

WLINK

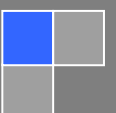
Quick Start

---Apply to WL-R220 Series OpenWrt Router

V1.2

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Shenzhen WLINK Technology Company Limited

Add: 3F, Yiben Building, Chaguang Rd., Xili, Nanshan Dist., China, 518000
Web: <http://www.wlink-tech.com>
Service Email: support@wlink-tech.com
Tel: 86-755-86089513
Fax: 86-755-26059261

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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.

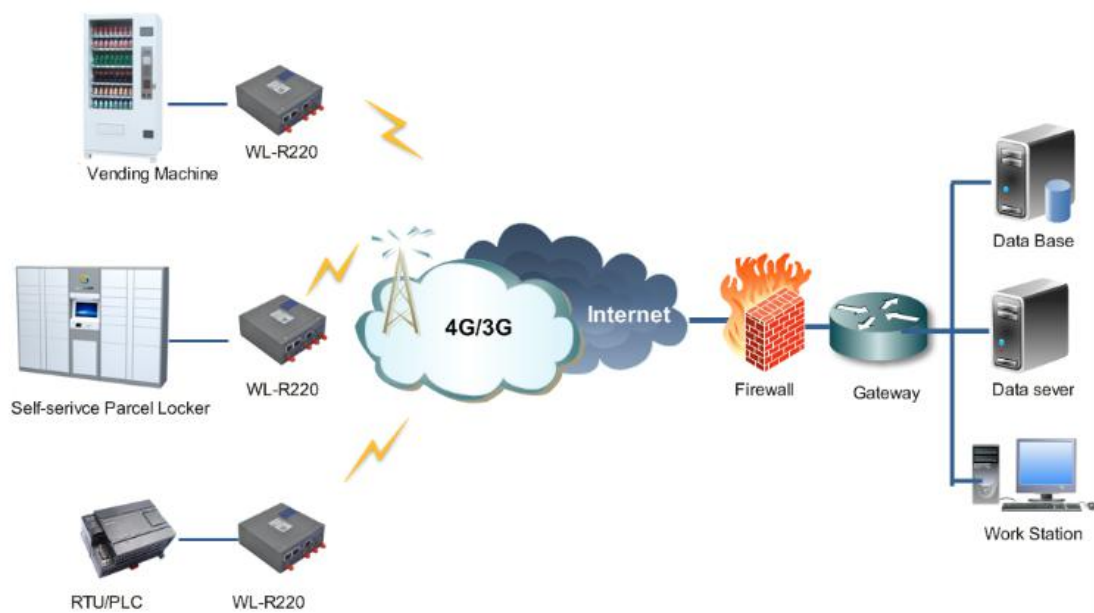


Figure 1-1 Network Topology

1.4 Hardware Features

- CPU: Atheros AR9344, 533MHz
- SPI Nor Flash - 8MB
- NAND Flash 512MB
- DDR2: 16Bit 64MB
- Mini PCIe Adapter USB2.0 3G/4G Module, 4G/HSPA+/WCDMA module

optional

- 1*USIM Slot/2*USIM Slot Optional
- 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

WLINK Tech.	WL-R220 OpenWrt Router
Front	
Top	



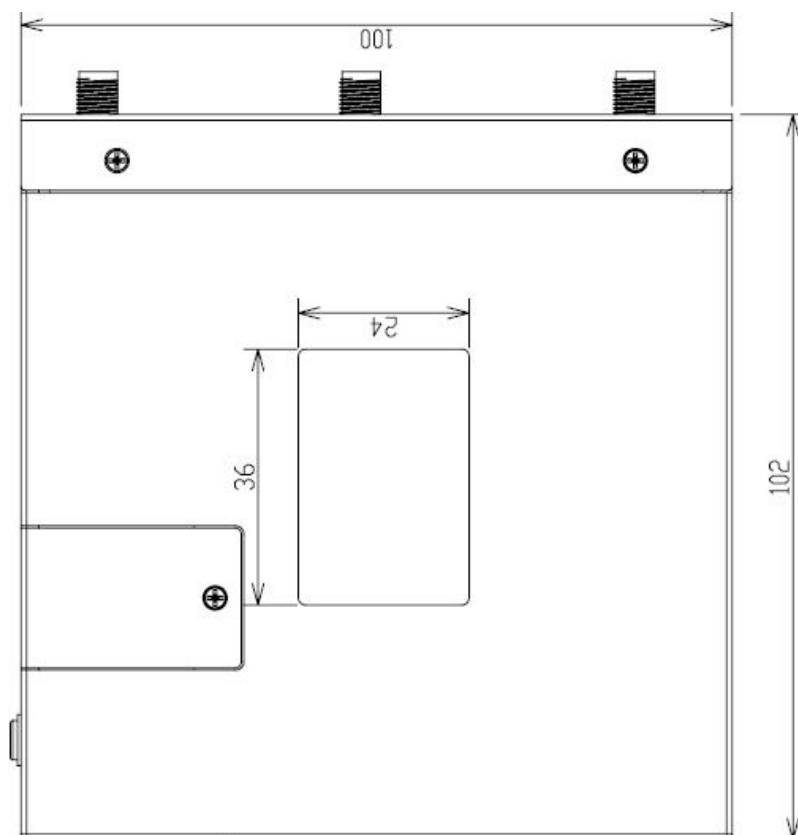
NOTE

There are some 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 ~ 26V 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: Low level as default
GPIO_2	Input GPIO_2_in	Digit input check: Low level as default
GPIO_3	Output SIM_Choose	SIM control: Low level for SIM1, and high level for SIM2. Low level as default.
GPIO_4	Output Signal	Watchdog heartbeat check: 500ms pulse signal
GPIO_1 1	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_1 2	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_1 3	Output 2G_WLAN_LED	Wi-Fi LED indication. On at low level and off at high level.
GPIO_1 4	Output Net_1_LED	3G/4G signal strength indication(weak): On at low level and off at high level.
GPIO_1	Output Net_2_LED	3G/4G signal strength indication(Normal): On at

5		low level and off at high level.
GPIO_1 6	Output Net_3_LED	3G/4G signal strength indication(good): On at low level and off at high level.
GPIO_1 7	Input Reset Button	Reset check: high level as default
GPIO_1 8	Output Internet_LED	WAN ACT LED. Light on for Low level and light off for high level.
GPIO_1 9	Output LED_LINK_1	LAN1 ACT LED. Light on for low level and light off for high level.
GPIO_2 0	Output LED_LINK_2	LAN2 ACT LED. Light on for low level and light off for high level.
GPIO_2 1	Output LED_LINK_3	LAN3 ACT LED. Light on for low level and light off for high level.
GPIO_2 2	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) 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.

2) 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.

3) 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.

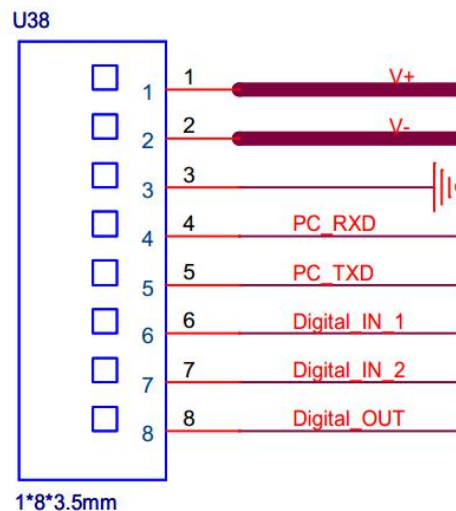
When signal value >12 and <=18, the GPIO14 will be constant light with GPIO15 together, it indicates the signal is normal.

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

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

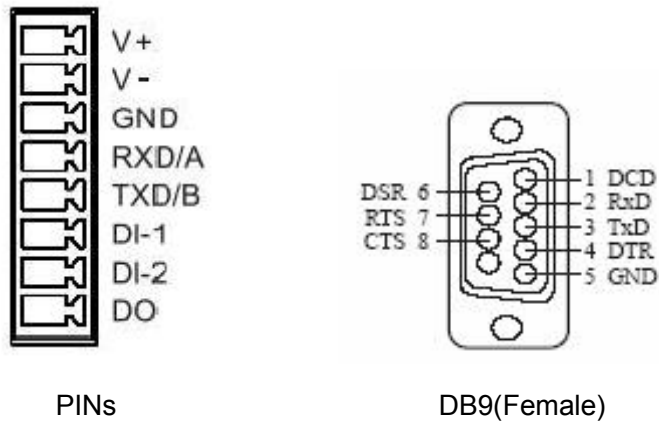
3.2 Interface(8PINs) indication

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

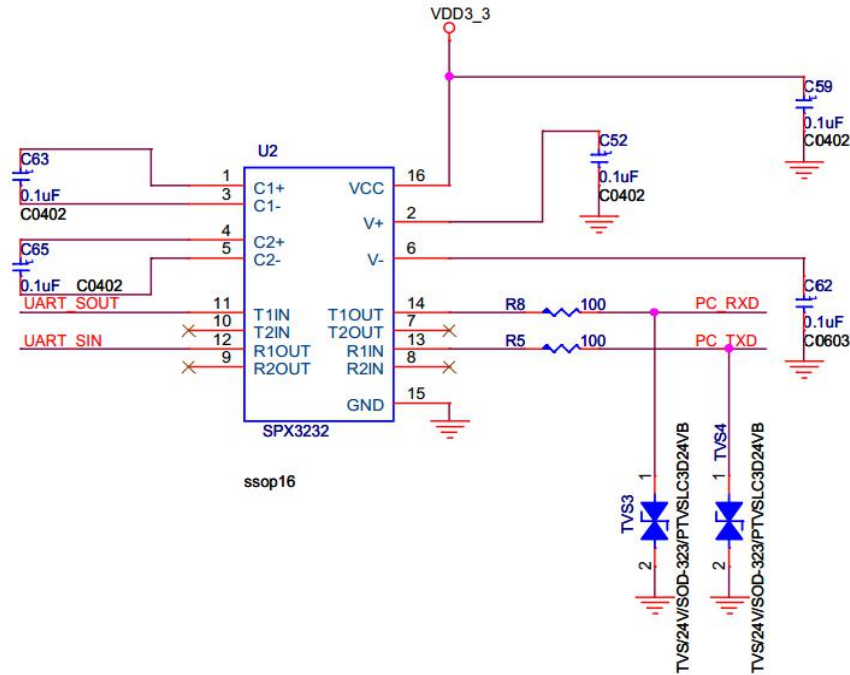


PINS		DB9(Female)
V+		
V-		
GND	----	5
RX	----	2
TX	----	3
DI-1		
DI-2		
DI-3		

Serial port properties

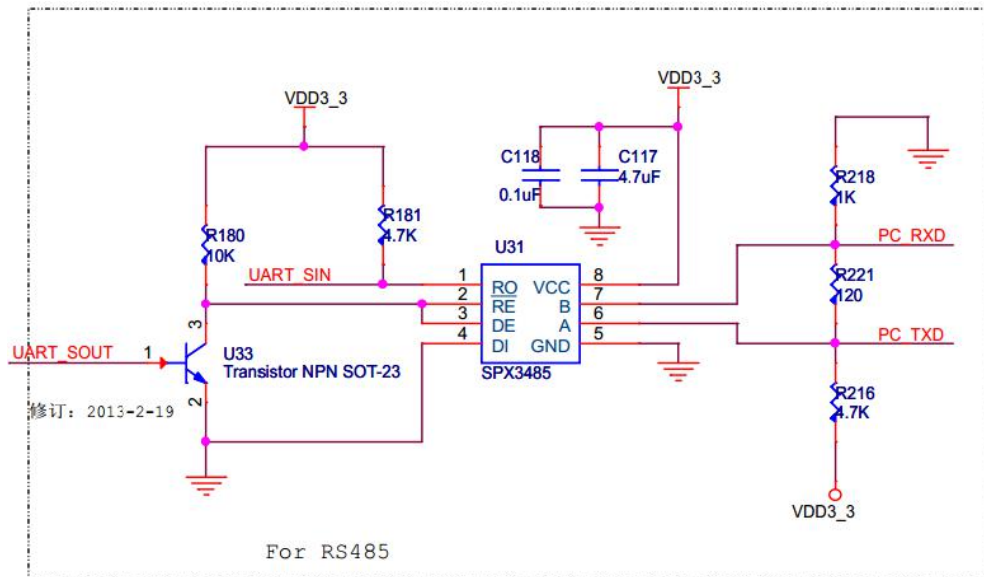
Properties	Note
Baud rate	115200bps
Data bits	8
Stop bits	1
Parity bits	none
Flow control	none

2) Serial Port Schematic Diagram



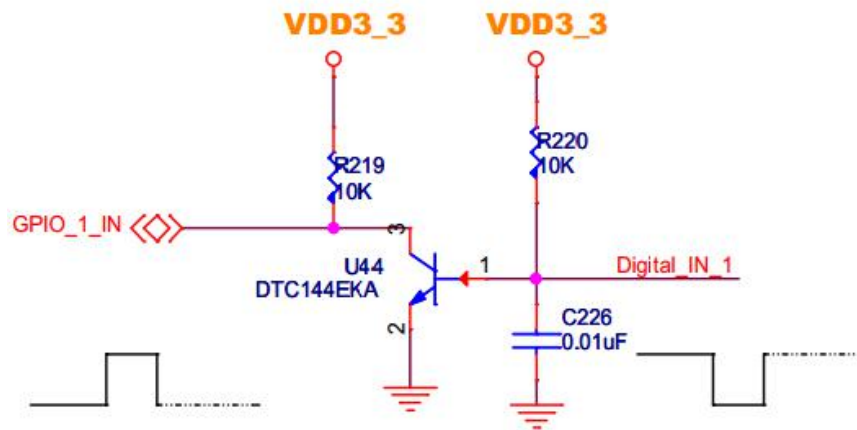
3) RS485 Schematic Diagram

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



4) GPIO DI Schematic Diagram

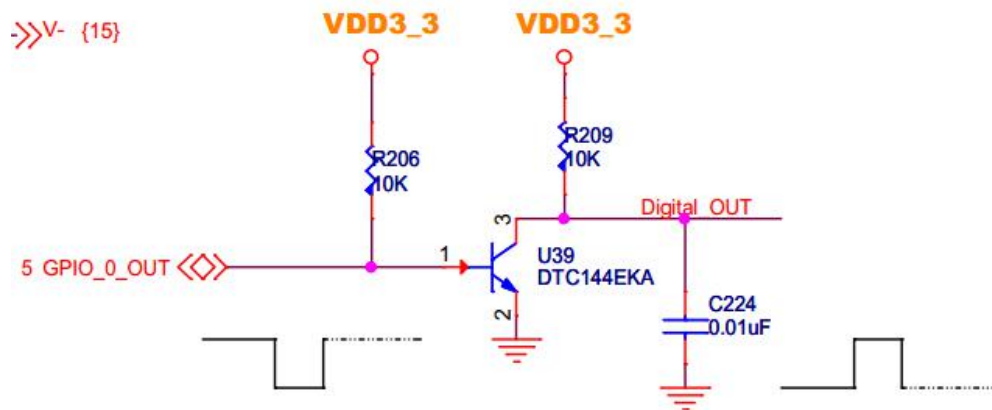
External 3.3V for voltage pull as default and GPIO_1 for 0 as The vacancy situation.



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

[svn co svn://svn.openwrt.org/openwrt/trunk](https://svn.openwrt.org/openwrt/trunk)

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 module
< > 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.. SMC 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-pppol2tp..... 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-pppoe..... PPPoE plugin
<> ppp-mod-pppoe12tp..... PPPoE12TP 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)
<> wlan-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 programed reboots
<> whereis... locate the binary, source, and manual page files for a command

```

3.3.3 Firmware Upgrade

```

fyang@DTServer:~/openwrt/trunk/bin/ar71xx$ ls -l
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 / Flash

192.168.1.1/cgi-bin/luci/admin/system/flashops

OpenWrt Status System Services Network Logout

Actions Configuration

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

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

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: 6921af4c6fea2835a22a207d2daed0a4
- Size: 7.39 MB (7.56 MB available)
- Note: Configuration files will be erased.

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

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 ▼
2	tagged ▼	untagged ▼	off ▼	off ▼	off ▼	off ▼

- 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	LAN 2 Port 1	LAN 1 Port 2	Port 3	Port 4	WAN 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 ▼
2	tagged ▼	off ▼	off ▼	off ▼	off ▼	untagged ▼

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

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...](#)

LED Configuration

Customizes the behaviour of the device [LEDs](#) if possible.

Delete

Name

LED Name

Default state
☐

Trigger

Add

Save & Apply
Save
Reset

3.6 4G/3G dial-up

- 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#

2) 4G/3G DHCP Dial-up Setting

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.VLANID` (e.g.: eth0.1).

Common Configuration

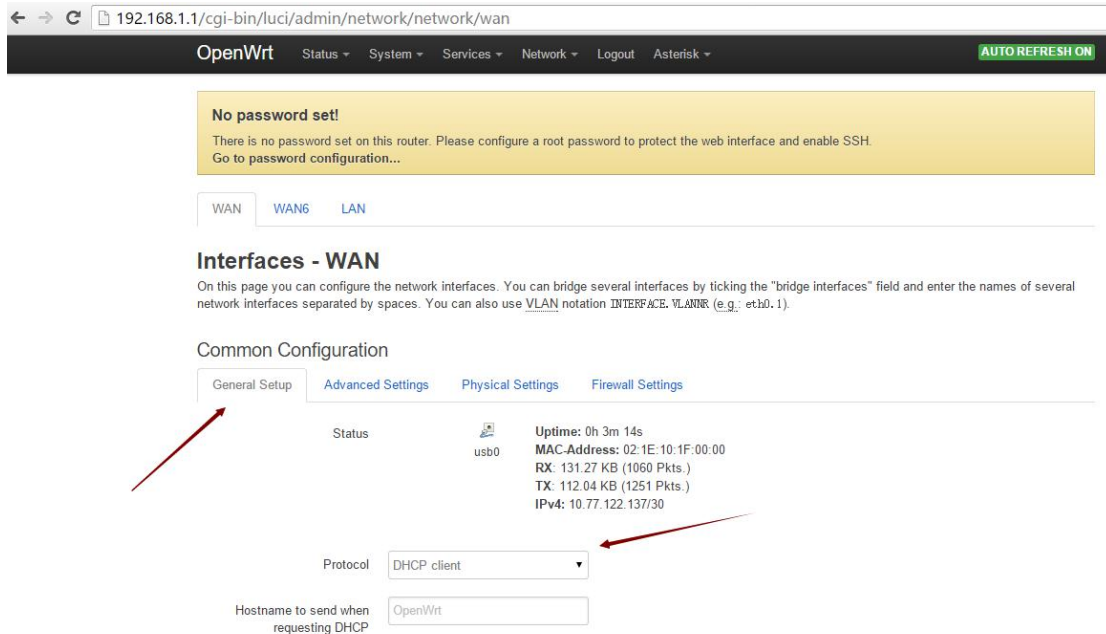
General Setup
Advanced Settings
Physical Settings
Firewall Settings

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



Enter OpenWRT console via serial port, then implement AT commands as below.

➤ Format

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

➤ Disconnect 4G network

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

➤ Connect 4G network

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

/dev/ttyUSB2



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
```



NOTE

3GNET for APN. Different module with different virtual ttyUSB number. Normally, ttyUSB0 for 3G module virtual number, and ttyUSB2 for 4G virtual number.

3) Overview Status

➤ PPP dial-up status

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

OpenWrt
Status
System
Services
Network
Logout
AUTO REFRESH ON

Uptime0h 2m 53s

Load Average0.53, 0.41, 0.17

Memory

Total Available36968 kB / 60792 kB (60%)

Free33780 kB / 60792 kB (55%)

Buffered3188 kB / 60792 kB (5%)

Network

IPv4 WAN Status

Type: 3g

3g- Address: 10.73.117.145

wan 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

3.7 NAND Flash

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
```

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"
mtd3:  00440000 00010000  "rootfs_data"
mtd4:  00160000 00010000  "kernel"
mtd5:  00010000 00010000  "nvram"
mtd6:  00010000 00010000  "art"
mtd7:  00790000 00010000  "firmware"
mtd8:  20000000 00020000  "ar934x-nfc"
```

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
```

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
```

5) Mount ubi

```
root@openwrt:~# ubiattach /dev/ubi_ctrl -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)
```

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_ctrl
root@openwrt:/#
```

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:/#
```

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-4B8B-B617-F5E96E55C621, small LPT model
root@openwrt:/mnt#
```

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           4/2256          16      46/404   0% /mnt
root@openwrt:/mnt#
```

3.8 GPIO Operation

3.8.1 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,
    }
};
```



3.8.2 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.

3.8.3 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.](#)

The control interval time more than 8s because it need to release the circuit protection during power off/on 4G/3G module.

-- THE END