

Sagi Summer School 2024

Software-Defined Radio

Demonstration on the FM radio receiver

Presenter: **Minh** Pham Anh

Advisors: **Bang** Nhan Dinh

Quy nhon, 2024

Outline

Background

- Telecommunication
- An introduction of software-defined radio

GNURadio Software

- GNU Software introduction

Demonstration

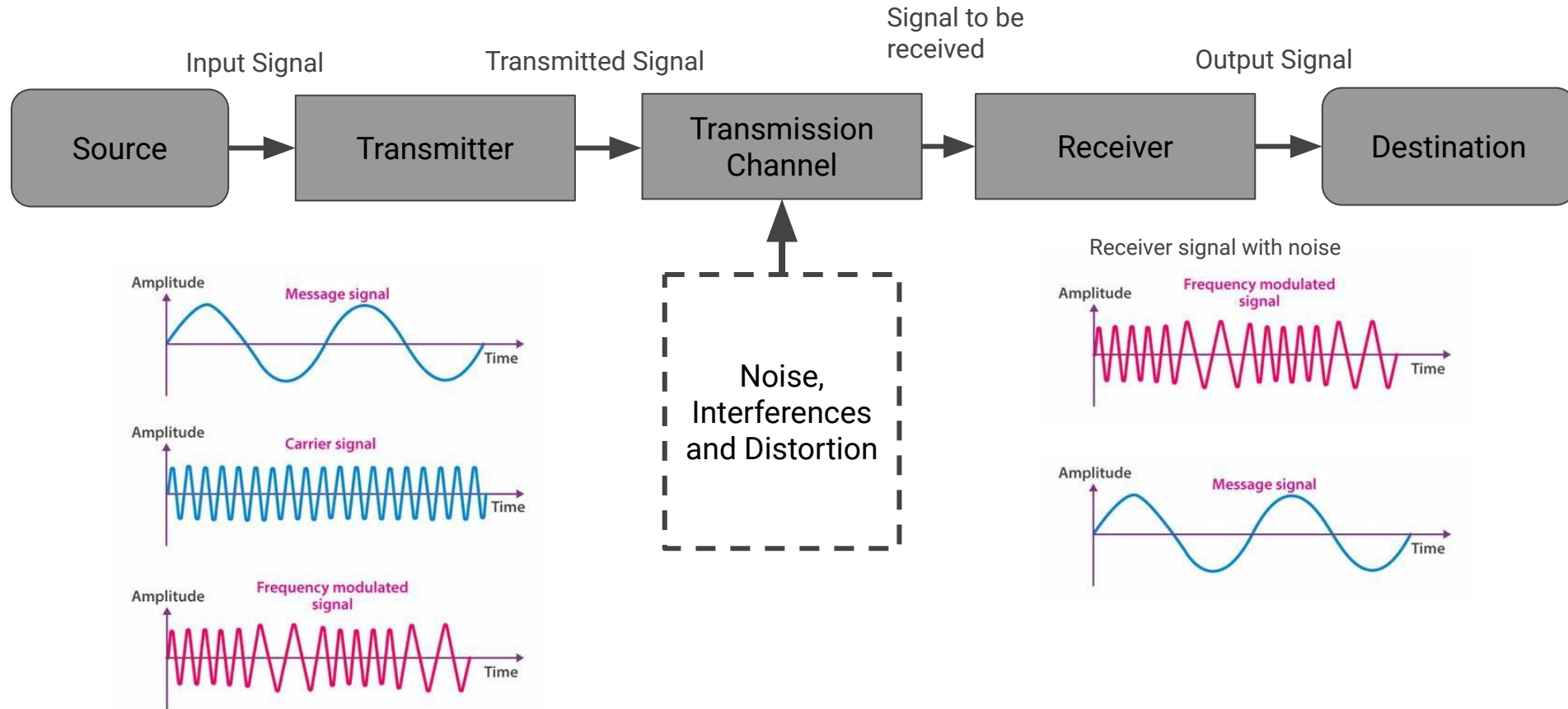
- The setup of the demonstration
- Demonstration result



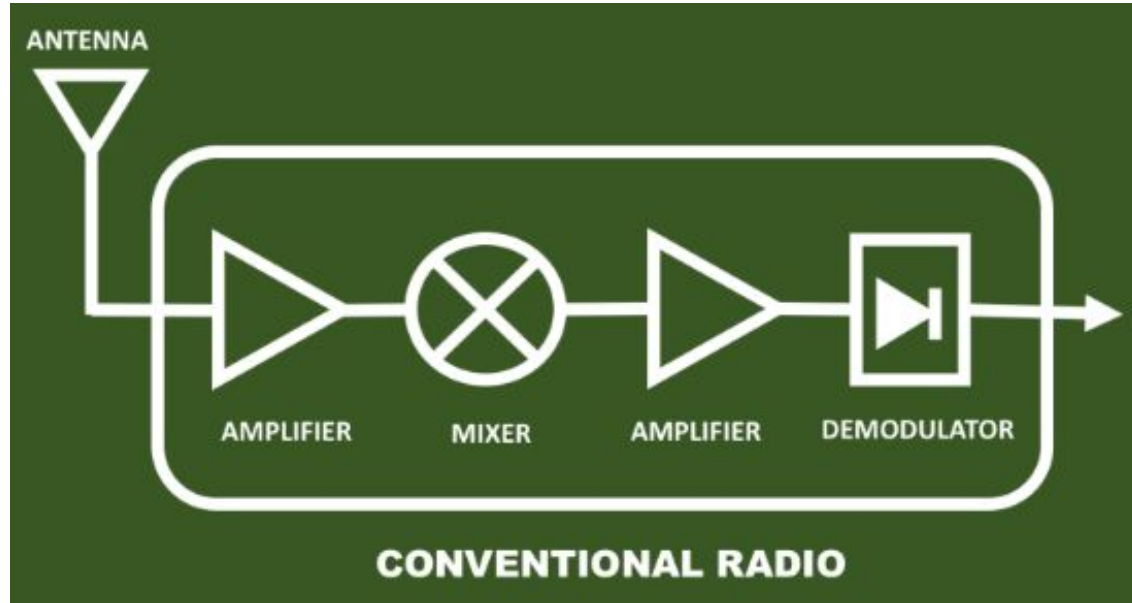
Telecommunication

Background

Elements of a Electronic Communication System

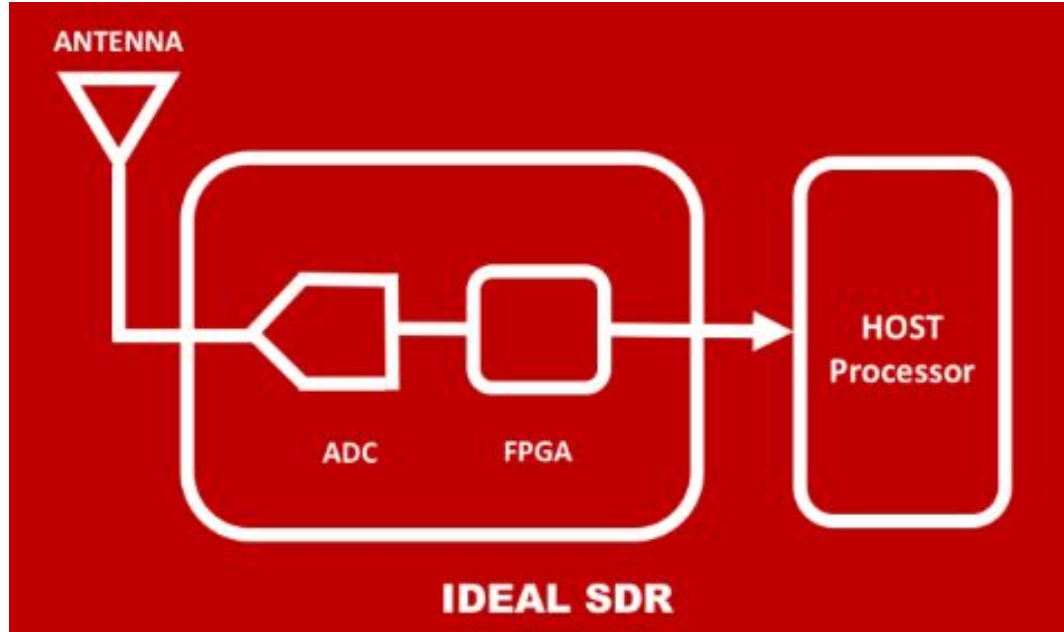


Conventional Radio Receiver Diagram



Comprised entirely of **analog building blocks** such as amplifiers and mixers

Software defined radio Diagram



Software-defined radio (SDR) is a radio system where traditional analog components are replaced with **digital components and software technologies**.



GNURadio Software

GNURadio Preparation

On Ubuntu:

```
sudo apt-get update  
sudo apt-get install gnuradio
```

On Windows:

- Download RadioConda
- Follow the installation instructions
[ryanvolz/radioconda: Software radio distribution and installer for conda \(github.com\)](#)

Device Driver:

- For window users, the driver of the hardware is required

Note:

- For different objectives, additional package needs to be installed



GNURadio Users Interface

The screenshot shows the GNU Radio Companion (GRC) interface. A large red oval encircles the main workspace, which includes the 'Options' and 'Variable' panels on the left and the 'Components Box' on the right. The 'Options' panel shows 'Title: Not titled yet', 'Output Language: Python', and 'Generate Options: QT GUI'. The 'Variable' panel shows 'ID: samp_rate' and 'Value: 2.16M'. The 'Components Box' on the right lists various blocks under a 'Core' category, including Audio, Boolean Operators, Byte Operators, Channel Models, Channelizers, Coding, Control Port, Debug Tools, Deprecated, Digital Television, Equalizers, Error Coding, File Operators, Filters, Fourier Analysis, GUI Widgets, Impairment Models, Instrumentation, IQ Correction, Level Controllers, Math Operators, Measurement Tools, Message Tools, Misc, and Modulators. A red arrow points from the 'Level Controllers' block in the Components Box to the 'Notification windows' area at the bottom left. The 'Notification windows' area contains a terminal window with the following text: '<<< Welcome to GNU Radio Companion 3.10.10.0', '>>>', 'Block paths:', 'C:\Users\Mai Ngoc\grc_gnuradio', 'C:\Program', 'Files\PothosSDR\share\gnuradio\grc\blocks', 'Loading: "C:\Users\Mai Ngoc\Downloads\Test1.grc"', and '>>> Done'. The 'Programming Area' is the large central workspace where the signal flow graph is built.

Options

Title: Not titled yet

Output Language: Python

Generate Options: QT GUI

Variable

ID: samp_rate

Value: 2.16M

Programming Area

Components Box

Notification windows

<<< Welcome to GNU Radio Companion 3.10.10.0

>>>

Block paths:

C:\Users\Mai Ngoc\grc_gnuradio

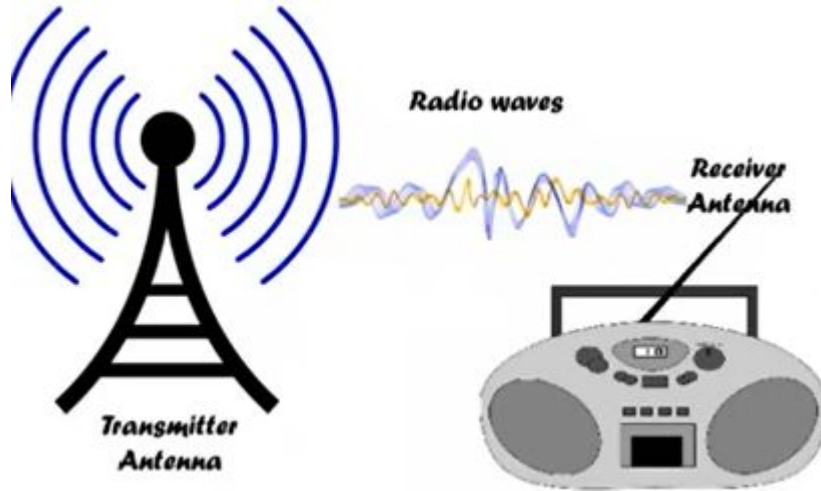
C:\Program

Files\PothosSDR\share\gnuradio\grc\blocks

Loading: "C:\Users\Mai Ngoc\Downloads\Test1.grc"

>>> Done

ID	Value
Imports	
Variables	
samp_rate	2160000.0



Demonstration

Required components



Antenna



Software Defined Radio KIT

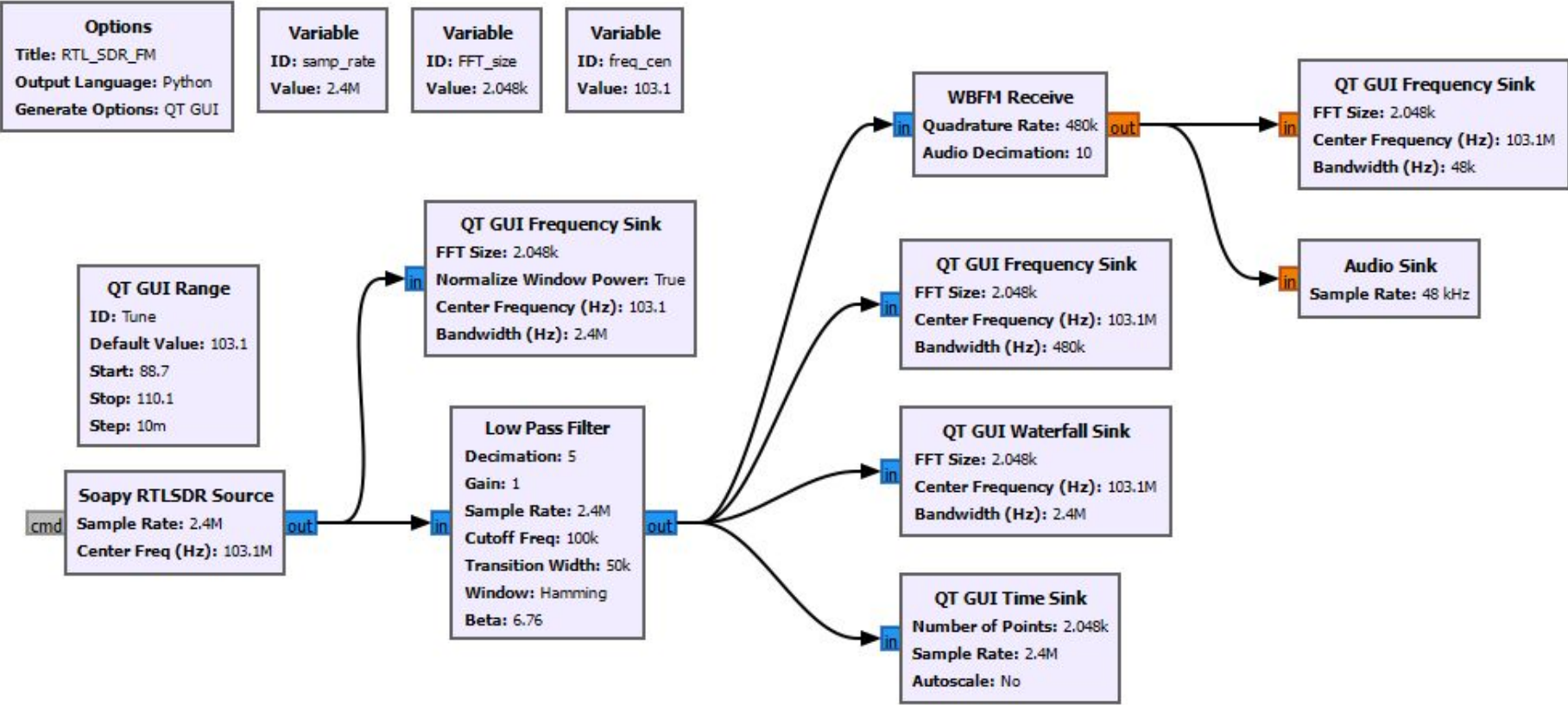


PC with GNUradio software

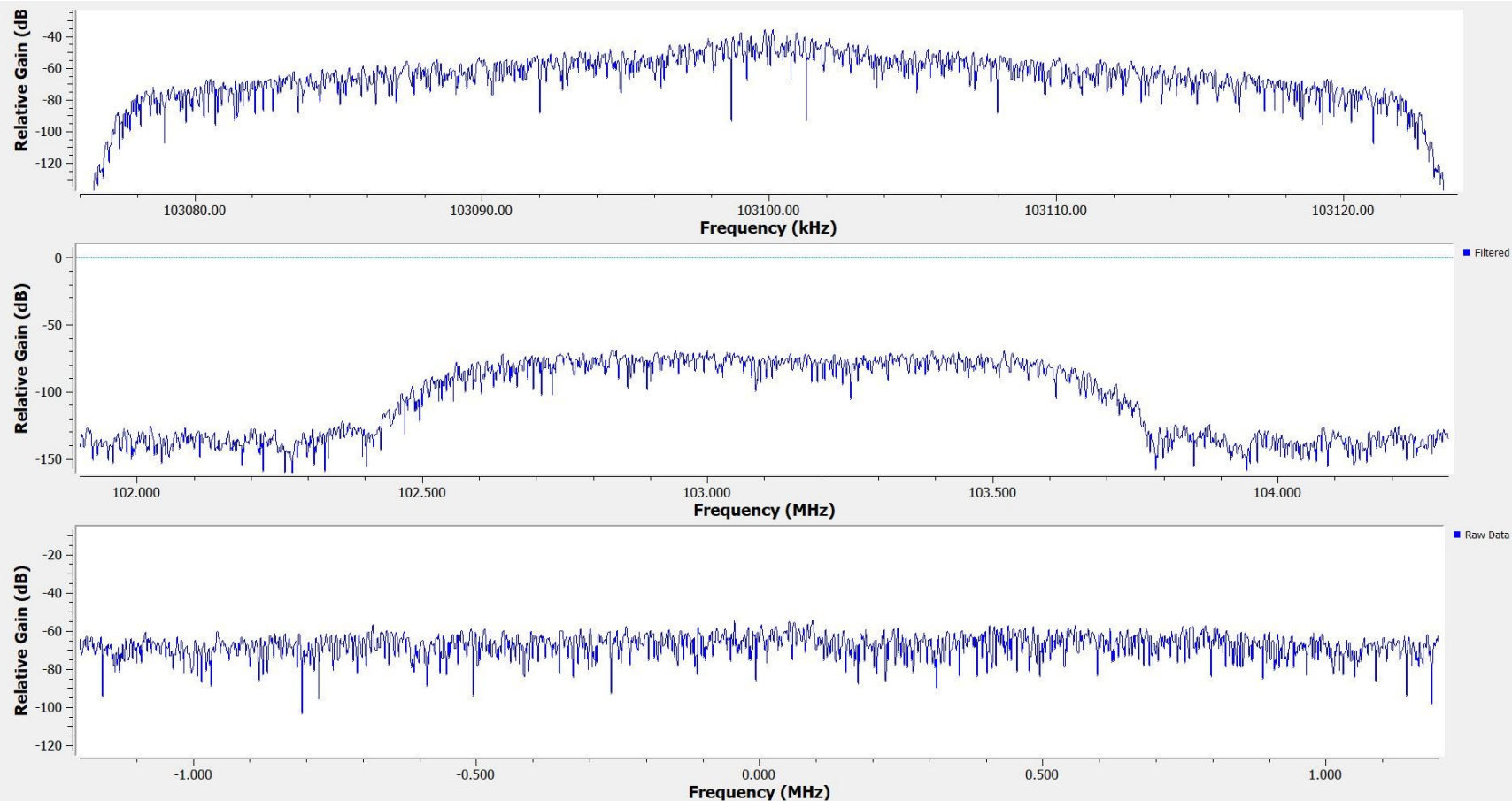


Coaxial Cable with SMA connector

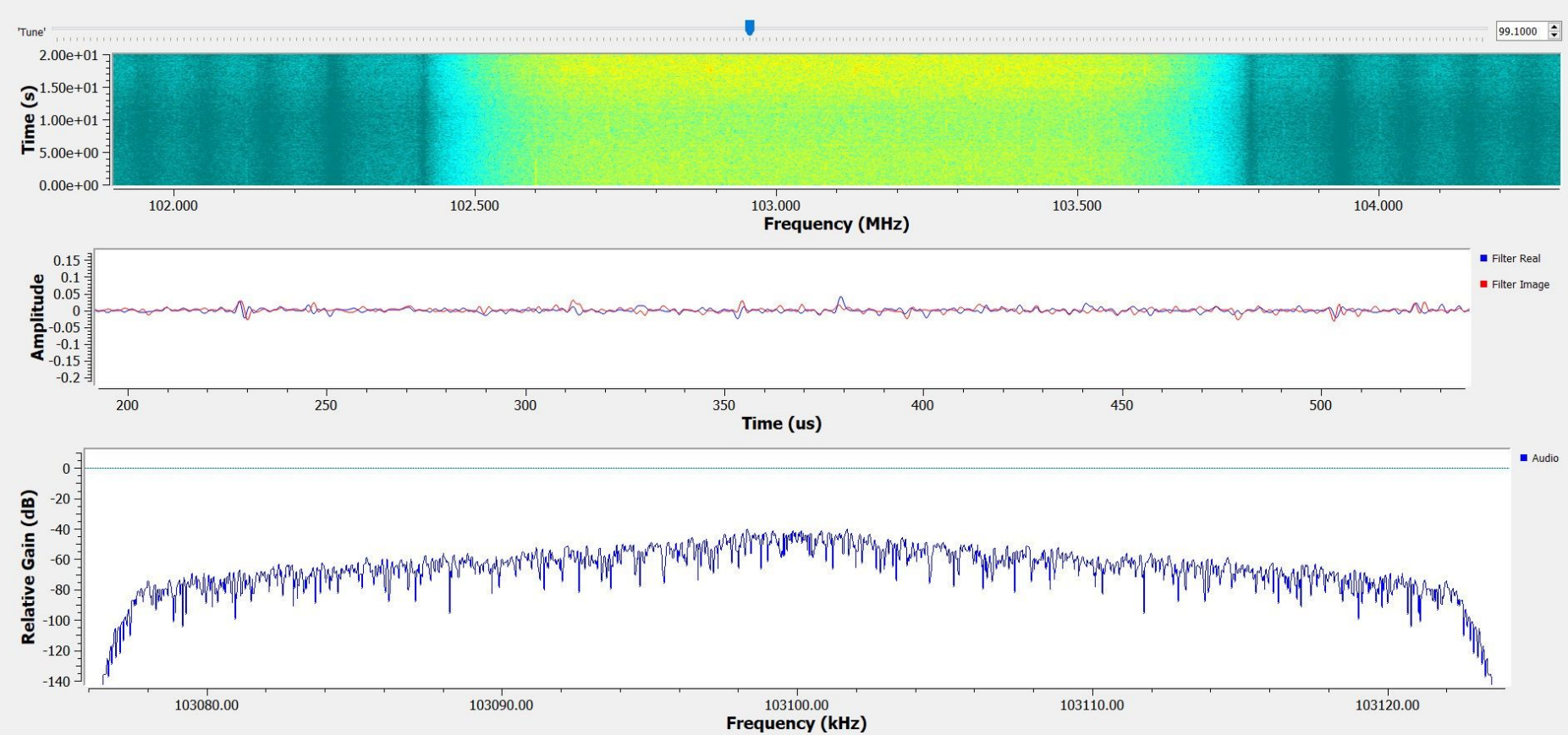
Functional Flow Block Diagram



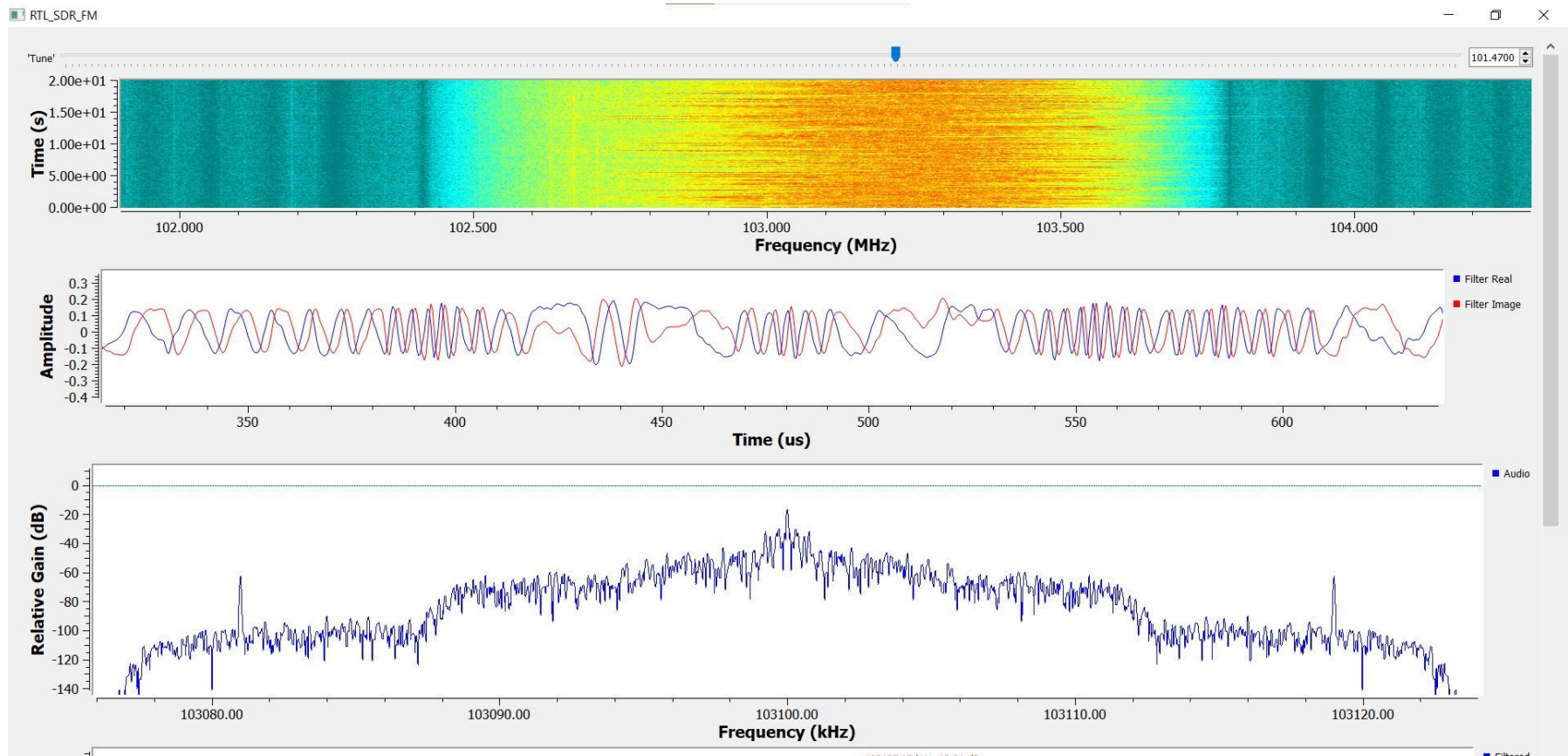
Demonstration results (1)



Demonstration results (2)



Demonstration results (3)



Conclusions

SDR is good tools kit for doing testing and demonstration the transmit and receive the radio signal.

GNURadio has a friendly user interface and easy to interact to the software, but the installation is difficult in some case.

Thank you very much for your listening