EM3576 Linux6.1 User Manual

V2.1

Boardcon Embedded Designer

Overview

The content of this document is intended solely for the EM3576 development board, aiming to help users quickly understand, apply, and test the EM3576 development board.

System Support

Development Board	Debian12	Buildroot
CM3576 V1 EM3576 V2	Y	Y

Revision History

Version	Date	Author	Revision History
V1.0	2024-12-17	Liu Yuan	Initial version
V2.1	2025-03-18	Qin Xueqin	Modify SDK version

Disclaimer

The information in this manual is for reference only. While Boardcon strives to ensure its accuracy, no guarantees are made regarding its completeness or correctness. All content is subject to change without prior notice. Boardcon reserves the right to revise the content of this manual without prior notification.

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Content

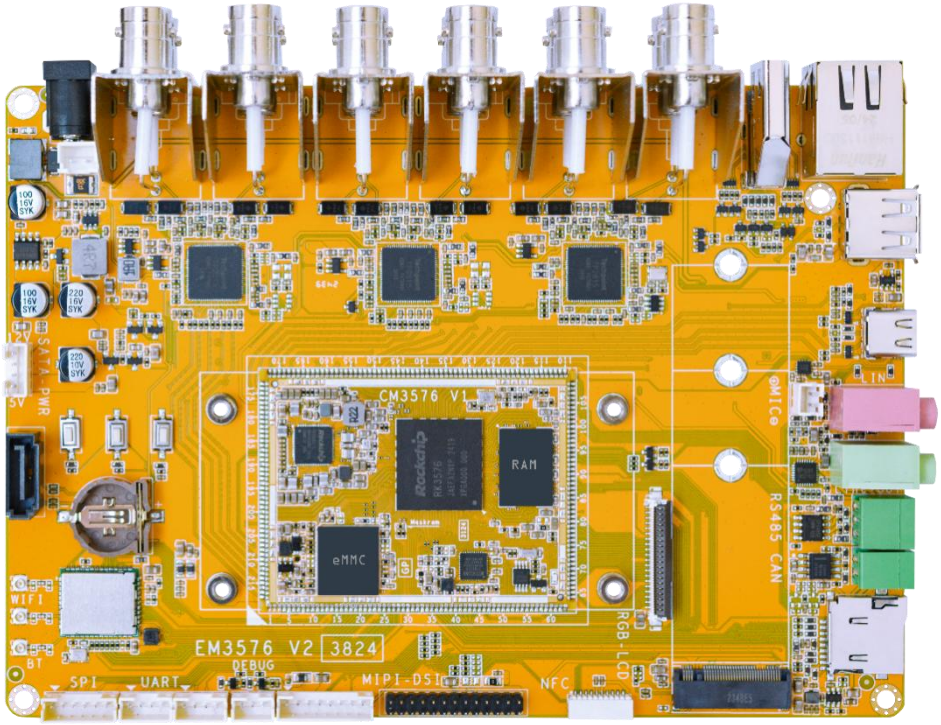
1.Introduction

1.1 Overview

The EM3576 development board is equipped with the RK3576 processor, featuring a quad-core Cortex-A72 and a quad-core Cortex-A53 architecture, providing powerful computing performance for smart devices and edge computing.

It includes a 16MP ISP that supports HDR, dehaze, sharpening, and other image optimization algorithms to enhance image quality, making it ideal for high-quality camera applications. The integrated AI computing unit supports popular neural network frameworks and offers robust inference capabilities to meet AI application needs.

The video decoder supports up to 8K@30fps and 4K@120fps, while the video encoder supports up to 4K@60fps. The board is equipped with a variety of peripheral interfaces, allowing flexible expansion and supporting diverse application scenarios to meet the requirements of different devices and applications.



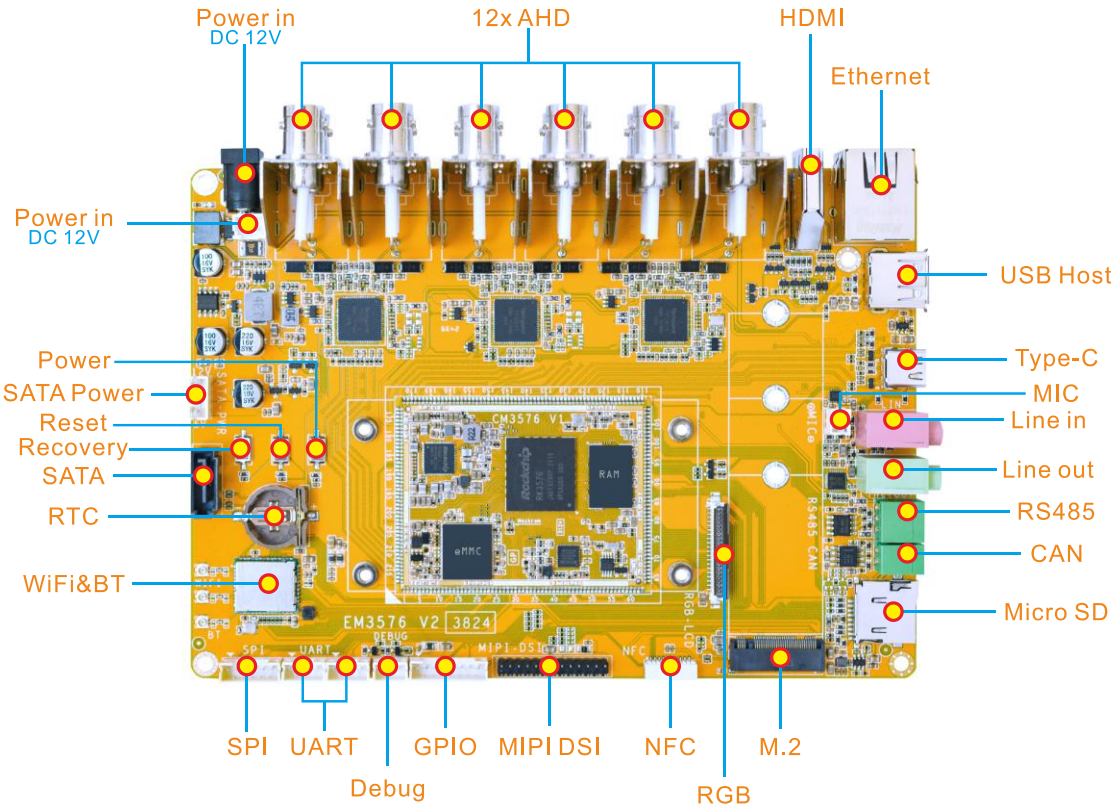
1.2 Product Parameters

Basic Parameters		
SOC		RK3576
CPU		• Octa-core 64-bit architecture (Quad-core Cortex-A72 + Quad-core Cortex-A53)
GPU		• ARM Mali-G52 MC3 • Support OpenGL ES 1.1/2.0/3.2 • Support Vulkan 1.1 • Support OpenCL 2.0 • Support AFBC
NPU		• 6 TOPS for INT8 operations. • Supports int4, int8, int16, FP16, BF16, TF32 operation
Video	Decoder	• Supports up to 8K@30fps for H.265/HEVC, VP9, AVS2, and AV1 video decoding • Supports up to 4K@120fps for H.265/HEVC, VP9, AVS2, and AV1 video decoding • Supports up to 4K@60fps for H.264/AVC and MVC video decoding
	Encoder	• Supports H.264/H.265 video encoding up to 4K@60fps
RAM		2GB LPDDR4X
ROM		32GB eMMC
Support system		Android, Debian, Buildroot
Hardware Parameters		

Extended Storage	• Support 1x M.2 PCIe2.1 SSD • Support 1xSATA • Support 1x MicroSD Card
Display	• Support 1x HDMI2.1 output, up to 4K@120fps • Support 1xMIPI output, up to 2560x1600@60fps • Support 1x DP AIT mode output, up to 4K@60fps
Audio	• Support 1x HDMI TX audio output • Support 1x DP AIT mode audio output • Support 1x Headphone output/input
USB	• Support 1xUSB2.0 • Support 1x USB3.1 Type-C (ADB/USB/DP AIT)
Network	• Support 1x Gigabit Ethernet • Support 1x WIFI/BT module
Camera	• Support 12xAHD
Peripheral communication	• Support 1xCAN • Support 1xRS485 • Support 2xUART • Support 1xSPI
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	57.5mm x 44.0mm
Motherboard dimensions	170mm x 120mm

1.3 Hardware Interface Introduction



Interface parameters	
Power in DC 12V	12V DC power input interface
12x AHD	12-channel AHD camera input interface
HDMI	HDMI2.1 TX interface

Ethernet	Gigabit Ethernet RJ45 interface
USB Host	USB2.0 Host interface
Type-C	USB Type-C interface, OTG download interface
MIC	Microphone input interface
Line in	Audio line-in interface
Line out	Audio line-out interface
RS485	RS485 communication interface
CAN	CAN communication interface
Micro SD	Micro SD card slot
M.2	M.2 interface for connecting SSD
RGB	RGB interface
NFC	NFC interface
MIPI DSI	MIPI DSI interface
GPIO	General Purpose Input/Output pins
Debug	debug the serial port
UART	• UART10, TTL level serial interface • UART11, TTL level serial interface
SPI	SPI interface
WIFI&BT	WIFI&Bluetooth module
RTC	RTC coin cell connector
SATA	SATA interface
Recovery	Recovery key
Reset	Reset key
SATA _Power	SATA Power interface, 5V
Power	Power key

2.Install Drivers and Tool

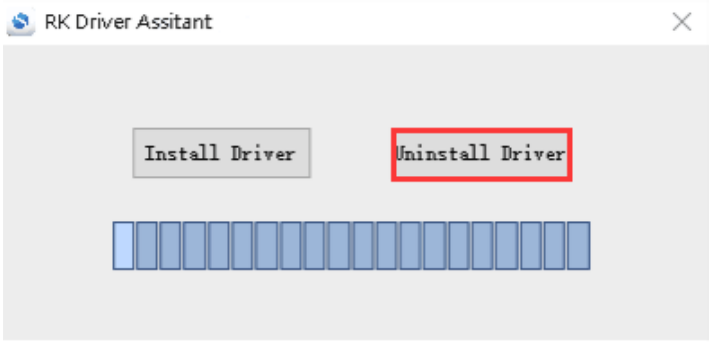
To download firmware and debug in the terminal, the following drivers and software need to be installed (for Windows computers):

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*.

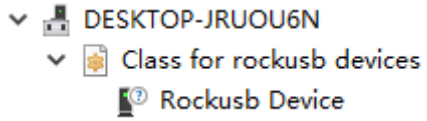
Step 2: To avoid driver conflicts, click **"Uninstall Driver"** to uninstall the driver.



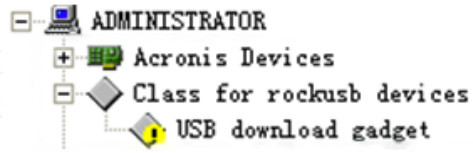
Step 3: Click button **"Install Driver"** to install.

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.

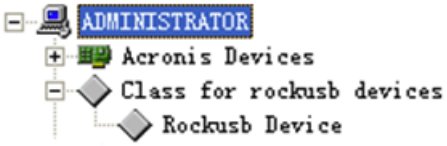


Step 5: If the following device information appears in the **Device Manager** after the operation in Step 4, user need to proceed to the next step.



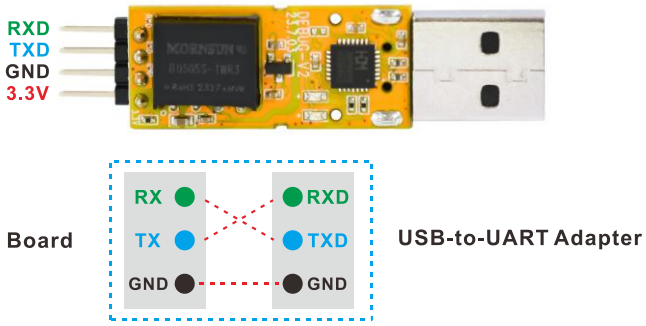
Step 6: The WINDOW will pop up found New Hardware Wizard dialog box, choose to install from the specified location, and then select: *DriverAssitant_v5.1.1/ADBDriver.*

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



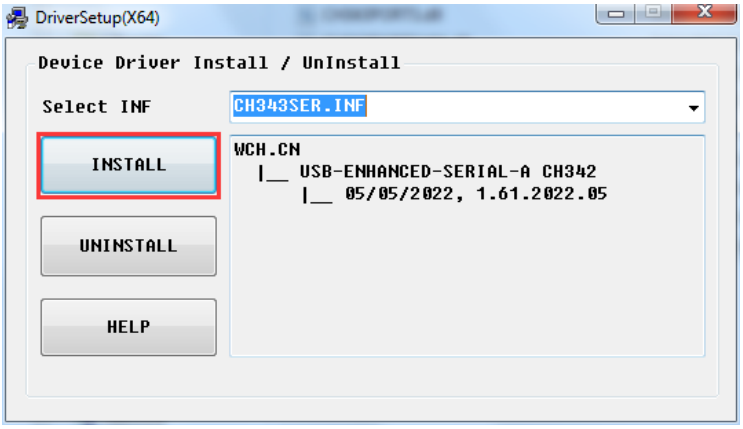
Pin	Connection Description
RXD	Receive, connect to TX pin of the board.
TXD	Transmit, connect to RX pin of the board.
GND	Ground, connect to GND pin of the board.
3V3	No need to connect.

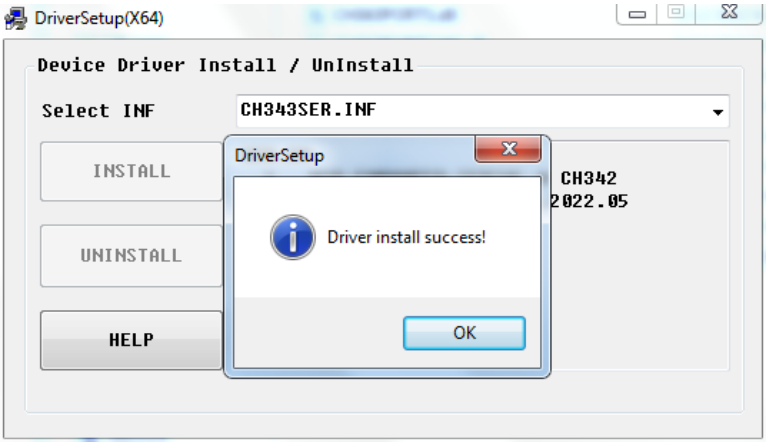
2.2.2 Install Driver

Step 1: Plug the CH9102X Module to the PC

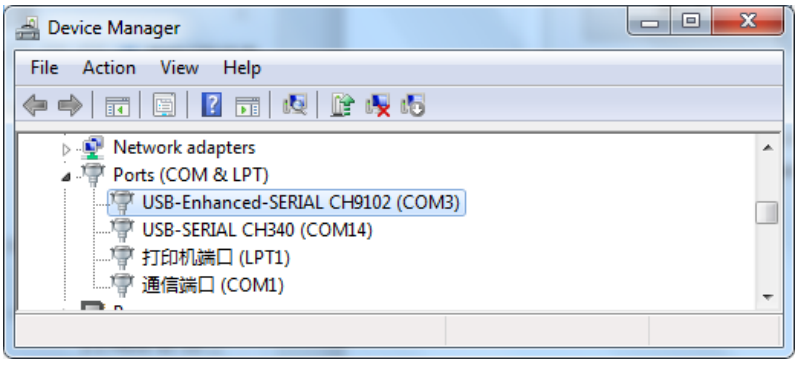
Step 2: Unzip *CH343SER.ZIP* on Windows.

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.

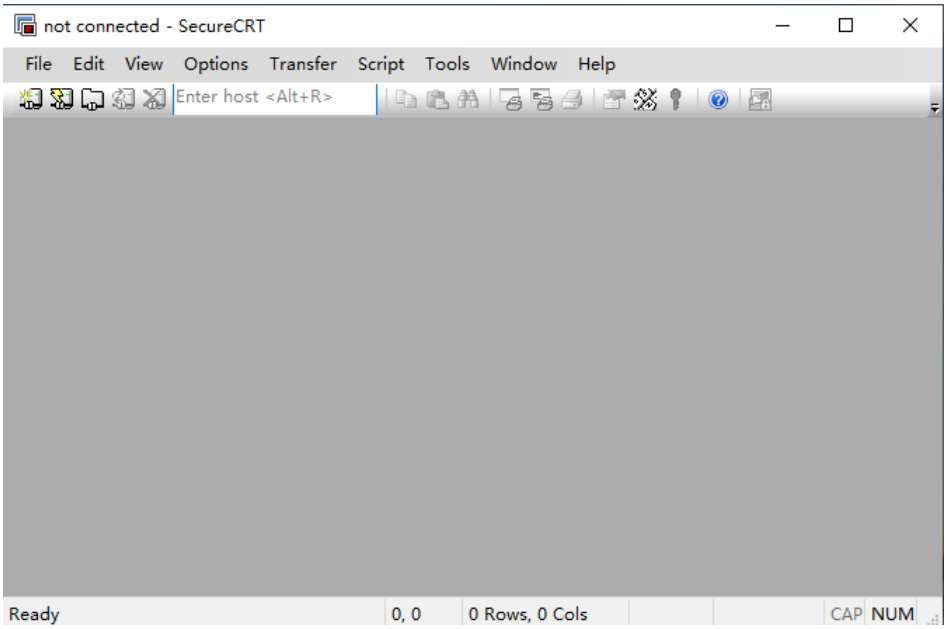


2.3 Install Serial Terminal Tool

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

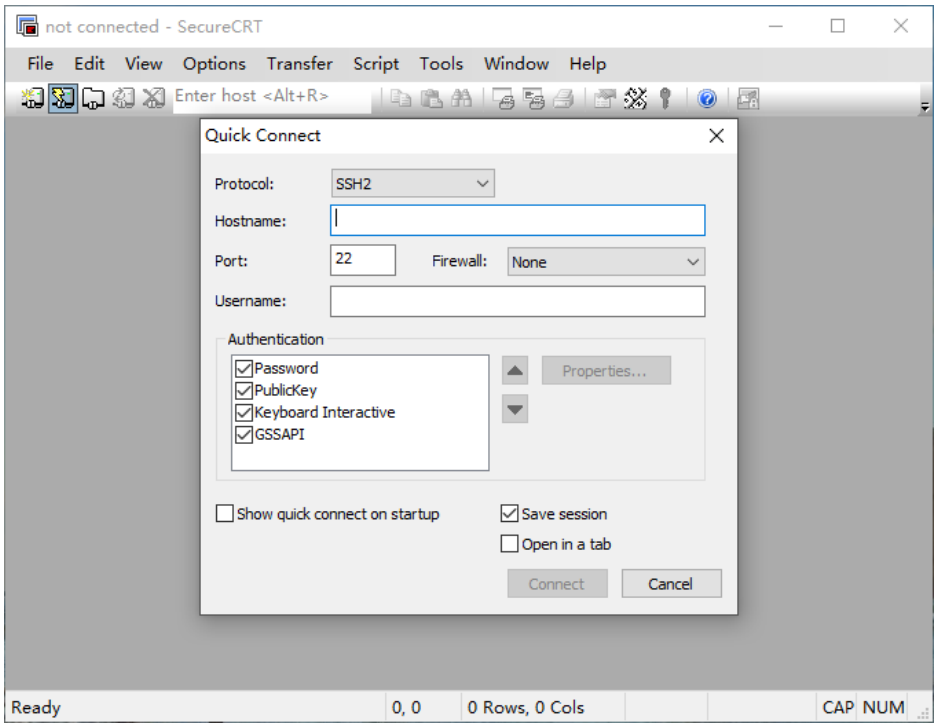
Step 1: Unzip *Platform/SecureCRT.rar* on PC.

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

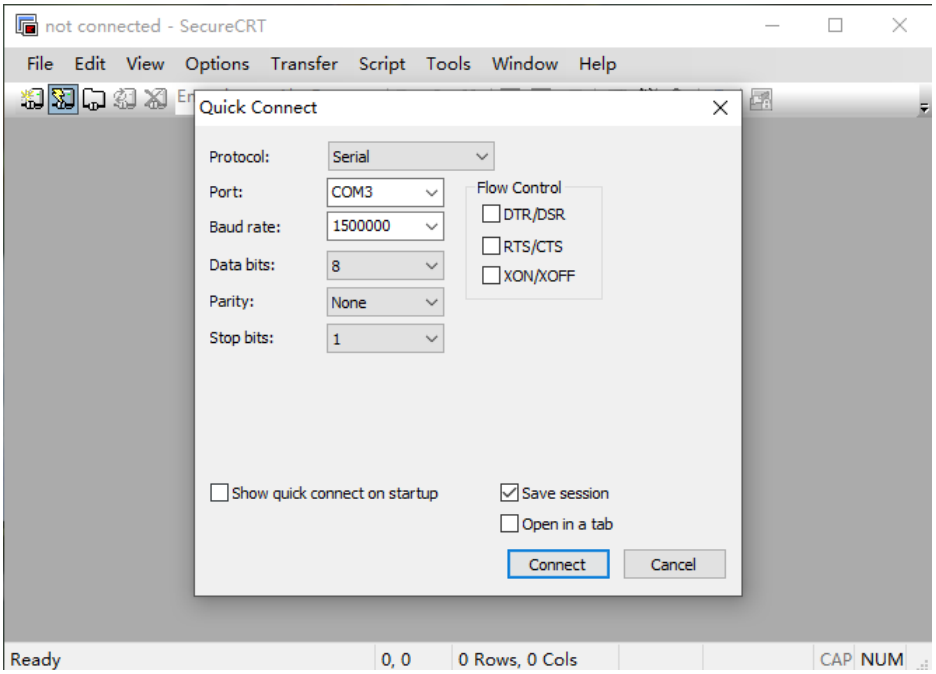


Step 3: Confirm that the CH9102X driver has been installed and the CH9102X module is connecting to the PC.

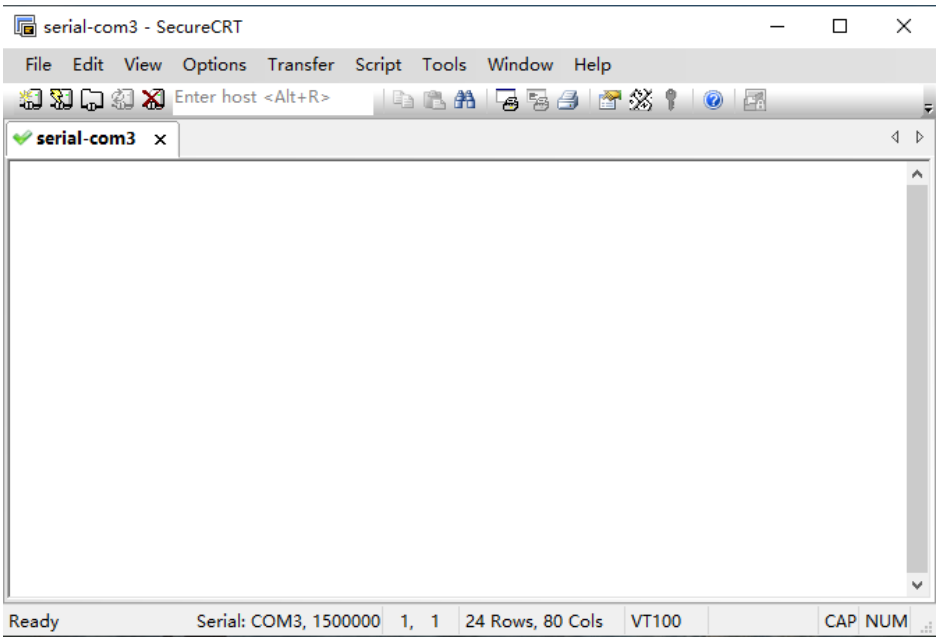
Step 4: Click the **"Quick Connect"** button to go to the Quick Connect configuration screen.



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

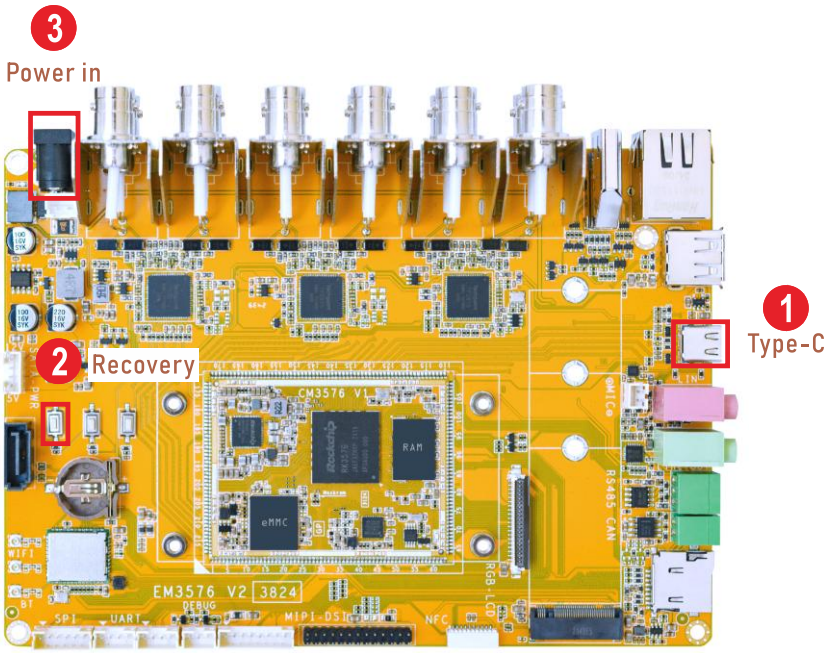
3.1.1.1 Hardware

Step 1: Disconnect the power adapter.

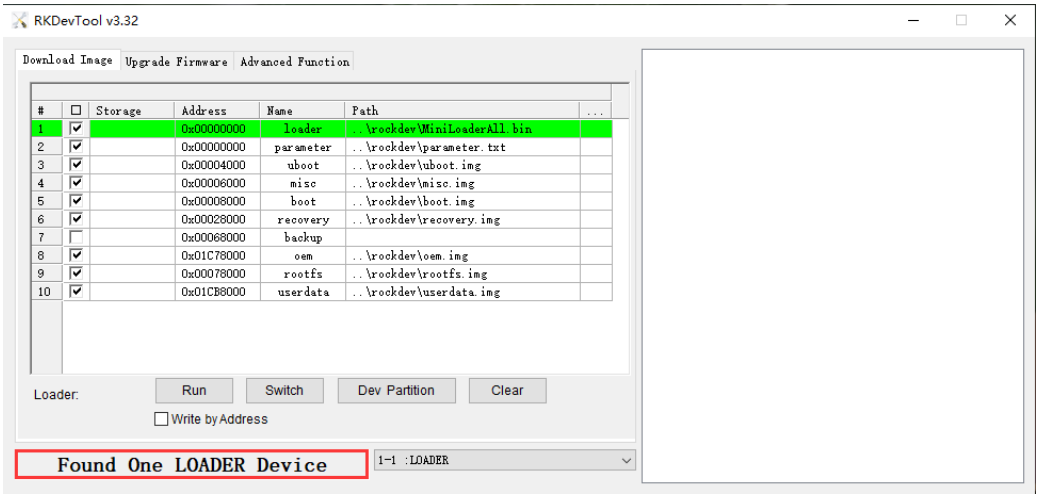
Step 2: Connect one end of the Type_C cable to the host and the other end to the development board.

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.

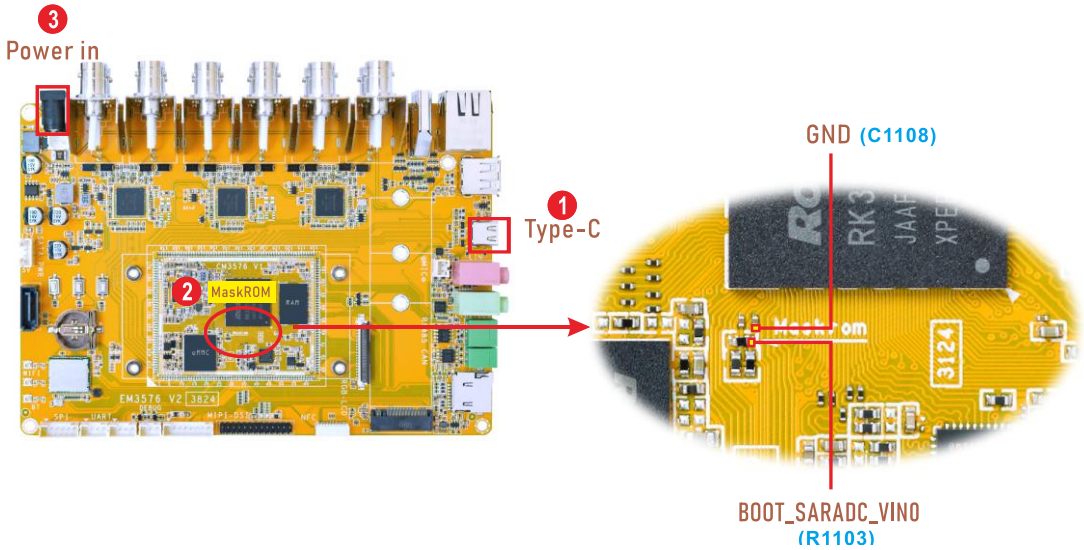
```
# reboot loader
```

3.1.2 How to Enter MaskRom Mode

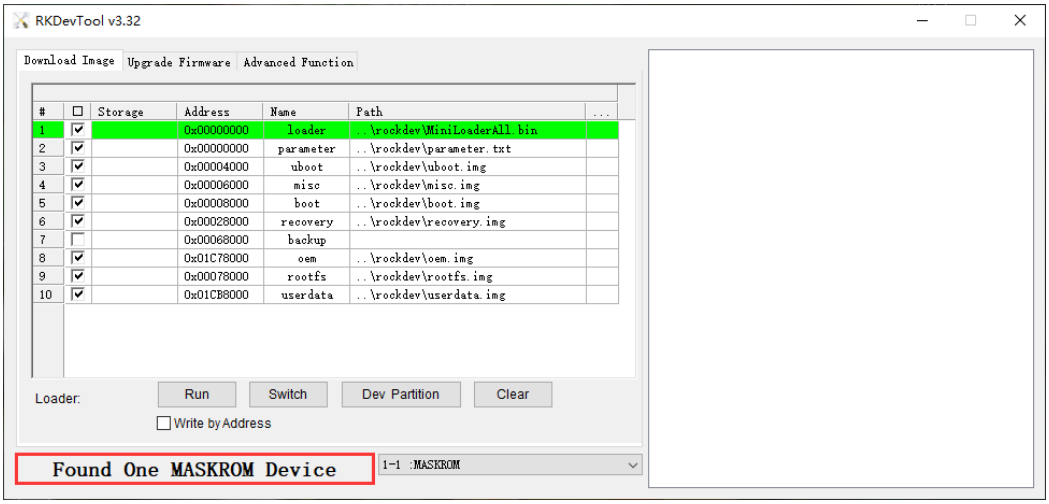
Step 1: Disconnect the power adapter.

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 CM3576.



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



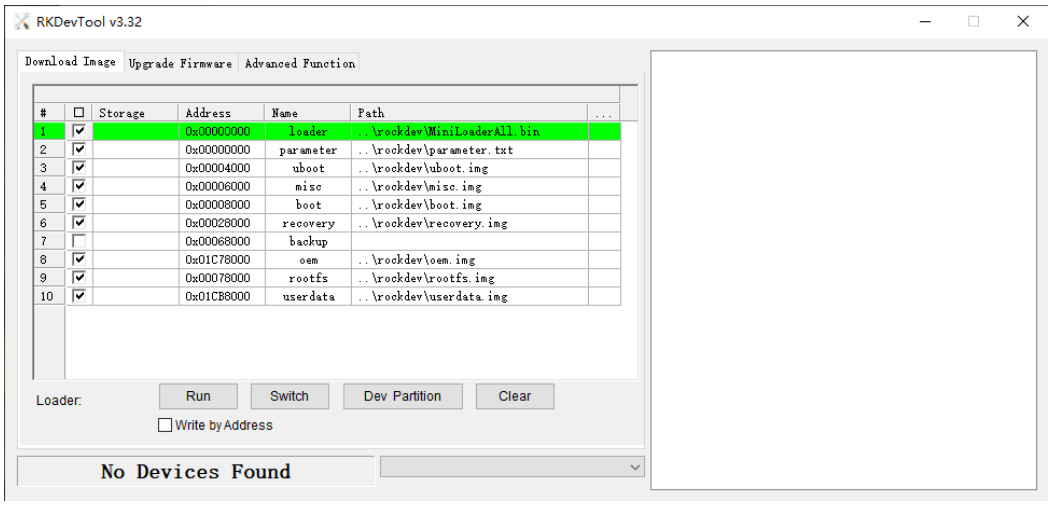
3.2 Burn firmware

Environment: Windows OS (Operating System).

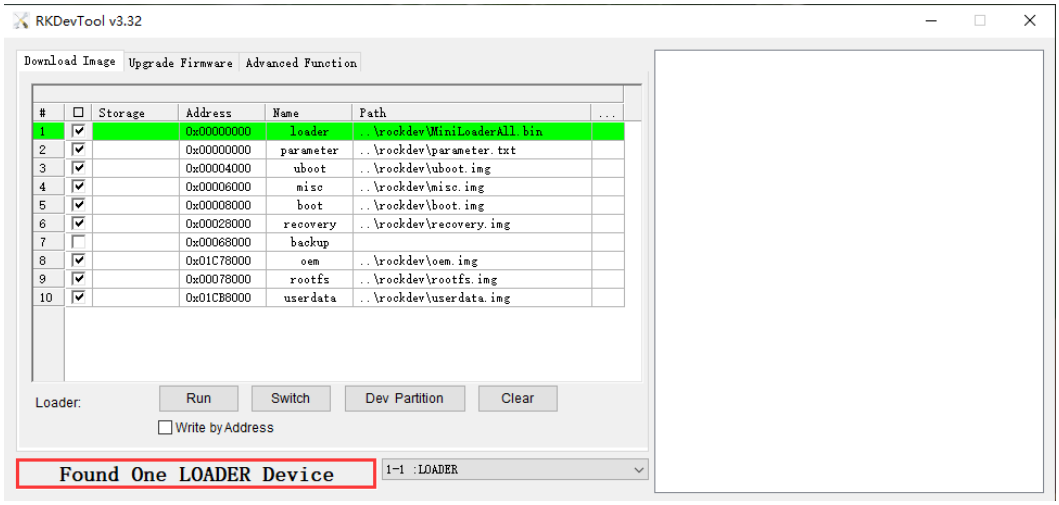
3.2.1 Burn Update.img Firmware

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

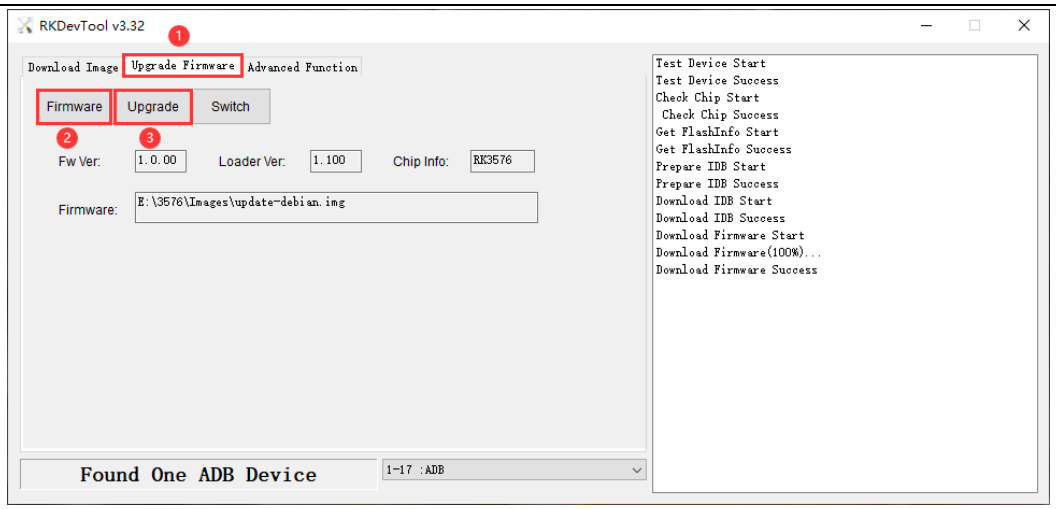
Step 2: Open *RKDevTool\RKDevTool_Release\RKDevTool.exe*.



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.

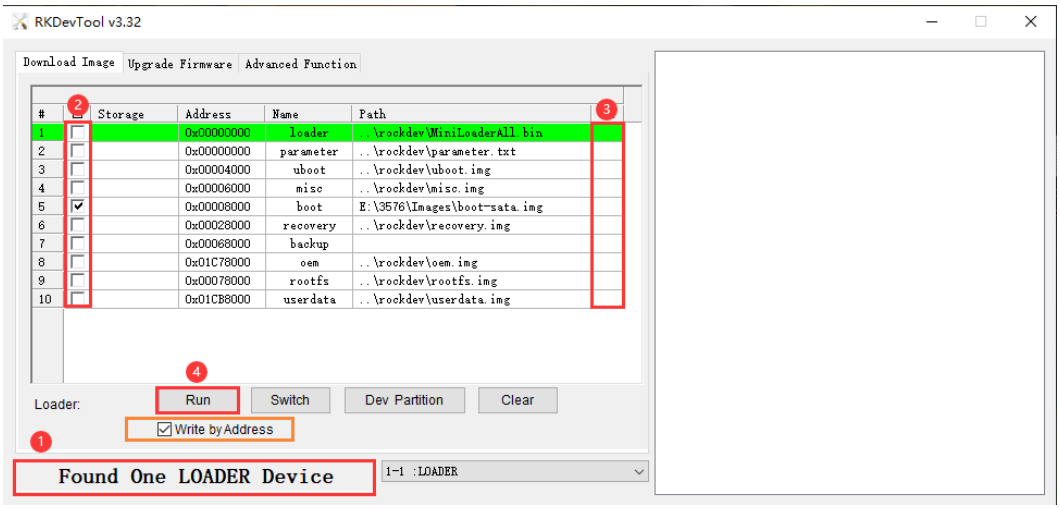
3.2.2 Burn Split Firmware

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

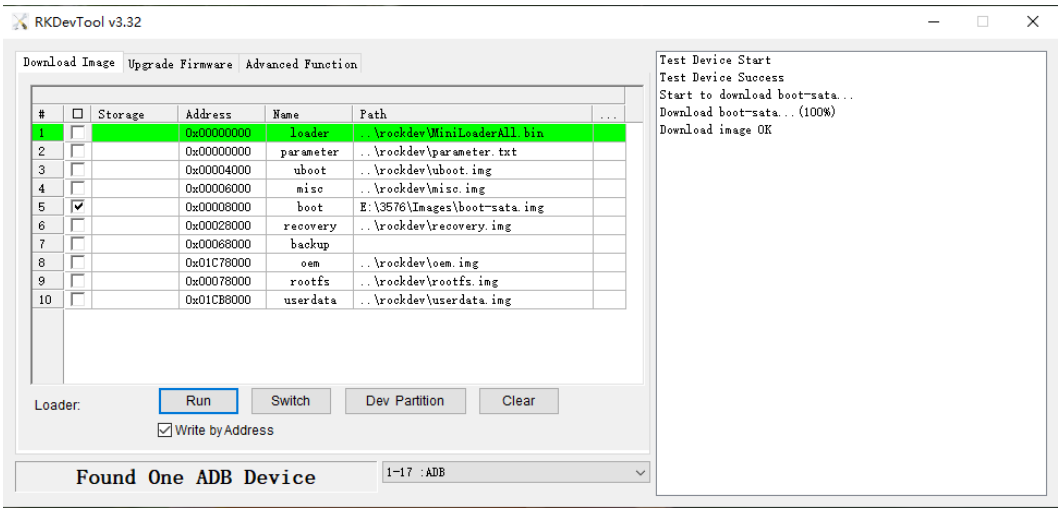
Step 2: Check the partitions to be flashed, multiple partitions can be selected.

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.



①Note

① Without burning the parameter.txt file, please check the "Write by Address" checkbox, otherwise the flashing may fail with the "Image is larger than partition size" error.

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 60G. 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

①Note

①☐ The Debian system, Buildroot system use the same SDK source package.
②The difference is in the rootfs.img, resulting in different filesystem building steps, while all other steps remain the same.

Step 1: Unzip the Source

To extract the source files, execute the following commands:

```
$ tar xvfj rk3576_linux6.1_sdk_*.tar.bz2
$ cd rk3576_linux6.1_sdk
```

Step 2: Configure the Compiled Board

To configure the board, execute:

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

```
################ Rockchip Linux SDK ################
Manifest: rk3576_linux6.1_release_v1.0.1_20240920.xml
Log colors: message notice warning error fatal
Log saved at /home/qinxueqin/3576/linux/linux6.1/output/sessions/2024-12-10_16-03-09
Pick a defconfig:
1. rockchip_defconfig
2. rockchip_rk3576_evb1_v10_defconfig
3. rockchip_rk3576_industry_evb_v10_defconfig
4. rockchip_rk3576_iotest_v10_defconfig
5. rockchip_rk3576_ipc_evb1_v10_defconfig
6. rockchip_rk3576_multi_ipc_evb1_v10_defconfig
7. rockchip_rk3576_test1_v10_defconfig
8. rockchip_rk3576_test2_v10_defconfig
9. rockchip_rk3576_vehicle_evb_v10_defconfig
10. rockchip_rk3576_vehicle_evb_v20_mos_defconfig
Which would you like? [1]: 2
```

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.

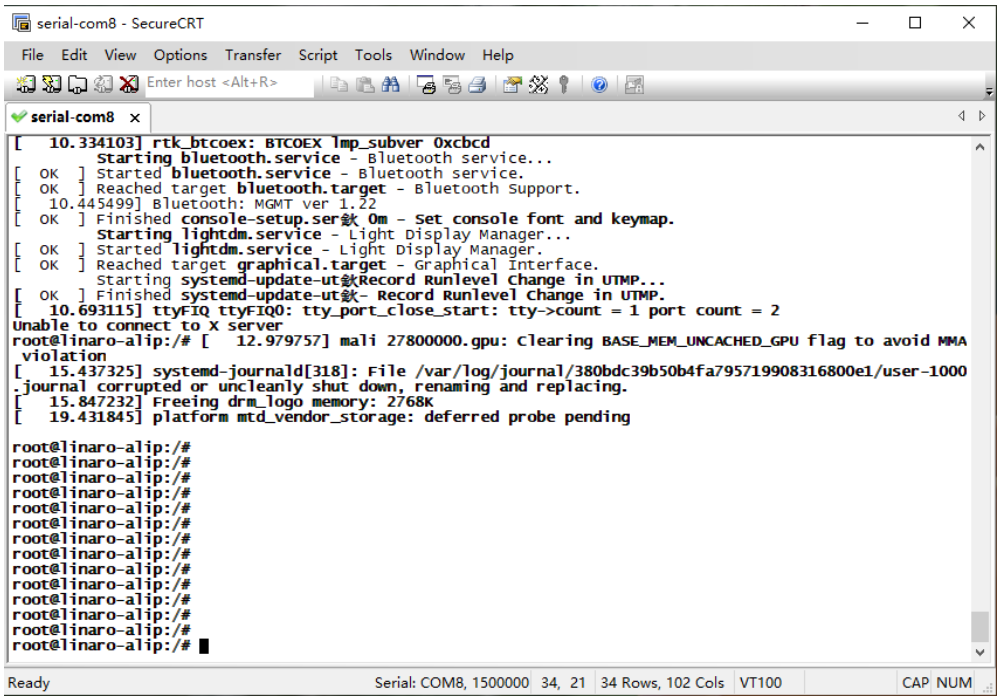
6.Debian12 Test

Account: linaro

Password: linaro

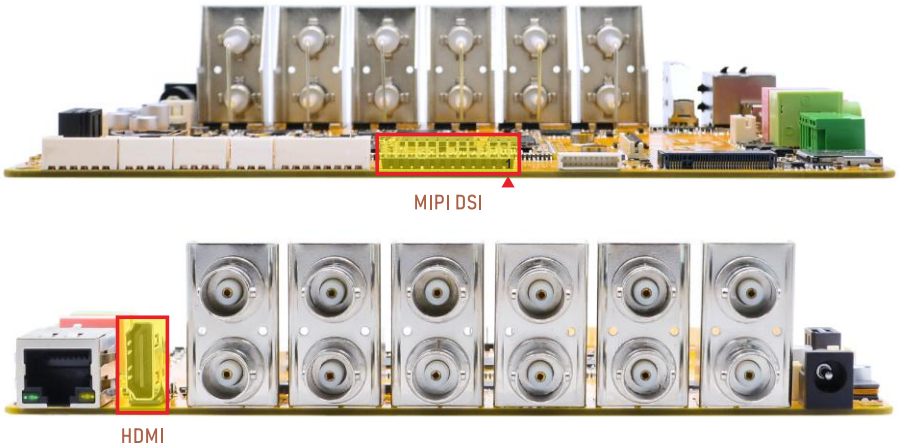
6.1 Serial Terminal

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



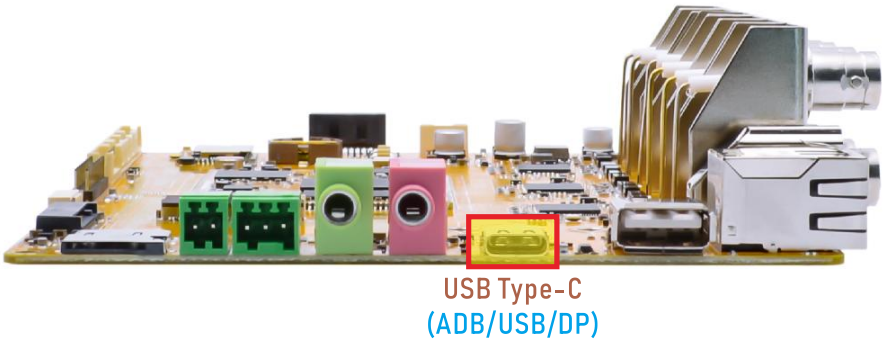
6.2 Display

The EM3576 supports dual independent displays, with default support for MIPI DSI and HDMI interfaces, and also includes asynchronous display capabilities, along with support for DP AIT functionality.



The display effect diagram is as follows:

6.3 USB Type-C



Features Supported by the Type-C Interface:

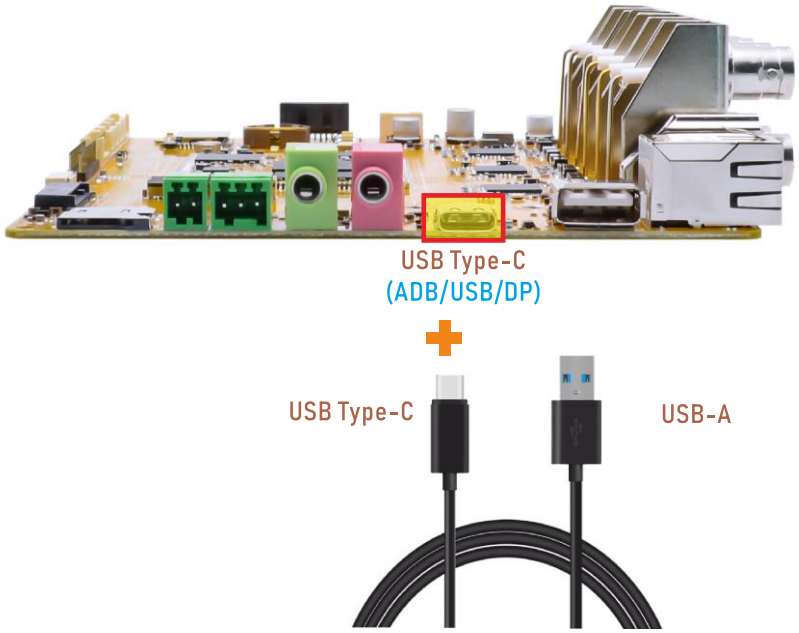
• **Reversible Design:** Allows insertion in either orientation for user convenience.

• **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.

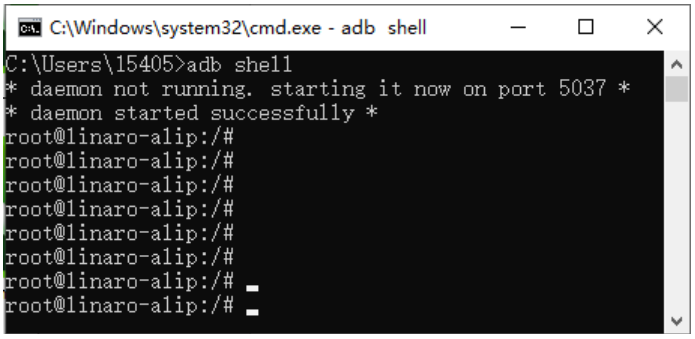


Step 2: Install ADB driver on Windows system.

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

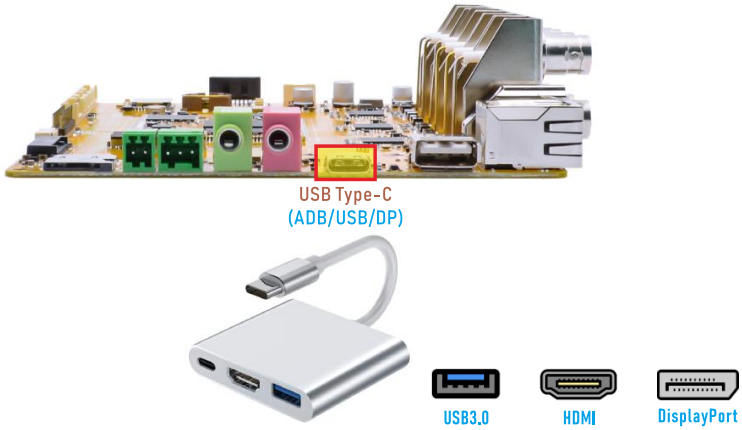
Step 4: Execute the following command to enable ADB.

```
# adb shell
```

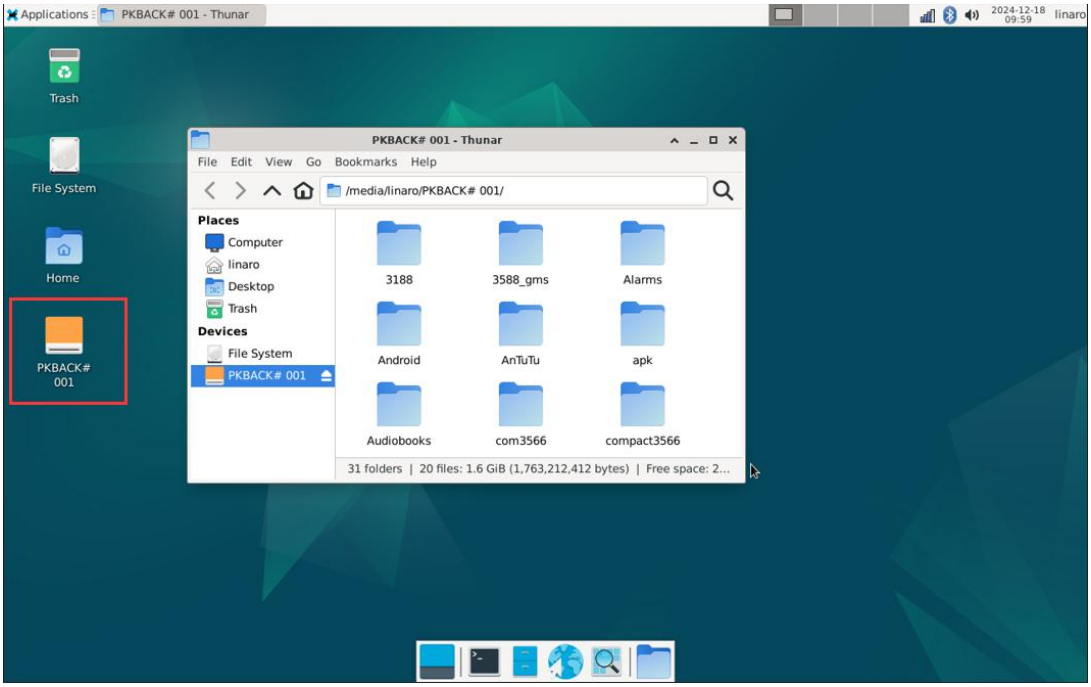


6.3.2 Type-C to USB

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

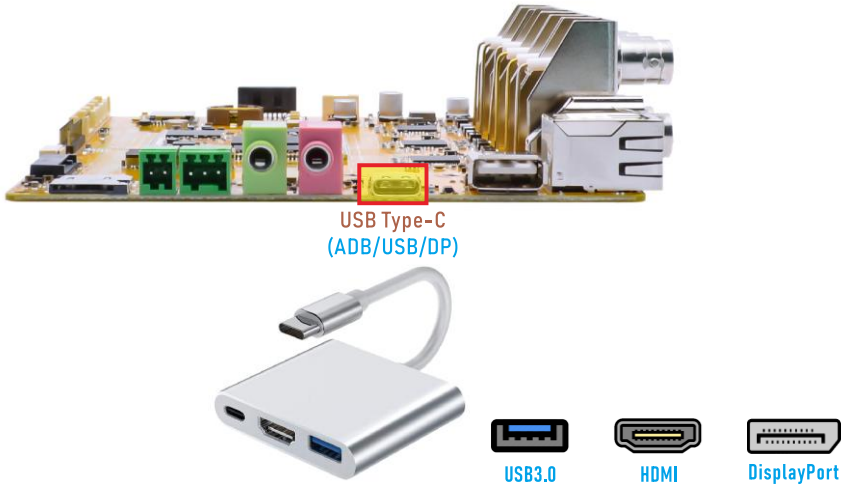


Step 2: After inserting the USB flash drive, if it is recognized successfully, an icon will appear on the desktop. Users need to click the icon in order to access the files on the USB flash drive.



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:/# [  579.496422] rk_gmac-dwmac 2a230000.ethernet end1: Link is Up - 1Gbps/Full - flow control
rx/tx
[  579.496572] IPv6: ADDRCONF(NETDEV_CHANGE): end1: link becomes ready
```

Step 2: View network interface information.

```
# ifconfig
```

```
root@linaro-alip:/# ifconfig
end1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.0.216  netmask 255.255.255.0  broadcast 192.168.0.255
        inet6 fe80::d9ee:fef5:287e:a836  prefixlen 64  scopeid 0x20<link>
        ether b2:ef:e7:4f:bf:85  txqueuelen 1000  (Ethernet)
        RX packets 370  bytes 41403 (40.4 KiB)
        RX errors 0  dropped 8  overruns 0  frame 0
        TX packets 153  bytes 13818 (13.4 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device interrupt 64
```

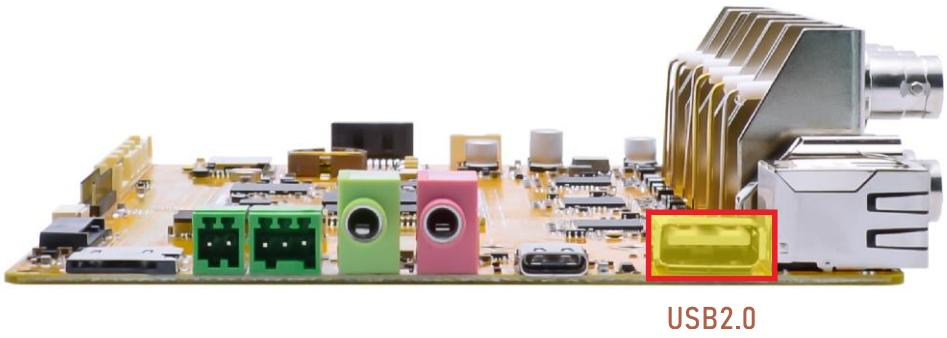
Step 3: Users can test network connectivity using the desktop's built-in browser or verify it through the following command method.

```
# ping -I end1 www.armdesigner.com
```

```
root@linaro-alip:/# ping -I end1 www.armdesigner.com
PING www.armdesigner.com (67.222.54.196) from 192.168.0.216 end1: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=48 time=194 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=48 time=192 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=48 time=193 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=48 time=193 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=48 time=192 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=48 time=193 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=7 ttl=48 time=196 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=8 ttl=48 time=193 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=9 ttl=48 time=193 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=10 ttl=48 time=192 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=11 ttl=48 time=193 ms
^C
--- www.armdesigner.com ping statistics ---
11 packets transmitted, 11 received, 0% packet loss, time 10015ms
rtt min/avg/max/mdev = 192.094/192.977/195.780/0.990 ms
```

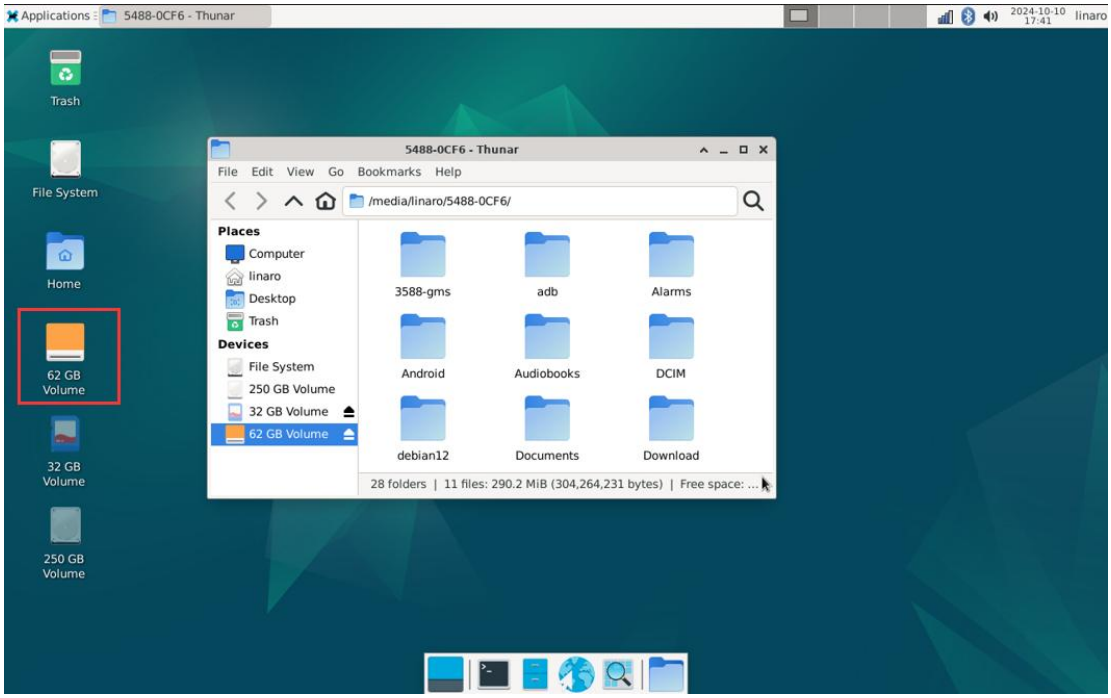
6.5 USB Host

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

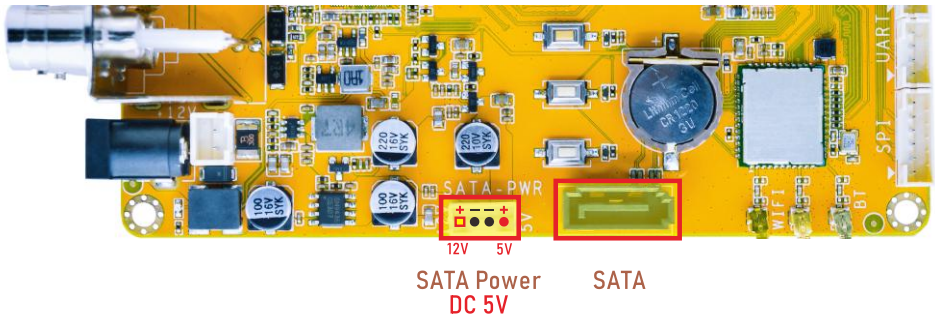
will appear on the desktop. Users need to click the icon in order to access the files on the device.



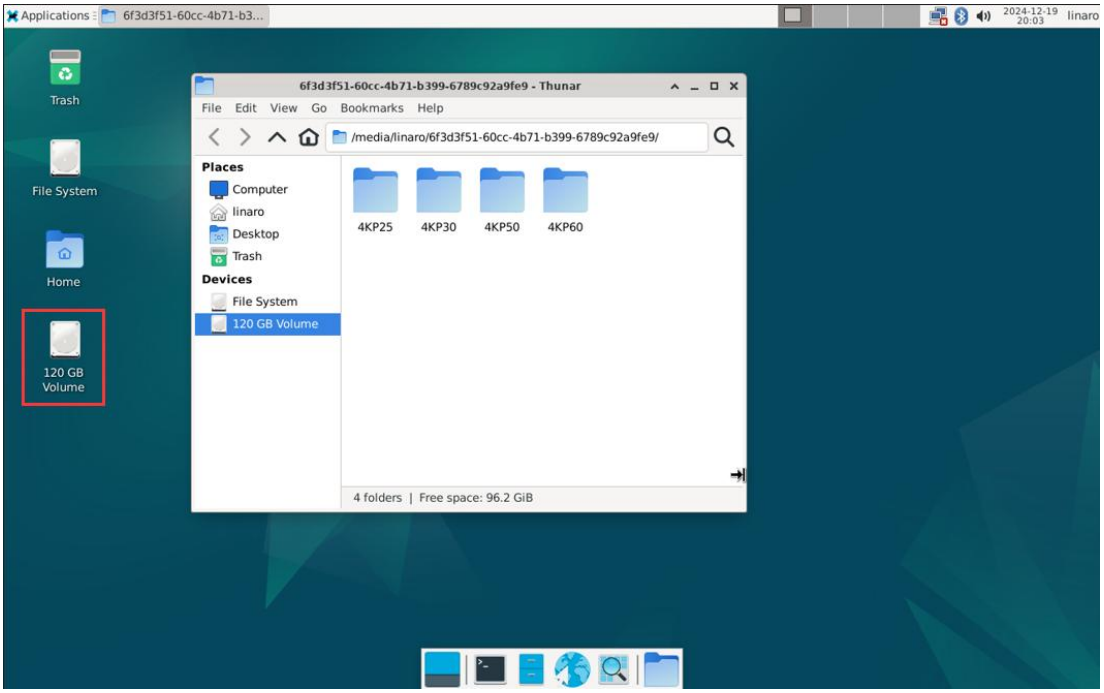
6.6 SATA (Multiplexed with USB Host)

The SATA on Debian 12 only supports the ext4 format.

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: 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/sda
```

①Note

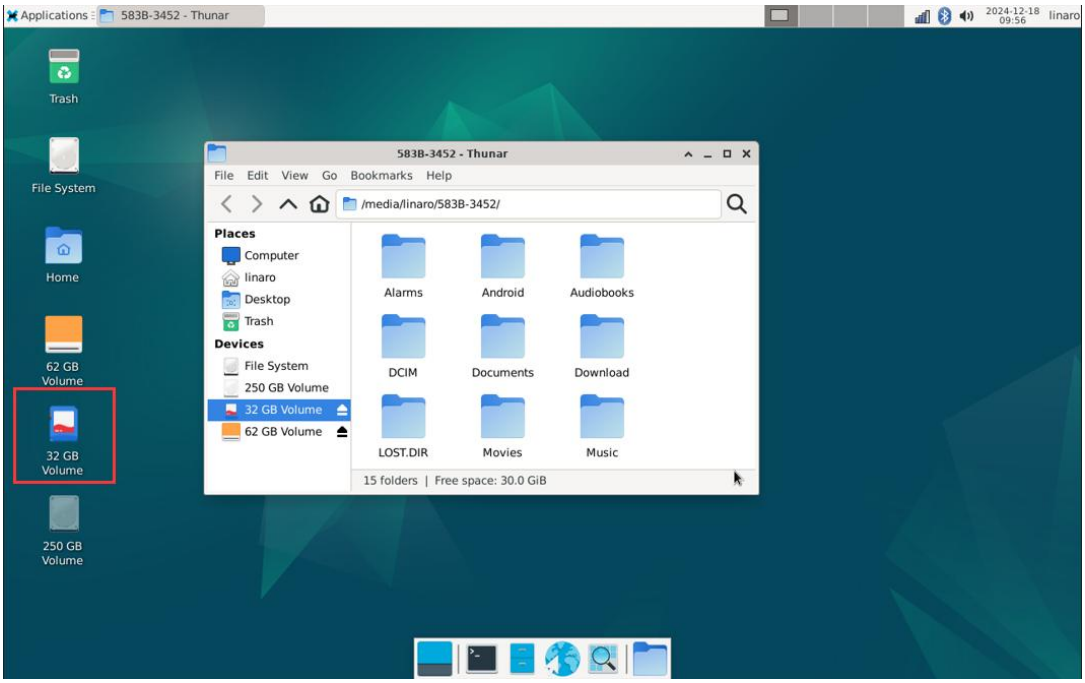
The update.img supports USB host functionality by default. If SATA functionality is required, users need to reflash the kernel image: boot-sata.img.

6.7 SD Card

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

Step 2: After inserting the SD card, if it is recognized successfully, an icon will appear

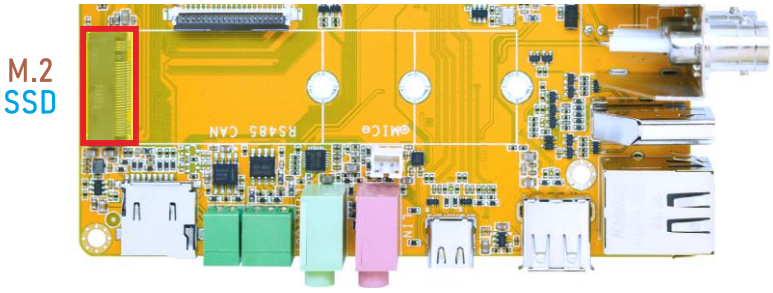
on the desktop. Users need to click the icon in order to access the SD card.



6.8 M.2 NVME SSD

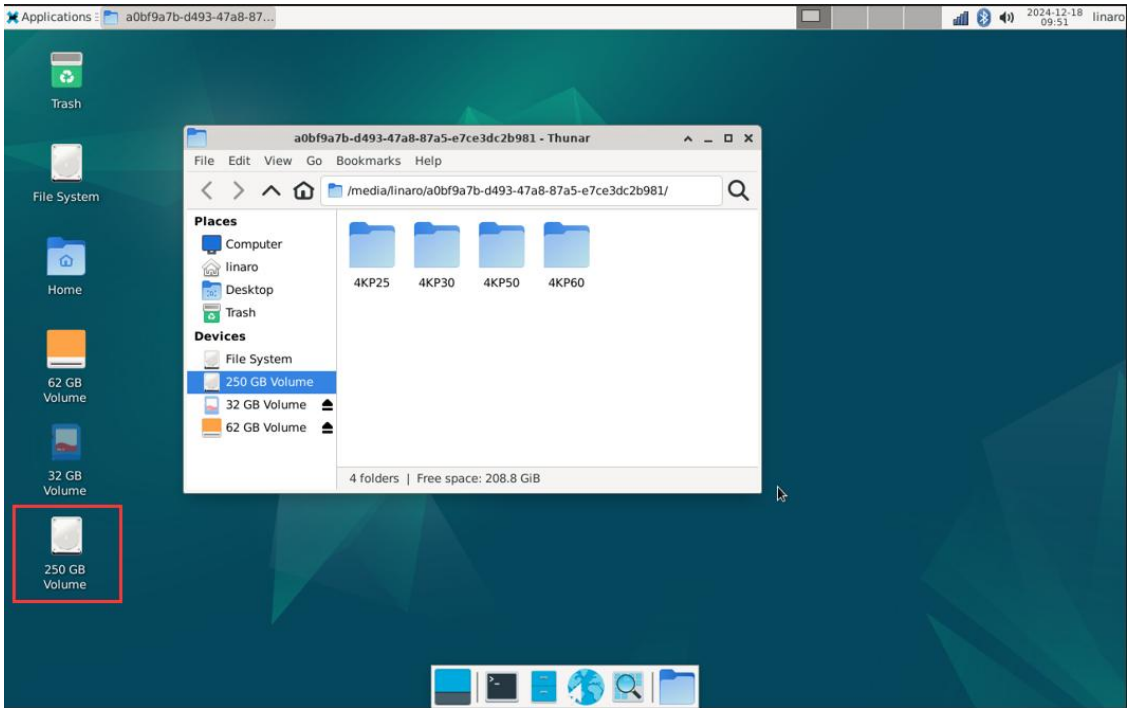
The SSD on Debian12 only supports the ext4 format.

Step 1: Connect the SSD, then power on.



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: 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.

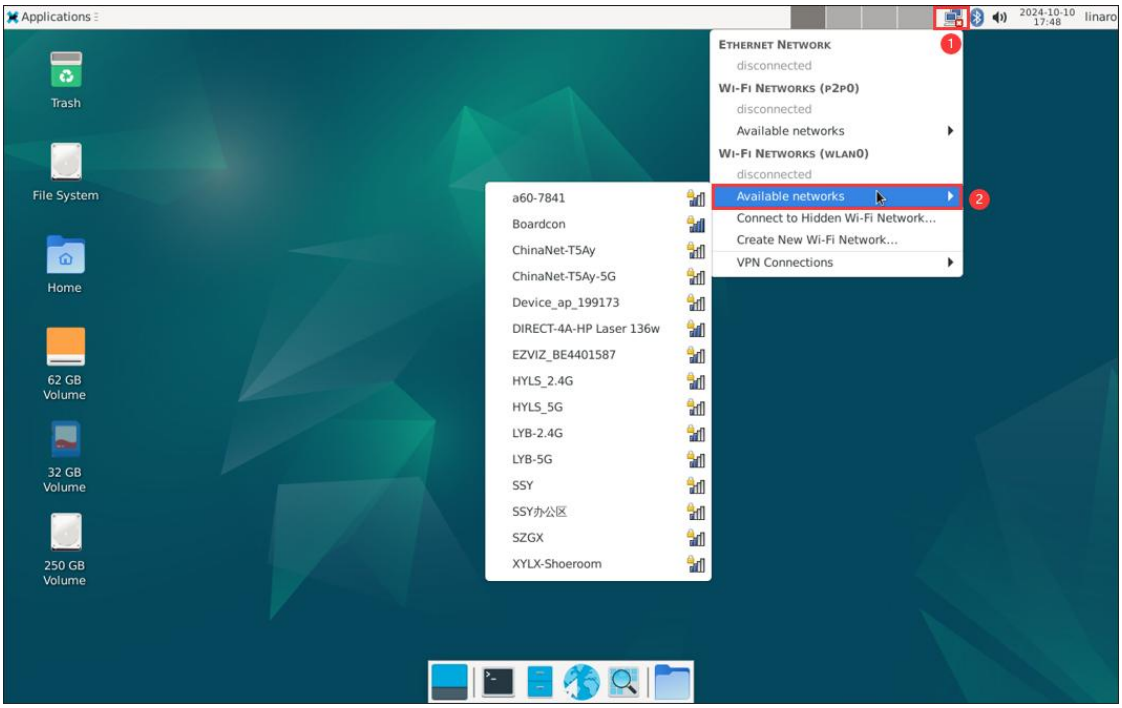
```
# mke2fs -t ext4 /dev/nvme0n1
```

6.9 WiFi & Bluetooth

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

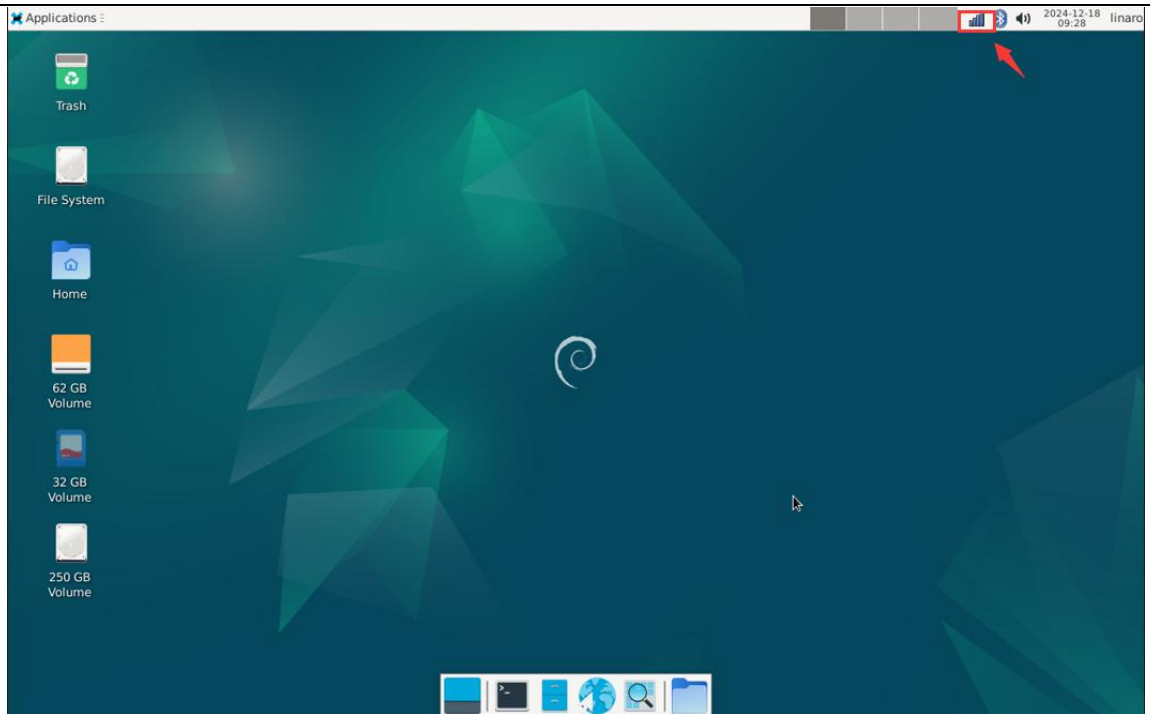
6.9.1 WiFi

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
```

```
root@linaro-alip:/# ifconfig
p2p0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        ether 3a:7a:cc:2a:11:87  txqueuelen 1000  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.0.217  netmask 255.255.255.0  broadcast 192.168.0.255
        inet6 fe80::3bcd:d135:688e:82e  prefixlen 64  scopeid 0x20<link>
        ether 38:7a:cc:2a:11:87  txqueuelen 1000  (Ethernet)
        RX packets 462  bytes 73121 (71.4 KiB)
        RX errors 0  dropped 66  overruns 0  frame 0
        TX packets 182  bytes 21007 (20.5 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

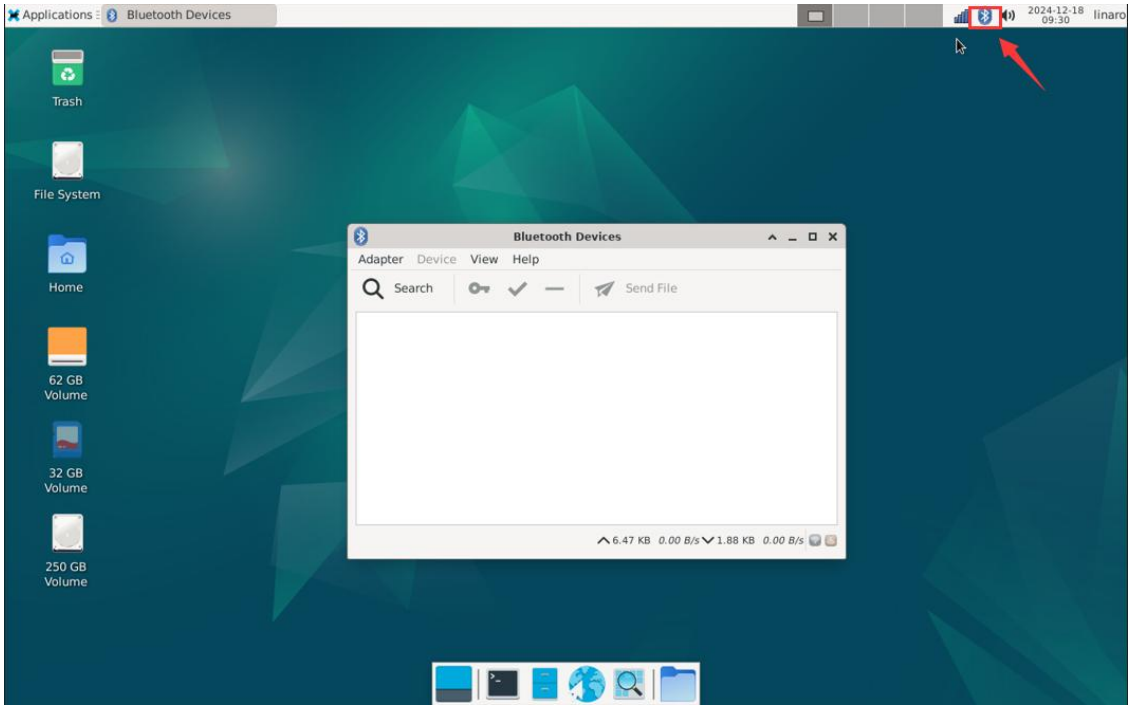
(2) Network connection test.

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

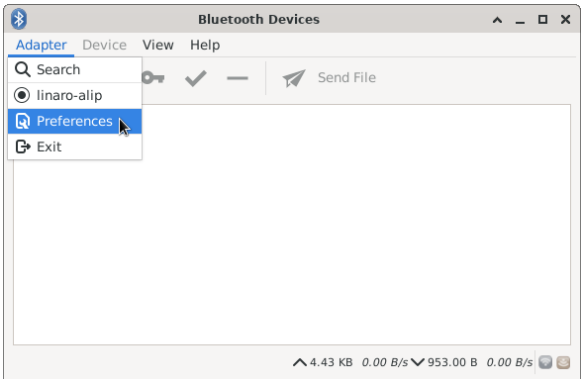
```
root@linaro-alip:/# ping -I wlan0 www.armdesigner.com
PING www.armdesigner.com (67.222.54.196) from 192.168.0.217 wlan0: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=48 time=204 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=48 time=205 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=48 time=195 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=48 time=197 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=48 time=195 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=48 time=195 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=7 ttl=48 time=199 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=8 ttl=48 time=204 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=9 ttl=48 time=200 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=10 ttl=48 time=196 ms
^C
--- www.armdesigner.com ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9013ms
rtt min/avg/max/mdev = 194.830/199.155/205.357/3.958 ms
```

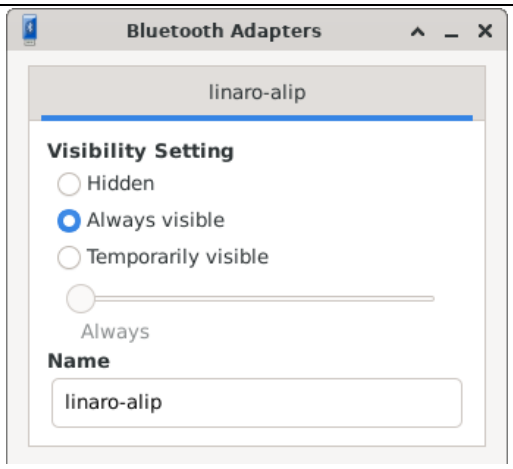
6.9.2 Bluetooth

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

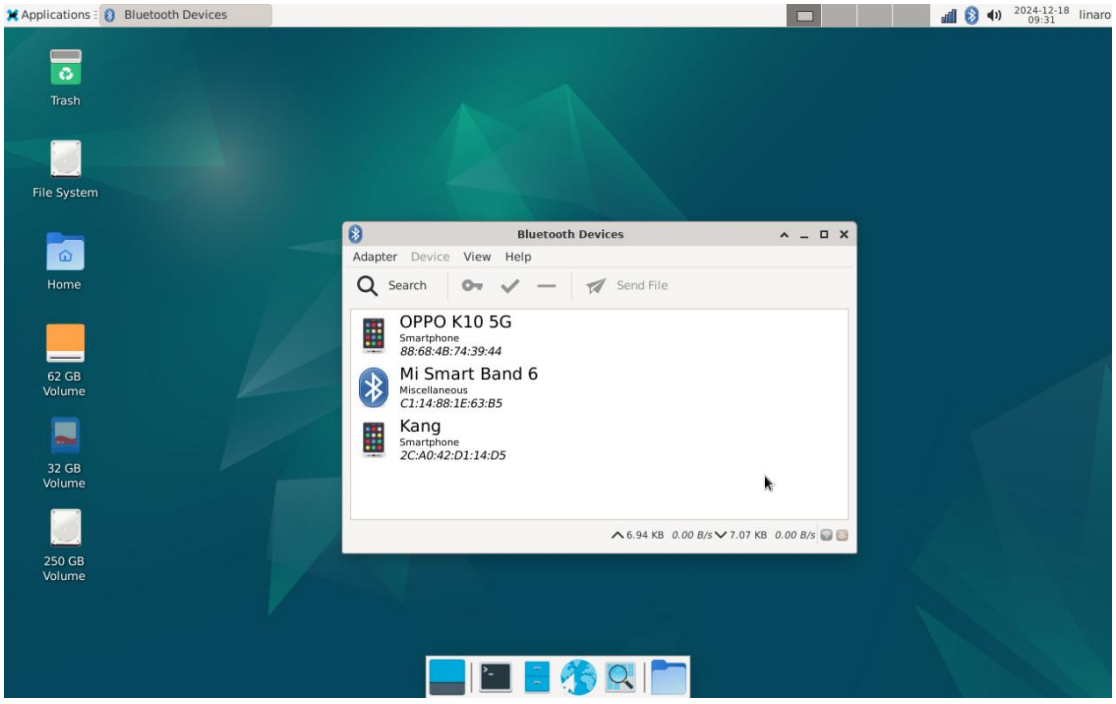


Step 2: The Bluetooth device name is hidden by default. Set it to be visible by clicking **Adapter** -> **Preferences** -> **Always visible**.





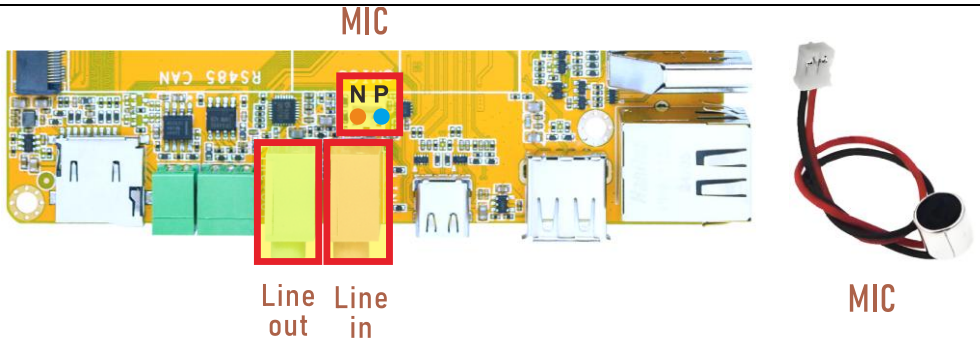
Step 3: Click Search to start searching and select the available device in the list to pair.



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

6.10 Audio

The audio input supports two channels: microphone (mic) and Line in, with the microphone (mic) channel as the default.



6.10.1 Audio input

• Execute the following command to switch to the **Line in** channel.

```
# amixer -c0 cset name='Right PGA Mux' 1
# amixer -c0 cset name='Left PGA Mux' 1
```

```
root@linaro-alip:/# amixer -c0 cset name='Right PGA Mux' 1
numid=69,iface=MIXER,name='Right PGA Mux'
  ; type=ENUMERATED,access=rw------,values=1,items=3
  ; Item #0 'Line 1R'
  ; Item #1 'Line 2R'
  ; Item #2 'DifferentialR'
  : values=1
root@linaro-alip:/# amixer -c0 cset name='Left PGA Mux' 1
numid=68,iface=MIXER,name='Left PGA Mux'
  ; type=ENUMERATED,access=rw------,values=1,items=3
  ; Item #0 'Line 1L'
  ; Item #1 'Line 2L'
  ; Item #2 'DifferentialL'
  : values=1
```

• Execute the following command to switch to the microphone (**mic**) channel.

```
# amixer -c0 cset name='Right PGA Mux' 2
# amixer -c0 cset name='Left PGA Mux' 2
```

```
root@linaro-alip:/# amixer -c0 cset name='Right PGA Mux' 2
numid=69,iface=MIXER,name='Right PGA Mux'
  ; type=ENUMERATED,access=rw------,values=1,items=3
  ; Item #0 'Line 1R'
  ; Item #1 'Line 2R'
  ; Item #2 'DifferentialR'
  : values=2
root@linaro-alip:/# amixer -c0 cset name='Left PGA Mux' 2
numid=68,iface=MIXER,name='Left PGA Mux'
  ; type=ENUMERATED,access=rw------,values=1,items=3
  ; Item #0 'Line 1L'
  ; Item #1 'Line 2L'
  ; Item #2 'DifferentialL'
  : values=2
```

• Execute the following command to start recording.

```
# arecord -D hw:0,0 -f cd -r 44100 -c 2 -t wav test.wav
```

```
root@linaro-alip:/# arecord -D hw:0,0 -f cd -r 44100 -c 2 -t wav test.wav
Recording WAVE 'test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

6.10.2 Audio output

Step 1: View sound card.

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

```
root@linaro-alip:/# cat /proc/asound/cards
 0 [rockchipes8388 ]: rockchip-es8388 - rockchip-es8388
                      rockchip-es8388
 1 [rockchipdp0    ]: rockchip-dp0 - rockchip-dp0
                      rockchip-dp0
 2 [rockchiphdmi   ]: rockchip-hdmi - rockchip-hdmi
                      rockchip-hdmi
```

Step 2: Execute the following command to set the **Line out** channel.

```
# amixer -c0 cset name='Speaker Switch' 1
# amixer -c0 cset name='Output 2 Playback Volume' 10  //(0-33)
# amixer -c0 cset name='PCM Volume' 140               //(0-192)
```

```
root@linaro-alip:/# amixer -c0 cset name='Speaker Switch' 1
numid=65,iface=MIXER,name='Speaker Switch'
  ; type=BOOLEAN,access=rw------,values=1
  : values=on
root@linaro-alip:/#
root@linaro-alip:/# amixer -c0 cset name='Output 2 Playback Volume' 10
numid=60,iface=MIXER,name='Output 2 Playback Volume'
  ; type=INTEGER,access=rw---R--,values=2,min=0,max=33,step=0
  : values=10,10
  | dBscale-min=-45.00dB,step=1.50dB,mute=0
root@linaro-alip:/#
root@linaro-alip:/# amixer -c0 cset name='PCM Volume' 140
numid=56,iface=MIXER,name='PCM Volume'
  ; type=INTEGER,access=rw---R--,values=2,min=0,max=192,step=0
  : values=140,140
  | dBscale-min=-96.00dB,step=0.50dB,mute=1
```

Step 3: Execute the following command to play audio and output it through **Line out**.

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

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

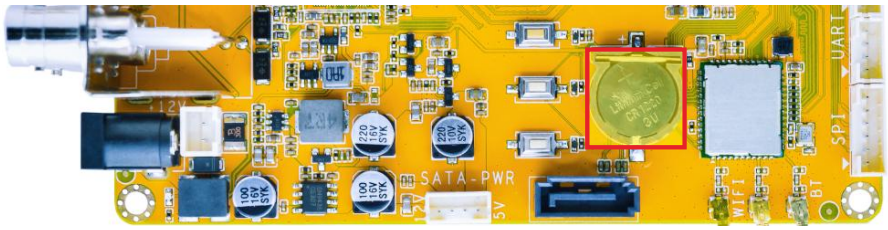
Supplementary instructions on audio output:

```
# aplay -Dhw:0,0 record.wav   // Line out audio output
# aplay -Dhw:1,0 record.wav   // DP AIT mode audio output
# aplay -Dhw:2,0 record.wav   // HDMI TX audio output
```

6.11 RTC

Step 1: Install the coin cell battery.

RTC



Step 2: Set the system time.

```
# date -s "2024-12-19 14:15:00"
```

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

```
# hwclock -w
```

Step 4: Display the current hardware clock time.

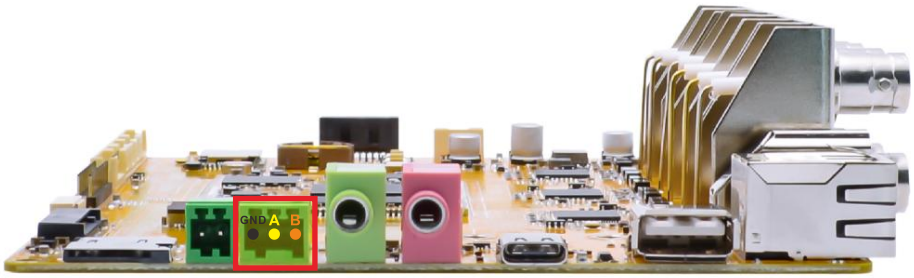
```
# hwclock
```

```
root@linaro-alip:/#  date -s "2024-12-19 14:16:30"
Thu Dec 19 02:16:30 PM UTC 2024
root@linaro-alip:/# hwclock -w
root@linaro-alip:/# hwclock
2024-12-19 14:16:38.196019+00:00
root@linaro-alip:/# hwclock
2024-12-19 14:16:57.107916+00:00
root@linaro-alip:/# hwclock
2024-12-19 14:17:06.993356+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
2024-12-19 14:41:24.294090+00:00
root@linaro-alip:/# hwclock
2024-12-19 14:41:36.702625+00:00
root@linaro-alip:/# hwclock
2024-12-19 14:42:00.991369+00:00
root@linaro-alip:/# hwclock
2024-12-19 14:42:32.525379+00:00
```

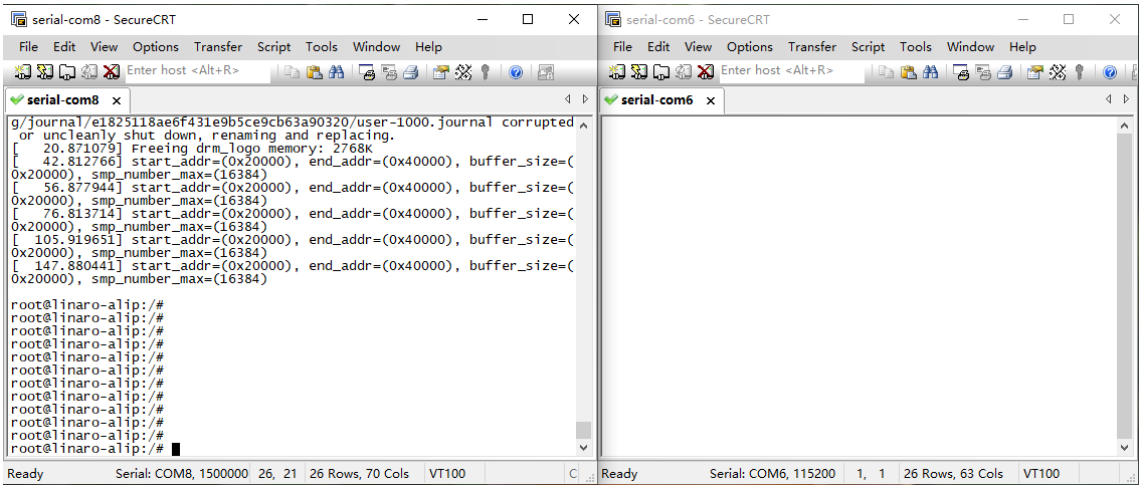
6.12 RS485



RS485

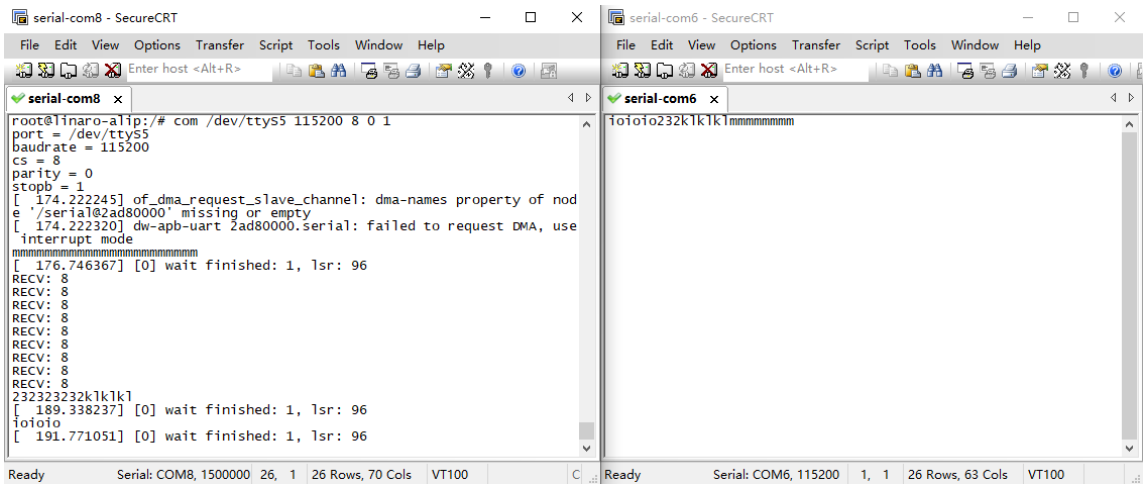
Step 1: As shown in the diagram, connect the RS485 test tool to the development board.

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.

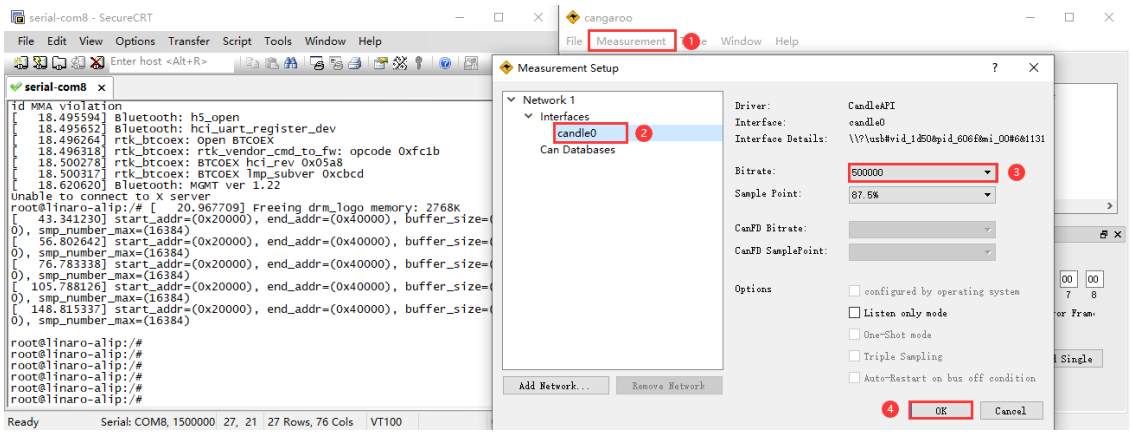
```
# com /dev/ttyS5 115200 8 0 1
```



6.13 CAN

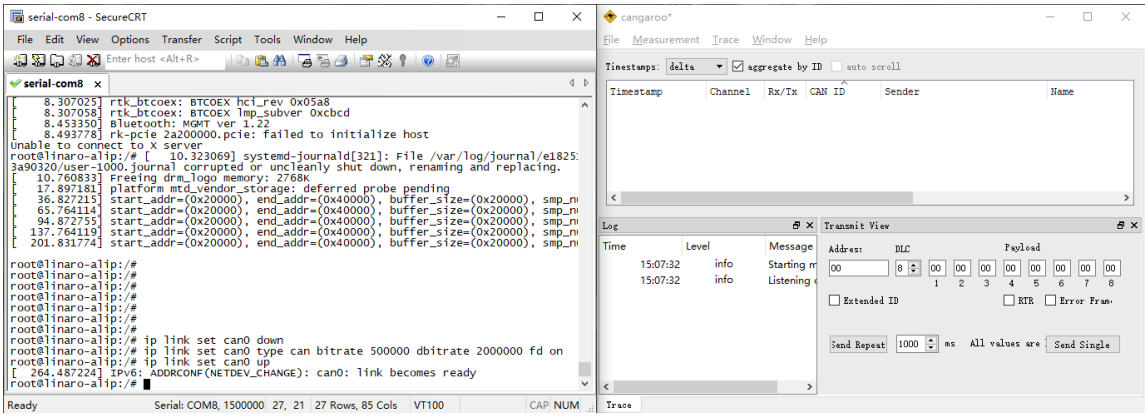
Step 1: Connect the CAN test tool to the board as shown in the diagram below.

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



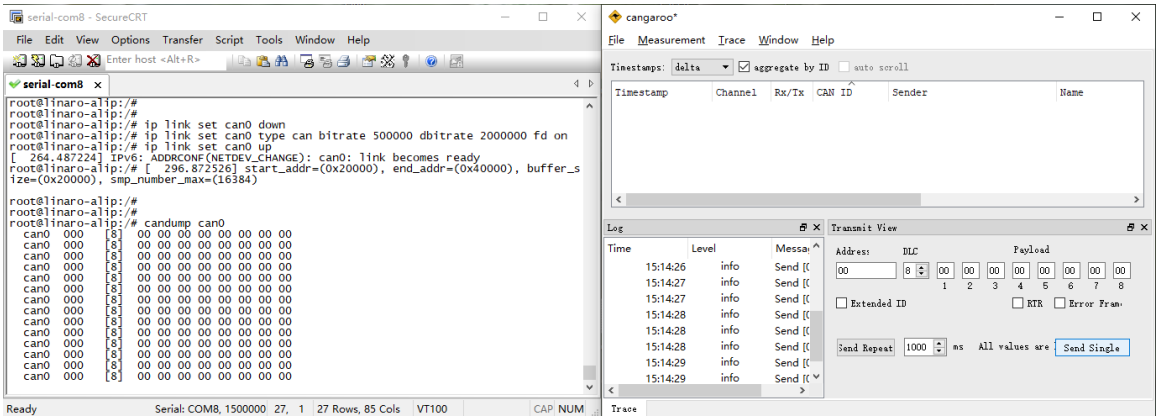
Step 3: Set up and activate the CAN network in CAN FD mode, with a nominal bitrate of 500000 and a data bitrate of 2000000.

```
# ip link set can0 down
# ip link set can0 type can bitrate 500000 dbitrate 2000000 fd on
# ip link set can0 up
```



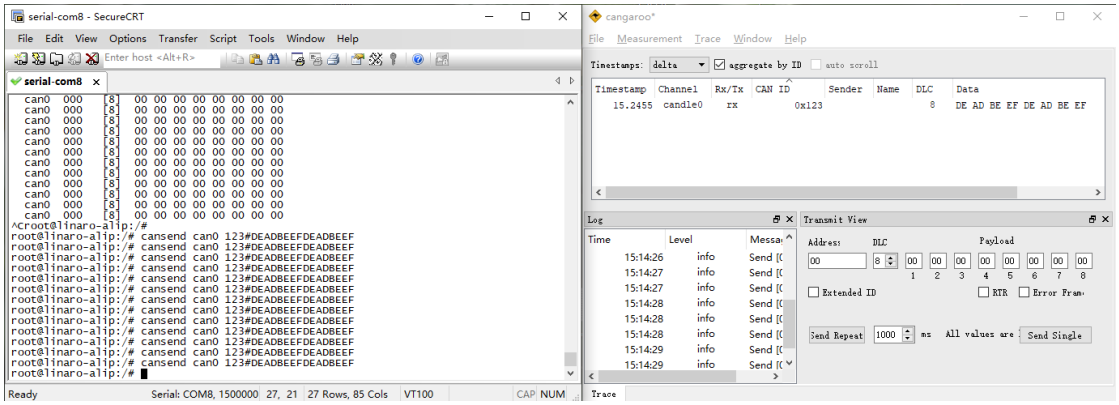
Step 4: Configure CAN as the receiver.

```
# candump can0
```



Step 5: Configure CAN as the sender.

```
# cansend can0 123#DEADBEEFDEADBEEF
```



6.14 UART

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

Step 2: UART10 test.

```
# com /dev/ttyS10 115200 8 0 1
```

```
root@linaro-alip:/# com /dev/ttyS10 115200 8 0 1
port = /dev/ttyS10
baudrate = 115200
cs = 8
parity = 0
stopb = 1
GGGGGGGGG
RECV: GGGGGGGGG
IIIIII22222
RECV: IIIIII22222
5656565656
RECV: 5656565656
UUU
RECV: UUU
```

Step 3: UART11 test.

```
# com /dev/ttyS11 115200 8 0 1
```

```
root@linaro-alip:/# com /dev/ttyS11 115200 8 0 1
port = /dev/ttyS11
baudrate = 115200
cs = 8
parity = 0
stopb = 1
PPPPPPPPPPPPPPP
RECV: PPPPPPPPPPPPPPP
RRRRRRRRTRTRTR
RECV: RRRRRRRRTRTRTR
8888888888888888
RECV: 8888888888888888
55
RECV: 55
```

6.15 SPI

Step 1: short circuit SPI3_MISO and SPI3_MOSI pins of SPI.

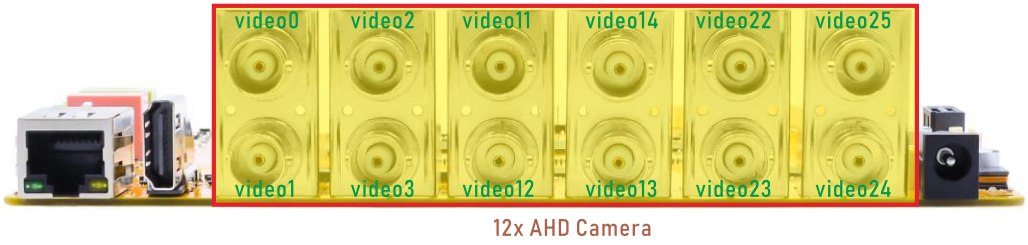
Step 2: Execute the test script: **spidev_test**.

```
# spidev_test
```

```
root@linaro-alip:/# spidev_test
spi mode: 0
bits per word: 8
max speed: 500000 Hz (500 KHz)

FF FF FF FF FF FF
40 00 00 00 00 95
FF FF FF FF FF FF
FF FF FF FF FF FF
FF FF FF FF FF FF
DE AD BE EF BA AD
F0 0D
```

6.16 Camera



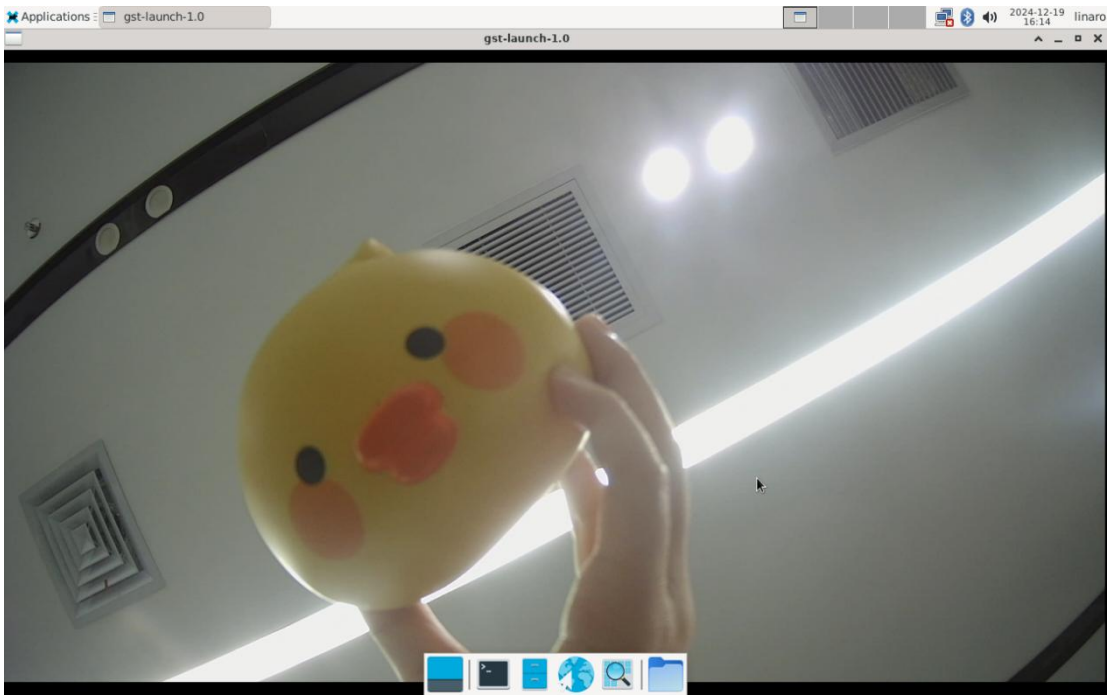
• Preview the footage from 12 cameras simultaneously.

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

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

```
# gst-launch-1.0 v4l2src device=/dev/video0 !
video/x-raw,format=NV16,width=1920,height=1080, framerate=25/1 ! xvimagesink
```

```
root@linaro-alip:/# gst-launch-1.0 v4l2src device=/dev/video0 !
video/x-raw,format=NV16,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
[ 1401.006441] rkcif-mipi-lvds: stream[0] start streaming
[ 1401.011321] rkcif-mipi-lvds: Allocate dummy buffer, size: 0x003f5000
[ 1401.019478] rockchip-mipi-csi2 mipi0-csi2: stream on, src_sd: 00000000c3fdf642, sd_name:rockchip-csi2-dphy0
[ 1401.019504] rockchip-mipi-csi2 mipi0-csi2: stream ON
[ 1401.019540] rockchip-csi2-dphy0: dphy0, data_rate_mbps 594
[ 1401.020005] rockchip-csi2-dphy csi2-dphy0: csi2_dphy_s_stream stream on:1, dphy0, ret 0
[ 1401.021396] techpoint 7-0047: detect channel 0 1080P_25
[ 1401.022225] techpoint 7-0047: set channel 0 1080P_25
[ 1401.059059] techpoint 7-0047: detect channel 1 is not supported, default 1080P_25
[ 1401.059875] techpoint 7-0047: set channel 1 1080P_25
[ 1401.095981] techpoint 7-0047: detect channel 2 is not supported, default 1080P_25
[ 1401.096749] techpoint 7-0047: set channel 2 1080P_25
[ 1401.133912] techpoint 7-0047: detect channel 3 is not supported, default 1080P_25
[ 1401.134692] techpoint 7-0047: set channel 3 1080P_25
[ 1401.185387] mipi0-csi2-hw ERR1:0xff0 (fs/fe mis,vc: 0 1 2 3) (f_seq,vc: 0 1 2 3)
Redistribute latency...
0:00:44.3 / 99:99:99.
```



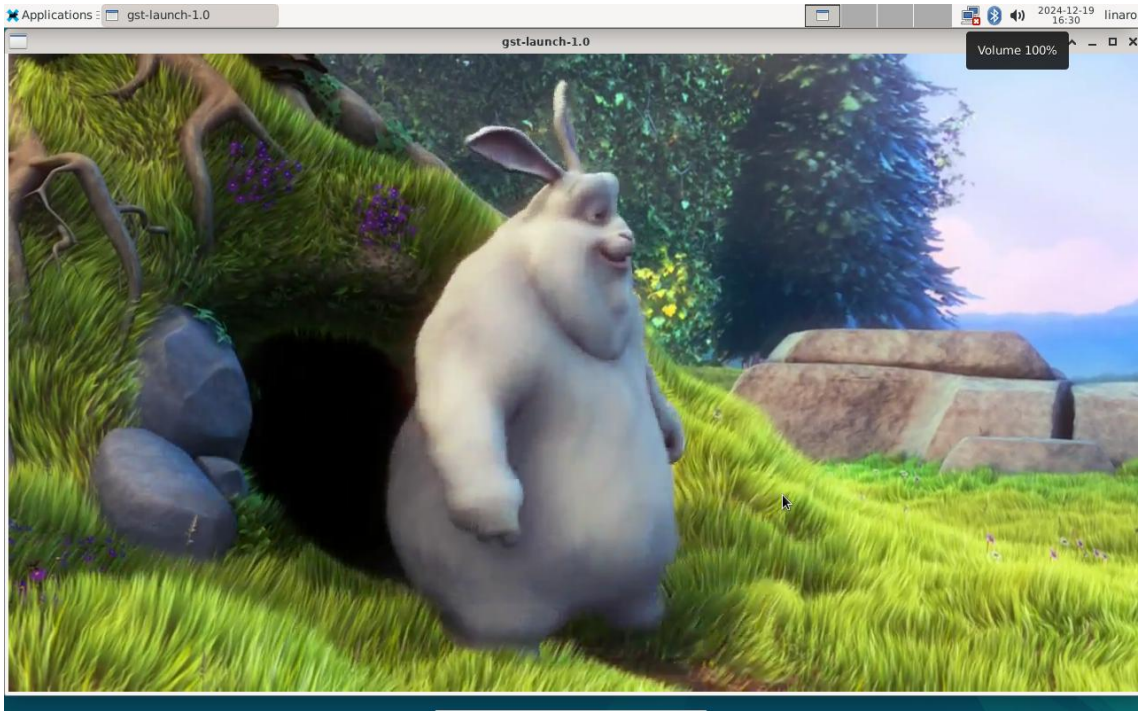
6.17 Video Playback

(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.sh
test_dec-mpv.sh     test_gst_multivideo.sh   video_stresstest.sh
test_dec-parole.sh  test_gst_video_fps.sh    video_test.sh
test_dec-qt.sh      test_gst_video_maxfps.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[2281]: mpp_info: mpp version: 48962a10 author: Hongjin Li    2024-09-19 fix[avsd]: Fix attach dev error
issue
mpp[2281]: mpp_info: mpp version: 48962a10 author: Hongjin Li    2024-09-19 fix[avsd]: Fix attach dev error
issue
mpp[2281]: mpp_info: mpp version: 48962a10 author: Hongjin Li    2024-09-19 fix[avsd]: Fix attach dev error
issue
mpp[2281]: mpp: unable to create enc vp8 for soc rk3576 unsupported
mpp[2281]: mpp_info: mpp version: 48962a10 author: Hongjin Li    2024-09-19 fix[avsd]: Fix attach dev error
issue
mpp[2281]: mpp_info: mpp version: 48962a10 author: Hongjin Li    2024-09-19 fix[avsd]: Fix attach dev error
issue
Redistribute latency...
mpp[2281]: h264d_api: is_avcC=1
Pipeline is PREROLLED ...
Prerolled, waiting for async message to finish...
Setting pipeline to PLAYING ...
Redistribute latency...
New clock: GstSystemClock
0:00:03.5 / 0:00:29.5 (12.1 %)
```

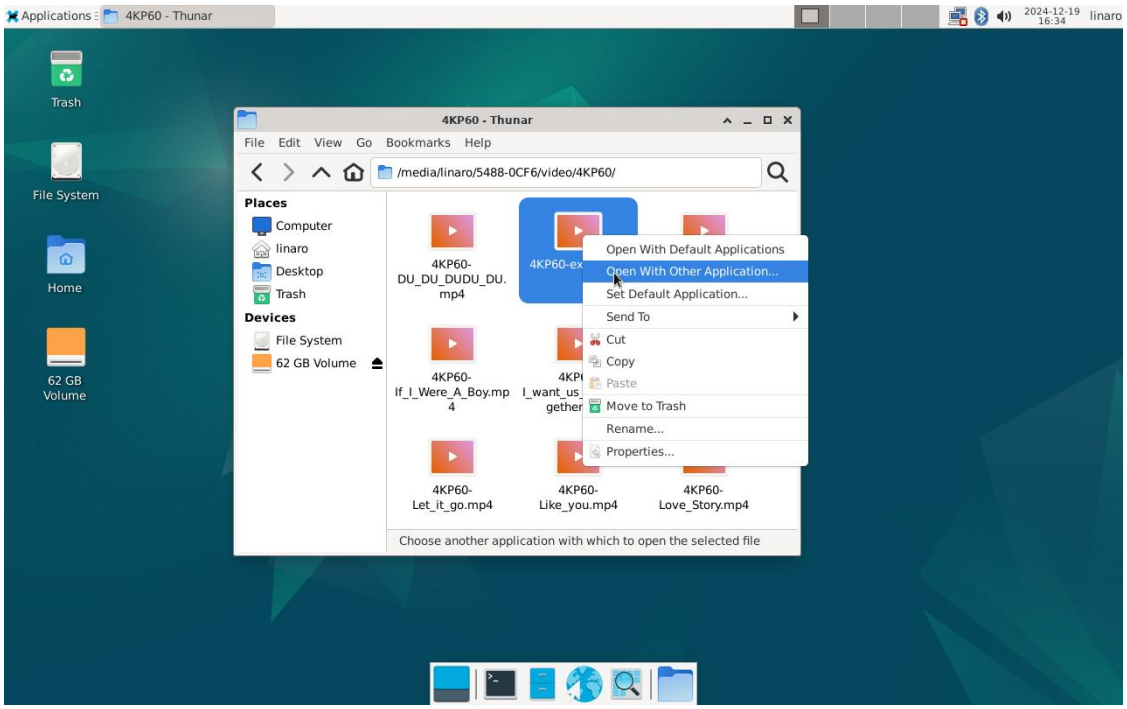


(2) Play the video using Google Chrome.

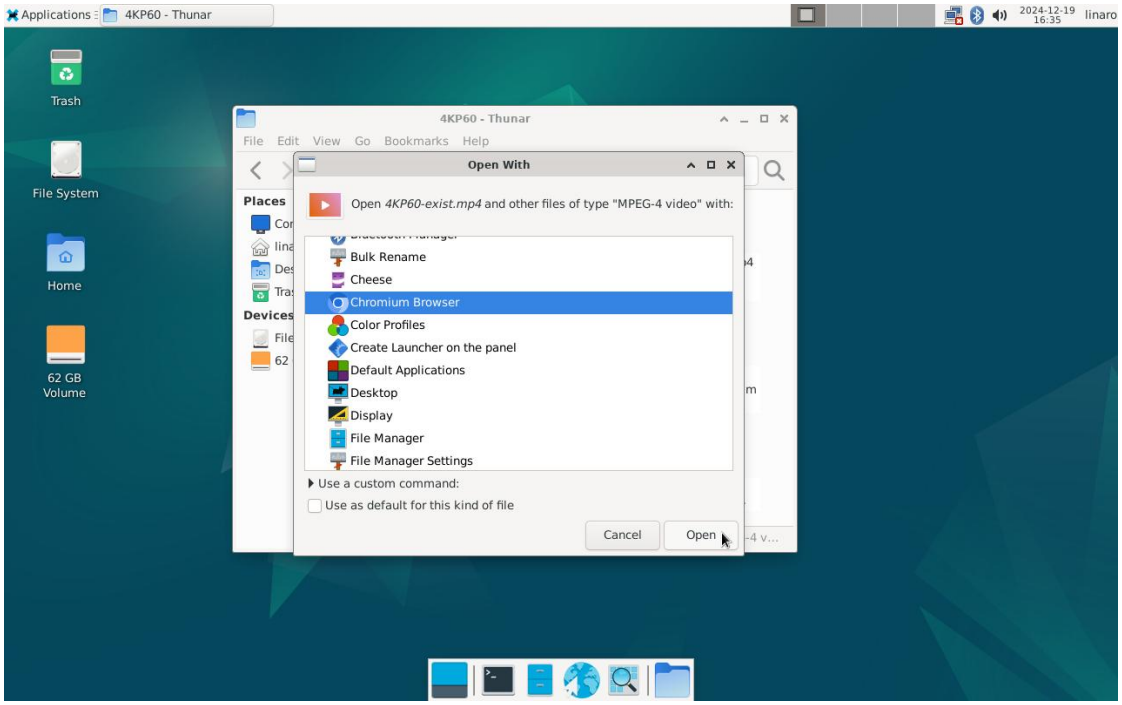
• Google Chrome supports video playback up to 4K at 60Hz, with support for the following decoding formats: VP8, H.264, H.265, VP9, and AV1.

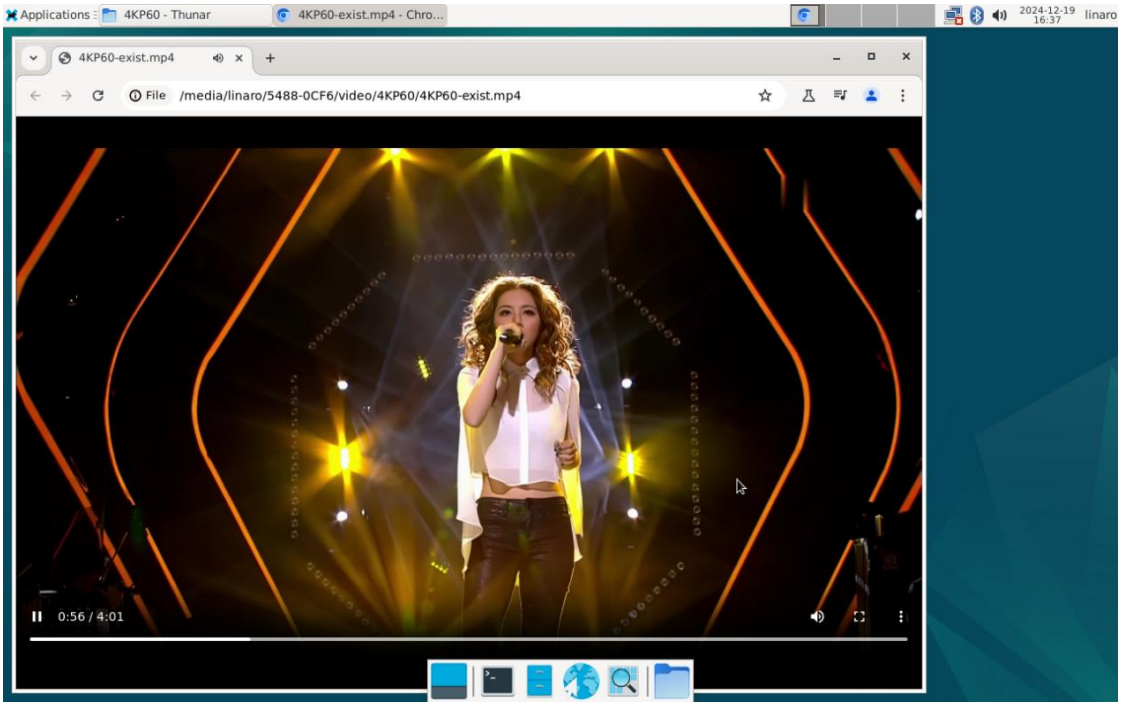
• However, it is only compatible with certain H.265 video files.

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.

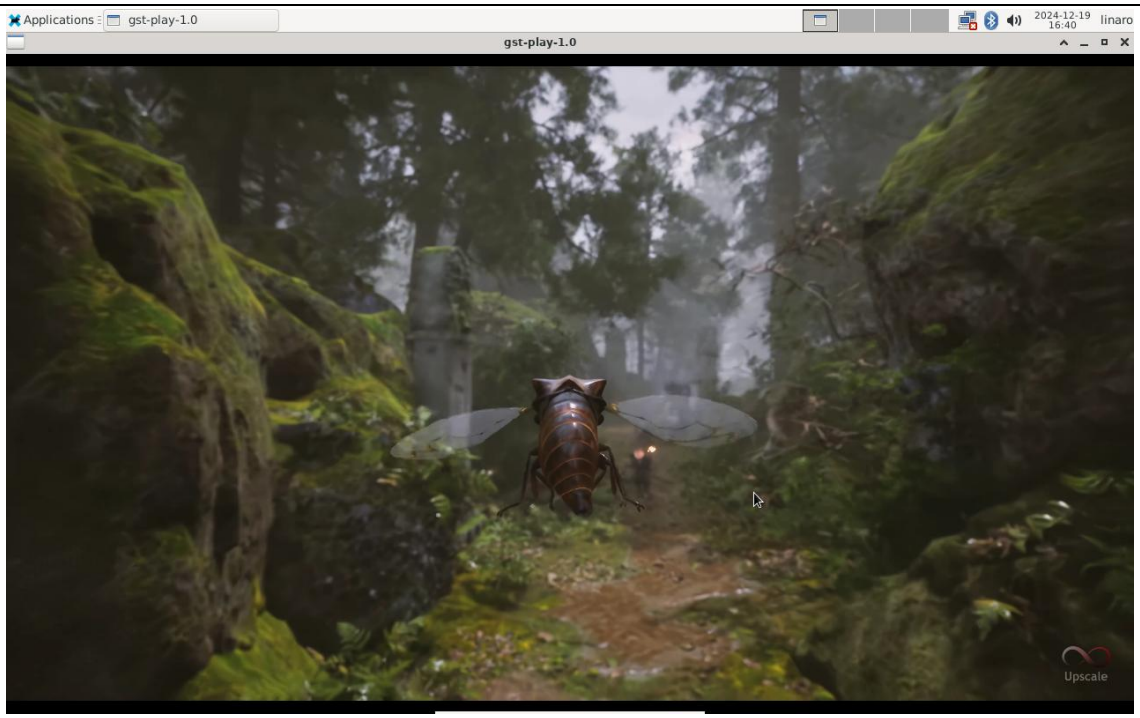
```
# gst-play-1.0 --videosink=xvimagesink
/media/linaro/5488-0CF6/video/8KP30/H265_8KP30-2.mp4 --audiosink="alsasink
```

Command explanation:

• /media/linaro/5488-0CF6/video/8KP30/H265_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.

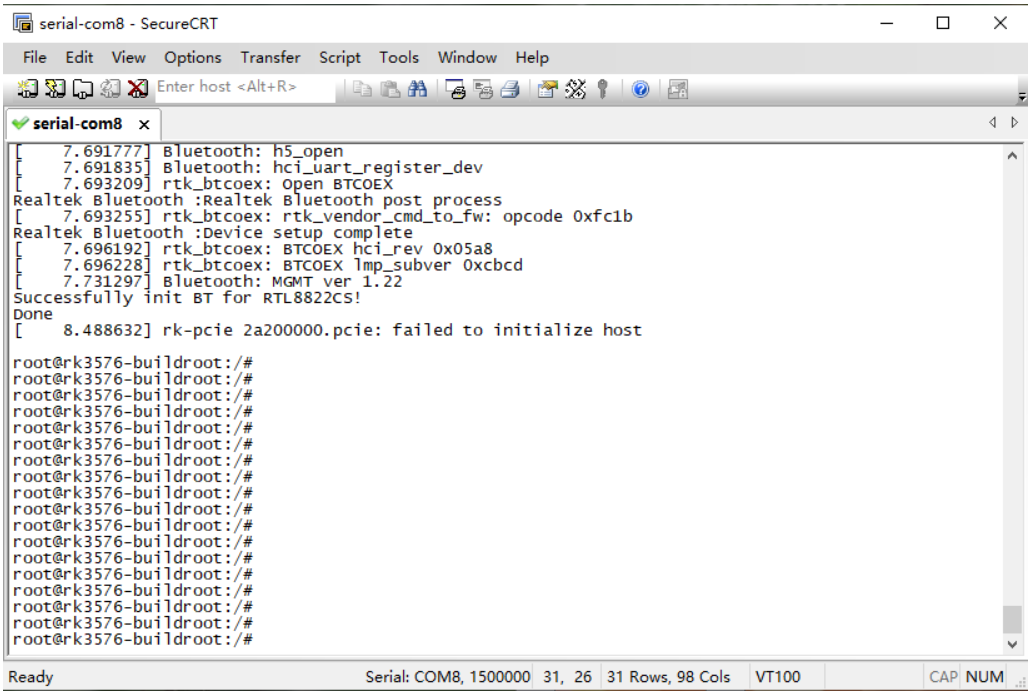
```
root@linaro-alip:/#                    gst-play-1.0                    --videosink=xvimagesink
/media/linaro/5488-0CF6/video/8KP30/H265_8KP30-2.mp4 --audiosink="alsasink device=hw:0,0"
Press 'k' to see a list of keyboard shortcuts.
Now playing /media/linaro/5488-0CF6/video/8KP30/H265_8KP30-2.mp4
Redistribute latency...
Redistribute latency...
Redistribute latency...
Redistribute latency...
Redistribute latency...
0:01:01.2 / 0:13:10.5
```



7.Buildroot Test

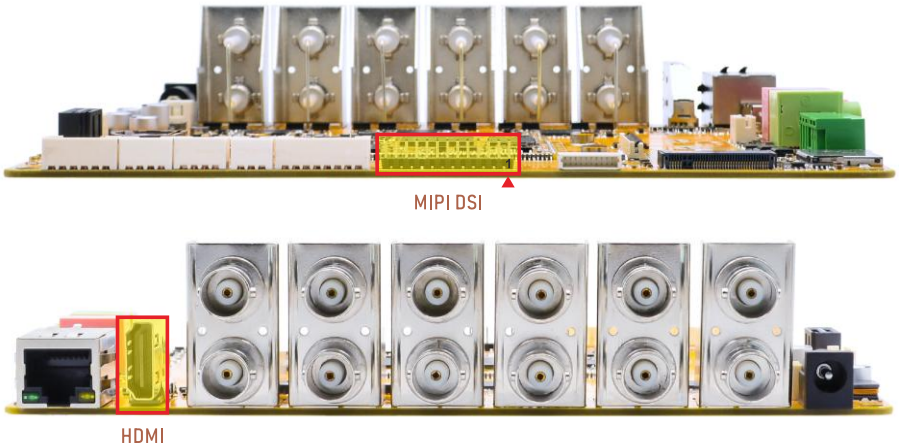
7.1 Serial Terminal

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



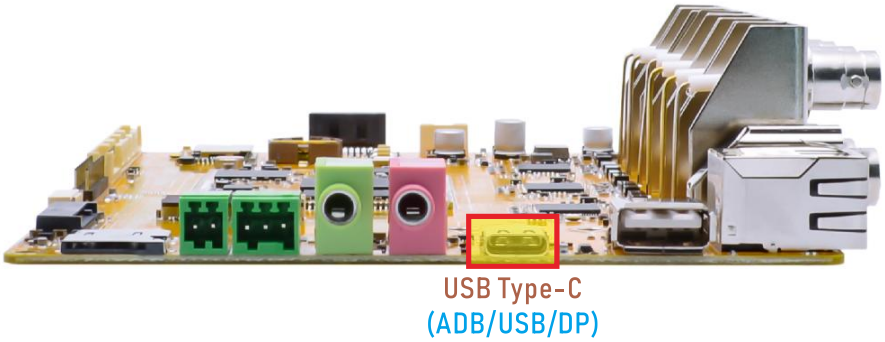
7.2 Display

The EM3576 supports dual independent displays, with default support for MIPI DSI and HDMI interfaces, and also includes synchronous display capabilities, along with support for DP AIT functionality.



The display effect diagram is as follows:

7.3 USB Type-C



Features Supported by the Type-C Interface:

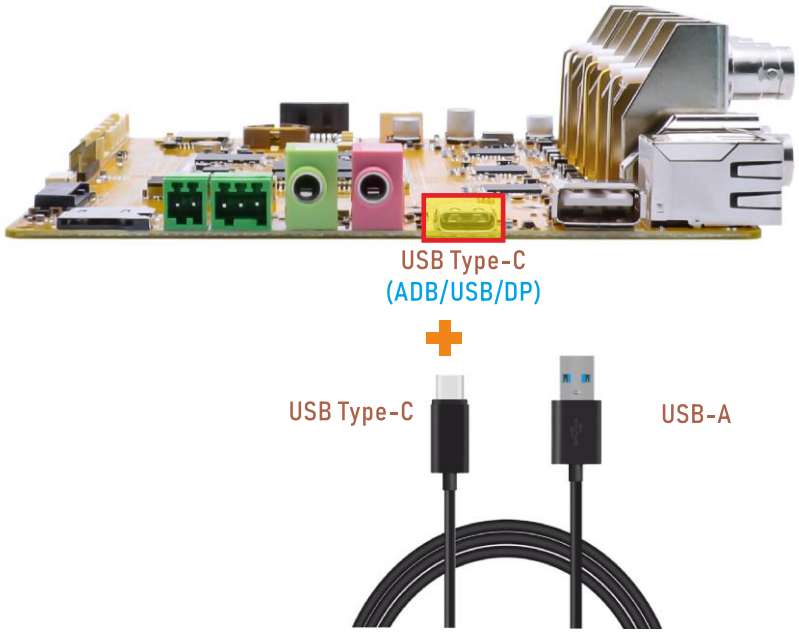
• **Reversible Design:** Allows insertion in either orientation for user convenience.

• **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.

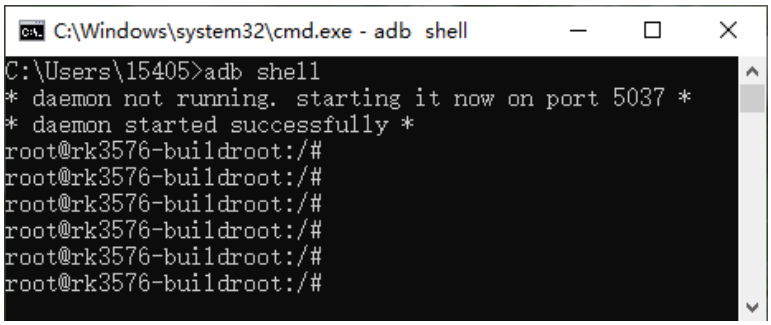


Step 2: Install ADB driver on Windows system.

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

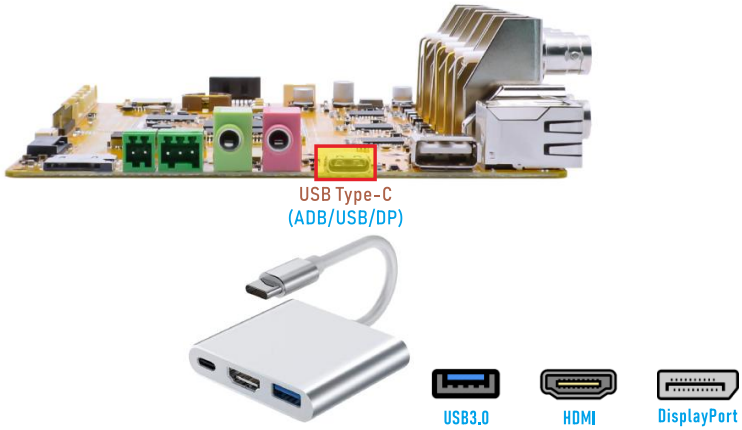
Step 4: Execute the following command to enable ADB.

```
# adb shell
```



7.3.2 Type-C to USB

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



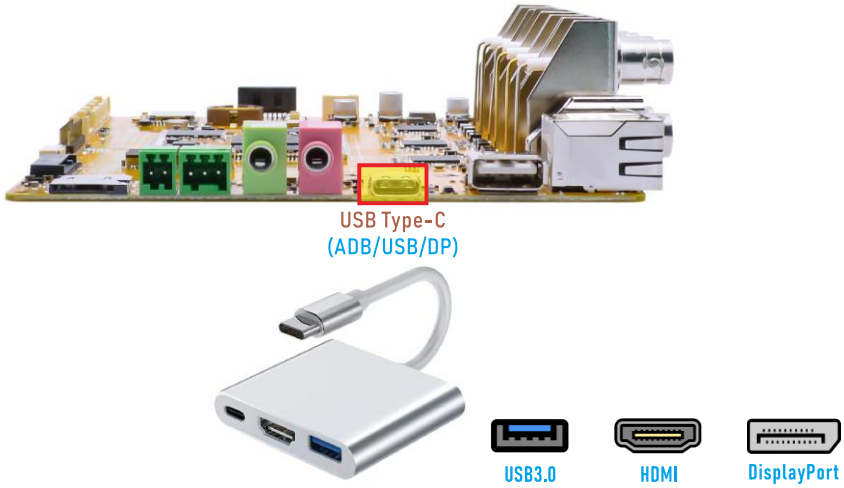
Step 2: After inserting the USB flash drive, the system will automatically mount the device. Use the following command to check the directory information of the automatically mounted device:

```
# df -h
```

```
root@rk3576-buildroot:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root        14G  689M   13G   6% /
devtmpfs        966M  8.0K  966M   1% /dev
tmpfs           978M  140K  978M   1% /tmp
tmpfs           978M  488K  977M   1% /run
tmpfs           978M  196K  978M   1% /var/log
tmpfs           978M     0  978M   0% /dev/shm
/dev/mmcblk2p7  123M   12M  110M  10% /oem
/dev/mmcblk2p8   15G  332K   15G   1% /userdata
/dev/sda1        31G   28G  2.2G  93% /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@rk3576-buildroot:/# [ 1959.366255] rk_gmac-dwmac 2a230000.ethernet eth0: Link is Up - 1Gbps/Full - flow
control rx/tx
[ 1959.366421] IPv6: ADDRCONF(NETDEV_CHANGE): eth0: link becomes ready
```

Step 2: View network interface information.

```
# ifconfig
```

```
root@rk3576-buildroot:/# ifconfig
eth0      Link encap:Ethernet  HWaddr B2:EF:E7:4F:BF:85
          inet addr:192.168.0.216  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::a645:3196:e4ea:385/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:59 errors:0 dropped:4 overruns:0 frame:0
          TX packets:10 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:13635 (13.3 KiB)  TX bytes:1340 (1.3 KiB)
          Interrupt:64
```

Step 3: Users can test network connectivity using the desktop's built-in browser or verify it through the following command method.

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

```
root@rk3576-buildroot:/# ping -I eth0 www.armdesigner.com
PING www.armdesigner.com (67.222.54.196) from 192.168.0.216 eth0: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=48 time=191 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=48 time=191 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=48 time=191 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=48 time=191 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=48 time=190 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=48 time=191 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=7 ttl=48 time=191 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=8 ttl=48 time=190 ms
^C
--- www.armdesigner.com ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7010ms
rtt min/avg/max/mdev = 190.493/190.668/191.365/0.274 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.

After connecting the USB flash drive, it will be automatically mounted, execute the

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

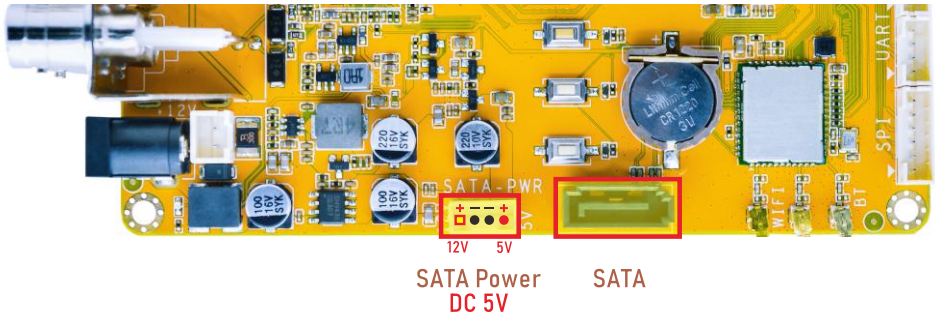
```
# df -h
```

```
root@rk3576-buildroot:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root        14G  689M   13G   6% /
devtmpfs        966M  8.0K  966M   1% /dev
tmpfs           978M  140K  978M   1% /tmp
tmpfs           978M  504K  977M   1% /run
tmpfs           978M  204K  978M   1% /var/log
tmpfs           978M     0  978M   0% /dev/shm
/dev/mmcblk2p7  123M   12M  110M  10% /oem
/dev/mmcblk2p8   15G  332K   15G   1% /userdata
/dev/sda1        58G   47G   12G  81% /mnt/udisk
/dev/sdb1        31G   28G  2.2G  93% /media/udisk1
```

7.6 SATA (Multiplexed with USB Host)

The SATA on Buildroot only supports the ext4 format.

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@rk3576-buildroot:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root        14G  689M   13G   6% /
devtmpfs        966M  8.0K  966M   1% /dev
tmpfs           978M  140K  978M   1% /tmp
tmpfs           978M  468K  977M   1% /run
tmpfs           978M  184K  978M   1% /var/log
tmpfs           978M     0  978M   0% /dev/shm
/dev/mmcblk2p7  123M   12M  108M  10% /oem
/dev/mmcblk2p8   15G  364K   15G   1% /userdata
/dev/nvme0n1    229G  7.8G  209G   4% /mnt/storage
/dev/sda        110G  7.8G   97G   8% /media/storage1
/dev/mmcblk1p1   30G  608K   30G   1% /mnt/sdcard
```

Note: 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.

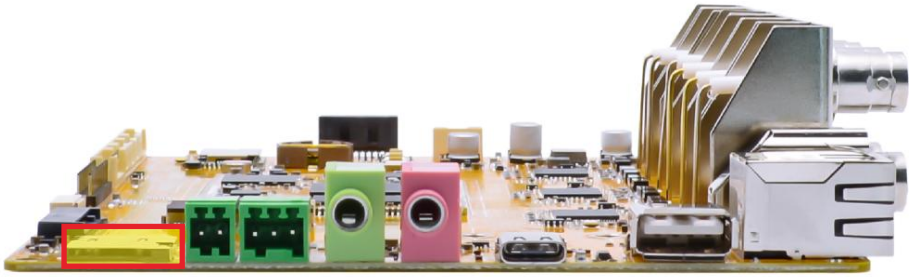
```
# mke2fs -t ext4 /dev/sda
```

①Note

The update.img supports USB host functionality by default. If SATA functionality is required, users need to reflash the kernel image: boot-sata.img.

7.7 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
```

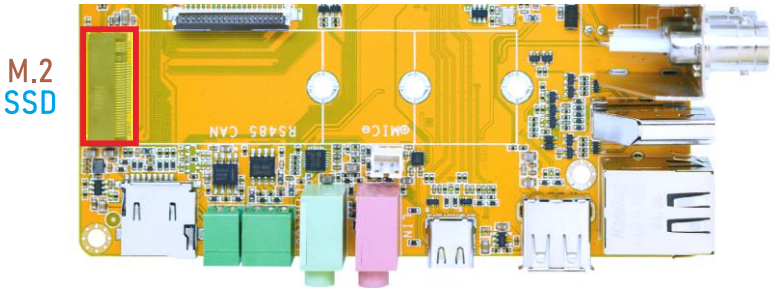
```
root@rk3576-buildroot:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root        14G  689M   13G   6% /
devtmpfs        966M  8.0K  966M   1% /dev
tmpfs           978M  140K  978M   1% /tmp
tmpfs           978M  512K  977M   1% /run
tmpfs           978M  208K  978M   1% /var/log
tmpfs           978M     0  978M   0% /dev/shm
/dev/mmcblk2p7  123M   12M  110M  10% /oem
/dev/mmcblk2p8   15G  332K   15G   1% /userdata
/dev/sda1        58G   47G   12G  81% /mnt/udisk
/dev/sdb1        31G   28G  2.2G  93% /media/udisk1
/dev/mmcblk1p1   30G  608K   30G   1% /mnt/sdcard
```

.

7.8 M.2 NVME SSD

The SSD on Buildroot only supports the ext4 format.

Step 1: Connect the SSD, then power on.



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

```
# df -h
```

```
root@rk3576-buildroot:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root        14G  689M   13G   6% /
devtmpfs        966M  8.0K  966M   1% /dev
tmpfs           978M  140K  978M   1% /tmp
tmpfs           978M  520K  977M   1% /run
tmpfs           978M  192K  978M   1% /var/log
tmpfs           978M     0  978M   0% /dev/shm
/dev/mmcblk2p7  123M   12M  108M  10% /oem
/dev/mmcblk2p8   15G  348K   15G   1% /userdata
/dev/nvme0n1    229G  7.8G  209G   4% /mnt/storage
/dev/mmcblk0p1   30G  608K   30G   1% /mnt/sdcard
/dev/sda1        58G   47G   12G  81% /mnt/udisk
/dev/sdb1        31G   28G  2.2G  93% /media/udisk1
```

Note: 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/nvme0n1
```

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
```

```
root@rk3576-buildroot:/# ifconfig
p2p0      Link encap:Ethernet  HWaddr 3A:7A:CC:2A:11:87
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

wlan0     Link encap:Ethernet  HWaddr 38:7A:CC:2A:11:87
          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)
```

Step 2: Scan for available WiFi hotspots.

```
# iwlist wlan0 scan
```

```
root@rk3576-buildroot:/# iwlist wlan0 scan
wlan0     Scan completed :
          Cell 01 - Address: D8:32:14:25:B7:A8
                    ESSID:"LYB-2.4G"
                    Protocol:IEEE 802.11bgn
                    Mode:Master
                    Frequency:2.412 GHz (Channel 1)
                    Encryption key:on
                    Bit Rates:300 Mb/s
                    Extra:wpa_ie=dd160050f20101000050f20401000050f20401000050f202
                    IE: WPA Version 1
                        Group Cipher : CCMP
                        Pairwise Ciphers (1) : CCMP
                        Authentication Suites (1) : PSK
                    Extra:
                    IE: IEEE 802.11i/WPA2 Version 1
                        Group Cipher : CCMP
                        Pairwise Ciphers (1) : CCMP
                        Authentication Suites (1) : PSK
                    IE: Unknown:
DDAD0050F204104A000110104400010210 3B00010310470010112233445566778899AAD8321425B7A01021001B5265616C74656B20
53656D69636F6E647563746F7220436F72702E1023000752544C387878781024000D45562D323031302D30392D32301042000F3132
3334353637383930313233343710540008000600 50F204000110110013526561 6C74656B20576972656C6573732041501008000201
00103C000103104900060037 2A000120
                    Quality=29/100  Signal level=39/100
                    Extra:fm=0003
          Cell 02 - Address: BC:1A:E4:EF:A0:D4
                    ESSID:"SZGX"
                    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                 Extra:fm=0003
          Cell 02 - Address: D8:32:14:25:B7:A2
                    ESSID:"LYB-5G"
                    Protocol:IEEE 802.11AC
                    Mode:Master
                    Frequency:5.805 GHz
                    Encryption key:on
                    Bit Rates:867 Mb/s
```

Step 3: Connect to the hotspot.

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

```
root@rk3576-buildroot:/# wifi-connect.sh Boardcon Boardcon43435656
connect to WiFi ssid: Boardcon, Passwd: Boardcon43435656
Successfully initialized wpa_supplicant
[   26.475462] IPv6: ADDRCONF(NETDEV_CHANGE): wlan0: link becomes ready
```

Step 4: View the network interface status.

```
# ifconfig
```

```
root@rk3576-buildroot:/# ifconfig
p2p0      Link encap:Ethernet  HWaddr 3A:7A:CC:2A:11:87
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

wlan0     Link encap:Ethernet  HWaddr 38:7A:CC:2A:11:87
          inet addr:192.168.0.217  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::5468:66de:9c2a:5b0e/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:60 errors:0 dropped:2 overruns:0 frame:0
          TX packets:32 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:8817 (8.6 KiB)  TX bytes:3872 (3.7 KiB)
```

Step 5: Test the WiFi network.

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

```
root@rk3576-buildroot:/# ping -I wlan0 www.armdesigner.com
PING www.armdesigner.com (67.222.54.196) from 192.168.0.217 wlan0: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=48 time=193 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=48 time=196 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=48 time=195 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=48 time=194 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=48 time=251 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=48 time=200 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=7 ttl=48 time=195 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=8 ttl=48 time=201 ms
^C
--- www.armdesigner.com ping statistics ---
9 packets transmitted, 8 received, 11.1111% packet loss, time 8011ms
rtt min/avg/max/mdev = 193.266/203.254/250.975/18.241 ms
```

7.9.2 Bluetooth

Step 1: View the Bluetooth device status.

```
# hciconfig -a
```

```
 root@rk3576-buildroot:/# hciconfig -a
hci0:   Type: Primary  Bus: UART
        BD Address: 38:7A:CC:2A:11:88  ACL MTU: 1021:5  SCO MTU: 255:11
        UP RUNNING
        RX bytes:2127 acl:0 sco:0 events:60 errors:0
        TX bytes:4418 acl:0 sco:0 commands:77 errors:0
        Features: 0xff 0xff 0xff 0xfa 0xdb 0xbf 0x7b 0x87
        Packet type: DM1 DM3 DM5 DH1 DH3 DH5 HV1 HV2 HV3
        Link policy: RSWITCH HOLD SNIFF PARK
        Link mode: PERIPHERAL ACCEPT
        Name: 'BlueZ 5.77'
        Class: 0x6c0414
        Service Classes: Rendering, Capturing, Audio, Telephony
        Device Class: Audio/Video, Loudspeaker
[  185.882030] rtk_btcoex: BTCOEX hci_rev 0x05a8
[  185.882081] rtk_btcoex: BTCOEX lmp_subver 0xcbcd
        HCI Version: 5.1 (0xa)  Revision: 0x5a8
        LMP Version: 5.1 (0xa)  Subversion: 0xcbcd
        Manufacturer: Realtek Semiconductor Corporation (93)
```

Step 2: Set the Bluetooth adapter to be discoverable.

```
# hciconfig hci0 piscan
```

Step 3: Control and configure the Bluetooth device.

```
# bluetoothctl
```

```
root@rk3576-buildroot:/# hciconfig hci0 piscan
root@rk3576-buildroot:/#
root@rk3576-buildroot:/# bluetoothctl
hci0 new_settings: powered connectable discoverable bondable ssp br/edr le secure-conn
Agent registered
[CHG] Controller 38:7A:CC:2A:11:88 Pairable: yes
[bluetooth]#
```

Step 4: Scanning for nearby Bluetooth devices.

• Run *scan on* to start searching for devices.

• After scanning, run *scan off* to stop the search and prevent continuous refreshing.

• Run *devices* to view the list of detected devices.

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

```
[bluetooth]# scan on
SetDiscoveryFilter success
hci0 type 7 discovering on
Discovery started
[CHG] Controller 38:7A:CC:2A:11:88 Discovering: yes
[NEW] Device 88:68:4B:74:39:44 OPPO K10 5G
[NEW] Device 4B:73:65:34:5F:5D 4B-73-65-34-5F-5D
[NEW] Device D4:6C:27:DF:40:46 D4-6C-27-DF-40-46
[NEW] Device 10:0E:A1:1C:13:A8 10-0E-A1-1C-13-A8
[CHG] Device A8:35:12:9A:EB:4D RSSI: 0xffffffe1 (-31)
[NEW] Device 7D:B8:B6:62:89:47 7D-B8-B6-62-89-47
[NEW] Device 2C:A0:42:D1:14:D5 Kang
 [NEW] Device 5D:9A:E9:D5:D8:9B 5D-9A-E9-D5-D8-9B
[NEW] Device 14:DE:39:72:B3:C3 Mate 40 Pro
[NEW] Device 43:C7:3D:C0:16:E4 43-C7-3D-C0-16-E4
[CHG] Device 14:DE:39:72:B3:C3 RSSI: 0xffffffb3 (-77)
[NEW] Device 7B:7E:22:4C:1B:08 7B-7E-22-4C-1B-08
[bluetooth]# scan off
hci0 type 7 discovering off
Discovery stopped
[CHG] Device 7B:7E:22:4C:1B:08 TxPower is nil
[CHG] Device 7B:7E:22:4C:1B:08 RSSI is nil
[CHG] Device 43:C7:3D:C0:16:E4 RSSI is nil
[CHG] Device 14:DE:39:72:B3:C3 RSSI is nil
[CHG] Device 5D:9A:E9:D5:D8:9B TxPower is nil
[CHG] Device 5D:9A:E9:D5:D8:9B RSSI is nil
[CHG] Device 2C:A0:42:D1:14:D5 RSSI is nil
[CHG] Device 7D:B8:B6:62:89:47 TxPower is nil
[CHG] Device 7D:B8:B6:62:89:47 RSSI is nil
[CHG] Device A8:35:12:9A:EB:4D RSSI is nil
[CHG] Device 10:0E:A1:1C:13:A8 RSSI is nil
[CHG] Device D4:6C:27:DF:40:46 RSSI is nil
[CHG] Device 4B:73:65:34:5F:5D TxPower is nil
[CHG] Device 4B:73:65:34:5F:5D RSSI is nil
[CHG] Device 88:68:4B:74:39:44 RSSI is nil
[CHG] Controller 38:7A:CC:2A:11:88 Discovering: no
[bluetooth]# devices
Device A8:35:12:9A:EB:4D liuy
Device 88:68:4B:74:39:44 OPPO K10 5G
Device 4B:73:65:34:5F:5D 4B-73-65-34-5F-5D
Device D4:6C:27:DF:40:46 D4-6C-27-DF-40-46
Device 10:0E:A1:1C:13:A8 10-0E-A1-1C-13-A8
Device 7D:B8:B6:62:89:47 7D-B8-B6-62-89-47
Device 2C:A0:42:D1:14:D5 Kang
Device 5D:9A:E9:D5:D8:9B 5D-9A-E9-D5-D8-9B
Device 14:DE:39:72:B3:C3 Mate 40 Pro
Device 43:C7:3D:C0:16:E4 43-C7-3D-C0-16-E4
Device 7B:7E:22:4C:1B:08 7B-7E-22-4C-1B-08
[bluetooth]#
```

Step 5: Pair the 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]# [  173.017134] rtk_btcoex: hci create connection, start paging
[  174.380179] rtk_btcoex: connected, handle 0001, status 0x00
[  174.380268] rtk_btcoex: Page success
hci0 A8:35:12:9A:EB:4D type BR/EDR connected eir_len 11
[CHG] Device A8:35:12:9A:EB:4D Connected: yes
[liuy]# [  174.460956] rtk_btcoex: io capability request
Request confirmation
[agent] Confirm passkey 622774 (yes/no): yes
[liuy]# [  178.036444] rtk_btcoex: link key notify
hci0 new_link_key A8:35:12:9A:EB:4D type 0x05 pin_len 0 store_hint 1
[CHG] Device A8:35:12:9A:EB:4D Bonded: yes
[liuy]# [  178.187364] rtk_btcoex: l2cap op 2, len 16, out 0
[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
[DEL] Device 4C:3E:56:53:EC:2D 4C-3E-56-53-EC-2D
[liuy]# [  181.164278] rtk_btcoex: l2cap op 6, len 16, out 1
[  181.164408] rtk_btcoex: TX l2cap disconn req, hndl 0x0001, dcid 0x0059, scid 0x0040
[DEL] Device 2C:A0:42:D1:14:D5 Kang
[  181.164442] rtk_btcoex: handle_l2cap_discon_req: handle 0x0001, dcid 0x0059, scid 0x0040, dir 1
[DEL] Device 78:AE:22:6E:47:2C 78-AE-22-6E-47-2C
[DEL] Device CC:64:1A:B6:C3:AE ubuntu
[liuy]# connect [  185.247311] rtk_btcoex: disconn cmpl evt: status 00, handle 0001, reason 13
hci0 A8:35:12:9A:EB:4D type BR/EDR disconnected with reason 3
[  185.247391] rtk_btcoex: process disconn complete event.
[CHG] Device A8:35:12:9A:EB:4D ServicesResolved: no
[CHG] Device A8:35:12:9A:EB:4D Connected: no
```

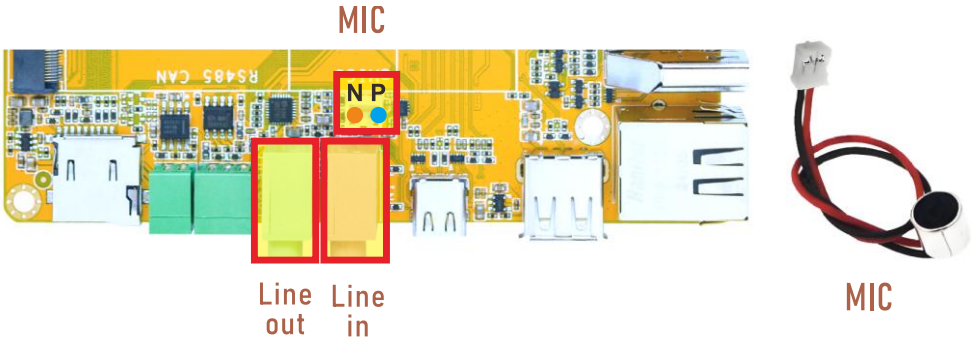
Step 6: Connect the device.

```
[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]# [  189.910955] rtk_btcoex: hci create connection, start paging
[  190.709669] rtk_btcoex: connected, handle 0002, status 0x00
[  190.709733] rtk_btcoex: Page success
hci0 A8:35:12:9A:EB:4D type BR/EDR connected eir_len 11
[CHG] Device A8:35:12:9A:EB:4D Connected: yes
[liuy]# [  190.914878] rtk_btcoex: l2cap op 2, len 16, out 1
```

7.10 Audio

The audio input supports two channels: microphone (mic) and Line in, with the microphone (mic) channel as the default.



7.10.1 Audio input

• Execute the following command to switch to the **Line in** channel.

```
# amixer -c0 cset name='Right PGA Mux' 1
# amixer -c0 cset name='Left PGA Mux' 1
```

```
root@rk3576-buildroot:/# amixer -c0 cset name='Right PGA Mux' 1
numid=69,iface=MIXER,name='Right PGA Mux'
  ; type=ENUMERATED,access=rw------,values=1,items=3
  ; Item #0 'Line 1R'
  ; Item #1 'Line 2R'
  ; Item #2 'DifferentialR'
  : values=1
root@rk3576-buildroot:/# amixer -c0 cset name='Left PGA Mux' 1
numid=68,iface=MIXER,name='Left PGA Mux'
  ; type=ENUMERATED,access=rw------,values=1,items=3
  ; Item #0 'Line 1L'
  ; Item #1 'Line 2L'
  ; Item #2 'DifferentialL'
  : values=1
```

• Execute the following command to switch to the microphone (**mic**) channel.

```
# amixer -c0 cset name='Right PGA Mux' 2
# amixer -c0 cset name='Left PGA Mux' 2
```

```
root@rk3576-buildroot:/# amixer -c0 cset name='Right PGA Mux' 2
numid=69,iface=MIXER,name='Right PGA Mux'
  ; type=ENUMERATED,access=rw------,values=1,items=3
  ; Item #0 'Line 1R'
  ; Item #1 'Line 2R'
  ; Item #2 'DifferentialR'
  : values=2
root@rk3576-buildroot:/# amixer -c0 cset name='Left PGA Mux' 2
numid=68,iface=MIXER,name='Left PGA Mux'
  ; type=ENUMERATED,access=rw------,values=1,items=3
  ; Item #0 'Line 1L'
  ; Item #1 'Line 2L'
  ; Item #2 'DifferentialL'
  : values=2
```

• Execute the following command to start recording.

```
# arecord -D hw:0,0 -f cd -r 44100 -c 2 -t wav test.wav
```

```
root@rk3576-buildroot:/# arecord -D hw:0,0 -f cd -r 44100 -c 2 -t wav test.wav
Recording WAVE 'test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

7.10.2 Audio output

Step 1: View sound card.

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

```
root@rk3576-buildroot:/# cat /proc/asound/cards
 0 [rockchipes8388 ]: rockchip-es8388 - rockchip-es8388
                      rockchip-es8388
 1 [rockchipdp0    ]: rockchip-dp0 - rockchip-dp0
                      rockchip-dp0
 2 [rockchiphdmi   ]: rockchip-hdmi - rockchip-hdmi
                      rockchip-hdmi
```

Step 2: Execute the following command to set the **Line out** channel.

```
# amixer -c0 cset name='Speaker Switch' 1
# amixer -c0 cset name='Output 2 Playback Volume' 10  //(0-33)
# amixer -c0 cset name='PCM Volume' 140               //(0-192)
```

```
root@rk3576-buildroot:/# amixer -c0 cset name='Speaker Switch' 1
numid=65,iface=MIXER,name='Speaker Switch'
  ; type=BOOLEAN,access=rw------,values=1
  : values=on
root@rk3576-buildroot:/# amixer -c0 cset name='Output 2 Playback Volume' 10
numid=60,iface=MIXER,name='Output 2 Playback Volume'
  ; type=INTEGER,access=rw---R--,values=2,min=0,max=33,step=0
  : values=10,10
  | dBscale-min=-45.00dB,step=1.50dB,mute=0
root@rk3576-buildroot:/#
root@rk3576-buildroot:/# amixer -c0 cset name='PCM Volume' 140
numid=56,iface=MIXER,name='PCM Volume'
  ; type=INTEGER,access=rw---R--,values=2,min=0,max=192,step=0
  : values=140,140
  | dBscale-min=-96.00dB,step=0.50dB,mute=1
```

Step 3: Execute the following command to play audio and output it through **Line out**.

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

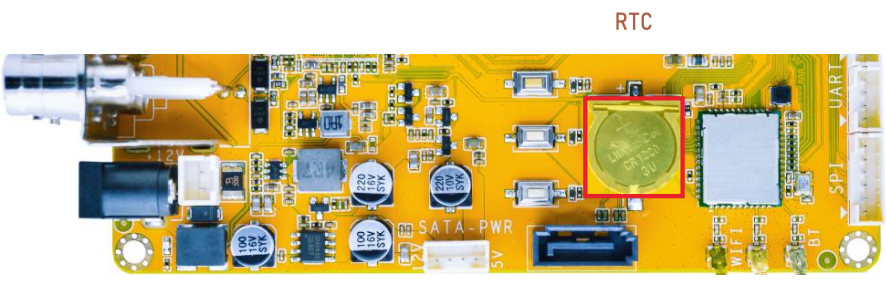
```
root@rk3576-buildroot:/# aplay -Dhw:0,0 test.wav
Playing WAVE 'test.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
```

Supplementary instructions on audio output:

```
# aplay -Dhw:0,0 record.wav   // Line out audio output
# aplay -Dhw:1,0 record.wav   // DP AIT mode audio output
# aplay -Dhw:2,0 record.wav   // HDMI TX audio output
```

7.11 RTC

Step 1: Install the coin cell battery.



Step 2: Set the system time.

```
# date -s "2024-12-20 11:23:00"
```

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

```
# hwclock -w
```

Step 4: Display the current hardware clock time.

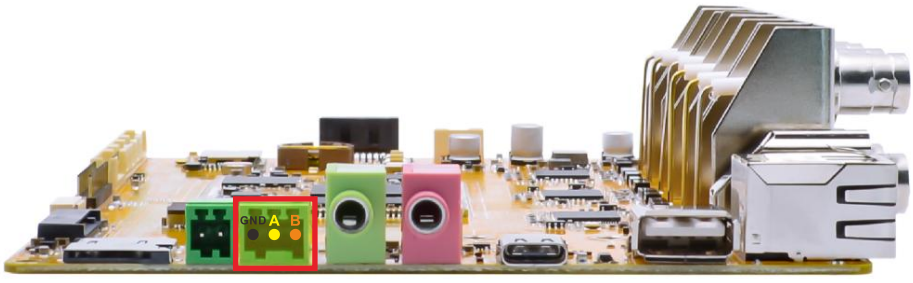
```
# hwclock
```

```
root@rk3576-buildroot:/# date -s "2024-12-20 11:23:00"
Fri Dec 20 11:23:00 UTC 2024
root@rk3576-buildroot:/# hwclock -w
root@rk3576-buildroot:/# hwclock
Fri Dec 20 11:23:06 2024  0.000000 seconds
root@rk3576-buildroot:/# hwclock
Fri Dec 20 11:23:17 2024  0.000000 seconds
root@rk3576-buildroot:/# hwclock
Fri Dec 20 11:23:55 2024  0.000000 seconds
root@rk3576-buildroot:/# hwclock
Fri Dec 20 11:24:01 2024  0.000000 seconds
```

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

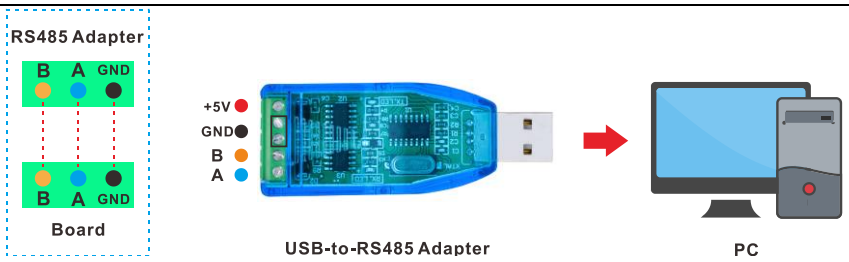
```
root@rk3576-buildroot:/# hwclock
Fri Dec 20 14:09:13 2024  0.000000 seconds
root@rk3576-buildroot:/# hwclock
Fri Dec 20 14:10:32 2024  0.000000 seconds
root@rk3576-buildroot:/# hwclock
Fri Dec 20 14:10:53 2024  0.000000 seconds
root@rk3576-buildroot:/# hwclock
Fri Dec 20 14:11:06 2024  0.000000 seconds
```

7.12 RS485

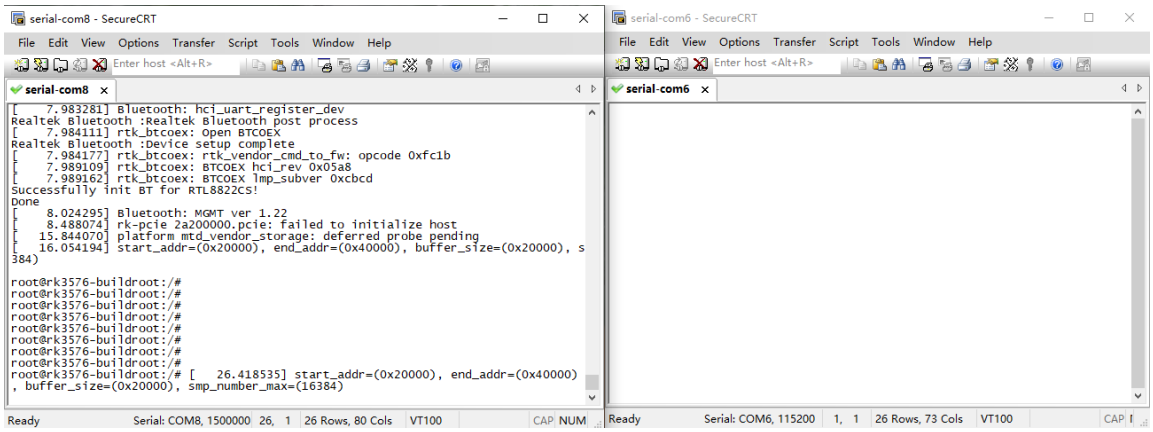


RS485

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

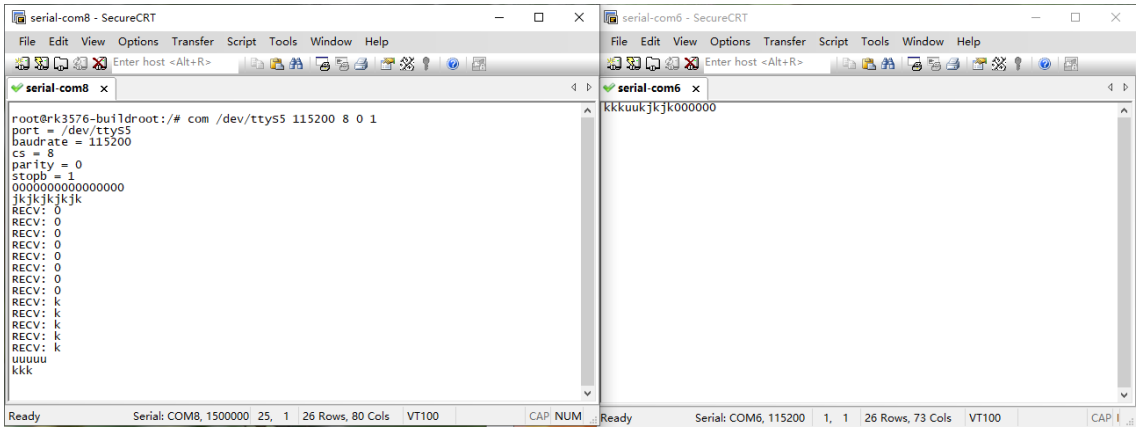


Step 2: Open the corresponding serial terminal, set the baud rate of the board to 1500000, and set the baud rate of the RS485 test tool to 115200.

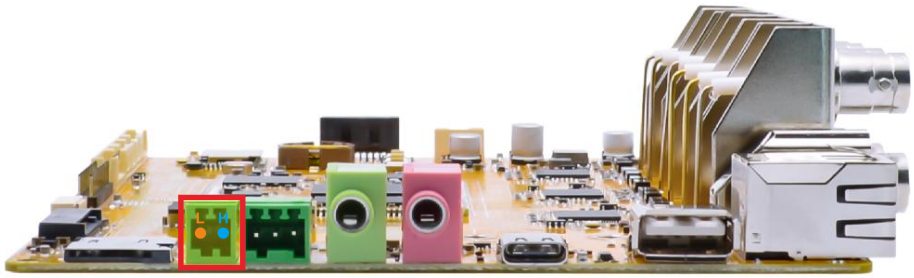


Step 3: Execute the following command on the board to test the RS485 transmission and reception functionality.

```
# com /dev/ttyS5 115200 8 0 1
```

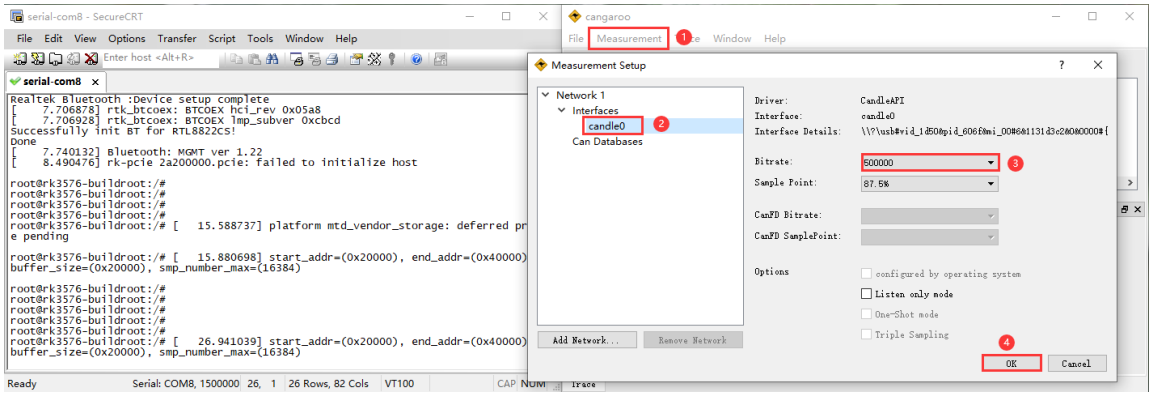


7.13 CAN



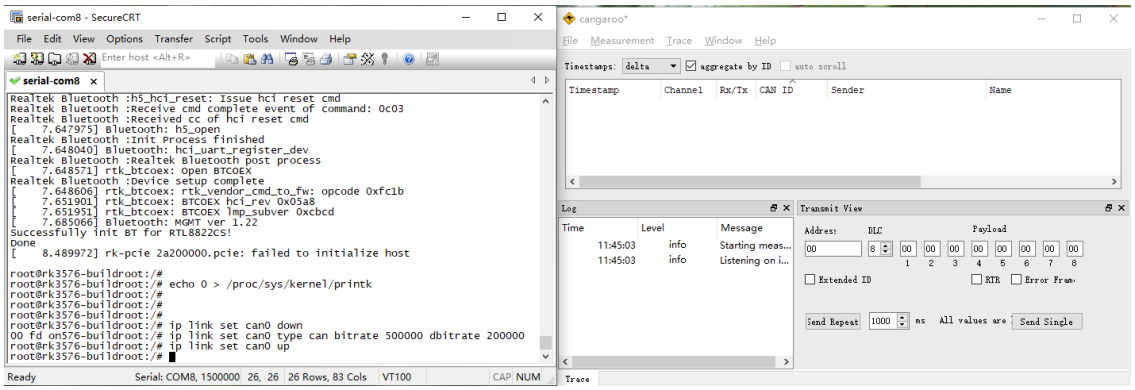
Step 1: Connect the CAN test tool to the board as shown in the diagram below.

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



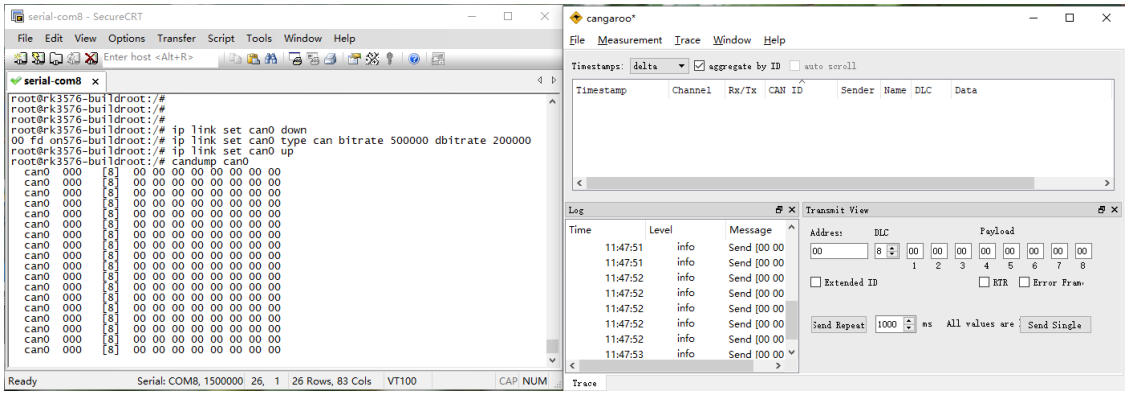
Step 3: Set up and activate the CAN network in CAN FD mode, with a nominal bitrate of 500000 and a data bitrate of 2000000.

```
# ip link set can0 down
# ip link set can0 type can bitrate 500000 dbitrate 2000000 fd on
# ip link set can0 up
```



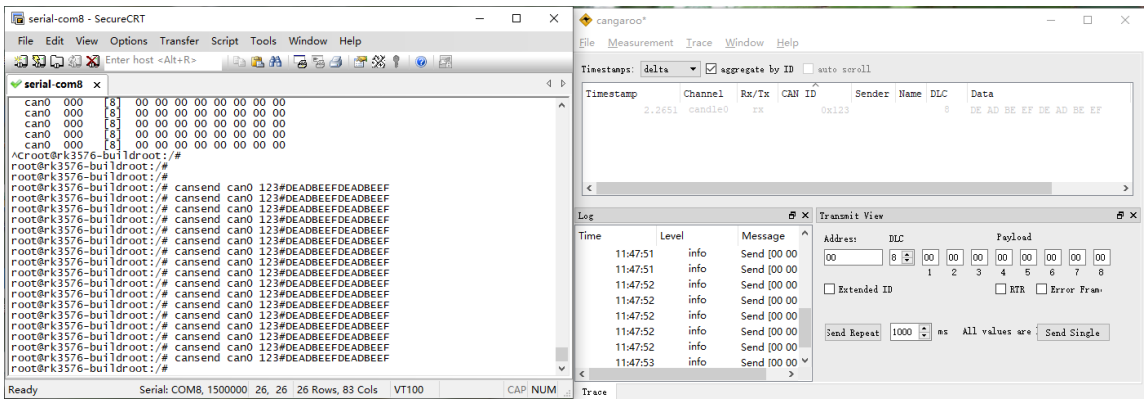
Step 4: Configure CAN as the receiver.

```
# candump can0
```



Step 5: Configure CAN as the sender.

```
# cansend can0 123#DEADBEEFDEADBEEF
```



7.14 UART

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

Step 2: UART10 test.

```
# com /dev/ttyS10 115200 8 0 1
```

```
root@rk3576-buildroot:/# com /dev/ttyS10 115200 8 0 1
port = /dev/ttyS10
baudrate = 115200
cs = 8
parity = 0
stopb = 1
hhhhhh
RECV: hhhhhh
uiuiui12121
RECV: uiuiui12121
uiuiui000
RECV: uiuiui000
k
RECV: k
```

Step 3: UART11 test.

```
# com /dev/ttyS11 115200 8 0 1
```

```
root@rk3576-buildroot:/# com /dev/ttyS11 115200 8 0 1
port = /dev/ttyS11
baudrate = 115200
cs = 8
parity = 0
stopb = 1
lolooooooo
RECV: lolooooooo
8989898989kk
RECV: 8989898989kk
uuuyu
RECV: uuuyu
33
RECV: 33
```

7.15 SPI

Step 1: short circuit SPI3_MISO and SPI3_MOSI pins of SPI.

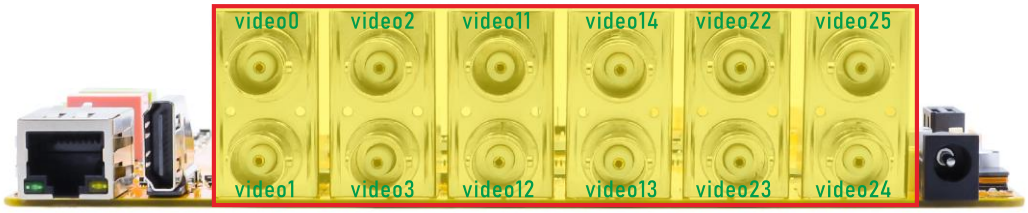
Step 2: Execute the test script: **spidev_test**.

```
# spidev_test
```

```
root@rk3576-buildroot:/# spidev_test
spi mode: 0
bits per word: 8
max speed: 500000 Hz (500 KHz)

FF FF FF FF FF FF
40 00 00 00 00 95
FF FF FF FF FF FF
FF FF FF FF FF FF
FF FF FF FF FF FF
DE AD BE EF BA AD
F0 0D
```

7.16 Camera



12x AHD Camera

• Preview the footage from 12 cameras simultaneously.

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

• 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@rk3576-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
Redistribute latency...
0:00:14.6 / 99:99:99.
```

7.17 Video Playback

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

```
root@rk3576-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@rk3576-buildroot:/# ./rockchip-test/video/test_gst_video.sh
Setting pipeline to PAUSED ...
Pipeline is PREROLLING ...
Redistribute latency...
mpp[1463]: mpp_info: mpp version: unknown mpp version for missing VCS info
mpp[1463]: mpp_info: mpp version: unknown mpp version for missing VCS info
mpp[1463]: mpp_info: mpp version: unknown mpp version for missing VCS info
mpp[1463]: mpp: unable to create enc vp8 for soc rk3576 unsupported
mpp[1463]: mpp_info: mpp version: unknown mpp version for missing VCS info
mpp[1463]: mpp_info: mpp version: unknown mpp version for missing VCS info
Redistribute latency...
mpp[1463]: h264d_api: is_avcC=1
Pipeline is PREROLLED ...
Prerolled, waiting for async message to finish...
Setting pipeline to PLAYING ...
Redistribute latency...
New clock: GstSystemClock
0:00:03.0 / 0:00:29.5 (10.4 %)
```

(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 /mnt/udisk/video/4KP60/4KP60-exist.mp4
```

Command explanation:

• chromium: Launches the Chromium browser.

• /mnt/udisk/video/4KP60/4KP60-exist.mp4: The media file path to be played.

```
 root@rk3576-buildroot:/# chromium /mnt/udisk/video/4KP60/4KP60-exist.mp4
[1625:1643:1220/120107.505014: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")
[1625:1643:1220/120107.505194: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")
[1625:1643:1220/120107.505484: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")
[1625:1643:1220/120107.505563: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")
[1625:1643:1220/120107.556509: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")
[1625:1643:1220/120107.556585: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")
[1625:1644:1220/120107.598805: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")
[1625:1640:1220/120107.598919: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:1625): GLib-GIO-CRITICAL **: 12:01:07.602: g_settings_schema_source_lookup: assertion 'source !=
NULL' failed
[1625:1625:1220/120107.704406:ERROR:object_proxy.cc(576)]       Failed       to       call       method:
org.freedesktop.DBus.NameHasOwner: object_path= /org/freedesktop/DBus: unknown error type:
[1625:1625:1220/120107.704451:ERROR:object_proxy.cc(576)]       Failed       to       call       method:
org.freedesktop.DBus.NameHasOwner: object_path= /org/freedesktop/DBus: unknown error type:
[1625:1641:1220/120107.704673: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")
[1625:1718:1220/120107.726120: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
[1625:1718:1220/120107.726576: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
[1625:1718:1220/120107.727060: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
[1625:1625:1220/120107.731131: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"
/mnt/udisk/video/8KP30/H265_8KP30-2.mp4 --audiosink="alsasink device=hw:0,0"
```

Command explanation:

• /mnt/udisk/video/8KP30/H265_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@rk3576-buildroot:/#
/mnt/udisk/video/8KP30/H265_8KP30-2.mp4 --audiosink="alsasink device=hw:0,0"ue" /
Press 'k' to see a list of keyboard shortcuts.
Now playing /mnt/udisk/video/8KP30/H265_8KP30-2.mp4
Redistribute latency...
Redistribute latency...
Redistribute latency...
Redistribute latency...
Redistribute latency...
0:00:13.2 / 0:13:10.5
```