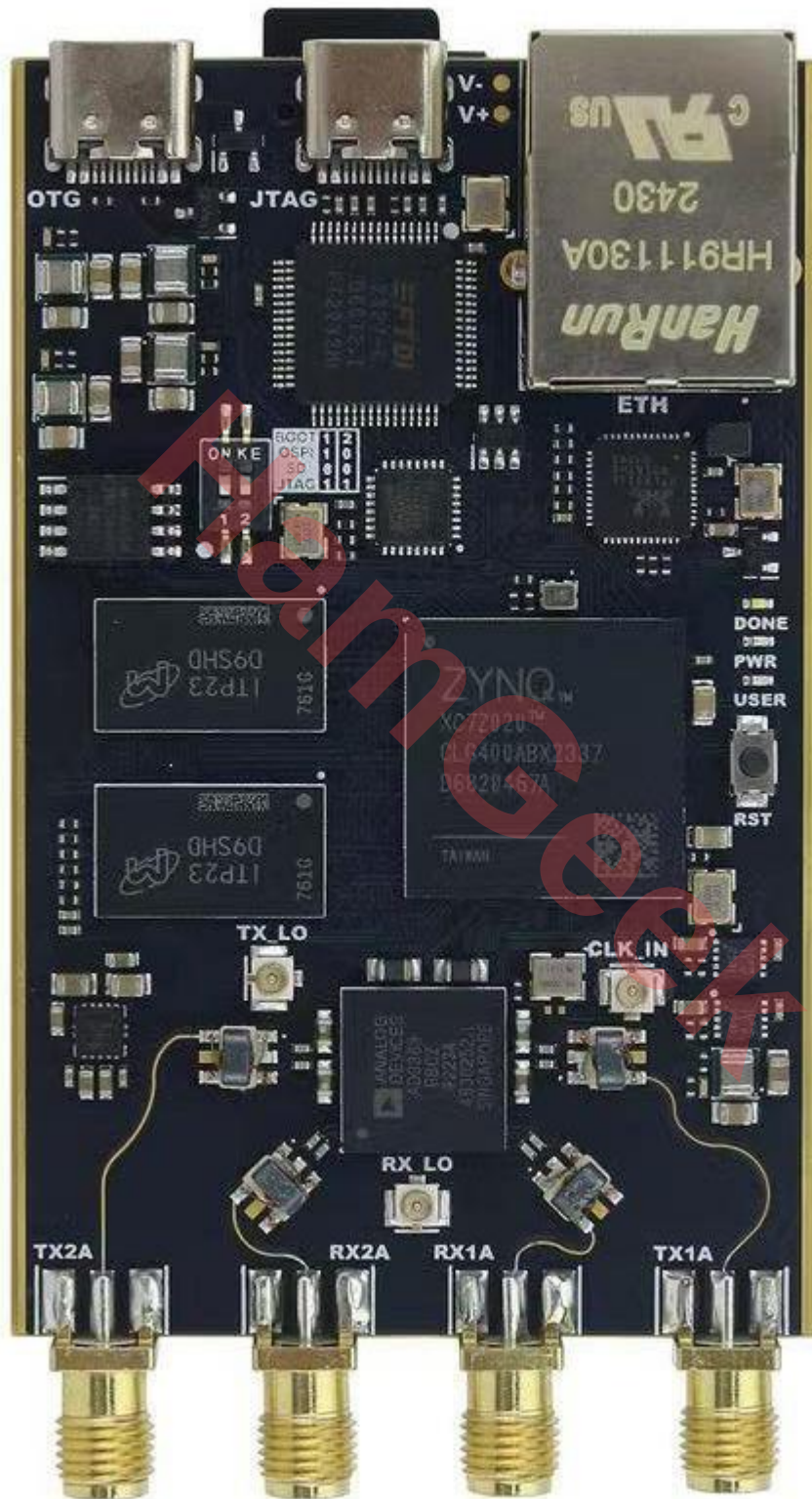


SDR Radio Unboxing and Inspection



1. Disclaimer:

This product is manufactured and distributed by HamGeek for research and educational purposes only. The purchaser is responsible for using this product in a lawful and appropriate manner. The user assumes full responsibility for any disputes, liabilities, or consequences arising from the use of this product. HamGeek shall not be held liable for any such disputes or consequences. This statement is hereby issued.

2. Package Contents and Unboxing Preparation:

Thank you for purchasing our SDR product. The product is designed with a focus on cost-effectiveness, so some commonly available accessories are not included.

Please check that your package contains the following items. If the SDR board is damaged, dented, exposed to water, or shows any other abnormality, please contact us promptly.



2.1 Package Contents:

- * HamGeek SDR Main Board ×1 (v0.38 firmware pre-installed on the included SD card, inserted into the board)
- * ZYNQ7010/ZYNQ7020 Heatsink ×1
- * AD936X Heatsink ×1
- * FM Antenna ×1

2.2 Required for Testing:

- * Windows PC ×1
- * USB Type-C Cable ×1
- * Ethernet Cable ×1
- * SMA Loopback Cable (Female Thread, Male Pin) ×2

Note:

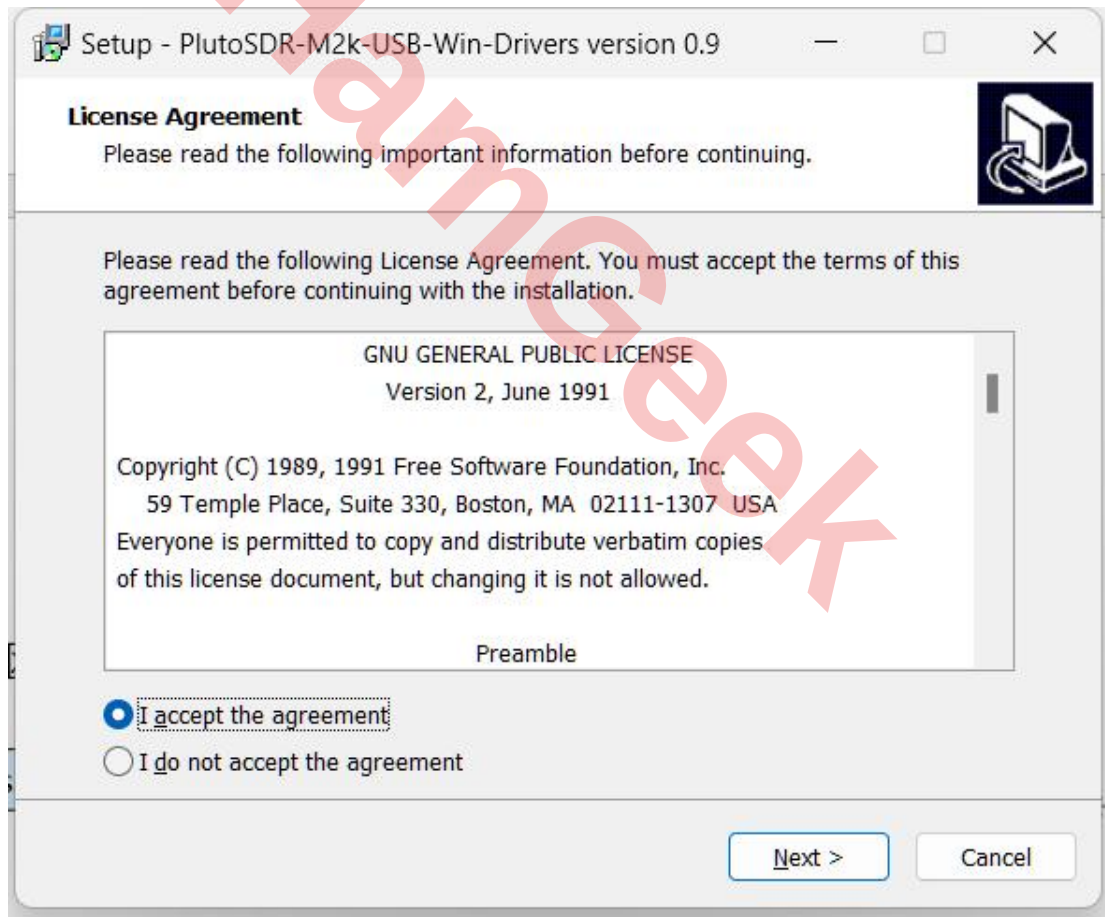
*** Both the ZYNQ and AD936X consume relatively high power. Due to the compact size of the board, some heat generation during operation is normal. For continuous operation of more than 2 hours, a fan or CNC-machined cooling enclosure is required.**

3. Driver Installation:

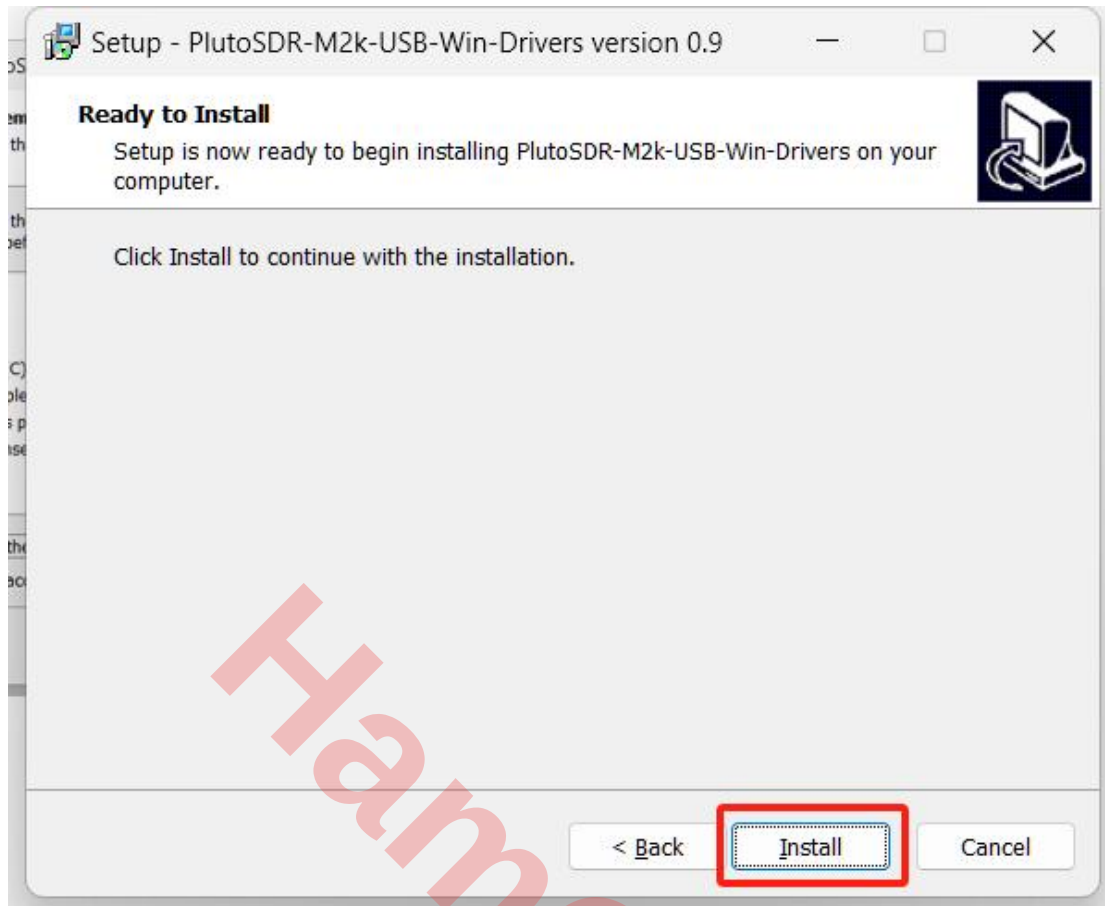
Click the link to download PlutoSDR-M2k-USB-Drivers

<https://www.comseek.com/download/93267/PlutoSDR-M2k-USB-Drivers.zip>

After extracting the folder, double-click the driver installer to begin the installation.



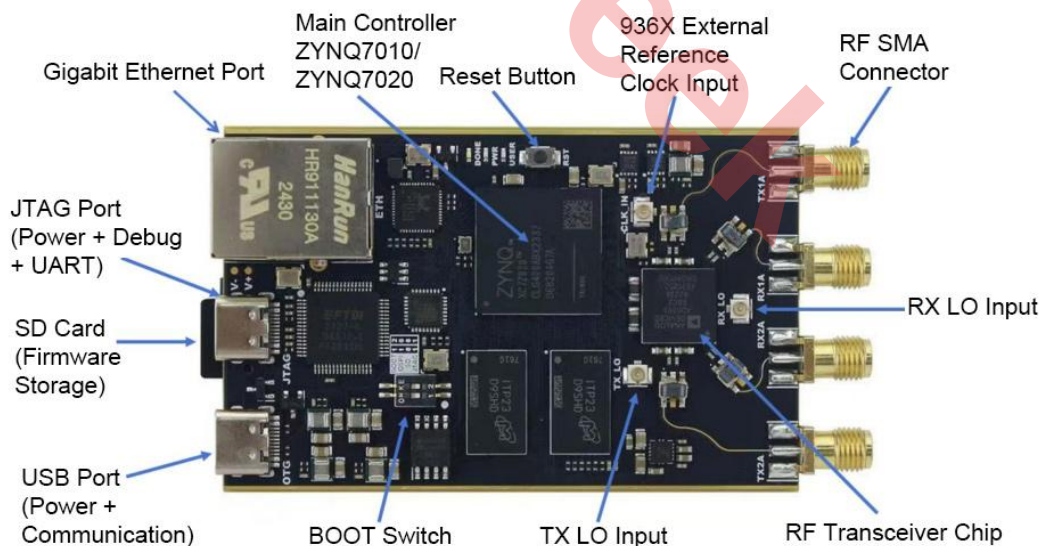
Click Next and then click Install.



Wait for the installation to complete.



4. SDR Functions and Interface Block Diagram:



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

- * Gigabit Ethernet Port: Added to support some functions of the ZEDBOARD + FMCOMMS2-3. The corresponding firmware can be provided, but it does not support the USB port.

- * JTAG Port: Added for power supply, FPGA debugging, and serial communication. This facilitates bare board driver development. With the factory firmware, the JTAG port is used for boot message output and for interactive functions such as IP configuration.
- * Main Controller Upgrade: The original Pluto uses an XC7Z010-CLG225. This board uses an XC7Z020-CLG400 or XC7Z010-CLG400.
- * Increased DDR Capacity: Upgraded to 1GB.
- * RF Interfaces: Dual transmit and dual receive channels are exposed. The original firmware is modified to enable AD9361 operation.
- * Local Oscillator and Reference Clock Inputs: Dedicated input interfaces are provided for the local oscillator and reference clock.

5. SDR# Software Testing:

5.1 Set the PC IP Address

Open Network & Internet Settings.



Go to Advanced Network Settings and select the Ethernet connection to be used.

 以太网
未连接 | Realtek PCIe GbE Family Controller

禁用 ^

媒体状态: 已启用

发送的字节数: 0

接收的字节数: 0

链接速度: 1000 (Mbps)

持续时间: 00:53:54

重命名此适配器 重命名

查看其他属性 >

更多适配器选项 **More Adapter Options** Edit 编辑

Click Edit next to More Adapter Options.



Double-click the selected option and set the local IP address as shown below.

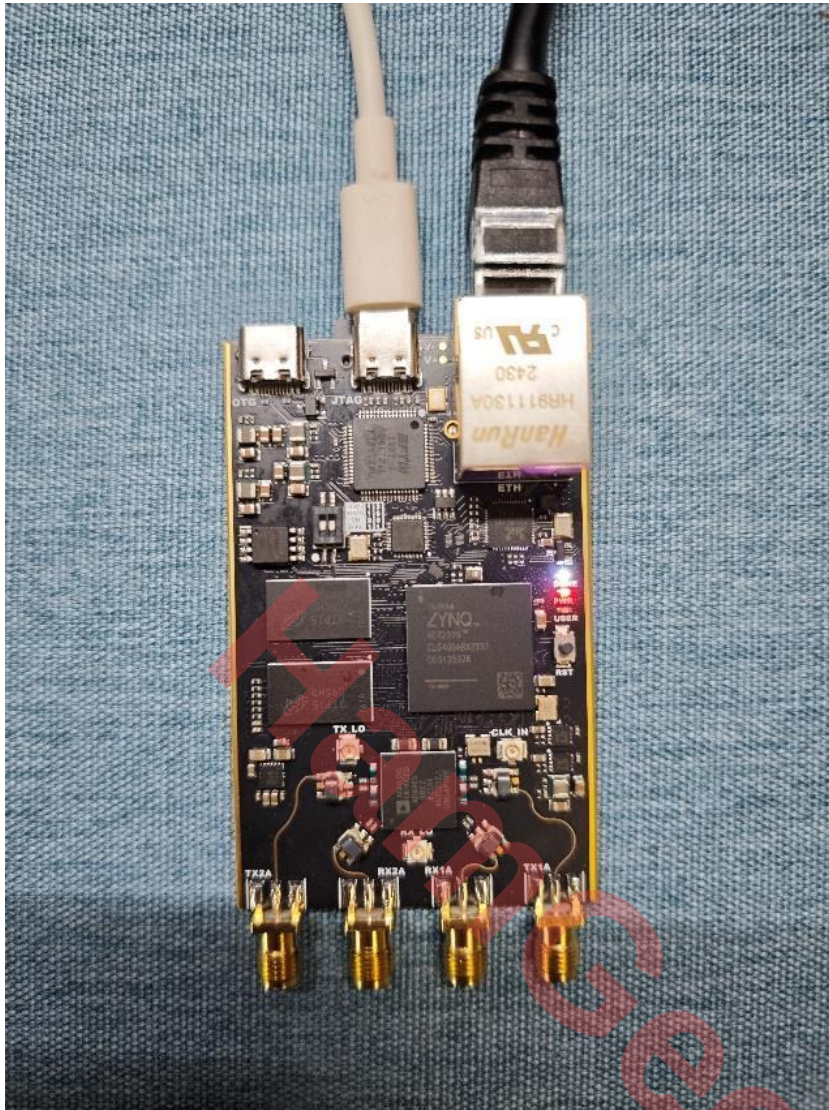


Click OK to complete the PC IP configuration.

5.2 Power On the SDR Development Board

Follow these steps:

- * Check that the SD card is properly inserted into the board (default configuration).
- * Check that the DIP switch is set to "00" (default configuration).
- * Make sure the board is not in contact with any metal conductor, as this may cause a short circuit.
- * Connect the PC to the board using an Ethernet cable.
- * Connect the PC to the JTAG port using a USB Type-C cable.



Wait approximately 30 seconds for the board to boot.

Under normal conditions: The white and red LEDs remain solid. The blue LED flashes. The Ethernet port LEDs flash.

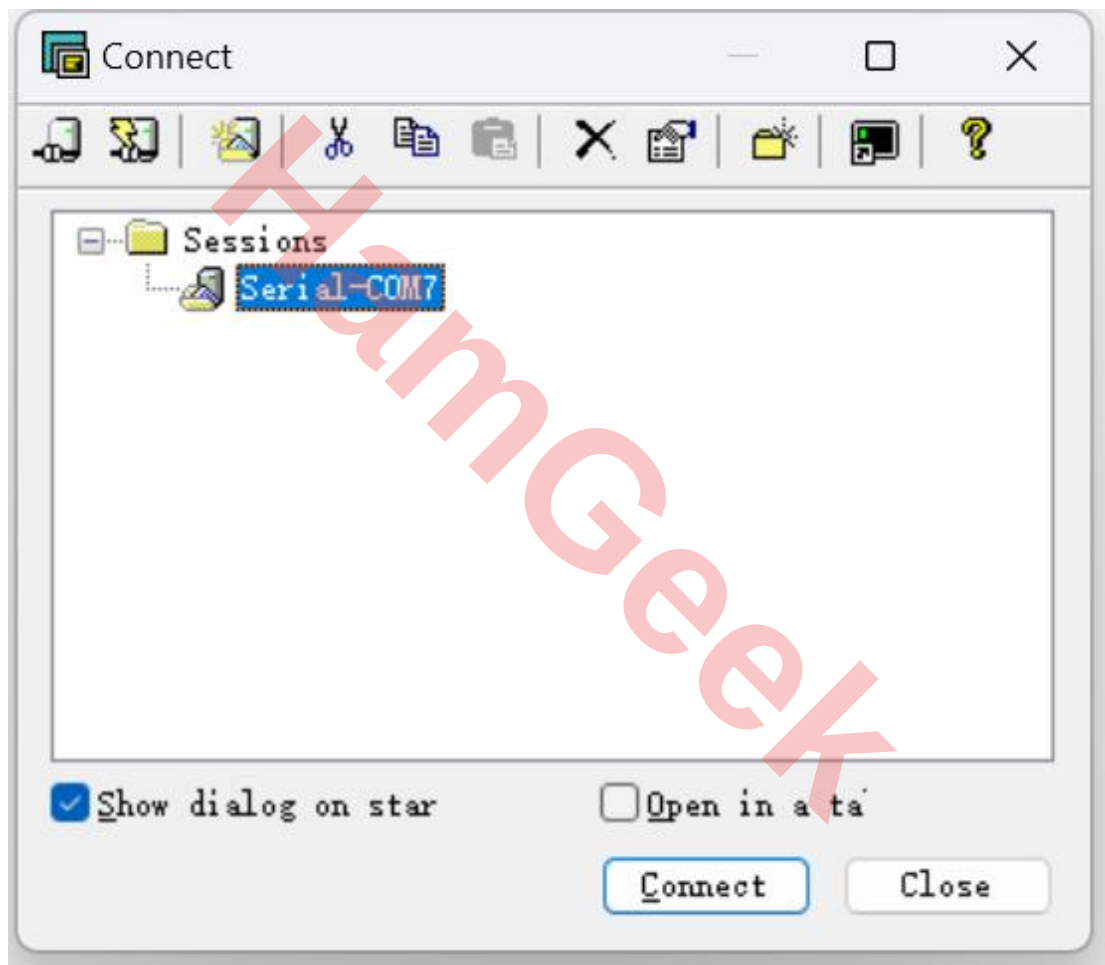
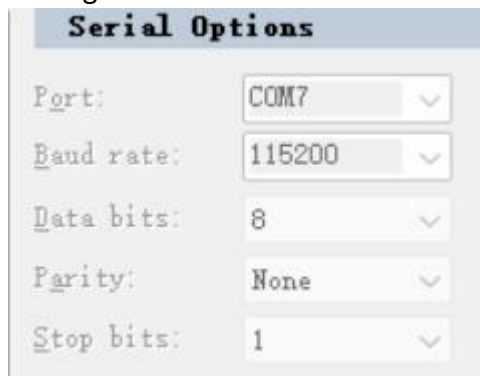
If the board does not behave as expected, check the previous steps. Common issues include:

- * The SD card is not properly inserted.
- * The DIP switch is not set to "00" (both switches facing downward).
- * The USB cable is too thin to provide sufficient current.

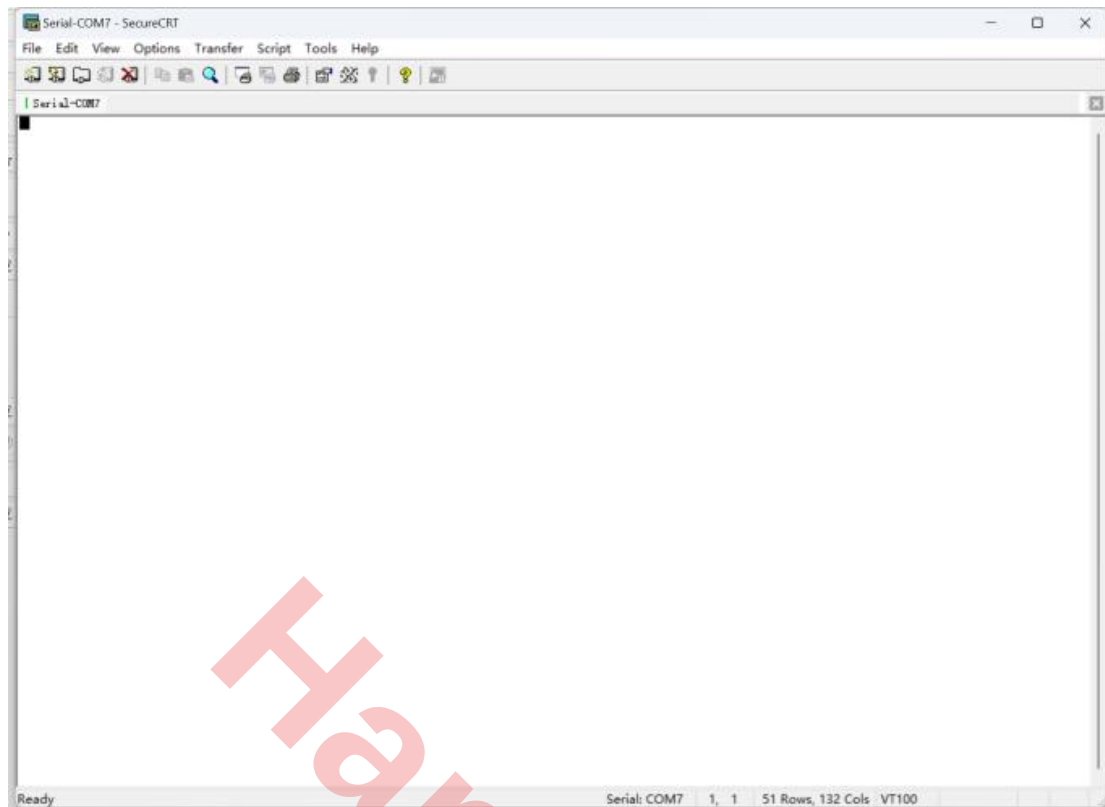
Next, configure the SDR board's IP address through the serial port. You may use your preferred serial terminal software or the serial terminal software SecureCRT5.5. Click the link to download SecureCRT5.5:

<https://www.comseek.com/download/93267/SecureCRT5.5.zip>

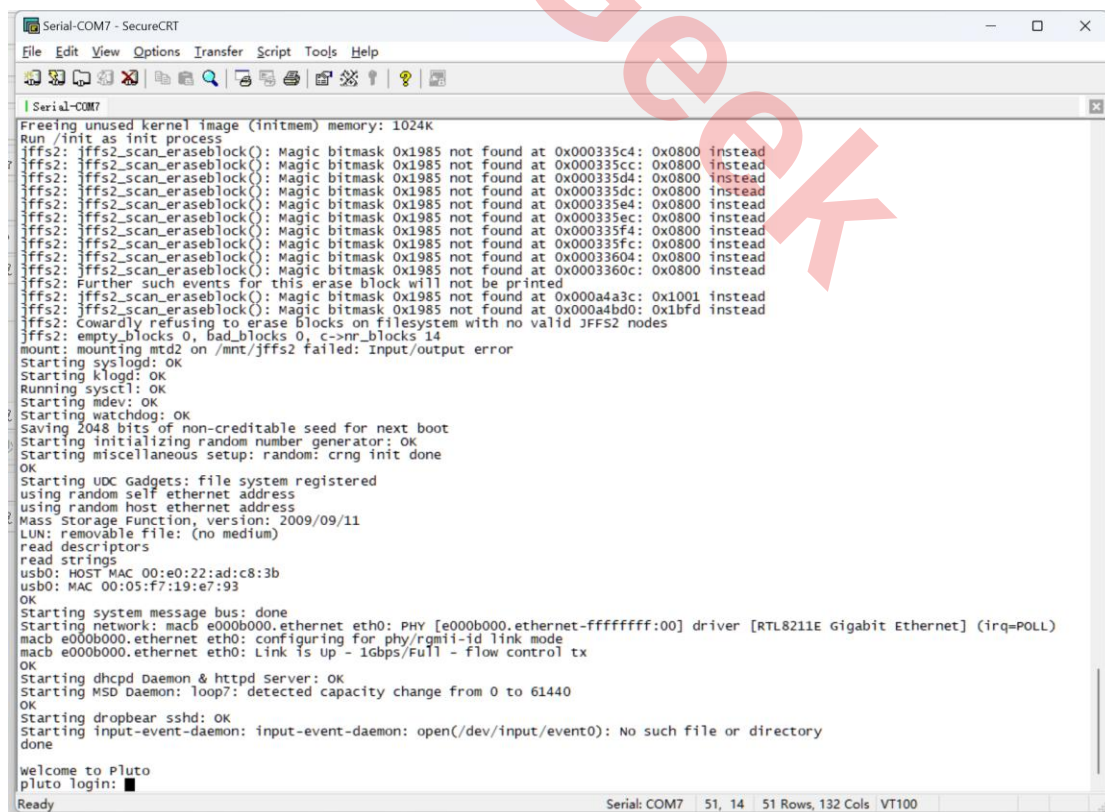
Connect to the SDR board's serial port. The COM port can be viewed in Device Manager. Set the baud rate and other parameters as shown below.



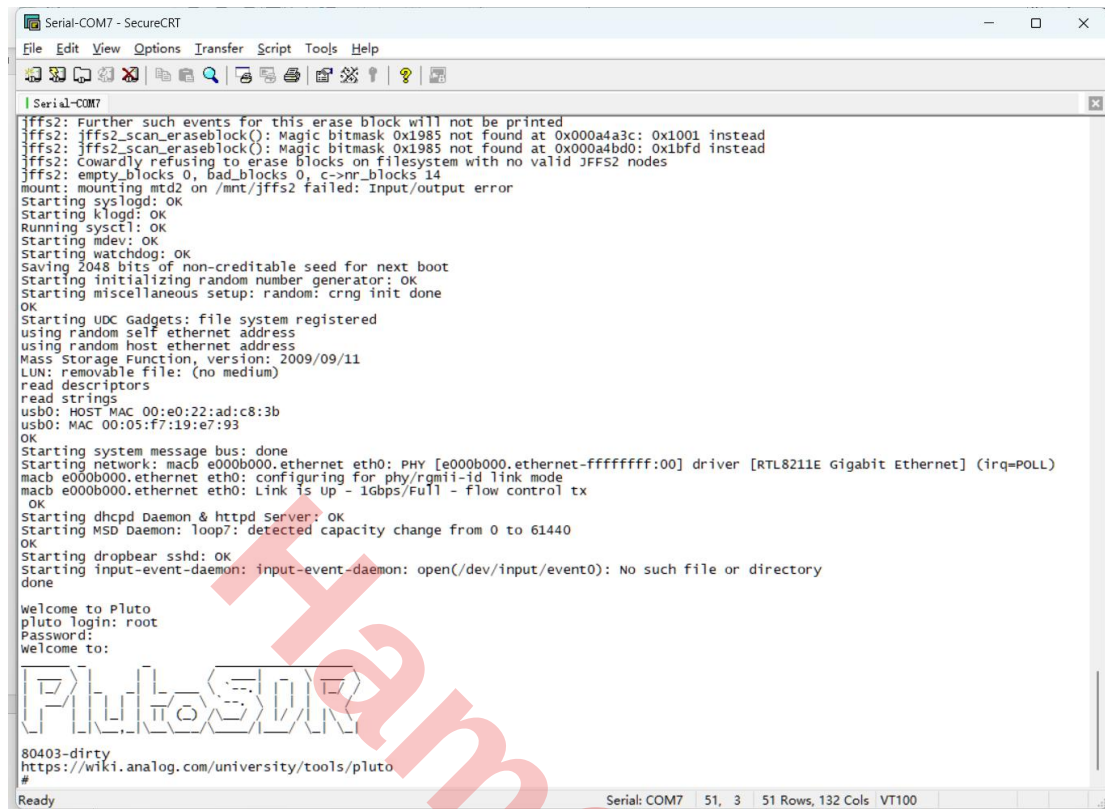
Click Connect to establish the connection.



Next, restart the board and check whether the boot messages are correct. Press and release the Reset button on the SDR main board to restart the board, then wait until all boot messages have been displayed.



Log in 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

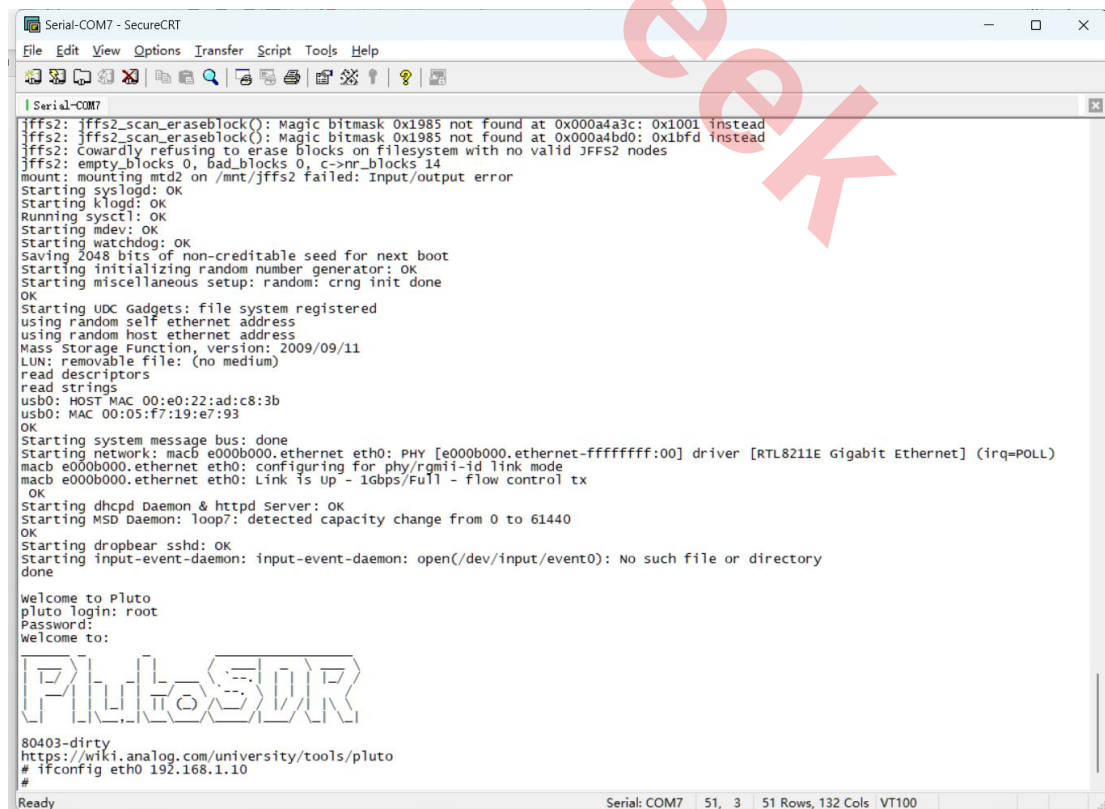
Welcome to Pluto
pluto login: root
Password:
Welcome to:

PlutoSDR

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

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

Enter the following command to set the board 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 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

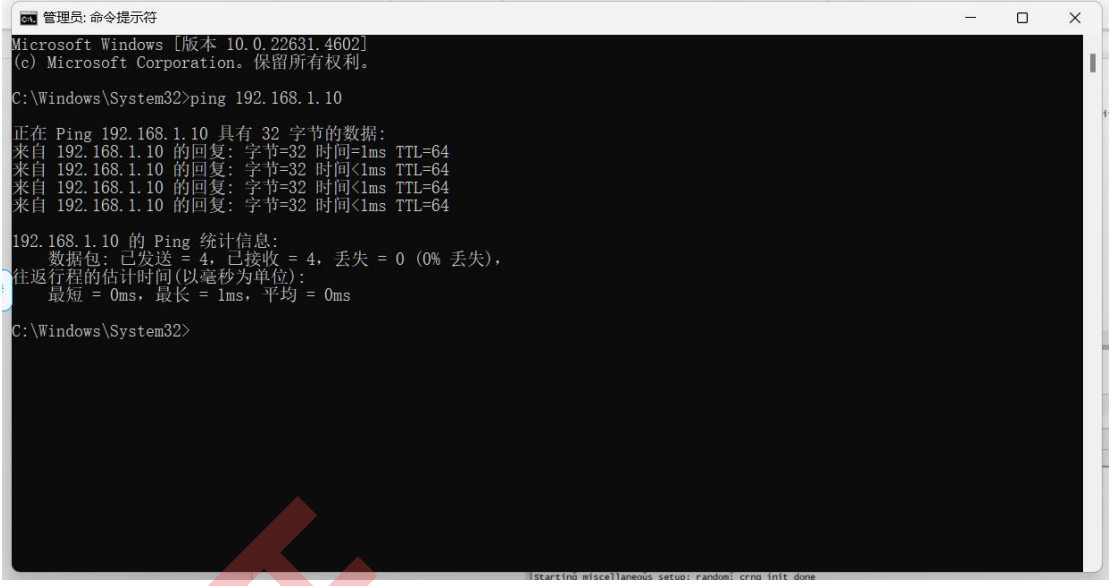
Welcome to Pluto
pluto login: root
Password:
Welcome to:

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 Command Prompt (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. Other serial terminal software can also be used to configure the IP address.

5.3 SDR# Software Testing

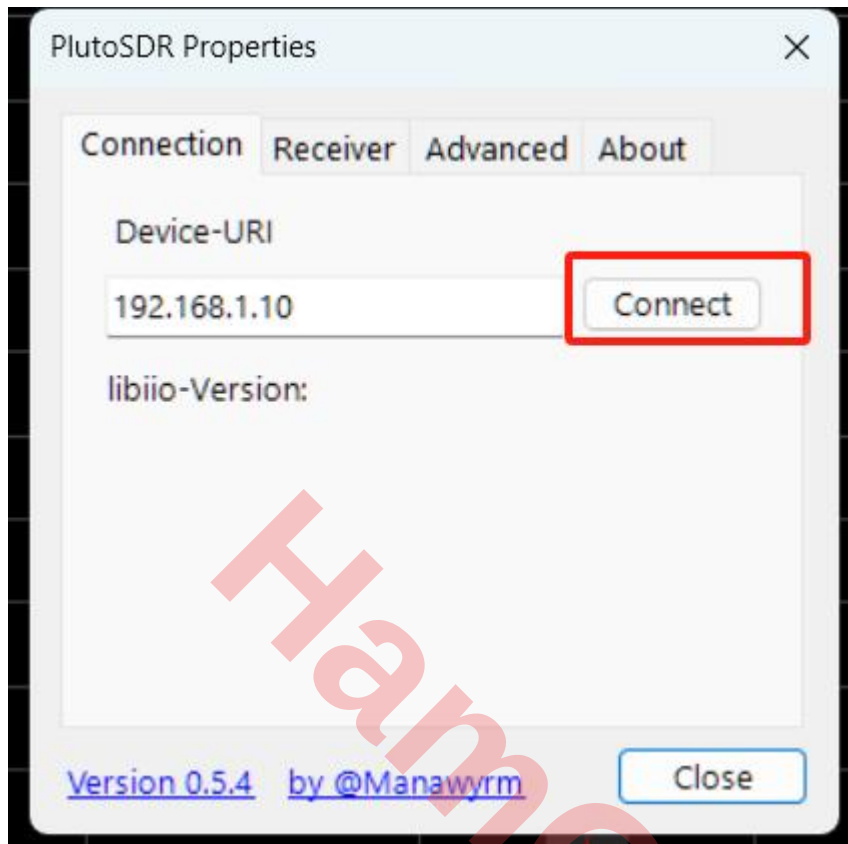
First, connect the included FM antenna to the RX1A RF interface. Click the link to download SDRSharp: <https://www.comseek.com/download/93267/SDRSharp.zip>

After extracting the folder, double-click SDRSharp.exe to launch it.

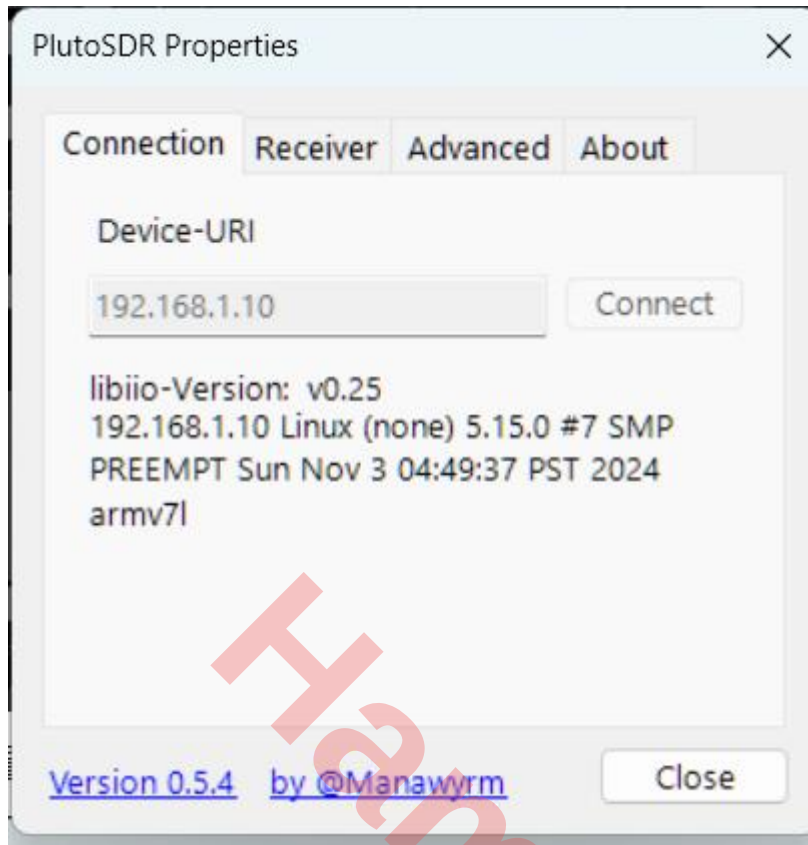
Click Settings icon.



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



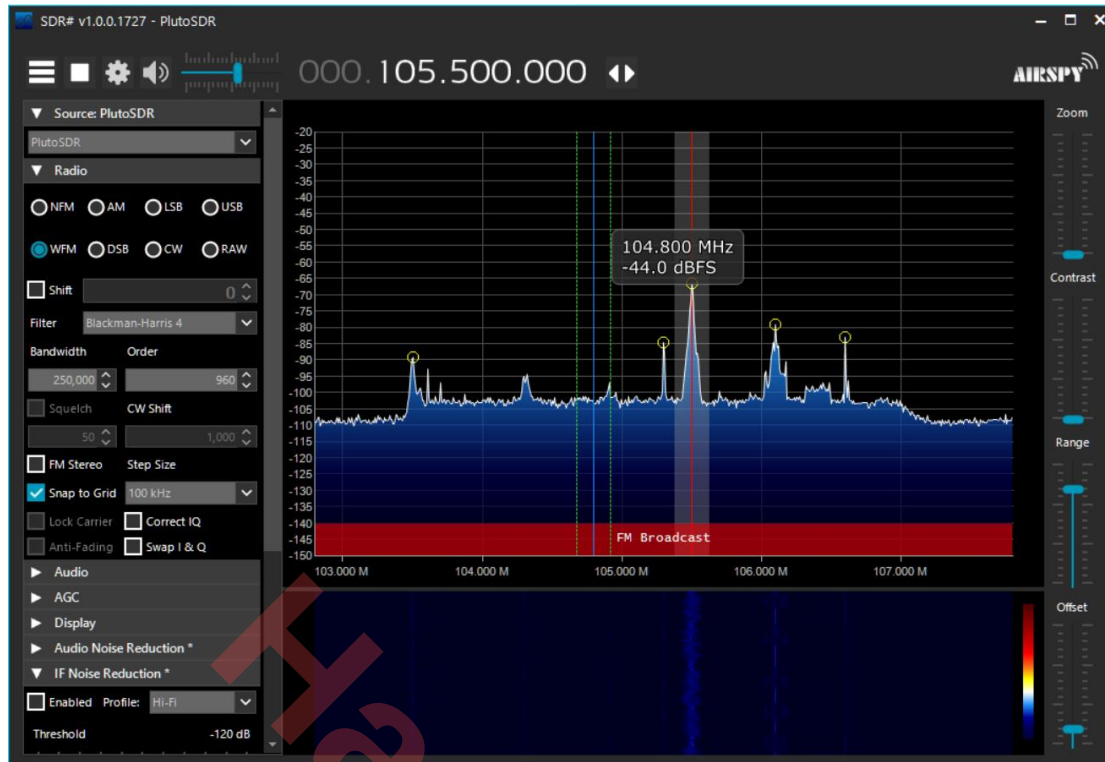
After the connection is established, close the settings window.



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

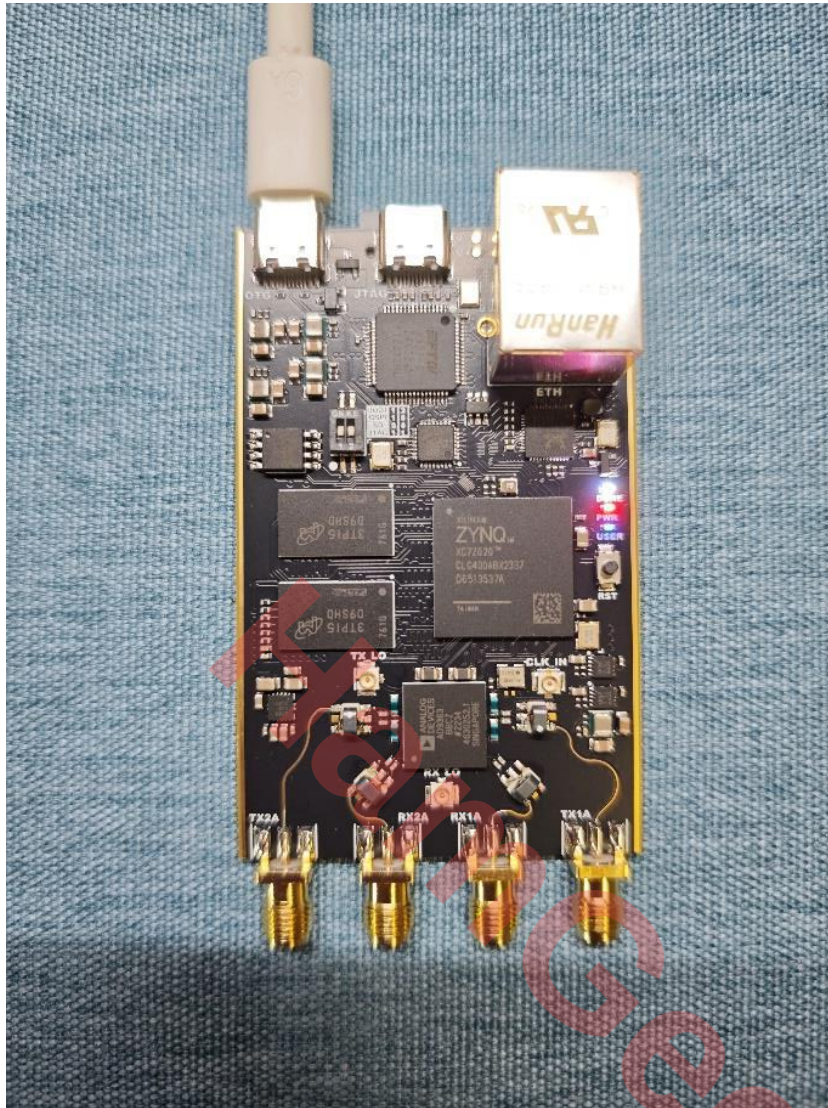


Move the red line to a signal peak to receive and hear the broadcast audio.



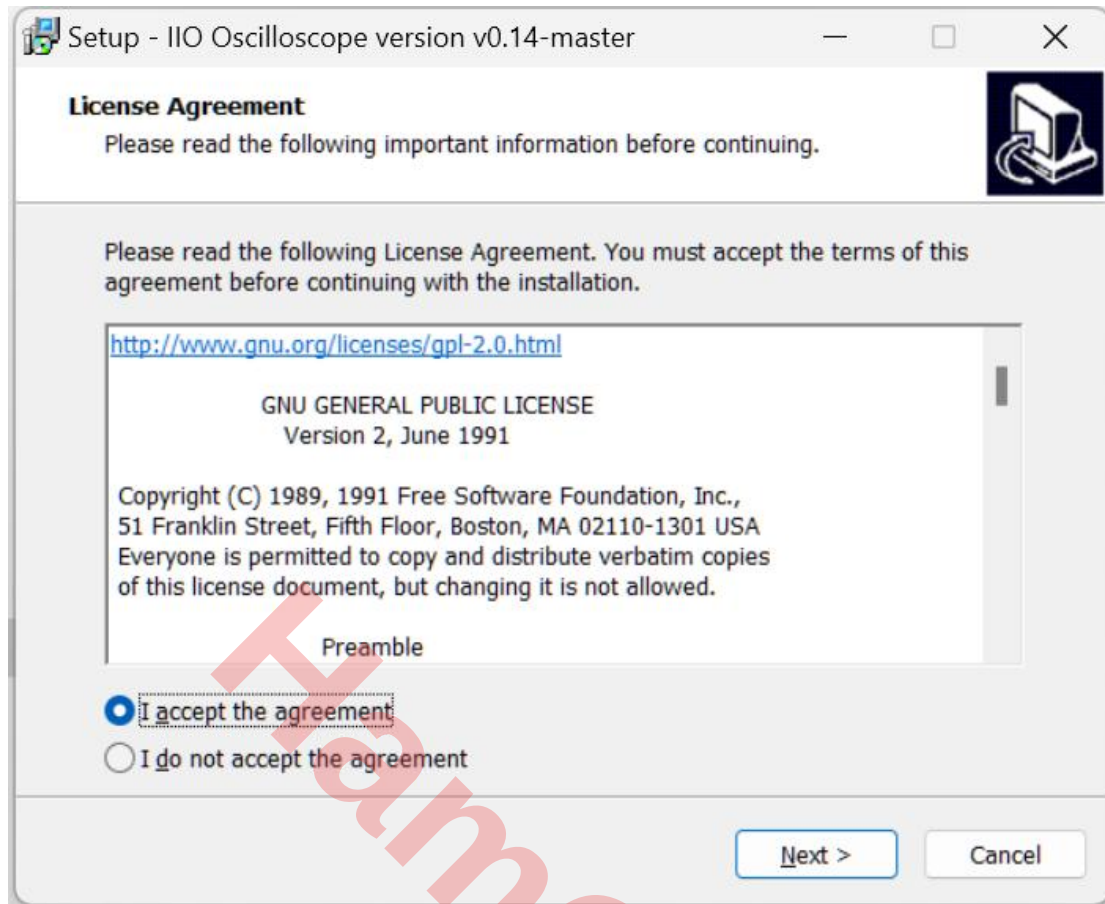
6. IIO Oscilloscope Test:

Next, use the IIO Oscilloscope software to test the hardware USB port. Connect a USB Type-C cable to the USB port and wait approximately 30 seconds for the board to boot. The normal status is the same: the white and red LEDs remain solid, while the blue LED flashes. The computer will also indicate that a storage device has been connected.

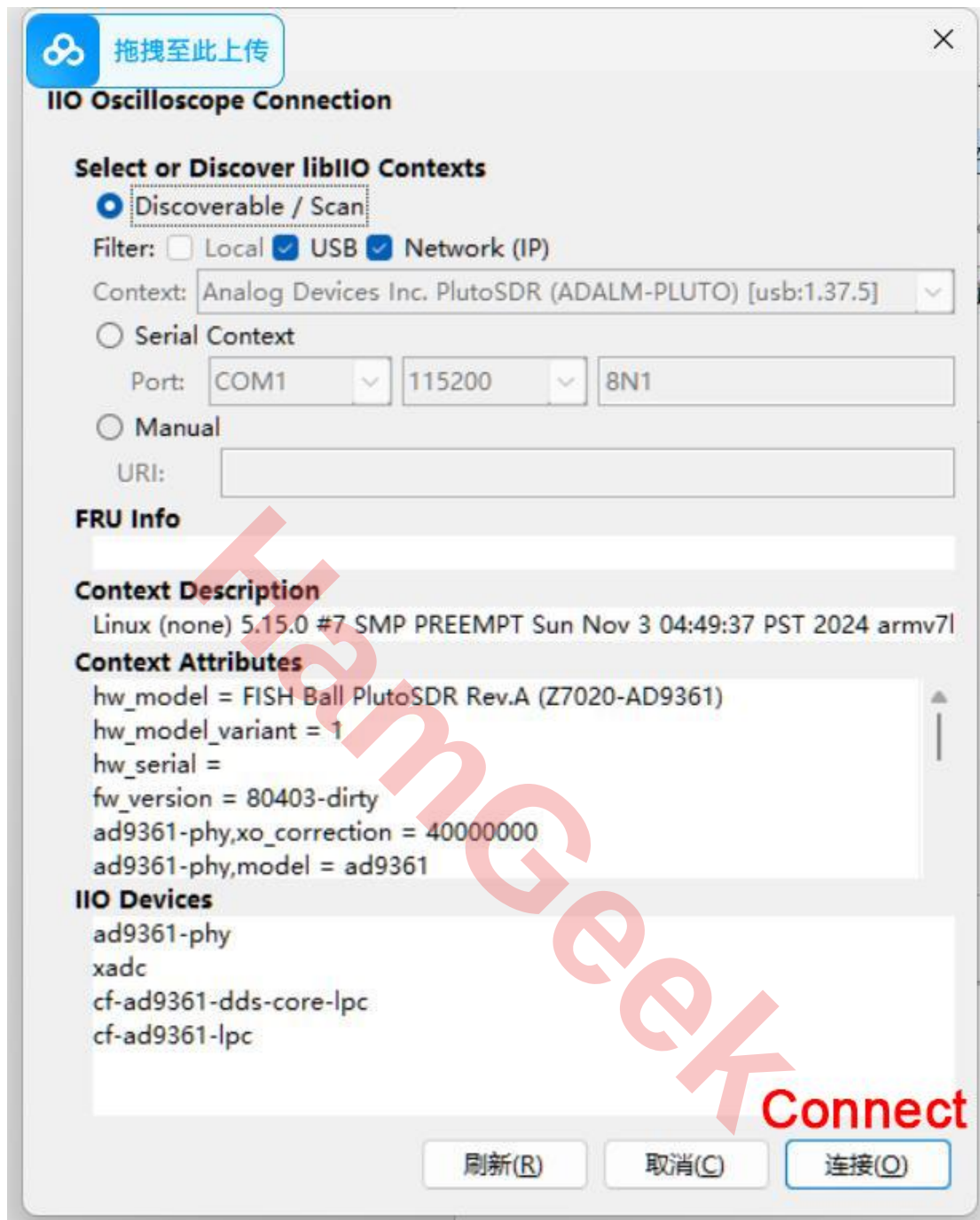


Extract the IIO Oscilloscope software (contact us to get the software).

Double-click to begin installation.



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



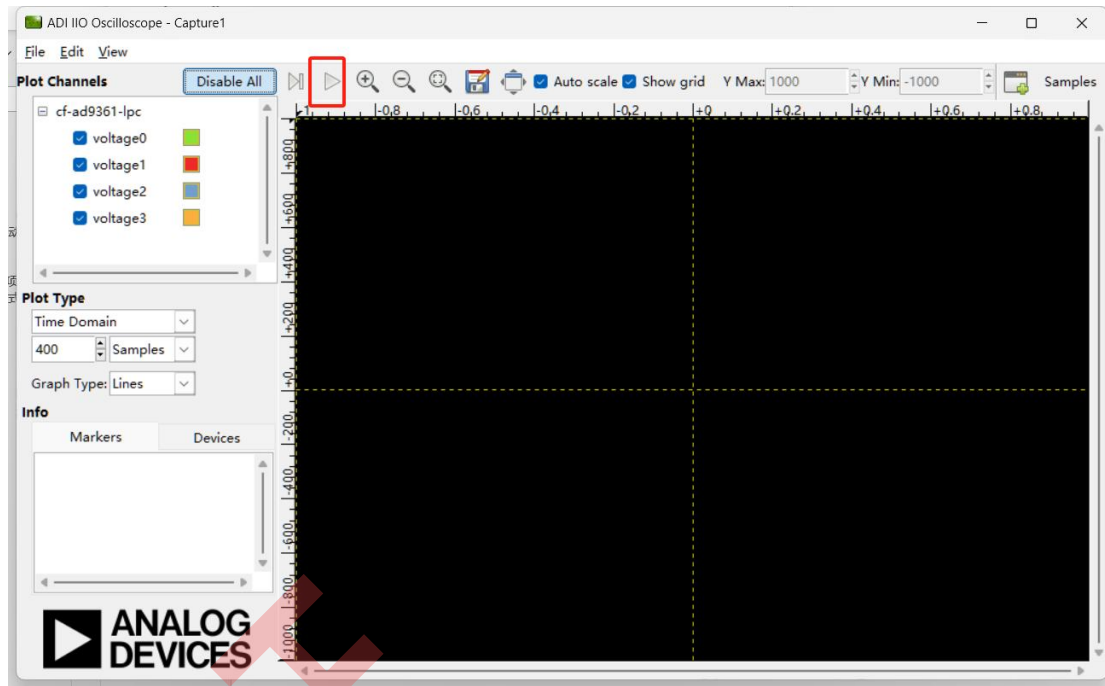
Click Connect and set the transmit and receive frequencies to the same value.

The screenshot shows the configuration interface for the AD9361 / AD9364 Receive and Transmit Chains. The top section is titled "AD9361 / AD9364 Receive Chain" and includes fields for RF Bandwidth (18.000 MHz), Sampling Rate (30.720000 MSPS), RX LO Frequency (2400.000000 MHz), RF Port Select (A_BALANCED), and Fastlock Profile (0). It also has checkboxes for External RX LO, Store, and Recall, and a Tracking section with checkboxes for Quadrature, RF DC, and BB DC. Below this are two columns for RX 1 and RX 2, each showing Hardware Gain (71.00 dB), RSSI (107.25 dB for RX 1, 108.25 dB for RX 2), Gain Control (slow_attack), and Gain Control Modes (slow_attack). The bottom section is titled "AD9361 / AD9364 Transmit Chain" and includes fields for RF Bandwidth (18.000 MHz), Sampling Rate (30.720000 MSPS), TX LO Frequency (2400.000000 MHz), RF Port Select (A), and Fastlock Profile (0). It also has checkboxes for External TX LO, Store, and Recall. Below this are two columns for TX 1 and TX 2, each showing Attenuation (10.00 dB) and RSSI (0.00 dB).

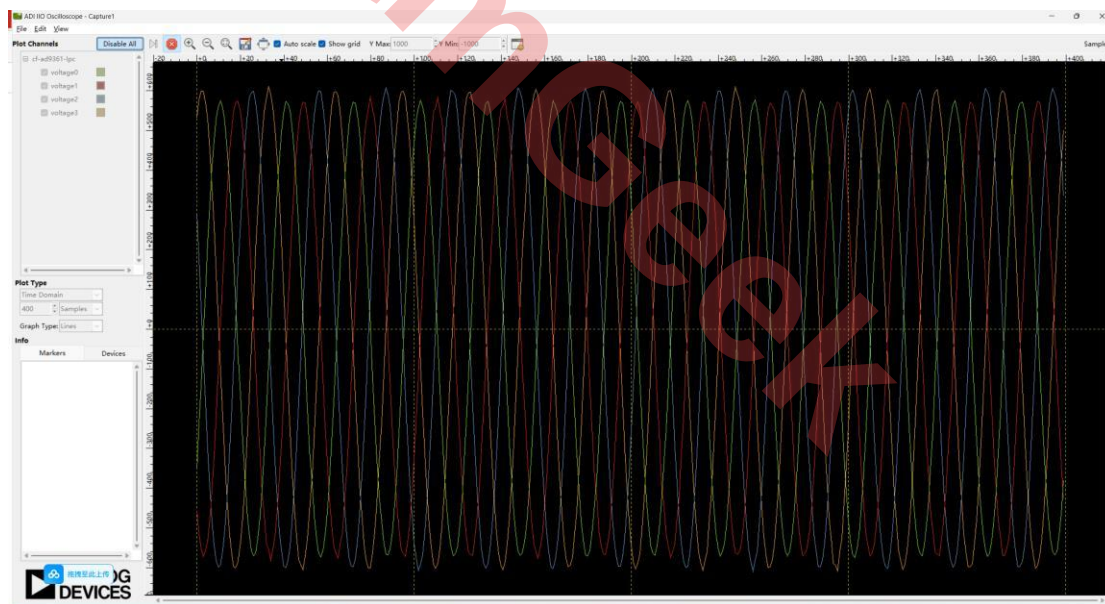
Configure the transmit signal.

The screenshot shows the "FPGA Settings" interface, specifically the "Transmit / DDS" section. It includes a "DMA Buffer" section with a Sampling Rate (MSPS) of 30720000. Below this is the "DDS" section, which is divided into two columns for TX 1 and TX 2. Each column has a "DDS Mode" dropdown set to "One CW Tone" and a "Single Tone" section. The "Single Tone" section includes fields for Frequency (0.999859 MHz), Scale (-12 dBFS), and Phase (90.000 degrees). The "Receive" section is partially visible at the bottom.

Use SMA loopback cable to connect TX1A to RX1A and TX2A to RX2A. Enable all four channels in the software and click Start icon.



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



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