

EM3288 Android9 User Manual

V1.1



Boardcon Embedded Design

www.boardcon.com

1. Introduction

1.1. About this Manual

This manual is intended to provide the user with an overview of the board and benefits, complete features specifications, and set up procedures. It contains important safety information as well.

1.2. Feedback and Update to this Manual

To help our customers make the most of our products, we are continually making additional and updated resources available on the Boardcon website (www.boardcon.com , www.armdesigner.com).

These include manuals, application notes, programming examples, and updated software and hardware. Check in periodically to see what's new!

When we are prioritizing work on these updated resources, feedback from customers is the number one influence, If you have questions, comments, or concerns about your product or project, please no hesitate to contact us at support@armdesigner.com.

1.3. Limited Warranty

Boardcon warrants this product to be free of defects in material and workmanship for a period of one year from date of buy. During this warranty period Boardcon will repair or replace the defective unit in accordance with the following process:

A copy of the original invoice must be included when returning the defective unit to Boardcon. This limited warranty does not cover damages resulting from lightning or other power surges, misuse, abuse, abnormal conditions of operation, or attempts to alter or modify the function of the product.

This warranty is limited to the repair or replacement of the defective unit. In no event shall Boardcon be liable or responsible for any loss or damages, including but not limited to any lost profits, incidental or consequential damages, loss of business, or anticipatory profits arising from the use or inability to use this product.

Repairs make after the expiration of the warranty period are subject to a repair charge and the cost of return shipping. Please contact Boardcon to arrange for any repair service and to obtain repair charge information.



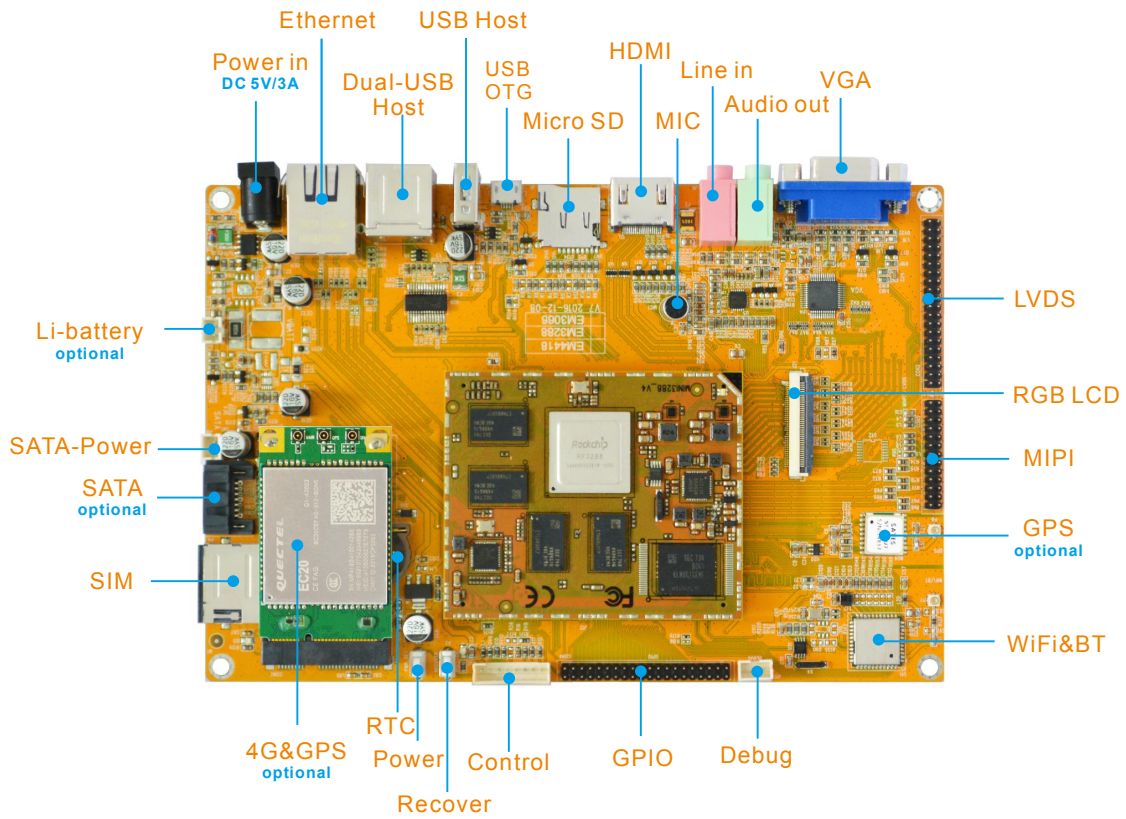
Revision History

Ver	Description	Author	Date
V1.0	Initial version android9	Liu Yuan	2020-09-10
V1.1	Modify test	Zhou Lijun	2021-7-27

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1 EM3288 Introduction



Feature	Specifications
CPU	<ul style="list-style-type: none"> Rockchip RK3288, Quad Core Cortex-A17 @ 1.8GHz 28nm HKMG process
GPU	<ul style="list-style-type: none"> ARM Mali-T764 GPU, with TE, ASTC, AFBC technology Support OpenGL ES1.1/2.0/3.0, OpenVG1.1, OpenCL, DirectX11
Memory	2GB DDR3
Flash	4G/8GB eMMC Flash
Power	5V/3A
USB	3x USB2.0 Host, 1x USB2.0 OTG
LCD	1x 40-pin LVDS for 10.1-inch 1280 x 800 LCD with multi-dot capacitive touchscreen; 1x 40-pin TTL LCD connector
VGA	1x VGA connector. Automatically adjust according to display size
Ethernet	100/1000M, RJ45 interface. RTL8211E-VB-CG controller
Serial port	1x 3pin connector, for debug
HDMI	HDMI V2.0, up to 4Kx2K@60fps. Audio sync-output
Audio	3.5mm jacks, MIC. ES8388 audio codec
SD card	1x Micro SD card slot

WiFi & Bluetooth	AP6236 module. WiFi - 2.4GHz, 802.11b/g/n. Bluetooth4.0.
4G	Quectel EC20, PCIe connector
GPS	SATES ST-91-U7
Camera	Supporting MIPI camera, and most of USB CMOS camera on the market,
RTC	Real Time Clock, powered by external lithium battery
Button	Power, Recover
GPIO	1x 8-pin Control, 1x 40-pin GPIO
Other interfaces	1x SATA, 1x SATA-Power, 1x SIM Card, 1x Lithium battery interface
Dimension	117.5 x 175.3mm

2 Compiler Environment

2.1 Vmware10.0+ubuntu16.04

Install Vmware10.0 in windows OS, and then install ubuntu16.04 in VMware to compile. Please visit the official website <http://www.ubuntu.com/> to download and install ubuntu operating system.

Note: Android9 should be compiled by ubuntu 64bit OS.

2.2 Install OpenJDK1.8

```
# sudo mkdir /usr/lib/java
# sudo tar zxvf java-8-openjdk-amd64.tar.gz -C /usr/lib/java/
```

Add the following information in the end of “**/etc/profile**”

```
export JAVA_HOME=/usr/lib/java/java-8-openjdk-amd64
export JRE_HOME=/usr/lib/java/java-8-openjdk-amd64/jre
export CLASSPATH=.:$JAVA_HOME/lib:$JRE_HOME/jre/lib:$CLASSPATH
export PATH=$JAVA_HOME/bin:$JRE_HOME/jre/bin:$PATH
```

```
# source /etc/profile
```

Check if the jdk has been installed successfully and check the revised version:

```
# java -version
```

2.3 Install Tools

PC OS: ubuntu system

Network: online

Permission: root

```
# sudo apt-get install build-essential
```



```
# sudo apt-get install zlib1g-dev
# sudo apt-get install flex
# sudo apt-get install libx11-dev
# sudo apt-get install gperf
# sudo apt-get install libncurses5-dev
# sudo apt-get install bison
# sudo apt-get install lsb-core
# sudo apt-get install lib32z1-dev
# sudo apt-get install g++-multilib
# sudo apt-get install lib32ncurses5-dev
# sudo apt-get install uboot-mkimage
# sudo apt-get install g++-4.4-multilib
```

3 Compile Source

Step 1, unzip the source.

```
# tar zxvf rk3288_mid_android-9.0_200421.tgz
# .repo/repo/repo sync -l
# .repo/repo/repo sync
```

Step 2, compile uboot

```
# cd sdk-9.0/uboot
# make clean
# make mrproper
# ./make.sh rk3288
```

Step 3, compile the kernel

```
# cd sdk-9.0/kernel
# make ARCH=arm rockchip_defconfig
# make ARCH=arm rk3288-evb-android-act8846-lvds-avb.img -j8
```

kernel.img, resource.img and **boot.img** are generated in current directory.

Step 4, compile the android

```
# cd sdk-9.0
# source build/envsetup.sh
# lunch
Choose rk3288-userdebug
# make -j8
```

Step 5, Generated image file

```
# ./mkimage.sh
# cd rockdev/Image-rk3288
# ls
```

Images are generated in current directory.

4 Images Operation

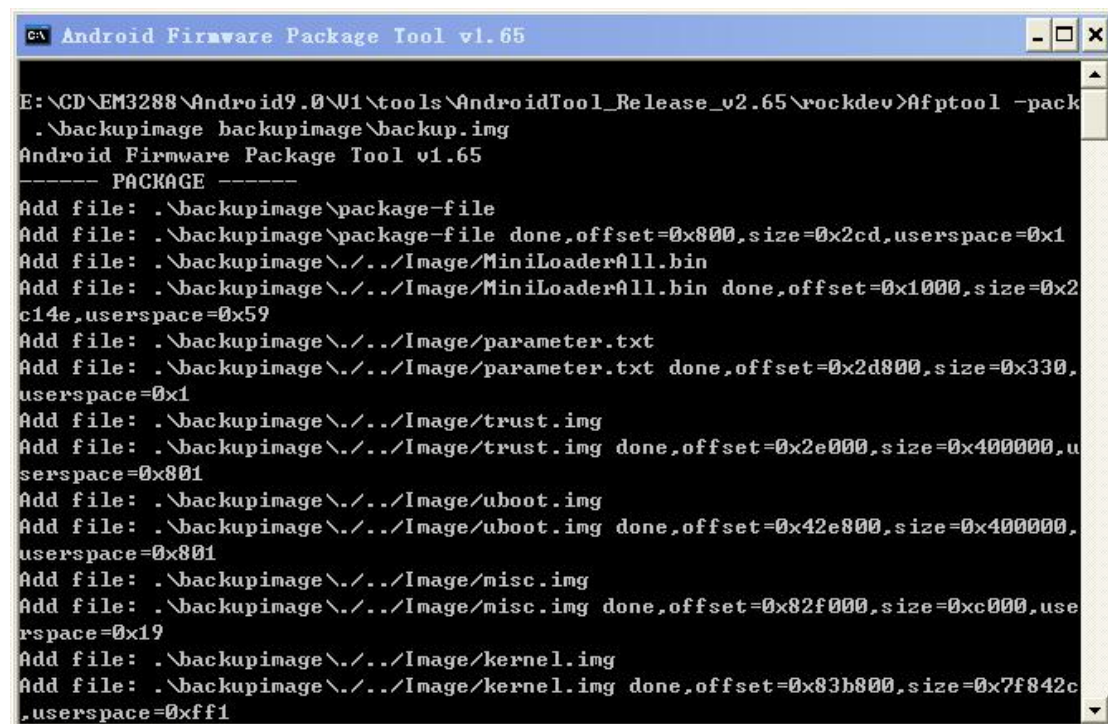
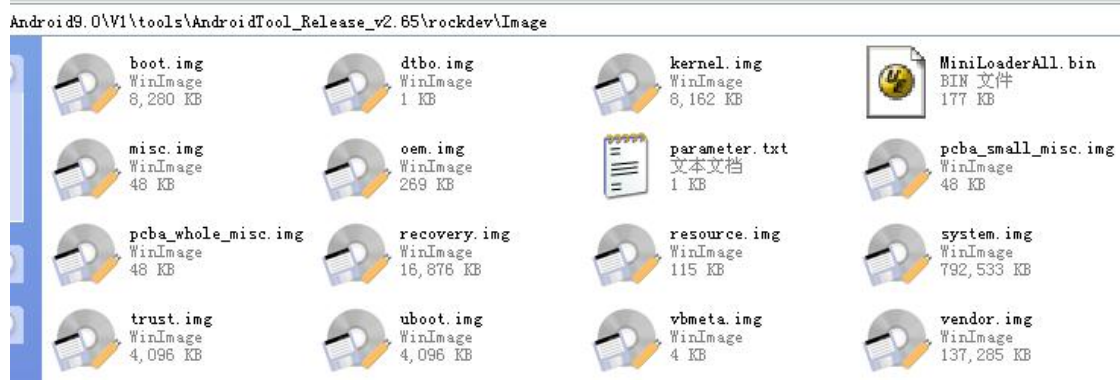
4.1 Pack Image

Step 1, copy all the files in Android directory **rockdev/Image** to the windows

AndroidTool_Release_v2.65/rockdev/Image

Step 2, enter **AndroidTool_Release_v2.65/rockdev/**, double-click to run **mkupdate.bat**.

Step 3, the **update.img** will be generated in **rockdev** directory.




```

CA Android Firmware Package Tool v1.65
Add file: .\recover-script done,offset=0x3b530800,size=0x10a,userspace=0x1
Add CRC...
Make firmware OK!
----- OK -----

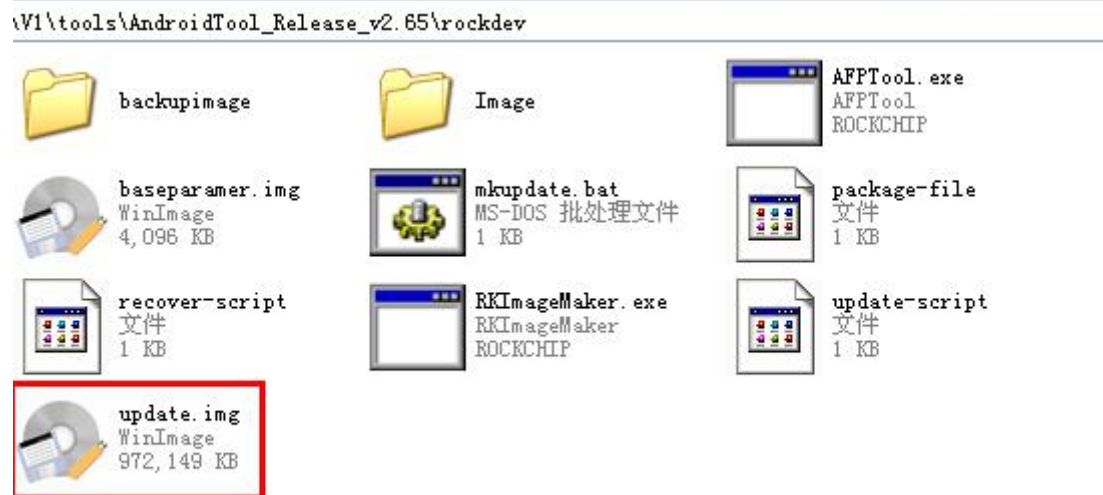
E:\CD\EM3288\Android9.0\W1\tools\AndroidTool_Release_v2.65\rockdev>RKImageMaker.
exe -RK32 Image\MiniLoaderAll.bin Image\update.img update.img -os_type:androido
s
*****RKImageMaker ver 1.66 *****
Generating new image, please wait...
Writing head info...
Writing boot file...
Writing firmware...
Generating MD5 data...
MD5 data generated successfully!
New image generated successfully!

E:\CD\EM3288\Android9.0\W1\tools\AndroidTool_Release_v2.65\rockdev>rem update.im
g is new format, Image\update.img is old format, so delete older format

E:\CD\EM3288\Android9.0\W1\tools\AndroidTool_Release_v2.65\rockdev>del Image\up
date.img

E:\CD\EM3288\Android9.0\W1\tools\AndroidTool_Release_v2.65\rockdev>pause
请按任意键继续. . .

```



4.2 Unzip Firmware

Unzip Firmware in ubuntu.

Step 1, copy **update.img** to the android source directory

RKTools/linux/Linux_Pack_Firmware/rockdev/

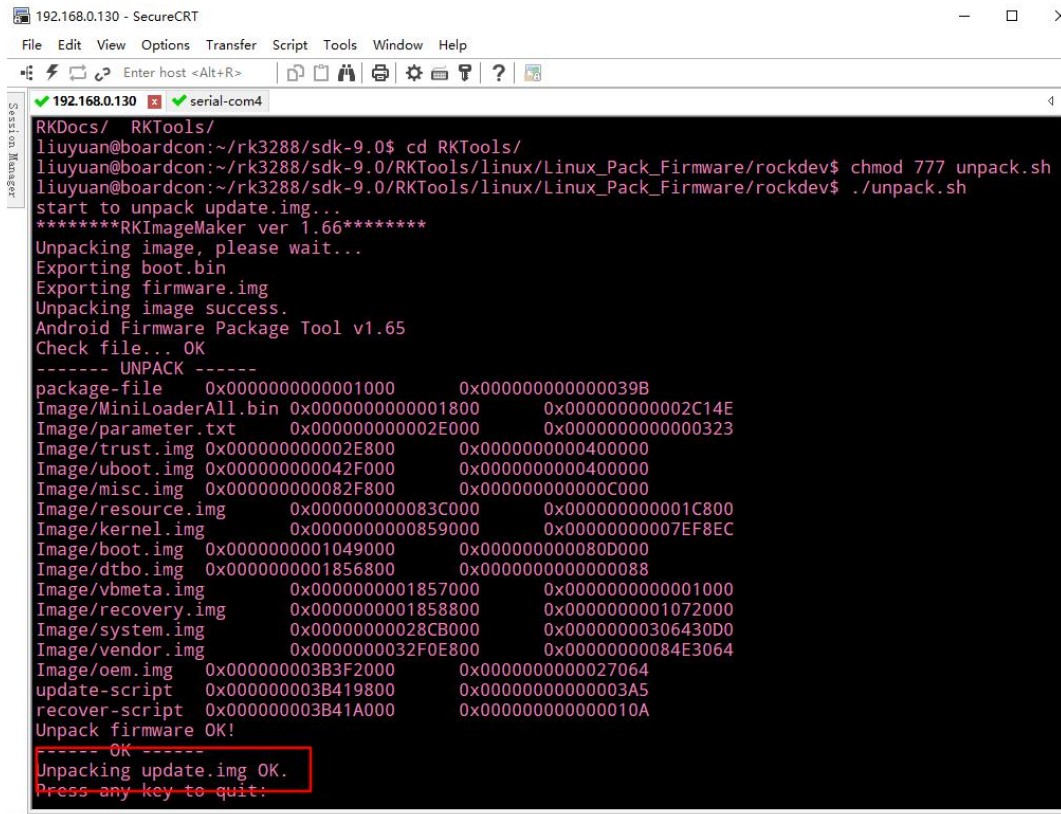
Step 2, execute the following command

```

# cd RKTools/linux/Linux_Pack_Firmware/rockdev/
# chmod 777 unpack.sh
# ./unpack.sh
# ls output/

```

ls output/Image/

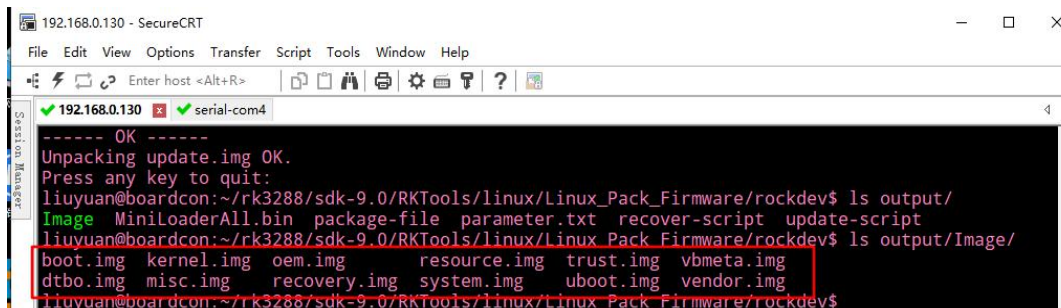


```

192.168.0.130 - SecureCRT
File Edit View Options Transfer Script Tools Window Help
Enter host <Alt+R>
192.168.0.130 serial-com4
RKDocs/ RKTools/
liuyuan@boardcon:~/rk3288/sdk-9.0$ cd RKTools/
liuyuan@boardcon:~/rk3288/sdk-9.0/RKTools/linux/Linux_Pack_Firmware/rockdev$ chmod 777 unpack.sh
liuyuan@boardcon:~/rk3288/sdk-9.0/RKTools/linux/Linux_Pack_Firmware/rockdev$ ./unpack.sh
start to unpack update.img...
*****RKImageMaker ver 1.66*****
Unpacking image, please wait...
Exporting boot.bin
Exporting firmware.img
Unpacking image success.
Android Firmware Package Tool v1.65
Check file... OK
----- UNPACK -----
package-file 0x0000000000001000 0x000000000000039B
Image/MiniLoaderAll.bin 0x0000000000001800 0x0000000000002C14E
Image/parameter.txt 0x000000000002E000 0x0000000000000323
Image/trust.img 0x0000000000002E800 0x00000000000400000
Image/uboot.img 0x0000000000042F000 0x00000000000400000
Image/misc.img 0x0000000000082F800 0x000000000000C000
Image/resource.img 0x0000000000083C000 0x000000000001C800
Image/kernel.img 0x00000000000859000 0x000000000007EF8EC
Image/boot.img 0x0000000001049000 0x0000000000080D000
Image/dtbo.img 0x00000000001856800 0x0000000000000088
Image/vbmeta.img 0x00000000001857000 0x0000000000001000
Image/recovery.img 0x00000000001858800 0x00000000001072000
Image/system.img 0x000000000028CB000 0x0000000000306430D0
Image/vendor.img 0x000000000032F0E800 0x0000000000084E3064
Image/oem.img 0x00000000003B3F2000 0x00000000000027064
update-script 0x00000000003B419800 0x000000000000003A5
recover-script 0x00000000003B41A000 0x0000000000000010A
Unpack firmware OK!
----- OK -----
Unpacking update.img OK.
Press any key to quit:

```

The unzip files will be generated in **output** directory.



```

192.168.0.130 - SecureCRT
File Edit View Options Transfer Script Tools Window Help
Enter host <Alt+R>
192.168.0.130 serial-com4
----- OK -----
Unpacking update.img OK.
Press any key to quit:
liuyuan@boardcon:~/rk3288/sdk-9.0/RKTools/linux/Linux_Pack_Firmware/rockdev$ ls output/
Image MiniLoaderAll.bin package-file parameter.txt recover-script update-script
liuyuan@boardcon:~/rk3288/sdk-9.0/RKTools/linux/Linux_Pack_Firmware/rockdev$ ls output/Image/
boot.img kernel.img oem.img resource.img trust.img vbmeta.img
dtbo.img misc.img recovery.img system.img uboot.img vendor.img
liuyuan@boardcon:~/rk3288/sdk-9.0/RKTools/linux/Linux_Pack_Firmware/rockdev$

```

Unzip Firmware in windows.

Step 1, copy **update.img** to the windows directory **AndroidTool_Release_v2.65/rockdev/**

Step 2, open Command Prompt then execute the following command in CMD

RKImageMaker.exe -unpack ./update.img ./

```

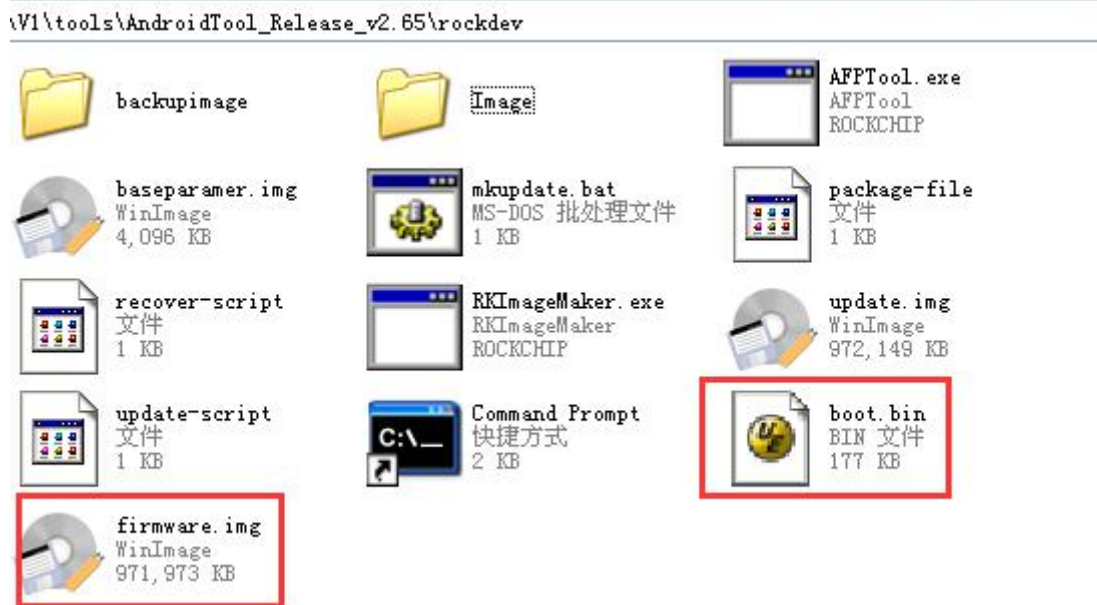
C:\> Command Prompt
Microsoft Windows XP [版本 5.1.2600]
(C) 版权所有 1985-2001 Microsoft Corp.

E:\CD\EM3288\Android9.0\U1\tools\AndroidTool_Release_v2.65\rockdev>RKImageMaker.
exe -unpack ./update.img ./
*****RKImageMaker ver 1.66 *****
Unpacking image, please wait...
Exporting boot.bin
Exporting firmware.img
Unpacking image success.

E:\CD\EM3288\Android9.0\U1\tools\AndroidTool_Release_v2.65\rockdev>_

```

After unzip the file to get boot.bin and firmware.img



Step 3, execute the following command in CMD to unzip **firmware.img**

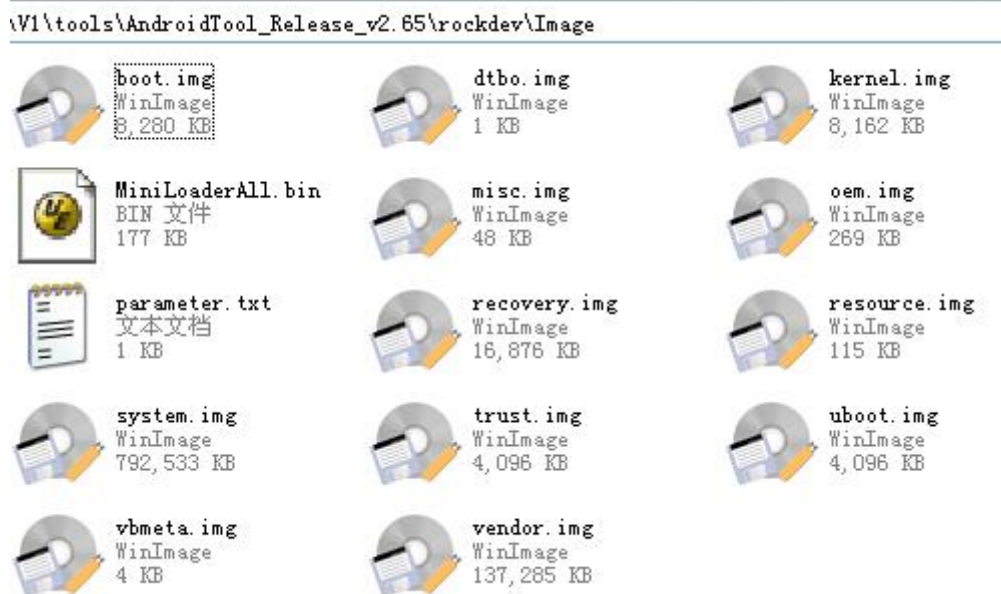
AFPTool.exe -unpack firmware.img ./

```

c:\ Command Prompt
E:\CD\EM3288\Android9.0\V1\tools\AndroidTool_Release_v2.65\rockdev>
E:\CD\EM3288\Android9.0\V1\tools\AndroidTool_Release_v2.65\rockdev>APPTool.exe -
unpack firmware.img ./
Android Firmware Package Tool v1.65
Check file... OK
----- UNPACK -----
package-file      0x00000000000001000      0x000000000000039B
Image/MiniLoaderAll.bin  0x0000000000001800      0x0000000000002C14E
Image/parameter.txt    0x0000000000002E000      0x0000000000000324
Image/trust.img        0x0000000000002E800      0x00000000000040000
Image/uboot.img        0x00000000000042F000     0x00000000000040000
Image/misc.img         0x00000000000082F800     0x000000000000C000
Image/resource.img     0x00000000000083C000     0x0000000000001CC00
Image/kernel.img       0x000000000000859000     0x0000000000007F842C
Image/boot.img         0x000000000001051800     0x000000000000816000
Image/dtbo.img         0x000000000001868000     0x0000000000000088
Image/vbmeta.img       0x000000000001868800     0x00000000000001000
Image/recovery.img     0x00000000000186A000     0x00000000000107B000
Image/system.img       0x0000000000028E5800     0x00000000000305F50AC
Image/vendor.img       0x0000000000032EDB000     0x0000000000008611064
Image/oem.img          0x000000000003B4EC800     0x00000000000043034
update-script         0x000000000003B530000     0x00000000000003A5
recover-script        0x000000000003B530800     0x0000000000000010A
Unpack firmware OK!
----- OK -----
E:\CD\EM3288\Android9.0\V1\tools\AndroidTool_Release_v2.65\rockdev>

```

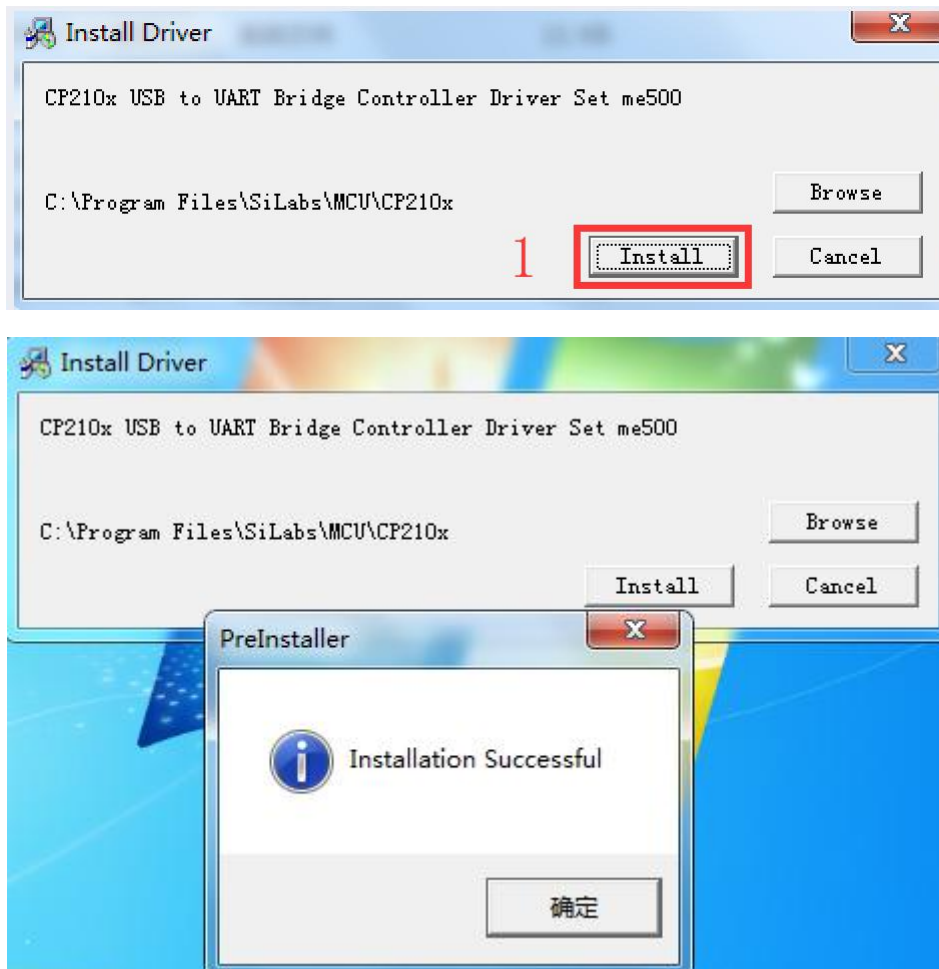
The unzip files will be generated in **AndroidTool_Release_v2.65\rockdev\Image** directory



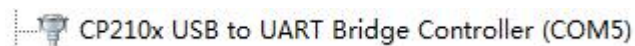
5 Install Tools

5.1 Install CP2102 Driver

Plug the **USB-to-UART cable CP2102** to the PC, unzip **CP2102WIN7.rar** on Windows, then click **preInstaller.exe** to install

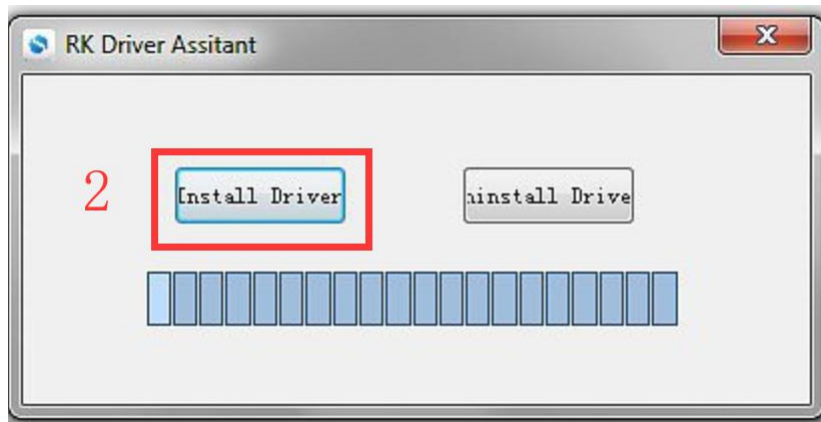
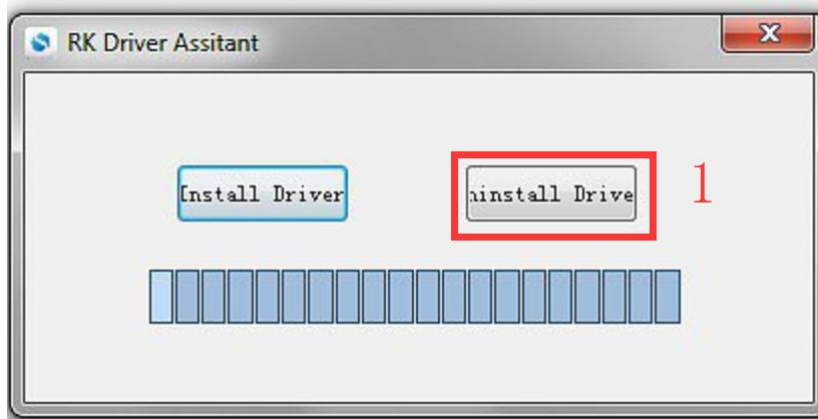


Now the device will be listed under **Device Manager** -> **PORTS** with unique serial port assigned

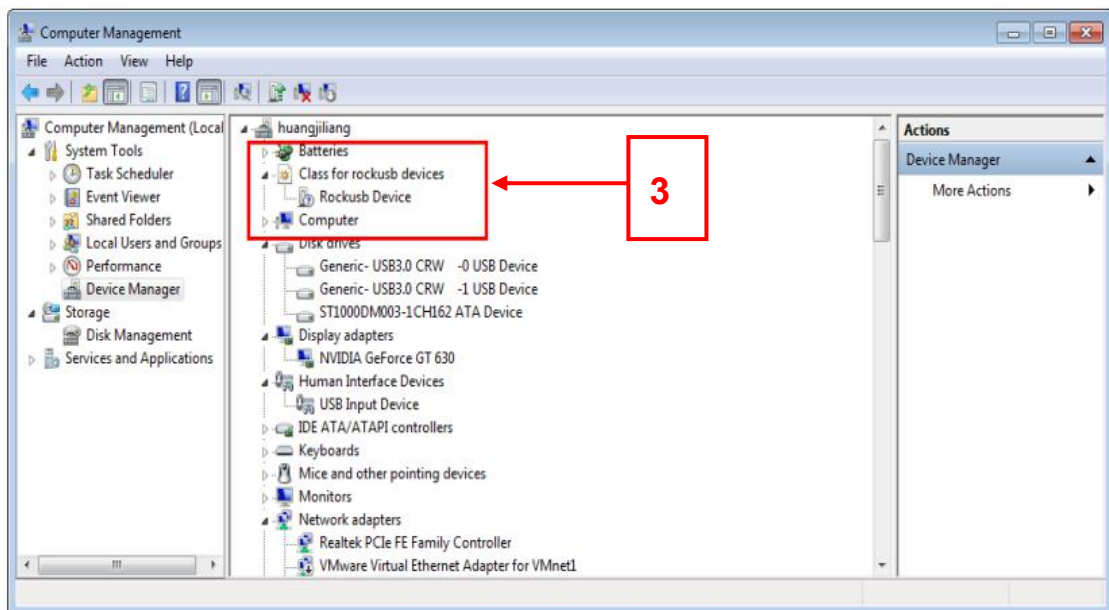


5.2 Install Rockchip Driver Assistant

Path: Release_DriverAssitant/DriverInstall.exe



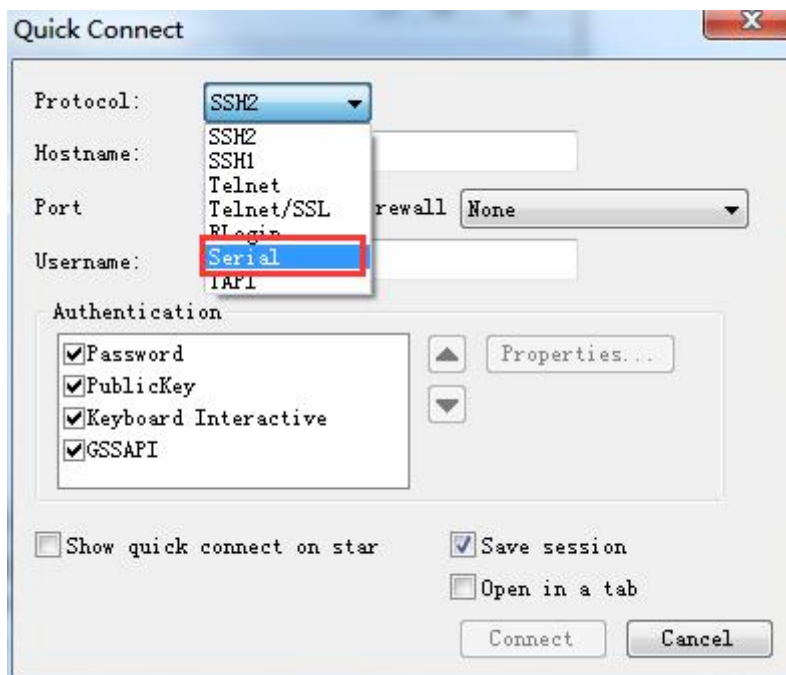
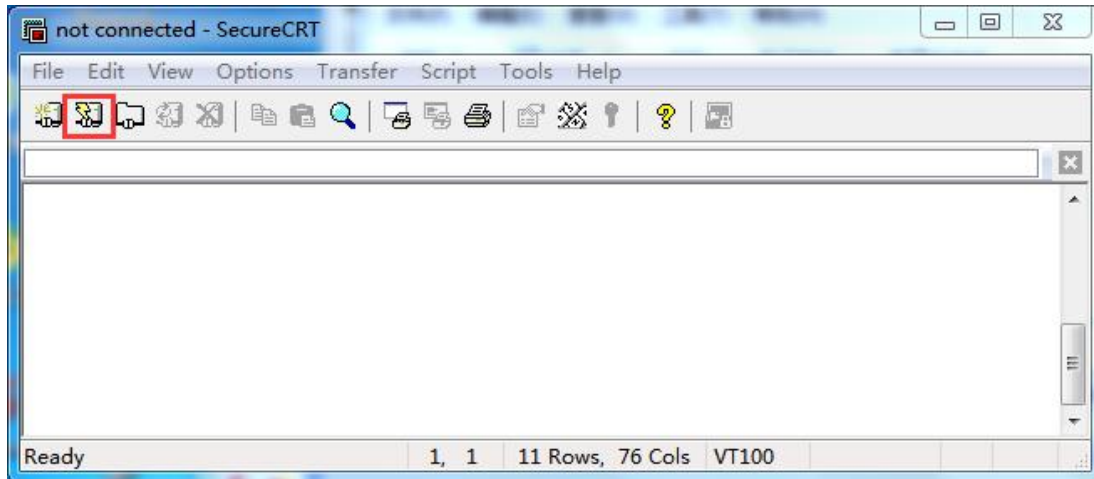
After the installation is complete, connect the board and PC with Micro USB cable (USB powered), in *Computer Management* can see the following information:



5.3 Install Serial Terminal Tool

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

Open SecureCRT.exe after copy to PC (path: tools\windows\SecureCRT.exe), then click the icon **Quick Connect** to config.



Set the parameters as follow:

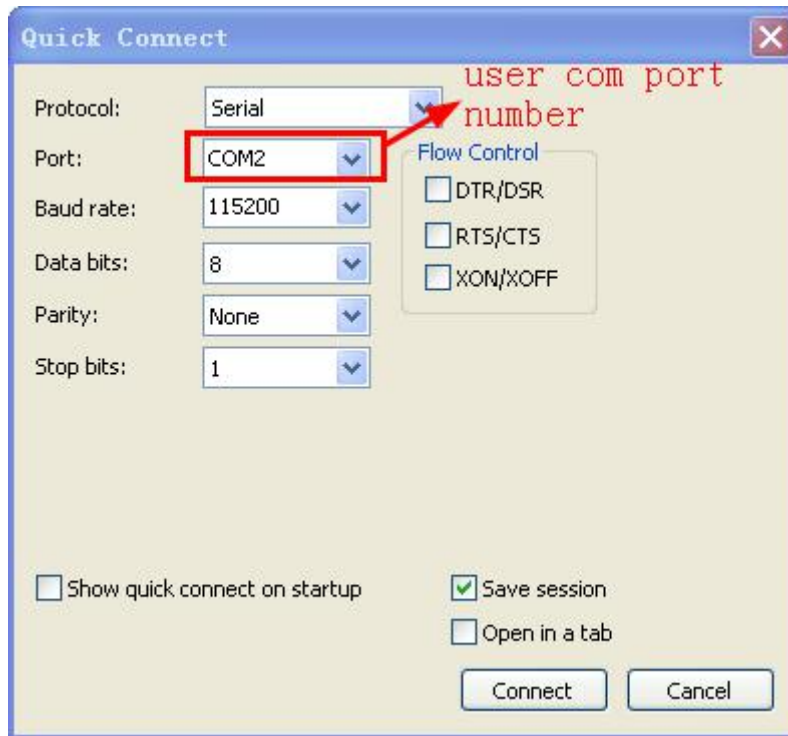
Protocol: Serial

Port: To be specified by user PC

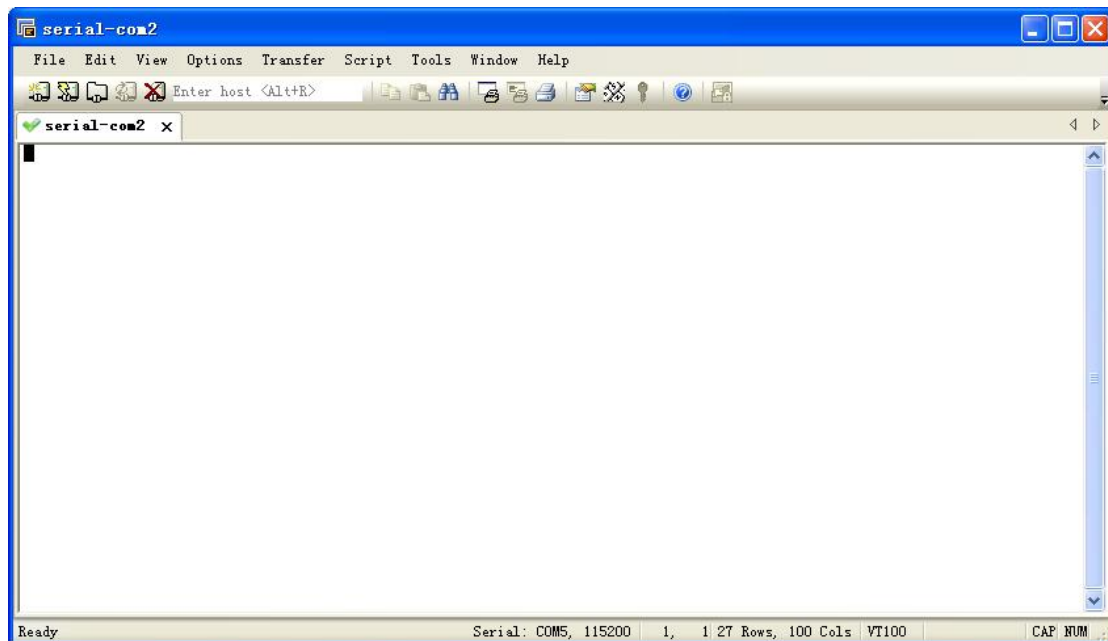
Baud rate: 115200

Please check XON/XOFF but not RTS/CTS

Check Save session



After all, click **connect**



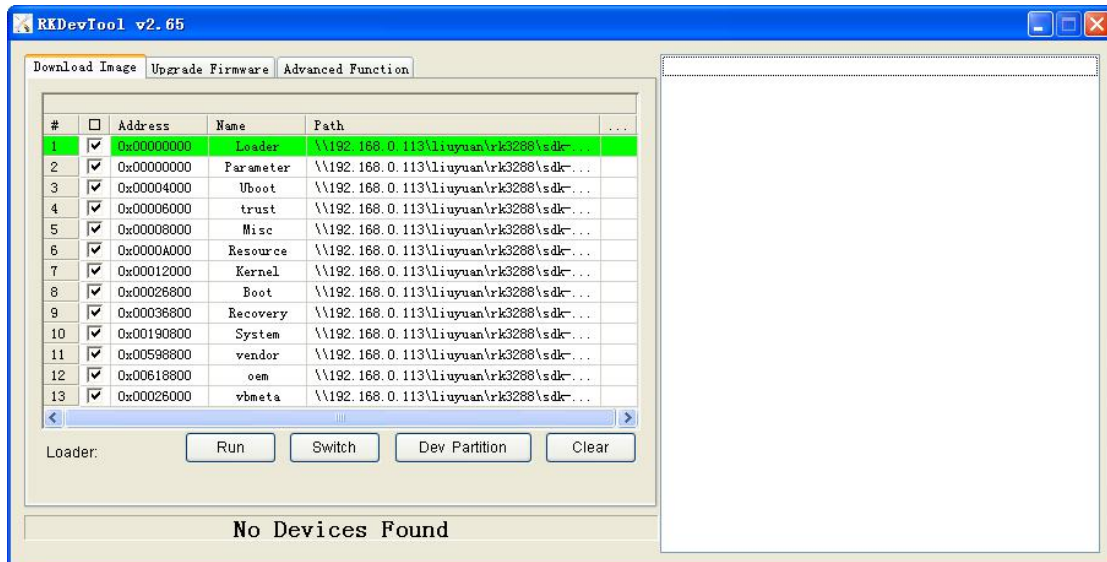
Illusion: If open more than one serial terminal tools, and they use the same serial port, there will be reported **the port is busy**.

Solution: Turn off the serial tool that unnecessary.

6 Burn Images

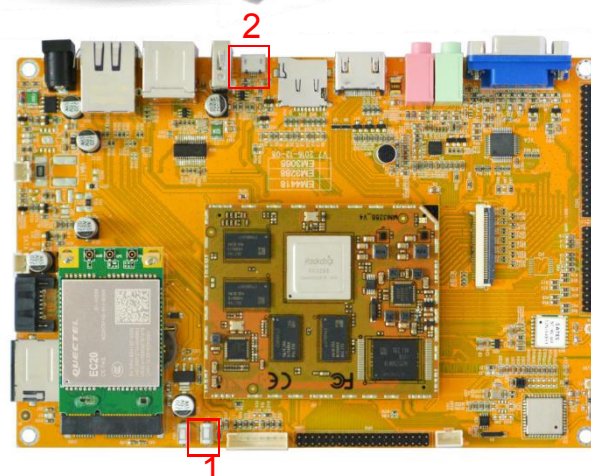
Step 1, unzip **AndroidTool_Release_v2.65** on Windows.

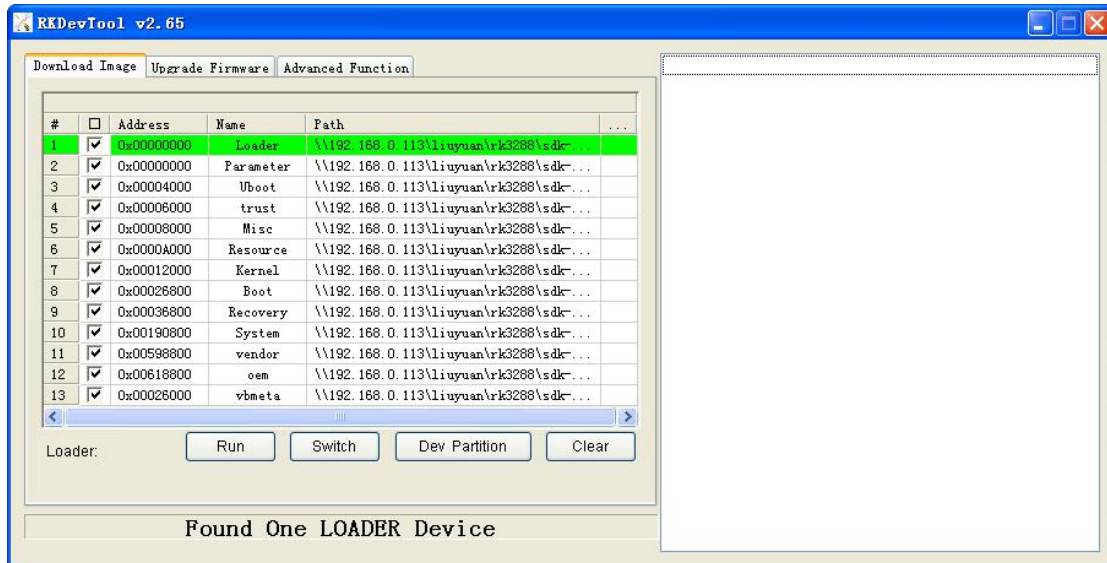
Step 2, open **AndroidTool.exe** (Path: *AndroidTool_Release_v2.65\AndroidTool.exe*)



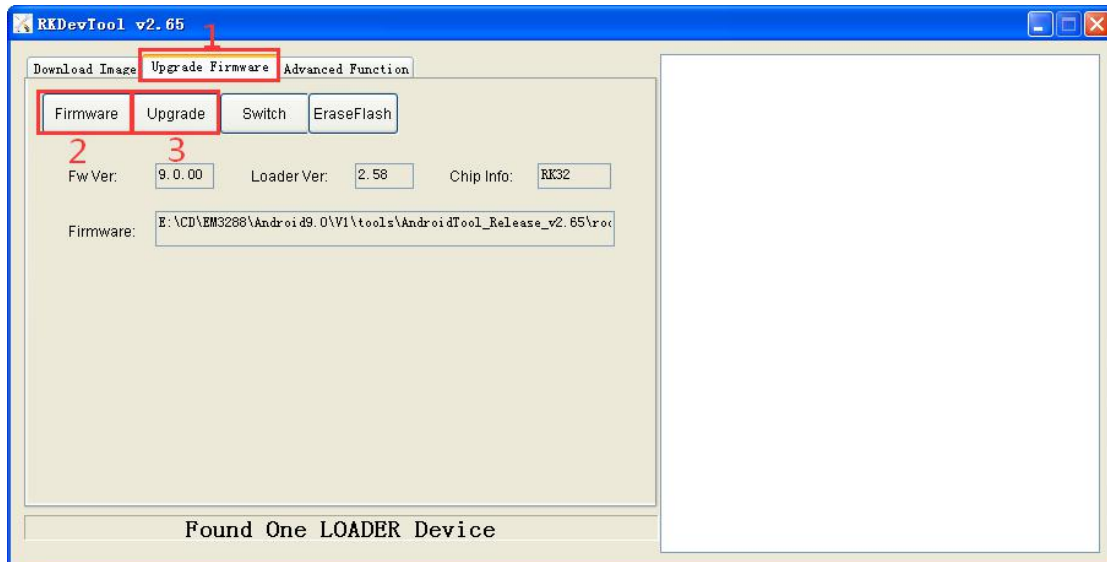
Step 3, keep pressing the **Recover Key**, then connect PC and development board with Micro USB cable until the windows PC shows **Found one LOADER Device**.

The USB power supply is only available for programming, and the current is not enough for the board to run.

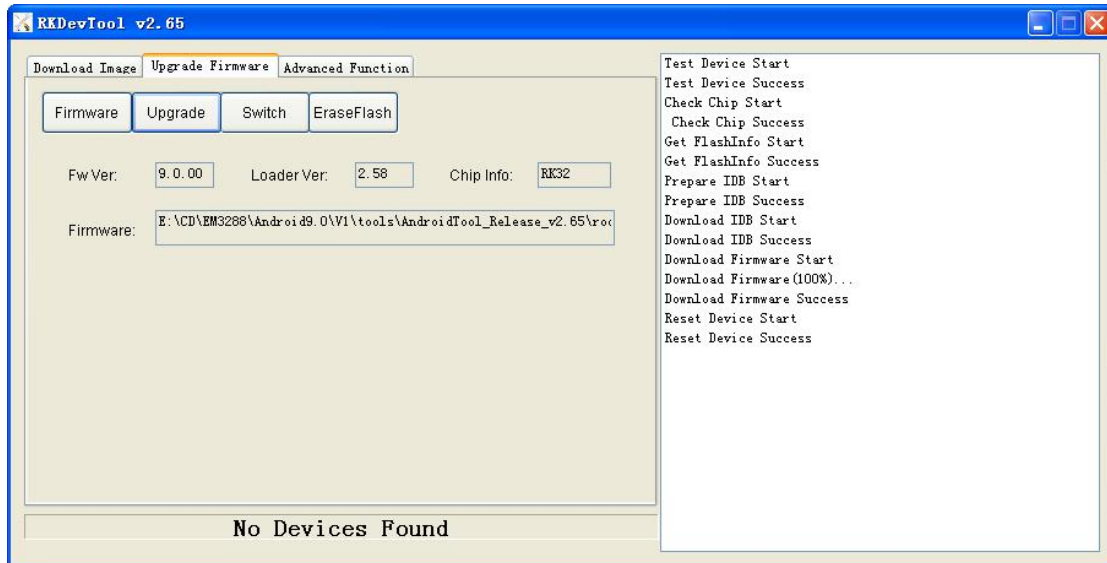




Step 4, click **Upgrade Firmware** -> **Firmware**, select **update.img**. Click **Upgrade** to flash.



Download complete.

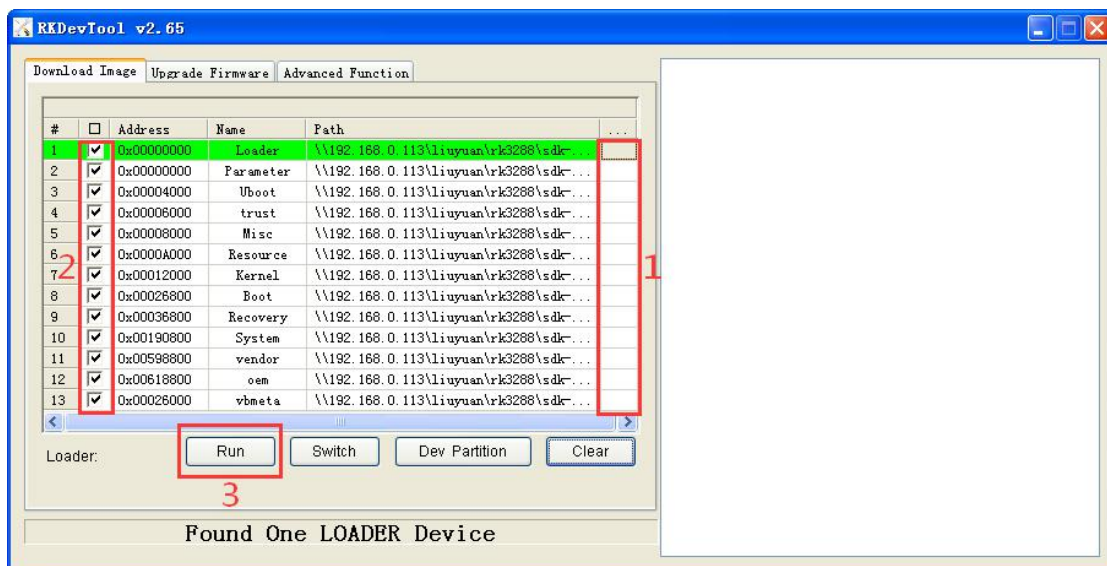


User can also update the firmware separately.

Step 1, Click the column on the right side for the path of the file want to flash.

Step 2, Select the checkbox on the left.

Step 3, Click “run” to flash the image.



7 Android Application

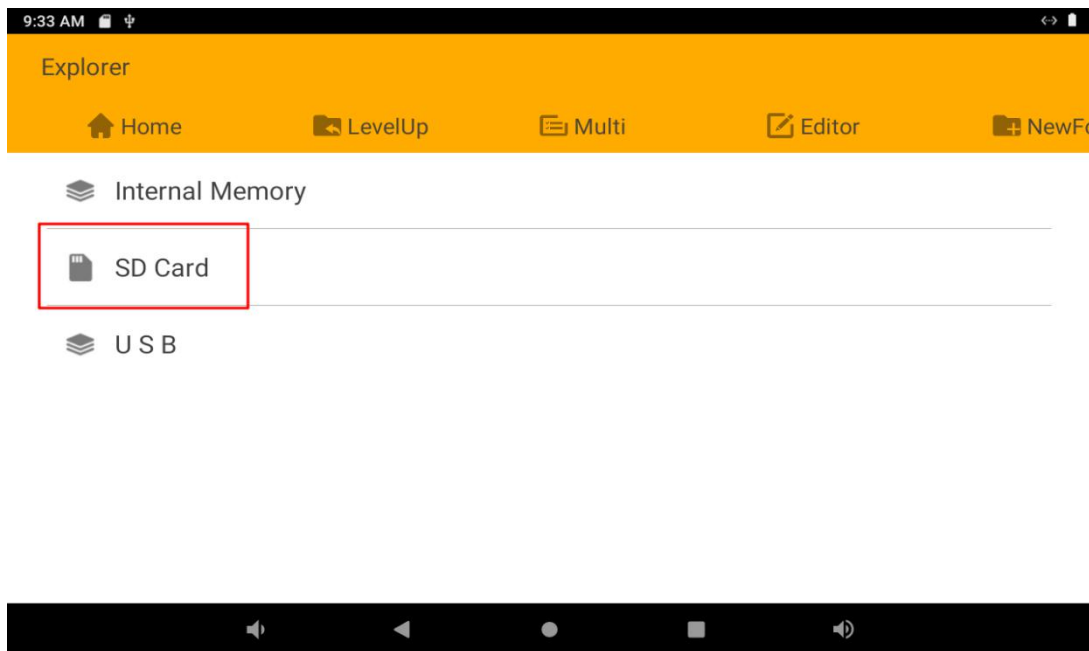
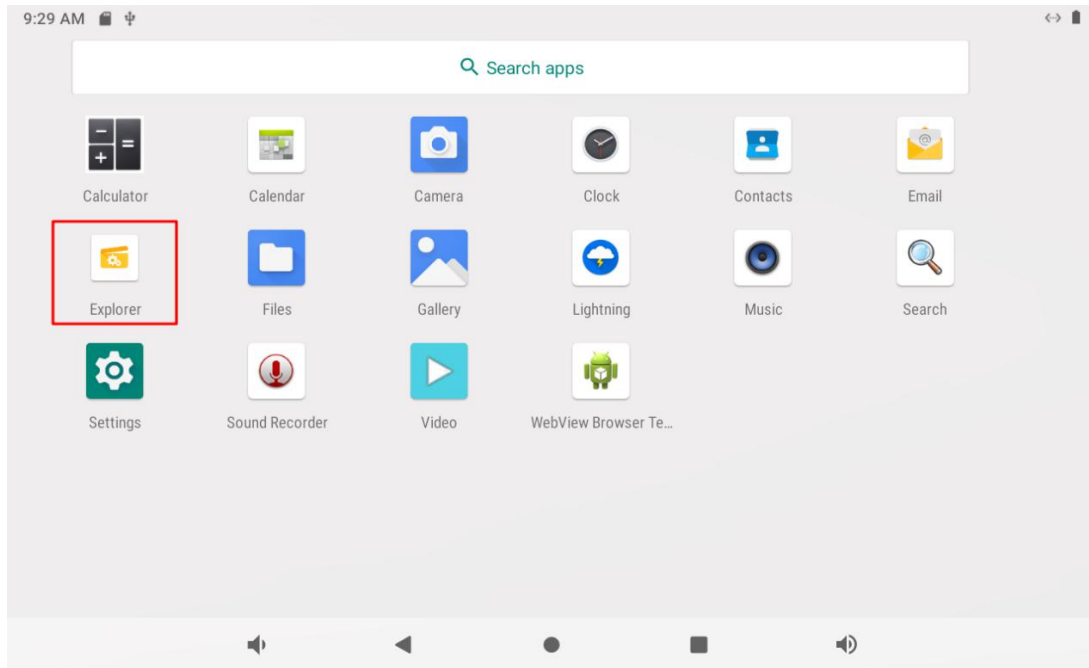
7.1 HDMI Display

Connect the board and monitor with a HDMI cable, then start up.



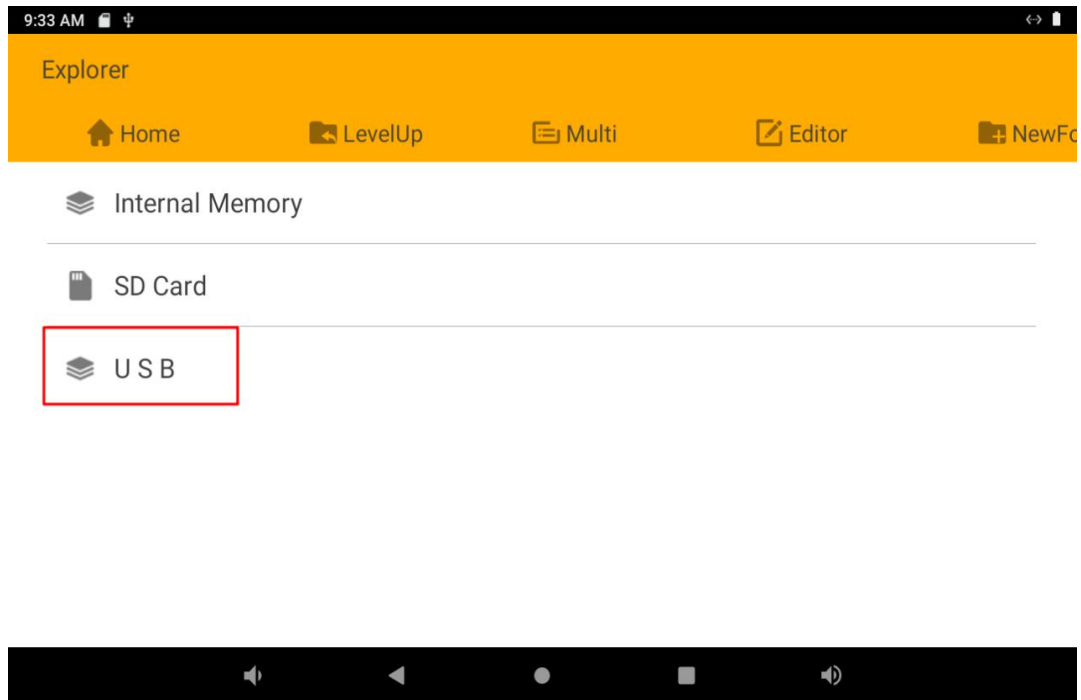
7.2 SD Card

EM3288 supports SD Hot-plug.



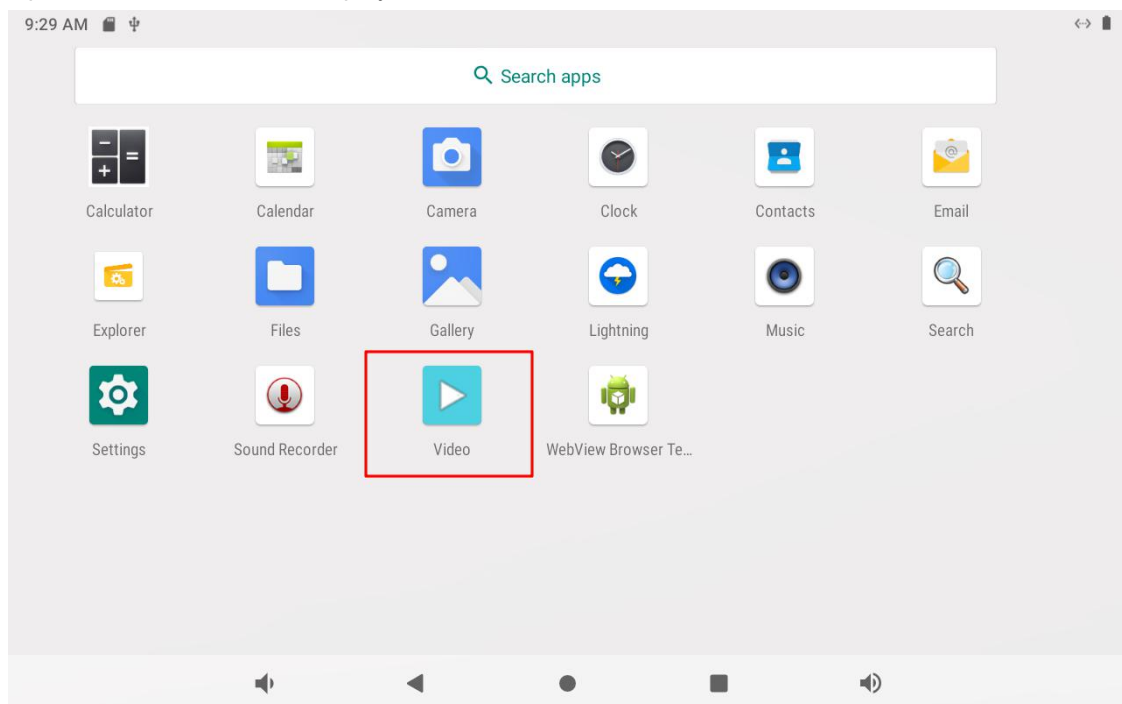
7.3 USB Host

The USB Host can be used to connect USB mouse, USB keyboard, U-Disk or other USB devices.



7.4 Video Player

Open **Video** and select file to play.



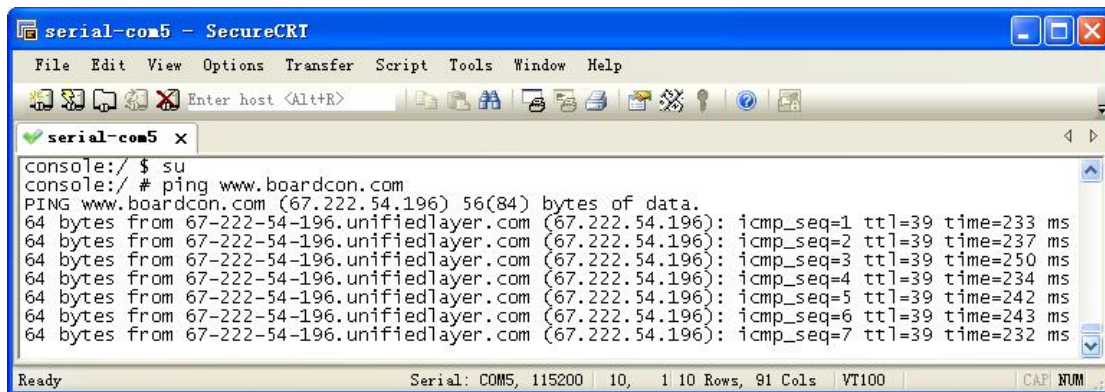


7.5 Ethernet

Connect the Board and router with an Ethernet cable (default DHCP=Yes). User can ping URL/IP at terminal, or open the browser to test Network.

su

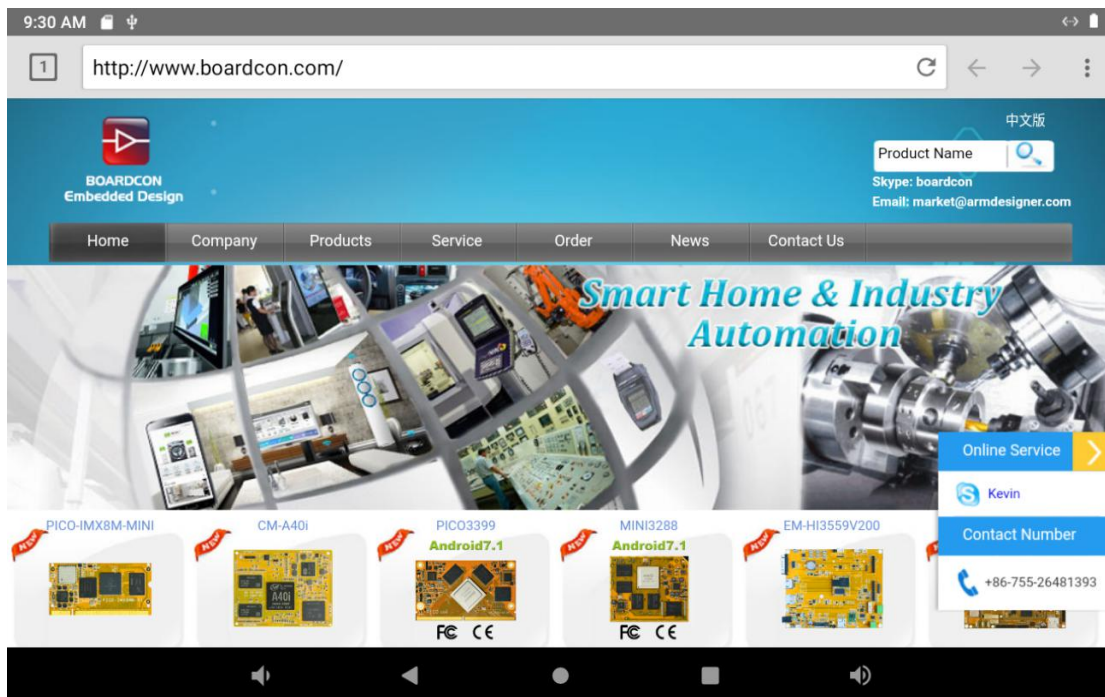
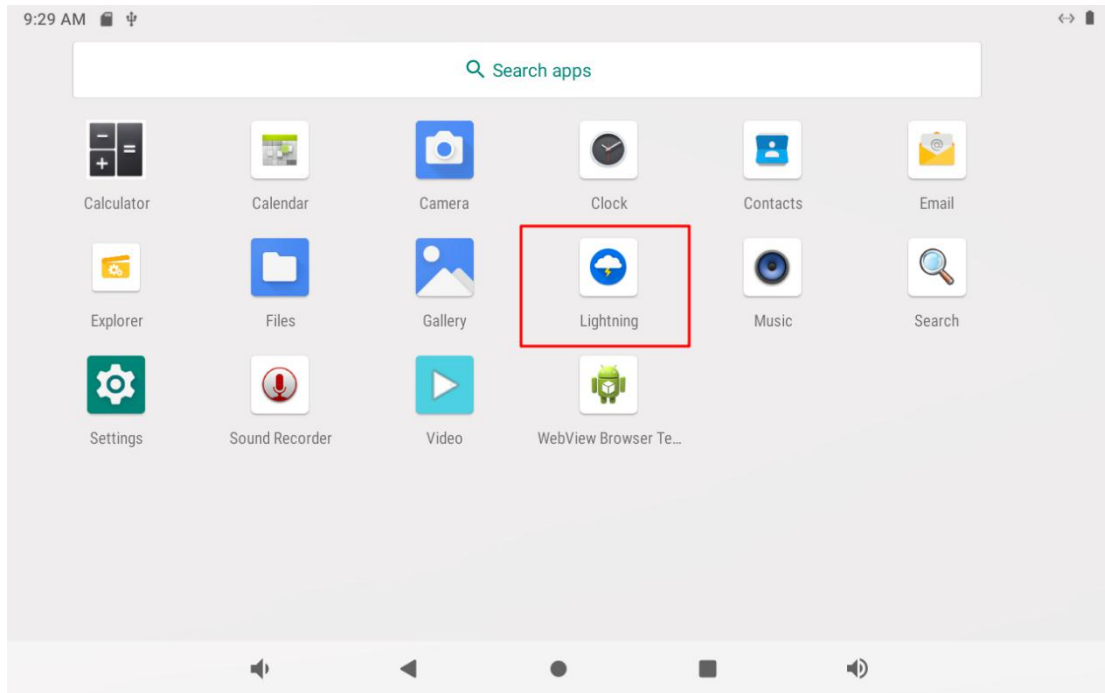
ping www.boardcon.com



```

serial-com5 - SecureCRT
File Edit View Options Transfer Script Tools Window Help
Enter host <Alt+R>
serial-com5 x
console:/ $ su
console:/ # ping www.boardcon.com
PING www.boardcon.com (67.222.54.196) 56(84) bytes of data:
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=1 ttl=39 time=233 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=2 ttl=39 time=237 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=3 ttl=39 time=250 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=4 ttl=39 time=234 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=5 ttl=39 time=242 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=6 ttl=39 time=243 ms
64 bytes from 67-222-54-196.unifiedlayer.com (67.222.54.196): icmp_seq=7 ttl=39 time=232 ms
Ready Serial: COM5, 115200 10, 1 10 Rows, 91 Cols VT100 CAP NUM

```

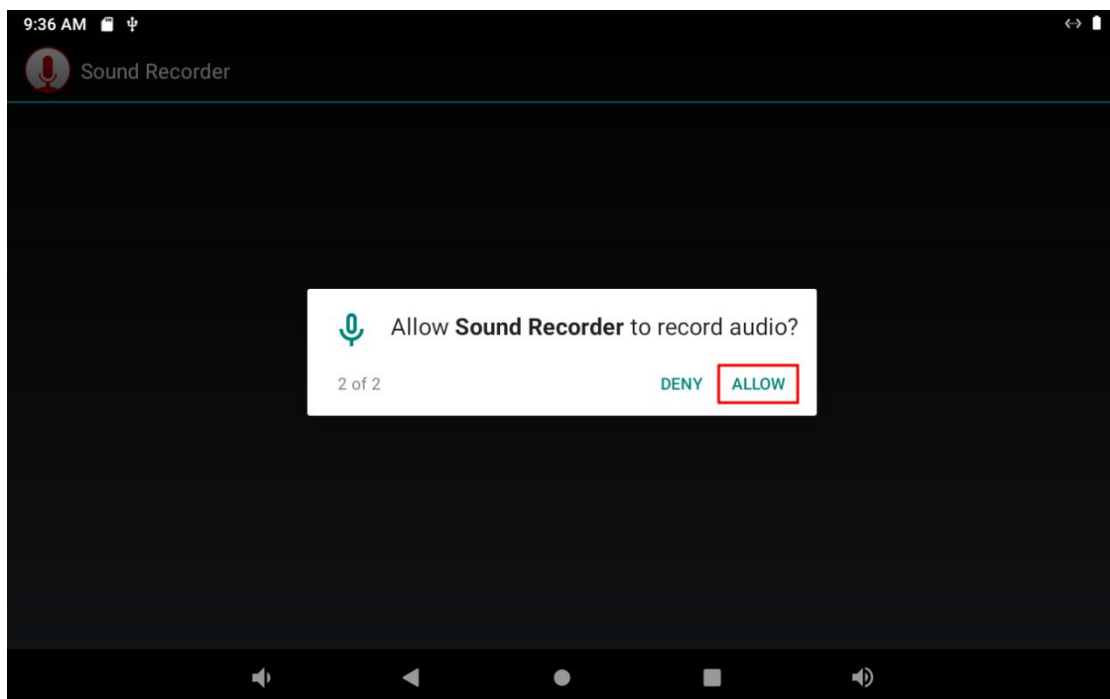
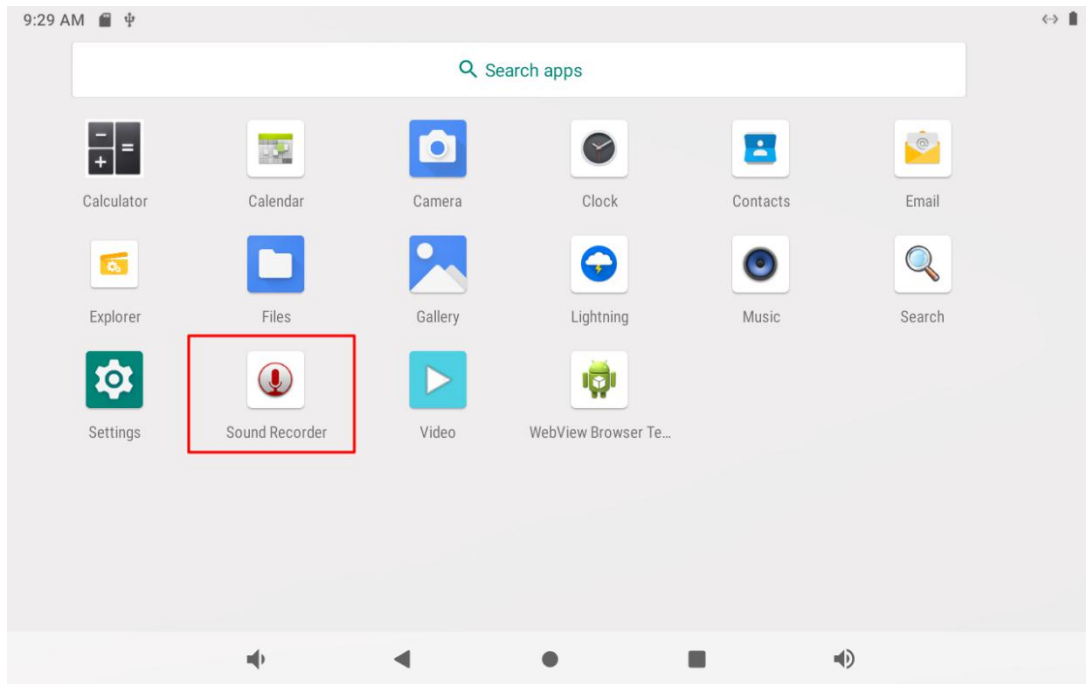



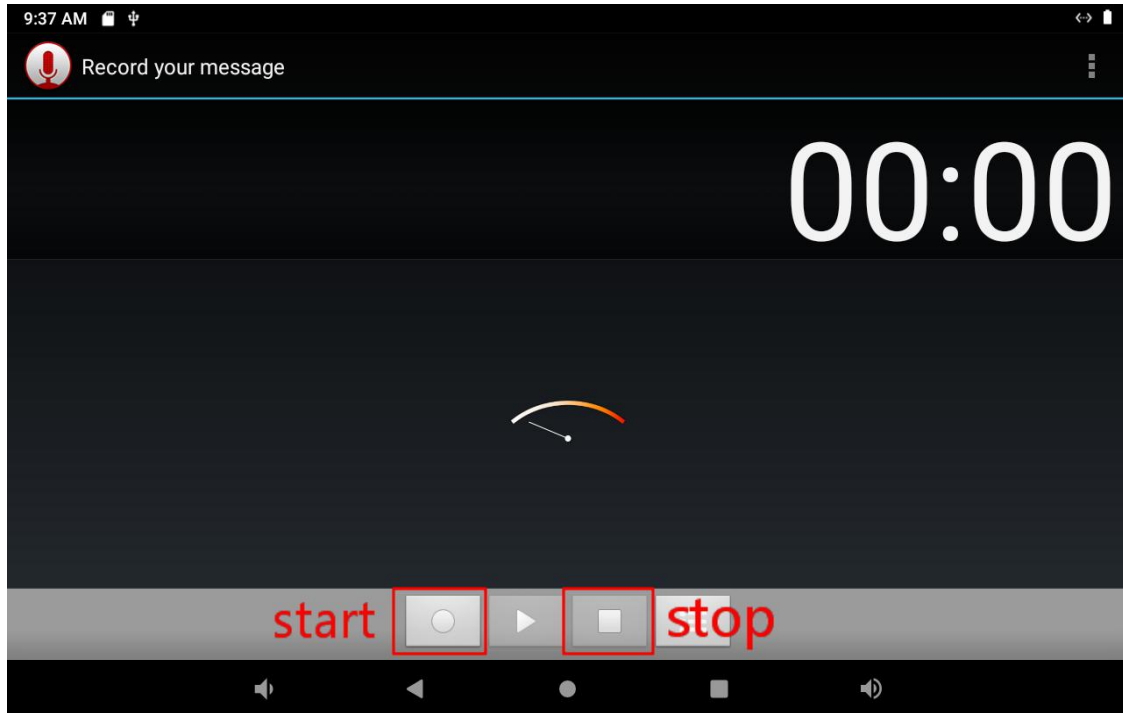
7.6 Record

Step 1, open the APP Recorder in Android.

Step 2, click on the APP to start recording, speech in front of the microphone then can record.

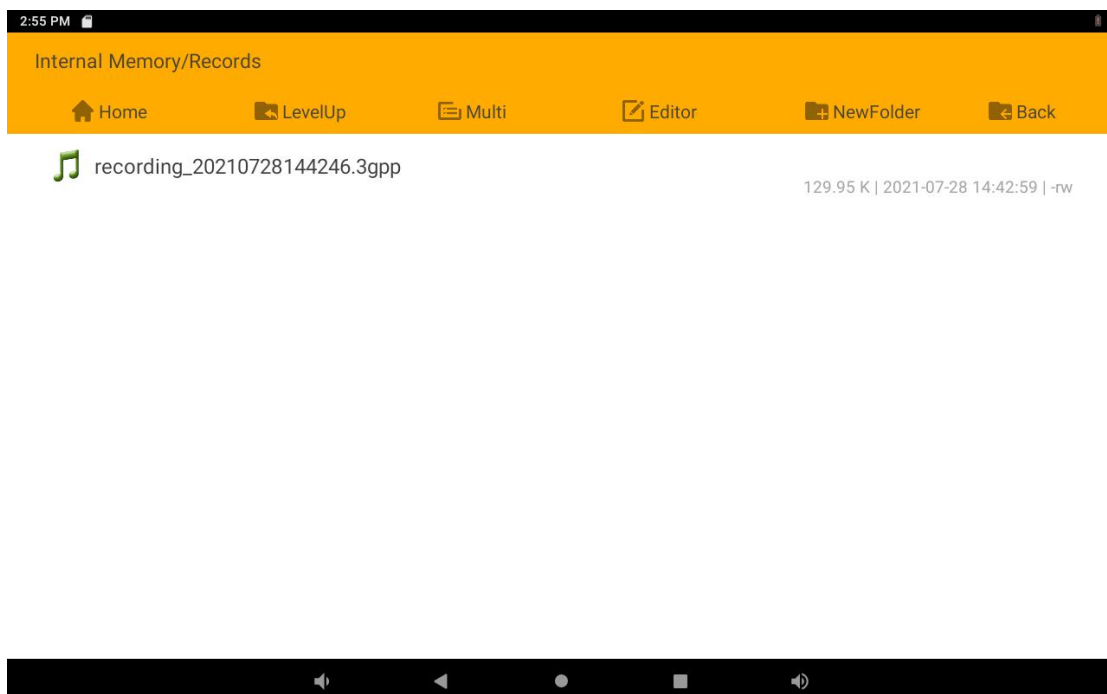
Note: Default microphone recording, if inserted the headset will switch to the headset recording automatically.





After finish recording, click **stop** menu and select **Save** to store file.

The default storage path is
Internal Memory/Records

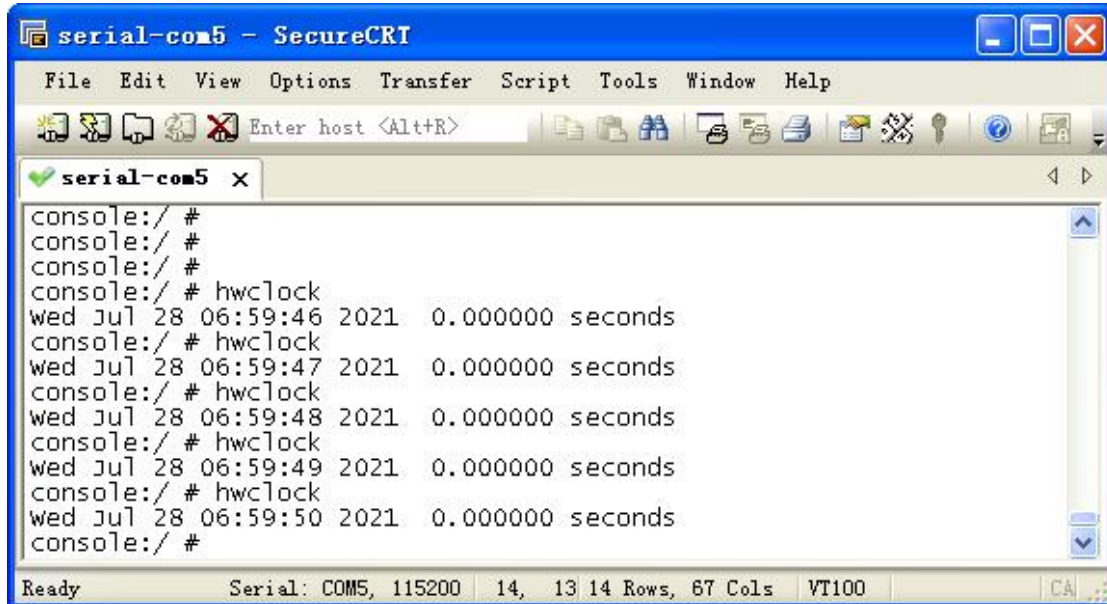


7.7 RTC

Execute the command **hwclock** at CRT terminal

hwclock

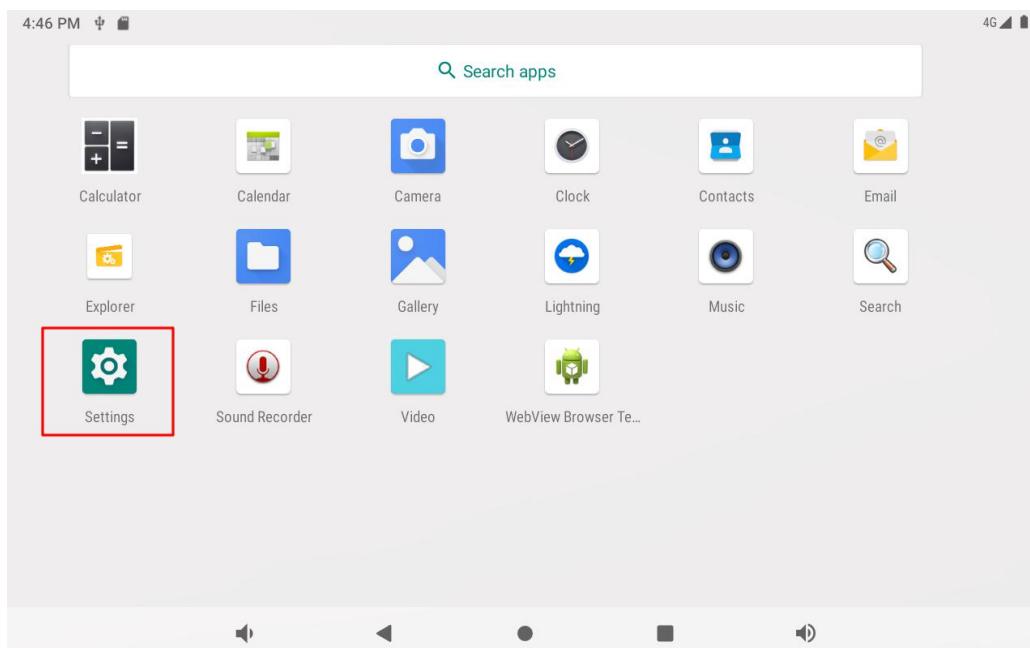
Wait a minute then run **hwclock** again, it can be seen the time has changed.

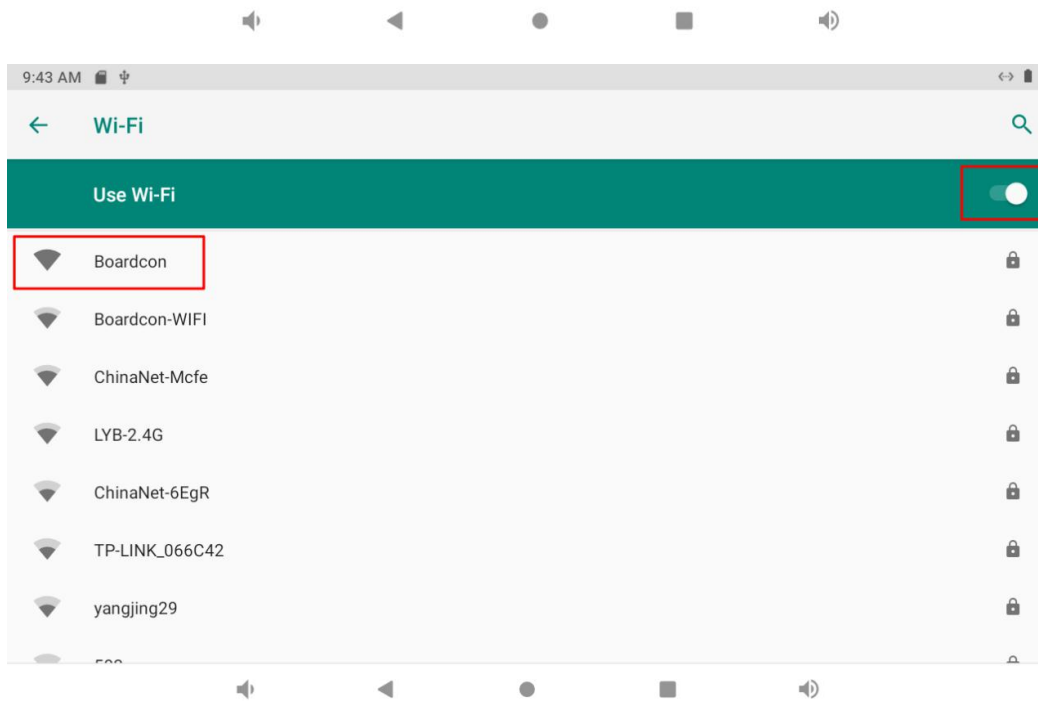
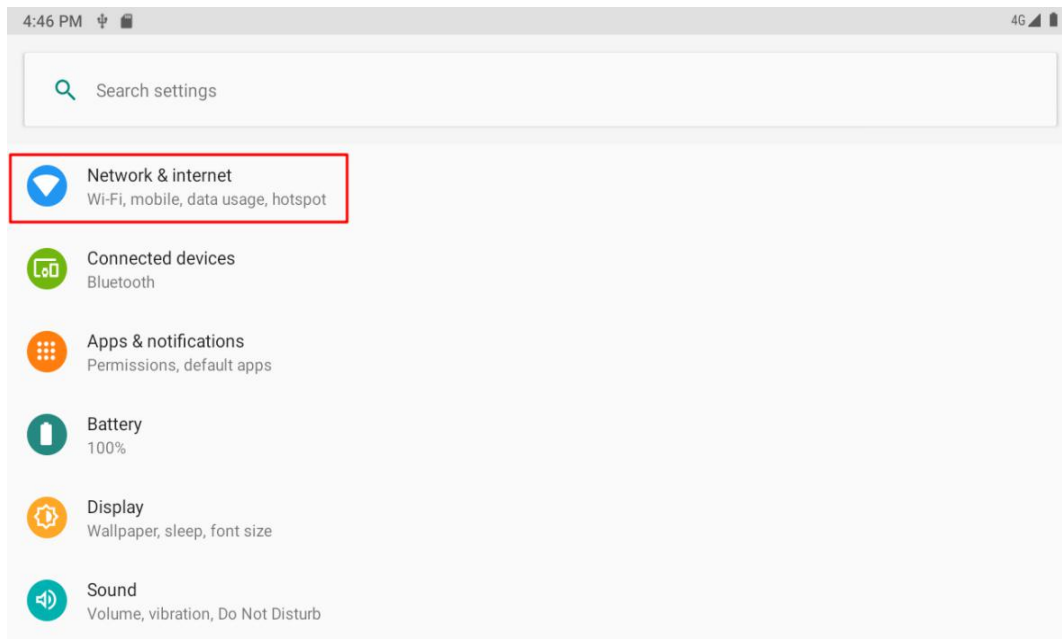


7.8 WiFi

Connect the WiFi antenna, then click **Settings -> Network&internet -> WiFi -> turn on**, select the SSID from the list of available networks and enter the password.

After connected, user can open the browser to browse the web.

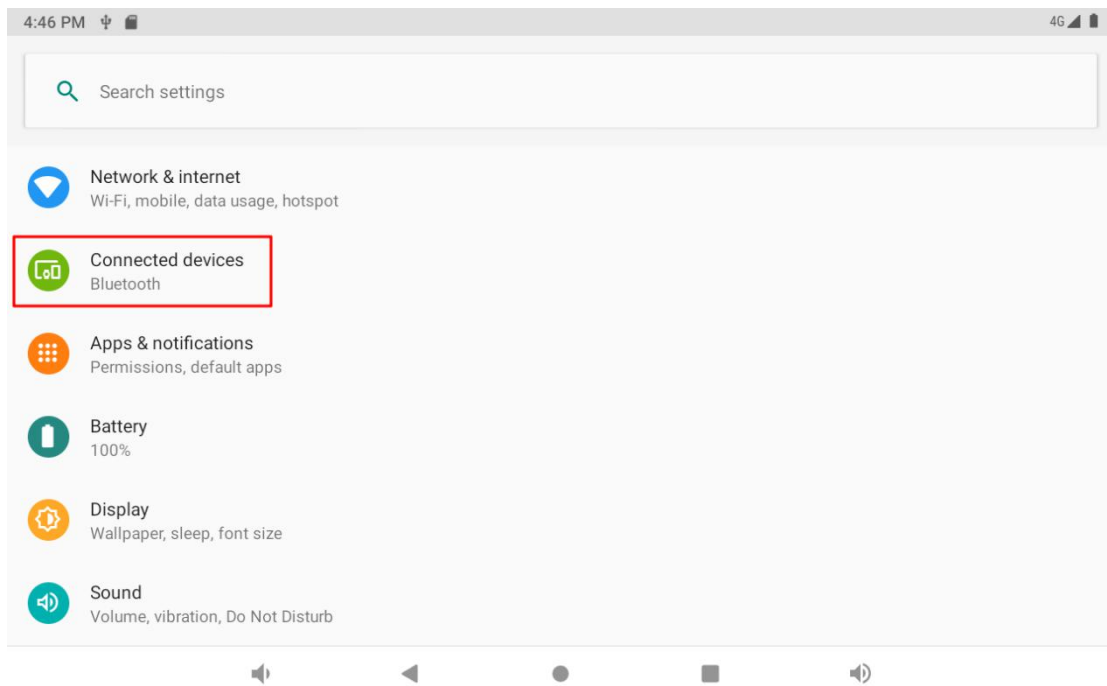
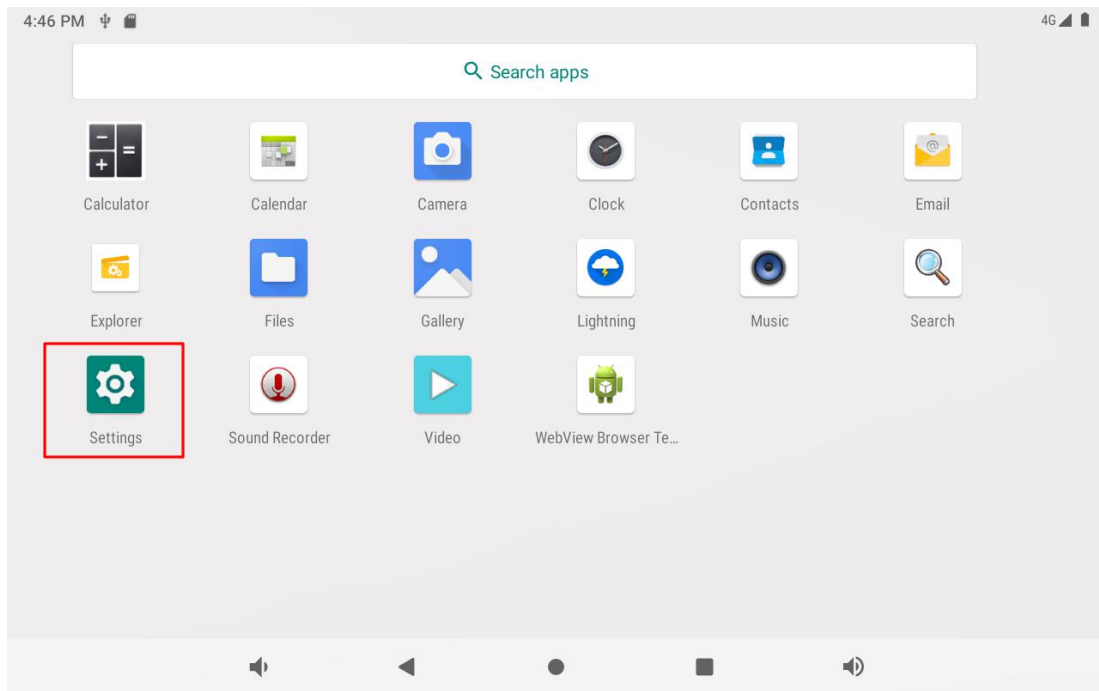


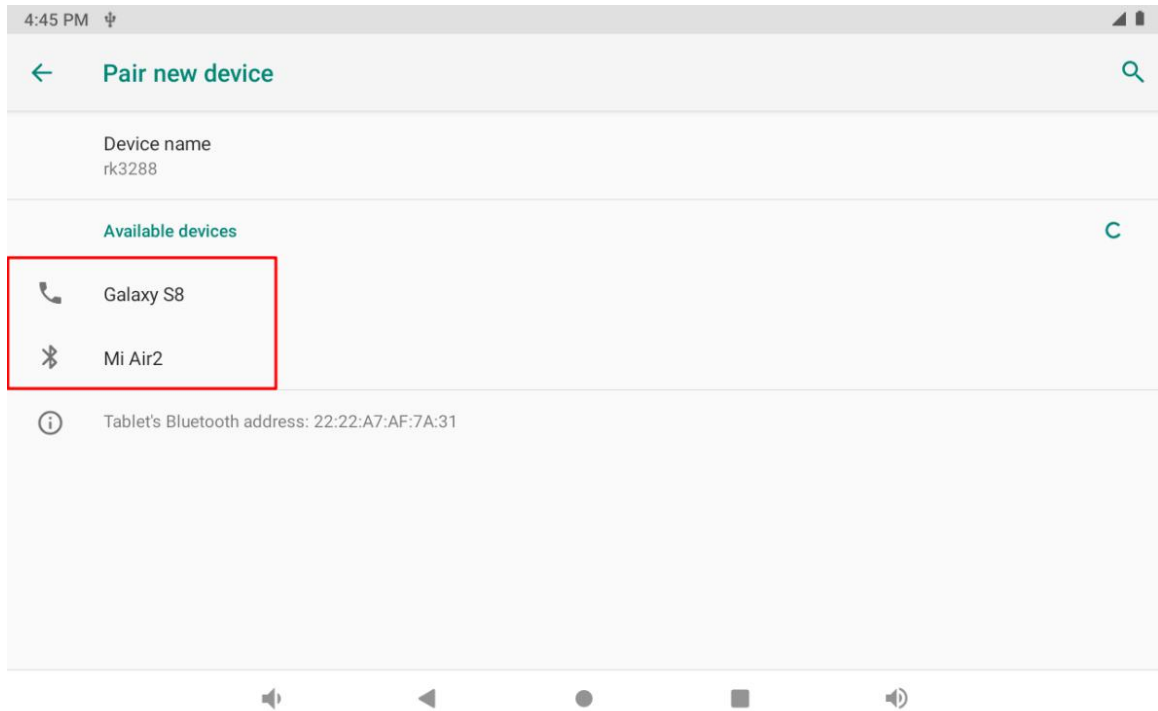


7.9 Bluetooth

Click **Settings** -> **Connected devices(Bluetooth)** -> **Connection preferences** -> **Bluetooth** -> **turn on**

Select the available device in the list to pair.





After pairing, devices can connect with each other automatically

7.10 4G Network

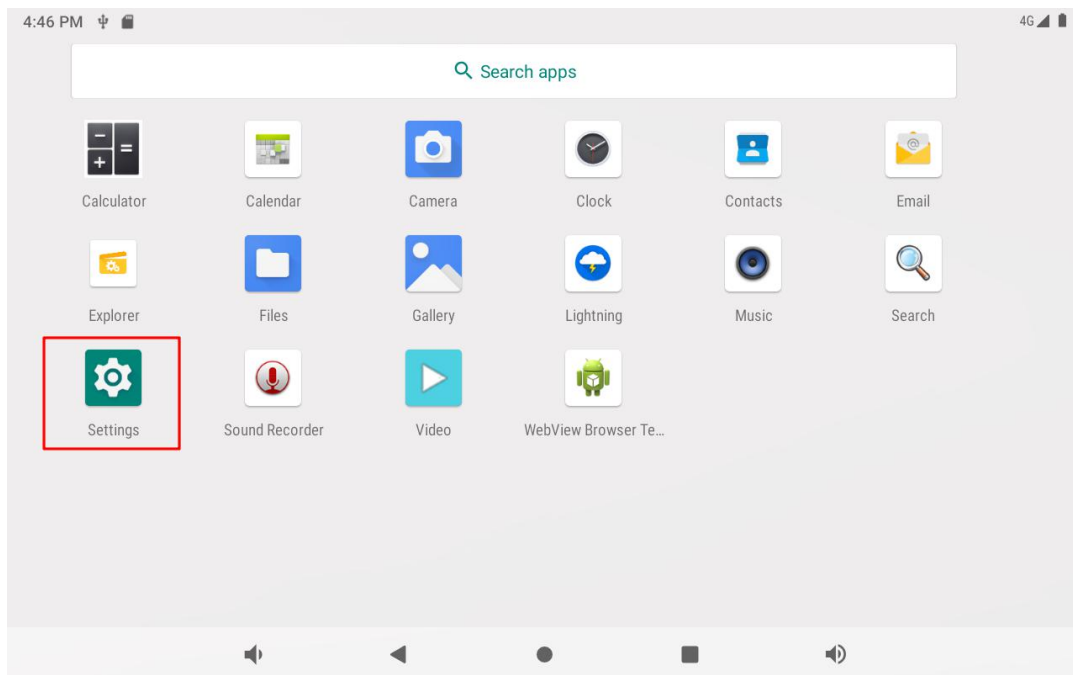
Step 1, Insert 4G module to PCI-E slot (4G model:EC20).

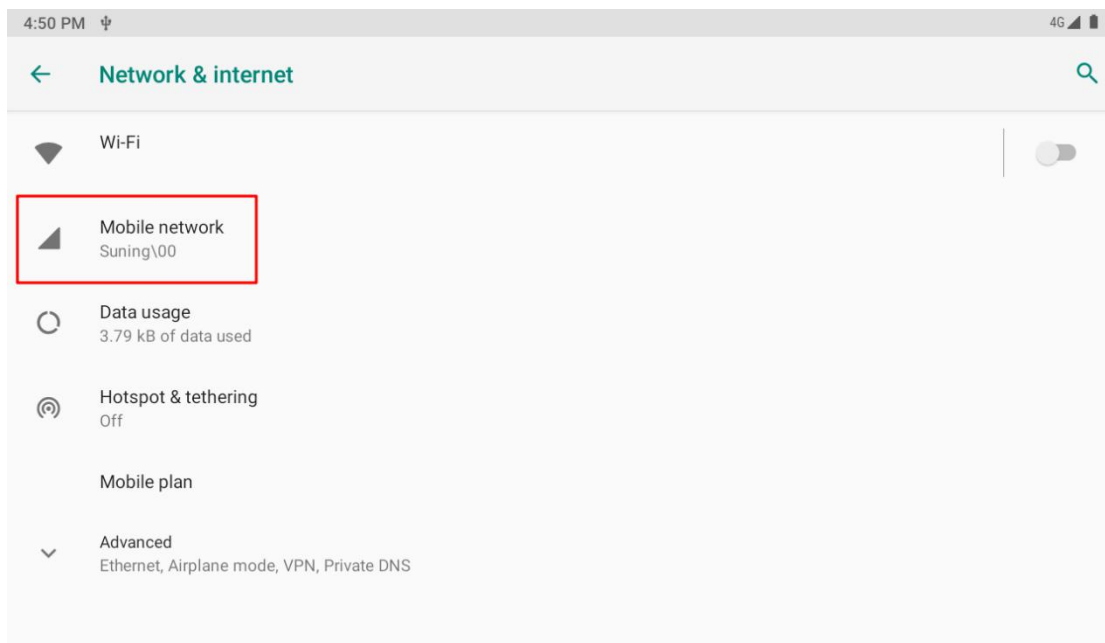
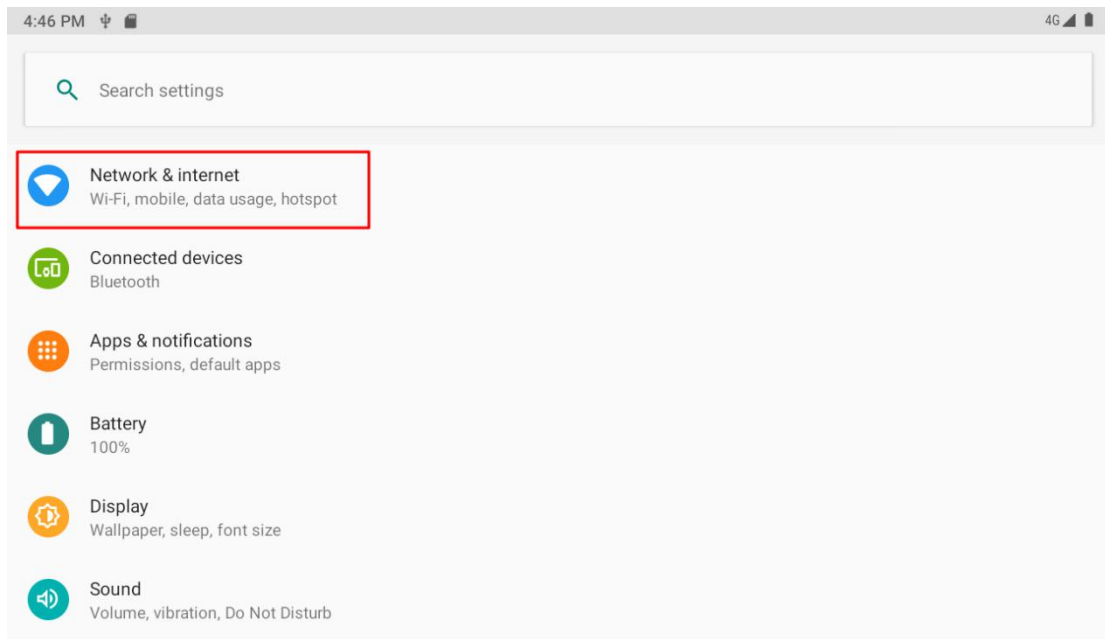
Step 2, Connect antenna and insert SIM card.

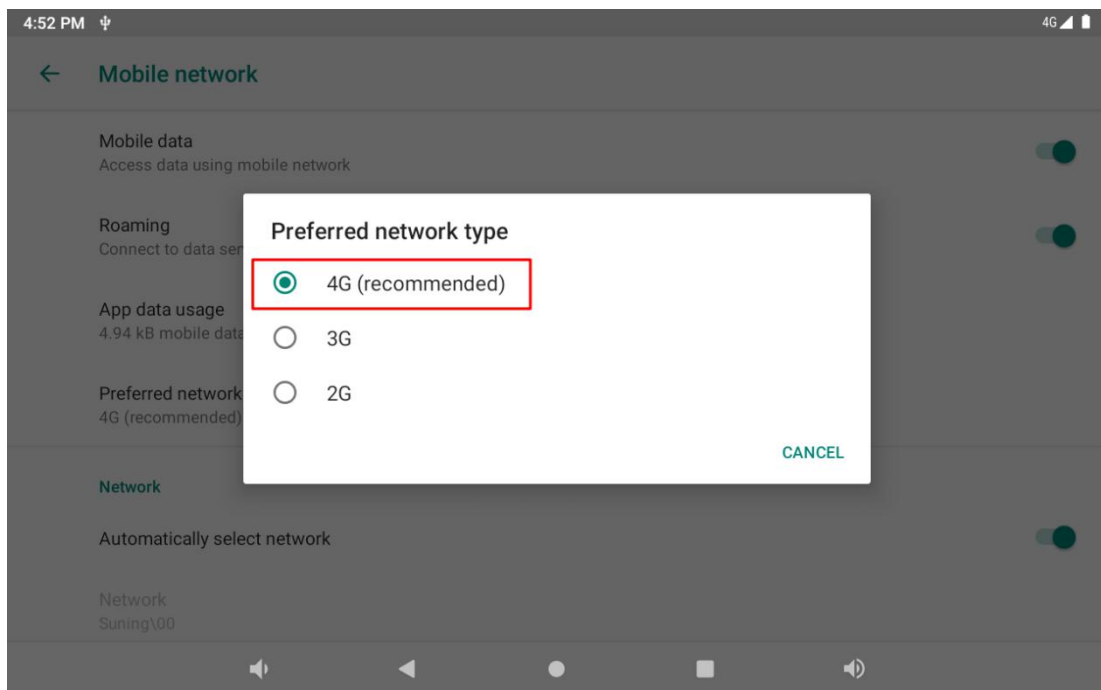
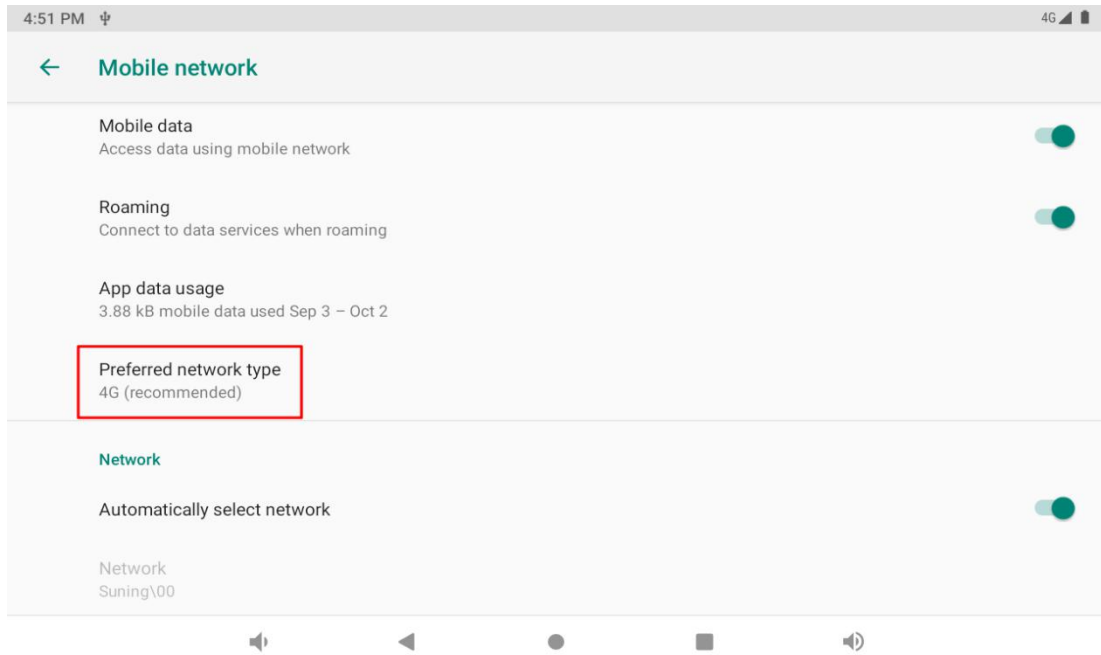
Step 3, The default connection is 4G network after power on.

4G network settings:

Settings -> Networks & internet -> Mobile network -> Preferred network type -> 4G

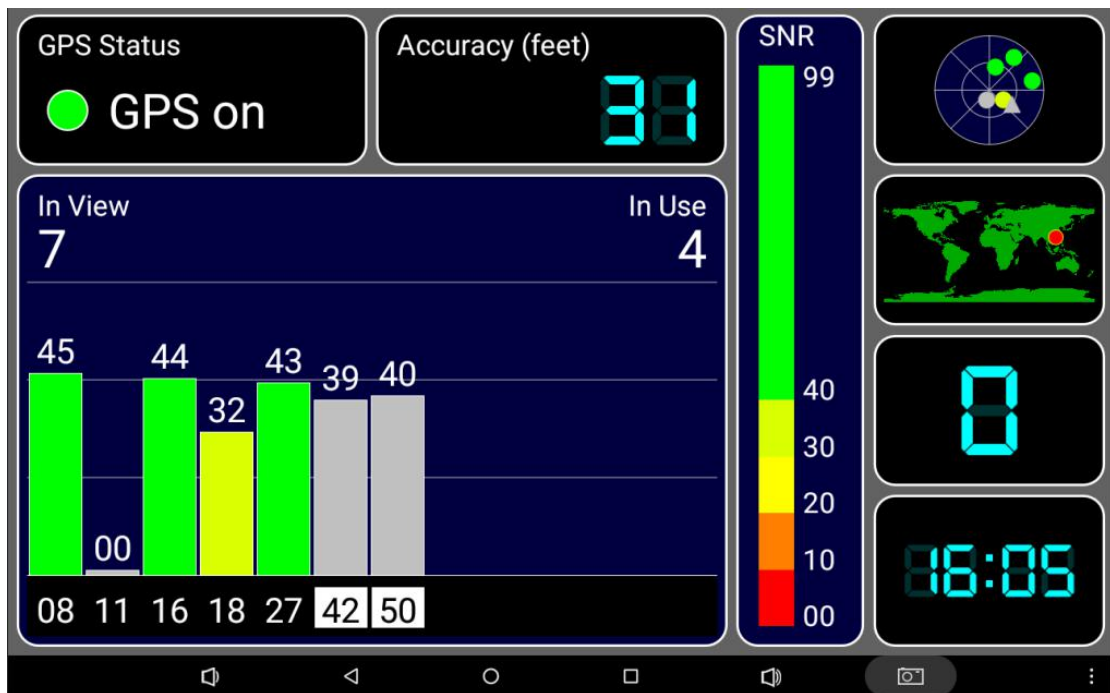
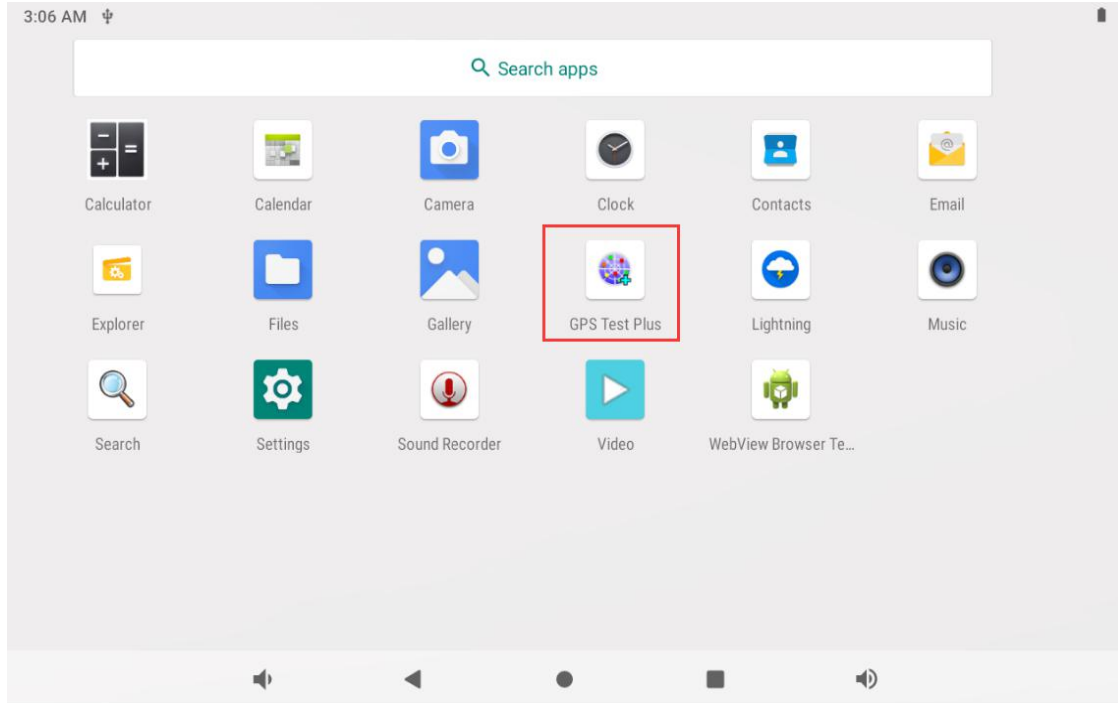






7.11 GPS

Connect GPS antenna, then power on and install the APP **GPS_test1.2.4.apk** (path: *CD/Tools/*)

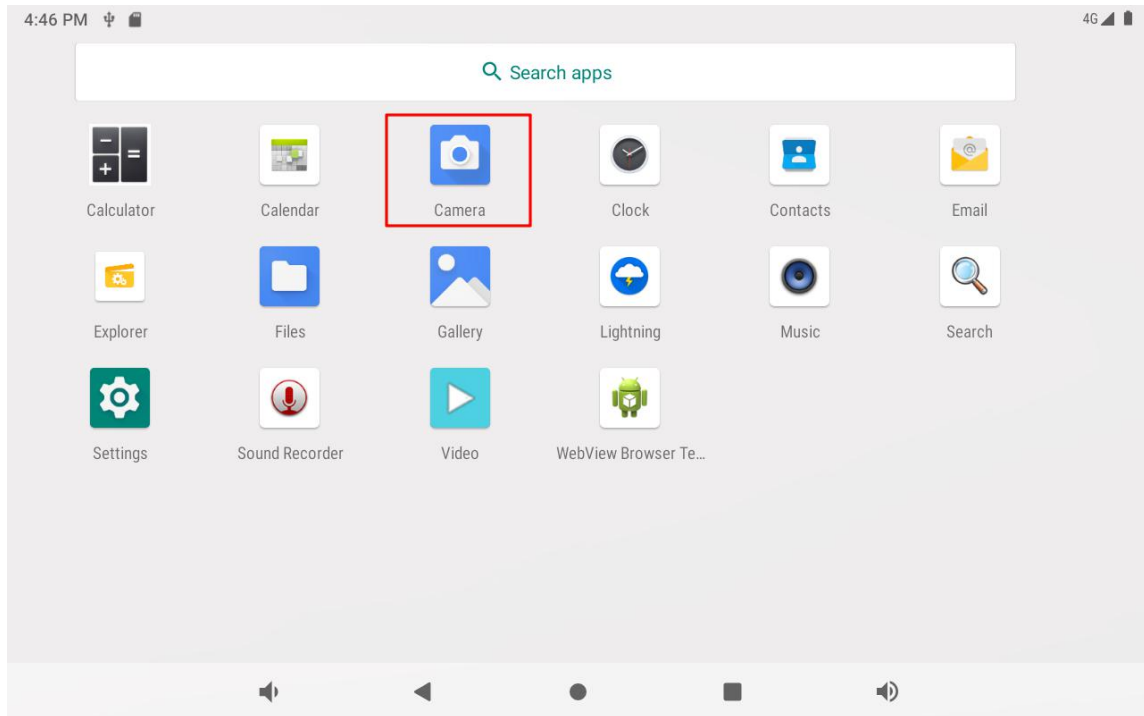




7.12 Camera

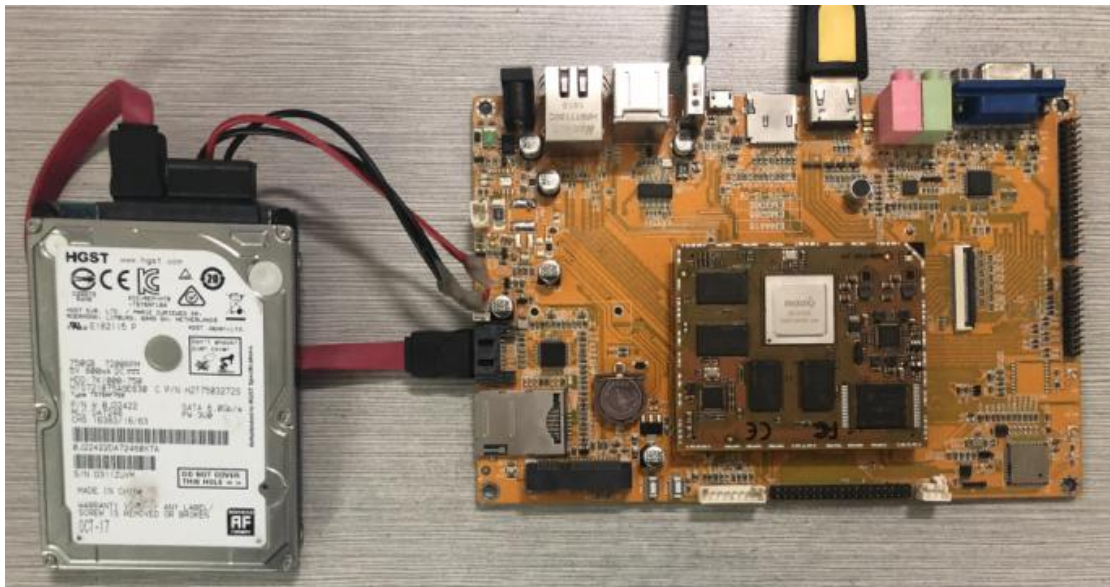
Connect the camera module (OV13850) to the development board **before power on**, then click the camera app to test.





7.13 Sata

EM3288 not support sata Hot-plug. Connect the sata module to the development board **before power on**, then the sata will auto mount.



```

serial-com5 - SecureCRT
File Edit View Options Transfer Script Tools Window Help
Enter host <Alt+R>
serial-com5 x
[ 67.446421] type=1400 audit(1627457856.344:52): avc: denied { open } for pid=1061 comm=".update.s
ervice" path="/dev/__properties__/_u:object_r:serialno_prop:s0" dev="tmpfs" ino=7047 scontext=u:r:sys
tem_app:s0 tcontext=u:object_r:serialno_prop:s0 tclass=file permissive=1
[ 67.446445] type=1400 audit(1627457856.344:53): avc: denied { getattr } for pid=1061 comm=".updat
e.service" path="/dev/__properties__/_u:object_r:serialno_prop:s0" dev="tmpfs" ino=7047 scontext=u:r:
system_app:s0 tcontext=u:object_r:serialno_prop:s0 tclass=file permissive=1

console:/dev/block #
console:/dev/block #
console:/dev/block #
console:/dev/block #
console:/dev/block #
console:/dev/block #
console:/dev/block #
console:/dev/block # ls
by-name loop5 mmcb1k2p10 mmcb1k2p17 mmcb1k2p6 ram1 ram2 ram9
dm-0 loop6 mmcb1k2p11 mmcb1k2p18 mmcb1k2p7 ram10 ram3 sda
loop0 loop7 mmcb1k2p12 mmcb1k2p19 mmcb1k2p8 ram11 ram4 sda1
loop1 mmcb1k2 mmcb1k2p13 mmcb1k2p2 mmcb1k2p9 ram12 ram5 vtd
loop2 mmcb1k2boot0 mmcb1k2p14 mmcb1k2p3 mmcb1k2rpmb ram13 ram6 zram0
loop3 mmcb1k2boot1 mmcb1k2p15 mmcb1k2p4 platform ram14 ram7
loop4 mmcb1k2p1 mmcb1k2p16 mmcb1k2p5 ram0 ram15 ram8
console:/dev/block # [ 78.046228] PM: suspend entry 2021-07-28 07:37:46.946857355 UTC
[ 78.046279] PM: syncing filesystems ... done.
[ 78.071267] Freezing user space processes ... █

Ready Serial: COM5, 115200 25, 50 25 Rows, 100 Cols VT100 CAP NUM

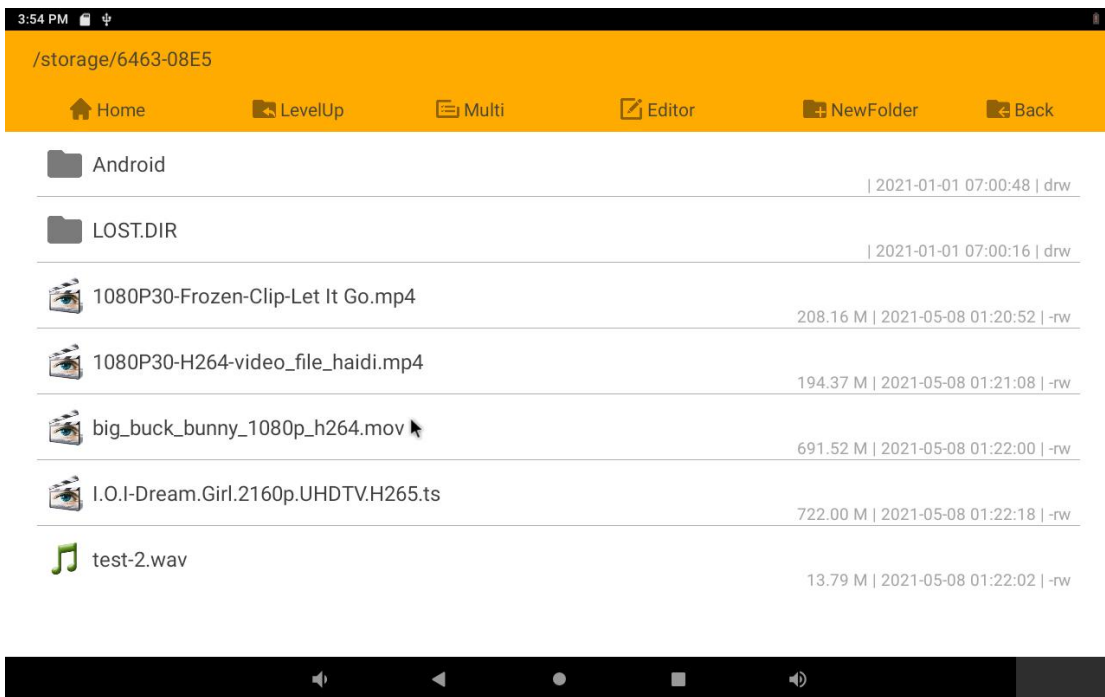
```

```

serial-com5 - SecureCRT
File Edit View Options Transfer Script Tools Window Help
Enter host <Alt+R>
serial-com5 x
1|console:/ # ls storage/
6463-08E5 emulated self
console:/ # ls storage/6463-08E5/
1080P30-Frozen-Clip-Let It Go.mp4 LOST.DIR
1080P30-H264-video_file_haidi.mp4 big_buck_bunny_1080p_h264.mov
Android test-2.wav
I.O.I-Dream.Girl.2160p.UHDTV.H265.ts
console:/ #

Ready Serial: COM5, 115200 8, 13 8 Rows, 100 Cols VT100 CAP NUM

```



Note: Because SATA requires a large current, the SATA power on the board may not have enough current and cause instability, so it is best to provide SATA power externally.