Vehicle to Everything (V2X) Communications using Software Defined Radio to Demodulate Signals

Cole Moreno (cmoreno1999@yahoo.com)

Mentors: Dr. Peter Stubberud, Dr. Ebrahim Saberinia

Electrical Engineering, University of Nevada Las Vegas, Smart Cities REU

1. Introduction:

- Communication systems require modulation and demodulation to send messages wirelessly
- Modulation increases the message's energy to travel a longer distance; this changes the signal
- Demodulation decreases the message's energy and gets the original message back
- V2X creates a communication system that helps drivers make better decisions by connecting them to other vehicles, pedestrians, and infrastructures
- Software Defined Radio is an umbrella term in which parts of the communication system are built using software rather than hardware

2. Purpose/Aim:

- Determine if the Software Defined Radio infrastructure is a viable option for V2X systems
- Implement customized demodulation schematics through MATLAB and Simulink using the Software Defined Radio architecture

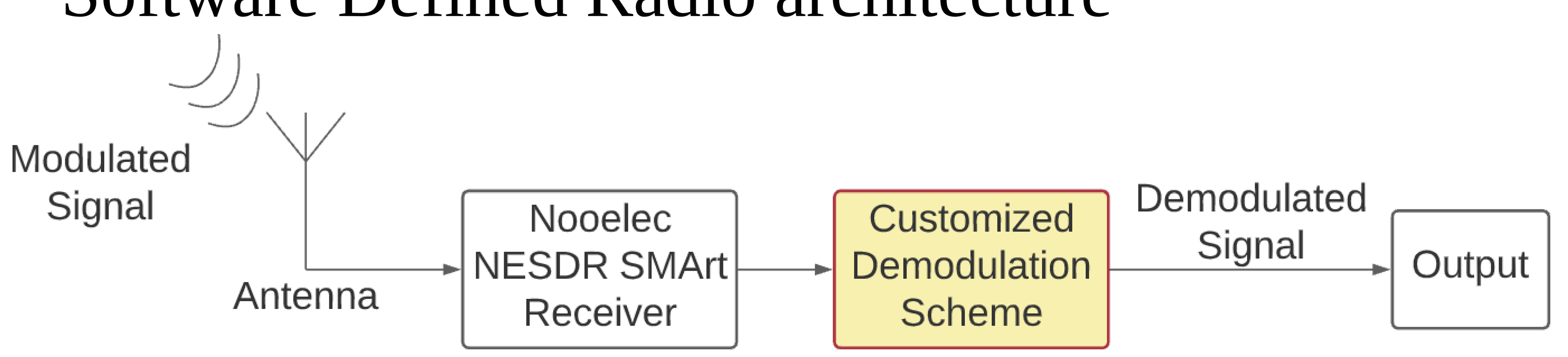

Fig 1: High Level Block Diagram

3. Methods:

- Antenna receives signal that is tuned from parameter inside MATLAB and Simulink
- The received signal then gets demodulated using customized code
- Output was tested with spectrum analyzer and speaker audio output
- The ideal output was the original signal without additional noise

4. Results:

- The output of the Amplitude Modulated Synchronous demodulation scheme had a noticeable amount of noise in Simulink
- The output the Amplitude Modulated Asynchronous demodulation scheme came out clear without much noise in Simulink
- The output the Frequency Modulated demodulation scheme came out clear without much noise in Simulink

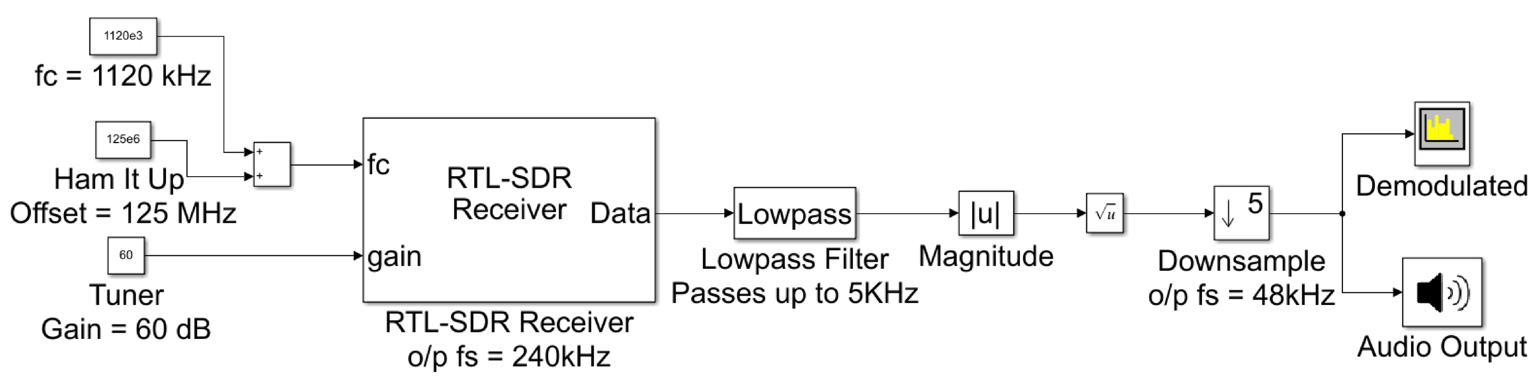

Fig 2: Amplitude Modulated Synchronous Simulink Block Diagram

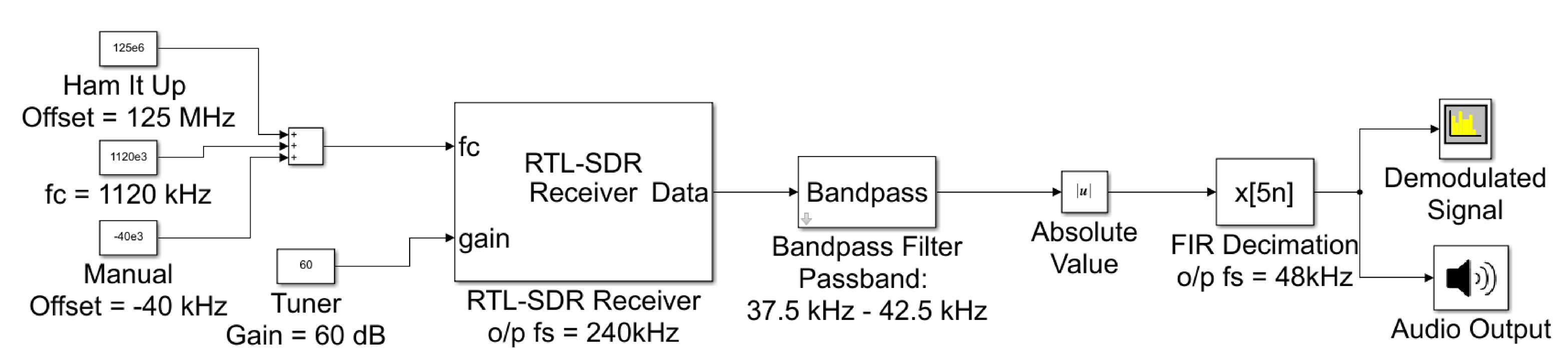

Fig 3: Amplitude Modulated Asynchronous Simulink Block Diagram

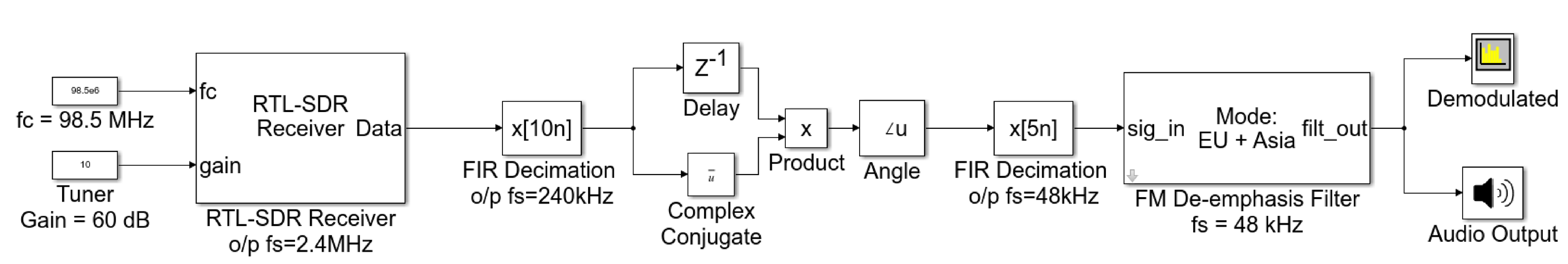

Fig 4: Frequency Modulated Simulink Block Diagram

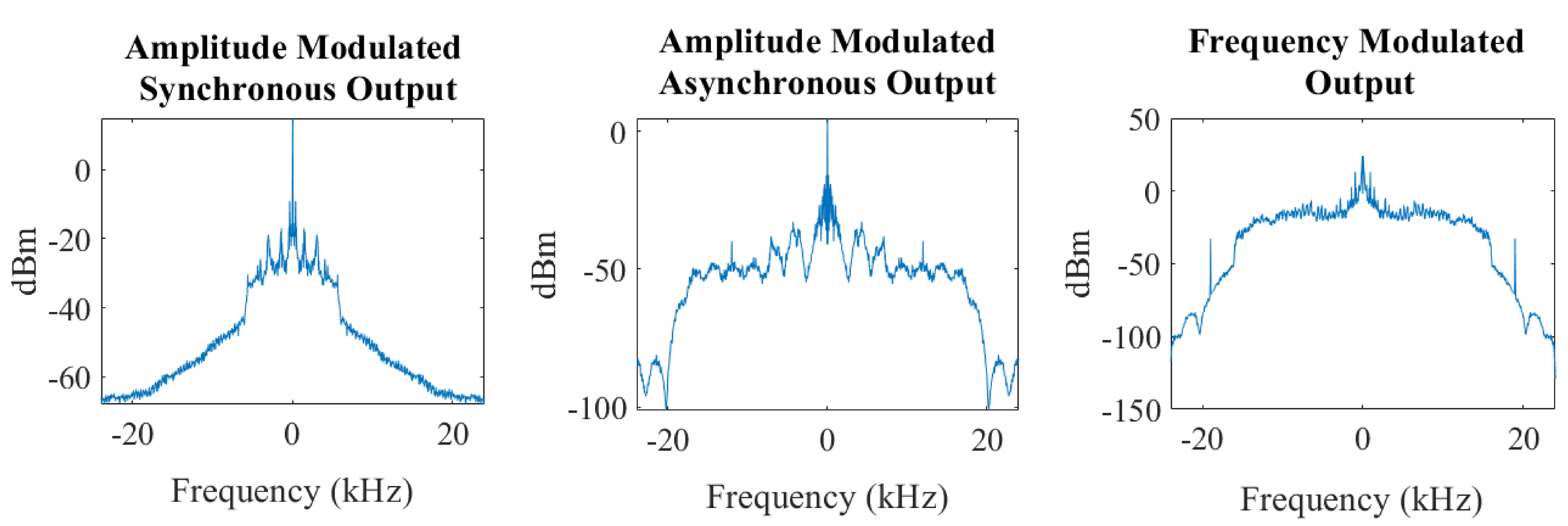

Fig 5: Simulink Output Plots. These plots will look different than the MATLAB output plots because the plots were taken at different times.

- The performance of the coded demodulation schemes was very similar to the block diagram performances for each demodulation scheme

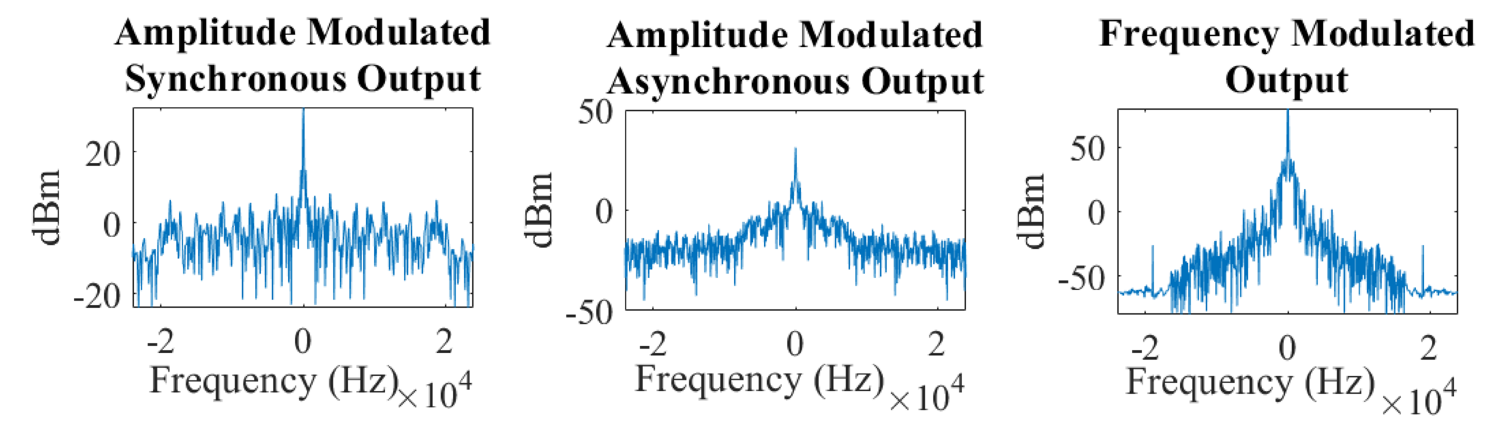

Fig 6: MATLAB Plotted Output. The plots will look different from the Simulink plotted outputs because the plots were taken at different times.

Fig 7: QR Code to MATLAB Code

5. Conclusions/Discussions:

- The Nooelec NESDR SMArt Receiver successfully interfaces with MATLAB and Simulink
- Successfully created demodulation schemes for both AM and FM signals
- Future research needs to focus on digital communication systems

Acknowledgements:

Peter Stubberud, Ph. D
Ebrahim Saberinia, Ph. D
Edgar Sanchez

UNLV HOWARD R. HUGHES COLLEGE OF ENGINEERING

NSF

Grant: #1950872