

HamGeek ZYNQ7020 SDR Unboxing and Inspection



1. Disclaimer:

This product is manufactured and sold by HamGeek for research and educational purposes only. Users are responsible for ensuring that the product is used properly and in compliance with all applicable laws and regulations. HamGeek shall not be liable for any disputes, damages, or consequences arising from the use or misuse of this product. By using this product, the user assumes full responsibility for its use.

2. Package Contents and Preparation:

Thank you for purchasing the HamGeek ZYNQ7020 SDR Professional Edition. Compared with the Standard Edition, this version features enhanced RF performance and expandability. It is equipped with a custom CNC-machined cooling enclosure for stable long-term operation.

2.1 The package should contain the following items:

- * HamGeek SDR Mainboard with CNC Enclosure x1 (Firmware v0.38 is pre-loaded on the SD card, which is inserted into the board.)
- * Type-C Cable x1
- * Telescopic Antenna x1

2.2 The following items are required for testing and should be prepared separately:

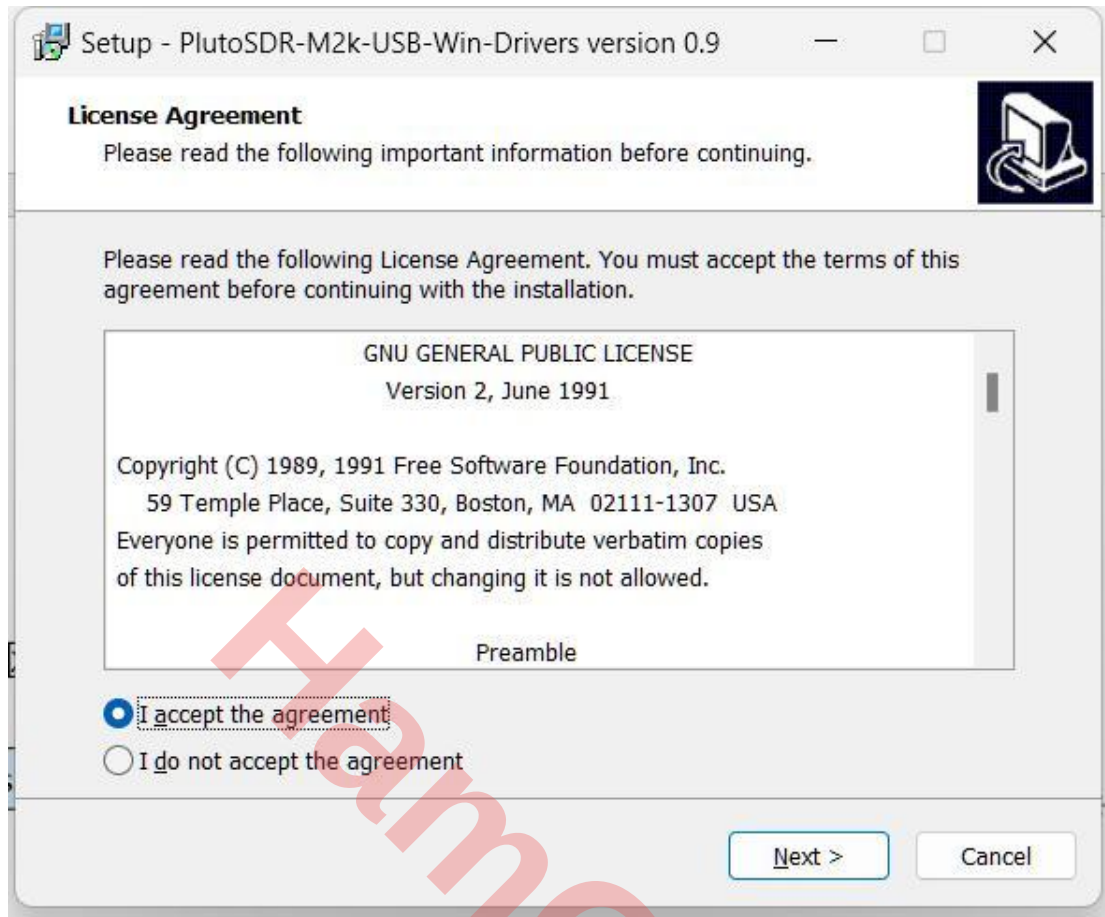
- * Windows PC x1
- * Ethernet Cable x1
- * SMA Loopback Cable (Female Thread, Male Pin) x2

3. Driver Installation:

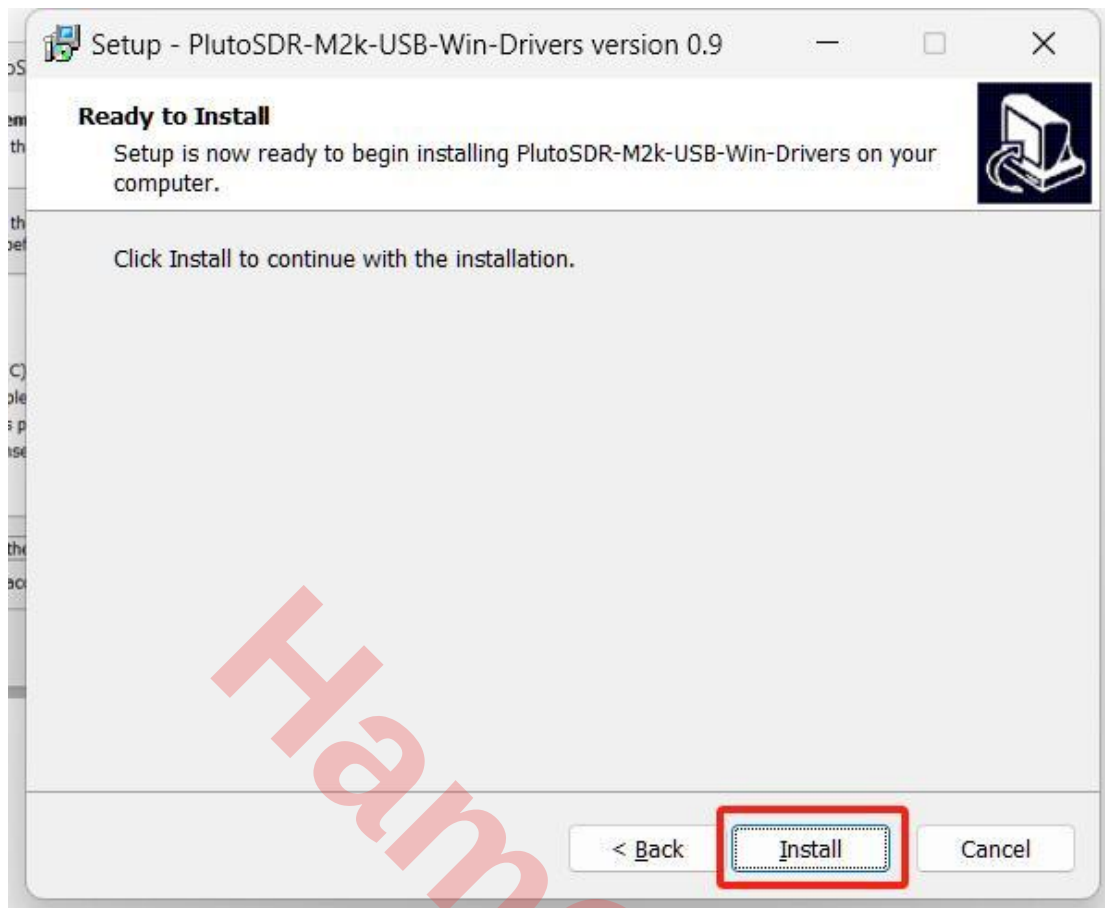
Click the link to download the USB virtual network adapter driver, then extract the downloaded file.

<https://www.comseek.com/download/98078/PlutoSDR-M2k-USB-Drivers.zip>

Double-click PlutoSDR-M2k-USB-Drivers.exe to start the installation.



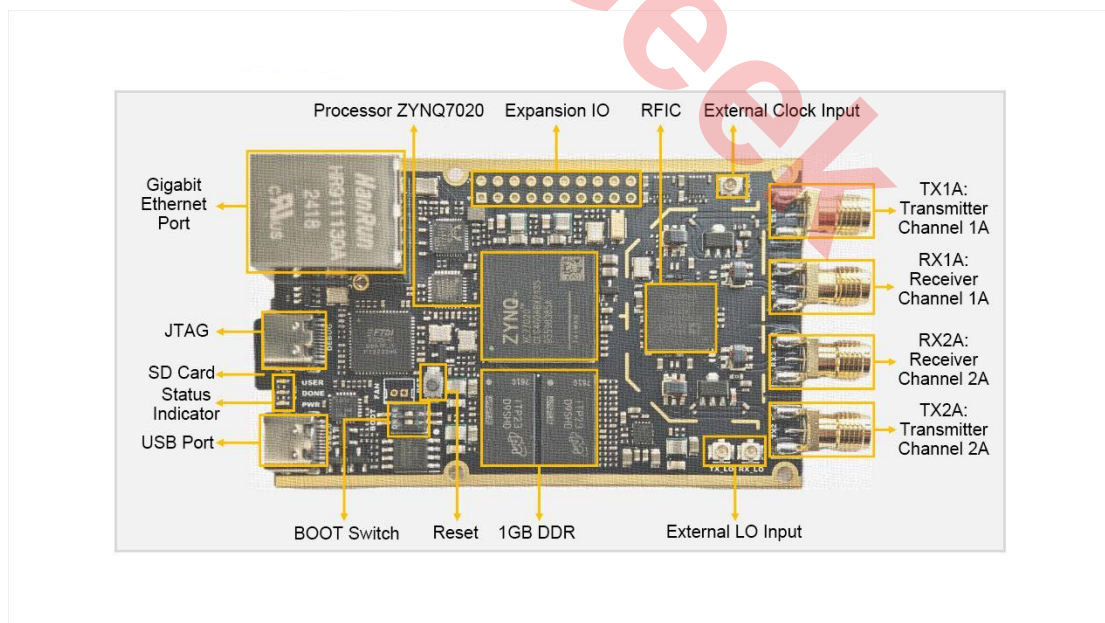
Next.



Wait for the installation to complete.



4. SDR Functions and Interface Block Diagram:



The SDR development board is an enhanced version of the official design. The main improvements are as follows:

- * Gigabit Ethernet port added: Supports some functions of the ZEDBOARD + FMCOMMS2-3 platform. The corresponding firmware can be provided. However, the

firmware does not support the USB port.

- * JTAG port added: The USB interface supports power supply, FPGA debugging, and serial communication, making bare board driver development more convenient. With the factory firmware, the JTAG port is used to output boot messages. It is also used to configure the Ethernet IP address and other settings.
- * Main processor upgraded: The original Pluto uses the XC7Z010-CLG225, which has been upgraded to the XC7Z020-CLG400.
- * DDR memory increased to 1GB.
- * RF interfaces expanded: Provides dual transmit and dual receive channels. The original firmware has also been modified to enable the use of the AD9361.
- * Local oscillator input and reference clock input interfaces added.
- * Multiple GPIO interfaces provided for user expansion.
- * RF section optimized: Strict RF simulation and impedance control are implemented, with an added power amplifier (PA) to increase output power.

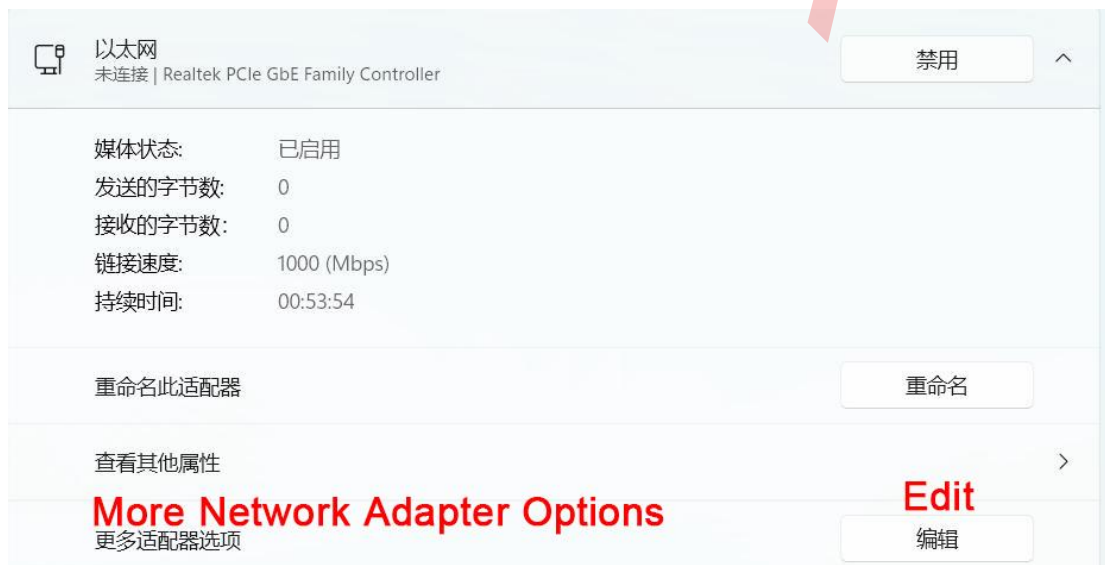
5. SDR# Software Testing

5.1 Configure the PC IP Address

Open Network & Internet Settings.



Go to Advanced Network Settings and select the Ethernet adapter you want to use.



Click Edit next to More Network Adapter Options.



Double-click the selected adapter and configure the local IP address as shown below.



Click OK to complete the PC IP configuration.

5.2 Power On the SDR Development Board

Follow the steps below:

- * Check that the SD card is properly inserted into the board. (The SD card is pre-installed by default.)
- * Connect the PC to the board using an Ethernet cable.
- * Connect the Type-C cable to the JTAG port and the PC.



Wait approximately 30 seconds for the board to complete the boot process.

The normal status is as follows:

- * The two LEDs on the left are on.
- * The LED on the right is flashing.
- * The Ethernet port LEDs are flashing.

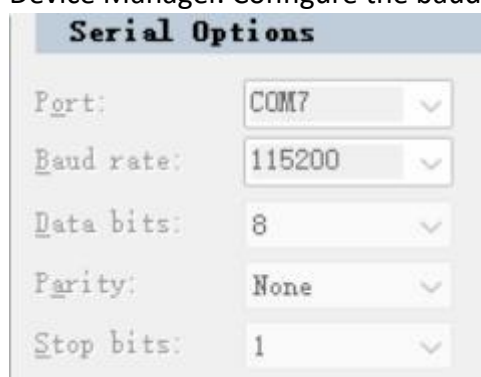
If the board does not behave as described above, check the previous steps. Common issues include:

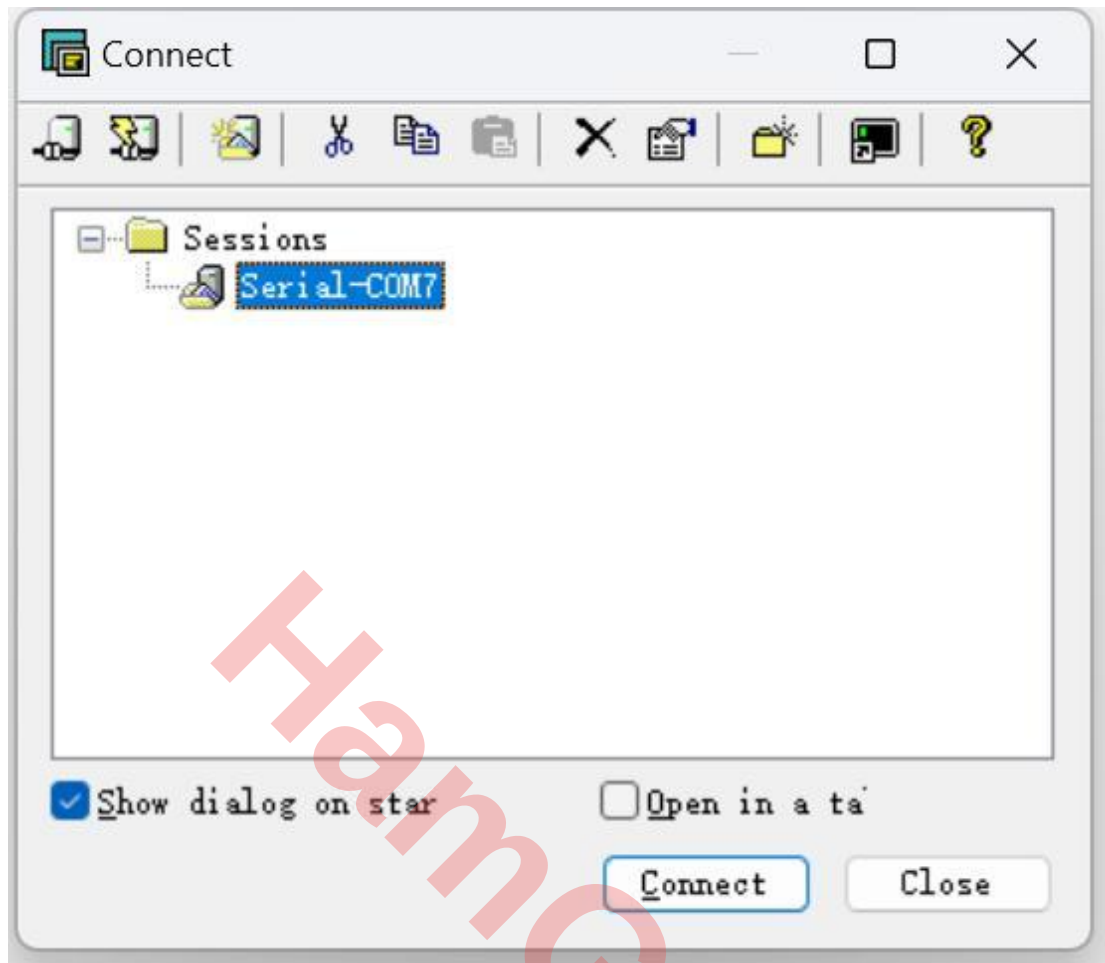
- * The SD card is not properly inserted.
- * The USB port does not provide sufficient current.
- * The Ethernet cable is not securely connected.

Next, use a serial port to configure the SDR board's IP address. You can use any serial terminal software already installed on your PC, or our serial terminal software SecureCRT5.5 (Click to download SecureCRT5.5

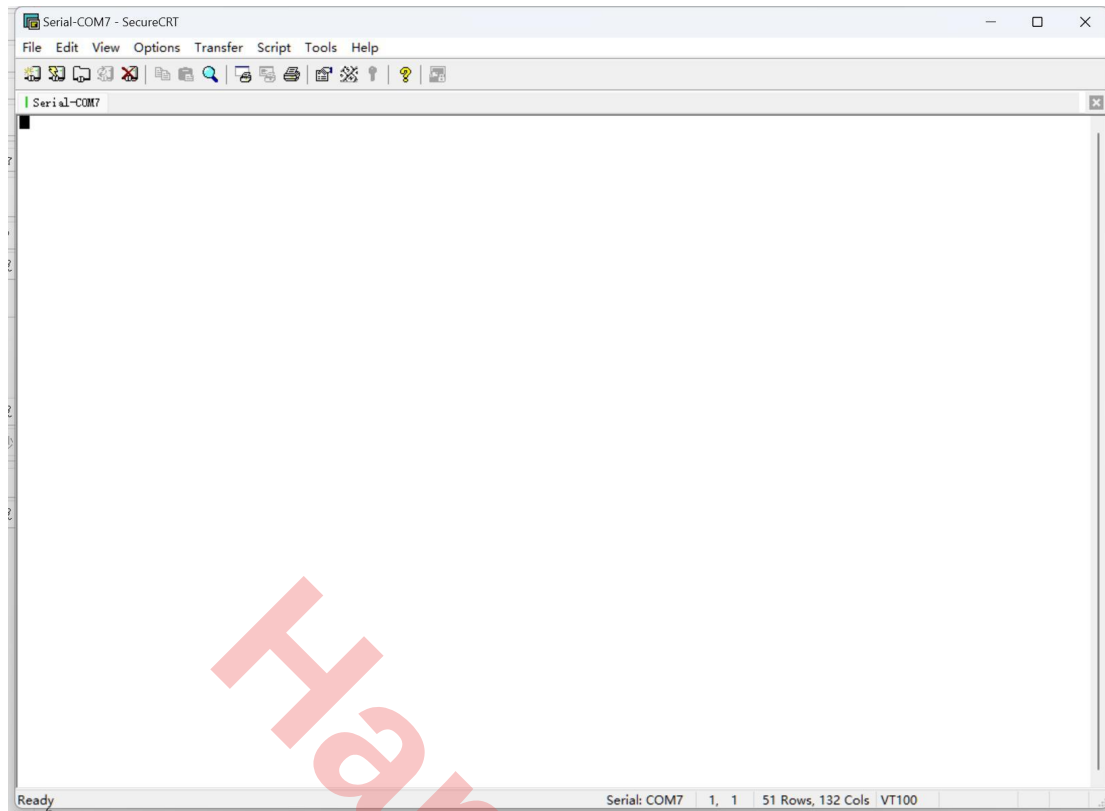
<https://www.comseek.com/download/98078/SecureCRT5.5.zip>).

Connect to the SDR board's serial port. You can find the corresponding COM port in Device Manager. Configure the baud rate and other parameters as shown below.

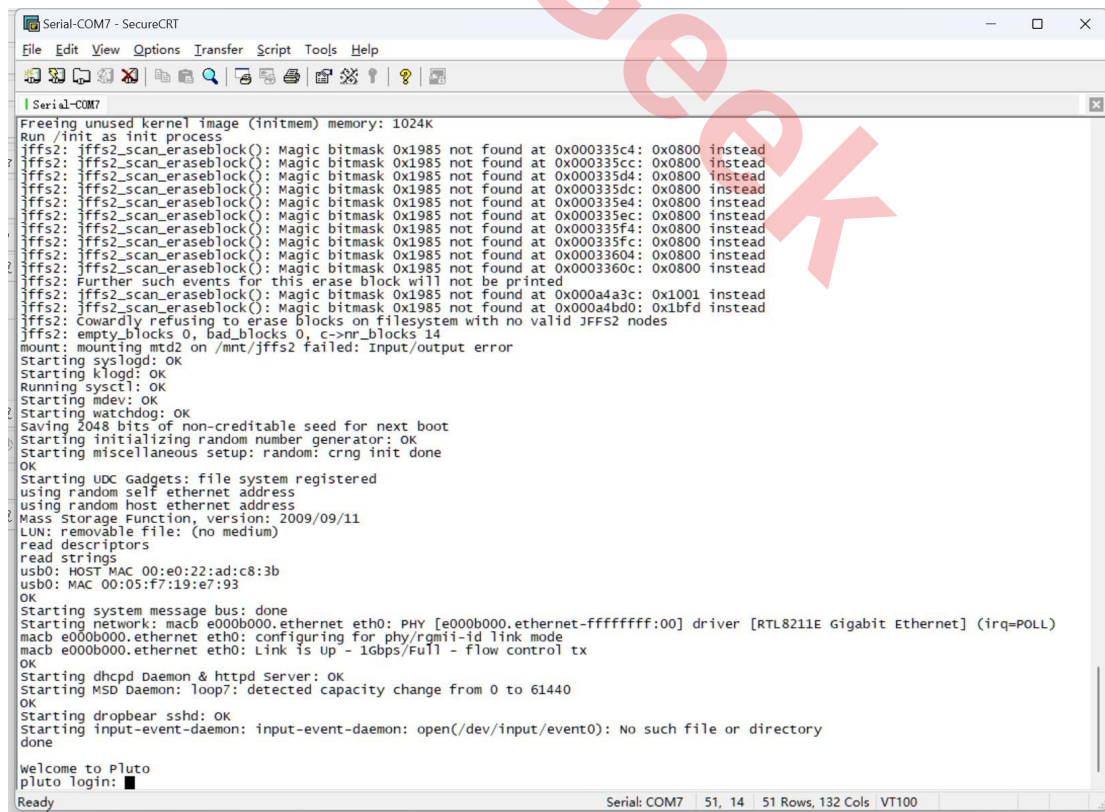




Click Connect to establish the connection.

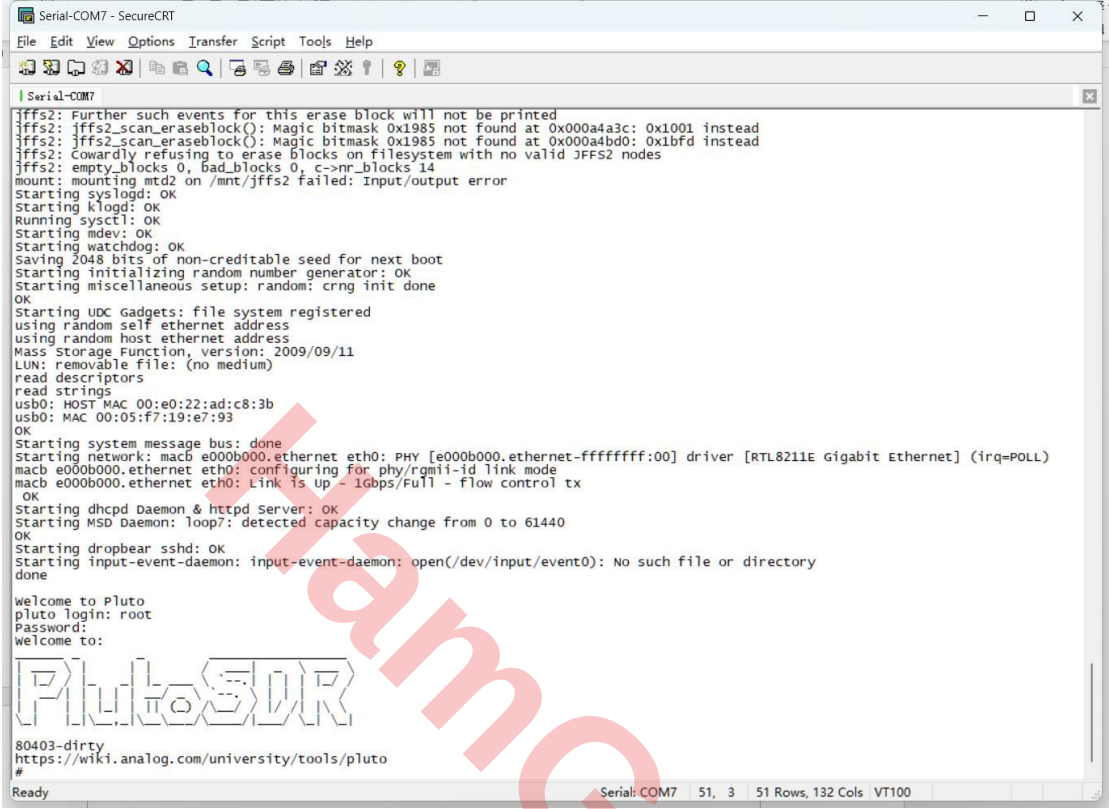


Next, restart the board to verify the boot messages. Press and release the Reset button on the SDR board to restart it. Wait until the boot messages are fully displayed.



Log in to the board using the following credentials:

- * Username: root
- * Password: analog



```
Serial-COM7 - SecureCRT
File Edit View Options Transfer Script Tools Help

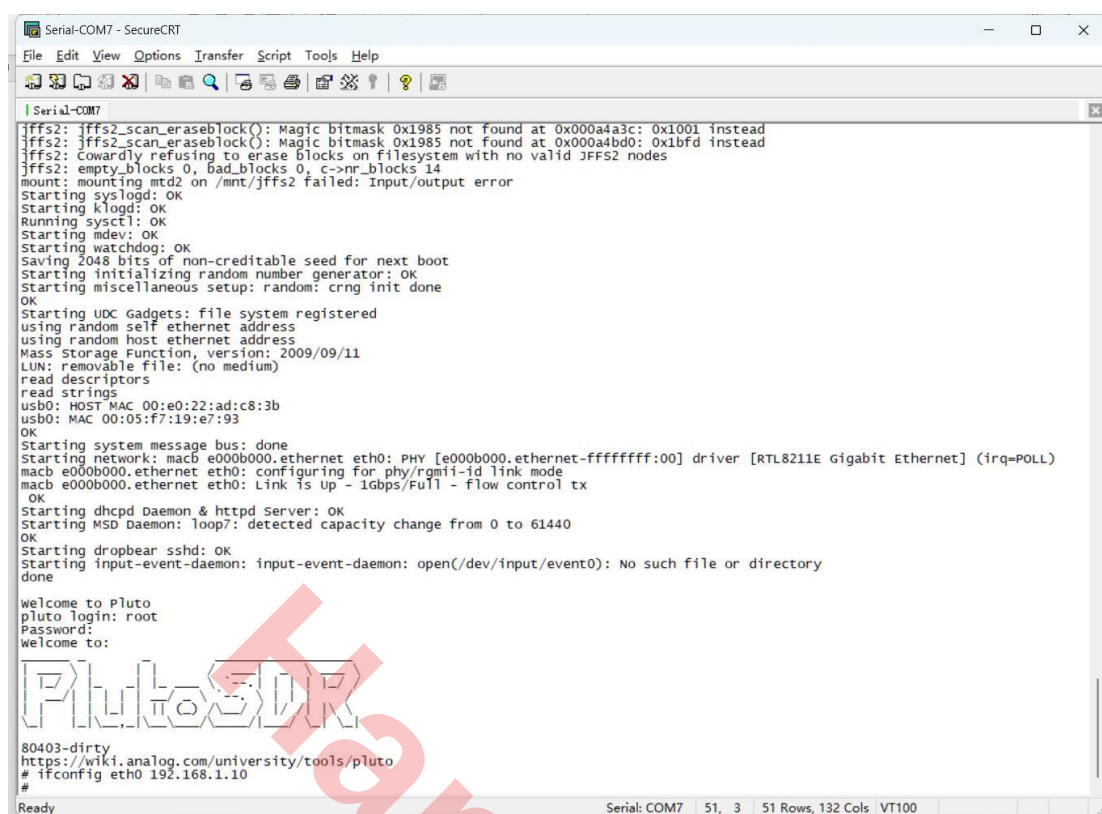
Serial-COM7
jffs2: Further such events for this erase block will not be printed
jffs2: jffs2_scan_eraseblock(): Magic bitmask 0x1985 not found at 0x000a4a3c: 0x1001 instead
jffs2: jffs2_scan_eraseblock(): Magic bitmask 0x1985 not found at 0x000a4bd0: 0x1bfd instead
jffs2: Cowardly refusing to erase blocks on filesystem with no valid JFFS2 nodes
jffs2: empty_blocks 0, bad_blocks 0, c->nr_blocks 14
mount: mounting mtd2 on /mnt/jffs2 failed: input/output error
Starting syslogd: OK
Starting klogd: OK
Running sysctl: OK
Starting mdev: OK
Starting watchdog: OK
Saving 2048 bits of non-creditable seed for next boot
Starting initializing random number generator: OK
Starting miscellaneous setup: random: crng init done
OK
Starting UDC Gadgets: file system registered
using random self ethernet address
using random host ethernet address
Mass Storage Function, version: 2009/09/11
LUN: removable file: (no medium)
read descriptors
read strings
usb0: HOST MAC 00:e0:22:ad:c8:3b
usb0: MAC 00:05:f7:19:e7:93
OK
Starting system message bus: done
Starting network: macb e000b000.ethernet eth0: PHY [e000b000.ethernet-ffffffff:00] driver [RTL8211E Gigabit Ethernet] (irq=POLL)
macb e000b000.ethernet eth0: configuring for phy/rgmii-id link mode
macb e000b000.ethernet eth0: Link is Up - 1Gbps/Full - flow control tx
OK
Starting dhcpd Daemon & httpd Server: OK
Starting MSD Daemon: loop7: detected capacity change from 0 to 61440
OK
Starting dropbear sshd: OK
Starting input-event-daemon: input-event-daemon: open(/dev/input/event0): No such file or directory
done

Welcome to Pluto
pluto login: root
Password:
Welcome to:

PlutoSR

80403-dirty
https://wiki.analog.com/university/tools/pluto
#
Ready
```

Enter the following command to set the board's IP address to 192.168.1.10:
`ifconfig eth0 192.168.1.10`



```
Serial-COM7 - SecureCRT
File Edit View Options Transfer Script Tools Help

Serial-COM7
jffs2: jffs2_scan_eraseblock(): Magic bitmask 0x1985 not found at 0x000a4a3c: 0x1001 instead
jffs2: jffs2_scan_eraseblock(): Magic bitmask 0x1985 not found at 0x000a4bd0: 0x1bfd instead
jffs2: Cowardly refusing to erase blocks on filesystem with no valid JFFS2 nodes
jffs2: empty_blocks 0, bad_blocks 0, c->nr_blocks 14
mount: mounting mtd2 on /mnt/jffs2 failed: Input/output error
Starting syslogd: OK
Starting klogd: OK
Running sysctl: OK
Starting mdev: OK
Starting watchdog: OK
Saving 2048 bits of non-creditable seed for next boot
Starting initializing random number generator: OK
Starting miscellaneous setup: random: crng init done
OK
Starting UDC Gadgets: file system registered
using random self ethernet address
using random host ethernet address
Mass Storage Function, version: 2009/09/11
LUN: removable file: (no medium)
read descriptors
read strings
usb0: HOST MAC 00:e0:22:ad:c8:3b
usb0: MAC 00:05:f7:19:e7:93
OK
Starting system message bus: done
Starting network: macb e00b000.ethernet eth0: PHY [e00b000.ethernet-ffffffff:00] driver [RTL8211E Gigabit Ethernet] (irq=POLL)
macb e00b000.ethernet eth0: configuring for phy/rgmii-id link mode
macb e00b000.ethernet eth0: Link is up - 1Gbps/Full - flow control tx
OK
Starting dhcpd Daemon & httpd Server: OK
Starting MSD Daemon: loop7: detected capacity change from 0 to 61440
OK
Starting dropbear sshd: OK
Starting input-event-daemon: input-event-daemon: open(/dev/input/event0): No such file or directory
done

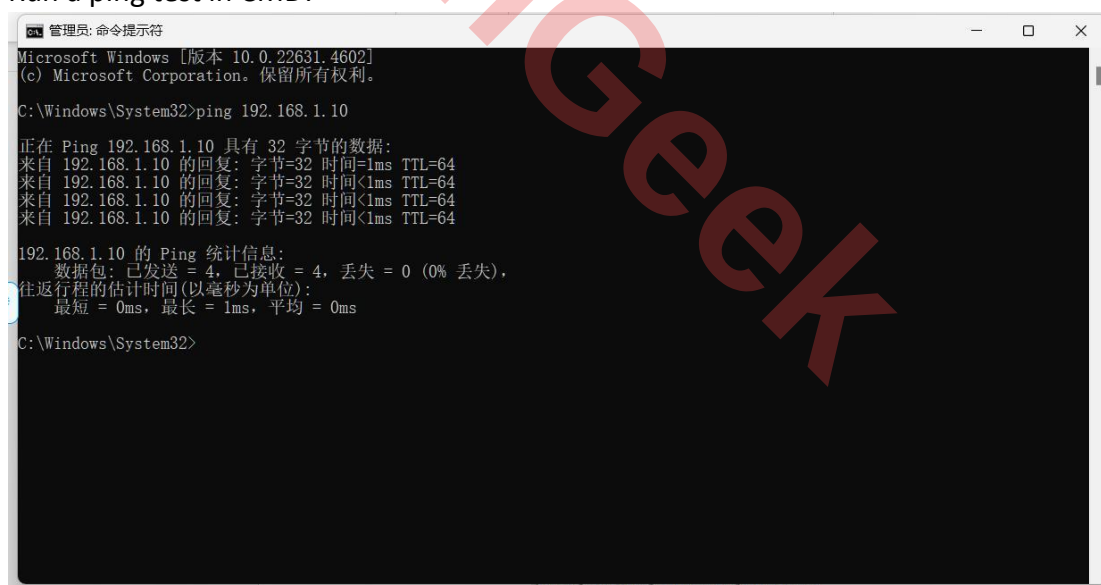
welcome to Pluto
pluto login: root
Password:
welcome to:

PlutoSDR

80403-dirty
https://wiki.analog.com/university/tools/pluto
# ifconfig eth0 192.168.1.10
#

Ready Serial: COM7 51, 3 51 Rows, 132 Cols VT100
```

Run a ping test in CMD:



```
管理员: 命令提示符
Microsoft Windows [版本 10.0.22631.4602]
(c) Microsoft Corporation. 保留所有权利。

C:\Windows\System32>ping 192.168.1.10

正在 Ping 192.168.1.10 具有 32 字节的数据:
来自 192.168.1.10 的回复: 字节=32 时间=1ms TTL=64
来自 192.168.1.10 的回复: 字节=32 时间<1ms TTL=64
来自 192.168.1.10 的回复: 字节=32 时间<1ms TTL=64
来自 192.168.1.10 的回复: 字节=32 时间<1ms TTL=64

192.168.1.10 的 Ping 统计信息:
    数据包: 已发送 = 4, 已接收 = 4, 丢失 = 0 (0% 丢失),
    往返行程的估计时间 (以毫秒为单位):
        最短 = 0ms, 最长 = 1ms, 平均 = 0ms

C:\Windows\System32>
```

The board IP configuration is now complete. You can also use other serial terminal software to configure the IP address.

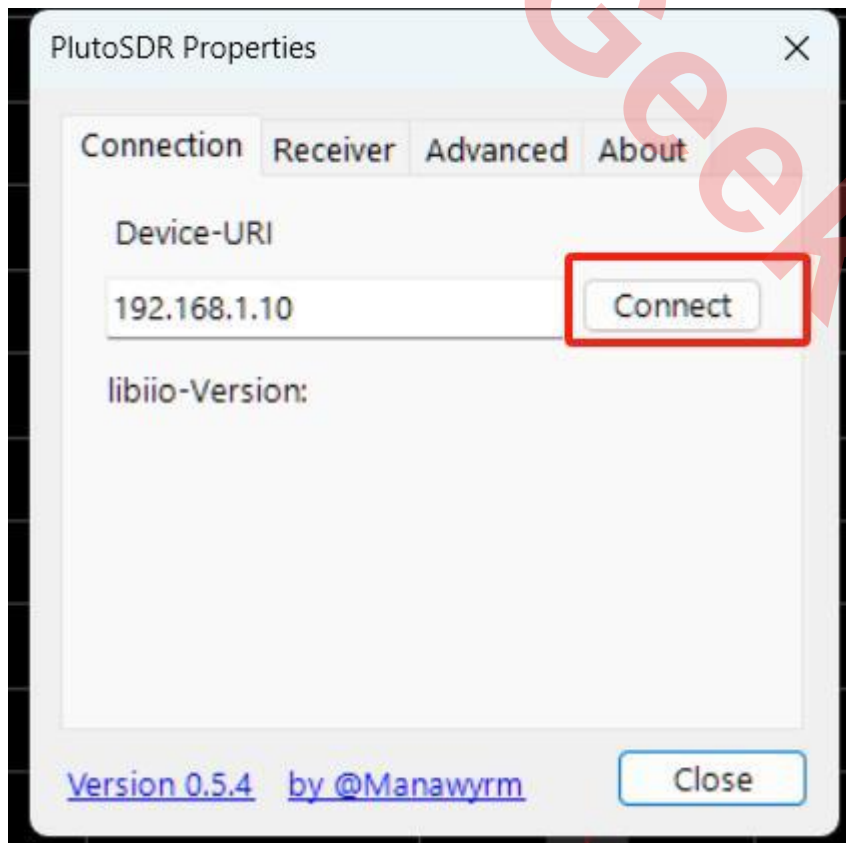
5.3 SDR# Software Testing

First, connect the included FM antenna to the RX1A RF port, then extract the SDRSharp software package (Click to download SDRSharp <https://www.comseek.com/download/98078/SDRSharp.zip>).

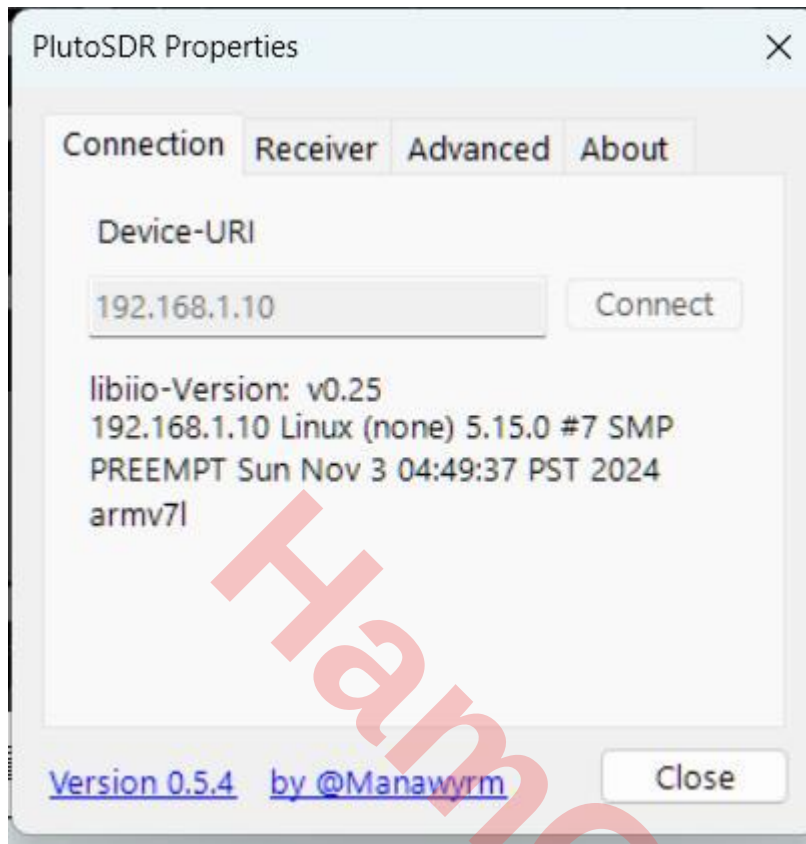
Click the Settings icon.



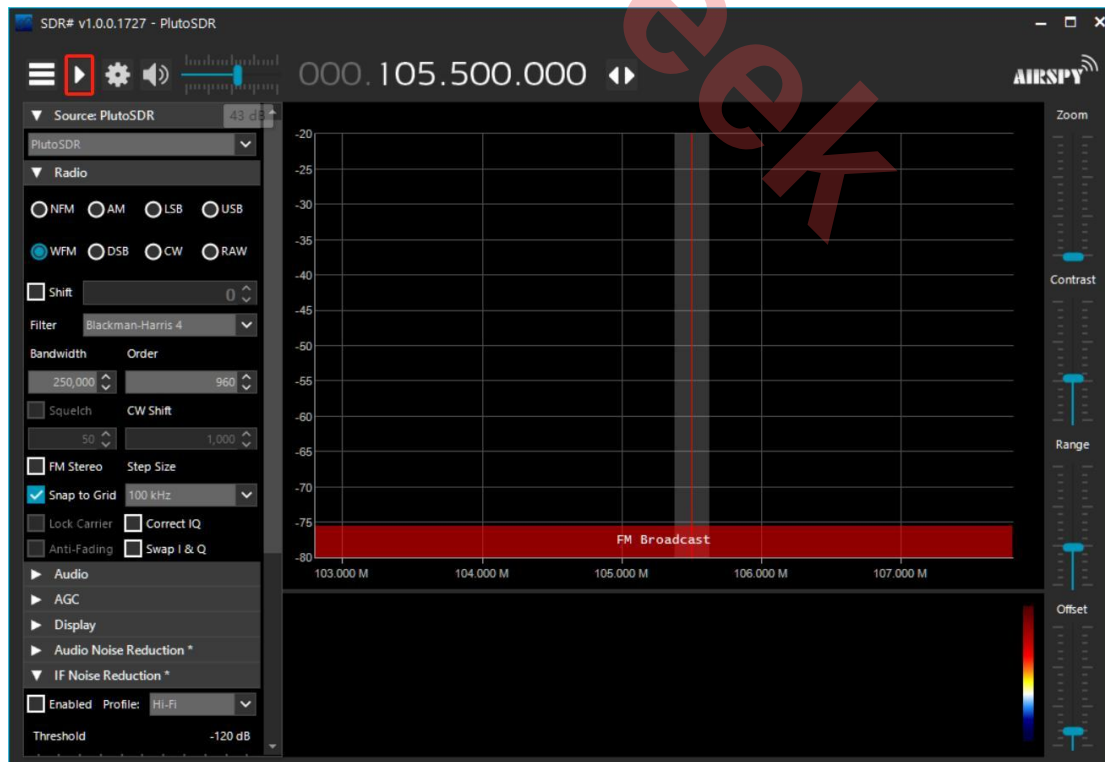
Enter the IP address configured in the previous step, then click Connect.



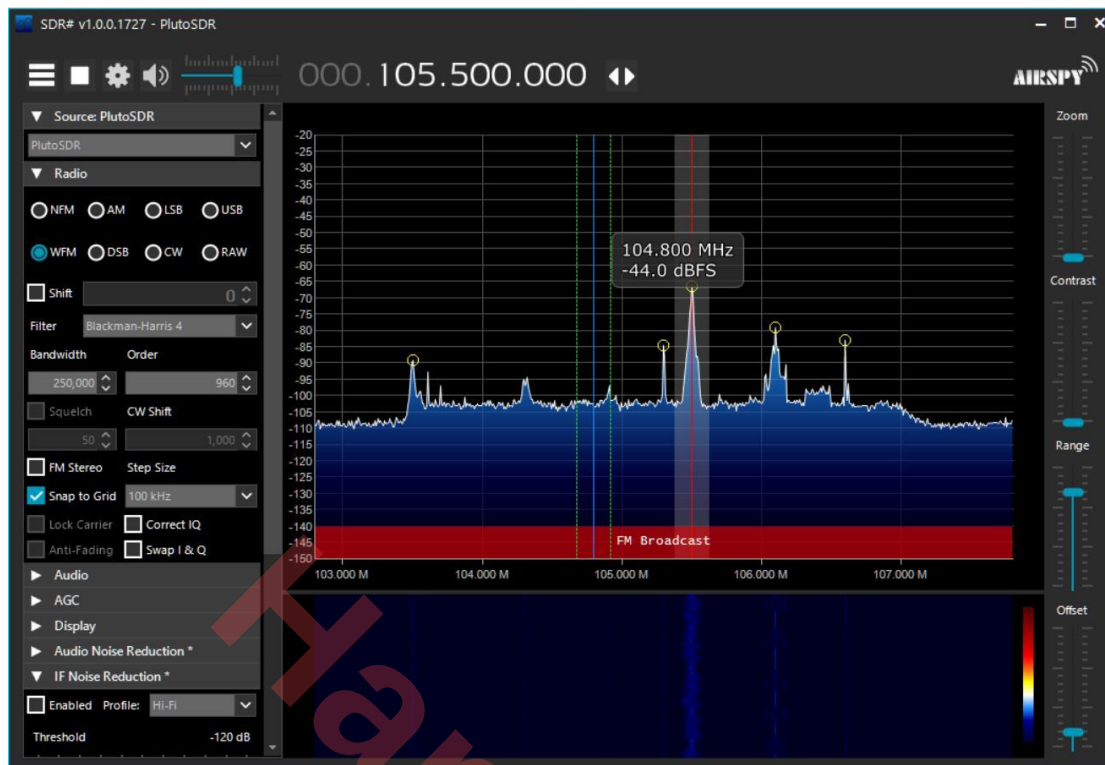
Once the connection is established, close this window.



Configure the interface parameters as shown below, then click the Start button.



Move the red tuning line to a signal peak to receive the broadcast audio.



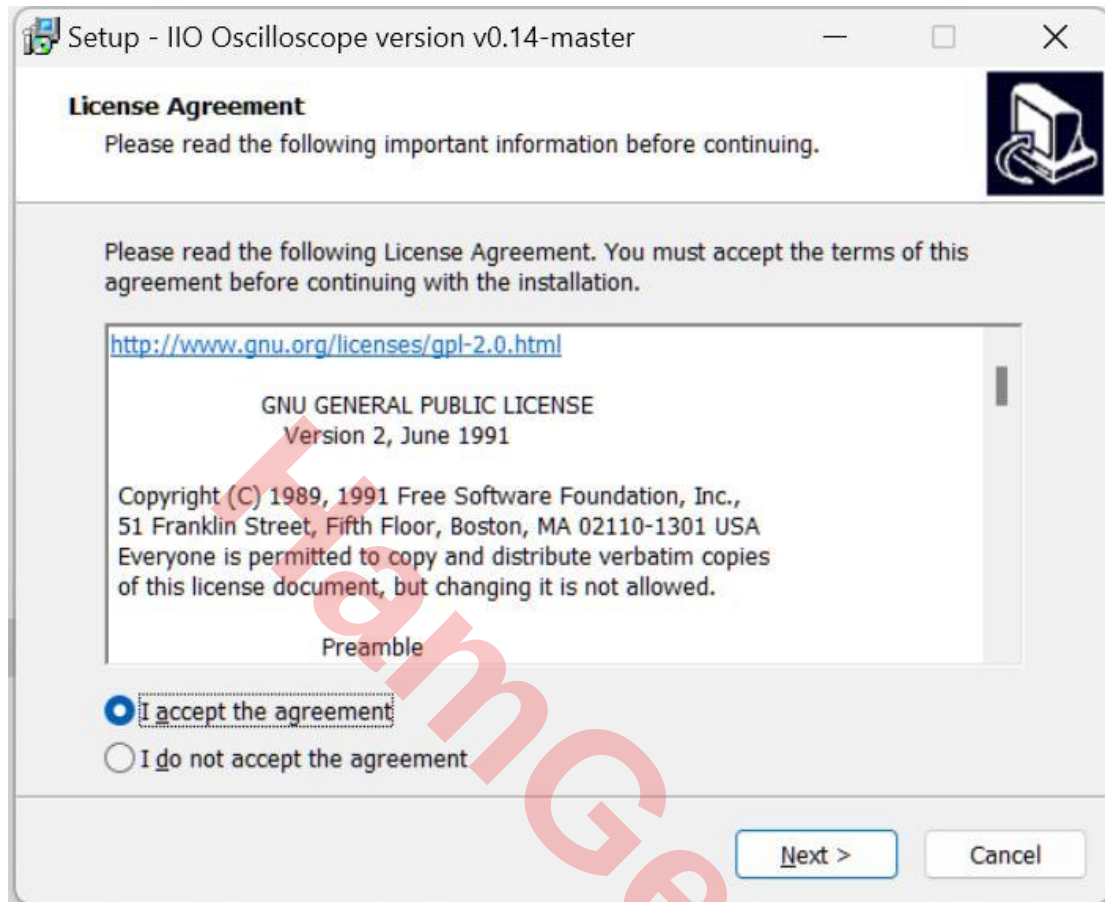
6. IIO Oscilloscope Test:

Next, use the IIO Oscilloscope software to test the hardware USB port. Connect a Type-C cable to the USB port and wait approximately 30 seconds for the board to complete the boot process. The normal status is the same as before: the white and red LEDs remain on, while the blue LED flashes. The computer will also detect a newly connected storage device.

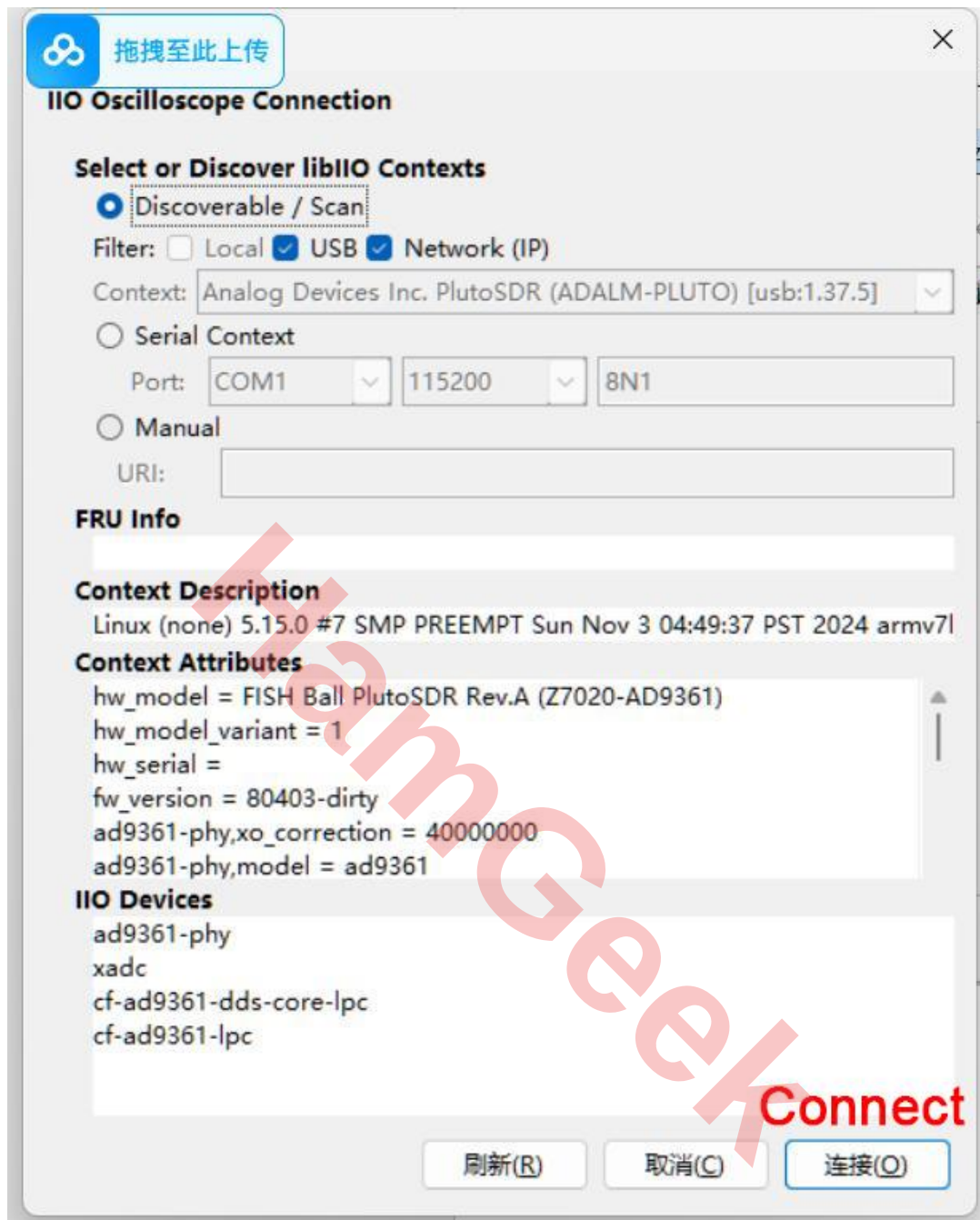


Next, extract the IIO Oscilloscope software package (Contact customer support to obtain the software).

Double-click the installer to start the installation.



Click Next and wait for the installation to complete. Then launch the software. It will automatically detect the connected Pluto device.



Click Connect, then set the transmit and receive frequencies to the same value.

The screenshot shows the configuration interface for the AD9361 / AD9364 Receive and Transmit Chains. The top section is for the Receive Chain, and the bottom section is for the Transmit Chain.

AD9361 / AD9364 Receive Chain

RF Bandwidth(MHz): 18.000 | Sampling Rate (MSPS): 30.720000 | RX LO Frequency(MHz): 2400.000000 | RF Port Select: A_BALANCED | Fastlock Profile: 0 | Tracking: ☒ Quadrature, ☒ RF DC, ☒ BB DC

☐ External RX LO | Store | Recall

RX 1

Hardware Gain(dB): 71.00 | RSSI(dB): 107.25 dB | Gain Control: slow_attack | Gain Control Modes: slow_attack

RX 2

Hardware Gain(dB): 71.00 | RSSI(dB): 108.25 dB | Gain Control: slow_attack | Gain Control Modes: slow_attack

AD9361 / AD9364 Transmit Chain

RF Bandwidth(MHz): 18.000 | Sampling Rate (MSPS): 30.720000 | TX LO Frequency(MHz): 2400.000000 | RF Port Select: A | Fastlock Profile: 0

☐ External TX LO | Store | Recall

TX 1

Attenuation(dB): 10.00 | RSSI(dB): 0.00 dB

TX 2

Attenuation(dB): 10.00 | RSSI(dB): 0.00 dB

Configure the transmit signal.

The screenshot shows the FPGA Settings - Transmit / DDS configuration interface. It includes a DMA Buffer section and a DDS section for configuring two transmit channels (TX 1 and TX 2).

FPGA Settings

Transmit / DDS

DMA Buffer

Sampling Rate (MSPS): 30720000

DDS

cf-ad9361-dds-core-lpc

TX 1

DDS Mode: One CW Tone

Single Tone

Tone 1

Frequency(MHz): 0.999859 | Scale(dBFS): -12 dB | Phase(degrees): 90.000

TX 2

DDS Mode: One CW Tone

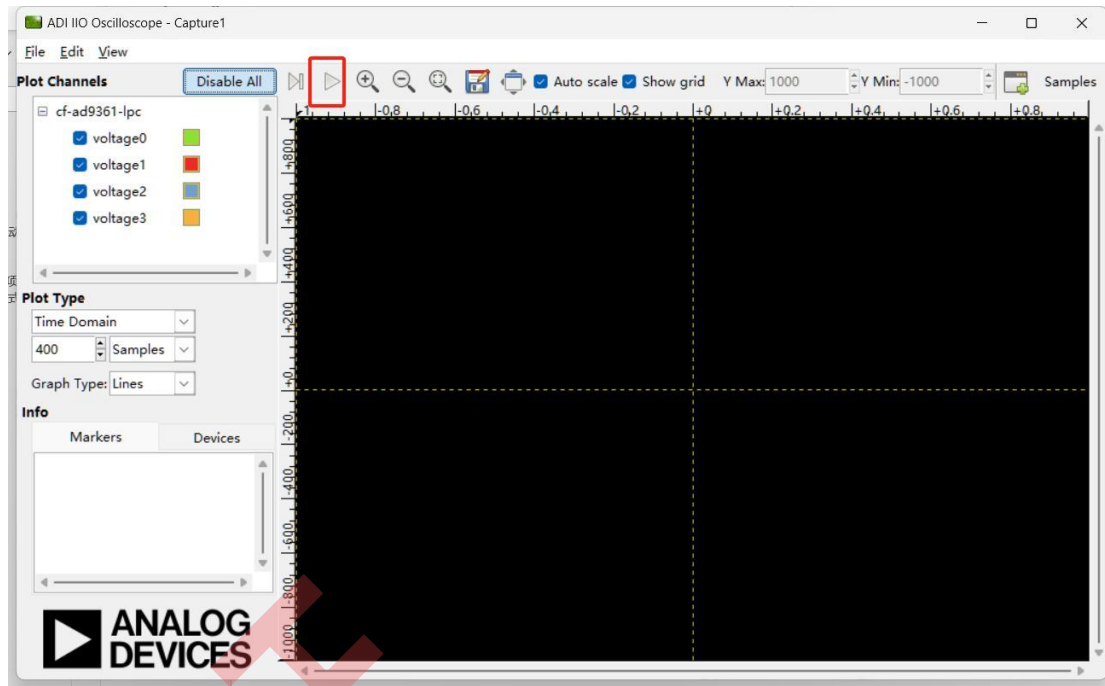
Single Tone

Tone 1

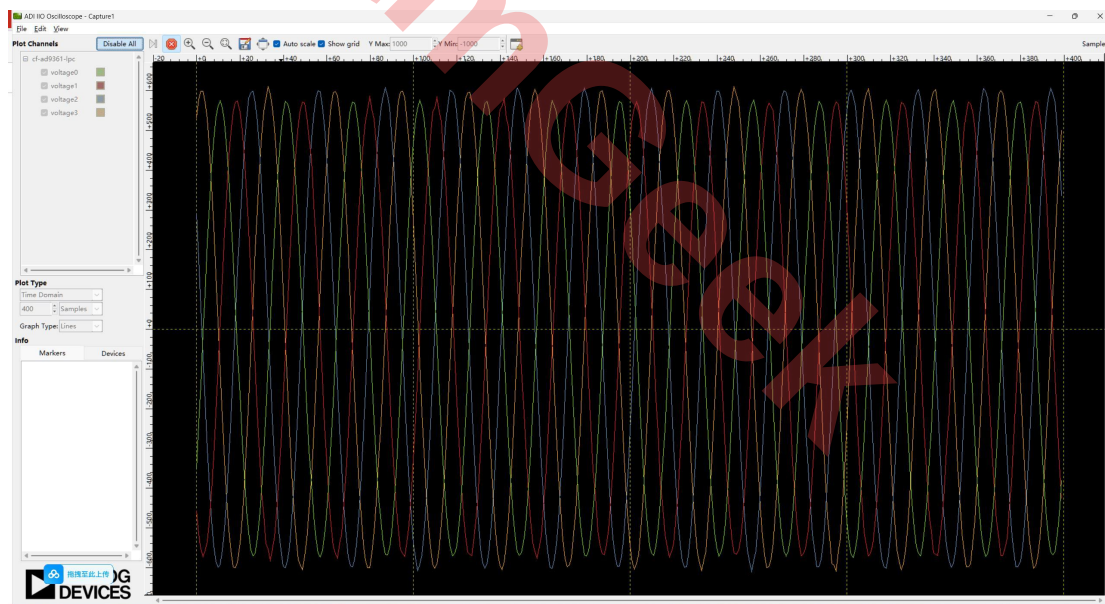
Frequency(MHz): 0.999859 | Scale(dBFS): -12 dB | Phase(degrees): 90.000

Receive

Use SMA loopback cables to connect TX1A to RX1A and TX2A to RX2A. Enable all four channels in the software, then click Start button.



The received waveform will be displayed, with the same frequency as the configured transmit waveform.



The IIO Oscilloscope transmit/receive loopback test is now complete.