EM3588 Android14 User Manual

V1.0

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	Android14
MINI3588 V1 EM3588 V1	Y

Revision History

Version	Date	Author	Revision History
V1.0	2025-06-18	Liu Yuan	Initial 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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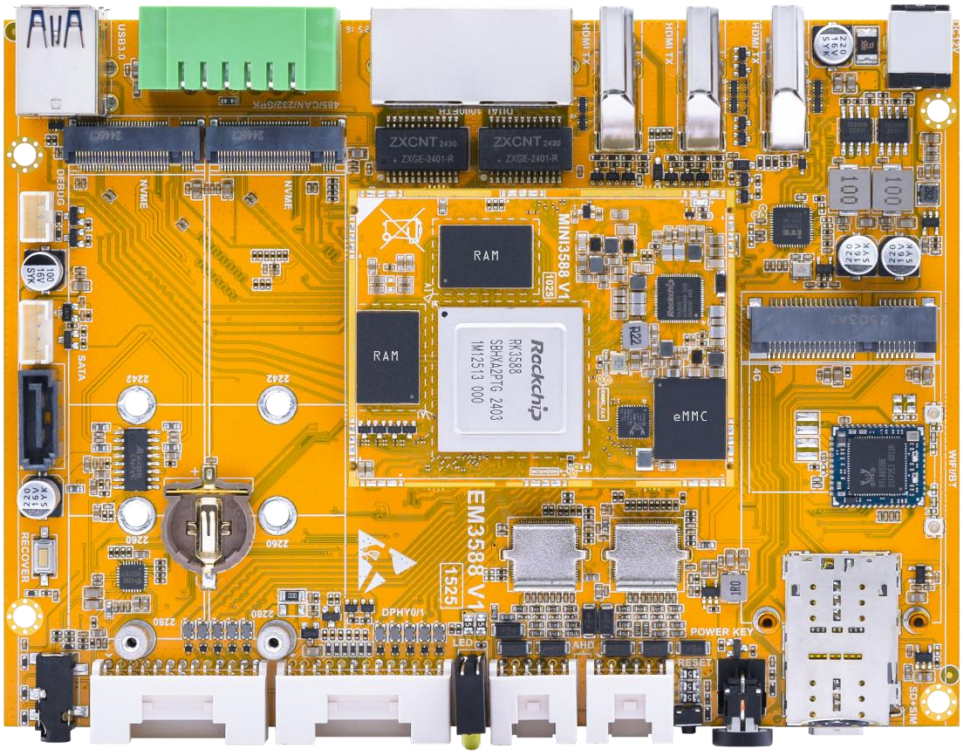
Content

1.Introduction

1.1 Overview

The 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.



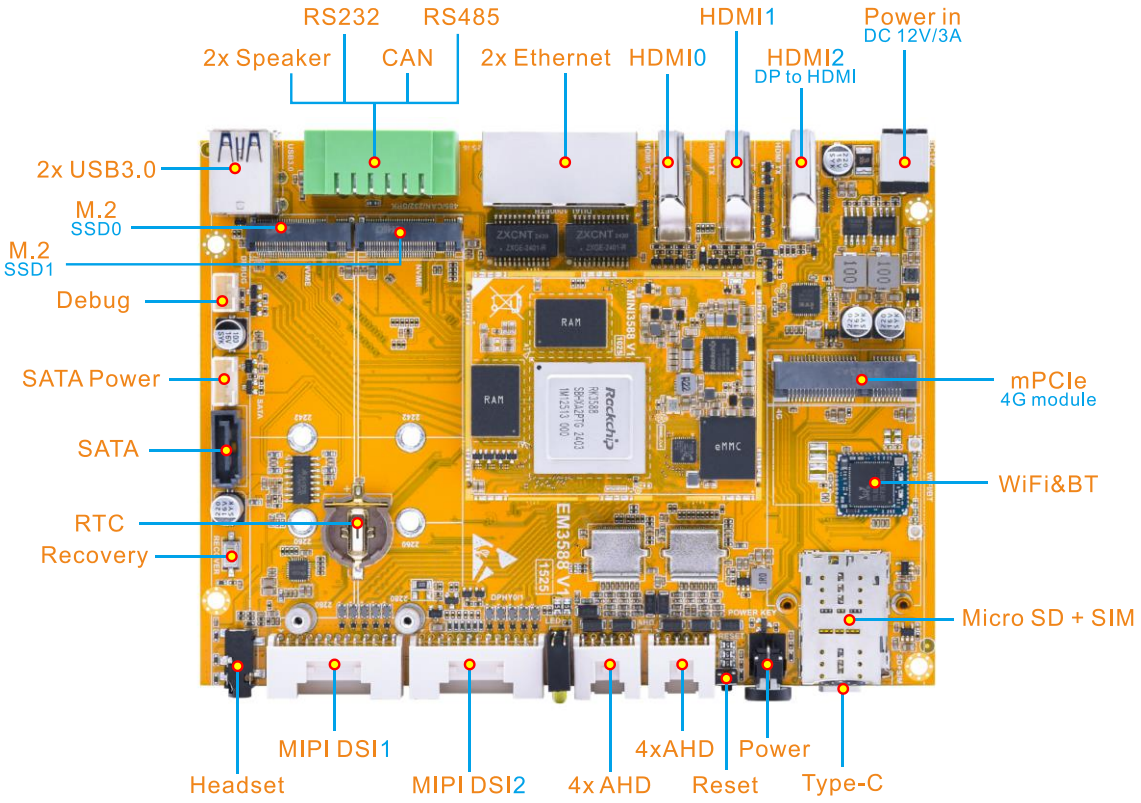
1.2 Product Parameters

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

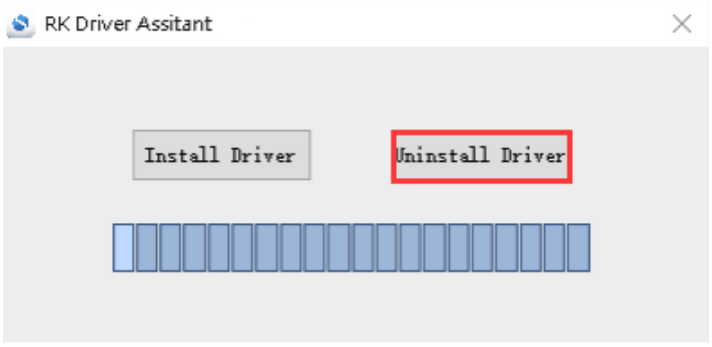
To download firmware and debug in the terminal, the following drivers and software need to be installed (for Windows computers):

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

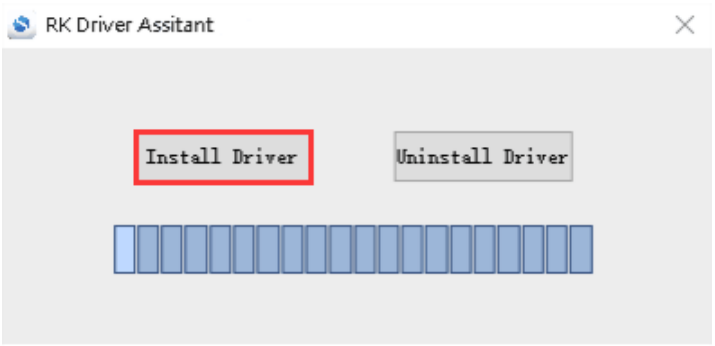
2.1 Install RK Driver Assitant

Step 1: Open *DriverAssitant_v5.1.1/DriverInstall.exe*.

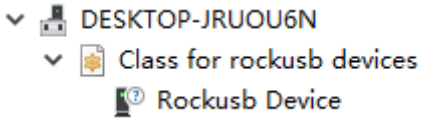
Step 2: To avoid driver conflicts, click **"Uninstall Driver"** to uninstall the driver.



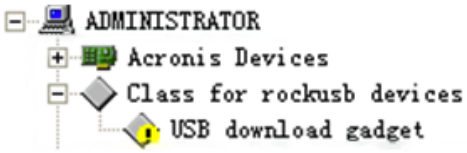
Step 3: Click button **"Install Driver"** to install.



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.

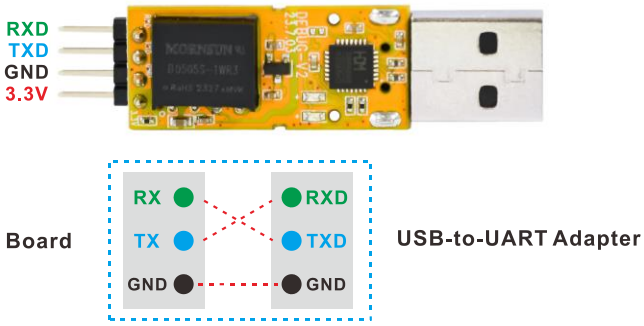


Step 6: The WINDOW will pop up found New Hardware Wizard dialog box, choose to install from the specified location, and then select: *DriverAssitant_v5.1.1/ADBDriver*.

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



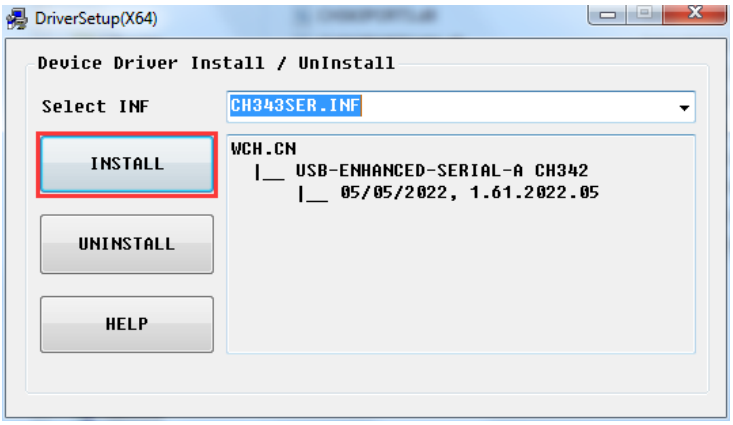
Pin	Connection Description
RXD	Receive, connect to TX pin of the board.
TXD	Transmit, connect to RX pin of the board.
GND	Ground, connect to GND pin of the board.
3V3	No need to connect.

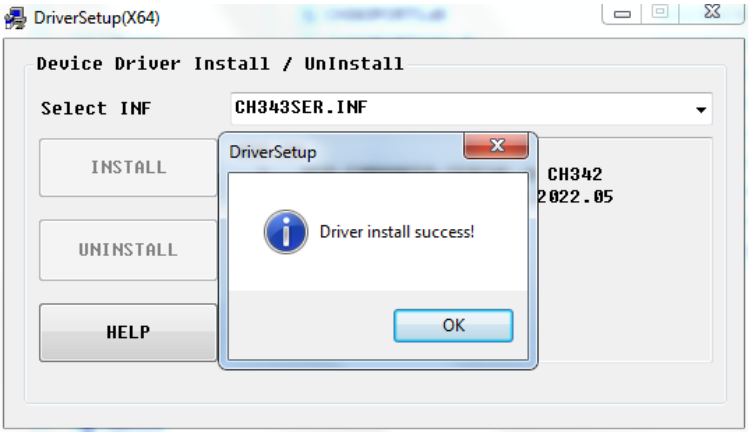
2.2.2 Install Driver

Step 1: Plug the CH9102X Module to the PC

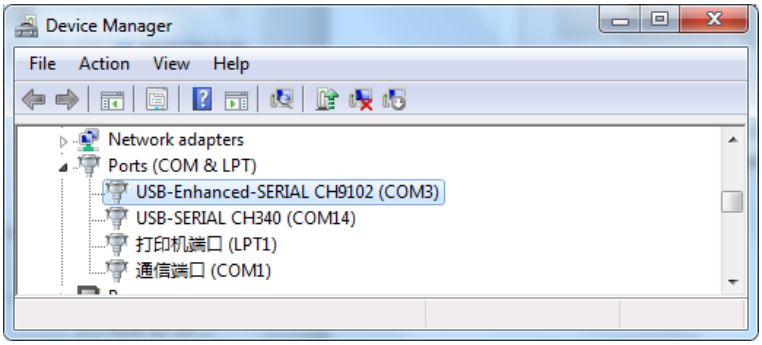
Step 2: Unzip *CH343SER.ZIP* on Windows.

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.

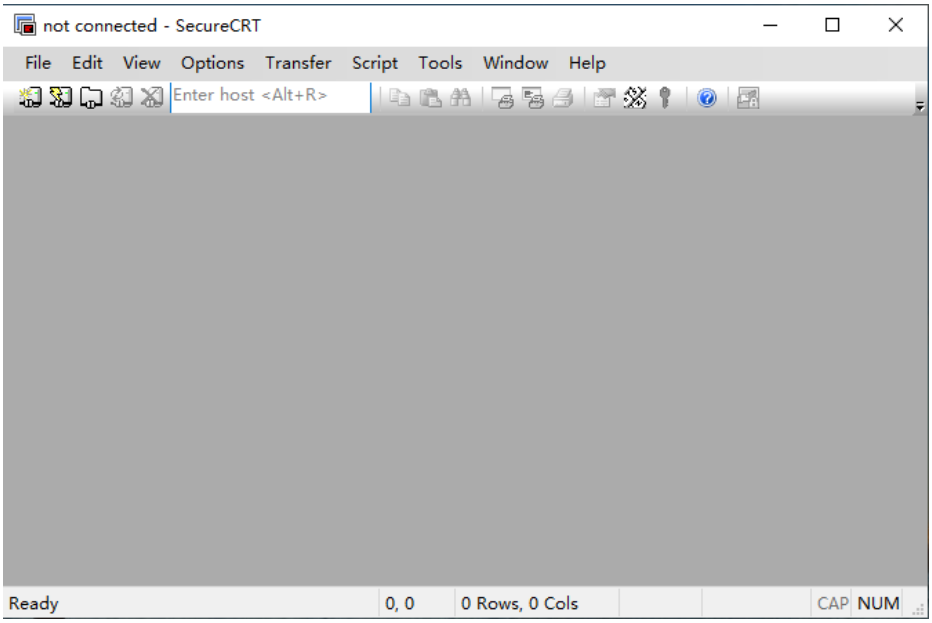


2.3 Install Serial Terminal Tool

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

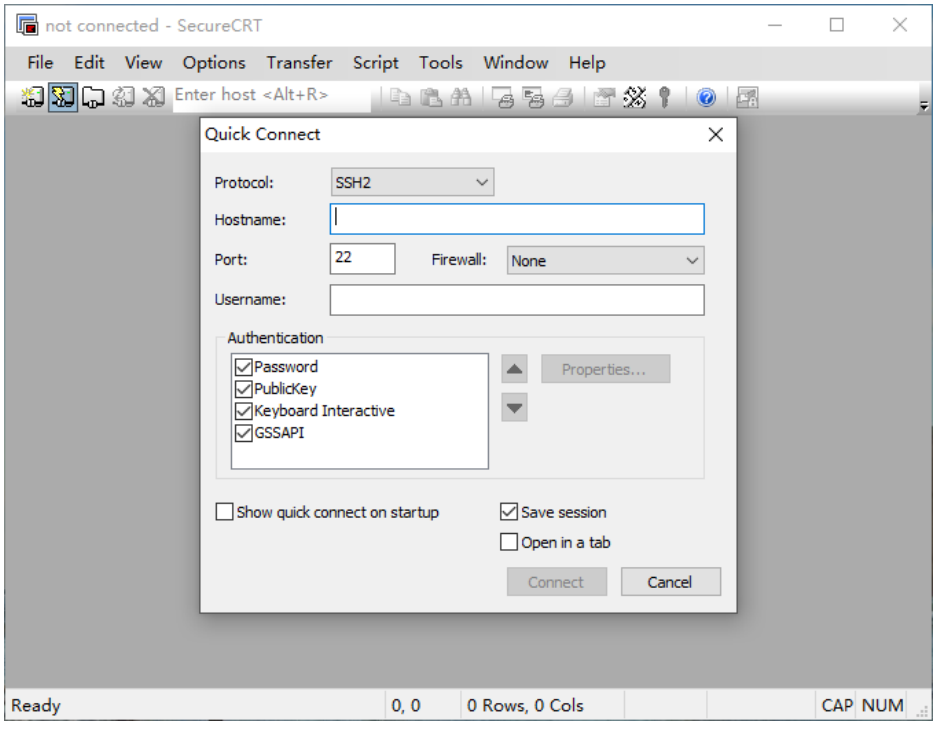
Step 1: Unzip *Platform/SecureCRT.rar* on PC.

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

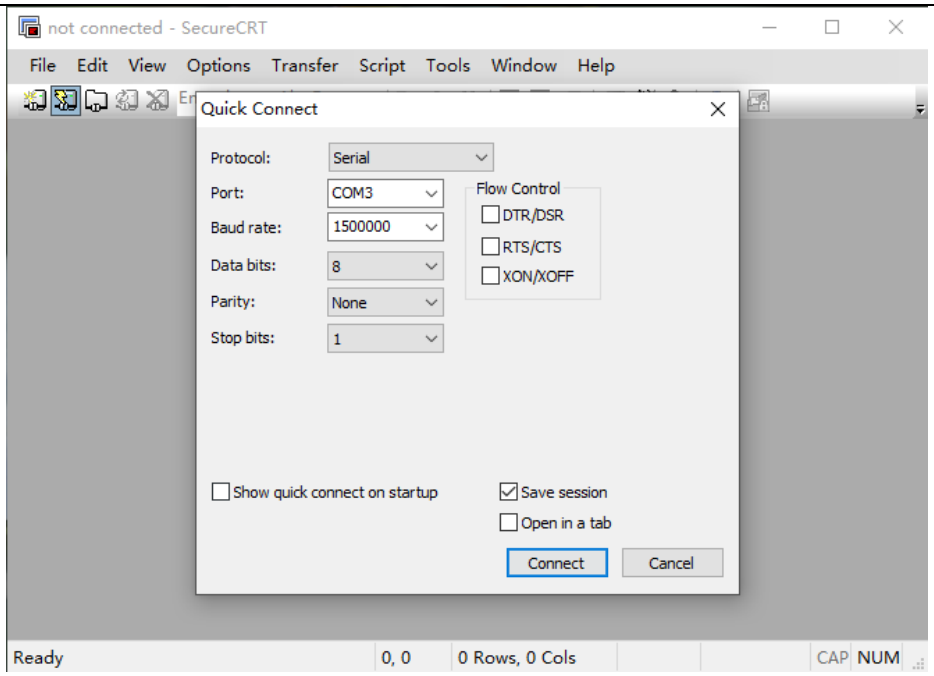


Step 3: Confirm that the CH9102X driver has been installed and the CH9102X module is connecting to the PC.

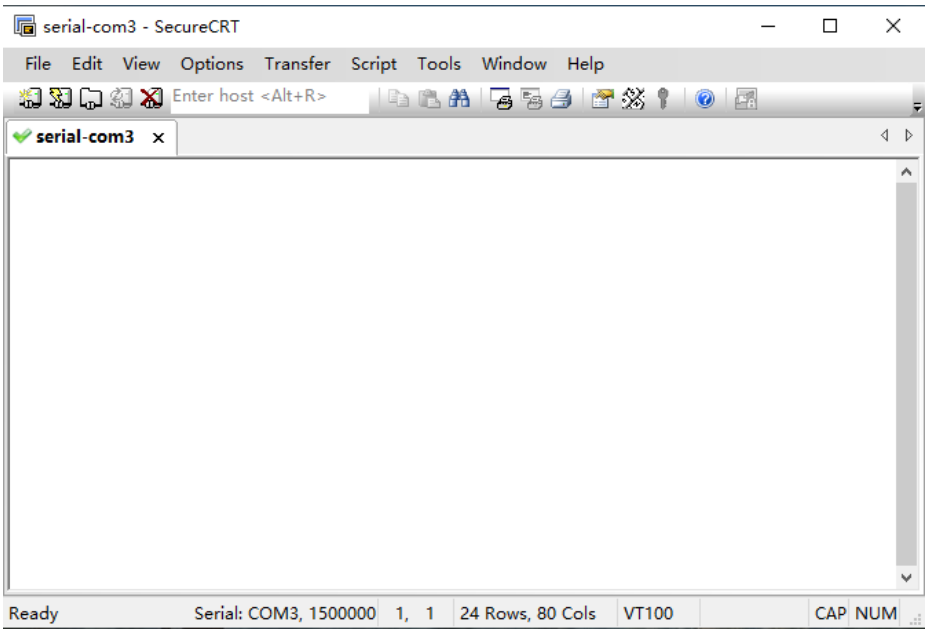
Step 4: Click the **"Quick Connect"** button to go to the Quick Connect configuration screen.



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

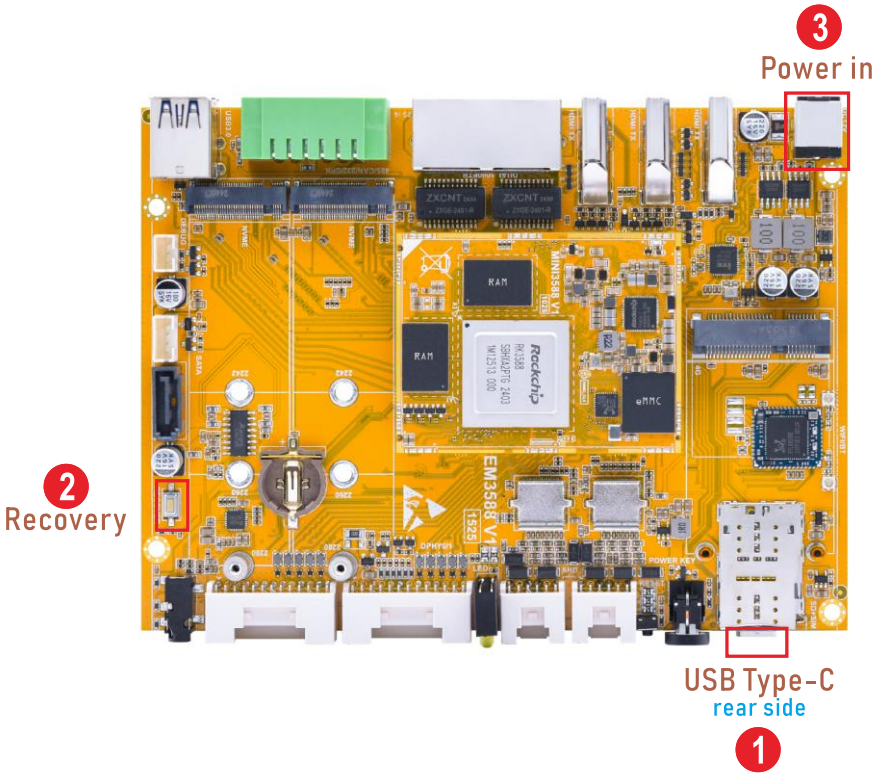
3.1.1.1 Hardware

Step 1: Disconnect the power adapter.

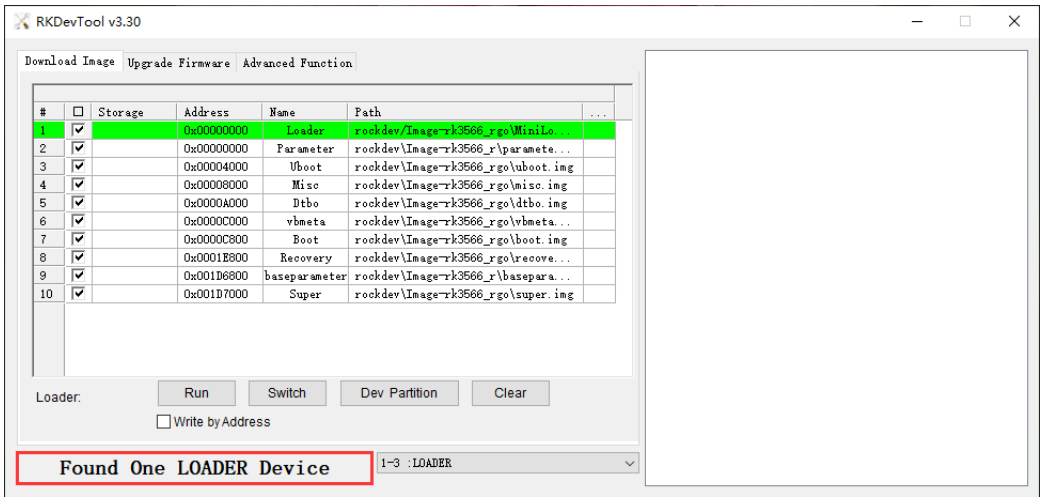
Step 2: Connect one end of the Type_C cable to the host and the other end to the development board.

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 Devic"**.



3.1.1.2 Software

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

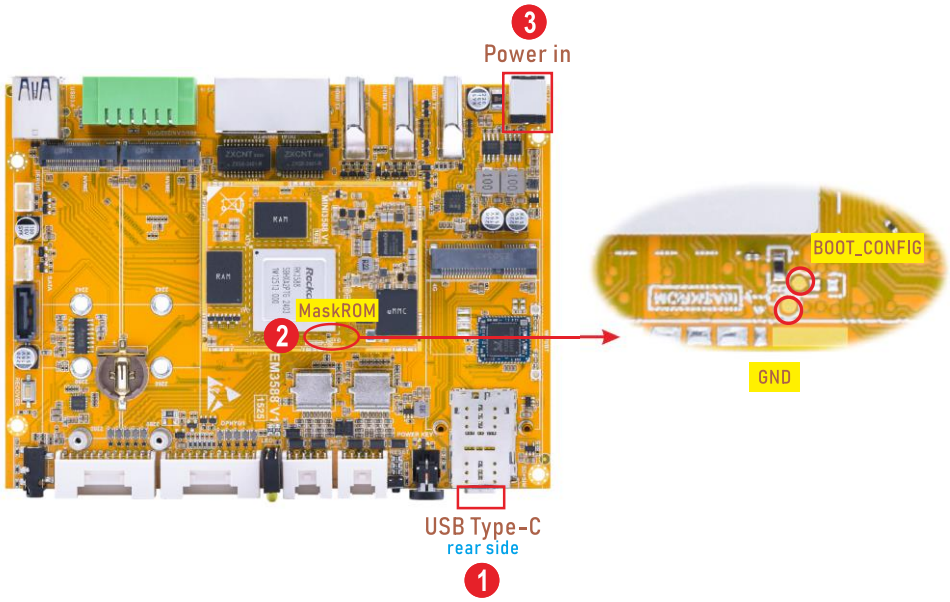
```
# reboot loader
```

3.1.2 How to Enter MaskRom Mode

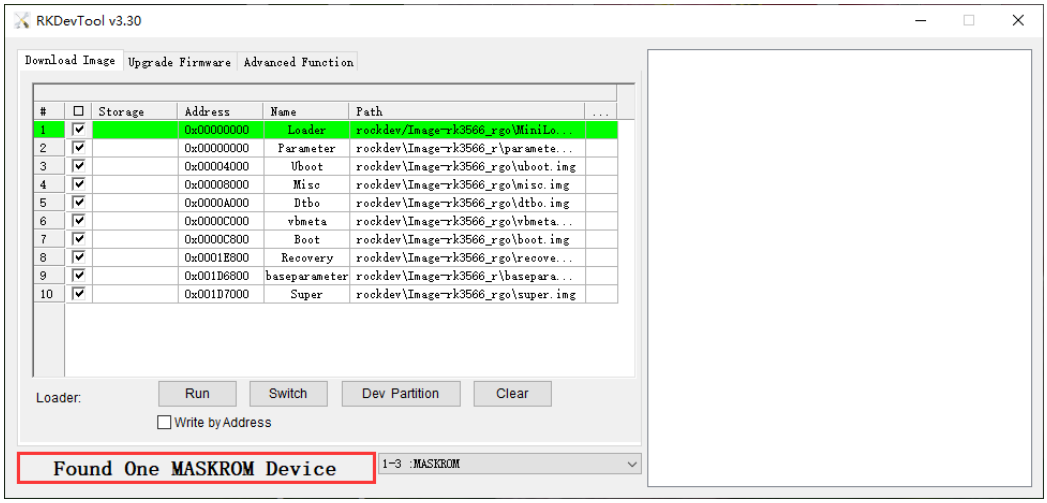
Step 1: Disconnect the power adapter.

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 MINI3588.



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



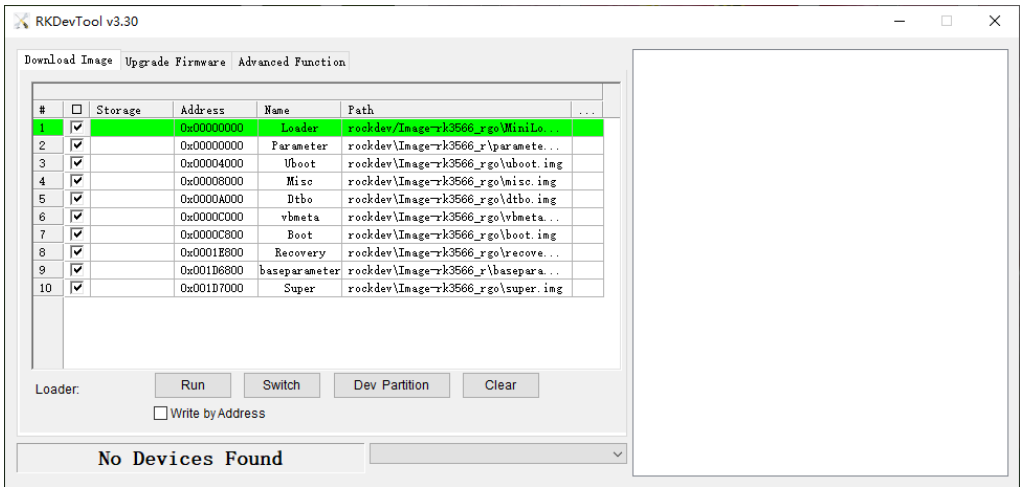
3.2 Burn firmware

Environment: Windows OS (Operating System).

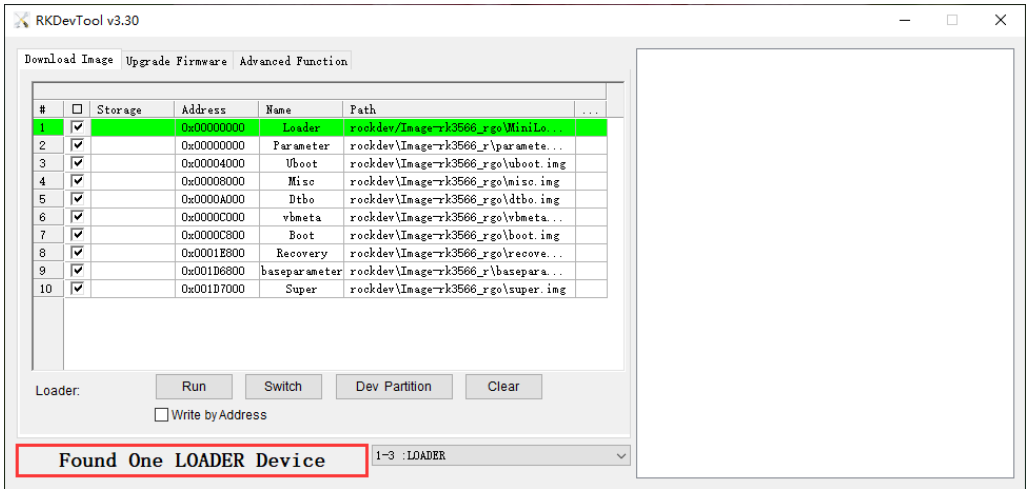
3.2.1 Burn Update.img Firmware

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

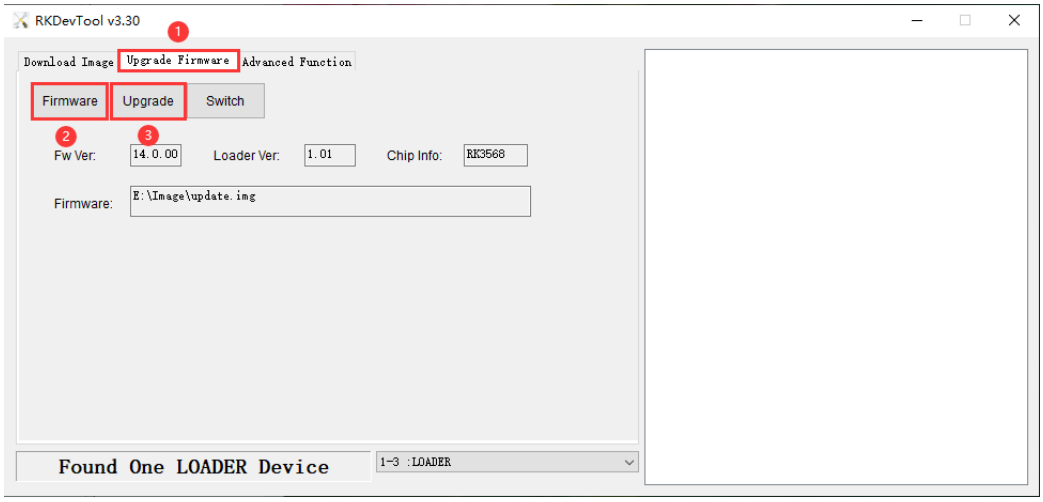
Step 2: Open *RKDevTool\RKDevTool_Release\RKDevTool.exe*.



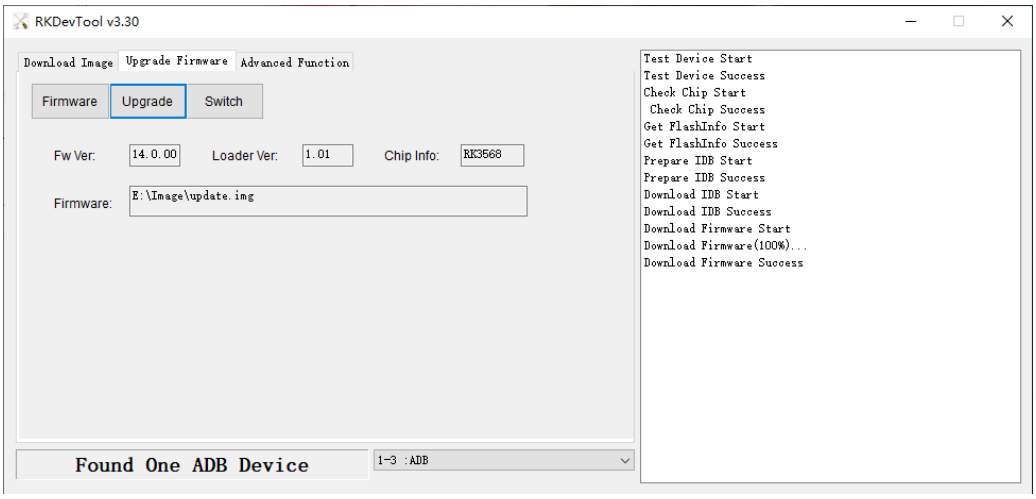
Step 3: Switch to **loader mode**. (*How to Enter Loader Mode*)



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



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



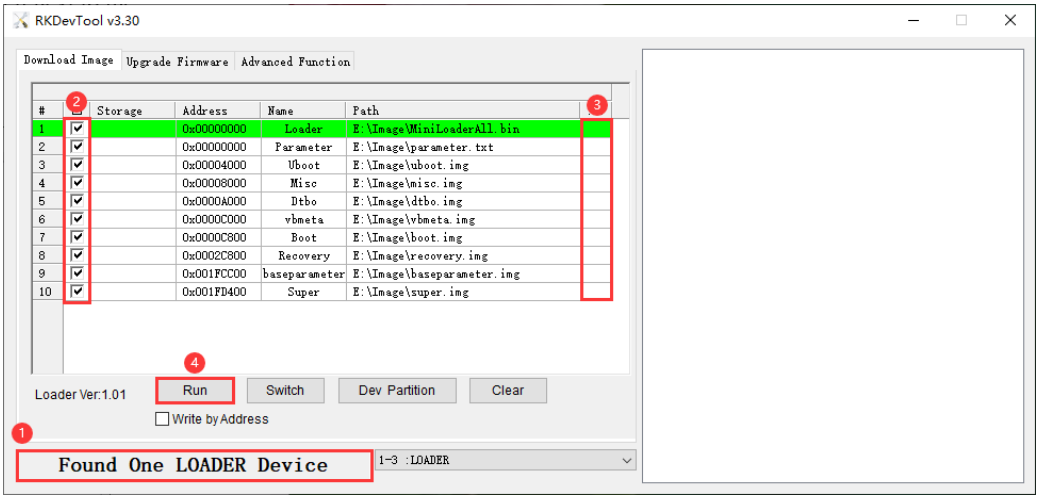
3.2.2 Burn Split Firmware

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

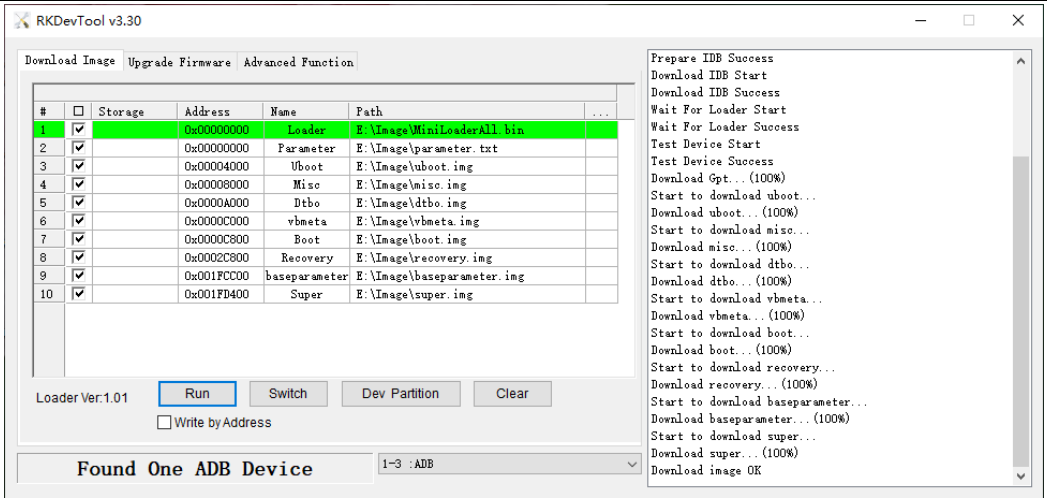
Step 2: Check the partitions to be flashed, multiple partitions can be selected.

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.



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
```

4.3 Installing the JDK

```
$ sudo apt-get update
$ sudo apt-get install openjdk-8-jdk
```

5.Compile Source

Step 1: Unzip the Source

To extract the source files, execute the following commands:

```
$ tar xvf rk3588-android14-rkr*.tar.bz2
$ cd rk3588-android14-rkr6
```

Step 2: Configure the Compiled Platform

To configure the board, execute:

```
$ source build/envsetup.sh
$ lunch em3588_u-userdebug
```

Step 3: One key compiling command

To compile uboot, kernel, and Android, execute the following command:

```
$ ./build.sh -AUCKu
```

```
./build.sh -UKAup
( WHERE: -U = build uboot
     -C = build kernel with Clang
     -K = build kernel
     -A = build android
     -p = will build packaging in IMAGE
     -o = build OTA package
     -u = build update.img
     -v = build android with 'user' or 'userdebug'
     -d = huild kernel dts name
     -V = build version
     -J = build jobs
------------you can use according to the requirement, no need to record
uboot/kernel compiling commands-----------------
)
============================================================
Please remember to set the environment variable before using the one key
compiling command, and select the platform to be compiled, for example:
source build/envsetup.sh
lunch rk3588_t-userdebug
============================================================
```

Images and **update.img** are generated in *rockdev/ Image-em3588_u* directory.

Other compiling instruction:

Android14 cannot directly flash **kernel.img** and **resource.img**. Using ./build.sh -AK will recompile the entire Android system, which is time-consuming. If the user only needs to compile the kernel, it is recommended to use the following command:

Export clang to the environment:

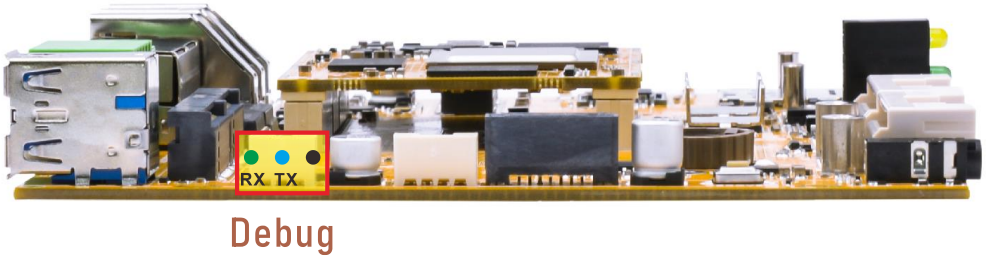
```
$ cd kernel-6.1
$ export PATH=../prebuilts/clang/host/linux-x86/clang-r487747c/bin:$PATH
$ alias msk='make CROSS_COMPILE=aarch64-linux-gnu- LLVM=1 LLVM_IAS=1'
```

```
$ msk ARCH=arm64 rockchip_defconfig android-14.config;
$ msk ARCH=arm64 BOOT_IMG=../rockdev/Image-em3588_u/boot.img boardcon-em3588.img
-j32
```

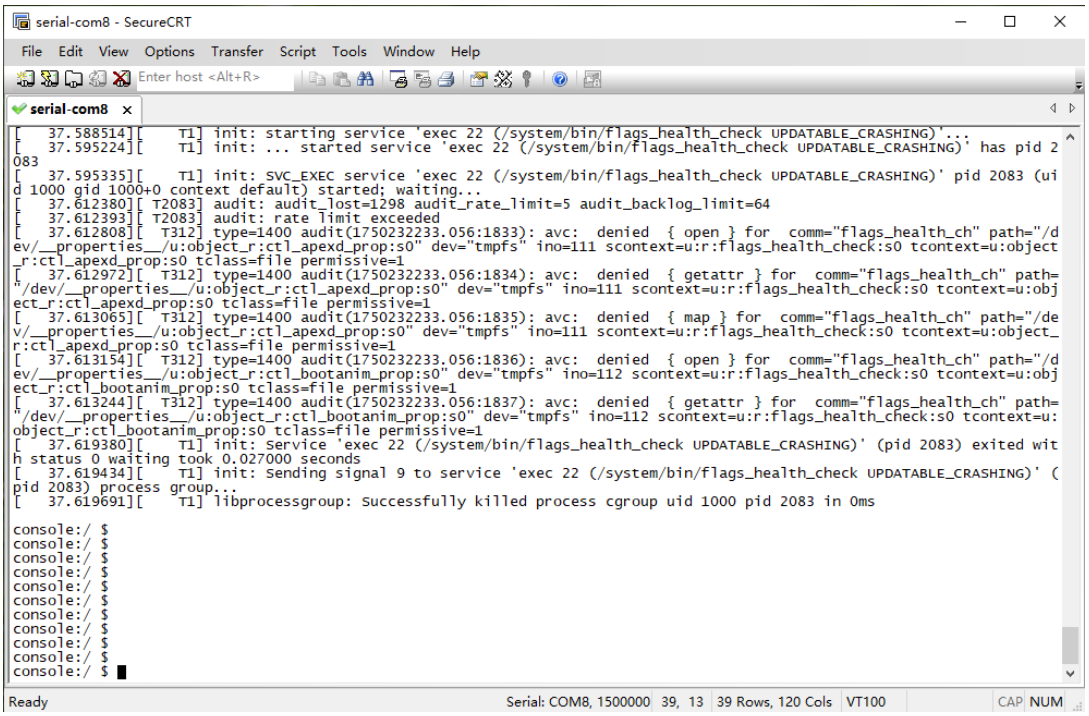
The user can flash **boot.img** under the catalogue of *kernel-6.1/* directly to boot position of machine after compiling, and please load the partition table（**parameter.txt**）when flashing, for fear of flashing to the wrong place.

6. Android14 Test

6.1 Serial Terminal

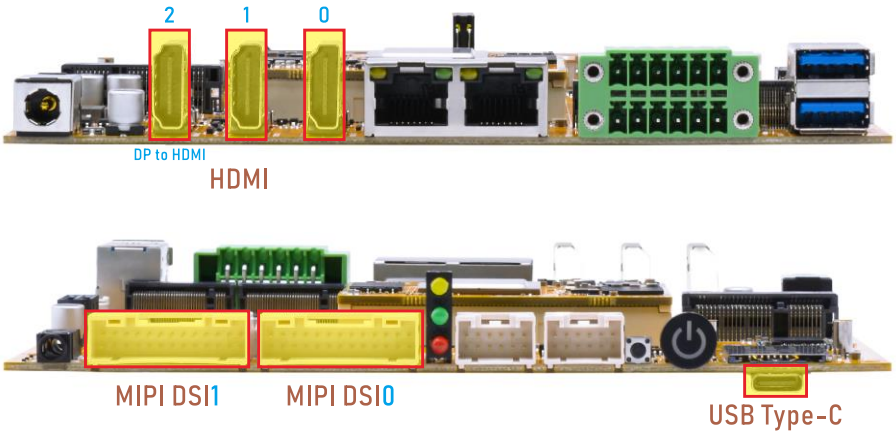


Connect the board and PC with USB Serial cable, then power on, the terminal will output boot information. The default baudrate is 1500000.



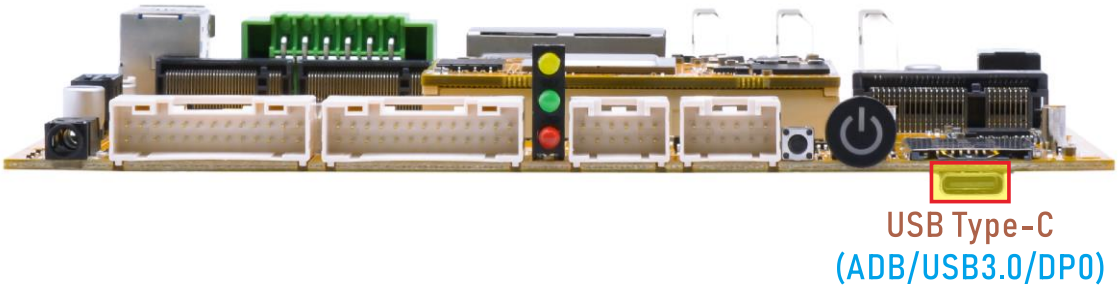
6.2 Display

EM3588 supports up to 6-screen synchronous display by default under Android 14. To achieve synchronized output on similar interfaces (such as HDMI0/HDMI1 or HDMI2/DP Alt Mode), identical display timing must be used. In this case, the maximum supported resolution is 4K@60fps.



The display effect diagram is as follows:

6.3 USB Type-C



Features Supported by the Type-C Interface:

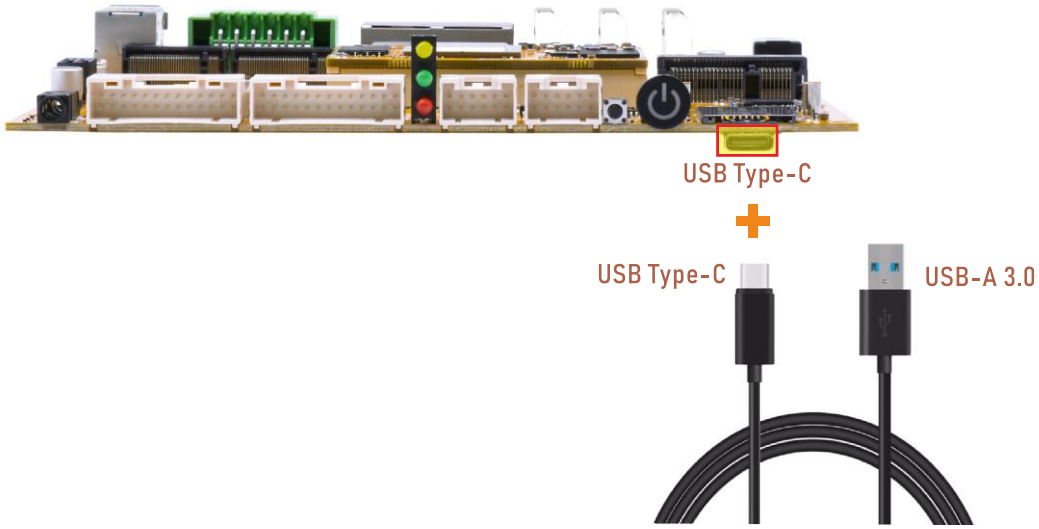
• **Reversible Design:** Allows insertion in either orientation for user convenience.

• **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.

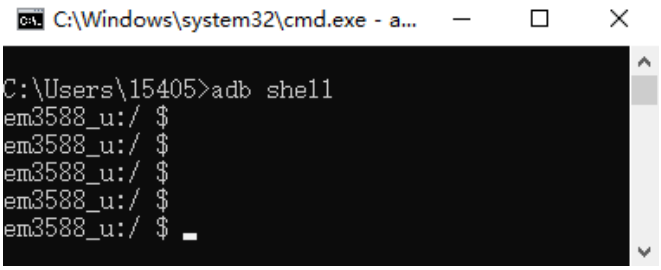


Step 2: Install ADB driver on Windows system.

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

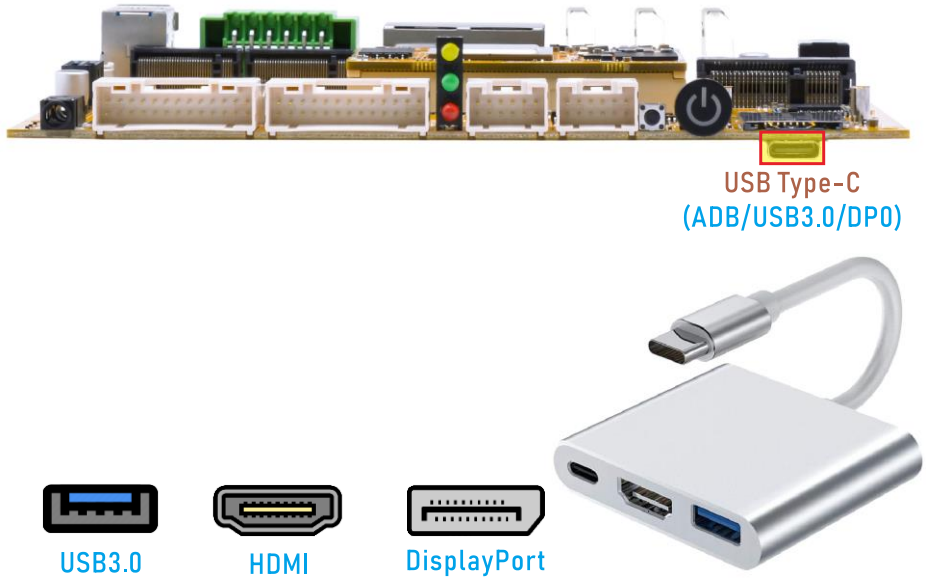
Step 4: Execute the following command to enable ADB.

```
# adb shell
```



6.3.2 Type-C to USB3.0

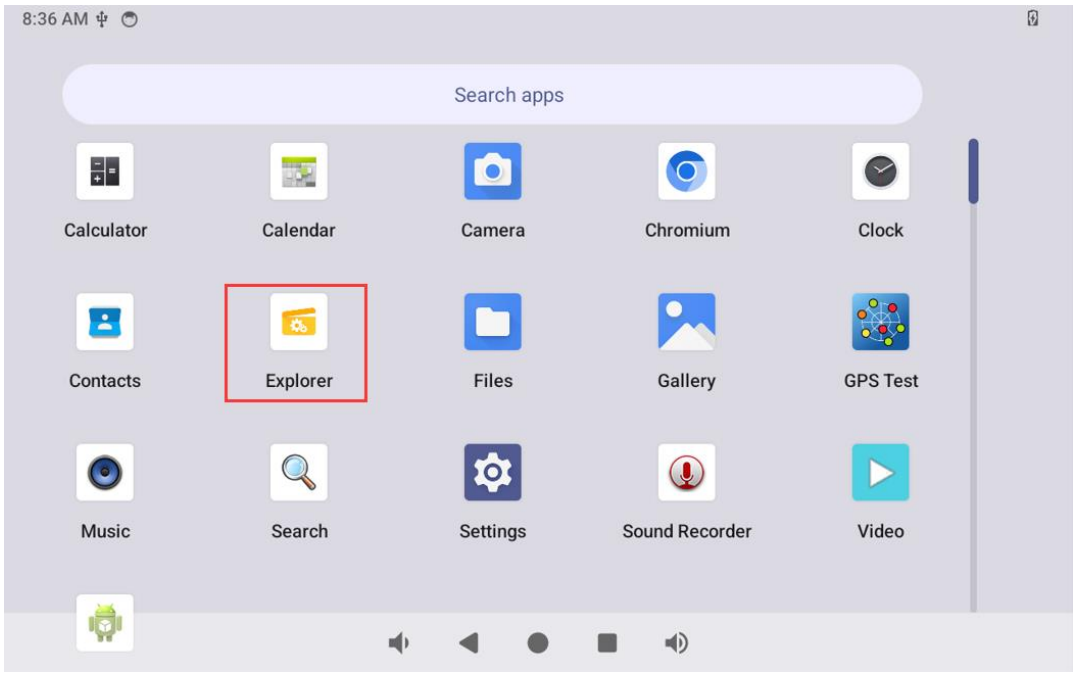
Step 1: Connect the Type-C to USB3.0 converter to the Type-C port of the development board, and then insert the USB3.0 flash drive into the USB3.0 port of the docking station.

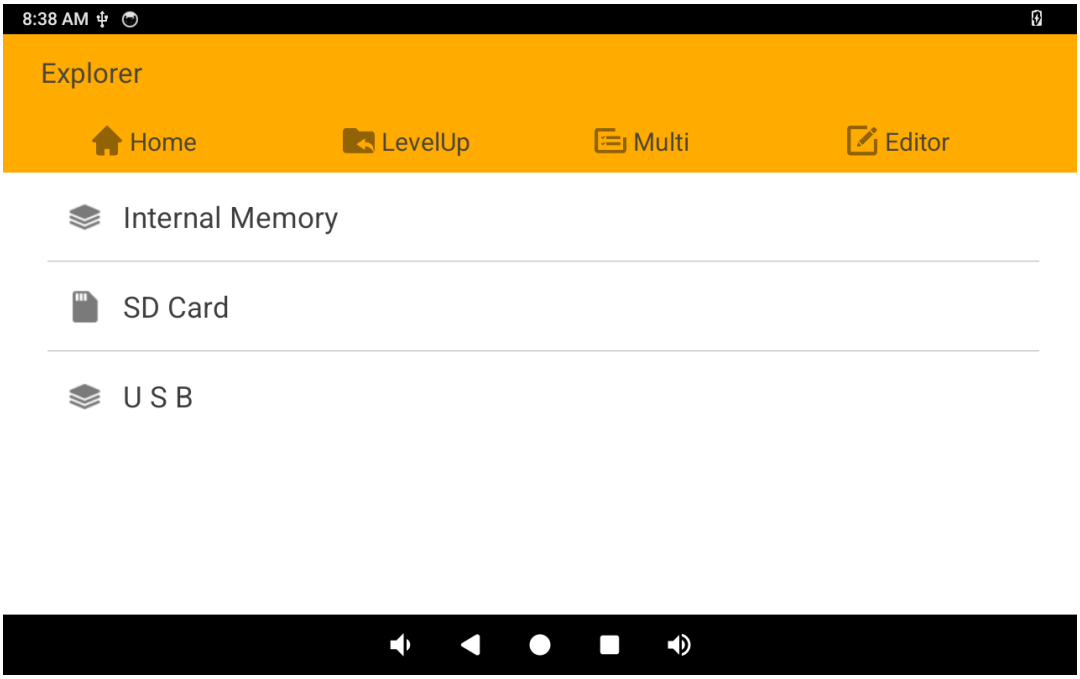


The serial port of the terminal will display the following message, indicating that the USB3.0 device is successfully recognized.

```
console:/ $ [ 1140.220209][ T2671] dwc3 fc000000.usb: request 0000000000000000 was not queued to ep0out
[ 1140.220309][  T129] android_work: did not send uevent (0 0 0000000000000000)
[ 1140.267530][ T2223] read descriptors
[ 1140.267640][ T2223] read strings
[ 1140.330457][ T2671] xhci-hcd xhci-hcd.15.auto: xHCI Host Controller
[ 1140.331340][ T2671] xhci-hcd xhci-hcd.15.auto: new USB bus registered, assigned bus number 9
[ 1140.331495][ T2671] xhci-hcd xhci-hcd.15.auto: hcc params 0x0220fe64 hci version 0x110 quirks
0x0000808002010010
[ 1140.331534][ T2671] xhci-hcd xhci-hcd.15.auto: irq 87, io mem 0xfc000000
[ 1140.331861][ T2671] xhci-hcd xhci-hcd.15.auto: xHCI Host Controller
[ 1140.332298][ T2671] xhci-hcd xhci-hcd.15.auto: new USB bus registered, assigned bus number 10
[ 1140.332317][ T2671] xhci-hcd xhci-hcd.15.auto: Host supports USB 3.0 SuperSpeed
[ 1140.332501][ T2671] usb usb9: New USB device found, idVendor=1d6b, idProduct=0002, bcdDevice= 6.01
[ 1140.332517][ T2671] usb usb9: New USB device strings: Mfr=3, Product=2, SerialNumber=1
[ 1140.332529][ T2671] usb usb9: Product: xHCI Host Controller
[ 1140.332540][ T2671] usb usb9: Manufacturer: Linux 6.1.99 xhci-hcd
[ 1140.332551][ T2671] usb usb9: SerialNumber: xhci-hcd.15.auto
[ 1140.333429][ T2671] hub 9-0:1.0: USB hub found
[ 1140.333543][ T2671] hub 9-0:1.0: 1 port detected
[ 1140.334097][ T2671] usb usb10: We don't know the algorithms for LPM for this host, disabling LPM.
[ 1140.334188][ T2671] usb usb10: New USB device found, idVendor=1d6b, idProduct=0003, bcdDevice= 6.01
[ 1140.334203][ T2671] usb usb10: New USB device strings: Mfr=3, Product=2, SerialNumber=1
[ 1140.334216][ T2671] usb usb10: Product: xHCI Host Controller
[ 1140.334226][ T2671] usb usb10: Manufacturer: Linux 6.1.99 xhci-hcd
[ 1140.334237][ T2671] usb usb10: SerialNumber: xhci-hcd.15.auto
[ 1140.335679][ T2671] hub 10-0:1.0: USB hub found
[ 1140.335728][ T2671] hub 10-0:1.0: 1 port detected
[ 1140.670629][  T129] usb 10-1: new SuperSpeed USB device number 2 using xhci-hcd
[ 1140.703070][  T129] usb 10-1: New USB device found, idVendor=0dd8, idProduct=3b00, bcdDevice= 0.02
[ 1140.703120][  T129] usb 10-1: New USB device strings: Mfr=1, Product=2, SerialNumber=3
[ 1140.703140][  T129] usb 10-1: Product: OnlyDisk
[ 1140.703157][  T129] usb 10-1: Manufacturer: Netac
[ 1140.703172][  T129] usb 10-1: SerialNumber: C0E8BFA3EC38F796
[ 1140.705488][  T129] usb-storage 10-1:1.0: USB Mass Storage device detected
[ 1140.706866][  T129] scsi host1: usb-storage 10-1:1.0
[ 1142.452771][  T148] scsi 1:0:0:0: Direct-Access     Netac    OnlyDisk        8.01 PQ: 0 ANSI: 6
[ 1142.455040][  T148] sd 1:0:0:0: Attached scsi generic sg0 type 0
[ 1142.456350][   T84] sd 1:0:0:0: [sda] 121610240 512-byte logical blocks: (62.3 GB/58.0 GiB)
[ 1142.456545][   T84] sd 1:0:0:0: [sda] Write Protect is off
[ 1142.456749][   T84] sd 1:0:0:0: [sda] Write cache: disabled, read cache: enabled, doesn't support DPO
```

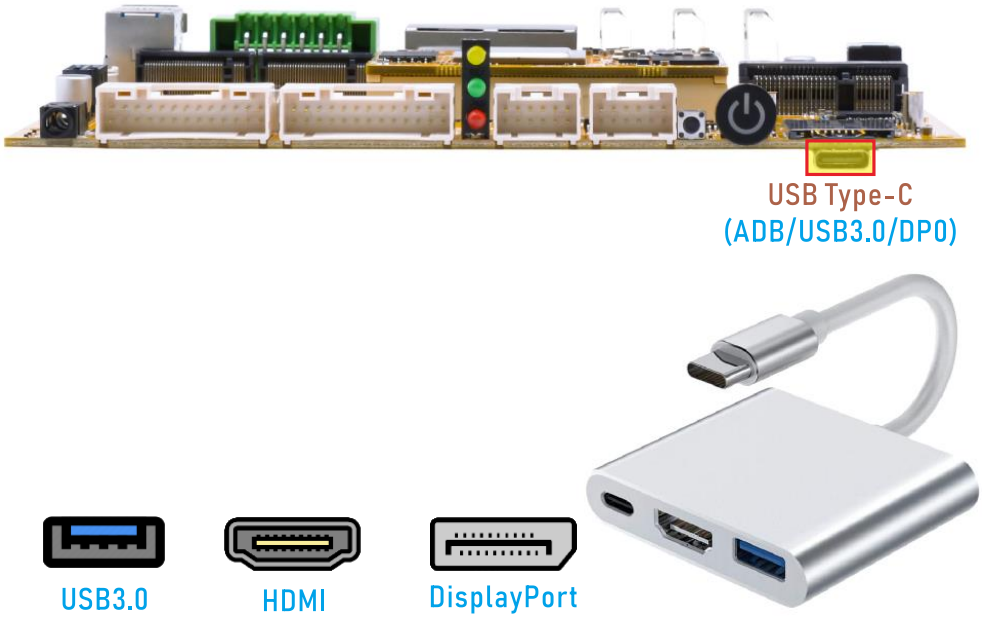
Step 2: After connecting the USB flash drive, the device will automatically mount, and it can be accessed directly through the Explorer app.





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.



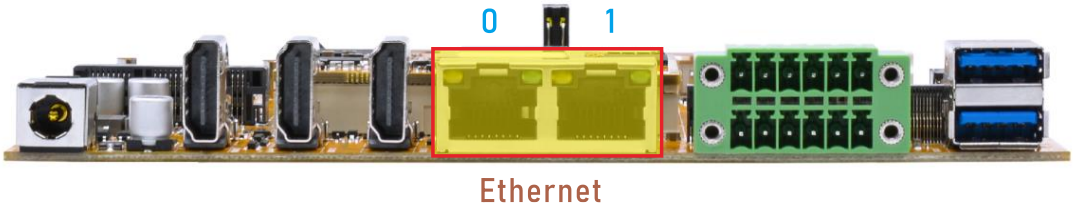
Currently, Boardcon has conducted the following output tests:

• **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.

```
console:/ $ [   26.388734][  T159] rk_gmac-dwmac fe1c0000.ethernet eth0: Link is Up - 1Gbps/Full - flow
control rx/tx
[   26.388912][  T159] IPv6: ADDRCONF(NETDEV_CHANGE): eth0: link becomes ready
[   38.676688][  T185] rk_gmac-dwmac fe1b0000.ethernet eth1: Link is Up - 1Gbps/Full - flow control rx/tx
[   38.676870][  T185] IPv6: ADDRCONF(NETDEV_CHANGE): eth1: link becomes ready
```

Step 2: View network interface information.

```
# ifconfig
```

```
console:/ # ifconfig
eth0      Link encap:Ethernet  HWaddr 5a:0d:96:f9:98:96  Driver rk_gmac-dwmac
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:304 errors:0 dropped:35 overruns:0 frame:0
          TX packets:62 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:35018 TX bytes:7527
          Interrupt:73

eth1      Link encap:Ethernet  HWaddr 56:0d:96:f9:98:96  Driver rk_gmac-dwmac
          inet addr:192.168.0.55  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::398d:8357:8b24:cbc4/64 Scope: Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:270 errors:0 dropped:0 overruns:0 frame:0
          TX packets:39 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:30396 TX bytes:4753
          Interrupt:75
```

Note: When eth0 and eth1 are enabled simultaneously, eth0 is dedicated to internal network communication, while eth1 is dedicated to external network communication.

Step 3: Network connection test.

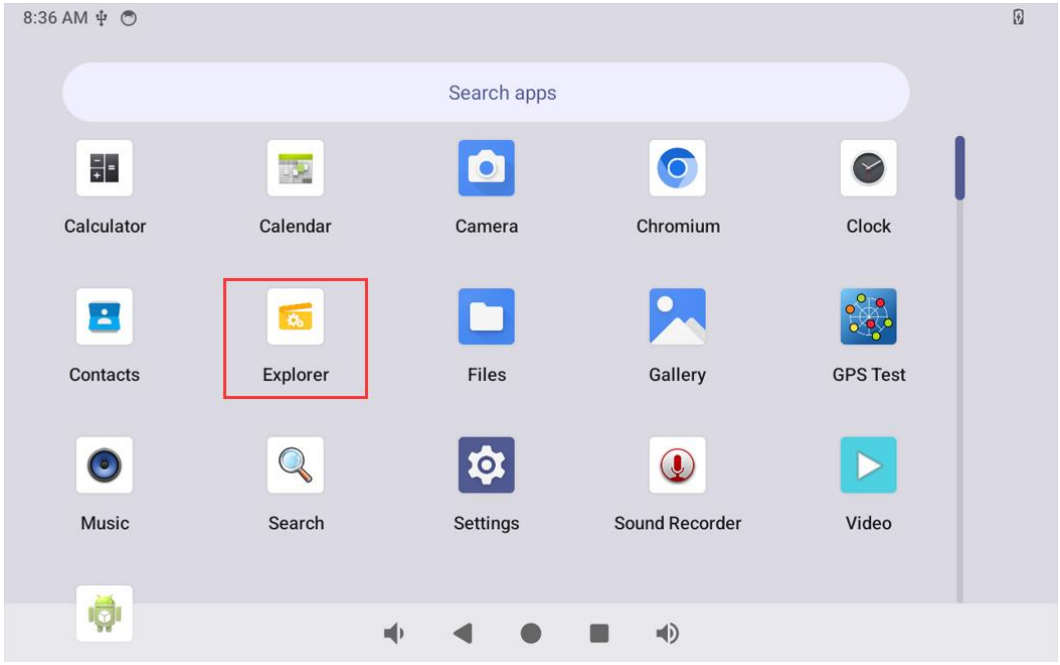
```
# ping -I eth0 192.168.0.1
# ping -I eth1 www.armdesigner.com
```

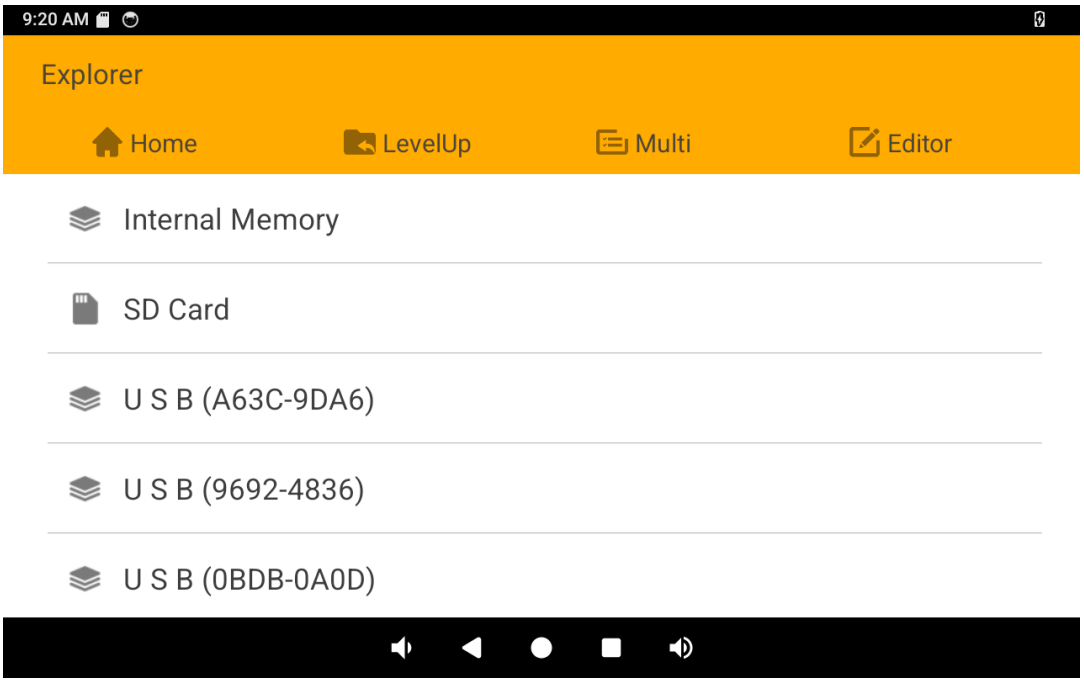
```
console:/ # ping -I eth0 192.168.0.1
ping: Warning: source address might be selected on device other than eth0.
PING 192.168.0.1 (192.168.0.1) from 192.168.0.55 eth0: 56(84) bytes of data.
64 bytes from 192.168.0.1: icmp_seq=1 ttl=255 time=3.03 ms
64 bytes from 192.168.0.1: icmp_seq=2 ttl=255 time=0.420 ms
64 bytes from 192.168.0.1: icmp_seq=3 ttl=255 time=0.300 ms
64 bytes from 192.168.0.1: icmp_seq=4 ttl=255 time=0.343 ms
64 bytes from 192.168.0.1: icmp_seq=5 ttl=255 time=0.604 ms
^C
--- 192.168.0.1 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4046ms
rtt min/avg/max/mdev = 0.300/0.940/3.035/1.052 ms
console:/ #
console:/ # ping -I eth1 www.armdesigner.com
PING www.armdesigner.com (67.222.54.196) from 192.168.0.55 eth1: 56(84) bytes of data.
64 bytes from www.armdesigner.com (67.222.54.196): icmp_seq=1 ttl=50 time=190 ms
64 bytes from www.armdesigner.com (67.222.54.196): icmp_seq=1 ttl=50 time=190 ms (DUP!)
64 bytes from www.armdesigner.com (67.222.54.196): icmp_seq=2 ttl=50 time=192 ms
64 bytes from www.armdesigner.com (67.222.54.196): icmp_seq=2 ttl=50 time=192 ms (DUP!)
64 bytes from www.armdesigner.com (67.222.54.196): icmp_seq=3 ttl=50 time=191 ms
64 bytes from www.armdesigner.com (67.222.54.196): icmp_seq=3 ttl=50 time=191 ms (DUP!)
64 bytes from www.armdesigner.com (67.222.54.196): icmp_seq=4 ttl=50 time=190 ms
64 bytes from www.armdesigner.com (67.222.54.196): icmp_seq=4 ttl=50 time=190 ms (DUP!)
^C
--- www.armdesigner.com ping statistics ---
4 packets transmitted, 4 received, +4 duplicates, 0% packet loss, time 3003ms
rtt min/avg/max/mdev = 190.428/191.140/192.173/0.676 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.

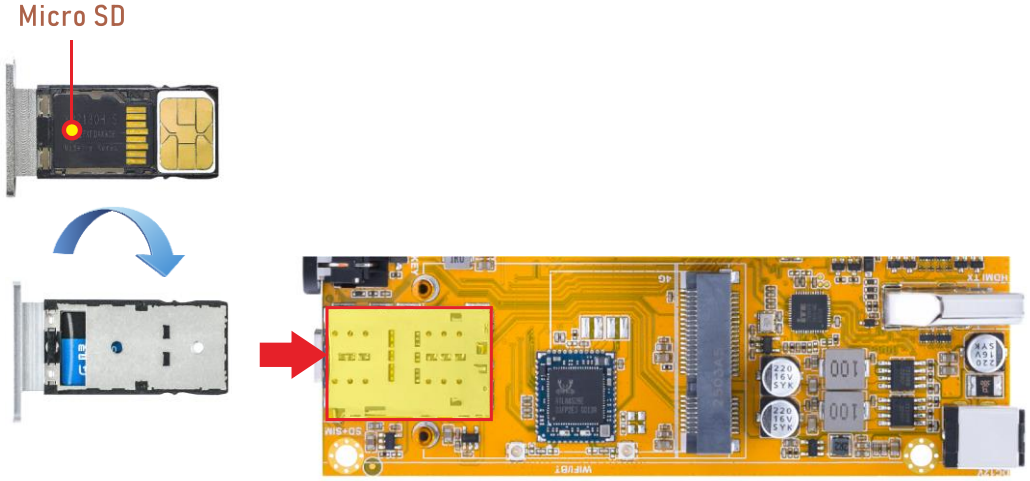
After connecting the USB flash drive, the device will automatically mount, and it can be accessed directly through the **Explorer** app.



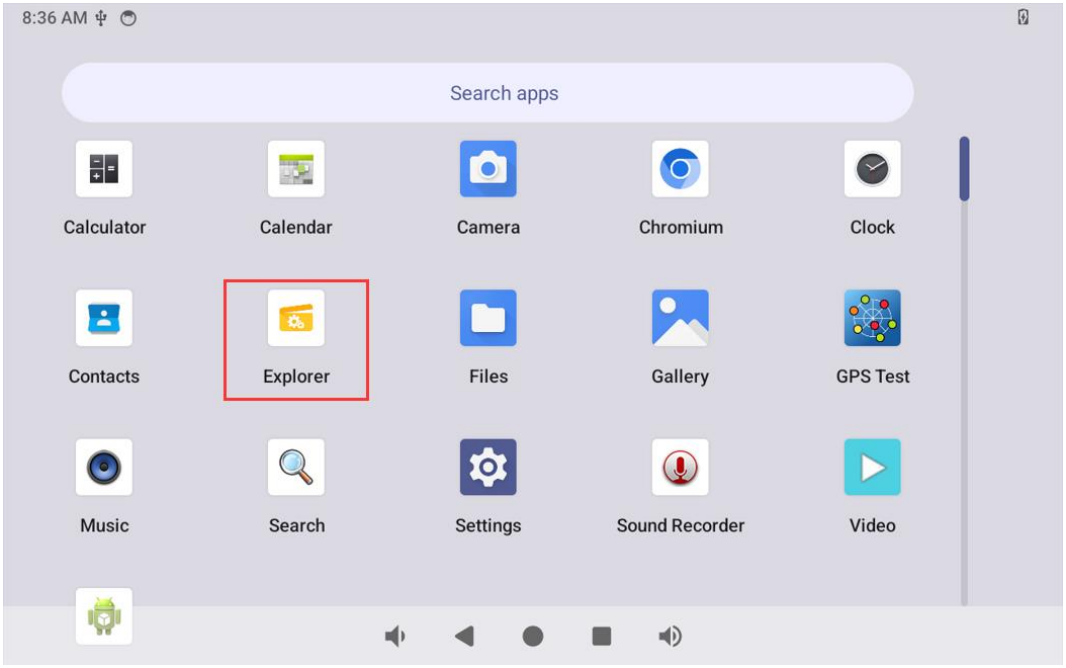


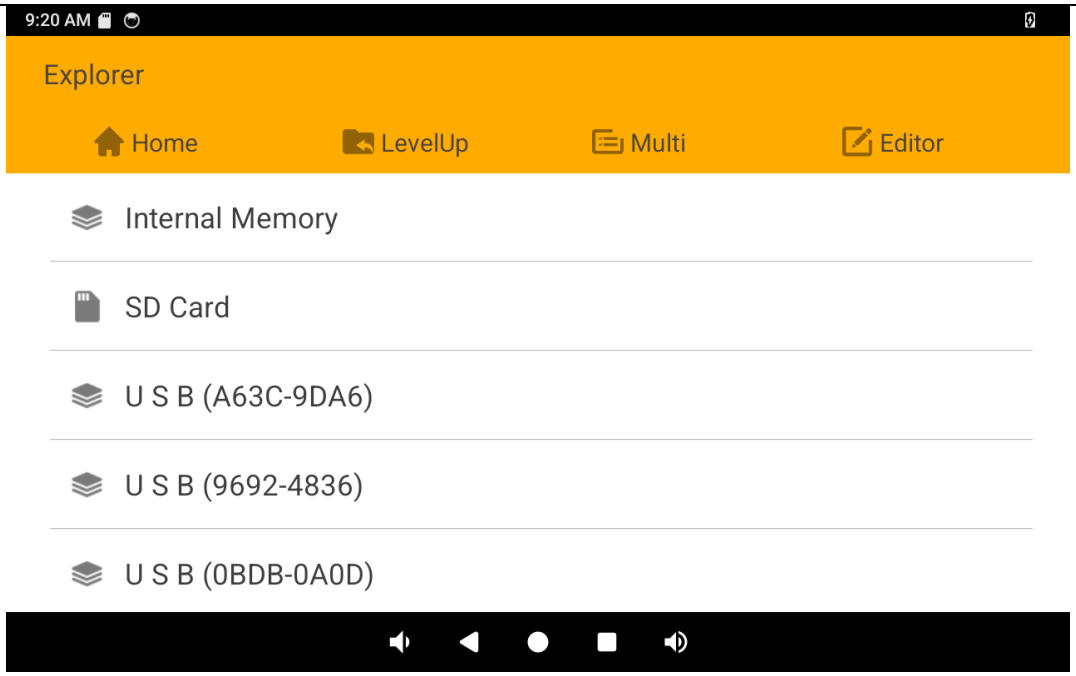
6.6 SD Card

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



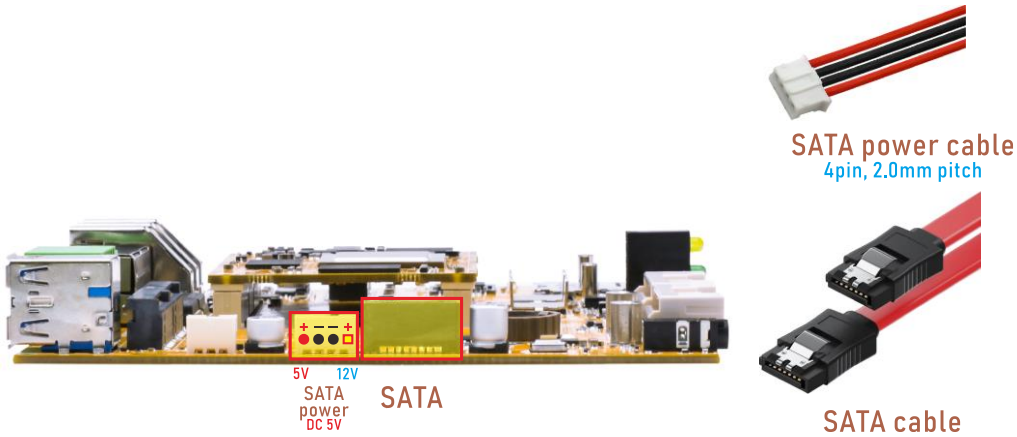
Step 2: After connecting the SD card drive, the device will automatically mount, and it can be accessed directly through the **Explorer** app.



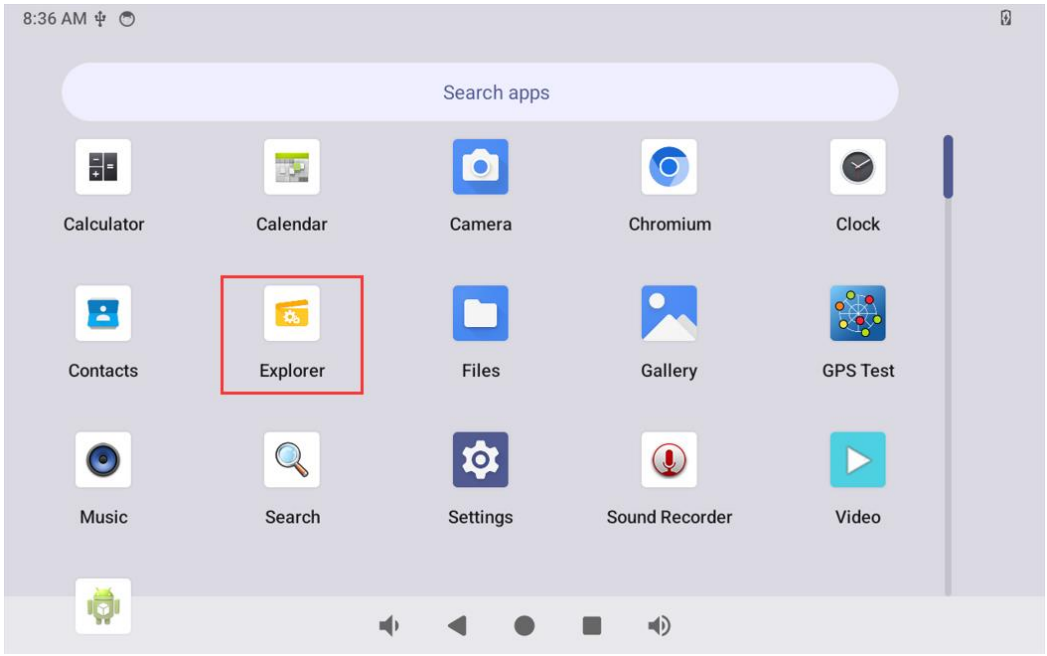


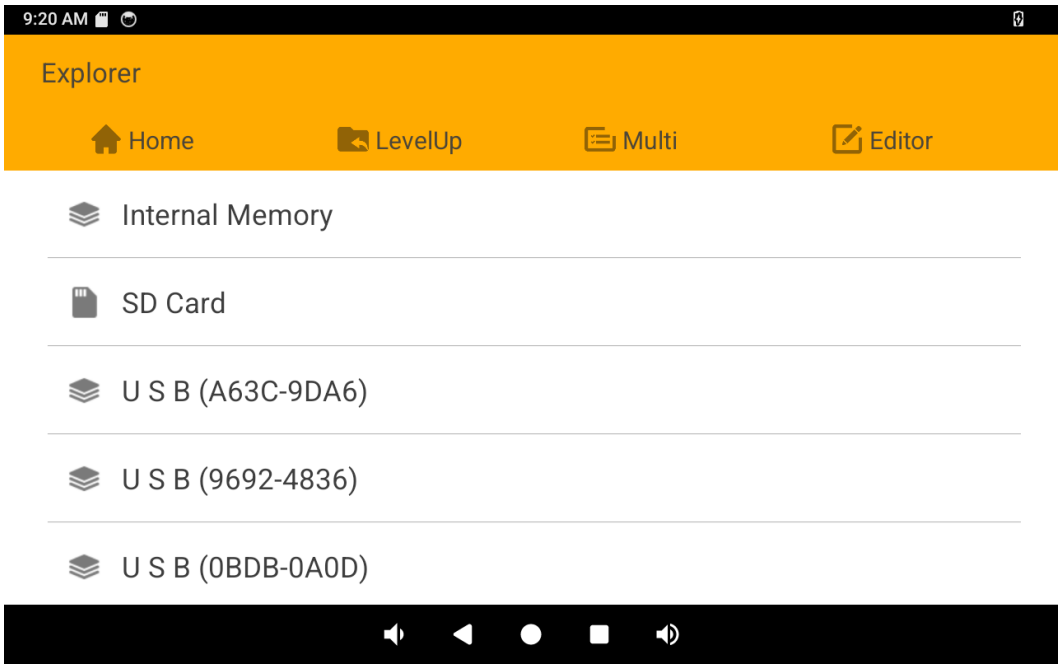
6.7 SATA

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



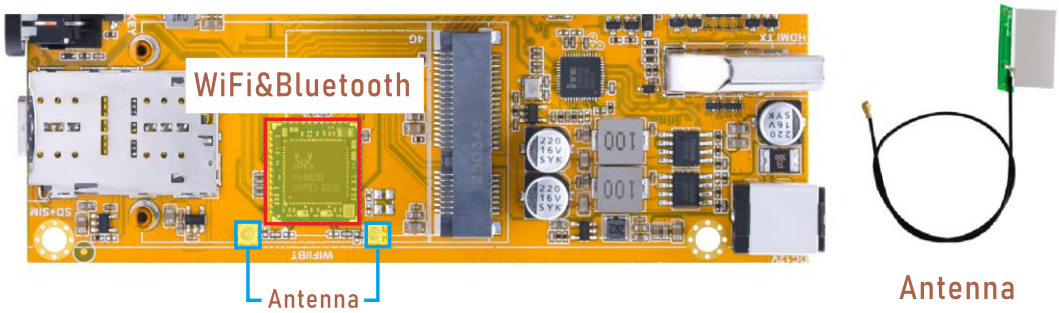
Step 2: After connecting the sata drive, the device will automatically mount, and it can be accessed directly through the **Explorer** app.





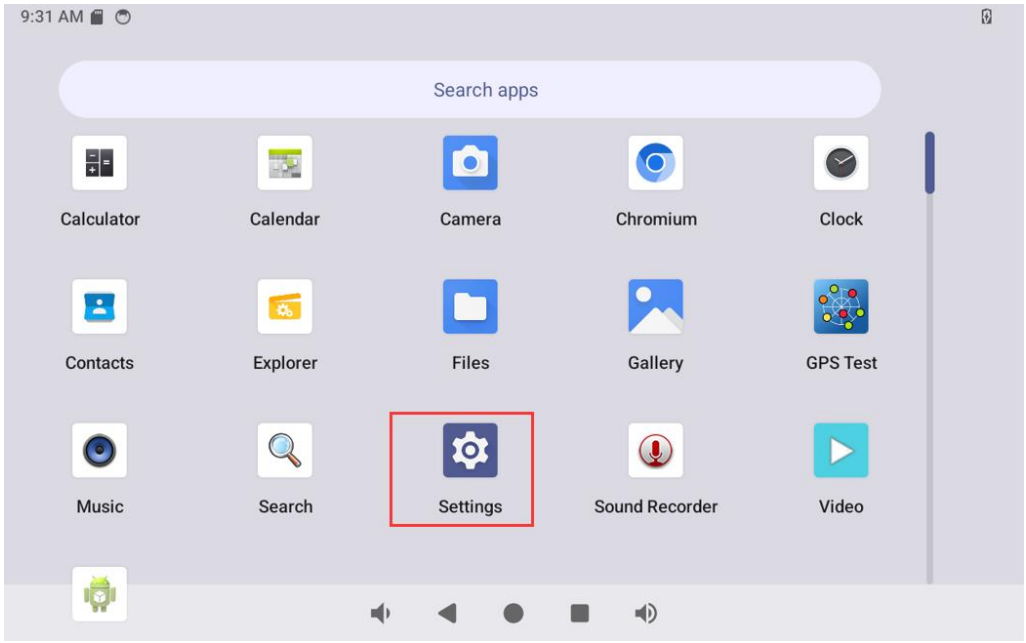
6.8 WiFi & Bluetooth

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

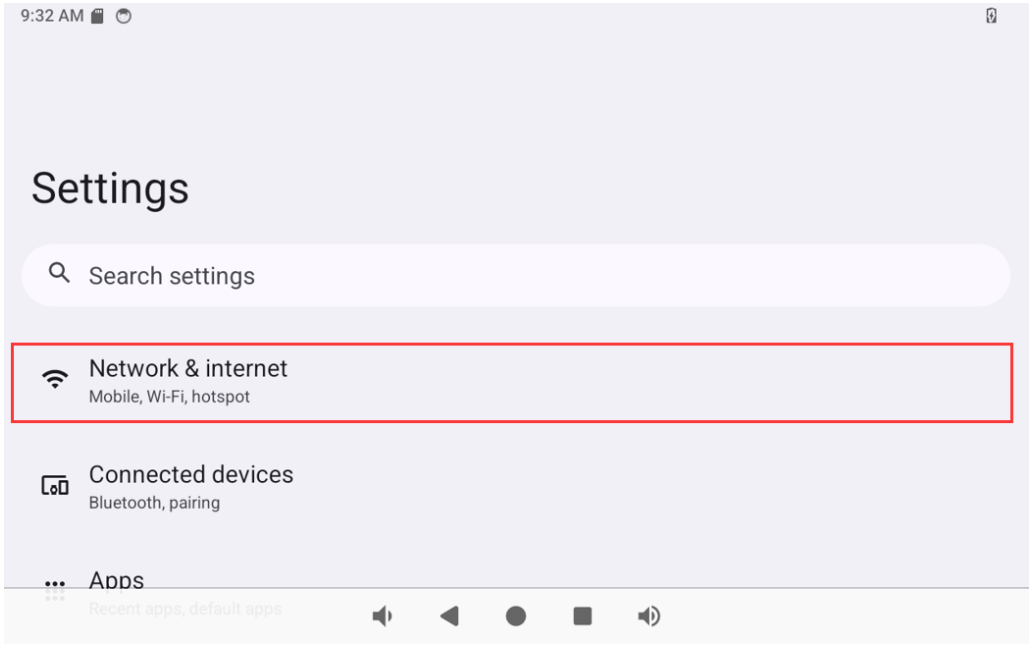


6.8.1 WiFi test

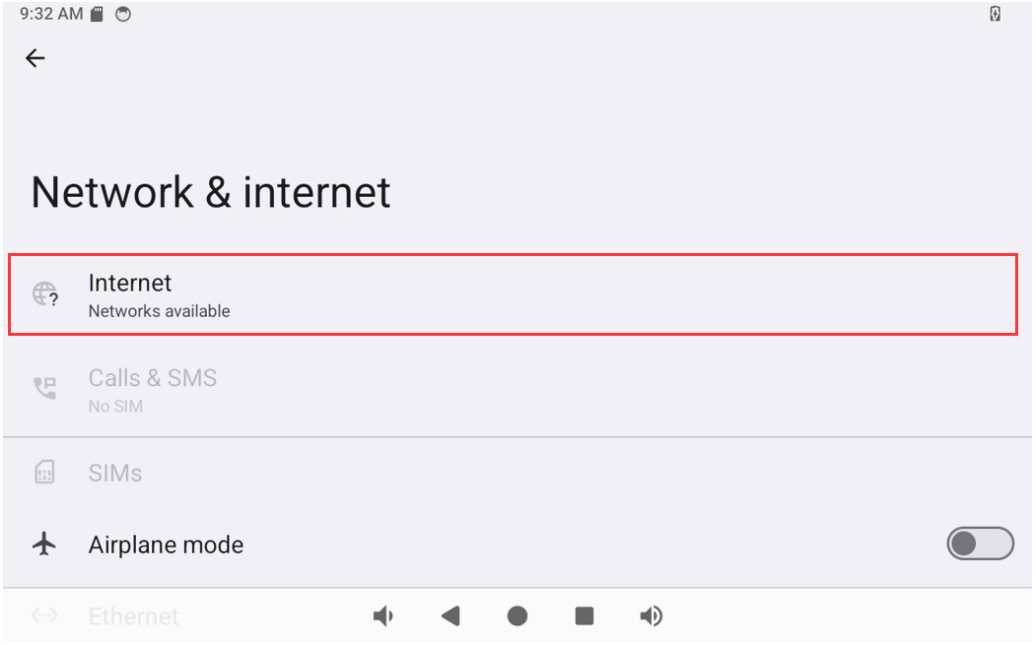
Step 1: Open the **Settings** app：



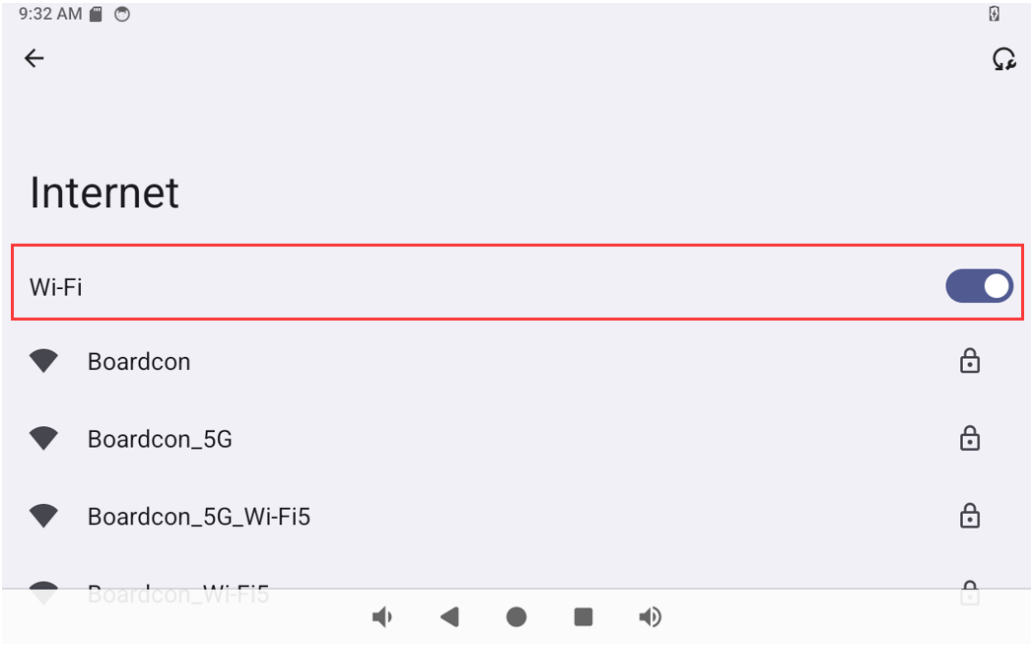
Step 2: Go to **Network & Internet**:



Step 3: Tap **Internet**:

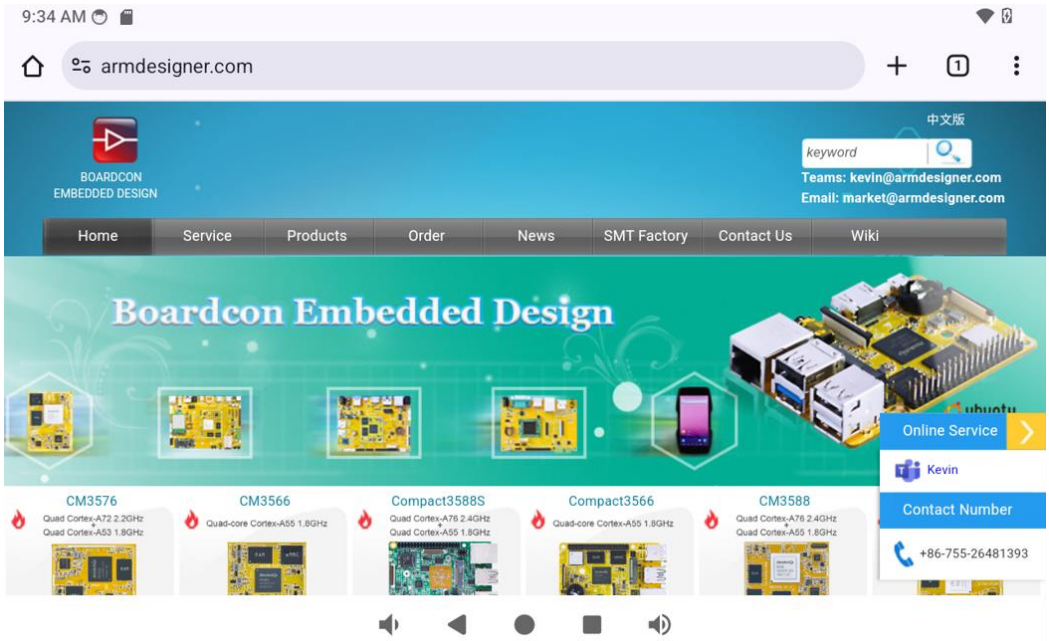


Step 4: Turn on the **Wi-Fi switch**:



Step 5: Select an available Wi-Fi hotspot from the list and connect:

Step 6: Internet test.



Users can also choose to use the ping command to test the connectivity of the wifi, as shown below:

(1) View network interface information.

```
# ifconfig
```

```
console:/ # ifconfig
wlan0     Link encap:Ethernet  HWaddr cc:64:1a:78:ed:d8  Driver rtl8852be
          inet addr:192.168.0.65  Bcast:192.168.0.255  Mask:255.255.255.0
          inet6 addr: fe80::7660:f88:32af:7023/64 Scope: Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1031 errors:0 dropped:0 overruns:0 frame:0
          TX packets:426 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:386755 TX bytes:97647
```

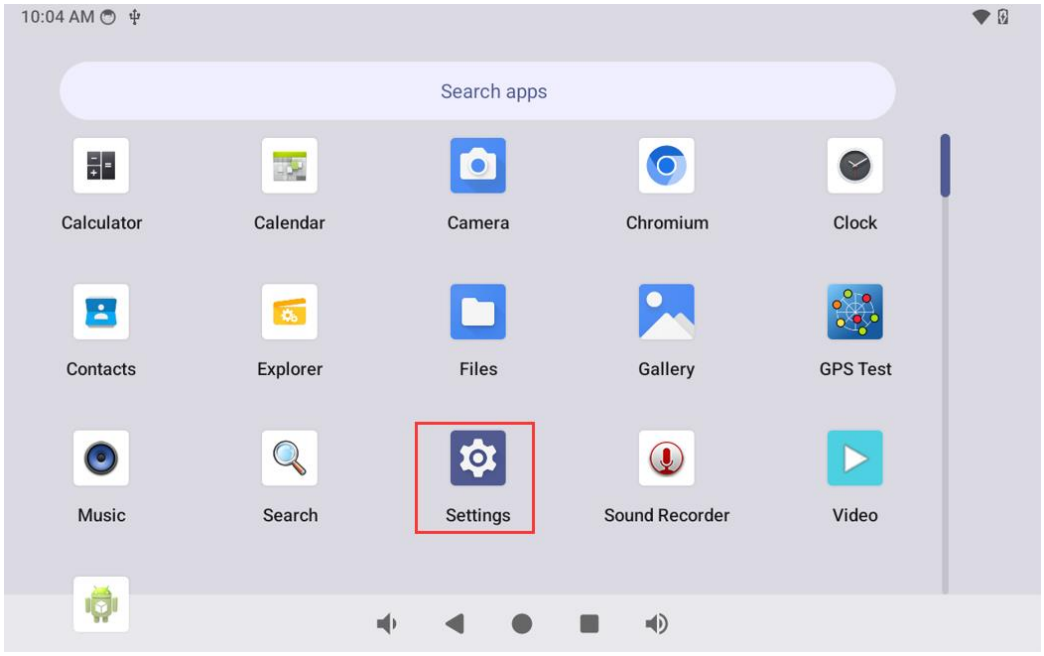
(2) Network connection test.

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

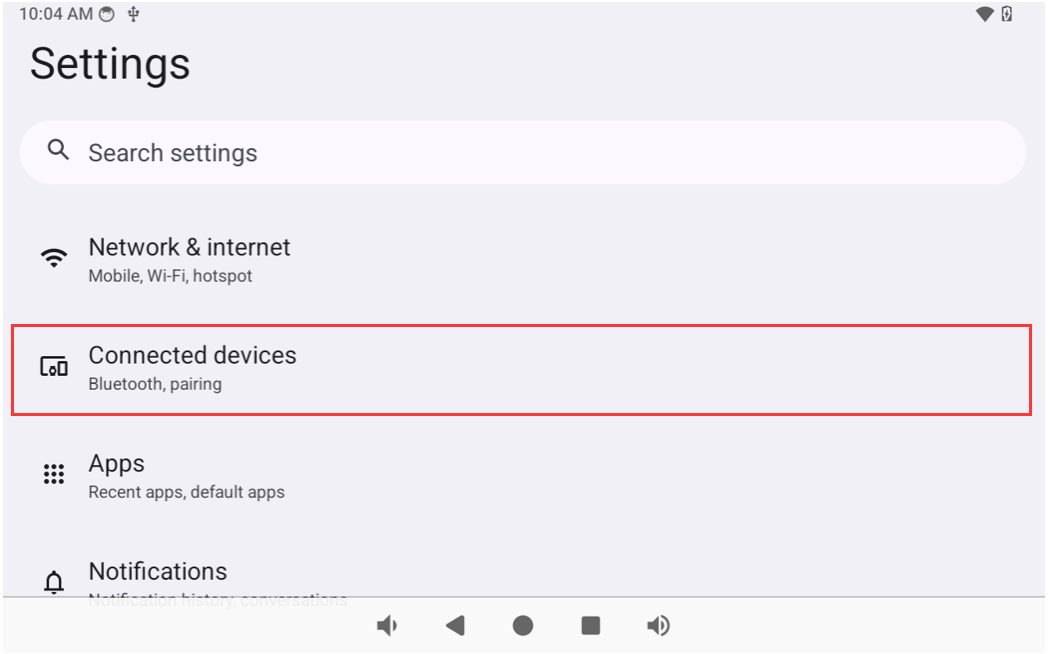
```
console:/ # ping -I wlan0 www.armdesigner.com
PING www.armdesigner.com (67.222.54.196) from 192.168.0.65 wlan0: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=48 time=256 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=48 time=189 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=48 time=188 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=193 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=48 time=188 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=7 ttl=48 time=189 ms
^C
--- www.armdesigner.com ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6009ms
rtt min/avg/max/mdev = 188.148/199.449/256.455/23.322 ms
```

6.8.2 Bluetooth test

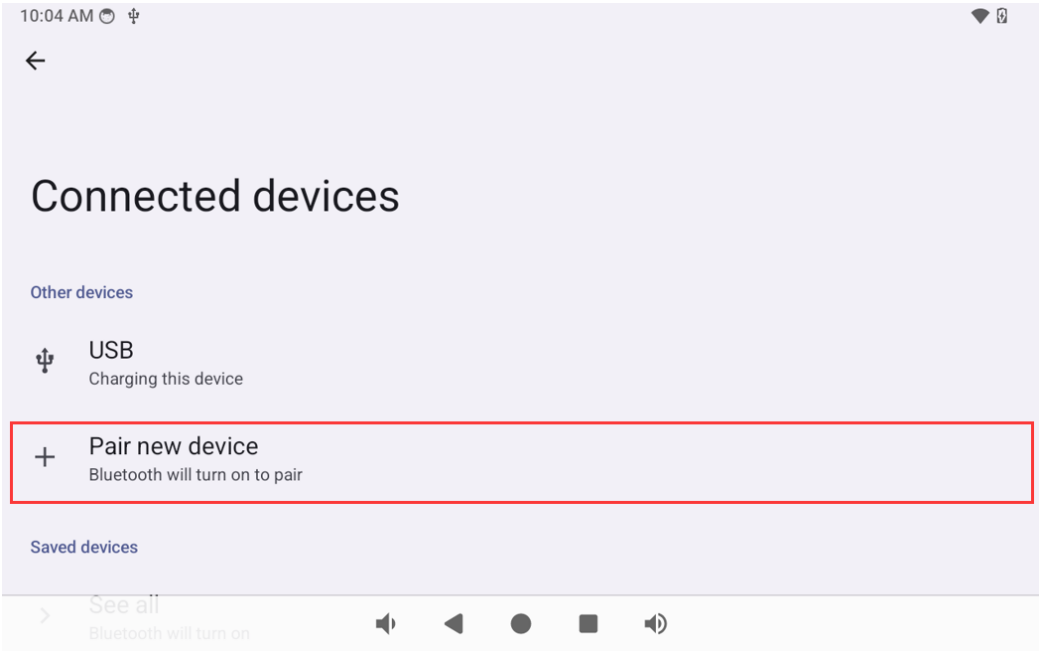
Step 1: Open the **Settings** app.



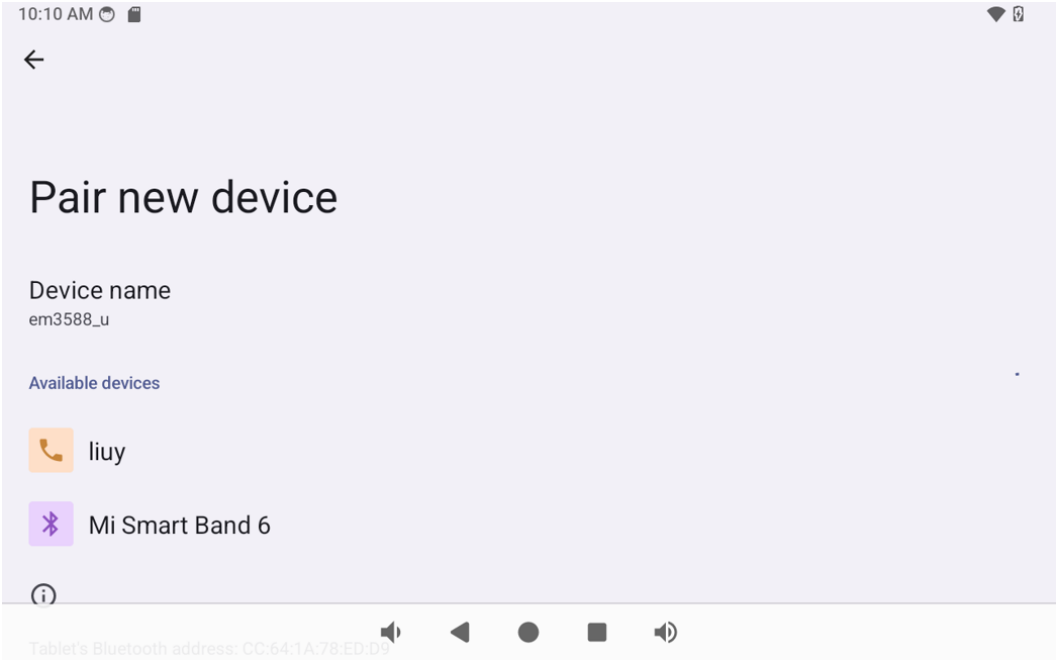
Step 2: Click on the option **Connected devices**



Step 3: Click on the option **Pair new device.**



Step 4: User can pair themselves in the Bluetooth device list.

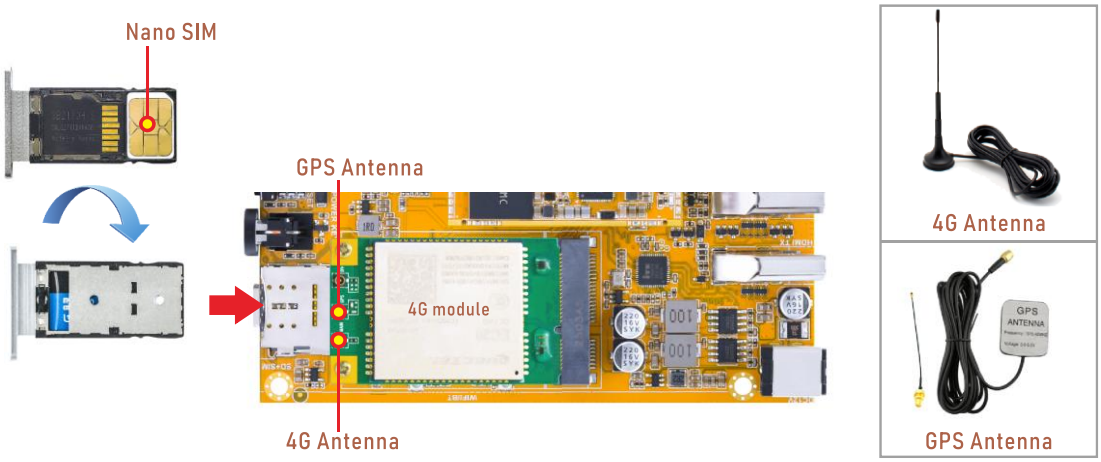


6.9 4G & GPS

Step 1: Insert 4G module to PCIe socket (4G model: EC20).

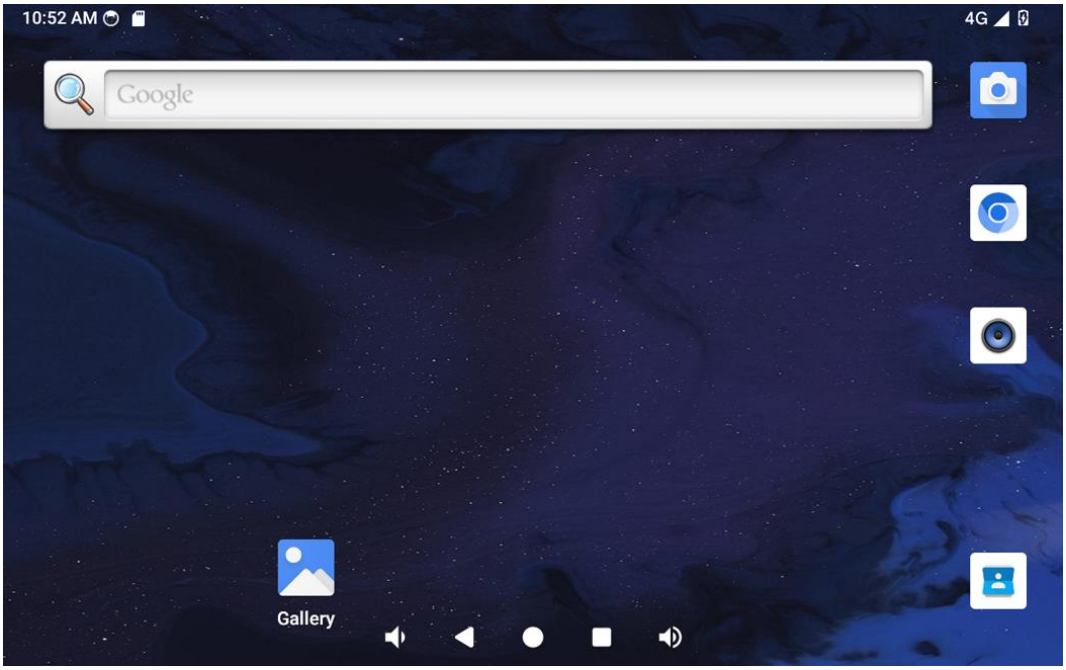
Step 2: Connect antenna and insert SIM card.

Step 3: Power on.

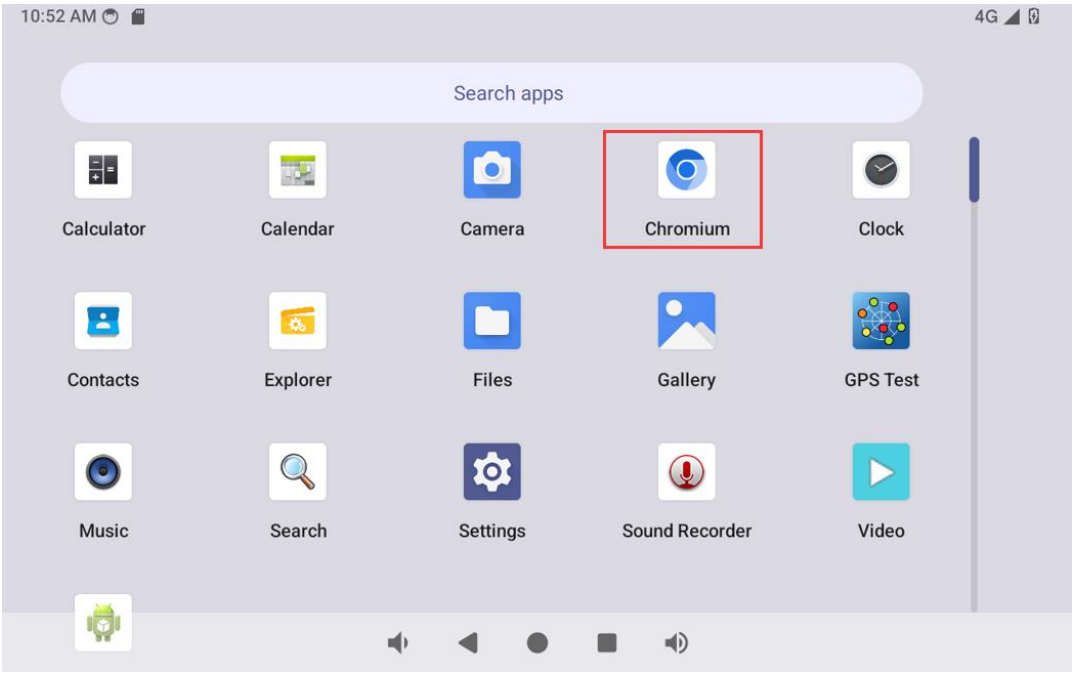


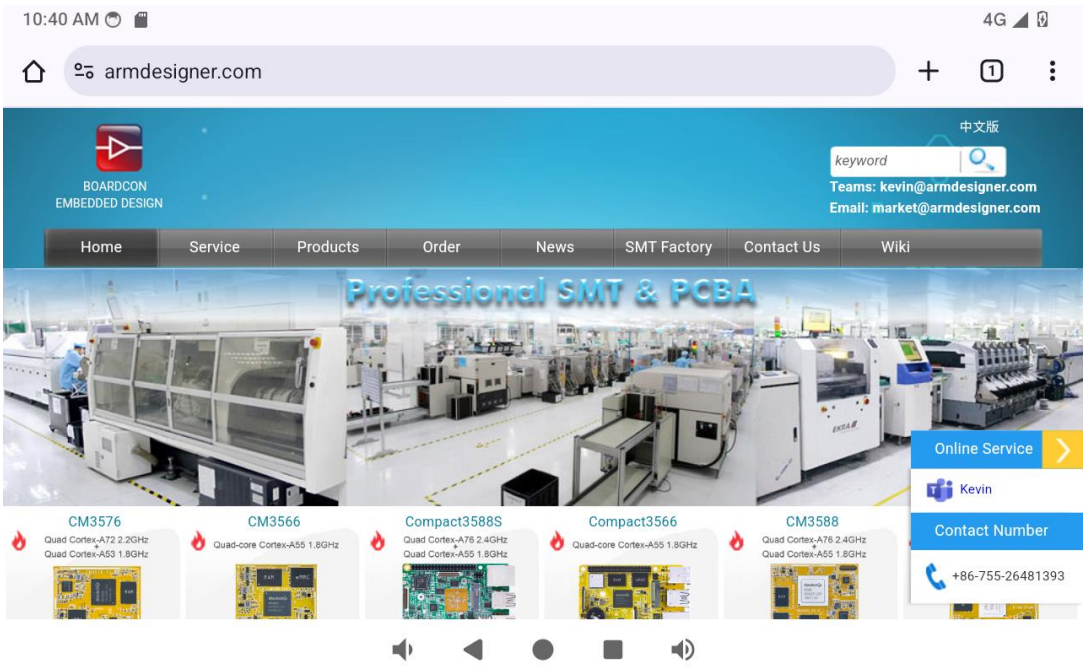
6.9.1 4G Test

After boot, the device defaults to 4G mode, and the corresponding icon will appear in the upper right corner of the desktop.



Test the 4G connection:





Users can also choose to use the ping command to test the connectivity of the 4G, as shown below:

(1) View network interface information.

```
# ifconfig
```

```
console:/ # ifconfig
wwan0     Link encap:Ethernet  HWaddr a2:ea:f9:46:6f:c8  Driver qmi_wwan_q
          inet addr:10.96.137.126  Mask:255.255.240.0
          inet6 addr: fe80::a0ea:f9ff:fe46:6fc8/64 Scope: Link
          UP RUNNING NOARP  MTU:1500  Metric:1
          RX packets:21 errors:0 dropped:0 overruns:0 frame:0
          TX packets:43 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:5766 TX bytes:3441
```

(2) Network connection test.

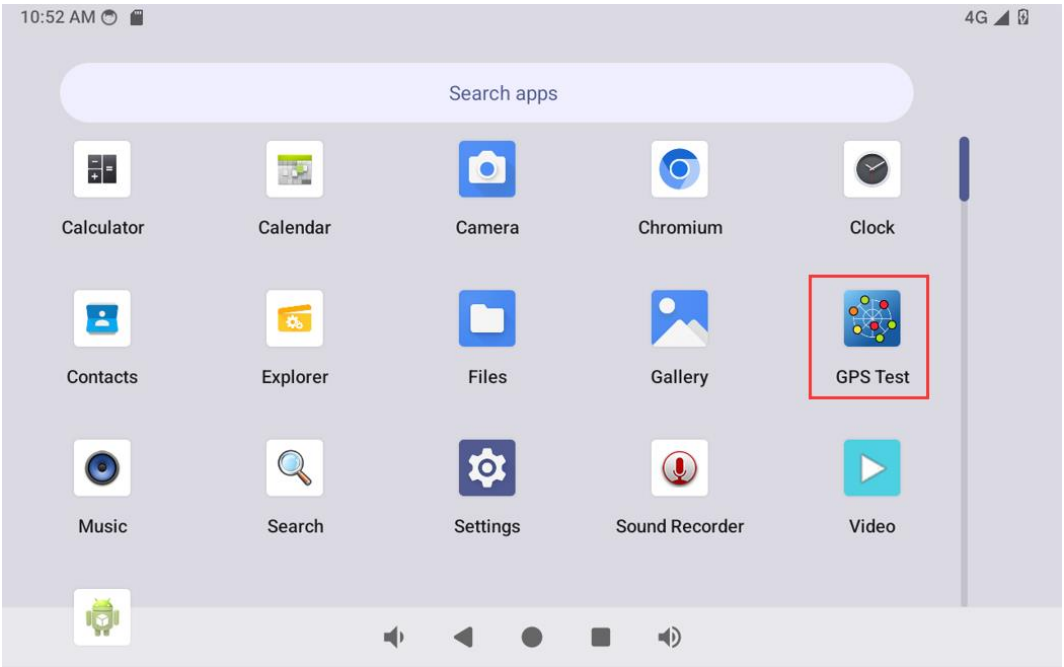
```
# ping -I wwan0 www.armdesigner.com
```

```
console:/ # ping -I wwan0 www.armdesigner.com
PING www.armdesigner.com (67.222.54.196) from 10.96.137.126 wwan0: 56(84) bytes of data.
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=47 time=220 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=47 time=209 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=47 time=213 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=47 time=208 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=47 time=208 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=47 time=208 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=7 ttl=47 time=207 ms
^C
--- www.armdesigner.com ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6002ms
rtt min/avg/max/mdev = 207.607/210.826/220.234/4.316 ms
```

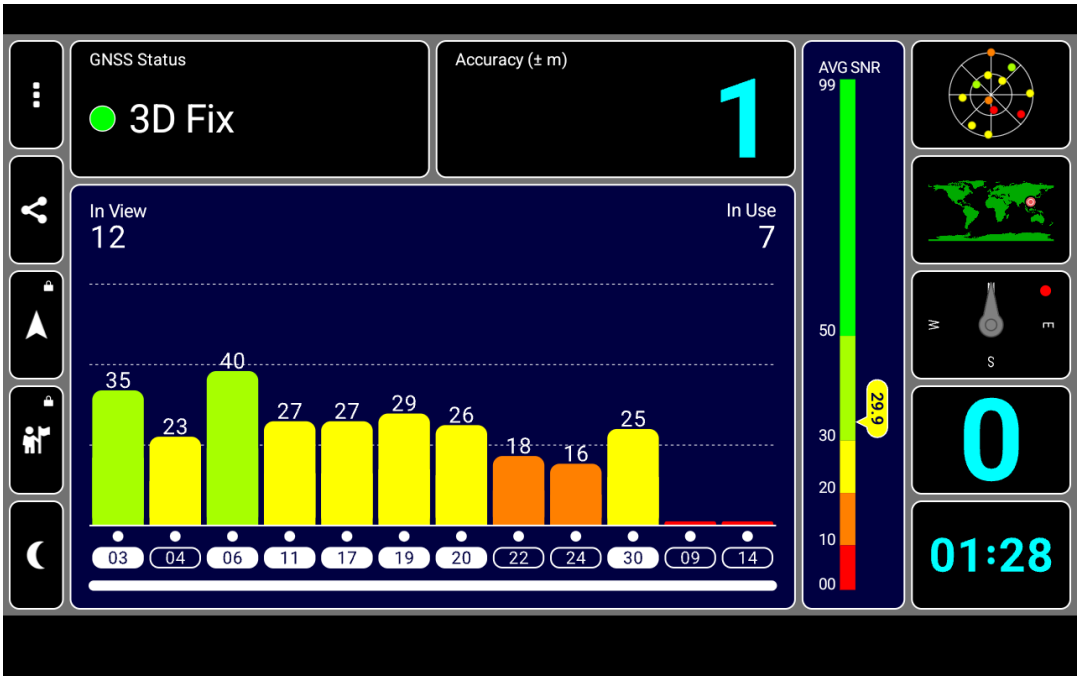
6.9.2 GPS Test

GPS positioning needs to be tested in open outdoor areas.

Step 1: Open **GPS Test** APP.

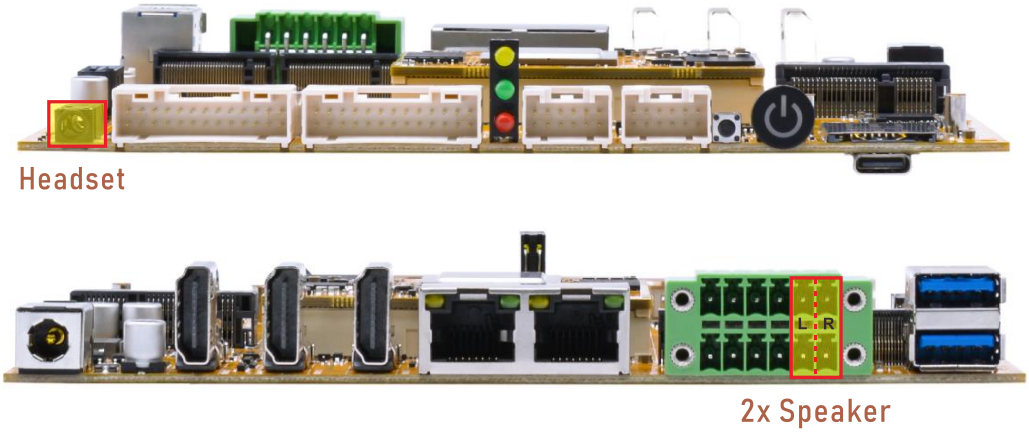


Step 2: Wait a moment to successfully obtain the location.

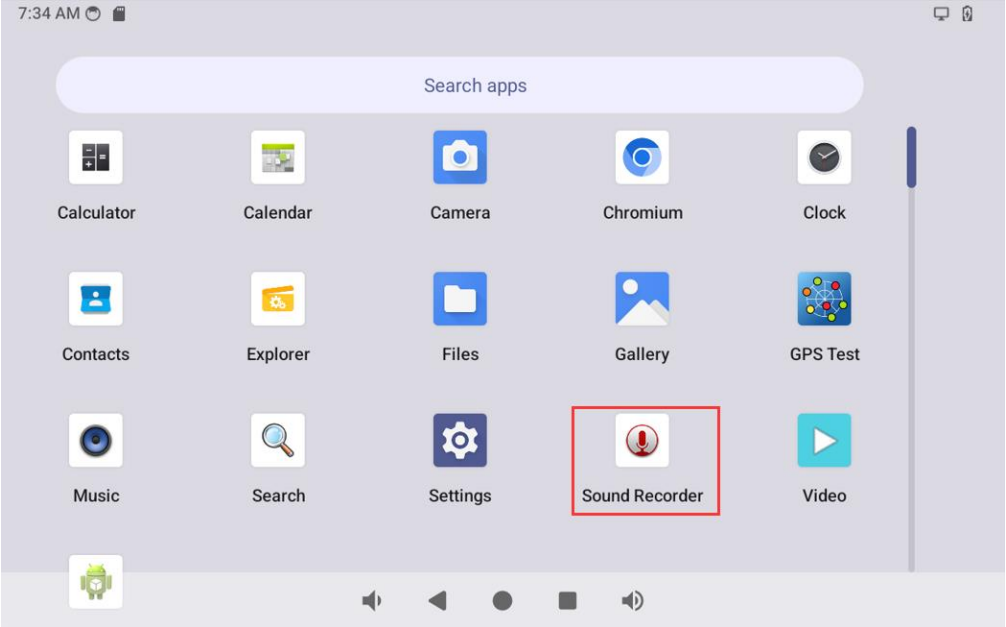


6.10 Headset

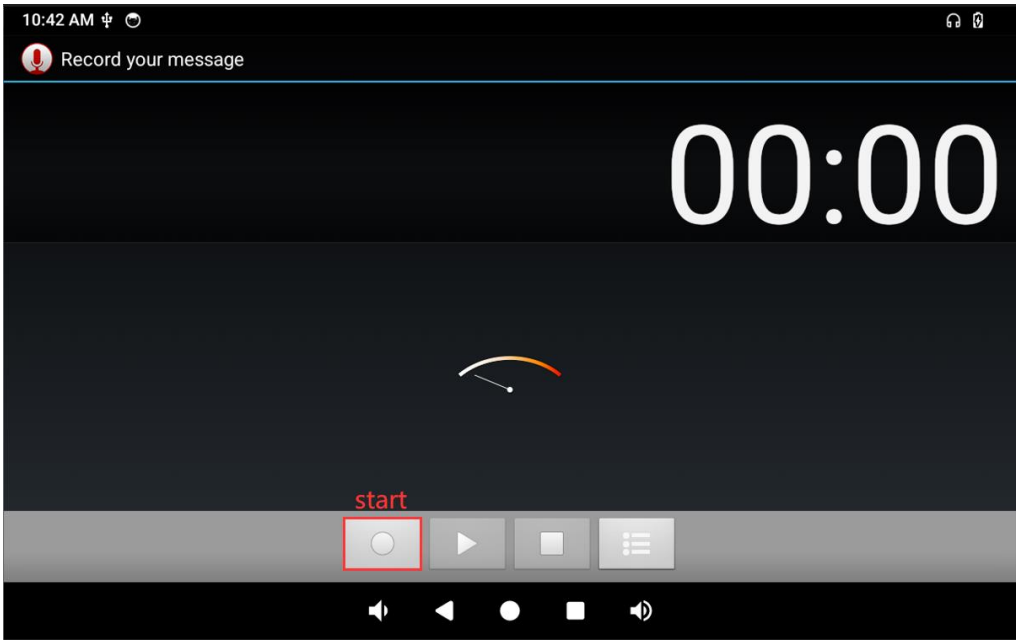
Step 1: Plug the headset into the headset jack and connect the speaker.



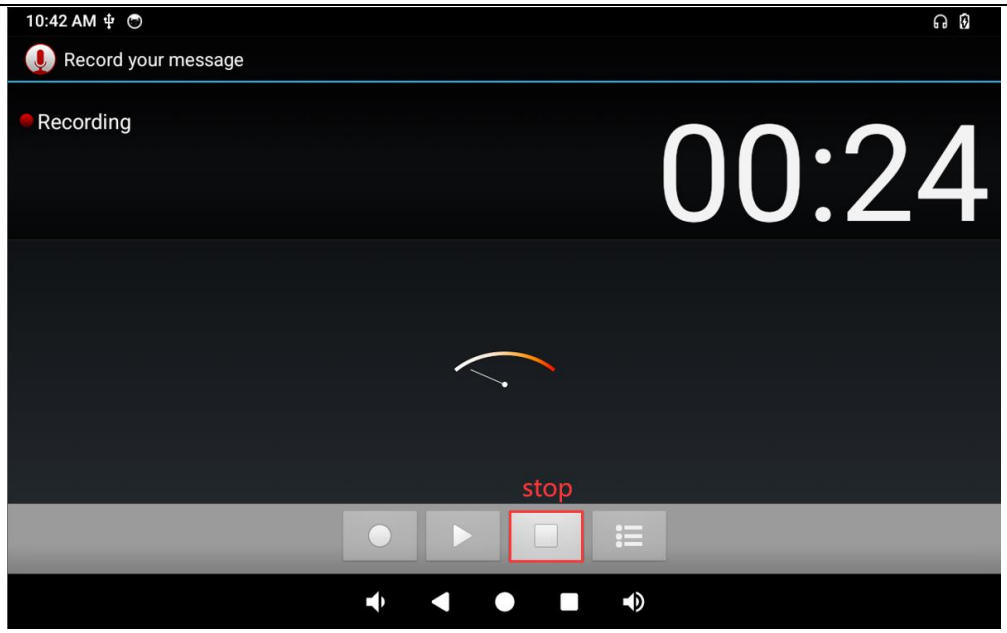
Step 2: Open the **Sound Recorder** app.



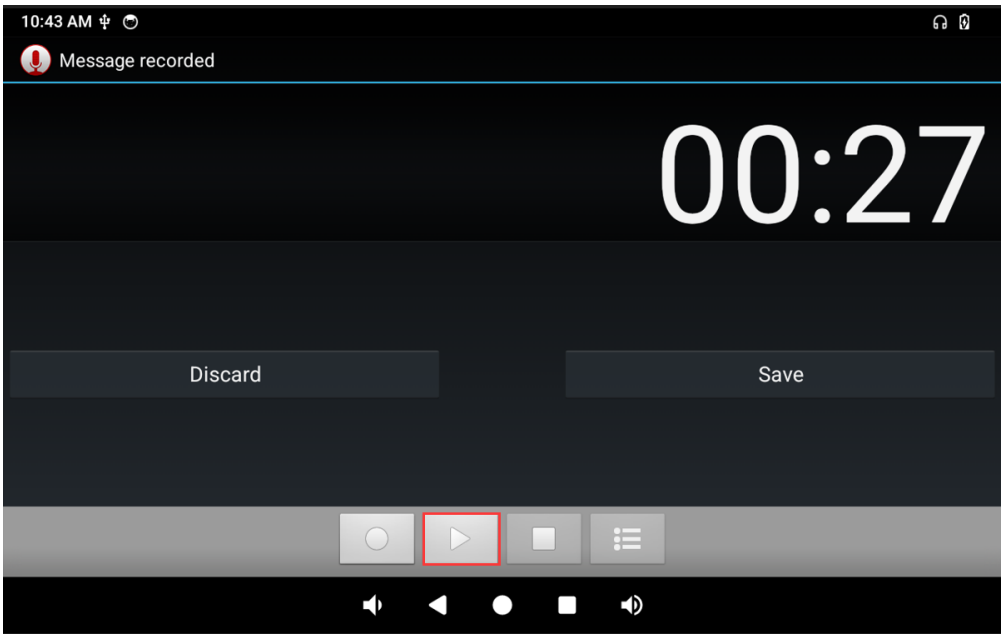
Step 3: Click the following button to start recording.



Step 4: Click the following button to stop recording.



Step 5: Click the following button to play back the recording.

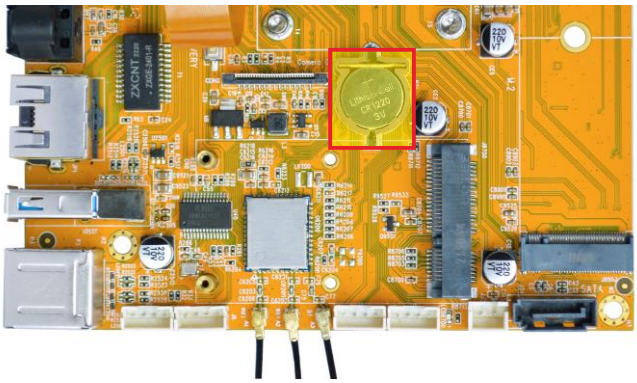


Note: Audio output level: Headset >HDMI > Speaker.

6.11 RTC

Step 1: Install the coin cell battery.

RTC



Step 2: Set the system time.

```
# date -s "2025-06-19 9:42:00"
```

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

```
# hwclock -w
```

Step 4: Display the current hardware clock time.

```
# hwclock
```

```
console:/ # date -s "2025-06-19 9:42:00"
Thu Jun 19 09:42:00 GMT 2025
console:/ # hwclock -w
console:/ # hwclock
2025-06-19 09:42:07+0000
console:/ # hwclock
2025-06-19 09:43:10+0000
console:/ # hwclock
2025-06-19 09:43:37+0000
```

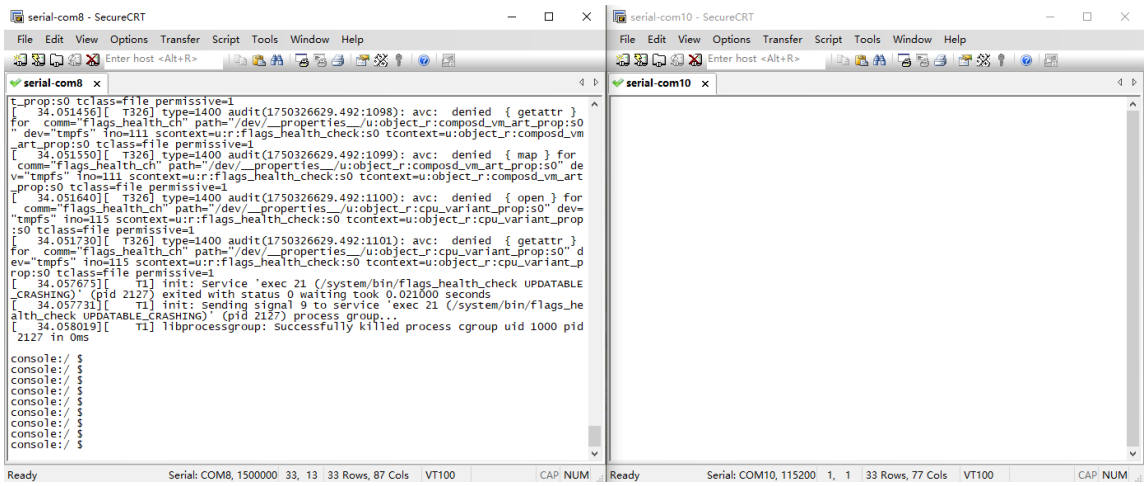
Step 5: Power off, after a period of time to turn on the power again, check whether the time is saved.

```
130|console:/ # hwclock
2025-06-19 14:12:30+0000
console:/ # hwclock
2025-06-19 14:15:00+0000
console:/ # hwclock
2025-06-19 14:15:56+0000
console:/ # hwclock
2025-06-19 14:17:25+0000
```

6.12 RS485

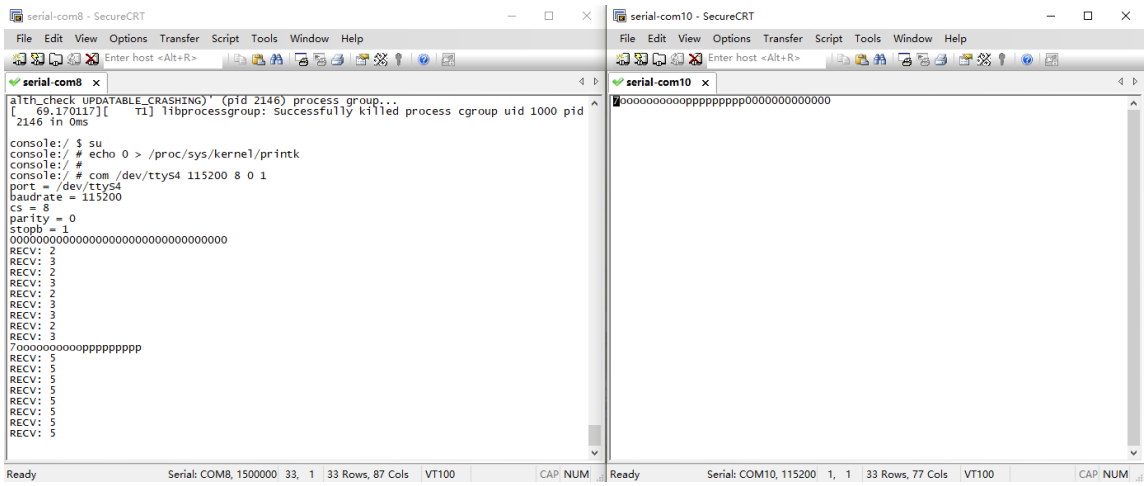
Step 1: As shown in the diagram, connect the RS485 test tool to the development board.

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.

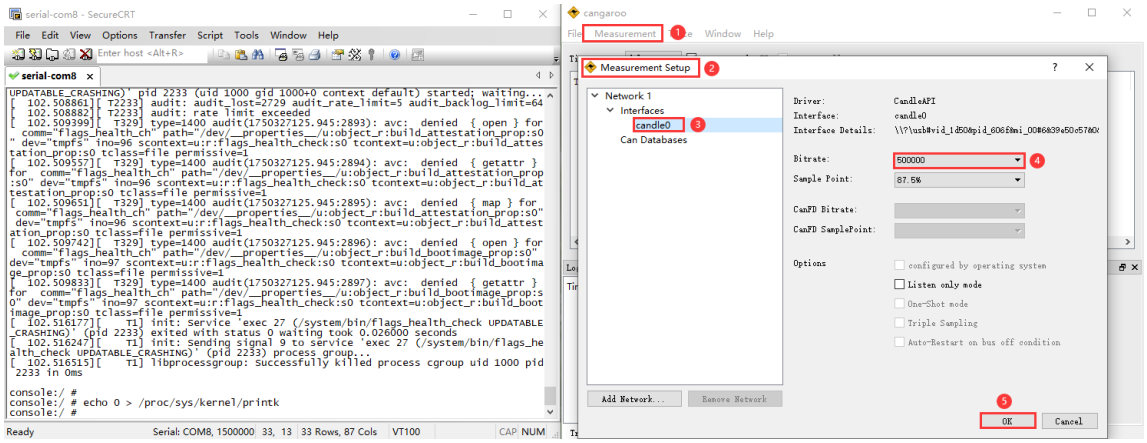
```
# com /dev/ttyS4 115200 8 0 1
```



6.13 CAN

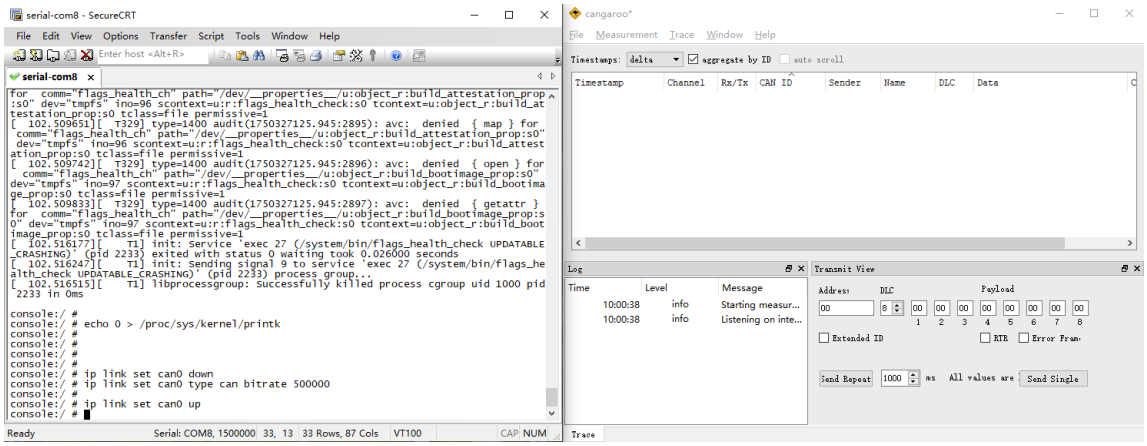
Step 1: Connect the CAN test tool to the board as shown in the diagram below.

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



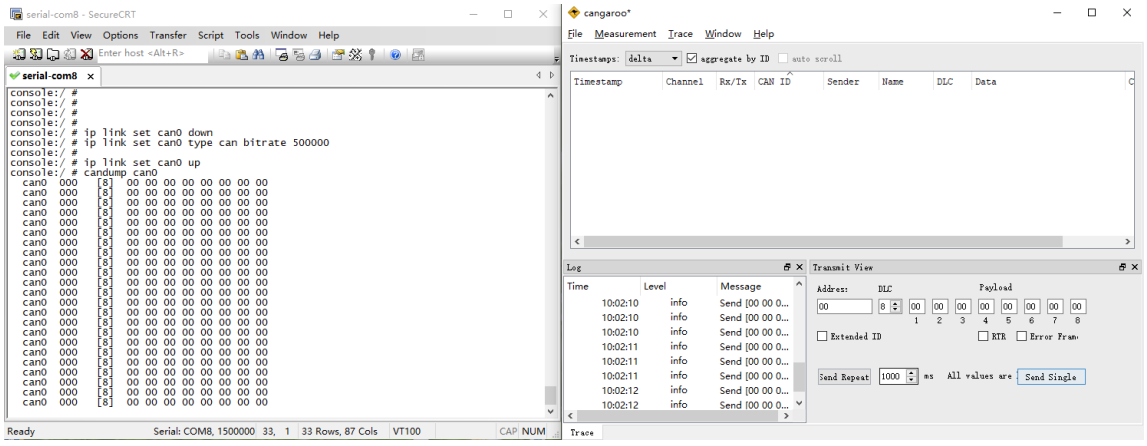
Step 3: Configure and activate the CAN network, setting the bitrate to 500000.

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



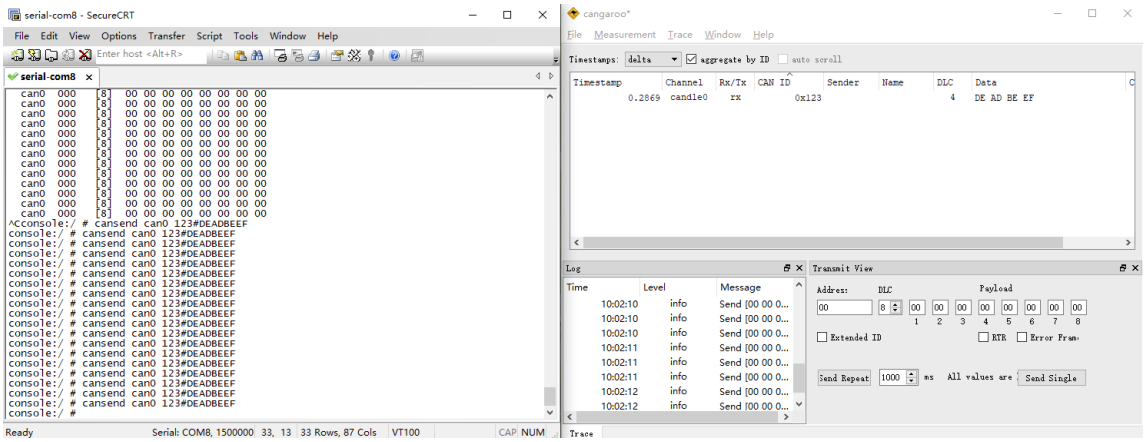
Step 4: Configure CAN as the receiver.

```
# candump can0
```



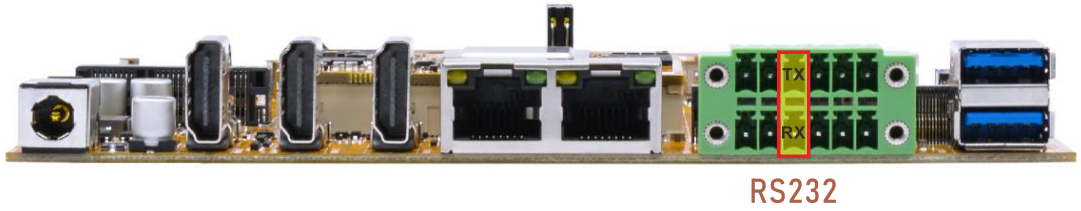
Step 5: Configure CAN as the sender.

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



6.14 RS232

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

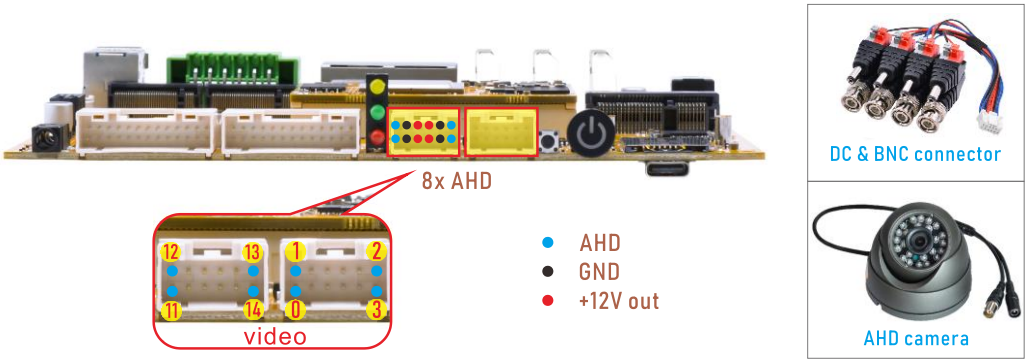


Step 2: RS232 test.

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

```
console:/ # com /dev/ttyS7 115200 8 0 1
port = /dev/ttyS7
baudrate = 115200
cs = 8
parity = 0
stopb = 1
KLKLKLKLKLKLKL
RECV: KLKLKLKLKLKLKL
225555566
RECV: 225555566
OOPOPOPOP
RECV: OOPOPOPOP
HHHHHHH
RECV: HHHHHHH
```

6.15 Camera



Note: This device only provides a video capture interface. Preview functionality must be implemented by the customer through custom application development based on their specific requirements.

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

```
# v4l2-ctl --verbose -d /dev/video11 --set-fmt-
video=width=1920,height=1080,pixelformat='NV12' --stream-mmap=4 --set-
selection=target=crop,flags=0,top=0,left=0,width=1920,height=1080 --stream-
to=/mnt/out0.yuv
```

```
130|console:/ #
op,flags=0,top=0,left=0,width=1920,height=1080 --stream-to=/mnt/out0.yuv     <
VIDIOC_QUERYCAP: ok
VIDIOC_G_FMT: ok
VIDIOC_S_FMT: ok
Format Video Capture Multiplanar:
       Width/Height      : 1920/1080
       Pixel Format      : 'NV12'
       Field             : None
       Number of planes  : 1
       Flags             :
       Colorspace        : Default
       Transfer Function : Default
       YCbCr Encoding    : Default
       Quantization      : Default
       Plane 0           :
          Bytes per Line : 1920
          Size Image     : 3110400
VIDIOC_G_SELECTION: ok
VIDIOC_S_SELECTION: ok
VIDIOC_REQBUFS: ok
VIDIOC_QUERYBUF: ok
VIDIOC_QUERYBUF: ok
VIDIOC_QBUF: ok
VIDIOC_QUERYBUF: ok
VIDIOC_QBUF: ok
VIDIOC_QUERYBUF: ok
VIDIOC_QBUF: ok
VIDIOC_QUERYBUF: ok
VIDIOC_QBUF: ok
VIDIOC_STREAMON: ok
idx: 0 seq:      0 bytesused: 3110400 ts: 1841.187472
idx: 1 seq:      1 bytesused: 3110400 ts: 1841.227545 delta: 40.073 ms
idx: 2 seq:      2 bytesused: 3110400 ts: 1841.267545 delta: 40.000 ms
idx: 3 seq:      3 bytesused: 3110400 ts: 1841.307546 delta: 40.001 ms
idx: 0 seq:      4 bytesused: 3110400 ts: 1841.347547 delta: 40.001 ms fps: 24.99
idx: 1 seq:      5 bytesused: 3110400 ts: 1841.387558 delta: 40.011 ms fps: 24.99
```

The file will save as under the current directory.

```
console:/ # ls /mnt/
androidwritable  expand     media_rw  out1_0.yuv    runtime  secure
appfuse          installer  obb       pass_through  scratch  user
asec             iso        out0.yuv  product       sdcard   vendor
```

Copy the file to PC then play it by **7yuv.**