Cairo University - Faculty of Engineering
Computer Engineering Department
Communication Engineering (ELC3252A6) – Fall 2020

Final Project

Team 25

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Q1)

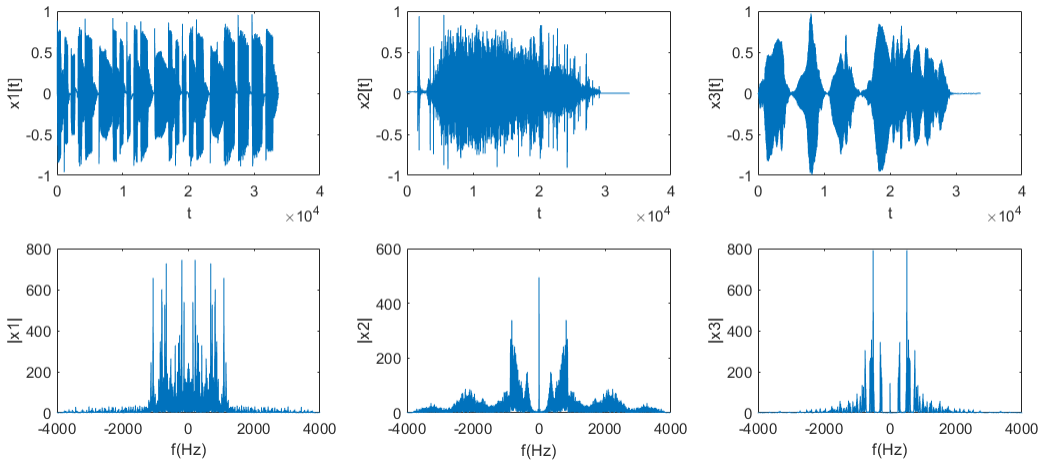

Figure 1 original signals in Time domain and magnitude spectrum

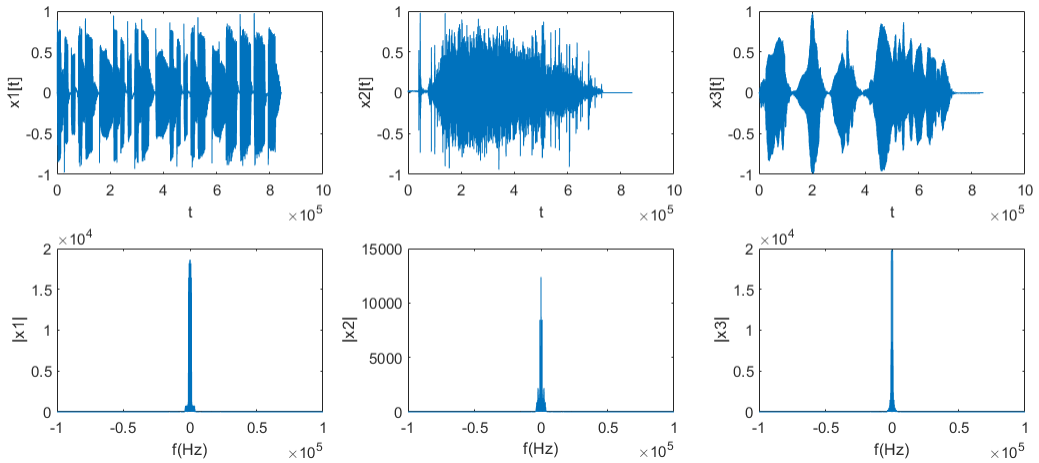

Figure 2 up sampled signals to have more room in frequency domain for manipulation

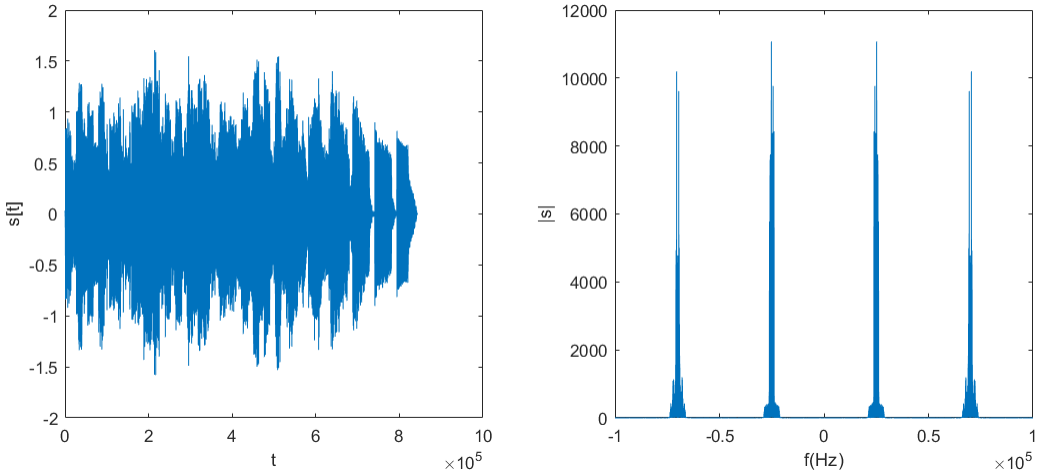

Figure 3 Modulated Signal in Time domain and magnitude spectrum

Q2)

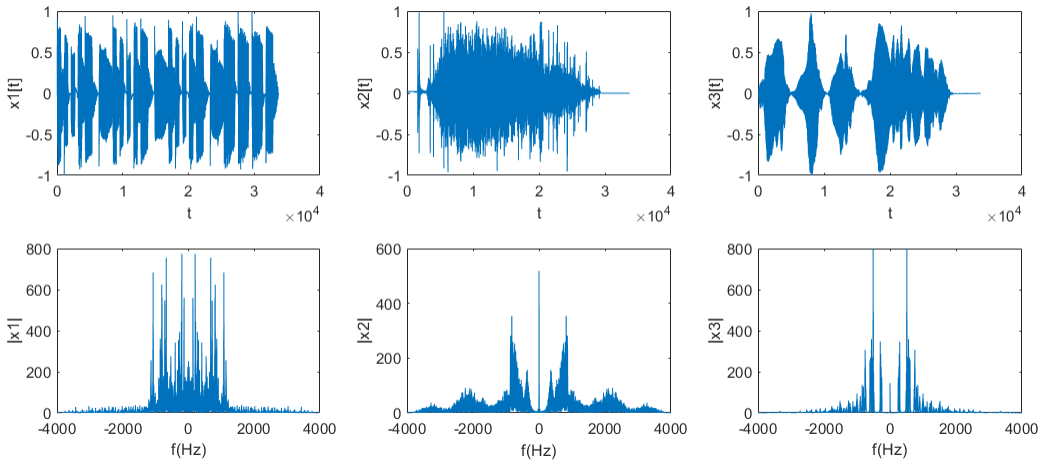

Figure 4 obtained signals after demodulation with phase shift 0

We notice that there is no interference at all between the three signals after demodulation with local carrier in phase with the carrier used in modulation due to wise choice of carrier frequency. As we can see in Figure 3 the first signal doesn't interfere with the other two signals and the other two signals don't interfere as they perpendicular to each other one has phase 0 while the other is phase 90.

Q3)

Due to producing phase shifts to the local carrier used in the demodulator for example the first signal x1 after demodulation will be $\frac{1}{2}X_1(t)cos(phaseShift)$ so if phaseShift changes to anything but zero this will cause attenuation to the recovered signal X_1.

While recovered X_2 will be $\frac{1}{2}[X_2(t)cos(phaseShift) - X_3sin(phaseShift)]$ and X_3 will be $\frac{1}{2}[X_3(t)cos(phaseShift) - X_2sin(phaseShift)]$

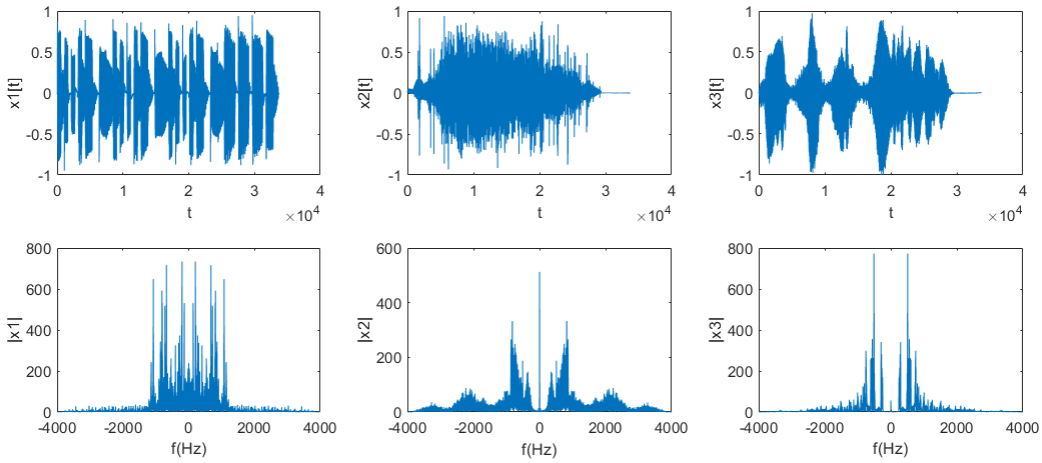

Figure 5 demodulated signals with phase shift 10

We begin to notice in Figure 5 that the signals X_2 and X_3 begin to interfere (cochannel interference). Also, attenuation starts to happen to all signals.

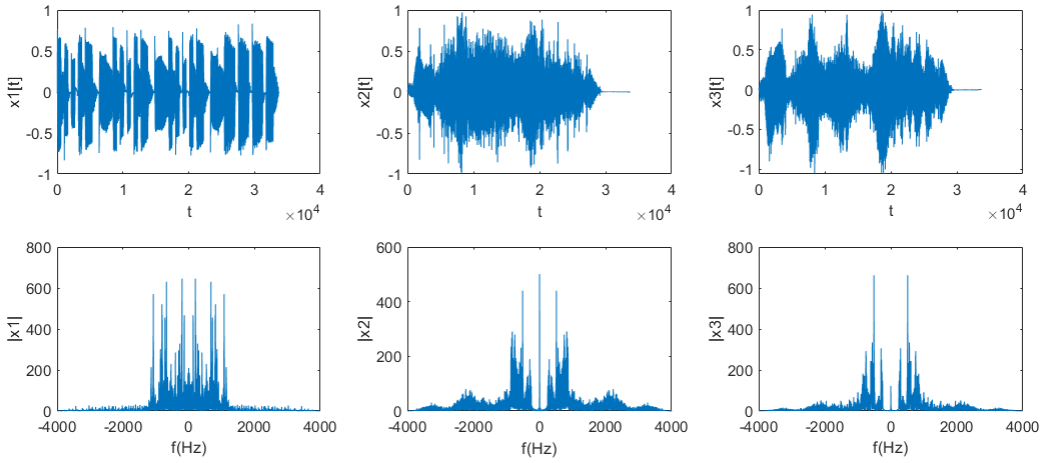

Figure 6 demodulated signals with phase shift 30

We begin to see in Figure 6 more attenuation in all signals and more cochannel interference between X_2 and X_3.

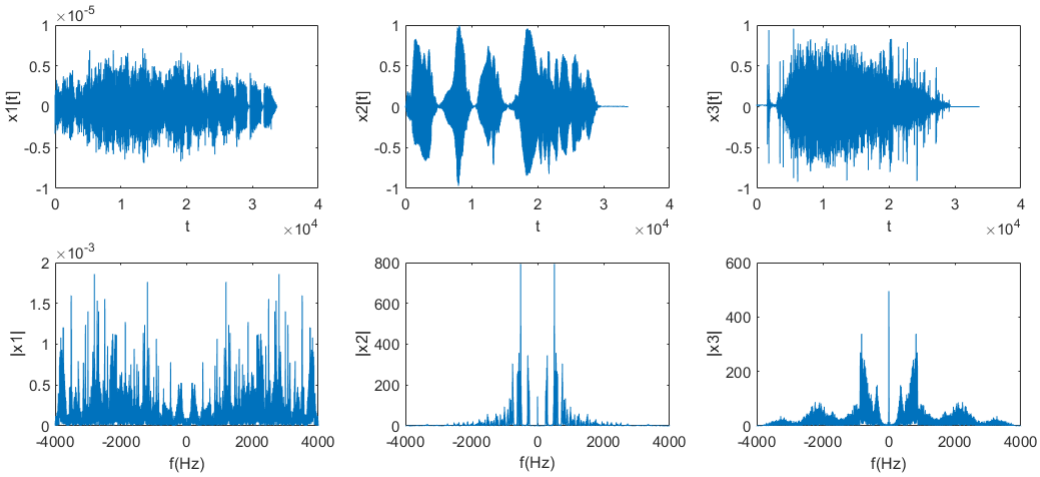

Figure 7 demodulated signals with phase shift 90

We notice in Figure 7 that the signal X_1 is now attenuated and has a very low amplitude (approx. zero) due to imperfection but it should be absolutely zero, we also notice that the signals X_2 and X_3 reached maximum interference as when we wanted to retrieve signal X_2 we got X_3 and vice versa.