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Installation Guide

Overview

This training program introduces **Software Defined Radio (SDR)** using **GNU Radio Companion (GRC)** with three popular SDR platforms: **RTL-SDR V4**, **ADALM-PLUTO**, and **USRP B210**. SDR replaces many traditional radio hardware blocks (filters, demodulators, decoders) with **software signal processing**, enabling learners to **tune, capture, visualize, and process real RF signals** using a PC and an SDR front-end. The core purpose is to help participants confidently use real SDR hardware inside GRC to build and run practical signal-processing flowgraphs.

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Purpose

This hands-on training is designed to help participants:

- Learn the end-to-end workflow: **Connect hardware → verify detection → configure RF parameters → build GRC flowgraph → run and observe results**

- Understand how real-world signals appear in **time domain, frequency domain (FFT)** displays

- Develop practical skills for SDR-based lab experiments such as **signal observation, basic reception, and controlled demonstrations**

- Gain familiarity with multiple hardware tiers:

  - **RTL-SDR V4** for low-cost receive-only learning

  - **ADALM-PLUTO** for mid-range RX/TX experiments

  - **USRP B210** for SDR workflows

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Key features

→ **Multi-device SDR exposure**

- Setup, detection, and operation for RTL-SDR V4, ADALM-PLUTO, and USRP B210

Signal visualization and validation

- Spectrum, and time-domain views to confirm signal presence and quality

Core RF control skills

- Center frequency (LO), sample rate, bandwidth, gain control, and basic troubleshooting

→ **Repeatable "sanity test" flowgraphs**

Ready-to-run templates for each device so participants can quickly confirm successful setup

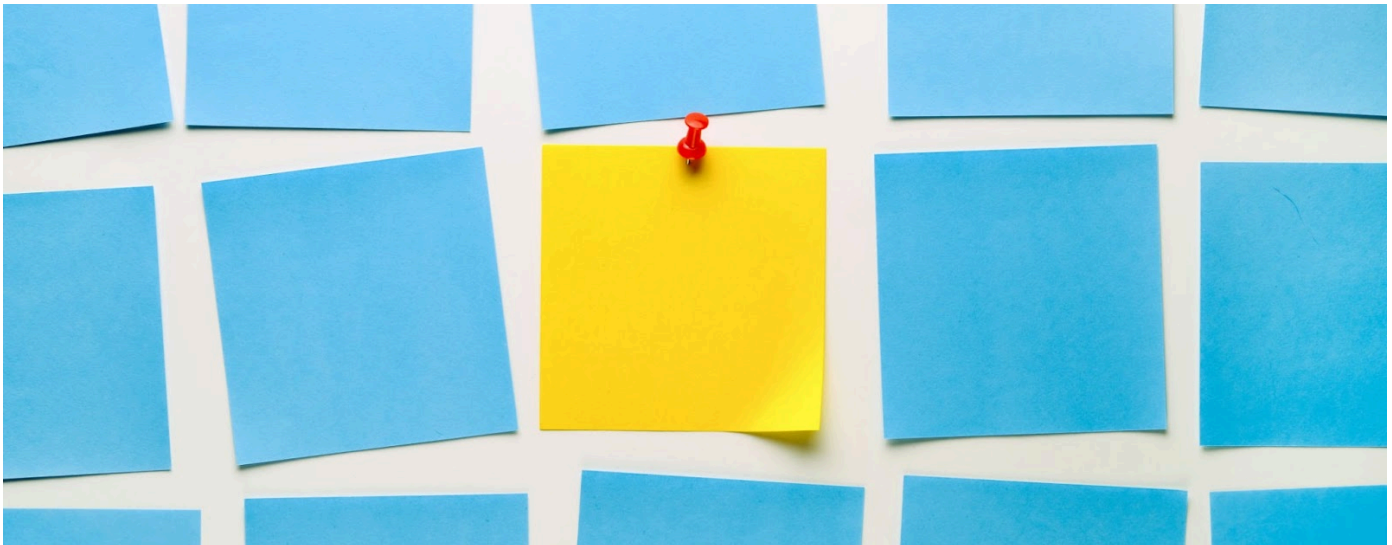STEM Smart Labs

SYSTEM REQUIREMENTS

Hardware (Minimum)

Laptop

- **RAM: 8 GB** minimum (recommended **16 GB** for smoother GUI + higher sample rates)

- **Storage: 10–20 GB free** (for GNU Radio / drivers / optional toolchains)

- **USB Ports:**

    - **1× USB 2.0/3.0** for **RTL-SDR V4**

    - **1× USB 2.0** (data-capable) for **ADALM-PLUTO**

Operating Systems (Compatible)

- **Windows**
- **Linux**
- **MacOS**

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INSTALLATION

Step-by-step instructions

Install GNU Radio Companion

STEP 1

RadioConda / Radioconda installer

Steps

1. Download the latest **Radioconda (Radioconda installer)** release from the project releases page.
   https://github.com/radioconda/radioconda-installer/releases

   https://github.com/radioconda/radioconda-installer/releases/download/2025.03.14/radioconda-2025.03.14-Windows-x86_64.exe

2. Run the installer

3. After install, open **GNU Radio Companion** from Start Menu (it should be available).

4. Confirm GRC starts:

   ○ Open GRC and see whether it opens without any errors then your base install is OK.

STEP 2

IIO (Pluto SDR)

Windows users

Install the latest USB drivers by download and installing

https://github.com/analogdevicesinc/plutosdr-m2k-drivers-win/releases/latest/download/PlutoSDR-M2k-USB-Drivers.exe

Install Libiio Library

https://github.com/analogdevicesinc/libiio/releases/download/v0.26/libiio-0.26.ga0eca0d2-setup.exe

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STEP 3

RTL-SDR

Windows users

Install the WinUSB driver with Zadig
https://github.com/radioconda/radioconda-installer?tab=readme-ov-file#installing-the-winusb-driver-with-zadig, selecting the device that is called "Bulk-In, Interface (Interface 0)".

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