Chipsee

Industrial PC

# Linux Qt 5.5 OS on iMX6UL User Manual

For iMX6UL Products

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# Linux Qt 5.5 OS

**Chipsee Linux Qt 5.5 OS User Manual**

This manual provides users with a fast guide of Chipsee Industrial Computer (Abbreviate as IPC) about Linux Qt 5.5 OS development. Through this manual, users can quickly understand the hardware resources; users can build a complete compilation of Linux development environment; users can debug Linux Qt 5.5 OS via serial and Internet.

| Revision | Date | Author | Description |
|---|---|---|---|
| V1.1 | 2021-12-30 | Randy | Revised |
| V1.0 | 2018-05-14 | Madi | Initial Version |

**SUPPORTED BOARDS:**

> *CS10600U070*

**PREBUILT FILES PACKAGE:**

Below is the link to the prebuilt images for the Linux Qt operating system on the various industrial PC.

`prebuilt-cs10600u070v1-emmc-20210719.tar.gz`

System Features

| Feature | Comment |
|---|---|
| Kernel | Kernel 3.14.52 |
| Bootloader | Uboot 2015.04 |
| System | Linux Qt 5.5 |

| Feature | Comment |
| --- | --- |
| Python | Python 2.7.9 |
| Qt | Qt 5.5.1 |
| Desktop | matchbox |
| user/password | [root/root] |

# Preparation

You will need to prepare the following items before you can start using the Prebuilt Files Package to re-flash the system.

Power Supply Unit (PSU) with the appropriate voltages, as follows:

- The CS10600U070 product needs a 6V to 36V power adapter.

You need to prepare the Power Adapter by yourself

## Hardware Requirements

- Chipsee Industrial PC
- PSU according to the instructions above
- USB-to-serial or other serial cable for debugging
- USB A-A cable (used only if the hardware configured as OTG)
- Windows 7 PC
- Mini-B USB OTG Cable
- TF Card (at least 4GB) and card reader

## Software Requirements

- Linux Qt 5.5 OS Prebuilt Files Package (from the link above)
- Xshell or other terminal emulation software
- VNC-Viewer
- Cross-toolchain
- Useful tools for Qt development

**Note**

- If you want to re-flash the system, you need the Prebuilt image package.
- You can use Xshell or other terminal emulation software to debug Chipsee Industrial PC products in Windows.
- You can use VNC-Viewer to to remote control Chipsee Industrial PC over Ethernet.

• The cross-toolchain can compile a program for Chipsee Industrial PC.

**Note**

In this documentation, all the commands are executed with `root` user privileges.

# Debug

In this document, we use Xshell to debug the Chipsee Industrial Computer. You can also use other tools such as Putty, Minicom, SecureCRT or any terminal emulation software.

## Serial Debug

You can refer to the RS232/RS485/CAN Connector section under the EPC/PPC-A7-070HB-C manual to understand the serial ports of the IPC. The debug serial port of Chipsee Industrial Computer is the first RS232 port. You can use it to debug directly, and the default user and password is [root/root]. You can use RS232_1_TXD, RS232_1_RXD, GND.

Follow these steps to perform serial debugging:

- Connect your Windows PC to the Chipsee IPC over a serial cable. Please reference the `How To Connect Board By Serial` manual to connect your PC and Chipsee Industrial Computer over a serial cable.
- **Open XShell and use the session properties as shown on the figure below.**

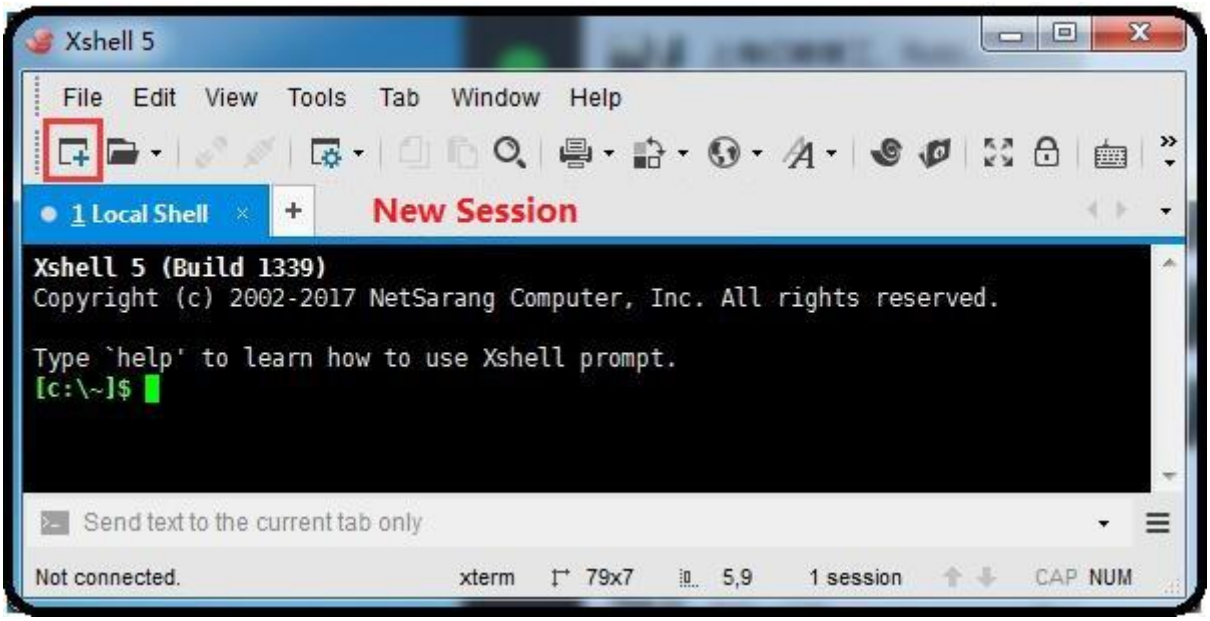



Figure 355: *Add Session*

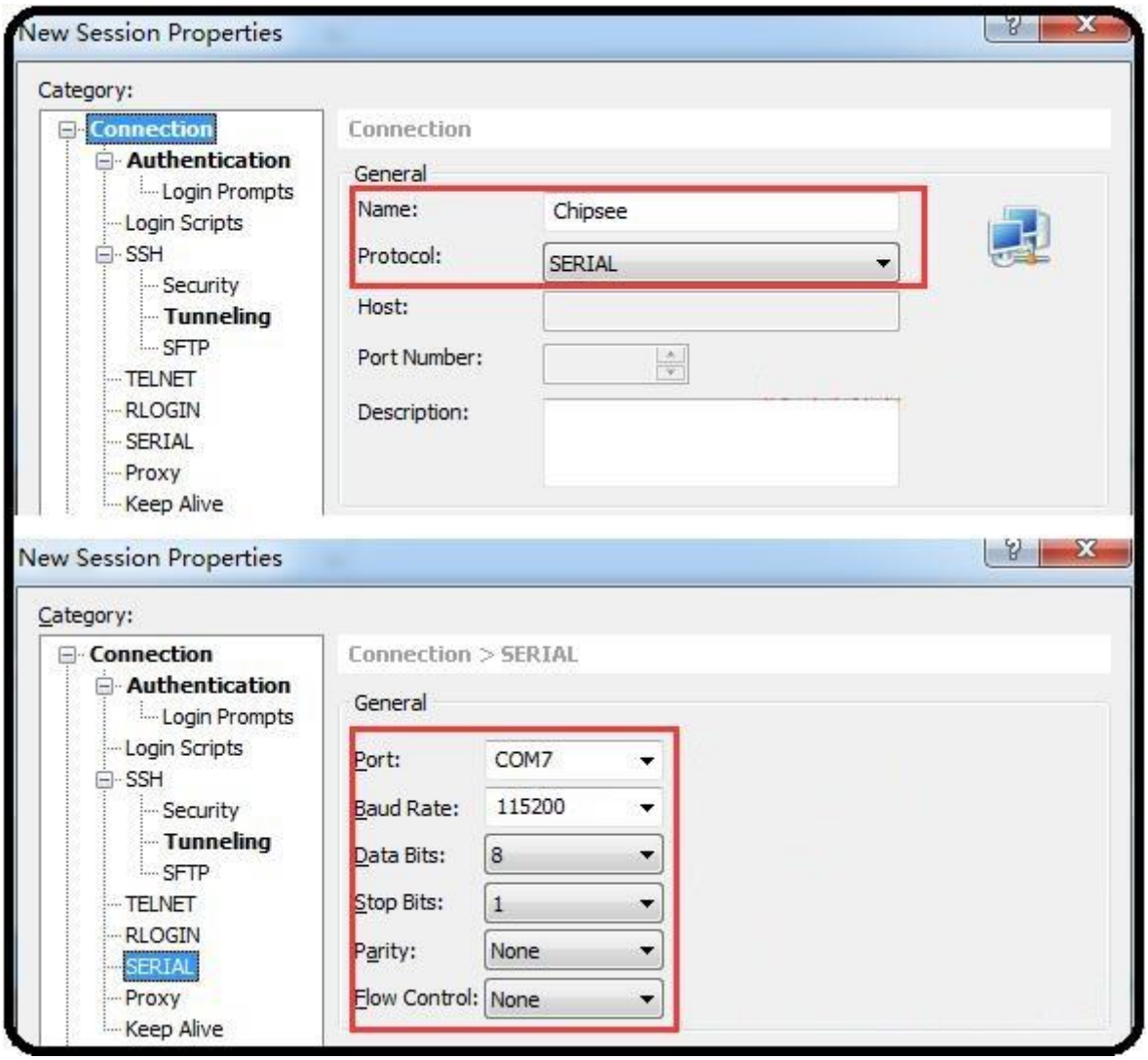



Figure 356: *Session Properties*

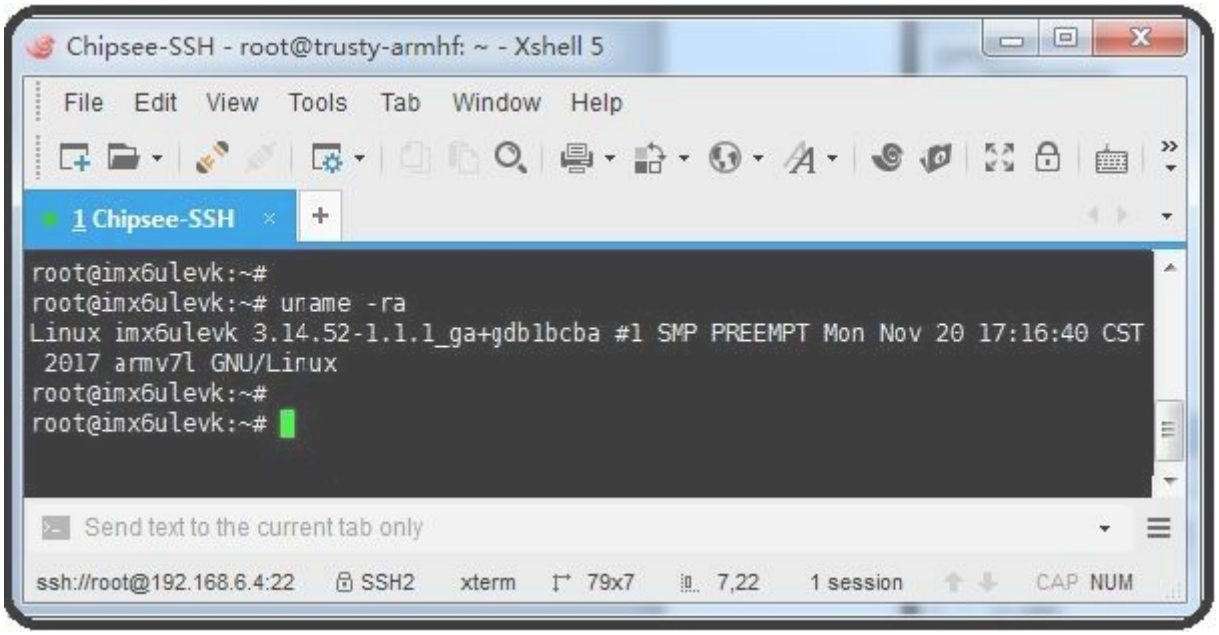



Figure 357: *Serial Debug*

## SSH Debug

To perform SSH debugging on the Chipsee IPC, you must first connect the product to the Internet.

Continue the debugging by follow these steps:

- Get the IP address of the Chipsee IPC product.
- You can configure XShell or you can directly use the SSH tool in Linux OS. In this tutorial, we will use the XShell tool to perform SSH debugging.
- **Open XShell and add a new session and set it as shown on the figure below.**

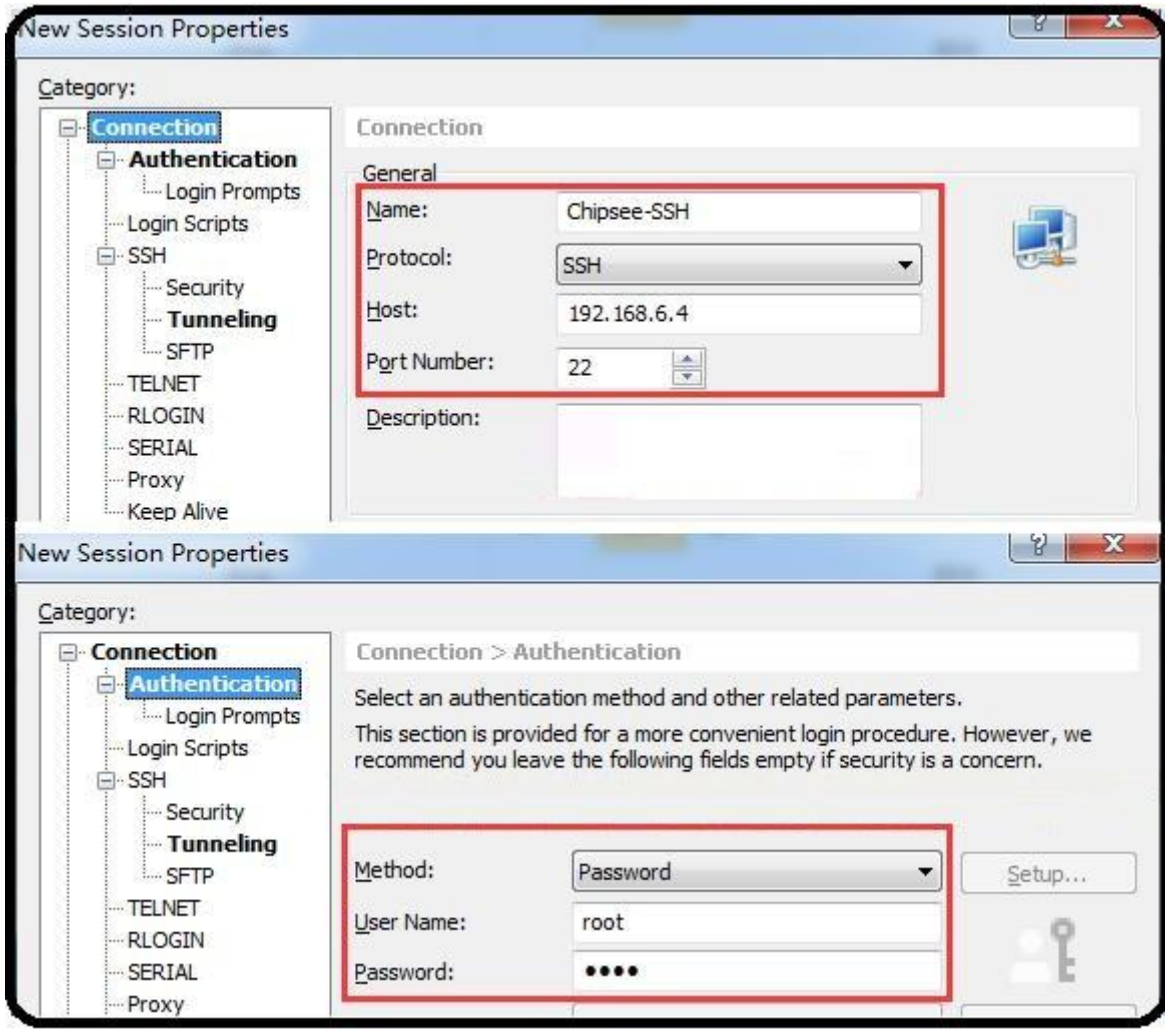



Figure 358: *SSH Setting*

- **Now we can perform SSH debugging using XShell.**

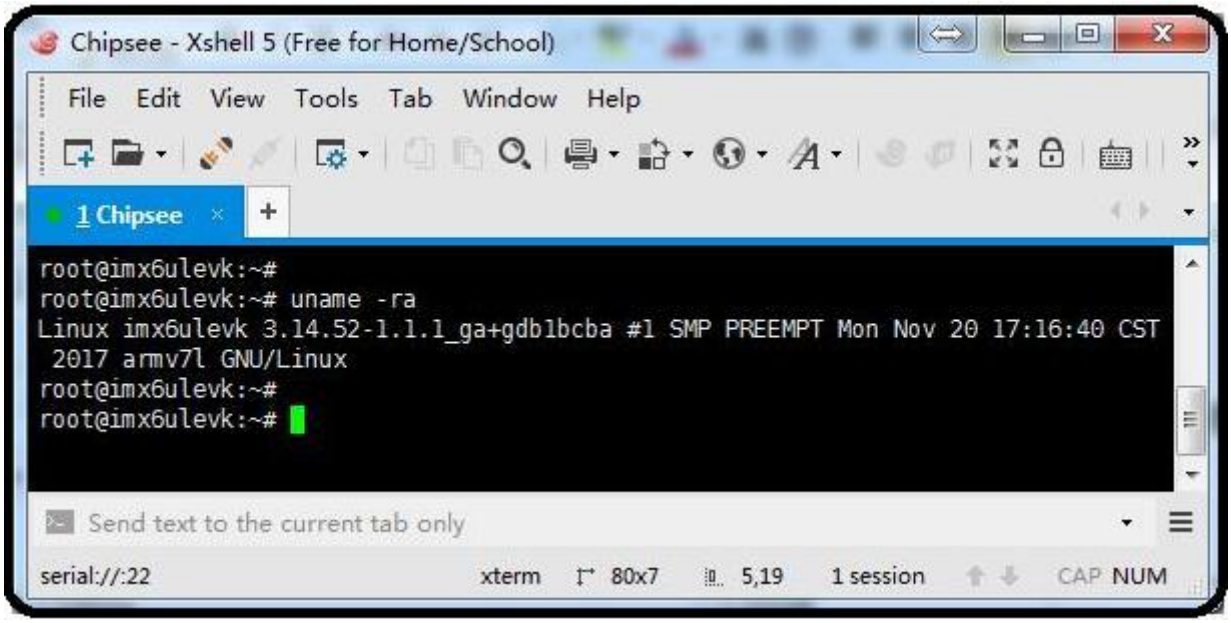



Figure 359: *SSH Debug*

## VNC Debug

You can use the VNC-Viewer software in Windows to control Chipsee IPC over Ethernet.

- **Open the VNC-Viewer software as shown on the figure below.**

Figure 360: *VNC Desktop*

- **Click on the X11VNC icon to enable the X11VNC.**

Figure 361: *X11VNC Enable*

- **Use VNC-Viewer in Windows to control it over Ethernet, as shown on the figure below.**

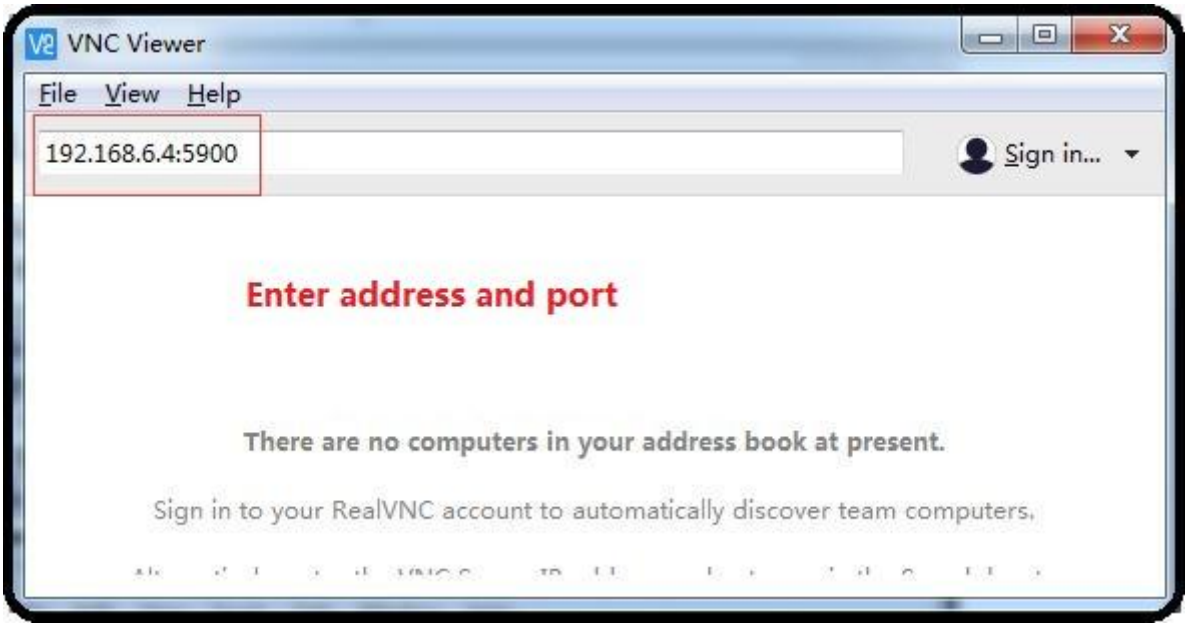



Figure 362: *VNC-Viewer Connect*

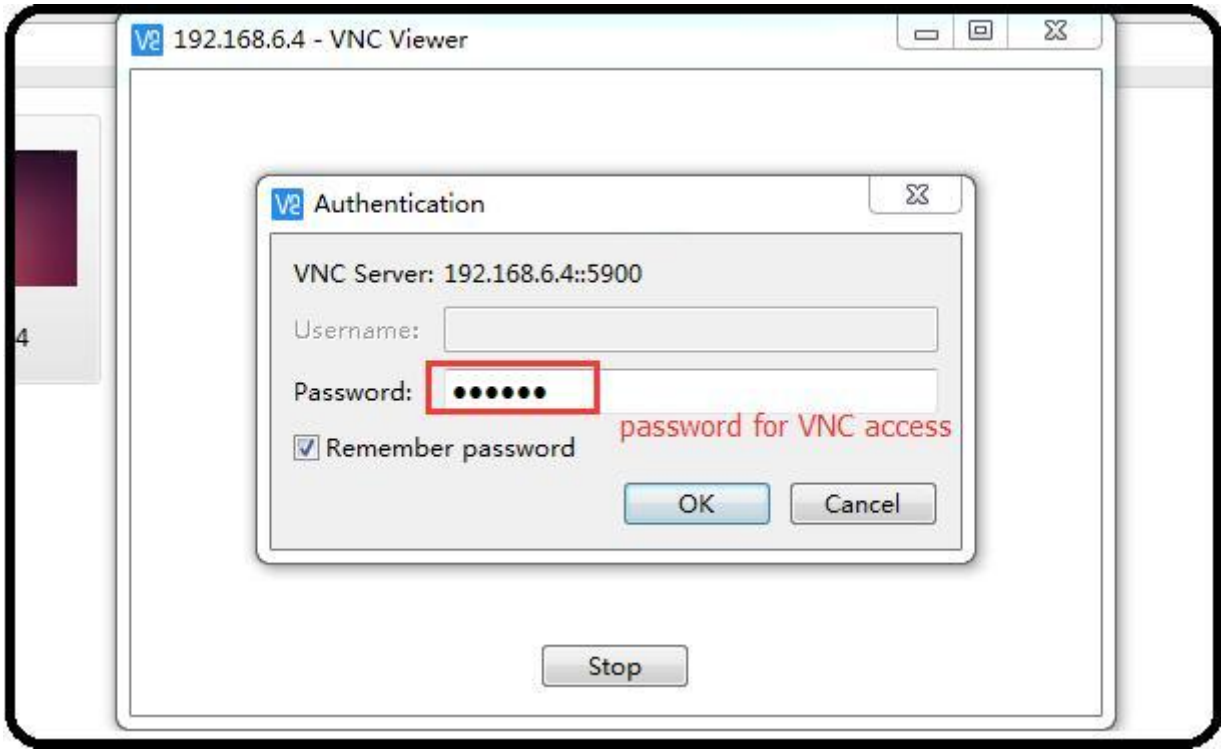



Figure 363: *Authentications*

# Downloading images

## Boot Switch Configuration

CS-IMX6 has a boot configuration select switch, as shown on the figure below. You can use the boot select switch to change between three modes, namely

- TF Card
- eMMC Boot
- Download

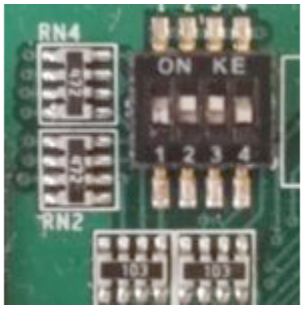



Figure 364: Boot Mode Setup

| SW Mode | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **TF Card** | 1 | 0 | 0 | 0 |
| **eMMC** | 1 | 1 | 0 | 1 |
| **Download** | 0 | 1 | 1 | 0 |

Table 76 Boot Configuration Selection

> **Note**
>
> The user can use both the pre-built Linux Qt 5.5 image files and the **MFGTools** software to download new images to the system, boot system and perform necessary software and hardware test.

## Prebuilt Files Package

You can get the Prebuilt Files Package for each model from links mentioned at the beginning of this documentation. You can also get the Prebuilt Files Package from the DVD in /Linux Qt 5.5/Prebuilds folder. However, it may be outdated so always compare the versions (the last number in the filename is the release date).

The prebuilt package has the following content:

| Contents | Comment |
|---|---|
| boot/imx6q-eisd.dtb | TF Card boot dtb file |
| boot/u-boot-sd.imx | TF Card boot bootloader |
| boot/zImage | TF Card boot kernel file |
| boot/logo.bmp | TF Card boot logo file |
| filesystem/rootfs-emmc-flasher.tar.bz2 | TF Card boot rootFS |
| mksdcard.sh | Shell tools to make bootable TF Card |
| README | Simple guidelines |
| S1.jpg | Boot Switch Config Figure |
| emmc-flash/emmc/rootfs.tar.bz2 | RootFS in target eMMC |
| emmc-flash/emmc/u-boot-emmc.imx | Bootloader in target eMMC |
| emmc-flash/emmc/zImage | Kernel file in target eMMC |
| emmc-flash/emmc/zImage_framebuffer | Kernel file with frame-buffer |
| emmc-flash/emmc/imx6q-eisd.dtb | Dtb file in target eMMC |
| emmc-flash/emmc/imx6q-eisd.dtb_framebuffer | Dtb file with frame-buffer |
| emmc-flash/emmc/logo.bmp | Logo file in eMMC |
| emmc-flash/mkemmc.sh | Shell tool to download images to eMMC |

Table 77 Prebuilt Files Package

> **Note**
>
> - The default `zImage` and `imx6q-sabresd.dtb` files support *'keep the logo from uboot to kernel'* but don't support framebuffer.

> • We also provide `zImage_framebuffer` and `imx6q-eisd.dtb_framebuffer` file versions that support the framebuffer function but do not support the *'keep the logo from uboot kernel'* feature. If you need the framebufer, just rename these two files to `zImage` and `imx6q-eisd.dtb`.

## Downloading Images by using the TF card

Follow the steps below to download images onto the eMMC by using the TF Card:

1. Copy the Prebuilt Files Package to a Linux environment (such as Ubuntu 14.04).
2. Insert the SD card into your computer. If you are using virtual machines, please ensure the SD card is mounted to the Linux operating system.
3. **Confirm the SD card mount point, `/dev/sdX` (e.g., `/dev/sdc` or `/dev/sdb`, be sure to use the right one). In a Linux system, you can use the command below to find out what *X* is.**

   ```
   $ sudo fdisk –l
   ```

4. Copy the `prebuilt-imxv1-csXXXXXfXXXvX-android6-emmc-YYYYMMDD.tar.gz` to somewhere(such as $HOME) on the Ubuntu PC.
5. **Extract the `prebuilt-imxv1-csXXXXXfXXXvX-android6-emmc-YYYYMMDD.tar.gz`**

   ```
   $ tar -xzvf prebuilt-imxv1-csXXXXXfXXXvX-android6-emmc-YYYYMMDD.tar.gz
   ```

6. **Go to the folder**

   ```
   $ cd prebuilt-imxv1-csXXXXXfXXXvX-android6-emmc-YYYYMMDD
   ```

7. **Use the following command to flash the Linux Qt 5.5 OS to the SD card**

   ```
   $ sudo ./mksdcard.sh --device /dev/sd<?>
   ```

   > **Note**
   >
   > • sd<?> means the SD card mount point, (e.g., `/dev/sdc` or `/dev/sdb`) in Ubuntu system.
   >
   > • The recommended SD card should be Sandisk Class4 level SD card or above.

8. The bootable SD Card is now ready. Power OFF the industrial PC and insert the SD Card.
9. Set the switch S1 to TF card boot mode. (refer to Boot Switch Configuration above)
10. Connect the industrial PC to PC via COM1. Power ON the IPC.

11. After 20 minutes, if the LED on industrial PC stays lit, flashing is completed. Using COM1, you can also find this message **>>>>>>> eMMC Flashing Completed <<<<<<<** which indicates that the system image was downloaded correctly to the eMMC.
12. Power OFF and set the switch S1 to eMMC boot mode. (refer to Boot Switch Configuration above)

# System Resource

## TF Card/USB Disk

The TF Card and USB Storage supports hot-plug. These devices will be automatically mounted on */run/media/mmcblk0P** , as shown in the figure.

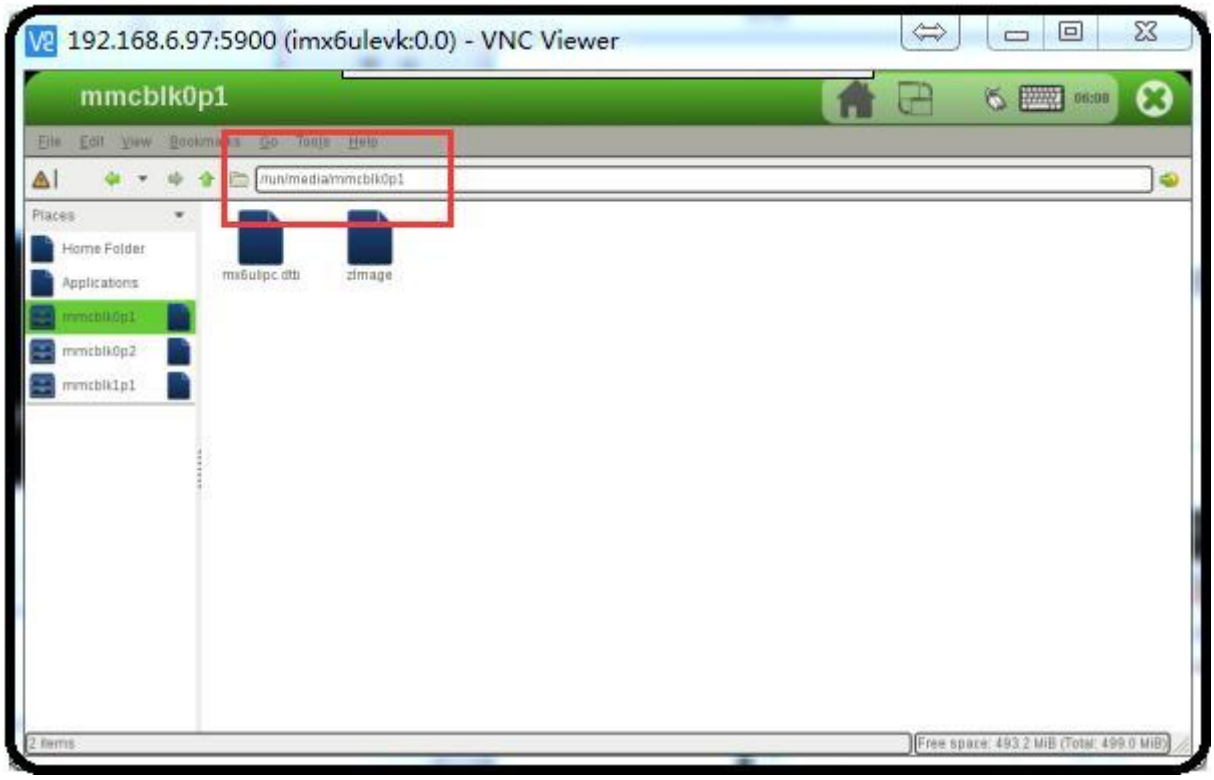



Figure 365: *TF Card*

> **Note**
>
> The TF card and USB Storage do not support NTFS format. Please format it to FAT32 first before plugging into IPC.

## Network

This system uses a networking service to control Ethernet and uses `wpa_supplicant` to control the WIFI network.

### Wired Ethernet

You can get the IP address from the following application, as shown on the figure below.

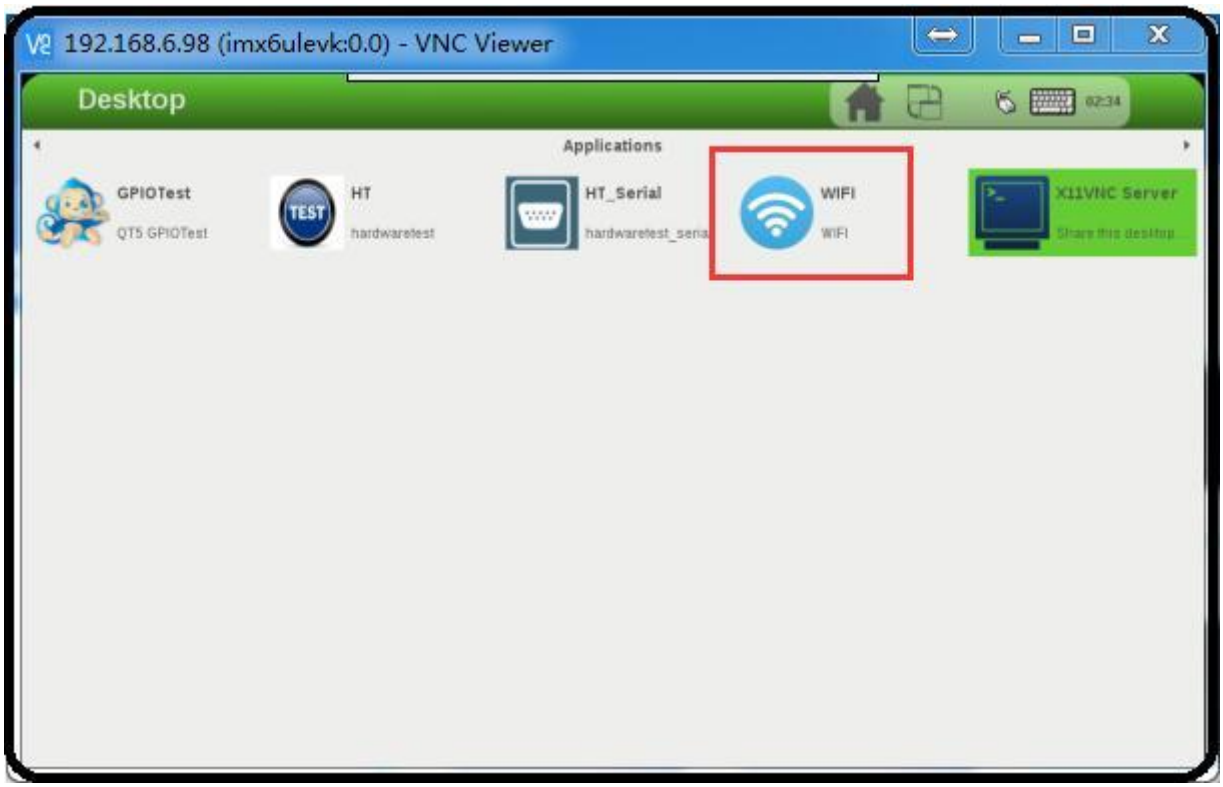



Figure 366: *Wired Connection*

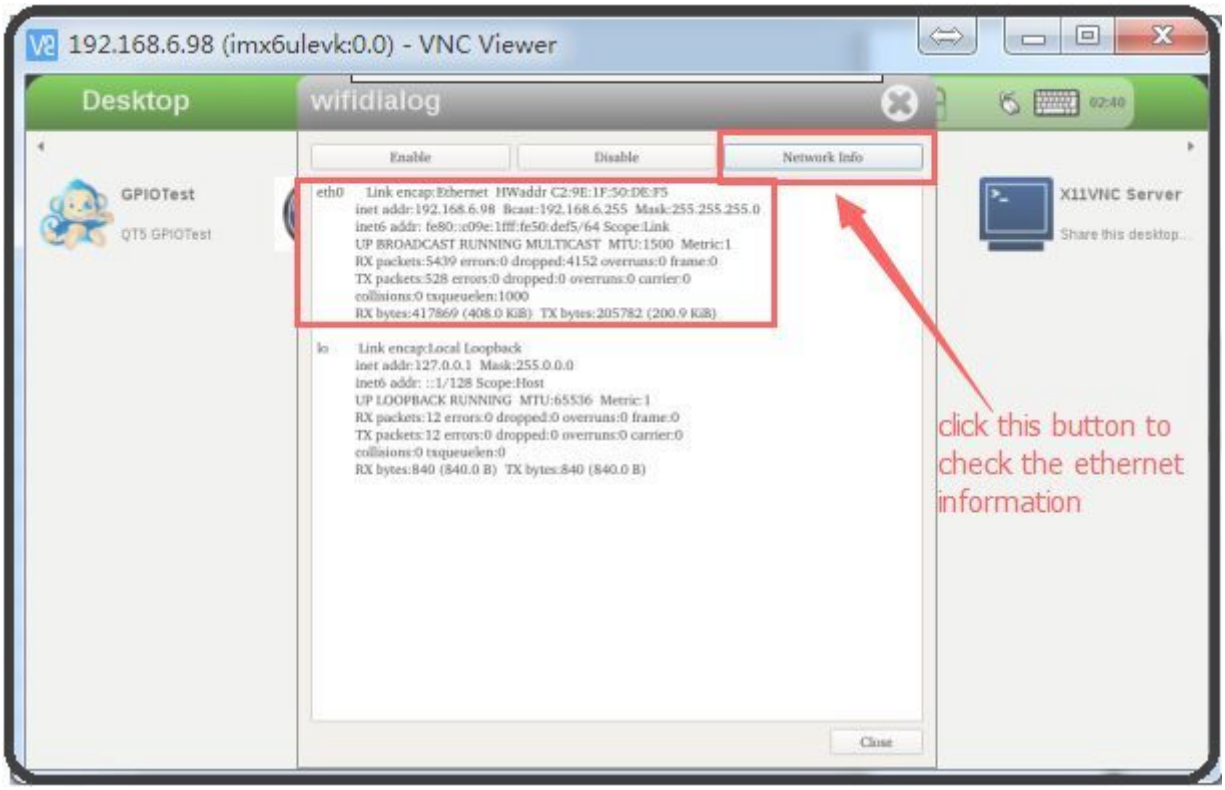



Figure 367: *Ethernet Information*

### Wi-Fi

You can configure the Wi-Fi using these methods:

- Config Wi-Fi by GUI
- Config Wi-Fi by Command

### Config Wi-Fi by GUI

- Click the **terminal** on the desktop
- Use the following command to generate network config information.

```
# wpa_passphrase "Chipsee" "1chipsee234567890"
```

- Replace the information in */etc/wpa_supplicant.conf* by setting the `ssid=Chipsee` and `psk=1chipsee234567890`, as shown on the figure below.

Figure 368: *Wi-Fi Config File*

- Open the **Wi-Fi** icon on the desktop, then click the **Enable** button. Wait for some time to get the Wi-Fi working. The Wi-Fi is working when the network tab displays the *WIFI Enabled!* message, as shown on the figure below.

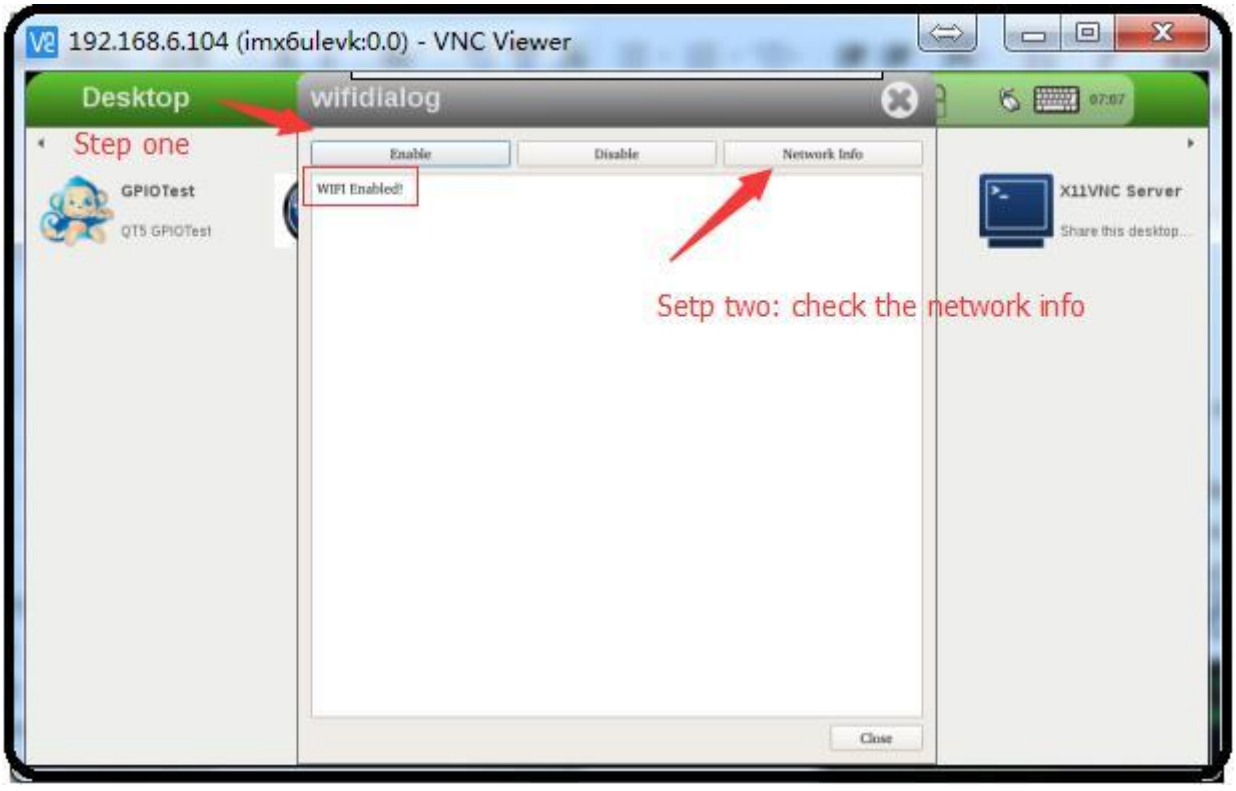



Figure 369: *Wi-Fi Enable*

### Config Wi-Fi by Command

- Use the command below to enable Wi-Fi.

```
# wifienable.sh
```

- List available network and remove default if exist using these commands

```
# wpa_cli list_network
# wpa_cli remove_network
# wpa_cli scan
# wpa_cli scan_result // get latest scan results
# wpa_cli ap_scan 1
```

- Add a new network and list added network using these commands

```
# wpa_cli add_network
# wpa_cli list_network
```

- Set SSID, Password, and key management using these commands

```
# wpa_cli set_network 0 ssid "Chipsee"
# wpa_cli set_network 0 key_mgmt WPA-PSK
# wpa_cli set_network 0 psk "1chipsee234567890"
```

- Enable the `network 0` with this command

```
# wpa_cli select_network 0
```

- Save config

```
# wpa_cli save_config
```

- Re-enable Wi-Fi

```
# wifienable.sh
```

## Sound Test

You can use the command below to record music. The `-d` parameter means *interrupt after # seconds*. In this example, `-d` is equal to 18 seconds.

```
$ sudo arecord -N -M -r 44100 -f S16_LE -c 2 -d 18 test.wav
```

You can use the command below to playback the recorded sound above.

```
$ sudo  aplay  -N  -M  test.wav
```

You can also use the **QT Test Application** to record and playback audio.

On the **QT Test Application** desktop, click on the **HT** button to perform a hardware test, as shown on the figure below.

Figure 370: *Hardware Test*

You can click the **Audio** button to playback audio. You can also click the **Record** button to record 18 seconds of audio then the application will playback the audio automatically.

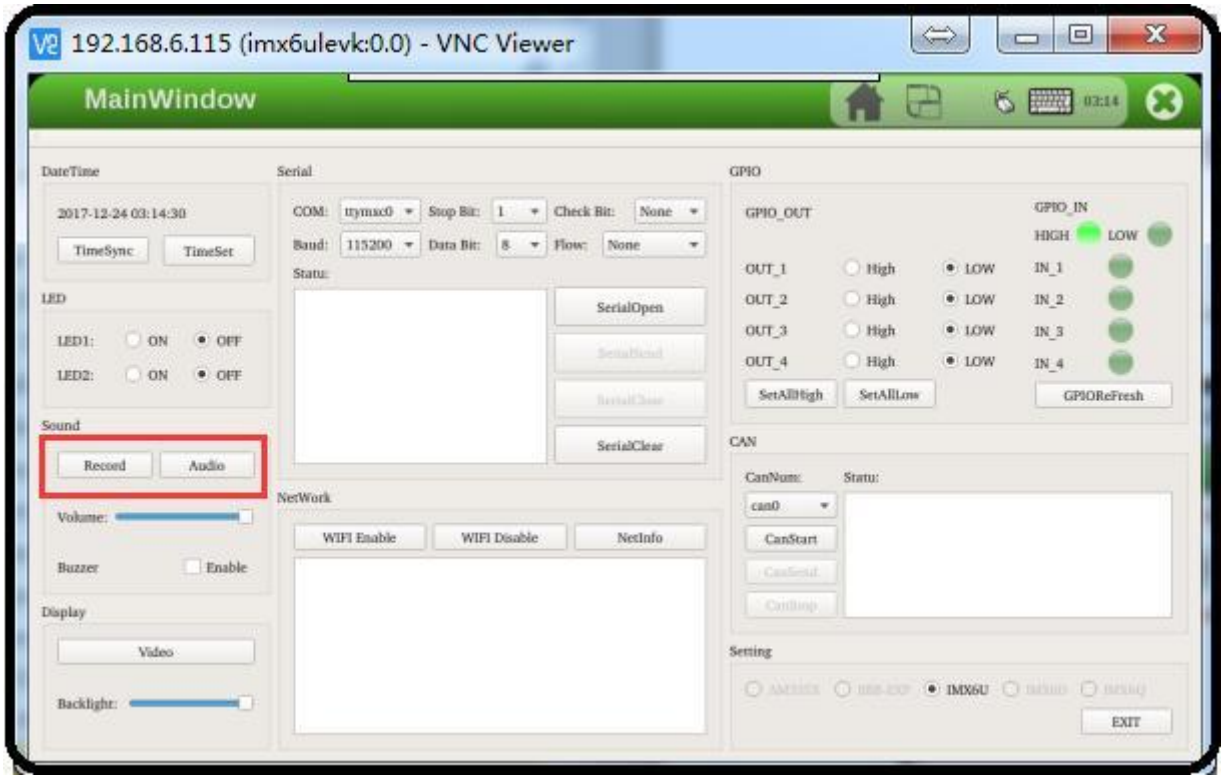



Figure 371: *Audio Test*

## Serial Port

There are five serial ports on the Chipsee IPC: 2 x RS232 and 3 x RS485 (can be customised). Refer to the table below for the available serial device nodes.

The default serial port configuration is 2 x RS232, 2 x RS485, 1 x RS485 which is shared with Bluetooth.
**Contact us** if you need help with changing the default serial port configuration

| Ports | Device Node |
|---|---|
| COM1(RS232, Debug) | /dev/ttymxc0 |
| COM2(RS485) | /dev/ttymxc1 |
| COM3(RS232) | /dev/ttymxc2 |
| COM4(RS485) | /dev/ttymxc3 |
| COM5(RS485) | /dev/ttymxc4 |

Table 78 Serial Ports Nodes on the System

> **Note**
>
> If you use COM2(RS485), you can't use Bluetooth because COM2(RS485) share pin with Bluetooth.

You can test the serial port by using the **HT_Serial Application** in the desktop, as shown on the figure below.

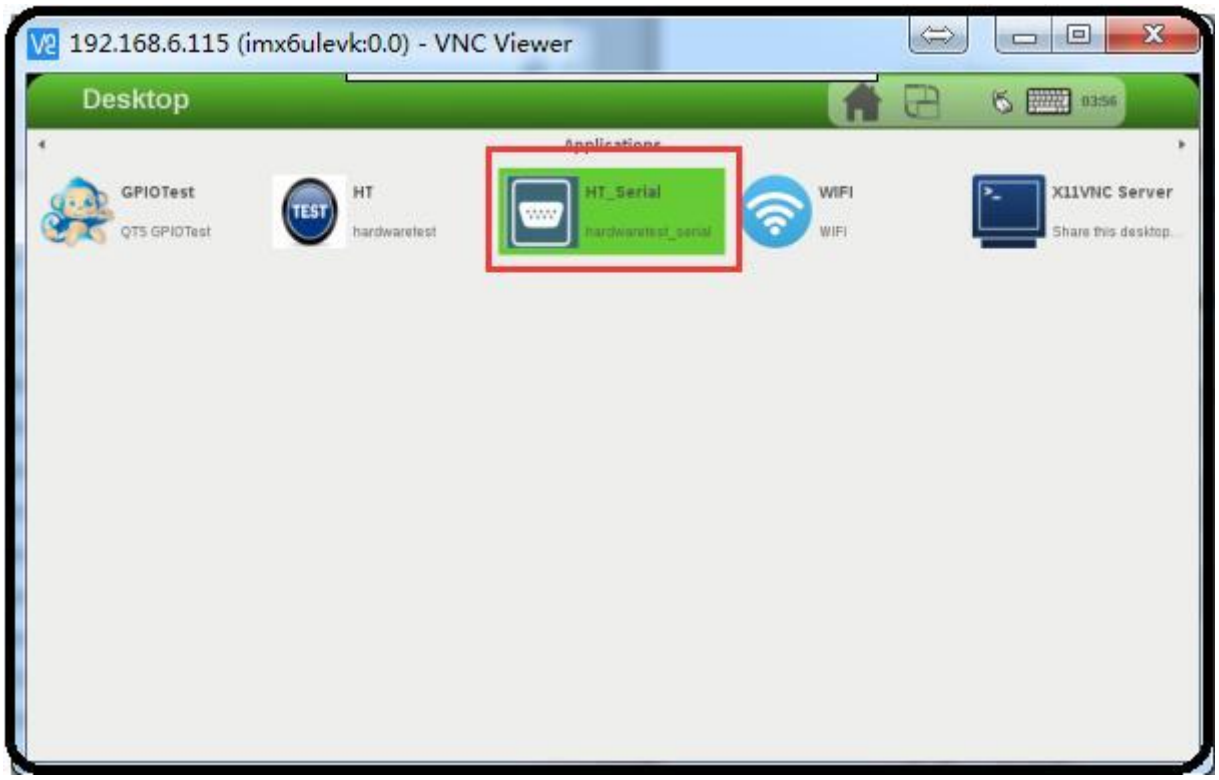



Figure 372: *HT_Serial Test*

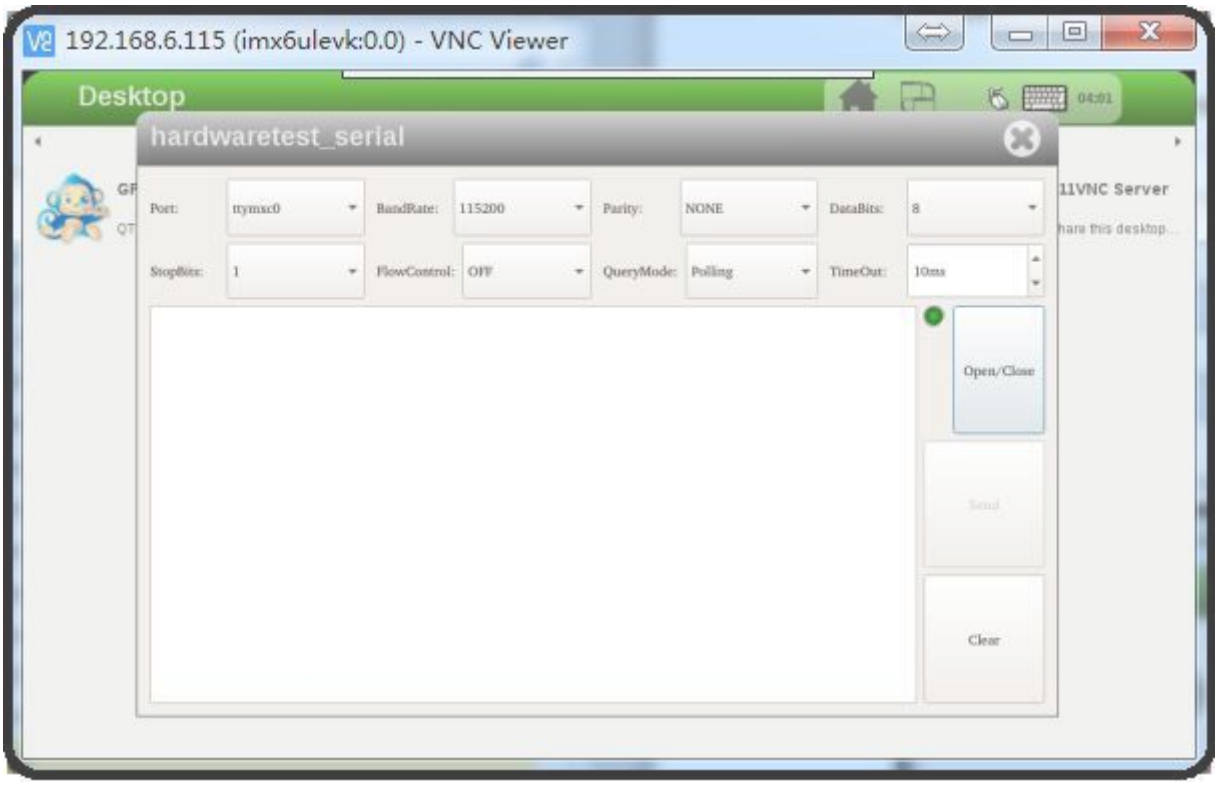



Figure 373: *HT_Serial Test*

## CAN Bus

Chipsee Industrial PC is equipped with two CAN busses (CAN1 and CAN2). Two devices can be interconnected. You can test the CAN buses by using the **HT application** but you must add one 120Ω resistor between CAN_H and CAN_L on one of the two Boards, as shown on the figure below.

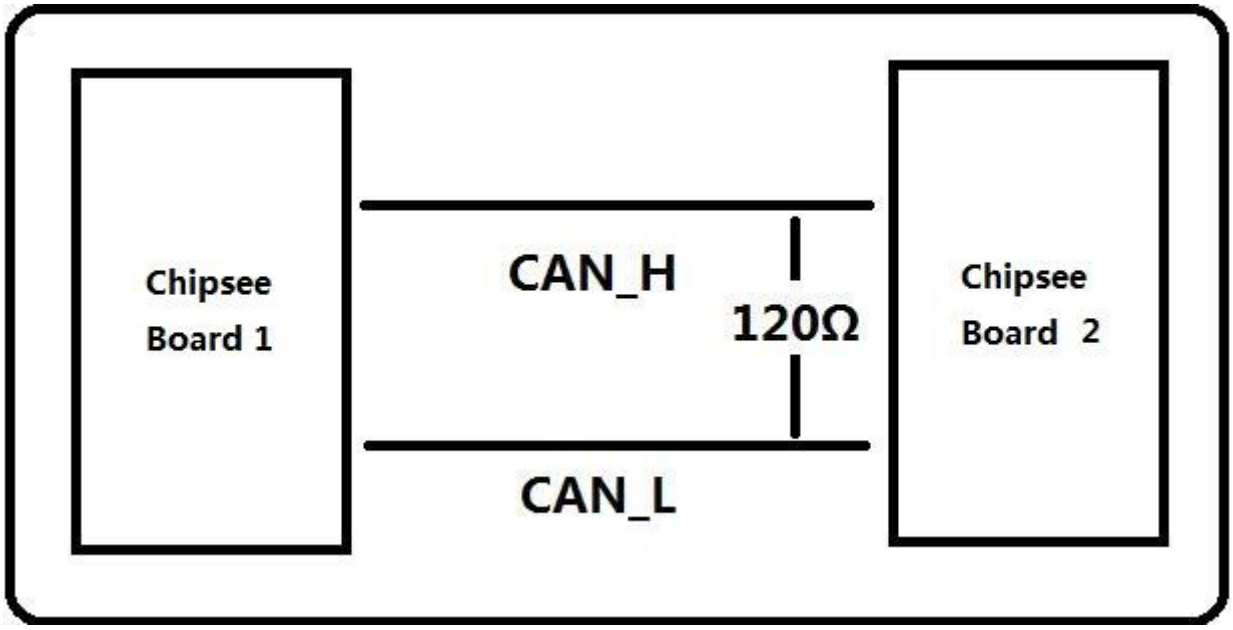



Figure 374: *CAN Connect*

**Note**

The Chipsee IPC does not mount the 120Ω matched resistor on all CAN signals by default.

Here are a few examples to test CAN by using CAN units

- **Install** *can-utils*

```
$ sudo apt install can-utils
```

- **Set the bit-rate to 50Kbits/sec with triple sampling using the following command (use ROOT user):**

```
$ sudo ip link set can0 type can bitrate 50000 triple-sampling on
```

- **Bring up the device using the command:**

```
$ sudo ip link set can0 up
```

- **Transfer packets**
  - Transmit 8 bytes with standard packet id number as 0x10

```
$ sudo cansend can0 -i 0x10 0x11 0x22 0x33 0x44 0x55 0x66 0x77 0x88
```

  - Transmit 8 bytes with extended packet id number as 0x800

```
$ sudo cansend can0 -i 0x800 0x11 0x22 0x33 0x44 0x55 0x66 0x77 0x88 - e
```

- Transmit 20 8 bytes with extended packet id number as 0xFFFFF

```
$ sudo cansend can0 -i 0xFFFFF 0x11 0x22 0x33 0x44 0x55 0x66 0x77 0x88 -e
--loop=20
```

- **Receive data from CAN bus**

```
$ sudo candump can0
```

- **Bring down the device**

```
$ sudo ip link set can0 down
```

You can use the **HT application** to test CAN. To perform the CAN test, you need two Chipsee IPC boards to perform the test.
Follow these steps to perform the CAN test:

- Connect the two IPC boards and select the CAN port `can0` or `can1` simultaneously on both IPC boards.
- Click on the **CanStart** button simultaneously on both IPC boards.

Refer to the figure below for the CAN part in the HT application.

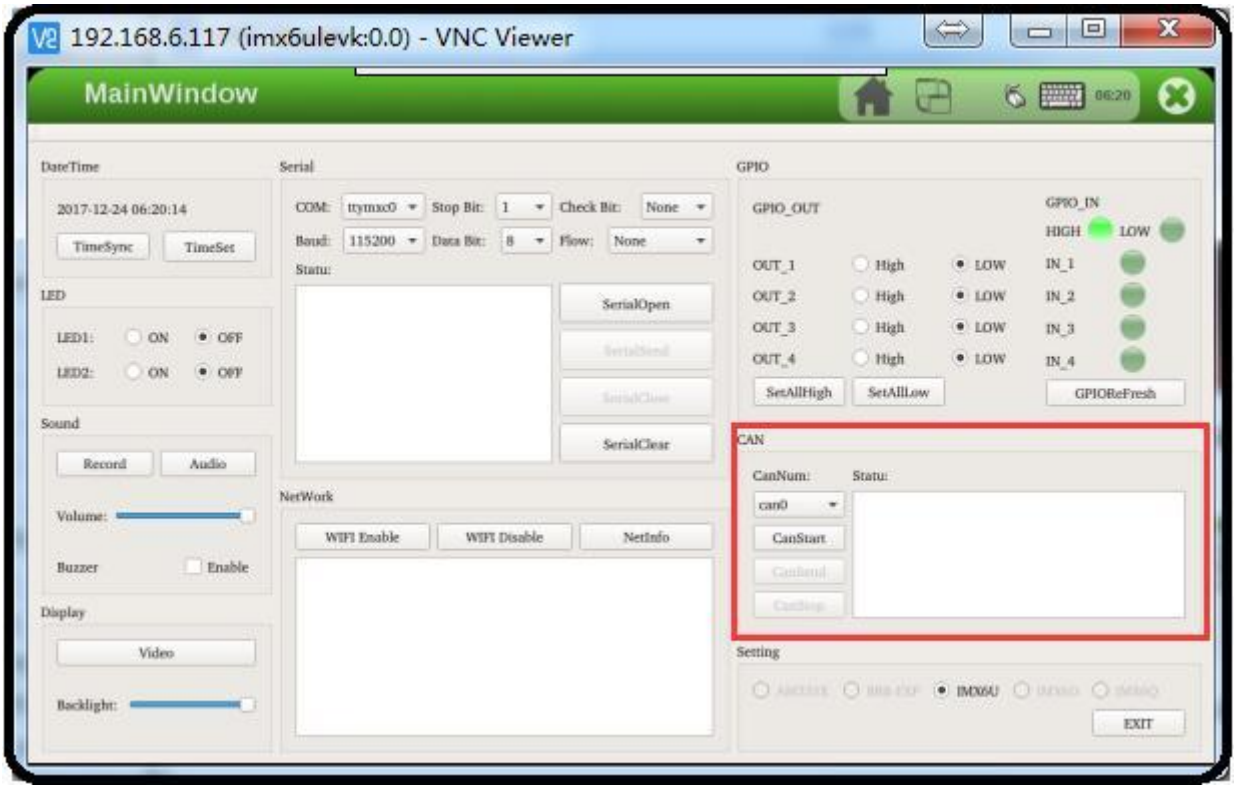



Figure 375: *CAN*

## GPIO

There are 8 GPIOs, 4 Output, and 4 Input, they are all isolated. You can control the output or input pin voltage by feeding the VDD_ISO suite voltage. The pin voltage should be from 5V to 24V. Refer to the tables below for a detailed port definition:

| Pin Number | Definition |
|---|---|
| 1 | VDD_24v |
| 2 | GND_ISO |
| 3 | /dev/chipsee-gpio1(out) |
| 4 | /dev/chipsee-gpio2(out) |
| 5 | /dev/chipsee-gpio3(out) |
| 6 | /dev/chipsee-gpio4(out) |
| 7 | /dev/chipsee-gpio5(in) |
| 8 | /dev/chipsee-gpio6(in) |
| 9 | /dev/chipsee-gpio7(in) |
| 10 | /dev/chipsee-gpio8(in) |

Table 79 CS10600F070 – V1.0 P23 Port

Set *GPIO1 Output* to high using this command

```
# echo 1 > /dev/chipsee-gpio1
```

Set *GPIO2 Output* to low using this command

```
# echo 0 > /dev/chipsee-gpio2
```

Check *GPIO5* value using this command

```
# cat /dev/chipsee-gpio5
```

You can use the **HT application** to test GPIO.
Follow these steps to perform the GPIO test:

- Before you test, you need to connect the output gpio and input gpio, like *pin 3 — pin 7* / *pin 4 — pin 8* / *pin 5 — pin 9* / *pin 6 — pin10* .
- Don't forget to give outside power to the pin 1 and pin2. You can use the outside 24V input power.
- Click on the **SetAllHigh** or **SetAllLow** button to check the right light status.

- Also, you can set the *output gpio* to high or low respectively. Then check the right *input gpio* status, as shown on the figure below.

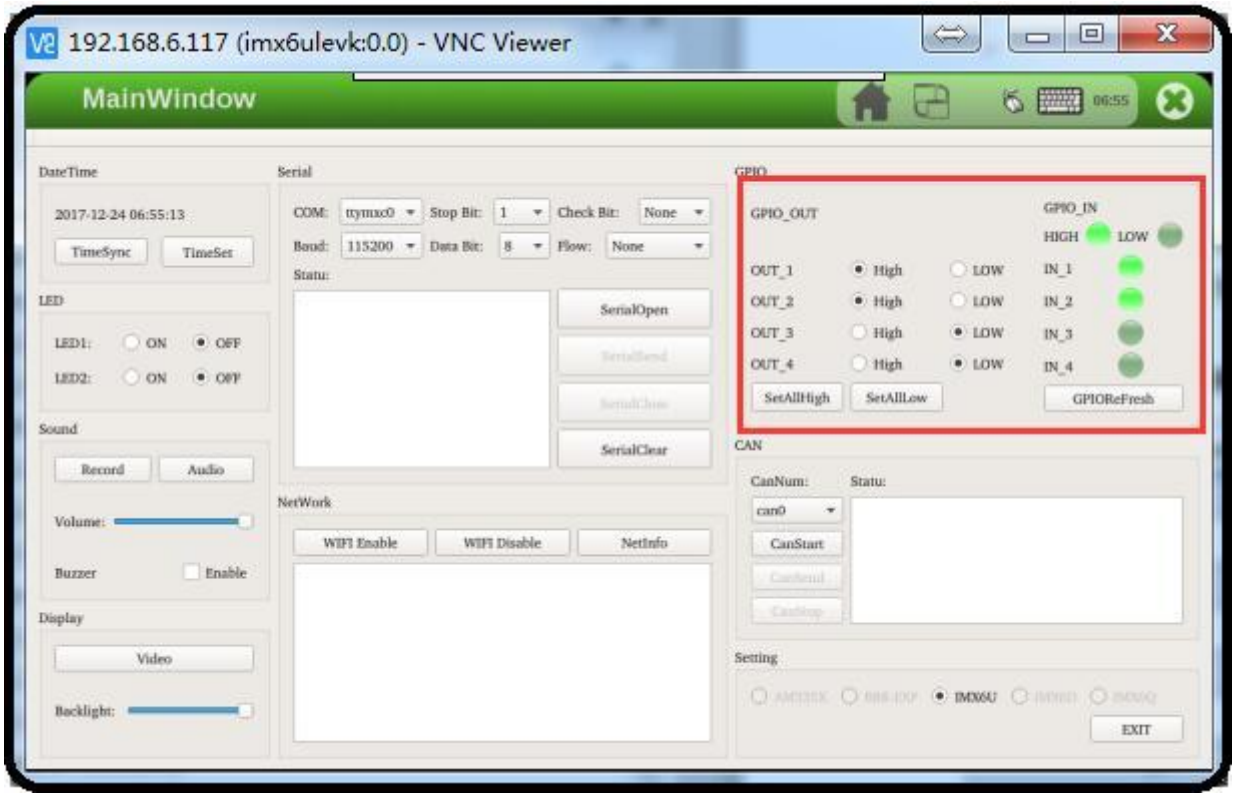



Figure 376: *GPIO Test*

> **Note**
>
> The default gpio has 4 Outputs and 4 Inputs. If you want a custom solution, please check the */etc/init.d/chipsee-init* file for details.

## Buzzer

You can control the buzzer easily, with the following command:

- **Enable the buzzer**

```
# echo 1 >/dev/buzzer
```

- **Disable the buzzer**

```
# echo 0 >/dev/buzzer
```

You also can use the HT application to test the buzzer.

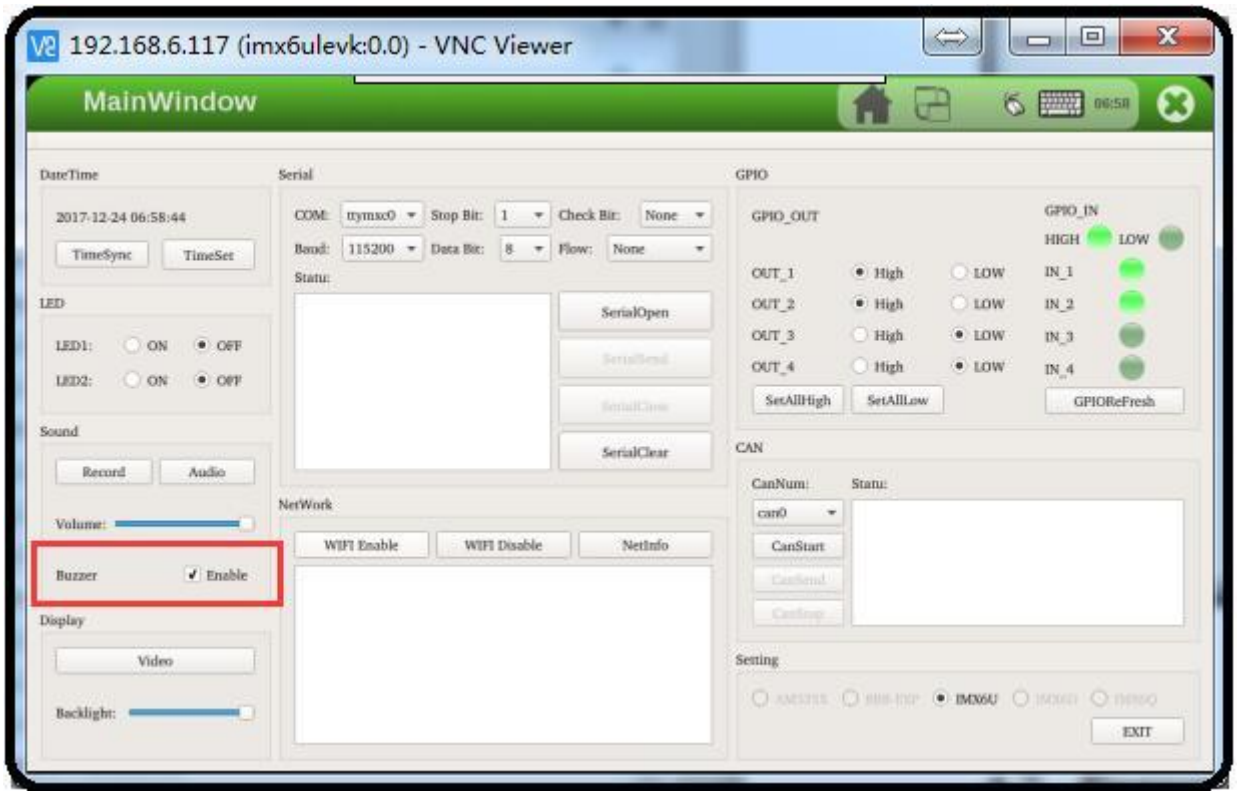



Figure 377: *Buzzer*

# Development

In this chapter, you will learn how to set up the QT development environment, and develop the first QT application on Chipsee IPC boards.

## Preparation

1. Download QT5.5.1 and install it on the system. Install it in the */home/<user>/program* directory.
2. **Install IMX6UL SDK. Get and install the SDK by using the following commands:**

```
# wget -c https://chipsee-tmp.s3.amazonaws.com/SDK/fsl-imx-x11-glibc-x86_64-meta-toolchain-qt5-cortexa7hf-vfp-neon-toolchain-3.14.52-1.1.1.sh
    # chmod +x fsl-imx-x11-glibc-x86_64-meta-toolchain-qt5-cortexa7hf-vfp-neon-toolchain-3.14.52-1.1.1.sh
# ./fsl-imx-x11-glibc-x86_64-meta-toolchain-qt5-cortexa7hf-vfp-neon-toolchain-3.14.52-1.1.1.sh
```

   The default install directory is */opt/fsl-imx-x11/3.14.52-1.1.1* . You can install it in this directory or you can also use another directory.

3. **Use the following command to test SDK:**

```
# source /opt/fsl-imx-x11/3.14.52-1.1.1/environment-setup-cortexa7hf-vfp-neon-poky-linux-gnueabi
# echo ${CC}
```

4. **Setting Qtcreator. If you installed `qt-opensource-linux-x64-5.5.1.run`, the Qtcreator will be installed automatically.**

    - **Before you open QtCreator, you need to add the following code-block in the first line of** */home/<user>/program/Qt5.5.1/Tools/QtCreator/bin/qtcreator.sh* **, as shown on the figure below.**

```
$ source /opt/fsl-imx-x11/3.14.52-1.1.1/environment-setup-cortexa7hf-vfp-neon-poky-linux-gnueabi
```

Figure 378: *Setting QtCreator*

5. **Use the following command to open Qtcreator.**

```
# /home/program/Qt5.5.1/Tools/QtCreator/bin/qtcreator.sh
```

6. **Open the QtCreator Options, then click on Tools->Options->Build & Run. Set the Debuggers/Compilers/Qt Versions/Kits as shown on the figures below.**

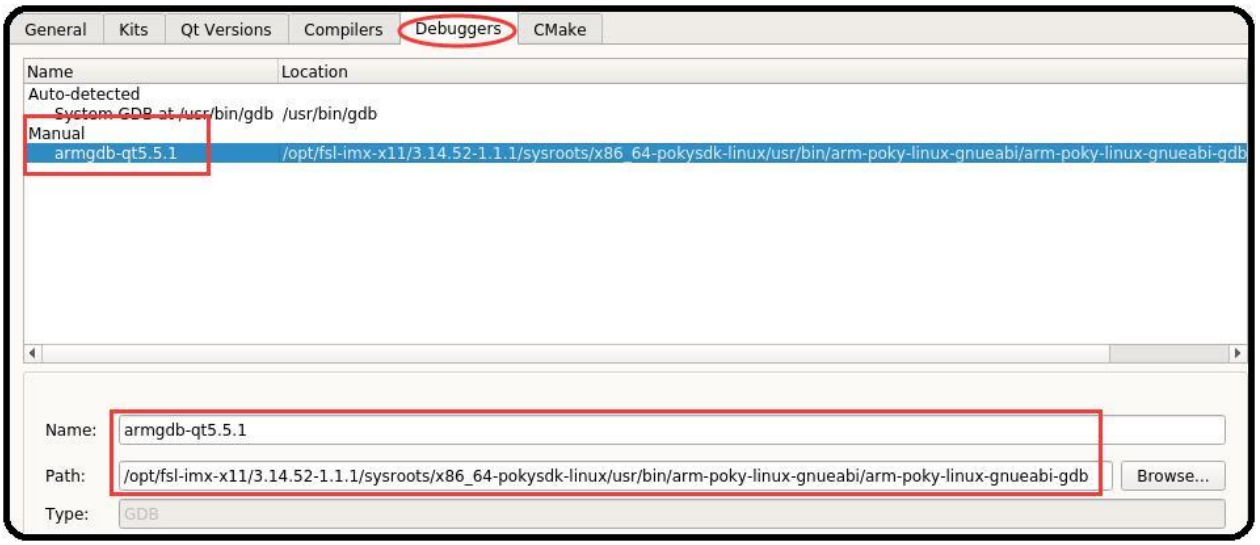


Figure 379: *Debuggers*

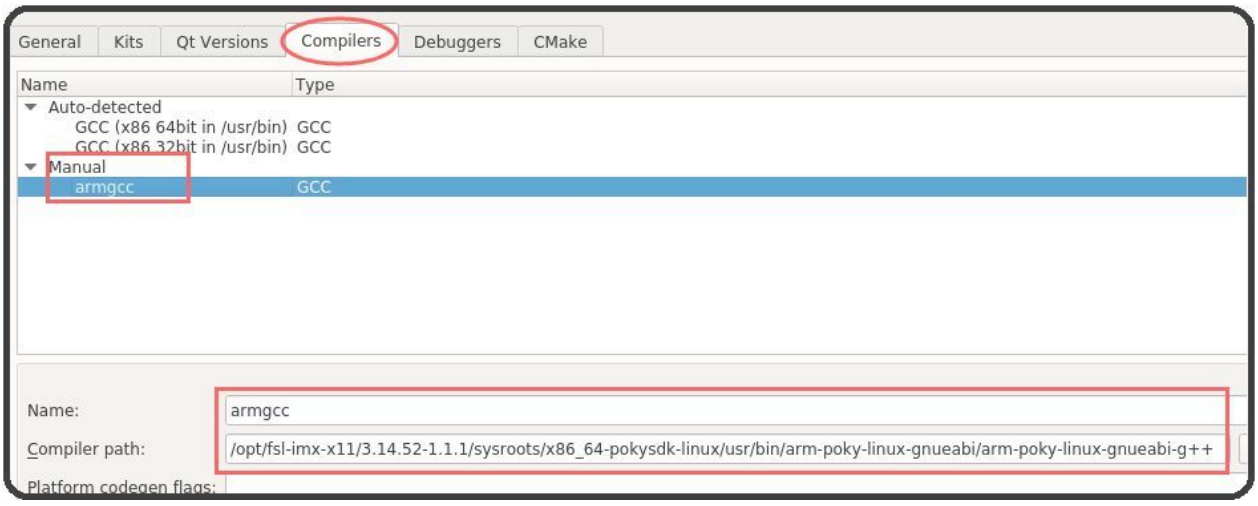



Figure 380: *Compilers*

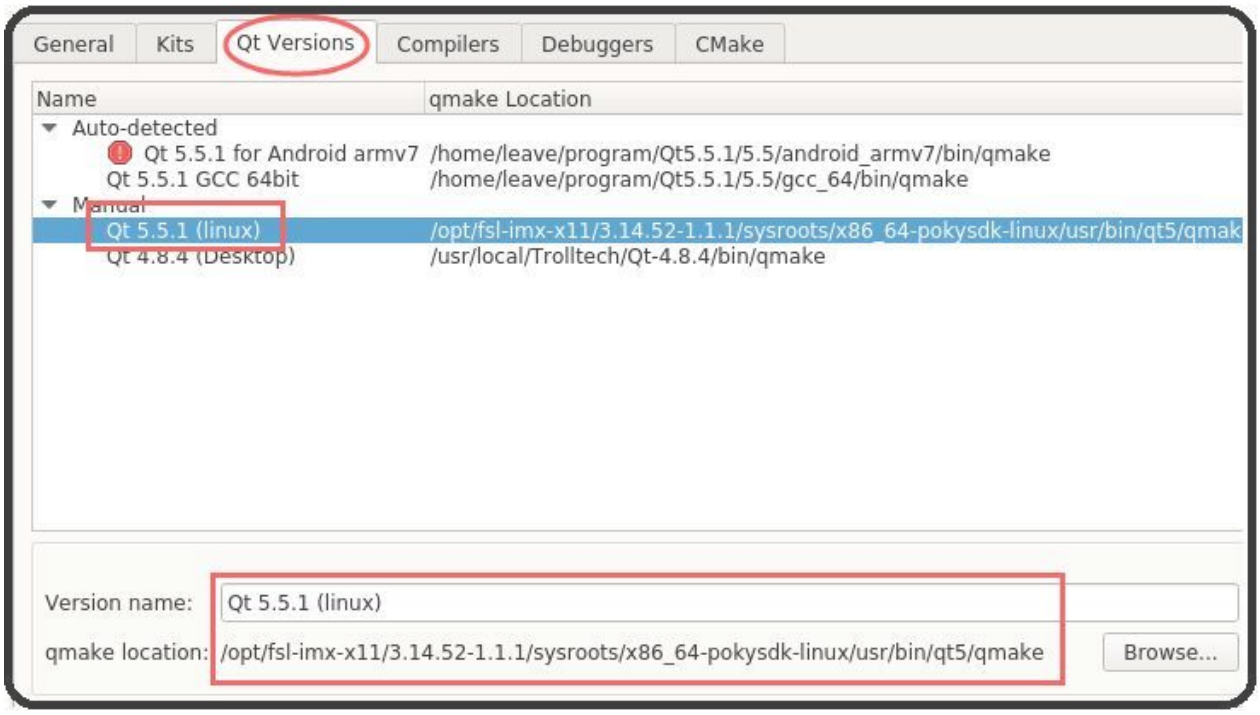



Figure 381: *Qt Versions*

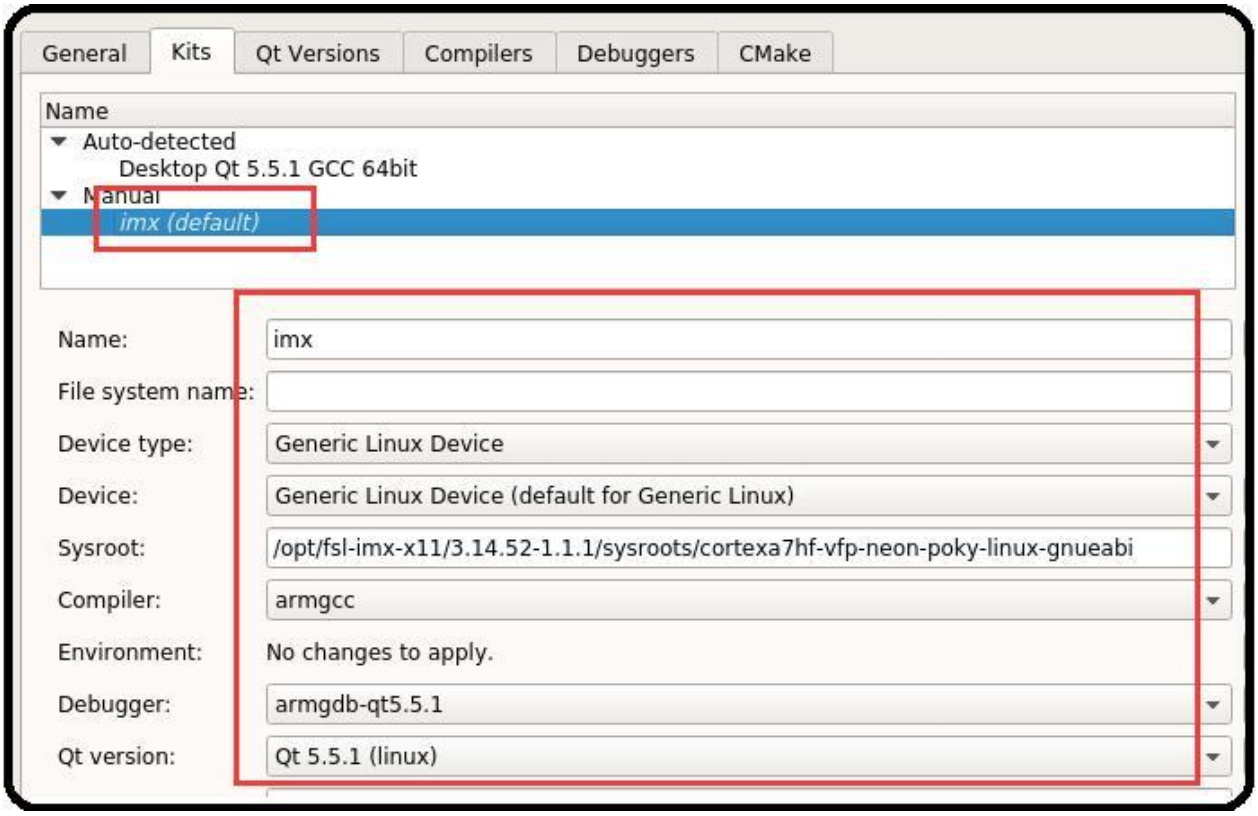



Figure 382: *Kits*

## Example — Develop a `HelloWorld` Program

1. **Use QtCreator to create a new Qt Widgets Application, named `HelloWorld`, as shown on the figure below.**

Figure 383: *Qt Widgets Application*

2. **Select IMX kits, as shown on the figure below.**

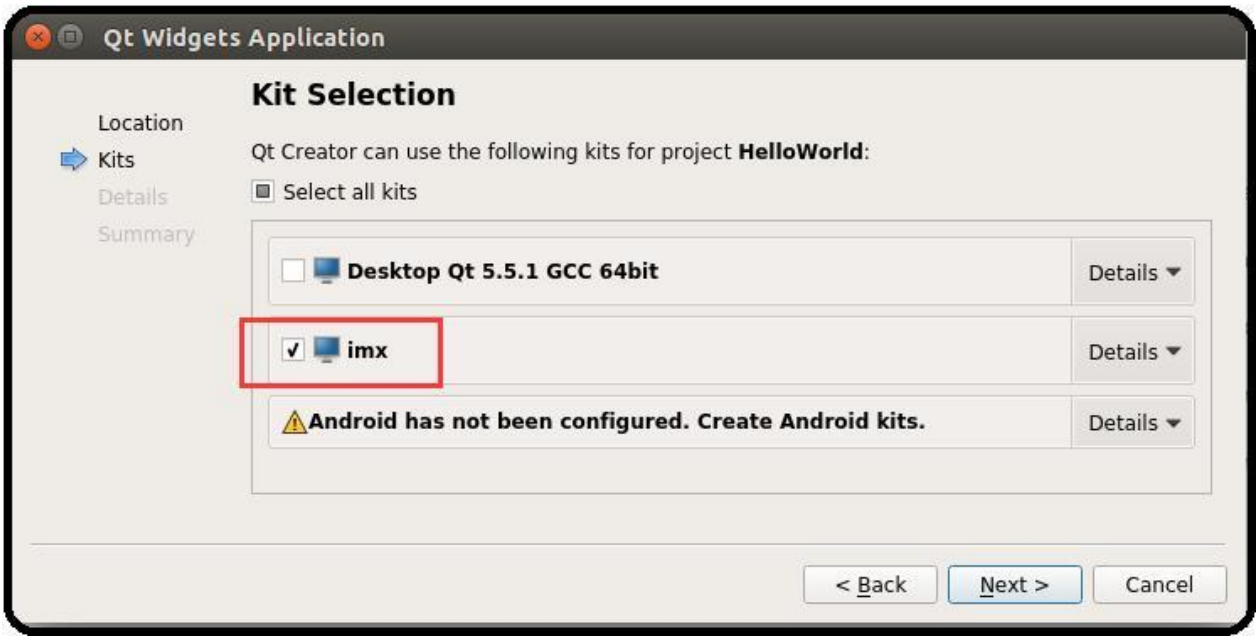



Figure 384: *Kit Selection*

3. **Use QMainWindow as the Base class, as shown on the figure below.**

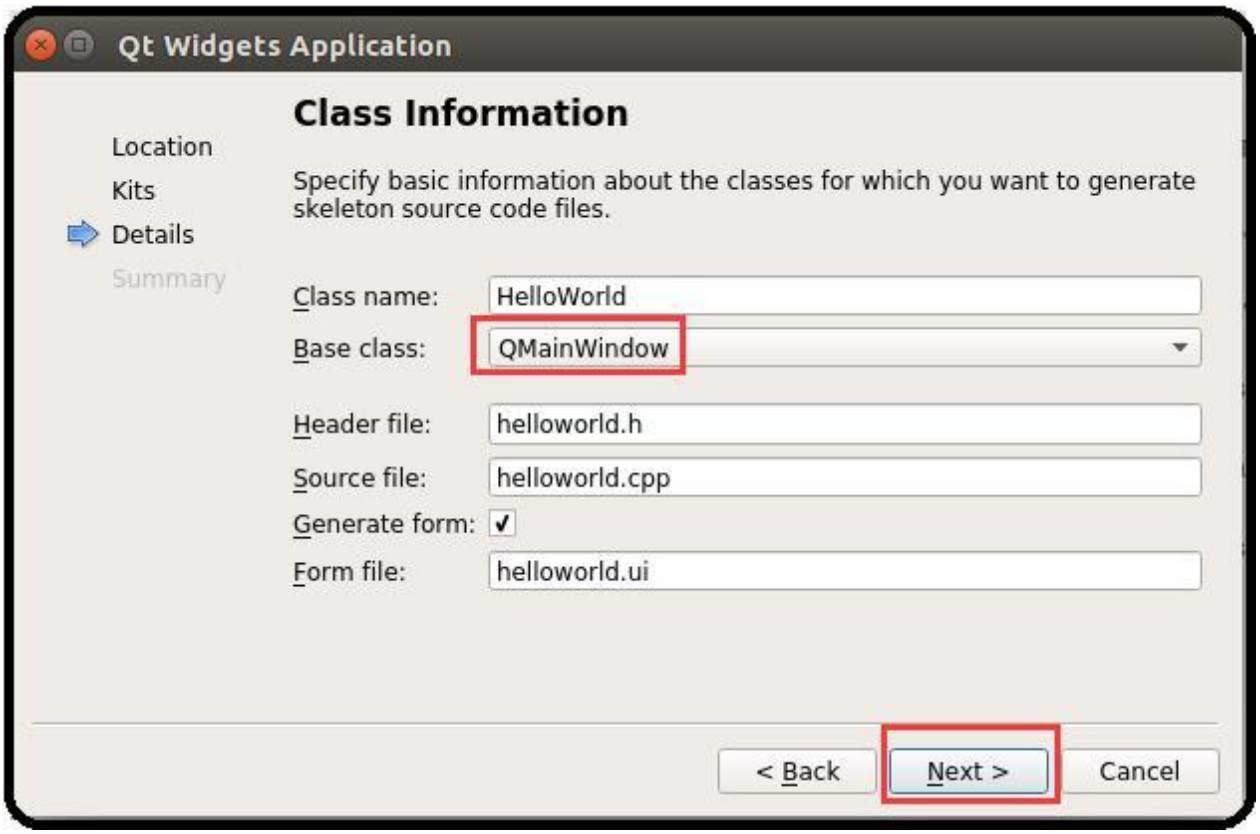



Figure 385: *Base Class*

4. **Click the Design icon to add one label widget, as shown on the figure below.**

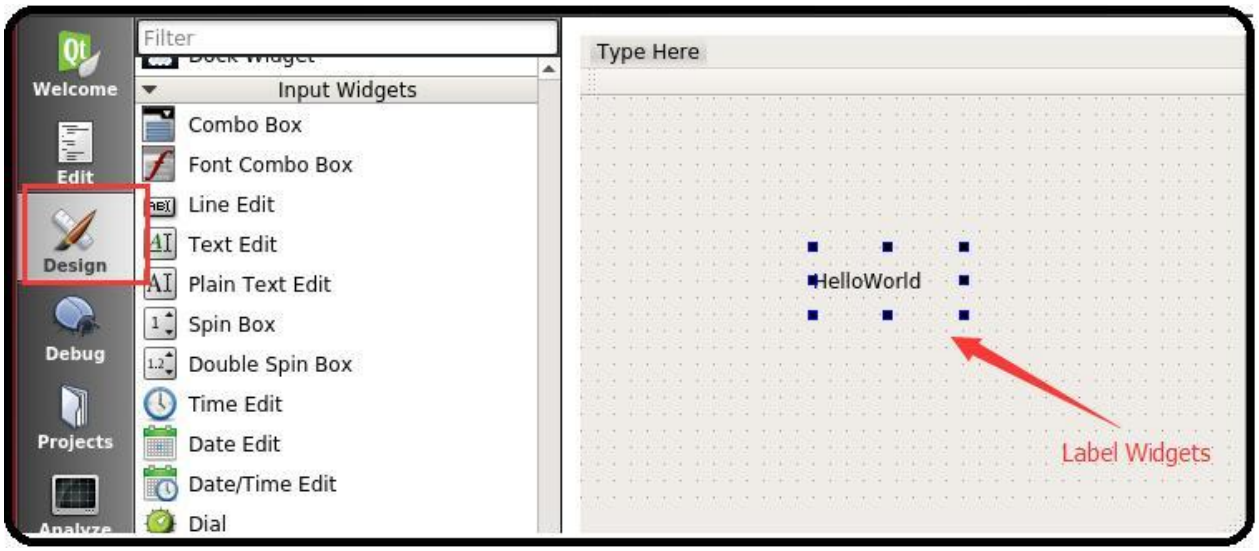



Figure 386: *Add Label Widget*

5. **Click on the Build icon to build app, as shown on the figure below.**

Figure 387: *Build App*

6. **Copy the `Helloworld` app to the IPC board's** */home/root/* **directory and use the following command to run it:**

```
# export DISPLAY=:0.0
# ./HelloWorld
```

You can get the `HelloWorld` app from the */home/leave/build-HelloWorld-imx-Debug* directory, but your directory might not be the same as this one.

## Q&A

In this chapter, you can learn how to set up the QT development environment, and develop the first QT application on Chipsee IPC boards.

## How to Change psplash's

- **Install IMX SDK and some Packages. Reference the install SDK point under the Preparation section above to install IMX SDK and install some recommends packages using this command:**

```
$ sudo  apt-get  install  autoconf  libgdk-pixbuf2.0-dev
```

- **Generate psplash of your own.**
  - **Get `psplash.tar.gz` from** *DVD/Linux+QT5/Tools/* **and extract it.**

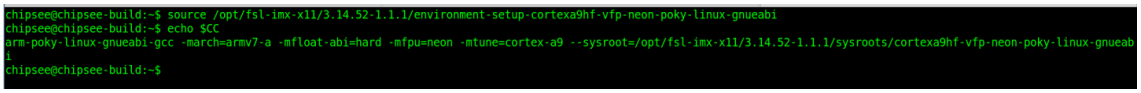
```
$ sudo tar zxvf psplash.tar.gz
```

  - **Prepare a PNG file, such as `chipsee.png`**

```
$ sudo cp chipsee.png psplash/
$ sudo cd psplash
```

  - **Setting environment**

```
$ source /opt/fsl-imx-x11/3.14.52-1.1.1/environment-setup-
cortexa9hf-vfp-neon-poky-linux-gnueabi
```




  - **Generate header file and modify the psplash.c, then config and make:**

```
$ ./make-image-header.sh chipsee.png POKY  //you will find a new
file named chipsee-img.h
$ vi psplash.c  // replace the header file name (psplash-poky-
img.h) in psplash.c with chipsee-img.h
$ ./autogen.sh
$ make  // you will generate the file psplash
```

  - Then you will find the file `psplash`, replace the one in `rootfs` */usr/bin/psplash* . Reboot your IPC board to apply the changes made to the psplash.
  - You can remove the */etc/init.d/psplash.sh* file in `rootfs` to disable it.
  - **If you want to rotate the psplash screen, just do the following in the system:**

```
# echo 180 > /etc/rotation   // rotate  180  angle
# echo 0 > /etc/rotation         // reset to default.
```

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