Advanced Topics in Computer Networks



Semester project presentation

Angelis Marios, AEM:2406 Charmanis Georgios, AEM:2443 **Project title:** FM station and receiver

Objectives: The objective of our project was to create an FM station and an FM receiver using as input 2 Adalm Pluto SDR devices. Also, we had to be able to decode the FM-RDS packets.

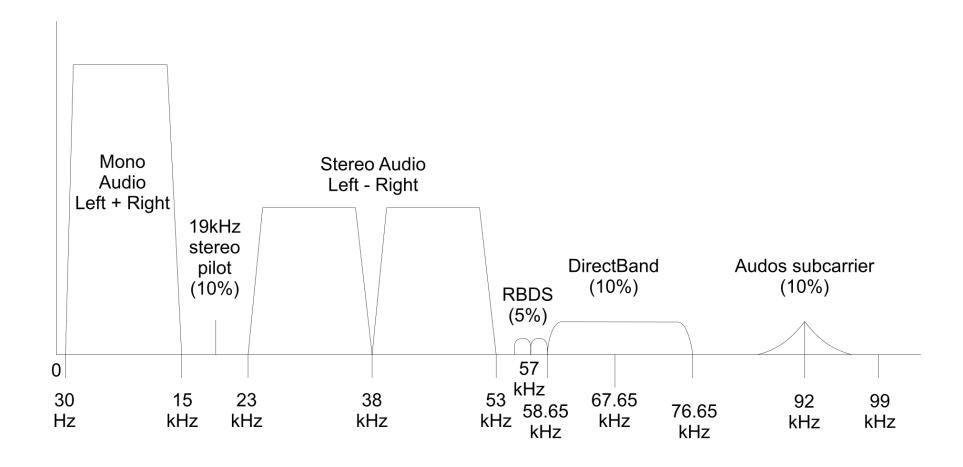
Extra objective: Implement a Stereo FM receiver and transmitter.

Implementation process:

- 1. Build the FM receiver and make it able to listen to our local existing FM radio frequencies.
- 2. Build the FM radio transmitter on the second device and achieve communication between the two components.
- 3. Add all the RDS setting to the receiver from the existing radio stations.
- 4. Add all the RDS setting to the transmitter and configure it.
- 5. Implement the STEREO mode on the receiver from existing stereo stations.
- 6. Implement the STEREO mode on the transmitter and configure it.



FM broadcasting

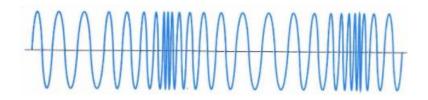




Hardware and software that we used

Hardware:







Software:





FM receiver with rds



Variable ID: samp_rate Value: 384k Variable ID: BW Value: 100M

Import
Import: math

WX GUI Slider

ID: volume Label: volume Default Value: 0 Minimum: 0 Maximum: 2 Converter: Float

WX GUI Chooser

Label: FM stations Default Value: 81M

ID: tuner

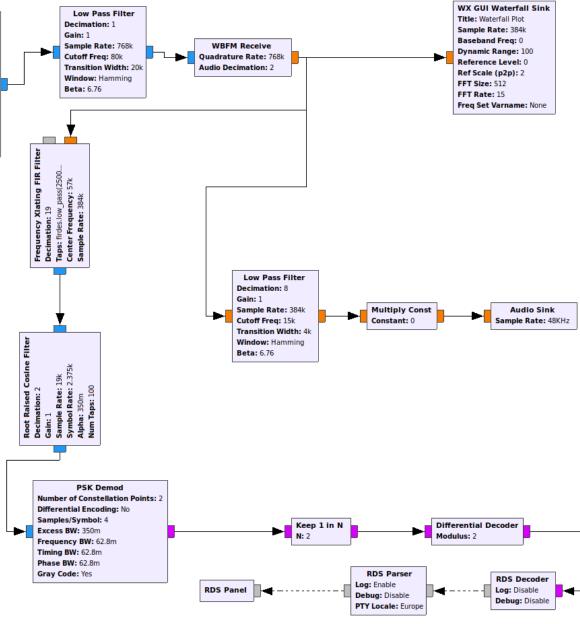
Choices: [96.7e6,96.0e6,91... Labels: ["96.7FM","96.0FM"... Type: Radio Buttons PlutoSDR Source Device URI: ip:192.168.3.1 LO Frequency: 81M Sample rate: 768k

RF bandwidth: 300k
Buffer size: 1.04858M
Quadrature: False
RF DC: False

BB DC: True Gain Mode: Manual Manual Gain (dB): 64

Filter:

Filter auto: True



FM station with rds

Options

WX GUI Chooser

ID: transmit frequency

Label: FM stations Default Value: 81M

Type: Radio Buttons

WX GUI Slider ID: volume

Label: volume

Minimum: 0

Maximum: 3

Variable

ID: outbuffer Value: 0

Variable

ID: sample rate

WX GUI Slider

Default Value: 500m

Value: 384k

ID: rds gain

Minimum: 0 Maximum: 3 Converter: Float

WX GUI Slider

Default Value: 8

Converter: Float

ID: signal gain

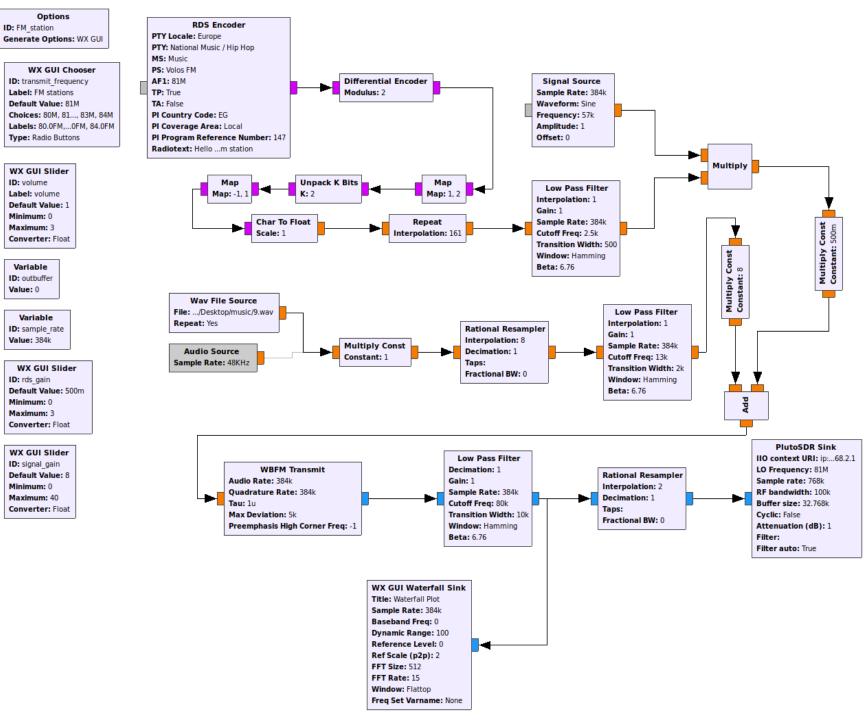
Minimum: 0

Maximum: 40

Default Value: 1

Converter: Float

ID: FM station



Stereo FM receiver with rds

Options ID: top block PlutoSDR Source Generate Options: WX GUI Device URI: ip:192.168.3.1 LO Frequency: 81M Low Pass Filter Sample rate: 768k Variable Variable Decimation: 1 RF bandwidth: 300k ID: samp rate ID: BW Gain: 1 Buffer size: 1.04858M **WBFM Receive** Value: 384k Value: 100M Sample Rate: 768k Quadrature: False Quadrature Rate: 768k Cutoff Freq: 80k RF DC: False Audio Decimation: 2 Transition Width: 20k Import BB DC: True Import: math Window: Hamming WX GUI Waterfall Sink Gain Mode: Manual Beta: 6.76 Title: Waterfall Plot Manual Gain (dB): 64 **WX GUI Slider** Sample Rate: 384k ID: volume Baseband Freq: 0 Filter auto: True Label: volume Dynamic Range: 100 Reference Level: 0 Default Value: 0 Minimum: 0 Ref Scale (p2p): 2 FFT Size: 512 Maximum: 2 FFT Rate: 15 Converter: Float Freq Set Varname: None WX GUI Chooser ID: tuner Label: FM stations Default Value: 81M Subtract Choices: [96.7e6,96.0e6,91... Labels: ["96.7FM","96.0FM".. Type: Radio Buttons **Complex To Real**

PSK Demod Number of Constellation Points: 2 Differential Encoding: No Samples/Symbol: 4

Excess BW: 350m Frequency BW: 62.8m Timing BW: 62.8m Phase BW: 62.8m Gray Code: Yes Audio Sink Sample Rate: 48KHz

RDS Parser

PTY Locale: Europe

Log: Enable

Debug: Disable

Differential Decoder

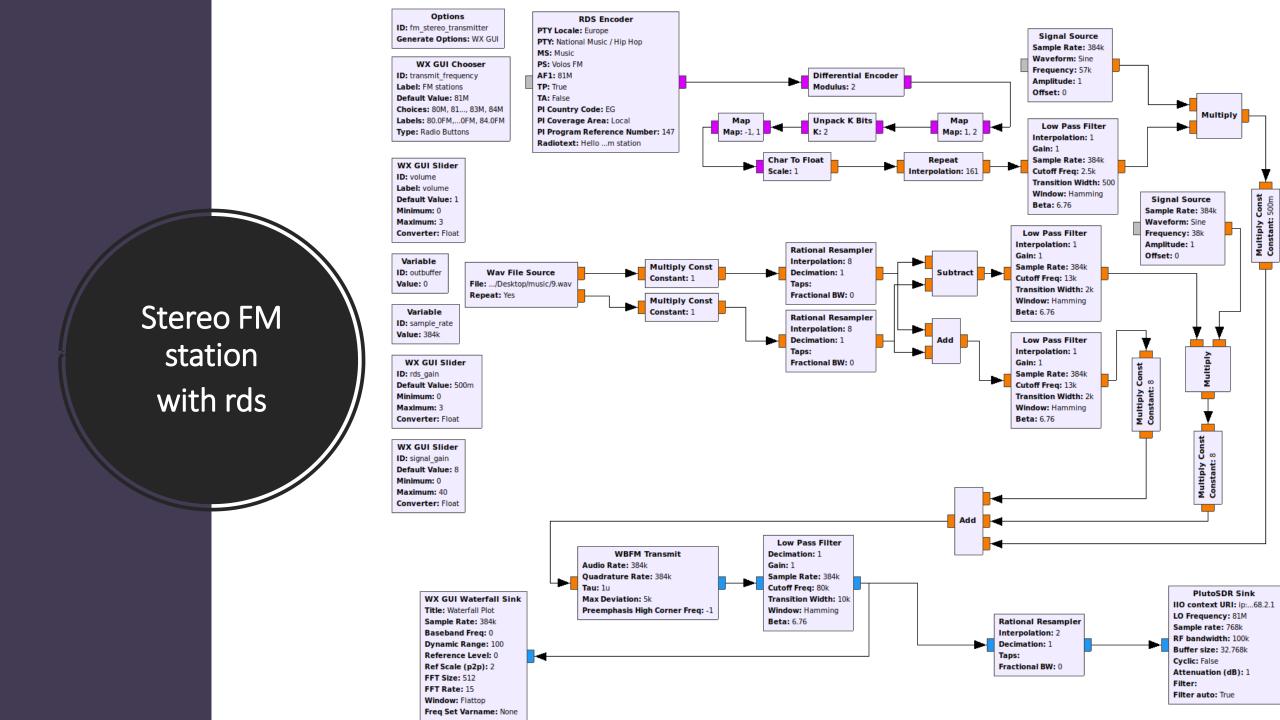
RDS Decoder

Debug: Disable

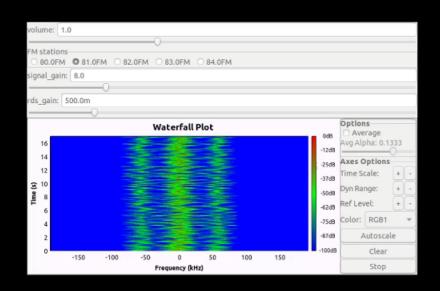
Log: Disable

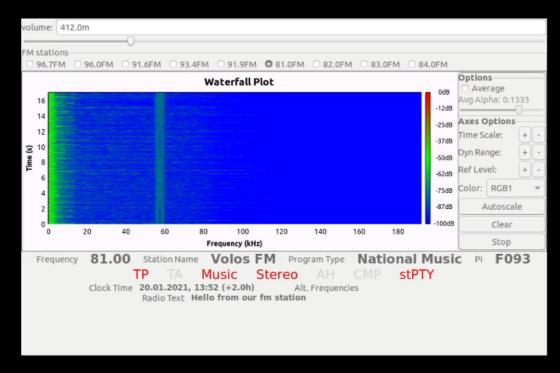
Keep 1 in N

RDS Panel

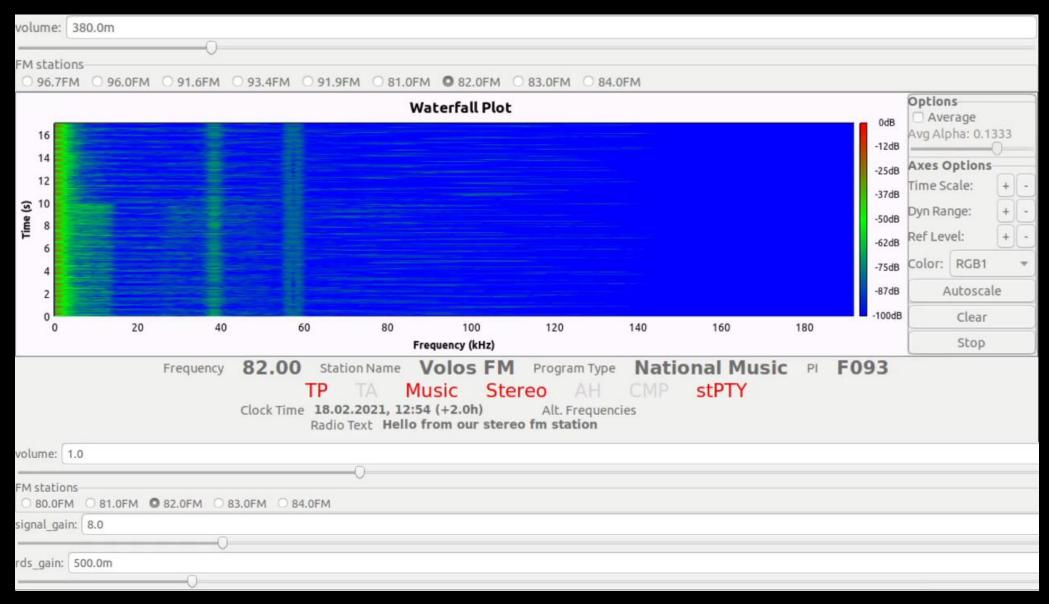


FM station and receiver with rds demo





Stereo FM station and receiver with rds demo



Any Questions?