EM3288 User Manual

V2.0

Boardcon Embedded Design

Preface

Overview

The content of this document is only described for the development board EM3288, aiming to help users quickly understand, apply and develop the EM3288 development board.

System Support

Development Board	Debian11	Buildroot
EM3288_V7 MINI3288_V4	Y	Y

Revision History

Version	Date	Author	Revision History
V1.0	2023-08-26	Liu Yuan	Initial version
V1.0	2023-11-26	Liu Yuan	Update linux_5.10

Version update instructions

Due to product version upgrades or other reasons, the content of this document will be updated from time to time. At the same time, it will be synchronized to the Boardcon website.

If you have any questions, concerns or comments about what is stated in the document, please feel free to contact us.

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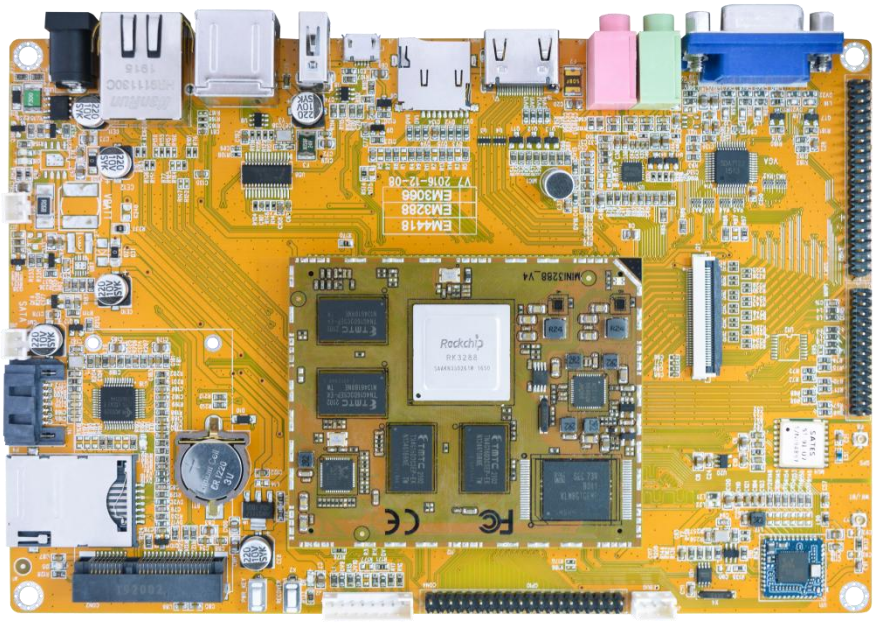
Content

Introduction

1.Overview

EM3288 is equipped with MINI3288 core board, which integrates quad-core CortexA17 and a separate NEON coprocessor. EM3288 is a high-performance platform with powerful multi-thread computing capabilities, graphics processing capabilities and hardware decoding capabilities, and supports 4K hardware decoding.

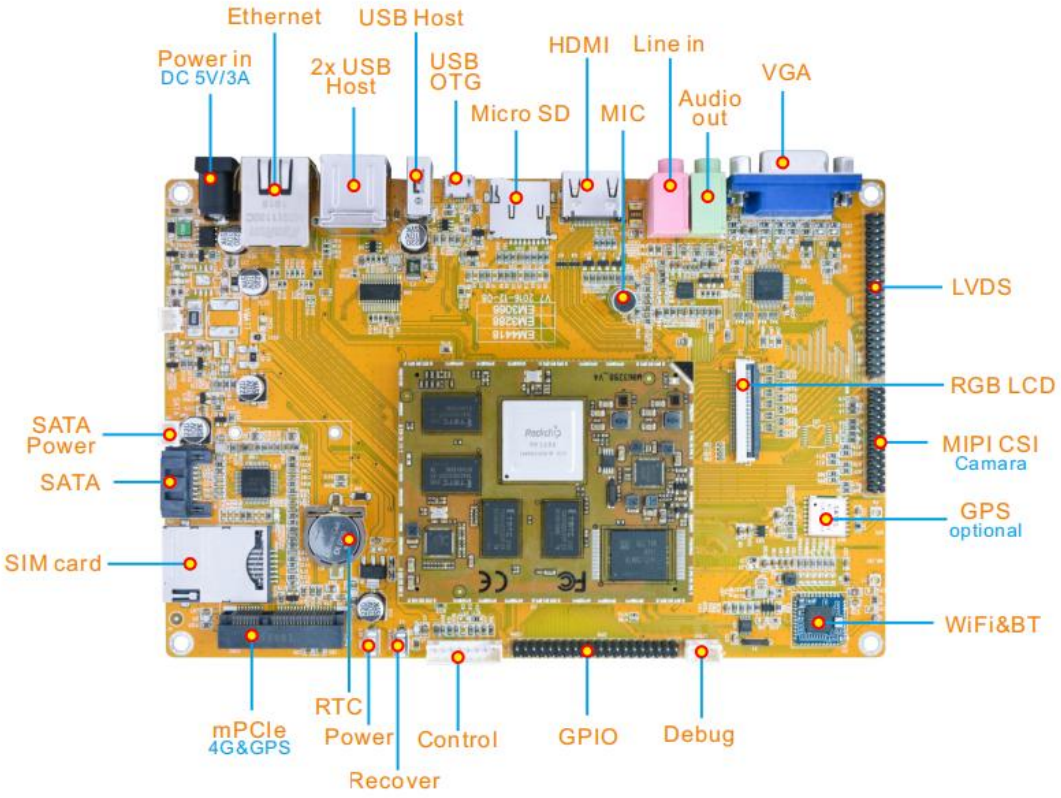


2.Product Parameters

Basic Parameters		
SOC		RK3288
CPU		Quad-core Cortex-A17 up to 1.8GHz
GPU		• ARM Mali-T764 GPU, support AFBC(frame buffer compression) • OpenGL ES1.1/2.0/3.0, OpenCL 1.2, DirectX 11 • Embedded high performance 2D acceleration hardware
Video	Decoder	• Support 4KP@30fps H.265/H.264 video decoding • Support 1080P@60fps VC-1/MPEG-4,2,1 video decoding
	Encoder	Support 1080P@60fps H.264/VP8 video encoding

RAM	2GB DDR3
ROM	8GB EMMC
Support system	Debian10, Buildroot
Hardware Parameters	
Extended Storage	• Support 1xSATA • Support 1x TF Card
Display	• Support 1x LVDS 1280x800@60fps output • Support 1x HDMI 4K@60fps output • Support 1x VGA output
Audio	Support 1x HDMI audio output Support 1x Headset output/input Support 1x MIC input
USB	Support 3xUSB2.0
Ethernet	Support 1x Gigabit Ethernet
Wireless Network	Support 1x WIFI/BT module Support 1x 4G module
Camera	Support 1xCamera
GPS	Support 1x GPS module
Peripheral communication	Support 1xUART, 1xSPI0
Other parameters	Support 1xDebug, 1xOTG, 1xRTC
Electrical Parameters	
Power supply input voltage	5V/3A
RTC input voltage	3V
Operating temperature	0~70º
Storage temperature	-40~85º
Structural Parameters	
Core board dimensions	70mm x 58mm
Motherboard dimensions	175.3mm x 117mm

3.Hardware Interface



Interface parameters	
Power in	5V/3A DC power input interface
Ethernet	Gigabit Ethernet RJ45 interface
2x USB Host	Dual-layer USB2.0 HOST interface
USB Host	USB HOST interface
USB OTG	OTG download interface
Micro SD	MicroSD card slot
HDMI	HDMI OUT interface
MIC	Microphone
Line in	Audio input interface
Audio out	Audio output interface
VGA	VGA display interface
LVDS	LVDS/MIPI screen display interface

RGB LCD	RGB screen display interface
MIPI CSI	MIPI camera interface
RTC	RTC coin cell connector
GPS	GPS module
WIFI&BT	Realtek RTL8723DS module
Debug	Debug the serial port
GPIO	GPIO extension interface
Control	Key GPIO interface
Recover	Recover key
Power	Power key
RTC	RTC coin cell connector
mPCIe 4G&GPS	4G module interface
SATA	SATA interface
SATA Power	SATA power Power

Install Drivers and Tool

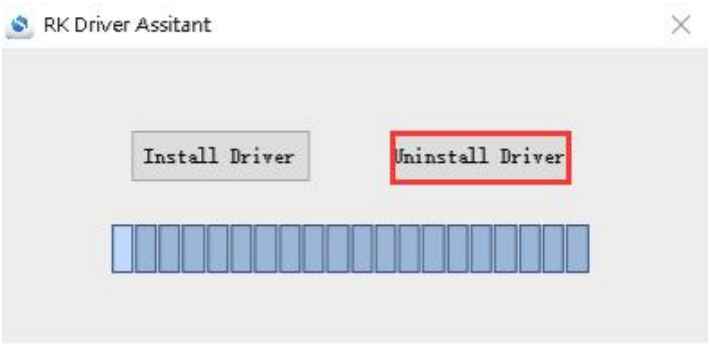
To download firmware and debug in the terminal, the following drivers and software need to be installed(for Windows computers):

Number	Driver name	Driver	Use
1	RK Driver Assitant	DriverInstall.exe	OTG USB driver installation assistant
2	CP210x	PreInstaller.exe	Serial port debugging driver
3	Serial Terminal Tool	SecureCRT.exe	Debugging tool

1.Install RK Driver Assitant

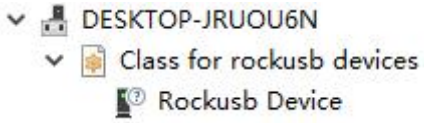
Step 1, open DriverAssitant_v5.12/DriverInstall.exe.

Step 2, to avoid driver conflicts, click **Uninstall Driver** to uninstall the driver.

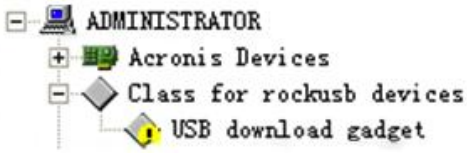


Step 3, click button **Install Driver** to install.

Step 4, after the installation is complete, connect the board and PC with Micro USB cable and press the **Recovery** key and hold then power the board, the following information is displayed in the Computer Device Manager, indicating that the USB driver was successfully installed.

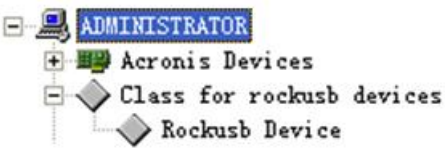


Step 5, if the following device information appears on the computer device manager after the operation in step 4, you need to proceed to the next step.



Step 6, the WINDOW will pop up found New Hardware Wizard dialog box, choose to install from the specified location, and then select: \DriverAssitant_v5.12\ADBDriver.

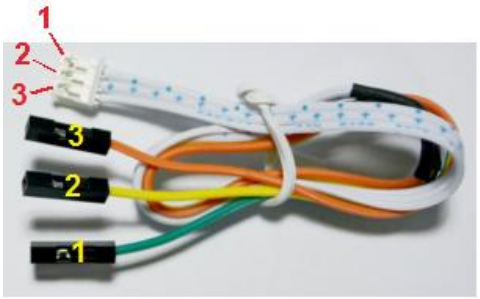
Step 7, after the installation is completed, the following device information can be seen in the Computer Device Manager.



2.Install CP210X Driver

2.1 How to connect the serial port tool

Pin	Connection Description
3V3	No need to connect.
TXD	Transmit, connect to TX pin of the board.
RXD	Receive, connect to RX pin of the board.
GND	Ground, connect to GND pin of the board.
+5V	No need to connect.



Pin	Connection Description
1	RX, connect to RXD pin of the CP210X Module.
2	TX, connect to TXD pin of the CP210X Module.
3	Ground, connect to GND pin of the CP210X Module.

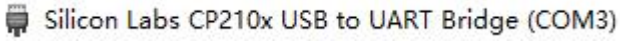
2.2 Install driver

Step 1, plug the CP2102 Module to the PC.

Step 2, unzip CP210x_Windows_Drivers_with_Serial_Enumeration.zip on Windows.

Step 3, select and install the corresponding PreInstaller.exe according to the computer properties.

Step 4, after the installation is completed, the device will be listed under **Device Manager -> ports** with unique serial port assigned.

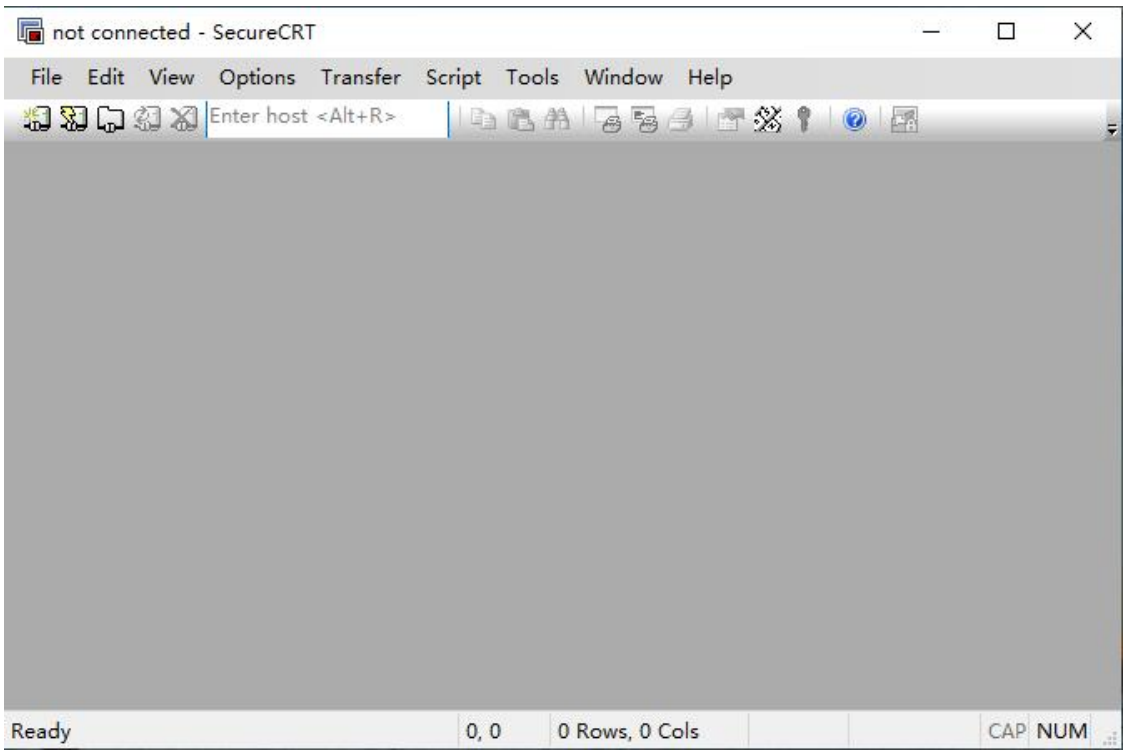


3.Install Serial Terminal Tool

The serial terminal SecureCRT is used for debugging in Windows. It can be used directly after decompression.

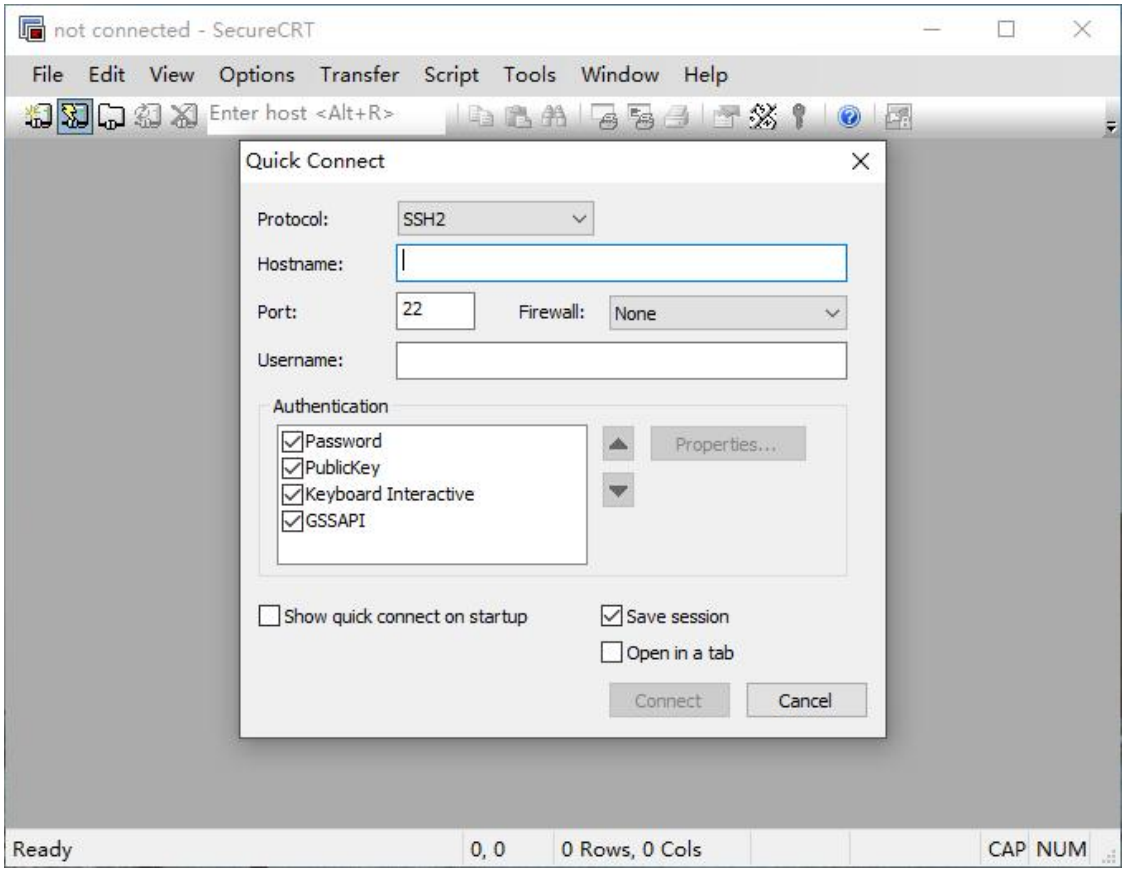
Step 1, unzip Platform/SecureCRT.rar on PC.

Step 2, click SecureCRT/SecureCRT.exe open the SecureCRT.

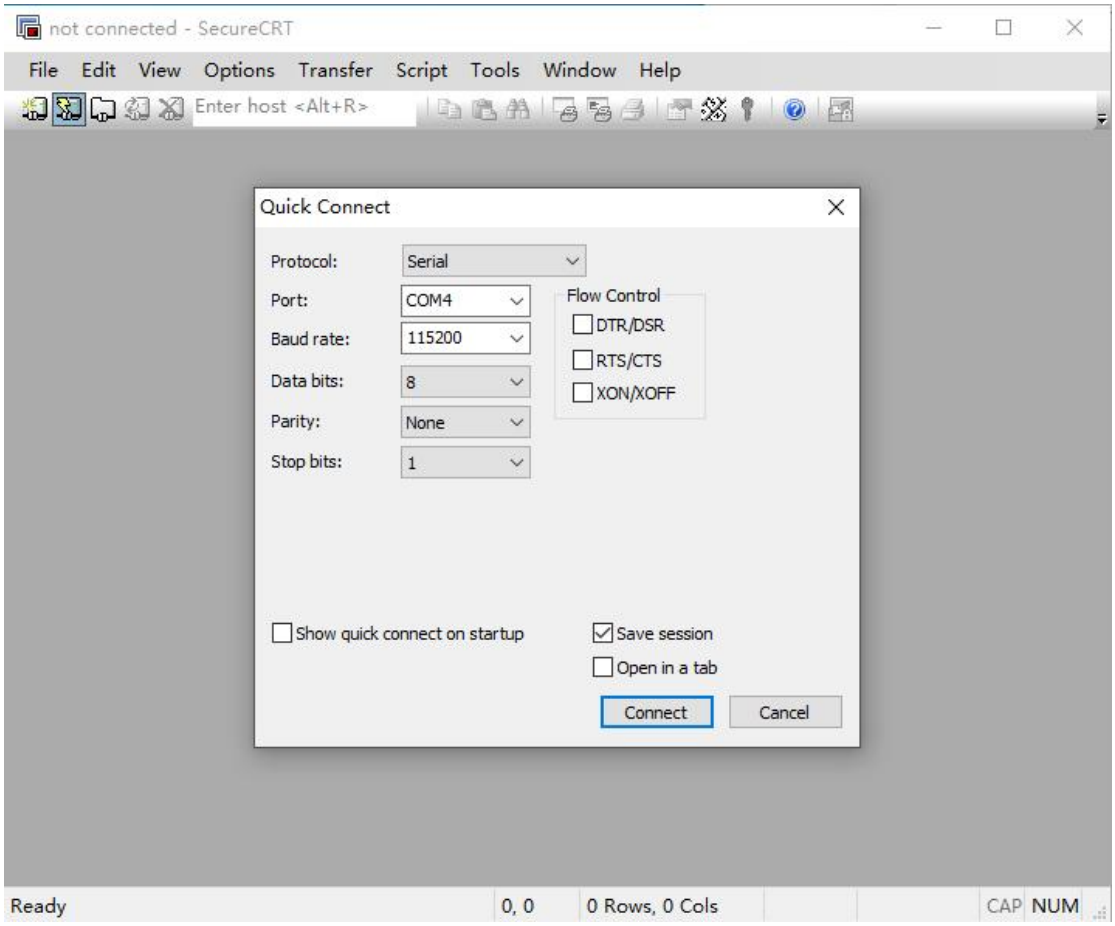


Step 3, confirm that the CP210x driver has been installed and the CP2102 module is connecting to the PC.

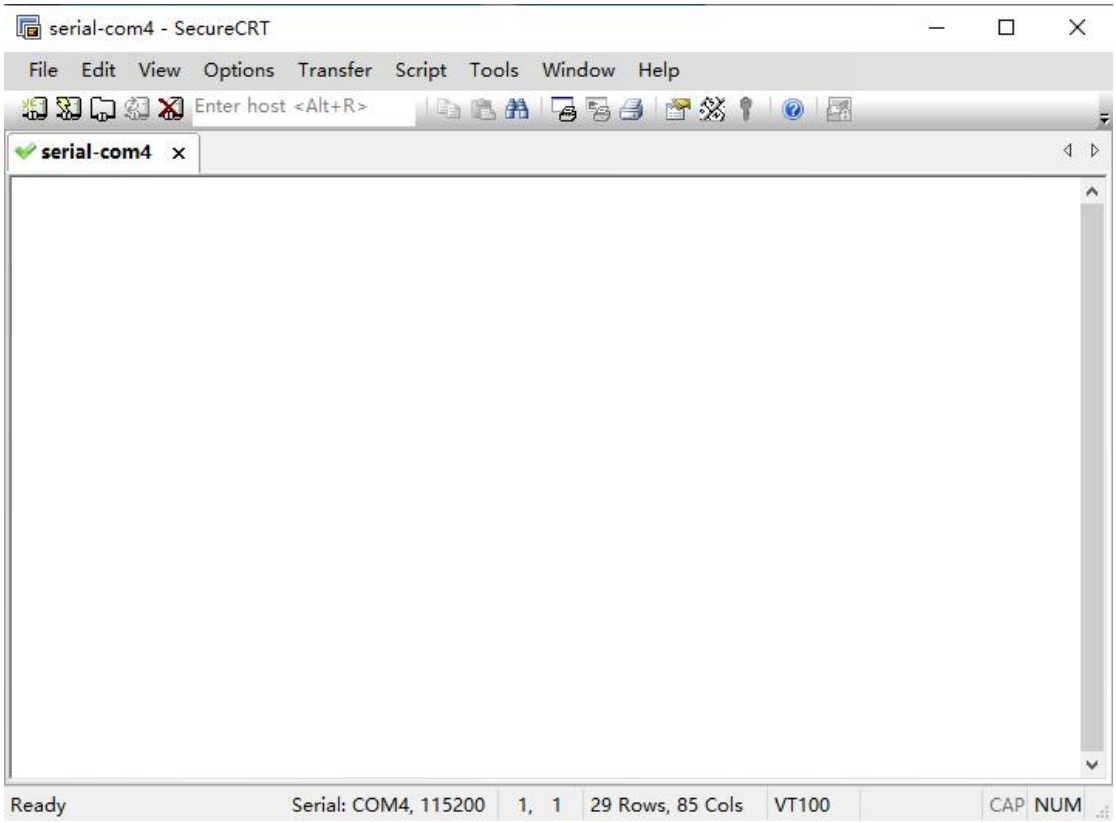
Step 4, click the **Quick Connect** button to go to the Quick Connect configuration screen.



Step 5, configure as shown in the following figure.



Step 6, after clicking connect button, the terminal serial interface will be successfully accessed.



Debian11

1.Compiler Environment

It is recommended to use Ubuntu 20.04 system or above. If you encounter an error during compilation, you can check the error message and install the corresponding software packages accordingly. Other Ubuntu versions may need to adjust the software package accordingly. In addition to the system requirements, there are other hardware and software requirements.

Hardware requirements	Software requirements
64-bit system, hard disk space should be greater than 40G. If you do multiple builds, you will need more hard drive space.	Ubuntu 20.04 system

2.Install Tools

The contents of this directory only provide the software package installation commands that are needed to build the compiled SDK environment. Please install other tools such as samba and ssh yourself.
PC OS: ubuntu 20.04 system
Network: online
Permission: root

```
# sudo apt-get install git ssh make gcc libssl-dev liblz4-tool
# sudo apt-get install expect g++ patchelf chrpath gawk texinfo chrpath diffstat
# sudo apt-get install binfmt-support qemuuser-static live-build bison flex fakeroot
# sudo apt-get install cmake gcc-multilib g++-multilib unzip device-tree-compiler
# sudo apt-get install ncurses-dev libgucharmap-2-90-dev bzip2 expat gpgv2
# sudo apt-get install cpp-aarch64-linux-gnu g++-aarch64-linux-gnu
# sudo apt install python2
# sudo apt install python-is-python3
```

3.Compile Source

Step 1, unzip the source

```
$ tar xvf xx.tar.bz2
$ cd xx
```

Step 2, configure the compiled board

```
$ ./build.sh lunch
```

liuyuan@boardcon:~/opt/EM3288/linux_5.10$ ./build.sh lunch

Pick a defconfig:

1. rockchip_defconfig
2. rockchip_rk3288w_evb_act8846_defconfig
3. rockchip_rk3288w_evb_rk808_defconfig
4. rockchip_rk3288w_firefly_defconfig

Which would you like? [1]: 2 // rockchip_rk3288w_evb_act8846_defconfig

Switching to defconfig:

/home/liuyuan/opt/EM3288/linux_5.10/device/rockchip/.chip/rockchip_rk3288w_evb_act8846_defconfig

Step 3, compile uboot

```
$ ./build.sh uboot
```

Step 4, compile the kernel

```
$ ./build.sh kernel
```

If you need to modify the kernel configuration, use the following command to open the kernel configuration menu:

```
$ cd kernel
$ make ARCH=arm menuconfig
```

The path to save the configuration content is .config by default, please update the modified content to the path ./arch/arm/configs/rockchip_linux_defconfig in time, and then recompile the kernel to make it take effect.

Step 5, compile recovery

```
$ ./build.sh recovery
```

Step 6, compile debian (Permission: root)

```
# ./build.sh debian
```

After compilation, generate linaro-rootfs. img in the Debian directory.

Description：When compiling Debian for the first time, you need to install dependency packages. (Permission: root)

Debian compilation requires a dependent environment:

```
# cd debian
# sudo apt-get install binfmt-support qemu-user-static live-build
# sudo dpkg -i ubuntu-build-service/packages/*
# sudo apt-get install -f
```

Step 7, build update image

```
$ ./build.sh firmware
$ ./build.sh updateimg
```

Images and update.img are generated in rockdev/ directory.

If both the buildroot and debain systems are compiled, the packaged image defaults to the last compiled system; If the last compilation was for the buildroot system, but you want to package the

image of the Debian system, you can execute the following command to package it:

```
$ ./build.sh firmware
$ export RK_ROOTFS_SYSTEM=debian
$ ./build.sh updateimg
```

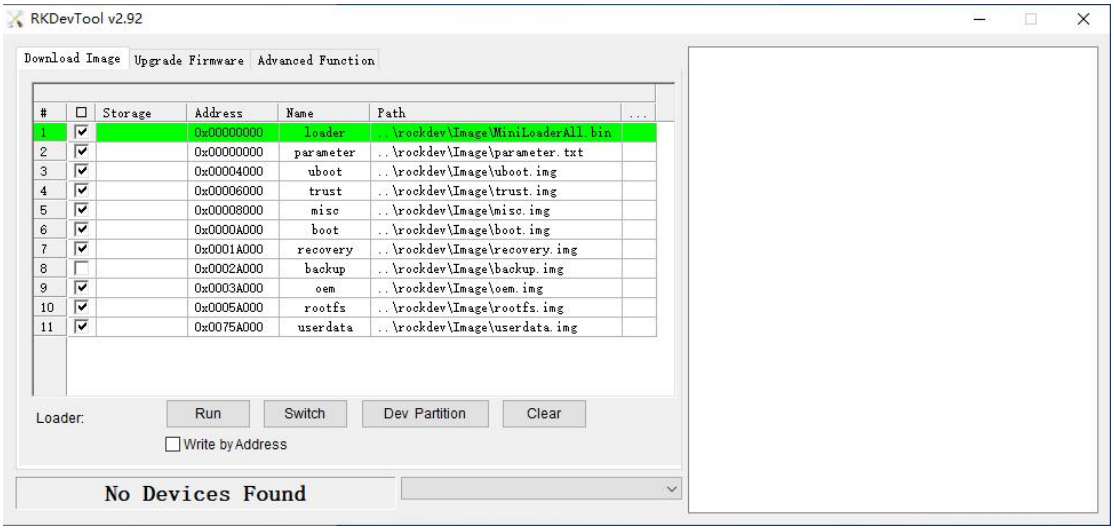
Because recompiling the Debian system takes a long time, while compiling the buildroot takes very little time. After switching to the Debian system using instructions, if you want to package the image of the buildroot system, you need to recompile the buildroot.

4.Images Operation

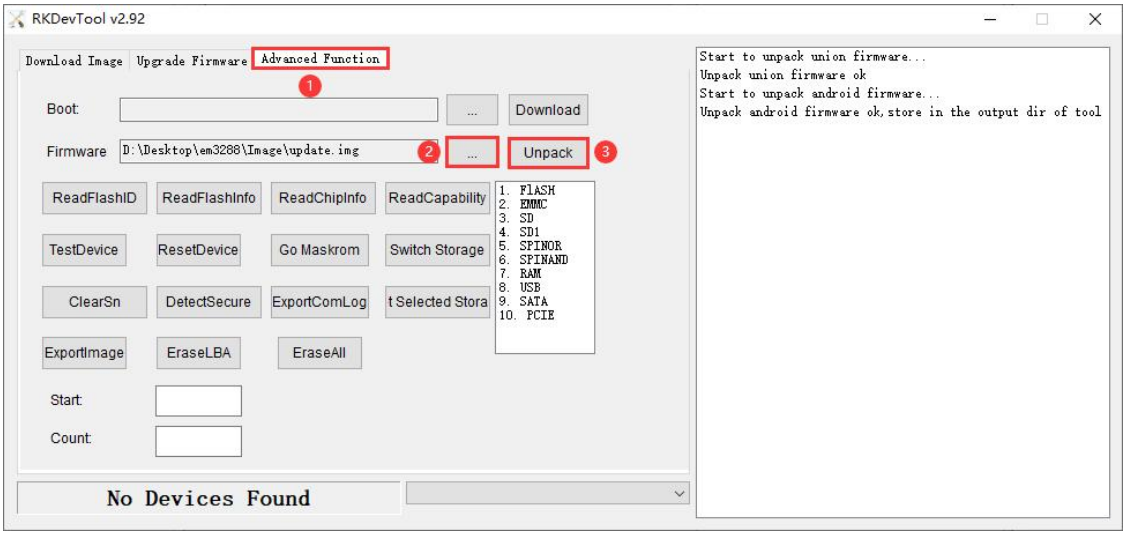
4.1 Unzip firmware

Step 1, unzip RKDevTool.rar on Windows.

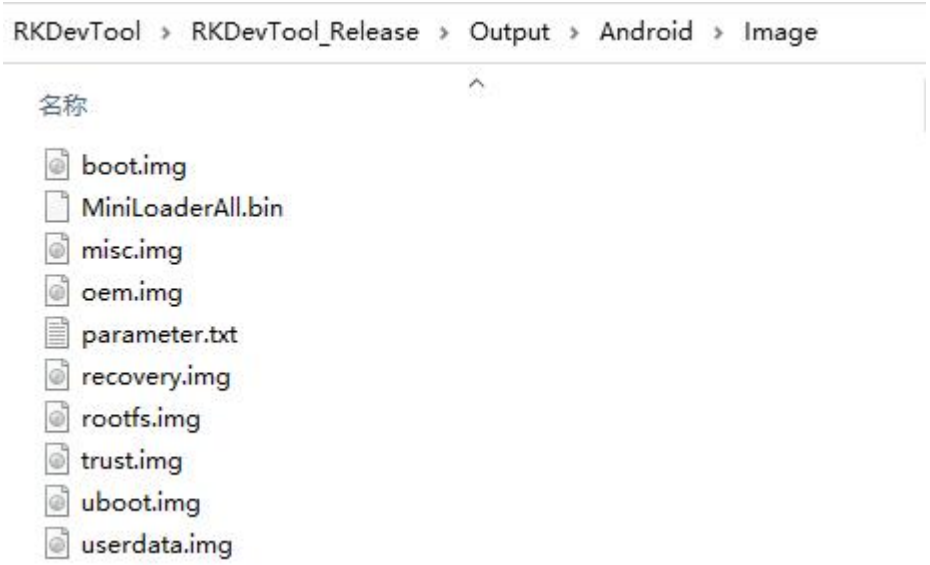
Step 2, open RKDevTool\RKDevTool_Release\RKDevTool.exe.



Step 3, click **Advanced Function** -> **Firmware**, select **update.img**, then click **Unpack** to unzip.

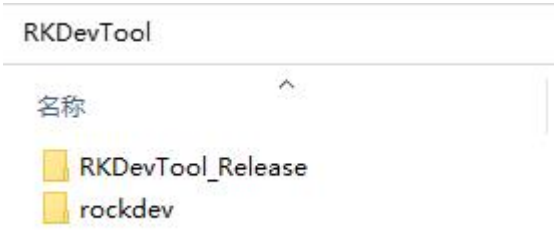


Step 4, the unzip files will be generated in \RKDevTool\RKDevTool_Release\Output\Android\Image directory.

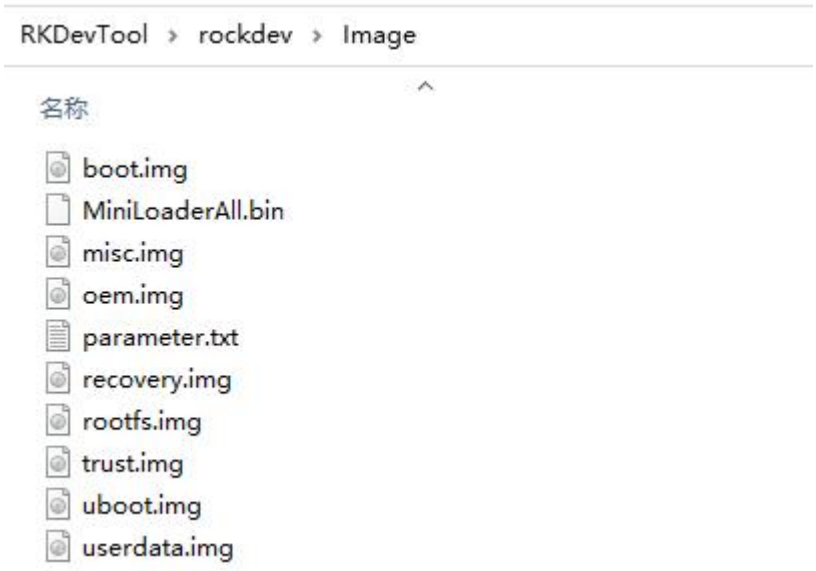


4.2 Pack image

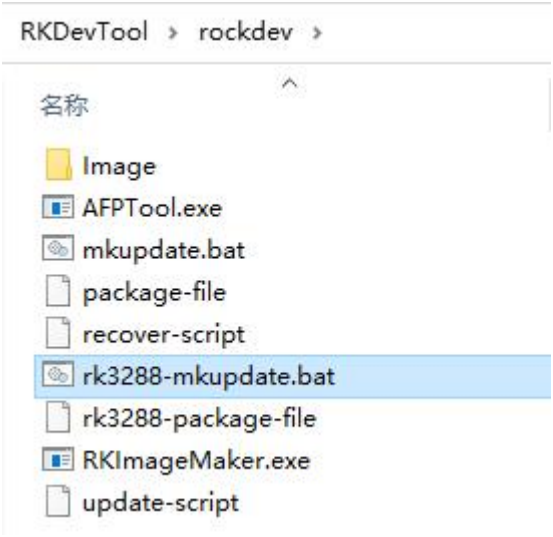
Step 1, unzip RKDevTool.rar on Windows.

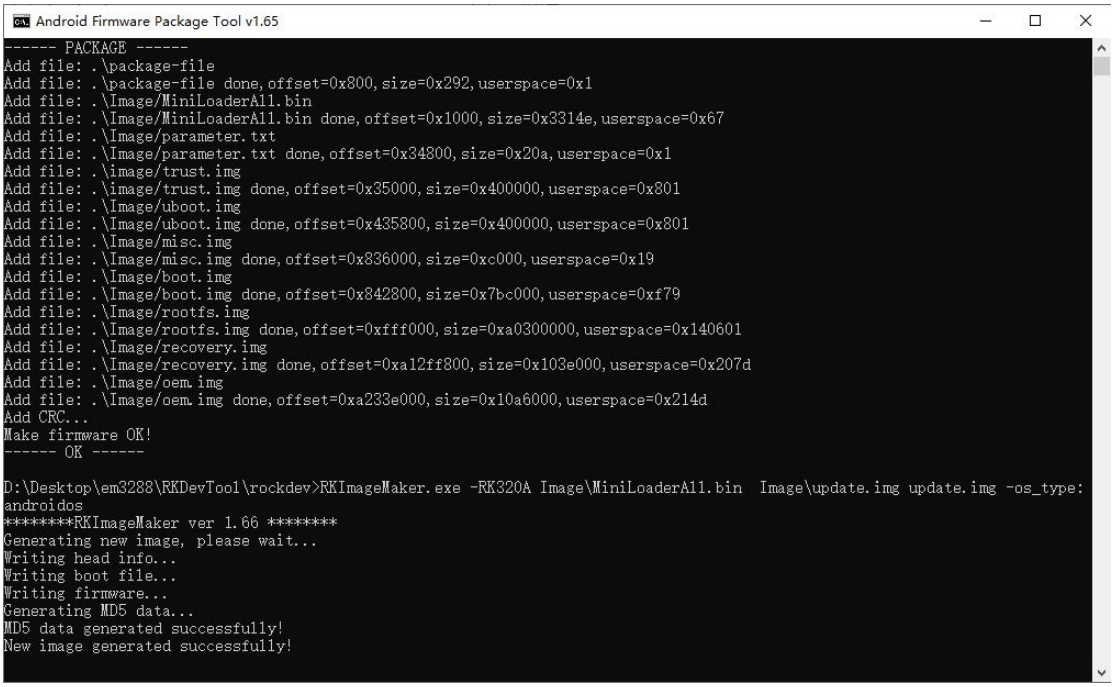


Step 2, copy the firmware file to be packaged to windows RKDevTool\rockdev\Image.

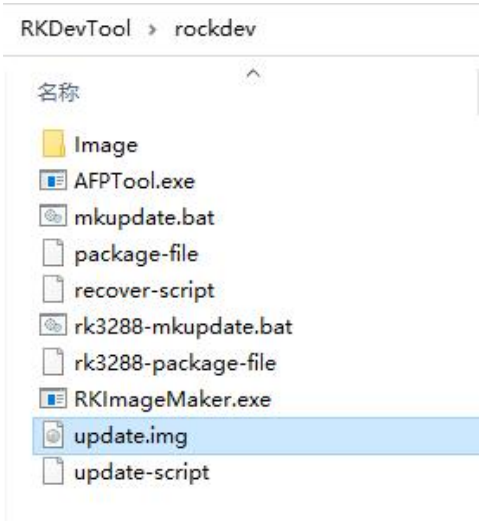


Step 3, enter RKDevTool\rockdev, double-click to run **rk3288-mkupdate.bat**.





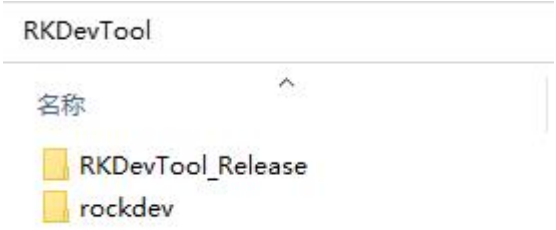
Step 4, the **update.img** will be generated in RKDevTool\rockdev directory.



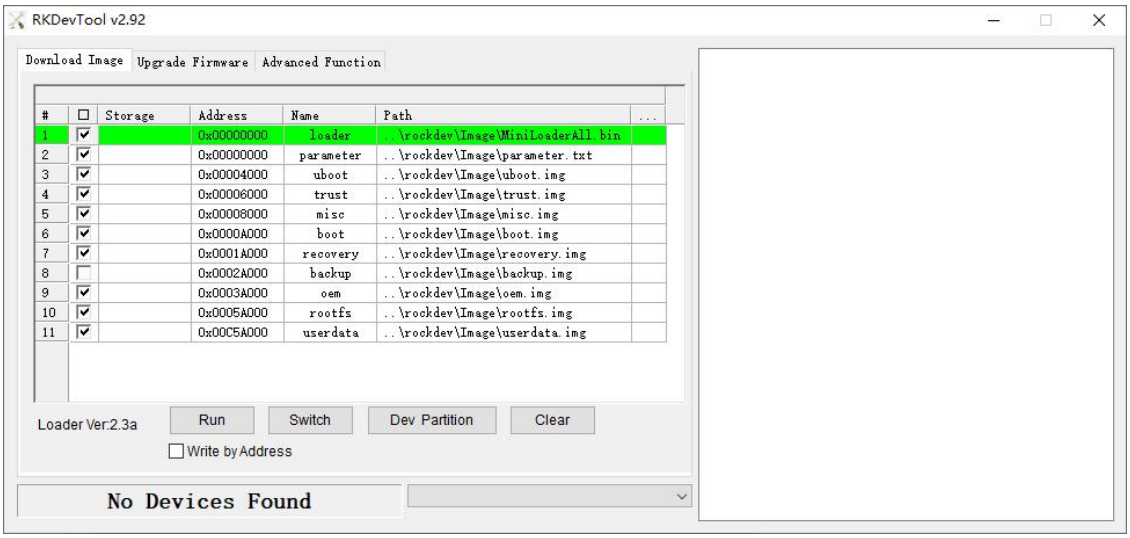
5.Burn Images

5.1 Burn update firmware

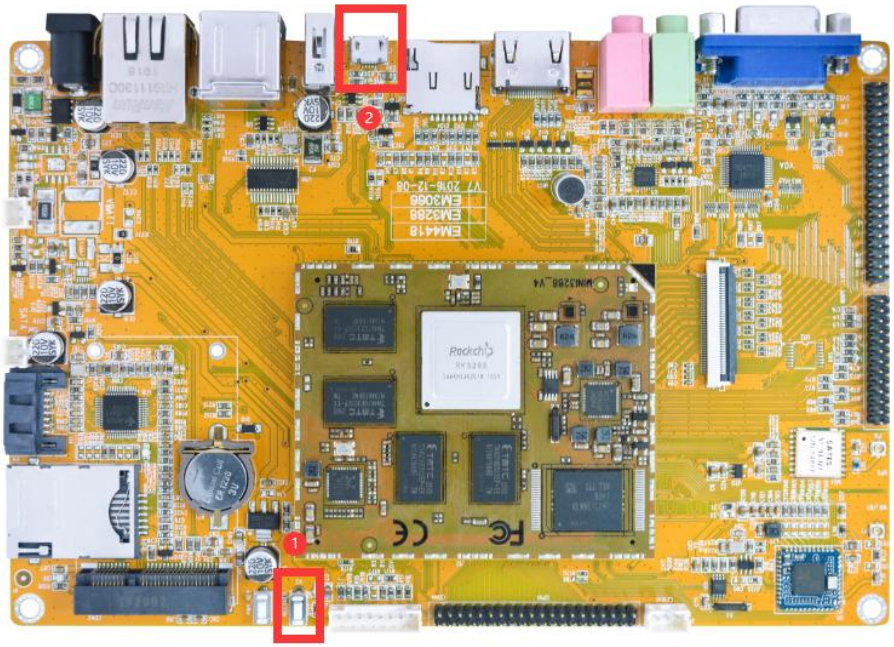
Step 1, unzip RKDevTool.rar on Windows.

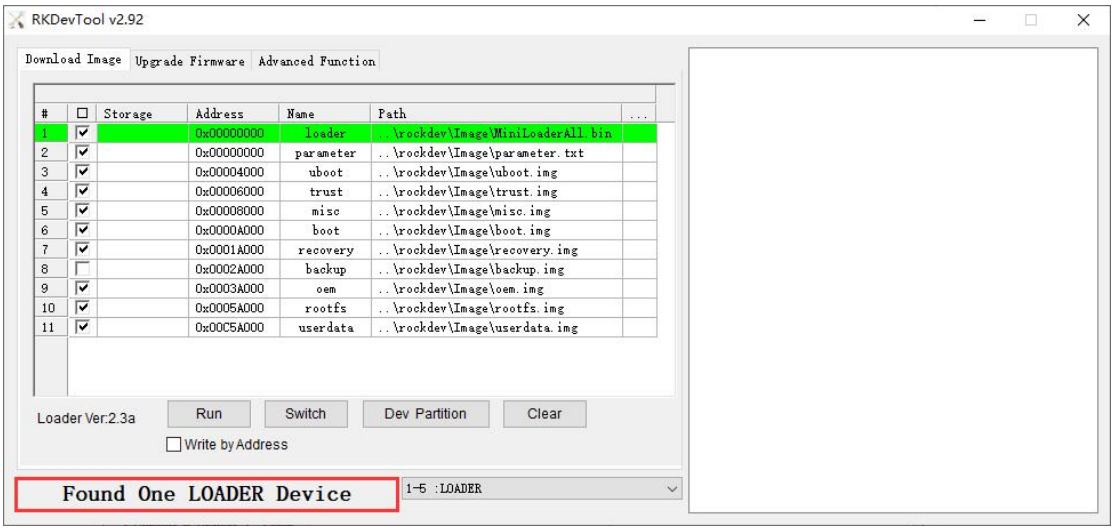


Step 2, open RKDevTool\RKDevTool_Release\RKDevTool.exe.

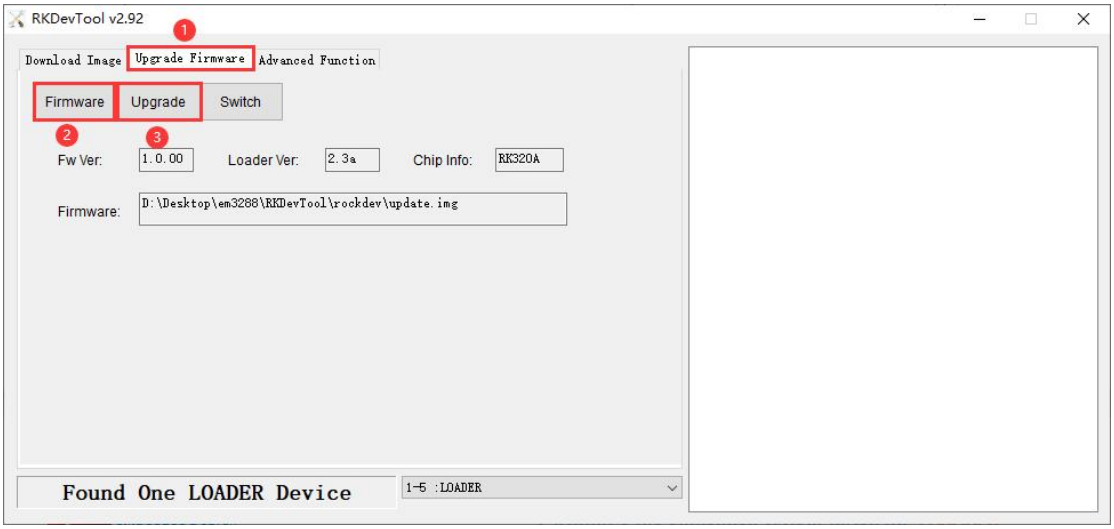


Step 3, keep pressing the **Recovery Key** and connect PC and development board with Micro USB cable, until the windows PC shows **Found one LOADER Device** release the **Recovery Key** .

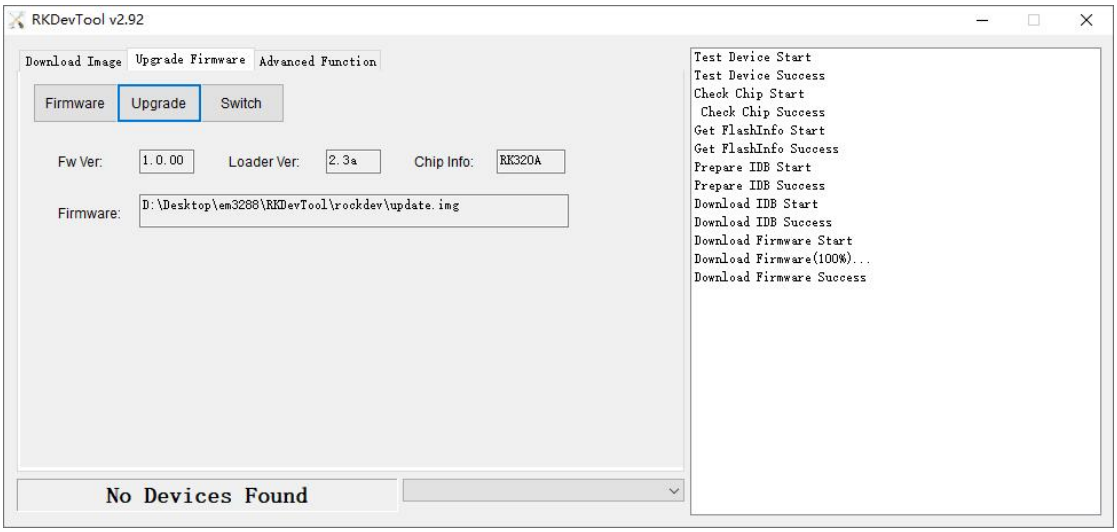




Step 4, click **Upgrade Firmware** -> **Firmware**, select **update.img**, then click **Upgrade** to flash.



Step 5, wait for the completion of burning.

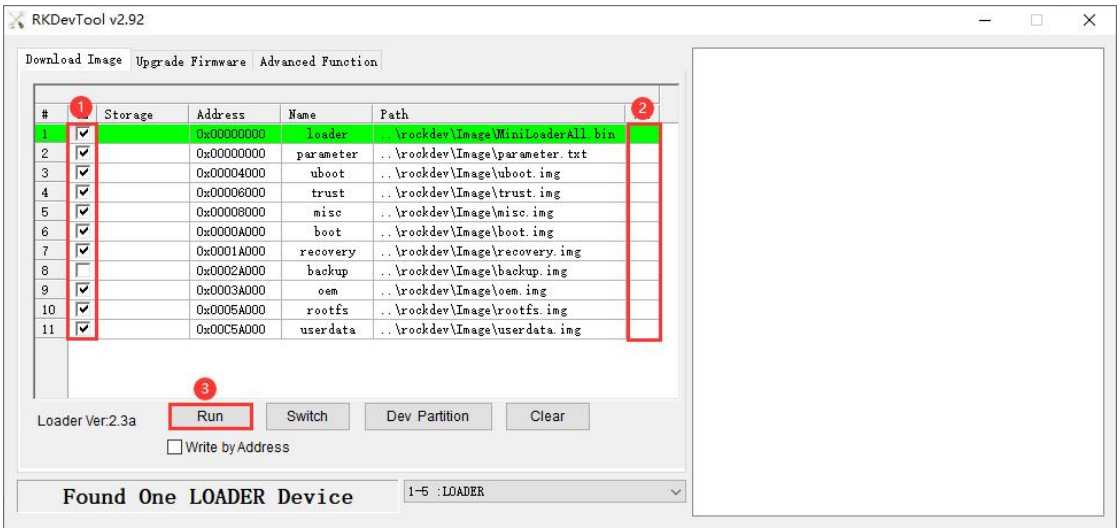


5.2 Burn split firmware

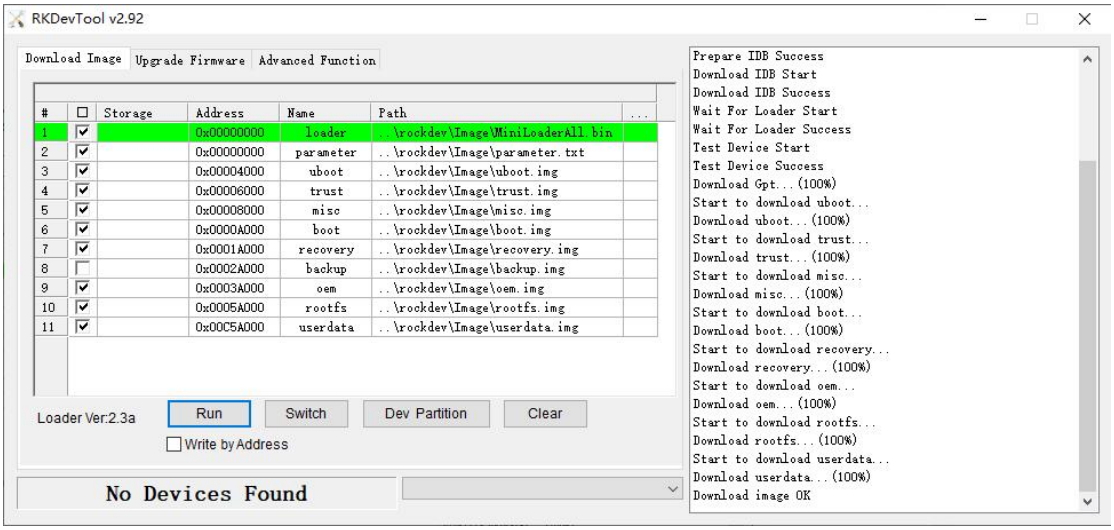
Step 1, select the checkbox on the left.

Step 2, click the column on the right side for the path of the file want to flash.

Step 3, click **run** button to flash the image.



Step 4, wait for the completion of burning.



6.Debian11 Test

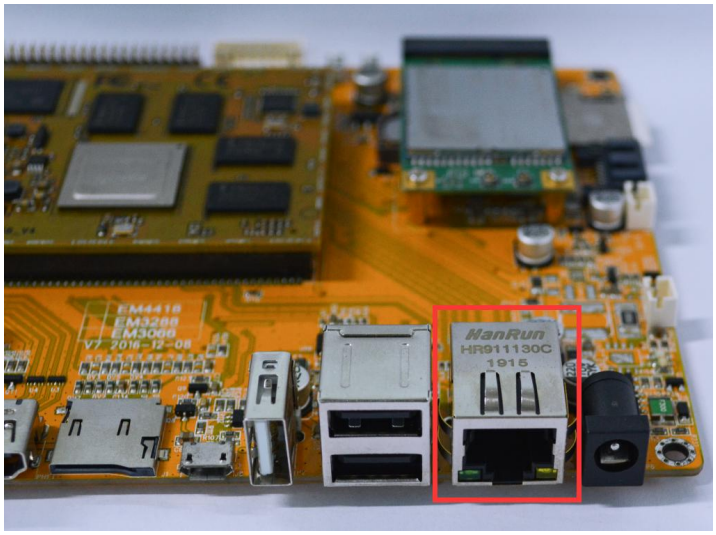
6.1 Display

1. EM3288 Debian11 supports LVDS and HDMI dual-screen different display by default, connect the monitor to the connectors shown below:

The display effect diagram is as follows:

6.2 Ethernet

Step 1, connect the network cable to the Ethernet port.



Step 2, according to the terminal serial port printing information, it can be seen that the Gigabit Ethernet recognition is successful.

```
# ifconfig
```

```
root@linaro-alip:/#
root@linaro-alip:/# [    92.378663] rk_gmac-dwmac ff290000.ethernet eth0: Link is Up - 1Gbps/Full - flow control rx/tx
[    92.387486] IPv6: ADDRCONF(NETDEV_CHANGE): eth0: link becomes ready

root@linaro-alip:/# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.0.190  netmask 255.255.255.0  broadcast 192.168.0.255
        inet6 fe80::edcf:13f7:4cdf:eed1  prefixlen 64  scopeid 0x20<link>
        ether 2e:de:43:c7:68:7b  txqueuelen 1000  (Ethernet)
        RX packets 28  bytes 2102 (2.0 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 9  bytes 1025 (1.0 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device interrupt 50
```

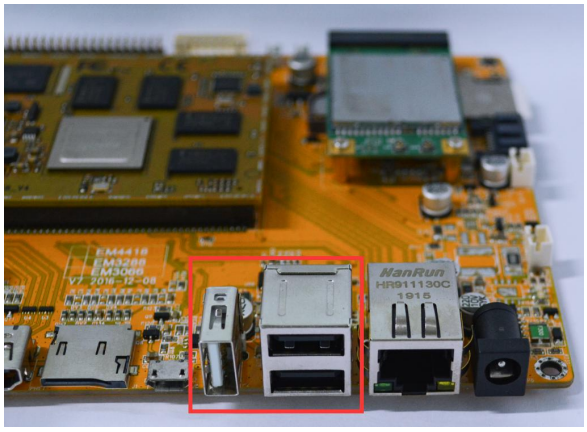
Step 3, internet test.

```
# ping -I eth0 www.armdesigner.com
```

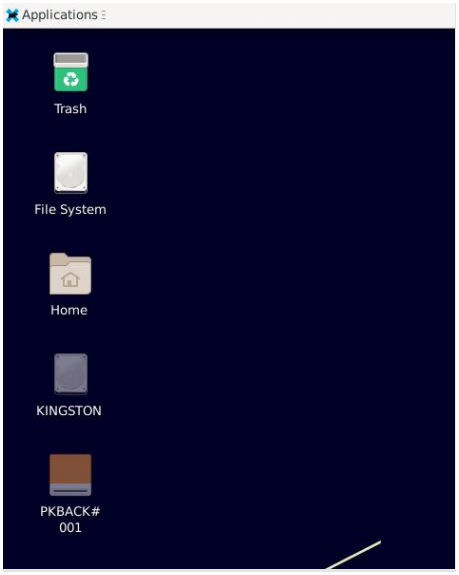
```
root@linaro-alip:/#
root@linaro-alip:/# ping -I eth0 www.armdesigner.com
PING www.armdesigner.com (8.219.70.131) from 192.168.0.190 eth0: 56(84) bytes of data.
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=1 ttl=46 time=199 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=2 ttl=46 time=200 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=3 ttl=46 time=200 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=4 ttl=46 time=199 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=5 ttl=46 time=200 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=6 ttl=46 time=200 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=7 ttl=46 time=199 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=8 ttl=46 time=200 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=9 ttl=46 time=199 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=10 ttl=46 time=200 ms
^C
--- www.armdesigner.com ping statistics ---
11 packets transmitted, 10 received, 9.09091% packet loss, time 10002ms
rtt min/avg/max/mdev = 199.322/199.648/200.147/0.255 ms
root@linaro-alip:/#
```

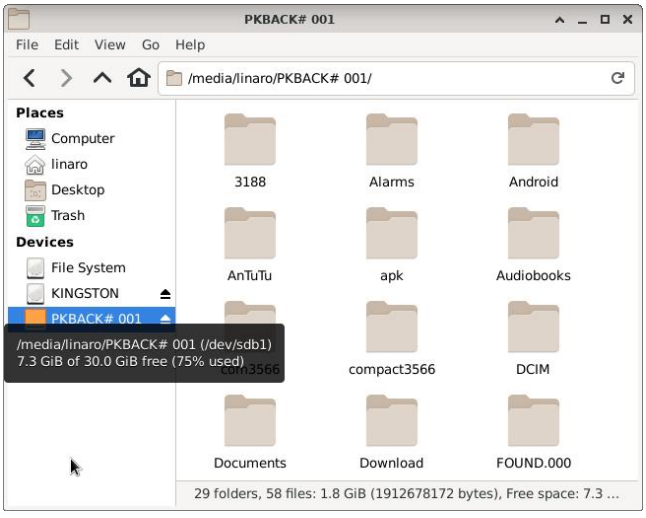
6.3 USB

Step 1, insert the USB flash drive into the USB interface.



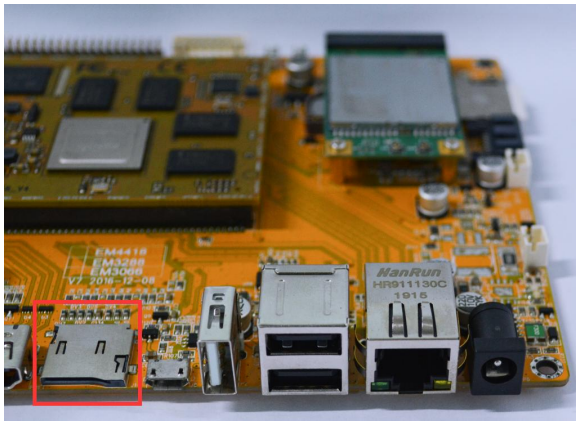
Step 2, after inserting the USB U disk device, such an icon will be produced on the desktop, click the icon to make it mount automatically.



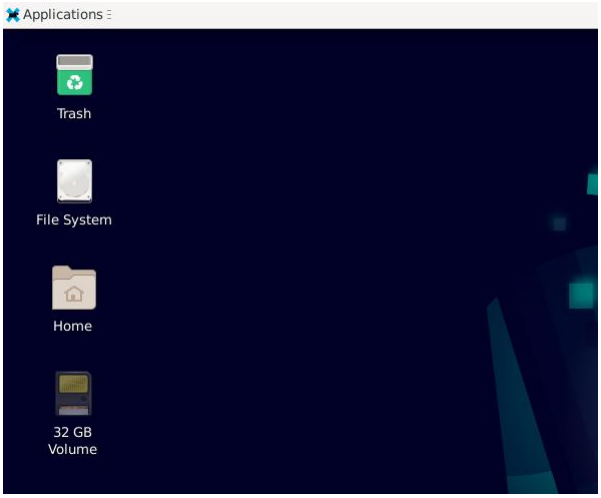


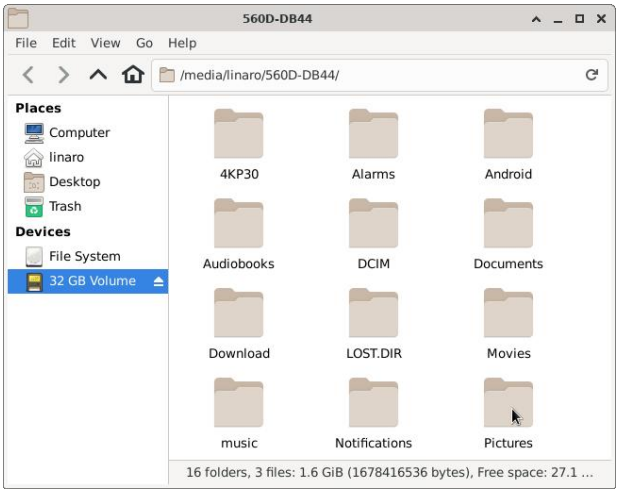
6.4 SD card

Step 1, insert the micro SD card into the card slot.



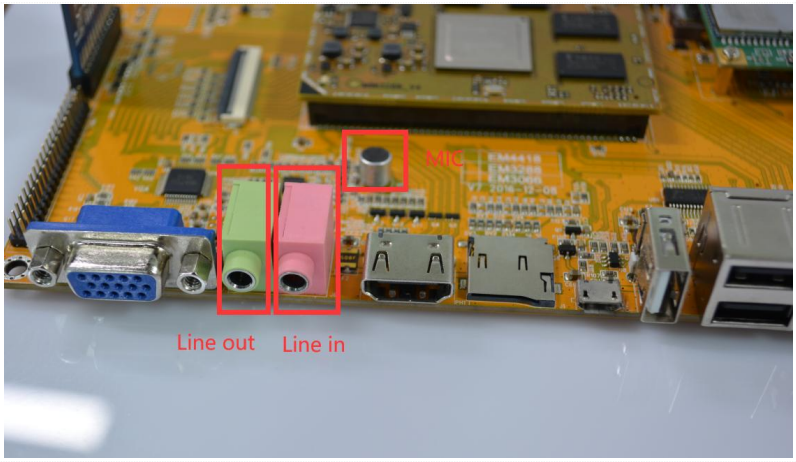
Step 2, after inserting the sd card device, such an icon will be produced on the desktop, click the icon to make it mount automatically.





6.5 Headset & MIC

Step 1, audio interface:



Step 2, MIC recording:

```
# amixer -c 0 cset numid=21 2
# amixer -c 0 cset numid=33 0
# arecord -Dhw:0,0 -f cd ww.wav
```

```
root@linaro-alip:/#
root@linaro-alip:/# amixer -c 0 cset numid=21 2
numid=21,iface=MIXER,name='Playback De-emphasis'
   ; type=ENUMERATED,access=rw------,values=1,items=4
   ; Item #0 'None'
   ; Item #1 '32Khz'
   ; Item #2 '44.1Khz'
   ; Item #3 '48Khz'
   : values=2
root@linaro-alip:/# amixer -c 0 cset numid=33 0
numid=33,iface=MIXER,name='Left PGA Mux'
   ; type=ENUMERATED,access=rw------,values=1,items=3
   ; Item #0 'Line 1L'
   ; Item #1 'Line 2L'
   ; Item #2 'DifferentialL'
   : values=0
root@linaro-alip:/# arecord -Dhw:0,0 -f cd ww.wav
Recording WAVE 'ww.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

Step 3, Line_in recording: // computer audio input

```
# amixer -c 0 cset numid=21 2
# amixer -c 0 cset numid=33 1
# arecord -Dhw:0,0 -f cd ww.wav
```

```
root@linaro-alip:/# amixer -c 0 cset numid=21 2
numid=21,iface=MIXER,name='Playback De-emphasis'
   ; type=ENUMERATED,access=rw------,values=1,items=4
   ; Item #0 'None'
   ; Item #1 '32Khz'
   ; Item #2 '44.1Khz'
   ; Item #3 '48Khz'
   : values=2
root@linaro-alip:/# amixer -c 0 cset numid=33 1
numid=33,iface=MIXER,name='Left PGA Mux'
   ; type=ENUMERATED,access=rw------,values=1,items=3
   ; Item #0 'Line 1L'
   ; Item #1 'Line 2L'
   ; Item #2 'DifferentialL'
   : values=1
root@linaro-alip:/# arecord -Dhw:0,0 -f cd ww.wav
Recording WAVE 'ww.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

Step 4, Line_out and HDMI play audio:

```
# aplay -Dhw:0,0 ww.wav        // simultaneous sound from headphones and HDMI
```

```
root@linaro-alip:/# aplay -Dhw:0,0 ww.wav
Playing WAVE 'ww.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

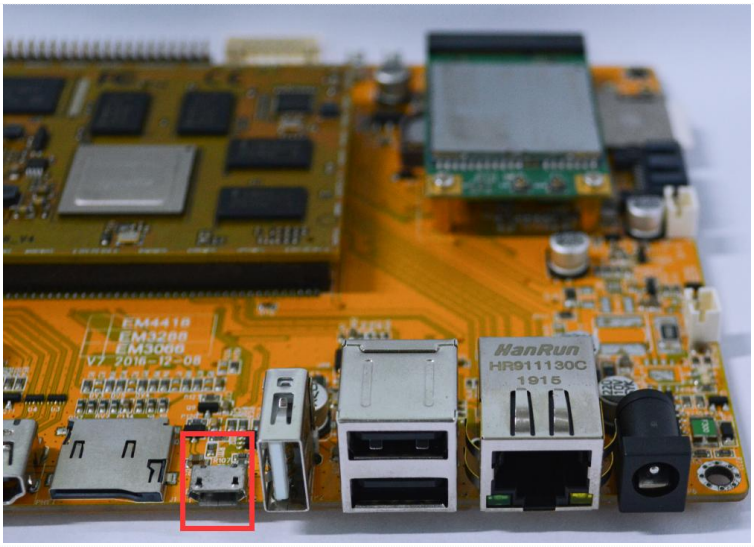
Execute the following command to view more audio parameter configurations：

```
# amixer -c 0 contents
```

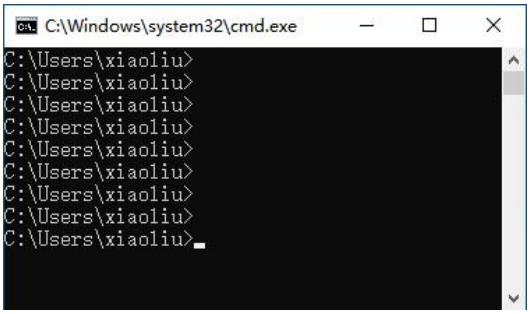
6.6 ADB

ADB: // Please install the ADB driver on your computer by yourself

Step 1, connect Micro USB cable and power on.

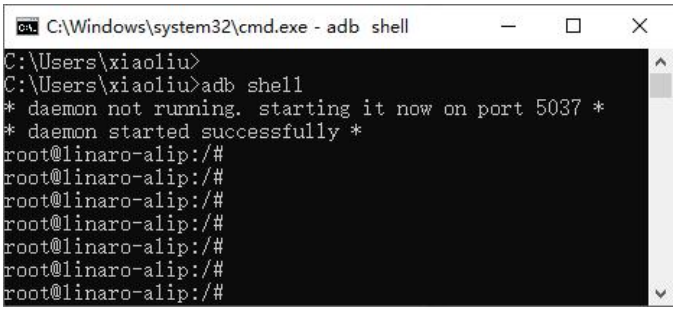


Step 2, use the shortcut keys **WIN + R** to open the windows command run box, type: **cmd**, open the windows console command window.



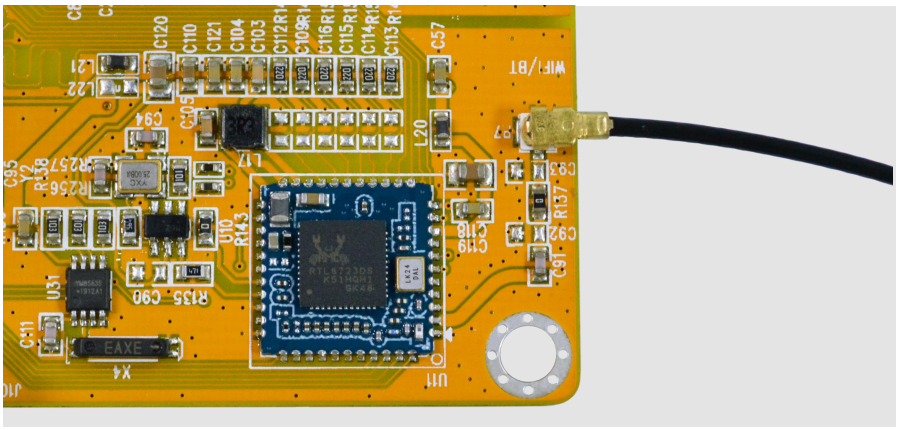
Step 3, execute the follow commands to enable ADB.

```
# adb shell
```



6.7 WiFi

Step 1, connect WiFi Antenna.

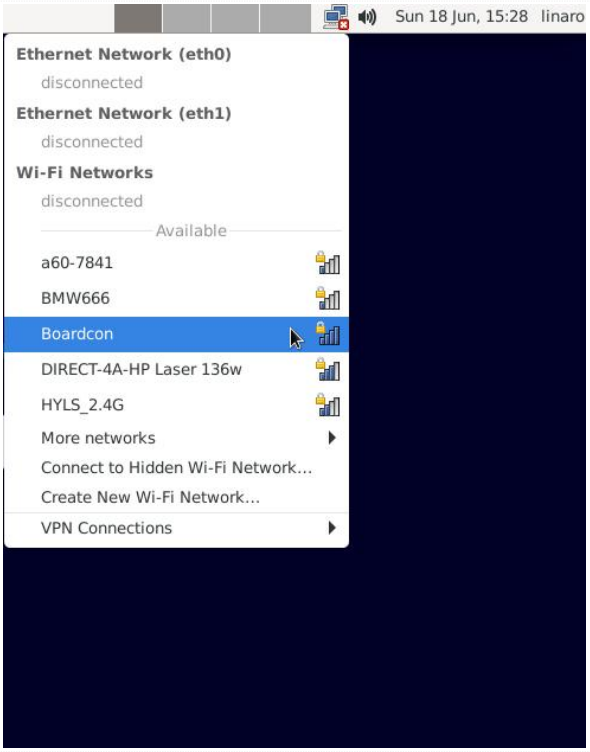


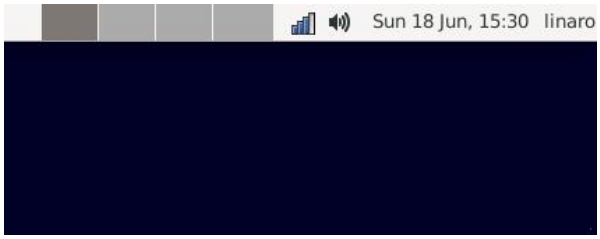
Step 2, execute the following command to open WiFi:

wifi_rtk_on

```
root@linaro-alip:/#
root@linaro-alip:/# wifi_rtk_on
[   63.273814] RTL8723DS: loading out-of-tree module taints kernel.
[   63.473154] [WLAN_RFKILL]: rockchip_wifi_get_oob_irq: Enter
root@linaro-alip:/#
root@linaro-alip:/# _
```

Step 3, click the network icon in the top right corner of the UI interface, select the SSID from the list of available networks and enter the password.





Step 4, execute the following to view the network interface status:ss

```
# ifconfig
```

```
root@linaro-alip:/# ifconfig
eth0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        ether 2e:de:43:c7:68:7b  txqueuelen 1000  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device interrupt 50

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

p2p0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.0.200  netmask 255.255.255.0  broadcast 192.168.0.255
        inet6 fe80::7ee8:313a:bd7d:2a79  prefixlen 64  scopeid 0x20<link>
        ether 0e:cf:89:0a:8d:74  txqueuelen 1000  (Ethernet)
        RX packets 46  bytes 5818 (5.6 KiB)
        RX errors 0  dropped 1  overruns 0  frame 0
        TX packets 13  bytes 2044 (1.9 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

wlan0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        ether 0c:cf:89:0a:8d:74  txqueuelen 1000  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

root@linaro-alip:/#
```

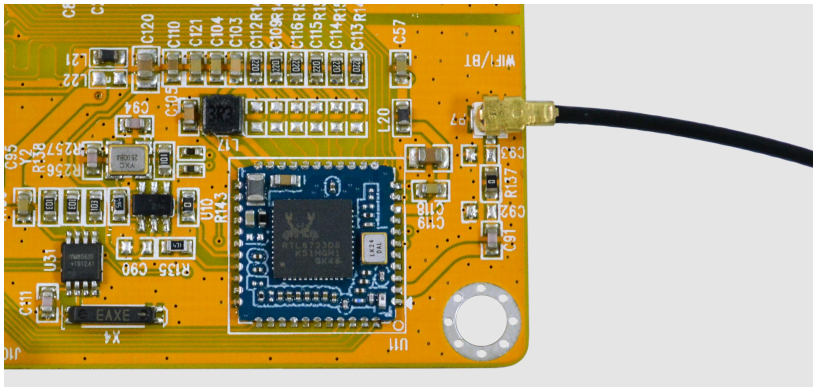
Step 5, internet test:

```
#   ping -I p2p0 www.armdesigner.com
```

```
root@linaro-alip:/#
root@linaro-alip:/# ping -I p2p0 www.armdesigner.com
PING www.armdesigner.com (8.219.70.131) from 192.168.0.200 p2p0: 56(84) bytes of data.
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=1 ttl=46 time=224 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=2 ttl=46 time=224 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=3 ttl=46 time=213 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=4 ttl=46 time=212 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=5 ttl=46 time=210 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=6 ttl=46 time=243 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=7 ttl=46 time=217 ms
^C
--- www.armdesigner.com ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6008ms
rtt min/avg/max/mdev = 209.785/220.334/242.606/10.528 ms
root@linaro-alip:/#
```

6.8 Bluetooth

Step 1, connect bluetooth Antenna.

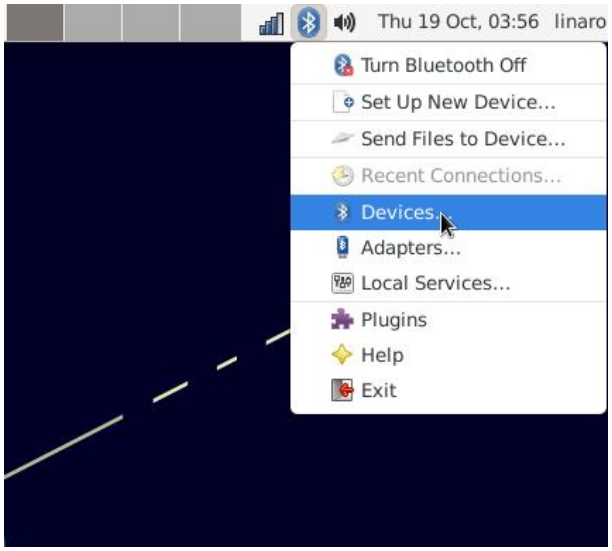


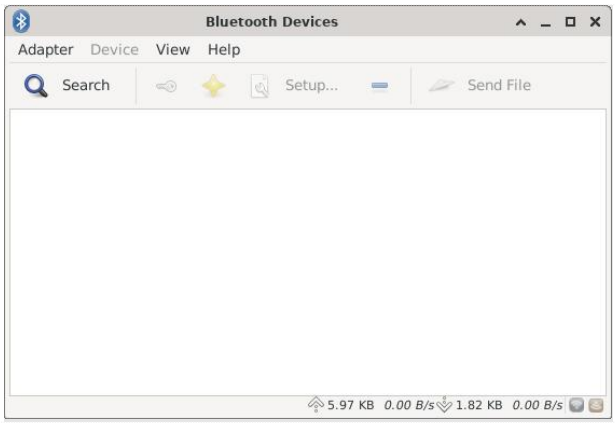
Step 2, execute the following command to enable Bluetooth:

bt_load_rtk_firmware

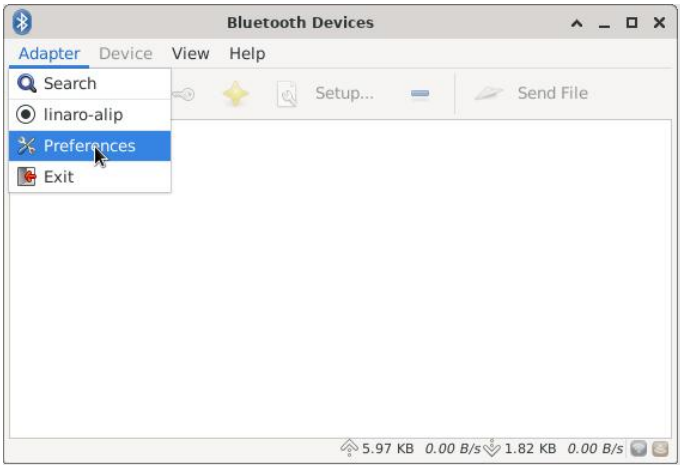
```
root@linaro-alip:/# bt_load_rtk_firmware
rtk_hciattach: no process found
[   453.719800] [BT_RFKILL]: bt shut off power
[   454.232862] [BT_RFKILL]: rfkill_rk_set_power: set bt wake_host high!
[   454.315789] [BT_RFKILL]: rfkill_rk_set_power: set bt wake_host input!
[   454.322314] [BT_RFKILL]: ENABLE UART_RTS
[   454.446143] [BT_RFKILL]: DISABLE UART_RTS
[   454.450314] [BT_RFKILL]: bt turn on power
[   454.454529] [BT_RFKILL]: Request irq for bt wakeup host
[   454.460591] [BT_RFKILL]: ** disable irq
[   455.031181] Bluetooth: HCI UART driver ver 2.2.3634cd9.20220519-142433
[   455.037813] Bluetooth: HCI H4 protocol initialized
[   455.042621] Bluetooth: HCI Realtek H5 protocol initialized
[   455.048141] rtk_btcoex: rtk_btcoex_init: version: 1.2
[   455.053188] rtk_btcoex: create workqueue
[   455.057389] rtk_btcoex: alloc buffers 1408, 2240 for ev and l2
Can't get device info: No such device
root@linaro-alip:/# [   455.085298] dw-apb-uart ff180000.serial: got rx and tx dma channels
Realtek Bluetooth :Realtek Bluetooth init uart with init speed:115200, type:HCI UART H5
Realtek Bluetooth :Realtek hciattach version 3.1.390bad8.20220519-142434

Realtek Bluetooth :Use epoll
Realtek Bluetooth :[SYNC] Get SYNC Resp Pkt
Realtek Bluetooth :[CONFIG] Get SYNC pkt
Realtek Bluetooth :[CONFIG] Get CONFG pkt
Realtek Bluetooth :[CONFIG] Get CONFG resp pkt
Realtek Bluetooth :dic is 1, cfg field 0x14
Realtek Bluetooth :H5 init finished
```

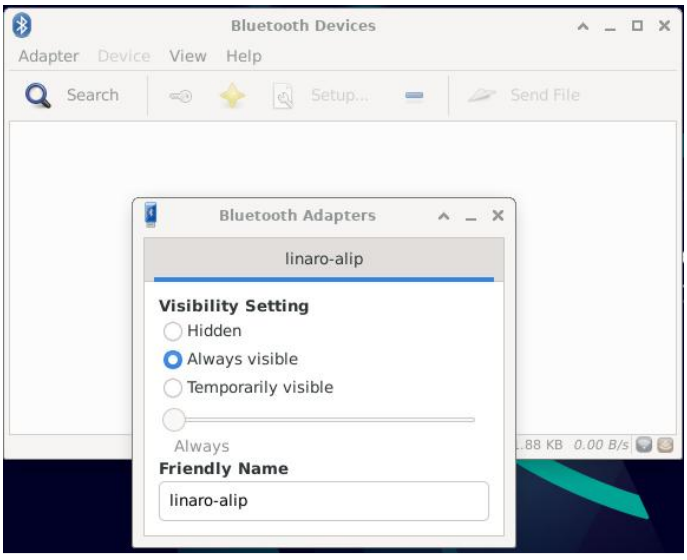
Step 3, click the Buletooth icon in the top right corner of the UI interface, Select “**Devices**” enter the Buletooth Devices.



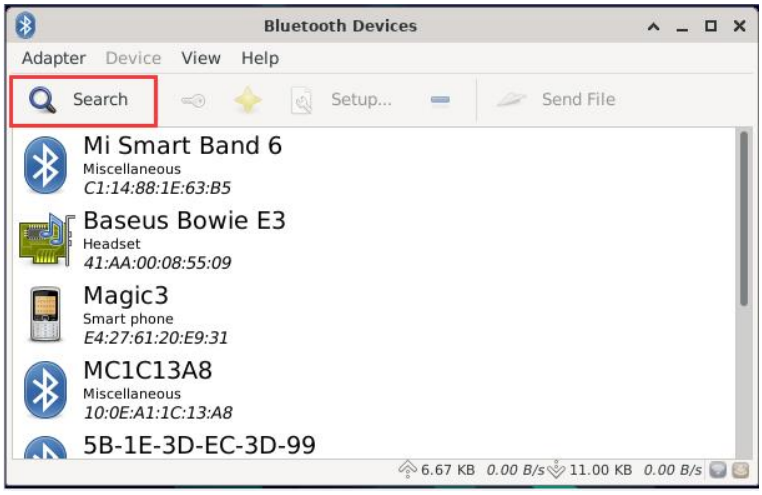


Step 4, the Bluetooth device name is hidden by default. Set the Bluetooth device name to be visible according to the following settings.



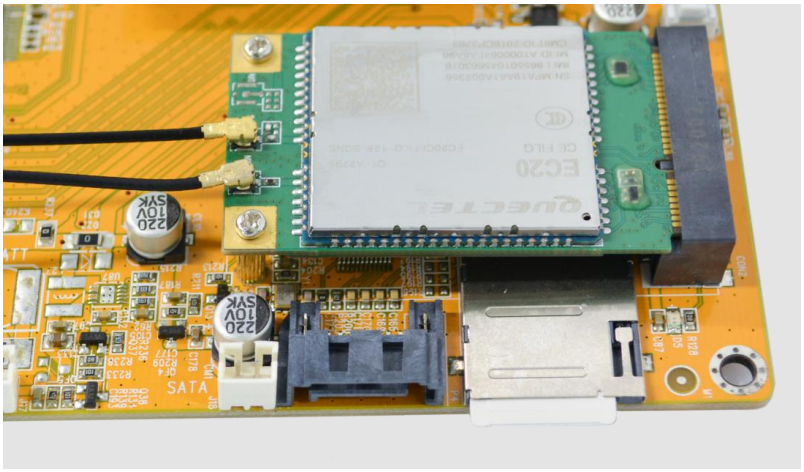


Step 5, click the "**Search**" button to start searching and select the available device in the list to pair.



6.9 4G(EC20)

Step 1, insert 4G module to PCIe slot (4G module:EC20), connect Antenna, inserting the SIM card, then power on.



Step 2, execute the following command to realize ppp dialing:

```
# pppd call quectel-ppp &
```

```
Script chat -s -v -f /etc/ppp/peers/quectel-chat-connect finished (pid 1496), status = 0x0
Serial connection established.
using channel 1
Using interface ppp0
Connect: ppp0 <--> /dev/ttyUSB3
sent [LCP ConfReq id=0x1 <asyncmap 0x0> <magic 0xd9519505> <pcomp> <accomp>]
rcvd [LCP ConfReq id=0x0 <asyncmap 0x0> <auth chap MD5> <magic 0xd11484b8> <pcomp> <accomp>]
sent [LCP ConfAck id=0x0 <asyncmap 0x0> <auth chap MD5> <magic 0xd11484b8> <pcomp> <accomp>]
rcvd [LCP ConfAck id=0x1 <asyncmap 0x0> <magic 0xd9519505> <pcomp> <accomp>]
sent [LCP EchoReq id=0x0 magic=0xd9519505]
rcvd [LCP DiscReq id=0x1 magic=0xd11484b8]
rcvd [CHAP Challenge id=0x1 <e7717a6c30a72739aa790a7265209cf6>, name = "UMTS_CHAP_SRVR"]
sent [CHAP Response id=0x1 <89586455ae889548f1911429bd605c24>, name = "test"]
rcvd [LCP EchoRep id=0x0 magic=0xd11484b8 d9 51 95 05]
rcvd [CHAP Success id=0x1 ""]
CHAP authentication succeeded
CHAP authentication succeeded
sent [IPCP ConfReq id=0x1 <addr 0.0.0.0> <ms-dns1 0.0.0.0> <ms-dns2 0.0.0.0>]
sent [IPV6CP ConfReq id=0x1 <addr fe80::485d:1ecf:002c:6022>]
rcvd [IPCP ConfReq id=0x0]
sent [IPCP ConfNak id=0x0 <addr 0.0.0.0>]
rcvd [IPCP ConfNak id=0x1 <addr 10.39.124.38> <ms-dns1 120.80.80.80> <ms-dns2 221.5.88.88>]
sent [IPCP ConfReq id=0x2 <addr 10.39.124.38> <ms-dns1 120.80.80.80> <ms-dns2 221.5.88.88>]
rcvd [IPCP ConfReq id=0x1]
sent [IPCP ConfAck id=0x1]
rcvd [IPCP ConfAck id=0x2 <addr 10.39.124.38> <ms-dns1 120.80.80.80> <ms-dns2 221.5.88.88>]
Could not determine remote IP address: defaulting to 10.64.64.64
Script /etc/ppp/ip-pre-up started (pid 1505)
Script /etc/ppp/ip-pre-up finished (pid 1505), status = 0x0
local  IP address 10.39.124.38
remote IP address 10.64.64.64
primary   DNS address 120.80.80.80
secondary DNS address 221.5.88.88
Script /etc/ppp/ip-up started (pid 1508)
Script /etc/ppp/ip-up finished (pid 1508), status = 0x0
sent [IPV6CP ConfReq id=0x1 <addr fe80::485d:1ecf:002c:6022>]
sent [IPV6CP ConfReq id=0x1 <addr fe80::485d:1ecf:002c:6022>]
sent [IPV6CP ConfReq id=0x1 <addr fe80::485d:1ecf:002c:6022>]
sent [IPV6CP ConfReq id=0x1 <addr fe80::485d:1ecf:002c:6022>]
```

Step 3, execute the following to view the network interface status:

```
# ifconfig
```

```
root@linaro-alip:/# ifconfig
eth0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        ether 2e:de:43:c7:68:7b  txqueuelen 1000  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device interrupt 50

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

ppp0: flags=4305<UP,POINTOPOINT,RUNNING,NOARP,MULTICAST>  mtu 1500
        inet 10.39.124.38  netmask 255.255.255.255  destination 10.64.64.64
        ppp  txqueuelen 3  (Point-to-Point Protocol)
        RX packets 8  bytes 463 (463.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 16  bytes 540 (540.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

root@linaro-alip:/#
```

Step 4, execute the following to check the connectivity of the detection network:

```
# ping -I ppp0 www.armdesigner.com
```

```
root@linaro-alip:/#
root@linaro-alip:/# ping -I ppp0 www.armdesigner.com
PING www.armdesigner.com (8.219.70.131) from 10.39.124.38 ppp0: 56(84) bytes of data.
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=1 ttl=47 time=76.9 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=2 ttl=47 time=94.5 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=3 ttl=47 time=93.4 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=4 ttl=47 time=91.5 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=5 ttl=47 time=91.0 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=6 ttl=47 time=117 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=7 ttl=47 time=108 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=8 ttl=47 time=106 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=9 ttl=47 time=104 ms
^C
--- www.armdesigner.com ping statistics ---
9 packets transmitted, 9 received, 0% packet loss, time 8013ms
rtt min/avg/max/mdev = 76.888/97.912/116.696/11.083 ms
root@linaro-alip:/#
```

6.10 GPS(EC20)

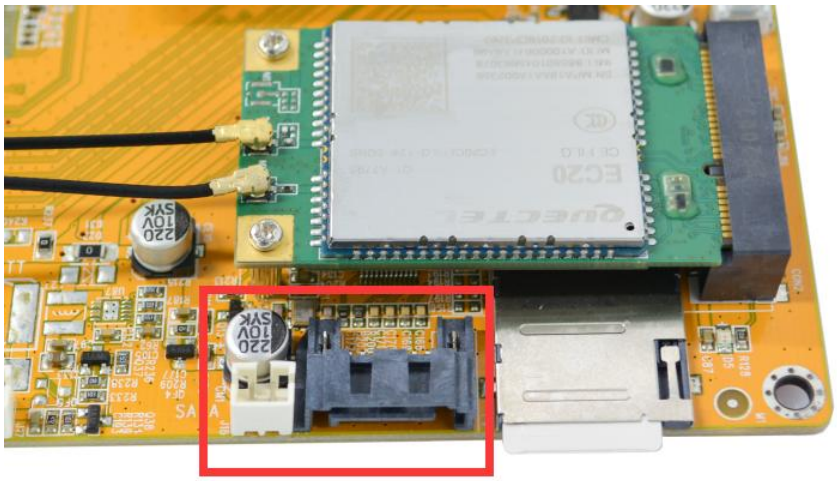
Refer to chapter **4G(EC20)** to connect the device and then power on, execute the following command to test GPS:

```
# echo -e "AT+QGPS=1\r\n" > /dev/ttyUSB2
# cat /dev/ttyUSB1
```

```
root@linaro-alip:/#
root@linaro-alip:/# echo -e "AT+QGPS=1\r\n" > /dev/ttyUSB2
root@linaro-alip:/# cat /dev/ttyUSB1
$GPVTG,,T,,M,,N,,K,N*2C

$GPGSA,A,1,,,,,,,,,,,,,,*1E

$GPGGA,,,,,,0,,,,,,,,*66

$GPRMC,,V,,,,,,,,,,N*53

$GPVTG,,T,,M,,N,,K,N*2C

$GPGSA,A,1,,,,,,,,,,,,,,*1E

$GPGGA,,,,,,0,,,,,,,,*66

$GPRMC,,V,,,,,,,,,,N*53

$GPVTG,,T,,M,,N,,K,N*2C

$GPGSA,A,1,,,,,,,,,,,,,,*1E

$GPGGA,,,,,,0,,,,,,,,*66

$GPRMC,,V,,,,,,,,,,N*53

$GPVTG,,T,,M,,N,,K,N*2C

$GPGSA,A,1,,,,,,,,,,,,,,*1E
```

6.11 SATA

Step 1, connect the SATA and the SATA power to the board.



Step 2, EM3288 Debain system only supports etx4 format SATA, if it is not etx4 format SATA, please execute the following command to format the SATA device:

```
// If the SATA device is in ext4 format, skip this step
# mke2fs -t ext4 /dev/sda
```

Step 3, execute follow command to mount SATA.

```
# ls /dev                    // view sata device name
```

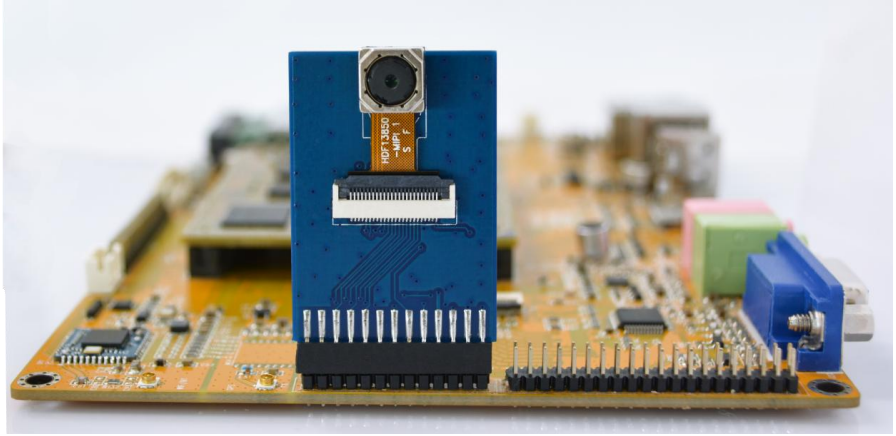
```
root@linaro-alip:/# ls /dev
ashmem           iep           net       tty22  tty54        vcs3
block            iio:device0   null      tty23  tty55        vcs4
bsg              initctl       ppp       tty24  tty56        vcs5
bus              input         ptmx      tty25  tty57        vcs6
cec0             kmsg          pts       tty26  tty58        vcs7
char             log           ram0      tty27  tty59        vcsa
console          loop-control  random    tty28  tty6         vcsa1
cpu_dma_latency  loop0         rfkill    tty29  tty60        vcsa2
crypto           loop1         rk_cec    tty3   tty61        vcsa3
disk             loop2         rtc       tty30  tty62        vcsa4
dri              loop3         rtc0      tty31  tty63        vcsa5
fb0              loop4         sda       tty32  tty7         vcsa6
fd               loop5         shm       tty33  tty8         vcsa7
full             loop6         snd       tty34  tty9         vcsu
fuse             loop7         stderr    tty35  ttyFIQ0      vcsu1
gpiochip0        mali0         stdin     tty36  ttyS0        vcsu2
gpiochip1        mapper        stdout    tty37  ttyS1        vcsu3
gpiochip2        media0        tee0      tty38  ttyS3        vcsu4
gpiochip3        mem           teepriv0  tty39  uhid         vcsu5
gpiochip4        mmcblk0       tty       tty4   uinput       vcsu6
gpiochip5        mmcblk0boot0  tty0      tty40  urandom      vcsu7
gpiochip6        mmcblk0boot1  tty1      tty41  usb          vhci
gpiochip7        mmcblk0p1     tty10     tty42  usb-ffs      video-camera0
gpiochip8        mmcblk0p2     tty11     tty43  usbmon0      video-dec0
hdmi_hdcp1x      mmcblk0p3     tty12     tty44  usbmon1      video-enc0
hidraw0          mmcblk0p4     tty13     tty45  usbmon2      video0
hidraw1          mmcblk0p5     tty14     tty46  usbmon3      video1
hidraw2          mmcblk0p6     tty15     tty47  usbmon4      video2
hwrng            mmcblk0p7     tty16     tty48  v4l          video3
i2c-0            mmcblk0p8     tty17     tty49  v4l-subdev0  video4
i2c-1            mmcblk0p9     tty18     tty5   v4l-subdev1  zero
i2c-2            mmcblk0rpmb   tty19     tty50  v4l-subdev2  zram0
i2c-3            mmcblk2       tty2      tty51  vcs
i2c-4            mmcblk2p1     tty20     tty52  vcs1
i2c-6            mpp_service   tty21     tty53  vcs2
root@linaro-alip:/#
```

```
# mkdir /mnt/sata              // create a new directory
# mount /dev/sda /mnt/sata/    // mount sata to the new directory
# ls /mnt/sata/                // view the contents of the sata
# df -h     // view the space size of the mounted disk
```

```
root@linaro-alip:/#
root@linaro-alip:/# mkdir /mnt/sata
root@linaro-alip:/# mount /dev/sda /mnt/sata/
[  123.866047] EXT4-fs (sda): mounted filesystem with ordered data mode. Opts: (null)
root@linaro-alip:/#
root@linaro-alip:/# ls /mnt/sata/
lost+found  rk3588_buildroot
root@linaro-alip:/#
root@linaro-alip:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root       5.9G  2.5G  3.2G  44% /
devtmpfs        990M  8.0K  990M   1% /dev
tmpfs           998M     0  998M   0% /dev/shm
tmpfs           400M  1.1M  398M   1% /run
tmpfs           5.0M  4.0K  5.0M   1% /run/lock
/dev/mmcblk0p8  121M   12M  103M  11% /oem
/dev/mmcblk0p9  722M  280K  703M   1% /userdata
tmpfs           200M   40K  200M   1% /run/user/1000
/dev/sda        110G   28K  104G   1% /mnt/sata
root@linaro-alip:/#
root@linaro-alip:/# _
```

6.12 Camera

Step 1, Power on after connecting the camera module (ov13850).



Step 2, check if there are threads in **rkisp_3A_server**, which indicates automatic startup:

```
# pidof rkisp_3A_server        // As shown in the following figure, rkisp_3A_server has started
```

```
root@linaro-alip:/#
root@linaro-alip:/# pidof rkisp_3A_server
189
root@linaro-alip:/# _
```

Step 3, if there are no threads, execute the following command to start **rkisp_3A_server,** if there are already threads, please skip this step.

```
# /etc/init.d/rkisp_3A.sh start
```

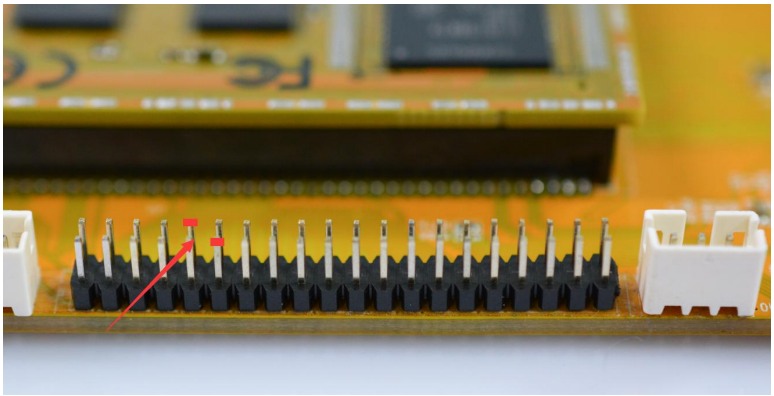
Step 4, execute the following command to preview:

```
# /rockchip-test/camera/camera_rkisp_test.sh
```

```
root@linaro-alip:/#
root@linaro-alip:/# /rockchip-test/camera/camera_rkisp_test.sh
/bin/bash: warning: setlocale: LC_ALL: cannot change locale (zh_CN.UTF-8)
Start RKISP Camera Preview!
Setting pipeline to PAUSED ...
Using mplane plugin for capture
Pipeline is live and does not need PREROLL ...
Pipeline is PREROLLED ...
Setting pipeline to PLAYING ...
New clock: GstSystemClock
[  433.074785] rockchip-mipi-dphy-rx ff968000.mipi-phy-tx1rx1: stream on:1
[  433.082147] rockchip-mipi-dphy-rx: data_rate_mbps 600
0:00:11.5 / 99:99:99.
```

6.13 UART

Step 1, short circuit RX and TX pins of UART.



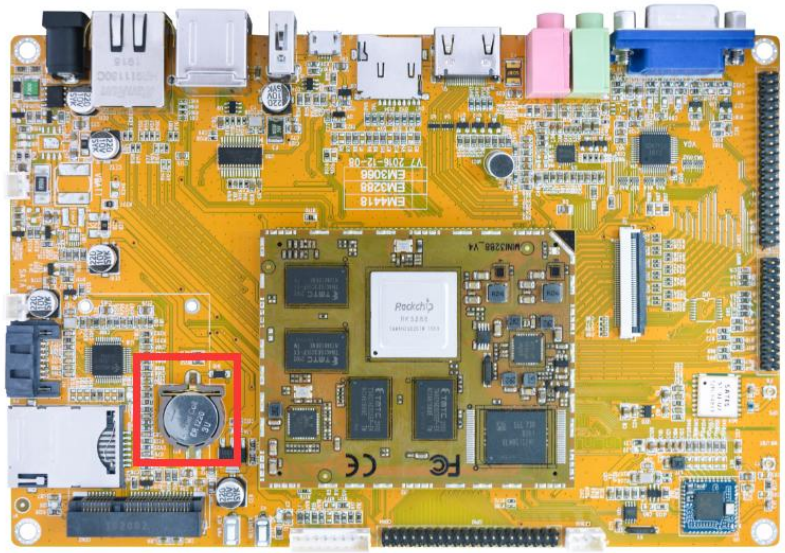
Step 2, UART1 test:

```
# com /dev/ttyS1 115200 8 0 1
```

```
root@linaro-alip:/# com /dev/ttyS1 115200 8 0 1
port = /dev/ttyS1
baudrate = 115200
cs = 8
parity = 0
stopb = 1
[  600.584849] dw-apb-uart ff190000.serial: got rx and tx dma channels
nnnnnnnnnn
RECV: nnnnnnnnnn
78787878
RECV: 78787878
88888
RECV: 88888
ppppp
RECV: ppppp
o
RECV: o
i
RECV: i
u
RECV: u
```

6.14 RTC

Step 1, install the coin cell battery.



Step 2, execute the follow command to set the RTC time:

```
# date -s "2023-11-16 17:39:00"     //use the command date -s "YY-MM-DD hh:mm:ss" to modif the date and time of the system
# hwclock -w          // set RTC from system time
# hwclock
```

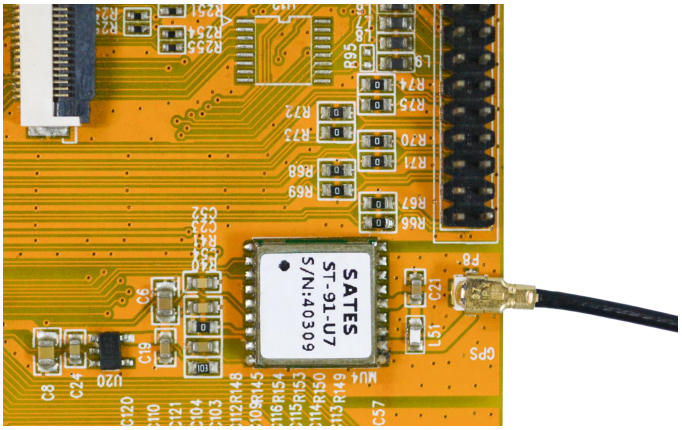
```
root@linaro-alip:/#
root@linaro-alip:/# date -s "2023-11-16 17:39:00"
Thu Nov 16 17:39:00 UTC 2023
root@linaro-alip:/# hwclock -w
root@linaro-alip:/# hwclock
2023-11-16 17:39:07.524461+00:00
root@linaro-alip:/# hwclock
2023-11-16 17:39:35.898300+00:00
root@linaro-alip:/# hwclock
2023-11-16 17:39:43.285547+00:00
root@linaro-alip:/# _
```

Step 3, after the power is off, turn on the power after a period of time to check whether the time is saved.

```
root@linaro-alip:/#
root@linaro-alip:/# hwclock
2023-11-16 17:51:22.351303+00:00
root@linaro-alip:/# hwclock
2023-11-16 17:51:30.968705+00:00
root@linaro-alip:/# hwclock
2023-11-16 17:51:43.274205+00:00
root@linaro-alip:/# hwclock
2023-11-16 17:52:02.587957+00:00
root@linaro-alip:/# _
```

6.16 GPS module

Step 1, Connect GPS Antenna.



Step 2, execute the following command to get GPS serial port information:

```
# cat /dev/ttyS3
```

6.17 About video playback

1. If you only need to try the video playback, the script instruction directory is in /rockchip-test/video, just run it.

```
root@linaro-alip:/#
root@linaro-alip:/# ls /rockchip-test/video/
test_dec-gst.sh      test_enc-gst.sh          test_gst_video_maxfps.sh
test_dec-mpv.sh      test_gst_multivideo.sh   video_stresstest.sh
test_dec-parole.sh   test_gst_video.sh        video_test.sh
test_dec-qt.sh       test_gst_video_fps.sh
root@linaro-alip:/# _
```

2. Play video using commands:

```
# chromium --no-sandbox xx.mp4
```

```
root@linaro-alip:/#
root@linaro-alip:/#
root@linaro-alip:/# chromium --no-sandbox /media/linaro/5488-0CF6/video/4KP30/4K30P-BLACKPINK-DDU-DU_DDU-DU.mp4
/bin/bash: warning: setlocale: LC_ALL: cannot change locale (zh_CN.UTF-8)
[3120:3139:1116/182628.122614:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182628.122860:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3152:3152:1116/182628.197128:ERROR:gpu_init.cc(525)] Passthrough is not supported, GL is egl, ANGLE is
[3120:3139:1116/182628.198226:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182628.198319:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182628.303494:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182628.303674:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
Failed to query video capabilities: Inappropriate ioctl for device
Failed to query video capabilities: Inappropriate ioctl for device
Failed to query video capabilities: Inappropriate ioctl for device
Failed to query video capabilities: Inappropriate ioctl for device
[3120:3139:1116/182630.927201:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182630.927759:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182630.928138:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182630.928503:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182630.928964:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182630.929345:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182630.929724:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182630.930100:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182630.930474:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182630.930976:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182630.931355:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182630.931825:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182630.932195:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182630.932556:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182631.432006:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182631.432122:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182631.432195:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182631.432286:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3139:1116/182631.432364:ERROR:bus.cc(399)] Failed to connect to the bus: Could not parse server address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[3120:3216:1116/182630.031330:ERROR:object_proxy.cc(623)] Failed to call method: org.freedesktop.DBus.Properties.Get: object_path= /org/freedesktop/UPower: org.freedesktop.DBus.Error.TimedOut: Failed to activate
 service 'org.freedesktop.UPower': timed out (service_start_timeout=25000ms)
```

Buildroot

1.Compiler Environment

It is recommended to use Ubuntu 20.04 system or above. If you encounter an error during compilation, you can check the error message and install the corresponding software packages accordingly. Other Ubuntu versions may need to adjust the software package accordingly. In addition to the system requirements, there are other hardware and software requirements.

Hardware requirements	Software requirements
64-bit system, hard disk space should be greater than 40G. If you do multiple builds, you will need more hard drive space.	Ubuntu 20.04 system

2.Install Tools

The contents of this directory only provide the software package installation commands that are needed to build the compiled SDK environment. Please install other tools such as samba and ssh yourself.
PC OS: ubuntu 20.04 system
Network: online
Permission: root

```
# sudo apt-get install git ssh make gcc libssl-dev liblz4-tool
# sudo apt-get install expect g++ patchelf chrpath gawk texinfo chrpath diffstat
# sudo apt-get install binfmt-support qemuuser-static live-build bison flex fakeroot
# sudo apt-get install cmake gcc-multilib g++-multilib unzip device-tree-compiler
# sudo apt-get install ncurses-dev libgucharmap-2-90-dev bzip2 expat gpgv2
# sudo apt-get install cpp-aarch64-linux-gnu g++-aarch64-linux-gnu
# sudo apt install python2
# sudo apt install python-is-python3
```

3.Compile Source

Step 1, unzip the source

```
$ tar xvf xx.tar.bz2
$ cd xx
```

Step 2, configure the compiled board

```
$ ./build.sh lunch
```

liuyuan@boardcon:~/opt/EM3288/linux_5.10$ ./build.sh lunch

Pick a defconfig:

1. rockchip_defconfig
2. rockchip_rk3288w_evb_act8846_defconfig
3. rockchip_rk3288w_evb_rk808_defconfig
4. rockchip_rk3288w_firefly_defconfig

Which would you like? [1]: 2 // rockchip_rk3288w_evb_act8846_defconfig

Switching to defconfig:

/home/liuyuan/opt/EM3288/linux_5.10/device/rockchip/.chip/rockchip_rk3288w_evb_act8846_defconfig

Step 3, compile uboot

```
$ ./build.sh uboot
```

Step 4, compile the kernel

```
$ ./build.sh kernel
```

If you need to modify the kernel configuration, use the following command to open the kernel configuration menu:

```
$ cd kernel
$ make ARCH=arm menuconfig
```

The path to save the configuration content is .config by default, please update the modified content to the path ./arch/arm/configs/rockchip_linux_defconfig in time, and then recompile the kernel to make it take effect.

Step 5, compile recovery

```
$ ./build.sh recovery
```

Step 6, compile Buildroot

```
$ ./build.sh buildroot
```

Step 7, generate and check firmwares

```
$ ./build.sh firmware
```

Step 8, build update image

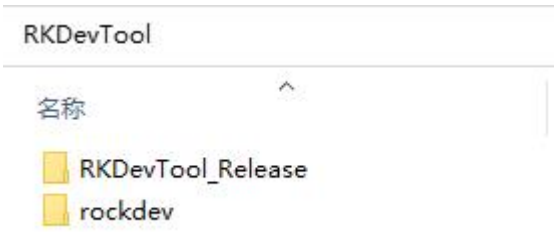
```
$ ./build.sh updateimg
```

Images and update.img are generated in rockdev/ directory.

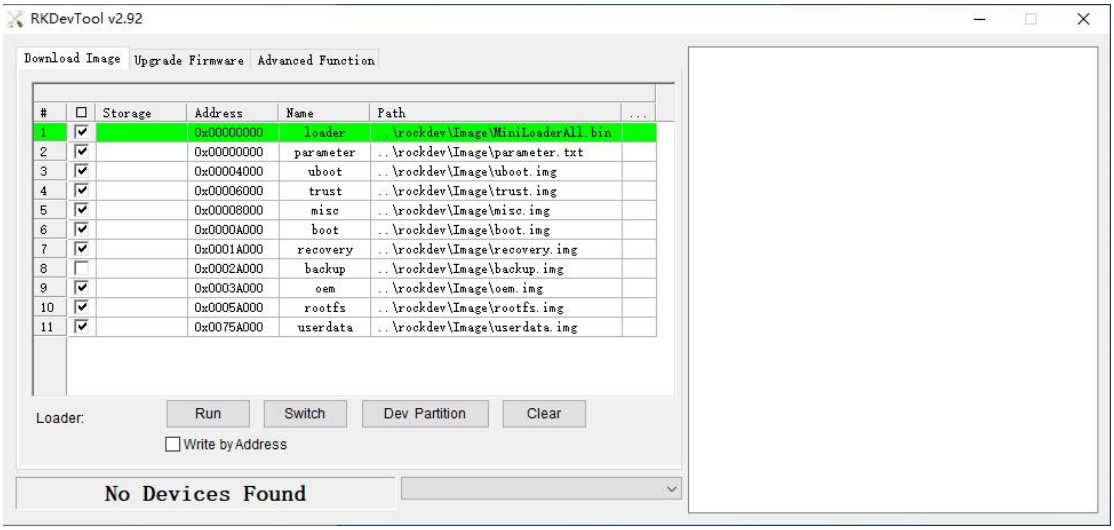
4.Images Operation

4.1 Unzip firmware

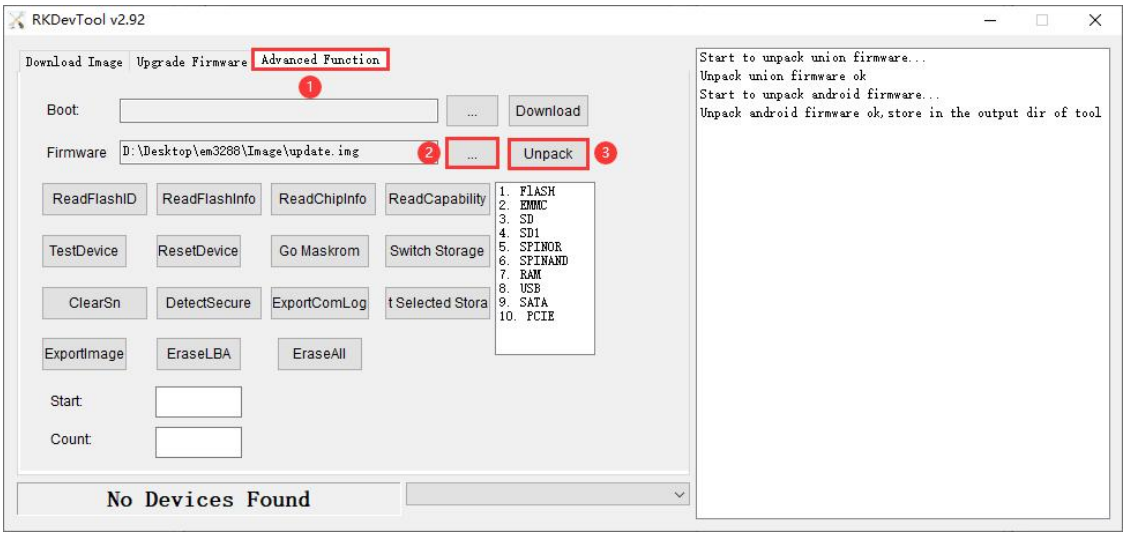
Step 1, unzip RKDevTool.rar on Windows.



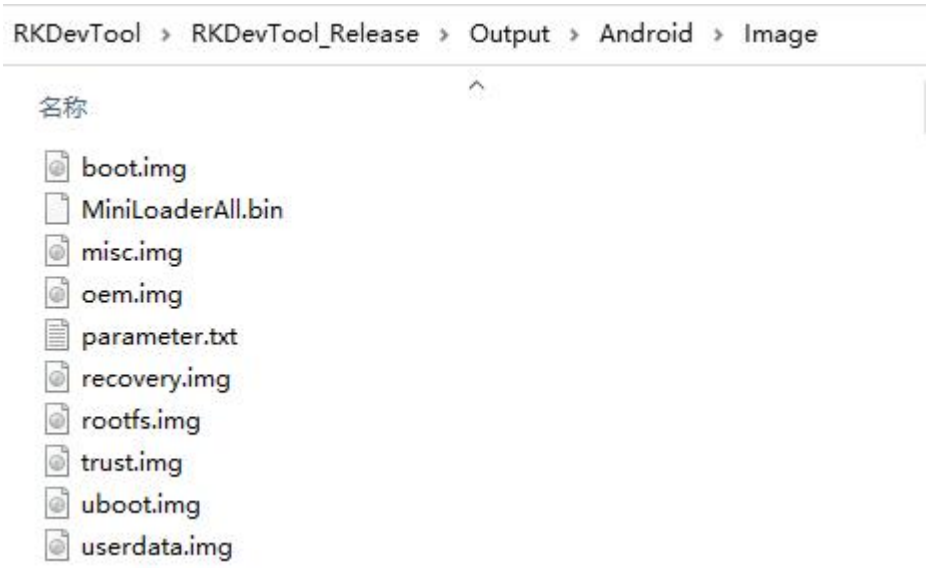
Step 2, open RKDevTool\RKDevTool_Release\RKDevTool.exe.



Step 3, click **Advanced Function** -> **Firmware**, select **update.img**, then click **Unpack** to unzip.



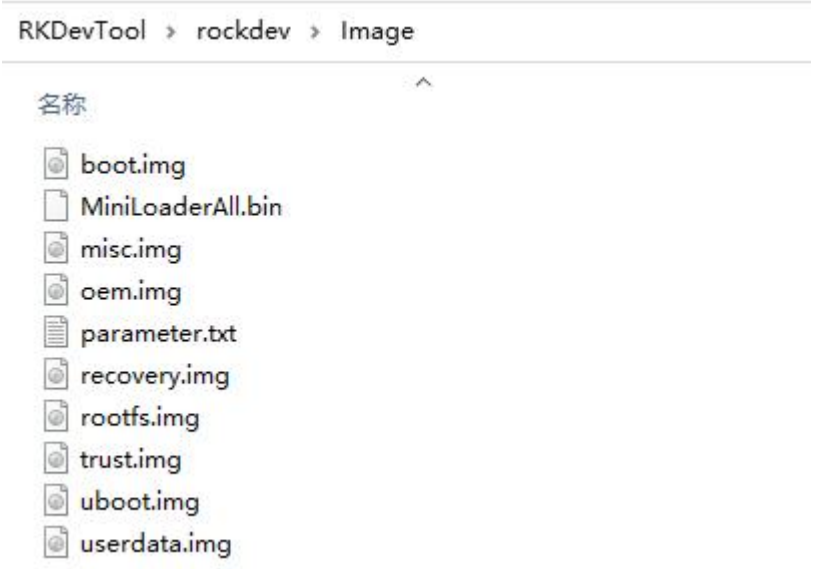
Step 4, the unzip files will be generated in \RKDevTool\RKDevTool_Release\Output\Android\Image directory.



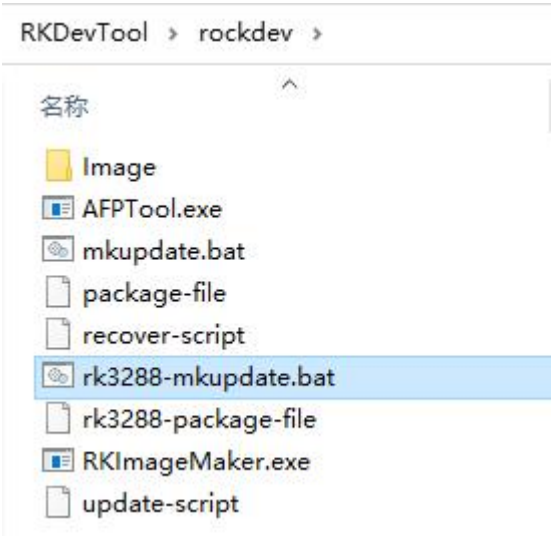
4.2 Pack image

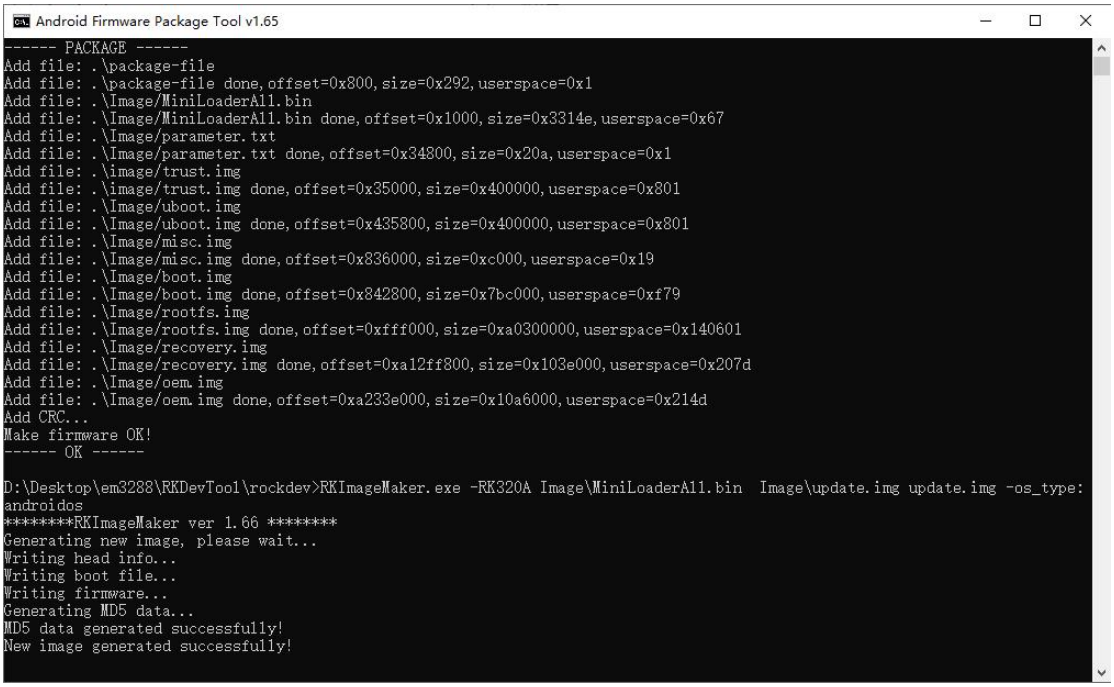
Step 1, unzip RKDevTool.rar on Windows.

Step 2, copy the firmware file to be packaged to windows RKDevTool\rockdev\Image.

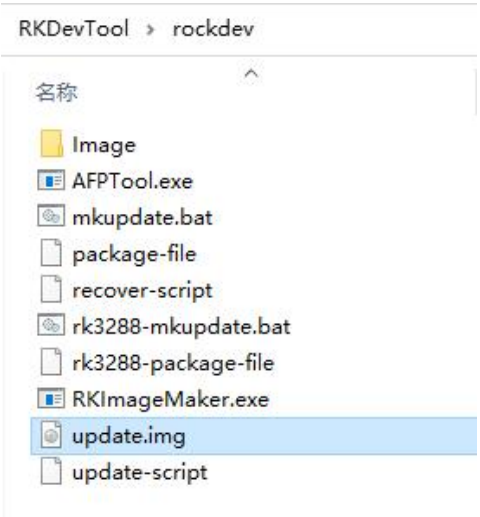


Step 3, enter RKDevTool\rockdev, double-click to run **rk356x-mkupdate.bat**.





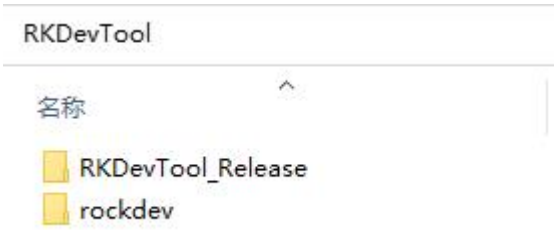
Step 4, the **update.img** will be generated in RKDevTool\rockdev directory.



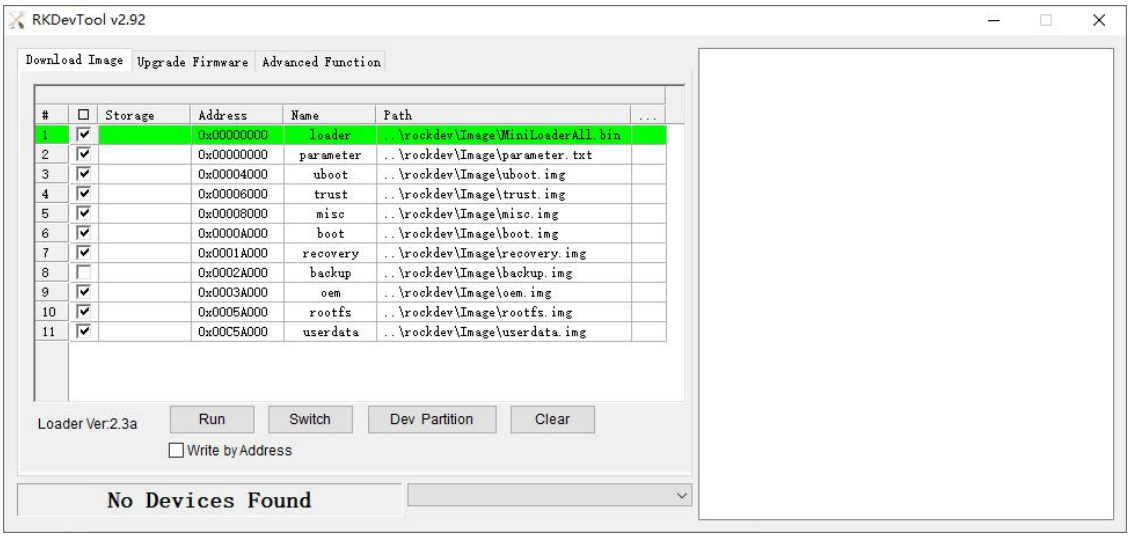
5.Burn Images

5.1 Burn update firmware

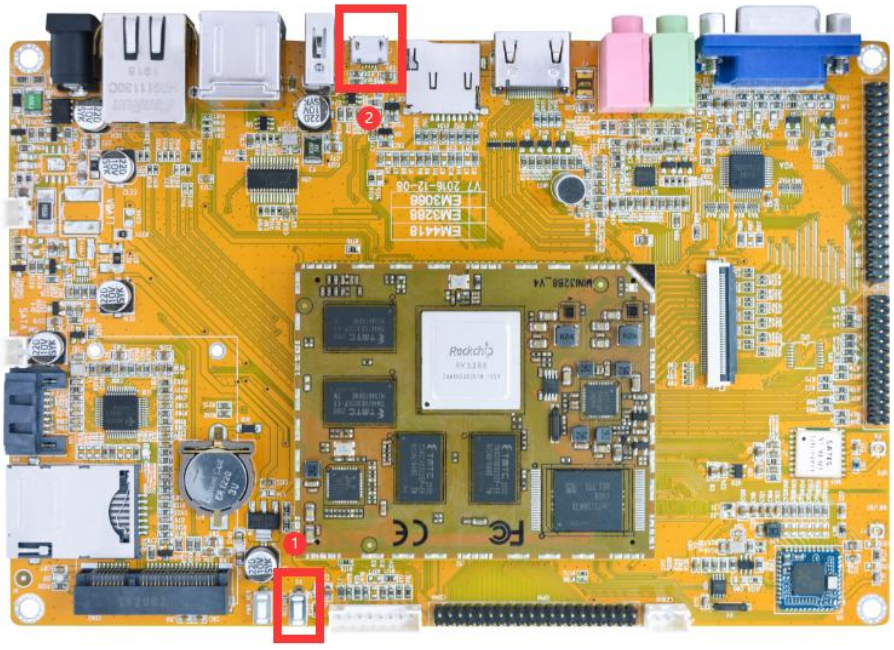
Step 1, unzip RKDevTool.rar on Windows.

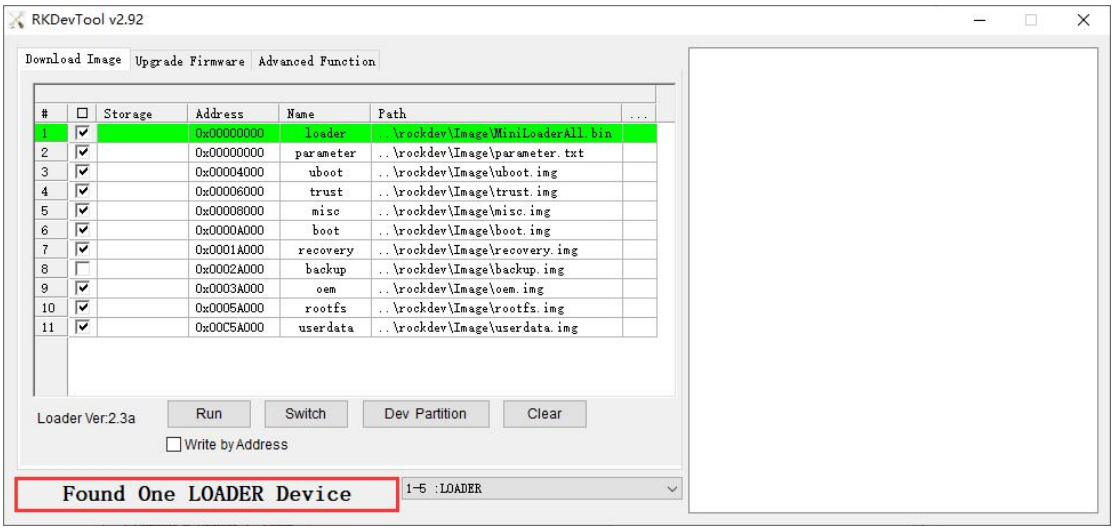


Step 2, open RKDevTool\RKDevTool_Release\RKDevTool.exe.

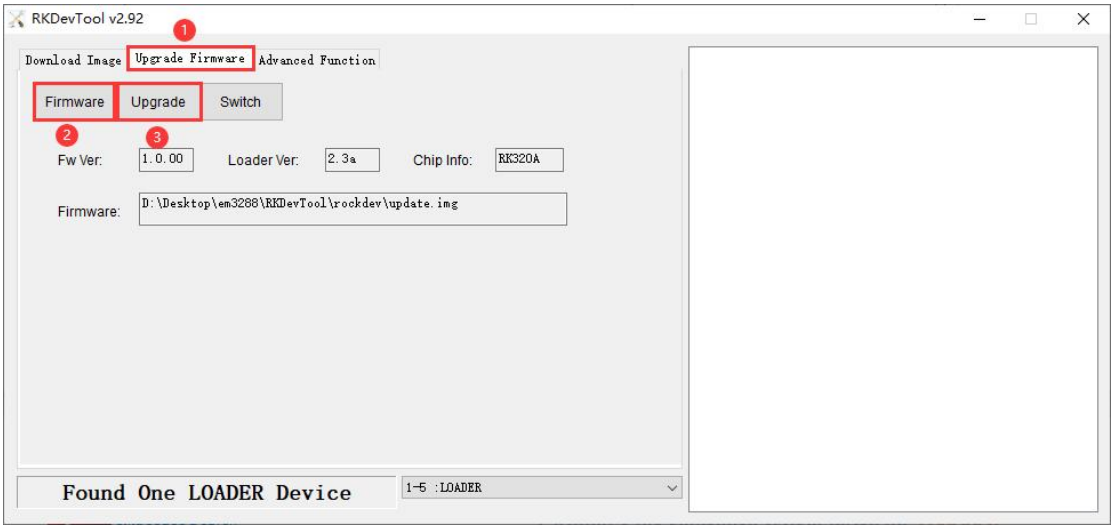


Step 3, keep pressing the **Recovery Key** and connect PC and development board with Micro USB cable, until the windows PC shows **Found one LOADER Device** release the **Recovery Key** .

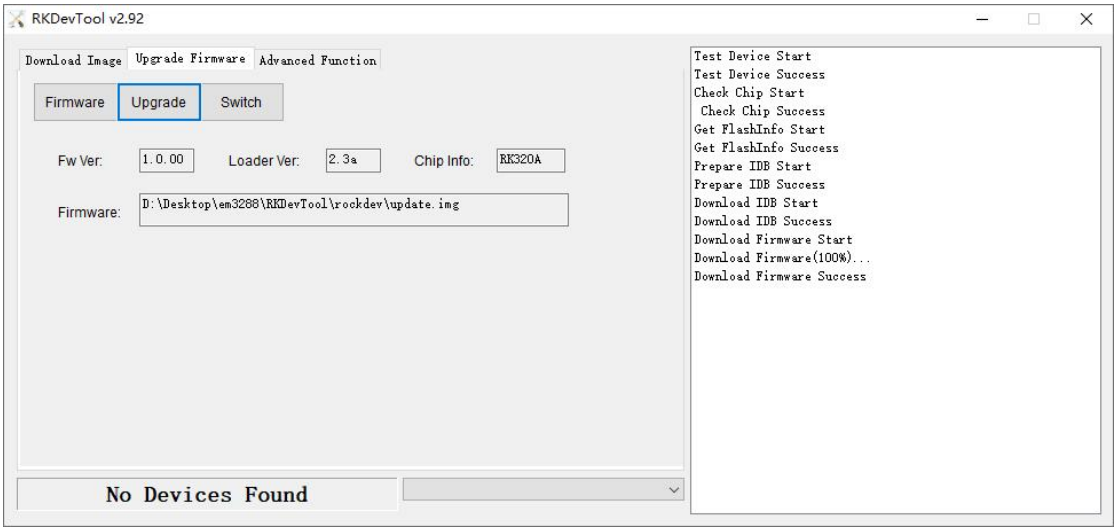




Step 4, click **Upgrade Firmware** -> **Firmware**, select **update.img**, then click **Upgrade** to flash.



Step 5, wait for the completion of burning.

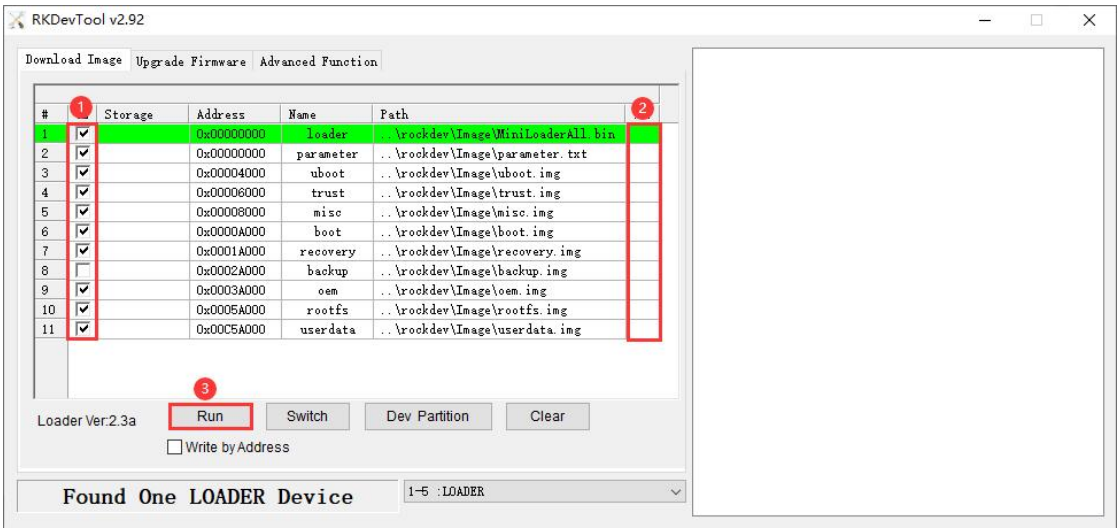


5.2 Burn split firmware

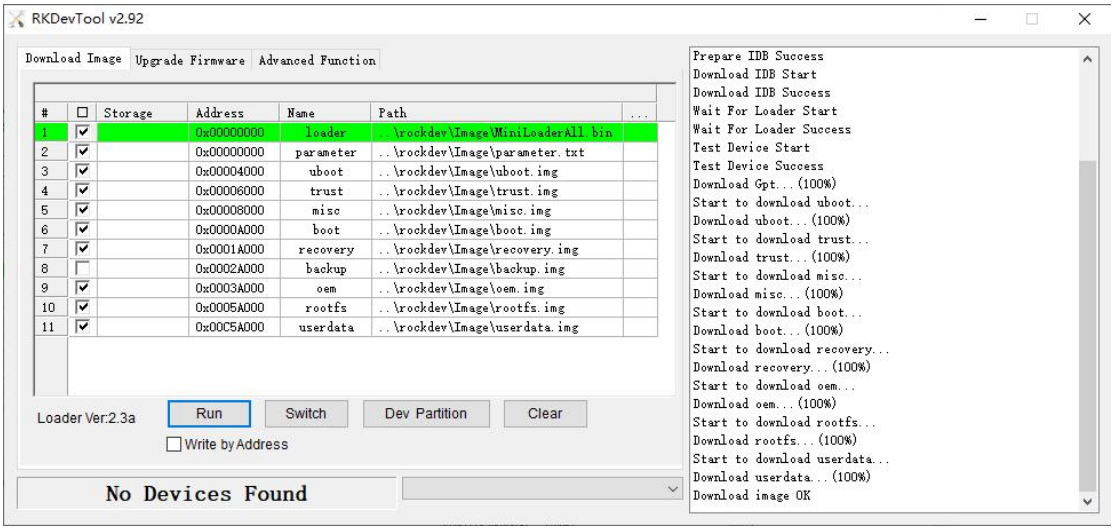
Step 1, select the checkbox on the left.

Step 2, click the column on the right side for the path of the file want to flash.

Step 3, click **run** button to flash the image.



Step 4, wait for the completion of burning.



6.Buildroot Test

6.1 Display

EM3568 Buildroot supports LVDS and HDMI dual-screen display by default, connect the monitor to the connectors shown below:

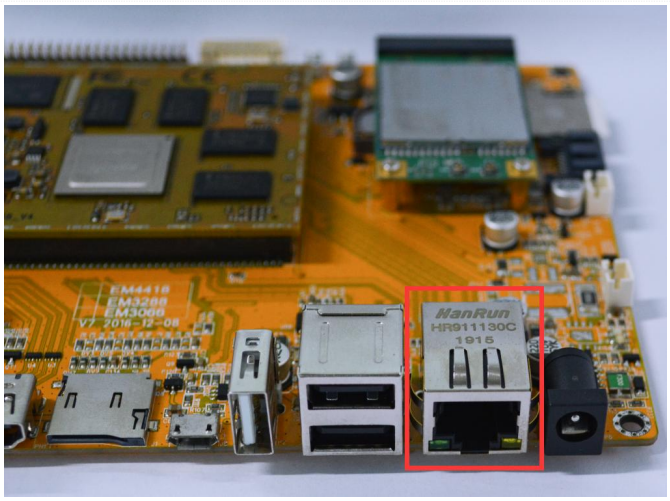
The display effect diagram is as follows:

If only HDMI is required to be displayed separately and displayed in full screen, you need to execute the following command to turn off the LVDS display:

```
# echo off > /sys/class/drm/card0-LVDS-1/status
```

6.2 Ethernet

Step 1, connect the network cable to the Ethernet port.



Step 2, according to the terminal serial port printing information, it can be seen that the Gigabit Ethernet recognition is successful.

ifconfig

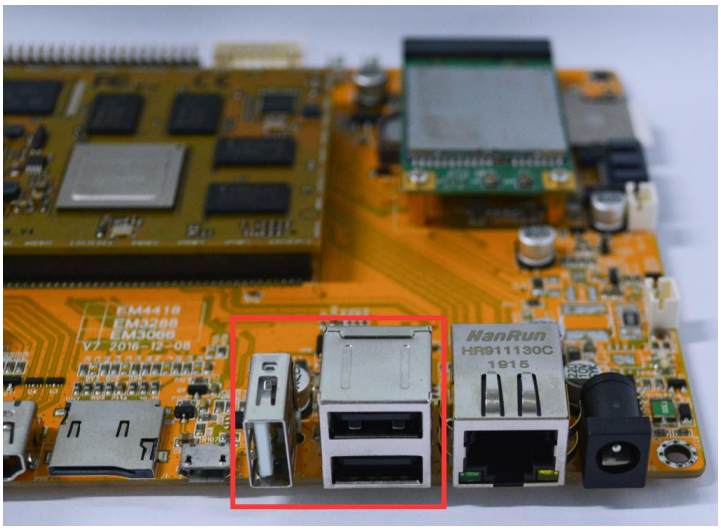
```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# [    85.817705] rk_gmac-dwmac ff290000.ethernet eth0: Link is Up - 1Gbps/Full - flow control rx/tx
[    85.826682] IPv6: ADDRCONF(NETDEV_CHANGE): eth0: link becomes ready

root@rk3288w-buildroot:/# ifconfig
eth0      Link encap:Ethernet  HWaddr 2E:DE:43:C7:68:7B
          inet addr:192.168.0.190  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::9957:b0ca:ed20:f478/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:90 errors:0 dropped:0 overruns:0 frame:0
          TX packets:41 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:7413 (7.2 KiB)  TX bytes:3106 (3.0 KiB)
          Interrupt:50
```

Step 3, internet test.

ping -I eth0 www.armdesigner.com

```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# ping -I eth0 www.armdesigner.com
PING www.armdesigner.com (8.219.70.131) from 192.168.0.190 eth0: 56(84) bytes of data.
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=1 ttl=46 time=200 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=2 ttl=46 time=200 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=3 ttl=46 time=200 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=4 ttl=46 time=200 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=5 ttl=46 time=200 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=6 ttl=46 time=200 ms
^C64 bytes from 8.219.70.131: icmp_seq=7 ttl=46 time=200 ms

--- www.armdesigner.com ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6001ms
rtt min/avg/max/mdev = 199.899/200.102/200.225/0.102 ms
root@rk3288w-buildroot:/#
```

6.3 USB



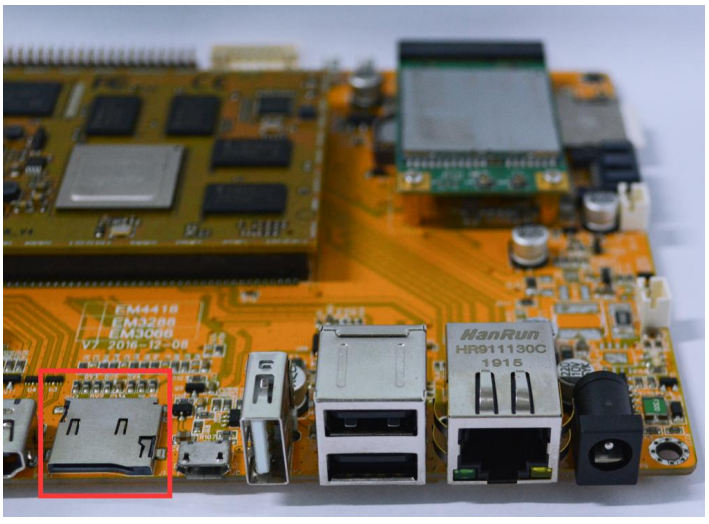
The USB interface can be connected to devices such as mouse, keyboard, USB, and U disk. If the device is connected to a U disk, use the following command to view the directory automatically mounted by the device.

df -h

```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root       5.9G  503M  5.2G   9% /
devtmpfs        990M  8.0K  990M   1% /dev
tmpfs           998M  104K  998M   1% /tmp
tmpfs           998M  368K  998M   1% /run
tmpfs           998M  104K  998M   1% /var/log
tmpfs           998M     0  998M   0% /dev/shm
/dev/mmcblk1p8  121M   12M  103M  11% /oem
/dev/mmcblk1p9  722M  297K  703M   1% /userdata
/dev/sdc         58G  3.8M   58G   1% /mnt/udisk
/dev/sdb1        31G   23G  7.3G  76% /media/udisk1
/dev/sdd1        58G   20G   39G  35% /media/udisk2
root@rk3288w-buildroot:/#
```

6.4 SD card

Step 1, insert the micro SD card into the card slot.



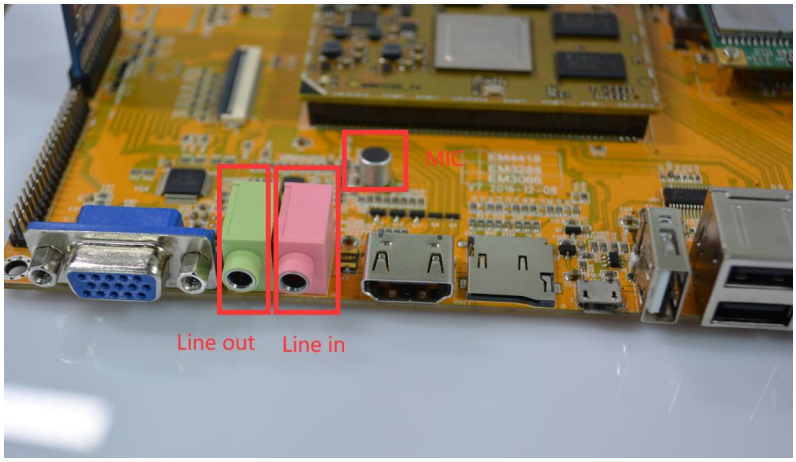
Step 2, use the following command to view the directory automatically mounted on the SD card.

df -h

```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root       5.9G  503M  5.2G   9% /
devtmpfs        990M  8.0K  990M   1% /dev
tmpfs           998M  104K  998M   1% /tmp
tmpfs           998M  376K  998M   1% /run
tmpfs           998M  104K  998M   1% /var/log
tmpfs           998M     0  998M   0% /dev/shm
/dev/mmcblk1p8  121M   12M  103M  11% /oem
/dev/mmcblk1p9  722M  297K  703M   1% /userdata
/dev/sdc         58G  3.8M   58G   1% /mnt/udisk
/dev/sdb1        31G   23G  7.3G  76% /media/udisk1
/dev/sdd1        58G   20G   39G  35% /media/udisk2
/dev/mmcblk2p1   30G  2.9G   28G  10% /mnt/sdcard
root@rk3288w-buildroot:/# _
```

6.5 Headset & MIC

Step 1, audio interface:



Step 2, MIC recording:

```
# amixer -c 0 cset numid=21 2
# amixer -c 0 cset numid=33 0
# arecord -Dhw:0,0 -f cd ww.wav
```

```
root@linaro-alip:/#
root@linaro-alip:/# amixer -c 0 cset numid=21 2
numid=21,iface=MIXER,name='Playback De-emphasis'
   ; type=ENUMERATED,access=rw------,values=1,items=4
   ; Item #0 'None'
   ; Item #1 '32Khz'
   ; Item #2 '44.1Khz'
   ; Item #3 '48Khz'
   : values=2
root@linaro-alip:/# amixer -c 0 cset numid=33 0
numid=33,iface=MIXER,name='Left PGA Mux'
   ; type=ENUMERATED,access=rw------,values=1,items=3
   ; Item #0 'Line 1L'
   ; Item #1 'Line 2L'
   ; Item #2 'DifferentialL'
   : values=0
root@linaro-alip:/# arecord -Dhw:0,0 -f cd ww.wav
Recording WAVE 'ww.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

Step 3, Line_in recording: // computer audio input

```
# amixer -c 0 cset numid=21 2
# amixer -c 0 cset numid=33 1
# arecord -Dhw:0,0 -f cd ww.wav
```

```
root@linaro-alip:/# amixer -c 0 cset numid=21 2
numid=21,iface=MIXER,name='Playback De-emphasis'
   ; type=ENUMERATED,access=rw------,values=1,items=4
   ; Item #0 'None'
   ; Item #1 '32Khz'
   ; Item #2 '44.1Khz'
   ; Item #3 '48Khz'
   : values=2
root@linaro-alip:/# amixer -c 0 cset numid=33 1
numid=33,iface=MIXER,name='Left PGA Mux'
   ; type=ENUMERATED,access=rw------,values=1,items=3
   ; Item #0 'Line 1L'
   ; Item #1 'Line 2L'
   ; Item #2 'DifferentialL'
   : values=1
root@linaro-alip:/# arecord -Dhw:0,0 -f cd ww.wav
Recording WAVE 'ww.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

Step 4, Line_out and HDMI play audio:

```
# aplay -Dhw:0,0 ww.wav        // simultaneous sound from headphones and HDMI
```

```
root@linaro-alip:/# aplay -Dhw:0,0 ww.wav
Playing WAVE 'ww.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

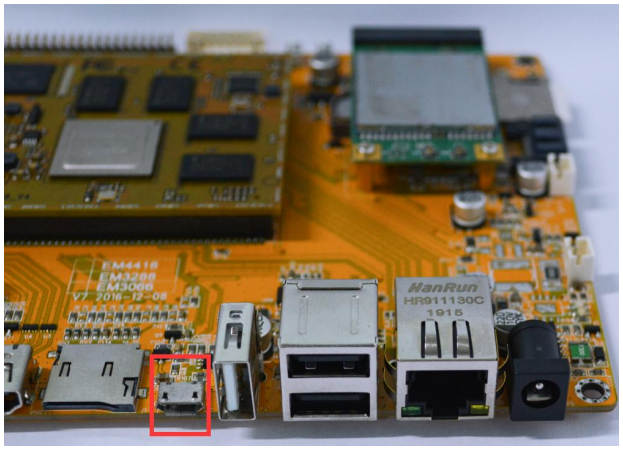
Execute the following command to view more audio parameter configurations：

```
# amixer -c 0 contents
```

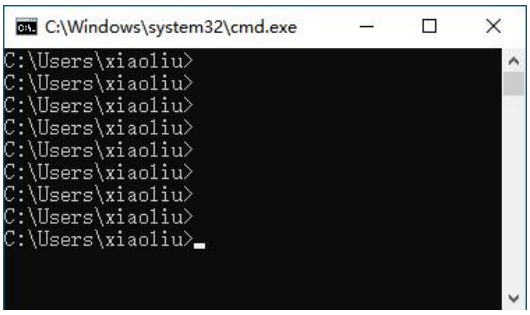
6.6 ADB

ADB: // Please install the ADB driver on your computer by yourself

Step 1, connect Micro USB cable and power on.

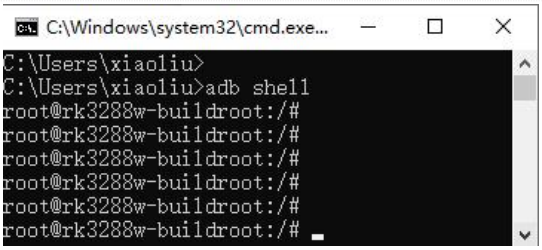


Step 2, use the shortcut keys **WIN + R** to open the windows command run box, type: **cmd**, open the windows console command window.



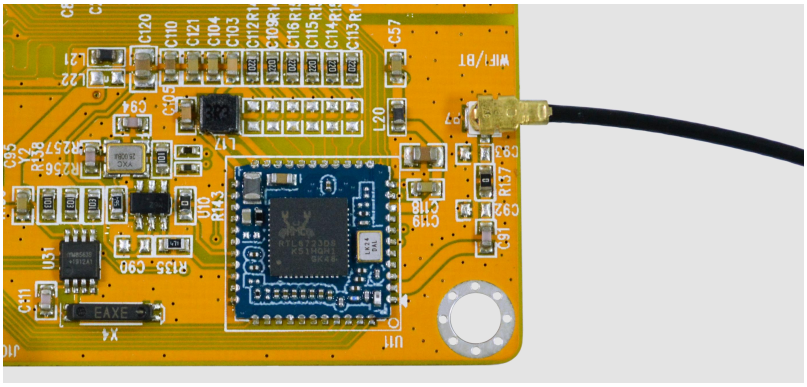
Step 3, execute the follow commands to enable ADB.

```
# adb shell
```



6.7 WiFi

Step 1, connect WiFi Antenna.



Step 2, check whether the wifi device exists：

ifconfig

```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# ifconfig
eth0      Link encap:Ethernet  HWaddr 2E:DE:43:C7:68:7B
          inet addr:192.168.0.190  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::9957:b0ca:ed20:f478/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1743 errors:0 dropped:0 overruns:0 frame:0
          TX packets:150 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:209607 (204.6 KiB)  TX bytes:9832 (9.6 KiB)
          Interrupt:50

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

p2p0      Link encap:Ethernet  HWaddr 0E:CF:89:0A:8D:74
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

wlan0     Link encap:Ethernet  HWaddr 0C:CF:89:0A:8D:74
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

root@rk3288w-buildroot:/#
```

Step 3, search for available WiFi hotspots：

iwlist wlan0 scan

```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# iwlist wlan0 scan
wlan0     Scan completed :
          Cell 01 - Address: 50:FA:84:CB:E4:35
                    ESSID:"HYLS_2.4G"
                    Protocol:IEEE 802.11bgn
                    Mode:Master
                    Frequency:2.412 GHz (Channel 1)
                    Encryption key:on
                    Bit Rates:144 Mb/s
                    Extra:wpa_ie=dd1a0050f20101000050f20202000050f2040050f20201000050f202
                    IE: WPA Version 1
                        Group Cipher : TKIP
                        Pairwise Ciphers (2) : CCMP TKIP
                        Authentication Suites (1) : PSK
                    Extra:
                    IE: IEEE 802.11i/WPA2 Version 1
                        Group Cipher : TKIP
                        Pairwise Ciphers (2) : CCMP TKIP
                        Authentication Suites (1) : PSK
                    Quality=83/100  Signal level=28/100
                    Extra:fm=0003
          Cell 02 - Address: D0:21:F9:1F:28:95
                    ESSID:"hzsm"
                    Protocol:IEEE 802.11bgn
                    Mode:Master
                    Frequency:2.412 GHz (Channel 1)
                    Encryption key:on
                    Bit Rates:144 Mb/s
                    Extra:rsn_ie=30140100000fac040100000fac040100000fac020000
                    IE: IEEE 802.11i/WPA2 Version 1
                        Group Cipher : CCMP
                        Pairwise Ciphers (1) : CCMP
                        Authentication Suites (1) : PSK
                    Quality=100/100  Signal level=36/100
                    Extra:fm=0003
          Cell 03 - Address: B2:22:7A:5A:B6:4A
                    ESSID:"DIRECT-4A-HP Laser 136w"
                    Protocol:IEEE 802.11gn
                    Mode:Master
                    Frequency:2.437 GHz (Channel 6)
                    Encryption key:on
                    Bit Rates:72 Mb/s
                    Extra:rsn_ie=30140100000fac040100000fac040100000fac020c00
                    IE: IEEE 802.11i/WPA2 Version 1
                        Group Cipher : CCMP
                        Pairwise Ciphers (1) : CCMP
                        Authentication Suites (1) : PSK
                    Quality=40/100  Signal level=56/100
                    Extra:fm=0003
          Cell 04 - Address: B4:F1:8C:6D:D1:24
                    ESSID:"Boardcon"
                    Protocol:IEEE 802.11bgn
```

Step 4, configure the name and password of the hotspot to be connected:

vi /etc/wpa_supplicant.conf

```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# vi /etc/wpa_supplicant.conf
root@rk3288w-buildroot:/#
```

```
ctrl_interface=/var/run/wpa_supplicant
ap_scan=1
update_config=1

network={
        ssid="Boardcon"
        psk="1234567890"
        key_mgmt=WPA-PSK
}
~
```

Step 5, connecting hotspots:

wpa_supplicant -B -i wlan0 -c /etc/wpa_supplicant.conf // Need to wait for 3-5 seconds

```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/#wpa_supplicant -B -i wlan0 -c /etc/wpa_supplicant.conf
Successfully initialized wpa_supplicantt -B -i wlan0 -c /etc/wpa_supplicant.conf
nl80211: kernel reports: Authentication algorithm number required
root@rk3288w-buildroot:/# [ 1039.771434] NOHZ tick-stop error: Non-RCU local softirq work is pending, handler #08!!!
[ 1039.829813] NOHZ tick-stop error: Non-RCU local softirq work is pending, handler #08!!!
[ 1039.846536] IPv6: ADDRCONF(NETDEV_CHANGE): wlan0: link becomes ready
[ 1039.869001] NOHZ tick-stop error: Non-RCU local softirq work is pending, handler #08!!!
[ 1040.377365] NOHZ tick-stop error: Non-RCU local softirq work is pending, handler #08!!!
[ 1040.462175] NOHZ tick-stop error: Non-RCU local softirq work is pending, handler #08!!!
[ 1040.669487] NOHZ tick-stop error: Non-RCU local softirq work is pending, handler #08!!!
[ 1040.783068] NOHZ tick-stop error: Non-RCU local softirq work is pending, handler #08!!!
[ 1041.791024] NOHZ tick-stop error: Non-RCU local softirq work is pending, handler #08!!!
[ 1041.825519] NOHZ tick-stop error: Non-RCU local softirq work is pending, handler #08!!!
[ 1041.860186] NOHZ tick-stop error: Non-RCU local softirq work is pending, handler #08!!!

root@rk3288w-buildroot:/# ifconfig
eth0      Link encap:Ethernet  HWaddr 2E:DE:43:C7:68:7B
          inet addr:192.168.0.190  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::9957:b0ca:ed20:f478/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:3632 errors:0 dropped:0 overruns:0 frame:0
          TX packets:264 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:438533 (428.2 KiB)  TX bytes:16576 (16.1 KiB)
          Interrupt:50

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

p2p0      Link encap:Ethernet  HWaddr 0E:CF:89:0A:8D:74
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

wlan0     Link encap:Ethernet  HWaddr 0C:CF:89:0A:8D:74
          inet addr:192.168.0.189  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::1d32:6a79:1095:7f12/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:40 errors:0 dropped:0 overruns:0 frame:0
          TX packets:19 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:4648 (4.5 KiB)  TX bytes:2406 (2.3 KiB)

root@rk3288w-buildroot:/#
```

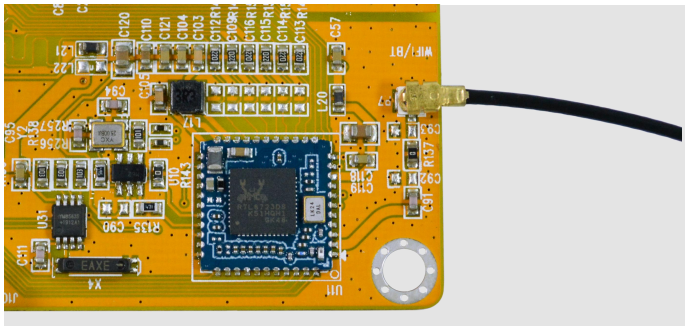
Step 6, internet test:

```
# ping -I wlan0 www.armdesigner.com
```

```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# ping -I wlan0 www.armdesigner.com
PING www.armdesigner.com (8.219.70.131) from 192.168.0.189 wlan0: 56(84) bytes of data.
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=1 ttl=46 time=241 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=2 ttl=46 time=224 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=3 ttl=46 time=210 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=4 ttl=46 time=209 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=5 ttl=46 time=218 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=6 ttl=46 time=217 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=7 ttl=46 time=217 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=8 ttl=46 time=215 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=9 ttl=46 time=215 ms
^C
--- www.armdesigner.com ping statistics ---
9 packets transmitted, 9 received, 0% packet loss, time 8008ms
rtt min/avg/max/mdev = 209.266/218.399/240.562/8.801 ms
root@rk3288w-buildroot:/#
```

6.8 Bluetooth

Step 1, connect WiFi/BT Antenna.



Step 2, viewing device status:

```
# hciconfig -a
```

```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# hciconfig -a
hci0:   Type: Primary  Bus: UART
        BD Address: 0C:CF:89:0A:8D:75  ACL MTU: 1021:8  SCO MTU: 255:12
        UP RUNNING
        RX bytes:1812 acl:0 sco:0 events:52 errors:0
        TX bytes:3942 acl:0 sco:0 commands:53 errors:0
        Features: 0xff 0xff 0xff 0xfe 0xdb 0xfd 0x7b 0x87
        Packet type: DM1 DM3 DM5 DH1 DH3 DH5 HV1 HV2 HV3
        Link policy: RSWITCH HOLD SNIFF PARK
        Link mode: PERIPHERAL ACCEPT
[ 1314.814286] Bluetooth: hu 66379fb4 retransmitting 1 pkts
        Name: 'BlueZ 5.62'
        Class: 0x2c0000
        Service Classes: Rendering, Capturing, Audio
        Device Class: Miscellaneous,
[ 1314.832704] rtk_btcoex: BTCOEX hci_rev 0xaaa8
        HCI Version: 4.1 (0x7)  Revision: 0xaaa8
        LMP Version: 4.1 (0x7)  Subversion: 0x2df5[ 1314.840663] rtk_btcoex: BTCOEX lmp_subver 0x2df5

        Manufacturer: Realtek Semiconductor Corporation (93)

root@rk3288w-buildroot:/#
```

Step 3, allow Bluetooth to search and be found:

hciconfig hci0 piscan // If this command is not executed, the Bluetooth device name may be hidden

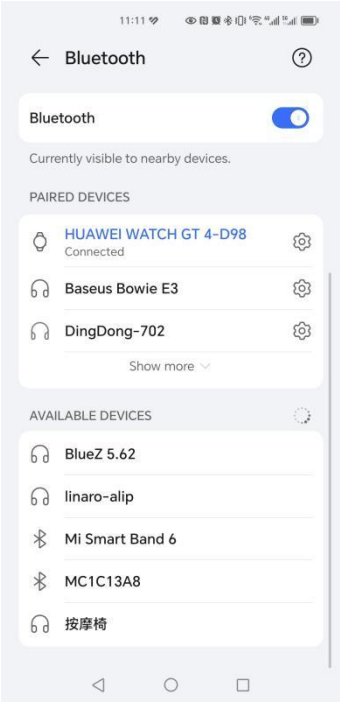
```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# hciconfig hci0 piscan
[ 1718.218218] Bluetooth: hu 66379fb4 retransmitting 1 pkts
root@rk3288w-buildroot:/#
```

Step 4, enter **bluetoothctl** for Bluetooth connection testing:

bluetoothctl

```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# bluetoothctl
Agent registered
[CHG] Controller 0C:CF:89:0A:8D:75 Pairable: yes
[bluetooth]# [ 1789.950046] rtk_btcoex: hci accept conn req
```

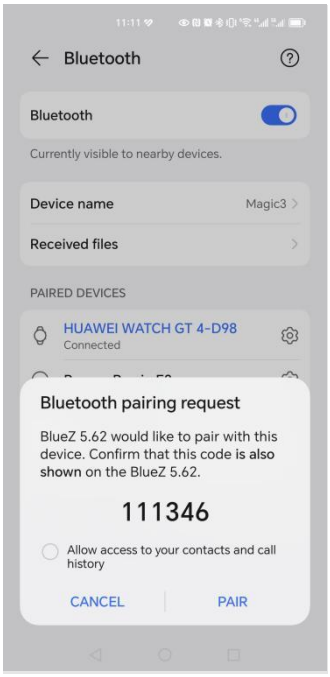
Step 5, find **BlueZ 5.62** (Bluetooth device name of EM3288 buildroot system) on the Bluetooth search interface of the mobile device, and then click to pair.



Step 6, regarding the pairing process, authorization authentication is required.

On the mobile device side:

// Click **PAIR** to confirm the connection



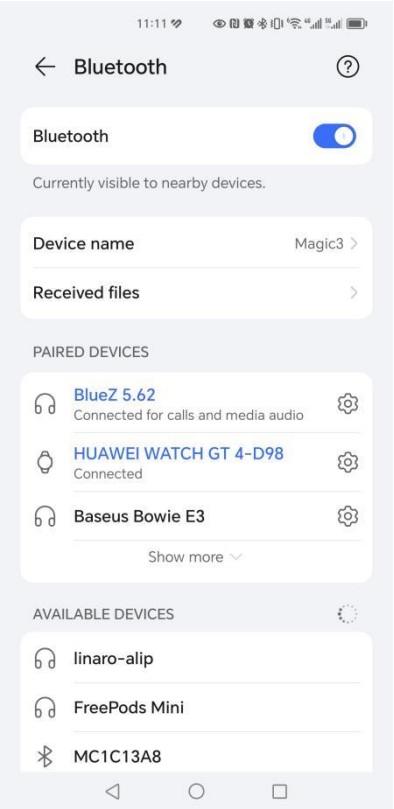
In the serial terminal:

// As long as there is permission authentication, enter: **yes**, until the pairing is successful.

```
root@rk3288w-buildroot:/# bluetoothctl
Agent registered
[CHG] Controller 0C:CF:89:0A:8D:75 Pairable: yes
[bluetooth]# [ 1789.950046] rtk_btcoex: hci accept conn req
[ 1790.131369] rtk_btcoex: connected, handle 0002, status 0x00
[ 1790.137264] rtk_btcoex: Page success
[ 1790.174171] rtk_btcoex: io capability request
[NEW] Device E4:27:61:20:E9:31 Magic3
Request confirmation
[agent] Confirm passkey 111346 (yes/no): yes
[Magic3]# [ 1799.845437] rtk_btcoex: link key notify
[ 1799.860360] rtk_btcoex: l2cap op 2, len 16, out 0
[ 1799.865444] rtk_btcoex: RX l2cap conn req, hndl 0x0002, PSM 0x0001, scid 0x0056
[ 1799.865654] rtk_btcoex: l2cap op 3, len 20, out 1
[ 1799.872886] rtk_btcoex: PSM(0x0001) do not need parse
[ 1799.883319] rtk_btcoex: TX l2cap conn rsp, hndl 0x0002, dcid 0x0040, scid 0x0056, result 0x0000
[ 1799.946528] rtk_btcoex: l2cap op 6, len 16, out 0
[ 1799.951614] rtk_btcoex: RX l2cap disconn req, hndl 0x0002, dcid 0x0040, scid 0x0056
[ 1799.959317] rtk_btcoex: handle_l2cap_discon_req: handle 0x0002, dcid 0x0040, scid 0x0056, dir 0
[ 1799.974019] rtk_btcoex: l2cap op 2, len 16, out 0
[ 1799.978946] rtk_btcoex: RX l2cap conn req, hndl 0x0002, PSM 0x0001, scid 0x0040
[ 1799.979108] rtk_btcoex: l2cap op 3, len 20, out 1
[ 1799.986393] rtk_btcoex: PSM(0x0001) do not need parse
[ 1799.996400] rtk_btcoex: TX l2cap conn rsp, hndl 0x0002, dcid 0x0040, scid 0x0040, result 0x0000
[ 1800.049085] rtk_btcoex: l2cap op 6, len 16, out 0
[ 1800.054089] rtk_btcoex: RX l2cap disconn req, hndl 0x0002, dcid 0x0040, scid 0x0040
[ 1800.061947] rtk_btcoex: handle_l2cap_discon_req: handle 0x0002, dcid 0x0040, scid 0x0040, dir 0
[ 1800.141848] rtk_btcoex: l2cap op 2, len 16, out 0
[ 1800.147209] rtk_btcoex: l2cap op 3, len 20, out 1
[ 1800.147510] rtk_btcoex: RX l2cap conn req, hndl 0x0002, PSM 0x0001, scid 0x005c
[ 1800.159607] rtk_btcoex: PSM(0x0001) do not need parse
[ 1800.164913] rtk_btcoex: TX l2cap conn rsp, hndl 0x0002, dcid 0x0040, scid 0x005c, result 0x0000
[ 1800.192610] rtk_btcoex: l2cap op 6, len 16, out 0
[ 1800.197368] rtk_btcoex: RX l2cap disconn req, hndl 0x0002, dcid 0x0040, scid 0x005c
[ 1800.205094] rtk_btcoex: handle_l2cap_discon_req: handle 0x0002, dcid 0x0040, scid 0x005c, dir 0
[ 1800.214373] rtk_btcoex: l2cap op 2, len 16, out 0
[ 1800.219113] rtk_btcoex: RX l2cap conn req, hndl 0x0002, PSM 0x0001, scid 0x0048
[ 1800.219139] rtk_btcoex: l2cap op 3, len 20, out 1
[ 1800.226499] rtk_btcoex: PSM(0x0001) do not need parse
[ 1800.236273] rtk_btcoex: TX l2cap conn rsp, hndl 0x0002, dcid 0x0040, scid 0x0048, result 0x0000
[ 1800.258867] rtk_btcoex: l2cap op 6, len 16, out 0
[ 1800.263647] rtk_btcoex: RX l2cap disconn req, hndl 0x0002, dcid 0x0040, scid 0x0048
[ 1800.271342] rtk_btcoex: handle_l2cap_discon_req: handle 0x0002, dcid 0x0040, scid 0x0048, dir 0
[ 1800.301845] rtk_btcoex: l2cap op 2, len 16, out 0
[ 1800.306578] rtk_btcoex: RX l2cap conn req, hndl 0x0002, PSM 0x0003, scid 0x004f
[ 1800.306618] rtk_btcoex: l2cap op 3, len 20, out 1
[ 1800.318713] rtk_btcoex: TX l2cap conn rsp, hndl 0x0002, dcid 0x0040, scid 0x004f, result 0x0000
[ 1800.327475] rtk_btcoex: l2cap connection success, update connection
[ 1800.333777] rtk_btcoex: update_profile_connection: is_add 1, profile_index 3
[ 1800.340820] rtk_btcoex: update_profile_connection: btrtl_coex.profile_bitmap 0x08
[ 1800.348315] rtk_btcoex: update_profile_connection: btrtl_coex.profile_refcount[0] = 0
[ 1800.356153] rtk_btcoex: update_profile_connection: btrtl_coex.profile_refcount[1] = 0
[ 1800.363987] rtk_btcoex: update_profile_connection: btrtl_coex.profile_refcount[2] = 0
[ 1800.371828] rtk_btcoex: update_profile_connection: btrtl_coex.profile_refcount[3] = 1
[ 1800.379646] rtk_btcoex: update_profile_connection: btrtl_coex.profile_refcount[4] = 0
[ 1800.387488] rtk_btcoex: update_profile_connection: btrtl_coex.profile_refcount[5] = 0
[ 1800.395330] rtk_btcoex: update_profile_connection: btrtl_coex.profile_refcount[6] = 0
[ 1800.403171] rtk_btcoex: update_profile_connection: btrtl_coex.profile_refcount[7] = 0
[ 1800.411008] rtk_btcoex: rtk_notify_profileinfo_to_fw: BufferSize 5
[ 1800.417185] rtk_btcoex: rtk_notify_profileinfo_to_fw: NumberOfHandles 1
[ 1800.423823] rtk_btcoex: rtk_notify_profileinfo_to_fw: handle 0x0002
[ 1800.430087] rtk_btcoex: rtk_notify_profileinfo_to_fw: profile_bitmap 0x08
```

```
[agent] Authorize service 0000110d-0000-1000-8000-00805f9b34fb (yes/no): [ 1806.722482] rtk_btcoex: count_pan_packet_timeout: pan_packet_count 6
[ 1806.729009] rtk_btcoex: timeout_handler: pan idle→busy!
[ 1806.734392] rtk_btcoex: update_profile_state: btrtl_coex.profie_bitmap = 8
[ 1806.741317] rtk_btcoex: update_profile_state: btrtl_coex.profile_status = 8
[ 1806.748331] rtk_btcoex: rtk_notify_profileinfo_to_fw: BufferSize 5
[ 1806.754559] rtk_btcoex: rtk_notify_profileinfo_to_fw: NumberOfHandles 1
[ 1806.761218] rtk_btcoex: rtk_notify_profileinfo_to_fw: handle 0x0002
[ 1806.767526] rtk_btcoex: rtk_notify_profileinfo_to_fw: profile_bitmap 0x08
[ 1806.774423] rtk_btcoex: rtk_notify_profileinfo_to_fw: profile_status 0x08
[ 1806.781278] rtk_btcoex: rtk_vendor_cmd_to_fw: opcode 0xfc19
[ 1807.842612] rtk_btcoex: count_pan_packet_timeout: pan busy→idle!
[ 1807.848851] rtk_btcoex: update_profile_state: btrtl_coex.profie_bitmap = 8
[ 1807.855825] rtk_btcoex: update_profile_state: btrtl_coex.profile_status = 0
[ 1807.863089] rtk_btcoex: rtk_notify_profileinfo_to_fw: BufferSize 5
[ 1807.869364] rtk_btcoex: rtk_notify_profileinfo_to_fw: NumberOfHandles 1
[ 1807.876066] rtk_btcoex: rtk_notify_profileinfo_to_fw: handle 0x0002
[ 1807.882421] rtk_btcoex: rtk_notify_profileinfo_to_fw: profile_bitmap 0x08
[ 1807.889409] rtk_btcoex: rtk_notify_profileinfo_to_fw: profile_status 0x00
[ 1807.896316] rtk_btcoex: rtk_vendor_cmd_to_fw: opcode 0xfc19
W: [pulseaudio] module-loopback.c: Configured latency of 200.00 ms is smaller than minimum latency, using minimum instead
W: [pulseaudio] module-loopback.c: Cannot set requested sink latency of 66.67 ms, adjusting to 250.00 ms
W: [pulseaudio] module-loopback.c: Cannot set requested source latency of 16.00 ms, adjusting to 39.91 ms
W: [pulseaudio] module-loopback.c: Configured latency of 200.00 ms is smaller than minimum latency, using minimum instead
W: [pulseaudio] module-loopback.c: Cannot set requested sink latency of 35.20 ms, adjusting to 39.91 ms
W: [pulseaudio] module-loopback.c: Cannot set requested source latency of 66.67 ms, adjusting to 250.00 ms
[ 1810.003153] rtk_btcoex: count_pan_packet_timeout: pan_packet_count 4
[agent] Authorize service 0000110d-0000-1000-8000-00805f9b34fb (yes/no): yes
[Magic3]# [ 1812.188724] rtk_btcoex: l2cap op 3, len 20, out 1
[ 1812.195273] rtk_btcoex: TX l2cap conn rsp, hndl 0x0002, dcid 0x0041, scid 0x0057, result 0x0000
[ 1812.204298] rtk_btcoex: l2cap connection success, update connection
[ 1812.210639] rtk_btcoex: update_profile_connection: is_add 1, profile_index 2
[ 1812.218060] rtk_btcoex: update_profile_connection: btrtl_coex.profile_bitmap 0x0c
[ 1812.225586] rtk_btcoex: update_profile_connection: btrtl_coex.profile_refcount[0] = 0
[ 1812.233431] rtk_btcoex: update_profile_connection: btrtl_coex.profile_refcount[1] = 0
[ 1812.241259] rtk_btcoex: update_profile_connection: btrtl_coex.profile_refcount[2] = 1
[ 1812.249114] rtk_btcoex: update_profile_connection: btrtl_coex.profile_refcount[3] = 1
[ 1812.256953] rtk_btcoex: update_profile_connection: btrtl_coex.profile_refcount[4] = 0
[ 1812.264793] rtk_btcoex: update_profile_connection: btrtl_coex.profile_refcount[5] = 0
[ 1812.272615] rtk_btcoex: update_profile_connection: btrtl_coex.profile_refcount[6] = 0
[ 1812.280459] rtk_btcoex: update_profile_connection: btrtl_coex.profile_refcount[7] = 0
[ 1812.288291] rtk_btcoex: rtk_notify_profileinfo_to_fw: BufferSize 5
[ 1812.294479] rtk_btcoex: rtk_notify_profileinfo_to_fw: NumberOfHandles 1
[ 1812.301085] rtk_btcoex: rtk_notify_profileinfo_to_fw: handle 0x0002
[ 1812.307361] rtk_btcoex: rtk_notify_profileinfo_to_fw: profile_bitmap 0x0c
[ 1812.314154] rtk_btcoex: rtk_notify_profileinfo_to_fw: profile_status 0x00
[ 1812.320932] rtk_btcoex: rtk_vendor_cmd_to_fw: opcode 0xfc19
[CHG] Device E4:27:61:20:E9:31 UUIDs: 0000046a-0000-1000-8000-00805f9b34fb
```

Step 7, after the Bluetooth pairing is successful, the EM3288 device can be used as an audio output device.



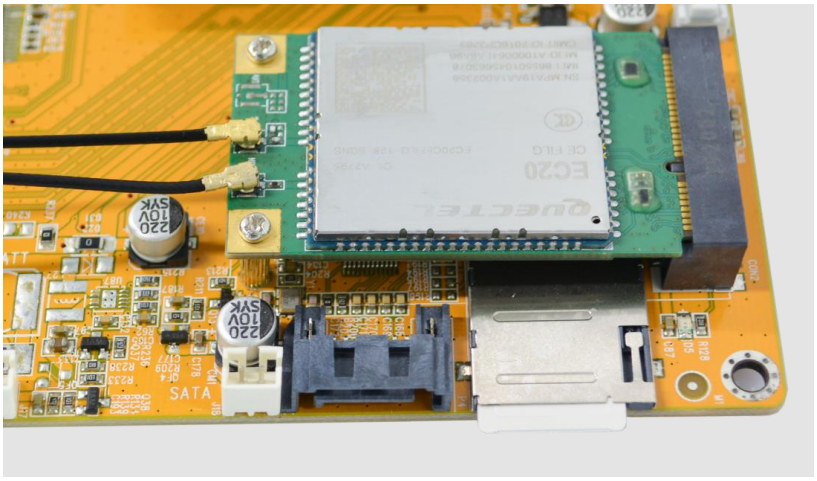
Step 8, exit the current bluetooth test:

```
[Magic3]# exit
```

```
[ 1848.817355] rtk_btcoex: rtk_notify_profileinfo_to_fw: handle 0x0002
[ 1848.823732] rtk_btcoex: rtk_notify_profileinfo_to_fw: profile_bitmap 0x8c
[ 1848.830628] rtk_btcoex: rtk_notify_profileinfo_to_fw: profile_status 0x00
[ 1848.837589] rtk_btcoex: rtk_vendor_cmd_to_fw: opcode 0xfc19
[Magic3]# [ 1854.166587] rtk_btcoex: update_hid_active_state: handle 0x0002, interval 600
[ 1854.173961] rtk_btcoex: HID not connected, nothing to be down
[Magic3]# exit
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/#
```

6.9 4G(EC20)

Step 1, insert 4G module to PCIe slot (4G module:EC20), connect Antenna, inserting the SIM card, then power on.



Step 2, execute the following command to realize ppp dialing:

```
# pppd call quectel-ppp &
```

```
root@rk3288w-buildroot:/# pppd call quectel-ppp &
[1] 1557
root@rk3288w-buildroot:/# pppd options in effect:
debug           # (from /etc/ppp/peers/quectel-ppp)
nodetach                # (from /etc/ppp/peers/quectel-ppp)
dump            # (from /etc/ppp/peers/quectel-ppp)
noauth          # (from /etc/ppp/peers/quectel-ppp)
user test               # (from /etc/ppp/peers/quectel-ppp)
password ??????         # (from /etc/ppp/peers/quectel-ppp)
remotename 3gppp                # (from /etc/ppp/peers/quectel-ppp)
/dev/ttyUSB3            # (from /etc/ppp/peers/quectel-ppp)
115200          # (from /etc/ppp/peers/quectel-ppp)
lock            # (from /etc/ppp/peers/quectel-ppp)
connect chat -s -v -f /etc/ppp/peers/quectel-chat-connect               # (from /etc/ppp/peers/quectel-ppp)
disconnect chat -s -v -f /etc/ppp/peers/quectel-chat-disconnect         # (from /etc/ppp/peers/quectel-ppp)
nocrtscts               # (from /etc/ppp/peers/quectel-ppp)
modem           # (from /etc/ppp/peers/quectel-ppp)
hide-password           # (from /etc/ppp/peers/quectel-ppp)
novj            # (from /etc/ppp/peers/quectel-ppp)
novjccomp               # (from /etc/ppp/peers/quectel-ppp)
ipcp-accept-local               # (from /etc/ppp/peers/quectel-ppp)
ipcp-accept-remote              # (from /etc/ppp/peers/quectel-ppp)
ipparam 3gppp           # (from /etc/ppp/peers/quectel-ppp)
noipdefault             # (from /etc/ppp/peers/quectel-ppp)
ipcp-max-failure 30             # (from /etc/ppp/peers/quectel-ppp)
defaultroute            # (from /etc/ppp/peers/quectel-ppp)
usepeerdns              # (from /etc/ppp/peers/quectel-ppp)
noccp           # (from /etc/ppp/peers/quectel-ppp)
abort on (BUSY)
abort on (NO CARRIER)
abort on (NO DIALTONE)
abort on (ERROR)
abort on (NO ANSWER)
timeout set to 30 seconds
send (AT^M)
expect (OK)
AT^M^M
OK
```

```
Script chat -s -v -f /etc/ppp/peers/quectel-chat-connect finished (pid 1558), status = 0x0
Serial connection established.
using channel 1
Using interface ppp0
Connect: ppp0 <--> /dev/ttyUSB3
sent [LCP ConfReq id=0x1 <asyncmap 0x0> <magic 0xb949ca7b> <pcomp> <accomp>]
rcvd [LCP ConfReq id=0x0 <asyncmap 0x0> <auth chap MD5> <magic 0xd136c1e2> <pcomp> <accomp>]
sent [LCP ConfAck id=0x0 <asyncmap 0x0> <auth chap MD5> <magic 0xd136c1e2> <pcomp> <accomp>]
rcvd [LCP ConfAck id=0x1 <asyncmap 0x0> <magic 0xb949ca7b> <pcomp> <accomp>]
rcvd [LCP DiscReq id=0x1 magic=0xd136c1e2]
rcvd [CHAP Challenge id=0x1 <487d48b90e4396d7fa97ca7e4b6a4bf9>, name = "UMTS_CHAP_SRVR"]
sent [CHAP Response id=0x1 <75c35a038abf6315763ad4496f70fb72>, name = "test"]
rcvd [CHAP Success id=0x1 ""]
CHAP authentication succeeded
CHAP authentication succeeded
sent [IPCP ConfReq id=0x1 <addr 0.0.0.0> <ms-dns1 0.0.0.0> <ms-dns2 0.0.0.0>]
rcvd [IPCP ConfReq id=0x0]
sent [IPCP ConfNak id=0x0 <addr 0.0.0.0>]
rcvd [IPCP ConfNak id=0x1 <addr 10.44.165.164> <ms-dns1 120.80.80.80> <ms-dns2 221.5.88.88>]
sent [IPCP ConfReq id=0x2 <addr 10.44.165.164> <ms-dns1 120.80.80.80> <ms-dns2 221.5.88.88>]
rcvd [IPCP ConfReq id=0x1]
sent [IPCP ConfAck id=0x1]
rcvd [IPCP ConfAck id=0x2 <addr 10.44.165.164> <ms-dns1 120.80.80.80> <ms-dns2 221.5.88.88>]
Could not determine remote IP address: defaulting to 10.64.64.64
not replacing existing default route via 192.168.0.2 with metric -1
local  IP address 10.44.165.164
remote IP address 10.64.64.64
primary   DNS address 120.80.80.80
secondary DNS address 221.5.88.88

root@rk3288w-buildroot:/#
```

Step 3, execute the following to view the network interface status:

```
# ifconfig
```

```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# ifconfig
eth0      Link encap:Ethernet  HWaddr 2E:DE:43:C7:68:7B
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:4929 errors:0 dropped:0 overruns:0 frame:0
          TX packets:374 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:591813 (577.9 KiB)  TX bytes:23085 (22.5 KiB)
          Interrupt:50

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

p2p0      Link encap:Ethernet  HWaddr 0E:CF:89:0A:8D:74
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

ppp0      Link encap:Point-to-Point Protocol
          inet addr:10.44.165.164  P-t-P:10.64.64.64  Mask:255.255.255.255
          UP POINTOPOINT RUNNING NOARP MULTICAST  MTU:1500  Metric:1
          RX packets:4 errors:0 dropped:0 overruns:0 frame:0
          TX packets:4 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:3
          RX bytes:52 (52.0 B)  TX bytes:58 (58.0 B)

wlan0     Link encap:Ethernet  HWaddr 0C:CF:89:0A:8D:74
          inet addr:192.168.0.189  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::1d32:6a79:1095:7f12/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:5214 errors:0 dropped:0 overruns:0 frame:0
          TX packets:101 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:757812 (740.0 KiB)  TX bytes:11318 (11.0 KiB)

root@rk3288w-buildroot:/#
```

Step 4, execute the following to check the connectivity of the detection network:

```
# ping -I ppp0 www.armdesigner.com
```

```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# ping -I ppp0 www.armdesigner.com
PING www.armdesigner.com (8.219.70.131) from 10.44.165.164 ppp0: 56(84) bytes of data.
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=1 ttl=47 time=159 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=2 ttl=47 time=73.1 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=3 ttl=47 time=74.6 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=4 ttl=47 time=63.7 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=5 ttl=47 time=63.3 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=6 ttl=47 time=72.9 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=7 ttl=47 time=65.3 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=8 ttl=47 time=66.4 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=9 ttl=47 time=65.7 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=10 ttl=47 time=66.1 ms
64 bytes from 8.219.70.131 (8.219.70.131): icmp_seq=11 ttl=47 time=66.6 ms
^C
--- www.armdesigner.com ping statistics ---
11 packets transmitted, 11 received, 0% packet loss, time 10016ms
rtt min/avg/max/mdev = 63.310/76.068/159.153/26.539 ms
root@rk3288w-buildroot:/#
```

6.10 GPS(EC20)

Refer to chapter **4G(EC20)** to connect the device and then power on, execute the following command to test GPS:

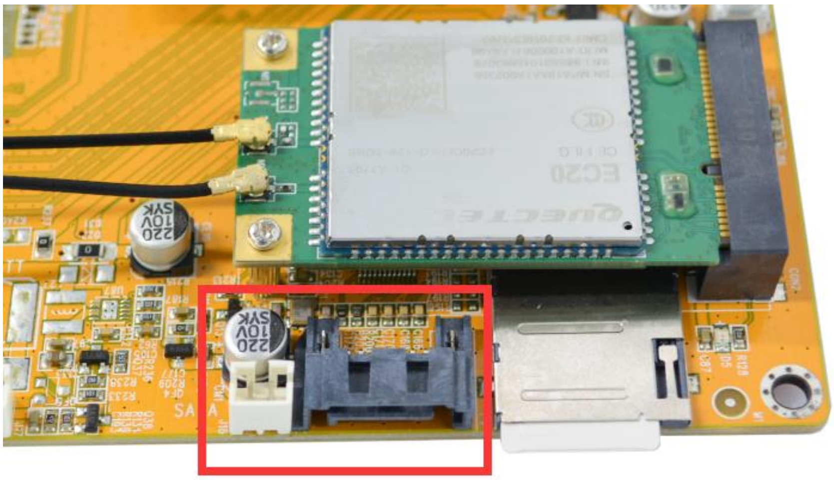
```
# echo -e "AT+QGPS=1\r\n" > /dev/ttyUSB2
```

cat /dev/ttyUSB1

```
root@rk3288w-buildroot:/# echo -e "AT+QGPS=1\r\n" > /dev/ttyUSB2
root@rk3288w-buildroot:/# cat /dev/ttyUSB1
$GPVTG,,T,,M,,N,,K,N*2C
$GPGSA,A,1,,,,,,,,,,,,,,,*1E
$GPGGA,,,,,,0,,,,,,,,*66
$GPRMC,,V,,,,,,,,,,N*53
$GPVTG,,T,,M,,N,,K,N*2C
$GPGSA,A,1,,,,,,,,,,,,,,,*1E
$GPGGA,,,,,,0,,,,,,,,*66
$GPRMC,,V,,,,,,,,,,N*53
$GPVTG,,T,,M,,N,,K,N*2C
$GPGSA,A,1,,,,,,,,,,,,,,,*1E
$GPGGA,,,,,,0,,,,,,,,*66
$GPRMC,,V,,,,,,,,,,N*53
$GPVTG,,T,,M,,N,,K,N*2C
$GPGSA,A,1,,,,,,,,,,,,,,,*1E
$GPGGA,,,,,,0,,,,,,,,*66
$GPRMC,,V,,,,,,,,,,N*53
$GPVTG,,T,,M,,N,,K,N*2C
$GPGSA,A,1,,,,,,,,,,,,,,,*1E
$GPGGA,,,,,,0,,,,,,,,*66
$GPRMC,,V,,,,,,,,,,N*53
$GPVTG,,T,,M,,N,,K,N*2C
$GPGSA,A,1,,,,,,,,,,,,,,,*1E
$GPGGA,,,,,,0,,,,,,,,*66
$GPRMC,,V,,,,,,,,,,N*53
$GPVTG,,T,,M,,N,,K,N*2C
$GPGSA,A,1,,,,,,,,,,,,,,,*1E
```

6.11 SATA

Step 1, connect the SATA and the SATA power to the board.



Step 2, execute the following command to test sata.

ls /dev // view sata device name

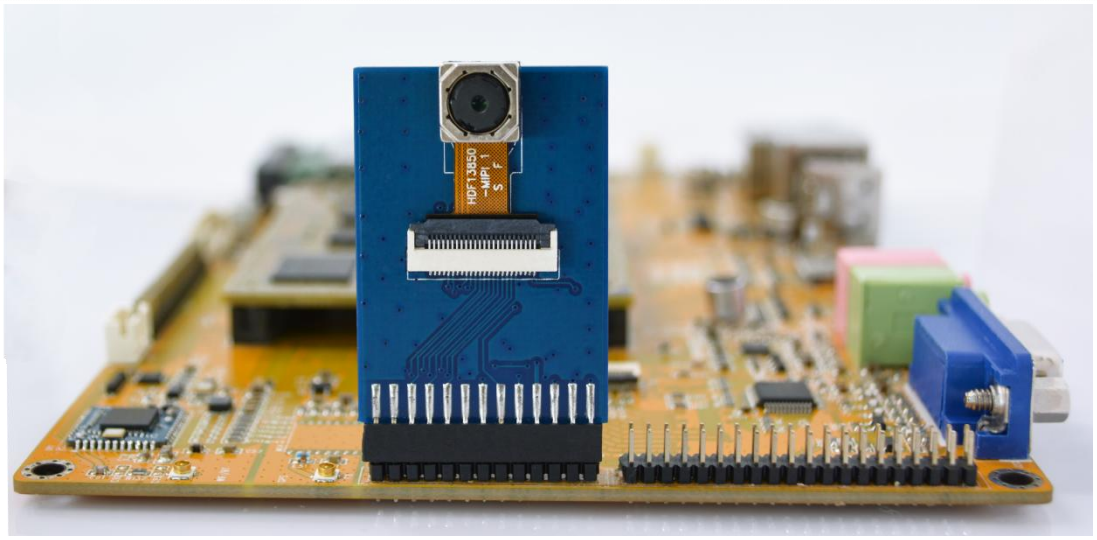
```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# ls /dev
ashmem           i2c-6         mmcblk0rpmb  tty17  tty45    usb-ffs
block            iep           mpp_service  tty18  tty46    usbmon0
bsg              iio:device0   net          tty19  tty47    usbmon1
bus              input         null         tty2   tty48    usbmon2
cec0             kmsg          ppp          tty20  tty49    usbmon3
char             log           ptmx         tty21  tty5     usbmon4
console          loop-control  pts          tty22  tty50    v4l
cpu_dma_latency  loop0         ram0         tty23  tty51    v4l-subdev0
crypto           loop1         random       tty24  tty52    v4l-subdev1
disk             loop2         rfkill       tty25  tty53    v4l-subdev2
dri              loop3         rk_cec       tty26  tty54    vcs
fb0              loop4         rtc          tty27  tty55    vcs1
fd               loop5         rtc0         tty28  tty56    vcsa
full             loop6         sda          tty29  tty57    vcsa1
fuse             loop7         shm          tty3   tty58    vcsu
gpiochip0        mali0         snd          tty30  tty59    vcsu1
gpiochip1        mapper        stderr       tty31  tty6     vhci
gpiochip2        media0        stdin        tty32  tty60    video-camera0
gpiochip3        mem           stdout       tty33  tty61    video-dec0
gpiochip4        mmcblk0       tee0         tty34  tty62    video-enc0
gpiochip5        mmcblk0boot0  teepriv0     tty35  tty63    video0
gpiochip6        mmcblk0boot1  tty          tty36  tty7     video1
gpiochip7        mmcblk0p1     tty0         tty37  tty8     video2
gpiochip8        mmcblk0p2     tty1         tty38  tty9     video3
hdmi_hdcp1x      mmcblk0p3     tty10        tty39  ttyFIQ0  video4
hwrng            mmcblk0p4     tty11        tty4   ttyS0    zero
i2c-0            mmcblk0p5     tty12        tty40  ttyS1    zram0
i2c-1            mmcblk0p6     tty13        tty41  ttyS3
i2c-2            mmcblk0p7     tty14        tty42  uhid
i2c-3            mmcblk0p8     tty15        tty43  uinput
i2c-4            mmcblk0p9     tty16        tty44  urandom
root@rk3288w-buildroot:/#
```

```
# mkdir /mnt/sata        // Create a directory
# mount /dev/sda /mnt/sata/      // mount sata device
# ls /mnt/sata/        // View sata device content
```

```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# mkdir /mnt/sata
root@rk3288w-buildroot:/# mount /dev/sda /mnt/sata/
[  287.082265] EXT4-fs (sda): recovery complete
[  287.086585] EXT4-fs (sda): mounted filesystem with ordered data mode. Opts: (null)
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# ls /mnt/sata/
lost+found  rk3588_buildroot
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root       5.9G  503M  5.2G   9% /
devtmpfs        990M  8.0K  990M   1% /dev
tmpfs           998M  104K  998M   1% /tmp
tmpfs           998M  288K  998M   1% /run
tmpfs           998M   92K  998M   1% /var/log
tmpfs           998M     0  998M   0% /dev/shm
/dev/mmcblk0p8  121M   12M  103M  11% /oem
/dev/mmcblk0p9  722M  305K  703M   1% /userdata
/dev/sda        110G   28K  104G   1% /mnt/sata
root@rk3288w-buildroot:/#
```

6.12 Camera

.*Step 1,* Power on after connecting the camera module (ov13850).



Step 2, check if there are threads in **rkisp_3A_server**, which indicates automatic startup:

```
# pidof rkisp_3A_server        // As shown in the following figure, pidof rkisp_3A_server has started
```

```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# pidof rkisp_3A_server
609
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/#
```

Step 3, if there are no threads, execute the following command to start **rkaiq_3A_server,** if there are already threads, please skip this step. // Multiple processes cannot exist at the same time

```
# /etc/init.d/rkisp_3A.sh start
```

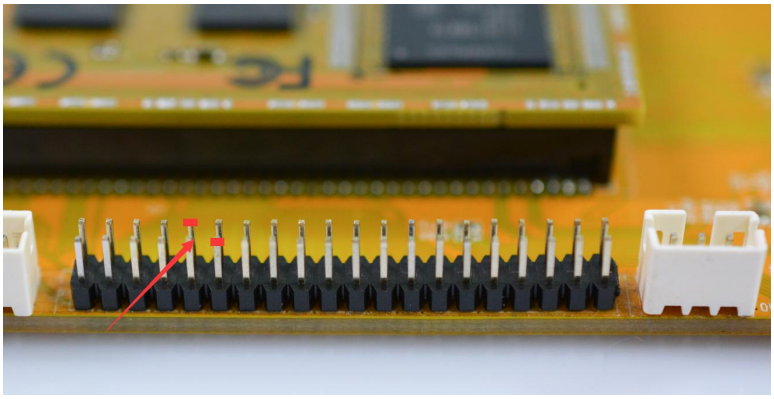
Step 4, execute the following command to open the camera preview mode:

```
# /rockchip-test/camera/camera_rkisp_test.sh
```

```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# /rockchip-test/camera/camera_rkisp_test.sh
Setting pipeline to PAUSED ...
Using mplane plugin for capture
Pipeline is live and does not need PREROLL ...
Pipeline is PREROLLED ...
Setting pipeline to PLAYING ...
New clock: GstSystemClock
[  436.872529] rockchip-mipi-dphy-rx ff968000.mipi-phy-tx1rx1: stream on:1
[  436.881409] rockchip-mipi-dphy-rx: data_rate_mbps 600
Redistribute latency...
0:00:02.8 / 99:99:99.
```

6.13 UART

Step 1, short circuit RX and TX pins of UART.



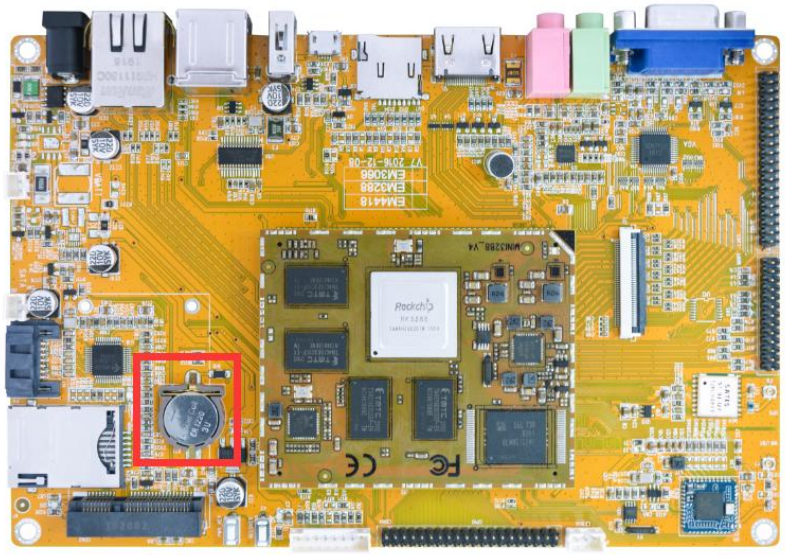
Step 2, UART1 test:

```
# com /dev/ttyS1 115200 8 0 1
```

```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# com /dev/ttyS1 115200 8 0 1
port = /dev/ttyS1
baudrate = 115200
cs = 8
parity = 0
stopb = 1
[  493.928730] dw-apb-uart ff190000.serial: got rx and tx dma channels
oooooo
RECV: oooooo
7
RECV: 7
8
RECV: 8
9
RECV: 9
45454545
RECV: 45454545
pppppp
RECV: pppppp
```

6.14 RTC

Step 1, install the coin cell battery.



Step 2, execute the follow command to set the RTC time:

```
# date -s "2023-11-17 11:37:00"    //use the command date -s "YY-MM-DD hh:mm:ss" to modif the date and time of the system
# hwclock -w          // set RTC from system time
# hwclock
```

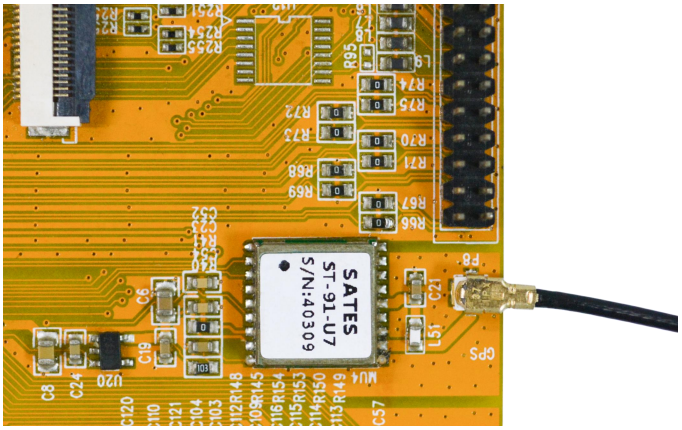
```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# date -s "2023-11-17 11:37:00"
Fri Nov 17 11:37:00 UTC 2023
root@rk3288w-buildroot:/# hwclock -w
root@rk3288w-buildroot:/# hwclock
Fri Nov 17 11:37:28 2023  0.000000 seconds
root@rk3288w-buildroot:/# hwclock
Fri Nov 17 11:37:37 2023  0.000000 seconds
root@rk3288w-buildroot:/# hwclock
Fri Nov 17 11:37:54 2023  0.000000 seconds
root@rk3288w-buildroot:/# hwclock
Fri Nov 17 11:38:08 2023  0.000000 seconds
root@rk3288w-buildroot:/#
```

Step 3, after the power is off, turn on the power after a period of time to check whether the time is saved.

```
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/# hwclock
Fri Nov 17 12:03:19 2023  0.000000 seconds
root@rk3288w-buildroot:/# hwclock
Fri Nov 17 12:03:29 2023  0.000000 seconds
root@rk3288w-buildroot:/# hwclock
Fri Nov 17 12:03:43 2023  0.000000 seconds
root@rk3288w-buildroot:/# hwclock
Fri Nov 17 12:04:03 2023  0.000000 seconds
root@rk3288w-buildroot:/#
root@rk3288w-buildroot:/#
```

6.15 GPS module

Step 1, Connect GPS Antenna.



Step 2, execute the following command to get GPS serial port information:

```
# cat /dev/ttyS3
```

6.16 About video playback

1. If you only need to try the video playback, the script instruction directory is in /rockchip-test/video, just run it.

```
root@linaro-alip:/#
root@linaro-alip:/# ls /rockchip-test/video/
test_dec-gst.sh      test_enc-gst.sh          test_gst_video_maxfps.sh
test_dec-mpv.sh      test_gst_multivideo.sh   video_stresstest.sh
test_dec-parole.sh   test_gst_video.sh        video_test.sh
test_dec-qt.sh       test_gst_video_fps.sh
root@linaro-alip:/#
```

3. Play video using commands:

```
# chromium --no-sandbox xx.mp4
```