Laboratory: AM demodulation

1 Objective

Objectives of the lab:

- To implement AM DSB FC demodulation.
- To get familiar with an IQ-demodulator.
- To analyse AM demodulation.
- To get familiar with the GNURadio software and the concepts of software defined radios.

2 Requirements

Note: This lab requires some preparation, in terms of theoretical background as well as the use of the tools (Matlab/Octave, the m-files, etc.). Students who are unable to do the lab because they have not prepared will be asked to leave.

Instructions, source material and preparation required:

- You are required to have completed Item 1 and Item 2 before the lab starts. These two sections will be marked as a lab test.
- One microphone (that can be connected to the sound card of a PC) per group is needed for this lab.
- Lab partners must operate in groups of three (and no larger) and may help each other during the lab but each should use his/her own examples in all the exercises and write his/her own lab report.

Report: The report will take the form of the following group of files which should all be attached to a single email:

- An answer sheet (in PDF format) with your name and your lab partners' names and student numbers, the date and experiment name, and your results.
- All the m files used in the lab.
- All the GRC-files used in the lab.
- Your report should include an introduction, as well as a conclusion section, briefly explaining all important results.

3 Outcomes

1. AM DSB FC demodulation (in Matlab)

1.a. Sketch a block diagram of how AM DSB FC can be demodulated. Show the necessary equations.

1.b. Use the Matlab code from Lab 1 to generate an AM DSB FC signal modulated with a single tone of 1 kHz. Demodulate this signal in Matlab and compare the output with your input signal. Verify that the demodulator is working by noting the change in amplitude and frequency when the amplitude and frequency of the input signal is changed.

2. AM DSB FC demodulation using an IQ structure (in Matlab)

2.a. Sketch a block diagram of how AM DSB FC can be demodulated. Show the necessary equations.

2.b. Use the Matlab code from Lab 1 to generate an AM DSB FC signal modulated with a single tone of 1 kHz. Demodulate this signal in Matlab and compare the output with your input signal. Verify that the demodulator is working by noting the change in amplitude and frequency when the amplitude and frequency of the input signal is changed.

2.c. Compare the output of the IQ demodulation with the output obtained in Question 1.

3. AM DSB FC demodulation using the USRP

3.a. Sketch a block diagram of how AM DSB FC can be demodulated using the USRP. Show the necessary equations.

3.b. Use a second USRP to generate an AM DSB FC signal modulated with a single tone of 1 kHz. Demodulate this signal. The output should be displayed on both an Oscilloscope Sink and an FFT sink. Verify that the demodulator is working by noting the change in amplitude and frequency when the amplitude and frequency of the input signal is changed. Note that you are only allowed to make use of low-level blocks, such as Math operators and filters. The use of the high-level demodulation blocks are prohibited. Call the demonstrator to verify the results (The demonstrator has to sign your name off on a list).

4. AM DSB FC demodulation using the USRP with voice

4.a. As an input source for the transmitting USRP, use a microphone. Demodulate this signal at the receiving USRP. Call the demonstrator to verify the results (The demonstrator has to sign your name off on a list).