Development Document

Document Name: DSGW-081
SmartGateway SDK QuickStart

Revision History

Specification		Sect.	Update Description	By
Rev	**Date**			
1.0	2023-04-20		New version release	au

Approvals

Organization	*Name*	*Title*	*Date*

Content

1. Introduction

This Quick Start Guide explains the basics: - how to connect and set up your target on the network - how to install the SDK - how to modify and build the firmware images
The Linux Software Developer's Kit (SDK) is an embedded hardware and software suite that enables Linux developers to create applications on Dusun's DSGW-081 gateway.

2. Gateway Information

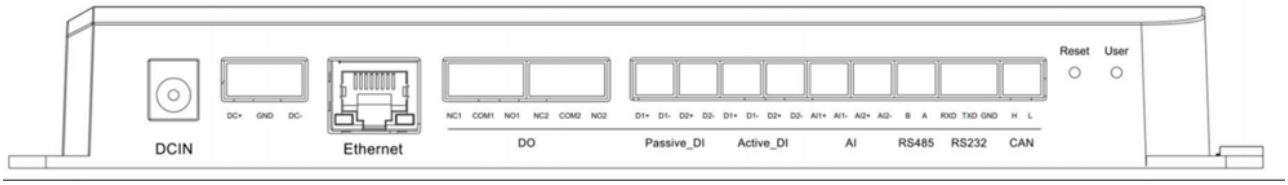
This section describes the gateway's basic resource infomation and interfaces.

2.1 Basic information

- Processor: I.MX6UL (ARM32)
- Supply: DC-12V/2A
- RAM: DDR2 512M
- EMMC: 8G

- Ethernet: WAN RJ45/10M/100M
- Bluetooth: ERF32BG21
- Zigbee: EFR32MG1B232
- LTE: BG96/EG91/..
- 1 User Button
- 1 Can
- 1 RS232
- 1 RS485
- 2 Analog in
- 2 Active In
- 2 Passive in
- 2 Digtal out

2.2 Interface



3. Debug Setup

This section describes how to connect the gateway into your host computer and network to debug for development.

3.1 Power

- Make sure that the power adapter is 12V/2A.
- Select the appropriate power plug adaptor for your geographical location. Insert it into the slot on the Universal Power Supply; then plug the power supply into an outlet.
- Connect the output plug of the power supply to the gateway

3.2 Wire Connect

Connect gateway to a router for login

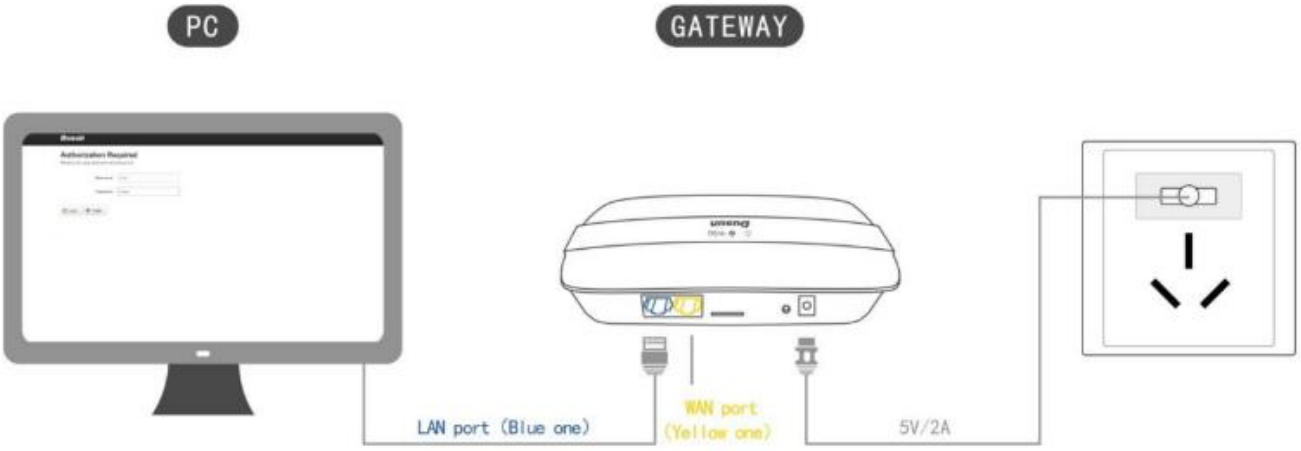
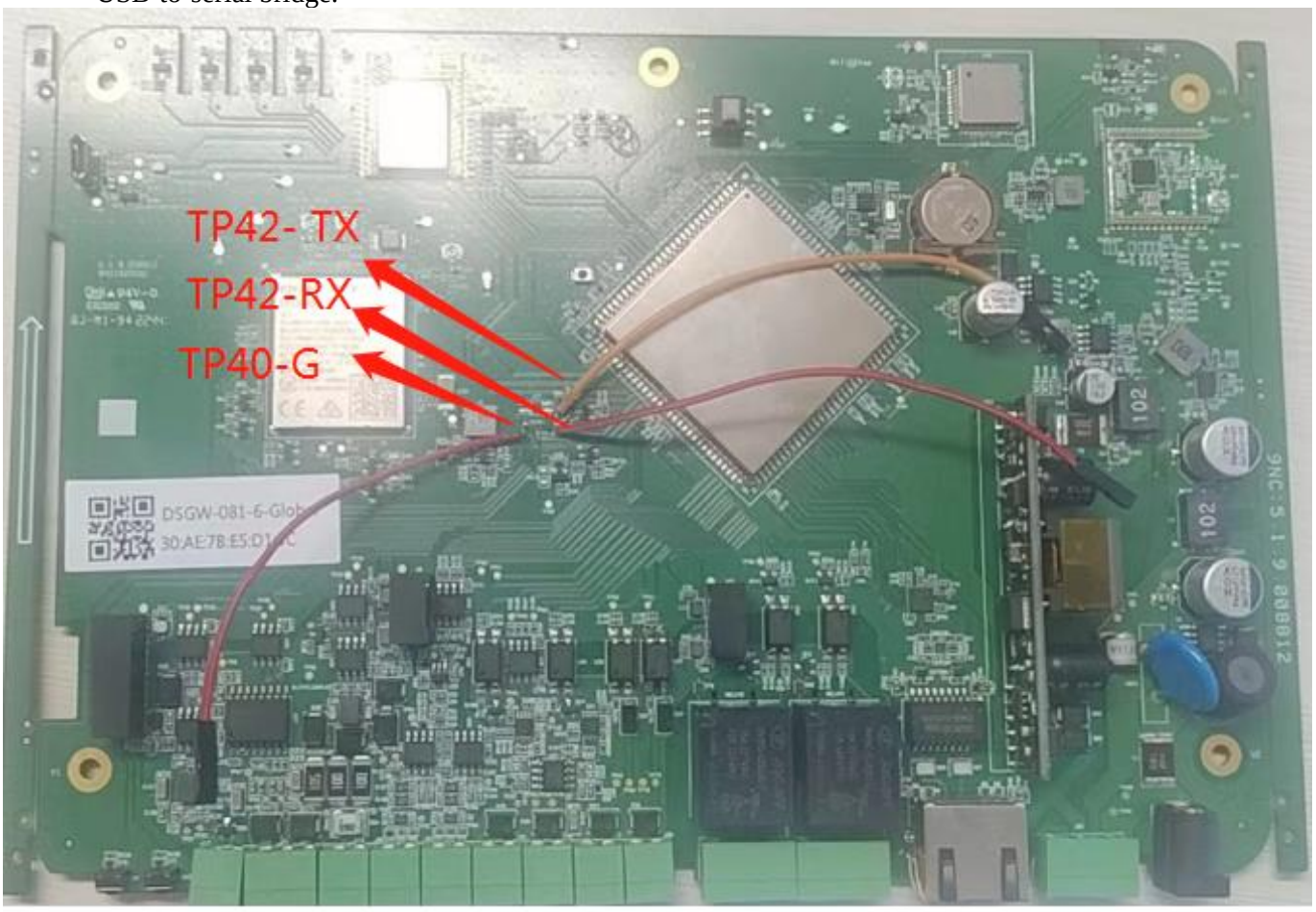


Figure3-1. Connecting a gateway via Ethernet port

3.3 Debug Uart Connect

- Before you set up your development test bed, please connect the PCB serial port to your develop PC via USB-to-serial bridge.



- PCB serial port on Gateway

USB-to-serial bridge. Serial port setting:
Baud rate: 115200
Bits: 8
Stop Bits: 1
Hardware flow control: None

4. SDK Download And Compile

This section describes how to download the sdk and compile it.

4.1 SDK Envirment Prepare

Compilation environment: Centos/Ubuntu Openwrt's compilation tool is automatically generated by SDK built, no additional installation is required

4.1 SDK Download

Get the source code from Dusun FTP server uncompress it under your work directory. For example:

```
mkdir -p ~/workdir/dsgw081
tar zxvf DSGW-081_sdk_AV1.0.0.10.tar.gz -C /workdir/dsgw081
cd ~/workdir/dsgw081
```

4.2 SDK Compile

```
cd ~/workdir/dsgw081
./build.sh
```

4.2 SDK Output

- zImage is the Kernel
- imx6ull-14x14-emmc-4.3-480x272-c.dtb is the dtb file
- modules.tar.bz2 is kernel module file
- fs.img the root filesystem

```
total 11M
drwxrwxr-x  2 au au 4.0K Apr 11 16:59 .
drwxrwxr-x 27 au au 4.0K Apr 11 16:59 ..
-rw-rw-r--  1 au au  34K Apr 11 16:59 DSGW-081.dtb
-rw-rw-r--  1 au au  39K Apr 11 16:59 imx6ull-14x14-emmc-10.1-1280x800-c.dtb
-rw-rw-r--  1 au au  39K Apr 11 16:59 imx6ull-14x14-emmc-4.3-480x272-c.dtb
-rw-rw-r--  1 au au  39K Apr 11 16:59 imx6ull-14x14-emmc-4.3-800x480-c.dtb
-rw-rw-r--  1 au au  39K Apr 11 16:59 imx6ull-14x14-emmc-7-1024x600-c.dtb
-rw-rw-r--  1 au au  39K Apr 11 16:59 imx6ull-14x14-emmc-7-800x480-c.dtb
-rw-rw-r--  1 au au  40K Apr 11 16:59 imx6ull-14x14-emmc-hdmi.dtb
-rw-rw-r--  1 au au  40K Apr 11 16:59 imx6ull-14x14-emmc-vga.dtb
-rw-rw-r--  1 au au  39K Apr 11 16:59 imx6ull-14x14-nand-10.1-1280x800-c.dtb
-rw-rw-r--  1 au au  39K Apr 11 16:59 imx6ull-14x14-nand-4.3-480x272-c.dtb
-rw-rw-r--  1 au au  39K Apr 11 16:59 imx6ull-14x14-nand-4.3-800x480-c.dtb
-rw-rw-r--  1 au au  39K Apr 11 16:59 imx6ull-14x14-nand-7-1024x600-c.dtb
```

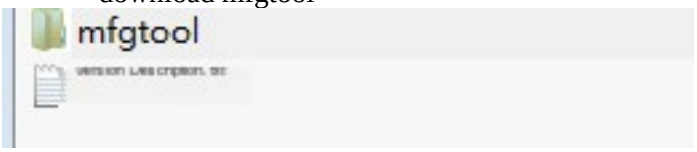
```
-rw-rw-r--  1 au au  39K Apr 11 16:59 imx6ull-14x14-nand-7-800x480-c.dtb
-rw-rw-r--  1 au au  40K Apr 11 16:59 imx6ull-14x14-nand-hdmi.dtb
-rw-rw-r--  1 au au  40K Apr 11 16:59 imx6ull-14x14-nand-vga.dtb
-rw-rw-r--  1 au au 2.8M Apr 11 16:59 modules.tar.bz2
-rwxrwxr-x  1 au au 7.7M Apr 11 16:59 zImage
total 4.8M
drwxrwxr-x  2 au au 4.0K Apr 11 17:00 .
drwxrwxr-x 23 au au 4.0K Apr 11 17:00 ..
-rwxrwxr-x  1 au au 369K Apr 11 17:00 u-boot-imx6ull-14x14-ddr256-emmc.bin
-rw-rw-r--  1 au au 375K Apr 11 17:00 u-boot-imx6ull-14x14-ddr256-emmc.imx
-rwxrwxr-x  1 au au 418K Apr 11 17:00 u-boot-imx6ull-14x14-ddr256-nand.bin
-rw-rw-r--  1 au au 423K Apr 11 17:00 u-boot-imx6ull-14x14-ddr256-nand.imx
-rwxrwxr-x  1 au au 421K Apr 11 16:59 u-boot-imx6ull-14x14-ddr256-nand-sd.bin
-rw-rw-r--  1 au au 427K Apr 11 16:59 u-boot-imx6ull-14x14-ddr256-nand-sd.imx
-rwxrwxr-x  1 au au 369K Apr 11 17:00 u-boot-imx6ull-14x14-ddr512-emmc.bin
-rw-rw-r--  1 au au 375K Apr 11 17:00 u-boot-imx6ull-14x14-ddr512-emmc.imx
-rwxrwxr-x  1 au au 418K Apr 11 17:00 u-boot-imx6ull-14x14-ddr512-nand.bin
-rw-rw-r--  1 au au 423K Apr 11 17:00 u-boot-imx6ull-14x14-ddr512-nand.imx
-rwxrwxr-x  1 au au 421K Apr 11 17:00 u-boot-imx6ull-14x14-ddr512-nand-sd.bin
-rw-rw-r--  1 au au 427K Apr 11 17:00 u-boot-imx6ull-14x14-ddr512-nand-sd.imx
```

5. Firmware Program And Program

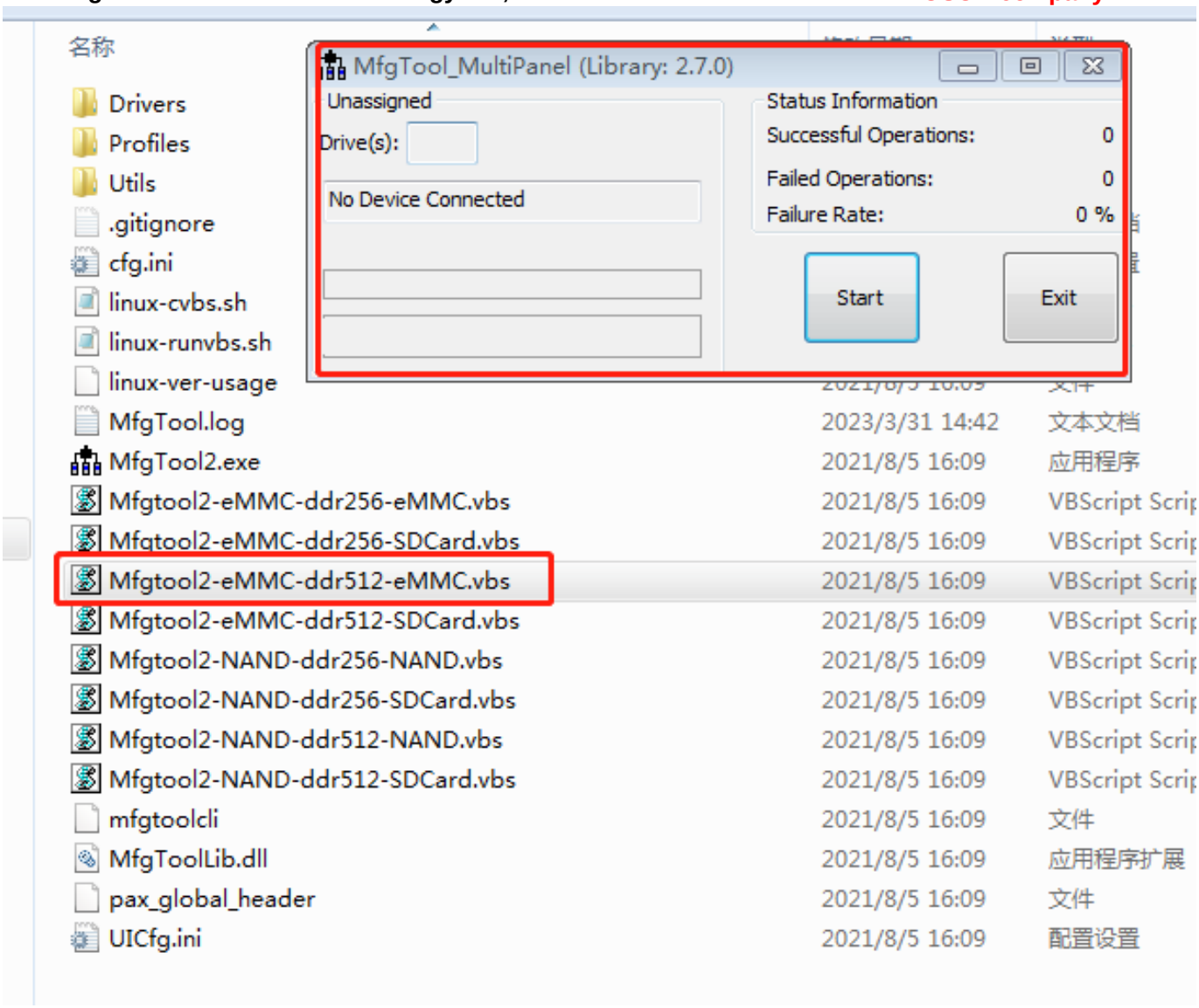
5.1 Firmware Program

5.1.1 USB OTG

- download mfgtool

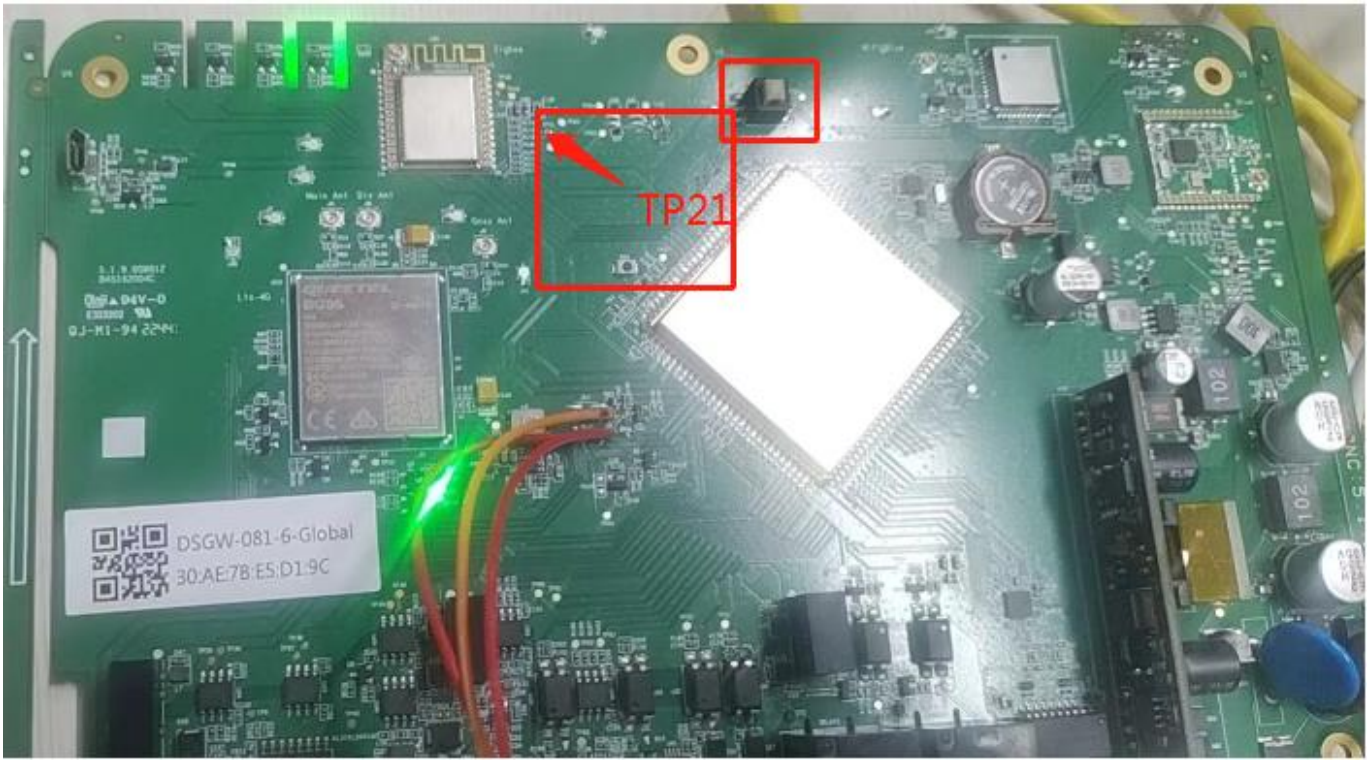


- open mfgtool

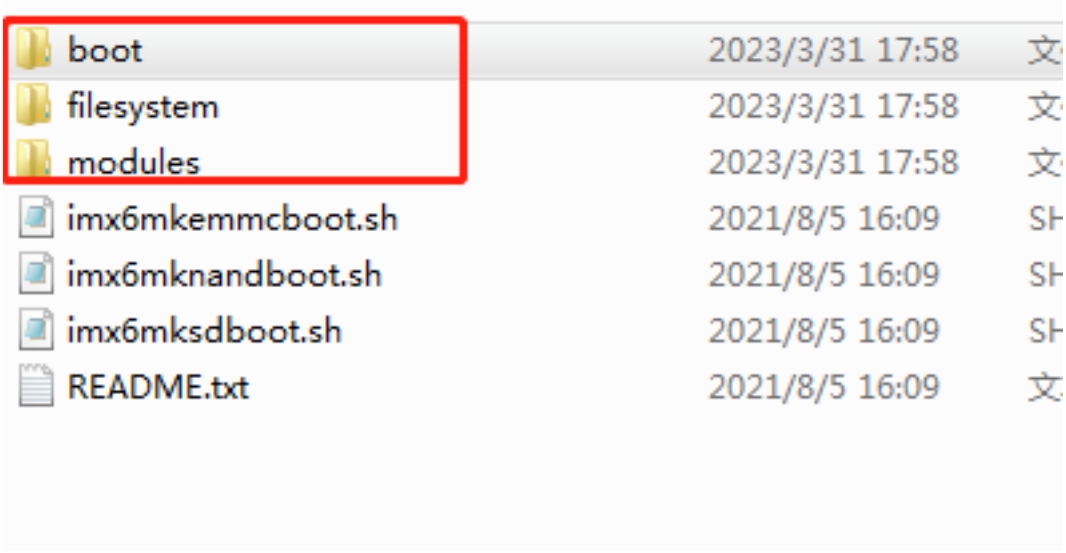


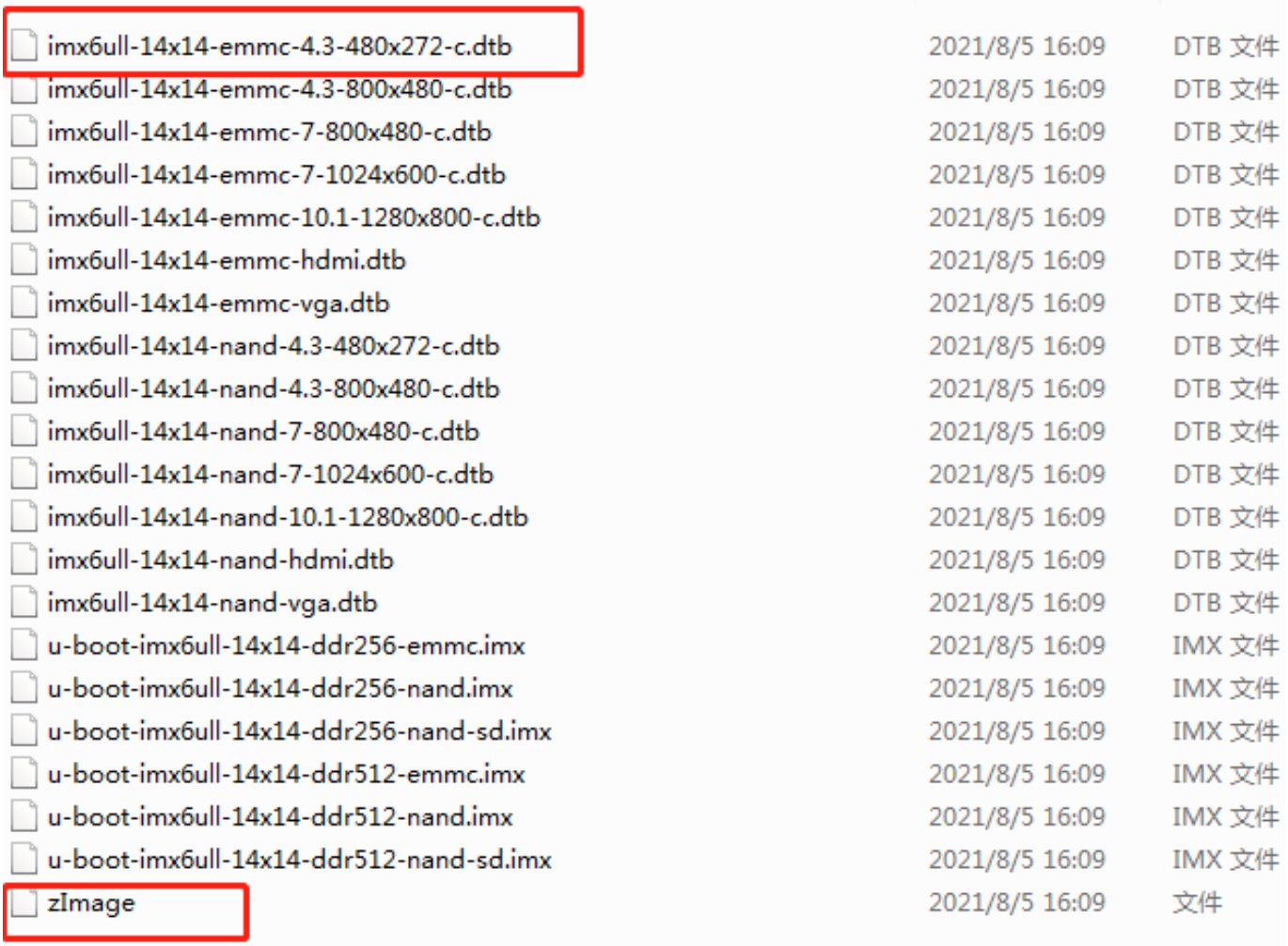
- switch to usb mode

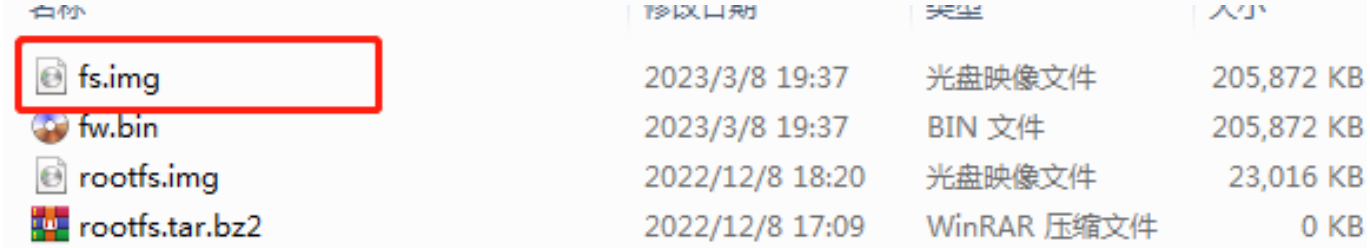
Press SW4 and ground TP21 at the same time, then power on or press the reset button to enter the burning mode

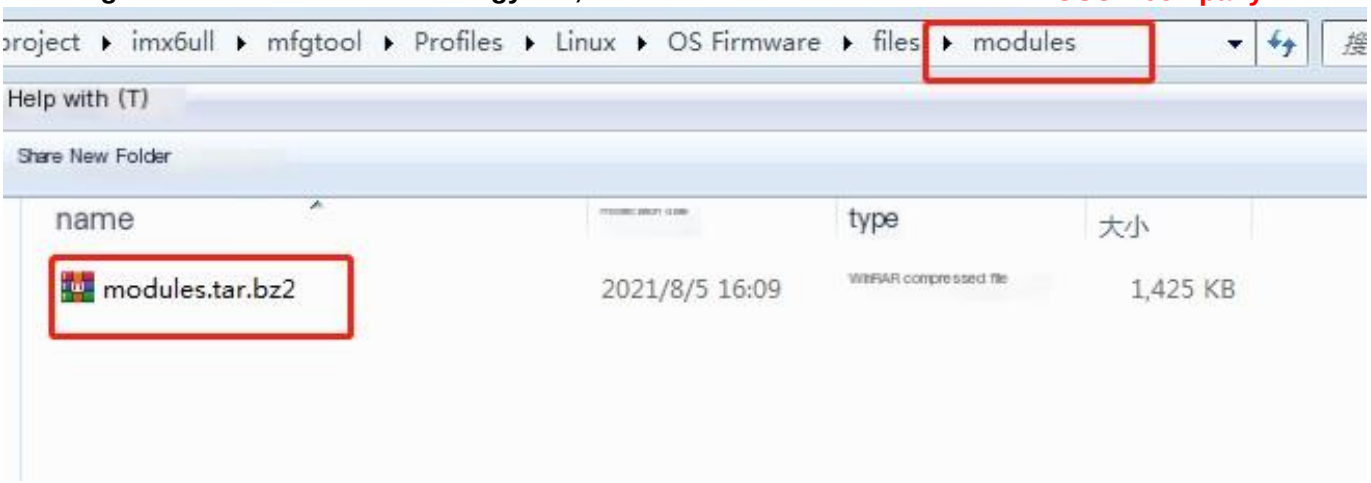


- update the program file

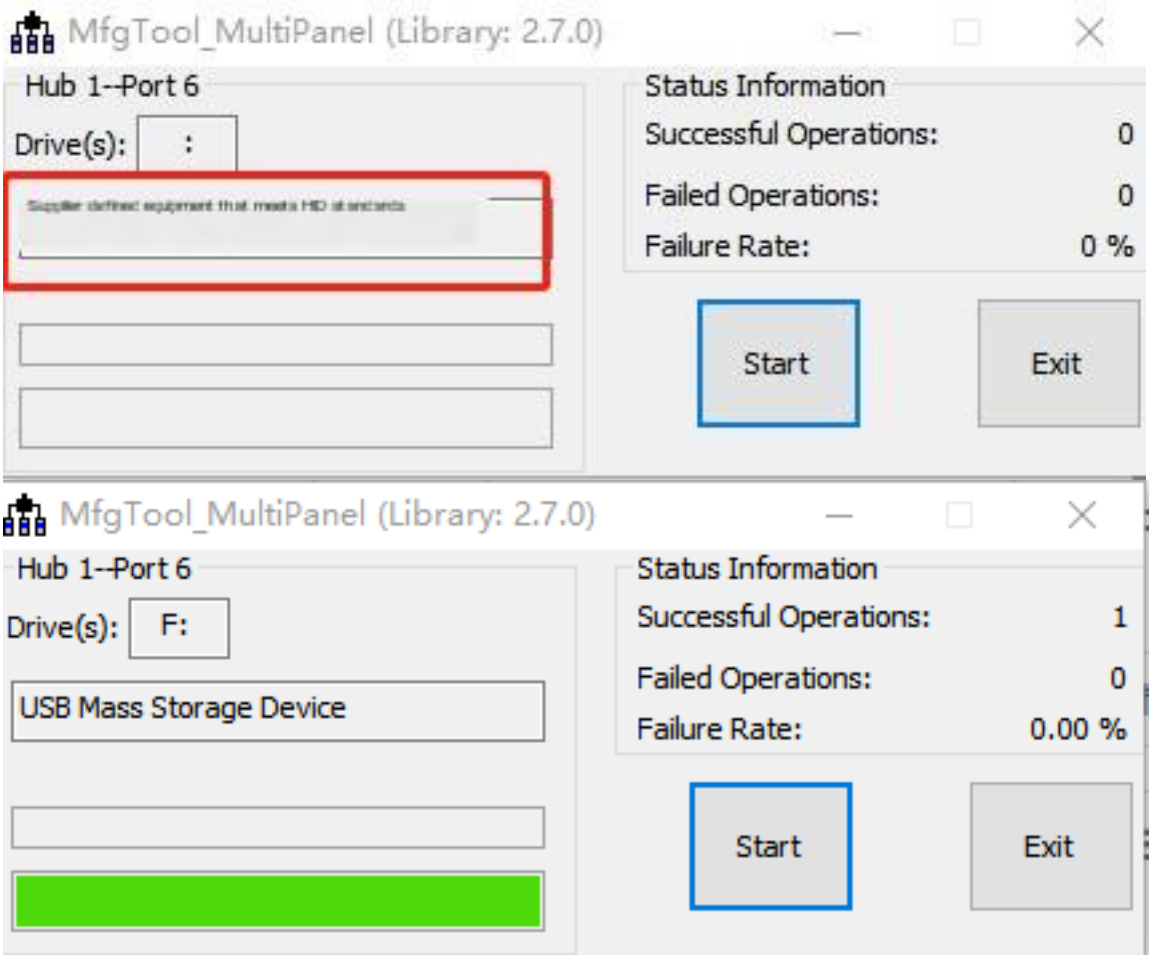



imx6ull-14x14-emmc-4.3-480x272-c.dtb 2021/8/5 16:09 DTB 文件
imx6ull-14x14-emmc-4.3-800x480-c.dtb 2021/8/5 16:09 DTB 文件
imx6ull-14x14-emmc-7-800x480-c.dtb 2021/8/5 16:09 DTB 文件
imx6ull-14x14-emmc-7-1024x600-c.dtb 2021/8/5 16:09 DTB 文件
imx6ull-14x14-emmc-10.1-1280x800-c.dtb 2021/8/5 16:09 DTB 文件
imx6ull-14x14-emmc-hdmi.dtb 2021/8/5 16:09 DTB 文件
imx6ull-14x14-emmc-vga.dtb 2021/8/5 16:09 DTB 文件
imx6ull-14x14-nand-4.3-480x272-c.dtb 2021/8/5 16:09 DTB 文件
imx6ull-14x14-nand-4.3-800x480-c.dtb 2021/8/5 16:09 DTB 文件
imx6ull-14x14-nand-7-800x480-c.dtb 2021/8/5 16:09 DTB 文件
imx6ull-14x14-nand-7-1024x600-c.dtb 2021/8/5 16:09 DTB 文件
imx6ull-14x14-nand-10.1-1280x800-c.dtb 2021/8/5 16:09 DTB 文件
imx6ull-14x14-nand-hdmi.dtb 2021/8/5 16:09 DTB 文件
imx6ull-14x14-nand-vga.dtb 2021/8/5 16:09 DTB 文件
u-boot-imx6ull-14x14-ddr256-emmc.imx 2021/8/5 16:09 IMX 文件
u-boot-imx6ull-14x14-ddr256-nand.imx 2021/8/5 16:09 IMX 文件
u-boot-imx6ull-14x14-ddr256-nand-sd.imx 2021/8/5 16:09 IMX 文件
u-boot-imx6ull-14x14-ddr512-emmc.imx 2021/8/5 16:09 IMX 文件
u-boot-imx6ull-14x14-ddr512-nand.imx 2021/8/5 16:09 IMX 文件
u-boot-imx6ull-14x14-ddr512-nand-sd.imx 2021/8/5 16:09 IMX 文件
zImage 2021/8/5 16:09 文件


fs.img 2023/3/8 19:37 光盘映像文件 205,872 KB
fw.bin 2023/3/8 19:37 BIN 文件 205,872 KB
rootfs.img 2022/12/8 18:20 光盘映像文件 23,016 KB
rootfs.tar.bz2 2022/12/8 17:09 WinRAR 压缩文件 0 KB



- power on and program



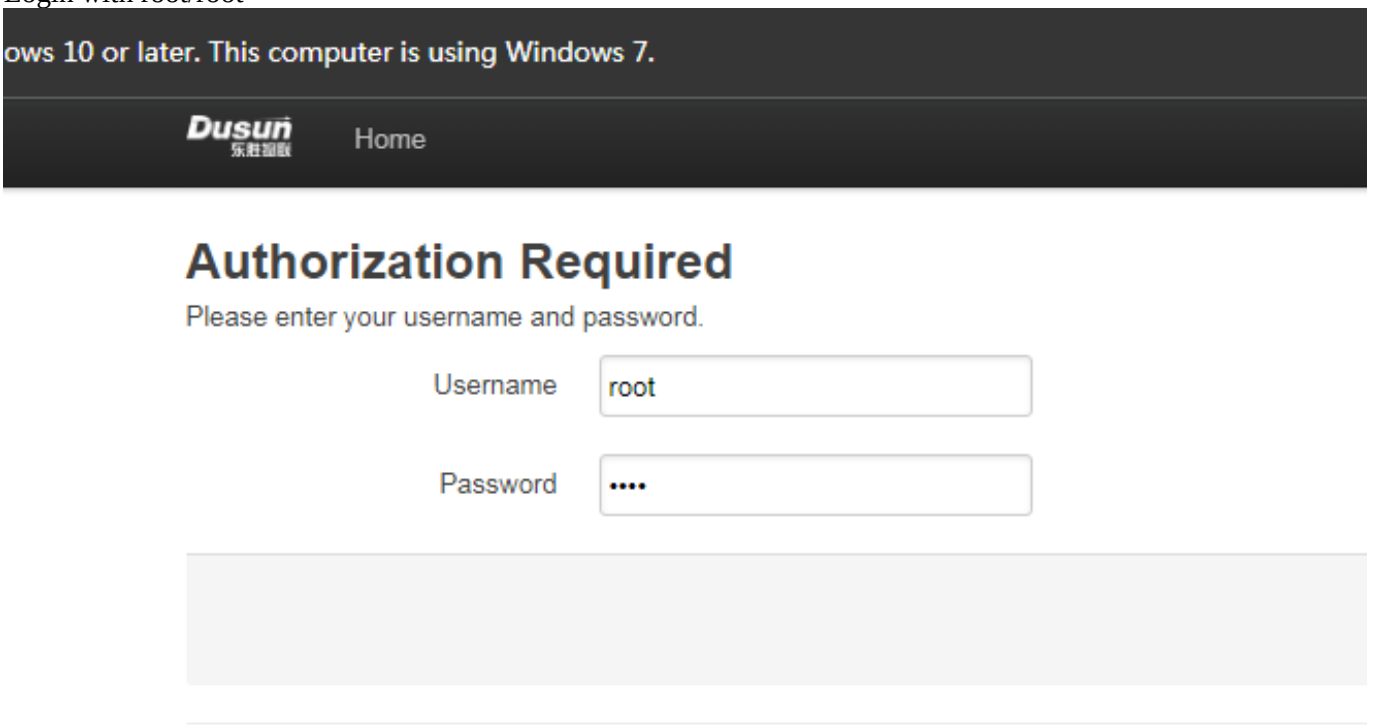
- repower the board after programering

5.2 Firmware Upgrade

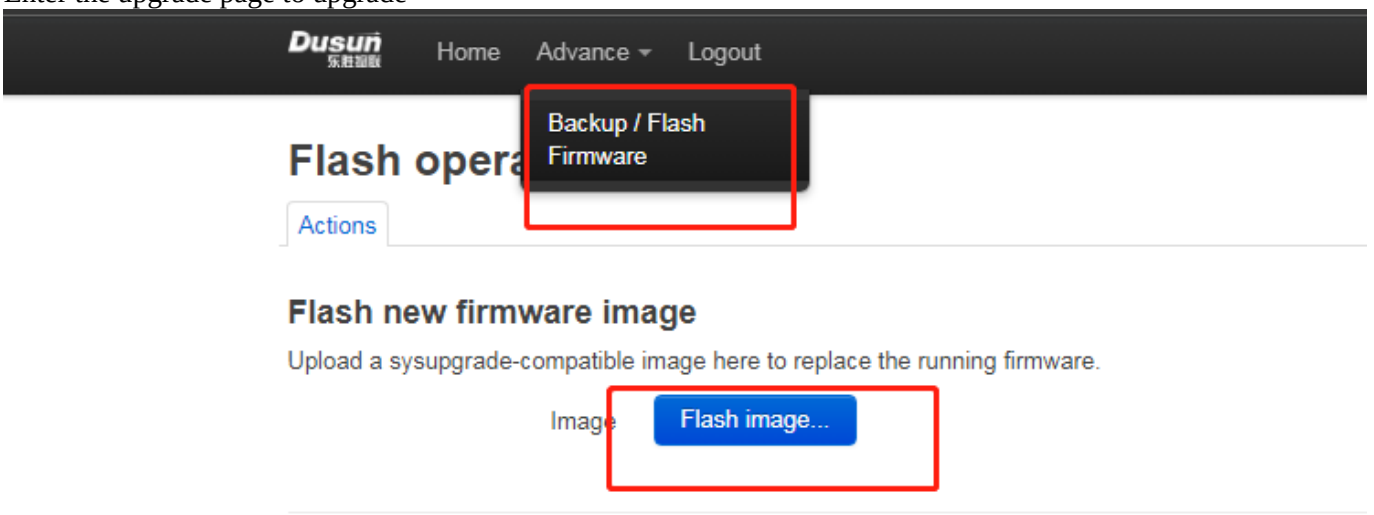
5.2.2 Uboot Web Upgrade

- Press and hold the ‘user key’ to power on, wait for 3 seconds to release, wait for about 20 seconds, and you can see the device DSGW081 hostname appearing on the router

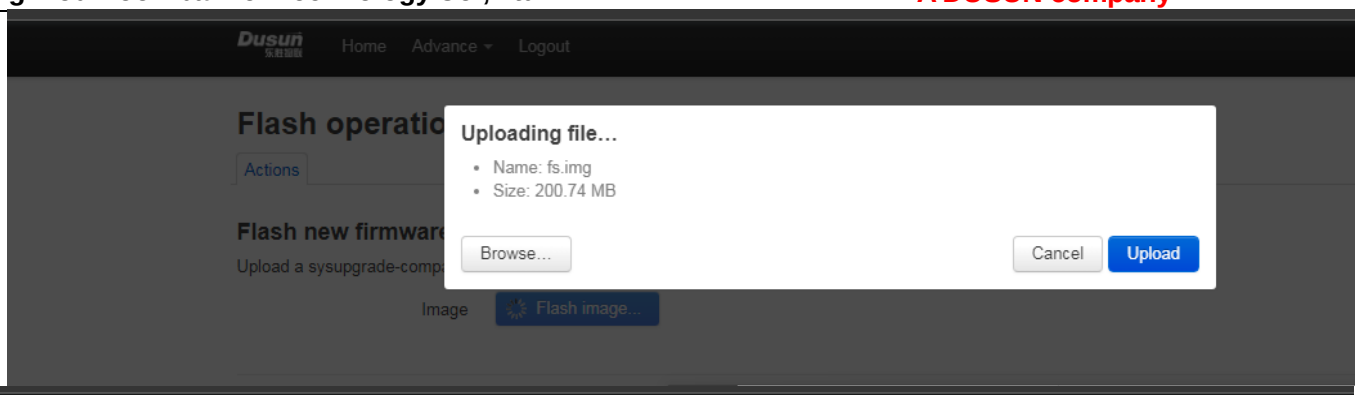
- Login with root/root

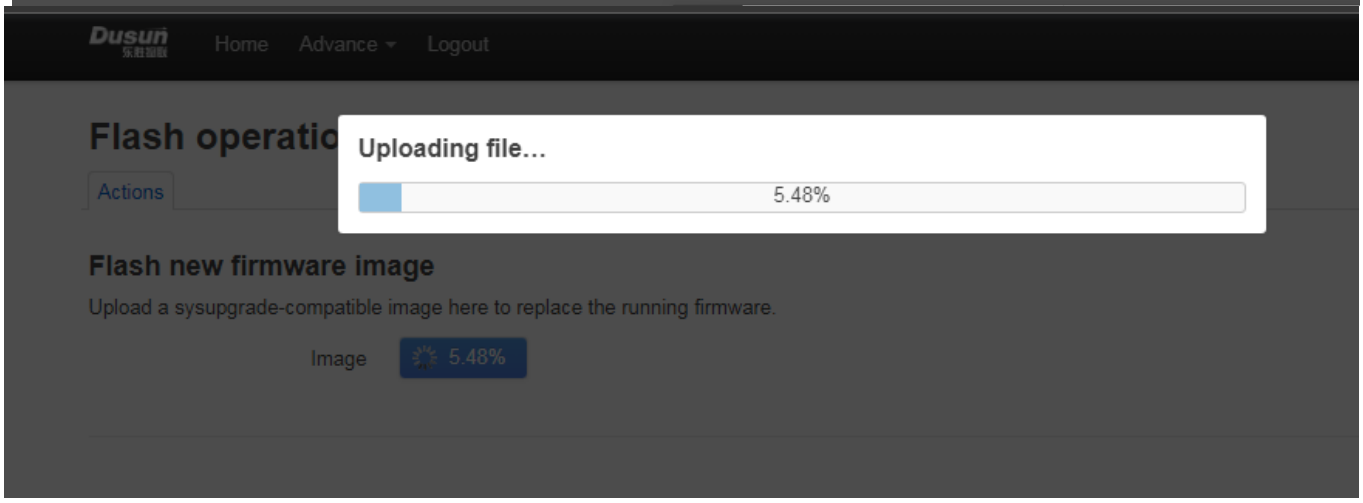


- Enter the upgrade page to upgrade

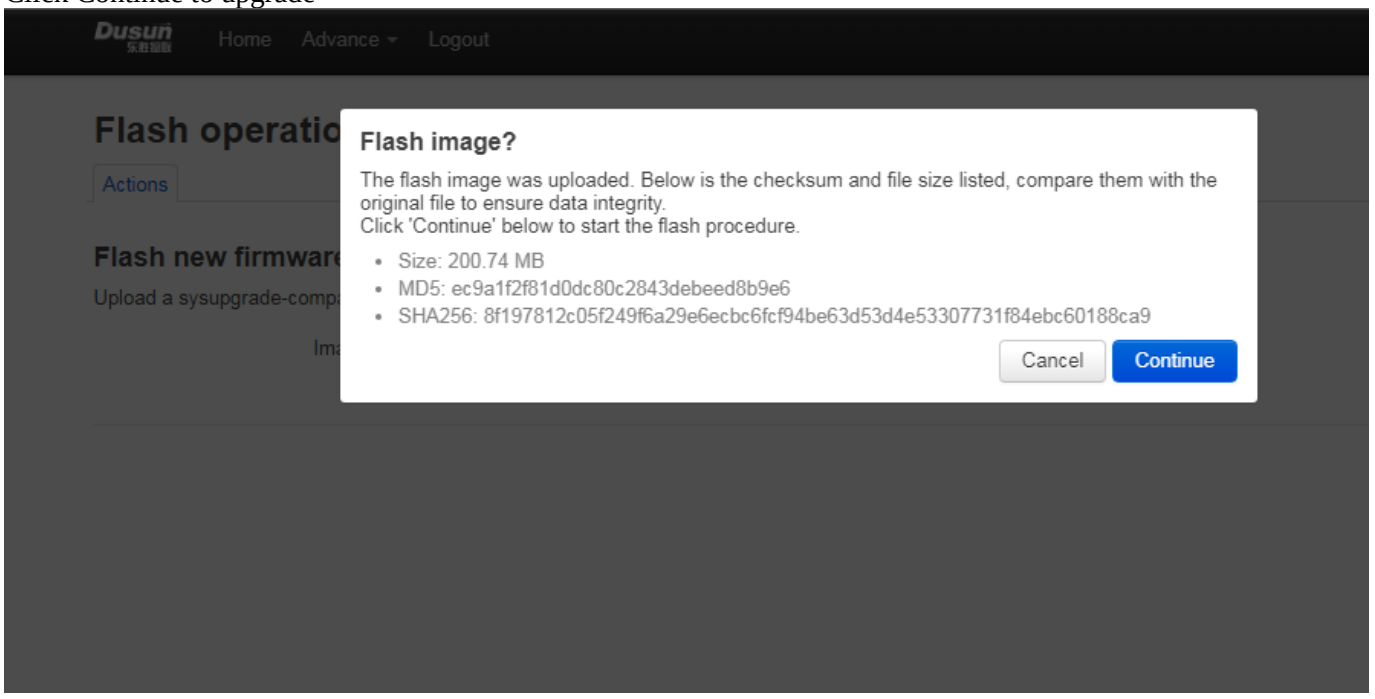


- Select the upgrade file and upload it

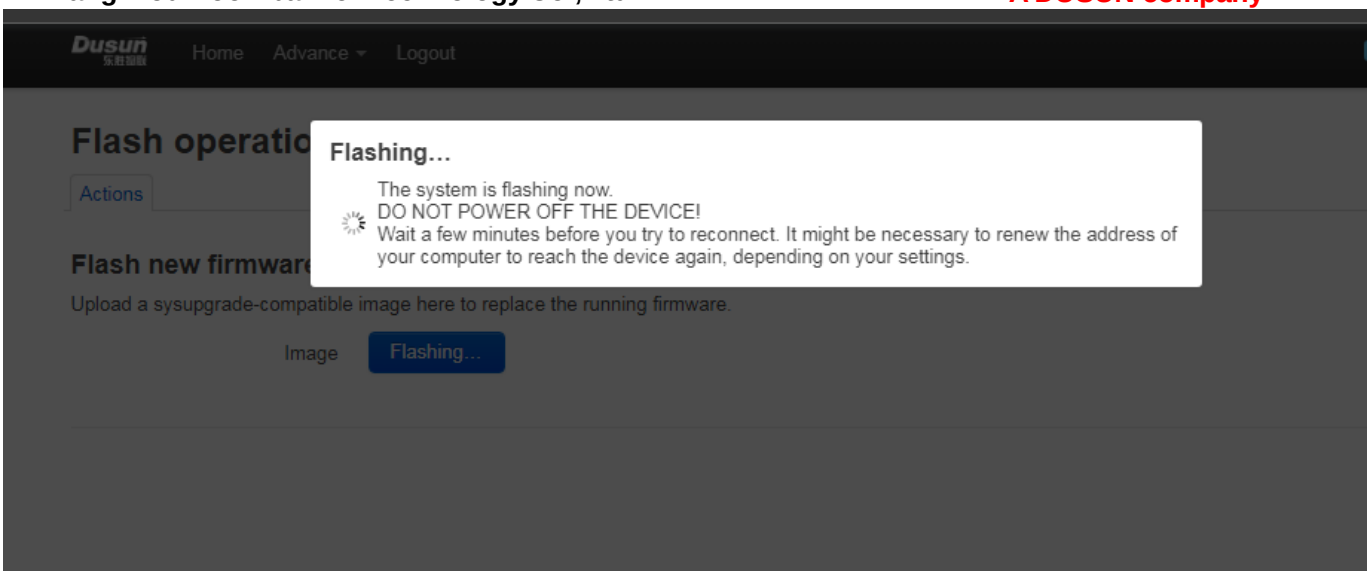




- Click Continue to upgrade

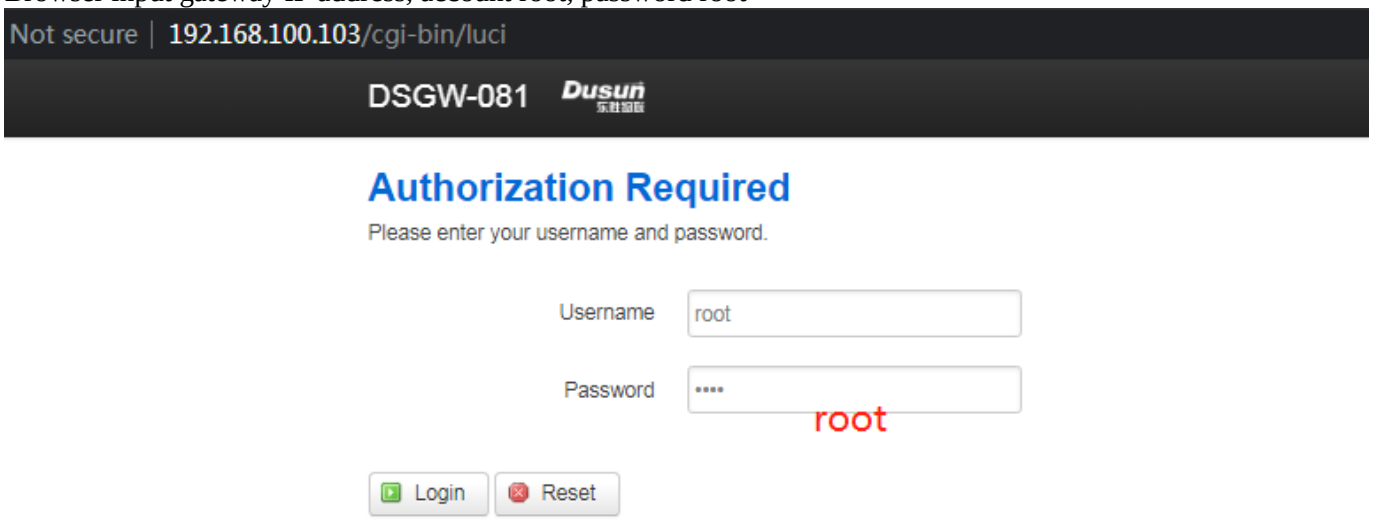


- Reminder not to power off and wait for the upgrade to complete (this page will not refresh after completion, so check it on the router yourself or watch the light indicator)

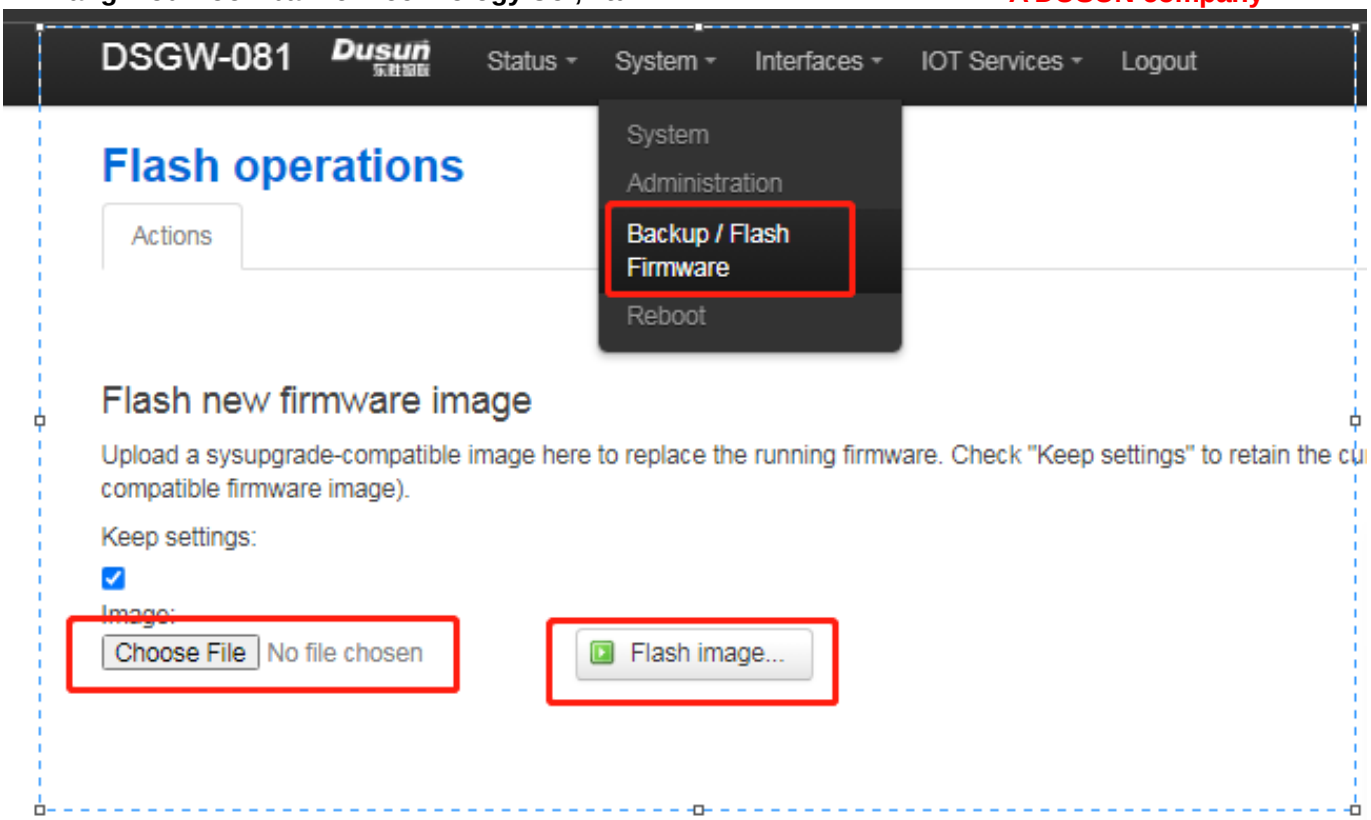


5.2.3 System Web Upgrade

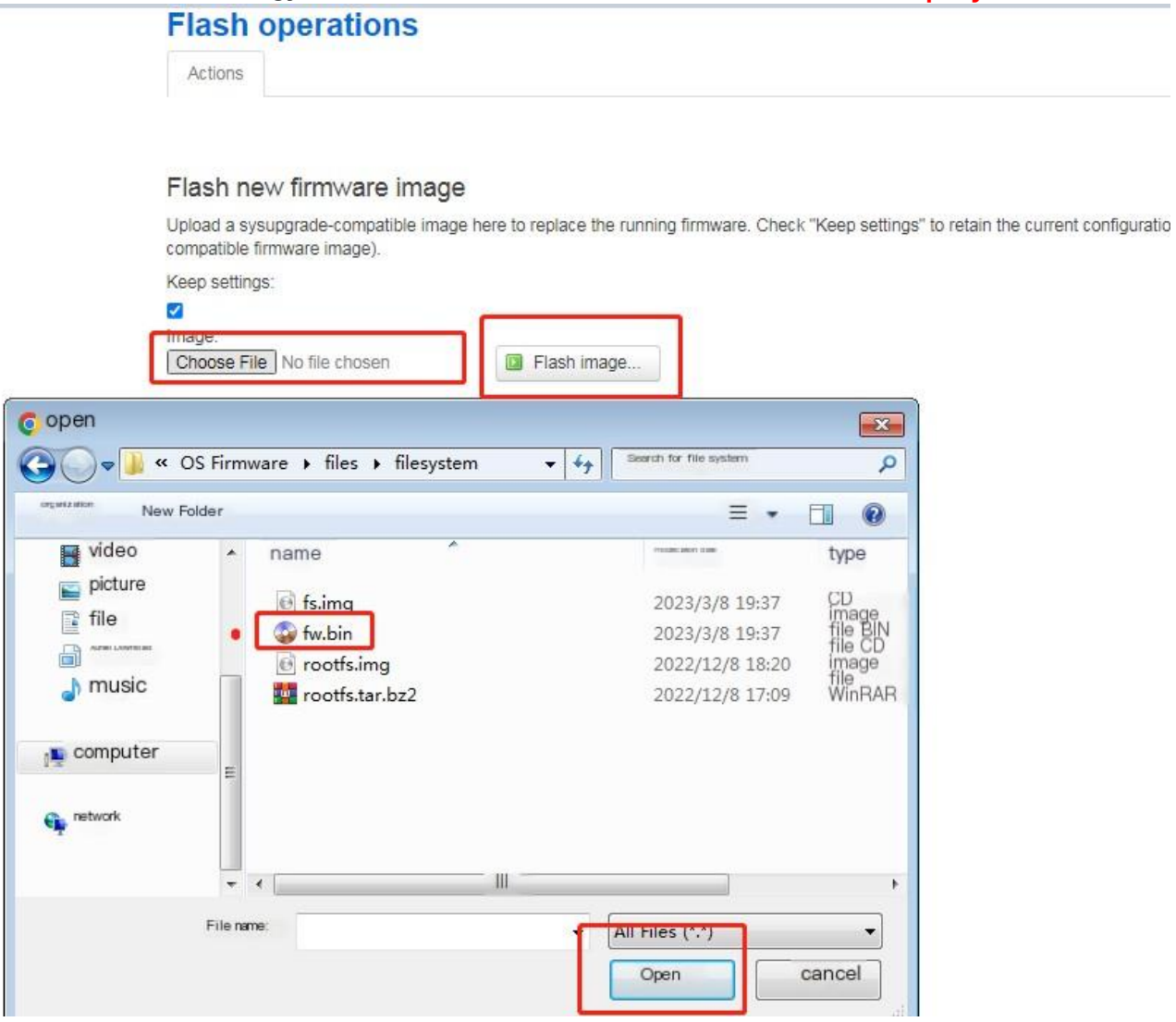
- Browser input gateway IP address, account root, password root

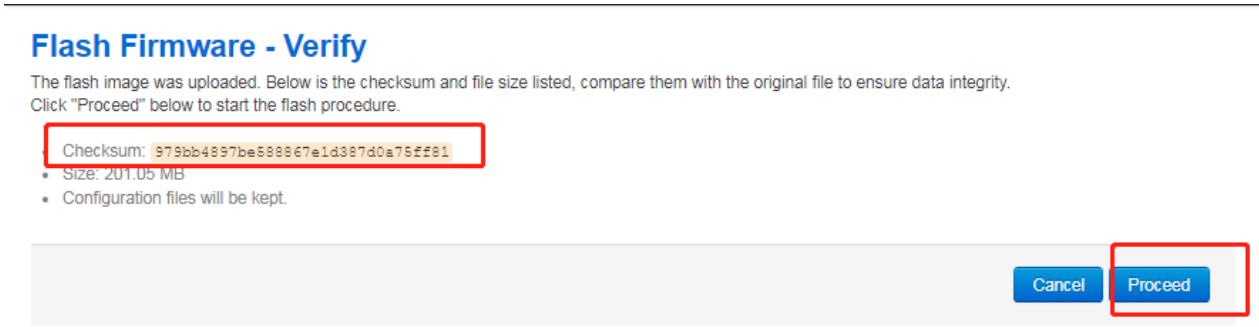


- Enter Advance->Backup And Flash Firmware Menu



- Select fw.bin Upgrade the firmware for upgrading (fw.bin here is the upgraded firmware compiled earlier)





5.2.4 System Command Upgrade

- use scp or winscp tool to put the fw.bin to the board's tmp

scp fw.bin root@192.168.xxx.xxx:/tmp/

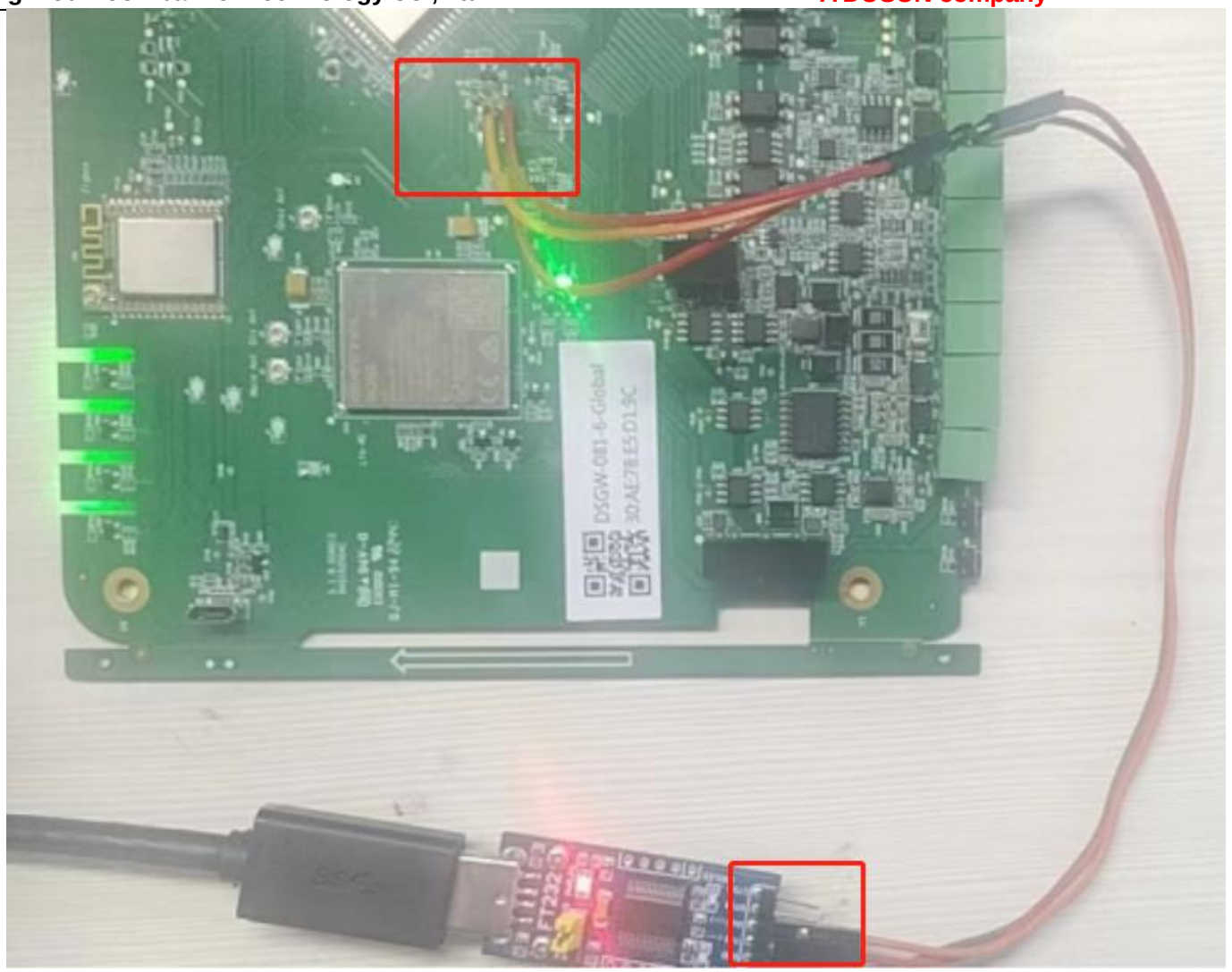
- run sysupgrade command to upgrade the firmware

sysupgrade 0 /tmp/fw.bin

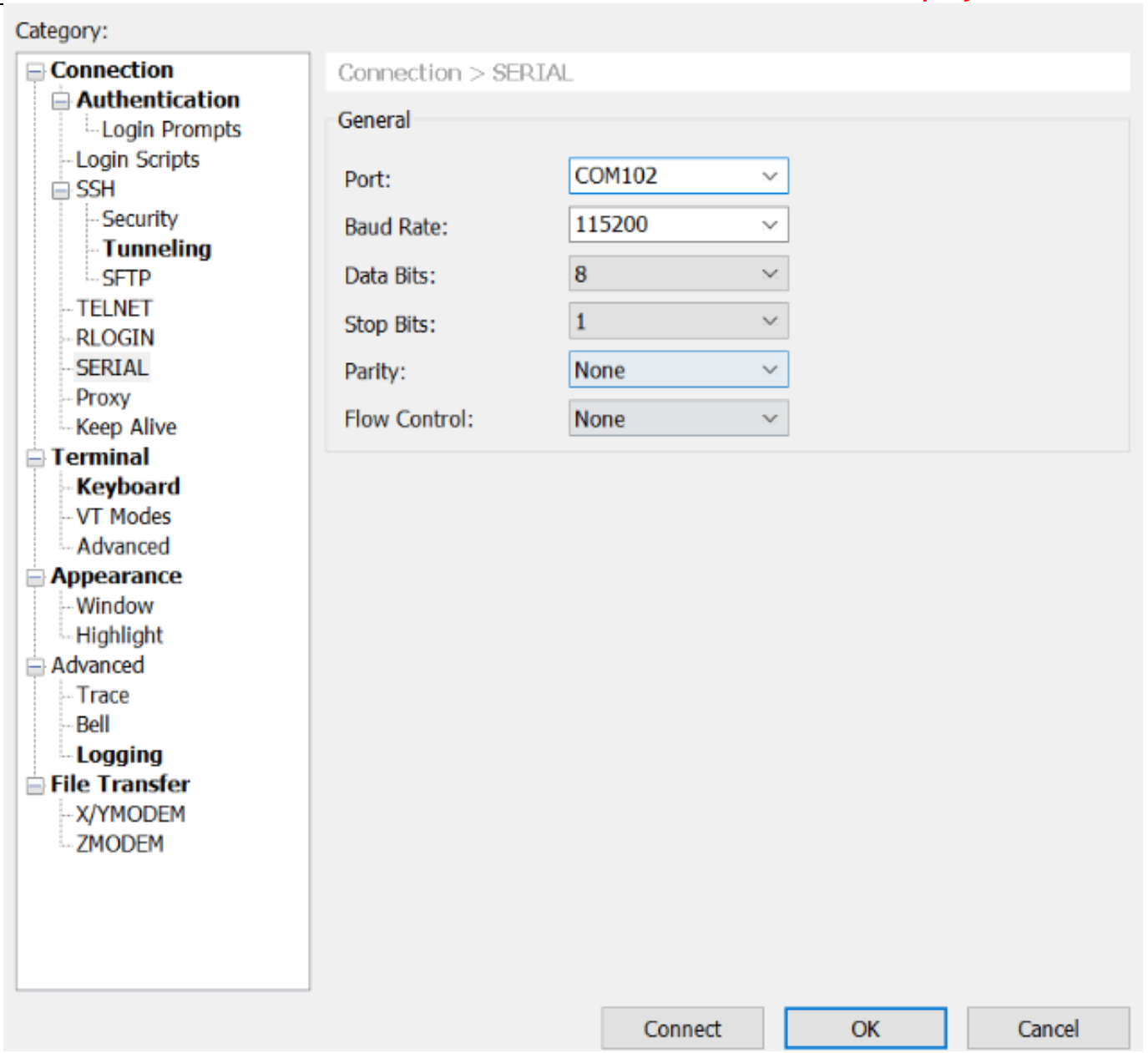
6 Gateway Login

6.1 Login Through Debug Uart

- connect uart serial tool to the board's debug uart port



- config the serial tools's uart config



- power on the gateway

U-Boot 2016.03 (Dec 08 2022 - 17:03:59 +0800)

CPU: Freescale i.MX6ULL rev1.1 792 MHz (running at 396 MHz)
CPU: Industrial temperature grade (-40C to 105C) at 46C
Reset cause: POR
Board: I.MX6U ALPHA|MINI
I2C: ready
DRAM: 512 MiB
force_idle_bus: sda=1 scl=0 sda.gp=0x1d scl.gp=0x1c
MMC: FSL_SDHC: 0, FSL_SDHC: 1
*** Warning - bad CRC, using default environment

Display: ATK-LCD-4.3-480x272 (480x272)

```
Video: 480x272x24
In:    serial
Out:   serial
Err:   serial
reading macaddr
22 bytes read in 21 ms (1000 Bytes/s)
mac : 30:ae:1b:1b:dd:63
key value:1
reading bootpart
2 bytes read in 15 ms (0 Bytes/s)
mem is 0xE5940A33
p: 3
switch to partitions #0, OK
mmc1(part 0) is current device
Net:   Board Net Initialization Failed
No ethernet found.
Normal Boot
Hit any key to stop autoboot:  0
switch to partitions #0, OK
mmc1(part 0) is current device
switch to partitions #0, OK
mmc1(part 0) is current device
reading boot.scr
** Unable to read file boot.scr **
reading zImage
7998896 bytes read in 256 ms (29.8 MiB/s)
Booting from mmc ...
reading imx6ull-14x14-emmc-4.3-480x272-c.dtb
34329 bytes read in 18 ms (1.8 MiB/s)
Kernel image @ 0x80800000 [ 0x000000 - 0x7a0db0 ]
## Flattened Device Tree blob at 83000000
   Booting using the fdt blob at 0x83000000
   Using Device Tree in place at 83000000, end 8300b618

Starting kernel ...
...

DSGW-081 login:
```

- input user(root), passwor(root) to login

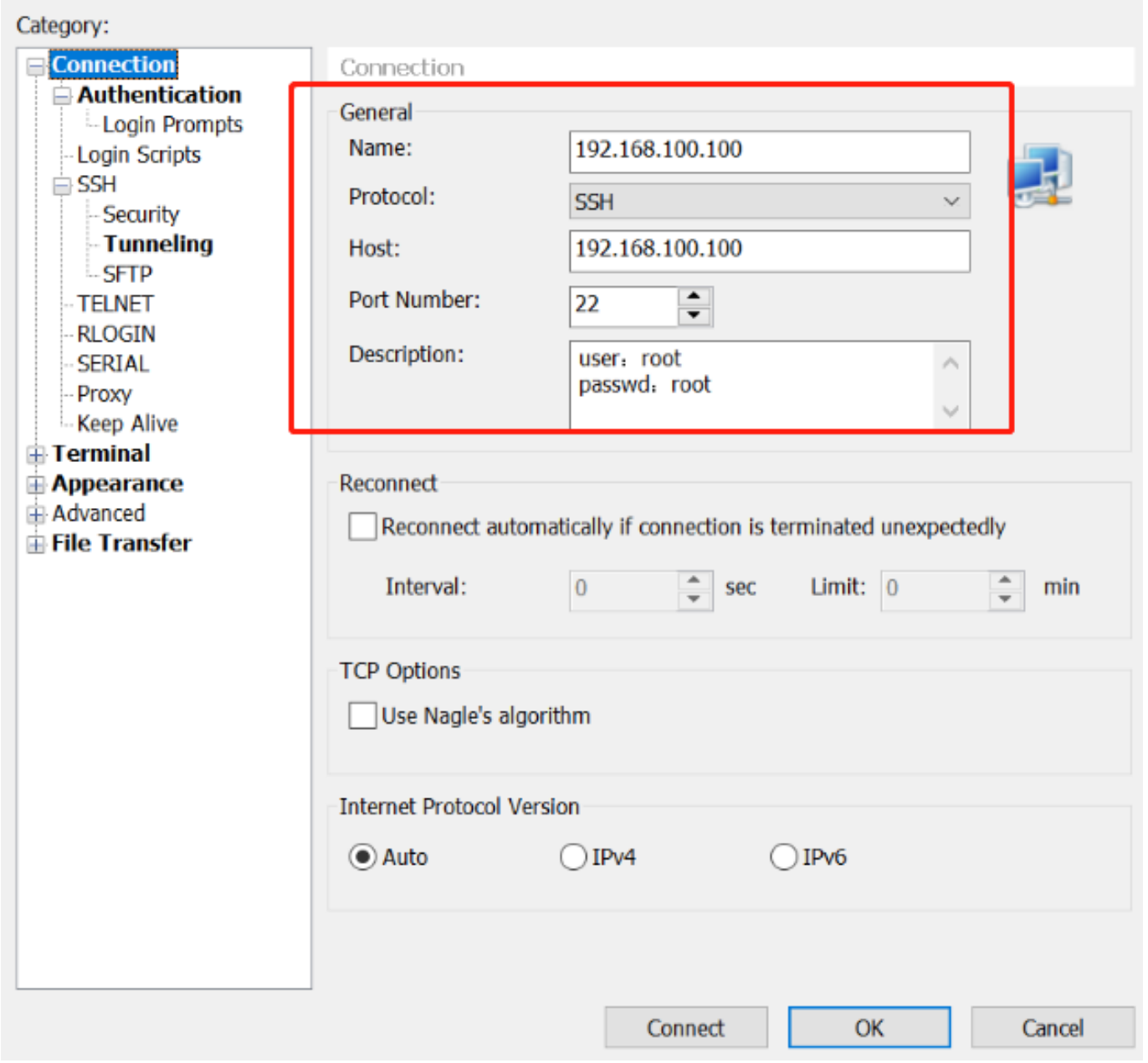
```
DSGW-081 login: root
Password:
Linux DSGW-081 4.1.15-g3c91580-dirty #47 SMP PREEMPT Mon Nov 7 20:04:35 CST 2022 armv7l

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Tue Apr 11 05:31:02 UTC 2023 on ttymxc0
```

6.2 Login Through Network(SSH)

- config the ssh connection parameters



- connect success

```
Linux DSGW-081 4.1.15-g3c91580-dirty #47 SMP PREEMPT Mon Nov 7 20:04:35 CST 2022 armv7l

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Tue Apr 11 05:34:09 2023
root@DSGW-081:~#
```

7. Easy Function Test Script

- download the test script

```
rm -rf /tmp/tools/;wget http://114.215.195.44:8080/au/gwtest/DSGW-081.tar.gz -O /tmp/x; tar xvf /tmp/x -C /;
```

- run the test script

```
root@DSGW-081:~# /tmp/tools/test.sh
Stopping done (via systemctl): done.serviceStopping dial (via systemctl): dial.serviceStopping amber (via systemct
l): amber.service.
==================================================
Testing [   version]..., please wait...
BUILD_VERSION="V1.0.0.10_zZBBE"
BUILD_TIME="Fri Feb 24 20:05:38 CST 2023"
BUILD_USER="root"
BUILD_HOST="git.roombanker.cn"
      Test Result : OK
==================================================
Testing [      wan]..., please wait...
      Test Result : OK
==================================================
Testing [      led]..., please wait...
      Test Result : OK
==================================================
Testing [      rtc]..., please wait...
Wed Jan  1 00:00:00 UTC 2003
2003-01-01 00:00:03.050919+00:00
Tue Apr 11 05:38:00 UTC 2023
2003
      Test Result : OK
==================================================
Testing [    dout_1]..., please wait...
      Test Result : OK
==================================================
Testing [    dout_2]..., please wait...
      Test Result : OK
==================================================
Testing [din_passtive_1]..., please wait...
      please shortcut the passtive input 1!
      Test Result : OK
==================================================
Testing [din_passtive_2]..., please wait...
      please shortcut the passtive intput 2!
      Test Result : OK
==================================================
Testing [din_active_1]..., please wait...
0 V
      Test Result : OK
==================================================
Testing [din_active_2]..., please wait...
0 V
      Test Result : OK
```

```
==================================================
Testing [     ain_1]..., please wait...
1
      Test Result : OK
==================================================
Testing [     ain_2]..., please wait...
5
      Test Result : OK
==================================================
Testing [     r485]..., please wait...
      please short circuit 485 tx & rx..
      Test Result : OK
==================================================
Testing [     r232]..., please wait...
      please short circuit 232 uart tx & rx..
      Test Result : OK
==================================================
Testing [      can]..., please wait...
      Test Result : OK
==================================================
Testing [      btn]..., please wait...
      please press the hold key!
      Test Result : OK
==================================================
Testing [    zigbee]..., please wait...
power on zigbee..
/dev/ttymxc1
ezsp ver 0x06 stack type 0x02
      Test Result : OK
==================================================
Testing [      ble]..., please wait...
power on ble..
/dev/ttymxc2


      Test Result : OK
==================================================
Testing [    wifi24]..., please wait...
      Test Result : OK
==================================================
Testing [      lte]..., please wait...
power on lte..
/dev/ttyUSB2

APP RDY
AT+QGMR
BG96MAR02A07M1G_01.016.01.016

OK
```

```
AT+CPIN?
+CME ERROR: 10

AT+QCCID
+CME ERROR: 13

AT+CSQ
+CSQ: 99,99

OK
```

Test Result : OK

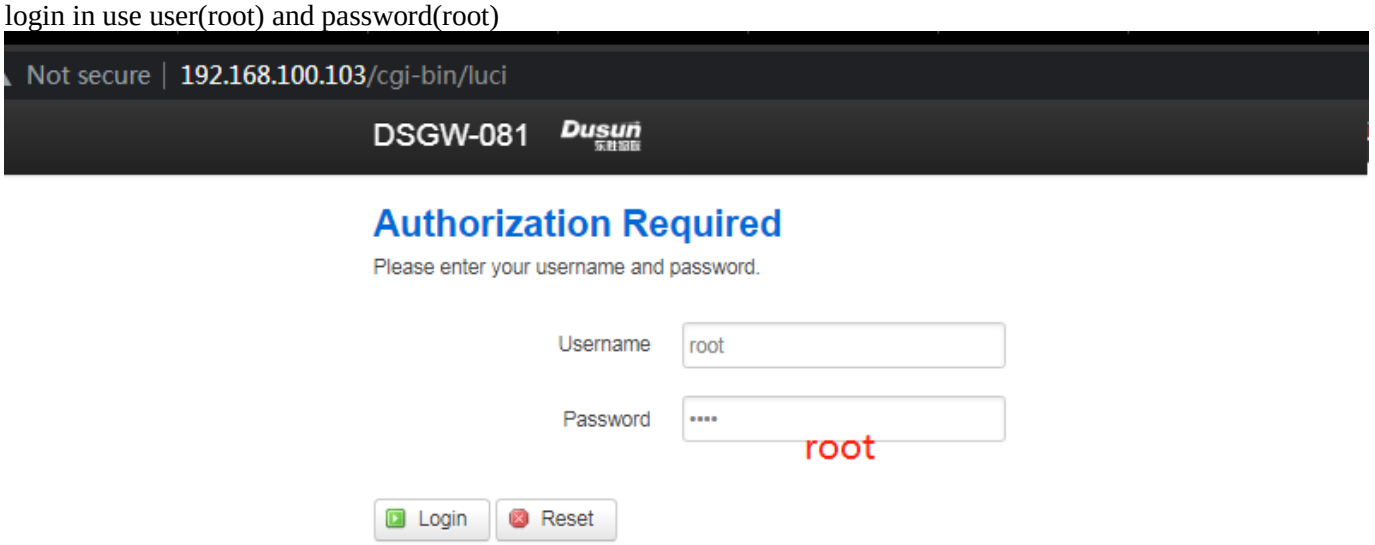
==========

Testing [hcible]..., please wait...

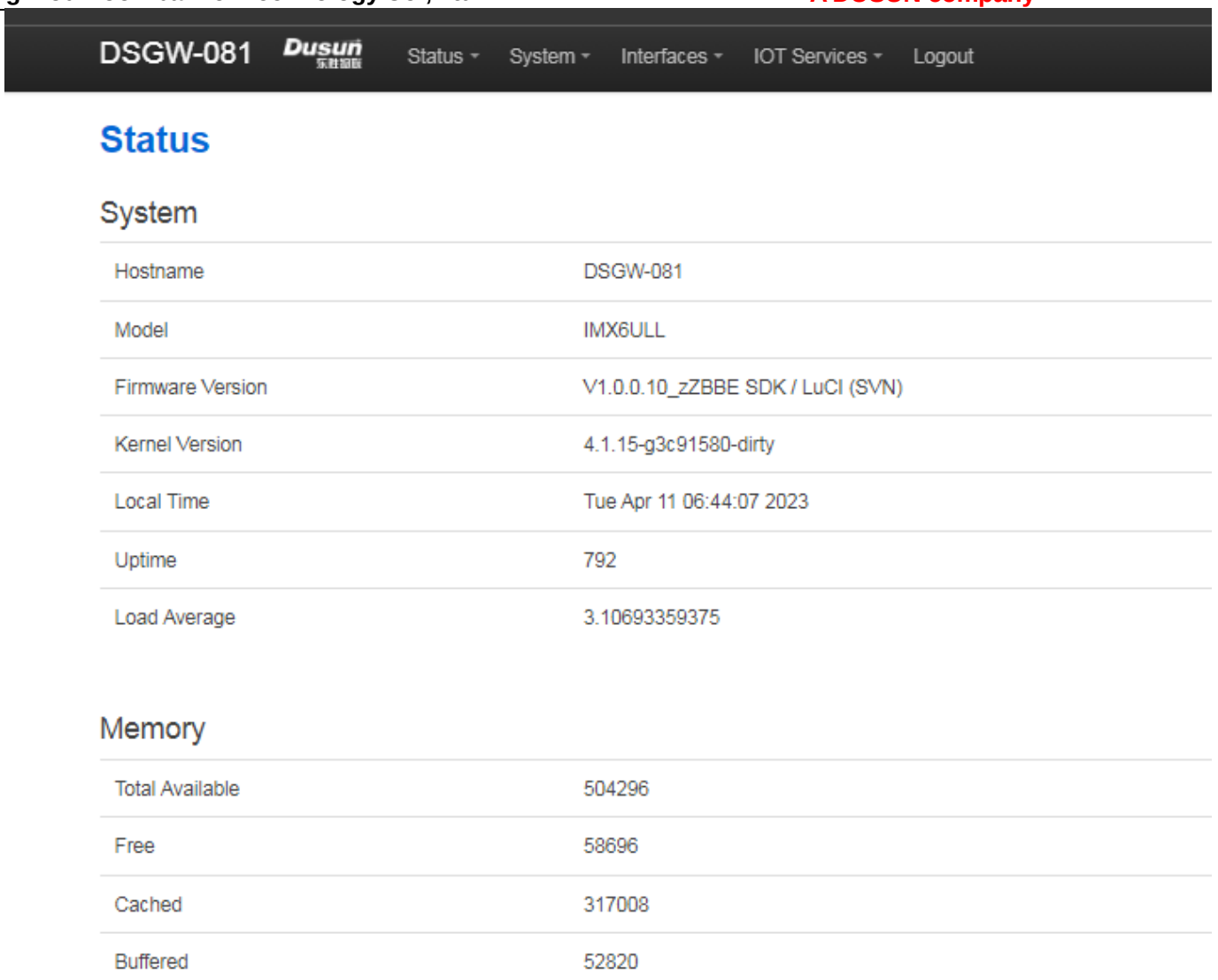
Test Result : OK

8. Luci Web Function Description

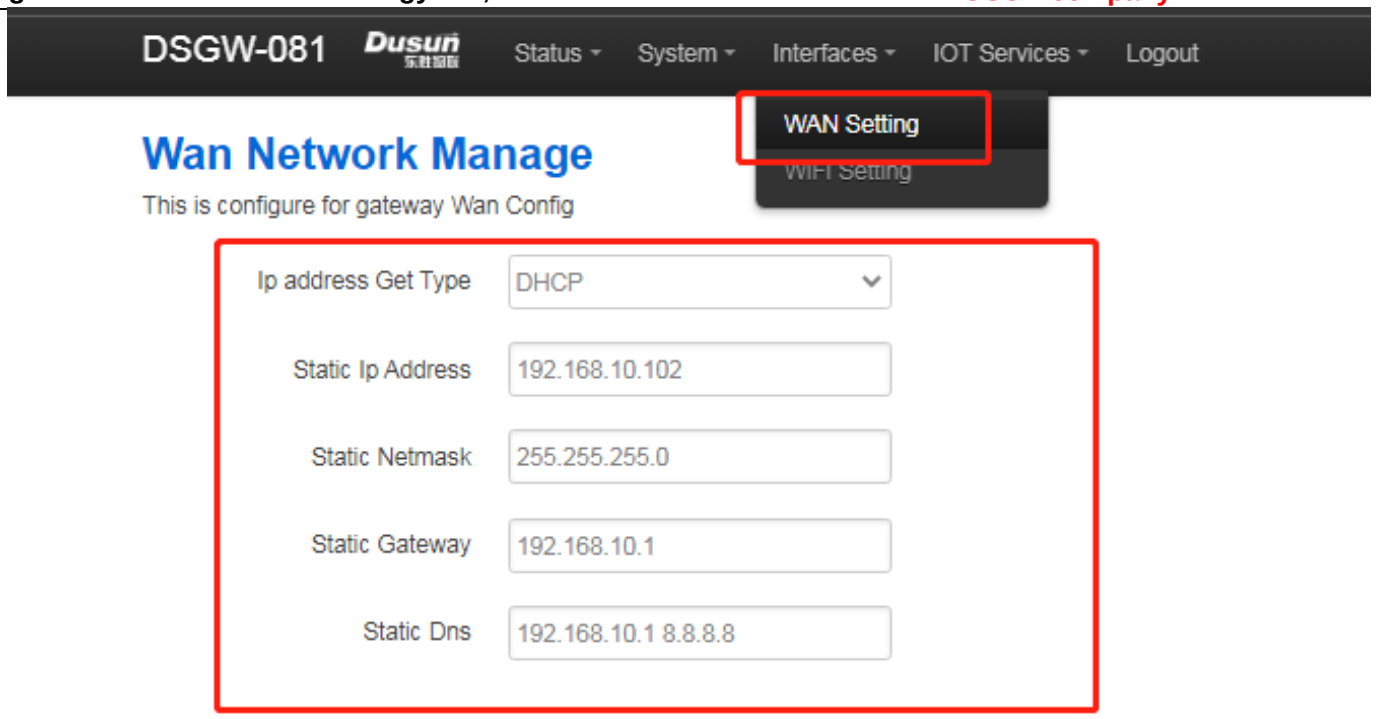
- login in use user(root) and password(root)



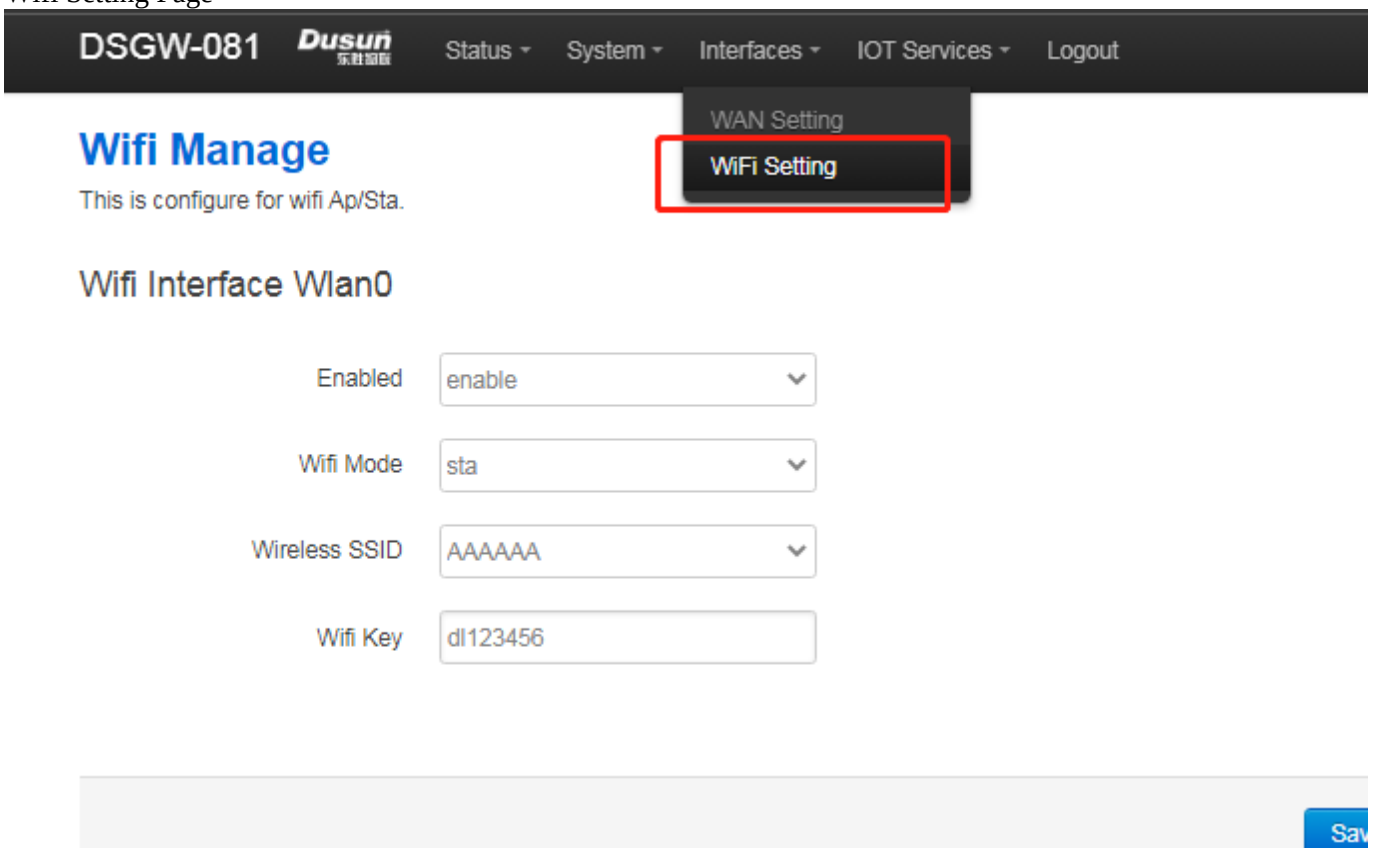
- Home Page



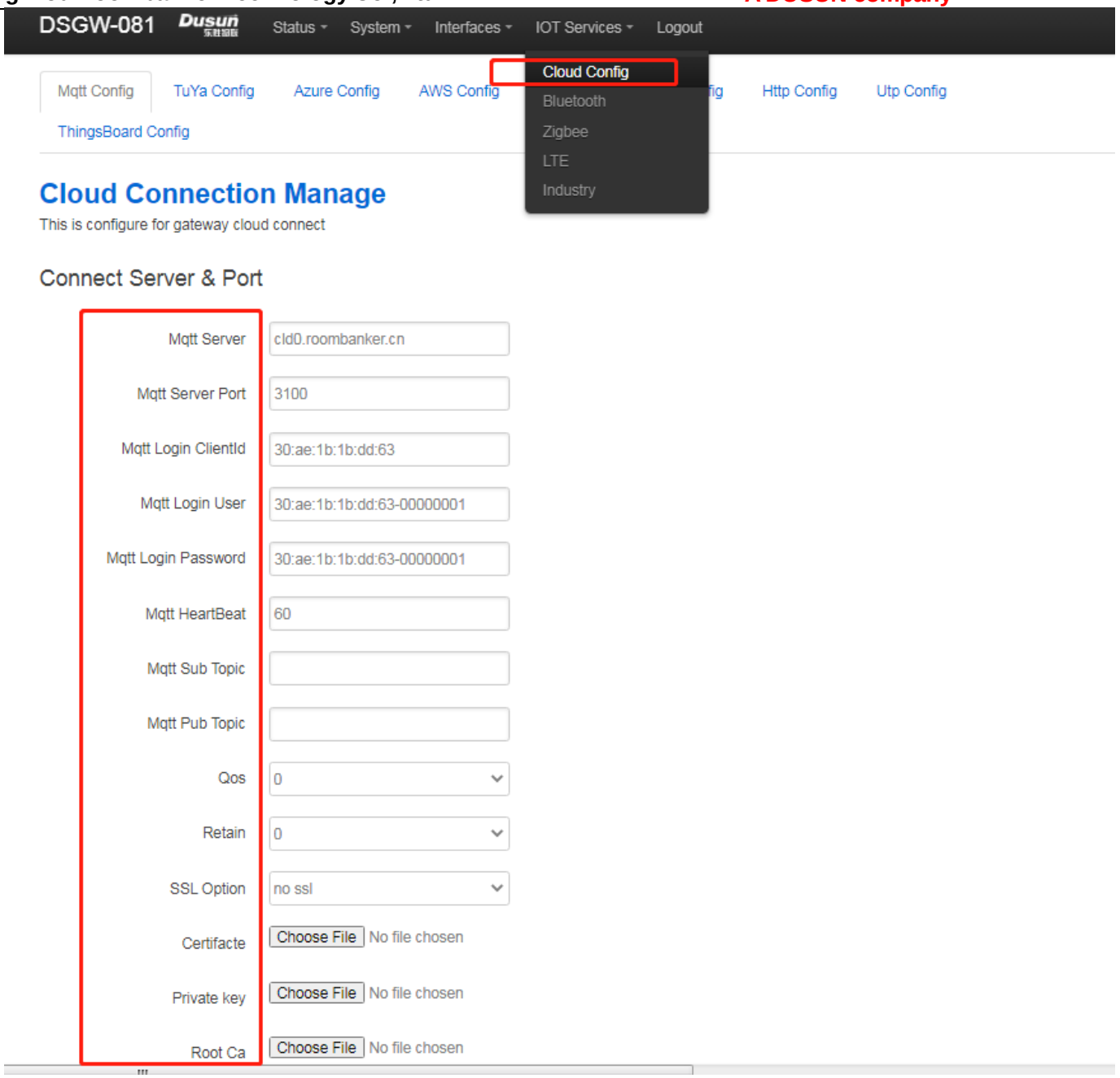
- Wan Setting Page



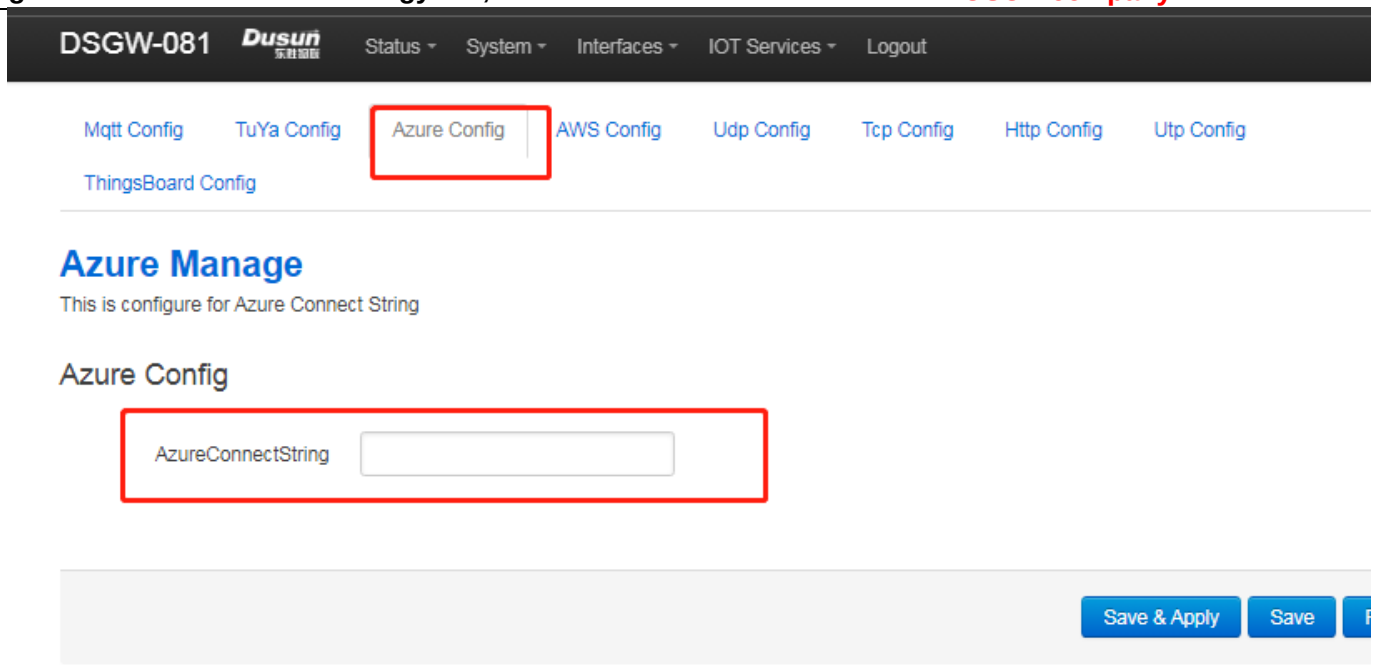
- Wifi Setting Page



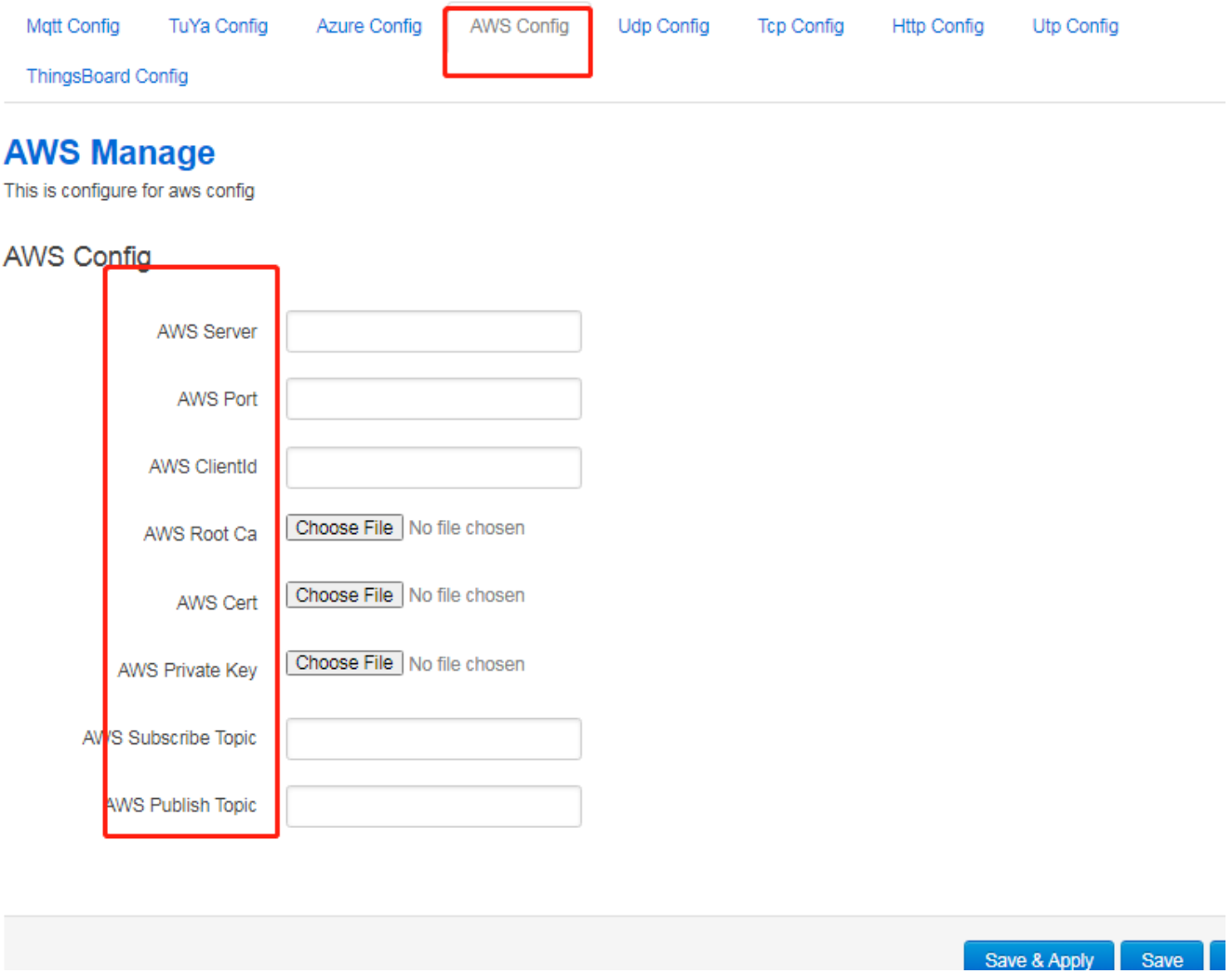
- Cloud Mqtt Config Page



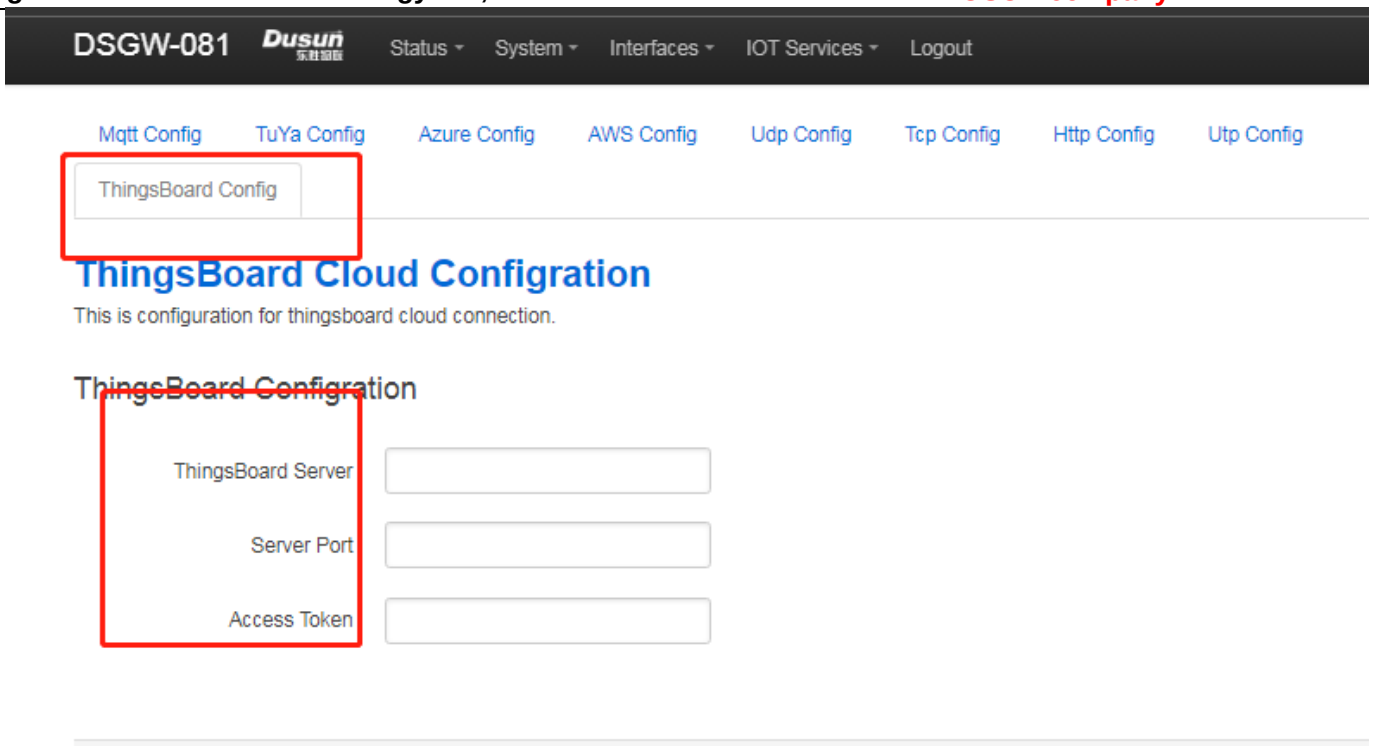
- Cloud Azure Config Page



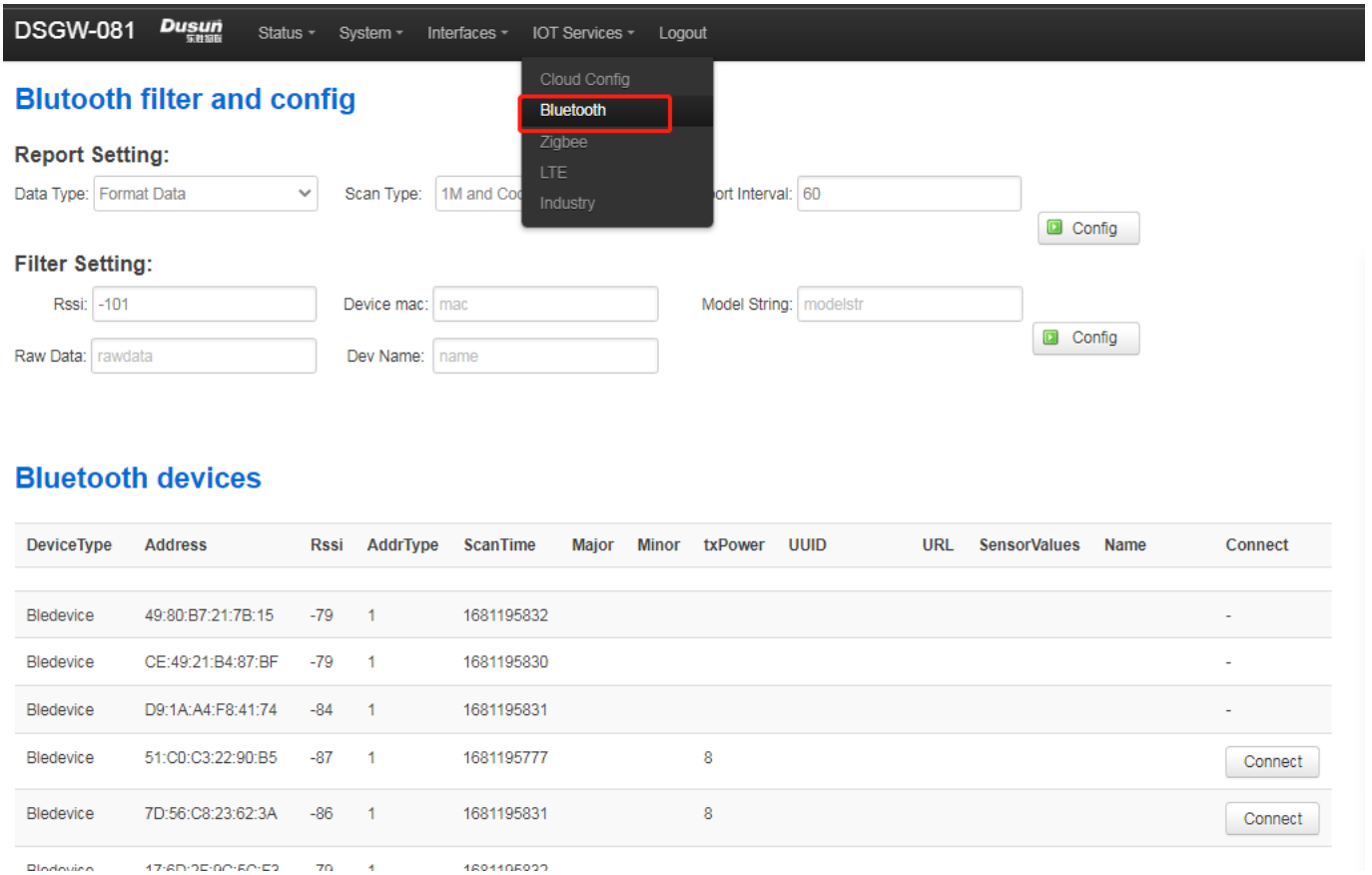
- Cloud Aws Mqtt Config Page



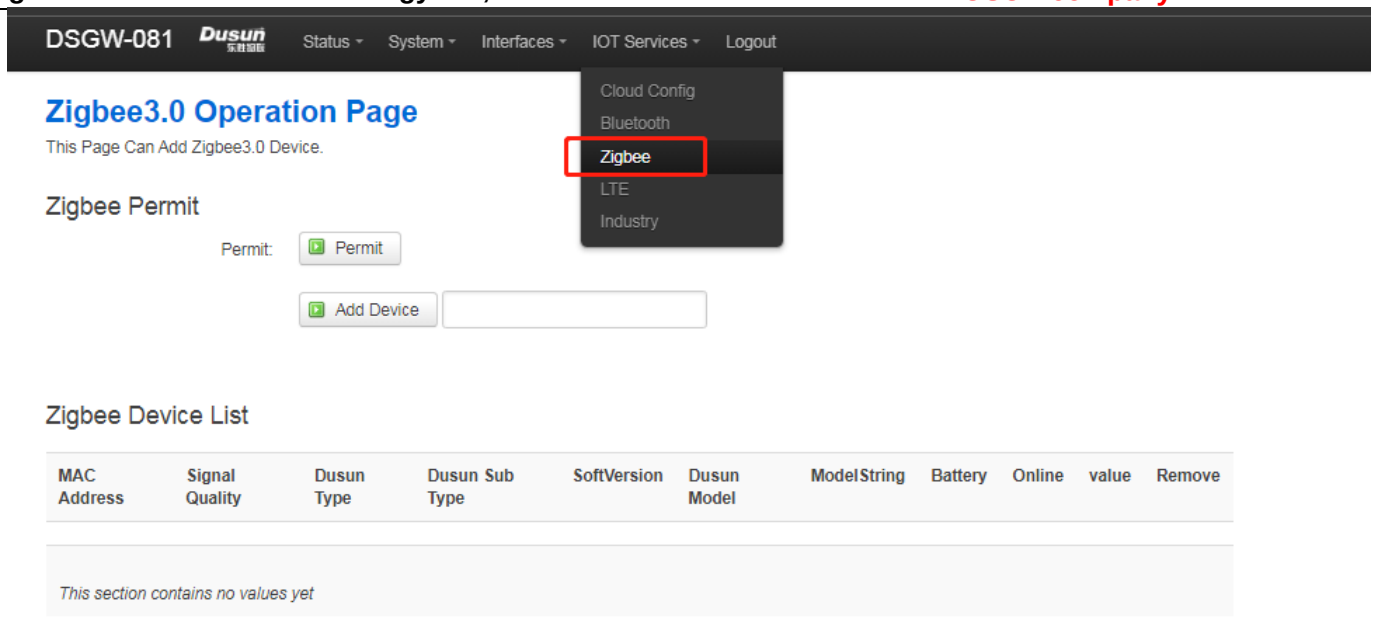
- Things Board page



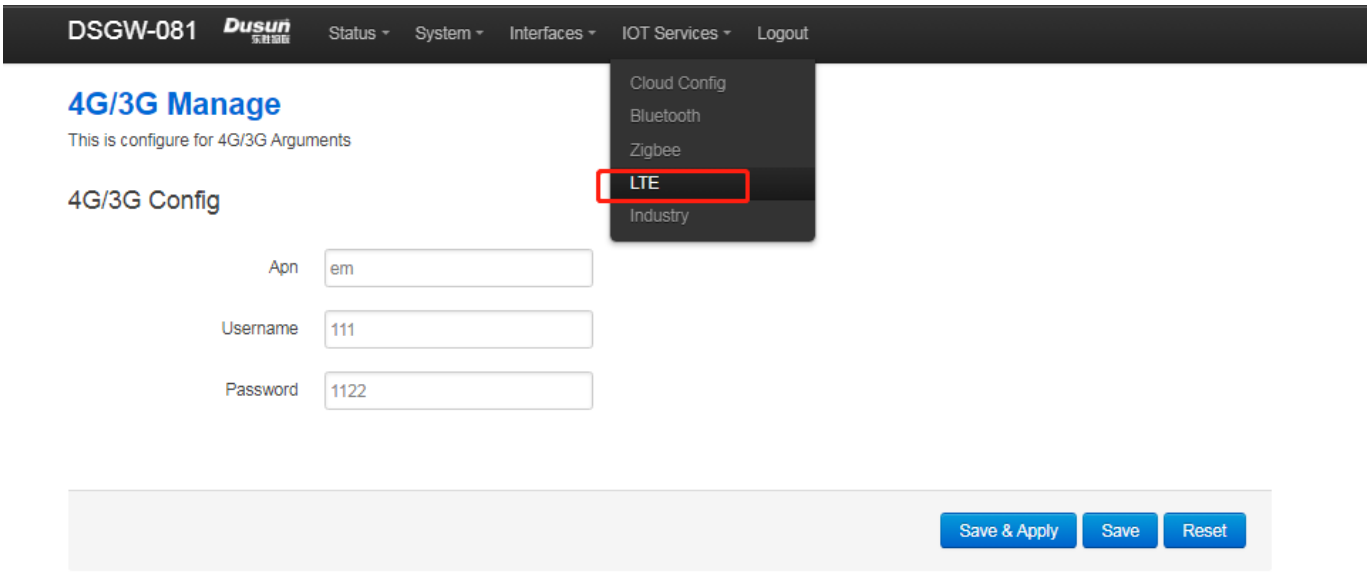
- Bluetooth



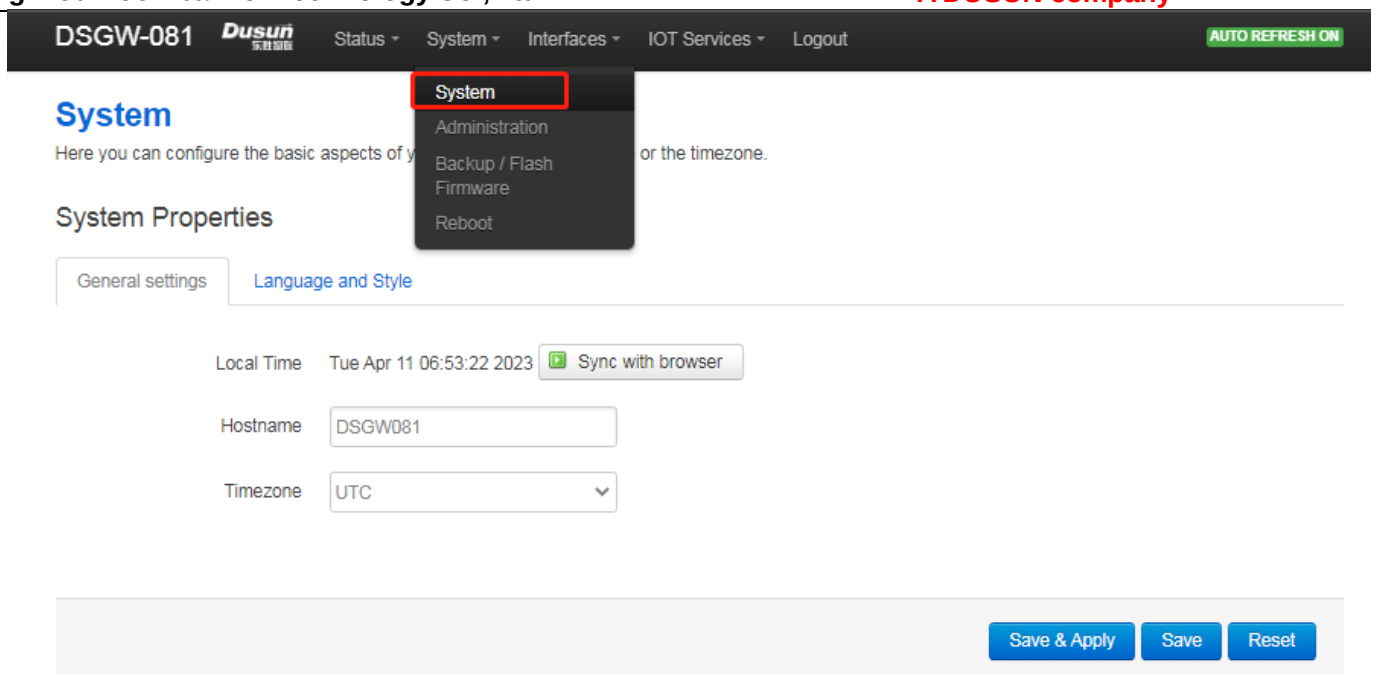
- Zigbee



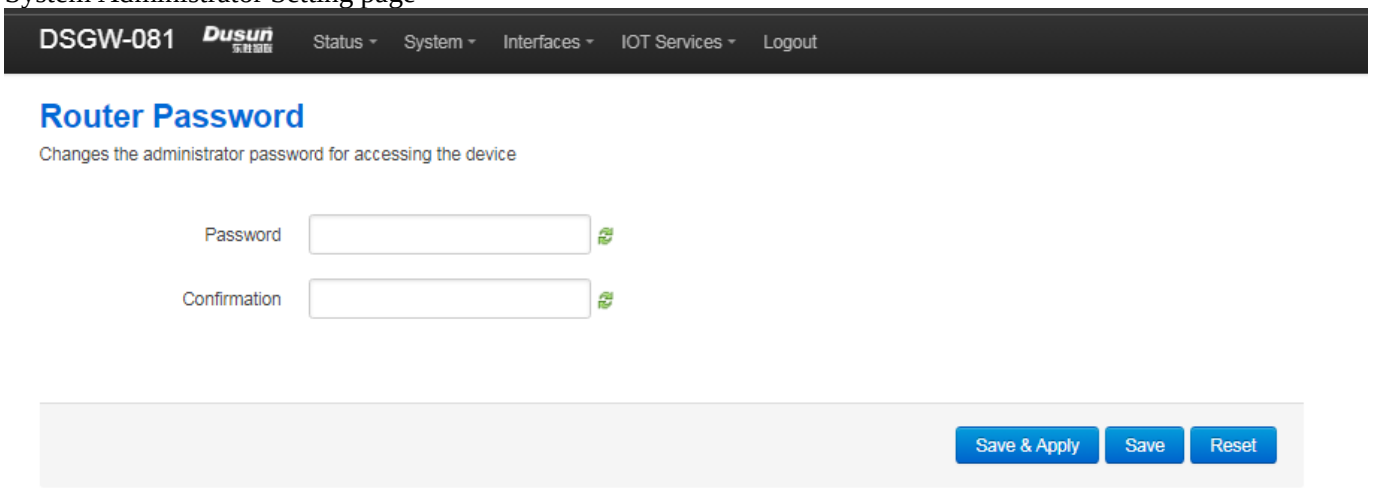
- LTE



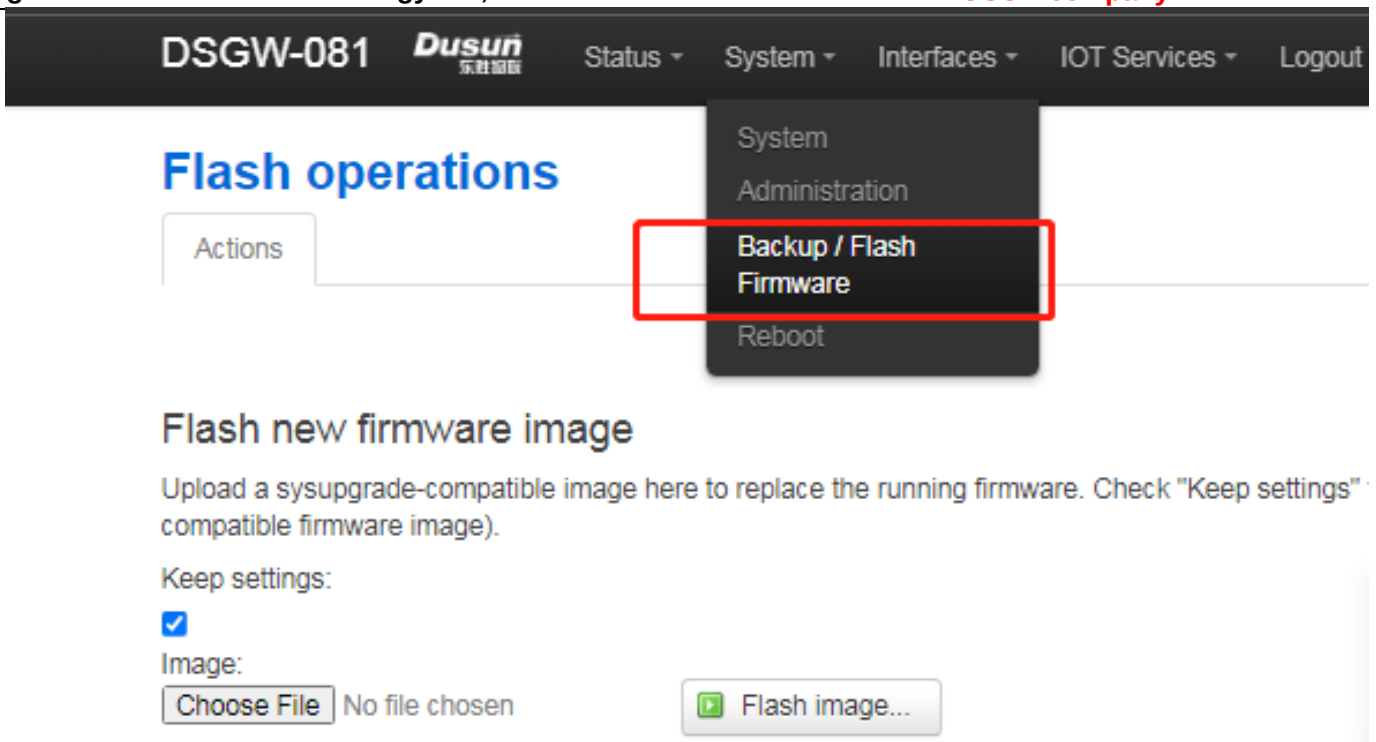
- System Setting Page



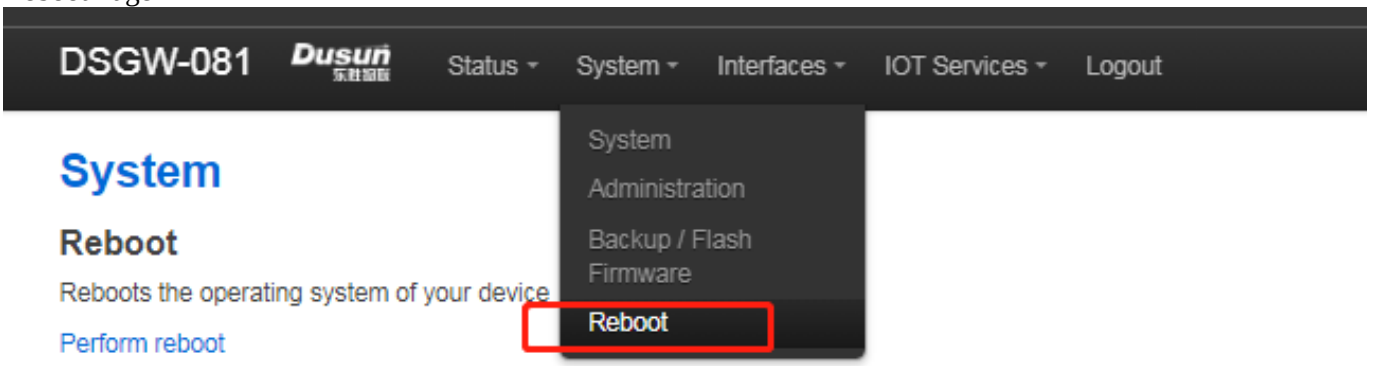
- System Administrator Setting page



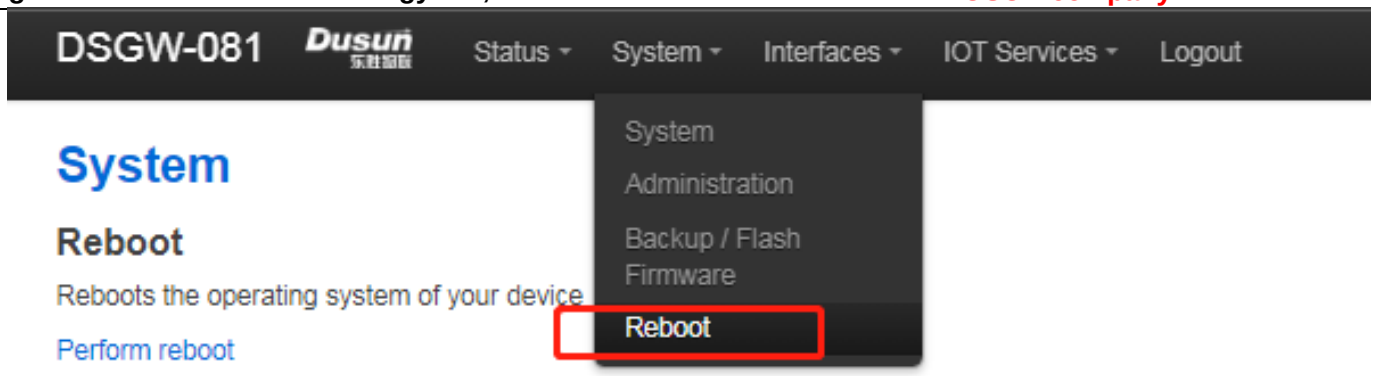
- System Upgrade Page



- Reboot Page



- Logout Page



9. Application Layer Development

9.1 Led

This board has three leds can be controlled by software, they are pwrled, zigbee, errled, led4

- 9.1 on led

```
echo none > /sys/class/led/pwrled/trigger
echo 1 > /sys/class/led/pwrled/brightness
```

- 9.2 off led

```
echo none > /sys/class/led/pwrled/trigger
echo 0 > /sys/class/led/pwrled/brightness
```

- 9.3 blink led

```
echo timer > /sys/class/led/pwrled/trigger
echo 500 > /sys/class/led/pwrled/delay_on
echo 500 > /sys/class/led/pwrled/delay_off
```

9.2 Button

This board has one button can used by software, when pressed, the system will auto call the button script in the /etc/rc.button/BTN1

here are two incomming parameters

- SEEN: this is the time, unit seconds
- ACTION: this is the action, it will we pressed or release

see the example has one function in the button script - firts is the long pressed 3 seconds open zigbee pair.

```
root@DSGW-081:~# cat /etc/rc.button/BTN_1
#!/bin/sh

#. /lib/functions.sh
#. /lib/functions/leds.sh

if [ "${ACTION}" = "pressed" ]; then
        touch /tmp/BTN_0_pressed
        touch /tmp/btn1
else
        rm -f /tmp/BTN_0_pressed
fi

if [ -f /tmp/dusun_upgrade ] ; then
```

```
        exit 0
fi

[ ! "${ACTION}" = "released" ] && {
        exit 0
}

led_off() {
        echo none > //sys/class/leds/$1/trigger
        echo 0 > /sys/class/leds/$1/brightness
}

led_timer() {
        echo timer > /sys/class/leds/$1/trigger
        echo $2 > /sys/class/leds/$1/delay_on
        echo $3 > /sys/class/leds/$1/delay_off
}


[ "$SEEN" -ge 3 ]  && {
        logger "Zigbee pairing"
        ubus send DS.GREENPOWER  '{"cmd" : "start_comission"}'

        logger "$BUTTON pressed for $SEEN seconds : Permit Join For Zigbee3.0/ZWave"
  /usr/bin/alink_ucmd.sh permit 1
  /usr/bin/dusun_ucmd.sh permit 1
  exit 0
}
```

9.3 Ethernet

this gateway has two ehternet port - wan port eth1
see the config

```
root@DSGW-081:~# cat /etc/network/interfaces
# interfaces(5) file used by ifup(8) and ifdown(8)
# Include files from /etc/network/interfaces.d:
source /etc/network/interfaces.d/*
auto eth1
iface eth1 inet dhcp


auto wlan0
iface wlan0 inet dhcp
        wpa-conf /etc/wpa_supplicant.conf
        metric 1
```

9.4 wifi

This gateway only have one 2.4 radio(rtl8821cs), when startup, it will auto start as sta mode.
see the config:

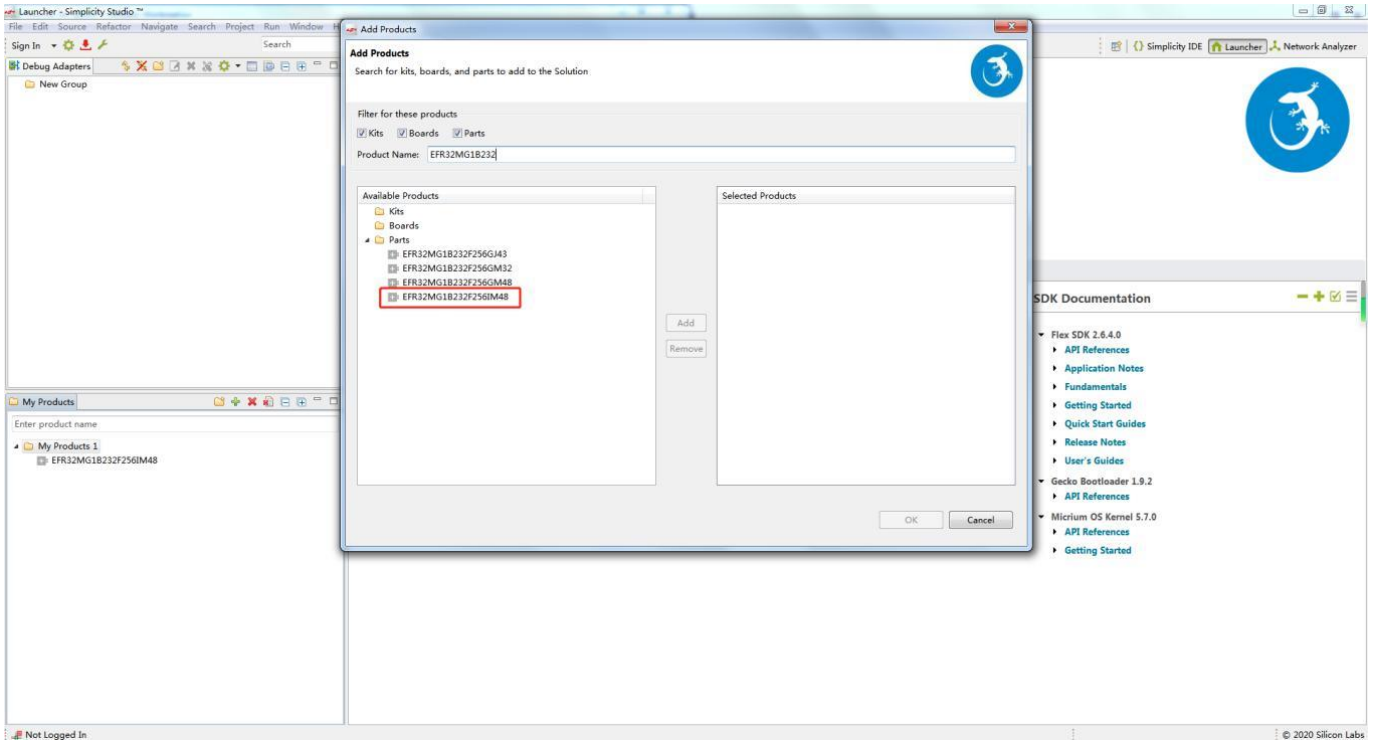
```
root@DSGW-081:~# cat /etc/network/interfaces
...
auto wlan0
```

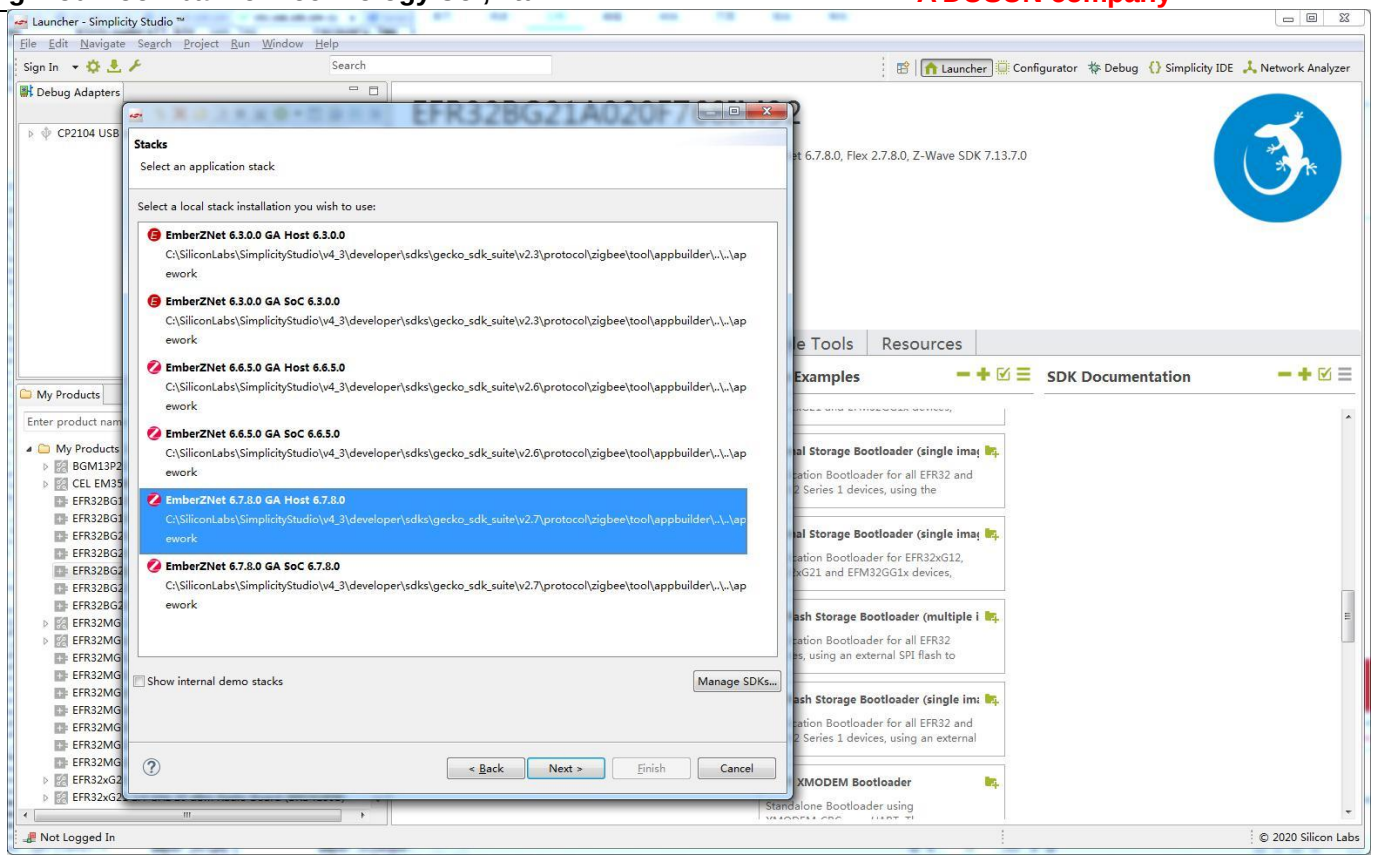
```
iface wlan0 inet dhcp
    wpa-conf /etc/wpa_supplicant.conf
    metric 1
```

9.5 Zigbee

This Gateway Has a Zigbee Module EFR32MG1B232

- Host Development Demo Example
- NCP Development
- User can obtained the zigbee module ¡¯s NCP program in simplicity studio, the module number is EFR32MG1B232F256G





For detailed information to flash image to the zigbee module, please refer to document ZIGBEE MODULE FLASH FIRMWAREv1.0 For SDK to develop program in gateway, please refer to document API Reference for EmberZNet PC Host. It can be found in the ss5 ¡¯s directory of C:\SiliconLabs\SimplicityStudio\v4_3\developer\sdks\gecko_sdk_suite\v2.7\protocol\zigbee\documentation

Silicon Labs EmberZNet Documentation

Release Notes / Quick Start Guide

- **EmberZNet PRO Release Notes**

  Lists compatibility requirements and sources for all software components in the development environment. Discusses the latest changes to the EmberZNet PRO stack (and associated utilities) including added/deleted/deprecated features/API, and lists bugs that have been fixed since the last release and any pending ones.

- **Getting Started with EmberZNet PRO -- QSG106**

  Provides basic information on configuring, building, and installing applications for the Mighty Gecko family and EM35x using the EmberZNet PRO stack and Simplicity Studio v4.

- **Using the Silicon Labs Dynamic Multiprotocol Demonstrations -- QSG155**

  Shows how to demonstrate Dynamic Multiprotocol functionality using a Bluetooth LE smartphone app with either Zigbee-Bluetooth or RAIL-Bluetooth demo applications.

Zigbee Fundamentals

- **Zigbee Fundamentals -- UG103-02**

  Describes the key features and characteristics of a Zigbee solution. It also includes a section on Zigbee 3.0.

API References

- **API Reference for the EmberZNet SOC Platform**

  Lists SoC Platform APIs used to interface to the EmberZNet PRO stack, HAL, and status of the application-controlled network. These APIs concern network management, device and stack management, messaging, fragmentation, serial communication, token access, peripheral access, bootload utilities, and others. They are independent of the Application Framework and therefore can be used to develop applications that do not rely on the Zigbee Cluster Library.

- **API Reference for the EmberZNet STM32F103RET Host**

  Lists STM32F103RET Host APIs used to interface to the EmberZNet PRO stack, HAL, and status of the application-controlled network. These APIs concern network management, device and stack configuration, message fragmentation, serial communication, peripheral access, and others. They are independent of the Application Framework and therefore can be used to develop applications that do not rely on the Zigbee Cluster Library.

- **API Reference for EmberZNet PC Host**

  Lists PC Host APIs used to interface to the EmberZNet stack, HAL, and status of the application-controlled network. These APIs concern network management, device and stack configuration, message fragmentation, serial communication, ASH (Asynchronus Serial Host) utilities, and others. They are independent of the Application Framework and therefore can be used for developing applications that do not rely on the ZigBee Cluster Library.

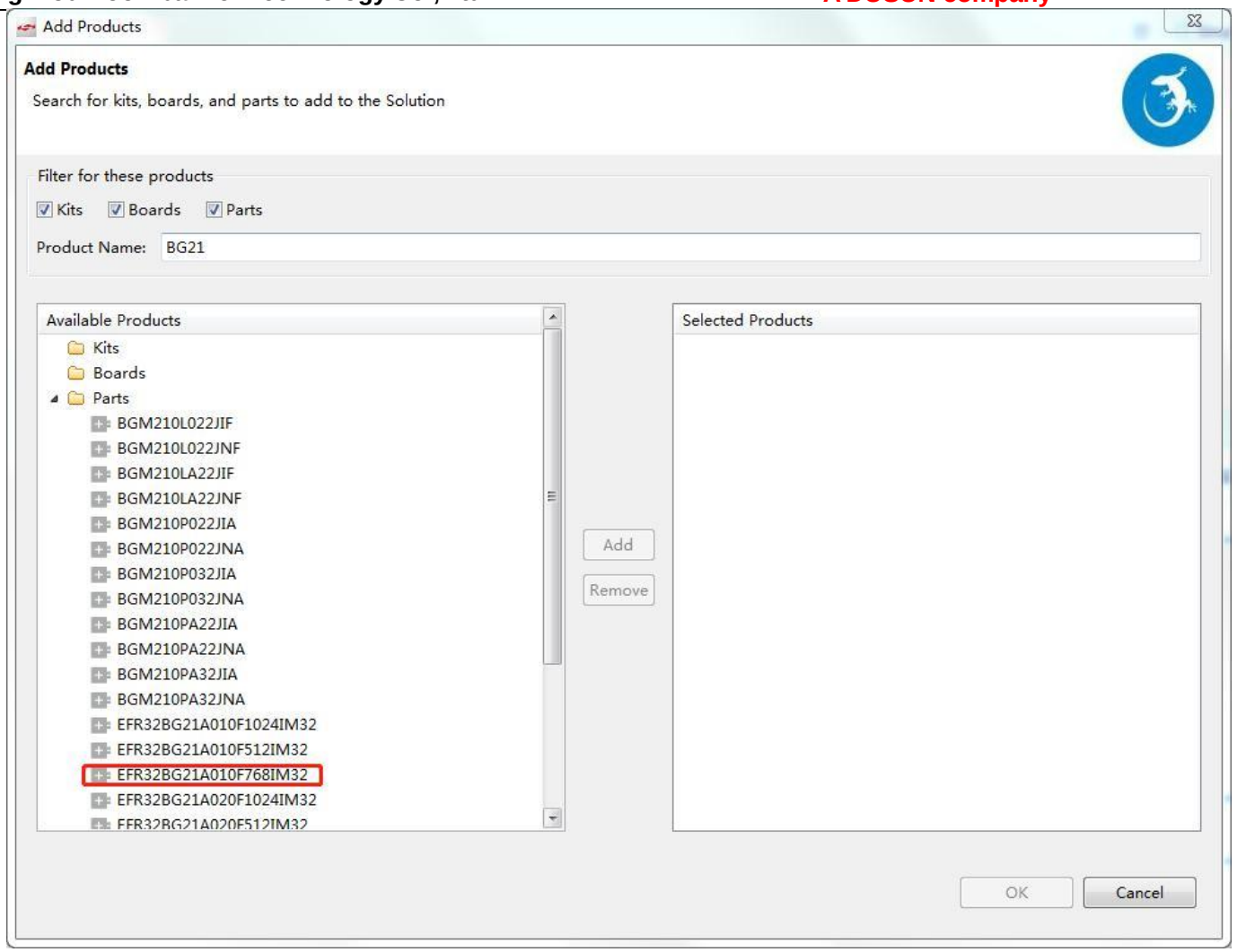
- **Advanced Application Programming with the Stack and HAL APIs -- UG105**

  A companion to the EmberZNet API references, for developers whose applications require functionality not available through AppBuilder and the application framework, or who prefer working with an API. Includes an introduction to the stack API, a discussion of advanced design issues to consider when developing an application using the API, and provides an example application.

9.6 Bluetooth

This Gateway Has a Bluetooth Module EFR32BG21

- Host Development Demo Example
- NcP Development User can obtained the ble module ¡¯s NCP program in simplicity studio, the module number is ERF32BG21



Find the correct BLE module in simplicity studio, then follow the same guide in section 10

9.7 RTC

9.8 LTE

This Gateway Has a LTE Module BG96 We use the pppd to dial and manage the bg96. here is some config and steps about the lte module

- the apn config

```
root@DSGW-081:~# cat /etc/config/ppp

config 'ppp' 'ppp'
        option 'apn' 'em'
        option 'username' '111'
        option 'password' '1122'
```

- pppd dial scripts

```
root@DSGW-081:~# ls /etc/ppp/peers/* -alh
-rwxr-xr-x    1 root     root         359 Feb 27  2020 /etc/ppp/peers/dial
-rwxr-xr-x    1 root     root         163 Feb 27  2020 /etc/ppp/peers/mo_3gmodule.dial
```

- do the pppd call in the foreground

1. stop the demo program.

```
/etc/init.d/done stop; /etc/init.d/dial stop;
```

2. modify the pppd to debug mode

```
root@DSGW-081:~# cat /etc/ppp/options
debug            // remove #, open the debug mode
nodetach         // add this
#logfile /dev/null // comment this line
noipdefault
```

3. open the lte module

```
echo 0 > /sys/class/leds/ltepwr/brightness
echo 0 > /sys/class/leds/lterst/brightness
echo 0 > /sys/class/leds/lterf/brightness
sleep 1
echo 1 > /sys/class/leds/ltepwr/brightness
echo 1 > /sys/class/leds/lterst/brightness
echo 1 > /sys/class/leds/lterf/brightness
sleep 15
```

4. pppd dial

```
root@DSGW-081:~# pppd call dial
timeout set to 3 seconds
send (ate0^M)
expect (OK)
^M
OK
 -- got it

send (at^M)
expect (OK)
^M
^M
OK
 -- got it

send (AT+CSQ^M)
expect (OK)
^M
^M
+CSQ: 99,99^M
^M
OK
 -- got it

send (AT+COPS?^M)
expect (OK)
^M
^M
+COPS: 0^M
^M
OK
 -- got it

send (AT+CREG?^M)
```

```
expect (OK)
^M
^M
+CREG: 0,0^M
^M
OK
 -- got it

send (AT+CEREG?^M)
expect (OK)
^M
^M
+CEREG: 0,0^M
^M
OK
 -- got it

send (AT+CPIN?^M)
expect (READY)
```

9.9 Can

this board has two can interace named can0
we can use loopback mode to test it

- set up can and start receive mode

```
ifconfig can0 down;
ip link set can0 type can bitrate 500000 loopback on;
ifconfig can0 up;
candump can0
```

- clone anther ssh send data

```
cansend can0 5A1#11.22.33.44.55.66.77.88
```

9.10 Dout

we can echo '0' or '1' to a file to control the dout1 and dout2 to on or off.

- on

```
echo 1 > /sys/class/leds/do01/brightness
```

- off

```
echo 0 > /sys/class/leds/do01/brightness
```

9.11 Passive In

the passive in will auto generate a event to the /dev/input/by-path/platform-gpio_keys\@0-event

9.12 Active in

here is two active input interfaces on the board(iio:device/iio:device1).
we can easy get the voltage input

```
local val=`cat /sys/bus/iio/devices/iio\:device1/in_voltage_raw`
val=$((val*33*11/2560))
echo $val V
```

9.13 Analog in

here is two analog input interfaces on the board(hwmon0/hwmon1).iio:device/iio:device1
we can easy get the voltage input.

```
local val=`cat /sys/class/hwmon/hwmon0/in1_input`
```

```
val=$((val*33*11/2560))
echo $val
```

9.13 RS232

here is a 232 port on the board
we can use minicom or other user serial tool to test it
the port is /dev/ttymxc3

9.12 RS485

here is a 485 port on the board
we can use minicom or other user serial tool to test it
the port is /dev/ttymxc4

10. Kernel Development DTS Description

- This Gateway's dts file is the ./arch/arm/boot/dts/DSGW-081.dts

10.1 Led

```
led1{
  //label = "led1";
  label = "pwrled";
  gpios = <&gpio1 4 GPIO_ACTIVE_HIGH>;
  default-state = "off";
  linux,default-trigger = "timer";
};


led2{
  //label = "led2";
  label = "zigbee";
  gpios = <&gpio1 2 GPIO_ACTIVE_HIGH>;
  default-state = "off";
};

led3{
  //label = "led3";
  label = "errled";
  gpios = <&gpio5 2 GPIO_ACTIVE_HIGH>;
  default-state = "off";
};

led4{
  label = "led4";
  gpios = <&gpio5 5 GPIO_ACTIVE_HIGH>;
  default-state = "off";
};
```

10.2 Button

```
gpio_keys: gpio_keys@0 {
  compatible = "gpio-keys";
  pinctrl-names = "default";
  pinctrl-0 = <&pinctrl_gpio_keys>;
  #address-cells = <1>;
  #size-cells = <0>;
```

```
    autorepeat;


    key1@1 {
      label = "USER-KEY1";
      linux,code = <BTN_0>;
      gpios = <&gpio1 19 GPIO_ACTIVE_LOW>;
      gpio-key,wakeup;
    };

  };
```

10.3 Ethernet

```
&fec2 {
  pinctrl-names = "default";
  /*
  pinctrl-0 = <&pinctrl_enet2
        &pinctrl_fec2_reset>;
  */
  phy-mode = "rmii";
  phy-handle = <ephy1>;
  //phy-reset-gpios = <&gpio5 8 GPIO_ACTIVE_LOW>;
  //phy-reset-duration = <200>;
  status = "okay";


mdio {
    #address-cells = <1>;
    #size-cells = <0>;

    ethphy0: ethernet-phy@2 {
      compatible = "ethernet-phy-ieee802.3-c22";
      reg = <0>;
    };

    ethphy1: ethernet-phy@1 {
      compatible = "ethernet-phy-ieee802.3-c22";
      reg = <1>;
    };

  };
};
```

10.4 wifi

```
&usdhc1 {
  pinctrl-names = "default", "state_100mhz", "state_200mhz";
  pinctrl-0 = <&pinctrl_usdhc1>;
  pinctrl-1 = <&pinctrl_usdhc1_100mhz>;
  pinctrl-2 = <&pinctrl_usdhc1_200mhz>;
  /* cd-gpios = <&gpio1 19 GPIO_ACTIVE_LOW>; */
  broken-cd;
```

```
 //non-removable;
 keep-power-in-suspend;
 enable-sdio-wakeup;
 vmmc-supply = <?_sd1_vmmc>;
 no-1-8-v;
 //
 //cd-post;
 //wifi-host;
 //non-removable;
 //pm-ignore-notify;
 //
 status = "okay";
};
```

10.5 Zigbee

```
&uart2 {
 pinctrl-names = "default";
 pinctrl-0 = <&pinctrl_uart2>;
 /* fsl,uart-has-rtscts; */
 /* for DTE mode, add below change */
 /* fsl,dte-mode; */
 /* pinctrl-0 = <&pinctrl_uart2dte>; */
 status = "okay";
};
```

10.6 Bluetooth

- Bluetooth use the tty->usb device

```
&uart3 {
 pinctrl-names = "default";
 pinctrl-0 = <&pinctrl_uart3>;
 status = "okay";
};
```

10.7 RTC

```
&i2c1 {
 clock-frequency = <100000>;
 pinctrl-names = "default";
 pinctrl-0 = <&pinctrl_i2c1>;
 status = "okay";

 pcf85063: rtc@51 {
      compatible = "nxp,pcf85063";
      reg = <0x51>;
   };

};
```

10.8 Can

```
&flexcan1 {
 pinctrl-names = "default";
 pinctrl-0 = <&pinctrl_flexcan1>;
```

```
 xceiver-supply = <?_can_3v3>;
 status = "okay";
};
```

10.9 Dout

```
  //Digtal output
  led8{
   label = "do01";
   //gpios = <&gpio3 0 GPIO_ACTIVE_LOW>;
   gpios = <&gpio5 6 GPIO_ACTIVE_LOW>;
   default-state = "on";
  };
  led9{
   label = "do02";
   gpios = <&gpio1 8 GPIO_ACTIVE_LOW>;
   default-state = "on";
  };
```

10.10 Passive in

```
 gpio_keys: gpio_keys@0 {
  compatible = "gpio-keys";
  pinctrl-names = "default";
  pinctrl-0 = <&pinctrl_gpio_keys>;
  #address-cells = <1>;
  #size-cells = <0>;
  autorepeat;

  key2@1 {
   label = "USER-KEY2";
   linux,code = <BTN_1>;
   gpios = <&gpio1 13 GPIO_ACTIVE_LOW>;
   gpio-key,wakeup;
  };
  key3@1 {
   label = "USER-KEY3";
   linux,code = <BTN_2>;
   gpios = <&gpio1 12 GPIO_ACTIVE_LOW>;
   gpio-key,wakeup;
  };

 };
```

10.11 Active in

```
&i2c4 {
 clock-frequency = <100000>;
 pinctrl-names = "default";
 pinctrl-0 = <&pinctrl_i2c4>;
 status = "okay";

 adc081c@55 {
     compatible = "ti,adc081c";
```

```
      reg = <0x55>;
    };
  adc081c@56 {
      compatible = "ti,adc081c";
      reg = <0x56>;
    };
};
```

10.12 Analog in

```
&i2c3 {
  clock-frequency = <100000>;
  pinctrl-names = "default";
  pinctrl-0 = <&pinctrl_i2c3>;
  status = "okay";


  ina219@40 {
    compatible = "ti,ina231";
      reg = <0x40>;
      shunt-resistor = <10000>;
    };
  ina219@41 {
    compatible = "ti,ina231";
      reg = <0x41>;
      shunt-resistor = <10000>;
    };
};
```

10.13 RS232

```
&uart4 {
  pinctrl-names = "default";
  pinctrl-0 = <&pinctrl_uart4>;
  status = "okay";
};
```

10.14 RS485

```
&uart5 {
  pinctrl-names = "default";
  pinctrl-0 = <&pinctrl_uart5>;
  status = "okay";
};
```

13. Support

Please contact our sell to get more support.

14. Reference

openwrt