EM3399 Ubuntu16.04 Reference User Manual

V1. 20190912

Boardcon Embedded Design

www. boardcon. com

Colophon

Ver	Description	Author	Date
V1.0	Initial version	Zhou Lijun	2019-09-12

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 lighting 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 products.

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.

Content

1 EM3399 Introduction

This document is part of a set of reference documents providing information necessary to operate and program Boardcon EM3399 SBC。

1.1 Overview

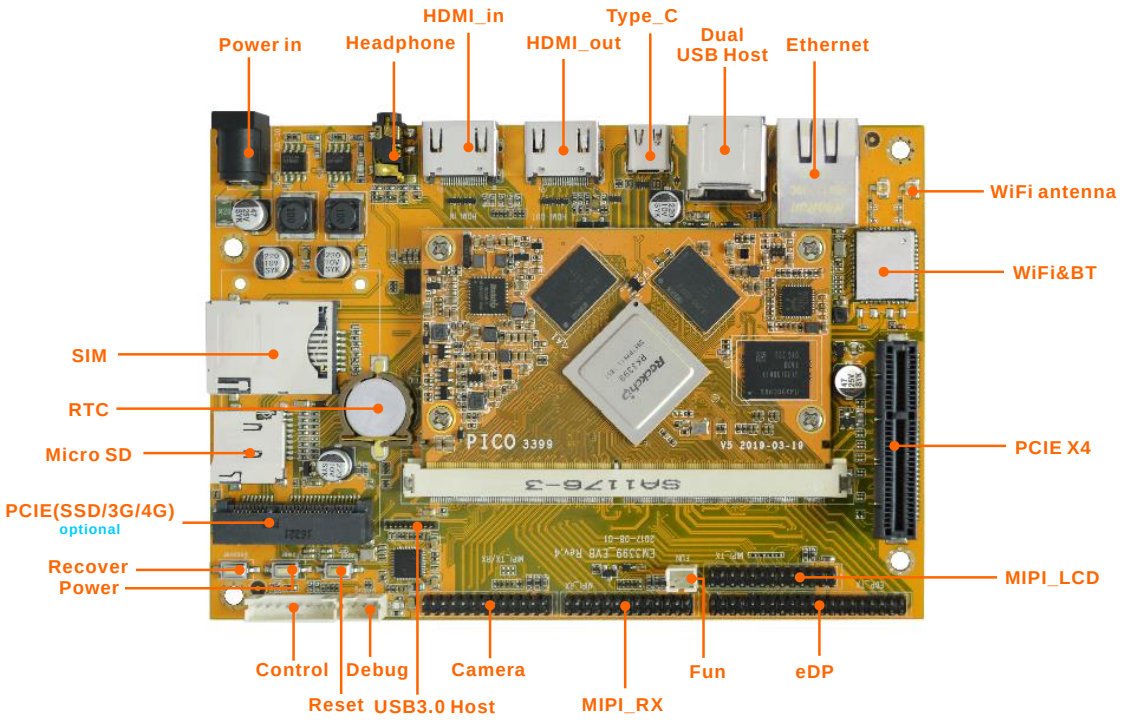
EM3399 is a single board computer equipped with RK3399 Cortex-A72 + Quad Cortex-A53 processor coupled with 4GB RAM, 8GB eMMC, an mPCIe slot for cellular connectivity, and other interactive interfaces geared towards to AI and IoT Applications.

Display features include an eDP port, HDMI and MIPI LCD. EM3399 adopts ALC5651 dual I2S interface audio codec that supports analog/digital input. The 1x USB3.0 Type-C can be converted to HDMI/USB3.0/USB2.0. In addition, Type-C also can be used for debugging.

The board is available with a WiFi/BT module with dual-band 802.11ac/a/b/g/n and Bluetooth 4.1 connectivity.

The EM3399 SBC is equipped with a 4G model(optional) that delivers 100Mbps downlink and 50Mbps uplink data rates, and GSM/GPRS networks to ensure that it can connect even in remote areas devoid of 4G or 3G coverage. The model also combines high-speed wireless connectivity with embedded multi-constellation high-sensitivity positioning GPS+GLONASS receiver.

1.2 Hardware Introduction



Feature	Specifications
CPU	· Rockchip RK3399. Big.Little architecture: Dual Cortex-A72 + Quad Cortex-A53, 64-bit CPU. Frequency is over 1.8GHz (Big cluster) · 28nm HKMG process · 1MB unified L2 Cache for Big cluster, 512KB unified L2 Cache for Little cluster
GPU	· Mali-T864 GPU, OpenGL ES1.1/2.0/3.0/3.1, OpenVG1.1, OpenCL, DX11 · Supports AFBC (ARM Frame Buffer Compression)
Memory	2GB/4GB
Flash	4GB/8GB eMMC Flash
Power	DC 12V/3A
USB	2x USB2.0 Host, 1x USB3.0 Host, 1x USB Type-C
UART	1x 3pin connector. For debug.
LCD	1x eDP LCD via 40-pin header interface, 1x 2-CH MIPI
Ethernet	1000M High performance Ethernet (RTL8211E), RJ45 interface
HDMI IN	Adopt Toshiba TC358749XBG bridge device
HDMI OUT	HDMI 1.4 /2.0
MIPI Camera	2-CH MIPI RX, Support 3-D video capture
Audio codec	Adopt ALC5651 Audio chip, 3.5mm Audio I / O interface
RTC	Real Time Clock, powered by external lithium battery
SD card	1x T-Flash card
SIM card	1x SIM card slot
Buttons	3x User Buttons, for Recover, Power, Reset
PCI-E x4	For Video card
WIFI&BT	AP6356S Module. 2.4/5G WiFi, Bluetooth 4.1
SSD (optional)	PCI-E connector. Shared interface with 4G.
WLAN	PCI-E connector. Supporting 3G/4G WLAN module
GPIO	5 groups of GPIO (GPIO0~GPIO4), total 122 GPIOs
Dimension	100mm x 145mm

2 Compiler Environment

2.1 Vmware10.0+ubuntu16.04

Install Vmware10.0 in windows OS first, and then install ubuntu16.04 in vmware and compile. There is no longer describes how to install Ubuntu system, if cannot understand, please visit the official website of Ubuntu, the operating system is also available for free download at the official website. http://www.ubuntu.com/

Note: It is suggested to install Ubuntu directly to the computer and compile due to running slowly in the

virtual machine and memory limited. ubuntu16.04 should be complied by ubuntu 64bit OS.

2.2 Install Compiler

Installing commands:

apt-get install git gnupg flex bison gperf build-essential zip curl

apt-get install libc6-dev libncurses5-dev:i386 x11proto-core-dev libx11-dev:i386

apt-get install libreadline6-dev:i386 libgl1-mesa-dri:i386 libgl1-mesa-dev g++-multilib

apt-get install tofrodos python-markdown libxml2-utils xsltproc zlib1g-dev:i386 dpkg-dev

apt-get install libncurses5-dev

3 Compile Source

Path

Uboot and Kernel: Source\em3399_ubuntu16.04.tar.bz2

Rootfs: Source\ubuntu16.04.tar.bz2

3.1 Compile u-boot

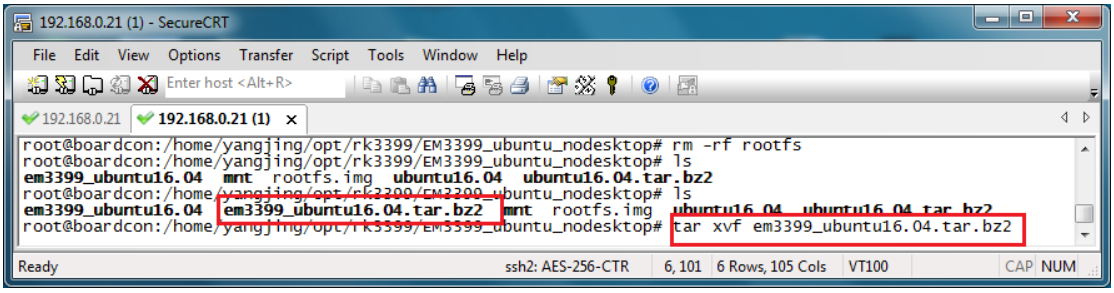
After setting and the compiler is effective, execute the follow commands to compile uboot:

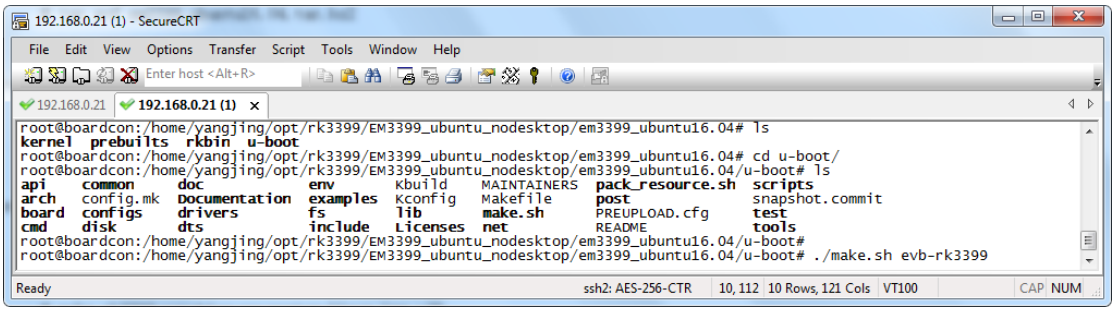
tar xvf em3399_ubuntu16.04.tar.bz2

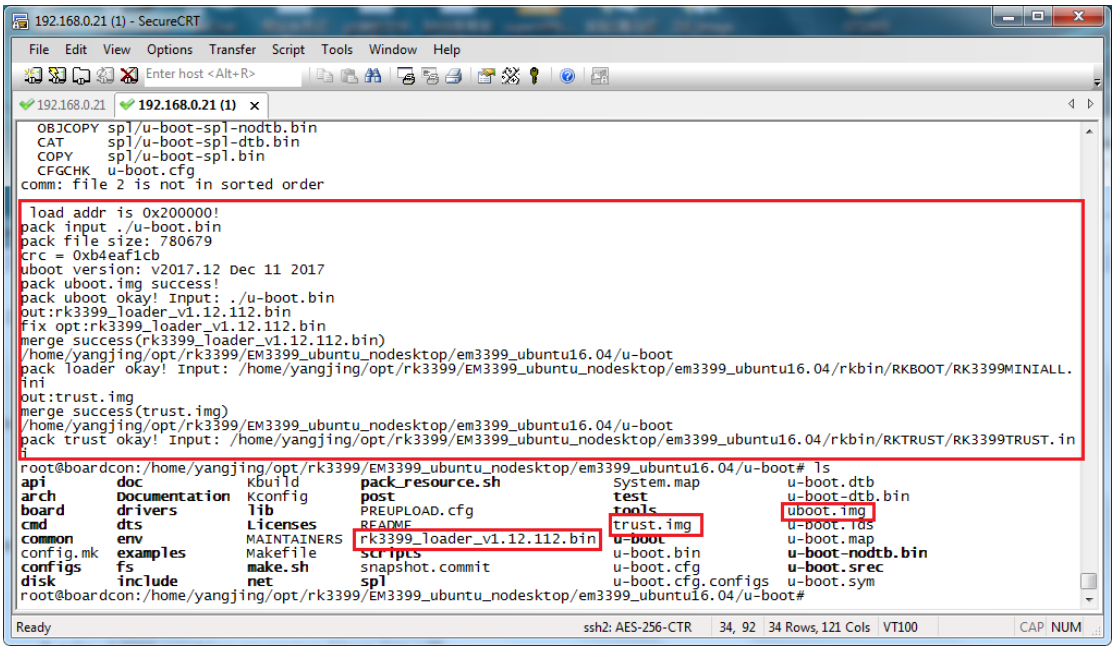
cd em3399_ubuntu16.04

cd u-boot

./make.sh evb-rk3399







After compile finish, it will get **trust.img, rk3399_loader_v1.12.112.bin, uboot.img** in the directory.

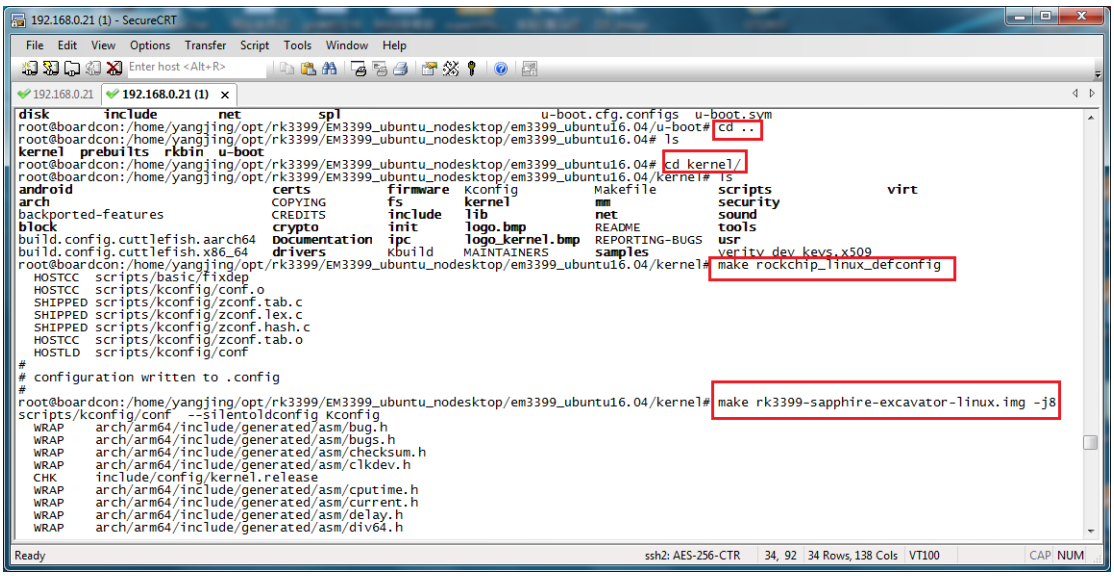
3.2 Compile Kernel

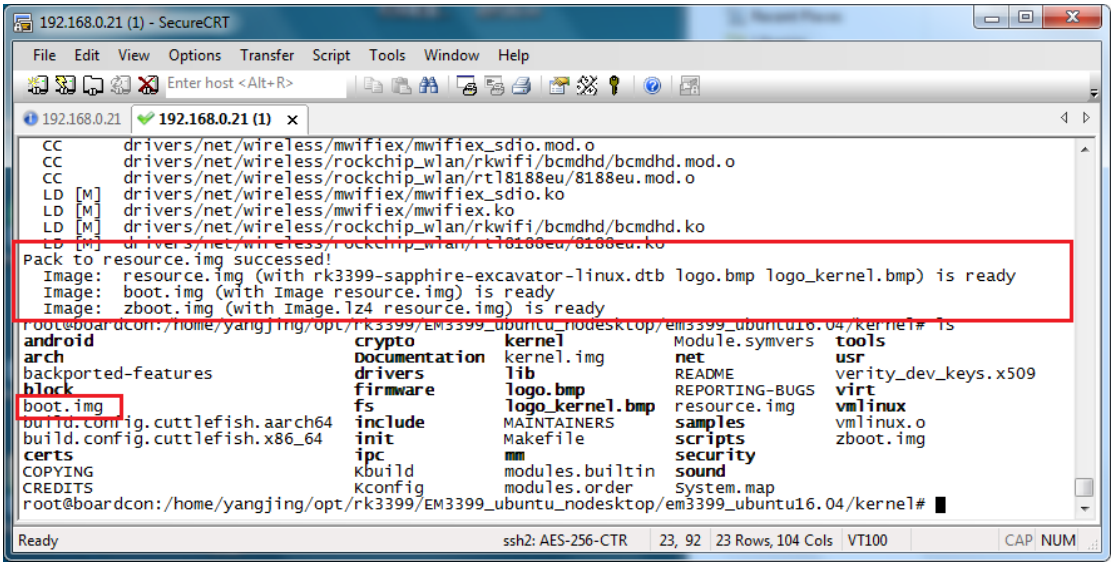
After setting and the compiler is effective, execute the follow commands to compile kernel:

cd kernel

make rockchip_linux_defconfig

make rk3399-sapphire-excavator-linux.img -j8





After compile finish will get **boot.img** in the directory.

3.3 Cure File System

Cure the file system required root user. Execute the follow command to Cure File System:

tar xvf ubuntu16.04.tar.bz2

dd if=/dev/zero of=rootfs.img bs=1M count=4096 (4GB)

mkfs.ext4 -F -L rootfs rootfs.img

mkdir mnt

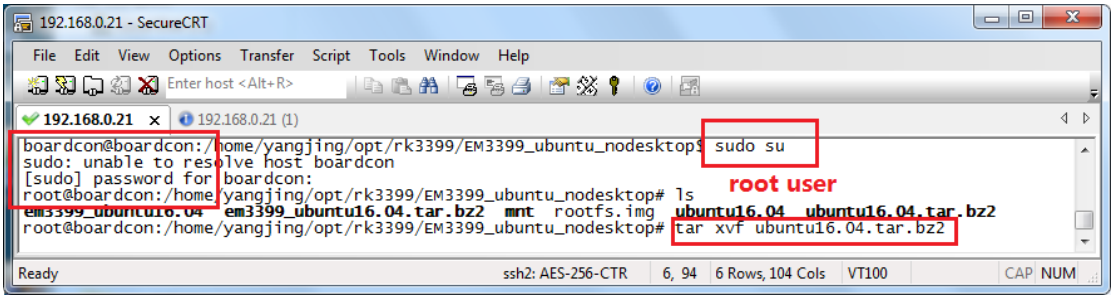
mount rootfs.img mnt

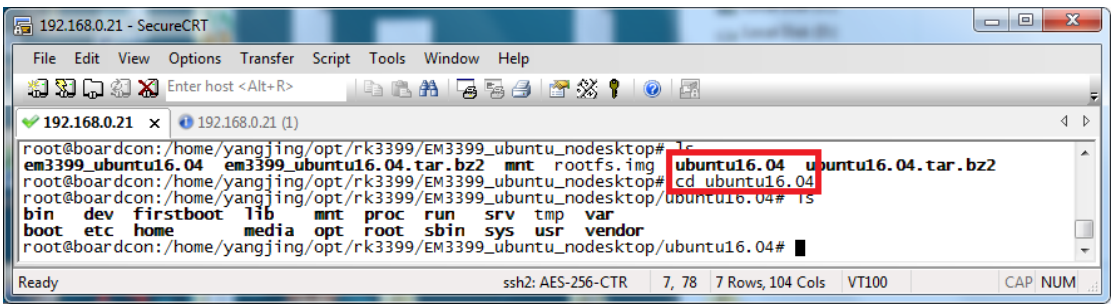
cp -rfp ubuntu16.04/* mnt/

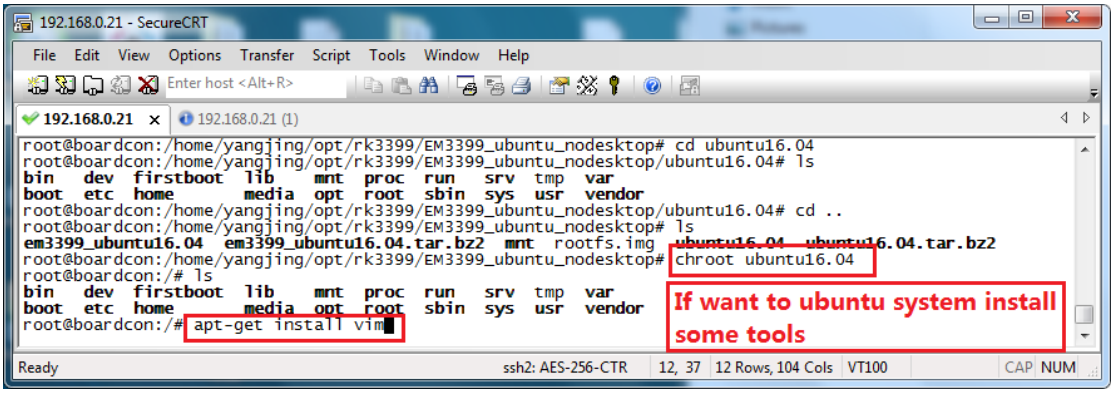
umount mnt

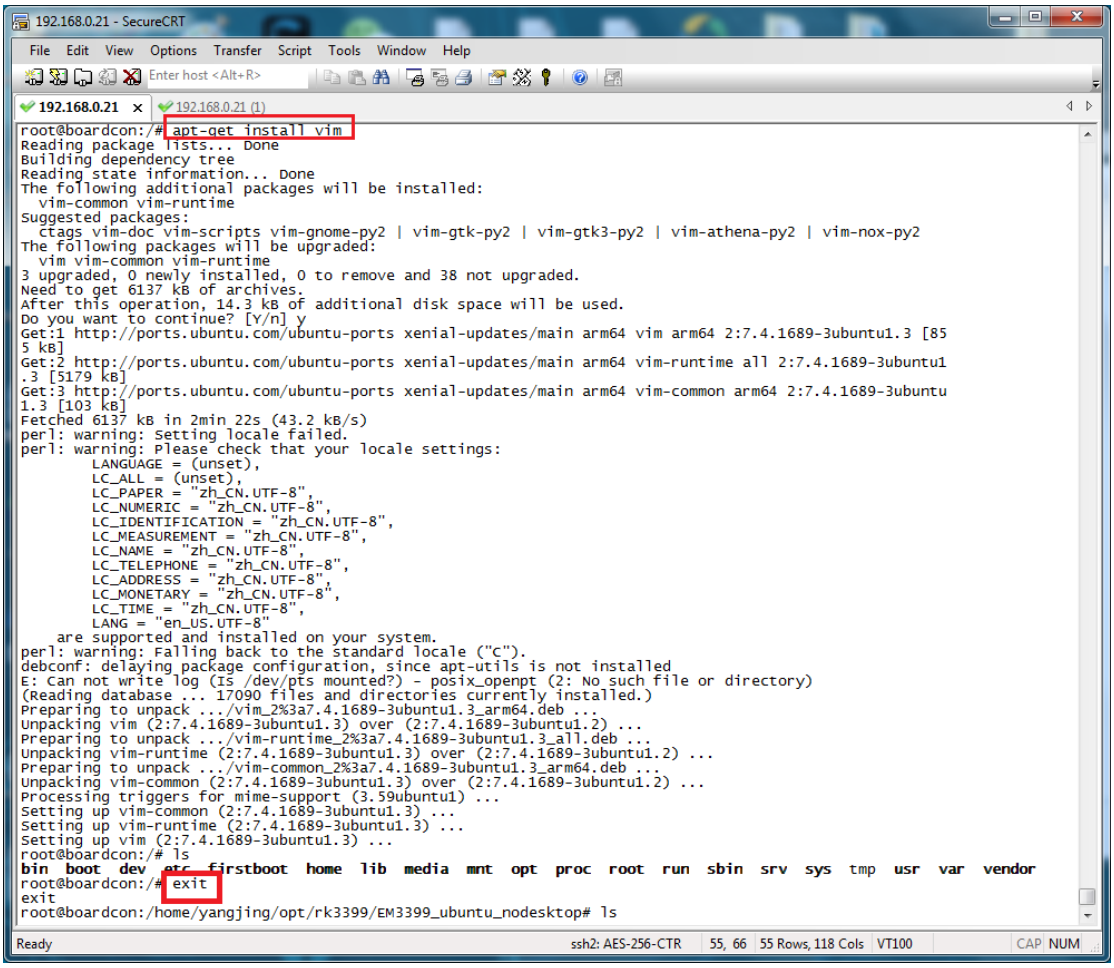
/sbin/e2fsck -p -f rootfs.img

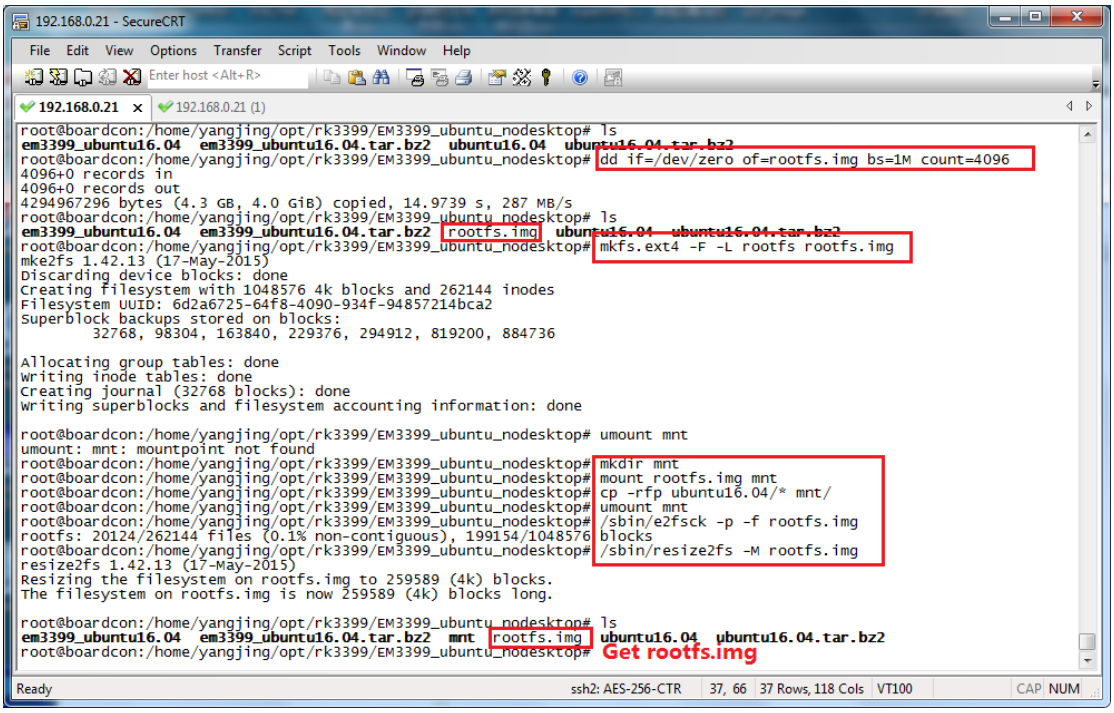
/sbin/resize2fs -M rootfs.img






192.168.0.21 - SecureCRT
File Edit View Options Transfer Script Tools Window Help
Enter host <Alt+R>
192.168.0.21
192.168.0.21 (1)
root@boardcon:/home/yangjing/opt/rk3399/EM3399_ubuntu_nodesktop# cd ubuntu16.04
root@boardcon:/home/yangjing/opt/rk3399/EM3399_ubuntu_nodesktop/ubuntu16.04# ls
bin dev firstboot lib mnt proc run srv tmp var
boot etc home media opt root sbin sys usr vendor
root@boardcon:/home/yangjing/opt/rk3399/EM3399_ubuntu_nodesktop/ubuntu16.04# cd ..
root@boardcon:/home/yangjing/opt/rk3399/EM3399_ubuntu_nodesktop# ls
em3399_ubuntu16.04 em3399_ubuntu16.04.tar.bz2 mnt rootfs.img ubuntu16.04 ubuntu16.04.tar.bz2
root@boardcon:/home/yangjing/opt/rk3399/EM3399_ubuntu_nodesktop# chroot ubuntu16.04
root@boardcon:/# ls
bin dev firstboot lib mnt proc run srv tmp var
boot etc home media opt root sbin sys usr vendor
root@boardcon:/# apt-get install vim
If want to ubuntu system install some tools
Ready
ssh2: AES-256-CTR
12, 37
12 Rows, 104 Cols
VT100
CAP NUM


192.168.0.21 - SecureCRT
File Edit View Options Transfer Script Tools Window Help
Enter host <Alt+R>
192.168.0.21
192.168.0.21 (1)
root@boardcon:/# apt-get install vim
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
vim-common vim-runtime
Suggested packages:
ctags vim-doc vim-scripts vim-gnome-py2 | vim-gtk-py2 | vim-gtk3-py2 | vim-athena-py2 | vim-nox-py2
The following packages will be upgraded:
vim vim-common vim-runtime
3 upgraded, 0 newly installed, 0 to remove and 38 not upgraded.
Need to get 6137 kB of archives.
After this operation, 14.3 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://ports.ubuntu.com/ubuntu-ports xenial-updates/main arm64 vim arm64 2:7.4.1689-3ubuntu1.3 [85
5 kB]
Get:2 http://ports.ubuntu.com/ubuntu-ports xenial-updates/main arm64 vim-runtime all 2:7.4.1689-3ubuntu1
.3 [5179 kB]
Get:3 http://ports.ubuntu.com/ubuntu-ports xenial-updates/main arm64 vim-common arm64 2:7.4.1689-3ubuntu
1.3 [103 kB]
Fetched 6137 kB in 2min 22s (43.2 kB/s)
perl: warning: Setting locale failed.
perl: warning: Please check that your locale settings:
LANGUAGE = (unset),
LC_ALL = (unset),
LC_PAPER = "zh_CN.UTF-8",
LC_NUMERIC = "zh_CN.UTF-8",
LC_IDENTIFICATION = "zh_CN.UTF-8",
LC_MEASUREMENT = "zh_CN.UTF-8",
LC_NAME = "zh_CN.UTF-8",
LC_TELEPHONE = "zh_CN.UTF-8",
LC_ADDRESS = "zh_CN.UTF-8",
LC_MONETARY = "zh_CN.UTF-8",
LC_TIME = "zh_CN.UTF-8",
LANG = "en_US.UTF-8"
are supported and installed on your system.
perl: warning: Falling back to the standard locale ("C").
debconf: delaying package configuration, since apt-utils is not installed
E: Can not write log (Is /dev/pts mounted?) - posix_openpt (2: No such file or directory)
(Reading database ... 17090 files and directories currently installed.)
Preparing to unpack .../vim_2%3a7.4.1689-3ubuntu1.3_arm64.deb ...
Unpacking vim (2:7.4.1689-3ubuntu1.3) over (2:7.4.1689-3ubuntu1.2) ...
Preparing to unpack .../vim-runtime_2%3a7.4.1689-3ubuntu1.3_all.deb ...
Unpacking vim-runtime (2:7.4.1689-3ubuntu1.3) over (2:7.4.1689-3ubuntu1.2) ...
Preparing to unpack .../vim-common_2%3a7.4.1689-3ubuntu1.3_arm64.deb ...
Unpacking vim-common (2:7.4.1689-3ubuntu1.3) over (2:7.4.1689-3ubuntu1.2) ...
Processing triggers for mime-support (3.59ubuntu1) ...
Setting up vim-common (2:7.4.1689-3ubuntu1.3) ...
Setting up vim-runtime (2:7.4.1689-3ubuntu1.3) ...
Setting up vim (2:7.4.1689-3ubuntu1.3) ...
root@boardcon:/# ls
bin boot dev etc firstboot home lib media mnt opt proc root run sbin srv sys tmp usr var vendor
root@boardcon:/# exit
exit
root@boardcon:/home/yangjing/opt/rk3399/EM3399_ubuntu_nodesktop# ls
Ready
ssh2: AES-256-CTR
55, 66
55 Rows, 118 Cols
VT100
CAP NUM



After compile finish will get **rootfs.img** in the directory.

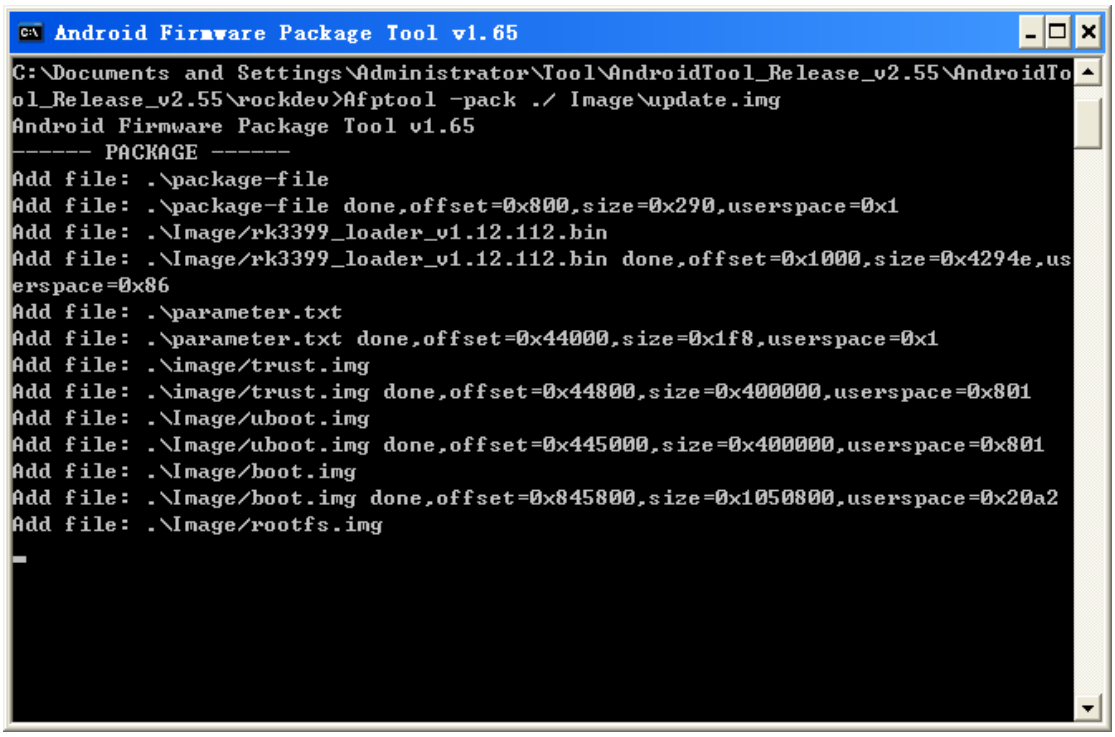
4 Images Introduction

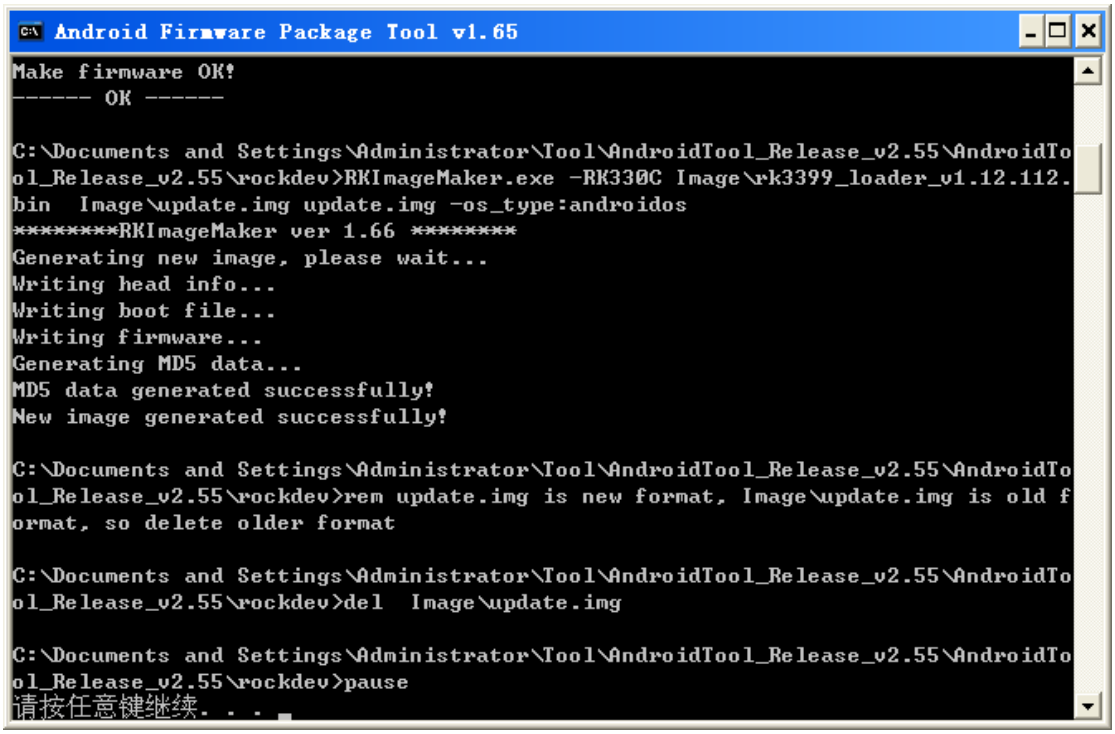
4.1 Pack Update.img

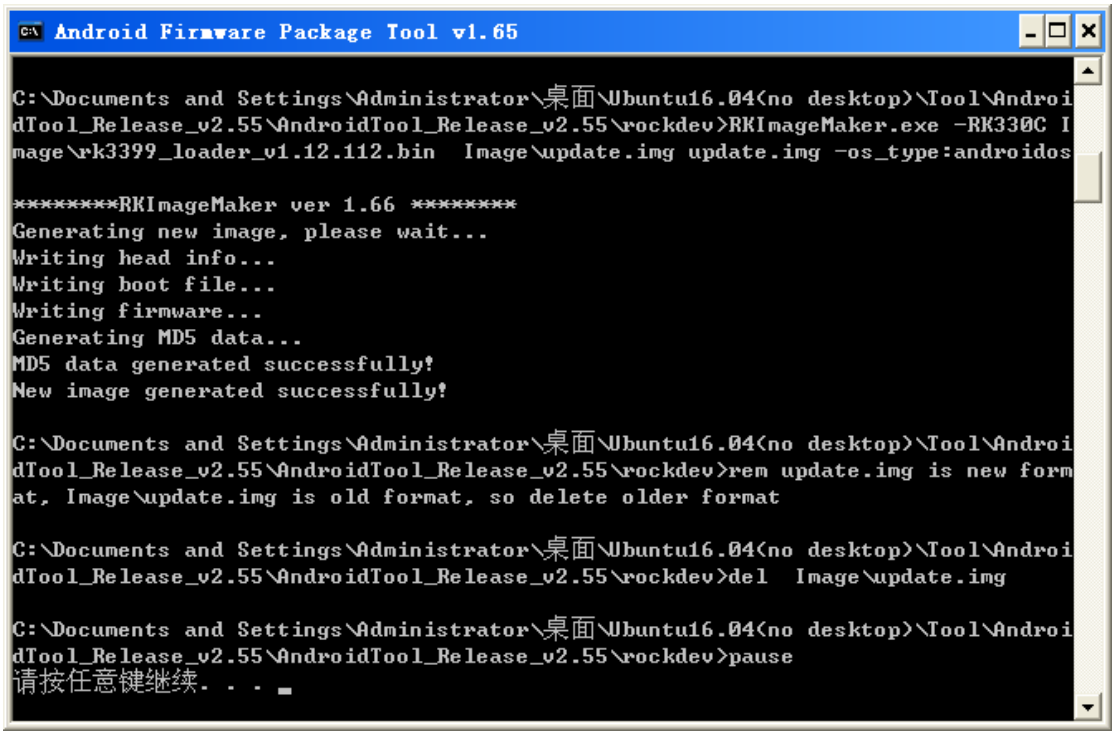
Step 1, unzip **AndroidTool_Release_v2.55.rar** in windows.

Step 2, Copy **trust.img, rk3399_loader_v1.12.112.bin, uboot.img, boot.img, rootfs.img** to development tools **rockdev/Image** directory.

Step 3, Double click Tool\AndroidTool_Release_v2.55\AndroidTool_Release_v2.55\rockdev\mkupdate.bat to pack **update.img**


Android Firmware Package Tool v1.65
C:\Documents and Settings\Administrator\Tool\AndroidTool_Release_v2.55\AndroidTo
ol_Release_v2.55\rockdev>Afptool -pack ./ Image\update.img
Android Firmware Package Tool v1.65
------ PACKAGE ------
Add file: .\package-file
Add file: .\package-file done,offset=0x800,size=0x290,userspace=0x1
Add file: .\Image/rk3399_loader_v1.12.112.bin
Add file: .\Image/rk3399_loader_v1.12.112.bin done,offset=0x1000,size=0x4294e,us
erspace=0x86
Add file: .\parameter.txt
Add file: .\parameter.txt done,offset=0x44000,size=0x1f8,userspace=0x1
Add file: .\image/trust.img
Add file: .\image/trust.img done,offset=0x44800,size=0x400000,userspace=0x801
Add file: .\Image/uboot.img
Add file: .\Image/uboot.img done,offset=0x445000,size=0x400000,userspace=0x801
Add file: .\Image/boot.img
Add file: .\Image/boot.img done,offset=0x845800,size=0x1050800,userspace=0x20a2
Add file: .\Image/rootfs.img


Android Firmware Package Tool v1.65
Make firmware OK!
------ OK ------
C:\Documents and Settings\Administrator\Tool\AndroidTool_Release_v2.55\AndroidTo
ol_Release_v2.55\rockdev>RKImageMaker.exe -RK330C Image\rk3399_loader_v1.12.112.
bin Image\update.img update.img -os_type:androidos
********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!
C:\Documents and Settings\Administrator\Tool\AndroidTool_Release_v2.55\AndroidTo
ol_Release_v2.55\rockdev>rem update.img is new format, Image\update.img is old f
ormat, so delete older format
C:\Documents and Settings\Administrator\Tool\AndroidTool_Release_v2.55\AndroidTo
ol_Release_v2.55\rockdev>del Image\update.img
C:\Documents and Settings\Administrator\Tool\AndroidTool_Release_v2.55\AndroidTo
ol_Release_v2.55\rockdev>pause
请按任意键继续. . .



After pack finish will get **update.img** in the Tool\AndroidTool_Release_v2.55\AndroidTool_Release_v2.55\rockdev directory.

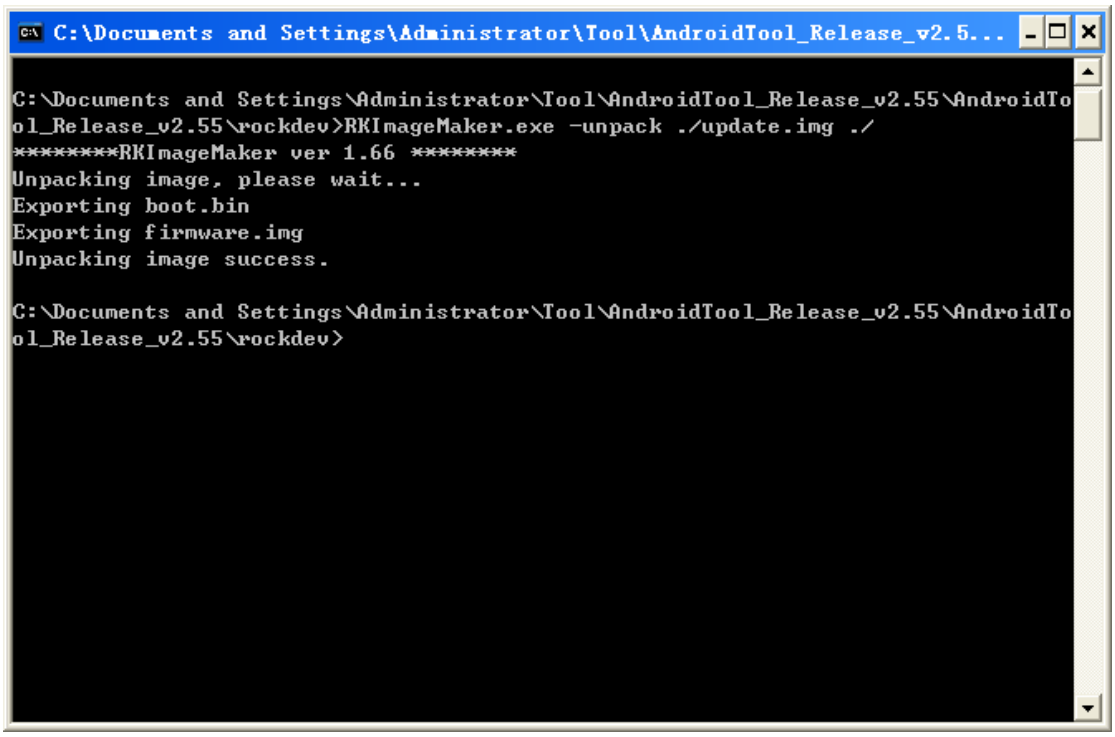
4.2 Unzip Firmware

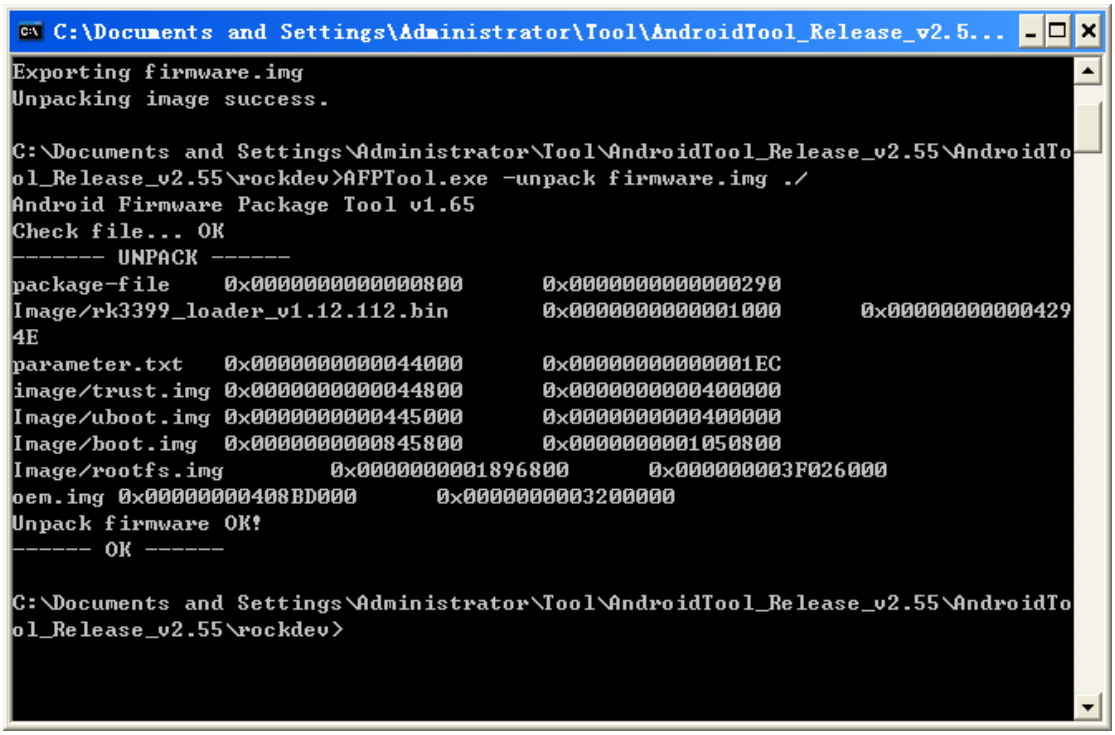
Step 1, Open Tool\AndroidTool_Release_v2.55\AndroidTool_Release_v2.55\rockdev\cmd.exe.

Execute the commands to unzip **update.img**

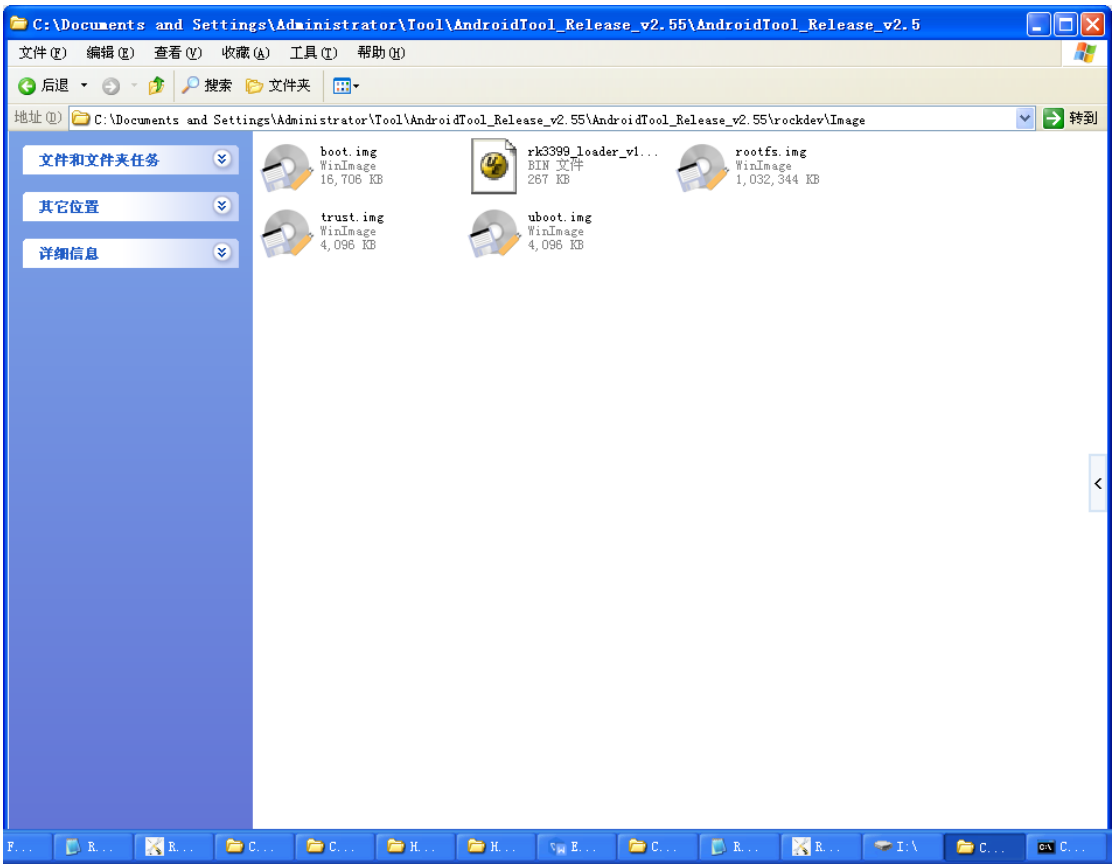
RKImageMaker.exe -unpack ./update.img ./

AFPTool.exe -unpack firmware.img ./





After **Unzip** finish will get **trust.img, rk3399_loader_v1.12.112.bin, uboot.img, boot.img, rootfs.img** in the Tool\AndroidTool_Release_v2.55\AndroidTool_Release_v2.55\rockdev\ **Image** directory.



5 Install Serial Terminal Tool

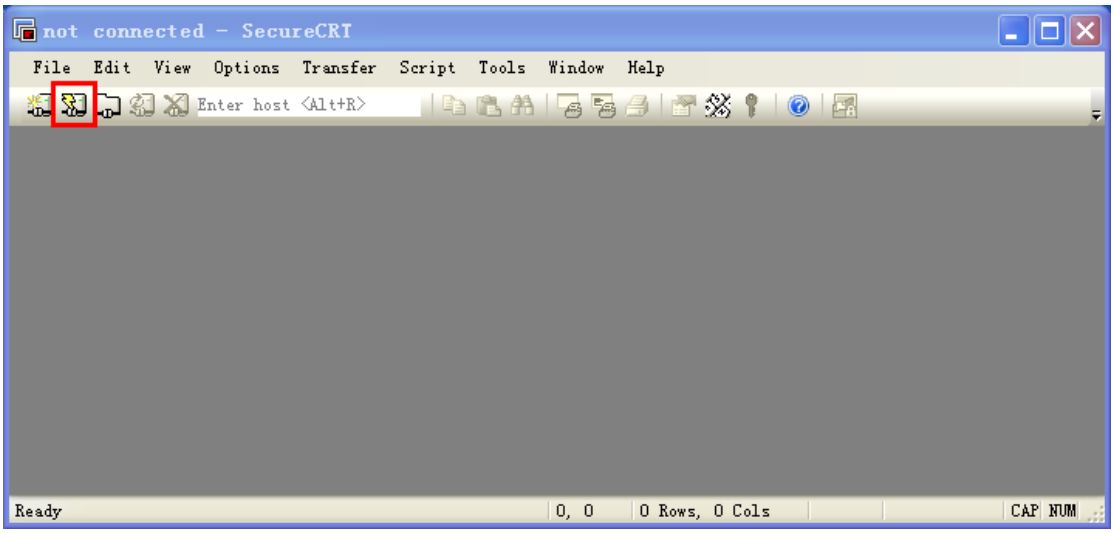
The common serial terminal tool is SecureCRT.

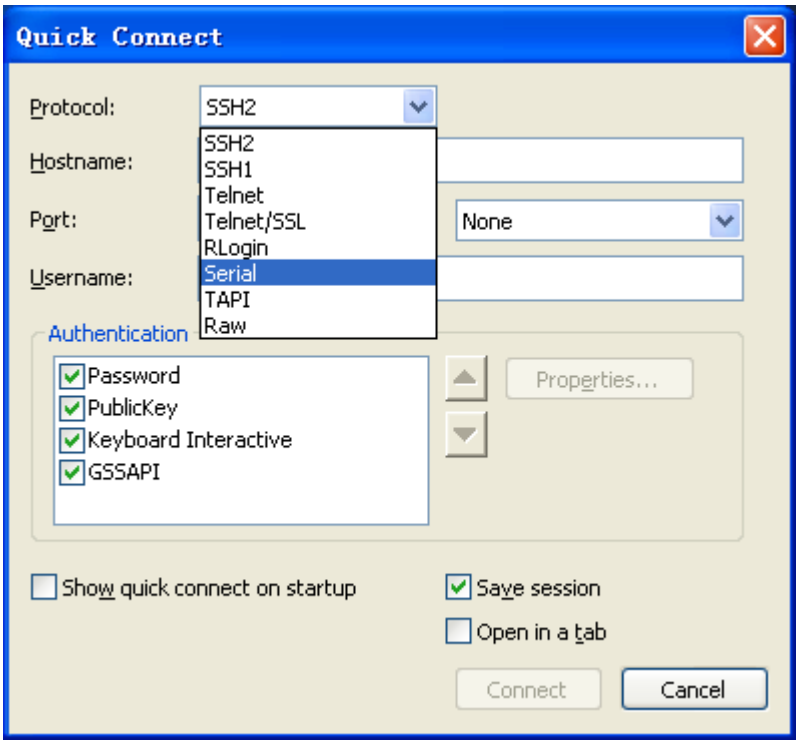
Install SecureCRT

SecureCRT can be used directly after decompression. Suggest create a shortcut to the desktop for the APP.

Copy SecureCRT (***path:*** tools\windows\SecureCRT.exe) to the PC.

Open SecureCRT.exe and click the icon **Quick Connect**





Set the parameters as follow.

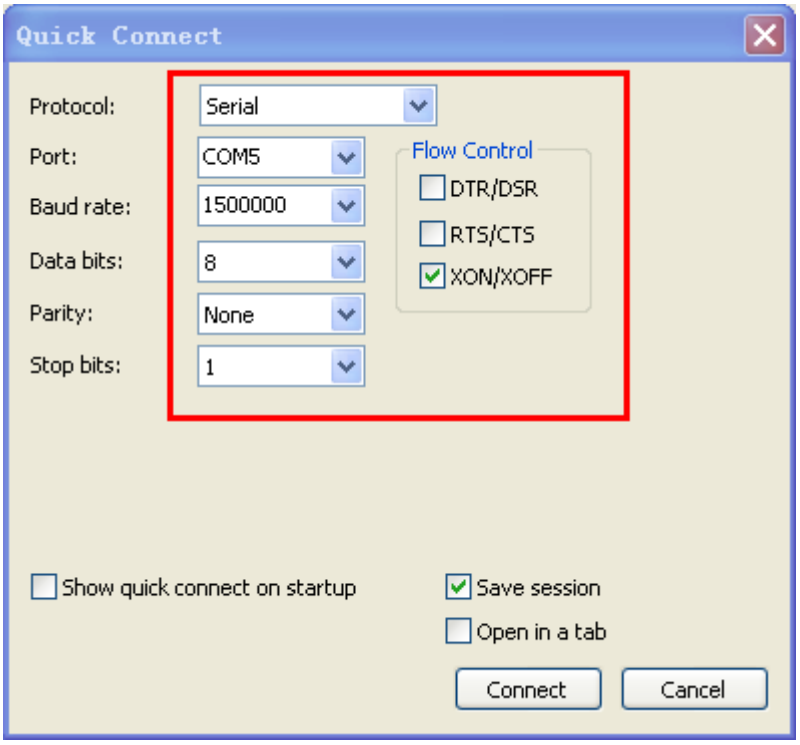
Protocol: Serial

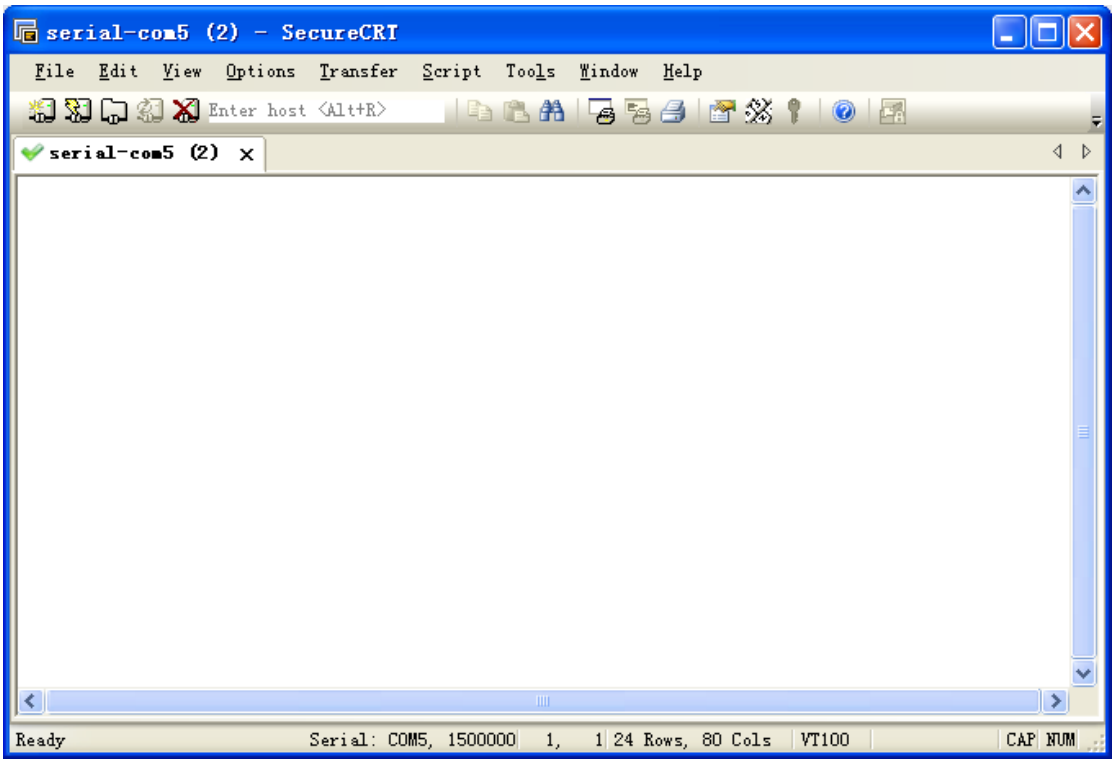
Port: To be specified by user PC

Baud rate: 1500000

Please check XON/XOFF but not RTS/CTS

Check Save session, then click **connect**





Illusion: When open more than one serial port 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 to iNand

Burn Images required files:

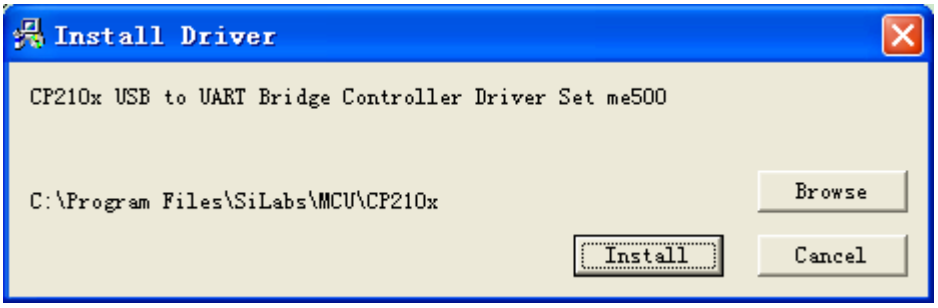
Image	file
AndroidTool.exe	Tools\AndroidTool_Release_V2.55
Terminal	Windows tools\SecureCRT
Fireware	Images\update.img

6.1 Install Debug Serial Driver

Connect the EM3399 and PC with the serial cable, USB OTG cable. After power on, the PC will report that found new hardware if it never installs the serial driver (CD\EM3399\tools\CP2102xp or CP2102WIN7), install the driver.

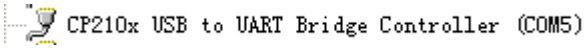
Step 1, install CP2102 driver

Unzip CP2102WIN7.rar to the windows, double click PreInstaller.exe.



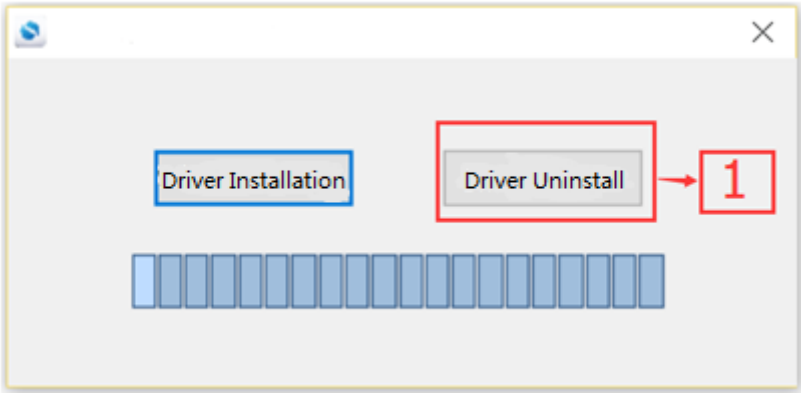
Step 2, click “Install” until the installation is finish, then click “Finish” to closing the windows.

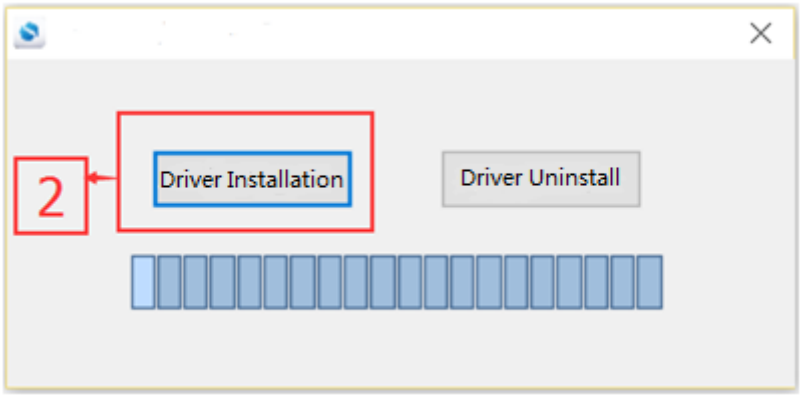
User can check whether the driver is installed successfully (Computer -> Device manager -> Port)



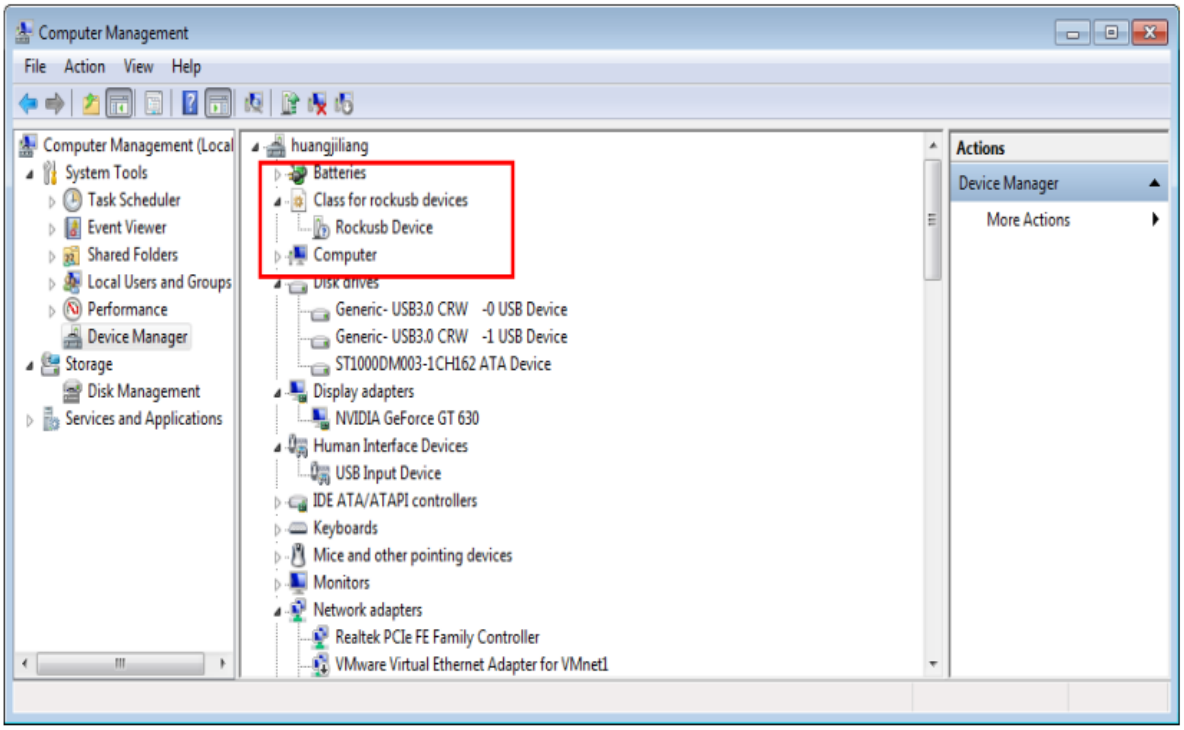
6.2 Install Download Driver

Step 1, install Rockchip driver assistant (AndroidTool_Release/DriverAssitant/DriverInstall.exe)





Step2, after installation is successful, it will be found the following information in the computer hardware management.

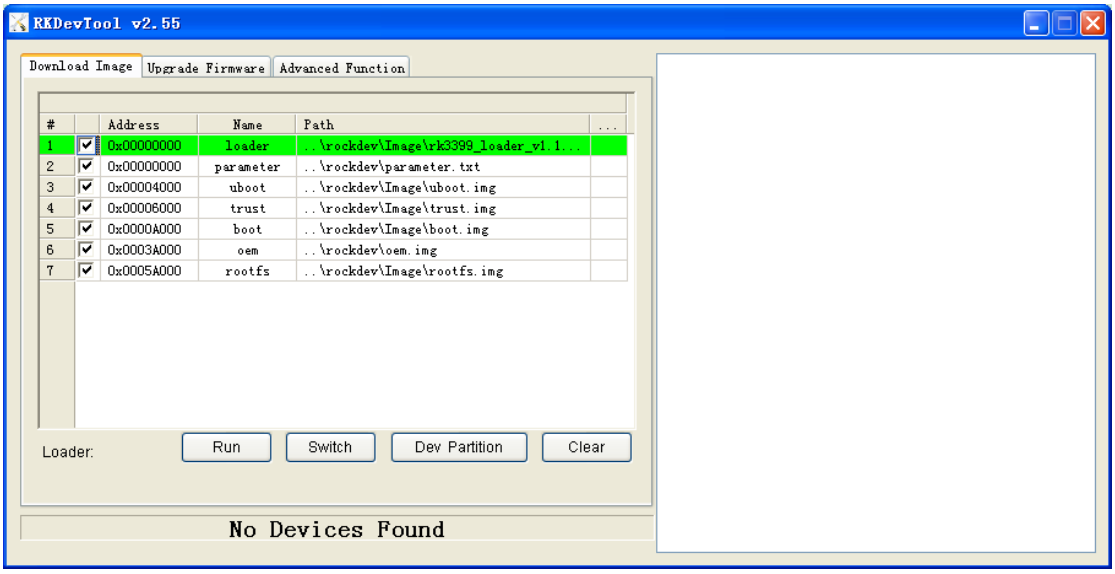


Now, the USB download driver is installed successfully.

6.3 Upgrade Firmware

Step 1, unzip **AndroidTool_Release_v2.55 tools** to the windows.

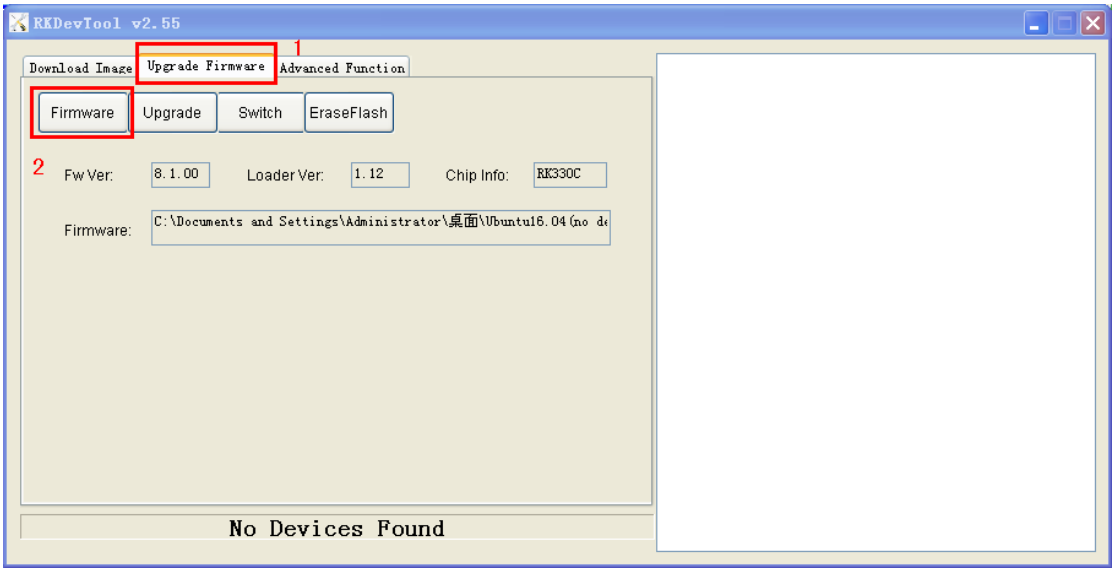
Step 2, open **AndroidTool_Release_v2.55/AndroidTool_Release_v2.33/AndroidTool.exe**



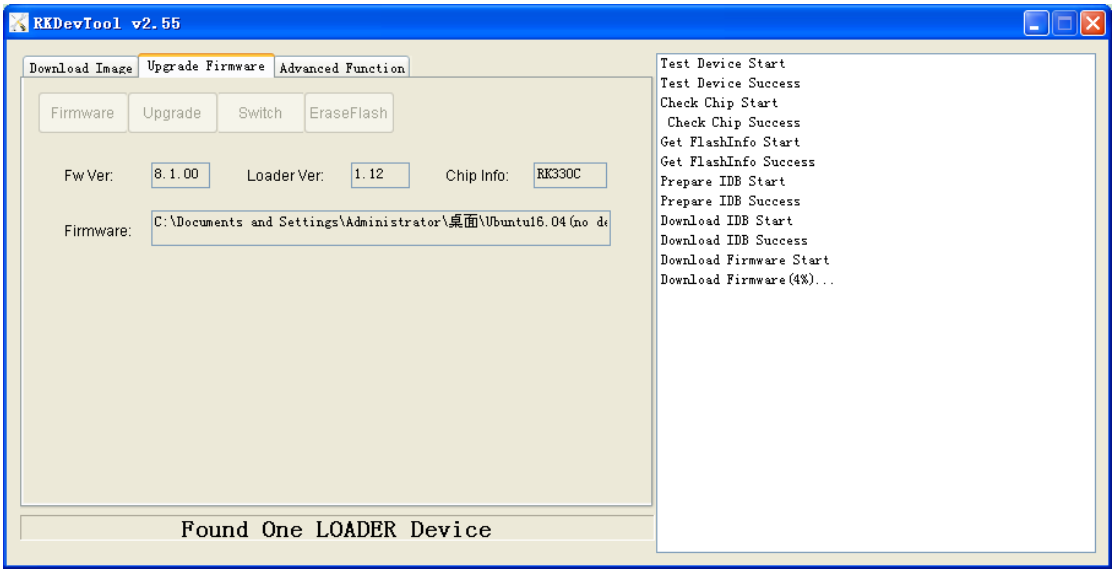
Step 3,

Method 1: Download Fireware “update.img” to the board:

Select “Upgrade Fireware” - “Firmware” then add the “update.img”



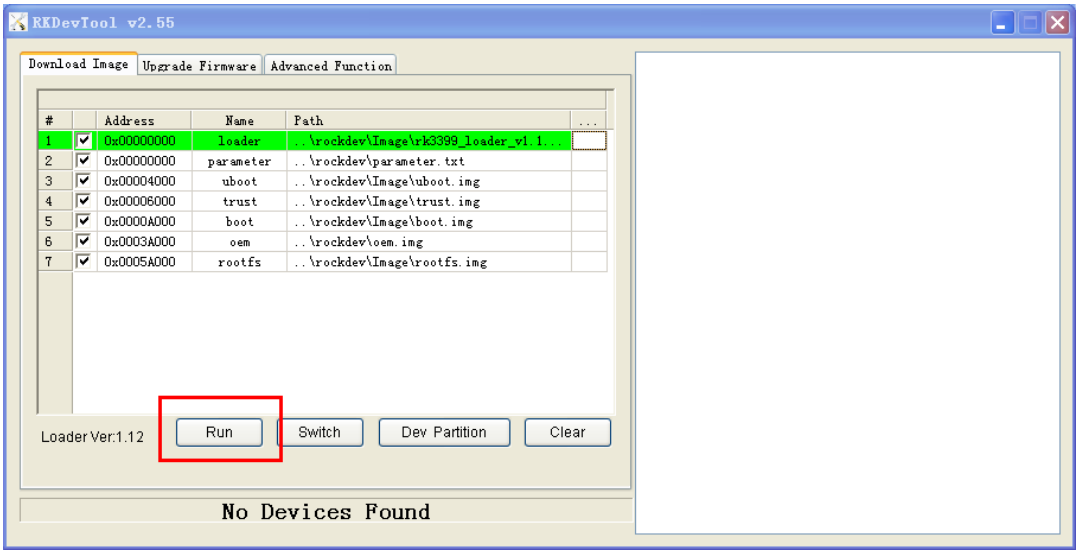
Keep holding the “Recover” key and connect the board to PC via USB type-C cable until pop-up **Found one LOADER Device.** Click “Upgrade” to download.

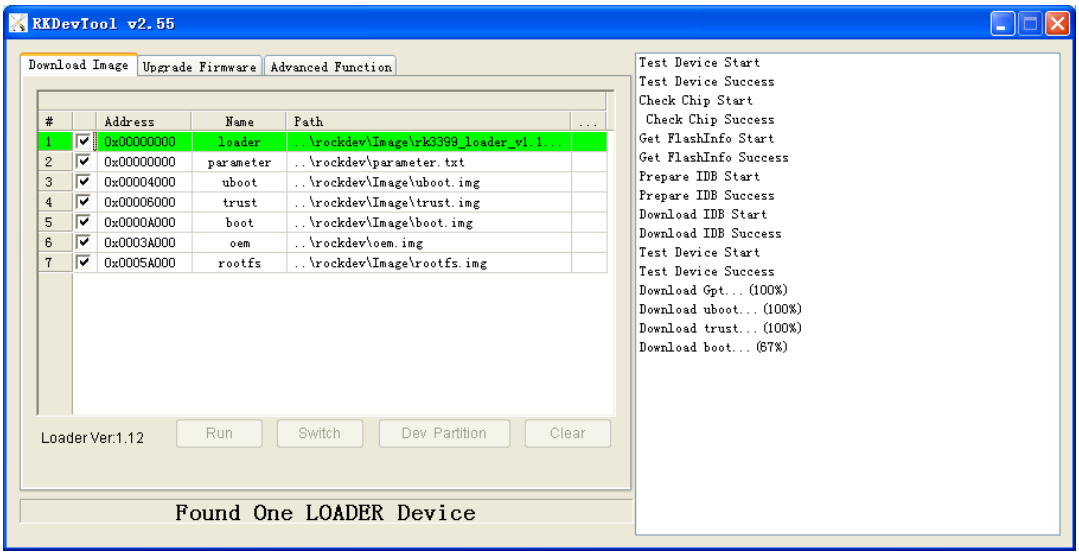


Method 2: Download separately.

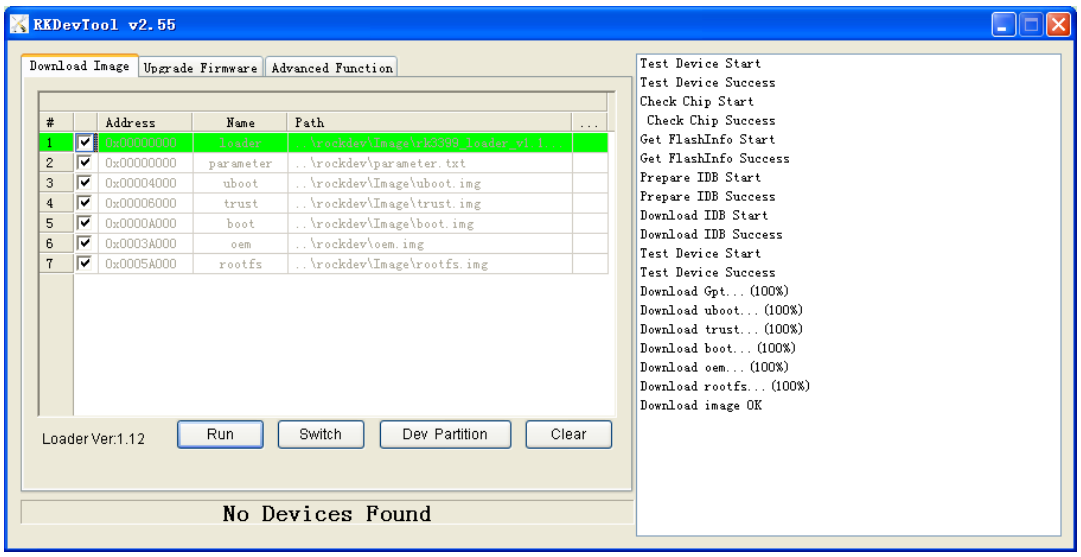
Copy **trust.img, rk3399_loader_v1.12.112.bin, uboot.img, boot.img, rootfs.img** to AndroidTool_Release_v2.55\rockdev\Image directory.

Keep holding the “Recover” key and connect the board to PC via USB type-C cable until pop-up **Found one LOADER Device.** Click “Run” to download.





Step 4, When the following message is displayed, indicating that the download is complete.



7 Ubuntu Application

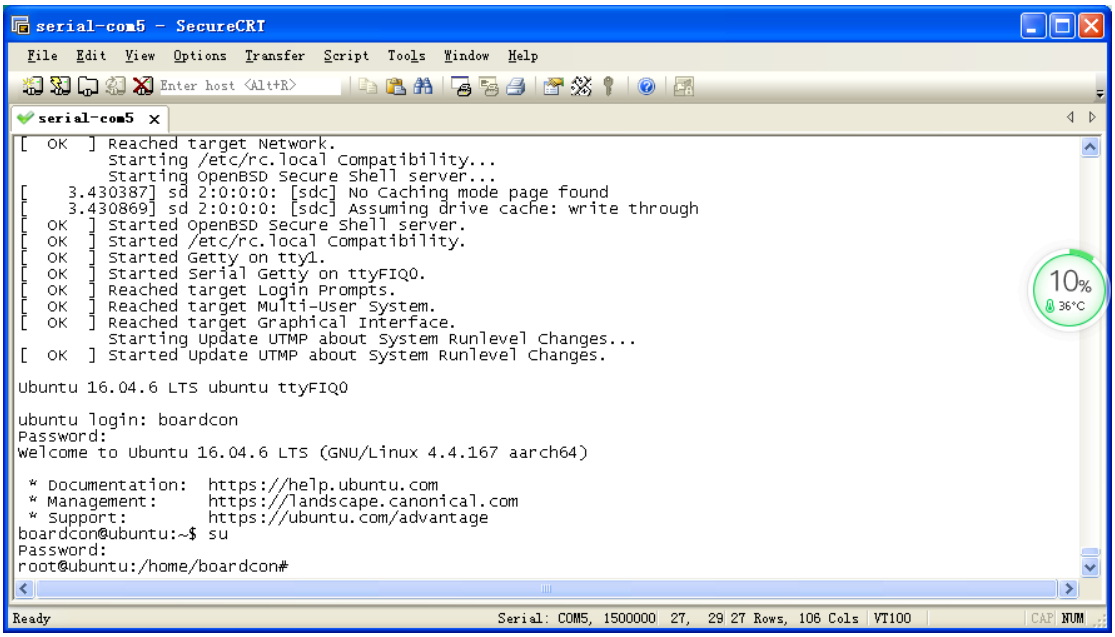
7.1 User and Password

User: boardcon

Password: boardcon

Root user: su

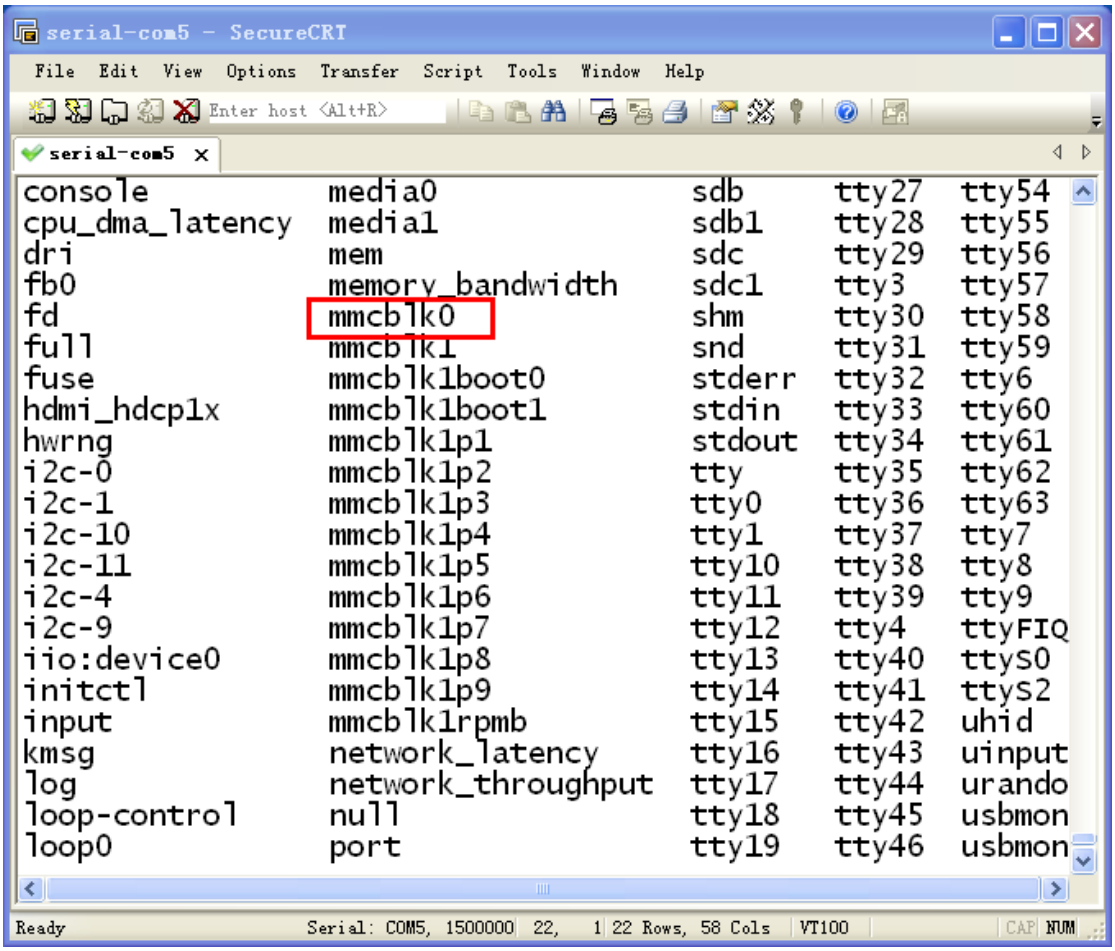
Password: root



7.2 Test SD card

Insert SD card to the board then execute the follow command to cat the device.

#ls /dev

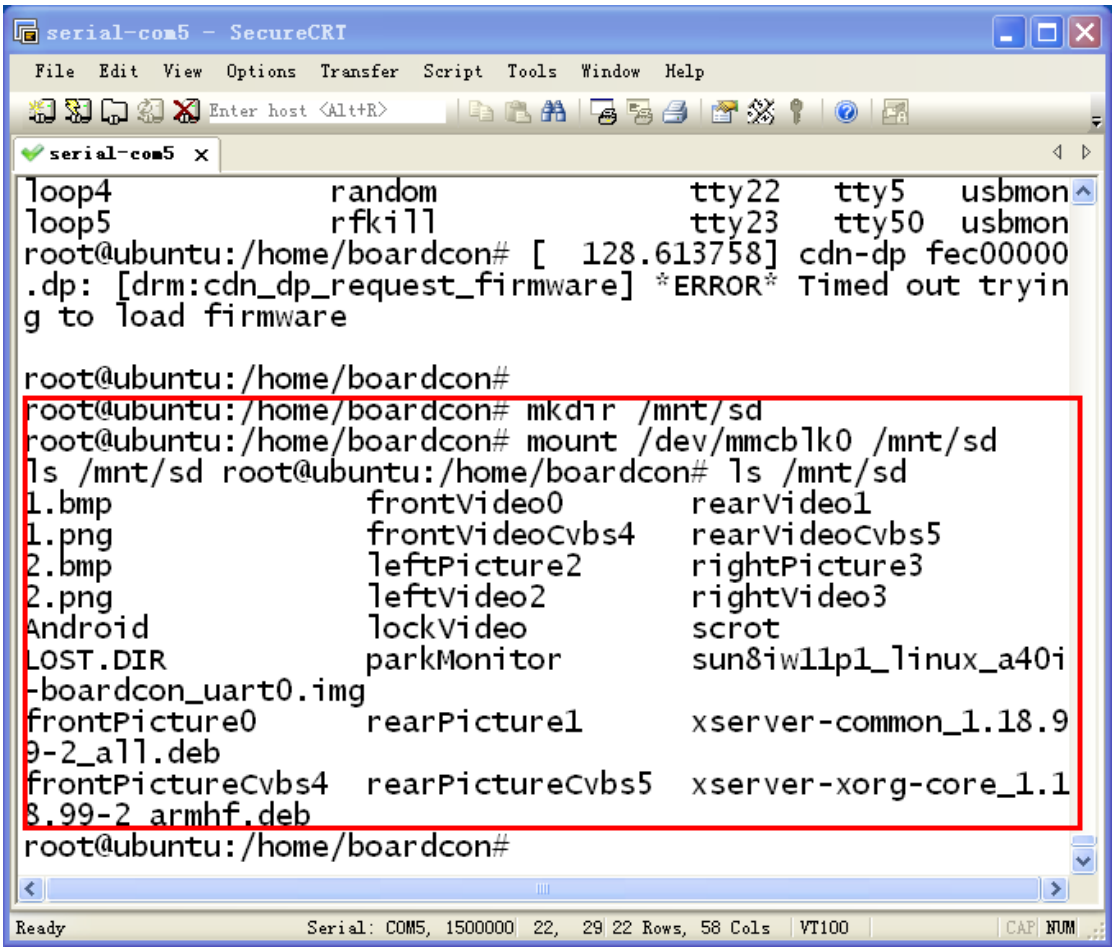


Execute the commands to mount the SD card.

#mkdir /mnt/sd

#mount /dev/mmcblk0 /mnt/sd

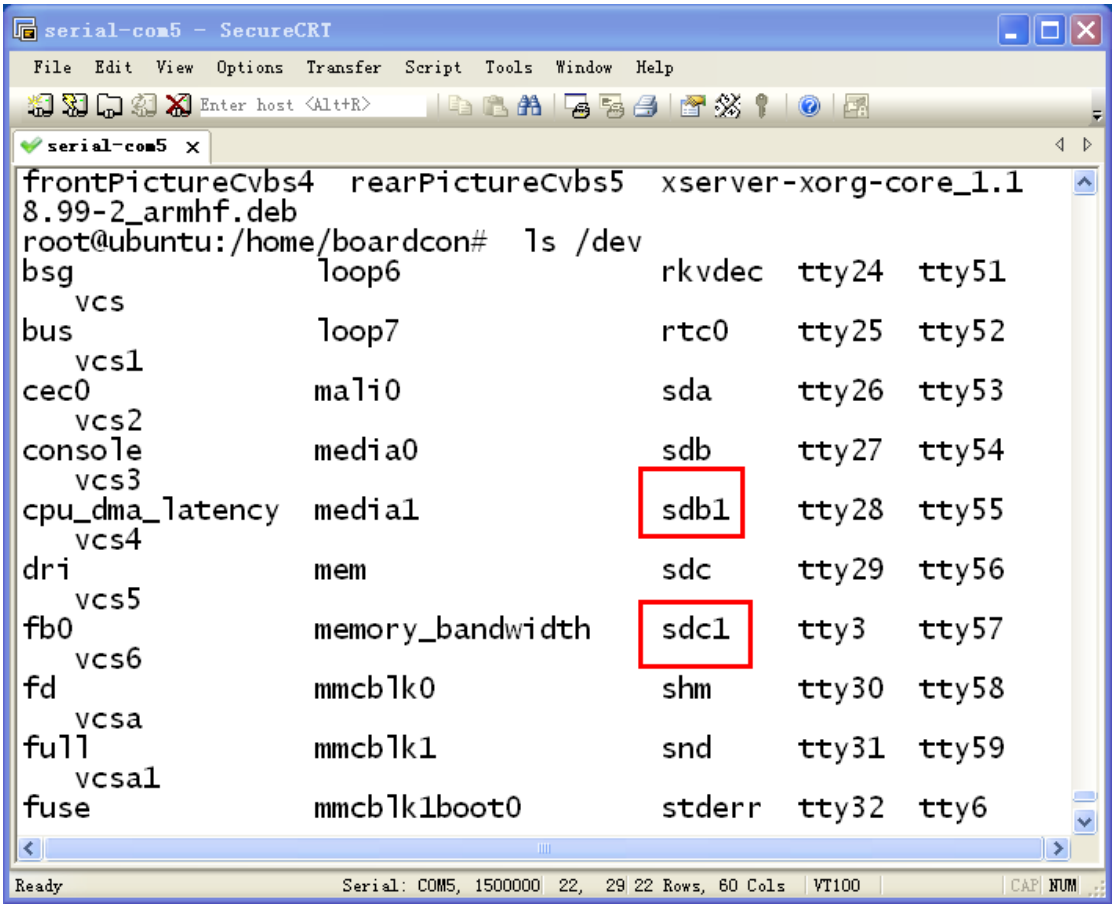
#ls /mnt/sd



7.3 Test USB Host

Connect U-disk to the board and execute the follow command to cat the device (2x U-Disk for example).

ls /dev



Execute the commands to mount the USB devices.

#mkdir /mnt/udisk1

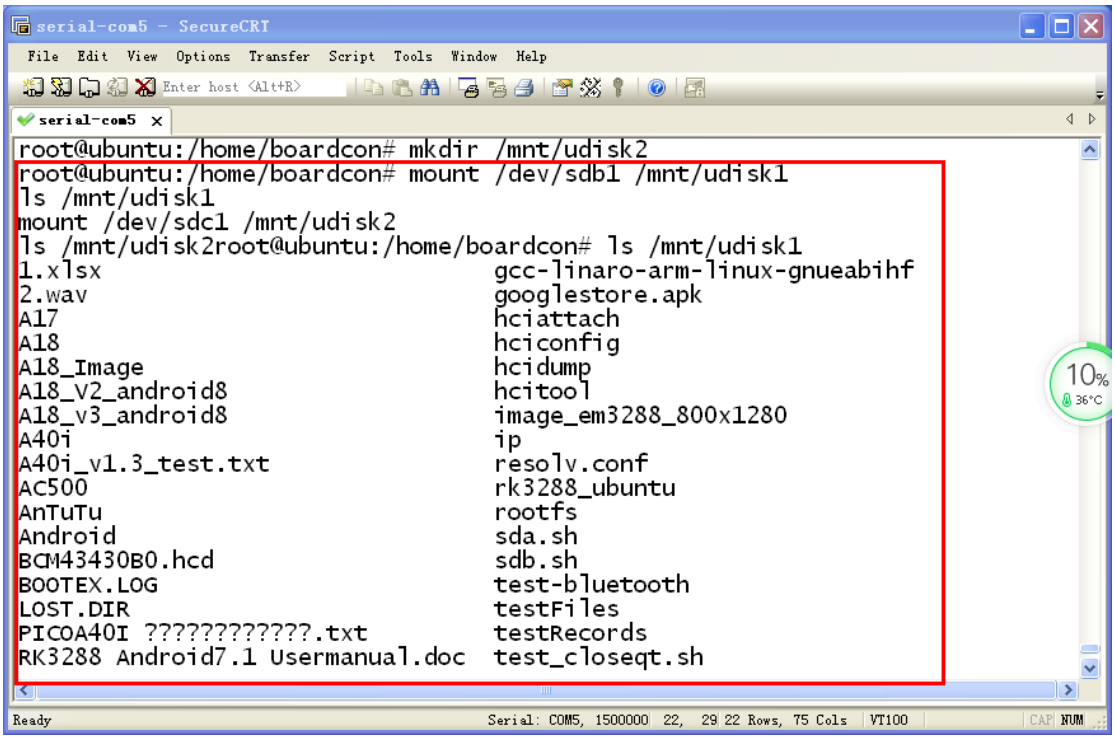
#mkdir /mnt/udisk2

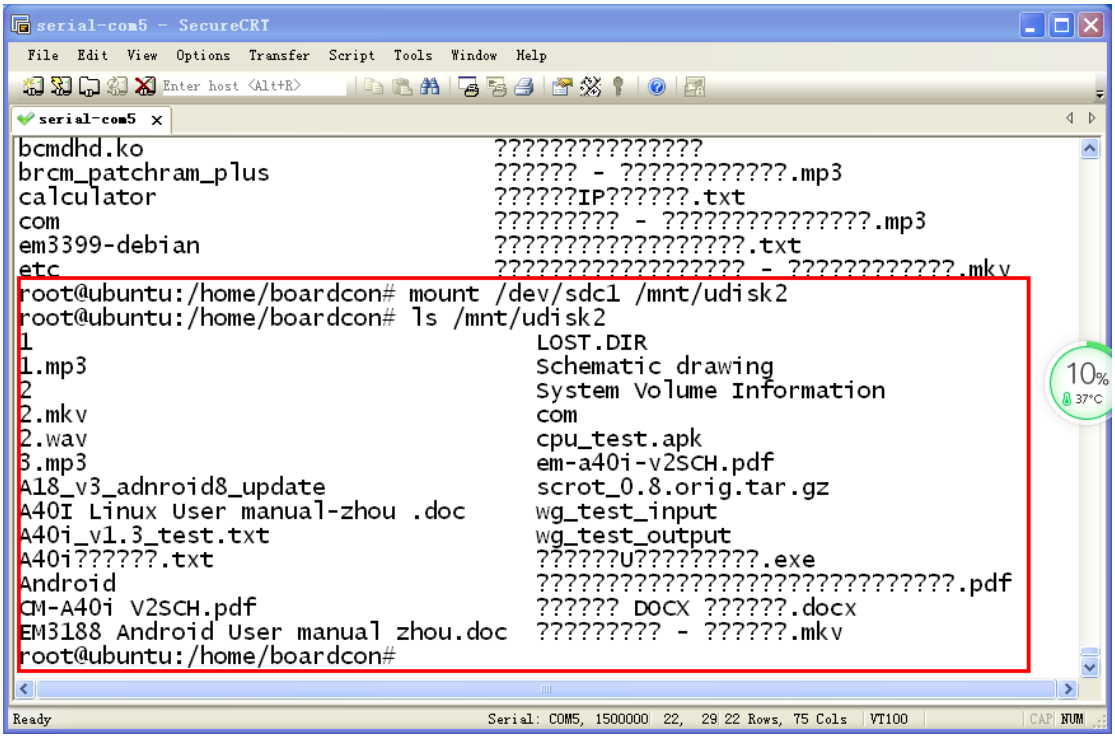
#mount /dev/sdb1 /mnt/udisk1

#ls /mnt/udisk1

#mount /dev/sdc1 /mnt/udisk2

#ls /mnt/udisk2





7.4 Test Ethernet

Connect ethernet cable to the board and power on. Execute the commands in serial terminal after system booting.

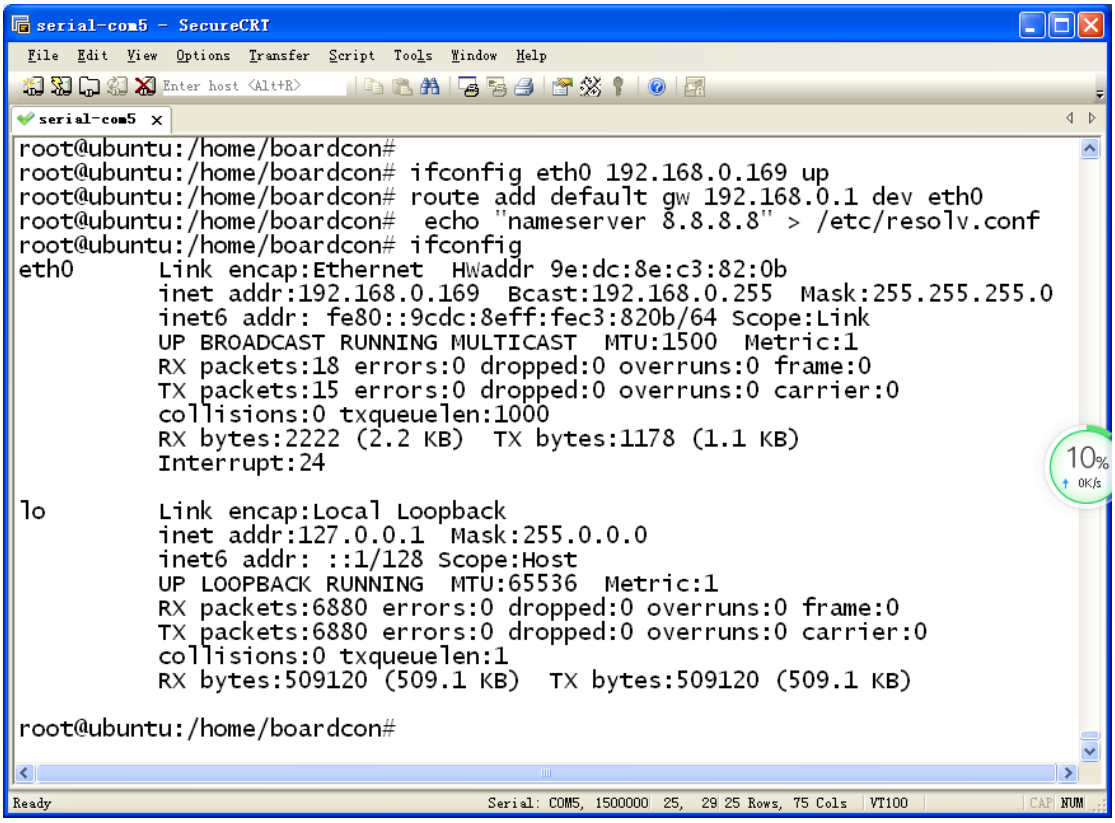
ifconfig eth0 192.168.0.169 up

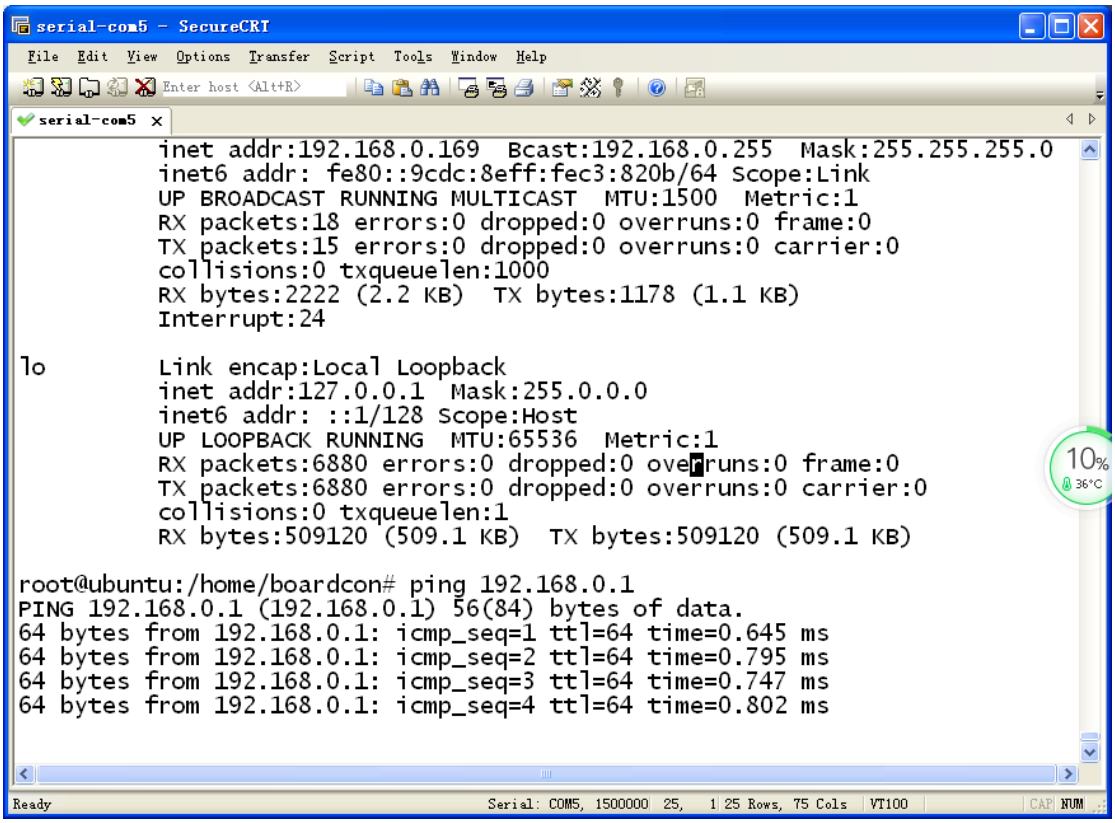
route add default gw 192.168.0.1 dev eth0 (192.168.0.1 is the ethernet gateway)

echo "nameserver 8.8.8.8" > /etc/resolv.conf

#ifconfig

ping www.baidu.com





7.5 Test WiFi

Connect WiFi antenna before test. Execute the follow commands after system booting.

Method1 Static IP Test

a). Config the SSID and password.

```
[root@ubuntu /]# wpa_passphrase Boardcon
                # reading passphrase from stdin
                boardcon43435656
               network={
                        ssid="Boardcon"
                        #psk="boardcon43435656"
        psk=bafeb7f673814bf7e06002a652e6d9f1ed749312a54481b5fa8efdd53bfa1123
                }
```

b). Copy the "ssid" and "#psk" to replace the default SSID and PSK of /etc/wpa_supplican.conf

c). Modify /etc/resolv.conf

```
# echo "nameserver 8.8.8.8" > /etc/resolv.conf
```

d). Config static IP

```
[root@ubuntu /]#ifconfig eth0 down
[root@ubuntu /]# ifconfig wlan0 192.168.0.169 up
```

e). Set the wlan0 gate way and ping URL

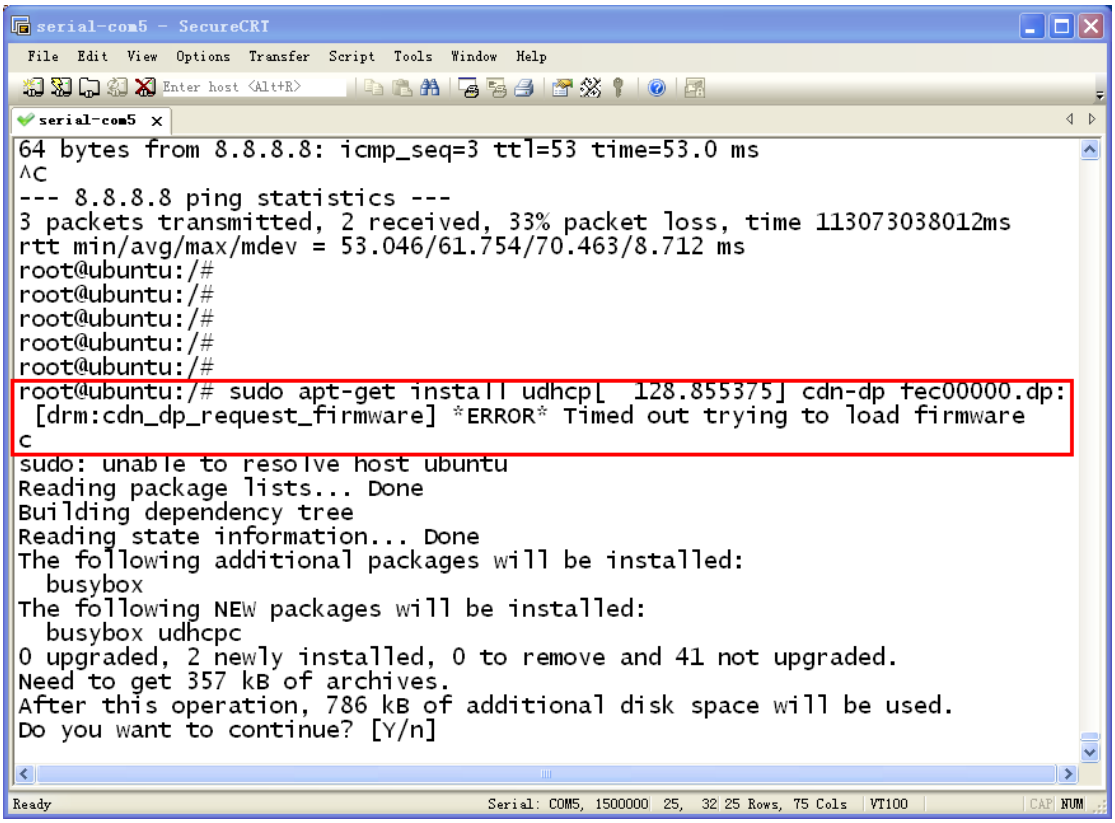
```
[root@ubuntu /]# route add default gw 192.168.0.2 dev wlan0    (Modify to User's Router gateway)
[root@ubuntu /]# wpa_supplicant -i wlan0 -Dnl80211 -c /etc/wpa_supplicant.conf -B
[root@ubuntu /]# ping www.baidu.com
[ 1818.110000] RTL871X: rtw_set_ps_mode: Leave 802.11 power save
[ 1818.110000] RTL871X: rtl8188e_set_FwPwrMode_cmd: Mode=0 SmartPS=2 UAPSD=0
PING www.baidu.com (180.97.33.67): 56 data bytes
64 bytes from 180.97.33.67: seq=0 ttl=52 time=25.886 ms
64 bytes from 180.97.33.67: seq=1 ttl=52 time=31.078 ms
64 bytes from 180.97.33.67: seq=2 ttl=52 time=36.742 ms
64 bytes from 180.97.33.67: seq=3 ttl=52 time=25.466 ms
```

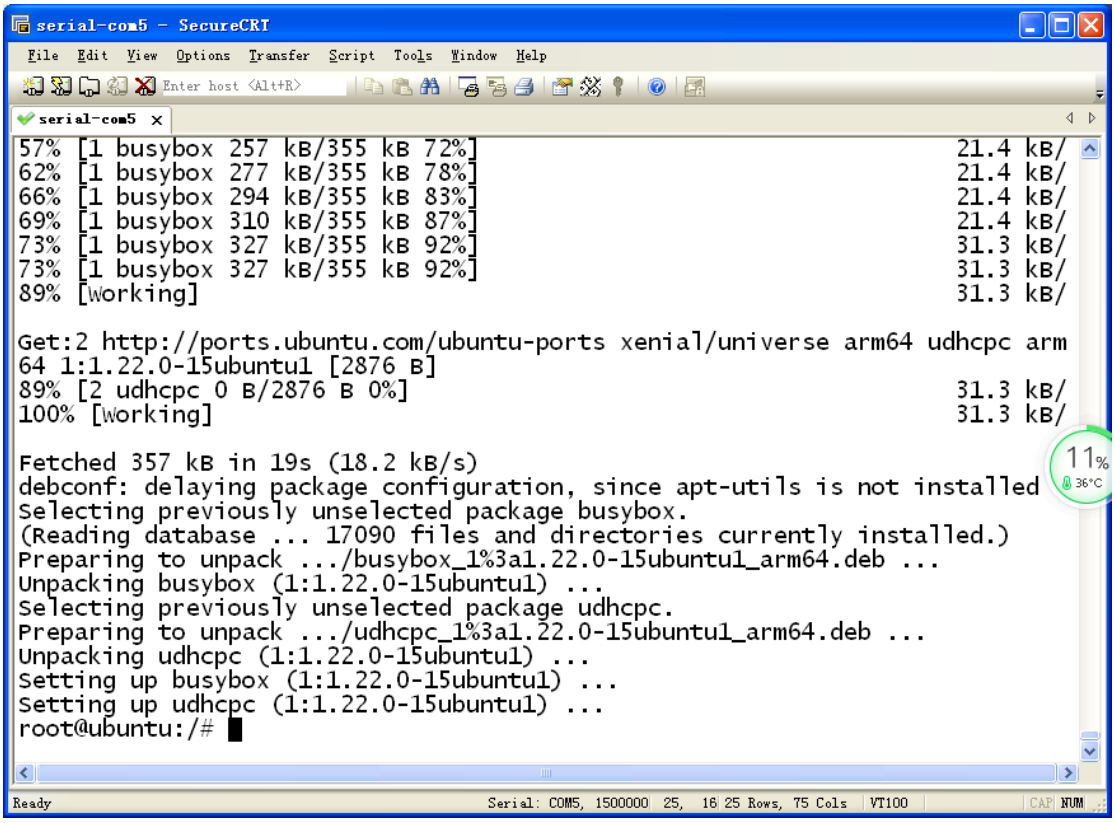
Method 2 DHCP Test

Install **udhcpc** first.

After connect to the wired network, execute the follow command and enter "**y**" to install

#sudo apt-get install udhcpc





a). Config the SSID and password.

[root@ubuntu /]# wpa_passphrase Boardcon

reading passphrase from stdin

boardcon43435656

```
network={
        ssid="Boardcon"
        #psk="boardcon43435656"
psk=bafeb7f673814bf7e06002a652e6d9f1ed749312a54481b5fa8efdd53bfa1123
        }
```

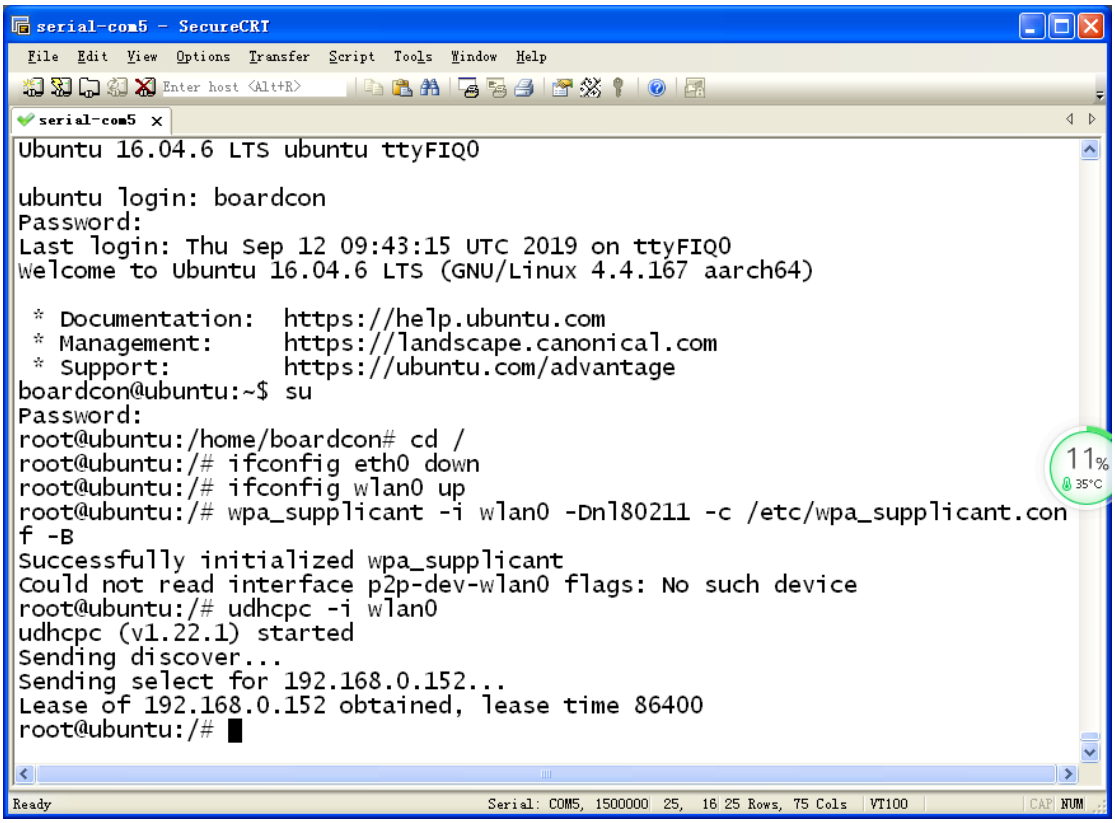
b). Copy and replace the "ssid" and "#psk" of the /etc/wpa_supplican.conf.

c). Modify /etc/resolv.conf

```
# echo "nameserver 8.8.8.8" > /etc/resolv.conf
```

d). Get dynamic IP

```
[root@ubuntu /]#ifconfig eth0 down
[root@ubuntu /]#ifconfig wlan0 up
[root@ubuntu /]# wpa_supplicant -i wlan0 -Dnl80211 -c /etc/wpa_supplicant.conf -B
[root@ubuntu /]# udhcpc -i wlan0
```




```
[root@ubuntu /]# ping www.baidu.com
[ 1818.110000] RTL871X: rtw_set_ps_mode: Leave 802.11 power save
[ 1818.110000] RTL871X: rtl8188e_set_FwPwrMode_cmd: Mode=0 SmartPS=2 UAPSD=0
PING www.baidu.com (180.97.33.67): 56 data bytes
64 bytes from 180.97.33.67: seq=0 ttl=52 time=25.886 ms
64 bytes from 180.97.33.67: seq=1 ttl=52 time=31.078 ms
64 bytes from 180.97.33.67: seq=2 ttl=52 time=36.742 ms
64 bytes from 180.97.33.67: seq=3 ttl=52 time=25.466 ms
```