AV332: Digital Communication Lab

Lab 1
DSBSC and AM using Emona DateX Kit — Date: 1st and 4th August 2016

1 Double side band suppressed carrier modulation and demodulation (DSBSC)

The objective of this lab session is to :

1. Revise the theory for DSBSC modulation and demodulation
2. Implement a DSBSC modulator and coherent demodulator using the Emona Datex kit
3. Study the effect of linear channel distortion
4. Study the effect of a phase difference and frequency offset in the demodulator's local carrier signal
5. Study the effect of a single tone interference

Task 1: With proper block diagrams write down what DSBSC modulation and coherent demodulation is. At each point in the signal flow, discuss the time domain and spectral representation of the signal for a general modulating signal $m(t)$ (with FT $X(f)$).
Task 2: Implement a DSBSC modulator and coherent demodulator using the components in the kit. Write down the block diagram that you have used, with the blocks labelled using the corresponding names on the kit. Use a single tone at $2kHz$ as the modulating signal $m(t)$. Use a $100kHz$ single tone as the carrier signal. Use the channel BPF on the kit as the communication channel. View the signals on your virtual instruments. Check the spectrum at different points in your system and include this in the report.
Now use a 2V peak to peak periodic triangular signal as the modulating signal $m(t)$. View the time domain signals and the spectral representations at different points in your system. Write down the theoretical spectral representations at different points in your system, and discuss the observed differences.
Task 3: Your task is to study how the channel distorts (linearly distorts) the transmitted signal. Use a square wave $0 - 2V$ with time period T_b as the modulating signal. If bandwidth is defined as the frequency range within which 90% of the total power lies, find out the bandwidth as a function of th time period T_b for $\frac{1}{T_b}$ in the range 10 kHz to 50 kHz (use a discrete step, max step size is $5kHz$).
The channel BPF on the kit has a passband of approximately 18 kHz. For the different values of T_b for the modulating signal $m(t)$ observe what fraction of the power in the bandwidth is passed through the channel. Observe the spectrum and time domain signals at different points in your system.
Task 4: In this task you will study the effect of phase difference and frequency offset in the demodulator's local carrier signal. Make your demodulator implementation such that the demodulator's local carrier's frequency f and phase ϕ can be tuned. Use a single tone at $2kHz$ as the modulating signal $m(t)$. Keeping $f = 100$ kHz vary ϕ and obtain the average power in the demodulated signal. Compare your results with that obtained theoretically. Consider the case where $\phi = 0$ but $f = 95kHz$. Obtain the average power in the demodulated signal and compare with theoretically obtained result. Write down your inferences.
Task 5: Use a modulating signal $m(t)$ of 2 kHz and a carrier of frequency 100 kHz. Add a single tone interference at frequency f_i. Observe the time domain signal and spectrum at different points in your system. Write down the theoretical output expected from your demodulator (assuming filters are ideal). Compare the theoretical results with what you have obtained.