

Ubuntu User Manual__AK201/203 SDRs Board

*Safety Note:

- ESD protection is critical when handling the AK201/203 SDR boards.
- Always use ESD protection pads under your feet when working with the device.
- Never power on the device without its case to ensure ESD protection and proper temperature management.

*Important: Before You Begin

- Ensure all connections (LAN, power, UART, SMA) are secure before powering on the AK201 SDR board. Pay special attention to the UART connection, as it is crucial for the following steps.
- Only after verifying all connections are properly secured, you should power on the board.
- Important: When disconnecting any cable, always power off the board first.



Power Light Indicators:

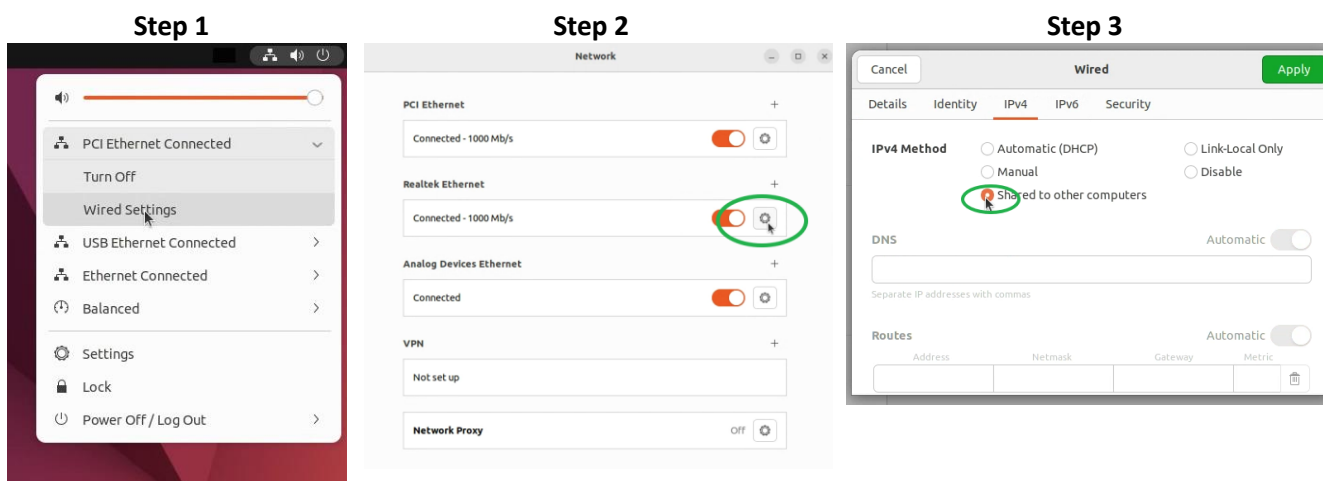
- Green light: Indicates the SDR is model AD9361
- Red light: Indicates the SDR is model AD9363



Troubleshooting Network Connection for SDR:

If the “`sudo minicom -D /dev/ttyUSB1`” command doesn't prompt as expected, you may need to configure your network settings. Follow these steps (Ubuntu 2022):

1. Open Ubuntu's network settings.
2. Navigate to **Wired Settings** or Ethernet settings.
3. Find the **Realtek Ethernet** option (or your specific Ethernet adapter).
4. Change the connection mode to "Shared to other devices".



This setting allows your computer to share its internet connection with the SDR device, creating a local network between your computer and the SDR. It's necessary because the SDR often doesn't have its own network

configuration, so it relies on your computer to provide network access. For Ubuntu 2024 (or future versions): The steps might be similar, but the exact menu names or locations could **change**. **Look for:**

- Network settings
- Ethernet or Wired Connection settings
- An option like "Connection sharing" or "Internet sharing"

If you prefer **using the terminal**, you can follow the command provided within the “**Network Configuration for SDR**” step to set up network sharing in the following.

Ubuntu

Identifying USB Devices:

To list all connected USB devices, enter the following command:

```
ls /dev/ttyUSB*
```

This command will display a list of all connected USB serial devices. The output will look similar to this:

```
/dev/ttyUSB0 /dev/ttyUSB1
```

Accessing the Console:

In the terminal, enter the following command using the correct USB device number you identified:

```
sudo minicom -D /dev/ttyUSB1
```

This command opens a serial connection to the AK201 SDR board. When prompted, enter your administrator password and you will see the following message:

```
Welcome to minicom 2.8  
OPTIONS: I18n  
Press CTRL-A Z for help on special keys
```

This indicates that the minicom is successfully running.

Logging into the AK201 SDR Board:

First press “enter”:

```
Welcome to minicom 2.8  
OPTIONS: I18n  
Port /dev/ttyUSB1, 20:53:58  
Press CTRL-A Z for help on special keys  
  
Welcome to AK  
AK login: █
```

Then at the login prompt, enter:

Username: **root**

Password: **artemis**

After successful login, you'll see:

```

Welcome to minicom 2.8

OPTIONS: I18n
Port /dev/ttyUSB1, 20:53:58

Press CTRL-A Z for help on special keys

Welcome to AK
AK login: root
Password:
Welcome to:

v0.37-1-g1077-dirty
https://artemiskaria.ir/
#

```

This confirms you're connected to the AK201 SDR board.

Configuring the Ethernet interface with a static IP:

- ❖ **More Elaborated Point:** At this stage, we assign a static IP address to the SDR locally. In the Linux operating system, local IP addresses can be set in the range of 10.42.0.0. For example, to communicate with the AK201 SDR, we assign it the IP address 10.42.0.2.

Steps to configure:

1. First, check your current network configuration:

Run "ifconfig"

```

# ifconfig
eth0      Link encap:Ethernet  HWaddr BE:1A:4B:76:80:06
          inet addr:10.42.0.2  Bcast:10.42.0.255  Mask:255.255.255.0
          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)
          Interrupt:36 Base address:0xb000

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:14 errors:0 dropped:0 overruns:0 frame:0
          TX packets:14 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1555 (1.5 KiB)  TX bytes:1555 (1.5 KiB)

usb0      Link encap:Ethernet  HWaddr 00:05:F7:19:E7:93
          inet addr:192.168.2.1  Bcast:0.0.0.0  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:164 errors:0 dropped:56 overruns:0 frame:0
          TX packets:59 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:17533 (17.1 KiB)  TX bytes:39280 (38.3 KiB)

```

This displays the current configuration of all active network interfaces. This is useful for:

- Identifying which interfaces are available (e.g., eth0, enp3s0, wlan0)
- Checking if any interface is already configured with an IP in the 10.42.0.x range
- Verifying the current state of your network interfaces

2. Look for your Ethernet interface (often named eth0 or enp3s0) and note its name.
- 3.If you don't see an IP address in the 10.42.0.x range, proceed to set it

```
ifconfig eth0 10.42.0.2 netmask 255.255.255.0
```

Replace **eth0** with your actual Ethernet interface name if different. This command assigns a static IP address to your Ethernet interface. It's setting up the basic network configuration for that interface.

- ❖ Note: If you see an IP address already set in the 10.42.0.x range, your SDR might already be configured. In this case, use that existing IP address for connecting to your SDR.

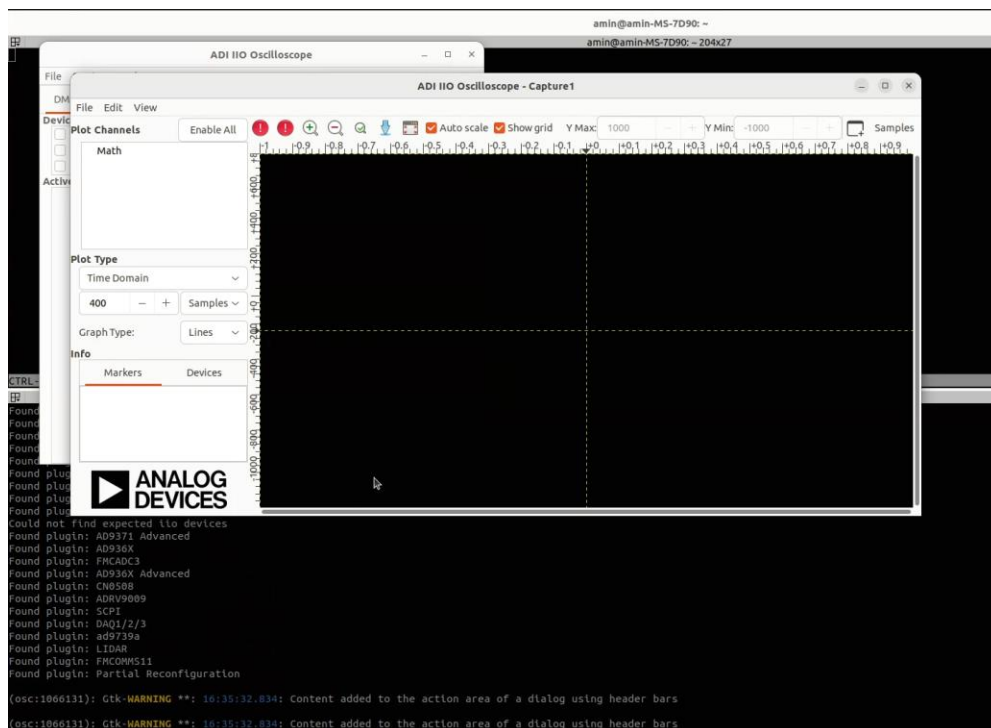
This configuration ensures a direct and consistent network connection between your computer and the AK201 SDR, facilitating reliable communication for data transfer and control.

Running IIO-Oscilloscope:

To initiate the IIO-Oscilloscope application, execute the following command in the terminal:

```
OSC
```

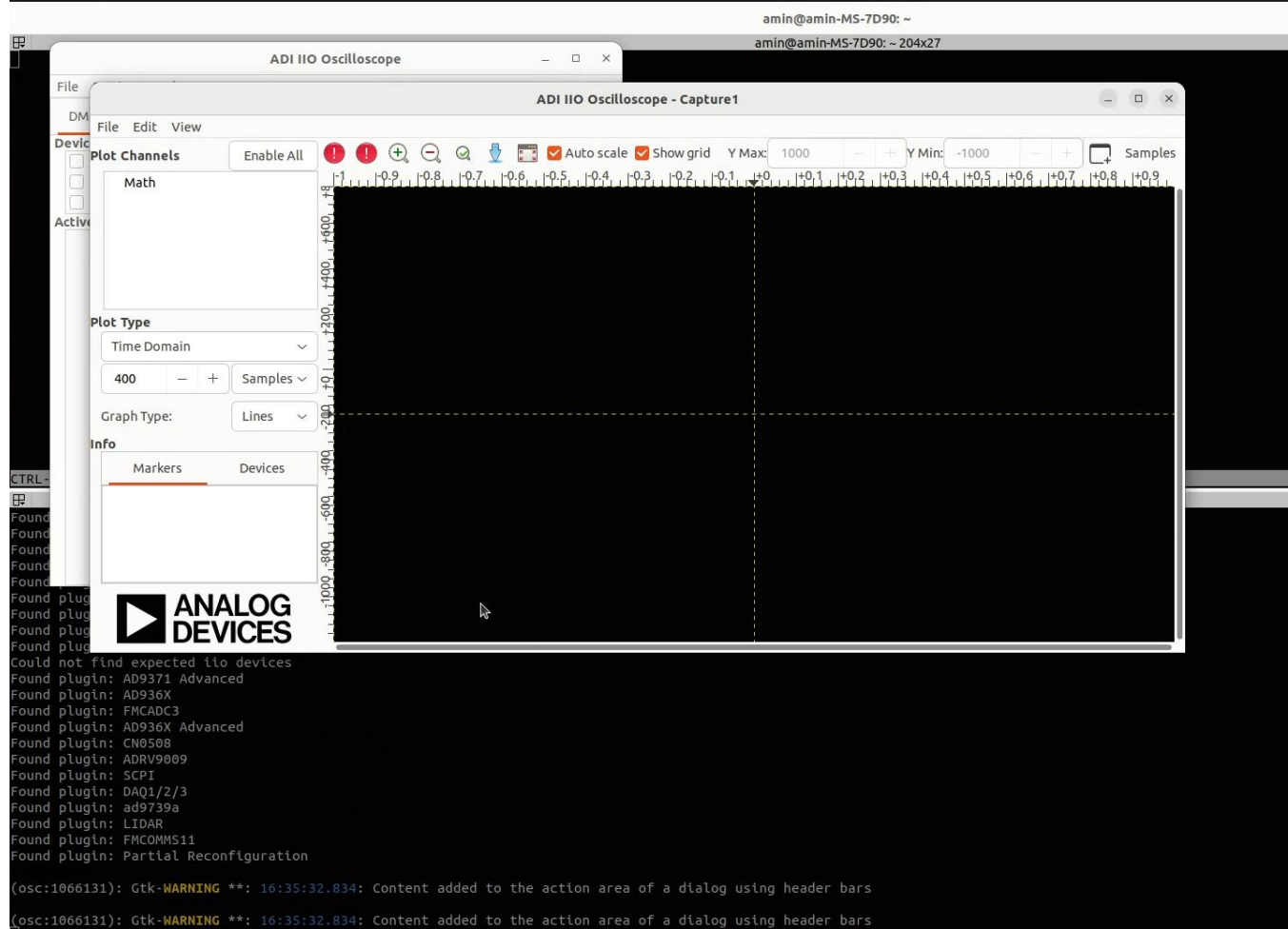
This command launches the ADI IIO Oscilloscope graphical user interface:



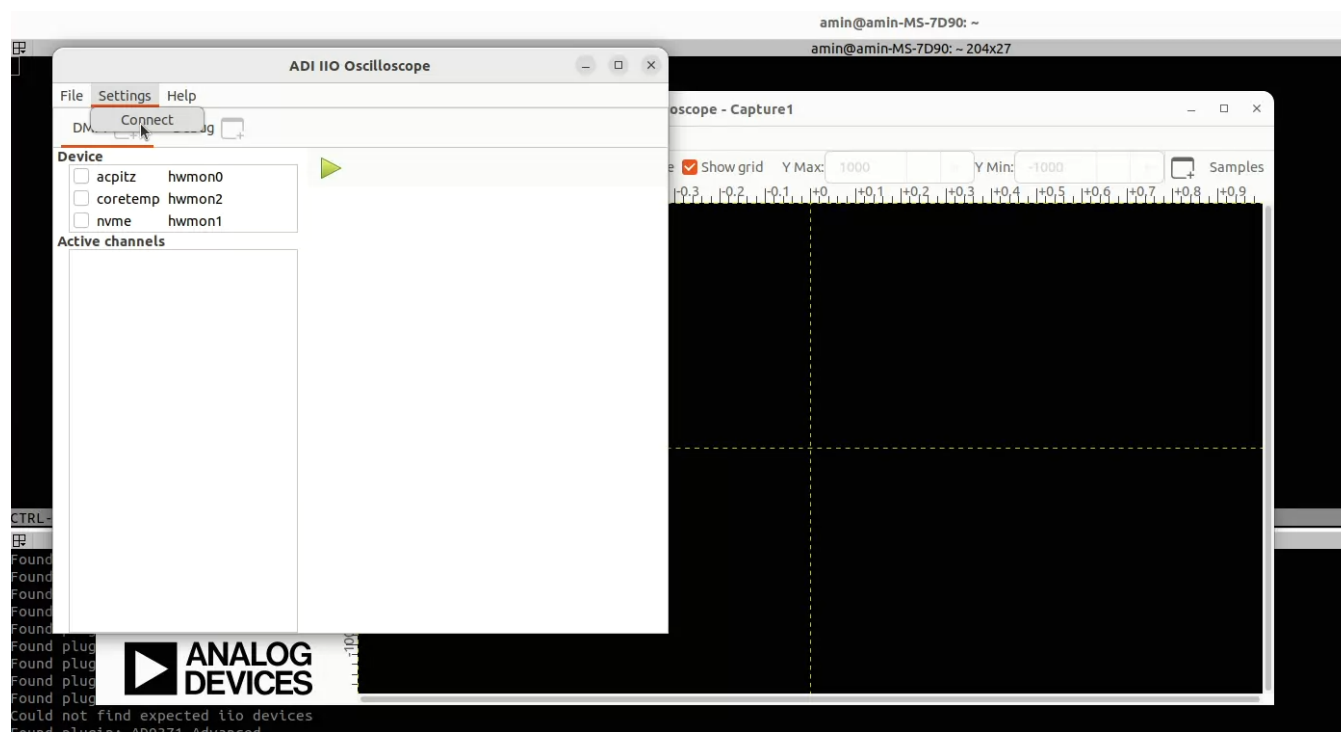
Configuring IIO-Oscilloscope:

Follow these steps to properly configure the IIO-Oscilloscope for use with your AK201/203 SDR:

Navigate to the main ADI IIO Oscilloscope window.



Access the "Settings" menu:



Select "Discoverable / Scan" from the dropdown menu and Finally, choose "Network (IP)":

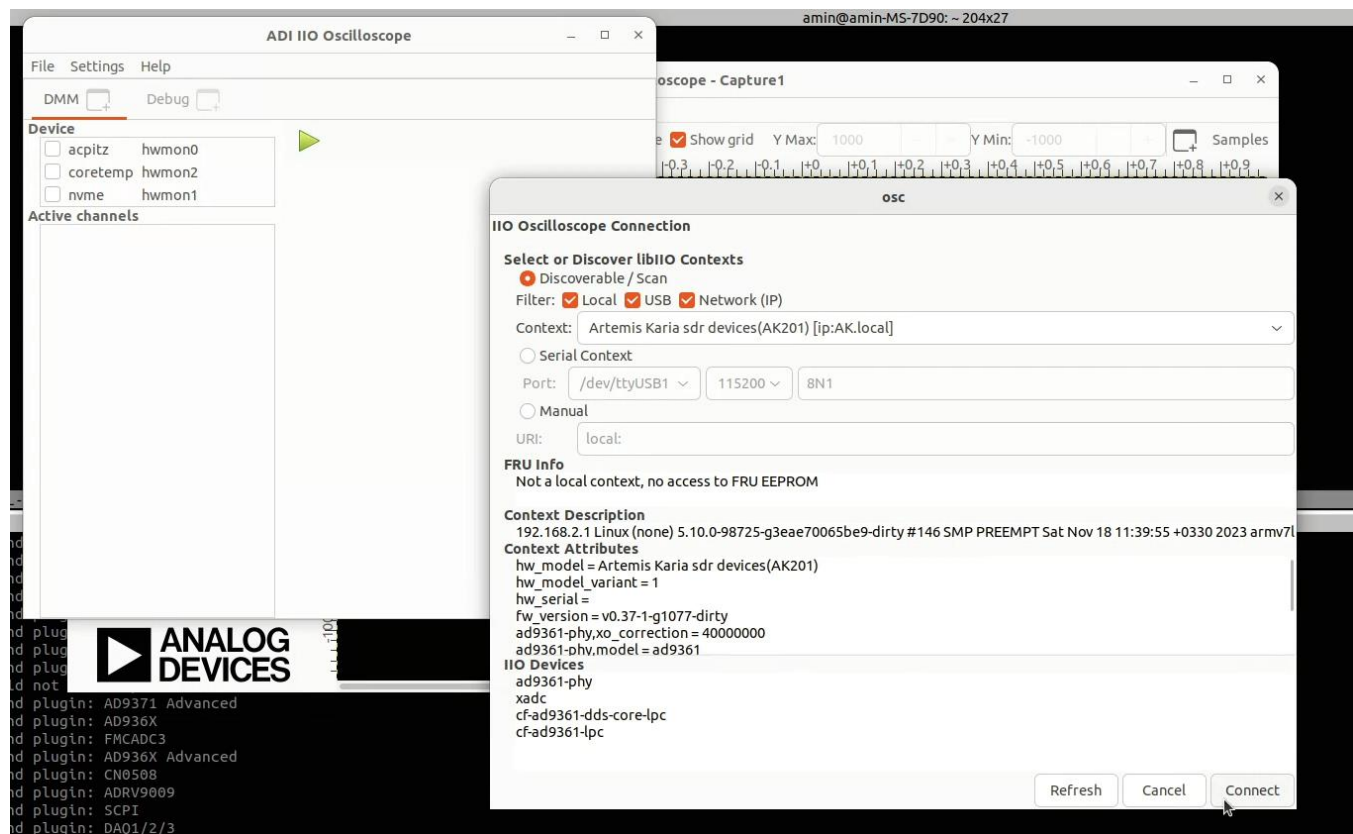
- ❖ This sequence ensures that the oscilloscope is configured to detect and communicate with your locally connected SDR device.

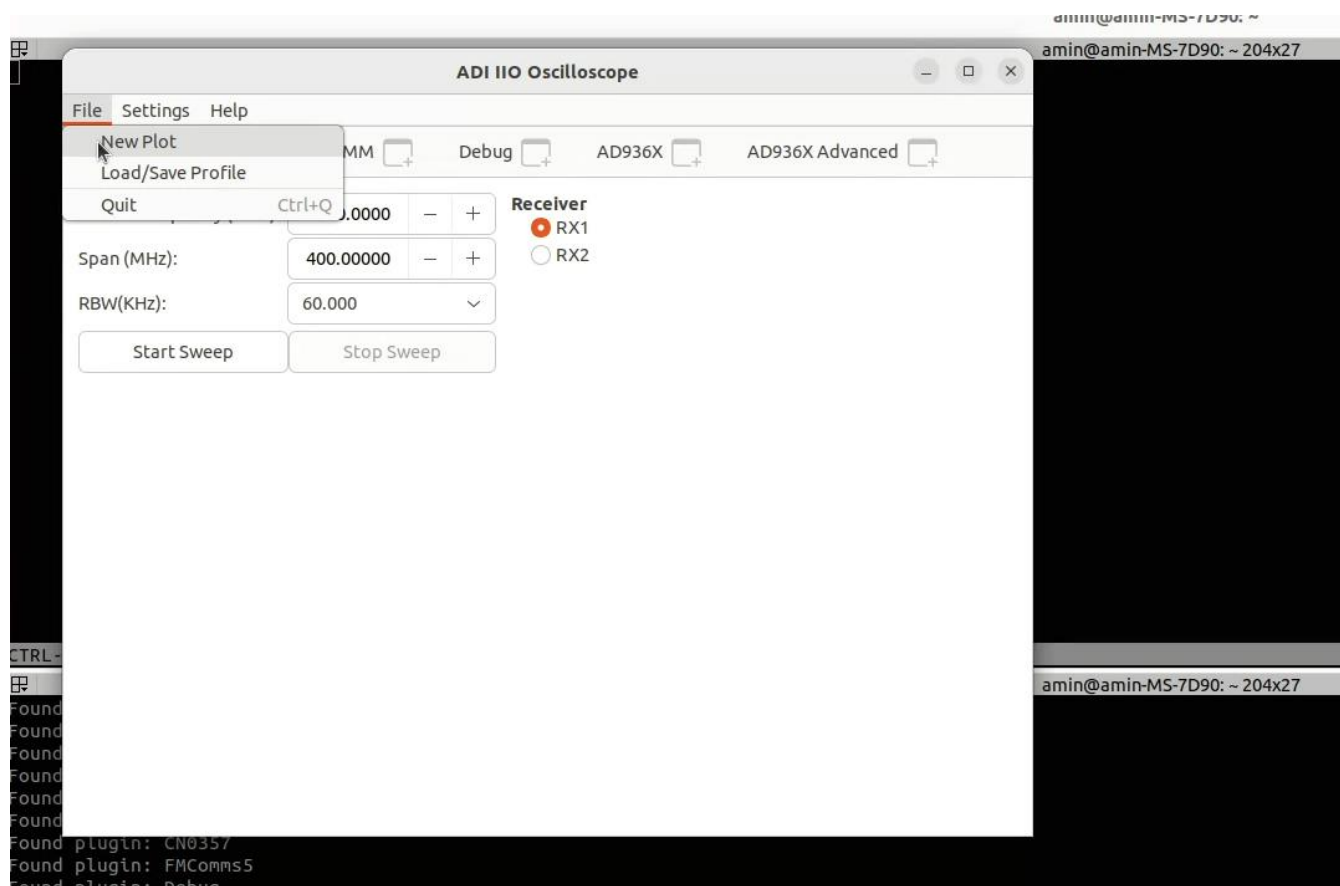
Establishing Connection with the SDR

After configuring the settings:

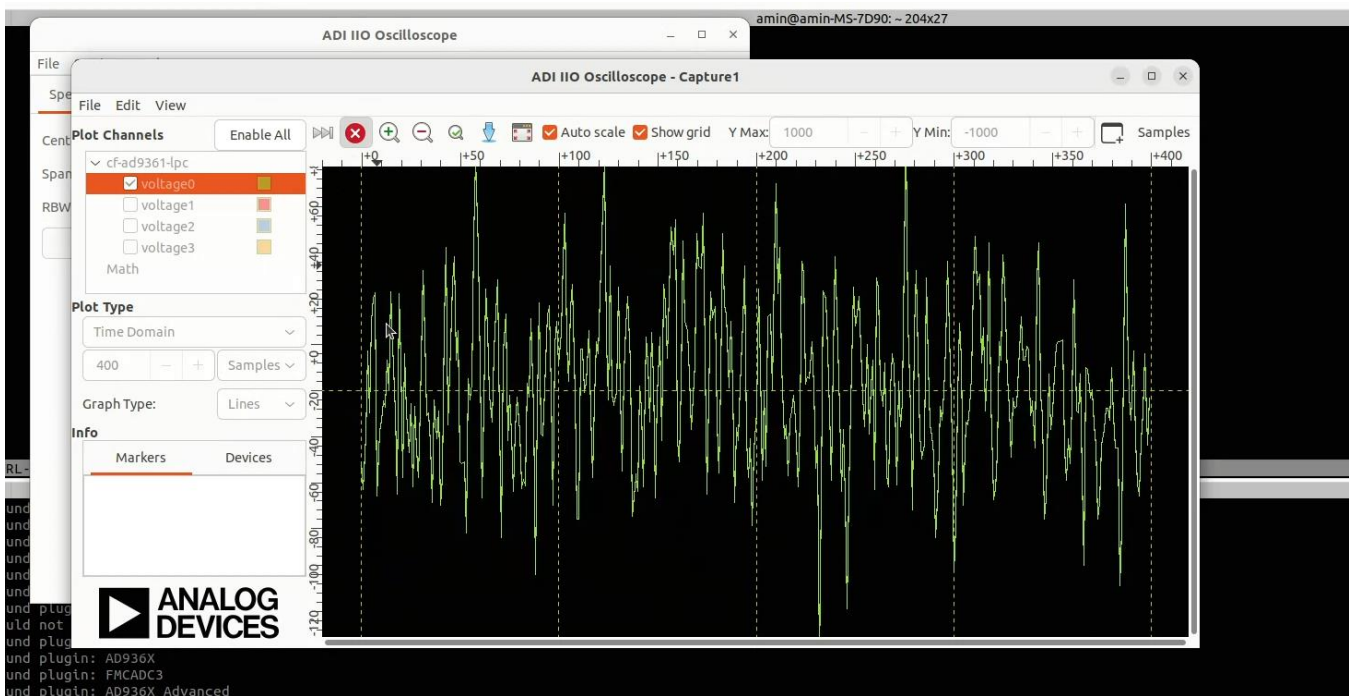
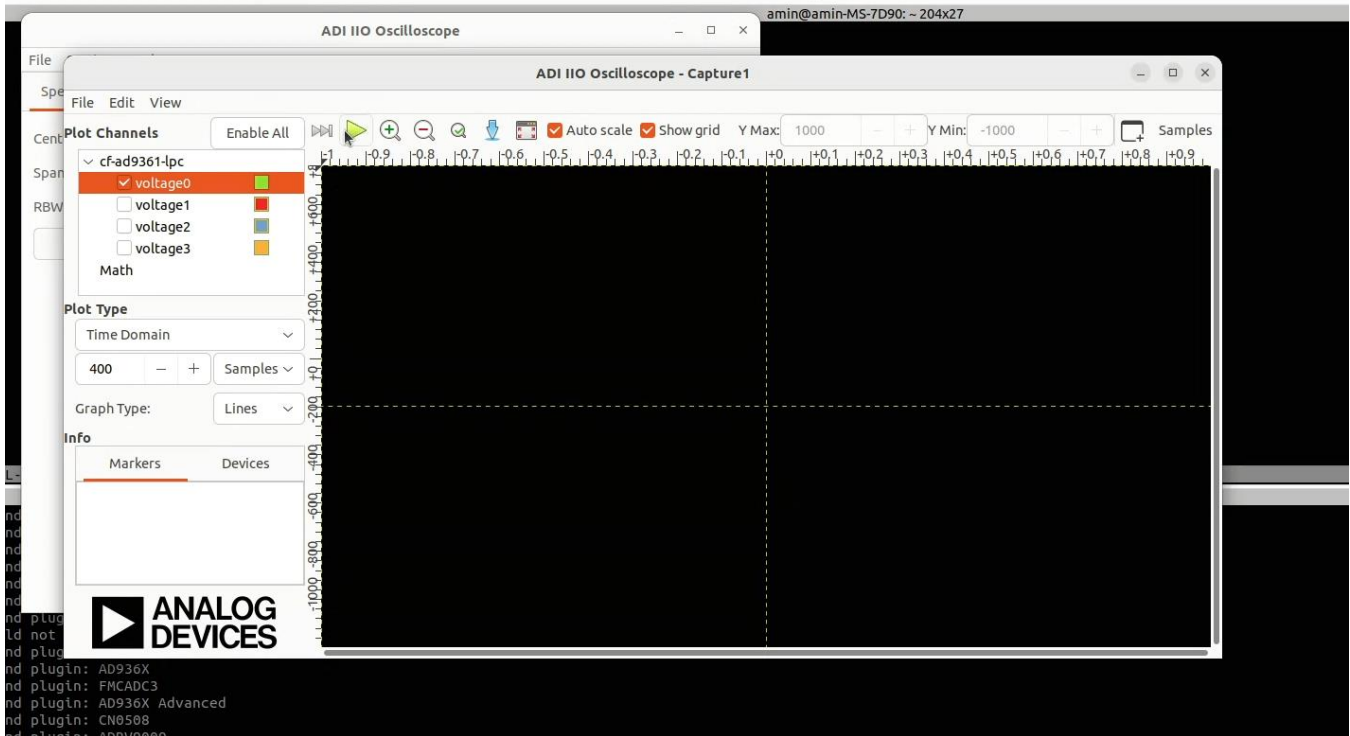
In the main oscilloscope window, locate and select your SDR device from the list of available devices.

Click "Connect" to establish a connection with the SDR.





In the subsequent menu, select "USB".

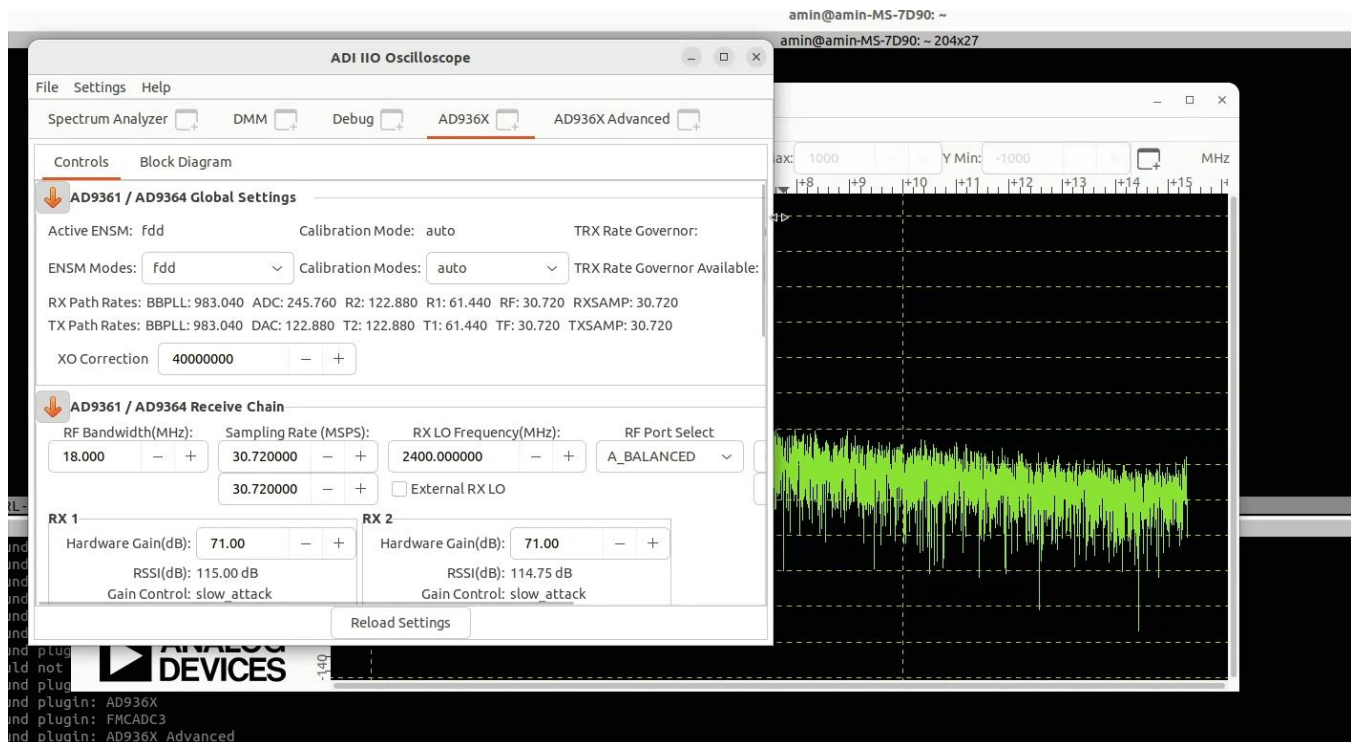




Initializing RF Parameters

To configure the RF parameters of the AK201/203 SDR:

1. Set TX LO (Local Oscillator) Frequency:
 - Navigate to the TX settings panel.
 - Locate the "LO Frequency" field and input the desired frequency (e.g., 800 MHz).
2. Configure DDS (Direct Digital Synthesis) Mode:
 - In the TX settings, find the "DDS Mode" option.
 - Select "One CW Tone" for single-frequency signal generation.
3. Set Signal Frequency:
 - Within the DDS settings, specify the desired signal frequency.
 - Ensure this frequency is within the capability range of your SDR model.
4. Adjust Attenuation Levels:
 - Set appropriate attenuation for both baseband and the AD9361 output (Tx1).
 - Baseband attenuation affects the digital signal strength before D/A conversion.
 - Tx1 attenuation controls the analog output power.



Set TX LO Frequency:

AD9361 / AD9364 Transmit Chain

RF Bandwidth(MHz): 18.000 — + Sampling Rate (MSPS): 30.720000 — + TX LO Frequency(MHz): 800.000000 — + RF Port Select: A Fastlock Profile: 0

☐ External TX LO [Store] [Recall]

TX 1 Attenuation(dB): 0.00 — + RSSI(dB): **TX 2** Attenuation(dB): 10.00 — + RSSI(dB):

FPGA Settings

Transmit / DDS

DMA Buffer Sampling Rate (MSPS) 30720000 ▾

DDS cf-ad9361-dds-core-lpc

TX 1 DDS Mode: One CW Tone ▾ **TX 2** DDS Mode: Disable ▾

Single Tone

Tone 1 Frequency(MHz): 5.000232 — + Scale(dBFS): -5 dB — + Phase(degrees): 90.000 — +

Receive DMA Buffer Sampling Rate (MSPS) 30720000 ▾

Rel

Choose “One CW Tone” in DDS Mode:

AD9361 / AD9364 Transmit Chain

RF Bandwidth(MHz): 18.000 — + Sampling Rate (MSPS): 30.720000 — + TX LO Frequency(MHz): 800.000000 — + RF Port Select: A Fastlock Profile: 0

☐ External TX LO [Store] [Recall]

TX 1 Attenuation(dB): 0.00 — + RSSI(dB): **TX 2** Attenuation(dB): 10.00 — + RSSI(dB):

FPGA Settings

Transmit / DDS

DMA Buffer Sampling Rate (MSPS) 30720000 ▾

DDS cf-ad9361-dds-core-lpc

TX 1 DDS Mode: One CW Tone ▾ **TX 2** DDS Mode: Disable ▾

Single Tone

Tone 1 Frequency(MHz): 5.000232 — + Scale(dBFS): -5 dB — + Phase(degrees): 90.000 — +

Receive DMA Buffer Sampling Rate (MSPS) 30720000 ▾

Rel

Set the Signal Frequency:

AD9361 / AD9364 Transmit Chain

RF Bandwidth(MHz): 18.000 — + Sampling Rate (MSPS): 30.720000 — + TX LO Frequency(MHz): 800.000000 — + RF Port Select: A ▾ Fastlock Profile: 0 ▾

☐ External TX LO Store Recall

TX 1 Attenuation(dB): 0.00 — + RSSI(dB):

TX 2 Attenuation(dB): 10.00 — + RSSI(dB):

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): 5.000232 — + Scale(dBFS): -5 dB — + Phase(degrees): 90.000 — +

TX 2 DDS Mode: Disable ▾

Receive

DMA Buffer Sampling Rate (MSPS) 30720000 ▾

Rel

Set the proper attenuation for boat baseband and the output of AD9361 (Tx1):

AD9361 / AD9364 Transmit Chain

RF Bandwidth(MHz): 18.000 — + Sampling Rate (MSPS): 30.720000 — + TX LO Frequency(MHz): 800.000000 — + RF Port Select: A ▾ Fastlock Profile: 0 ▾

☐ External TX LO Store Recall

TX 1 ↓ Attenuation(dB): 0.00 — + RSSI(dB):

TX 2 Attenuation(dB): 10.00 — + RSSI(dB):

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): 5.000232 — + Scale(dBFS): -5 dB — + Phase(degrees): 90.000 — +

TX 2 DDS Mode: Disable ▾

Receive

DMA Buffer

Sampling Rate (MSPS) 30720000 ▾

Rel

By following these steps, you can effectively configure, operate, and analyze the performance of your AK201/203 SDR using the IIO-Oscilloscope tool. This process allows for comprehensive characterization and testing of the SDR's RF capabilities.

