Transmit Dongle for Communications Lab

Abhin Shah
Karan Chadha
Kalpesh Krishna
Faculty Mentor : Shalabh Gupta

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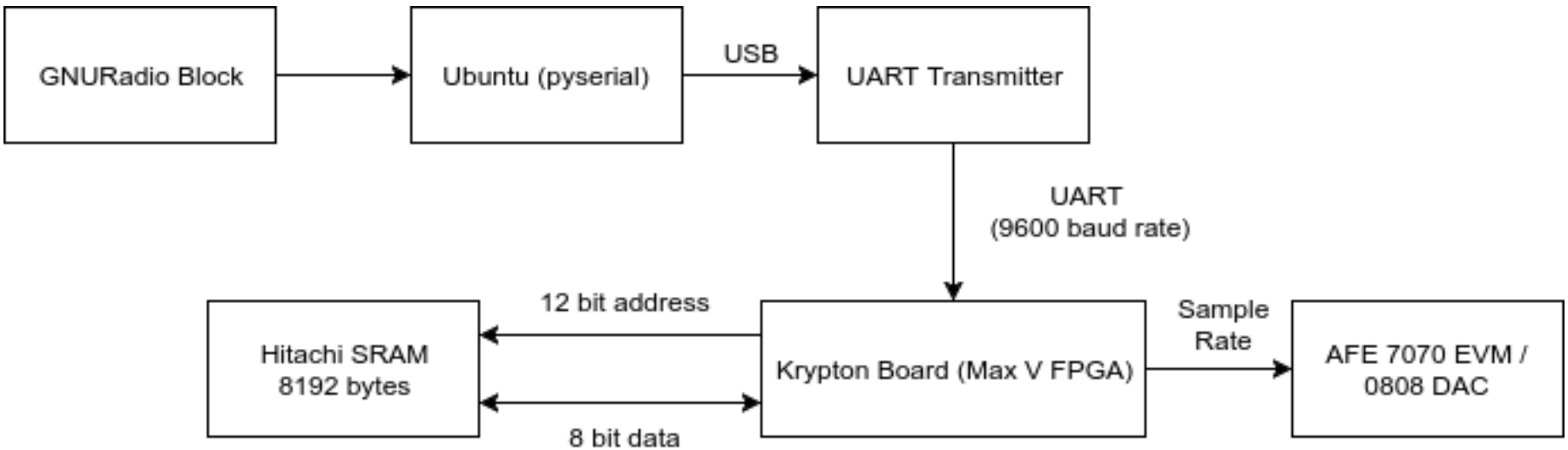
Outline

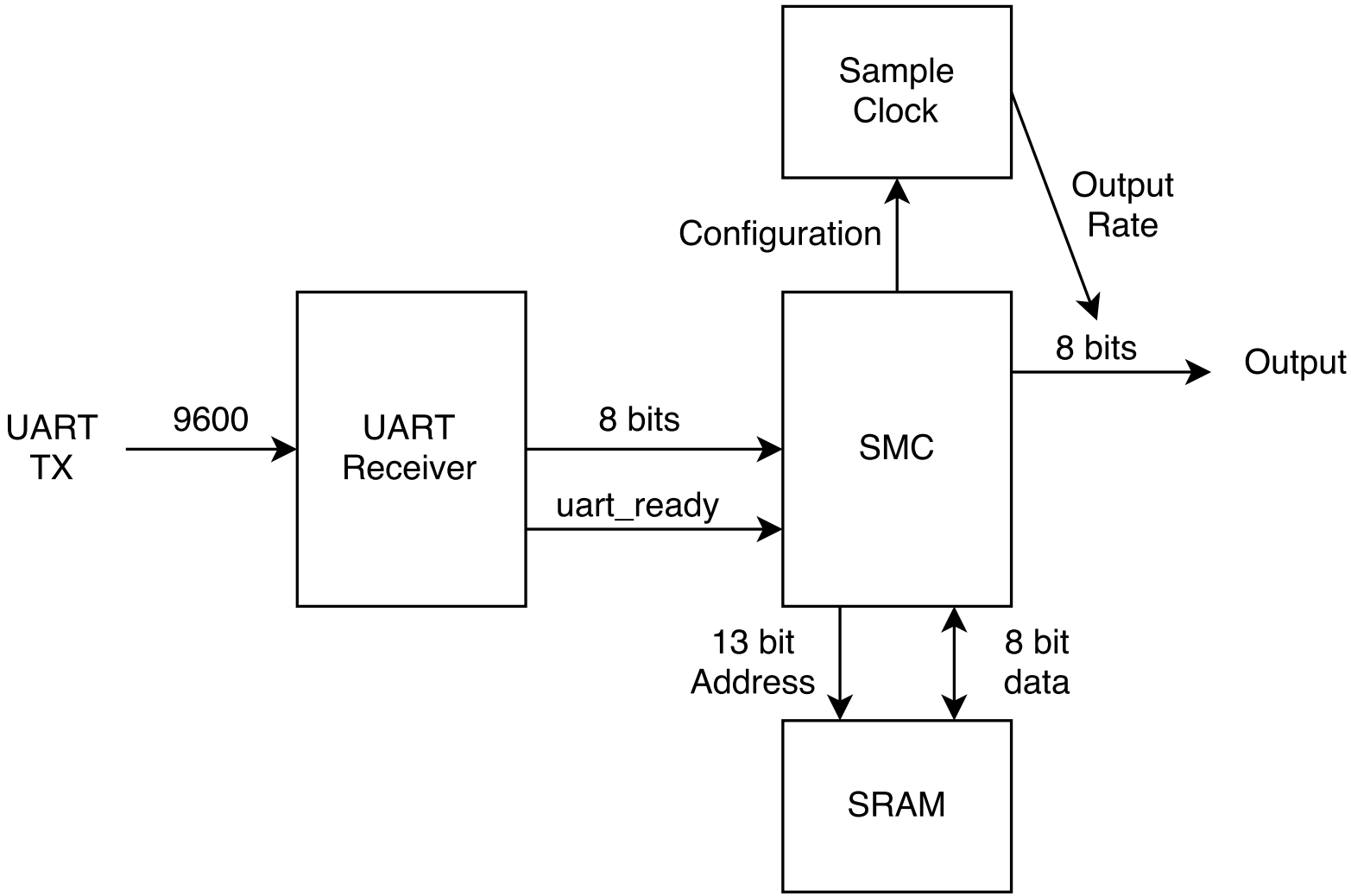
Motivation and Project Objectives

1. **Project Objectives -**
   - A low cost, portable transmit dongle compatible with GNURadio which can be used for our communication lab [EE340] at the very least.
2. **Motivation**
   - In communication lab, to generate any custom signal we need to generate the signal using PC and convert it into a specific format using a propriety software to use with the IQ Modulator Board.
   - Expensive alternatives (USRPs) cost around USD 1500, and therefore cant be used on a mass-scale.
   - The low cost receive dongle (10$ RTL-SDR) is available, but a similar low-cost hardware is not available for the transmitter. This motivates us to make a low-cost RF transmit-Dongle.

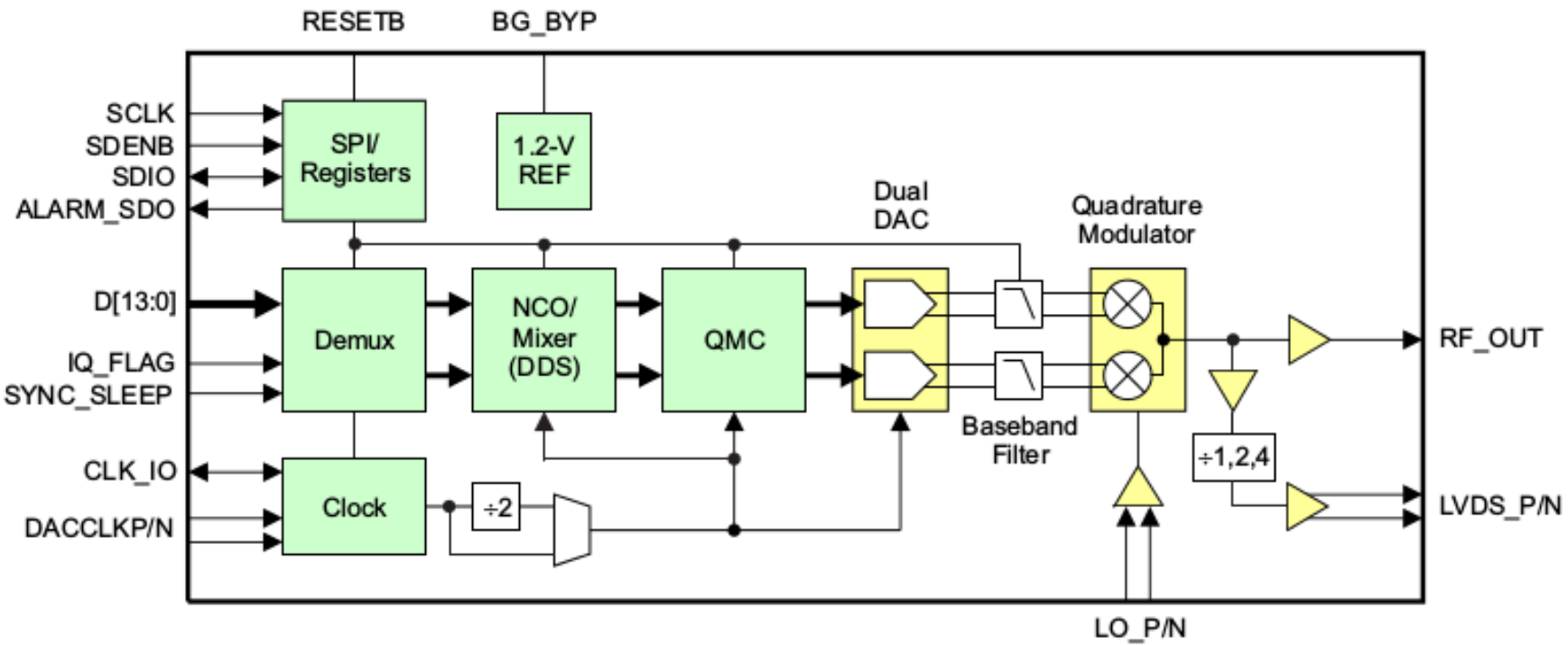
Overall Block Diagram



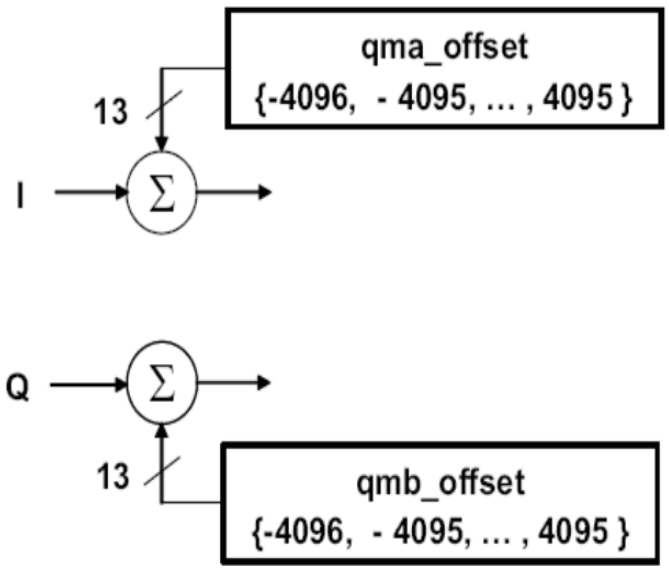
FPGA Block Diagram

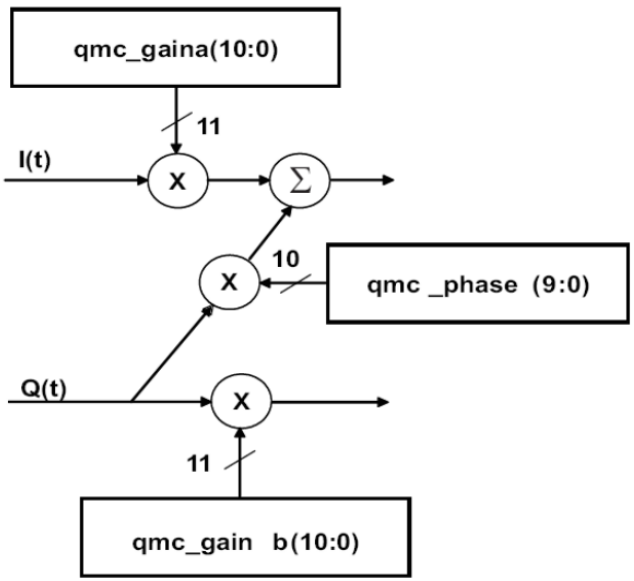


AFE7070 IC Block Diagram

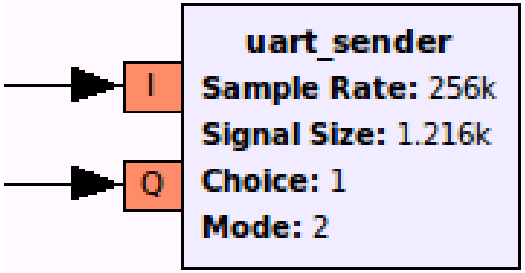


Quadrature Modulator Correction





GNURadio Module Diagram



1. `sample_rate` -This is the final sample rate of I & Q channels.
2. `signal_size` - The total number of samples that are to be sent and played in a loop
3. `mode` - The block can operate in phase mode or interleave I & Q signals at double the `sample_rate`
4. `choice` - FPGA Mode of operation

Results

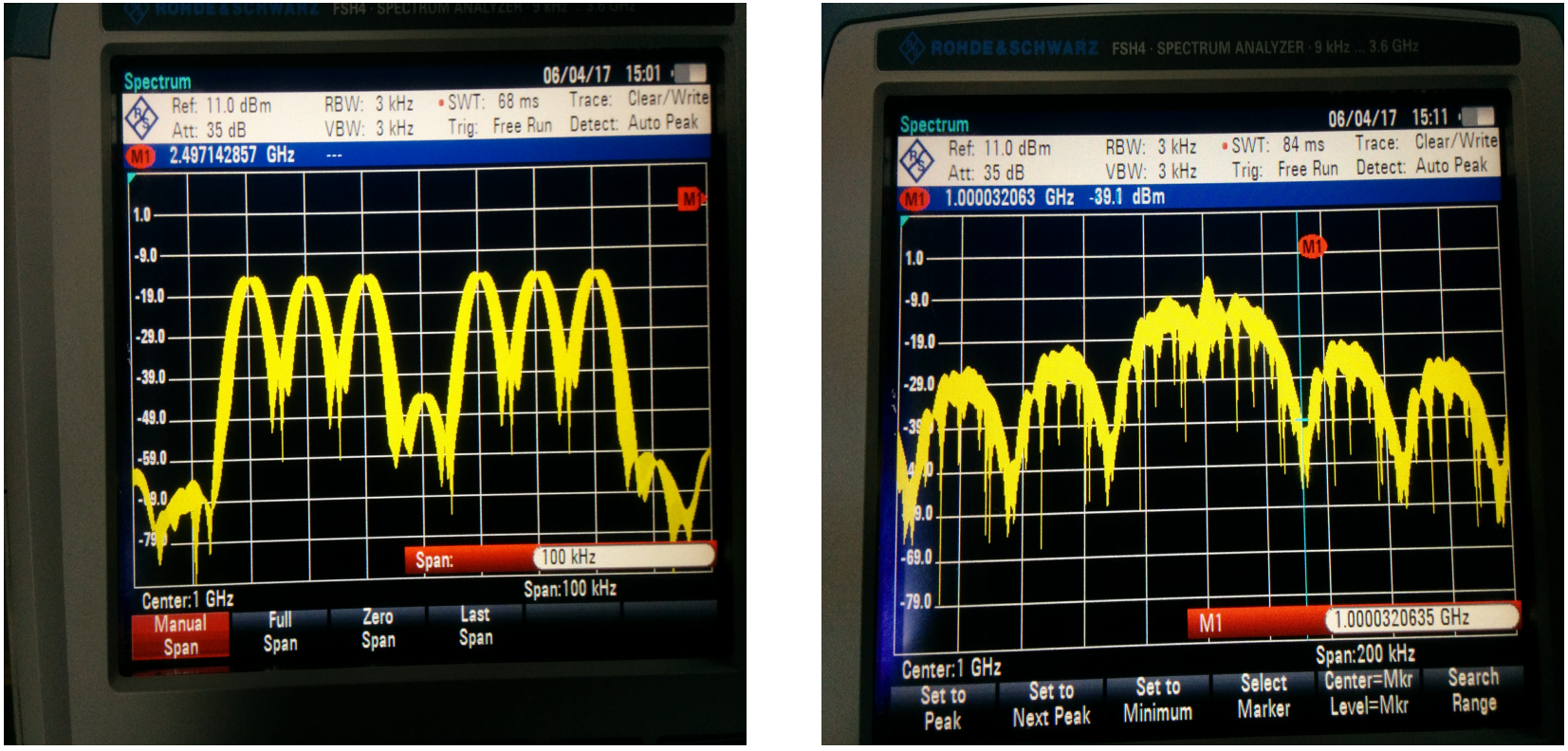


Figure : Spectrum Output for Sinusoidal and BPSK signals

Summary

1. **FPGA** - Accurate signals upto 5MSPS. Total storage capacity of 8192 samples.
2. **GNURadio** - Working UART Sender block that can configure and communicate with FPGA.
3. **AFE7070** - Accurate modulated signals at the local oscillator frequency and proper baseband signal on the 0808DAC circuit.

The other clock modes of the AFE7070 EVM could be explored further to get proper IQ modulation.

Thank You

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