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Implementation of Band-rejection filter

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What is Gnu radio?

GNU Radio is a software library, which can be used to develop complete applications for radio engineering and signal processing.

Introduction

GNU Radio is a free and open-source software development toolkit that provides signal processing blocks to implement software radios. It can be used with readily-available low-cost external RF hardware to create software-defined radios, or without hardware in a simulation-like environment.

GNU Radio is licensed under the GNU General Public License (GPL) version 3. All of the code is copyright of the Free Software Foundation. While all the applications are implemented using python language while critical signal processing path is done using C++ language.

Idea behind GNURADIO

The goal is to give ordinary software people the ability to 'hack' the electromagnetic spectrum, i.e. to understand the radio spectrum and think of clever ways to use it.

Why GNURADIO

Instead of purchasing multiple expensive radios, a single generic radio can be implemented using gnu radio software and with support of minimal hardware to receive and transmit processed signal at required frequencies and any data type can be passed from one block to another i.e.it can be in bits, bytes, vectors, bursts or more complex data types

Since the performance critical blocks are implemented in C++ using processor floating point extensions the developers are able to implement real-time, high-throughput radio systems in a simple-to-use, rapid-application-development environment.

One can use it to write applications to receive data out of digital streams or to send data into digital streams, which is then transmitted using hardware. GNU Radio has filters, channel codes, synchronisation elements, equalizers, demodulators, vocoders, decoders, and many other elements which are called as blocks that are typically found in radio systems.

Features

The main features of gnu radio are **flexibility** and **configurability.**

Extending GNU Radio is also quite easy, if you find a specific block that is missing you can quickly create and add it.

What is Band-rejection filter?

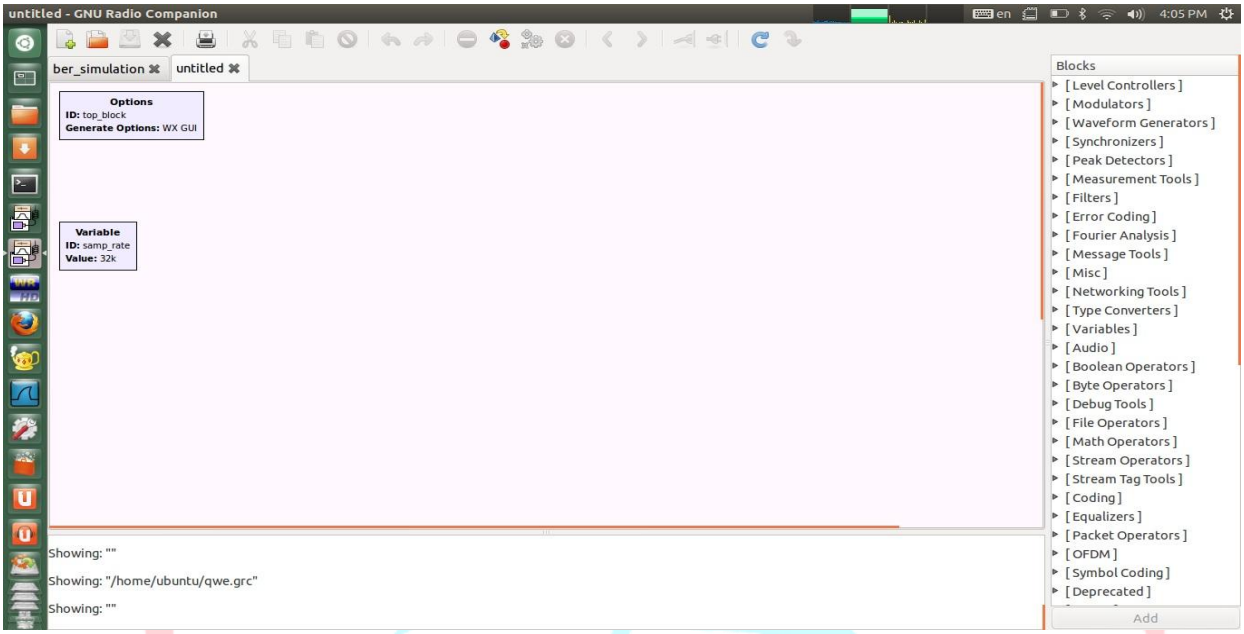
In signal processing, a band-stop filter or band-rejection filter is a filter that passes most frequencies unaltered, but attenuates those in a specific range to very low levels. It is the opposite of a band-pass filter. A notch filter is a band-stop filter with a narrow stopband (high Q factor).

Narrow notch filters (optical) are used in Raman spectroscopy, live sound reproduction (public address systems, or PA systems) and in instrument amplifiers (especially amplifiers or preamplifiers for acoustic instruments such as acoustic guitar, mandolin, bass instrument amplifier, etc.) to reduce or prevent audio feedback, while having little noticeable effect on the rest of the frequency spectrum (electronic or software filters). Other names include 'band limit filter', 'T-notch filter', 'band-elimination filter', and 'band-reject filter'.

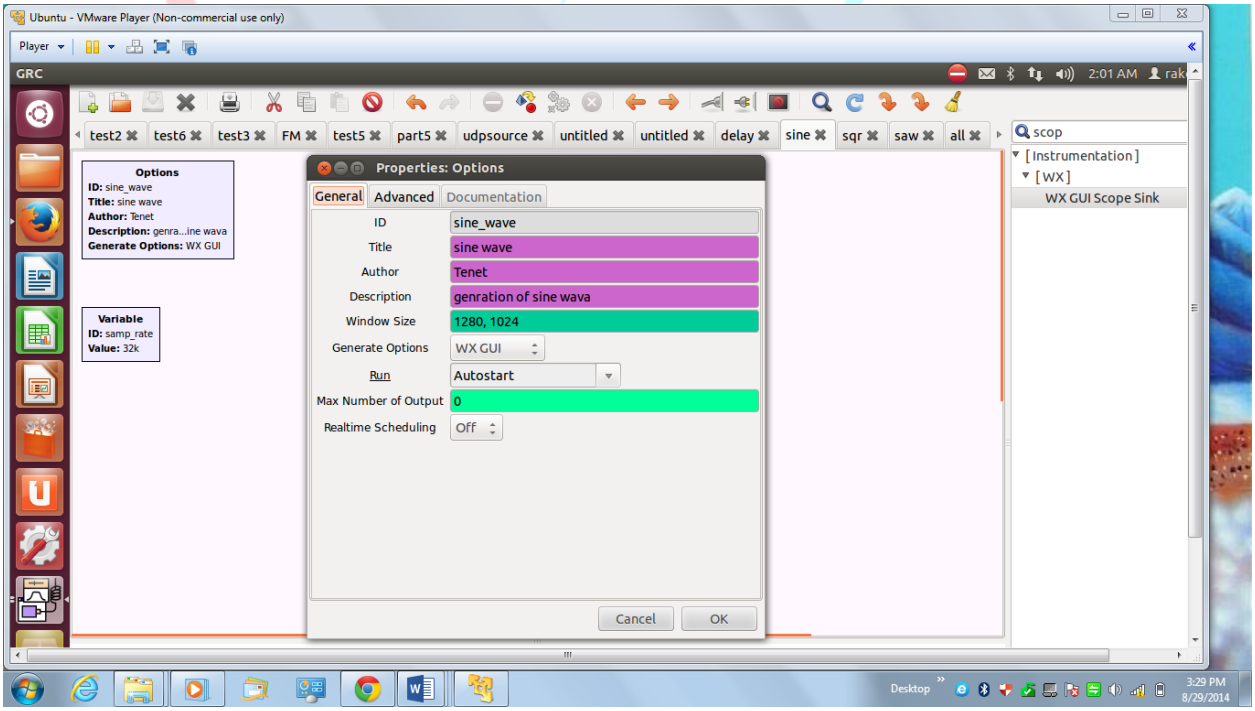
Typically, the width of the stopband is 1 to 2 decades (that is, the highest frequency attenuated is 10 to 100 times the lowest frequency attenuated). However, in the audio band, a notch filter has high and low frequencies that may be only semitones apart. A bandpass filter allows signals within a selected range of frequencies to be heard or decoded, while preventing signals at unwanted frequencies from getting through. A bandpass filter also optimizes the signal-to-noise ratio and sensitivity of a receiver.

Band-rejection filter

The GNUradio Companion with basic blocks (Options block and Variable block)

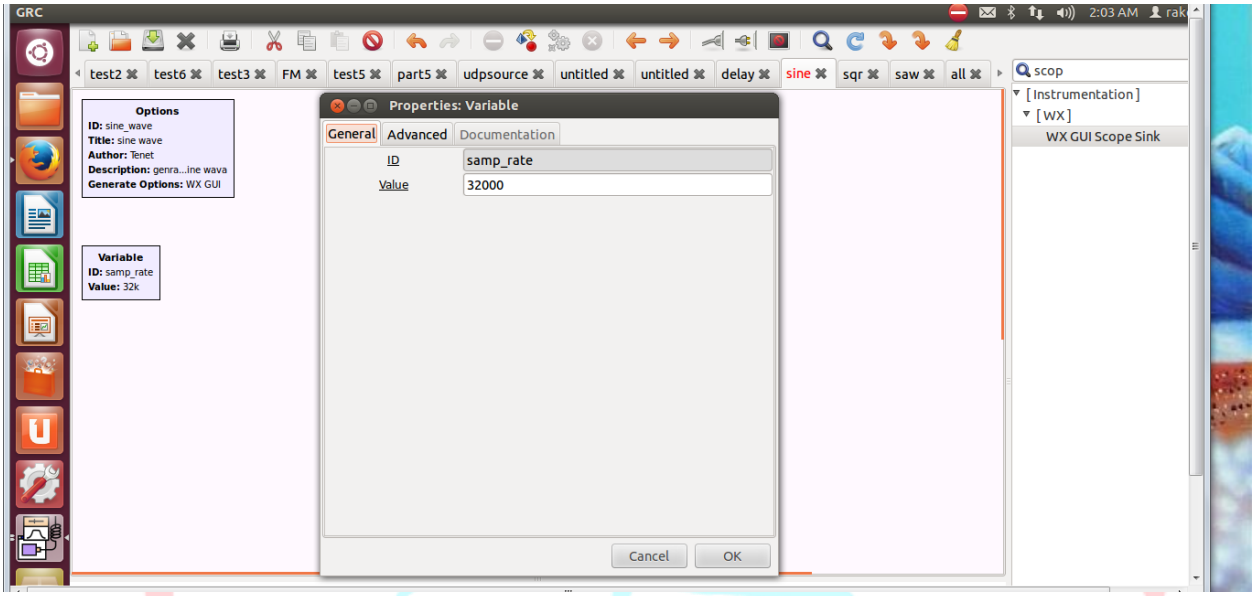


Options block defines the ID, Title and Description of the experiment.



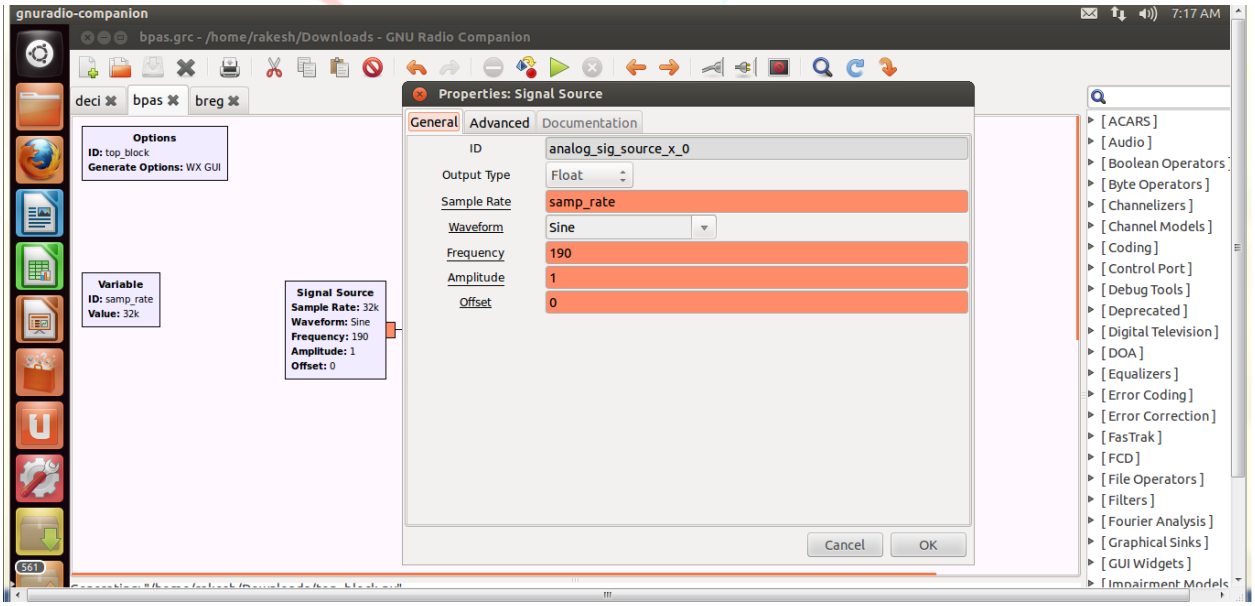
Variable Block defines to declare variables globally. This block maps a value to a unique variable. This variable block has no graphical representation. The variable can be referenced (by ID) from other blocks in the flowgraph.

- ID = samp_rate
- Value = 32000Hz

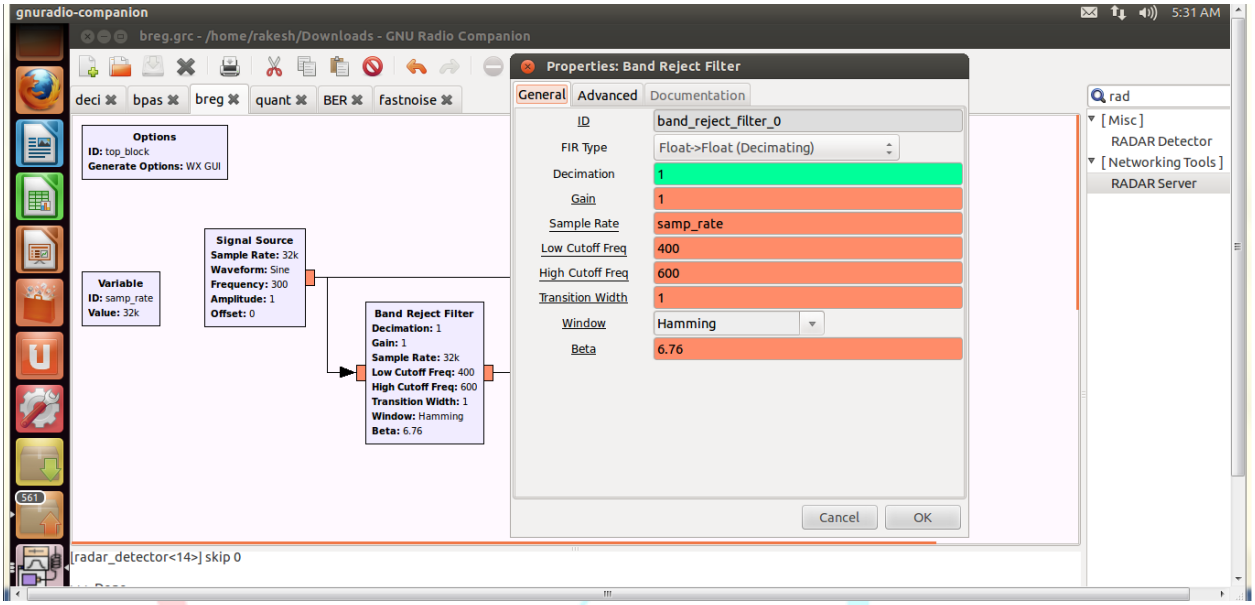


Signal source is a wave form genrator. Very first block genrates the sine wave, second block genrates the square wave, third block genrates triangler wave and finaly fourth block genrates the sawtooth waveform.

- ID:analog_sig_source_0
- Output type: float
- Freq: 190Hz

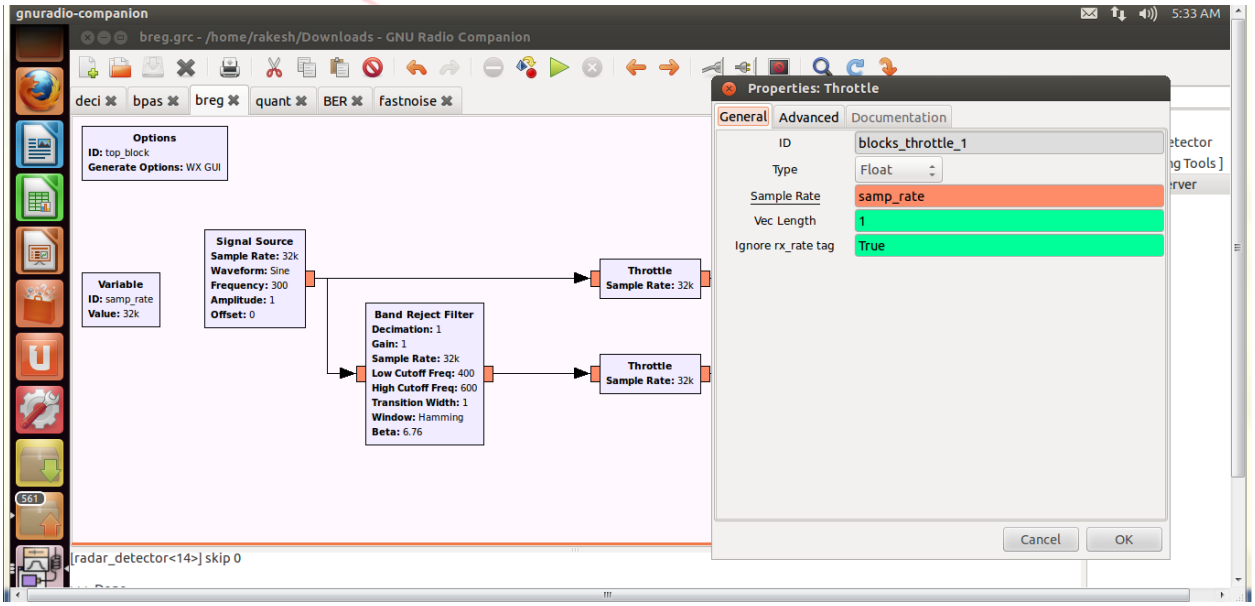


Band-rejection filter: This filter is a convenience wrapper for an fir filter. Sample rate, cutoff freqency and transition width are in Hertz.
ID: band_reject_filter_0
Type: float
Low cutoff freq: 400Hz
High cutoff freq: 600Hz



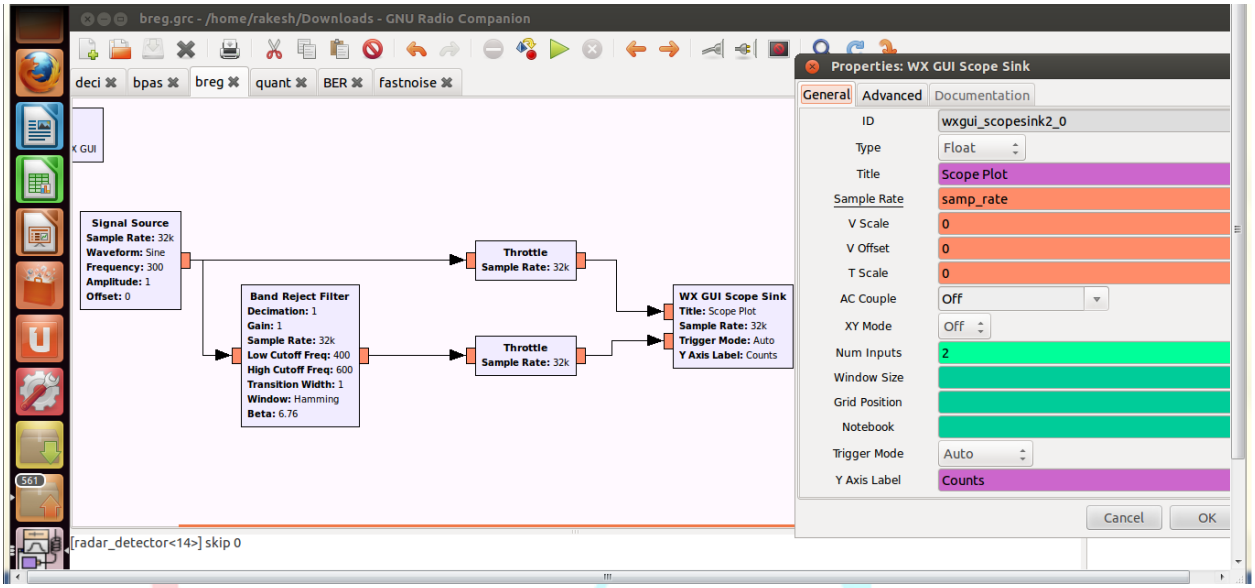
Throttel block: Throttel is a device that control the flow of samples such that average rate does not exceeds samples/sec. Throttle is used because no hardware interface has done.

- ID: blocks_throttel
- Type: float
- Vec length: 1

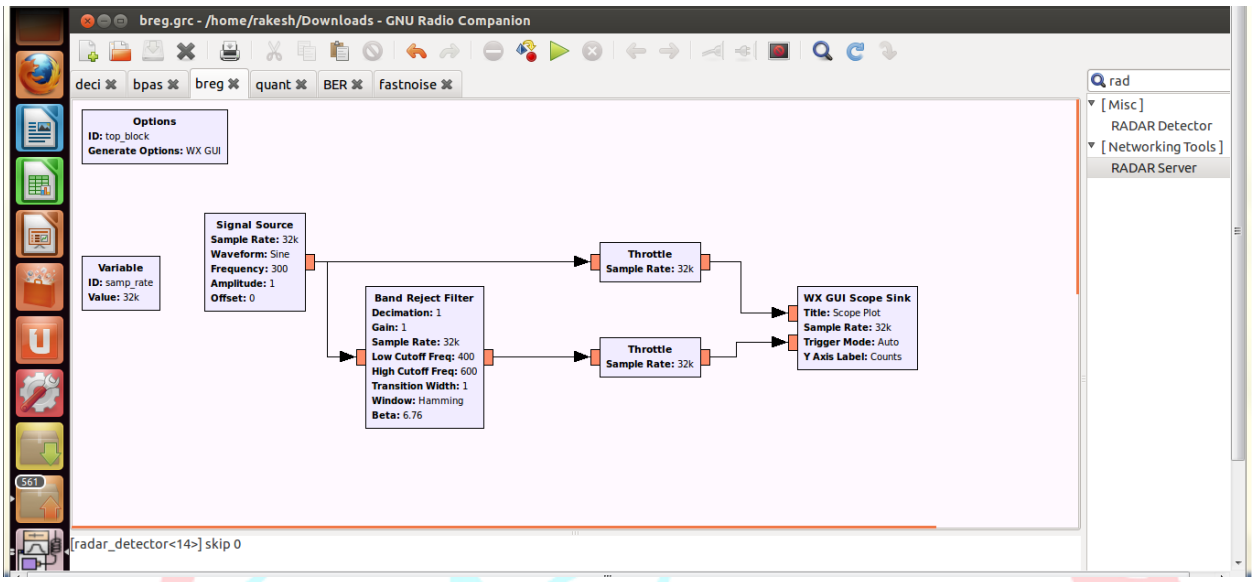


WX GUI scope sink: The WX GUI Scope sink is the destination block of the flow chart. This block is used to view the time domain representation of the output. The simulation output of the received signal is seen with this block.

- ID: wxgui_scopesink2_0
- Type: float



The Complete block representation



Genrated output