Laboratory: AM Modulation

1 Objective

Objectives of the lab:

- To get familiar at a high level of what the various AM modulation and demodulation techniques entail
- To observe the output-versus-input voltage characteristics of Amplitude Modulation Double Sideband Full Carrier (AM DSB FC) modulation.
- To gain some practical exposure to the AM concepts and algorithms presented in class.

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 do all the preparation needed to implement the algorithms beforehand.
- 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 sample text 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 uploaded to the course website:

- 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.
- Your report should include an introduction, as well as a conclusion section, briefly explaining all important results.

3 Outcomes

1. Single-tone injection

1.a. Work out by hand the expected frequency spectrum and output waveform when a sinusoidal signal of amplitude A_m and frequency of 10 kHz is used to modulate a AM DSB SC modulator with the carrier frequency to 1 MHz.

1.b. Simulate this system in Matlab and plot the output waveform and output spectrum. Call the demonstrator to verify the results (The demonstrator has to sign your name off on a list). Calculate the period and frequency of the carrier wave, as well as the period and frequency of the envelope (if present). (The calculations should be included in your report.)

2. AM Double sideband full-carrier modulation

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

2.b. Work out by hand the expected frequency spectrum and output waveform when a sinusoidal signal of 1 kHz is input to the AM DSB FC modulator, and 100 % modulation is achieved. Assume that the carrier frequency of the modulator is set to 1 MHz.

2.c. Generate a single tone of 1 kHz, input this to the AM DSB FC modulator and observe the output in Matlab. Change the output such that 100 % modulation is achieved. Call the demonstrator to verify the results (The demonstrator has to sign your name off on a list). Calculate the period and frequency of the carrier wave, as well as the period frequency of the envelope (if present). Also determine all important amplitude levels. (The calculations should be included in your report.)

3. Do the exact same steps as for Step 2, but now assume a modulation index of 50 %.

4. Do the exact same steps as for Step 2, but now assume a modulation index of 25 %.