

EM3588 Linux6.1 User Manual

V2.0



Boardcon Embedded Design

Overview

The content of this document is intended solely for the EM3588 development board, aiming to help users quickly understand, apply, and test the EM3588 development board.

System Support

Development Board	Debian12	Buildroot
MINI3588 V1 EM3588 V1	Y	Y

Revision History

Version	Date	Author	Revision History
V1.0	2025-08-28	Liu Yuan	Initial version
V2.0	2026-06-04	Xue Junchao	Update Debian12 and Buildroot (rkr7)

Disclaimer

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Content

1.Introduction.....	5
1.1 Overview.....	5
1.2 Product Parameters	5
1.3 Hardware Interface Introduction.....	8
2.Install Drivers and Tool	9
2.1 Install RK Driver Assitant.....	10
2.2 Install CH9102X Driver.....	11
2.2.1 How to Connect the Serial Port Tool	11
2.2.2 Install Driver	11
2.3 Install Serial Terminal Tool.....	12
3.Upgrade Introduction	14
3.1 Upgrade Mode	14
3.1.1 How to Enter Loader Mode	15
3.1.2 How to Enter MaskRom Mode.....	16
3.2 Firmware Flashing	17
3.2.1 Flash Full Firmware Image.....	17
3.2.2 Flash Separate Partition Images.....	19
4.Development Environment	20
4.1 Preparing the Development Environment.....	20
4.2 Installing Libraries and Toolkits	20
5.Compile Source.....	21
6.Debian12 Test	24
6.1 Serial Terminal.....	24
6.2 Display.....	24
6.3 USB Type-C.....	26
6.3.1 ADB	26
6.3.2 Type-C to USB3.0.....	27

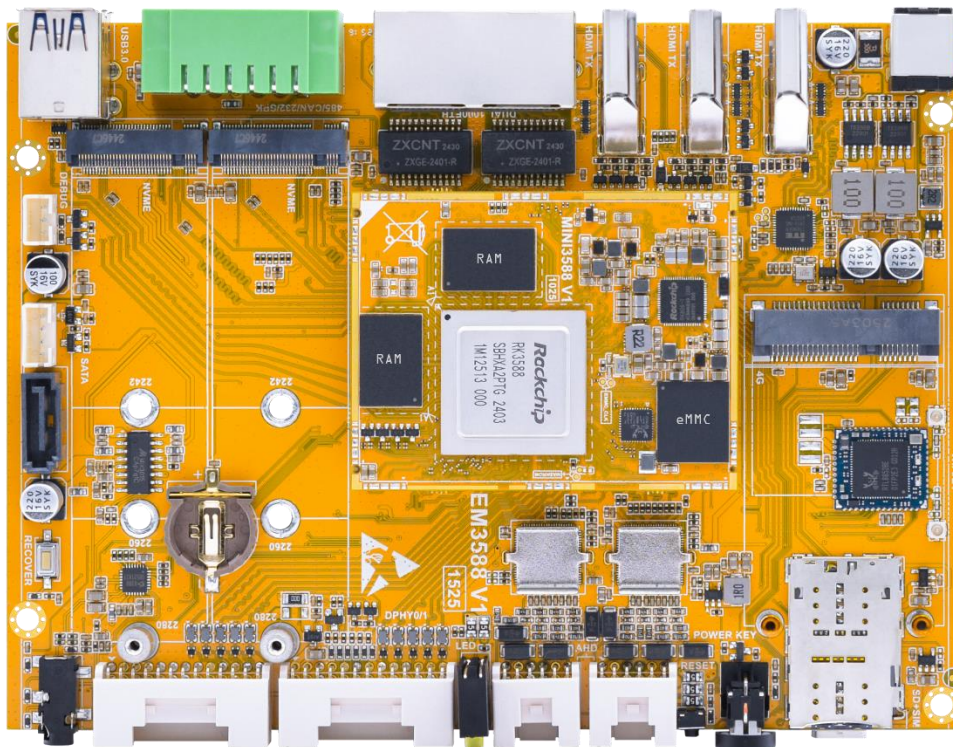
6.3.3 DP Alt Mode	29
6.4 Ethernet.....	30
6.5 USB Host.....	31
6.6 SD Card.....	32
6.7 SATA.....	33
6.8 PCIe M.2 SSD.....	34
6.9 WiFi & Bluetooth.....	36
6.9.1 WiFi	36
6.9.2 Bluetooth.....	38
6.10 4G & GPS	40
6.10.1 4G Test	41
6.10.2 GPS Test.....	43
6.11 Audio.....	43
6.12 RTC.....	44
6.13 RS485.....	45
6.14 CAN.....	47
6.15 RS232.....	49
6.16 Camera	50
6.17 Video Playback	51
7.Buildroot Test.....	55
7.1 Serial Terminal.....	55
7.2 Display	55
7.3 USB Type-C.....	56
7.3.1 ADB	57
7.3.2 Type-C to USB3.0.....	58
7.3.3 DP Alt Mode	59
7.4 Ethernet.....	61
7.5 USB Host	62
7.6 SD Card.....	63

7.7 SATA.....	64
7.8 PCIe M.2 SSD.....	65
7.9 WiFi & Bluetooth.....	65
7.9.1 WiFi	66
7.9.2 Bluetooth.....	69
7.10 4G & GPS	74
7.10.1 4G Test	74
7.10.2 GPS Test.....	76
7.11 Audio	77
7.12 RTC	78
7.13 RS485.....	79
7.14 CAN	80
7.15 RS232.....	82
7.16 Camera	83
7.17 Video Playback	84

1.Introduction

1.1 Overview

The EM3588 is a high-performance, low-power processor platform built on an octa-core 64-bit architecture, featuring four Cortex-A76 and four Cortex-A55 cores. It integrates a powerful NPU with up to 6 TOPS computing power, supports 8K video encoding and decoding, and includes advanced image processing capabilities with a 48MP ISP. The EM3588 provides extensive multimedia support, flexible display interfaces, rich peripheral connectivity, and high-speed communication interfaces, making it ideal for edge computing, intelligent vision systems, industrial control, and other embedded AI applications.



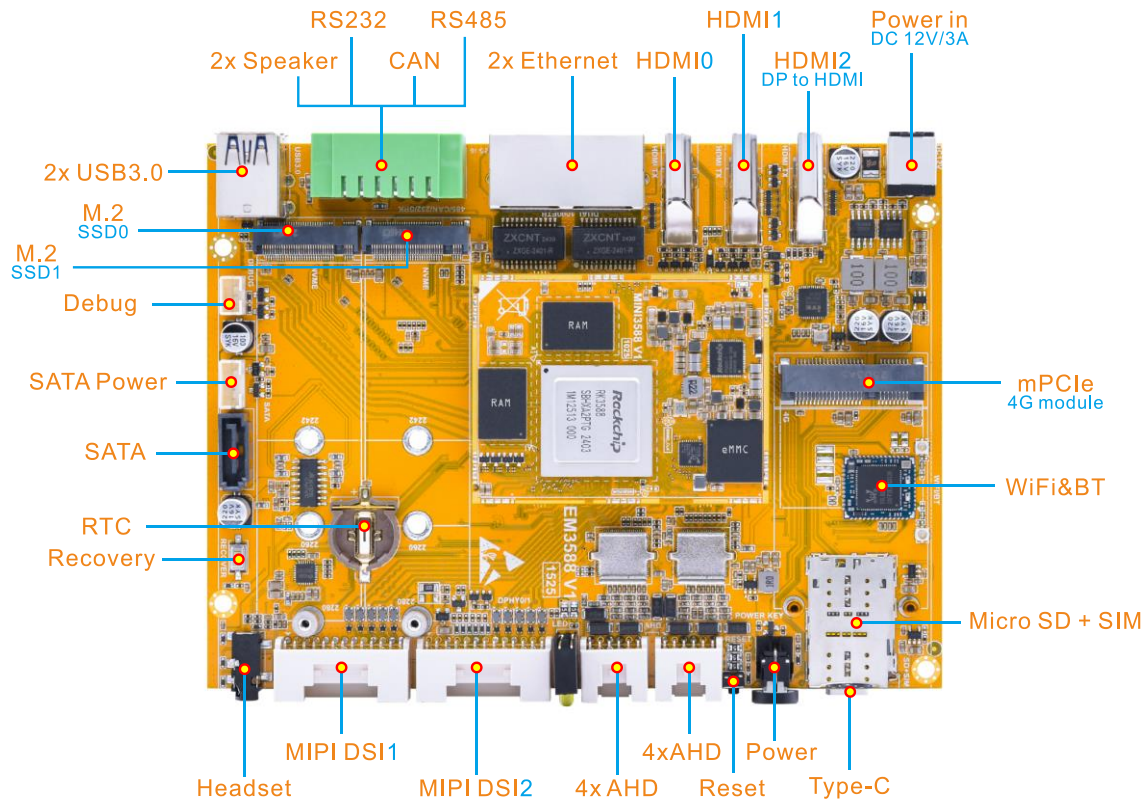
1.2 Product Parameters

Basic Parameters	
SOC	RK3588

CPU		• Octa-core 64-bit architecture: Quad-core Cortex-A76 + Quad-core Cortex-A55
GPU		• ARM Mali-G610 MC4 • OpenGL ES 1.1/2.0/3.2 • Vulkan 1.2 • OpenCL 2.2 • Embedded high performance 2D image acceleration module
NPU		• Up to 6 TOPS AI computing power • Supports int4, int8, int16, FP16, BF16, TF32 operation
Video	Decoder	• Support 8K@60fps H.265/VP9 video decoding • Support 8K@30fps H.264 video decoding • Support 4K@60fps AV1 video decoding • Support 1080P@60fps MPEG-2/MPEG-1/VC-1/VP8 video decoding
	Encoder	• Support H.264/H.265 video encoding, up to 8K@30fps
RAM		8GB LPDDR4X
ROM		32GB eMMC
Support system		Android, Debian, Buildroot
Hardware Parameters		
Extended Storage		• Support 2x M.2 PCIe3.0 SSD • Support 1xSATA3.0 • Support 1x MicroSD Card
Display		• Support 2x HDMI2.1 TX, up to 7680x4320@60fps • Support 1x DP to HDMI2.0, up to 4K@60fps • Support 2x DSI MIPI, up to 4K@60fps • Support 1x DP Alt mode, up to 4K@60fps
Audio		• Support 2x HDMI TX audio output

	• Support 2x DP audio output • Support 1x Stereo speaker output • Support 1x Headphone output/input
USB	• Support 2xUSB3.0 • Support 1x USB3.1 Type-C (ADB/USB3.0/DP)
Network	• Support 2x Gigabit Ethernet • Support 1x WIFI/BT module • Support 1x 4G module
Camera	• Support 8xAHD
Peripheral communication	• Support 1xCAN • Support 1xRS485 • Support 1xRS232
Other parameters	Support 1xDebug, 1xRTC
Electrical Parameters	
Power supply input voltage	12V/3A
RTC input voltage	3V/0.6uA
Operating temperature	0~70°
Storage temperature	-40~85°
Structural Parameters	
Core board dimensions	62mm x 41mm
Motherboard dimensions	155mm x 115mm

1.3 Hardware Interface Introduction



Interface parameters	
Power in DC 12V	12V DC power input interface
HDMI2	DP1 TX to HDMI interface
HDMI1	HDMI TX1 interface
HDMI0	HDMI TX0 interface
2x Ethernet	2x Gigabit Ethernet RJ45 interface
RS485	RS485 communication interface
CAN	CAN communication interface
RS232	RS232 communication interface
2x Speaker	Stereo speaker output via 2x speaker channels (L/R)
2XUSB3.0	2x USB3.0 Host interface
M.2 SSD0	M.2 SSD0 interface

M.2 SSD1	M.2 SSD1 interface
Debug	Debug the serial port
SATA Power	SATA Power interface, 5V
SATA	SATA3.0 interface
RTC	RTC coin cell connector
Recovery	Recovery key
Headset	Headset output/input interface
MIPI DIS1	MIPI0 display interface
MIPI DIS2	MIPI1 display interface
4x AHD	AHD camera interface
4x AHD	AHD camera interface
Reset	Reset key
Power	Power key
Type-C	USB Type-C interface, OTG download interface
Mirco SD + SIM	All-in-one card holder
WIFI&BT	WIFI&Bluetooth module
mPCIe 4G module	4G model interface

2.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 assitant
2	CH9102x	SETUP.EXE	Serial port debugging driver
3	Serial Terminal Tool	SecureCRT.exe	Debugging tool

2.1 Install RK Driver Assitant

Step 1: Open [DriverAssitant_v5.1.1/DriverInstall.exe](#).

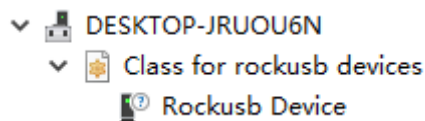
Step 2: To avoid driver conflicts, click “**Uninstall Driver**” to uninstall the driver.



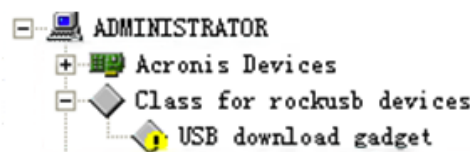
Step 3: Click button “**Install Driver**” to install.



Step 4: After the installation is complete, connect the board and PC with Type_C 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 in the **Device Manager** after the operation in Step 4, user need to proceed to the next step.



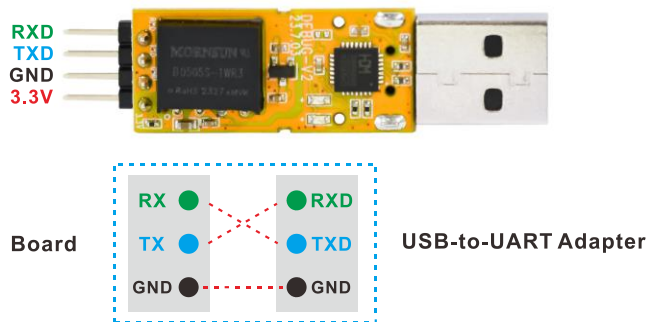
Step 6: The WINDOW will pop up found New Hardware Wizard dialog box, choose to install from the specified location, and then select: [DriverAssitant_v5.1.1/ADBDriver](#).

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



2.2 Install CH9102X Driver

2.2.1 How to Connect the Serial Port Tool



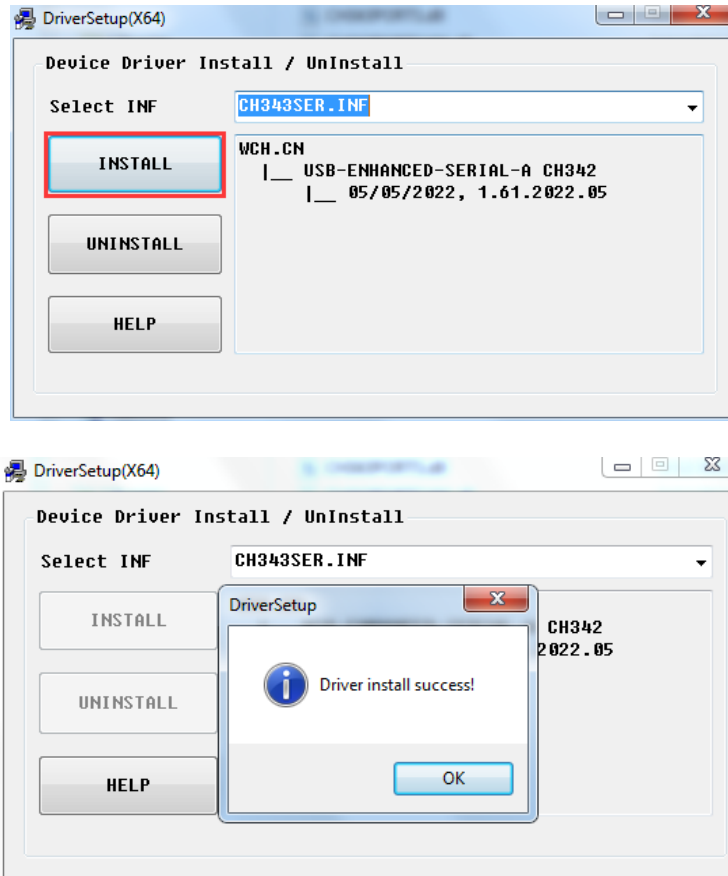
Pin	Connection Description
RXD	Receive, connect to TX pin of the board.
TXD	Transmit, connect to RX pin of the board.
GND	Ground, connect to GND pin of the board.
3V3	No need to connect.

2.2.2 Install Driver

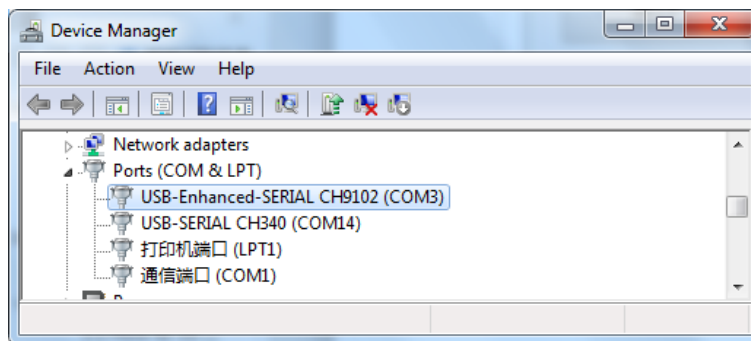
Step 1: Plug the CH9102X Module to the PC

Step 2: Unzip [CH343SER.ZIP](#) on Windows.

Step 3: Select and install the corresponding [SETUP.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.

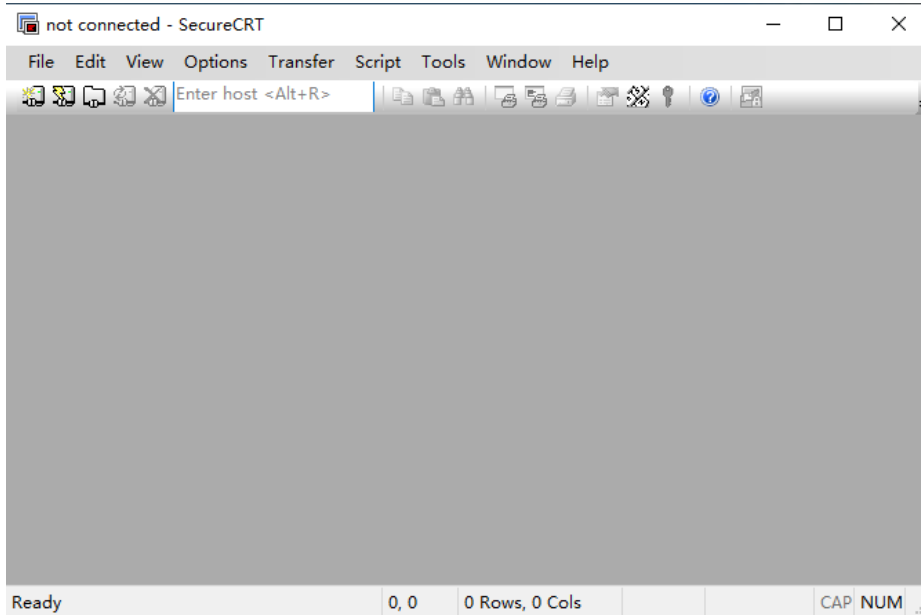


2.3 Install Serial Terminal Tool

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

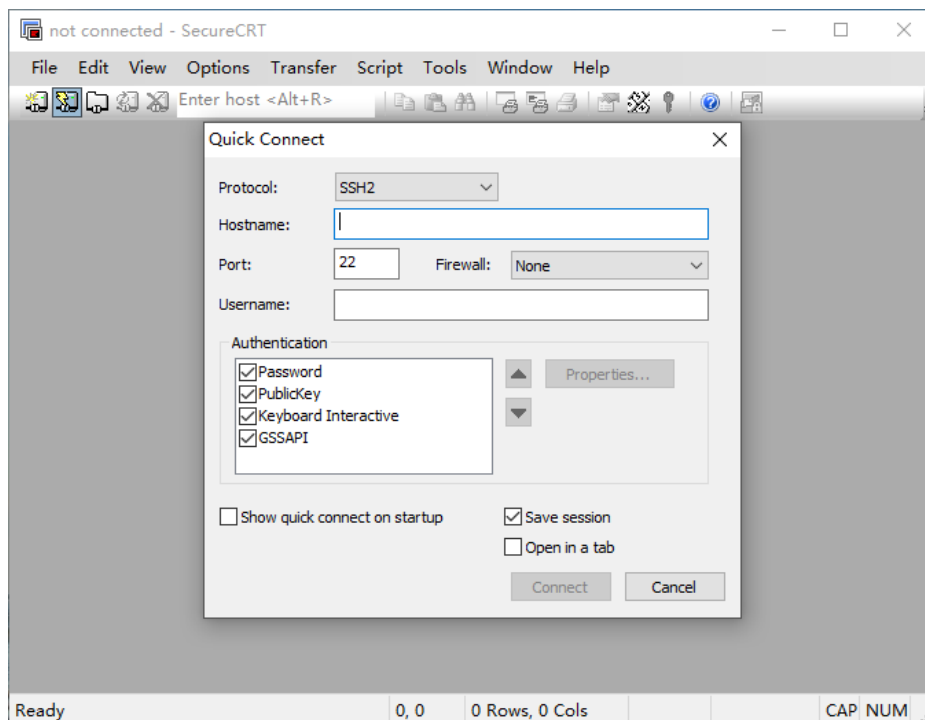
Step 1: Unzip *Platform/SecureCRT.rar* on PC.

Step 2: Click *SecureCRT/SecureCRT.exe* open the SecureCRT.

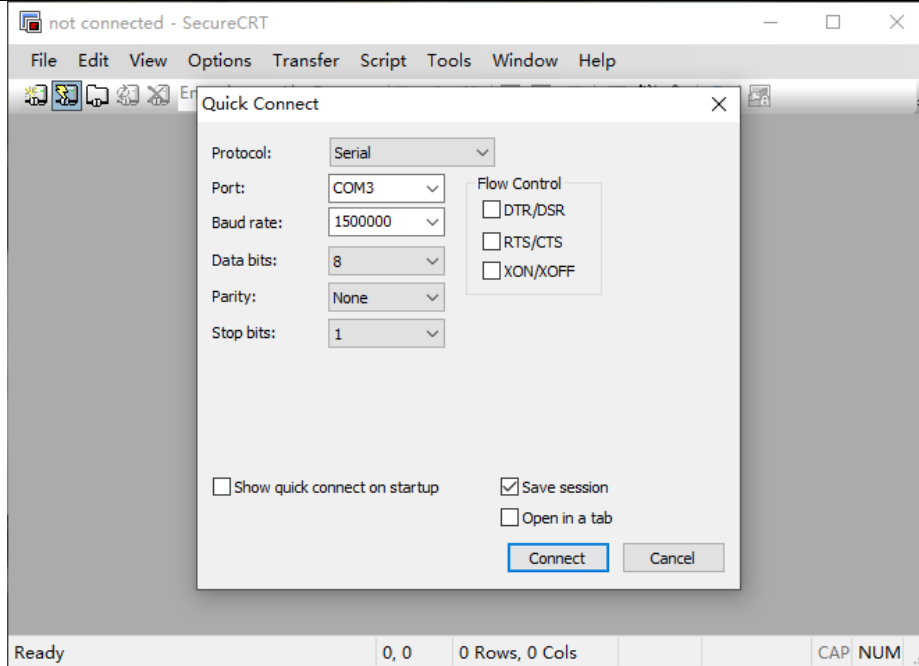


Step 3: Confirm that the CH9102X driver has been installed and the CH9102X module is connecting to the PC.

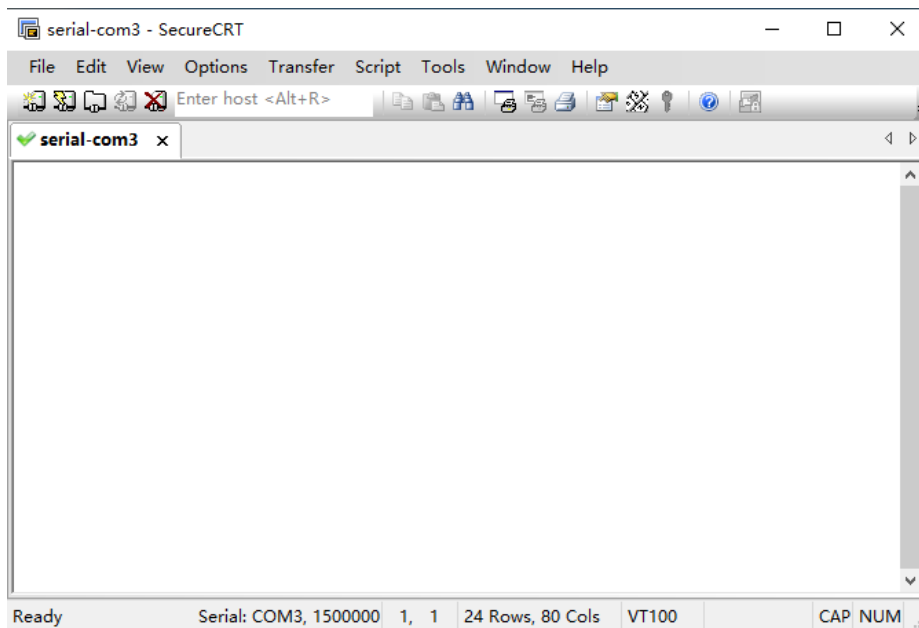
Step 4: Click the “**Quick Connect**” button to go to the Quick Connect configuration screen.



Step 5: Configure as shown in the following figure.



Step 6: After clicking “**Connect**” button, the terminal serial interface will be successfully accessed.



3.Upgrade Introduction

3.1 Upgrade Mode

The firmware can be upgraded via USB cable in two modes:

1. Loader Mode:

The standard mode used for firmware upgrades.

2. MaskRom Mode:

A last-resort mode used when the device is bricked. Entering MaskRom mode requires hardware manipulation, which involves certain risks. It should only be attempted if Loader mode is unavailable.

• Prerequisite

Before upgrading the firmware via USB cable, ensure that the necessary drivers are installed. For installation instructions, refer to the section [Install RK Driver Assistant](#).

3.1.1 How to Enter Loader Mode

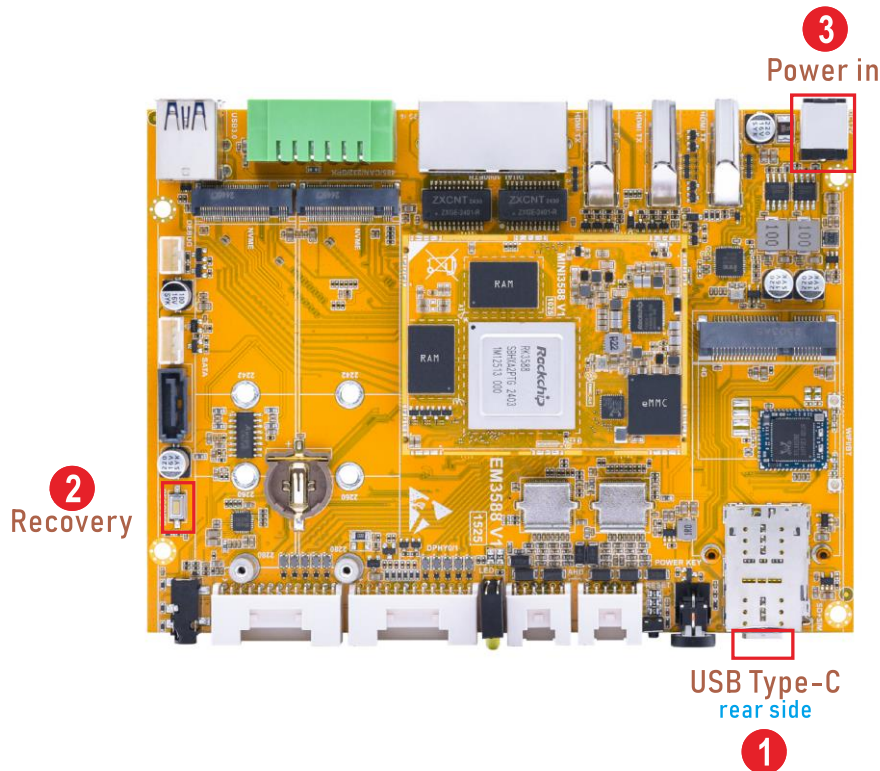
3.1.1.1 Hardware

Step 1: Disconnect the power adapter.

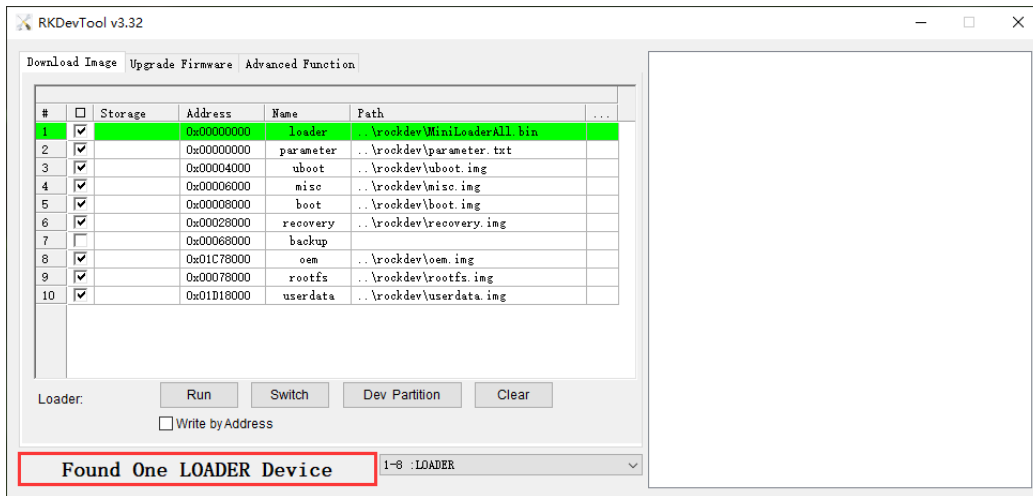
Step 2: Connect one end of the Type_C cable to the host and the other end to the development board.

Step 3: Press and hold the **Recovery** button on the board

Step 4: Connect the power supply.



Step 5: After a few seconds, release the **Recovery** button when the flashing tool shows **“Found one LOADER Device”**.



3.1.1.2 Software

After connecting the Type_C USB cable, execute the following command in the serial debug terminal or adb shell.

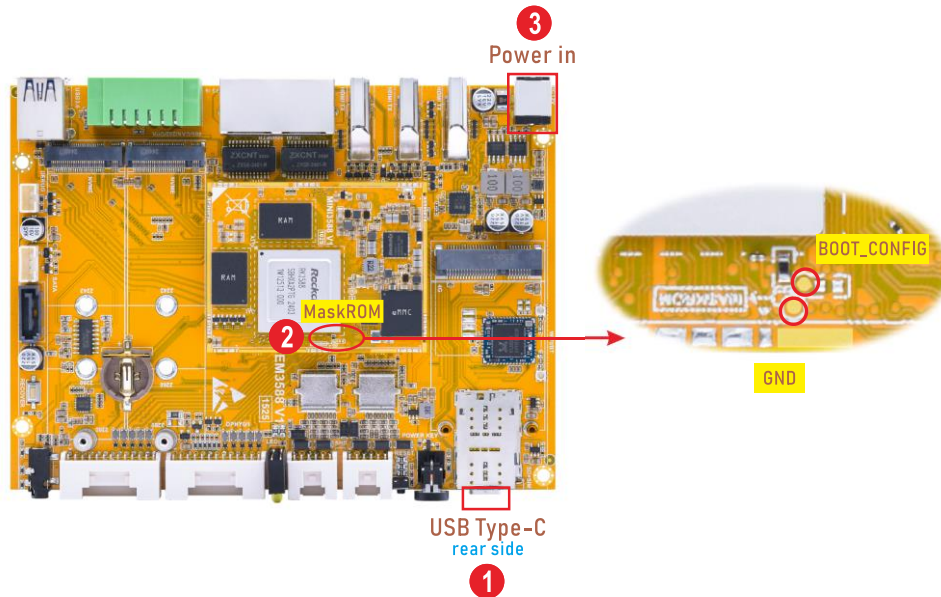
```
# reboot loader
```

3.1.2 How to Enter MaskRom Mode

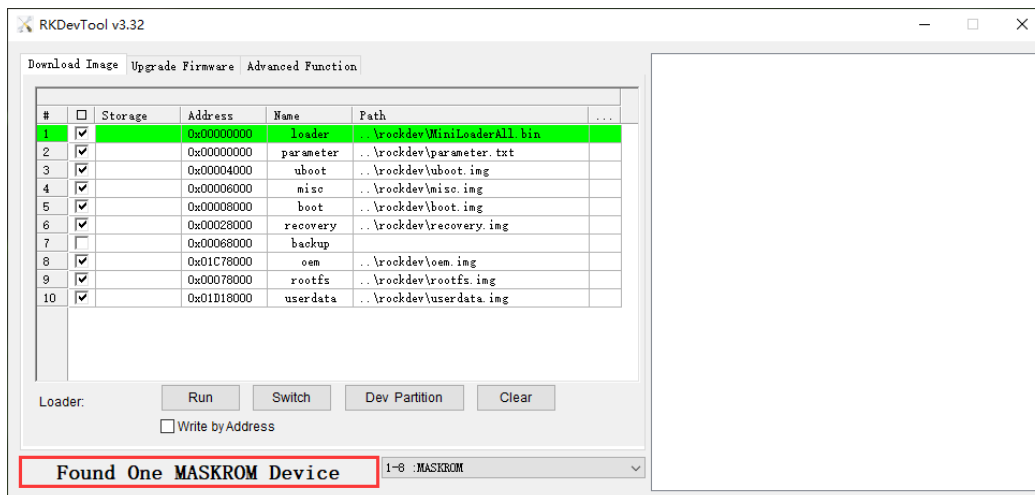
Step 1: Disconnect the power adapter.

Step 2: Connect one end of the Type_C cable to the host and the other end to the development board.

Step 3: Use tweezers to short the two test points on the CM3588.



Step 4: After connecting the power cable, the device will enter MaskRom mode.



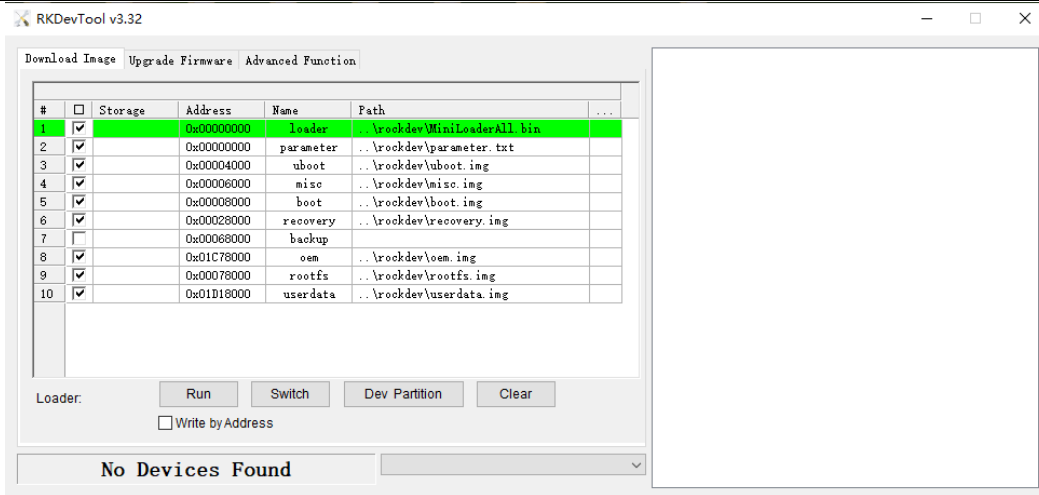
3.2 Firmware Flashing

Environment: Windows OS (Operating System).

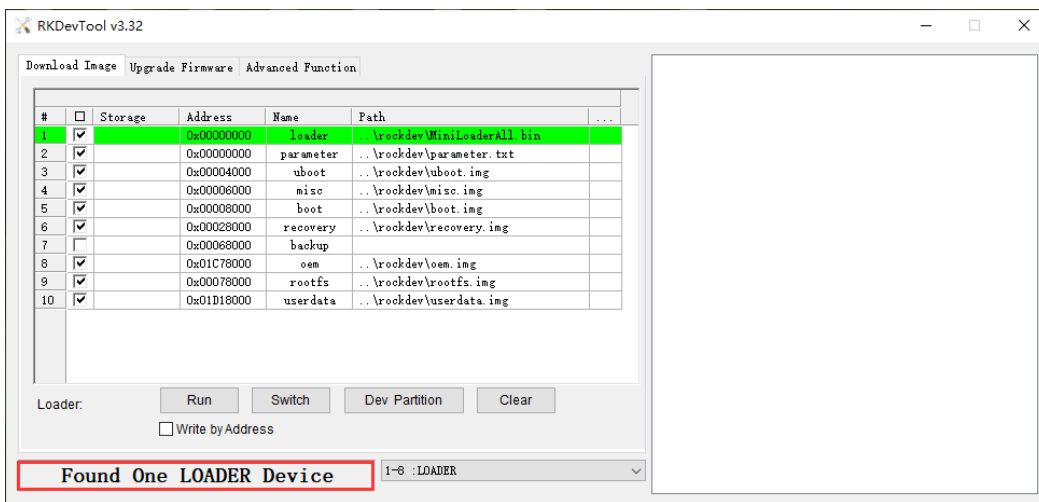
3.2.1 Flash Full Firmware Image

Step 1: Unzip *RKDevTool.rar* on Windows.

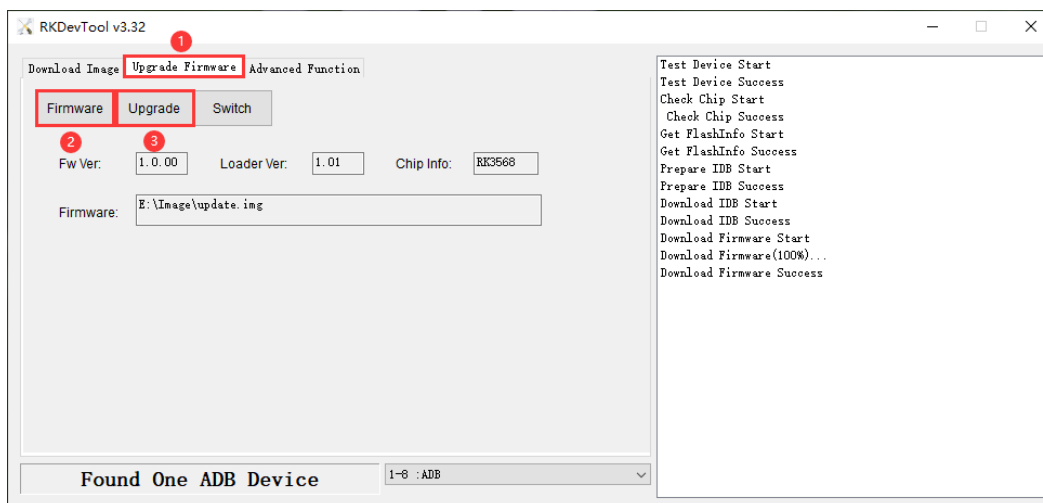
Step 2: Open *RKDevTool\RKDevTool_Release\RKDevTool.exe*.



Step 3: Switch to loader mode. ([How to Enter Loader Mode](#))



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



After the flashing is complete, the board will automatically reboot.

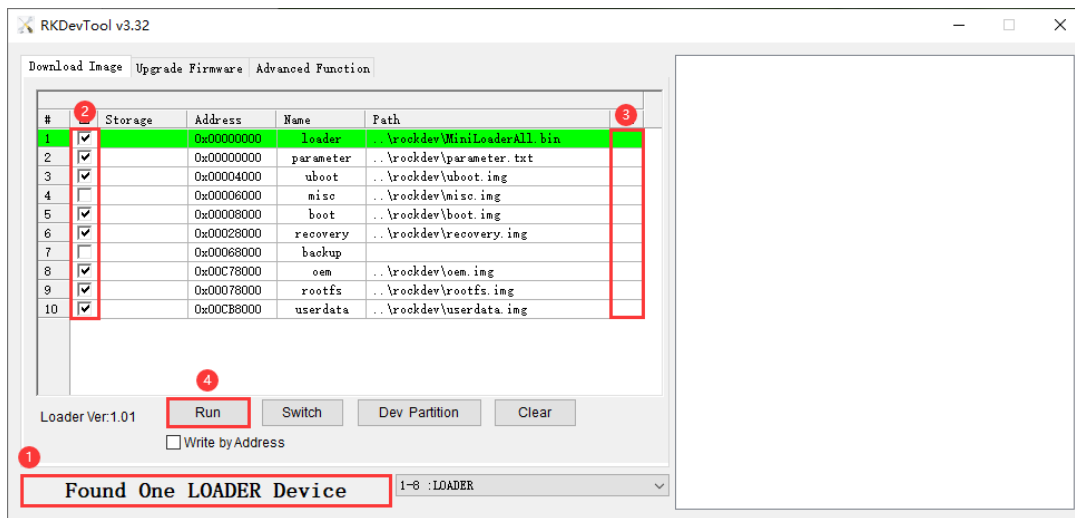
3.2.2 Flash Separate Partition Images

Step 1: Switch to **Loader mode**.

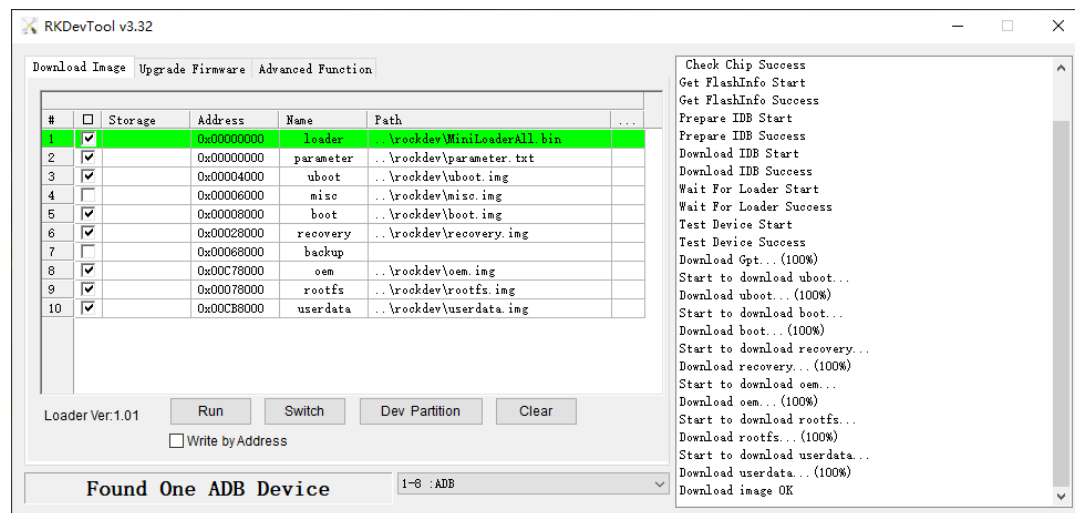
Step 2: Check the partitions to be flashed, multiple partitions can be selected.

Step 3: Ensure the image file path is correct. If necessary, click the blank cell next to the path to reselect it.

Step 4: Click the **Run** button to flash the image.



After the flashing is complete, the board will automatically reboot.



4. Development Environment

4.1 Preparing the Development Environment

It is recommended to use Ubuntu 22.04 or higher version for compilation. If you encounter an error during compilation, user can check the error message and install the corresponding software packages accordingly. Other Linux 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 200G. If you do multiple builds, you will need more hard drive space.	Ubuntu 22.04

4.2 Installing Libraries and Toolkits

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	Network	Permission
Ubuntu 22.04	online	root

To install the required tools, execute the following commands:

```
$ sudo apt-get install git ssh make gcc libssl-dev liblz4-tool libmpc-dev
$ sudo apt-get install expect g++ patchelf chrpath gawk texinfo chrpath diffstat
$ sudo apt-get install binfmt-support live-build bison flex fakeroot libgmp-dev
$ 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 python-is-python3
```

5.Compile Source

Step 1: Unzip the Source

To extract the source files, execute the following commands:

```
$ tar xvf rk3588-linux6.1-rkr7.tar.bz2
$ cd rk3588-linux6.1-rkr7
```

Step 2: Configure the Compiled Board

To configure the board, execute:

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

After executing **./build.sh lunch**, the system will list available defconfig files. Select the 2th option: **2. boardcon_em3588_defconfig**, this configuration ensures hardware compatibility with the EM3588 development board. Using other options may cause kernel mismatches and prevent proper booting.

```
xuejunchao@boardcon:~/3588/rk3588-linux6.1-rkr7$ ./build.sh lunch
Log colors: message notice warning error fatal

Log saved at /home/xuejunchao/3588/rk3588-linux6.1-rkr7/output/sessions/2026-06-04_18-04-14
Pick a defconfig:

1. rockchip_defconfig
2. boardcon_em3588_defconfig
3. boardcon_idea3588_defconfig
4. boardcon_sbc3588_defconfig
5. rockchip_rk3588_evb10_v10_defconfig
6. rockchip_rk3588_evb1_lp4_v10_amp_defconfig
7. rockchip_rk3588_evb1_lp4_v10_defconfig
8. rockchip_rk3588_evb1_lp4_v10_mcu_defconfig
9. rockchip_rk3588_evb7_v11_defconfig
10. rockchip_rk3588_ipc_evb1_v10_defconfig
11. rockchip_rk3588_ipc_evb7_lp4_v11_defconfig
12. rockchip_rk3588_multi_ipc_evb1_v10_defconfig
13. rockchip_rk3588s_evb1_lp4x_v10_defconfig
Which would you like? [1]: 2
Switching to defconfig: /home/xuejunchao/3588/rk3588-linux6.1-
rkr7/device/rockchip/.chip/boardcon_em3588_defconfig
#
# configuration written to /home/xuejunchao/3588/rk3588-linux6.1-rkr7/output/.config
#
Using last kernel version(6.1)
```

Step 3: Compile U-Boot

To compile uboot, execute the following command:

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

Step 4: Compile Kernel

To compile kernel, execute the following command:

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

Step 5: Compile Recovery

To compile recovery, execute the following command:

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

Step 6: Compile rootfs

(1) Compile Debian12 (Permission: root)

To compile debian12, execute the following command:

```
$ sudo ./build.sh debian
```

After compilation, a **linaro-rootfs.img** is generated in the *debian/* directory.

Note: Related dependencies must be installed beforehand.

```
$ 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
```

(2) Compile Buildroot

To compile buildroot, execute the following command:

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

Step 7: Generate and Check Firmwares

To generate firmware, execute the following command:

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

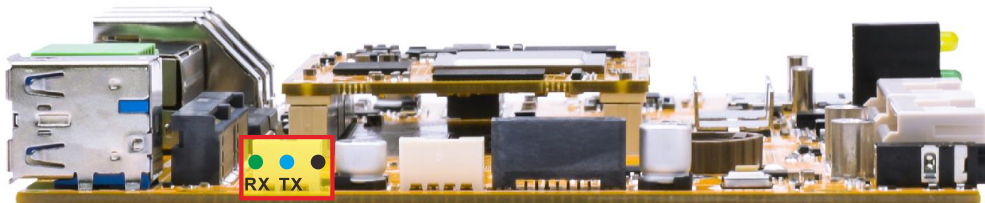
Images and **update.img** are generated in *rockdev/* directory.

6. Debian12 Test

Account: linaro

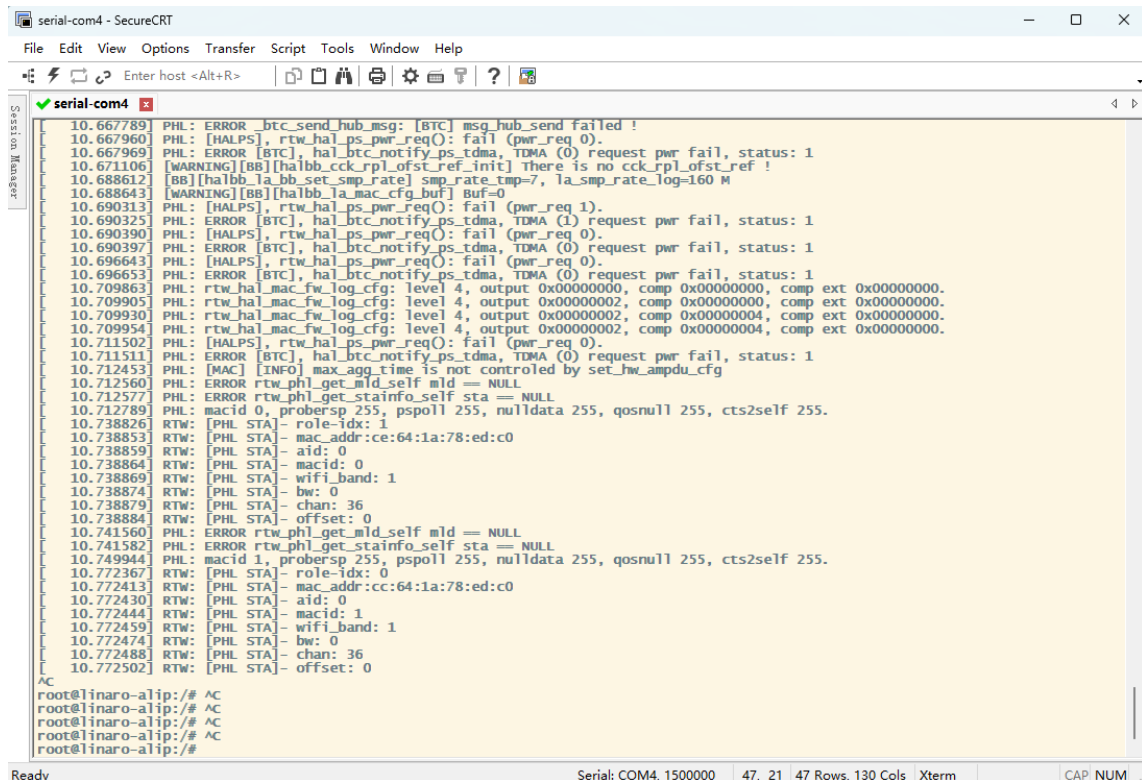
Password: linaro

6.1 Serial Terminal



Debug

Connect the board and PC with USB Serial cable, then power on, the terminal will output boot information. The default baudrate is 1500000.



```

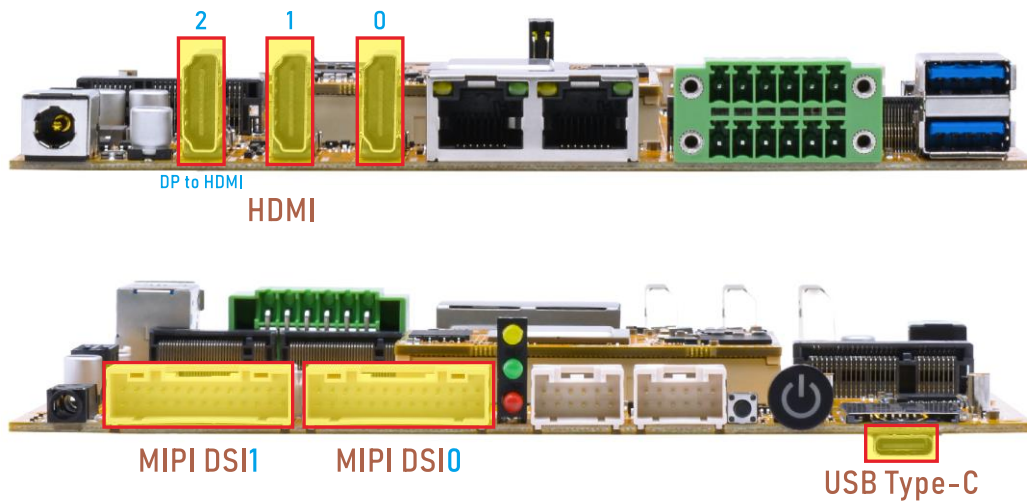
10.667789 PHL: ERROR btc_send_hub_msg: [BTC] msg_hub_send failed !
10.667960 PHL: [HALPS], rtw_hal_ps_pwr_req(): fail (pwr_req 0).
10.667969 PHL: ERROR [BTC], hal_btc_notify_ps_tdma, TDMA (0) request pwr fail, status: 1
10.671106 [WARNING][BB][halbb_cck_rpl_ofst_ref_init] there is no cck_rpl_ofst_ref !
10.688612 [BB][halbb_la_bb_set_smp_rate] smp_rate_tmp=7, la_smp_rate_log=160 M
10.688643 [WARNING][BB][halbb_la_mac_cfg_buf] Buf=0
10.690313 PHL: [HALPS], rtw_hal_ps_pwr_req(): fail (pwr_req 1).
10.690325 PHL: [HALPS], hal_btc_notify_ps_tdma, TDMA (1) request pwr fail, status: 1
10.690390 PHL: [HALPS], rtw_hal_ps_pwr_req(): fail (pwr_req 0).
10.690397 PHL: ERROR [BTC], hal_btc_notify_ps_tdma, TDMA (0) request pwr fail, status: 1
10.696643 PHL: [HALPS], rtw_hal_ps_pwr_req(): fail (pwr_req 0).
10.696653 PHL: ERROR [BTC], hal_btc_notify_ps_tdma, TDMA (0) request pwr fail, status: 1
10.709863 PHL: rtw_hal_mac_fw_log_cfg: level 4, output 0x00000000, comp 0x00000000, comp ext 0x00000000.
10.709905 PHL: rtw_hal_mac_fw_log_cfg: level 4, output 0x00000002, comp 0x00000000, comp ext 0x00000000.
10.709930 PHL: rtw_hal_mac_fw_log_cfg: level 4, output 0x00000002, comp 0x00000004, comp ext 0x00000000.
10.709954 PHL: rtw_hal_mac_fw_log_cfg: level 4, output 0x00000002, comp 0x00000004, comp ext 0x00000000.
10.711502 PHL: [HALPS], rtw_hal_ps_pwr_req(): fail (pwr_req 0).
10.711511 PHL: ERROR [BTC], hal_btc_notify_ps_tdma, TDMA (0) request pwr fail, status: 1
10.712453 PHL: [MAC] [INFO] max_agg_time is not controlled by set_hw_ampdu_cfg
10.712560 PHL: ERROR rtw_phl_get_mld_self mld = NULL
10.712577 PHL: ERROR rtw_phl_get_sta_info_self sta = NULL
10.712789 PHL: macid 0, probersp 255, pspoll 255, nulldata 255, qosnull 255, cts2self 255.
10.738826 RTW: [PHL STA]- role-idx: 1
10.738853 RTW: [PHL STA]- mac_addr: ce:64:1a:78:ed:c0
10.738859 RTW: [PHL STA]- aid: 0
10.738864 RTW: [PHL STA]- macid: 0
10.738869 RTW: [PHL STA]- wlan_bond: 1
10.738874 RTW: [PHL STA]- bw: 0
10.738879 RTW: [PHL STA]- chan: 36
10.738884 RTW: [PHL STA]- offset: 0
10.741560 PHL: ERROR rtw_phl_get_mld_self mld = NULL
10.741582 PHL: ERROR rtw_phl_get_sta_info_self sta = NULL
10.749944 PHL: macid 1, probersp 255, pspoll 255, nulldata 255, qosnull 255, cts2self 255.
10.772367 RTW: [PHL STA]- role-idx: 0
10.772413 RTW: [PHL STA]- mac_addr: cc:64:1a:78:ed:c0
10.772430 RTW: [PHL STA]- aid: 0
10.772444 RTW: [PHL STA]- macid: 1
10.772459 RTW: [PHL STA]- wlan_bond: 1
10.772474 RTW: [PHL STA]- bw: 0
10.772488 RTW: [PHL STA]- chan: 36
10.772502 RTW: [PHL STA]- offset: 0
AC
root@linaro-alip:/# AC
root@linaro-alip:/# AC
root@linaro-alip:/# AC
root@linaro-alip:/# AC
root@linaro-alip:/# AC

```

6.2 Display

The EM3588 Linux system supports simultaneous output to up to four displays. With six

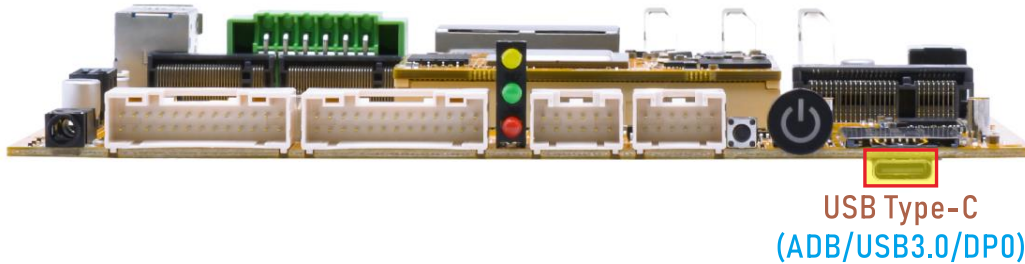
available display interfaces, users can freely choose and configure them as needed.



The display effect diagram is as follows:



6.3 USB Type-C

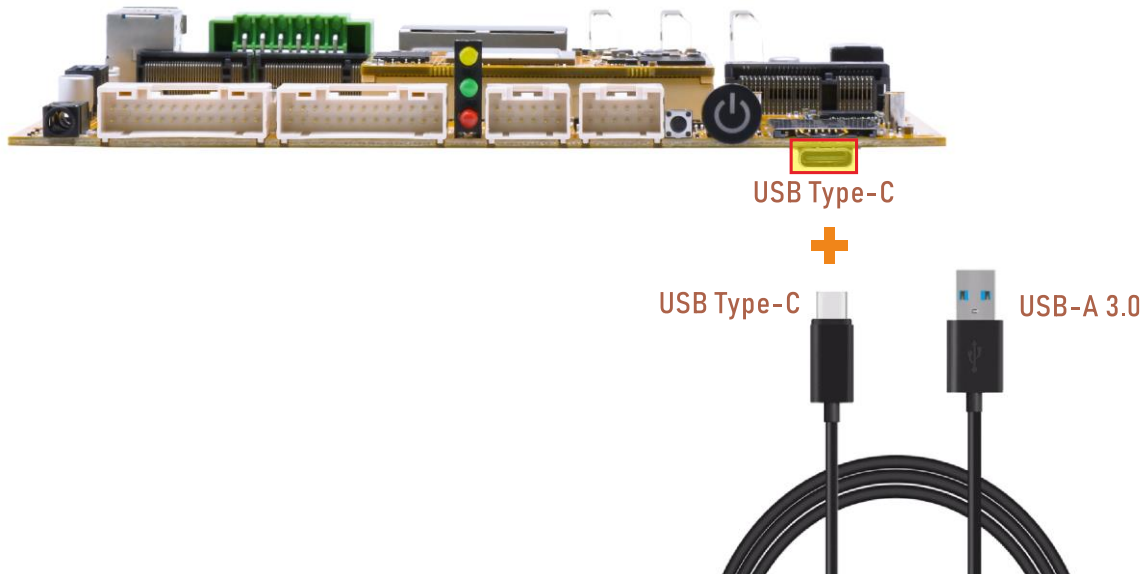


Features Supported by the Type-C Interface:

- **Reversible Design:** Allows insertion in either orientation for user convenience.
- **Data Transmission Roles:** Supports flexible designation of host and device roles.
- **Multiple Protocol Support:** Compatible with USB 3.0 and DisplayPort, enabling high-speed data transmission.

6.3.1 ADB

Step 1: Connect the board and PC host with Type-C cable.



Step 2: Install ADB driver on Windows system.

Step 3: Press **Windows + R** to open the Run program. Type “cmd” and press Enter.

Step 4: Execute the following command to enable ADB.

```
# adb shell
```

```

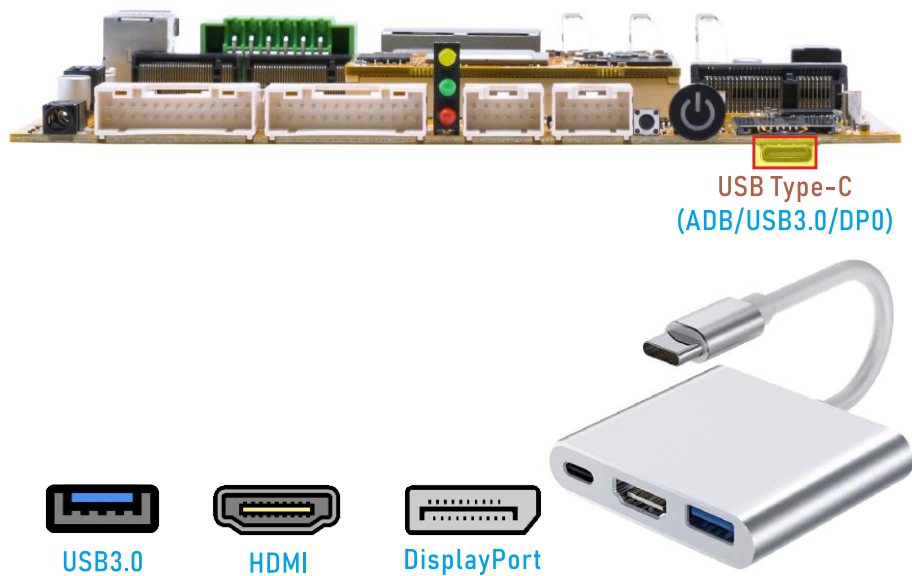
C:\WINDOWS\system32\cmd. X + v
Microsoft Windows [版本 10.0.26200.8457]
(c) Microsoft Corporation. 保留所有权利。

C:\Users\28675>adb shell
* daemon not running; starting now at tcp:5037
* daemon started successfully
root@linaro-alip:/#

```

6.3.2 Type-C to USB3.0

Step 1: Connect the Type-C to USB3.0 converter to the Type-C port of the development board, and then insert the USB3.0 flash drive into the USB3.0 port of the docking station.

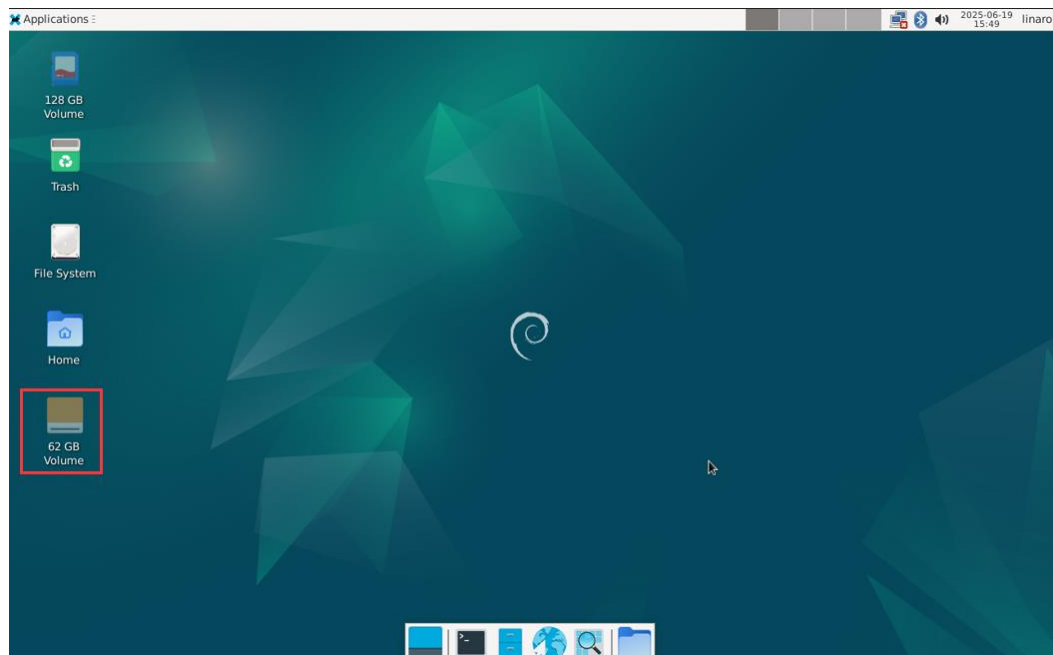


The serial port of the terminal will display the following message, indicating that the USB3.0 device is successfully recognized.

```

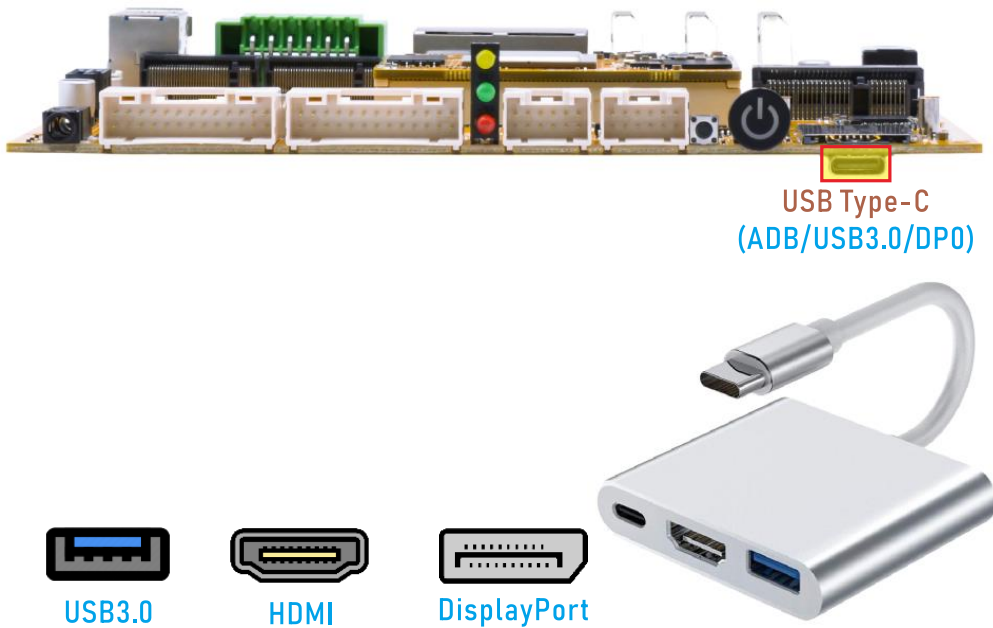
root@linaro-alip:/# [ 460.419122] dwc3 fc000000.usb: request 0000000015ae04ea was not queued to ep0out
[ 460.419223] android_work: did not send uevent (0 0 0000000000000000)
[ 460.528667] xhci-hcd xhci-hcd.15.auto: xHCI Host Controller
[ 460.529167] xhci-hcd xhci-hcd.15.auto: new USB bus registered, assigned bus number 9
[ 460.529342] xhci-hcd xhci-hcd.15.auto: hcc params 0x0220fe64 hci version 0x110 quirks
0x0000808002010010
[ 460.529389] xhci-hcd xhci-hcd.15.auto: irq 87, io mem 0xfc000000
[ 460.529539] xhci-hcd xhci-hcd.15.auto: xHCI Host Controller
[ 460.530014] xhci-hcd xhci-hcd.15.auto: new USB bus registered, assigned bus number 10
[ 460.530039] xhci-hcd xhci-hcd.15.auto: Host supports USB 3.0 SuperSpeed
[ 460.530187] usb usb9: New USB device found, idVendor=1d6b, idProduct=0002, bcdDevice= 6.01
[ 460.530206] usb usb9: New USB device strings: Mfr=3, Product=2, SerialNumber=1
[ 460.530220] usb usb9: Product: xHCI Host Controller
[ 460.530233] usb usb9: Manufacturer: Linux 6.1.99 xhci-hcd
[ 460.530245] usb usb9: SerialNumber: xhci-hcd.15.auto
[ 460.530726] hub 9-0:1.0: USB hub found
[ 460.530753] hub 9-0:1.0: 1 port detected
[ 460.530988] usb usb10: We don't know the algorithms for LPM for this host, disabling LPM.
[ 460.531049] usb usb10: New USB device found, idVendor=1d6b, idProduct=0003, bcdDevice= 6.01
[ 460.531060] usb usb10: New USB device strings: Mfr=3, Product=2, SerialNumber=1
[ 460.531069] usb usb10: Product: xHCI Host Controller
[ 460.531078] usb usb10: Manufacturer: Linux 6.1.99 xhci-hcd
[ 460.531086] usb usb10: SerialNumber: xhci-hcd.15.auto
[ 460.531342] hub 10-0:1.0: USB hub found
[ 460.531362] hub 10-0:1.0: 1 port detected
[ 460.864720] usb 10-1: new SuperSpeed USB device number 2 using xhci-hcd
[ 460.896639] usb 10-1: New USB device found, idVendor=0dd8, idProduct=3b00, bcdDevice= 0.02
[ 460.896681] usb 10-1: New USB device strings: Mfr=1, Product=2, SerialNumber=3
[ 460.896697] usb 10-1: Product: OnlyDisk
[ 460.896710] usb 10-1: Manufacturer: Netac
[ 460.896723] usb 10-1: SerialNumber: C0E8BFA3EC38F796
[ 460.899571] usb-storage 10-1:1.0: USB Mass Storage device detected
[ 460.900842] scsi host1: usb-storage 10-1:1.0
[ 462.153786] scsi 1:0:0:0: Direct-Access Netac OnlyDisk 8.01 PQ: 0 ANSI: 6
[ 462.158525] sd 1:0:0:0: [sda] 121610240 512-byte logical blocks: (62.3 GB/58.0 GiB)
[ 462.159114] sd 1:0:0:0: [sda] Write Protect is off
[ 462.159509] sd 1:0:0:0: [sda] Write cache: disabled, read cache: enabled, doesn't support DPO or FUA
[ 462.167172] sda: sda1
[ 462.167540] sd 1:0:0:0: [sda] Attached SCSI removable disk
  
```

Step 2: After inserting the USB3.0 flash drive, if it is recognized successfully, an icon will appear on the desktop. Users need to click the icon in order to access the files on the USB3.0 flash drive.



6.3.3 DP Alt Mode

DisplayPort Alternate Mode (DP Alt Mode) is a technology that facilitates the transmission of DisplayPort video signals through a USB Type-C interface. It enables devices to output video and audio via a USB-C connection without requiring a dedicated DisplayPort connector. This allows users to connect a display using a single USB-C port while transmitting video, audio, and additional data.



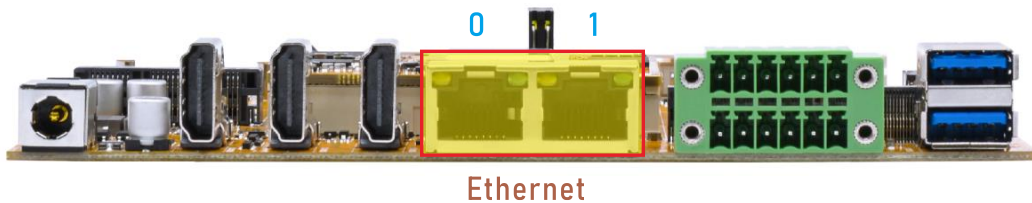
Currently, Boardcon has conducted the following output tests:

- **Type-C to HDMI:** Supports 3840x2160p60 resolution.
- **Type-C to DisplayPort (DP):** Supports 3840x2160p60 resolution.



6.4 Ethernet

Step 1: Connect the network cable to the Ethernet port.



According to the log, it can be seen that the Gigabit Ethernet recognition is successful.

```
root@linaro-alip:/# [ 257.097915] rk_gmac-dwmac fe1c0000.ethernet end1: Link is Up - 1Gbps/Full - flow control rx/tx
[ 257.097991] IPv6: ADDRCONF(NETDEV_CHANGE): end1: link becomes ready
[ 264.756122] systemd-journald[312]: Time jumped backwards, rotating.
[ 272.298291] rk_gmac-dwmac fe1b0000.ethernet eth0: Link is Up - 1Gbps/Full - flow control rx/tx
[ 272.298402] IPv6: ADDRCONF(NETDEV_CHANGE): eth0: link becomes ready
```

Step 2: View network interface information.

```
# ifconfig
```

```

root@linaro-alip:~# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.0.55 netmask 255.255.255.0 broadcast 192.168.0.255
    inet6 fe80::f9cb:8340:3cf4:22e2 prefixlen 64 scopeid 0x20<link>
    ether 56:0d:96:f9:98:96 txqueuelen 1000 (Ethernet)
    RX packets 567 bytes 60814 (59.3 KiB)
    RX errors 0 dropped 68 overruns 0 frame 0
    TX packets 15 bytes 1556 (1.5 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device interrupt 75

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.0.152 netmask 255.255.255.0 broadcast 192.168.0.255
    inet6 fe80::2664:e8eb:922f:5e8d prefixlen 64 scopeid 0x20<link>
    ether 5a:0d:96:f9:98:96 txqueuelen 1000 (Ethernet)
    RX packets 779 bytes 80883 (78.9 KiB)
    RX errors 0 dropped 79 overruns 0 frame 0
    TX packets 172 bytes 15392 (15.0 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device interrupt 73
  
```

Step 3: Network connection test.

```

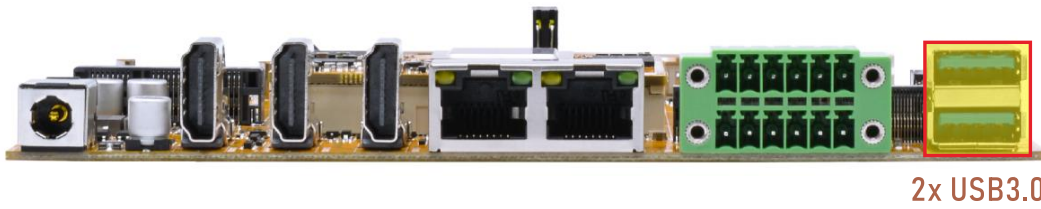
# ping -I eth0 www.armdesigner.com
# ping -I eth1 www.armdesigner.com
  
```

```

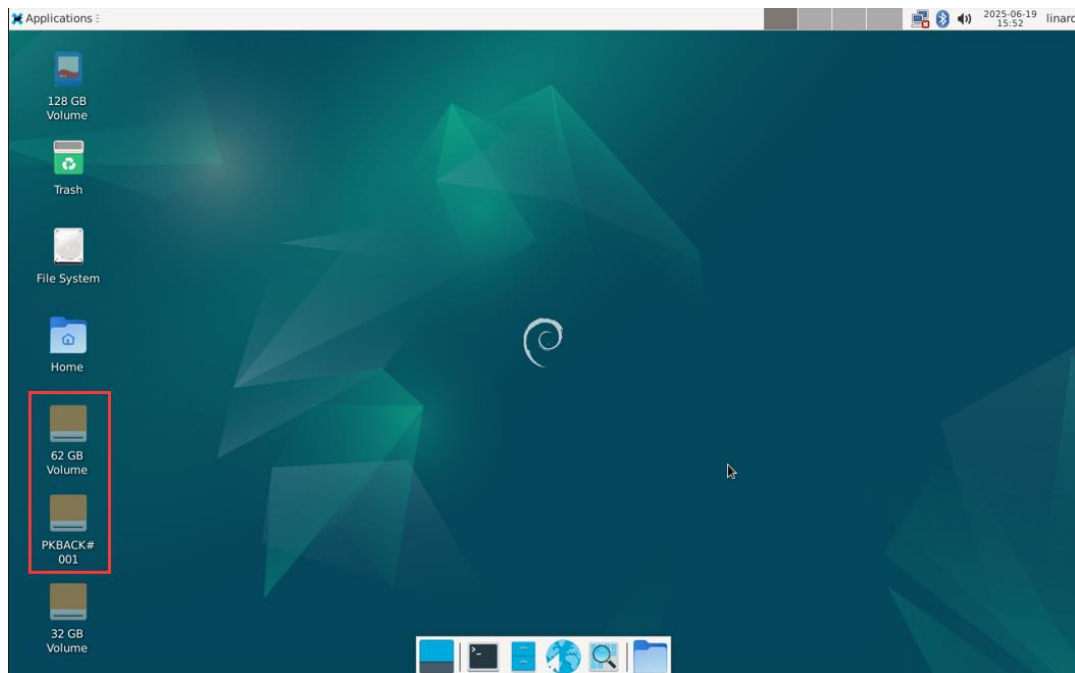
root@linaro-alip:~# ping -I eth0 www.armdesigner.com
PING www.armdesigner.com (67.222.54.196) from 192.168.0.55 eth0: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=50 time=190 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=50 time=190 ms (DUP!)
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=50 time=191 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=50 time=191 ms (DUP!)
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=50 time=191 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=50 time=191 ms (DUP!)
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=50 time=190 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=50 time=190 ms (DUP!)
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=50 time=191 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=50 time=191 ms (DUP!)
^C
--- www.armdesigner.com ping statistics ---
5 packets transmitted, 5 received, +5 duplicates, 0% packet loss, time 4006ms
rtt min/avg/max/mdev = 190.476/190.664/190.915/0.194 ms
root@linaro-alip:~#
root@linaro-alip:~# ping -I eth1 www.armdesigner.com
PING www.armdesigner.com (67.222.54.196) from 192.168.0.152 eth1: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=50 time=192 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=50 time=192 ms (DUP!)
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=50 time=191 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=50 time=191 ms (DUP!)
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=50 time=191 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=50 time=191 ms (DUP!)
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=50 time=191 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=50 time=191 ms (DUP!)
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=50 time=191 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=50 time=191 ms (DUP!)
^C
--- www.armdesigner.com ping statistics ---
5 packets transmitted, 5 received, +5 duplicates, 0% packet loss, time 4006ms
rtt min/avg/max/mdev = 190.619/190.972/191.992/0.512 ms
  
```

6.5 USB Host

The USB host can be used to connect devices such as USB mouse, USB keyboards, USB flash drives, and other USB peripherals.



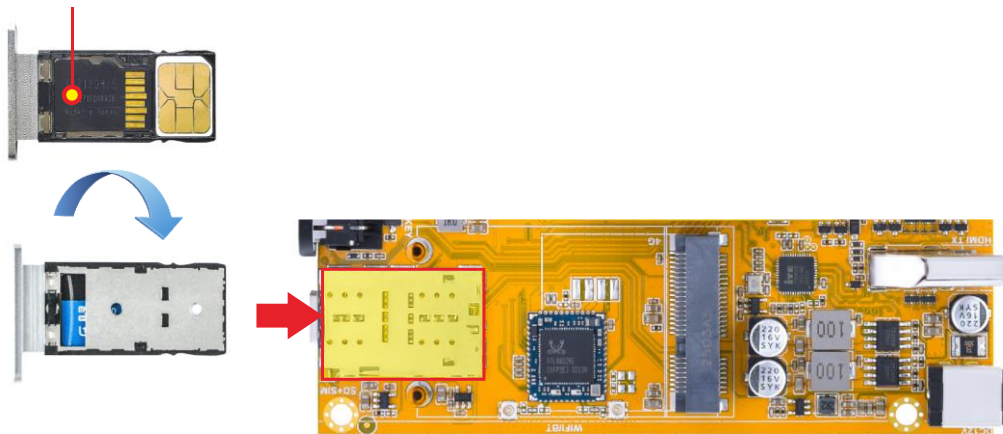
After connecting the USB flash drive, if the device is successfully recognized, an icon will appear on the desktop. Users need to click the icon in order to access the files on the device.



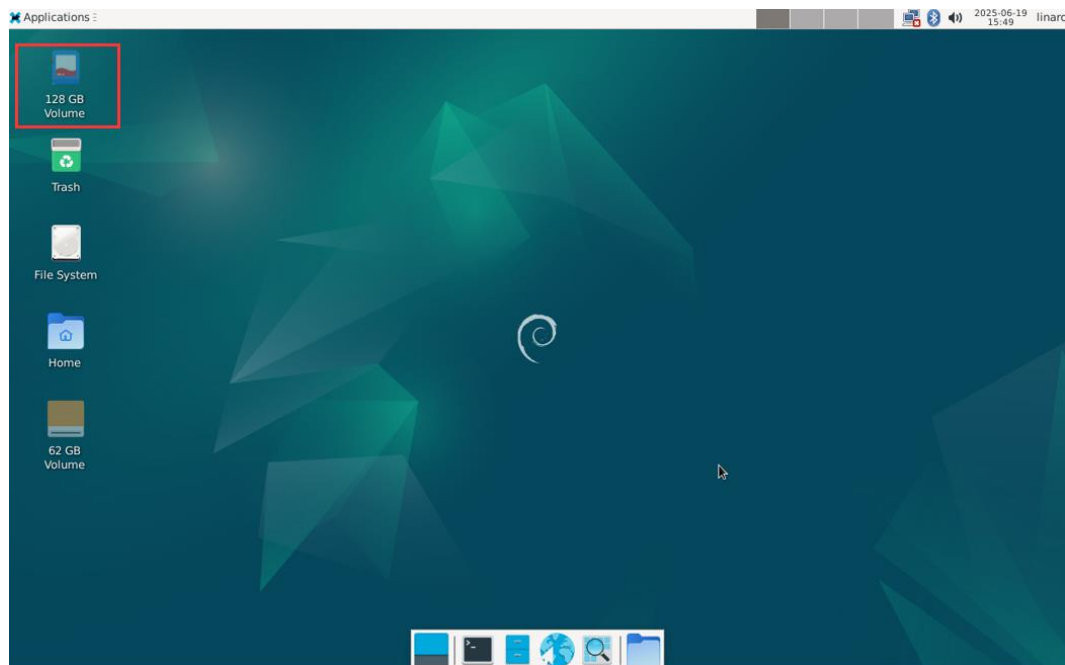
6.6 SD Card

Step 1: Insert the micro SD card into the card slot.

Micro SD

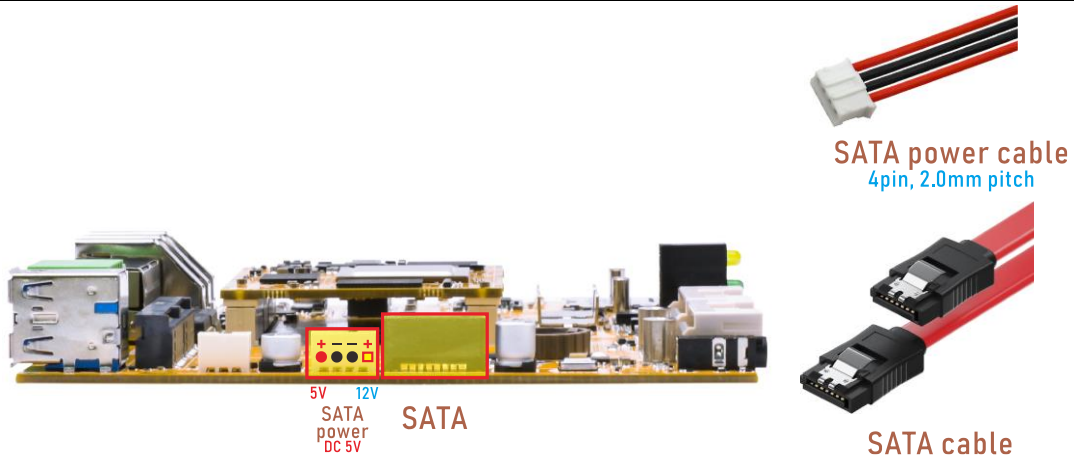


Step 2: After inserting the SD card, if it is recognized successfully, an icon will appear on the desktop. Users need to click the icon in order to access the SD card.



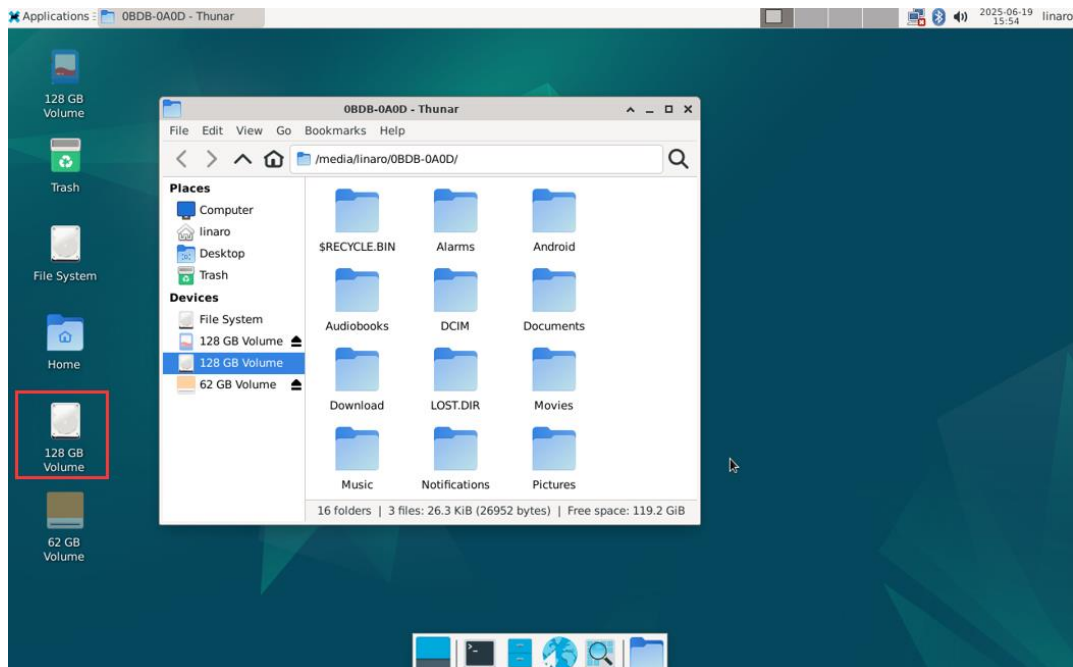
6.7 SATA

Step 1: Connect the sata and sata power, then power on.



Step 2: If the SATA device is successfully recognized, an icon will appear on the desktop.

Users can click the icon to access the SATA device.

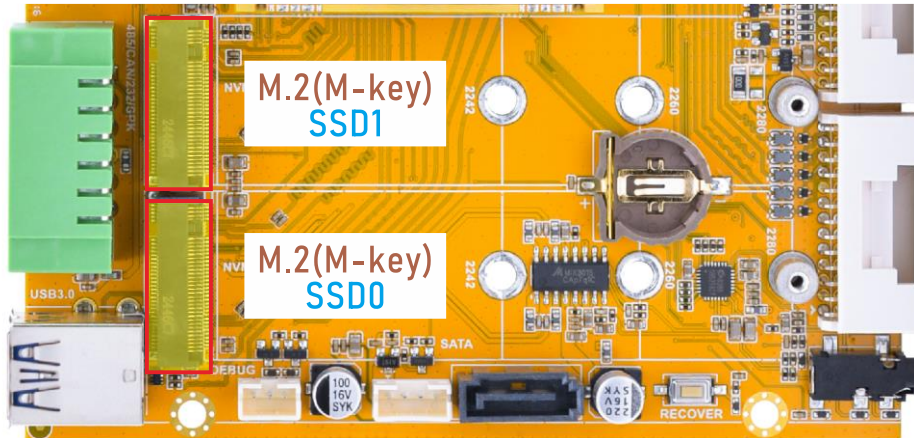


Note: The SATA on Debian 12 only supports the ext4 format. If devices that are not in ext4 format, the user can choose to format them on the board. After formatting, **the files on the device will be permanently lost**, so please proceed with caution.

```
# mke2fs -t ext4 /dev/sda1
```

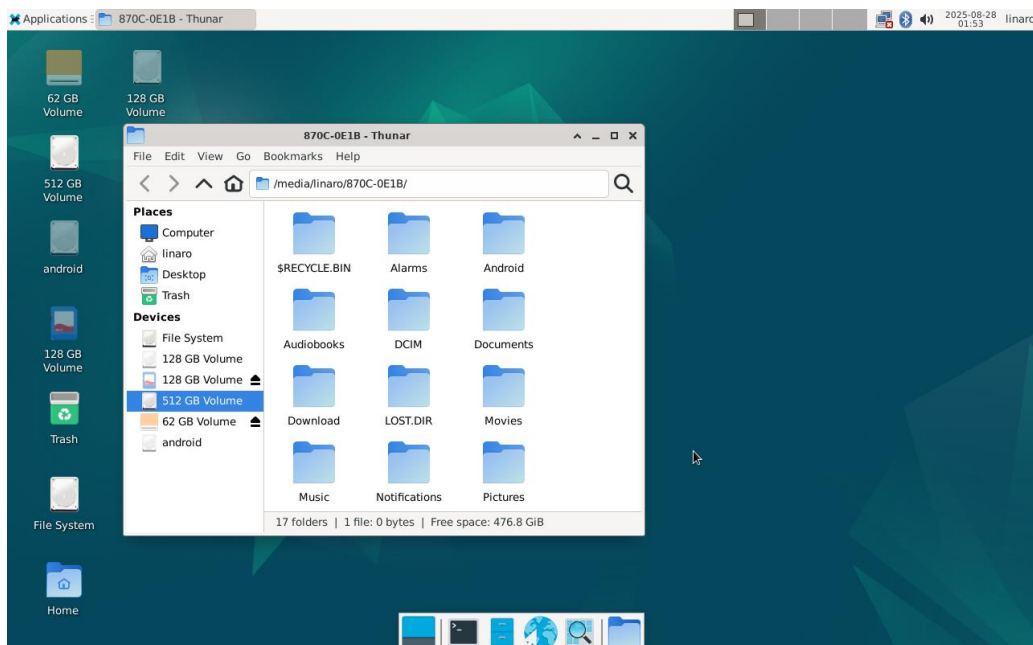
6.8 PCIe M.2 SSD

Step 1: Insert the M.2 SSD into the M.2 card slot, then power on the device.



Step 2: If the SSD device is successfully recognized, an icon will appear on the desktop.

Users can click the icon to access the SSD device.



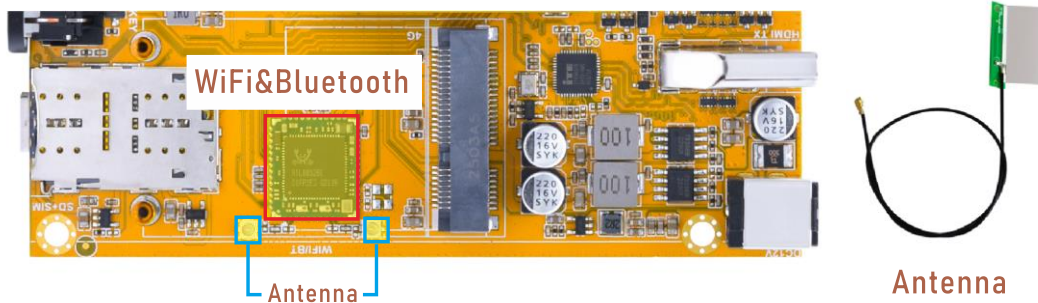
Note: The SSD on buildroot only supports the ext4 format. If devices that are not in ext4 format, the user can choose to format them on the board. After formatting, **the files on the device will be permanently lost**, so please proceed with caution.

```
# mke2fs -t ext4 /dev/ nvme0n1p1
```

- Use `/dev/nvme0n1p1` for the first SSD
- Use `/dev/nvme1n1p1` for the second SSD

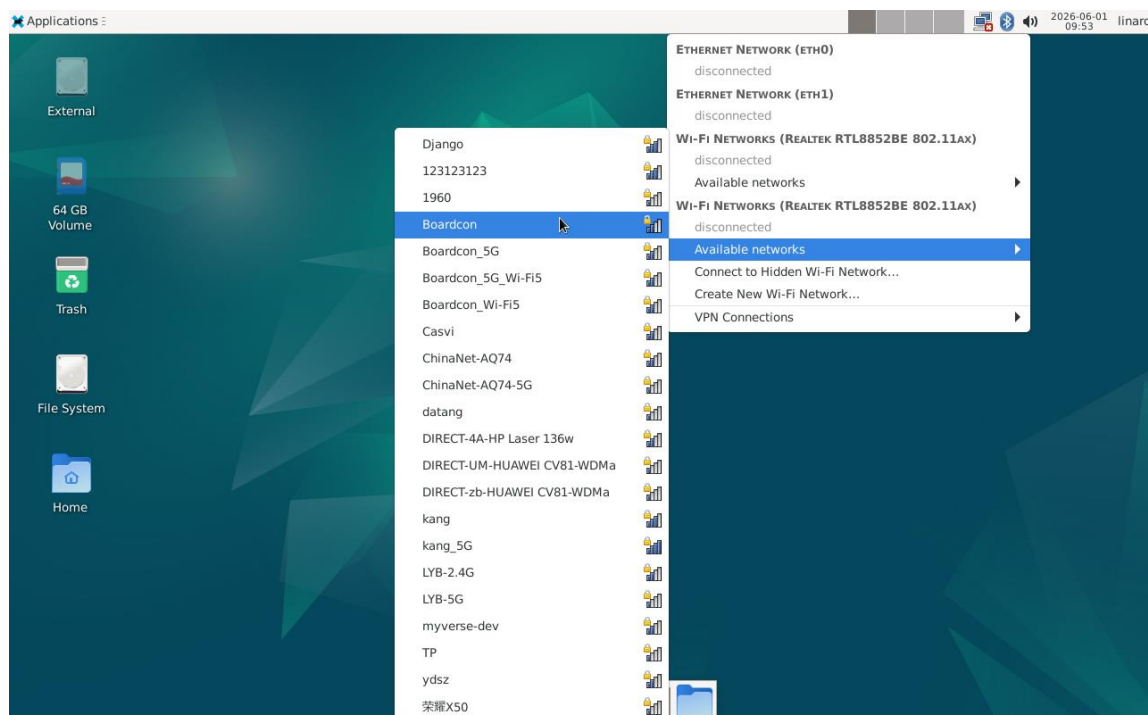
6.9 WiFi & Bluetooth

To use Wi-Fi and Bluetooth functions properly, the antenna needs to be connected.

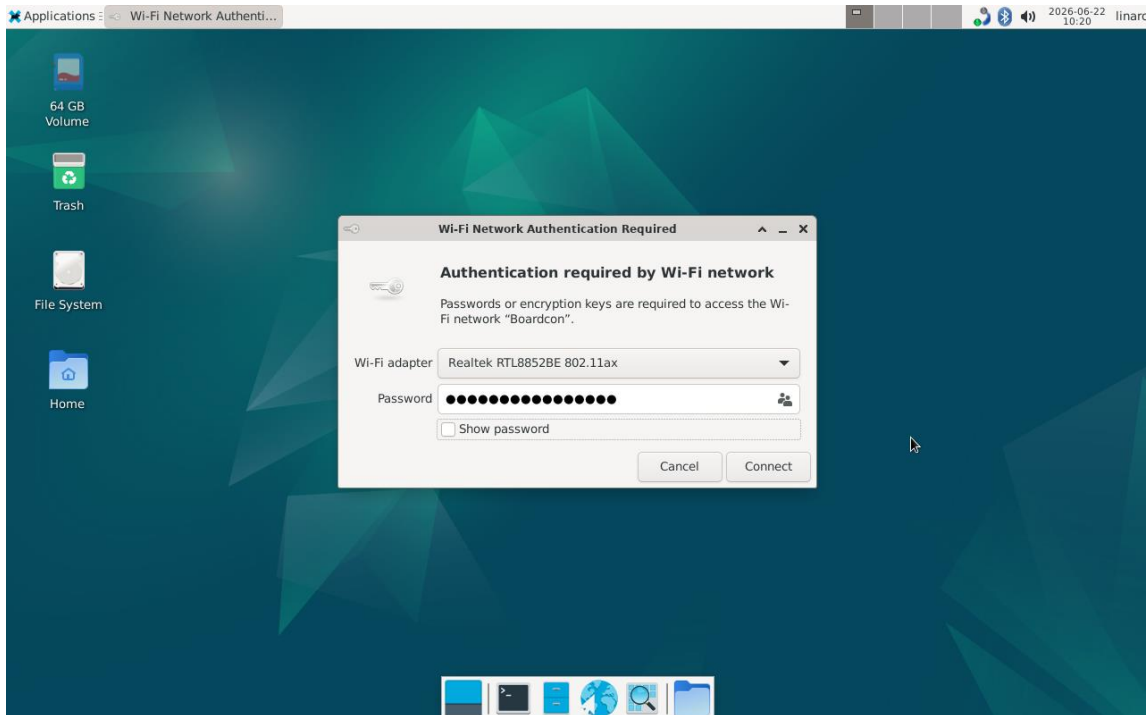


6.9.1 WiFi

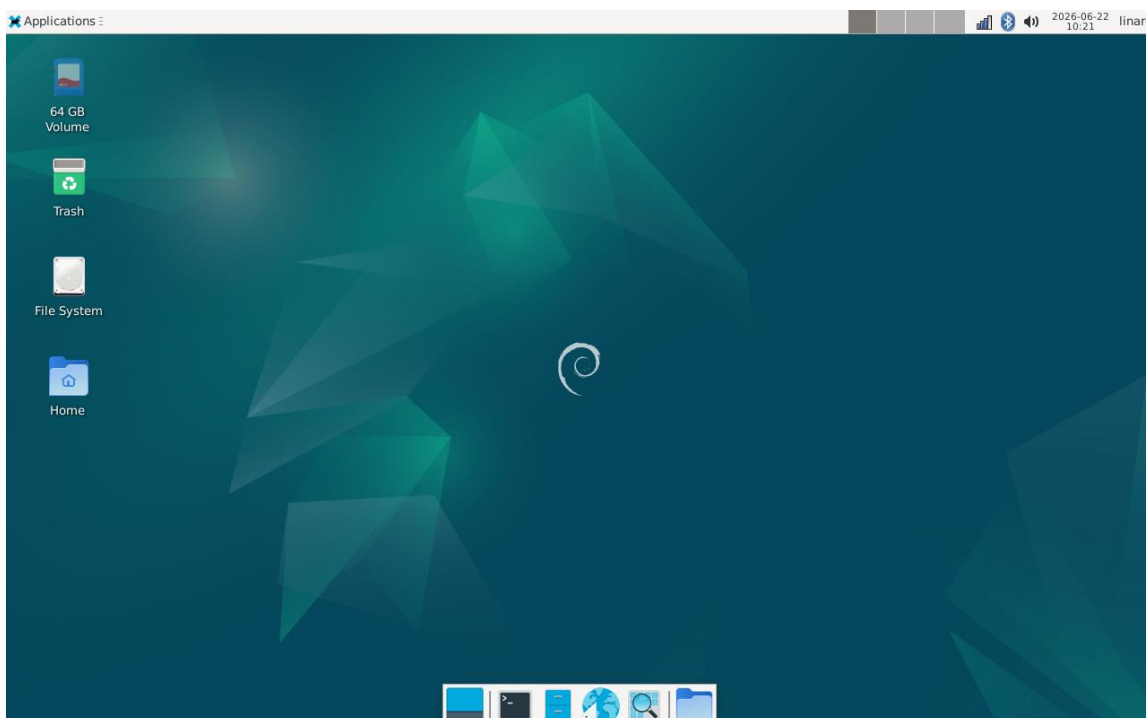
Step 1: Click the network icon in the top right corner of the interface, then select the **"Available Networks"** option to view the list of available hotspots.



Step 2: Select the SSID from the list of available networks and enter the password.



Step 3: After the WiFi successfully connects to the hotspot, the system will display the corresponding connection status icon in the top right corner.



Step 4: Users can test network connectivity using the desktop's built-in browser or verify it through the following command method.

(1) View network interface information.

```
# ifconfig wlan0
```

```
root@linaro-alip:~# ifconfig wlan0
wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.43.8 netmask 255.255.255.0 broadcast 192.168.43.255
    inet6 240e:47e:3060:61dc:619c:ba59:95d:26a7 prefixlen 64 scopeid 0x0<global>
    inet6 fe80::509b:66de:d23b:3163 prefixlen 64 scopeid 0x20<link>
    ether cc:64:1a:78:ed:c0 txqueuelen 1000 (Ethernet)
    RX packets 227 bytes 30914 (30.1 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 258 bytes 20314 (19.8 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device interrupt 160
```

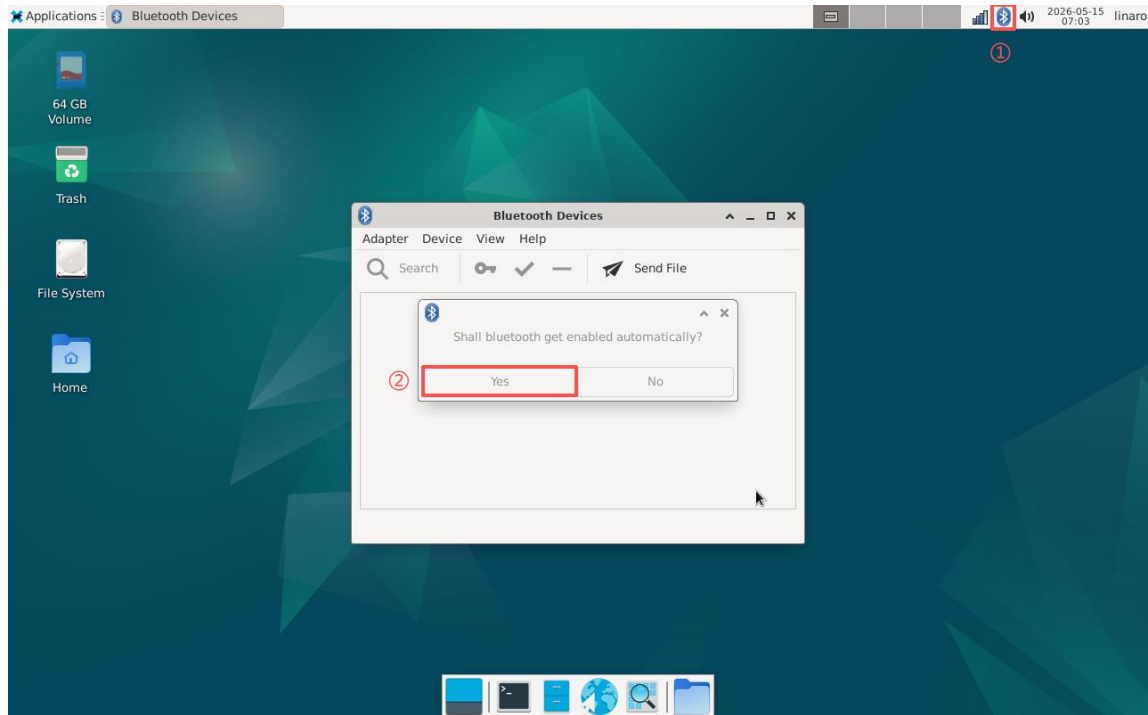
(2) Network connection test.

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

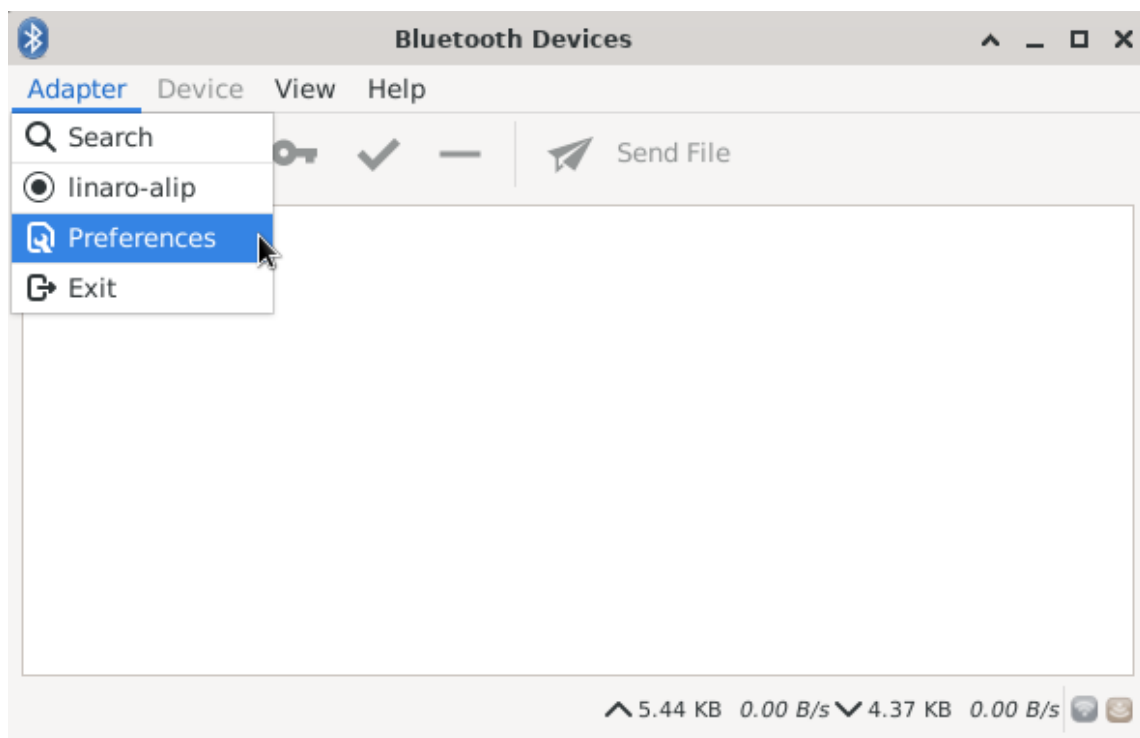
```
root@linaro-alip:~# ping -I wlan0 www.armdesigner.com
PING d3dsoj86mhwk6.cloudfront.net (13.35.202.10) from 192.168.43.8 wlan0: 56(84) bytes of data.
64 bytes from server-13-35-202-10.sin2.r.cloudfront.net (13.35.202.10): icmp_seq=1 ttl=244 time=172 ms
64 bytes from server-13-35-202-10.sin2.r.cloudfront.net (13.35.202.10): icmp_seq=2 ttl=244 time=118 ms
64 bytes from server-13-35-202-10.sin2.r.cloudfront.net (13.35.202.10): icmp_seq=3 ttl=244 time=108 ms
64 bytes from server-13-35-202-10.sin2.r.cloudfront.net (13.35.202.10): icmp_seq=4 ttl=244 time=111 ms
64 bytes from server-13-35-202-10.sin2.r.cloudfront.net (13.35.202.10): icmp_seq=5 ttl=244 time=91.4 ms
64 bytes from server-13-35-202-10.sin2.r.cloudfront.net (13.35.202.10): icmp_seq=6 ttl=244 time=89.0 ms
^C
--- d3dsoj86mhwk6.cloudfront.net ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5005ms
rtt min/avg/max/mdev = 89.013/114.945/171.511/27.381 ms
```

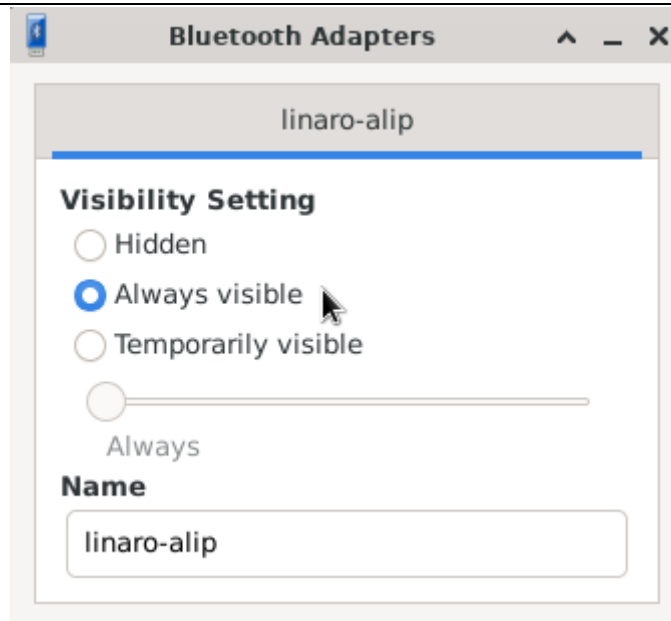
6.9.2 Bluetooth

Step 1: Click the Bluetooth icon in the top right corner of the desktop.

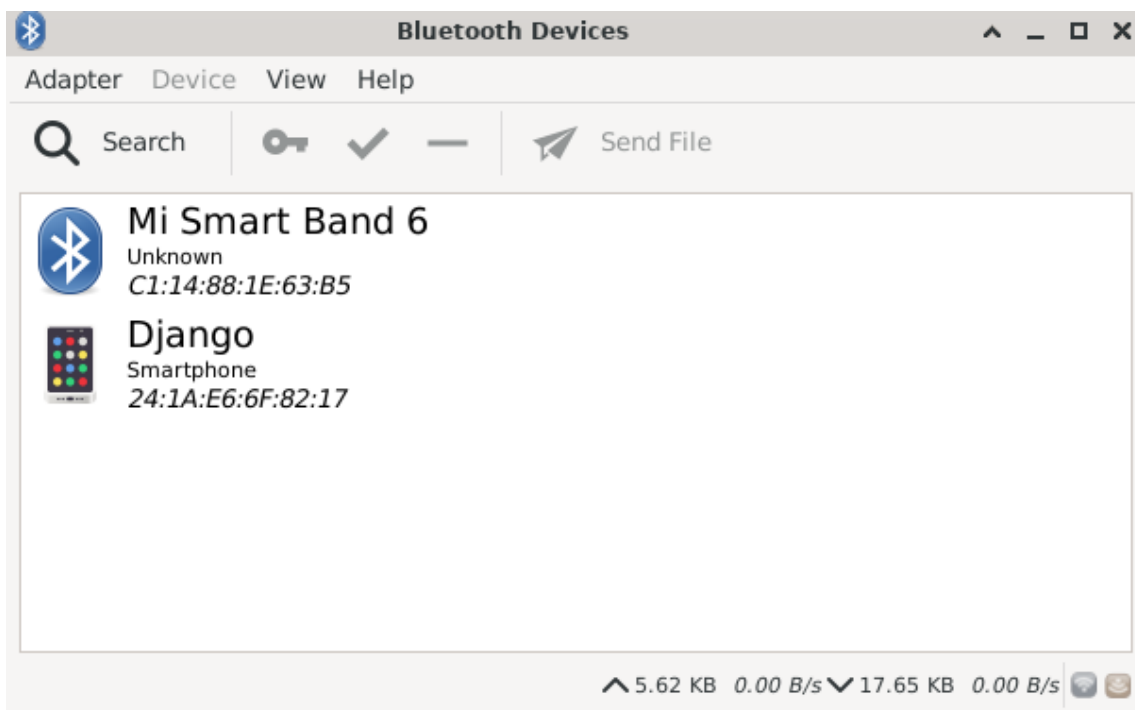


Step 2: The Bluetooth device name is hidden by default. Set it to be visible by clicking **Adapter -> Preferences -> Always visible**.





Step 3: Click Search to start searching and select the available device in the list to pair.

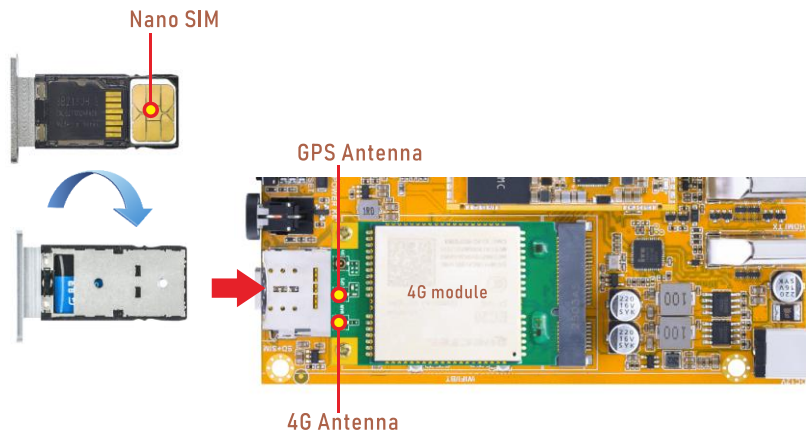


After successful configuration, Bluetooth devices can communicate with each other directly.

6.10 4G & GPS

Step 1: Insert 4G module to PCIe socket (4G model: EC20), and connect antenna.

Step 2: Connect antenna and insert SIM card.



Step 3: Power on.

6.10.1 4G Test

Step 1: Initiate the PPP connection.

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



```
root@linaro-alip:/#
root@linaro-alip:/# pppd call quectel-ppp &
[1] 2845
root@linaro-alip:/# 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/ttyUSB_4G # (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)
noctrlcts   # (from /etc/ppp/peers/quectel-ppp)
modem       # (from /etc/ppp/peers/quectel-ppp)
asynmap 0   # (from /etc/ppp/options)
lcp-echo-failure 4 # (from /etc/ppp/options)
lcp-echo-interval 30 # (from /etc/ppp/options)
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)
noccip      # (from /etc/ppp/peers/quectel-ppp)
noipx       # (from /etc/ppp/options)
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
-- got it

send (ATE0^M)
expect (OK)
```

Step 2: Check the status of the network interfaces.

```
# ifconfig ppp0
```

```
root@linaro-alip:/# ifconfig ppp0
ppp0: flags=4305<UP,POINTOPOINT,RUNNING,NOARP,MULTICAST> mtu 1500
    inet 10.99.158.154 netmask 255.255.255.255 destination 10.64.64.64
    ppp txqueuelen 3 (Point-to-Point Protocol)
    RX packets 4 bytes 52 (52.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 14 bytes 198 (198.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

Step 3: Test the PPP connection.

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

```
root@linaro-alip:/# ping -I ppp0 www.armdesigner.com
PING www.armdesigner.com (67.222.54.196) from 10.99.158.154 ppp0: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=41 time=392 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=41 time=265 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=42 time=263 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=42 time=263 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=42 time=262 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=42 time=260 ms
^C
--- www.armdesigner.com ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5004ms
rtt min/avg/max/mdev = 260.141/284.252/392.052/48.228 ms
```

6.10.2 GPS Test

Step 1: Enable GPS functionality.

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

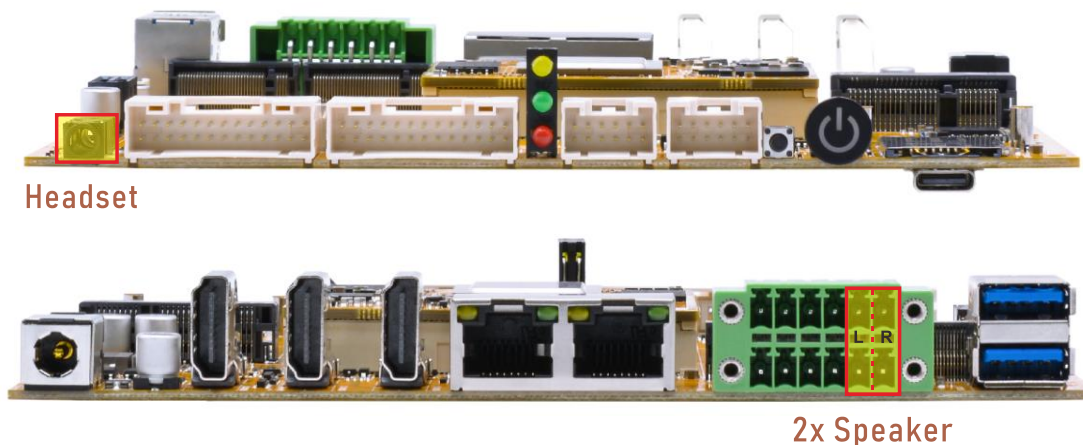
Step 2: Read GPS data.

```
# cat /dev/ttyUSB1
```

```
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,,,,,,,,,,,,,*32
$GPGGA,,,,,0,,,,,,*66
$GPRMC,,V,,,,,,,,,N,V*29
$GPVTG,,T,,M,,N,,K,N*2C
$GPGSA,A,1,,,,,,,,,,,,,*32
$GPGGA,,,,,0,,,,,,*66
$GPRMC,,V,,,,,,,,,N,V*29
```

6.11 Audio

Step 1: Plug the headset into the headset jack and connect the speaker.



Step 2: View sound card.

```
# cat /proc/asound/cards
```

```
root@linaro-alip:/# cat /proc/asound/cards
0 [rockchip-es8388 ]: rockchip-es8388 - rockchip-es8388
  rockchip-es8388
1 [rockchiphdmi0 ]: rockchip-hdmi0 - rockchip-hdmi0
  rockchip-hdmi0
2 [rockchiphdmi1 ]: rockchip-hdmi1 - rockchip-hdmi1
  rockchip-hdmi1
3 [rockchipdp0 ]: rockchip-dp0 - rockchip-dp0
  rockchip-dp0
4 [rockchipdp1 ]: rockchip-dp1 - rockchip-dp1
  rockchip-dp1
```

Step 3: Headset recording.

```
# arecord -Dhw:0,0 -f cd record.wav
```

```
root@linaro-alip:/# arecord -Dhw:0,0 -f cd record.wav
Recording WAVE 'record.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

Step 4: Headset play audio. (Headset> speaker)

```
# aplay -Dhw:0,0 record.wav
```

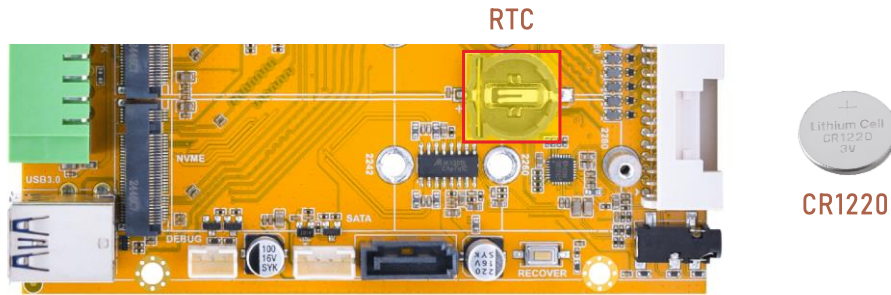
```
root@linaro-alip:/# aplay -Dhw:0,0 record.wav
Playing WAVE 'record.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

Supplementary instructions on audio output:

```
# aplay -Dhw:0,0 record.wav // Headset or speaker audio output
# aplay -Dhw:1,0 record.wav // HDMI0 TX audio output (HDMI0)
# aplay -Dhw:2,0 record.wav // HDMI1 TX audio output (HDMI1)
# aplay -Dhw:3,0 record.wav // DP AIT mode audio output
# aplay -Dhw:4,0 record.wav // DP to HDMI audio output (HDMI2)
```

6.12 RTC

Step 1: Install the coin cell battery.



Step 2: Set the system time.

```
# date -s "2026-12-11 19:00:00"
```

Step 3: Write the system time to the hardware clock.

```
# hwclock -w
```

Step 4: Display the current hardware clock time.

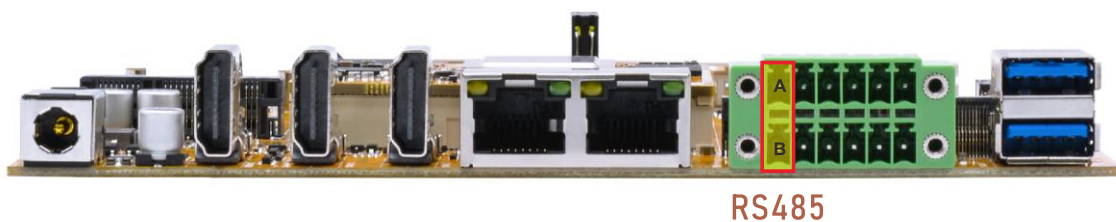
```
# hwclock
```

```
root@linaro-alip:/# date -s "2026-12-11 19:00:00"
Fri Dec 11 07:00:00 PM UTC 2026
root@linaro-alip:/# hwclock -w
root@linaro-alip:/# hwclock
2026-12-11 19:00:02.944664+00:00
root@linaro-alip:/# hwclock
2026-12-11 19:00:10.666488+00:00
```

Step 5: Power off, after a period of time to turn on the power again, check whether the time is saved.

```
root@linaro-alip:/# hwclock
2026-12-11 19:01:17.479482+00:00
root@linaro-alip:/# hwclock
2026-12-11 19:01:21.293676+00:00
root@linaro-alip:/# hwclock
2026-12-11 19:01:23.555443+00:00
```

6.13 RS485



Step 1: As shown in the diagram, connect the RS485 test tool to the development board.



Step 2: Open the corresponding serial terminal, set the baud rate of the board to 1500000, and set the baud rate of the RS485 test tool to 115200.

The image shows two side-by-side screenshots of a 'serial-com5 - SecureCRT' window. The left window displays a log of system boot messages and kernel logs, including warnings about 'rtw_hal_mac_fw_log_cfg' and 'rtw_hal_mac_fw_log_cfg' level 4 outputs. The right window shows a similar log, but with a different baud rate setting of 115200. Both windows show the status 'Ready' at the bottom.

Step 3: Execute the following command on the board to test the RS485 transmission and reception functionality.

```
# com /dev/ttyS4 115200 8 0 1
```

The image shows two side-by-side screenshots of a 'serial-com5 - SecureCRT' window. The left window shows the execution of the command '# com /dev/ttyS4 115200 8 0 1' and the resulting output, which includes a warning about 'dma-request_slave_channel' and a message about 'failed to request DMA, use interrupt mode'. The right window shows the same command being executed, but with a different baud rate setting of 115200. Both windows show the status 'Ready' at the bottom.

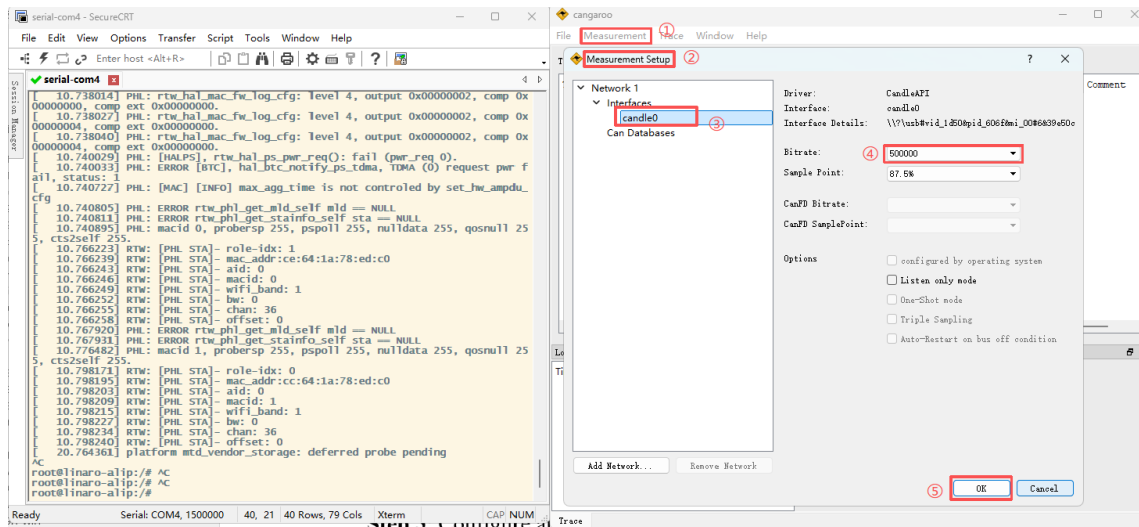
6.14 CAN



Step 1: Connect the CAN test tool to the board as shown in the diagram below.

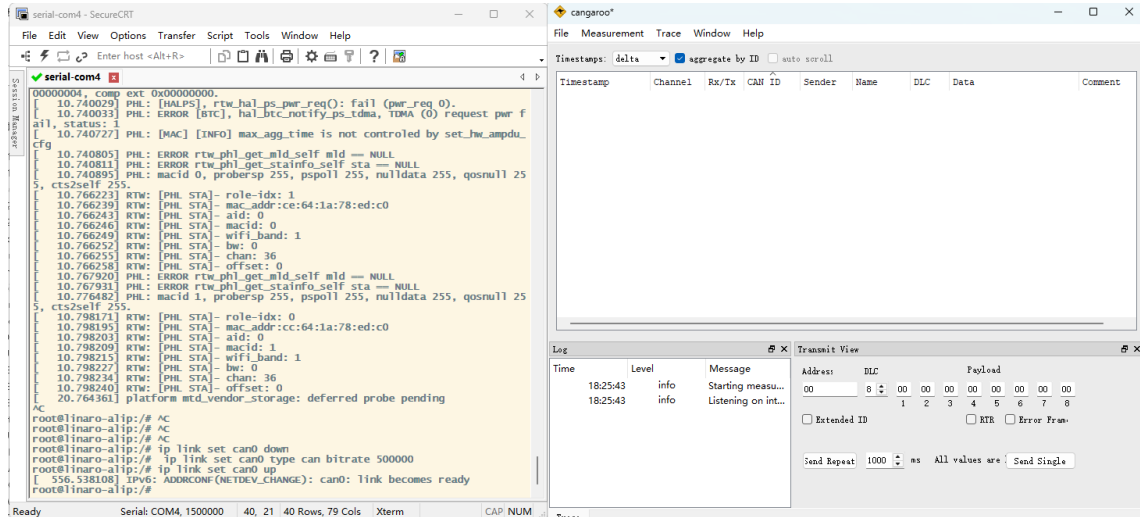


Step 2: Open the CAN test software and set the baud rate to 500000.



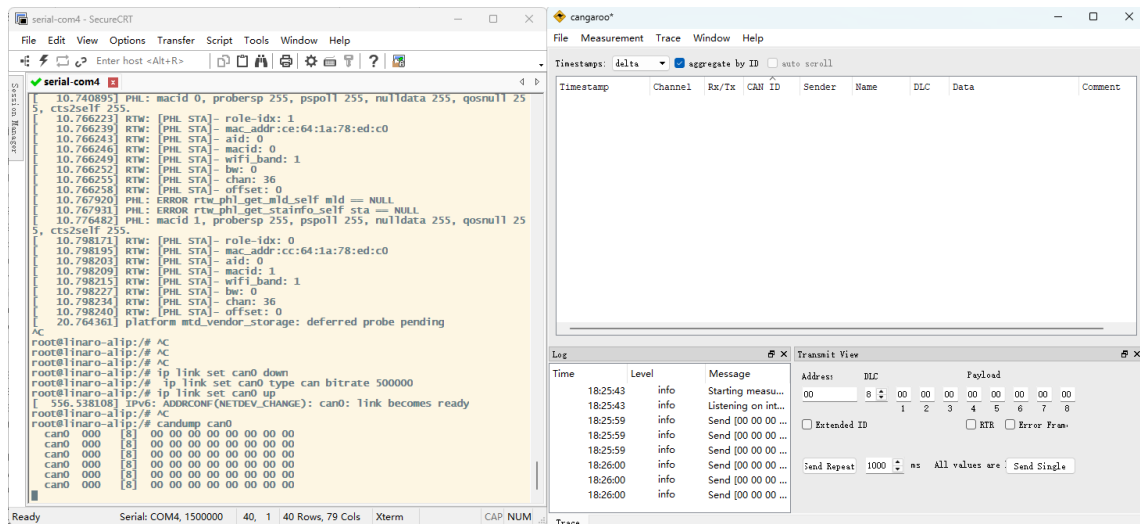
Step 3: Configure and activate the CAN network, setting the bitrate to 500000.

```
# ip link set can0 down
# ip link set can0 type can bitrate 500000
# ip link set can0 up
```



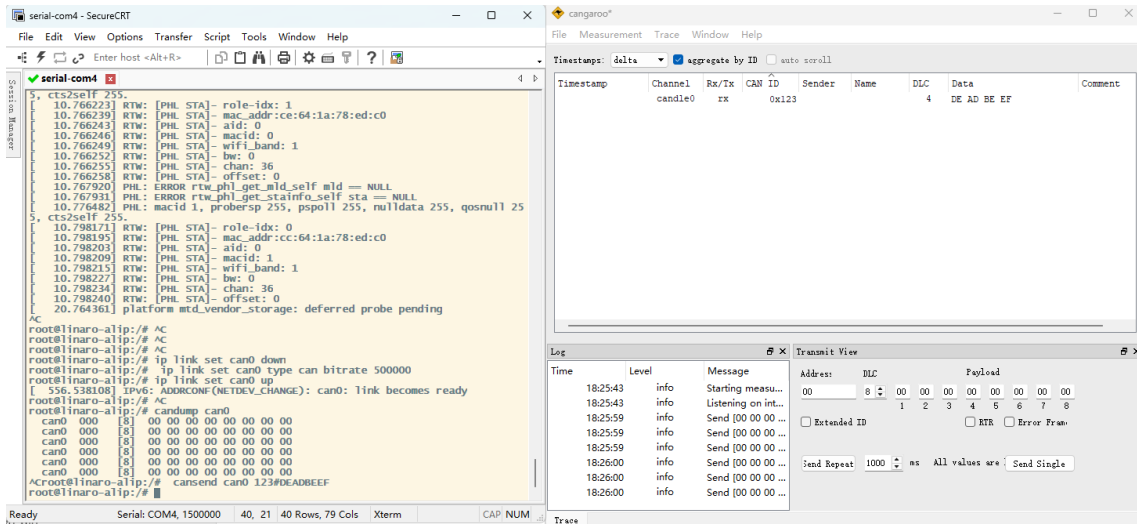
Step 4: Configure CAN as the receiver.

```
# candump can0
```



Step 5: Configure CAN as the sender.

```
# cansend can0 123#DEADBEEF
```



6.15 RS232

Step 1: Short circuit RX and TX pins of UART.



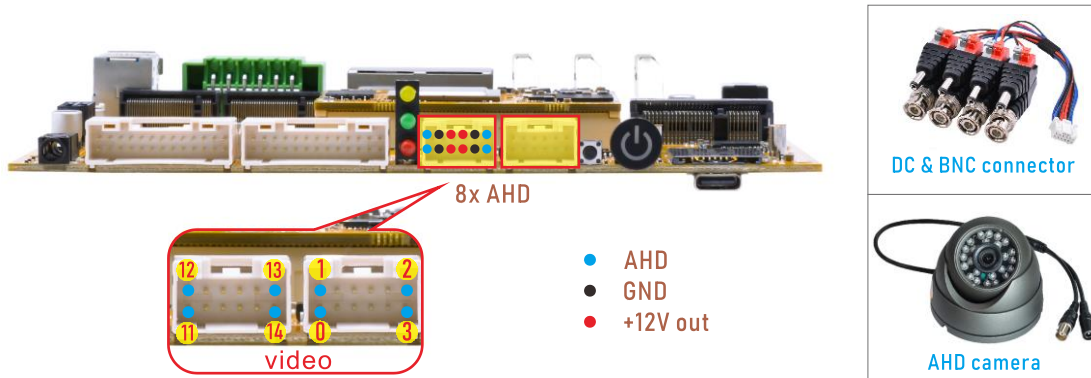
RS232

Step 2: RS232 test.

```
# com /dev/ttyS7 115200 8 0 1
```

```
root@linaro-alip:~# com /dev/ttyS7 115200 8 0 1
port = /dev/ttyS7
baudrate = 115200
cs = 8
parity = 0
stopb = 1
ioioioioioioio
RECV: ioioioioioioio
2323232uiui
RECV: 2323232uiui
uuut
RECV: uuut
888
RECV: 888
```

6.16 Camera



- Single-camera preview, using video11 as an example.

```
# gst-launch-1.0 v4l2src device=/dev/video11 ! video/x-raw, format=NV12,
width=1920, height=1080, framerate=25/1 ! xvimagesink
```

```
root@linaro-alip:/# gst-launch-1.0 v4l2src device=/dev/video11 ! video/x-raw, format=NV12, width=1920,
height=1080, framerate=25/1 ! xvimagesink
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
[ 387.923184] rkCIF-mipi-lvds4: stream[0] start streaming
[ 387.924309] rkCIF-mipi-lvds4: Allocate dummy buffer, size: 0x003f5000
[ 387.927061] rockchip-mipi-csi2 mipi4-csi2: stream on, src_sd: 00000000c40b8311, sd_name:rockchip-csi2-
dphy3
[ 387.927084] rockchip-mipi-csi2 mipi4-csi2: stream ON
[ 387.927125] rockchip-csi2-dphy3: dphy3, data_rate_mbps 594
[ 387.927164] rockchip-csi2-dphy csi2-dphy3: csi2_dphy_s_stream stream on:1, dphy3, ret 0
[ 387.928512] techpoint 2-0044: detect channel 0 1080P_25
[ 387.929297] techpoint 2-0044: set channel 0 1080P_25
[ 387.966565] techpoint 2-0044: detect channel 1 is not supported, default 1080P_25
[ 387.967327] techpoint 2-0044: set channel 1 1080P_25
[ 388.005126] techpoint 2-0044: detect channel 2 is not supported, default 1080P_25
[ 388.005926] techpoint 2-0044: set channel 2 1080P_25
[ 388.042124] techpoint 2-0044: detect channel 3 is not supported, default 1080P_25
[ 388.042887] techpoint 2-0044: set channel 3 1080P_25
[ 388.082393] (0xfdd50000)MIPI_CSI2 ERR1:0x20 (fs/fe mis,vc: 1)
[ 388.083973] (0xfdd50000)MIPI_CSI2 ERR1:0x200 (f_seq,vc: 1)
[ 388.089844] (0xfdd50000)MIPI_CSI2 ERR1:0x8000000 (crc,vc: 3)
[ 388.089913] (0xfdd50000)MIPI_CSI2 ERR1:0xf20 (fs/fe mis,vc: 1) (f_seq,vc: 0 1 2 3)
[ 388.092694] (0xfdd50000)MIPI_CSI2 ERR1:0xff0 (fs/fe mis,vc: 0 1 2 3) (f_seq,vc: 0 1 2 3)
Redistribute latency...
0:00:08.6 / 99:99:99.
```

To preview 8 camera streams simultaneously, run the corresponding script based on the desired output device:

- MIPI display output: [/rockchip-test/camera/camera-ahd_1280x800.sh](#)
- HDMI display output: [/rockchip-test/camera/camera-ahd_3640x2160.sh](#)

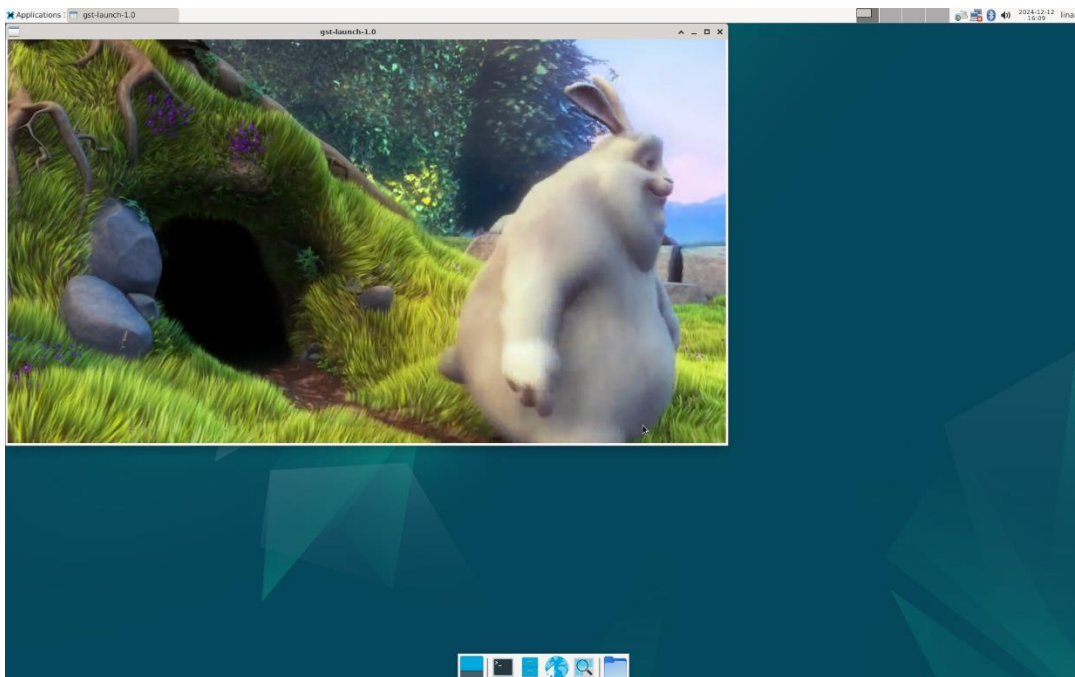
6.17 Video Playback

(1) The directory for the built-in video testing scripts in the system: */rockchip-test/video*

```
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
```

Simply execute the script.

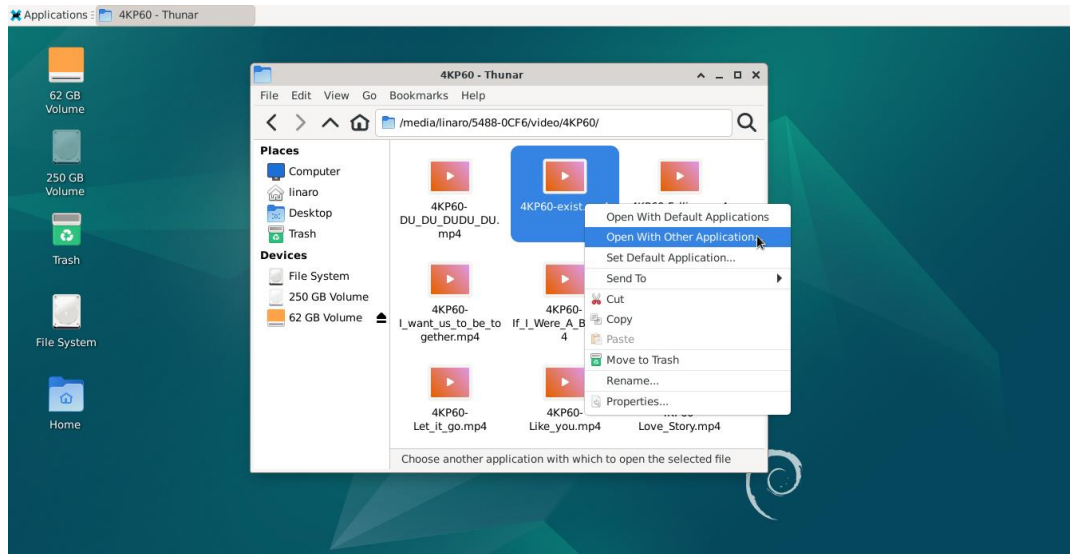
```
root@linaro-alip:/rockchip-test/video# ./test_gst_video.sh
Setting pipeline to PAUSED ...
Pipeline is PREROLLING ...
Redistribute latency...
mpp[4383]: mpp_info: mpp version: 48962a10 author: Hongjin Li    2024-09-19 fix[avsd]: Fix attach dev error
issue
mpp[4383]: mpp_info: mpp version: 48962a10 author: Hongjin Li    2024-09-19 fix[avsd]: Fix attach dev error
issue
mpp[4383]: mpp_info: mpp version: 48962a10 author: Hongjin Li    2024-09-19 fix[avsd]: Fix attach dev error
issue
mpp[4383]: mpp_info: mpp version: 48962a10 author: Hongjin Li    2024-09-19 fix[avsd]: Fix attach dev error
issue
mpp[4383]: mpp_info: mpp version: 48962a10 author: Hongjin Li    2024-09-19 fix[avsd]: Fix attach dev error
issue
Redistribute latency...
mpp[4383]: h264d_api: is_avc=1
Pipeline is PREROLLED ...
Prerolled, waiting for async message to finish...
Setting pipeline to PLAYING ...
Redistribute latency...
New clock: GstSystemClock
0:00:06.6 / 0:00:29.5 (22.7 %)
```



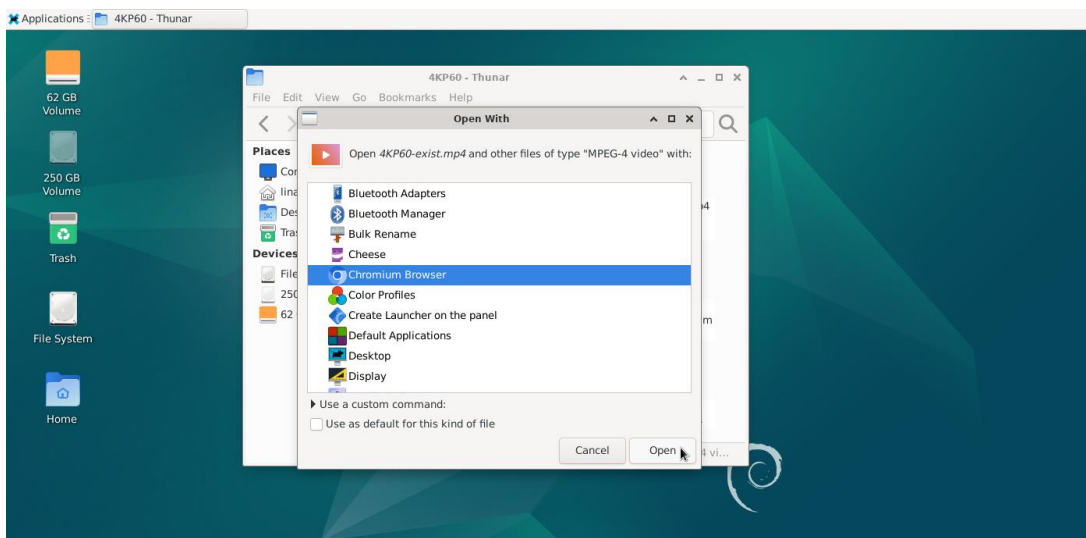
(2) Play the video using Google Chrome.

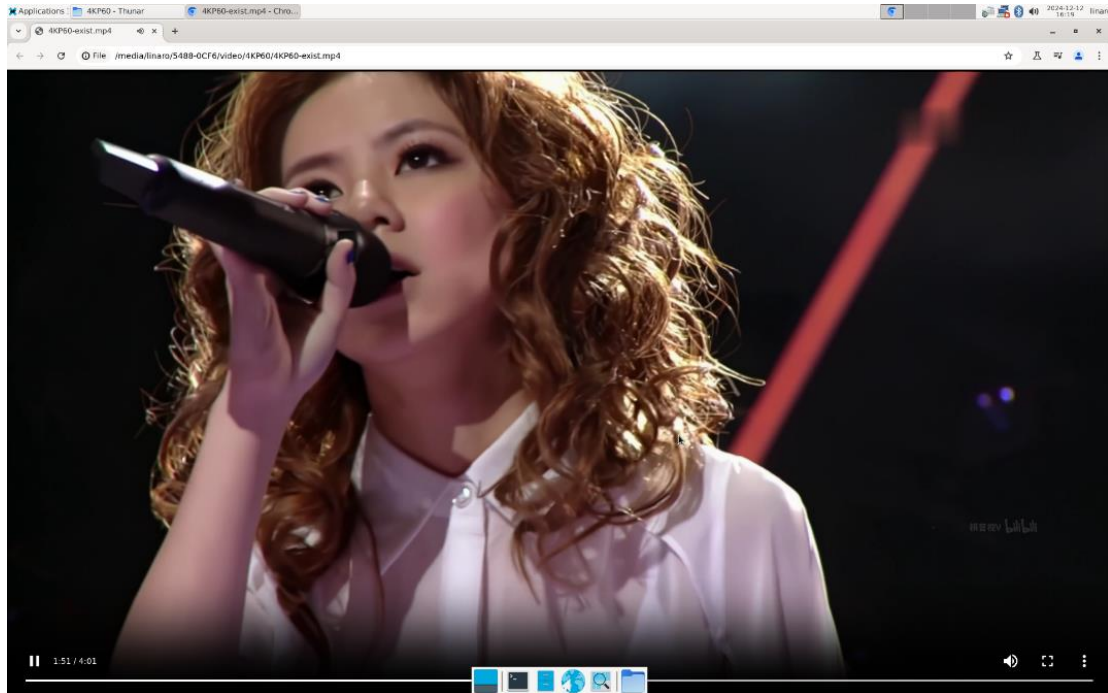
- Google Chrome supports video playback up to 4K at 60Hz, with support for the following decoding formats: VP8, H.264, H.265, VP9, and AV1.
- However, it is only compatible with certain H.265 video files.

Step 1: Select the video file, right-click, and choose “Open With Other Application...”.



Step 2: Find **Chromium Browser** in the list, select it, and click **“Open”** to play the video file.





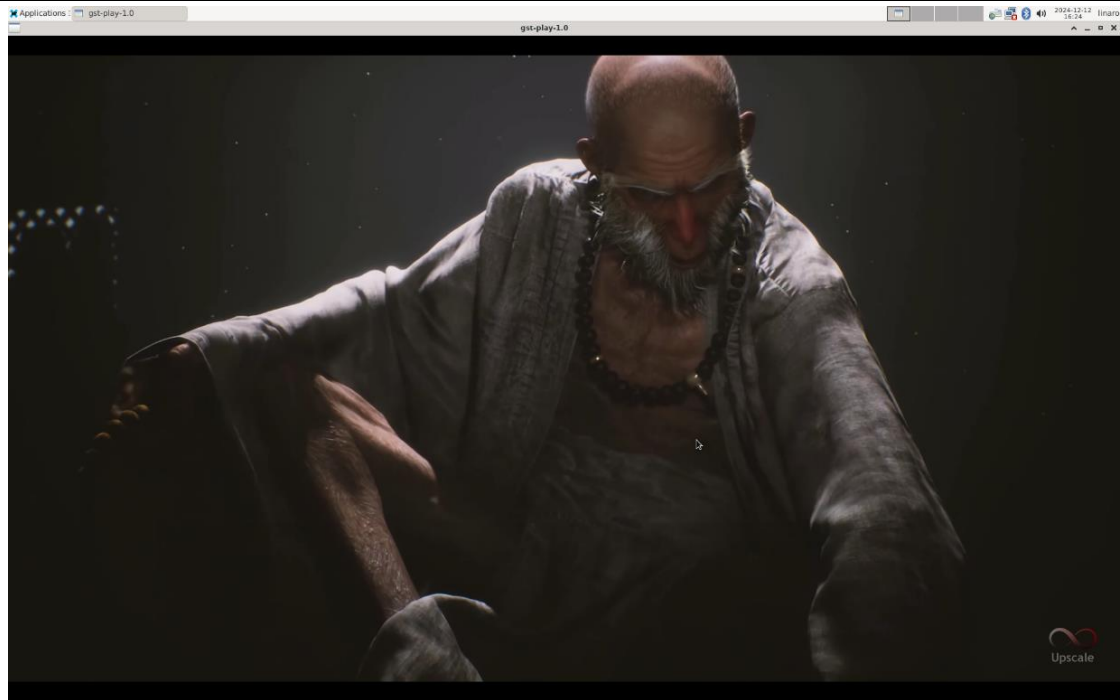
(3) Use the `gst-play-1.0` command to play the video.

```
# gst-play-1.0 --videosink=xvimagesink /media/linaro/5488-
0CF6/video/8KP30/H265_8KP30-2.mp4 --audiosink="alsasink device=hw:1,0"
```

Command explanation:

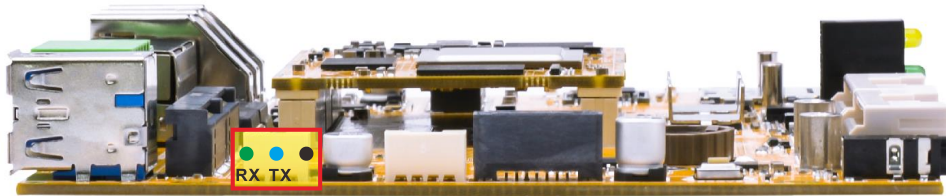
- `/media/linaro/5488-0CF6/video/8KP30/H265_8KP30-2.mp4`: The media file path to be played.
- `--audiosink="alsasink device=hw:1,0"`: Specifies the audio output device as `hw:1,0`.

```
root@linaro-alip:/# gst-play-1.0 --videosink=xvimagesink /media/linaro/5488-0CF6/video/8KP30/H265_8KP30-
2.mp4 --audiosink="alsasink device=hw:1,0"
Press 'k' to see a list of keyboard shortcuts.
Now playing /media/linaro/5488-0CF6/video/8KP30/H265_8KP30-2.mp4
Redistribute latency...
Redistribute latency...
Redistribute latency...
Redistribute latency...
0:01:35.0 / 0:13:10.5
```



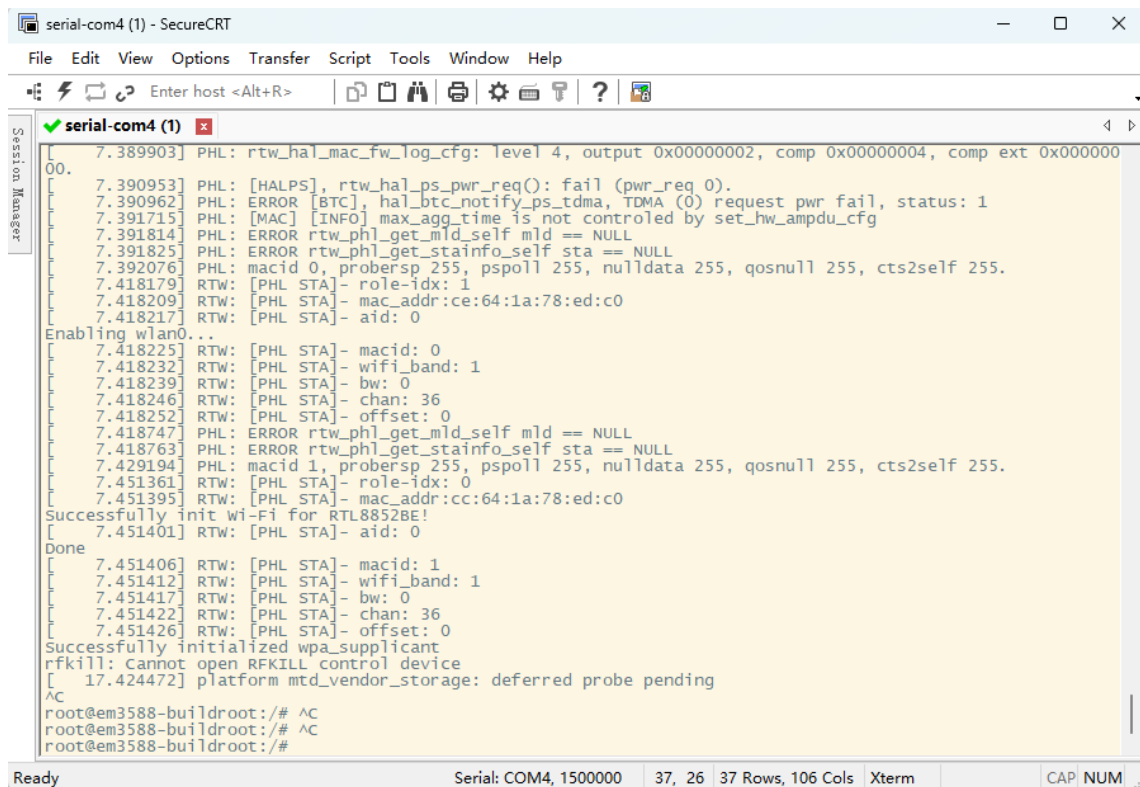
7.Buildroot Test

7.1 Serial Terminal



Debug

Connect the board and PC with USB Serial cable, then power on, the terminal will output boot information. The default baudrate is 1500000.

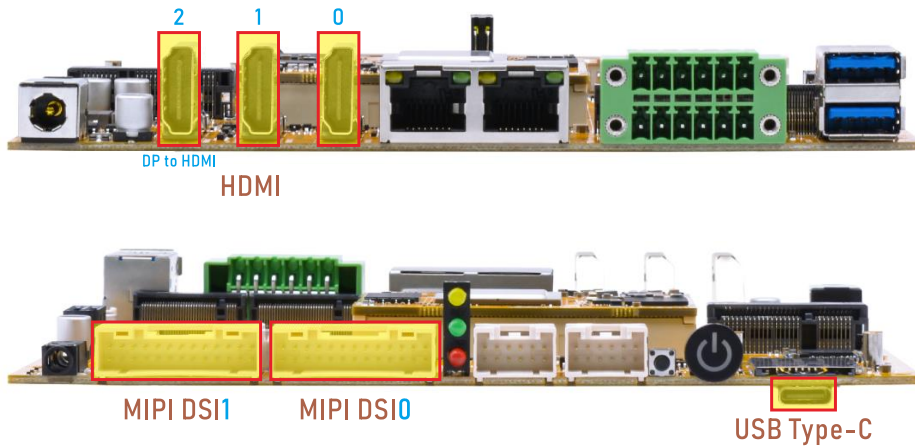


```

serial-com4 (1) - SecureCRT
File Edit View Options Transfer Script Tools Window Help
Enter host <Alt+R>
serial-com4 (1)
7.389903] PHL: rtw_hal_mac_fw_log_cfg: level 4, output 0x00000002, comp 0x00000004, comp ext 0x000000
00.
7.390953] PHL: [HALPS], rtw_hal_ps_pwr_req(): fail (pwr_req 0).
7.390962] PHL: ERROR [BTC], hal_btc_notify_ps_tdma, TDMA (0) request pwr fail, status: 1
7.391715] PHL: [MAC] [INFO] max_agg_time is not controlled by set_hw_ampdu_cfg
7.391814] PHL: ERROR rtw_phl_get_mld_self mld == NULL
7.391825] PHL: ERROR rtw_phl_get_stainfo_self sta == NULL
7.392076] PHL: macid 0, probersp 255, pspoll 255, nulldata 255, qosnull 255, cts2self 255.
7.418179] RTW: [PHL STA]- role-idx: 1
7.418209] RTW: [PHL STA]- mac_addr:ce:64:1a:78:ed:c0
7.418217] RTW: [PHL STA]- aid: 0
Enabling wlan0...
7.418225] RTW: [PHL STA]- macid: 0
7.418232] RTW: [PHL STA]- wifi_band: 1
7.418239] RTW: [PHL STA]- bw: 0
7.418246] RTW: [PHL STA]- chan: 36
7.418252] RTW: [PHL STA]- offset: 0
7.418747] PHL: ERROR rtw_phl_get_mld_self mld == NULL
7.418763] PHL: ERROR rtw_phl_get_stainfo_self sta == NULL
7.429194] PHL: macid 1, probersp 255, pspoll 255, nulldata 255, qosnull 255, cts2self 255.
7.451361] RTW: [PHL STA]- role-idx: 0
7.451395] RTW: [PHL STA]- mac_addr:cc:64:1a:78:ed:c0
Successfully init wi-fi for RTL8852BE!
7.451401] RTW: [PHL STA]- aid: 0
Done
7.451406] RTW: [PHL STA]- macid: 1
7.451412] RTW: [PHL STA]- wifi_band: 1
7.451417] RTW: [PHL STA]- bw: 0
7.451422] RTW: [PHL STA]- chan: 36
7.451426] RTW: [PHL STA]- offset: 0
Successfully initialized wpa_supplicant
rfkill: Cannot open RFKILL control device
[ 17.424472] platform mtd_vendor_storage: deferred probe pending
^C
root@em3588-buildroot:/# ^C
root@em3588-buildroot:/# ^C
root@em3588-buildroot:/#
Ready Serial: COM4, 1500000 37, 26 37 Rows, 106 Cols Xterm CAP NUM
  
```

7.2 Display

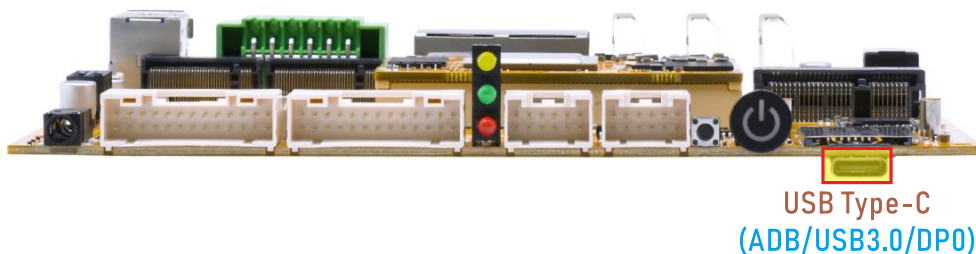
The EM3588 Linux system supports simultaneous output to up to four displays. With six available display interfaces, users can freely choose and configure them as needed.



The display effect diagram is as follows:



7.3 USB Type-C



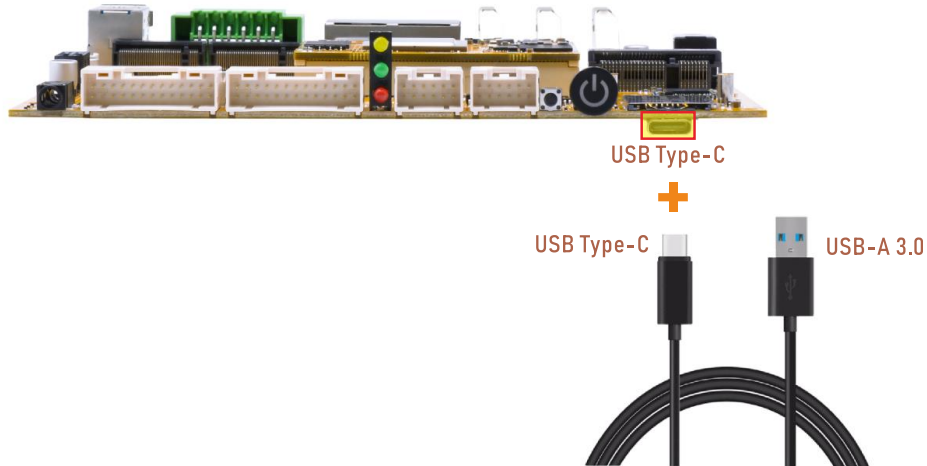
Features Supported by the Type-C Interface:

- **Reversible Design:** Allows insertion in either orientation for user convenience.
- **Data Transmission Roles:** Supports flexible designation of host and device roles.

- **Multiple Protocol Support:** Compatible with USB 3.0 and DisplayPort, enabling high-speed data transmission.

7.3.1 ADB

Step 1: Connect the board and PC host with Type-C cable.

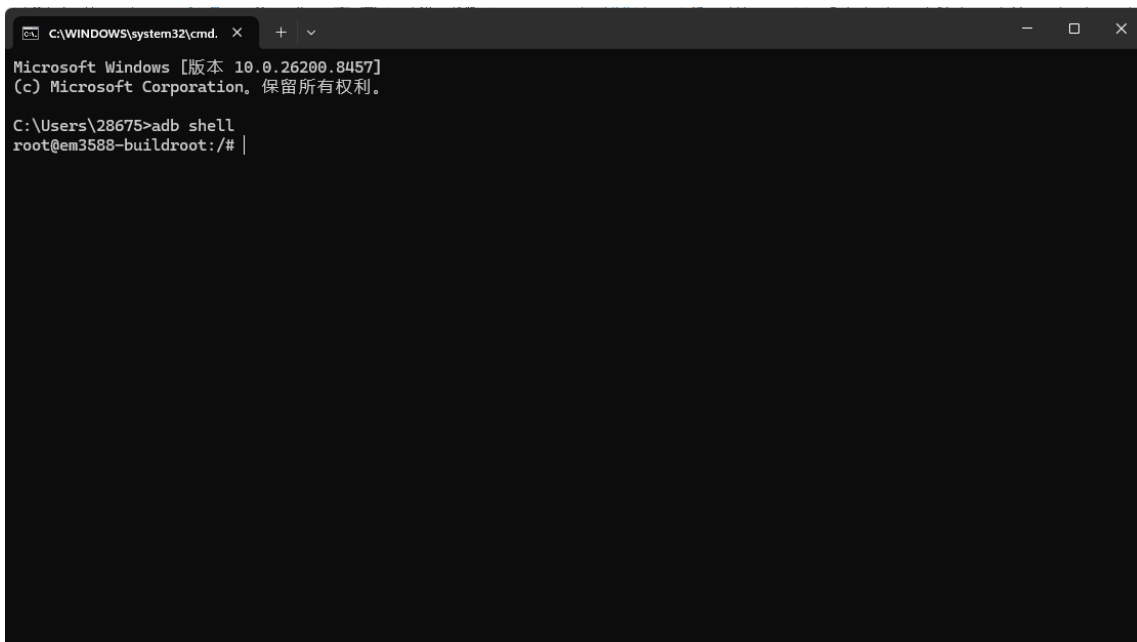


Step 2: Install ADB driver on Windows system.

Step 3: Press **Windows + R** to open the Run program. Type “cmd” and press Enter.

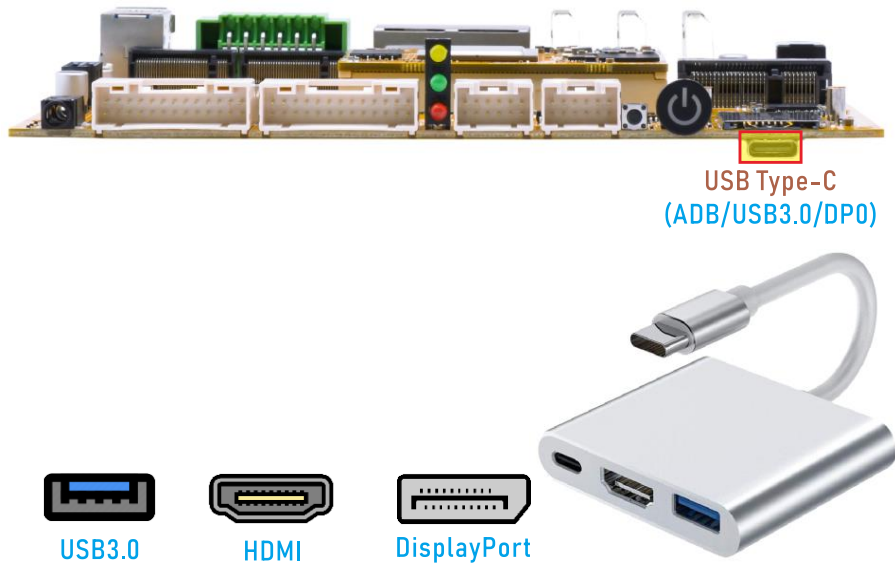
Step 4: Execute the following command to enable ADB.

```
# adb shell
```

The screenshot shows a Windows command prompt window with the title bar 'C:\WINDOWS\system32\cmd.' and standard window controls. The text inside the window reads: 'Microsoft Windows [版本 10.0.26200.8457] (c) Microsoft Corporation. 保留所有权利。 C:\Users\28675>adb shell root@em3588-buildroot:/# |'. The prompt shows that the 'adb shell' command has been successfully executed, resulting in a root shell on the 'em3588-buildroot' device.

7.3.2 Type-C to USB3.0

Step 1: Connect the Type-C to USB3.0 converter to the Type-C port of the development board, and then insert the USB3.0 flash drive into the USB3.0 port of the docking station.



The serial port of the terminal will display the following message, indicating that the USB3.0 device is successfully recognized.

```

root@em3588-buildroot:/# [ 556.531623] dwc3 fc000000.usb: request 00000000ee205c7 was not queued to
ep0out
[ 556.531646] android_work: did not send uevent (0 0 0000000000000000)
[ 556.640222] xhci-hcd xhci-hcd.15.auto: xHCI Host Controller
[ 556.640655] xhci-hcd xhci-hcd.15.auto: new USB bus registered, assigned bus number 9
[ 556.640814] xhci-hcd xhci-hcd.15.auto: hcc params 0x0220fe64 hci version 0x110 quirks
0x0000808002010010
[ 556.640861] xhci-hcd xhci-hcd.15.auto: irq 87, io mem 0xfc000000
[ 556.640996] xhci-hcd xhci-hcd.15.auto: xHCI Host Controller
[ 556.641181] xhci-hcd xhci-hcd.15.auto: new USB bus registered, assigned bus number 10
[ 556.641200] xhci-hcd xhci-hcd.15.auto: Host supports USB 3.0 SuperSpeed
[ 556.641335] usb usb9: New USB device found, idVendor=1d6b, idProduct=0002, bcdDevice= 6.01
[ 556.641352] usb usb9: New USB device strings: Mfr=3, Product=2, SerialNumber=1
[ 556.641366] usb usb9: Product: xHCI Host Controller
[ 556.641378] usb usb9: Manufacturer: Linux 6.1.99 xhci-hcd
[ 556.641391] usb usb9: SerialNumber: xhci-hcd.15.auto
[ 556.641879] hub 9-0:1.0: USB hub found
[ 556.641911] hub 9-0:1.0: 1 port detected
[ 556.642216] usb usb10: We don't know the algorithms for LPM for this host, disabling LPM.
[ 556.642308] usb usb10: New USB device found, idVendor=1d6b, idProduct=0003, bcdDevice= 6.01
[ 556.642323] usb usb10: New USB device strings: Mfr=3, Product=2, SerialNumber=1
[ 556.642336] usb usb10: Product: xHCI Host Controller
[ 556.642347] usb usb10: Manufacturer: Linux 6.1.99 xhci-hcd
[ 556.642359] usb usb10: SerialNumber: xhci-hcd.15.auto
[ 556.642759] hub 10-0:1.0: USB hub found
[ 556.642788] hub 10-0:1.0: 1 port detected
[ 556.976604] usb 10-1: new SuperSpeed USB device number 2 using xhci-hcd
[ 557.007299] usb 10-1: New USB device found, idVendor=0dd8, idProduct=3b00, bcdDevice= 0.02
[ 557.007376] usb 10-1: New USB device strings: Mfr=1, Product=2, SerialNumber=3
[ 557.007410] usb 10-1: Product: OnlyDisk
[ 557.007438] usb 10-1: Manufacturer: Netac
[ 557.007465] usb 10-1: SerialNumber: C0E8BFA3EC38F796
[ 557.009686] usb-storage 10-1:1.0: USB Mass Storage device detected
[ 557.011257] scsi host1: usb-storage 10-1:1.0
[ 558.220066] scsi 1:0:0:0: Direct-Access Netac OnlyDisk 8.01 PQ: 0 ANSI: 6
[ 558.223574] sd 1:0:0:0: [sdb] 121610240 512-byte logical blocks: (62.3 GB/58.0 GiB)
[ 558.224064] sd 1:0:0:0: [sdb] Write Protect is off
[ 558.224387] sd 1:0:0:0: [sdb] Write cache: disabled, read cache: enabled, doesn't support DPO or FUA
[ 558.228834] sdb: sdb1
[ 558.229224] sd 1:0:0:0: [sdb] Attached SCSI removable disk
  
```

Step 2: After inserting the USB 3.0 flash drive, the system will automatically mount the device. Use the following command to check the directory information of the automatically mounted device:

```
# df -h
```

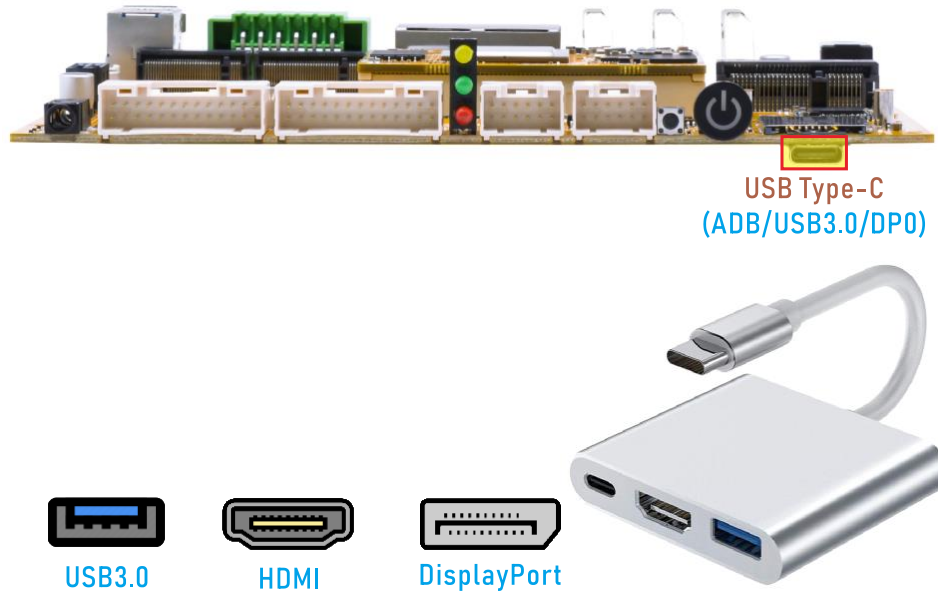
```

root@em3588-buildroot:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root        14G   701M   13G    6% /
devtmpfs         3.9G   8.0K   3.9G    1% /dev
tmpfs            3.9G  140K   3.9G    1% /tmp
tmpfs            3.9G  612K   3.9G    1% /run
tmpfs            3.9G  232K   3.9G    1% /var/log
tmpfs            3.9G    0   3.9G    0% /dev/shm
/dev/mmcblk0p8   15G   332K   15G    1% /userdata
/dev/mmcblk0p7  123M   12M   110M   10% /oem
/dev/sda1        120G   1.6M   120G    1% /mnt/storage
/dev/mmcblk1p1   120G   70M   120G    1% /mnt/sdcard
/dev/sdb1        58G    33G   26G   56% /mnt/udisk
  
```

7.3.3 DP Alt Mode

DisplayPort Alternate Mode (DP Alt Mode) is a technology that facilitates the transmission of DisplayPort video signals through a USB Type-C interface. It enables

devices to output video and audio via a USB-C connection without requiring a dedicated DisplayPort connector. This allows users to connect a display using a single USB-C port while transmitting video, audio, and additional data.



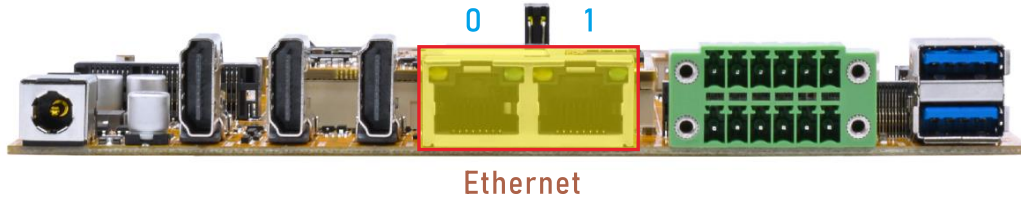
Currently, Boardcon has conducted the following output tests:

- **Type-C to HDMI:** Supports 3840x2160p60 resolution.
- **Type-C to DisplayPort (DP):** Supports 3840x2160p60 resolution.



7.4 Ethernet

Step 1: Connect the network cable to the Ethernet port.



According to the log, it can be seen that the Gigabit Ethernet recognition is successful.

```
root@em3588-buildroot:/# [ 933.895721] rk_gmac-dwmac fe1b0000.ethernet eth1: Link is Up - 1Gbps/Full -
flow control rx/tx
[ 933.895903] IPv6: ADDRCONF(NETDEV_CHANGE): eth1: link becomes ready

root@em3588-buildroot:/# [ 946.055718] rk_gmac-dwmac fe1c0000.ethernet eth0: Link is Up - 1Gbps/Full -
flow control rx/tx
[ 946.056250] IPv6: ADDRCONF(NETDEV_CHANGE): eth0: link becomes ready
```

Step 2: View network interface information.

```
# ifconfig
```

```
root@em3588-buildroot:/# ifconfig
eth0      Link encap:Ethernet  HWaddr 5A:0D:96:F9:98:96
          inet addr:192.168.0.190  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::e702:e500:4496:e6c9/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:71 errors:0 dropped:13 overruns:0 frame:0
          TX packets:11 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:6954 (6.7 KiB)  TX bytes:1410 (1.3 KiB)
          Interrupt:73

eth1      Link encap:Ethernet  HWaddr 56:0D:96:F9:98:96
          inet addr:192.168.0.215  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::5367:a846:5ed5:b1bc/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:112 errors:0 dropped:22 overruns:0 frame:0
          TX packets:11 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:11440 (11.1 KiB)  TX bytes:1410 (1.3 KiB)
          Interrupt:75
```

Step 3: Network connection test.

```
# ping -I eth0 www.armdesigner.com
# ping -I eth1 www.armdesigner.com
```

```

root@em3588-buildroot:/#
root@em3588-buildroot:/# ping -I eth0 www.armdesigner.com
PING www.armdesigner.com (67.222.54.196) from 192.168.0.190 eth0: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=50 time=183 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=50 time=183 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=50 time=183 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=50 time=183 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=50 time=183 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=50 time=183 ms
^C
--- www.armdesigner.com ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5007ms
rtt min/avg/max/mdev = 182.578/182.987/183.289/0.230 ms
root@em3588-buildroot:/#
root@em3588-buildroot:/# ping -I eth1 www.armdesigner.com
PING www.armdesigner.com (67.222.54.196) from 192.168.0.215 eth1: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=50 time=186 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=50 time=183 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=50 time=183 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=50 time=184 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=50 time=183 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=50 time=184 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=7 ttl=50 time=183 ms
^C
--- www.armdesigner.com ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6007ms
rtt min/avg/max/mdev = 182.695/183.642/186.285/1.125 ms

```

7.5 USB Host

The USB host can be used to connect devices such as USB mouse, USB keyboards, USB flash drives, and other USB peripherals.



2x USB3.0

After connecting the USB flash drive, it will be automatically mounted. The user can identify whether the mounted flash drive is USB 2.0 or USB 3.0 from the debug log.

- USB2.0 print information in **high-speed** mode.

```

root@em3588-buildroot:/# [ 1344.424024] usb 5-1: new high-speed USB device number 3 using ehci-platform
[ 1344.582342] usb 5-1: New USB device found, idVendor=23a9, idProduct=ef18, bcdDevice= 1.00
[ 1344.582425] usb 5-1: New USB device strings: Mfr=1, Product=2, SerialNumber=3
[ 1344.582459] usb 5-1: Product: Teclast CoolFlash
[ 1344.582487] usb 5-1: Manufacturer: Generic
[ 1344.582514] usb 5-1: SerialNumber: 12DE9A41EC364FC0
[ 1344.583914] usb-storage 5-1:1.0: USB Mass Storage device detected
[ 1344.585465] scsi host1: usb-storage 5-1:1.0
[ 1345.606164] scsi 1:0:0:0: Direct-Access Teclast CoolFlash 1.00 PQ: 0 ANSI: 4
[ 1345.610811] sd 1:0:0:0: [sdb] 62947520 512-byte logical blocks: (32.2 GB/30.0 GiB)
[ 1345.611787] sd 1:0:0:0: [sdb] Write Protect is off
[ 1345.612813] sd 1:0:0:0: [sdb] No Caching mode page found
[ 1345.612872] sd 1:0:0:0: [sdb] Assuming drive cache: write through
[ 1345.619150] sdb: sdb1
[ 1345.619430] sd 1:0:0:0: [sdb] Attached SCSI removable disk
[ 1345.809752] FAT-fs (sdb1): utf8 is not a recommended IO charset for FAT filesystems, filesystem will be case sensitive!
[ 1345.814065] FAT-fs (sdb1): Volume was not properly unmounted. Some data may be corrupt. Please run

```

- USB3.0 print information in **SuperSpeed** mode.

```

root@em3588-buildroot:/# [ 1353.632440] usb 4-1: new SuperSpeed USB device number 2 using xhci-hcd
[ 1353.663422] usb 4-1: New USB device found, idVendor=0dd8, idProduct=3b00, bcdDevice= 0.02
[ 1353.663503] usb 4-1: New USB device strings: Mfr=1, Product=2, SerialNumber=3
[ 1353.663537] usb 4-1: Product: OnlyDisk
[ 1353.663565] usb 4-1: Manufacturer: Netac
[ 1353.663593] usb 4-1: SerialNumber: C0E8BFA3EC38F796
[ 1353.665906] usb-storage 4-1:1.0: USB Mass Storage device detected
[ 1353.666915] scsi host2: usb-storage 4-1:1.0
[ 1355.394806] scsi 2:0:0:0: Direct-Access    Netac    OnlyDisk        8.01 PQ: 0 ANSI: 6
[ 1355.398369] sd 2:0:0:0: [sdc] 121610240 512-byte logical blocks: (62.3 GB/58.0 GiB)
[ 1355.398749] sd 2:0:0:0: [sdc] Write Protect is off
[ 1355.398932] sd 2:0:0:0: [sdc] Write cache: disabled, read cache: enabled, doesn't support DPO or FUA
[ 1355.403086] sdc: sdc1
[ 1355.403397] sd 2:0:0:0: [sdc] Attached SCSI removable disk
  
```

Execute the following command to view the path where the device is mounted:

```
# df -h
```

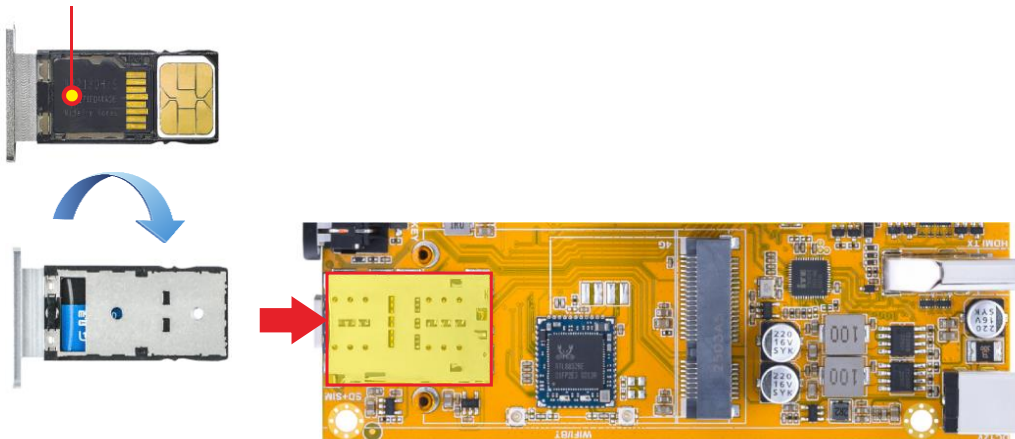
```

root@em3588-buildroot:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root        14G   701M   13G   6% /
devtmpfs         3.9G   8.0K   3.9G   1% /dev
tmpfs            3.9G   140K   3.9G   1% /tmp
tmpfs            3.9G   568K   3.9G   1% /run
tmpfs            3.9G   252K   3.9G   1% /var/log
tmpfs            3.9G    0   3.9G   0% /dev/shm
/dev/mmcblk0p8   15G   332K   15G   1% /userdata
/dev/mmcblk0p7  123M   12M  110M  10% /oem
/dev/sda1        120G   1.6M  120G   1% /mnt/storage
/dev/mmcblk1p1   120G    70M  120G   1% /mnt/sdcard
/dev/sdb1         31G    24G   6.6G  79% /mnt/udisk
/dev/sdc1         58G    33G   26G  56% /media/udisk1
  
```

7.6 SD Card

Step 1: Insert the micro SD card into the card slot.

Micro SD



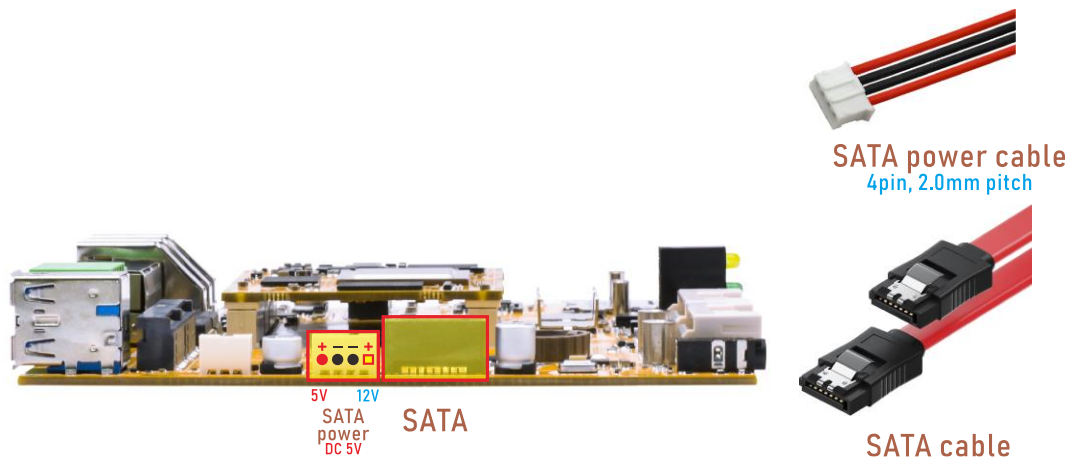
Step 2: The system will automatically mount it, view the device mount path.

```
# df -h
```

```
root@em3588-buildroot:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root        14G   774M   13G   6% /
devtmpfs         3.9G   8.0K   3.9G   1% /dev
tmpfs            3.9G  528K   3.9G   1% /run
tmpfs            3.9G  272K   3.9G   1% /var/log
tmpfs            3.9G    0   3.9G   0% /dev/shm
tmpfs            3.9G  140K   3.9G   1% /tmp
/dev/mmcblk0p7   124M   5.3M  118M   5% /oem
/dev/mmcblk0p8   15G   320K   15G   1% /userdata
/dev/mmcblk1p1   60G   33G   27G   56% /mnt/sdcard
```

7.7 SATA

Step 1: Connect the sata and sata power, then power on.



Step 2: The system will automatically mount it, view the device mount path.

```
# df -h
```

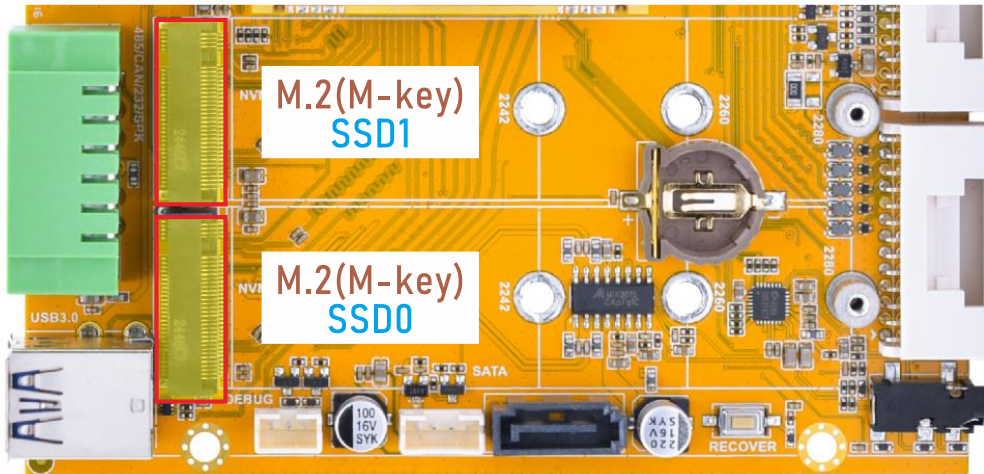
```
root@em3588-buildroot:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root        14G   774M   13G   6% /
devtmpfs         3.9G   8.0K   3.9G   1% /dev
tmpfs            3.9G  528K   3.9G   1% /run
tmpfs            3.9G  268K   3.9G   1% /var/log
tmpfs            3.9G    0   3.9G   0% /dev/shm
tmpfs            3.9G  140K   3.9G   1% /tmp
/dev/mmcblk0p7   124M   5.3M  115M   5% /oem
/dev/mmcblk0p8   15G   328K   15G   1% /userdata
/dev/sda1        112G   90G   23G   80% /mnt/storage
```

Note: The SATA on Buildroot only supports the ext4 format. If devices that are not in ext4 format, the user can choose to format them on the board. After formatting, **the files on the device will be permanently lost**, so please proceed with caution.

```
# mke2fs -t ext4 /dev/sda1
```

7.8 PCIe M.2 SSD

Step 1: Insert the M.2 SSD into the M.2 card slot, then power on the device.



Step 2: The system will automatically mount it, view the device mount path.

```
# df -h
```

```
root@em3588-buildroot:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root        14G   774M   13G   6% /
devtmpfs         3.9G   8.0K   3.9G   1% /dev
tmpfs            3.9G   552K   3.9G   1% /run
tmpfs            3.9G   280K   3.9G   1% /var/log
tmpfs            3.9G    0     3.9G   0% /dev/shm
tmpfs            3.9G   140K   3.9G   1% /tmp
/dev/mmcblk0p8   15G   312K   15G   1% /userdata
/dev/mmcblk0p7  124M    5.3M  118M   5% /oem
/dev/nvme0n1p1   233G    15M   233G   1% /mnt/storage
/dev/nvme1n1p1   477G    1.3M   477G   1% /media/storage1
/dev/mmcblk1p1   120G    85M   119G   1% /mnt/sdcard
```

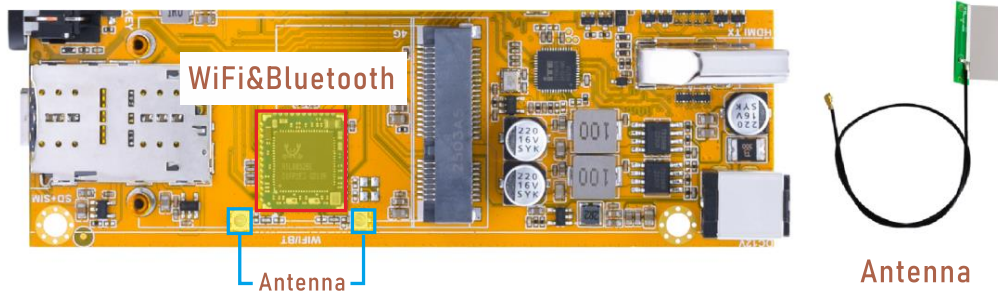
Note: The SSD on buildroot only supports the ext4 format. If devices that are not in ext4 format, the user can choose to format them on the board. After formatting, **the files on the device will be permanently lost**, so please proceed with caution.

```
# mke2fs -t ext4 /dev/nvme0n1p1
# mke2fs -t ext4 /dev/nvme1n1p1
```

- Use `/dev/nvme0n1p1` for the first SSD
- Use `/dev/nvme1n1p1` for the second SSD

7.9 WiFi & Bluetooth

To use Wi-Fi and Bluetooth functions properly, the antenna needs to be connected.



7.9.1 WiFi

Step 1: View the device information.

```
# ifconfig wlan0
```

```
root@em3588-buildroot:/# ifconfig wlan0
wlan0    Link encap:Ethernet  HWaddr CC:64:1A:78:ED:C0
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)
Interrupt:196
```

Step 2: Scan for available WiFi hotspots.

```
# iwlist wlan0 scan
```

```
root@em3588-buildroot:/# iwlist wlan0 scan
wlp4p65s0 Scan completed :
    Cell 01 - Address: B2:22:7A:5A:B6:4A
                ESSID:"DIRECT-4A-HP Laser 136w"
                Protocol:IEEE 802.11gn
                Mode:Master
                Frequency:2.412 GHz (Channel 1)
                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=56/100 Signal level=56/100
                Extra:fm=0003
    Cell 02 - Address: B4:F1:8C:6D:D1:29
                ESSID:""
                Protocol:IEEE 802.11bgn
                Mode:Master
                Frequency:2.412 GHz (Channel 1)
                Encryption key:on
                Bit Rates:780 Mb/s
                Extra:rsn_ie=30140100000fac040100000fac040100000fac020c00
                IE: IEEE 802.11i/WPA2 Version 1
                        Group Cipher : CCMP
                        Pairwise Ciphers (1) : CCMP
                        Authentication Suites (1) : PSK
                IE: Unknown: DD230050F204104A0001101044000102100800020780103C0001011049000600372A000120
                Quality=74/100 Signal level=74/100
                Extra:fm=0002
    Cell 03 - Address: B4:F1:8C:6D:D1:24
                ESSID:"Boardcon"
                Protocol:IEEE 802.11bgn
                Mode:Master
                Frequency:2.412 GHz (Channel 1)
                Encryption key:on
                Bit Rates:780 Mb/s
                Extra:fm=0003
```

Step 3: Connect to the hotspot.

```
# wifi-connect.sh SSID PSK
```



```
root@em3588-buildroot:/# wifi-connect.sh Boardcon Boardcon43435656
connect to Wifi ssid: Boardcon, Passwd: Boardcon43435656
Successfully initialized wpa_supplicant
rfkill: Cannot open RFKILL control device
[ 141.917804] RTW: rtw_set_802_11_connect(wlan0) fw_state=0x00000008
[ 141.919037] RTW: ERROR _connect_msg_hdlr(wlan0): assoc_AP_vendor gone!
[ 141.919081] RTW: [PHL STA]- role-idx: 0
[ 141.919090] RTW: [PHL STA]- mac_addr:b4:f1:8c:6d:d1:24
[ 141.919096] RTW: [PHL STA]- aid: 0
[ 141.919102] RTW: [PHL STA]- macid: 1
[ 141.919108] RTW: [PHL STA]- wifi_band: 1
[ 141.919113] RTW: [PHL STA]- bw: 0
[ 141.919119] RTW: [PHL STA]- chan: 36
[ 141.919124] RTW: [PHL STA]- offset: 0
[ 141.923310] PHL: [MAC] band_idle_ck: cnt 2199, band 0, 0x8
[ 142.062392] RTW: start auth
[ 142.070069] RTW: auth success, start assoc
[ 142.080847] RTW: assoc success
[ 142.081058] RTW: Updated A-MPDU number to 64 as default for b4:f1:8c:6d:d1:24
[ 142.081421] PHL: _hal_mac_add_pkt_ofld: len 24.
[ 142.081454] PHL: _hal_mac_add_pkt_ofld: id 0.
[ 142.084768] RTW: recv eapol packet 1/4
[ 142.085404] RTW: send eapol packet 2/4
[ 142.087481] PHL: _hal_mac_chk_pkt_ofld, check count = 1.
[ 142.087510] PHL: macid 1, probersp 255, pspoll 255, nulldata 0, qosnull 255, cts2self 255.
[ 142.087559] PHL: _hal_mac_add_pkt_ofld: len 26.
[ 142.087588] PHL: _hal_mac_add_pkt_ofld: id 1.
[ 142.093265] PHL: _hal_mac_chk_pkt_ofld, check count = 1.
[ 142.093289] PHL: macid 1, probersp 255, pspoll 255, nulldata 0, qosnull 1, cts2self 255.
[ 142.093327] PHL: [MAC] [INFO] max_agg_time is not controled by set_hw_ampdu_cfg
[ 142.093575] RTW: [PHL STA]- role-idx: 0
[ 142.093592] RTW: [PHL STA]- mac_addr:b4:f1:8c:6d:d1:24
[ 142.093601] RTW: [PHL STA]- aid: 24
[ 142.093608] RTW: [PHL STA]- macid: 1
[ 142.093615] RTW: [PHL STA]- wifi_band: 0
[ 142.093622] RTW: [PHL STA]- bw: 1
[ 142.093629] RTW: [PHL STA]- chan: 11
[ 142.093636] RTW: [PHL STA]- offset: 3
[ 142.103047] RTW: recv eapol packet 3/4
[ 142.103774] RTW: send eapol packet 4/4
[ 142.104584] PHL: ERROR _fail_evt_hdlr :: MDL_ID(77)_FAIL - MSG_EVT_ID=74
[ 142.104587] RTW: setkey_hdl: set group key for b4:f1:8c:6d:d1:24, kid:1 type:1 algo:TKIP
[ 142.104759] PHL: ERROR _fail_evt_hdlr :: MDL_ID(77)_FAIL - MSG_EVT_ID=74
[ 142.104818] IPv6: ADDRCONF(NETDEV_CHANGE): wlan0: link becomes ready
```

Step 4: View the network interface status.

```
# ifconfig wlan0
```

```
root@em3588-buildroot:/# ifconfig wlan0
wlan0      Link encap:Ethernet  HWaddr CC:64:1A:78:ED:C0
          inet addr:192.168.0.234  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::7e11:81b3:2dd1:aa67/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:236 errors:0 dropped:39 overruns:0 frame:0
          TX packets:20 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:31492 (30.7 KiB)  TX bytes:2492 (2.4 KiB)
          Interrupt:196
```

Step 5: Test the WiFi network.

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

```
root@em3588-buildroot:/# ping -I wlan0 www.armdesigner.com
PING d3dsoj86mhwkk6.cloudfront.net (108.138.246.8) from 192.168.0.234 wlan0: 56(84) bytes of data.
64 bytes from www.armdesigner.com (108.138.246.8): icmp_seq=1 ttl=246 time=212 ms
64 bytes from www.armdesigner.com (108.138.246.8): icmp_seq=2 ttl=246 time=176 ms
64 bytes from www.armdesigner.com (108.138.246.8): icmp_seq=3 ttl=246 time=152 ms
64 bytes from www.armdesigner.com (108.138.246.8): icmp_seq=4 ttl=246 time=180 ms
64 bytes from www.armdesigner.com (108.138.246.8): icmp_seq=5 ttl=246 time=199 ms
64 bytes from www.armdesigner.com (108.138.246.8): icmp_seq=6 ttl=246 time=163 ms
^C
--- d3dsoj86mhwkk6.cloudfront.net ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5007ms
rtt min/avg/max/mdev = 152.040/180.307/211.977/20.297 ms
```

7.9.2 Bluetooth

By default, Bluetooth is configured to work as a Bluetooth speaker.

Follow the steps below to pair and connect a device:

Step 1: Start the Bluetooth control tool

```
# bluetoothctl
```

```
root@em3588-buildroot:/# bluetoothctl
hci0 new_settings: powered bondable ssp br/edr le secure-conn cis-central cis-peripheral
Agent registered
[CHG] Controller CC:64:1A:78:B3:E7 Pairable: yes
[bluetooth]#
```

Step 2: Scan for nearby Bluetooth devices.

Turn scanning on, then off after discovering devices (otherwise it will keep searching and refreshing).

```
[bluetooth]# scan on
[bluetooth]# scan off
```

```
[bluetooth]# scan on
SetDiscoveryFilter success
[bluetooth]# [ 238.841649] rtk_btcoex: hci (periodic)inq start
hci0 type 7 discovering on
Discovery started
[CHG] Controller CC:64:1A:78:B3:E7 Discovering: yes
[NEW] Device 62:C4:BC:DB:F6:CC 62-C4-BC-DB-F6-CC
[NEW] Device A8:35:12:9A:EB:4D liuy
[NEW] Device 62:B8:78:F2:78:08 62-B8-78-F2-78-08
[NEW] Device 75:F4:53:77:15:99 75-F4-53-77-15-99
[NEW] Device C1:14:88:1E:63:B5 C1-14-88-1E-63-B5
[NEW] Device 79:63:4C:2A:04:50 NZbI73aRlO1JD/BBPtMyHLHK0
[CHG] Device A8:35:12:9A:EB:4D RSSI: 0xffffffffb8 (-72)
[NEW] Device 7F:6C:64:88:4D:DF 7F-6C-64-88-4D-DF
[NEW] Device 08:1A:91:55:4D:22 08-1A-91-55-4D-22
[NEW] Device 44:5E:76:2E:8A:56 44-5E-76-2E-8A-56
[NEW] Device 75:12:98:ED:80:B6 75-12-98-ED-80-B6
[NEW] Device D4:6C:27:DF:40:46 D4-6C-27-DF-40-46
[CHG] Device 62:B8:78:F2:78:08 RSSI: 0xffffffff96 (-106)
[NEW] Device 4D:82:D9:E0:69:FA 4D-82-D9-E0-69-FA
[CHG] Device 79:63:4C:2A:04:50 RSSI: 0xfffffffffa4 (-92)
[CHG] Device 75:F4:53:77:15:99 RSSI: 0xfffffffffa2 (-94)
[CHG] Device D4:6C:27:DF:40:46 RSSI: 0xffffffff98 (-104)
[NEW] Device 66:51:05:89:D4:18 66-51-05-89-D4-18
[NEW] Device 5A:F1:9B:78:0D:AC 5A-F1-9B-78-0D-AC
[CHG] Device C1:14:88:1E:63:B5 RSSI: 0xfffffffffaa (-86)
[CHG] Device 5A:F1:9B:78:0D:AC RSSI: 0xfffffffffa2 (-94)
[CHG] Device D4:6C:27:DF:40:46 RSSI: 0xfffffffffa0 (-96)
[CHG] Device 79:63:4C:2A:04:50 RSSI: 0xffffffff94 (-108)
[bluetooth]# scan off
[bluetooth]# [ 244.787547] rtk_btcoex: hci (periodic)inq cancel/exit
hci0 type 7 discovering off
Discovery stopped
[CHG] Device 5A:F1:9B:78:0D:AC TxPower is nil
[CHG] Device 5A:F1:9B:78:0D:AC RSSI is nil
[CHG] Device 66:51:05:89:D4:18 TxPower is nil
[CHG] Device 66:51:05:89:D4:18 RSSI is nil
[CHG] Device 4D:82:D9:E0:69:FA TxPower is nil
[CHG] Device 4D:82:D9:E0:69:FA RSSI is nil
[CHG] Device D4:6C:27:DF:40:46 RSSI is nil
[CHG] Device 75:12:98:ED:80:B6 TxPower is nil
[CHG] Device 75:12:98:ED:80:B6 RSSI is nil
[CHG] Device 44:5E:76:2E:8A:56 TxPower is nil
[CHG] Device 44:5E:76:2E:8A:56 RSSI is nil
[CHG] Device 08:1A:91:55:4D:22 RSSI is nil
[CHG] Device 7F:6C:64:88:4D:DF TxPower is nil
[CHG] Device 7F:6C:64:88:4D:DF RSSI is nil
[CHG] Device 79:63:4C:2A:04:50 TxPower is nil
[CHG] Device 79:63:4C:2A:04:50 RSSI is nil
[CHG] Device C1:14:88:1E:63:B5 RSSI is nil
[CHG] Device 75:F4:53:77:15:99 TxPower is nil
[CHG] Device 75:F4:53:77:15:99 RSSI is nil
[CHG] Device 62:B8:78:F2:78:08 TxPower is nil
[CHG] Device 62:B8:78:F2:78:08 RSSI is nil
[CHG] Device A8:35:12:9A:EB:4D RSSI is nil
[CHG] Device 62:C4:BC:DB:F6:CC RSSI is nil
[CHG] Controller CC:64:1A:78:B3:E7 Discovering: no
```

Step 3: List available devices

```
[bluetooth]# devices
```

```
[bluetooth]# devices
Device 62:C4:BC:DB:F6:CC 62-C4-BC-DB-F6-CC
Device A8:35:12:9A:EB:4D liuy
Device 62:B8:78:F2:78:08 62-B8-78-F2-78-08
Device 75:F4:53:77:15:99 75-F4-53-77-15-99
Device C1:14:88:1E:63:B5 C1-14-88-1E-63-B5
Device 79:63:4C:2A:04:50 NZbI73aR101JD/BBPtMyHLHK0
Device 7F:6C:64:88:4D:DF 7F-6C-64-88-4D-DF
Device 08:1A:91:55:4D:22 08-1A-91-55-4D-22
Device 44:5E:76:2E:8A:56 44-5E-76-2E-8A-56
Device 75:12:98:ED:80:B6 75-12-98-ED-80-B6
Device D4:6C:27:DF:40:46 D4-6C-27-DF-40-46
Device 4D:82:D9:E0:69:FA 4D-82-D9-E0-69-FA
Device 66:51:05:89:D4:18 66-51-05-89-D4-18
Device 5A:F1:9B:78:0D:AC 5A-F1-9B-78-0D-AC
```

Step 4: Pair with a device

Replace the MAC address with the one of your target device.

```
[bluetooth]# pair A8:35:12:9A:EB:4D
```

```
[bluetooth]# pair A8:35:12:9A:EB:4D
Attempting to pair with A8:35:12:9A:EB:4D
hci0 device_flags_changed: A8:35:12:9A:EB:4D (BR/EDR)
  supp: 0x00000000 curr: 0x00000000
[bluetooth]# [ 338.394633] rtk_btcoex: hci create connection, start paging
[ 339.157433] rtk_btcoex: connected, handle 0001, status 0x00
[ 339.157521] rtk_btcoex: Page success
[CHG] Device A8:35:12:9A:EB:4D Connected: yes
[liuy]# [ 339.194604] rtk_btcoex: io capability request
hci0 A8:35:12:9A:EB:4D type BR/EDR connected eir_len 5
Request confirmation
[agent] Confirm passkey 085701 (yes/no): yes
[liuy]# [ 345.695474] rtk_btcoex: link key notify
[CHG] Device A8:35:12:9A:EB:4D Bonded: yes
[liuy]# [ 345.859749] rtk_btcoex: l2cap op 2, len 16, out 0
[ 345.859904] rtk_btcoex: RX l2cap conn req, hndl 0x0001, PSM 0x0001, scid 0x0045
hci0 A8:35:12:9A:EB:4D type BR/EDR connected eir_len 5
[ 345.859942] rtk_btcoex: PSM(0x0001) do not need parse
[liuy]# [ 345.860210] rtk_btcoex: l2cap op 3, len 20, out 1
[ 345.860297] rtk_btcoex: TX l2cap conn rsp, hndl 0x0001, dcid 0x0041, scid 0x0045, result 0x0001
hci0 A8:35:12:9A:EB:4D type BR/EDR connected eir_len 5
[ 346.158682] rtk_btcoex: l2cap op 3, len 20, out 1
[liuy]# [ 346.158771] rtk_btcoex: TX l2cap conn rsp, hndl 0x0001, dcid 0x0042, scid 0x005e, result 0x0000
hci0 A8:35:12:9A:EB:4D type BR/EDR connected eir_len 5
[CHG] Device A8:35:12:9A:EB:4D Modalias: bluetooth:v010Fp107Ed1436
[CHG] Device A8:35:12:9A:EB:4D UUIDs: 0000046a-0000-1000-8000-00805f9b34fb
[CHG] Device A8:35:12:9A:EB:4D UUIDs: 00001105-0000-1000-8000-00805f9b34fb
[CHG] Device A8:35:12:9A:EB:4D UUIDs: 0000110a-0000-1000-8000-00805f9b34fb
[CHG] Device A8:35:12:9A:EB:4D UUIDs: 0000110c-0000-1000-8000-00805f9b34fb
[CHG] Device A8:35:12:9A:EB:4D UUIDs: 00001112-0000-1000-8000-00805f9b34fb
[CHG] Device A8:35:12:9A:EB:4D UUIDs: 00001115-0000-1000-8000-00805f9b34fb
[CHG] Device A8:35:12:9A:EB:4D UUIDs: 00001116-0000-1000-8000-00805f9b34fb
[CHG] Device A8:35:12:9A:EB:4D UUIDs: 0000111f-0000-1000-8000-00805f9b34fb
[CHG] Device A8:35:12:9A:EB:4D UUIDs: 0000112f-0000-1000-8000-00805f9b34fb
[CHG] Device A8:35:12:9A:EB:4D UUIDs: 00001132-0000-1000-8000-00805f9b34fb
[CHG] Device A8:35:12:9A:EB:4D UUIDs: 00001200-0000-1000-8000-00805f9b34fb
[CHG] Device A8:35:12:9A:EB:4D UUIDs: 00001800-0000-1000-8000-00805f9b34fb
[CHG] Device A8:35:12:9A:EB:4D UUIDs: 00001801-0000-1000-8000-00805f9b34fb
[CHG] Device A8:35:12:9A:EB:4D UUIDs: 0000fe35-0000-1000-8000-00805f9b34fb
[CHG] Device A8:35:12:9A:EB:4D UUIDs: 11c8b310-80e4-4276-afc0-f81590b2177f
[CHG] Device A8:35:12:9A:EB:4D UUIDs: 8ce255c0-200a-11e0-ac64-0800200c9a66
[CHG] Device A8:35:12:9A:EB:4D UUIDs: 9664aa26-d76c-43ad-9775-d310f253a408
[CHG] Device A8:35:12:9A:EB:4D ServicesResolved: yes
[CHG] Device A8:35:12:9A:EB:4D Paired: yes
Pairing successful
```

Step 5: Trust the device (to avoid having to pair again each time)

```
[bluetooth]# trust A8:35:12:9A:EB:4D
```

```
[bluetooth]# trust A8:35:12:9A:EB:4D
[CHG] Device A8:35:12:9A:EB:4D Trusted: yes
Changing A8:35:12:9A:EB:4D trust succeeded
```

Step 6: Connect to the paired device

```
[bluetooth]# connect A8:35:12:9A:EB:4D
```

```
[bluetooth]# connect A8:35:12:9A:EB:4D
Attempting to connect to A8:35:12:9A:EB:4D
[bluetooth]# [ 365.704531] rtk_btcoex: hci create connection, start paging
[ 367.301010] rtk_btcoex: connected, handle 0002, status 0x00
[ 367.301105] rtk_btcoex: Page success
[CHG] Device A8:35:12:9A:EB:4D Connected: yes
[liuy]# [ 367.638107] rtk_btcoex: l2cap op 2, len 16, out 1
hci0 A8:35:12:9A:EB:4D type BR/EDR connected eir_len 5
[ 367.638226] rtk_btcoex: TX l2cap conn req, hndl 0x0002, PSM 0x0019, scid 0x0040
[liuy]# [ 367.638265] rtk_btcoex: list_allocate_add: Add a2dp signal channel
[ 367.756506] rtk_btcoex: l2cap op 3, len 20, out 0
[ 367.756655] rtk_btcoex: RX l2cap conn rsp, hndl 0x0002, dcid 0x005a, scid 0x0040, result 0x0000
hci0 A8:35:12:9A:EB:4D type BR/EDR connected eir_len 5
[ 367.756697] rtk_btcoex: l2cap connection success, update connection
[liuy]# [ 367.756721] rtk_btcoex: update_profile_connection: is_add 1, profile_index 2
[ 367.756756] rtk_btcoex: update_profile_connection: phci_conn->profile_bitmap 0x04
[ 367.756784] rtk_btcoex: rtk_notify_profileinfo_to_fw: BufferSize 7
[ 367.756807] rtk_btcoex: rtk_notify_profileinfo_to_fw: NumberOfHandles 1
[ 367.756831] rtk_btcoex: rtk_notify_profileinfo_to_fw: profile_status 0xfd8c
[ 367.756856] rtk_btcoex: rtk_notify_profileinfo_to_fw: profile_bitmap 0x04
[ 367.756883] rtk_btcoex: rtk_vendor_cmd_to_fw: opcode 0xfc1b
[NEW] Endpoint /org/bluez/hci0/dev_A8_35_12_9A_EB_4D/sep1
[NEW] Endpoint /org/bluez/hci0/dev_A8_35_12_9A_EB_4D/sep2
[NEW] Endpoint /org/bluez/hci0/dev_A8_35_12_9A_EB_4D/sep3
[NEW] Endpoint /org/bluez/hci0/dev_A8_35_12_9A_EB_4D/sep4
hci0 A8:35:12:9A:EB:4D type BR/EDR connected eir_len 5
[NEW] Transport /org/bluez/hci0/dev_A8_35_12_9A_EB_4D/sep1/fd0
hci0 A8:35:12:9A:EB:4D type BR/EDR connected eir_len 5
hci0 A8:35:12:9A:EB:4D type BR/EDR connected eir_len 5
[liuy]# [ 367.972714] rtk_btcoex: l2cap op 2, len 16, out 1
[ 367.972714] rtk_btcoex: TX l2cap conn req, hndl 0x0002, PSM 0x0019, scid 0x0041
[ 367.972756] rtk_btcoex: list_allocate_add: Add a2dp media channel
[ 367.992965] rtk_btcoex: l2cap op 3, len 20, out 0
[ 367.993091] rtk_btcoex: RX l2cap conn rsp, hndl 0x0002, dcid 0x0049, scid 0x0041, result 0x0000
hci0 A8:35:12:9A:EB:4D type BR/EDR connected eir_len 5
[ 367.993133] rtk_btcoex: l2cap connection success, update connection
[liuy]# [ 367.993157] rtk_btcoex: update_profile_connection: is_add 1, profile_index 2
[ 367.993186] rtk_btcoex: update_profile_connection: phci_conn->profile_bitmap 0x04
[liuy]# [ 368.015640] rtk_btcoex: l2cap op 2, len 16, out 1
[ 368.015683] rtk_btcoex: TX l2cap conn req, hndl 0x0002, PSM 0x0001, scid 0x0042
Connection successful
[ 368.015695] rtk_btcoex: PSM(0x0001) do not need parse
[liuy]#
```

Step 7: Remove a paired device (unpair)

```
[bluetooth]# remove A8:35:12:9A:EB:4D
```

```
[liuy]# remove A8:35:12:9A:EB:4D
[liuy]# [ 776.858051] rtk_btcoex: l2cap op 6, len 16, out 1
[ 776.858178] rtk_btcoex: l2cap op 6, len 16, out 1
[ 776.858233] rtk_btcoex: TX l2cap disconn req, hndl 0x0002, dcid 0x0052, scid 0x0044
[ 776.858269] rtk_btcoex: handle_l2cap_discon_req: handle 0x0002, dcid 0x0052, scid 0x0044, dir 1
[DEL] Player /org/bluez/hci0/dev_A8_35_12_9A_EB_4D/player0 [default]
[ 776.858304] rtk_btcoex: update_profile_connection: is_add 0, profile_index 3
[liuy]# [01:46:50.107] event10 - liuy (AVRCP): device removed
[ 776.858331] rtk_btcoex: update_profile_connection: phci_conn->profile_bitmap 0x0c
[ 776.858356] rtk_btcoex: Delete profile: hndl 0x0002, psm 0x001b, dcid 0x0052, scid 0x0044
[ 776.858396] rtk_btcoex: TX l2cap disconn req, hndl 0x0002, dcid 0x005d, scid 0x0043
[ 776.858424] rtk_btcoex: handle_l2cap_discon_req: handle 0x0002, dcid 0x005d, scid 0x0043, dir 1
[ 777.083512] rtk_btcoex: update_hid_active_state: handle 0x0002, interval 0
[ 777.083598] rtk_btcoex: HID not connected, nothing to be down
hci0 A8:35:12:9A:EB:4D type BR/EDR connected eir_len 5
[liuy]# [ 777.135979] rtk_btcoex: l2cap op 6, len 16, out 1
[ 777.136067] rtk_btcoex: TX l2cap disconn req, hndl 0x0002, dcid 0x0049, scid 0x0041
[ 777.136104] rtk_btcoex: handle_l2cap_discon_req: handle 0x0002, dcid 0x0049, scid 0x0041, dir 1
[ 777.136138] rtk_btcoex: update_profile_connection: is_add 0, profile_index 2
[ 777.136167] rtk_btcoex: update_profile_connection: phci_conn->profile_bitmap 0x0c
[ 777.136194] rtk_btcoex: Delete profile: hndl 0x0002, psm 0x0019, dcid 0x0049, scid 0x0041
[ 777.139428] rtk_btcoex: l2cap op 6, len 16, out 1
[DEL] Transport /org/bluez/hci0/dev_A8_35_12_9A_EB_4D/sep1/fd0
[ 777.139516] rtk_btcoex: TX l2cap disconn req, hndl 0x0002, dcid 0x005a, scid 0x0040
[liuy]# [ 777.139552] rtk_btcoex: handle_l2cap_discon_req: handle 0x0002, dcid 0x005a, scid 0x0040, dir 1
[ 777.139585] rtk_btcoex: update_profile_connection: is_add 0, profile_index 2
[DEL] Endpoint /org/bluez/hci0/dev_A8_35_12_9A_EB_4D/sep1
[ 777.139612] rtk_btcoex: rtk_check_del_timer: handle 0x 2
[liuy]# [ 777.139641] rtk_btcoex: update_profile_connection: phci_conn->profile_bitmap 0x08
[DEL] Endpoint /org/bluez/hci0/dev_A8_35_12_9A_EB_4D/sep2
[ 777.139668] rtk_btcoex: rtk_notify_profileinfo_to_fw: BufferSize 7
[DEL] Endpoint /org/bluez/hci0/dev_A8_35_12_9A_EB_4D/sep3
[ 777.139692] rtk_btcoex: rtk_notify_profileinfo_to_fw: NumberOfHandles 1
[DEL] Endpoint /org/bluez/hci0/dev_A8_35_12_9A_EB_4D/sep4
[ 777.139716] rtk_btcoex: rtk_notify_profileinfo_to_fw: profile_status 0xfd80
[liuy]# [ 777.139741] rtk_btcoex: rtk_notify_profileinfo_to_fw: profile_bitmap 0x08
[ 777.139767] rtk_btcoex: rtk_vendor_cmd_to_fw: opcode 0xfc1b
[ 777.139830] rtk_btcoex: Delete profile: hndl 0x0002, psm 0x0019, dcid 0x005a, scid 0x0040
hci0 A8:35:12:9A:EB:4D type BR/EDR connected eir_len 5
hci0 A8:35:12:9A:EB:4D type BR/EDR connected eir_len 5
hci0 A8:35:12:9A:EB:4D type BR/EDR connected eir_len 5
hci0 A8:35:12:9A:EB:4D type BR/EDR connected eir_len 5
[liuy]# [ 778.982920] rtk_btcoex: HCI Disconnect, handle 0002, reason 0x13
[ 779.119198] rtk_btcoex: disconn cmpl evt: status 0x00, handle 0002, reason 0x16
[ 779.119273] rtk_btcoex: process disconn complete event.
hci0 A8:35:12:9A:EB:4D type BR/EDR disconnected with reason 2
[ 779.119298] rtk_btcoex: hci disconn, hndl 2, psm 3, dcid 44, scid 42, profile 3
[CHG] Device A8:35:12:9A:EB:4D ServicesResolved: no
[ 779.119328] rtk_btcoex: disconn_profile: profile_ref[3] 1
Device has been removed
[ 779.119356] rtk_btcoex: rtk_check_del_timer: handle 0x 2
[liuy]# [ 779.119388] rtk_btcoex: Delete profile: hndl 0x0002, psm 0x0003, dcid 0x0044, scid 0x0042
[ 779.119421] rtk_btcoex: rtk_notify_profileinfo_to_fw: BufferSize 1
[ 779.119445] rtk_btcoex: rtk_notify_profileinfo_to_fw: NumberOfHandles 0
[ 779.119473] rtk_btcoex: rtk_vendor_cmd_to_fw: opcode 0xfc1b
[CHG] Device A8:35:12:9A:EB:4D Connected: no
[DEL] Device A8:35:12:9A:EB:4D liuy
[bluetooth]#
```

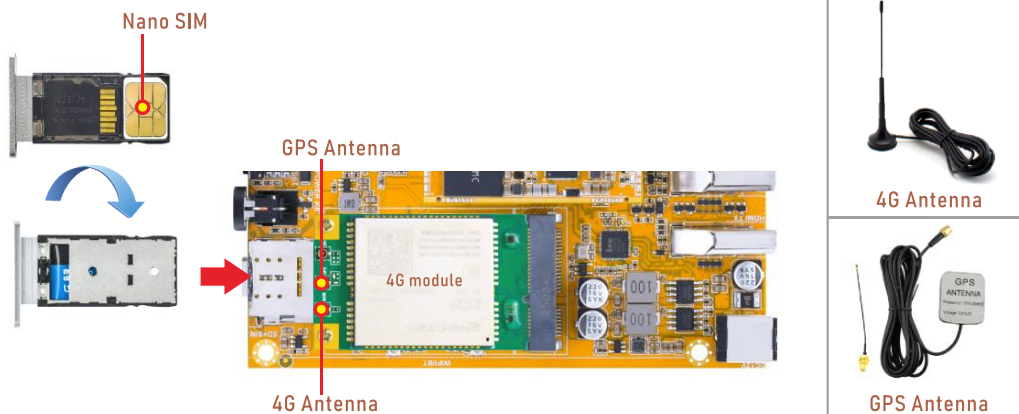
Bluetoothctl Common Commands:

```
# bluetoothctl                                /* Start bluetoothctl interactive tool */
[bluetooth]# scan on                          /* Enable scanning for nearby devices */
[bluetooth]# scan off                        /* Disable scanning, stop refreshing */
[bluetooth]# devices                         /* Show discovered devices with MAC addresses */
[bluetooth]# pair XX:XX:XX:XX:XX:XX          /* Pair with specified device */
[bluetooth]# trust XX:XX:XX:XX:XX:XX         /* Trust device for auto-connect */
[bluetooth]# connect XX:XX:XX:XX:XX:XX       /* Connect to paired device */
[bluetooth]# disconnect XX:XX:XX:XX:XX:XX    /* Disconnect from device */
[bluetooth]# remove XX:XX:XX:XX:XX:XX        /* Remove (unpair) device */
[bluetooth]# paired-devices                  /* List previously paired devices */
[bluetooth]# list                           /* Show local Bluetooth adapters */
[bluetooth]# discoverable on                 /* Make device discoverable */
[bluetooth]# discoverable off                /* Make device non-discoverable */
[bluetooth]# exit                           /* Exit bluetoothctl */
```

7.10 4G & GPS

Step 1: Insert 4G module to PCIe socket (4G model: EC20), and connect antenna.

Step 2: Connect antenna and insert SIM card.



Step 3: Power on.

7.10.1 4G Test

Step 1: Initiate the PPP connection.

```
# mkdir -p var/run/pppd/lock
# pppd call quectel-ppp &
```



```
root@em3588-buildroot:/# mkdir -p var/run/pppd/lock
root@em3588-buildroot:/# pppd call quectel-ppp &
[1] 1495
root@em3588-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/ttyUSB_4G # (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)
noccps       # (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)
^M
OK
-- got it

send (ATE0^M)
expect (OK)
^M
^M
OK
-- got it

send (ATI;+CSUB;+CSQ;+CPIN?;+COPS?;+CGREG?;&D2^M)
expect (OK)
^M
^M
Quectel^M
EC25^M
Revision: EC25EUXGAR08A17M1G^M
^M
SubEdition: V01^M
^M
+CSQ: 28,99^M
^M
+CPIN: READY^M
^M
+COPS: 0,0,"Suning\00",7^M
^M
+CGREG: 0,1^M
^M
OK
-- got it

send (AT+CGDCONT=1,"IP","3gnet",,0,0^M)
expect (OK)
^M
^M
OK
-- got it

send (ATD*99#^M)
expect (CONNECT)
^M
^M
CONNECT
-- got it
```

Step 2: Check the status of the network interfaces.

```
# ifconfig ppp0
```

```
root@em3588-buildroot:/# ifconfig ppp0
ppp0      Link encap:Point-to-Point Protocol
          inet addr:10.71.26.87 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:14 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:3
          RX bytes:52 (52.0 B) TX bytes:198 (198.0 B)
```

Step 3: Test the PPP connection.

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

```
root@em3588-buildroot:/# ping -I ppp0 www.armdesigner.com
PING www.armdesigner.com (67.222.54.196) from 10.71.26.87 ppp0: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=44 time=566 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=44 time=524 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=44 time=499 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=44 time=459 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=44 time=402 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=44 time=370 ms
^C
--- www.armdesigner.com ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5003ms
rtt min/avg/max/mdev = 369.647/469.937/566.323/68.045 ms
```

7.10.2 GPS Test

Step 1: Enable GPS functionality.

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

Step 2: Read GPS data.

```
# cat /dev/ttyUSB1
```

```
root@em3588-buildroot:/# echo -e "AT+QGPS=1\r\n" > /dev/ttyUSB2
root@em3588-buildroot:/# cat /dev/ttyUSB1
$GPVTD,,T,,M,,N,,K,N*2C

$GPGSA,A,1,,,,,,,,,,,,,*,32

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

$GPRMC,,V,,,,,,,,,N,V*29

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

$GPGSA,A,1,,,,,,,,,,,,,*,32

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

$GPRMC,,V,,,,,,,,,N,V*29

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

$GPGSA,A,1,,,,,,,,,,,,,*,32

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

7.11 Audio

Step 1: Plug the headset into the headset jack and connect the speaker.



Headset



2x Speaker

Step 2: View sound card.

```
# cat /proc/asound/cards
```

```
root@em3588-buildroot:/# cat /proc/asound/cards
0 [rockchip-es8388 ]: rockchip-es8388 - rockchip-es8388
rockchip-es8388
1 [rockchip-hdmi0 ]: rockchip-hdmi0 - rockchip-hdmi0
rockchip-hdmi0
2 [rockchip-hdmi1 ]: rockchip-hdmi1 - rockchip-hdmi1
rockchip-hdmi1
3 [rockchip-dp0 ]: rockchip-dp0 - rockchip-dp0
rockchip-dp0
4 [rockchip-dp1 ]: rockchip-dp1 - rockchip-dp1
rockchip-dp1
```

Step 3: Headset recording.

```
# arecord -Dhw:0,0 -f cd record.wav
```

```
root@em3588-buildroot:/# arecord -Dhw:0,0 -f cd record.wav
Recording WAVE 'record.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

Step 4: Headset or speaker play audio. (Headset> speaker)

```
# aplay -Dhw:0,0 record.wav
```

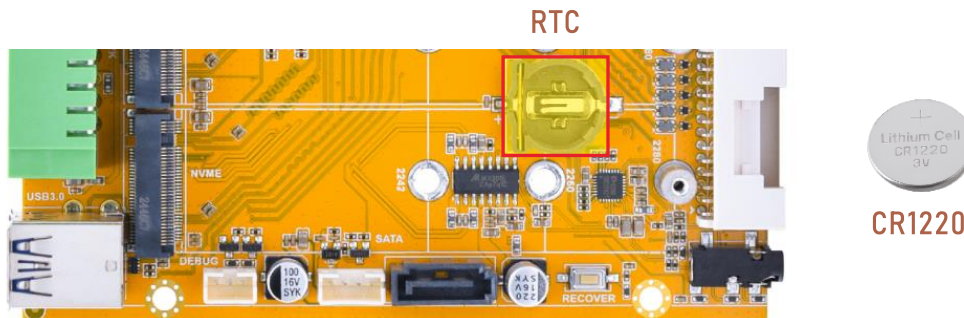
```
root@em3588-buildroot:/# aplay -Dhw:0,0 record.wav
Playing WAVE 'record.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

Supplementary instructions on audio output:

```
# aplay -Dhw:0,0 record.wav // Headset or speaker audio output
# aplay -Dhw:1,0 record.wav // HDMI0 TX audio output (HDMI0)
# aplay -Dhw:2,0 record.wav // HDMI1 TX audio output (HDMI1)
# aplay -Dhw:3,0 record.wav // DP AIT mode audio output
# aplay -Dhw:4,0 record.wav // DP to HDMI audio output (HDMI2)
```

7.12 RTC

Step 1: Install the coin cell battery.



Step 2: Set the system time.

```
# date -s "2026-06-19 15:00:00"
```

Step 3: Write the system time to the hardware clock.

```
# hwclock -w
```

Step 4: Display the current hardware clock time.

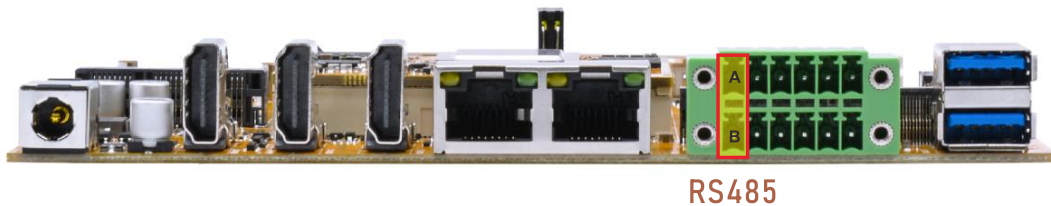
```
# hwclock
```

```
root@em3588-buildroot:/# date -s "2026-06-19 15:00:00"
Fri Jun 19 15:00:00 UTC 2026
root@em3588-buildroot:/# hwclock -w
root@em3588-buildroot:/# hwclock
Fri Jun 19 15:00:02 2026 0.000000 seconds
root@em3588-buildroot:/# hwclock
Fri Jun 19 15:00:06 2026 0.000000 seconds
```

Step 5: Power off, after a period of time to turn on the power again, check whether the time is saved.

```
root@em3588-buildroot:/# hwclock
Fri Jun 19 15:01:46 2026 0.000000 seconds
root@em3588-buildroot:/# hwclock
Fri Jun 19 15:01:49 2026 0.000000 seconds
root@em3588-buildroot:/# hwclock
Fri Jun 19 15:02:02 2026 0.000000 seconds
```

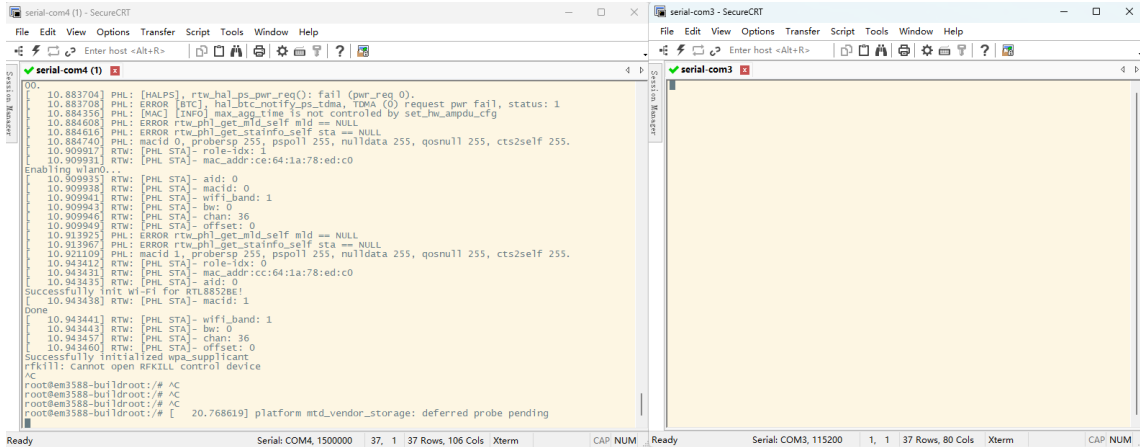
7.13 RS485



Step 1: As shown in the diagram, connect the RS485 test tool to the development board.

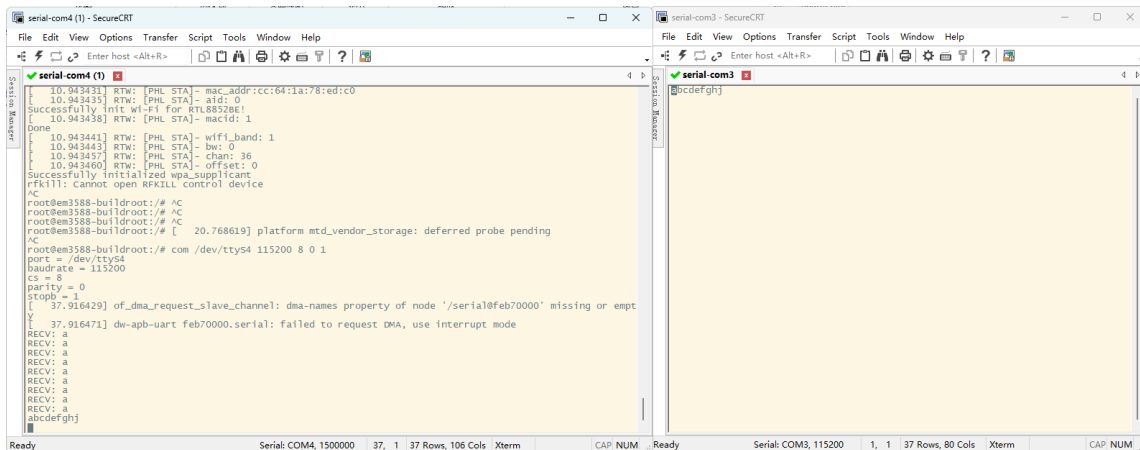


Step 2: Open the corresponding serial terminal, set the baud rate of the board to 1500000, and set the baud rate of the RS485 test tool to 115200.



Step 3: Execute the following command on the board to test the RS485 transmission and reception functionality.

```
# com /dev/ttyS4 115200 8 0 1
```



7.14 CAN

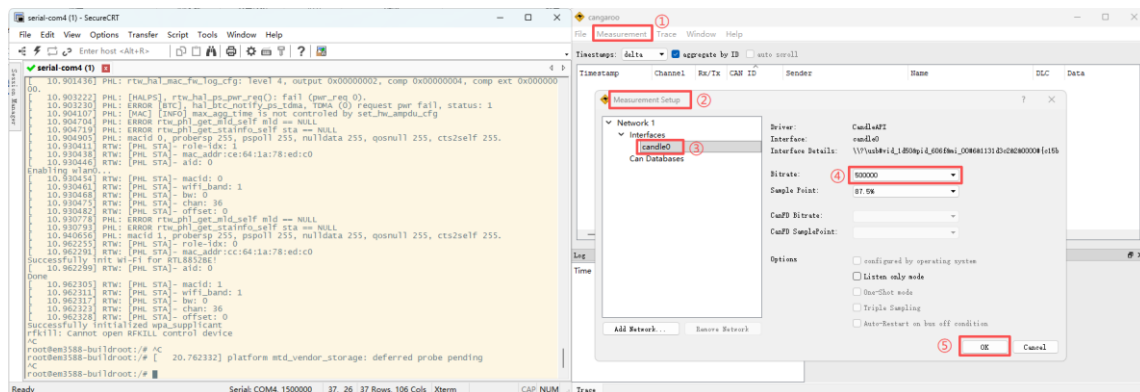


CAN

Step 1: Connect the CAN test tool to the board as shown in the diagram below.

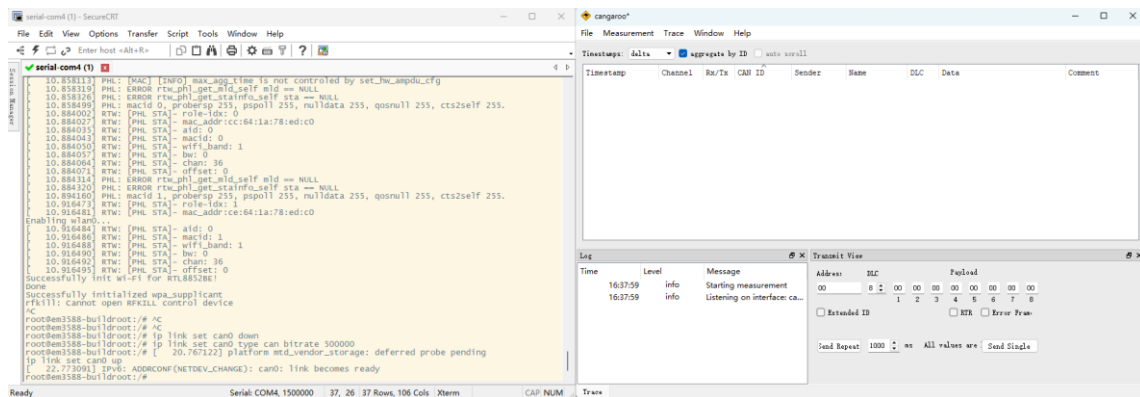


Step 2: Open the CAN test software and set the baud rate to 500000.



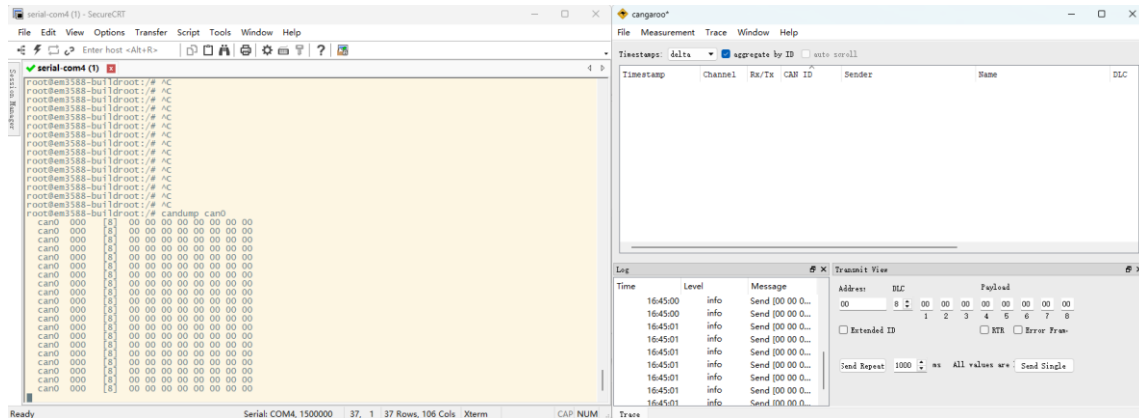
Step 3: Configure and activate the CAN network, setting the bitrate to 500000.

```
# ip link set can0 down
# ip link set can0 type can bitrate 500000
# ip link set can0 up
```



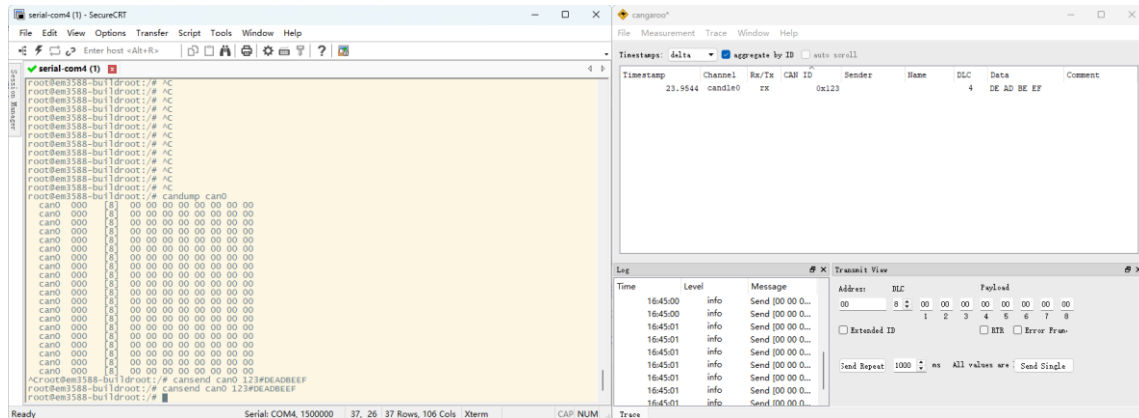
Step 4: Configure CAN as the receiver.

```
# candump can0
```



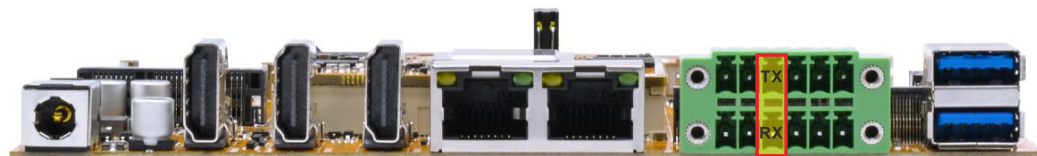
Step 5: Configure CAN as the sender.

```
# cansend can0 123#DEADBEEF
```



7.15 RS232

Step 1: Short circuit RX and TX pins of UART.



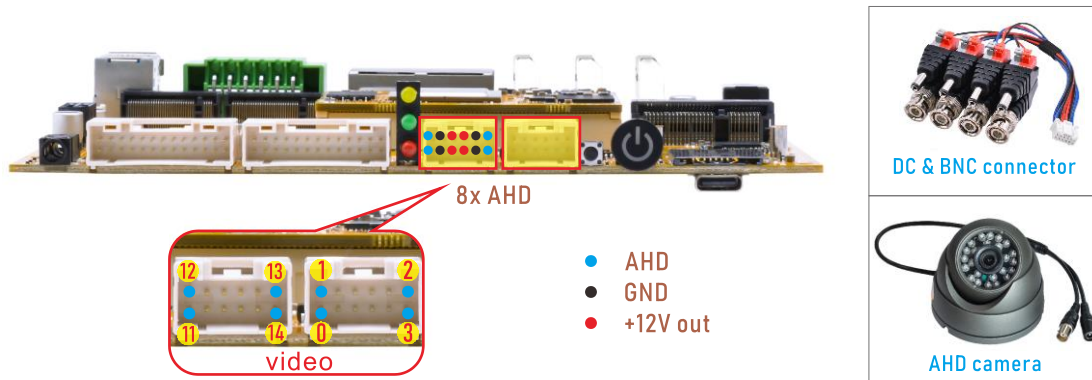
RS232

Step 2: RS232 test.

```
# com /dev/ttyS7 115200 8 0 1
```

```
root@em3588-buildroot:/# com /dev/ttyS7 115200 8 0 1
port = /dev/ttyS7
baudrate = 115200
cs = 8
parity = 0
stopb = 1
jjjjjjj
RECV: jjjjjjj
yuyuyuy
RECV: yuyuyuy
888888888
RECV: 888888888
777
RECV: 777
```

7.16 Camera



- Single-camera preview, using video0 as an example.

```
# gst-launch-1.0 v4l2src device=/dev/video0 ! video/x-raw, format=NV12,
width=1920, height=1080, framerate=25/1 ! waylandsink
```

```

root@em3588-buildroot:/#
video-sink=glimagesink text-overlay=false rate=25/1 ! fpsdisplaysink name=video0 v
WARNING: erroneous pipeline: could not set property "video-sink" in element "fpsdisplaysink" to
"glimagesink"
root@em3588-buildroot:/#
root@em3588-buildroot:/#
root@em3588-buildroot:/#
, format=NV12, width=1920, height=1080, framerate=25/1 ! waylandsink video/x-raw,
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
[ 693.563014] rkCIF-mipi-lvds2: stream[0] start streaming
[ 693.564381] rkCIF-mipi-lvds2: Allocate dummy buffer, size: 0x003f5000
[ 693.564416] rockchip-mipi-csi2 mipi2-csi2: stream on, src_sd: 00000000af12b001, sd_name:rockchip-csi2-
dphy0
[ 693.564436] rockchip-mipi-csi2 mipi2-csi2: stream ON
[ 693.564479] rockchip-csi2-dphy0: dphy0, data_rate_mbps 594
[ 693.564519] rockchip-csi2-dphy0 csi2-dphy0: csi2_dphy_s_stream stream on:1, dphy0, ret 0
[ 693.565867] techpoint 2-0047: detect channel 0 1080P_25
[ 693.566763] techpoint 2-0047: set channel 0 1080P_25
[ 693.605424] techpoint 2-0047: detect channel 1 1080P_25
[ 693.606252] techpoint 2-0047: set channel 1 1080P_25
[ 693.645741] techpoint 2-0047: detect channel 2 is not supported, default 1080P_25
[ 693.646698] techpoint 2-0047: set channel 2 1080P_25
[ 693.690390] techpoint 2-0047: detect channel 3 is not supported, default 1080P_25
[ 693.691436] techpoint 2-0047: set channel 3 1080P_25
[ 693.739792] (0xfdd30000)MIPI_CSI2 ERR1:0x10000000 (ecc2)
[ 693.741327] (0xfdd30000)MIPI_CSI2 ERR1:0x100 (f_seq,vc: 0)
[ 693.742226] (0xfdd30000)MIPI_CSI2 ERR1:0x80 (fs/fe mis,vc: 3)
[ 693.748017] (0xfdd30000)MIPI_CSI2 ERR1:0x710 (fs/fe mis,vc: 0) (f_seq,vc: 0 1 2)
[ 693.750825] (0xfdd30000)MIPI_CSI2 ERR1:0x770 (fs/fe mis,vc: 0 1 2) (f_seq,vc: 0 1 2)
[ 693.751231] (0xfdd30000)MIPI_CSI2 ERR1:0x800 (f_seq,vc: 3)
Redistribute latency...
[11:40:53.210] seeing the first app
0:00:16.3 / 99:99:99.

```

To preview 8 camera streams simultaneously, run the corresponding script based on the desired output device:

- **MIPI display output:** [/rockchip-test/camera/camera-ahd_1280x800.sh](#)
- **HDMI display output:** [/rockchip-test/camera/camera-ahd_3640x2160.sh](#)

7.17 Video Playback

(1) The directory for the built-in video testing scripts in the system: [/rockchip-test/video](#)

```

root@em3588-buildroot:/# ls /rockchip-test/video/
test_gst_multivideo.sh  test_gst_video_fps.sh  video_stresstest.sh
test_gst_video.sh      test_gst_video_maxfps.sh  video_test.sh

```

Simply execute the script.

```

root@em3588-buildroot:/# /rockchip-test/video/test_gst_video.sh
Setting pipeline to PAUSED ...
Pipeline is PREROLLING ...
Redistribute latency...
mpp[1834]: mpp_info: mpp version: ab796560 author: Herman Chen 2024-12-30 docs: Update 1.0.8 CHANGELOG.md
mpp[1834]: mpp_info: mpp version: ab796560 author: Herman Chen 2024-12-30 docs: Update 1.0.8 CHANGELOG.md
mpp[1834]: mpp_info: mpp version: ab796560 author: Herman Chen 2024-12-30 docs: Update 1.0.8 CHANGELOG.md
mpp[1834]: mpp_info: mpp version: ab796560 author: Herman Chen 2024-12-30 docs: Update 1.0.8 CHANGELOG.md
mpp[1834]: mpp_info: mpp version: ab796560 author: Herman Chen 2024-12-30 docs: Update 1.0.8 CHANGELOG.md
Redistribute latency...
mpp[1834]: h264d_api: is_avcC=1
Pipeline is PREROLLED ...
Prerolled, waiting for async message to finish...
Setting pipeline to PLAYING ...
Redistribute latency...
New clock: GstSystemClock
0:00:02.6 / 0:00:29.5 (9.0 %)
  
```

(2) Play the video using Google Chrome.

- Google Chrome supports video playback up to 4K at 60Hz, with support for the following decoding formats: VP8, H.264, H.265, VP9, and AV1.
- However, it is only compatible with certain H.265 video files.

Execute the following command to play the video using Google Chrome:

```
# chromium /media/udisk1/video/4KP60/4KP60-exist.mp4
```

Command explanation:

- **chromium**: Launches the Chromium browser.
- **/media/udisk1/video/4KP60/4KP60-exist.mp4**: The media file path to be played.

```

root@em3588-buildroot:/# chromium /media/udisk1/video/4KP60/4KP60-exist.mp4
[1993:2010:0606/114355.291024:ERROR:bus.cc(407)] Failed to connect to the bus: Could not parse server
address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[1993:2010:0606/114355.291076:ERROR:bus.cc(407)] Failed to connect to the bus: Could not parse server
address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[1993:2010:0606/114355.291091:ERROR:bus.cc(407)] Failed to connect to the bus: Could not parse server
address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[1993:2010:0606/114355.291180:ERROR:bus.cc(407)] Failed to connect to the bus: Could not parse server
address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[1993:2010:0606/114355.331642:ERROR:bus.cc(407)] Failed to connect to the bus: Could not parse server
address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[1993:2010:0606/114355.331677:ERROR:bus.cc(407)] Failed to connect to the bus: Could not parse server
address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[1993:2020:0606/114355.348424:ERROR:bus.cc(407)] Failed to connect to the bus: Could not parse server
address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[1993:2013:0606/114355.348419:ERROR:bus.cc(407)] Failed to connect to the bus: Could not parse server
address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")

(process:1993): Glib-GIO-CRITICAL **: 11:43:55.350: g_settings_schema_source_lookup: assertion 'source !=
NULL' failed
[1993:1993:0606/114355.409363:ERROR:object_proxy.cc(576)] Failed to call method:
org.freedesktop.DBus.NameHasOwner: object_path= /org/freedesktop/DBus: unknown error type:
[1993:1993:0606/114355.409389:ERROR:object_proxy.cc(576)] Failed to call method:
org.freedesktop.DBus.NameHasOwner: object_path= /org/freedesktop/DBus: unknown error type:
[1993:2009:0606/114355.409496:ERROR:bus.cc(407)] Failed to connect to the bus: Could not parse server
address: Unknown address type (examples of valid types are "tcp" and on UNIX "unix")
[1993:2077:0606/114355.419421:ERROR:object_proxy.cc(576)] Failed to call method:
org.freedesktop.DBus.Properties.Get: object_path= /org/freedesktop/UPower:
org.freedesktop.DBus.Error.ServiceUnknown: The name org.freedesktop.UPower was not provided by any .service
files
[1993:2077:0606/114355.419649:ERROR:object_proxy.cc(576)] Failed to call method:
org.freedesktop.UPower.GetDisplayDevice: object_path= /org/freedesktop/UPower:
org.freedesktop.DBus.Error.ServiceUnknown: The name org.freedesktop.UPower was not provided by any .service
files
[1993:2077:0606/114355.419851:ERROR:object_proxy.cc(576)] Failed to call method:
org.freedesktop.UPower.EnumerateDevices: object_path= /org/freedesktop/UPower:
org.freedesktop.DBus.Error.ServiceUnknown: The name org.freedesktop.UPower was not provided by any .service
files
[1993:1993:0606/114355.421839:ERROR:object_proxy.cc(576)] Failed to call method:
org.freedesktop.DBus.NameHasOwner: object_path= /org/freedesktop/DBus: unknown error type:
  
```

(3) Use the `gst-play-1.0` command to play the video.

```
# gst-play-1.0 --videosink="waylandsink fullscreen=true"  
/media/udisk1/video/8KP30/8KP30-2.mp4 --audiosink="alsasink device=hw:0,0"
```

Command explanation:

- `/media/udisk1/video/8KP30/8KP30-2.mp4`: The media file path to be played.
- `--audiosink="alsasink device=hw:0,0"`: Specifies the audio output device as hw:0,0.

```
root@em3588-buildroot:/#  
/media/udisk1/video/8KP30/8KP30-2.mp4 --audiosink="alsasink device=hw:0,0"rue"  
Press 'k' to see a list of keyboard shortcuts.  
Now playing /media/udisk1/video/8KP30/8KP30-2.mp4  
Redistribute latency...  
Redistribute latency...  
Redistribute latency...  
Redistribute latency...  
Redistribute latency...  
0:00:08.2 / 0:13:10.5
```