level.
GPIO_21	Output LED_LINK_3	LAN3 ACT LED. Light on for low level and light off for high level.
GPIO_22	Output PA_PWR_Control	Wi-Fi PA Power Control. High level to disable and low level to enable. If no need Wi-Fi feature, suggest turn off the Wi-Fi power to reduce power consumption.



Function Description.

1) GPIO 0~3. Disabled as default. It need to be disabled JTAG and enabled GPIO 0~3.

```
/* Disable JTAG, enabling GPIOs 0-3 */
ath79_gpio_function_enable(AR934X_GPIO_FUNC_JTAG_DISABLE);
```

2) GPIO11. Error LED Indication. If the 3G/4G module or SIM card is not detected, the LED will indicate the router can't connect cellular network.

3) GPIO12. The GPIO12 will control 3G/4G module power. The power is turn on as default, and the default value is 0 (low level).

If dial-up is failed after several times or module status is abnormal, it need to restart 3G/4G module. It will reset 3G/4G module when GPIO12 outputs high level for

3 seconds first and then pull low this level.

4) GPIO14. This GPIO is multiplexed. It is blinking when dial-up. After 3G/4G is online, it will be constant light. Meanwhile, it also indicates the signal value is less than or equal to 12.

When signal value >12 and <=18, the GPIO14 will be constant light with GPIO15 together, it indicates the signal is normal.

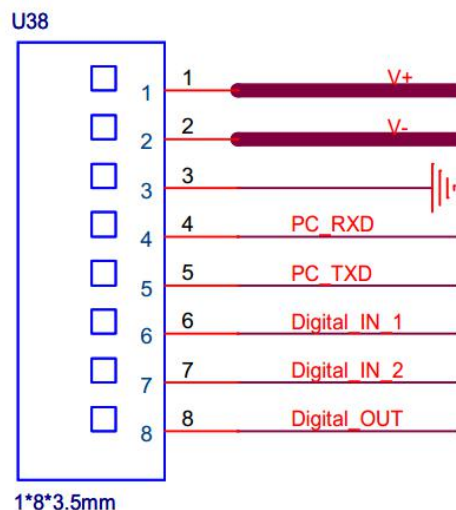
When signal value >18, GPIO14 will be constant light with GPIO15 and GPIO16 together, it indicates signal is good.

5) GPIO17. WPS as default. When GPIO17 detects constant low level more than 5sec, the router will reset to default setting.

```
static struct gpio_keys_button db120_gpio_keys[] __initdata = {
    {
        .desc           = "Reset button",
        .type           = EV_KEY,
        .code           = KEY_WPS_BUTTON,
        .debounce_interval = DB120_KEYS_DEBOUNCE_INTERVAL,
        .gpio           = DB120_GPIO_BTN_WPS,
        .active_low     = 1,
    },
};
```

### 3.2 Interface(8PINS) indication

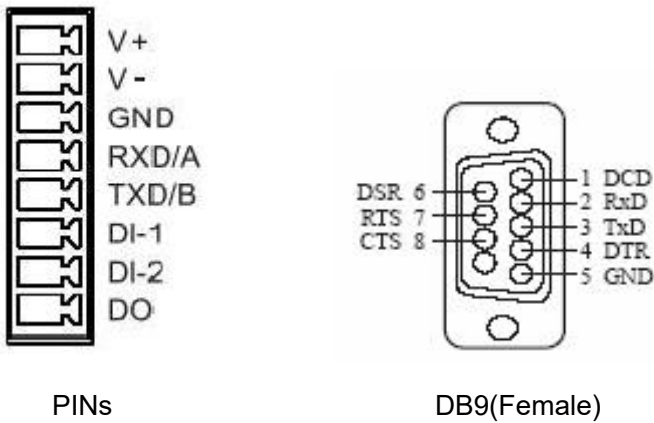
The RS232 port is used to debugging OpenWrt.



Pin	Indication	Note
1	V+	Vin+ (Nonpolar)

2	V-	Vin- (Nonpolar)
3	GND	GND
4	PC_RXD/485-B	RX
5	PC_TXD/485-A	TX
6	Digital_IN_1	Digital Input (I/O1)
7	Digital_IN_2	Digital Input (I/O2)
8	Digital_Output	Digital Output I/O

### 1) Serial Port Connection



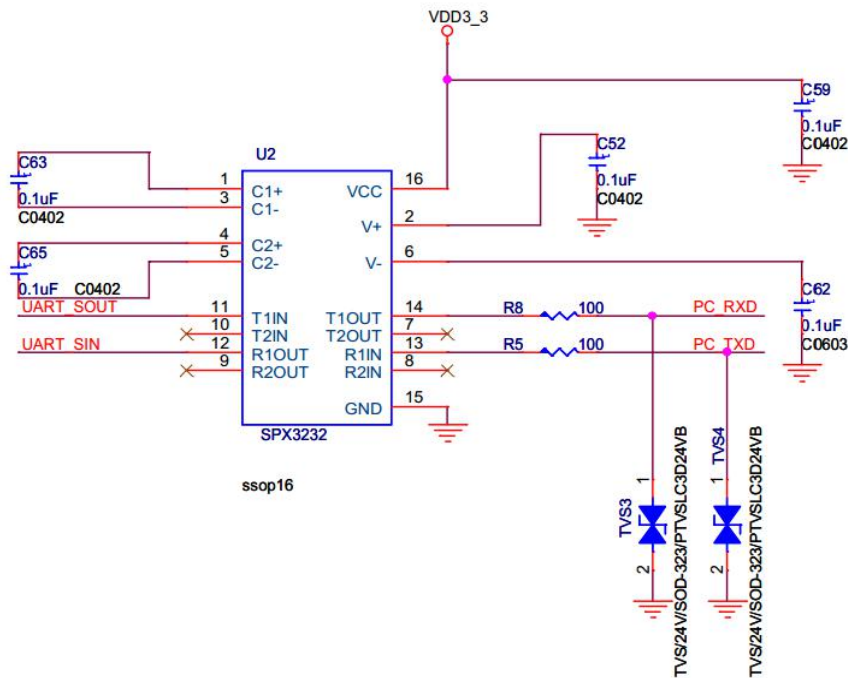
PINs		DB9(Female)
V+		
V-		
GND	----	5
RX	----	2
TX	----	3
DI-1		
DI-2		
DI-3		

#### Serial port properties

Properties	Note
Baud rate	115200bps
Data bits	8
Stop bits	1
Parity bits	none

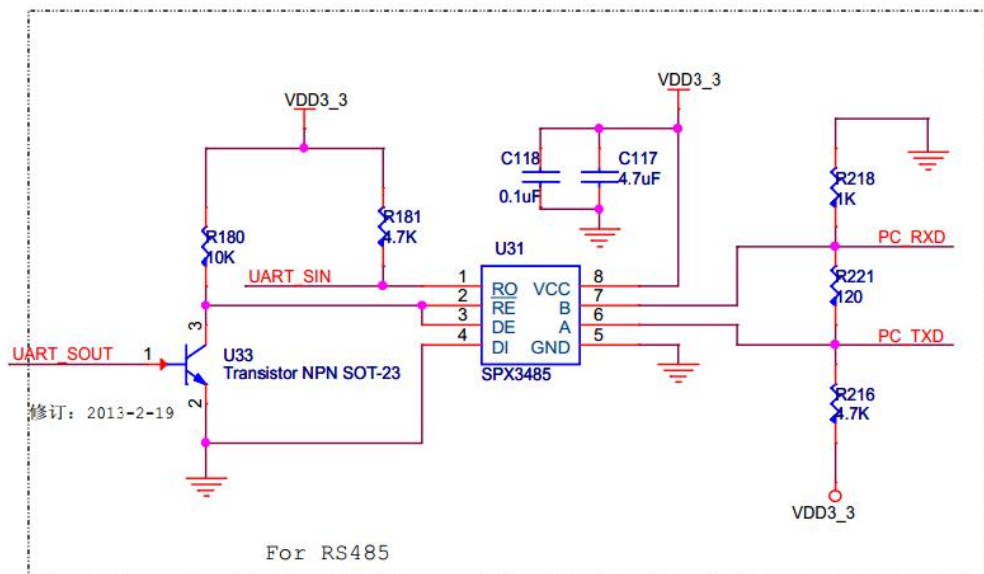
Flow control	none
--------------	------

## 2) Serial Port Schematic Diagram



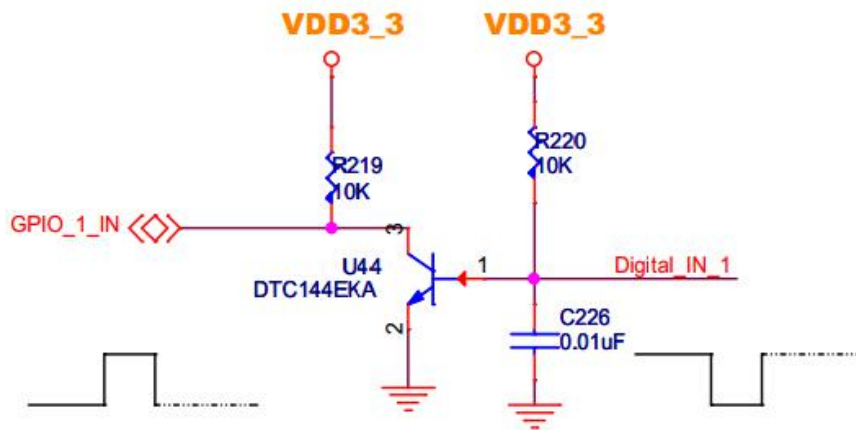
## 3) RS485 Schematic Diagram

The baud rate should be configured less than 57600bps when serial port is RS485.



## 4) GPIO DI Schematic Diagram

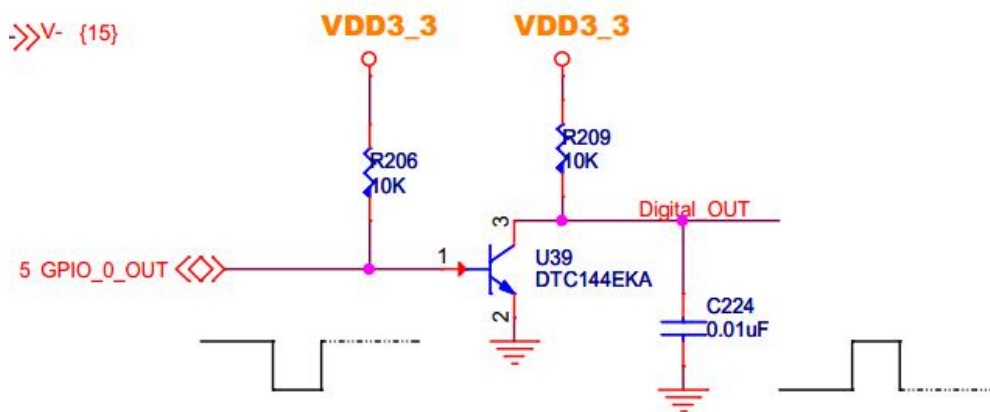
External 3.3V for voltage pull as default and GPIO\_1 for 0 as The vacancy situation.



### 5) GPIO DO Schematic Diagram

When GPIO\_0 output high level, external detection for low level.

When GPIO\_0 output low level, external detection for high level 3.3v.



## 3.3 OpenWrt Configuration

### 3.3.1 OpenWrt Source Code Libraries

`git clone https://github.com/openwrt/openwrt.git`

### 3.3.2 OpenWrt Edit Tool

`Make menuconfig`



```
Target System (Atheros AR7xxx/AR9xxx) --->
Subtarget (Generic) --->
Target Profile (Atheros DB120 reference board) --->
Target Images --->
Global build settings --->
[ ] Advanced configuration options (for developers) ----
[ ] Build the openwrt Image Builder
[ ] Build the openwrt SDK
[ ] Package the Openwrt-based Toolchain
[ ] Image configuration --->
Base system --->
Boot Loaders --->
Development --->
Firmware --->
Kernel modules --->
Languages --->
Libraries --->
LUCI --->
Mail --->
Multimedia --->
Network --->
Sound --->
Utilities --->
```

### 3.3.2.1 USB Support

```

<*> kmod-usb-acm..... Support for modems/isdn controllers
<> kmod-usb-atm..... Support for ATM on USB bus
<> kmod-usb-cm109..... Support for CM109 device
-* kmod-usb-core..... Support for USB
kmod-usb-dwc2..... DWC2 USB controller driver
<> kmod-usb-dwc3..... DWC3 USB controller driver
<> kmod-usb-hid..... Support for USB Human Input Devices
-* kmod-usb-net..... Kernel modules for USB-to-Ethernet converters
<> kmod-usb-net-asix..... Kernel module for USB-to-Ethernet Asix convertor
kmod-usb-net-asix-ax88179
<> kmod-usb-net-cdc-eem..... Support for CDC EEM connection
-* kmod-usb-net-cdc-ether..... Support for cdc ethernet connection
<*> kmod-usb-net-cdc-mbim..... Kernel module for MBIM Device
-* kmod-usb-net-cdc-ncm..... Support for CDC NCM connection
<*> kmod-usb-net-cdc-subset..... Support for CDC Ethernet subset connection
<> kmod-usb-net-dm9601-ether..... support for DM9601 ethernet connection
<*> kmod-usb-net-hso.. Kernel module for Option USB High Speed Mobile Device
<*> kmod-usb-net-huawei-cdc-ncm..... Support for Huawei CDC NCM connection
<> kmod-usb-net-ipheth..... Apple iPhone USB Ethernet driver
kmod-usb-net-kalmia..... Samsung Kalmia based LTE USB modem
<> kmod-usb-net-kaweth.. Kernel module for USB-to-Ethernet Kaweth convertor
<> kmod-usb-net-mcs7830
<> kmod-usb-net-pegasus
-* kmod-usb-net-qmi-wwan..... QMI WWAN driver
<*> kmod-usb-net-rndis..... Support for RNDIS connection
<> kmod-usb-net-rtl8150
<> kmod-usb-net-rtl8152
<*> kmod-usb-net-sierrawireless..... Support for Sierra wireless device
<> kmod-usb-net-smc95xx. SMSC LAN95XX based USB 2.0 10/100 ethernet device
kmod-usb-ohci..... Support for OHCI controllers
<> kmod-usb-ohci-pci..... Support for PCI OHCI controllers
<> kmod-usb-printer..... Support for printers
<*> kmod-usb-serial..... Support for USB-to-Serial converters
<> kmod-usb-serial-ark3116..... Support for ArkMicrochips ARK3116 device
<> kmod-usb-serial-belkin..... Support for Belkin device
<> kmod-usb-serial-ch341..... Support for CH341 device
<> kmod-usb-serial-cp210x..... Support for silicon Labs cp210x device
<> kmod-usb-serial-cypress-m8..... Support for cypressM8 USB-Serial
<> kmod-usb-serial-ftdi..... Support for FTDI device
<> kmod-usb-serial-garmin..... Support for Garmin GPS devices
<> kmod-usb-serial-ipw..... Support for IPWireless 3G devices
<> kmod-usb-serial-keyspan..... Support for Keyspan USB-to-Serial devices
<> kmod-usb-serial-mct..... Support for Magic Control Tech. devices
<> kmod-usb-serial-mos7720..... Support for Moschip MOS7720 devices
<*> kmod-usb-serial-option..... Support for Option HSDPA modems
<> kmod-usb-serial-oti6858..... Support for ours Technology OTI6858 devices
<> kmod-usb-serial-pl2303..... Support for Prolific PL2303 devices
<*> kmod-usb-serial-qualcomm..... Support for Qualcomm USB serial
<*> kmod-usb-serial-sierrawireless..... Support for Sierra wireless devices
<> kmod-usb-serial-simple..... USB Serial Simple (Motorola phone)
<> kmod-usb-serial-ti-usb..... Support for TI USB 3410/5052
<> kmod-usb-serial-visor..... Support for Handspring visor devices
-* kmod-usb-serial-wwan..... Support for GSM and CDMA modems
-* kmod-usb-storage..... USB Storage support
<*> kmod-usb-storage-extras..... Extra drivers for usb-storage
<> kmod-usb-uhci..... Support for UHCI controllers
-* kmod-usb-wdm..... USB Wireless Device Management
<> kmod-usb-yealink..... USB Yealink VOIP phone
<*> kmod-usb2..... Support for USB2 controllers
<> kmod-usb2-pci..... Support for PCI USB2 controllers
<> kmod-usb3..... Support for USB3 controllers
<> kmod-usbip..... USB-over-IP kernel support
<> kmod-usbip-client..... USB-over-IP client driver
<> kmod-usbip-server..... USB-over-IP host driver
<> kmod-usbmon..... USB traffic monitor
    
```

### 3.3.2.1 Network Support

```

< > kmod-8021q..... 802.1Q VLAN support
< > kmod-appletalk..... Appletalk protocol support
< > kmod-atm..... ATM support
< > kmod-ax25..... AX25 support
< > kmod-bonding..... Ethernet bonding driver
< > kmod-bridge..... Ethernet bridging support
< > kmod-capi..... CAPI (ISDN) support
< > kmod-dnsresolver..... In-kernel DNS Resolver
< > kmod-gre..... GRE support
< > kmod-gre6..... GRE support over IPV6
< > kmod-ip6-tunnel..... IP-in-IPV6 tunnelling
< > kmod-ipip..... IP-in-IP encapsulation
< > kmod-ipsec..... IPsec related modules (IPV4 and IPV6)
< > kmod-iptunnel6..... IPV6 tunneling
< > kmod-isdn4linux..... Old ISDN4Linux (deprecated)
< > kmod-l2tp..... Layer Two Tunneling Protocol (L2TP)
< > kmod-l2tp-eth..... L2TP ethernet pseudowire support for L2TPv3
< > kmod-l2tp-ip..... L2TP IP encapsulation for L2TPv3
< > kmod-llc..... ANSI/IEEE 802.2 LLC support
< > kmod-misdn..... MISDN (ISDN) support
< > kmod-netem..... Network emulation functionality
< > kmod-pktgen..... Network packet generator
-* kmod-ppp..... PPP modules
< > kmod-mppe..... Microsoft PPP compression/encryption
< > kmod-ppp-sync tty..... PPP sync tty support
< > kmod-pppoe..... PPPoE support
-* kmod-pppoe..... PPPoE support
< > kmod-ppp-l2tp..... PPPoL2TP support
-* kmod-pppox..... PPPoX helper
< > kmod-pptp..... PPTP support
< > kmod-rxrpc..... AF_RXRPC support
< > kmod-sched..... Extra traffic schedulers
-* kmod-sched-connmark..... Traffic shaper conntrack mark support
-* kmod-sched-core..... Traffic schedulers
< > kmod-sched-esfq..... Traffic shaper ESFQ support
< > kmod-sctp..... SCTP protocol kernel support
< > kmod-sit..... IPv6-in-IPv4 tunnel
< > kmod-slip..... SLIP modules
< > kmod-stp..... Ethernet Spanning Tree Protocol support
< > kmod-trelay..... Trivial Ethernet Relay
-* kmod-tun..... Universal TUN/TAP driver
< > kmod-udptunnel4..... IPv4 UDP tunneling support
< > kmod-udptunnel6..... IPv6 UDP tunneling support
< > kmod-veth..... Virtual ethernet pair device
< > kmod-vxlan..... Native VXLAN Kernel support
    
```

### 3.3.2.3 LuCI

```

< * > luci-proto-3g..... Support for 3G
-* luci-proto-ipv6..... Support for DHCPv6/6in4/6to4/6rd/DS-Lite/aiccu
< > luci-proto-openconnect..... Support for OpenConnect VPN
-* luci-proto-ppp..... Support for PPP/PPPoE/PPPoA/PPTP
< > luci-proto-relay..... Support for relayd pseudo bridges
< * > luci-proto-vpnc..... Support for VPNC VPN
    
```



### 3.3.2.4 Network

```

A(-)
<> ipip..... IP in IP Tunnel config support
<> ipset..... IPset administration utility
<> ipset-dns..... A lightweight DNS forwarder to populate ipsets
<> iputils-arping..... iputils - arping
<> iputils-clockdiff..... iputils - clockdiff
<> iputils-ping..... iputils - ping
<> iputils-ping6..... iputils - ping6
<> iputils-tftpd..... iputils - tftpd
<> iputils-tracepath..... iputils - tracepath
<> iputils-tracepath6..... iputils - tracepath6
<> iputils-traceroute6..... iputils - traceroute6
-* iw..... cfg80211 interface configuration utility
<> map..... MAP-E and Lightweight 4over6 configuration support
<> mdns..... Openwrt Multicast DNS Daemon
<> netdiscover..... An active/passive address reconnaissance tool
<> noping.... Ncurses application to send ICMP echo request to network hosts
<> nut..... Network UPS Tools
<*> odhcp6c..... Embedded DHCPv6-client for OpenWrt
(0) CER-ID Extension ID (0 = disabled)
<*> odhcpd..... Openwrt DHCP/DHCPv6(-PD)/RA server & Relay
(0) CER-ID Extension ID (0 = disabled)
<> omcproxy..... IGMPv3 and MLDv2 Multicast Proxy
<> oping..... Send ICMP echo request to network hosts
<*> ppp..... PPP daemon
<> ppp-mod-pppoe..... PPPoE plugin
<*> ppp-mod-pppoe2tp..... PPPoE2TP plugin
<> ppp-mod-pppoe2tp..... PPPoE2TP plugin
<> ppp-mod-ptp..... PPTP plugin
<> ppp-mod-radius..... RADIUS plugin
<> ppp-multilink..... PPP daemon (with multilink support)
<> pppdump..... Read PPP record file
<> pppstats..... Report PPP statistics
<> rssileds..... RSSI real-time LED indicator
<> samba36-client..... Samba 3.6 SMB/CIFS client
-* samba36-server..... Samba 3.6 SMB/CIFS server
(-1) Maximum level of compiled-in debug messages
<> snmp-utils..... Open source SNMP implementation (utilities)
<> snmpd..... Open source SNMP implementation (daemon)
<> snmpd-static..... Open source SNMP implementation (daemon)
<> soloscli..... Configuration utility for Solos ADSL2+ modems
<> tcpdump..... Network monitoring and data acquisition tool
<> tcpdump-mini
<> uclient-fetch..... Tiny wget replacement using libuclient
<> udpxy..... Convert UDP IPTV streams into HTTP streams
<> umbim..... Control utility for mobile broadband modems
<*> uqmi..... Control utility for mobile broadband modems
<> vnstat..... Console-based network traffic monitor
<> vsc7385-ucode-ap83. Vitesse VSC7385 microcode for the Atheros AP83 boards
<> vsc7385-ucode-pb44. Vitesse VSC7395 microcode for the Atheros PB44 boards
<> vsc7395-ucode-ap83. Vitesse VSC7395 microcode for the Atheros AP83 boards
<> vsc7395-ucode-pb44. Vitesse VSC7395 microcode for the Atheros PB44 boards
<> wpa-cli..... WPA supplicant command line interface
<> wpa-supPLICANT..... WPA supplicant
[ ] Disable timestamp check
[ ] Add rfkill support
(3) Minimum debug message priority
<> wpa-supPLICANT-mesh..... WPA Supplicant (with 802.11s and SAE)
<> wpa-supPLICANT-mini..... WPA Supplicant (minimal version)
<> wpa-supPLICANT-p2p..... WPA Supplicant (with Wi-Fi P2P support)
<> wpad..... IEEE 802.1x Authenticator/Supplicant (full)
<> wpad-mesh
<*> wpad-mini..... IEEE 802.1x Authenticator/Supplicant (WPA-PSK only)
<> wpan-tools..... cfg802154 interface configuration utility
<> wshaper..... wshaper
<*> wwan..... Generic OpenWrt 3G/4G proto handler
    
```



### 3.3.2.5 Utilities

```

SSL --->
Terminal --->
database --->
disc --->
<> bash..... The GNU Bourne Again Shell
<> cal..... display a calendar
<> collectd..... Lightweight system statistics collection daemon
<*> comgt..... Option/Vodafone 3G/GPRS control tool
<> comgt-directip..... Sierra wireless Direct-IP support
<*> comgt-ncm..... NCM 3G/4G Support
<> coreutils..... The GNU core utilities
<> dbus..... simple interprocess messaging system (daemon)
<*> dmesg..... print or control the kernel ring buffer
<> dropbearconvert..... utility for converting SSH keys
<> dump1090..... Mode S decoder for the Realtek RTL2832U (dump1090)
<> fconfig..... RedBoot configuration editor
<> flock..... manage locks from shell scripts
<> getopt..... parse command options (enhanced)
<> gnupg..... GNU privacy guard - a free PGP replacement
<> hwclock..... query or set the hardware clock
<> iconv..... Character set conversion utility
<> iwcap..... simple radiotap capture utility
<*> iinfo..... Generalized Wireless Information utility
<> jpeg-tools..... The Independent JPEG Group's JPEG manipulation tools
<*> jshn..... JSON Shell Notation
<*> libjson-script..... Minimalistic JSON based scripting engine
<> lm-sensors..... lm-sensors
<> lm-sensors-detect..... lm-sensors-detect
<> logger..... a shell command interface to the syslog system log module
<> look..... display lines beginning with a given string
<> losetup..... set up and control loop devices
<> maccalc..... MAC address calculation
<> mcookie..... generate magic cookies for xauth
<> mdadm..... A tool for managing Soft RAID under Linux
<> mount-utils..... related (u)mount utilities
<> mountd..... Openwrt automount daemon
<> namei..... follow a pathname until a terminal point is found
<> ocf-crypto-headers..... OCF-Linux cryptodev header
<> openssl-util..... Open source SSL toolkit (utility)
<> owipcalc..... Simple IPv4/IPv6 address calculator
<> prlimit..... get and set process resource limits
<> px5g..... X.509 certificate generator (using PolarSSL)
<> px5g-standalone
<> qrencode..... qrencode binary for producing qr codes
<> rbcfg..... RouterBOOT configuration tool
<> rename..... rename files
<> rrdcgil..... Round Robin Database (RRD) CGI graphing tool
<> rrdtool..... Round Robin Database (RRD) management tools
<> rtl-sdr..... Software Defined Radio with Realtek RTL2832U
<> shadow-utils..... The PLD Linux shadow utilities
<> spidev-test..... SPI testing utility
<> stoken ----
<> strace..... system call tracer
<*> uboot-envtools..... read/modify U-Boot bootloader environment
[ ] support environment in UBI volume
<> ugps..... Openwrt GPS Daemon
<*> usb-modeswitch..... USB mode switching utility
<> usbreset..... utility to send a USB port reset to a USB device
<> usbutils..... USB devices listing utilities
<> uuid..... UUID generation daemon
<> uuidgen..... create a new UUID value
<> v4l-utils..... Video 4 Linux utilities
<> view1090..... Mode S decoder for the Realtek RTL2832U (view1090)
<> watchcat..... Enable the configuration of programmed reboots
<> whereis... locate the binary, source, and manual page files for a command

```

### 3.3.3 Firmware Upgrade

```
fyang@DTServer:~/openwrt/trunk/bin/ar71xx$ ll
total 36260
drwxr-xr-x 3 fyang fyang 4096 Dec 31 10:11 ./
drwxr-xr-x 3 fyang fyang 4096 Dec 30 16:50 ../
-rw-r--r-- 1 fyang fyang 931 Dec 31 17:37 md5sums
-rw-r--r-- 1 fyang fyang 1310720 Dec 31 17:37 openwrt-ar71xx-generic-db120-kernel.bin
-rw-r--r-- 1 fyang fyang 4325376 Dec 31 17:37 openwrt-ar71xx-generic-db120-rootfs-squashfs.bin
-rw-r--r-- 1 fyang fyang 7752004 Dec 31 17:37 openwrt-ar71xx-generic-db120-squashfs-sysupgrade.bin
-rw-r--r-- 1 fyang fyang 4325376 Dec 31 17:37 openwrt-ar71xx-generic-root.squashfs
-rw-r--r-- 1 fyang fyang 4194308 Dec 31 17:37 openwrt-ar71xx-generic-root.squashfs-64k
-rw-r--r-- 1 fyang fyang 1776637 Dec 31 17:37 openwrt-ar71xx-generic-uImage-gzip.bin
-rw-r--r-- 1 fyang fyang 1263787 Dec 31 17:37 openwrt-ar71xx-generic-uImage-lzma.bin
-rwxr-xr-x 1 fyang fyang 3860300 Dec 31 17:37 openwrt-ar71xx-generic-vmlinux.bin*
-rwxr-xr-x 1 fyang fyang 3865364 Dec 31 17:37 openwrt-ar71xx-generic-vmlinux.elf*
-rw-r--r-- 1 fyang fyang 1835008 Dec 31 17:37 openwrt-ar71xx-generic-vmlinux.gz
-rw-r--r-- 1 fyang fyang 1310720 Dec 31 17:37 openwrt-ar71xx-generic-vmlinux.lzma
-rwxr-xr-x 1 fyang fyang 1335765 Dec 31 17:37 openwrt-ar71xx-generic-vmlinux-lzma.elf*
drwxr-xr-x 9 fyang fyang 4096 Dec 31 10:11 packages/
-rw-r--r-- 1 fyang fyang 1451 Dec 31 17:37 sha256sums
fyang@DTServer:~/openwrt/trunk/bin/ar71xx$
```

OpenWrt Backup / Restore

Click "Generate archive" to download a tar archive of the current configuration files. To reset the firmware to its initial state, click "Perform reset" (only possible with squashfs images).

Download backup:

Reset to defaults:

To restore configuration files, you can upload a previously generated backup archive here.

Restore backup:  未选择任何文件

Flash new firmware image

Upload a sysupgrade-compatible image here to replace the running firmware. Check "Keep settings" to retain the current configuration (requires an OpenWrt compatible firmware image).

Keep settings:

Image:  openwrt-ar71...\_supgrade.bin

OpenWrt Status System Services Network Logout

**No password set!**

There is no password set on this router. Please configure a root password to protect the web interface and enable SSH.  
Go to password configuration...

**Flash Firmware - Verify**

The flash image was uploaded. Below is the checksum and file size listed, compare them with the original file to ensure data integrity. Click "Proceed" below to start the flash procedure.

- Checksum: 6921af4c6fea2835a22a207d2daed0e4
- Size: 7.39 MB (7.56 MB available)
- Note: Configuration files will be erased.

## 3.4 VLAN Configuration

1) LAN1 is LAN port and LAN2 is WAN port as default in OpenWrt.

VLANs on "switch0" (AR934X built-in switch)

VLAN ID	CPU	Port 1	Port 2	Port 3	Port 4	Port 5	
Port status:	1000baseT full-duplex	100baseT full-duplex	no link	no link	no link	100baseT full-duplex	
1	tagged ▼	off ▼	untagged ▼	untagged ▼	untagged ▼	untagged ▼	Delete
2	tagged ▼	untagged ▼	off ▼	off ▼	off ▼	off ▼	Delete

2) Modify LAN setting as below.

OpenWrt Status ▼ System ▼ Services ▼ Network ▼ Logout AUTO REFRESH ON

**No password set!**  
 There is no password set on this router. Please configure a root password to protect the web interface and enable SSH.  
[Go to password configuration...](#)

### Switch

The network ports on this device can be combined to several VLANs in which computers can communicate directly with each other. VLANs are often used to separate different network segments. Often there is by default one Uplink port for a connection to the next greater network like the internet and other ports for a local network.

Switch "switch0" (AR934X built-in switch)

Enable VLAN functionality

VLANs on "switch0" (AR934X built-in switch)

VLAN ID	CPU	Port 1	Port 2	Port 3	Port 4	Port 5	
Port status:	1000baseT full-duplex	100baseT full-duplex	no link	no link	no link	100baseT full-duplex	
1	tagged ▼	untagged ▼	untagged ▼	untagged ▼	untagged ▼	off ▼	Delete
2	tagged ▼	off ▼	off ▼	off ▼	off ▼	untagged ▼	Delete



## 3.5 GPIO Debugging

- 1) GPIO definition in the DB120 OpenWrt as below.

```
root@openwrt:/sys/class/gpio# cat /sys/kernel/debug/gpio
GPIOs 0-22, ath79:
gpio-11 (green:usb          ) out hi
gpio-12 (green:wlan-5g      ) out hi
gpio-13 (green:wlan-2g      ) out hi
gpio-14 (green:status       ) out hi
gpio-15 (green:wps          ) out hi
gpio-16 (WPS button         ) in  hi
gpio-17 (sysfs              ) out lo
gpio-18 (sysfs              ) out lo
root@openwrt:/sys/class/gpio#
```

- 2) Modify LED indication in GUI

## 3.6 4G/3G dial-up


### 3.6.1 4G/3G PPP Dial-up Setting



OpenWrt Status System Services Network Logout UNSAVED CHANGES: 4 AUTO REFRESH ON

Common Configuration

General Setup **Advanced Settings** Firewall Settings

Status  3g-wan RX: 0.00 B (0 Pkts.)  
TX: 0.00 B (0 Pkts.)

Protocol UMTS/GPRS/EV-DO ▼


Modem device /dev/ttyUSB0 ▼

Service Type UMTS/GPRS ▼

APN 3GNET

PIN

PAP/CHAP username CARD

PAP/CHAP password \*\*\*\* 

Dial number \*99\*\*\*1#

- 1) Huawei MU709s/ME909s-120/ME909s-821/MU609 modem interface for ttyUSB0 and AT command interface for ttyUSB2.
- 2) SLM630 modem interface for ttyUSB2 and AT command interface for ttyUSB1.
- 3) ME3630/ZM8620 modem interface for ttyUSB1 and AT command interface for ttyUSB2.

*Note: Different 4G/3G module with different interface in Linux OS.*

### 3.6.2 4G/3G ECM/DHCP Dial-up Setting


WAN **WAN6** LAN

**Interfaces - WAN**


On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge interfaces" field and enter the names of several network interfaces separated by spaces. You can also use VLAN notation INTERFACE.VLANNR (e.g.: eth0.1).


Common Configuration

General Setup

Status  ppp-wan RX: 0.00 B (0 Pkts.)  
TX: 0.00 B (0 Pkts.)  
IPv4: 10.174.255.125/30

Protocol DHCP client ▼

Really switch protocol?  Switch protocol 

 Back to Overview **Save & Apply** Save Reset

192.168.1.1/cgi-bin/luci/admin/network/network/wan

OpenWrt Status System Services Network Logout Asterisk AUTO REFRESH ON

WAN WAN6 LAN

### Interfaces - WAN

On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge interfaces" field and enter the names of several network interfaces separated by spaces. You can also use VLAN notation INTERFACE.VLANNR (e.g.: eth0.1).

Common Configuration

General Setup Advanced Settings Physical Settings Firewall Settings

Bridge interfaces  creates a bridge over specified interface(s)

Interface

- Ethernet Switch: "eth0"
- VLAN Interface: "eth0.1" (lan)
- VLAN Interface: "eth0.2" (wan6)
- Ethernet Adapter: "eth1" (lan)
- Ethernet Adapter: "teql0"
- Ethernet Adapter: "usb0" (wan)
- Custom Interface:

Back to Overview Save & Apply Save Reset

192.168.1.1/cgi-bin/luci/admin/network/network/wan

OpenWrt Status System Services Network Logout Asterisk AUTO REFRESH ON

**No password set!**  
There is no password set on this router. Please configure a root password to protect the web interface and enable SSH.  
[Go to password configuration...](#)

WAN WAN6 LAN

### Interfaces - WAN

On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge interfaces" field and enter the names of several network interfaces separated by spaces. You can also use VLAN notation INTERFACE.VLANNR (e.g.: eth0.1).

Common Configuration

General Setup Advanced Settings Physical Settings Firewall Settings

Status Uptime: 0h 3m 14s  
MAC-Address: 02:1E:10:1F:00:00  
RX: 131.27 KB (1060 Pkts.)  
TX: 112.04 KB (1251 Pkts.)  
IPv4: 10.77.122.137/30

Protocol DHCP client

Hostname to send when requesting DHCP OpenWrt

En

ter OpenWRT console via serial port, then implement AT commands.

Run the command `ls /dev/ttyUSB*` to query the device file names of Huawei modules' ports (such as the Modem and Debugging ports)



```
root@localhost:~/linux-3.9# ls /dev/ttyUSB*
/dev/ttyUSB0 /dev/ttyUSB1 /dev/ttyUSB2 /dev/ttyUSB3 /dev/ttyUSB4 /dev/ttyUSB5
```

### 1) EM909s-821/ ME909s-120 ECM dial-up

ME909s-821/ ME909s-120 modem interface for ttyUSB0 and AT command interface for ttyUSB2.

*Note: ifconfig usb0 up before dial-up*

- Format

```
Chat -t 3 -e " 'AT Command' OK >> /dev/ttyUSB2 < /dev/ttyUSB2
```

- Connect 4G network

```
chat -t 3 -e " 'AT^NDISDUP=1,1,'3GNET'" OK >> / dev/ttyUSB2 < /dev/ttyUSB2
```

- Disconnect 4G network

```
chat -t 3 -e " 'AT^NDISDUP=1,0' OK >> /dev/ttyUSB2 < /dev/ttyUSB2
```

*Note: AT command format as below.*

*AT^NDISDUP=1,1,"<APN>","<Username>","<Password>",<Auth-type>*

- Check 4G Register status

```
root@openwrt:/etc/chatscripts# chat -t 3 -e '' 'AT+COPS?' OK >> /dev/ttyUSB2 < /dev/ttyUSB2
AT+COPS?
+COPS: 0,0,"CHN-UNICOM",2
OK
```

- Check current network

```
root@openwrt:/etc/chatscripts# chat -t 3 -e '' 'AT^SYSINFOEX' OK >> /dev/ttyUSB2 < /dev/ttyUSB2
^RSSI: 16
^HCSQ: "WCDMA",46,41,55
AT^SYSINFOEX
^SYSINFOEX: 2,3,0,1,,3,"WCDMA",46,"DC-HSPA+"
OK
```

- Check signal strength

```
root@openwrt:/etc/chatscripts# chat -t 3 -e '' 'AT+CSQ' OK >> /dev/ttyUSB2 < /dev/ttyUSB2
AT+CSQ
+CSQ: 16,99
OK
```

## 2) SLM630 ECM Dial-up

SLM630 modem interface for ttyUSB2 and AT command interface for ttyUSB1.

*Note: ifconfig usb0 up before dial-up*

- Format

```
Chat -t 3 -e '' 'AT Command' OK >> /dev/ttyUSB1 < /dev/ttyUSB1
```

- Connect 4G network

```
chat -t 3 -e '' 'AT^NDISDUP=1,1,"3GNET"' OK >> /dev/ttyUSB1 < /dev/ttyUSB1
```

- Disconnect 4G network

```
chat -t 3 -e '' 'AT^NDISDUP=1,0' OK >> /dev/ttyUSB1 < /dev/ttyUSB1
```

*Note: AT command format as below.*

*AT^NDISDUP=1,1,"<APN>","<Username>","<Password>",<Auth-type>*

- Check 4G Register status

```
chat -t 3 -e '' 'AT+PSRAT?' OK >> /dev/ttyUSB1 < /dev/ttyUSB1
```

```
root@Openwrt:/# chat -t 3 -e '' 'AT+PSRAT?' OK >> /dev/ttyUSB1 < /dev/ttyUSB1
AT+PSRAT?

+PSRAT:FDD LTE

OK
```

### 3) ME3630/ZM8620 ECM Dial-up

ME3630/ZM8620 modem interface for ttyUSB1 and AT command interface for ttyUSB2.

*Note: ifconfig usb0 up before dial-up*

- Connect 4G network  
 chat -t 3 -e '' 'AT+ZECMCALL=1' OK >> /dev/ttyUSB2 < /dev/ttyUSB2
- Check 4G Register status  
 chat -t 3 -e '' 'AT+ZCURAT?' OK >> /dev/ttyUSB1 < /dev/ttyUSB2

## 3.6.3 Overview Status

### ➤ PPP dial-up status

192.168.1.1/cgi-bin/luci//admin/status/overview

The screenshot shows the OpenWrt status overview page. At the top, there is a navigation bar with 'OpenWrt', 'Status', 'System', 'Services', 'Network', and 'Logout' menus, and an 'AUTO REFRESH ON' button. Below the navigation bar, the system status is displayed:

- Uptime: 0h 2m 53s
- Load Average: 0.53, 0.41, 0.17

The 'Memory' section shows three bars representing memory usage:

- Total Available: 36968 kB / 60792 kB (60%)
- Free: 33780 kB / 60792 kB (55%)
- Buffered: 3188 kB / 60792 kB (5%)

The 'Network' section shows the status of IPv4 and IPv6 WAN connections:

- IPv4 WAN Status: Type: 3g, Address: 10.73.117.145, Netmask: 255.255.255.255, Gateway: 10.64.64.64, DNS 1: 120.80.80.80, DNS 2: 221.5.88.88, Connected: 0h 0m 17s
- IPv6 WAN Status: Not connected

### ➤ DHCP dial-up status

192.168.1.1/cgi-bin/luci/admin/status/overview

OpenWrt Status System Services Network Logout Asterisk

AUTO REFRESH ON

Uptime 1h 18m 34s  
Load Average 0.03, 0.03, 0.05

Memory

Total Available 31728 kB / 60392 kB (52%)  
Free 27360 kB / 60392 kB (45%)  
Buffered 4368 kB / 60392 kB (7%)

Network

IPv4 WAN Status  
usb0 Type: dhcp  
Address: 10.77.122.137  
Netmask: 255.255.255.252  
Gateway: 10.77.122.138  
DNS 1: 120.80.80.80  
DNS 2: 221.5.88.88  
Expires: 5d 23h 55m 43s  
Connected: 0h 4m 17s

IPv6 WAN Status  
? Not connected

## 1.1 GPS Debugging

### 1.1.1 Huawei ME909/MU609

```
chat -t 3 -e " 'AT\^WPDST=1' OK >> /dev/ttyUSB0 < /dev/ttyUSB0
```

```
chat -t 3 -e " 'AT\^WPDGP' OK >> /dev/ttyUSB0 < /dev/ttyUSB0
```

```
cat /dev/ttyUSB3
```

*Note: Huawei ME909u-521/523 AT interface for ttyUSB2*

### 1.1.2 Forge SLM630

```
chat -t 3 -e " 'AT+FGGPSINIT' OK >> /dev/ttyUSB1 < /dev/ttyUSB1
```

```
chat -t 3 -e " 'AT+FGGPSMODE=0,0,1,6,0' OK >> /dev/ttyUSB1 < /dev/ttyUSB1
```

```
chat -t 3 -e " 'AT+FGGPSRUN' OK >> /dev/ttyUSB1 < /dev/ttyUSB1
```

```
cat /dev/ttyUSB3
```

*Note: implement reset command before reboot router as below*

```
chat -t 3 -e " 'AT+RESET' OK >> /dev/ttyUSB1 < /dev/ttyUSB1
```

### 1.1.3 Quectel EC20/EC25

```
chat -t 3 -e " 'AT+QGPS=1' OK >> /dev/ttyUSB2 < /dev/ttyUSB2
```

```
cat /dev/ttyUSB1
```

### 1.1.4 SIMCOM 7100E

```
chat -t 3 -e " 'AT+CGPS=1,1' OK >> /dev/ttyUSB2 < /dev/ttyUSB2
```

```
cat /dev/ttyUSB1
```

### 1.1.5 ZTE ME3630

```
chat -t 3 -e " 'at+zginit' OK >> /dev/ttyUSB2 < /dev/ttyUSB2
```

```
chat -t 3 -e " 'at+zgmode=3' OK >> /dev/ttyUSB2 < /dev/ttyUSB2
```

```
chat -t 3 -e " 'at+zgfixrate=2,5' OK >> /dev/ttyUSB2 < /dev/ttyUSB2
```

```
chat -t 3 -e " 'at+zgqos=50,100' OK >> /dev/ttyUSB2 < /dev/ttyUSB2
```

```
chat -t 3 -e " 'at+zgrun=1' OK >> /dev/ttyUSB2 < /dev/ttyUSB2
```

```
chat -t 3 -e " 'at+zgpsr=1' OK >> /dev/ttyUSB2 < /dev/ttyUSB2
```

```
chat -t 3 -e " 'at+zgmeasure=1' OK >> /dev/ttyUSB2 < /dev/ttyUSB2
```

```
cat /dev/ttyUSB2
```

## 1.2 NAND Flash

### 1.2.1 Edit Driver and BI Tool

~/openwrt/trunk/target/linux/ar71xx/generic/config-default:

```
CONFIG_CMDLINE="rootfstype=squashfs,jffs2 noinitrd"
```

```
# CONFIG_IP17XX_PHY is not set
```

```
# CONFIG_MARVELL_PHY is not set
```

```
# CONFIG_MICREL_PHY is not set
```

```
# CONFIG_MTD_CFI is not set
```

```
CONFIG_MTD_CFI_I2=y
```

```
CONFIG_MTD_M25P80=y
```

```
CONFIG_MTD_MAP_BANK_WIDTH_1=y
```

```
CONFIG_MTD_MAP_BANK_WIDTH_4=y
```

```
# CONFIG_MTD_MYLOADER_PARTS is not set
```

```
CONFIG_MTD_NAND=y
```

```
CONFIG_MTD_NAND_AR934X=y
```

```
CONFIG_MTD_NAND_AR934X_HW_ECC=y
```

```
CONFIG_MTD_NAND_ECC=y
```

```
CONFIG_MTD_NAND_ECC_BCH=y
```

```
# CONFIG_MTD_REDBOOT_PARTS is not set
```

```
# CONFIG_MTD_SM_COMMON is not set
```

```
# CONFIG_MTD_SPLIT_SEAMA_FW is not set
```

```
# CONFIG_MTD_TPLINK_PARTS is not set
```

```
CONFIG_MTD_UBI=y
```

```
CONFIG_MTD_UBI_BEELIMIT=20
```

```
CONFIG_MTD_UBI_BLOCK=y
```

```
# CONFIG_MTD_UBI_FASTMAP is not set
```



```
# CONFIG_MTD_UBI_GLUEBI is not set

CONFIG_MTD_UBI_WL_THRESHOLD=4096

# CONFIG_RTL8306_PHY is not set

# CONFIG_RTL8366_SMI is not set

# CONFIG_SOC_AR71XX is not set

# CONFIG_SOC_AR724X is not set

# CONFIG_SOC_AR913X is not set

CONFIG_SPI_ATH79=y

# CONFIG_SPI_BITBANG is not set

CONFIG_UBIFS_FS=y

# CONFIG_UBIFS_FS_ADVANCED_COMPR is not set
```

## 1.2.2 Loading driver information

```
0.864702] nand: device found, Manufacturer ID: 0xad, chip ID: 0xdc
0.871200] nand: Hynix NAND 512MiB 3,3V 8-bit
0.875708] nand: 512 MiB, SLC, erase size: 128 KiB, page size: 2048, oob size: 64
```

### 1) MTD Partition

```
root@openwrt:~# cat /proc/mtd
dev:   size:   erasesize:  name
mtd0: 00040000 00010000 "u-boot"
mtd1: 00010000 00010000 "u-boot_env"
mtd2: 00630000 00010000 "rootfs_data"
mtd3: 00440000 00010000 "kernel"
mtd4: 00160000 00010000 "nvram"
mtd5: 00010000 00010000 "art"
mtd6: 00010000 00010000 "firmware"
mtd7: 00790000 00010000 "ar934x-nfc"
mtd8: 20000000 00020000 "ar934x-nfc"
```

## 1.2.3 Partition Information

```
root@openwrt:~# cat /proc/partitions
major minor #blocks name
31        0         256 mtdblock0
31        1          64 mtdblock1
31        2        6336 mtdblock2
31        3       4352 mtdblock3
31        4       1408 mtdblock4
31        5          64 mtdblock5
31        6          64 mtdblock6
31        7       7744 mtdblock7
31        8     524288 mtdblock8
```

## 1.2.4 Formatting dblock8

```
root@openwrt:~# ubiformat /dev/mtd8
ubiformat: mtd8 (nand), size 536870912 bytes (512.0 MiB), 4096 eraseblocks of 131072 bytes (128.0 KiB), min. I/O size 2048 bytes
libscan: scanning eraseblock 4095 -- 100 % complete
ubiformat: 4096 eraseblocks are supposedly empty
ubiformat: formatting eraseblock 4095 -- 100 % complete
```

## 1.2.5 Mount ubi

```

root@openwrt:~# ubiattach /dev/ubi_ctrl1 -m 8
[ 791.697638] ubi0: attaching mtd8
[ 798.189295] ubi0: scanning is finished
[ 798.218787] ubi0: attached mtd8 (name "ar934x-nfc", size 512 MiB)
[ 798.224985] ubi0: PEB size: 131072 bytes (128 KiB), LEB size: 129024 bytes
[ 798.232016] ubi0: min./max. I/O unit sizes: 2048/2048, sub-page size 512
[ 798.238825] ubi0: VID header offset: 512 (aligned 512), data offset: 2048
[ 798.245713] ubi0: good PEBs: 4096, bad PEBs: 0, corrupted PEBs: 0
[ 798.251905] ubi0: user volume: 0, internal volumes: 1, max. volumes count: 128
[ 798.259242] ubi0: max/mean erase counter: 0/0, WL threshold: 4096, image sequence number: 1718978395
[ 798.268519] ubi0: available PEBs: 4012, total reserved PEBs: 84, PEBs reserved for bad PEB handling: 80
[ 798.278805] ubi0: background thread "ubi_bgt0d" started, PID 1016
UBI device number 0, total 4096 LEBs (528482304 bytes, 504.0 MiB), available 4012 LEBs (517644288 bytes, 493.7 MiB), LEB size 129024 bytes (126.0 KiB)
    
```

## 1.2.6 Ubi information

```

root@openwrt:~# ls /sys/class/ubi/
ubi0
root@openwrt:~# cat /sys/class/ubi/ubi0/dev
253:0
root@openwrt:~# cat /sys/class/ubi/ubi0/volumes_count
0
root@openwrt:~# ls /dev/ubi*
/dev/ubi0 /dev/ubi_ctrl1
root@openwrt:~#
    
```

## 1.2.7 Partition volume

```

root@openwrt:~# ubimkvol /dev/ubi0 -s 493MiB -N ubi_vol1
Volume ID 0, size 4007 LEBs (516999168 bytes, 493.0 MiB), LEB size 129024 bytes (126.0 KiB), dynamic, name "ubi_vol1", alignment 1
root@openwrt:~#
    
```

## 1.2.8 Mount ubi file system

```

root@openwrt:~# mnt# mount -t ubifs /dev/ubi0_0 /mnt
[ 1131.759941] UBIFS (ubi0:0): default file-system created
[ 1131.766777] UBIFS (ubi0:0): background thread "ubifs_bgt0_0" started, PID 1035
[ 1131.906683] UBIFS (ubi0:0): UBIFS: mounted UBI device 0, volume 0, name "ubi_vol1"
[ 1131.914416] UBIFS (ubi0:0): LEB size: 129024 bytes (126 KiB), min./max. I/O unit sizes: 2048 bytes/2048 bytes
[ 1131.924508] UBIFS (ubi0:0): FS size: 514934784 bytes (491 MiB, 3991 LEBs), journal size 25804800 bytes (24 MiB, 200 LEBs)
[ 1131.935636] UBIFS (ubi0:0): reserved for root: 4952683 bytes (4836 KiB)
[ 1131.942367] UBIFS (ubi0:0): media format: w4/r0 (latest is w4/r0), UUID 8C6DEBD5-048F-488B-B617-F5E96E55C621, small LPT mode1
root@openwrt:~# mnt#
    
```

## 1.2.9 Df file system Partition

```

root@openwrt:~# mnt# df
Filesystem          1k-blocks      Used Available Use% Mounted on
/dev/root            2048          2048         0 100% /rom
tmpfs                30204           56      30148   0% /tmp
/dev/mtdblock3      4352           296      4056   7% /overlay
overlayfs:/overlay 4352           296      4056   7% /
tmpfs                 512             0         512   0% /dev
/dev/ubi0_0         472256          16      467404   0% /mnt
root@openwrt:~# mnt#
    
```

# 1.3 GPIO Operation

## 3.9.1 GPIO Definition in Kernel

[./openwrt/trunk/build\\_dir/target-mips\\_34kc\\_musl-1.1.11/linux-ar71xx\\_generic/linux-4.1.13/arch/mips/ath79/mach-db120.c](#)

```

#define DB120_GPIO_LED_USB
#define DB120_GPIO_LED_WLAN_5G
#define DB120_GPIO_LED_WLAN_2G
#define DB120_GPIO_LED_STATUS
#define DB120_GPIO_LED_WPS

#define DB120_GPIO_BTN_WPS

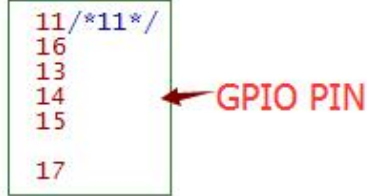
#define DB120_KEYS_POLL_INTERVAL 20 /* msecs */
#define DB120_KEYS_DEBOUNCE_INTERVAL (3 * DB120_KEYS_POLL_INTERVAL)

#define DB120_MAC0_OFFSET 0
#define DB120_MAC1_OFFSET 6
#define DB120_WMAC_CALDATA_OFFSET 0x1000
#define DB120_PCIE_CALDATA_OFFSET 0x5000

static struct gpio_led db120_leds_gpio[] __initdata = {
    {
        .name = "db120:green:signal1",
        .gpio = DB120_GPIO_LED_STATUS,
        .active_low = 1,
    },
    {
        .name = "db120:green:signal2",
        .gpio = DB120_GPIO_LED_WPS,
        .active_low = 1,
    },
    {
        .name = "db120:green:signal3",
        .gpio = DB120_GPIO_LED_WLAN_5G,
        .active_low = 1,
    },
    {
        .name = "db120:green:wlan-2g",
        .gpio = DB120_GPIO_LED_WLAN_2G,
        .active_low = 1,
    },
    {
        .name = "db120:green:status",
        .gpio = DB120_GPIO_LED_USB,
        .active_low = 1,
    }
};

static struct gpio_keys_button db120_gpio_keys[] __initdata = {
    {
        .desc = "Reset button",
        .type = EV_KEY,
        .code = KEY_WPS_BUTTON,
        .debounce_interval = DB120_KEYS_DEBOUNCE_INTERVAL,
        .gpio = DB120_GPIO_BTN_WPS,
        .active_low = 1,
    }
};

```



### 3.9.2 GPIO Operation by User

- 1) GPIO Control Contents: [/sys/class/gpio](#)
- 2) GPIO Export Control: [/sys/class/gpio/export](#)

It is used to inform system which GPIO pins need to be exported control.

- 3) Cancel Export Control: [/sys/class/gpio/unexport](#)

It is used to inform that system cancels export control.

4) GPIO Register Information: [/sys/class/gpio/gpiochipX](#)

It is used to save GPIO register information in contents system including register Pins number base, register name and Pins quantity.

### 3.9.3 Export a GPIO Operation

1) Count Pin number

Pin number=Register cardinal number of GPIO+ Register bits of GPIO

2) Write Pins number to [/sys/class/gpio/export](#).

e.g. Pins number is 11. We implement the below command in the shell.

```
echo 12 > /sys/class/gpio/export
```

If command is available, it will generate `echo 12 > /sys/class/gpio/export` contents.

If no the related contents, it indicates the Pin is unavailable.

3) Enter [direction file](#) of GPIO11 contents, and define input direction as below.

```
echo out > direction
```

```
echo in > direction
```

Note: direction parameter for `in` and `out`.

4) Enter [value file](#) of GPIO11 contents, and define high level(1) and low level(0) as below.

```
echo 0 > value
```

```
echo 1 > value
```

5) Reset button and GPIO input detection

In the initialization function `db120_setup`, KEY device is registered as

```
ath79_register_gpio_keys_polled(-1, DB120_KEYS_POLL_INTERVAL,
                                ARRAY_SIZE(db120_gpio_keys),
                                db120_gpio_keys);
```

It will be setup `platform` type device, and binding `gpio-keys-polled` driver(`gpio-button-hotplug.c`) after call the initialization function.

When press the reset button, it'll trigger `button_hotplug_event` function (`gpio-button-hotplug.c`).

Firstly, Call the `ueven` of `button_hotplug_create_event`

Secondly, Call the `fill even`(JSON format)of `button_hotplug_fill_even`

Finanlly, Call the `uevent` broadcast of `button_hotplug_work`



The `uevent` broadcast is received by `hotplug_handler` (`procd/plugin/hotplug.c`) of `procd` process. In according to the pre-defined `JSON` condition in `etc/hotplug.json`, it will be positioned to the related executive function as below.

```
[ "if",
  [ "and",
    [ "has", "BUTTON" ],
    [ "eq", "SUBSYSTEM", "button" ],
  ],
  [ "exec", "/etc/rc.button/%BUTTON%" ]
],
```

#### 6) Dual-SIM GPIO Control

In according to Pin3 definition in the GPIO table, control `/sys/class/gpio/gpio3`. The process as following.

Power off 4G/3G module--->GPIO high/low level to switch SIM card---> power on 4G/3G module.

After Power off 4G/3G module, please wait 8sec interval because it need to release the circuit protection.

## 1.4 Console Guide

### 1.4.1 Upgrade Firmware in Console

1) Connect Console(RS232) to WL-R220, and open serial port tool, then power on router. Please immediately press any key once indicated the information as below. The router will enter console mode.

```
Boot and Recovery Environment for Embedded Devices
Copyright (C) 2015 HackPascal <hackpascal@gmail.com>
Build date 2015-10-18 [git-bb5218f]
Version 1.0 (r777)

DRAM: 64MB
Platform: Atheros AR9344 rev 3
Board: Generic AR9344 with built-in 10/100M switch
Clocks: CPU: 560MHZ, DDR: 450MHZ, AHB: 225MHZ, Ref: 40MHZ
Flash: Macronix MX25L6435E (8MB) on ath79-spi
ag71xx-eth: Using MAC address 00:23:45:67:89:ab
eth0: Atheros AR8228/AR8229 rev 1

Network started on eth0, inet addr 192.168.1.1, netmask 255.255.255.0
Press any key to interrupt autoboot ... 2
Autoboot aborted due to key press.

starting breed built-in shell
breed>
```

2) Plug RJ5 cable on LAN2 port, then input 192.168.1.1 in browser to enter console GUI.

192.168.1.1/upgrade.html

## Breed Web 恢复控制台

Upgrade Firmware Button

Choose firmware bin

Upload Button

Bootloader	选择文件	未选择任何文件
固件	选择文件	未选择任何文件
<input checked="" type="checkbox"/> ART	选择文件	34.0B.05.16.22.A0.bin

### 3) Upgrade Firmware

192.168.1.1/upload.html

## Breed Web 恢复控制台

更新确认

文件已上传，请确认下方列出的信息

类型	ART
文件名	34.0B.05.16.22.A0.bin
大小	64KB (65536B)
MD5	1a8d0428b5de777c20cdb09be58f0458

更新

Upgrade Button

Please don't power off the router during upgrade. It'll take 10sec to upgrade.

192.168.1.1/upgrading.html

## Breed Web 恢复控制台

操作正在进行

您选择的操作正在进行  
正在更新固件，请耐心等待至进度条完成

更新完成，设备正在重启。本页面不会刷新，请手动检查设备状态。

警告：在操作进行过程中请不要断开电源

### 1.4.2 Reset in Console

Access to 192.168.1.1 to implement the "restore factory settings"



## 1.5 Testing Guide

### 1) Login

Default LAN IP is 192.168.1.1 without password as below.

**No password set!**

There is no password set on this router. Please configure a root password to protect the web interface and enable SSH.  
Go to password configuration...

### Authorization Required

Please enter your username and password.

Username

Password

Powered by LuCI (git-15.363.63969-f168692) / OpenWrt Designated Driver r48016

### 2) 4G/3G Setting

Click "Network > Interfaces > WAN > Edit" to enter the cellular settings.

OpenWrt
Status ▾ System ▾ Services ▾ Network ▾ Logout Asterisk ▾
AUTO REFRESH ON

**No password set!**  
 There is no password set on this router. Please configure a root password to protect the web interface and enable SSH.  
 Go to [password configuration...](#)

[WAN](#)   [WAN6](#)   [LAN](#)

---

## Interfaces

### Interface Overview

Network	Status	Actions
<b>LAN</b>  br-lan	Uptime: 0h 4m 4s MAC-Address: 34:08:06:17:22:B1 RX: 150.76 KB (1181 Pkts.) TX: 274.21 KB (1086 Pkts.) IPv4: 192.168.1.1/24 IPv6: fd87:9c82:8292::1/60	<input type="button" value="Connect"/> <input type="button" value="Stop"/> <input type="button" value="Edit"/> <input type="button" value="Delete"/>
<b>WAN</b>  3g-wan	Uptime: 0h 3m 54s MAC-Address: 00:00:00:00:00:00 RX: 53.94 KB (291 Pkts.) TX: 38.06 KB (358 Pkts.) IPv4: 10.64.47.168/32	<input type="button" value="Connect"/> <input type="button" value="Stop"/> <input type="button" value="Edit"/> <input type="button" value="Delete"/>
<b>WAN6</b>  eth0.2	Uptime: 0h 0m 0s MAC-Address: 34:08:06:17:22:B1 RX: 0.00 B (0 Pkts.) TX: 3.42 KB (28 Pkts.)	<input type="button" value="Connect"/> <input type="button" value="Stop"/> <input type="button" value="Edit"/> <input type="button" value="Delete"/>

Add new interface...

You can check the status of cellular network, and modify SIM card parameters such as PAN as requested.




WAN WAN6 LAN

## Interfaces - WAN

On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge interfaces" field and enter the names of several network interfaces separated by spaces. You can also use VLAN notation INTERFACE.VLANNR (e.g.: eth0.1).

### Common Configuration

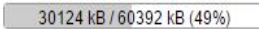
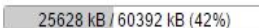
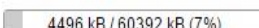
General Setup Advanced Settings Firewall Settings

Status	 3g-wan	<b>Uptime:</b> 0h 8m 23s <b>MAC-Address:</b> 00:00:00:00:00:00 <b>RX:</b> 65.87 KB (394 Pkts.) <b>TX:</b> 49.14 KB (489 Pkts.) <b>IPv4:</b> 10.64.47.168/32
Protocol	<input type="text" value="UMTS/GPRS/EV-DO"/>	
Modem device	<input type="text" value="/dev/ttyUSB0"/>	
Service Type	<input type="text" value="UMTS/GPRS"/>	
APN	<input type="text" value="3GNET"/>	
PIN	<input type="text"/>	
PAP/CHAP username	<input type="text" value="CARD"/>	
PAP/CHAP password	<input type="password" value="****"/>	

### 3) 4G/3G status

SIM card IP and DNS as below.

## Memory

Total Available	 30124 kB / 60392 kB (49%)
Free	 25628 kB / 60392 kB (42%)
Buffered	 4496 kB / 60392 kB (7%)

## Network

IPv4 WAN Status	 <b>Type:</b> 3g  <b>Address:</b> 10.18.76.71  <b>Netmask:</b> 255.255.255.255 <b>Gateway:</b> 10.64.64.64 <b>DNS 1:</b> 120.80.80.80 <b>DNS 2:</b> 221.5.88.88 <b>Connected:</b> 0h 56m 0s
-----------------	--

You may click "Network > Diagnostics" to test the network is available.

**No password set!**  
 There is no password set on this router. Please configure a root password to protect the web interface and enable SSH.  
[Go to password configuration...](#)

## Diagnostics

### Network Utilities

dev.openwrt.org      dev.openwrt.org      dev.openwrt.org

IPv4       IPv4      

```

PING dev.openwrt.org (217.115.15.26): 56 data bytes
64 bytes from 217.115.15.26: seq=0 ttl=45 time=431.002 ms
64 bytes from 217.115.15.26: seq=1 ttl=45 time=468.694 ms
64 bytes from 217.115.15.26: seq=2 ttl=45 time=424.421 ms
64 bytes from 217.115.15.26: seq=3 ttl=45 time=460.155 ms
64 bytes from 217.115.15.26: seq=4 ttl=45 time=421.994 ms

--- dev.openwrt.org ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 421.994/441.253/468.694 ms
    
```

## 4) WI-FI Setting

Click "Network > WIFI" to enter the General Setup and Advanced Settings. Then click "Enable" to use this feature.

**No password set!**  
 There is no password set on this router. Please configure a root password to protect the web interface and enable SSH.  
[Go to password configuration...](#)

radio0: Client "OpenWrt"

### Wireless Network: Client "OpenWrt" (radio0.network1)

The *Device Configuration* section covers physical settings of the radio hardware such as channel, transmit power or antenna selection which are shared among all defined wireless networks (if the radio hardware is multi-SSID capable). Per network settings like encryption or operation mode are grouped in the *Interface Configuration*.

#### Device Configuration

General Setup **Advanced Settings**

Status 🚫 **SSID: OpenWrt | Mode: Client**  
 0% Wireless is disabled or not associated

Wireless network is disabled

Operating frequency: Mode: N Channel: 11 (2462 MHz) Width: 20 MHz

Transmit Power: 23 dBm (199 mW)

-- THE END