User Guide
T113X Evaluation Board



Chengdu Ebyte Electronic Technology Co.,Ltd.

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Contents

Disclaimer 2
1. Overview 3
1.1. Software Resources 3
2. Preparation before use 3
2.1. Serial port software installation 3
2.2. Quick Start 4
3. Functional testing 6
3.1. Core Resources 6
3.2. Peripheral Interface 15
3.3. Network Interface 35
3.4. Audio Interface 50
4. References 52
5. Revision Notes 52
6. About us 53

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1. Overview

The Linux Software Evaluation Guide is used to introduce the test steps and evaluation methods of the core resources and peripheral resources under the open source Linux system running on Ebyte's development board. This article can be used as a preliminary evaluation guide, and can also be used as a test guide for general system development.

1.1. Software Resources

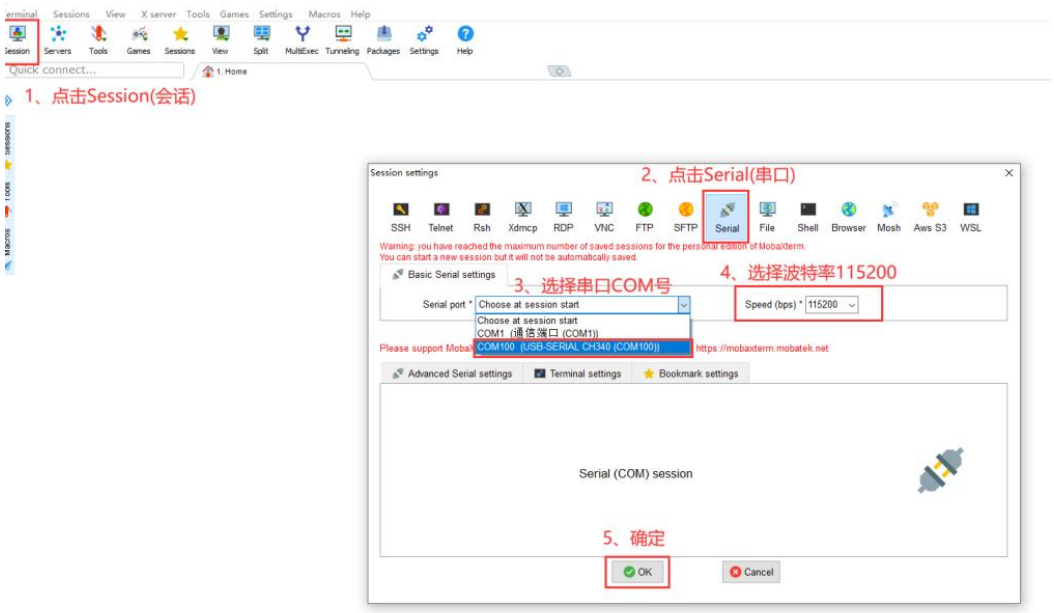
ECB30 and E CB31 are equipped with an operating system based on the Linux 5.4 kernel. The development board comes with a cross-compilation tool chain required for embedded Linux system development, U-boot source code, source code for the Linux kernel and various driver modules, as well as various development and debugging tools suitable for Windows desktop environment and Linux desktop environment, application development samples, etc.

2. Preparation before use

2.1. Serial port software installation

Before using the serial port, you need to install the CH340 serial port driver and Moba Xterm serial port terminal. For specific installation methods, see the core board development guide.

After connecting the serial port, install Moba X term and configure it, and open the serial port as follows.



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2.2. Quick Start

The single-board computers shipped by Ebyte do not come with boot firmware by default, and users need to burn a firmware by themselves. Users can choose to burn firmware according to the single-board computer model. Here we mainly help users quickly start the single-board computer and only explain how to use official tools to burn firmware to eMMC . The same is true for NAND . For more burning methods and problems in burning, see Development_Guide .

2.2.1. Burn the development board Flash

First, you need to use a USB data cable to connect the single-board computer and the computer, and access the OTG interface of the single-board computer .

Use Allwinner official tool PhoenixSuit to achieve USB fast burning.



Click the "One-click Flash" item above to enter the image selection. The images we provide are divided into nand version and emmc version. Users need to choose the correct image. E CB30 and E CB31 series currently use emmc core boards. After selecting, you do not need to click the upgrade button immediately.

ECB30-T113I select t113_i_linux_ebyte_t113i_uart0.img

ECB31-P4T13SA1* select t113_linux_ebyte_t113_uart0.img

ECB31-P4T13SA2* select t113_s4_linux_ebyte_t113s4_uart0.img

ECB31-PB1E8 select t113_linux_ebyte_t113_PI_uart0.img

ECB31-PB2E8 select t113_s4_linux_ebyte_t113s4_PI_uart0.img

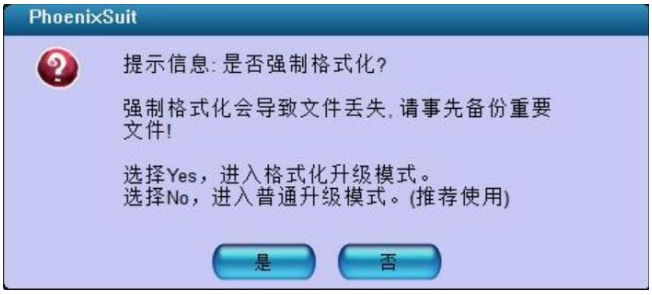
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Next we connect two USB - TypeC cables, one for viewing the flash log and one for flashing the board . After the connection is complete, we need to enter the flash mode .

ECB30 leads out the FEL button. The user can press FEL and hold it, then press the reset button or power on the board to enter the programming mode , and a programming inquiry box will pop up. ECB31 does not lead out the FEL button. The user can first open the serial terminal software, use the keypad to press keypad 2 on the serial terminal, then press the reset button or power on the board to enter the programming mode , and a programming inquiry box will pop up.



Users can choose whether to format and upgrade as needed and wait for the burning to be completed .

It should be noted that T113 starts from the SD card first. After burning to the onboard flash , you need to remove the SD card to start from the onboard flash .

2.2.2. Using the serial port to interact with the single board computer

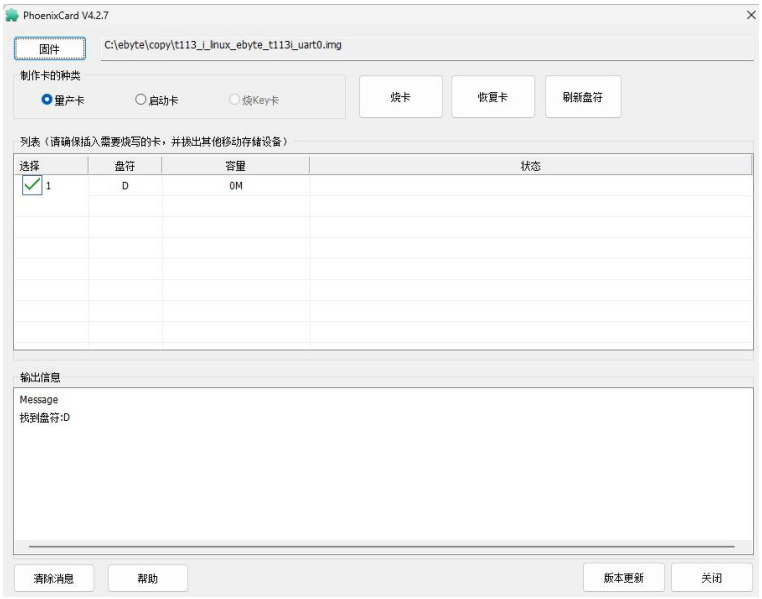
The burning is completed , we can access the serial port to check the startup of the single board computer. You need to use a USB data cable to connect to the debugging serial port of the single board computer. Then use the above serial port software moba X term to select the correct serial port number and baud rate 1 15200. Next, we can enter the functional test content of Chapter 3.

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2.2.3. Burn SD card

This section is a supplement to the burning function. Users can burn to the SD card to start the development board. Here we need to use PhoenixCard to burn the SD card.



Please select the firmware to be burned in turn . The firmware can be selected according to the emmc version of the board to be burned. For example, if the CPU model of the board on hand is t1 13s4 , then select t113_s4_linux_ebyte_t113s4_uart0.img . Select the card type as "startup card", and then select the SD card device to be burned . The software will automatically scan the available mobile storage devices. Please be careful not to select the wrong device. Finally, click the "Burn Card" button, and the current progress will be displayed in real time during the burning process .

3. Functional testing

3.1. Core Resources

In Linux system, the proc virtual file system is provided to query the parameters of various core resources and some general tools are provided to evaluate the performance of resources. The following will specifically read and test the parameters of core resources such as CPU, memory, eMMC, RTC, etc.

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3.1.1. CPU

3.1.1.1. View CPU information

Run cat /proc/ cpuinfo to view CPU information .

```
processor       : 0
model name      : ARMv7 Processor rev 5 (v7l)
BogoMIPS        : 48.00
Features        : half thumb fastmult vfp edsp neon vfpv3 tls vfpv4 idiva idivt vfpd32 lpae
CPU implementer : 0x41
CPU architecture: 7
CPU variant     : 0x0
CPU part        : 0xc07
CPU revision    : 5

processor       : 1
model name      : ARMv7 Processor rev 5 (v7l)
BogoMIPS        : 48.00
Features        : half thumb fastmult vfp edsp neon vfpv3 tls vfpv4 idiva idivt vfpd32 lpae
CPU implementer : 0x41
CPU architecture: 7
CPU variant     : 0x0
CPU part        : 0xc07
CPU revision    : 5

Hardware        : Generic DT based system
Revision        : 0000
Serial          : 0000000000000000
```

processor: The number of the logical processing core in the system. For a multi-core processor, it can be a physical core or a virtualized logical core using hyperthreading technology.
model name: the name and number of the CPU

BogoMIPS : A rough estimate of the number of instructions executed by the CPU per second when the system kernel is booted (MillionInstructions Per Second)

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3.1.1.2. Check CPU usage

```
top - 13:56:36 up 58 min,  0 users,  load average: 0.00, 0.00, 0.11
Tasks:  64 total,   1 running,  33 sleeping,   0 stopped,   0 zombie
%Cpu(s):  0.0 us,  1.0 sy,  0.0 ni, 99.0 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
KiB Mem :   449616 total,   370472 free,    30388 used,    48756 buff/cache
KiB Swap:        0 total,        0 free,        0 used.   407640 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
  255 root      20   0    4908   2284   1868 R   0.7   0.5   0:00.16 top
    1 root      20   0   28520   5696   4472 S   0.0   1.3   0:03.30 systemd
    2 root      20   0       0      0      0 S   0.0   0.0   0:00.01 kthreadd
    3 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 rcu_gp
    4 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 rcu_par_gp
    5 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 slub_flushwq
    6 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 netns
    8 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/0:0+
    9 root      20   0       0      0      0 I   0.0   0.0   0:03.06 kworker/u2:+
   10 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 mm_percpu_wq
   11 root      20   0       0      0      0 I   0.0   0.0   0:00.00 rcu_tasks_k+
   12 root      20   0       0      0      0 I   0.0   0.0   0:00.00 rcu_tasks_t+
   13 root      20   0       0      0      0 S   0.0   0.0   0:00.25 ksoftirqd/0
   14 root      20   0       0      0      0 I   0.0   0.0   0:00.34 rcu_preempt
   15 root      20   0       0      0      0 S   0.0   0.0   0:00.02 kdevtmpfs
   16 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 inet_frag_wq
   20 root      20   0       0      0      0 I   0.0   0.0   0:00.77 kworker/0:4+
```

% usr : represents the user space program cpu Utilization

%sys : represents the system space cpu Utilization

%idle ： idle cpu

% irq : cpu Number of hard interrupts processed

% sirq : cpu The number of soft interrupts to process

3.1.1.3. View CPU temperature information

Check the internal temperature of the CPU via cat /sys/class/thermal/thermal_zone0/temp .

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```
#cat /sys/class/thermal/thermal_zone0/temp
39061
```

The above value divided by 1000 is the correct temperature value in degrees Celsius.

3.1.2. Memory

3.1.2.1. View memory information

You can view memory information through cat /proc/ meminfo .

```
#cat /proc/meminfo
MemTotal:         231080 kB
MemFree:          197528 kB
MemAvailable:     206076 kB
Buffers:            3596 kB
Cached:             8052 kB
SwapCached:            0 kB
Active:             9908 kB
```

MemTotal : Total memory . The value shown here is 449616 kB, which means that the system has a total of about 449 MB of physical memory available.

MemFree : The amount of free memory. The value displayed here is 370472 kB, which means that there are about 370 MB of free memory in the current system and it is not being used.

MemAvailable : The amount of available memory. The value shown here is 407640 kB, which represents the total amount of memory currently available to the system, including cached memory and available memory.

Buffers: Buffer usage. The value shown here is 0 kB, which means that the system is not currently using any memory as a buffer.

Cached: The amount of cached memory. The value shown here is 39208 kB, which indicates the amount of memory currently used by the system for caching.

SwapCached : The amount of memory that is swap cached. The value shown here is 0 kB, indicating that there is currently no memory cached in the swap space.

Active: The amount of active memory. The value shown here is 13408 kB, which indicates the amount of memory currently in use.

3.1.2.2. Memory stress test

By specifying the size and number of test memory, the system's existing memory can be

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stress tested. You can use the system tool memtester to test, such as specifying a memory size of 10MB , a test number of 1, and a test command of " memtester 1 0M 10".

```
#memtester 10M 1
memtester version 4.3.0 (32-bit)
Copyright (C) 2001-2012 Charles Cazabon.
Licensed under the GNU General Public License version 2 (only).

pagesize is 4096
pagesizemask is 0xfffff000
want 10MB (10485760 bytes)
got  10MB (10485760 bytes), trying mlock ...locked.
Loop 1/1:
  Stuck Address       : ok
  Random Value        : ok
  Compare XOR         : ok
  Compare SUB         : ok
  Compare MUL         : ok
  Compare DIV         : ok
  Compare OR          : ok
  Compare AND         : ok
  Sequential Increment: ok
  Solid Bits          : ok
  Block Sequential    : ok
  Checkerboard        : ok
  Bit Spread          : ok
  Bit Flip            : ok
  Walking Ones        : ok
  Walking Zeroes      : ok
  8-bit Writes        : ok
  16-bit Writes       : ok

Done.
```

3.1.3. eMMC Test

View eMMC capacity

The eMMC partition information and capacity can be queried through the fdisk -l command.

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```
#fdisk -l
Found valid GPT with protective MBR; using GPT

Disk /dev/mmcblk0: 15147008 sectors, 3300M
Logical sector size: 512
Disk identifier (GUID): ab6f3888-569a-4926-9668-80941dcb40bc
Partition table holds up to 7 entries
First usable sector is 73728, last usable sector is 15146974

Number  Start (sector)    End (sector)  Size Name
     1           73728          108165 16.8M boot-resource
     2          108166          110213 1024K env
     3          110214          112261 1024K env-redund
     4          112262          147461 17.1M boot
     5          147462         2244613 1024M rootfs
     6         2244614         2277381 16.0M private
     7         2277382        15146974 6283M UDISK
Disk /dev/sda: 29 GB, 30784094208 bytes, 60125184 sectors
3742 cylinders, 255 heads, 63 sectors/track
Units: sectors of 1 * 512 = 512 bytes

Device  Boot StartCHS    EndCHS        StartLBA     EndLBA    Sectors  Size Id
Type
/dev/sda1       0,0,33      1023,254,63       32   60125183   60125152 28.6G  c
Win95 FAT32 (LBA)
```

View emmc partition

The df command can be used to query eMMC partition information, usage, mount directory and other information.

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```
#df -h
Filesystem                Size      Used Available Use% Mounted on
/dev/root               991.9M    180.5M    795.4M  18% /
devtmpfs                484.5M         0    484.5M   0% /dev
tmpfs                   493.7M         0    493.7M   0% /dev/shm
tmpfs                   493.7M    204.0K    493.5M   0% /tmp
tmpfs                   493.7M    128.0K    493.5M   0% /run
/dev/sda1                28.7G    269.5M     28.4G   1% /mnt/usb/sda1
/dev/by-name/UDISK        6.1G      4.0K      6.1G   0% /mnt/UDISK
```

3.1.4. Nand Flash Test

3.1.4.1. Check Nand capacity and size

```
#cat /proc/mtd
dev:        size     erasesize    name
mtd0: 00100000 00040000 "boot0"
mtd1: 00300000 00040000 "uboot"
mtd2: 00100000 00040000 "secure_storage"
mtd3: 0fb00000 00040000 "sys"
```

3.1.4.2. Nand Performance Test

Writing files

The performance test mainly tests the reading and writing speed of files by NAND under Linux system, and is generally tested by combining the time and dd commands .

```
#time dd if=/dev/zero of=write_file bs=100M count=1 conv=fsync
100+0 records in
100+0 records out

real       0m16.041s
user       0m0.000s
sys        0m2.115s
```

Calculation shows that the file writing speed is about 6.25MB / s.

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Reading Files

In embedded systems, it is often necessary to test the system file read and write performance, ignoring the effect of cache when reading files. First execute the following command to clear the cache.

```
#sync; echo 3 > /proc/sys/vm/drop_caches
#time dd if=write_file of=read_file bs=100M count=1
1+0 records in
1+0 records out

real    0m15.925s
user    0m0.000s
sys     0m0.937s
```

3.1.5. RTC

The Linux system is divided into system clock (software clock) and RTC clock (hardware clock). The system clock will disappear when the power is off, and the RTC clock will run for a long time if a battery is installed. If you need to use an external RTC clock, please install the ML2032 (3V rechargeable) or CR2032 (3V non-rechargeable) battery into the RTC button battery holder .

Setting the system time

Set the system time to 2 024.07.12 16:35:15

```
# date 071216352024.15

Fri Jul 12 16:35:15 UTC 2024
```

Write system time to R TC

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```
# hwclock -w
```

```
# hwclock -r
2000-01-01 07:07:15.965766+0000
```

Keep RTC time when power off

Turn off the development board and disconnect the power supply. After a while, turn it back on. Check the RTC time and system time:

```
# hwclock -r
2024-07-12 16:52:42.648561+0000
```

3.1.6. Watch Dog

Use the test routine to test the watchdog. The file has been compiled and placed in the tool directory. After copying it to the development board, run the watchdog application , with a timeout of 4s and feed the dog every 1s:

```
# ./watchdog 4 1 0
Starting wdt_driver (timeout: 4, sleep: 1, test: ioctl)
Trying to set timeout value=4 seconds
The actual timeout was set to 4 seconds
Now reading back -- The timeout is 4 seconds
```

If the above 1s is changed to greater than 4s, the required 4s dog feeding time will be exceeded and the development board will restart.

3.1.7. Power Management

This chapter demonstrates the Suspend function of Linux power management, which allows the development board to sleep and be awakened by external events. The Linux kernel generally provides three types of Suspend: Freeze and STR (Suspend to RAM). They can be triggered by writing " freeze " and " mem " to the " /sys/power/state " file in user space .

View currently supported modes

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```
# cat /sys/power/state
freeze mem
```

Hibernate to RAM

```
root@ebyte-ubuntu:~# echo "mem" > /sys/power/state
```

3.2. Peripheral Interface

3.2.1. GPIO

View all GPIOs and list all registered pins.

```
#mount -t debugfs none /sys/kernel/debug
#cat /sys/kernel/debug/pinctrl/pio/pins
registered pins: 88
pin 32 (PB0)
pin 33 (PB1)
pin 34 (PB2)
pin 35 (PB3)
pin 36 (PB4)
pin 37 (PB5)
pin 38 (PB6)
pin 39 (PB7)
pin 40 (PB8)
pin 41 (PB9)
pin 42 (PB10)
pin 43 (PB11)
pin 44 (PB12)
pin 64 (PC0)
pin 65 (PC1)
******
```

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Export G PIO

Here we take T113I as an example. From the schematic diagram, we can see that the 31st pin of the baseboard is GPIO6 . We can find out that GPIO6 corresponds to PB0 by searching the schematic diagram . From the pins above, we can know that the GPIO number is 32. We export GPIO 3 through gpiofs as shown below.

```
#cd /sys/class/gpio/
#ls
export        gpiochip0    unexport
#echo 32 > export
#ls
export        gpio32        gpiochip0    unexport
```

Set G PIO direction

enter

```
#cd gpio32
#ls
active_low                edge                        uevent
device                    power                       value
direction                 subsystem                   waiting_for_supplier
#echo in > direction
```

Output

```
#echo out > direction
```

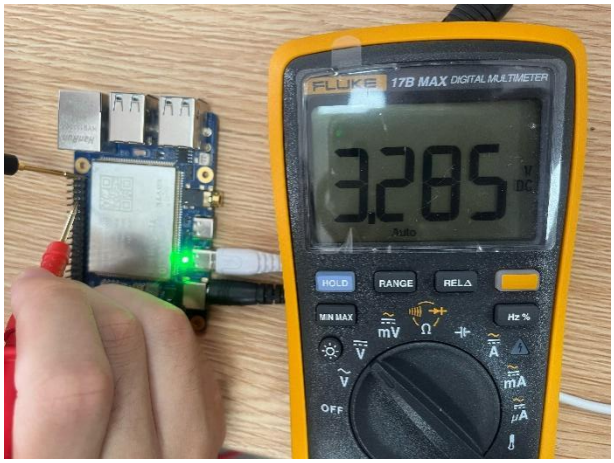
setting the G PIO value to 1, you can use a multimeter to measure and find that the 31st pin of J10 is 3.3V .

The actual measurement error range is ±5 % .

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```
#echo 1 > value
```



Unregister G PIO

```
#echo 32 > unexport
]#ls
export          gpiochip0    unexport
```

3.2.2. LED Light

The Linux system provides an independent subsystem to facilitate the operation of LED devices from user space. This subsystem provides operation interfaces for LED devices in the form of files. These interfaces are located in the /sys/class/ leds directory. In the hardware resource list, we have listed all the LEDs on the development board. Next, we test the LED by reading and writing sysfs commands . The following commands are all general commands and are also general methods for operating LEDs.

```
#cd /sys/class/leds/
#ls
heartbeat
```

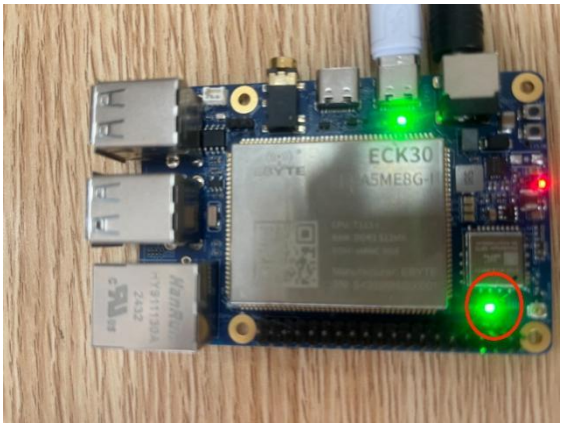
LEDs on and off

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```
# echo 0 > brightness

# echo 1 > brightness
```



View LED Trigger Mode

```
root@ebyte-ubuntu:/sys/class/leds/green:heartbeat# cat trigger

[none] rfkill-any rfkill-none kbd-scrolllock kbd-numlock kbd-capslock kbd-kanalock kbd-shiftlock kbd-altgrlock kbd-ctrllock kbd-altlock kbd-shiftllock kbd-shiftrlock kbd-ctrlllock kbd-ctrlrlock timer oneshot heartbeat backlight gpio cpu cpu0 default-on transient flash torch mmc0 mmc1
```

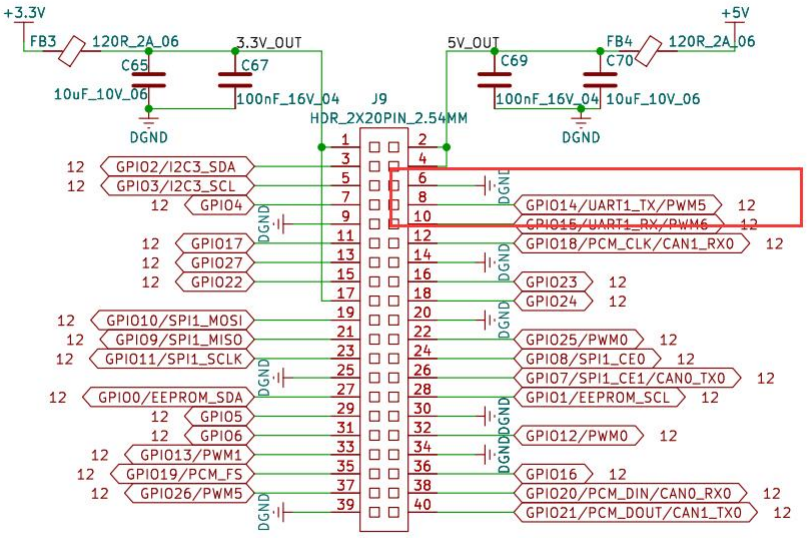
3.2.3. Serial Port

The single board computer has two serial ports for use. The T113I has UART0 (D EBUG) and U ART1 . The T113S has UART0 (D EBUG) and U ART3 . The following takes the T113I as an example.

Serial port 1 needs to be opened using device tree configuration. The schematic diagram is as follows.

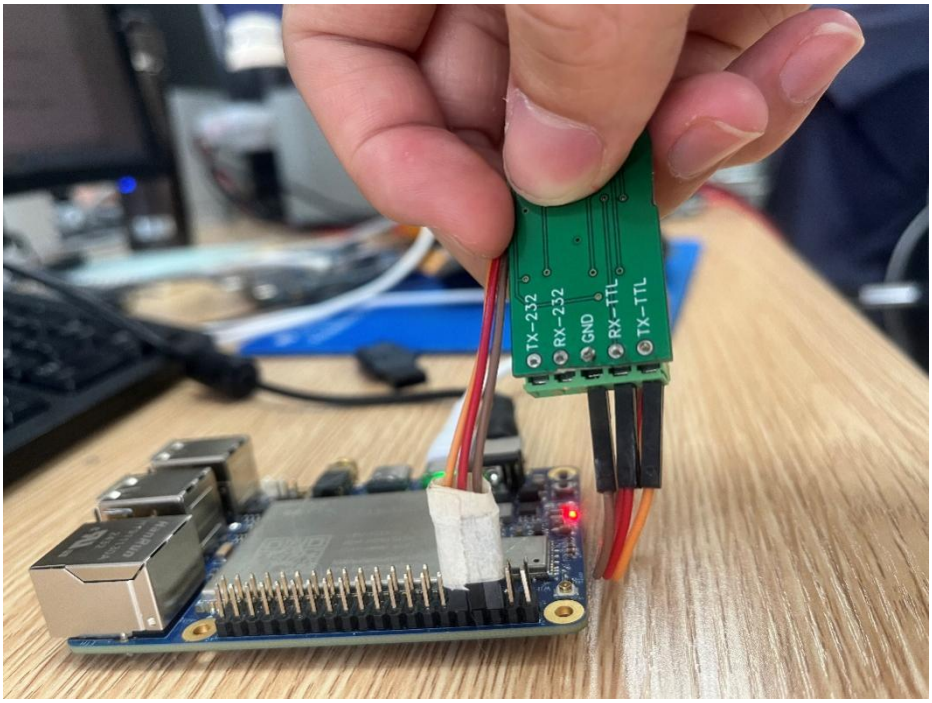
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GPIO

pins 6 , 8, and 10 are GND, UART1_TX, and UART1_RX respectively . We can use USB-TTL to connect to the PC .



Then we check if the device tree is configured. The configuration of <SDK>/device/config/chips/t113_i/configs/ebyte_t113i/ board.dts should be as follows. The SDK is configured by default.

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```
&uart1 {
 pinctrl-names = "default", "sleep";
 pinctrl-0 = <&uart1_pins_a>;
 pinctrl-1 = <&uart1_pins_b>;
 status = "okay";
};

 uart1_pins_a: uart1_pins@0 {
  pins = "PB8", "PB9";
  function = "uart1";
  drive-strength = <10>;
  bias-pull-up;
 };

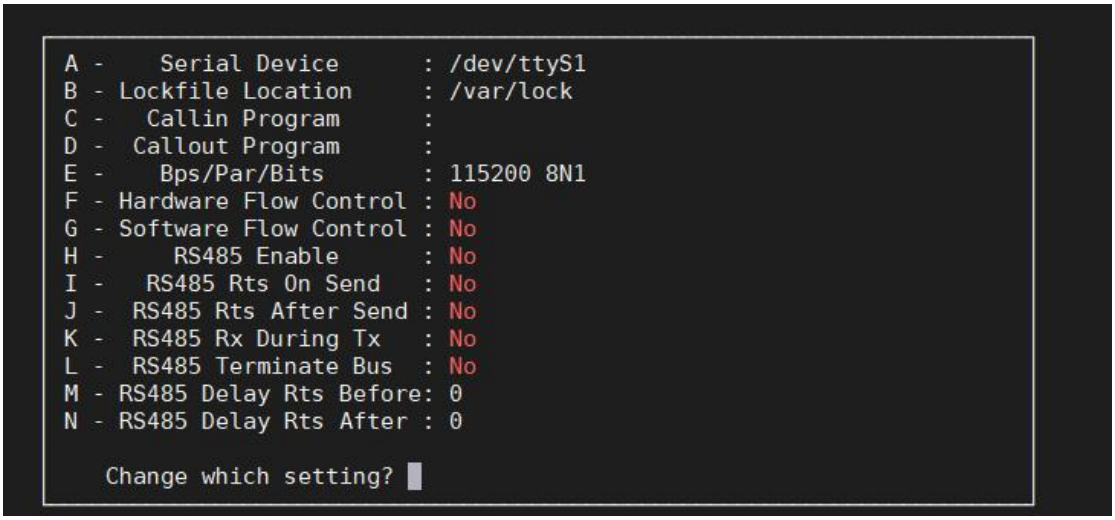
 uart1_pins_b: uart1_pins@1 {
  pins = "PB8", "PB9";
  function = "gpio_in";
 };
```

This serial port can be directly connected to the PC using a USB - TTL adapter cable for testing. It is registered as tty S1 in the single-board computer , and UART 3 of T113S is registered as tty AS3 . We use minicom to open tty S1 for communication testing.

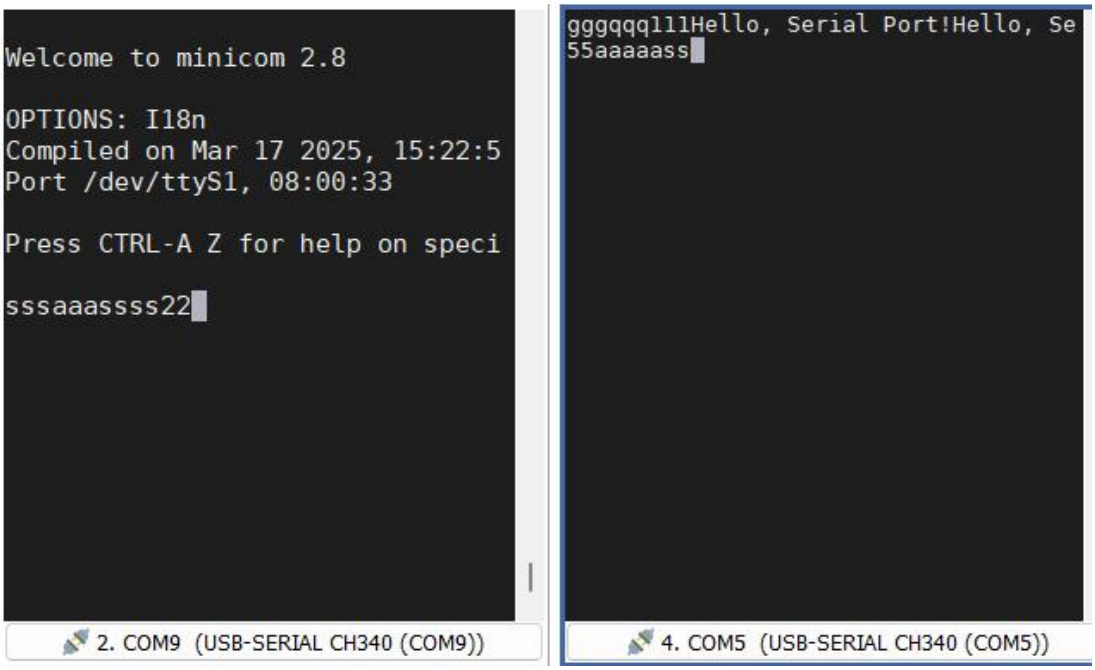
```
minicom -s #Enter the setup mode
Press A to set the serial port number, press Enter to end
Press F to turn off hardware flow control, press Enter to end
Select exit to enter the communication interface.
```

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You can use minicom to send and receive data normally



3.2.4. USB

This section verifies the feasibility of the USB Host driver through related commands or hot plugging and USB HUB, and realizes the functions of reading and writing U disk and USB enumeration.

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3.2.4.1. 1. Insert the USB drive

Insert the USB drive and use df -h to find the storage device.

```
#df -h
Filesystem                Size      Used Available Use% Mounted on
ubi0_5                   83.1M     41.2M     41.9M  50% /
tmpfs                   113.3M    100.0K    113.2M   0% /tmp
tmpfs                   113.3M     16.0K    113.3M   0% /run
devtmpfs                104.8M         0    104.8M   0% /dev
/dev/by-name/UDISK        2.8M     28.0K      2.5M   1% /mnt/UDISK
/dev/sda1                28.7G    326.1M     28.3G   1% /mnt/usb/sda1
```

3.2.4.2. U disk mount read and write

Mount the USB drive, the system will automatically mount the USB drive, / dev / sda1 to / mnt / usb / sda1 / directory

Reading Files

Create some files in the USB drive in advance

```
# cd /mnt/usb/sda1/
#cat mic_in_test.sh
tinymix set "ADC1 Input FMINL Switch" 0
tinymix set "ADC1 Input MIC1 Boost Switch" 1
tinymix set "ADC1 Input LINEINL Switch" 0
***
```

Writing files

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```
#touch test
#echo hello > test
#cat test
hello
```

3.2.5. OTG

3.2.5.1. USB HOST mode test

Please connect the USB flash drive to the USB0 DRD port of the evaluation board via the Type-C adapter.

When the system is powered on, the USB0 DRD interface is in DEVICE mode by default. When a DEVICE device is connected, the system will automatically switch to HOST mode. Execute the following command to view that the current mode is HOST mode.

```
#cat /sys/bus/platform/drivers/otg\ manager/soc\@3000000\:usbc0\@0/otg_role
usb_host
```





3.2.5.2. USB DEVICE mode test

When the system is powered on, the USB0 DRD interface is configured as DEVICE mode by default. When a DEVICE device is connected, the system will automatically switch to HOST mode. Please make sure that the USB0 DRD interface is not connected to a device, and then

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execute the following command to view that the current mode is DEVICE.

```
#cat /sys/bus/platform/drivers/otg\ manager/soc\@3000000\:usbc0\@0/otg_role
usb_device
```

the product document "4-Software Documentation\Demo\base-demos\ otg \" directory to the evaluation board file system "/opt/" directory. Execute the following command to virtualize the 10MByte DDR memory space of the evaluation board as a USB flash drive. Use a data cable to connect to the computer.

mounting the USB flash drive, you need to move the startup program S50adb_start to another directory, otherwise the script will fail to execute successfully .

```
#mv /etc/init.d/S50adb_start /root/
```

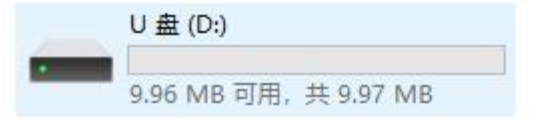
Then execute the script otg.sh

```
#!/bin/bash
dd if=/dev/zero of=/dev/a.bin bs=1M count=10
mount -t configfs none /sys/kernel/config
mkdir /sys/kernel/config/usb_gadget/g1
echo "0x18d1" > /sys/kernel/config/usb_gadget/g1/idVendor
echo "0x0001" > /sys/kernel/config/usb_gadget/g1/idProduct
mkdir /sys/kernel/config/usb_gadget/g1/strings/0x409
mkdir /sys/kernel/config/usb_gadget/g1/functions/mass_storage.usb0
echo /dev/a.bin > /sys/kernel/config/usb_gadget/g1/functions/mass_storage.usb0/lun.0/file
mkdir /sys/kernel/config/usb_gadget/g1/configs/c.1
echo 0xc0 > /sys/kernel/config/usb_gadget/g1/configs/c.1/bmAttributes
echo 500 > /sys/kernel/config/usb_gadget/g1/configs/c.1/MaxPower
mkdir /sys/kernel/config/usb_gadget/g1/configs/c.1/strings/0x409
ln -s /sys/kernel/config/usb_gadget/g1/functions/mass_storage.usb0/
/sys/kernel/config/usb_gadget/g1/configs/c.1/
ls /sys/class/udc/ | xargs echo > /sys/kernel/config/usb_gadget/g1/UDC
```

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Use a type-c data cable to connect to the computer, you can see the information that needs to be formatted. After the formatting is completed, there will be a 10M partition.



3.2.6. CAN

The ECB3X series includes ECB31-PBxE8-I with CAN, and it is a two-channel CAN.

We CAN use the CAN box to connect to the PC for transmitting and receiving tests, or short-circuit the CAN-H and CAN-L of the two CAN channels respectively for testing. This test uses EBITt's ECAN-U01S, and the connection method is shown in the figure.



Allwinner's can is also known as awlink. We can see awlink0 and awlink1 by using ifconfig -a.

```
[root@ebyte /]#ifconfig -a
awlink0   Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
          UP RUNNING NOARP  MTU:16  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:10
          RX bytes:0 (0.0 B)  TX bytes:8 (8.0 B)
          Interrupt:2

awlink1   Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
          NOARP  MTU:16  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:10
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
          Interrupt:3
```

Open awlink0 and set the can device communication baud rate of awlink0 to 1,000,000, which means the communication baud rate is 1MBit/s.

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```
ip link set awlink0 up type can bitrate 1000000
```

Open the CAN transceiver software ECAN-Tools that comes with ECAN-U01S on the PC, as shown below.



The evaluation board sends can data:

```
cansend awlink0 123#01.02.03.04.05.06.07.08
```

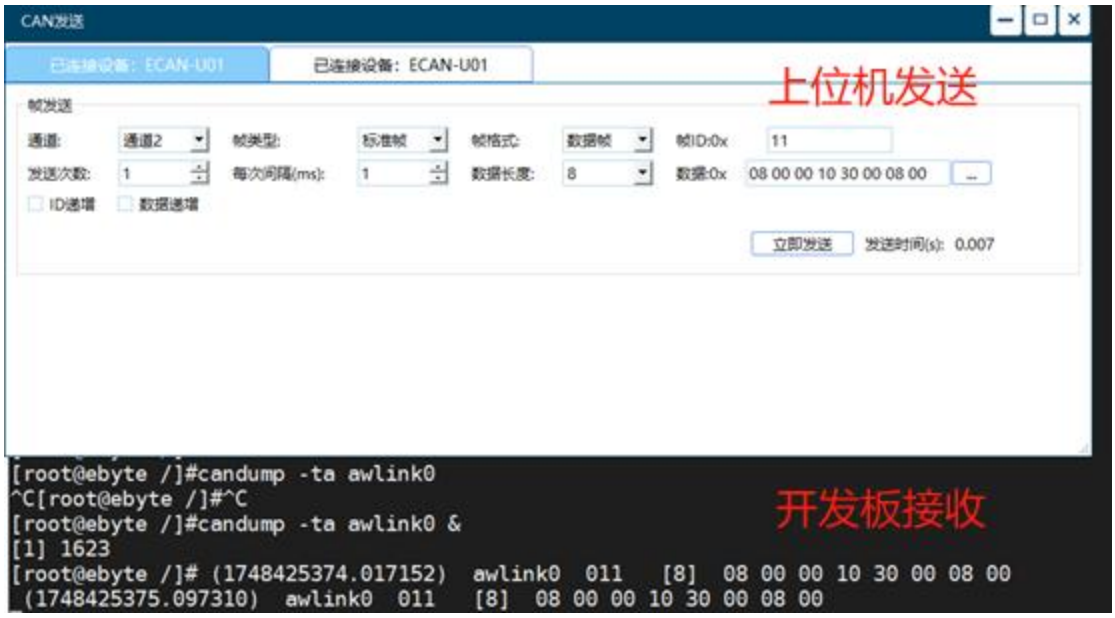


The evaluation board receives can data:

```
candump -ta awlink0 &
```

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3.2.7. SD Card

32GB Micro SD card from SanDisk to test the performance of the evaluation board's Micro SD interface. Please refer to the document "Linux System Boot Card Production and System Hardening" to make it into a Linux system boot card before testing. Different Micro SD cards and different test methods will cause certain differences in the Micro SD interface test results.

insert the Linux system boot card into the Micro SD card slot of the evaluation board, power on the evaluation board, enter the evaluation board file system and execute the following command to view the Linux system boot card information.

3.2.7.1. Check TF card capacity

The TF card partition information and capacity can be queried through the fdisk -l command:

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```
#fdisk -l
Found valid GPT with protective MBR; using GPT
Disk /dev/mmcblk0: 62333952 sectors, 1764M
Logical sector size: 512
Disk identifier (GUID): ab6f3888-569a-4926-9668-80941dcb40bc
Partition table holds up to 12 entries
First usable sector is 73728, last usable sector is 62333947
Number  Start (sector)    End (sector)  Size Name
     1           73728          108165 16.8M boot-resource
     2          108166          110213 1024K env
     3          110214          112261 1024K env-redund
     4          112262          147461 17.1M boot
     5          147462         2244613 1024M rootfs
     6         2244614         2246661 1024K dsp0
     7         2246662         2248709 1024K riscv0
     8         2248710         2281477 16.0M private
     9         2281478        62331903 28.6G UDISK
```

3.2.7.2. TF card performance test

The performance test mainly tests the reading and writing speed of eMMC files under the Linux system, and is generally tested by combining the time and dd commands . Mount the TF card partition to be tested. Here, the last partition /dev/mmcblk0p 9 is taken as an example, and the mounting directory is /run / meida /mmcblk0p9 .

Run the following commands to create a directory and mount the partition.

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```
mkdir -p /run/media/mmcblk0p9
mount /dev/mmcblk0p9 /run/media/mmcblk0p9
```

Micro SD interface write speed test

Enter the evaluation board system and execute the following command to test the Micro SD interface write speed

```
echo 3 > /proc/sys/vm/drop_caches
time dd if=/dev/zero of=/run/media/mmcblk0p9/test bs=1024K count=100 conv=fsync


100+0 records in
100+0 records out


real    0m6.473s
user    0m0.000s
sys     0m1.633s
```

The time command is used for timing, dd is used for copying, reading from the if (input file) file and writing to the file specified by of (output file), bs is the size of each write block, and count is the number of read and write blocks.

"if=/dev/zero" does not generate IO, that is, it continuously outputs data and can be used to test the pure write speed.

Here, a total of 100MByte of test data is written to the test file of the Linux system boot card . It can be seen that the write speed of the Micro SD interface in this test is approximately: 100MByte / 6.47 s ≈ 15.45 MB/s.

Micro SD interface read speed test

Execute the following command to test the Micro SD interface read speed .

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```
echo 3 > /proc/sys/vm/drop_caches
time dd if=/run/media/mmcblk0p9/test of=/dev/null bs=1024K count=100
```

"of=/dev/null" does not generate IO, that is, it continuously receives data and can be used to test the pure read speed .

interface reading speed of this test can be seen.

The speed is approximately: 100MByte / 4.4 7 s ≈ 22.40MB/s.

After the test is completed, execute the following command to unmount the mounted partition.

```
umount /run/media/mmcblk0p9/
rm -r /run/media/mmcblk0p9
```

3.2.8. show

This module consists of a display engine (DE) and various types of controllers (tcon). After the input layers are processed in the DE, they are output to the display device through one or more interfaces to achieve the purpose of synthesizing the layers rendered by many applications and presenting them to the user on the display. DE has two independent units (can be referred to as de0 and de1), which can respectively accept the layers input by the user for synthesis and output to different displays to achieve dual display. Each independent unit of DE has 1-4 channels (typically, de0 has 4 and de1 has 2) , and each channel can process and accept 4 layers of the same format at the same time . The sunxi platform is divided into video channels and UI channels. The video channel is powerful and can support YUV format and RGB layers. The UI channel only supports RGB layers.

3.2.8.1. 5.5 -inch MIPI display

Please correctly connect the 5.5 -inch MIPI display (model: Ebyte ECA11-5P5LCDMIPI1019CT-C , resolution: 1080 x 1920) to the MIPILCD (display) and CAP TS (touch) interfaces of the evaluation board.

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flexible cable provided by our company , and make hardware connections as follows. If third-party accessories are used, the line sequence of the evaluation board interface, FFC flexible cable , and MIPI display must be carefully checked , otherwise the MIPI LCD screen may be burned.

Please connect the MIPI LCD screen to the MIPI LCD interface of the evaluation board via the 26- pin FFC flexible cable .

After the evaluation board restarts, the startup logo can be observed on the MIPI display.

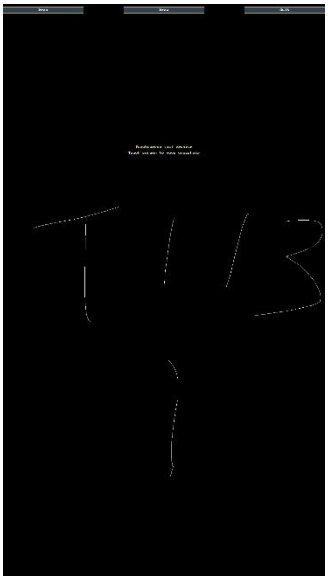
The E mmc board supports Q T , while the N and board does not support Q T . N and board users can use the display and touch through the ts _test command

You can also use screenshots to debug. Here, ts_test is used to draw the image of T113 S and then take a screenshot, verifying the display and touch at the same time.

```
echo 0 > /sys/class/disp/disp/attr/disp
echo filename.bmp > /sys/class/disp/disp/attr/capture_dump
```

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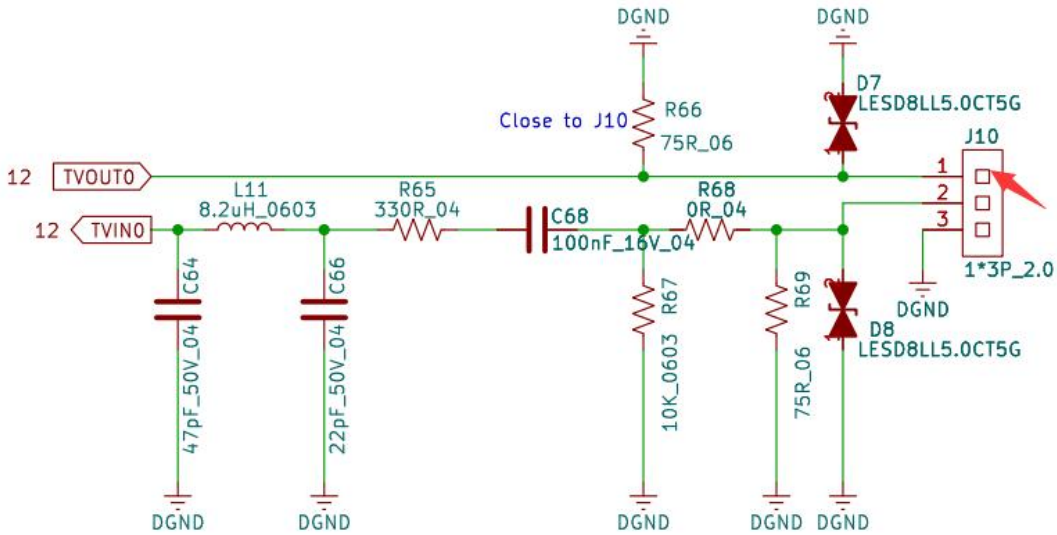


3.2.8.2. CVBS display

CVBS Output

Cvbs display requires changing the device tree file so that screen0_output_type and screen0_output_mode switch to cvbs mode.

After compiling the kernel and uboot , replace the image file on the board and connect cvbs using a monitor. out pin. The display can display images normally.



模拟信号接口

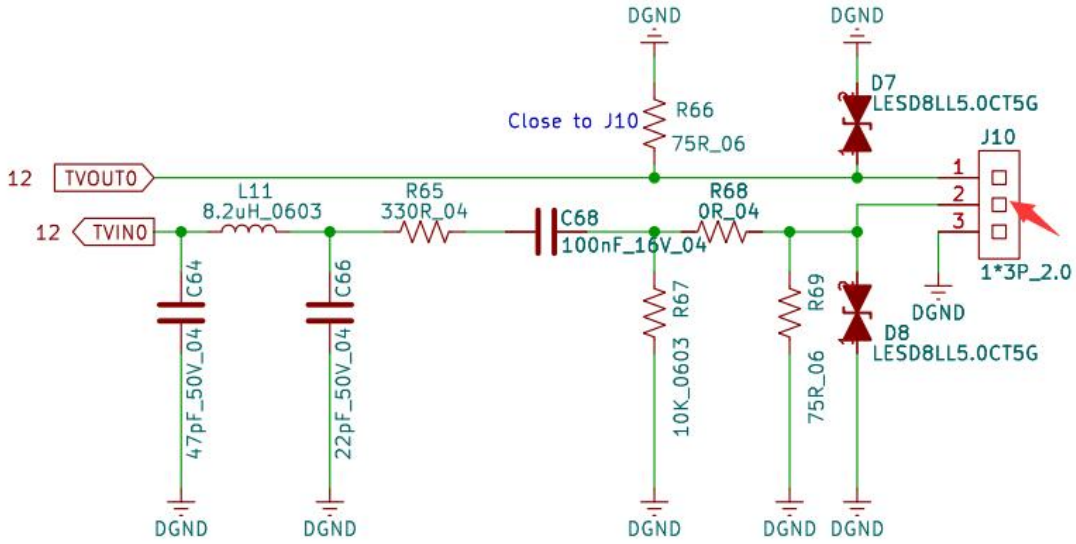
CVBS Input

We use the camera as the signal input of CVBS , and we can also use the method of short-circuiting CVBSOUT and CVBSIN to verify the input signal.

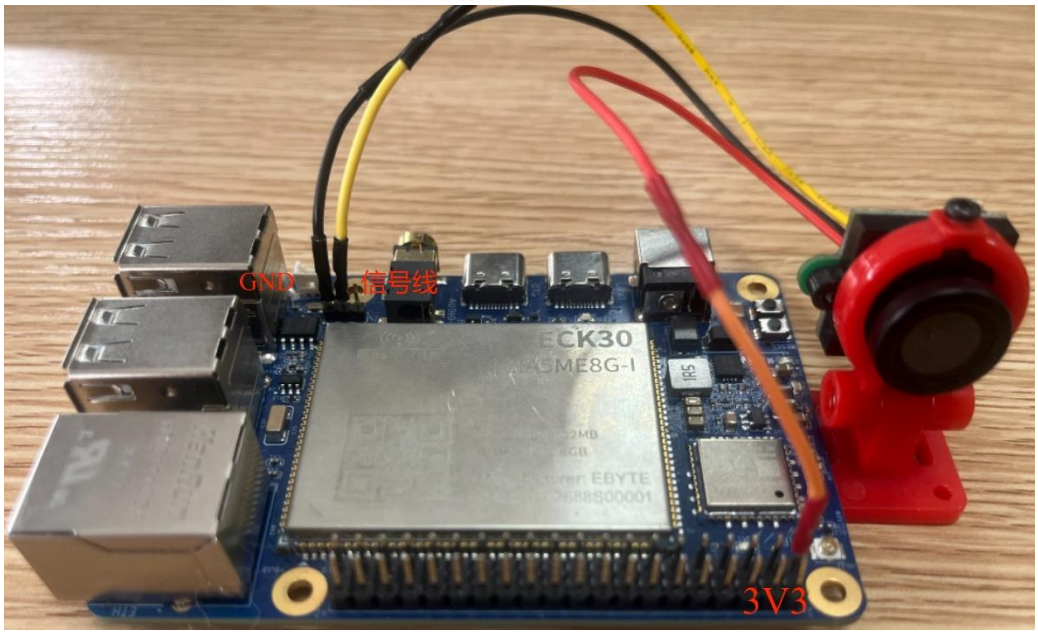
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Connect the camera to the C VBS in pin



模拟信号接口



After powering on the camera, use tvd_test_mmap to collect the camera input. We need to specify the parameters here according to the width and height of the camera, and use the default configuration for other parameters. Then a fb4_yuv4_720_576.bin will be generated in the root directory .

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```
tvd_test_mmap 4 0 720 576 /root 4 30 30
#tvd_test_mmap -h
============================Usage============================
tvd_test_mmap <videoX> <sel> <width> <height> <path> <format_mode> <test_cnt> <fps>
videoX                means: open /dev/videoX
sel                   means: select subdev-X
width                 means: camera capture pic width
height                means: camera capture pic height
path                  means: camera capture save file path, default "/tmp/tvd_test/"
format_mode           means: camera capture pic format, default 4(NV21)
test_cnt              means: camera capture pic count, default 20
fps                   means: camera capture fps, default 30
============================Usage============================
```

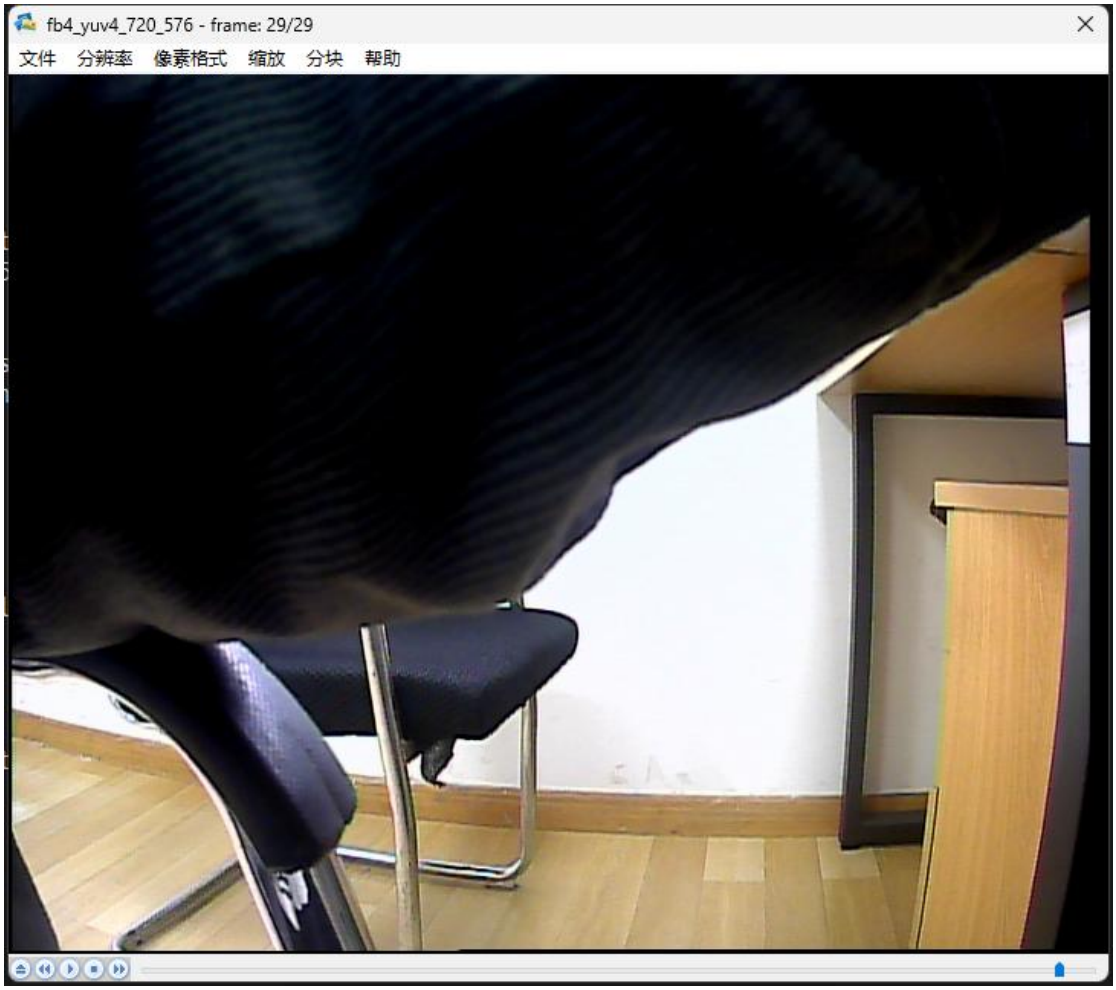
We need to copy this bin file to Windows and open it with specific software. Here we use a USB flash drive to transfer it.

```
#cp fb4_yuv4_720_576.bin /mnt/usb/sda1/
```

using YUV P layer, you need to set the resolution to 720 *576, set the pixel format to NV21 , and then open fb4_yuv4_720_576.bin.

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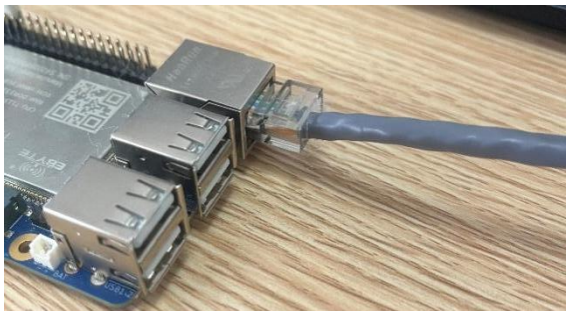
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3.3. Network Interface

3.3.1. Ethernet

Use ifconfig in the net-tools toolkit to manually configure the network. First, view the network device information through the ifconfig command as follows.



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```
#ifconfig eth0 192.168.1.250 netmask 255.255.255.0 up
#ifconfig eth0
eth0        Link encap:Ethernet  HWaddr 2E:3A:BA:FB:7A:B6
            inet addr:192.168.1.250  Bcast:192.168.1.255  Mask:255.255.255.0
            inet6 addr: fe80::2c3a:baff:fefb:7ab6/64 Scope:Link
            UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
            RX packets:0 errors:0 dropped:0 overruns:0 frame:0
            TX packets:6 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:1000
            RX bytes:0 (0.0 B)  TX bytes:586 (586.0 B)
            Interrupt:37
```

After configuring the Ethernet connection, you can use PING to perform a simple test on the network connection and ping the virtual machine on the same network segment.

```
ping 192.168.1.130
PING 192.168.1.130 (192.168.1.130) 56(84) bytes of data.
64 bytes from 192.168.1.130: icmp_seq=1 ttl=64 time=1.53 ms
64 bytes from 192.168.1.130: icmp_seq=2 ttl=64 time=1.34 ms
64 bytes from 192.168.1.130: icmp_seq=3 ttl=64 time=1.37 ms
64 bytes from 192.168.1.130: icmp_seq=4 ttl=64 time=1.30 ms
```

3.3.1.1. Iperf3

iperf3 is a tool for actively measuring the maximum achievable bandwidth on IP networks. It supports adjusting the test time, buffering

zone size and protocol (TCP, UDP, SCTP under IPV4 and IPV6). iperf3 can be divided into server mode or client mode according to its role. We can use it to test and view the network bandwidth, TCP window value, retransmission probability, etc. under TCP mode, and we can also test the packet loss rate, delay and jitter under the specified UDP bandwidth.

MobaXterm on the development host , use the host with a Gigabit network card as the iperf3 server, and use the tested development board as the client to test the TCP and UDP performance of

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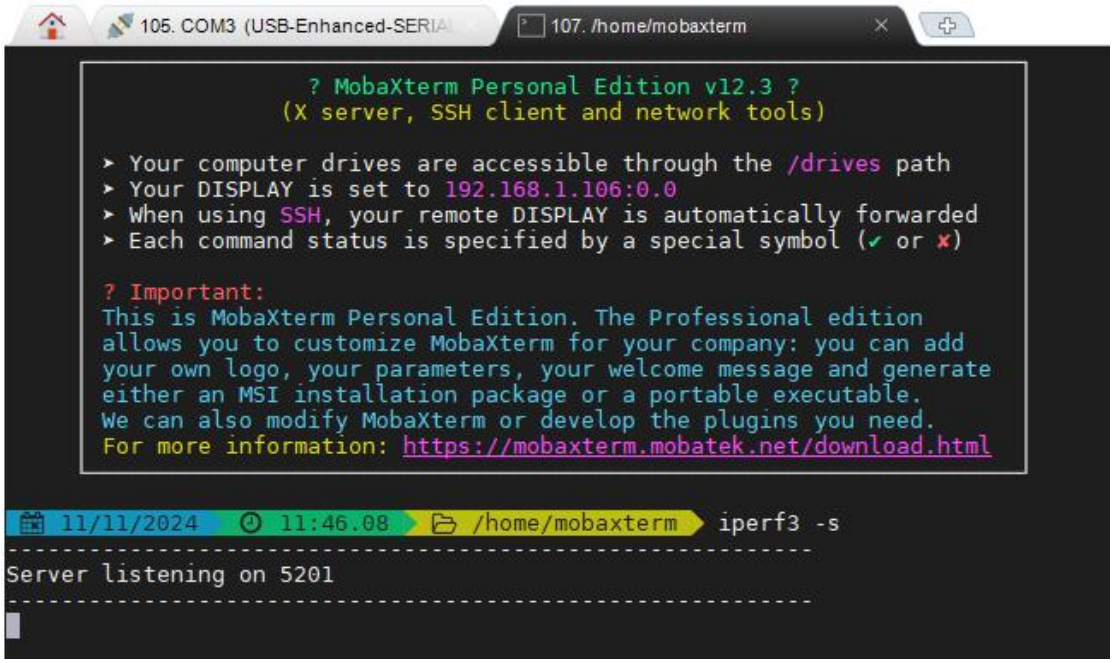
the development board network card.

the server and development board directly via CAT6 network cable and configure their respective IP addresses. For example, we set the server IP to 192.168.1.106 and the development board IP to 192.168.1.250 , and use the ping command to test to ensure that they are connected.

Note: Try not to connect a router or switch to prevent the test results from being affected by the transmission forwarding of intermediate devices.

Testing TCP Performance

On the server, iperf3 uses the -s parameter to indicate that it works in server mode.



The iperf3 program running on the development board works in client, TCP mode, where the parameters are described as follows:

➢ -c 192.168.0.102: works on the client side, connecting to the server side 192.168.1.106

➢ - i 2: The test result report interval is 2 seconds

➢ -t 10: total test duration is 10 seconds

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```
#iperf3 -c 192.168.1.106 -i 2 -t 10
Connecting to host 192.168.1.106, port 5201
[  5] local 192.168.1.250 port 58936 connected to 192.168.1.106 port 5201
[ ID] Interval           Transfer     Bitrate         Retr  Cwnd
[  5]   0.00-2.00   sec   215 MBytes   900 Mbits/sec    0    754 KBytes
[  5]   2.00-4.00   sec   216 MBytes   906 Mbits/sec    0    754 KBytes
[  5]   4.00-6.00   sec   202 MBytes   851 Mbits/sec    0    847 KBytes
[  5]   6.00-8.00   sec   198 MBytes   828 Mbits/sec    0    936 KBytes
[  5]   8.00-10.00  sec   216 MBytes   907 Mbits/sec    0    936 KBytes
- - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Retr
[  5]   0.00-10.00  sec  1.02 GBytes   878 Mbits/sec    0             sender
[  5]   0.00-10.00  sec  1.02 GBytes   876 Mbits/sec                  receiver

iperf Done.
```

seconds, the client ends the test and displays the above test results, indicating that the TCP bandwidth is 900 Mbits or so.

Testing UDP performance

Continue to run iperf3 on the server and use the -s parameter to indicate that it works in server mode.

On the device, iperf3 works in client mode, UDP mode, and the parameters are as follows:

➢ -u : Work in UDP mode

➢ -c 192.168.1.106: works on the client side, connecting to the server side 192.168.0.106

➢ - i 2: The test result report interval is 2 seconds

➢ -t 10: total test duration is 10 seconds

➢ -b 100M: Set the UDP transmission bandwidth to 100Mbps.

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```
#iperf3 -c 192.168.1.106 -u -i 2 -t 10 -b 100M
Connecting to host 192.168.1.106, port 5201
[  5] local 192.168.1.250 port 58311 connected to 192.168.1.106 port 5201
[ ID] Interval           Transfer     Bitrate         Total Datagrams
[  5]   0.00-2.00   sec  1.50 MBytes  6.28 Mbits/sec  1085
[  5]   2.00-4.00   sec  80.6 KBytes   330 Kbits/sec  57
[  5]   4.00-6.00   sec   322 KBytes  1.32 Mbits/sec  228
[  5]   6.00-8.00   sec   161 KBytes   660 Kbits/sec  114
[  5]   8.00-10.00  sec   242 KBytes   990 Kbits/sec  171
- - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Jitter    Lost/Total Datagrams
[  5]   0.00-10.00  sec  2.29 MBytes  1.92 Mbits/sec  0.000 ms  0/1655 (0%)  sender
[  5]   0.00-10.00  sec  2.29 MBytes  1.92 Mbits/sec  0.099 ms  0/1655 (0%)  receiver
```

after 10 seconds on the client and the above test result is displayed, indicating that UDP has no packet loss when the specified bandwidth is 100Mbps.

3.3.1.2. Access the external net

After connecting the network cable, you can manually configure the DNS and gateway to access the external network. Or you can automatically configure the network through DHCP to access the external network.

The network segment assigned by our router is 1 92.168.20.* , so we manually configure the network as follows.

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```
#ifconfig eth0 192.168.20.7 up

#echo "nameserver 114.114.114.114" > /etc/resolv.conf #Add dns

#ip route add default via 192.168.20.1 #Add gateway
```

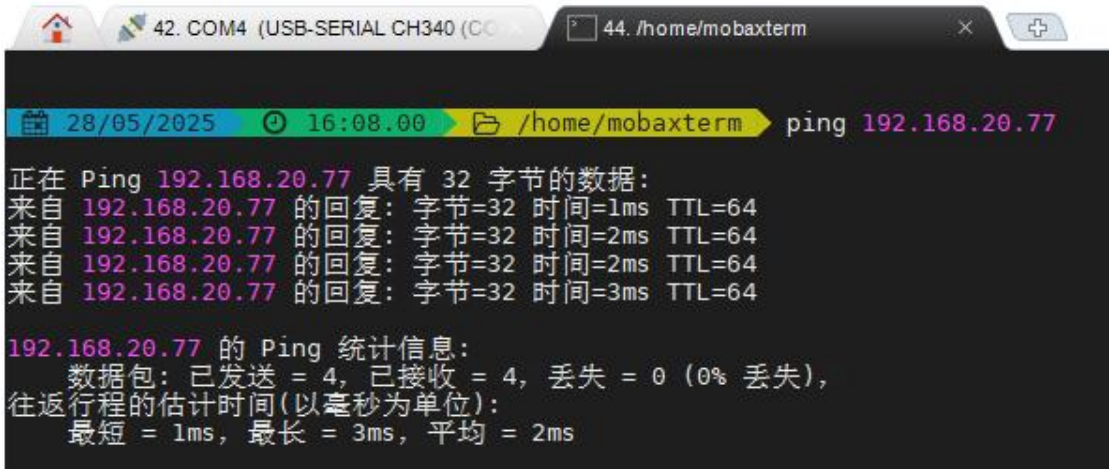
The only command needed to automatically configure the network is the udhcpc command.

```
# udhcpc -i eth0
```

3.3.1.3. SSH

You can log in to the development board via SSH, provided that the machine you need to log in to and the evaluation board are in the same network segment and can PING each other. You can use the SSH service provided by mobaExterm or the built-in SSH of the cmd command line. mobaExterm is more convenient for file transfer. Let's take mobaExterm as an example.

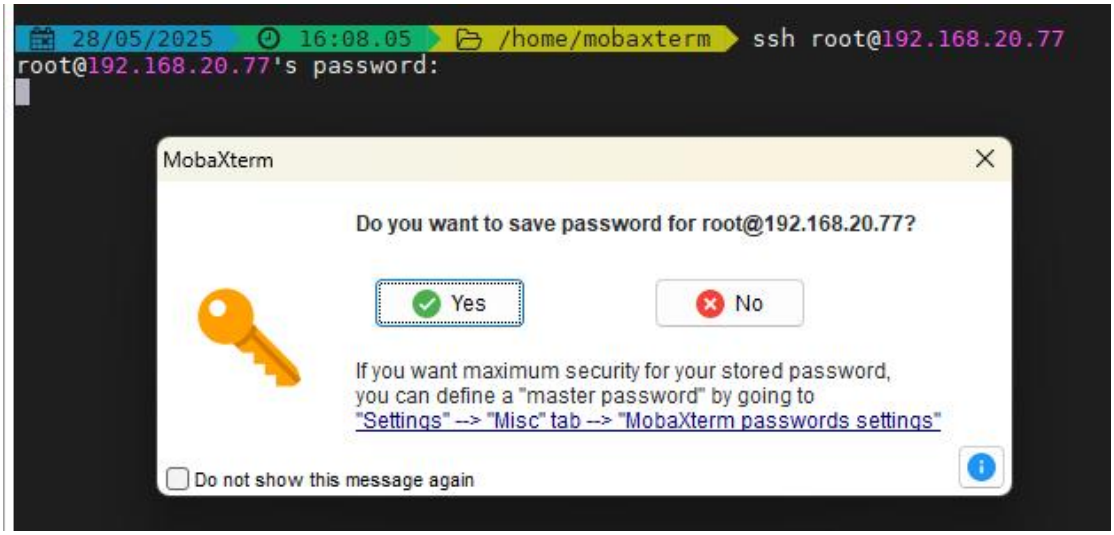
First, ensure that the host can ping the evaluation board. 192.168.20.77 is the IP

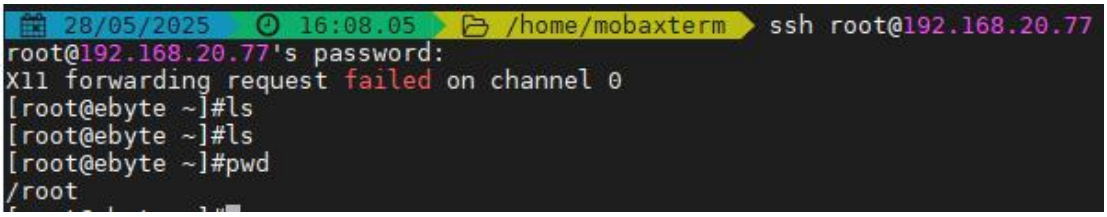


The default username and password for the evaluation board are both root.

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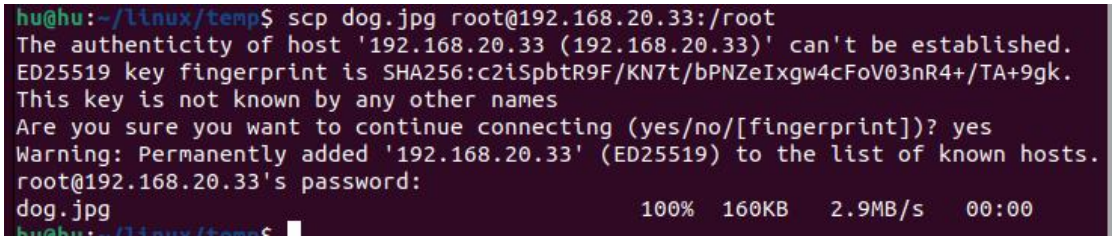
If you need to transfer files, simply drag the files you want to transfer to the sftp service bar on the left.

3.3.1.4. SCP

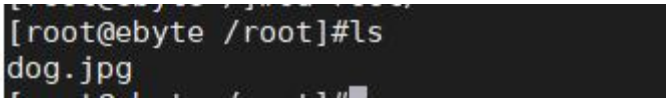
If you want to transfer files between the virtual machine and the evaluation version, simply use scp to copy the files.

The prerequisite is that both the virtual machine and the evaluation board have enabled ssh services and can ping each other.

The virtual machine copies files to the development board



The file can be seen in the root directory of the evaluation board



If you need to copy the folder, just add the -r parameter after "scp", for example:

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```
#scp -r test-dir root@192.168.20.33:/root
```

The evaluation board copies files to the virtual machine

```
[root@ebyte /root]#echo helloworld > a.file
[root@ebyte /root]#scp a.file hu@192.168.20.140:/home/hu/linux/temp
The authenticity of host '192.168.20.140 (192.168.20.140)' can't be established.
ECDSA key fingerprint is SHA256:FcbovPE9fo9FD1LVzqRHVpNAtfDeLaSK/a6NmQwyIOQ.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.20.140' (ECDSA) to the list of known hosts.
hu@192.168.20.140's password:
```

Files can be seen in the corresponding directory of the virtual machine

```
hu@hu:~/linux/temp$ ls a.file
a.file
```

3.3.1.5. NFS

If you want the evaluation version to directly access the directory of the virtual machine, you can use the NFS shared directory. This makes it more convenient for the evaluation version to use large files or for development.

First, the NFS server of the virtual machine needs to be set up. After installing the NFS service, configure the folder location and finally restart the NFS service.

```
#sudo apt-get install nfs-kernel-server rpcbind
#sudo vi /etc/exports     #文件最后一行添加配置内容


/home/hu/linux/nfs *(rw,sync,no_root_squash)
```

Finally, restart the NFS service.

```
#sudo /etc/init.d/nfs-kernel-server restart
```

It is necessary to ensure that the evaluation version can ping the virtual machine successfully. Then create a directory to mount the NFS server.

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```
#mkdir /mnt/nfs

#mount -t nfs 192.168.20.140:/home/hu/linux/nfs /mnt/nfs
```



3.3.2. WIFI

Wi-Fi uses module loading, and the single board will automatically load the driver. You can use lsmod to check whether the 8821cu driver is loaded.

```
#cd /lib/modules/5.4.61-rt37/

#modprobe 8821cu.ko
```

This section mainly introduces the configuration and use of Wi-Fi under Linux. Usually, the Wi-Fi module can support two working modes, namely STA mode and AP mode. Some devices also support STA and AP modes working at the same time. STA mode allows the device to connect to external Wi-Fi hotspots, and AP mode turns the device into a Wi-Fi hotspot for other devices to connect.

```
#ifconfig wlan0 up
```

The Wi-Fi network node wlan0 is as follows

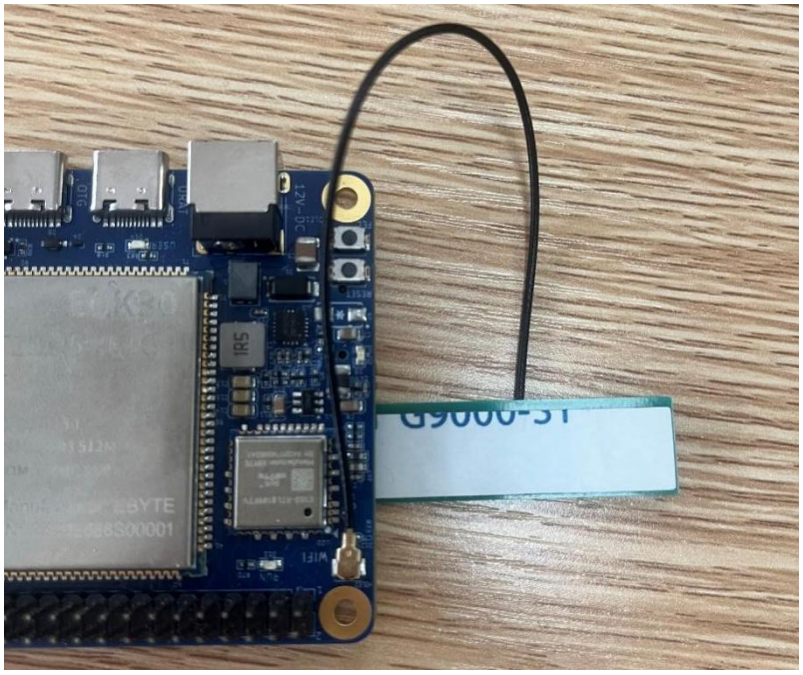
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```
#ifconfig wlan0
wlan0     Link encap:Ethernet  HWaddr E0:3C:7A:F1:DC:40
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
```

3.3.2.1. STA mode connects to WIFI hotspot

Scan nearby Wi-Fi hotspots and get a list of nearby Wi-Fi hotspots as follows. Using an antenna will work better.



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```
#iw dev wlan0 scan | grep SSID
        SSID: ChinaNet-ShJR
        SSID: TP-LINK_8BF6
        SSID: zhendu
        SSID: TP-LINK_\xef\xbc\x88\xe7\xa1\xac\xe4\xbb\xb6\xe7\xbb\x84)
        SSID: TEST_ZW
        SSID: xiaomi_gywl_yzd
                * SSID List
        SSID:
                * SSID List
```

Next, try to manually connect to the nearby Wi-Fi hotspot " TP-LINK_8BF6 ", which is a Wi-Fi hotspot using WPA2 encryption with a password of EC12345678 .

```
#iw dev wlan0 scan | grep SSID
        SSID: ChinaNet-ShJR
        SSID: TP-LINK_8BF6
        SSID: zhendu
        SSID: TP-LINK_\xef\xbc\x88\xe7\xa1\xac\xe4\xbb\xb6\xe7\xbb\x84)
        SSID: TEST_ZW
```

Use wifi_set.sh to connect to wifi . The directory is under 02_Sources / example.

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```
#./wifi_setup.sh -i TP-LINK_8BF6 -p EC12345678
conf    : /etc/wpa_supplicant.conf
ssid    : TP-LINK_8BF6
psk     : EC12345678
device: wlan0
update /etc/wpa_supplicant.conf
startup wpa_supplicant ...
Successfully initialized wpa_supplicant
udhcpc: started, v1.33.2
udhcpc: sending discover
udhcpc: sending discover
udhcpc: sending select for 192.168.1.199
udhcpc: sending select for 192.168.1.199
udhcpc: lease of 192.168.1.199 obtained, lease time 7200
deleting routers
adding dns 114.114.114.114
adding dns 61.139.2.69
wifi setup successfully!
```

View connection status

```
#iw wlan0 link
Connected to ec:26:ca:6a:8b:f6 (on wlan0)
        SSID: TP-LINK_8BF6
        freq: 2412
        signal: -60 dBm
        tx bitrate: 150.0 MBit/s
```

Network connectivity test: execute the following command to test whether the network function is normal.

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```
ping baidu.com
PING baidu.com (110.242.68.66): 56 data bytes
64 bytes from 110.242.68.66: seq=0 ttl=47 time=209.845 ms
64 bytes from 110.242.68.66: seq=1 ttl=47 time=203.668 ms
64 bytes from 110.242.68.66: seq=2 ttl=47 time=116.356 ms
64 bytes from 110.242.68.66: seq=3 ttl=47 time=126.607 ms
64 bytes from 110.242.68.66: seq=4 ttl=47 time=199.377 ms
```

If the network function is not normal, you need to add the content "nameserver 114.114.114.114" to the " /etc/resolv.conf " file.

You can use your mobile phone to connect to the above hotspots to test the Internet access.

3.3.3. 4G Modules

The ECB3X series includes the ECB31-PBxE8-I with a 4G module. The others can skip this chapter.

Here, Quectel's EC20 is used for testing. The Quectel EC20 4G module is a high-performance and highly reliable wireless communication module, specifically designed for embedded systems. It supports 4G LTE network, has excellent data transmission speed and stability, and can be widely applied in fields such as the Internet of Things, Internet of Vehicles, and industrial automation.

By default, the flashing status of the LED light corresponding to LED_WWAN:

引脚工作状态	所指示的网络状态
慢闪(200ms 高/1800ms 低)	找网状态
慢闪(1800ms 高/200ms 低)	待机状态
快闪(125ms 高/125ms 低)	数据传输模式
高电平	通话中

Before officially using the EC20 4G module, please first insert it into the MiniPCIE socket of the evaluation board, tighten the screw, insert the Nano SIM card, and connect the antenna, as shown in the figure.

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After connecting the module and powering on, you should be able to see four additional ttyUSB devices. Otherwise, you need to check the connection of the 4G module.

```
[root@ebyte /]#ls /dev/ttyUSB
ttyUSB0  ttyUSB1  ttyUSB2  ttyUSB3
```

The meanings of these four USB ports are as follows.

ttyUSB	描述
ttyUSB0	DM
ttyUSB1	GPS 的 NMEA 信息输出接口
ttyUSB2	AT 指令接口
ttyUSB3	PPP 连接或 AT 指令接口

The ones we use most frequently are ttyUSB1 and ttyUSB2. If the EC20 module you purchase has GPS functionality, you can read GPS data through the ttyUSB1 interface. If you want to use the AT command function of the EC20, then you can simply use the ttyUSB2 interface.

Before using pppd for dial-up Internet access, four files need to be created first, and these four files must be placed in the same directory. We provide these four files in the directory "example/4G-test/" and copy them to the root directory of the development board.

Among them, lines 9 and 10 of the content of the quectel_ppp_dialer file are the network APN codes.

If it is a China Unicom card, then the contents of lines 9 and 10 are as follows:

```
OK AT+CGDCONT=1,\"IP\",\"3GNET\"
OK ATD*99#
```

If it is a telecom card, as follows:

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```
OK AT+CGDCONT=1,\"IP\",\"CTNET\"

OK ATD*99#
```

If it is a mobile card, as follows:

```
OK AT+CGDCONT=1,\"IP\",\"CMNET\"

OK ATD*99#
```

After all four files are ready, grant the executable permissions to the ppp-on and disconnect files.

```
[root@ebyte ~]#ls
disconnect  ppp-on  quectel_options  quectel_ppp_dialer
[root@ebyte ~]#chmod +x ppp-on disconnect
```

Then enter the following command to connect to the 4G network.

```
./ppp-on &
```

As shown in the following figure, it is the log print of the EC20 successfully connecting to the 4G network and automatically applying for an IP address.

```
sent [LCP ConfReq id=0x1 <asyncmap 0x0> <magic 0x1858a259> <pcomp> <accomp>]
rcvd [LCP ConfReq id=0x0 <asyncmap 0x0> <auth chap MD5> <magic 0x563efda1> <pcomp> <accomp>]
sent [LCP ConfAck id=0x0 <asyncmap 0x0> <auth chap MD5> <magic 0x563efda1> <pcomp> <accomp>]
rcvd [LCP ConfAck id=0x1 <asyncmap 0x0> <magic 0x1858a259> <pcomp> <accomp>]
rcvd [LCP DiscReq id=0x1 magic=0x563efda1]
rcvd [CHAP Challenge id=0x1 <6f64a32932c66efbeae22401142148f0>, name = "UMTS_CHAP_SRVR"]
sent [CHAP Response id=0x1 <d712e95eb8dfcac3f2ed35ecd9a7ffc7>, name = "Anyname"]
rcvd [CHAP Success id=0x1 ""]
CHAP authentication succeeded
CHAP authentication succeeded
sent [IPCP ConfReq id=0x1 <addr 0.0.0.0> <ms-dns1 0.0.0.0> <ms-dns2 0.0.0.0>]
rcvd [IPCP ConfReq id=0x0]
sent [IPCP ConfNak id=0x0 <addr 0.0.0.0>]
rcvd [IPCP ConfNak id=0x1 <addr 10.143.69.227> <ms-dns1 223.87.253.100> <ms-dns2 223.87.253.253>]
sent [IPCP ConfReq id=0x2 <addr 10.143.69.227> <ms-dns1 223.87.253.100> <ms-dns2 223.87.253.253>]
rcvd [IPCP ConfReq id=0x1]
sent [IPCP ConfAck id=0x1]
rcvd [IPCP ConfAck id=0x2 <addr 10.143.69.227> <ms-dns1 223.87.253.100> <ms-dns2 223.87.253.253>]
Could not determine remote IP address: defaulting to 10.64.64.64
local  IP address 10.143.69.227
remote IP address 10.64.64.64
primary   DNS address 223.87.253.100
secondary DNS address 223.87.253.253
```

An additional ppp0 network interface will be automatically added, as shown in the following figure.

```
[root@ebyte /root]#ifconfig ppp0
ppp0      Link encap:Point-to-Point Protocol
          inet addr:10.143.69.227  P-t-P:10.64.64.64  Mask:255.255.255.255
          UP POINTOPOINT RUNNING NOARP MULTICAST  MTU:1500  Metric:1
          RX packets:35 errors:0 dropped:0 overruns:0 frame:0
          TX packets:39 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:3
          RX bytes:2797 (2.7 KiB)  TX bytes:2590 (2.5 KiB)
```

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Let's visit Baidu's website for a test. If there is no problem, it indicates that the 4G connection to the network is successful.

```
[root@ebyte /root]#ping baidu.com -I ppp0
PING baidu.com (39.156.66.10): 56 data bytes
64 bytes from 39.156.66.10: seq=0 ttl=52 time=66.968 ms
64 bytes from 39.156.66.10: seq=1 ttl=52 time=63.734 ms
```

3.4. Audio Interface

Please prepare a headset with a microphone and connect it to the HP OUT/MIC IN port.



Play

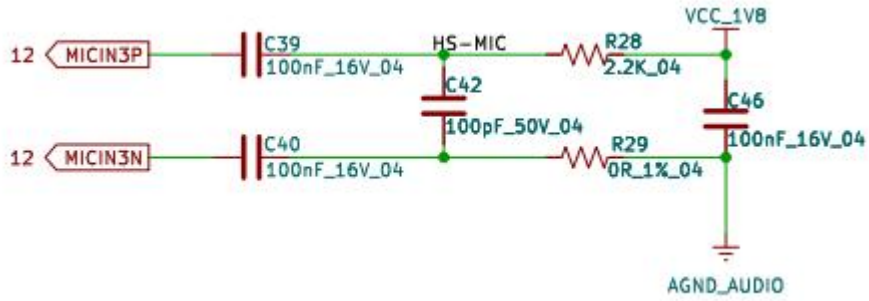
```
#aplay /etc/test.wav
```

Recording

Since different evaluation boards use different mics, it is necessary to check the schematic diagram. Take T113-S as an example. MIC3 is used and the following mic_in_test.sh script can be directly used. If it is T113-I and MIC1 is used, then the tinymix set "ADC1 Input MIC1 Boost Switch" needs to be changed from 0 to 1. Meanwhile, set the tinymix set "ADC3 Input MIC3 Boost Switch" 1 to 0.

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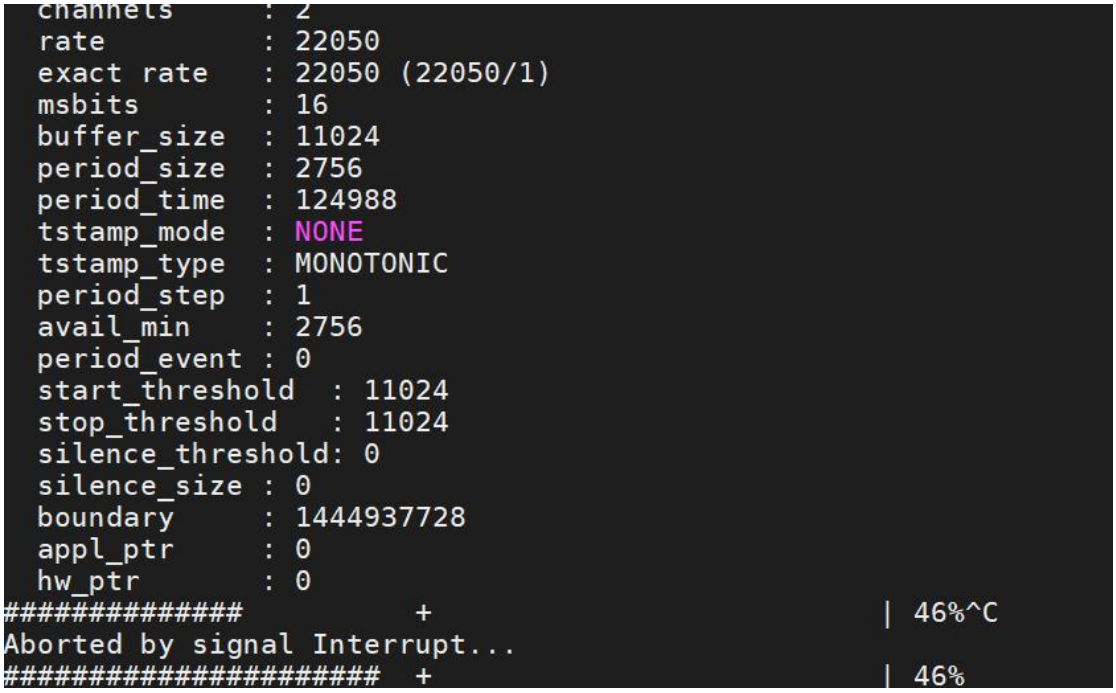
Copy the mic_in_test.sh script to the evaluation board file system, enter the evaluation board file system, and execute the following command to use the headset microphone to record. Press "Ctrl + C" to terminate the recording, and the recording file will be saved as "test.wav".

```
tinymix set "ADC1 Input FMINL Switch" 0
tinymix set "ADC1 Input MIC1 Boost Switch" 0
tinymix set "ADC1 Input LINEINL Switch" 0
tinymix set "ADC2 Input FMINR Switch" 0
tinymix set "ADC2 Input MIC2 Boost Switch" 0
tinymix set "ADC2 Input LINEINR Switch" 0
tinymix set "ADC3 Input MIC3 Boost Switch" 1
tinymix set "HpSpeaker Switch" 1
tinymix set "LINEOUT Switch" 0
tinymix set "MIC1 Input Select" 0
tinymix set "MIC2 Input Select" 0
tinymix set "MIC3 Input Select" 0
tinymix set "Headphone Switch" 1
tinymix set "Headphone volume" 7
arecord -Dhw:audiocodec -f S24_LE -r    16000    -vvv    test.wav
```

Execute the following command, and the headset will play the recording of the "test.wav" file normally without noise or distortion. Press "Ctrl + C" to stop playing.

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If the T113S4 recording noise is very loud, you need to adjust the MIC3 gain volume value to 0. Repeat the above recording operation.

```
tinymix set "MIC3 gain volume" 0
```

4. References

- Linux kernel open source community:

https://www.kernel.org/

- Allwinner S DK Module Development Guide

5. Revision Notes

Revision Notes Table

Version	Modifications	Modification time	prepared by	Proofreading	Approval
V1.0	First Draft	24-11-12	HSL	WYQ	WFX
V 1.1	Modify section 2.2.3	24-11-21	HSL	WYQ	WFX
V1.2	Adding Quick Start Content	24-12-17	HSL	WYQ	WFX
V 1.3	Modify some issues	25-3-17	HSL	WYQ	W FX
V 1.4	Add wiring diagrams and hardware resources	25-4-22	HSL	WYQ	W FX
V1.5	Add relevant content about SSH, 4G and CAN	25-5-28	HSL	WYQ	WFX

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