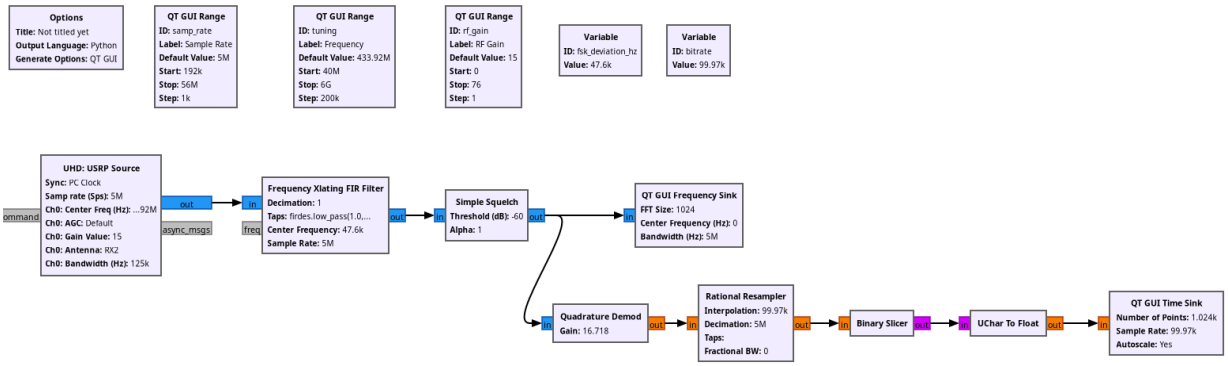
Arduino Tx and First-Time NOAA Reception

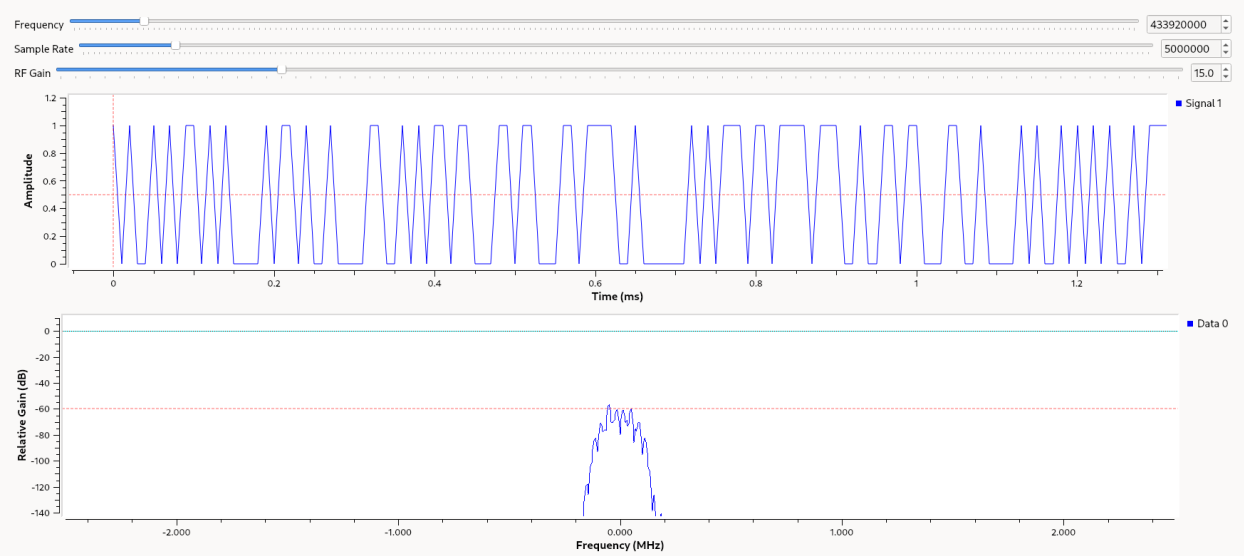
This document contains information on the progress with the Arduino UNO device, as well as a first (unsuccessful) attempt at NOAA reception.

Arduino Tx

The Arduino UNO devices are currently being used to send data in byte form, using a 2-FSK modulation scheme. The transmission end uses a CC1011 device, that has an SMA connector. 2-FSK stands for binary frequency shift keying, so for each bit, a high or low frequency signal will be sent, centered around a carrier. The carrier is set to 433.82 MHz, with a frequency deviation of 47.60 kHz. This information can be found in the advtransmit file.



The above block code is what is contained in the BFSK.grc file, to demodulate the data. It is still not reliable, as decision-making algorithms need to be implemented, but the data is visually similar, when compared to the expected “Hello World” string in binary, which indicates that the devices are working as expected.



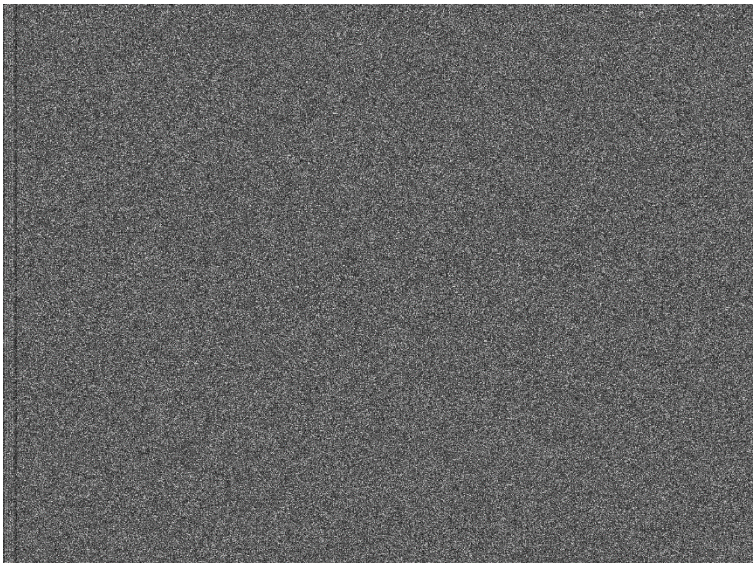
Above is the decimated signal, along with the spectrum. These were obtained by triggering the time and frequency sink blocks off of a falling edge, so that the plot wouldn't be lost due to framerate. I believe that when this was not being properly triggered, this is what caused the periodic fading in and out on the spectrogram, as the sampling rate was not an integer multiple of 1 second (transmission burst period) so it appeared to fade.

The time-domain bit stream is flawed, as no proper decision-making algorithm is used based on the appropriate samples per symbol. What is shown is the maximally interpolated-decimated signal, based on the 5MHz sampling rate of the SDR and the 99.97kHz bit rate. This results in only one sample per symbol, which causes many errors. Instead, the Arduino can be programmed for a 100kHz bit rate, drastically improving our samples per symbol.

The thing is though, is that we already have working Rx from a second Arduino device, so why bother developing this on the SDR? As mentioned previously, the devices have SMA connectors, so it is theoretically possible to actually hook it up to the antenna along with the RF amplifiers and filters.

First Attempt at NOAA reception

The first try was completely unsuccessful. On Friday morning, NOAA 18 was predicted to pass overhead, being visible in the SE direction. However, in probably the most unfortunate stroke of bad luck, an earthquake struck, rendering the terrace inaccessible due to safety concerns. I made the best of it, trying a nearby room with a window, however the roof of the building got in the way of the signal. Below is the "image" of the 15-minute pass.



There is a sync line to the left of the noise, showing some hope that this is receivable, but other than that, nothing.

This scan line was visible in the frequency plot as a tiny peak.

The coming days do not look promising for reception according to N2YO's 10-day predictions, but Friday April 12th at 10 AM could be possible for NOAA 18.

It seems that the best passes happen at night when the terrace is closed. There are so many things that get in the way that it begs the question if out-of-schedule roof access is possible.

Written by Jay Williams, April 7th 2024.