Cairo University

Faculty of Engineering

Computer Engineering Department

Third Year

COMMUNICATION ENGINEERING

Lab 1

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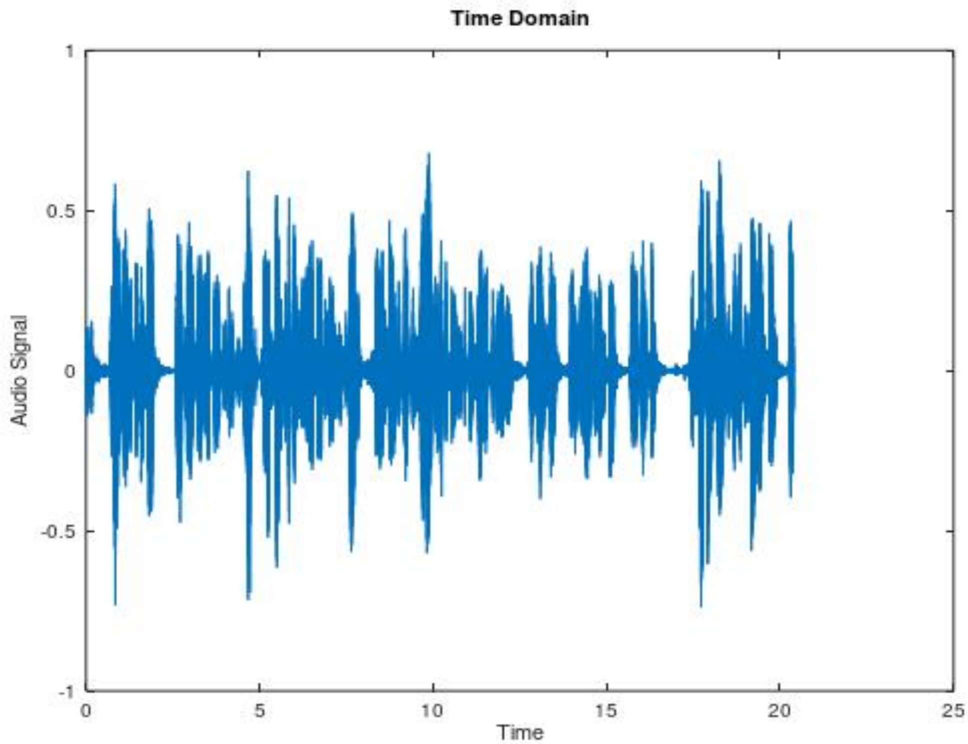
Section: 2

B.N.: 27

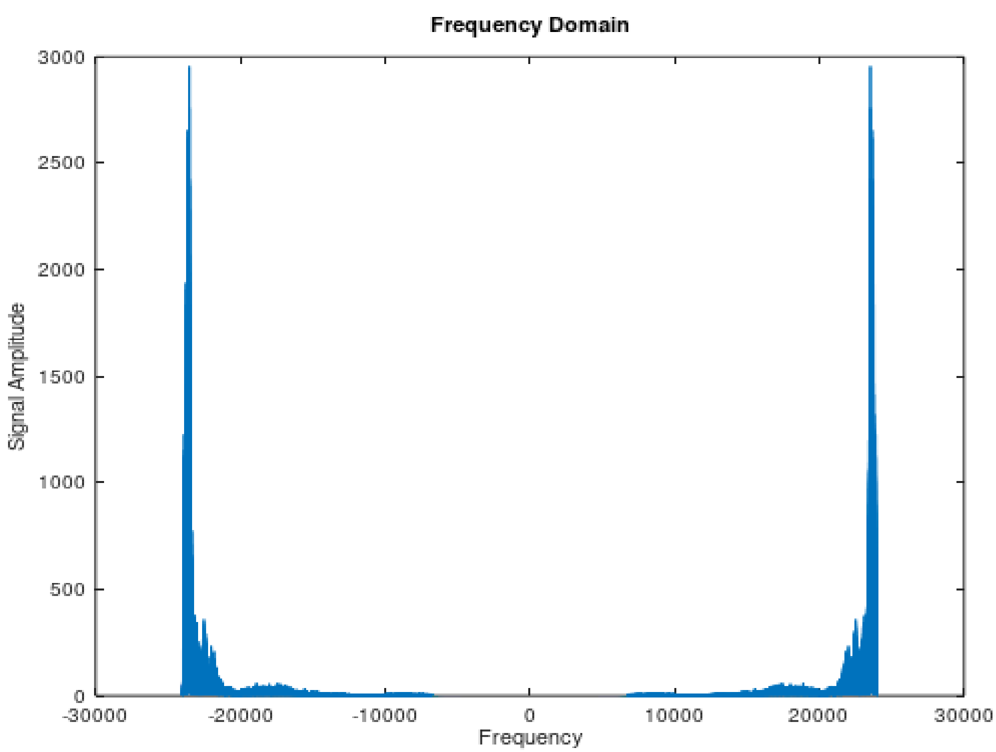
December, 2021

Requirement 1

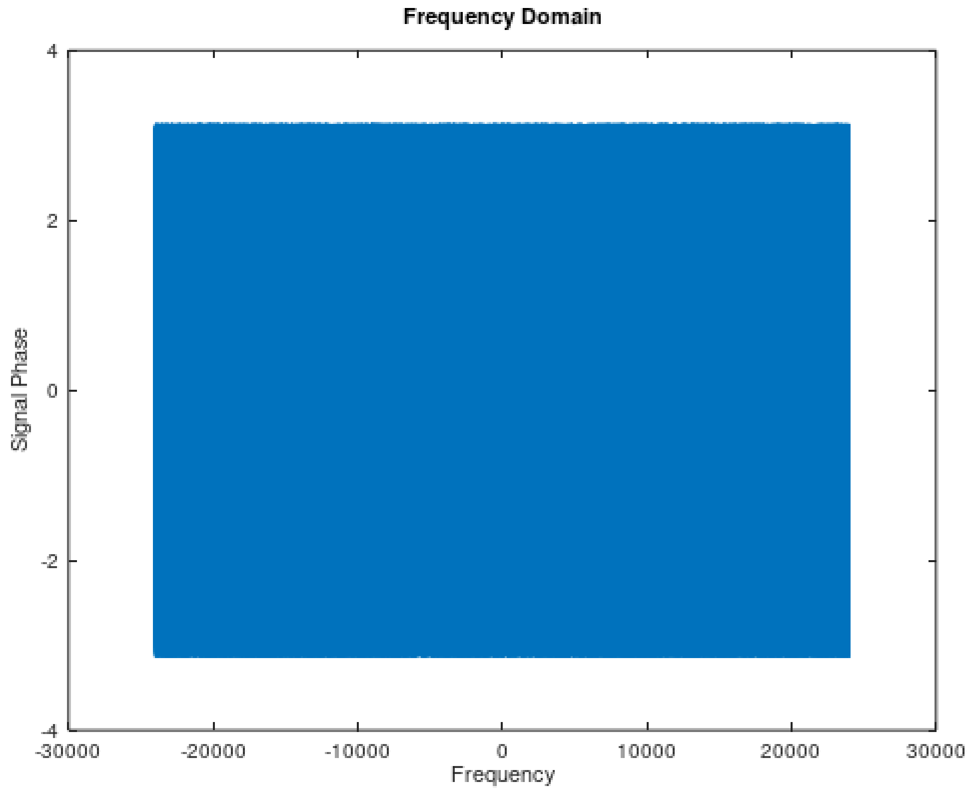
Audio signal in time domain:



The audio signal's amplitude in frequency domain:



The audio signal’s phase in frequency domain:



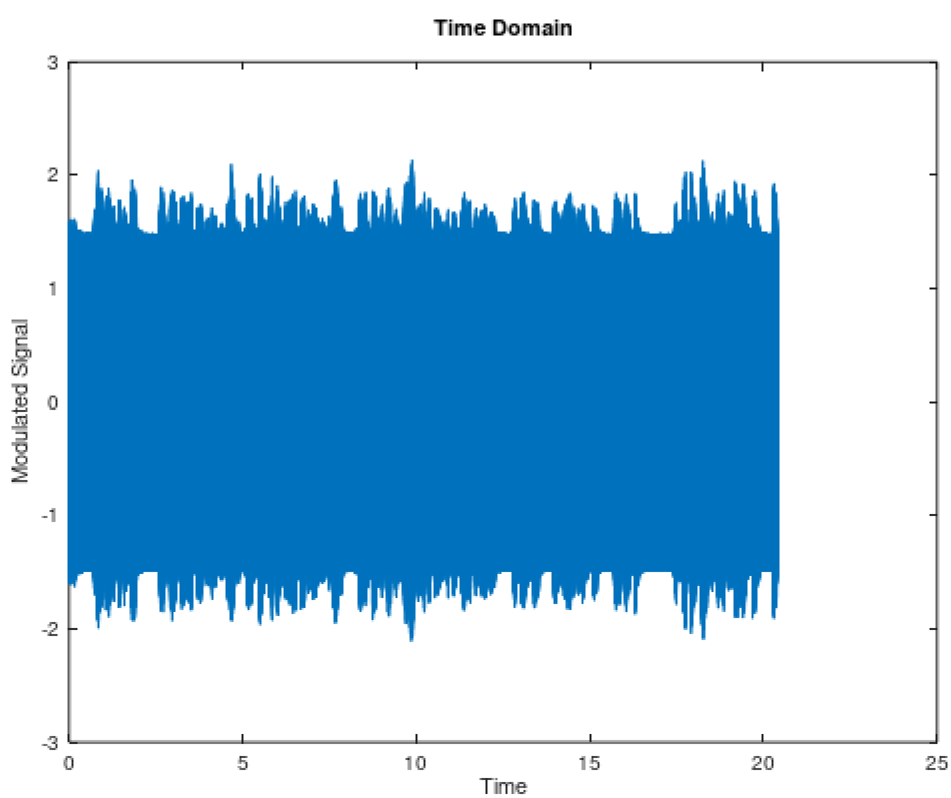
Requirement 2

$y(t) = (A + x(t)) \cos(wt)$

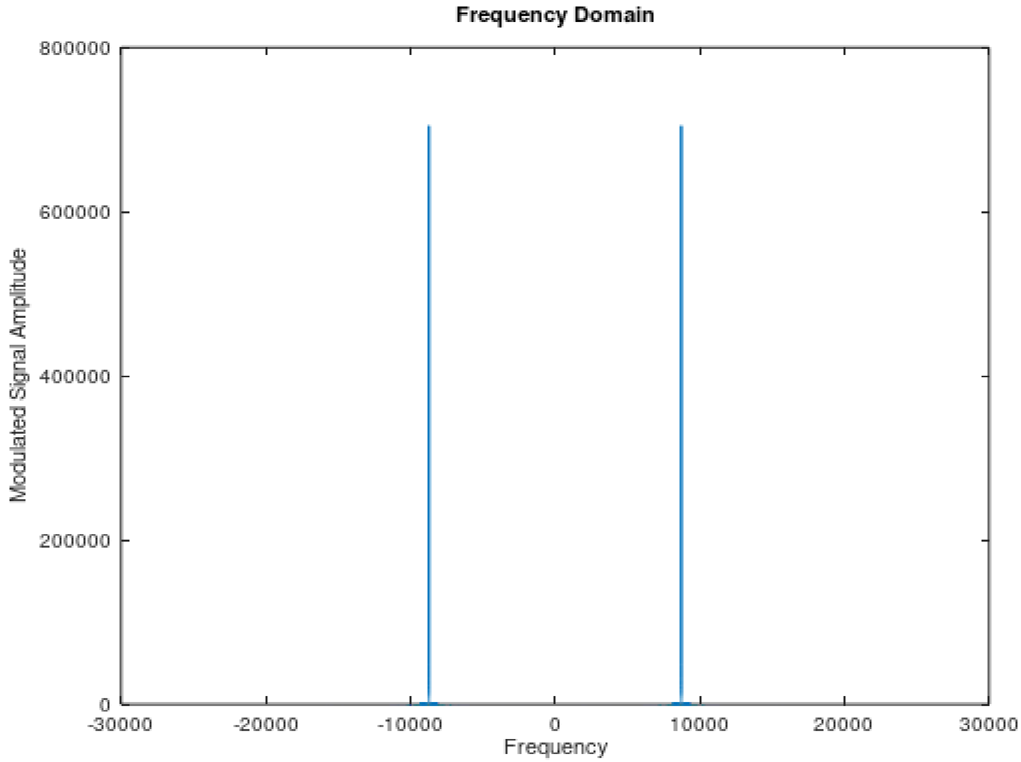
The value of 'A' should be greater than or equal to absolute negative peak amplitude of the signal so that we can use envelope detector in the demodulator instead of using synchronous demodulation which has high cost (however, in case of synchronous demodulation, the value of 'A' doesn't affect the demodulation process). In the code, I set the value of modulation index to 0.5, and then calculated the value of A using the modulation index equation.

The value of 'w' should be greater than or equal to the bandwidth of the signal so that after the modulation process, no interference between the two sidebands of the signal should happen in the frequency domain. In the code, the minimum value of f_c is half of the value of the sampling frequency.

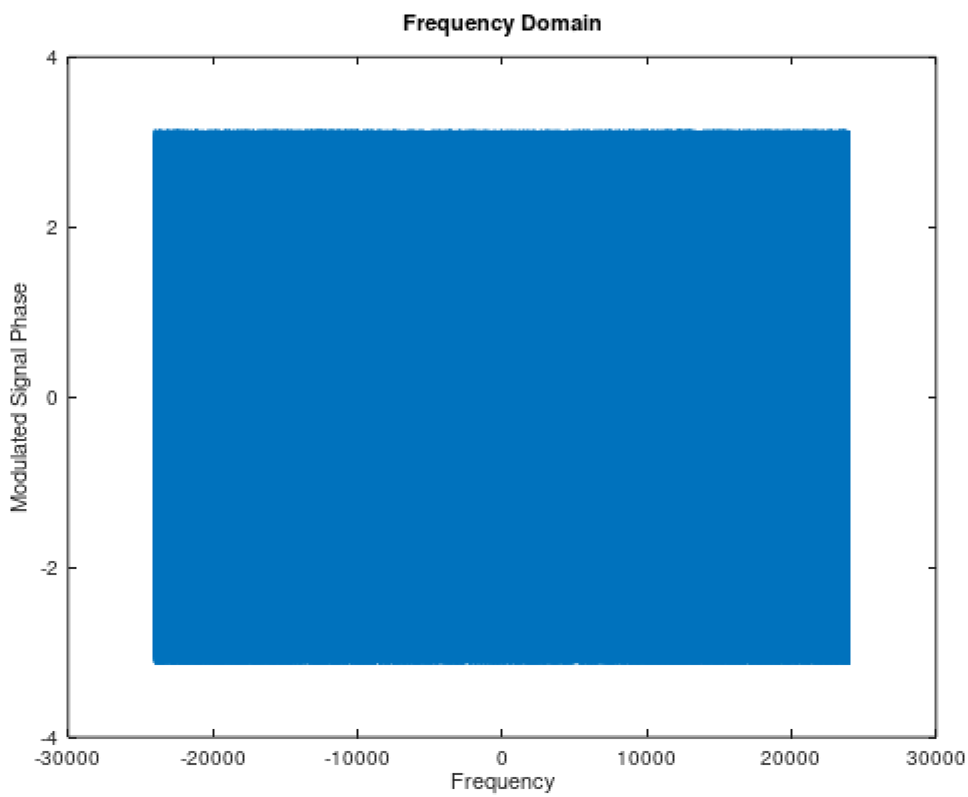
The modulated signal in time domain:



The modulated signal’s amplitude in frequency domain:



The modulated signal’s phase in frequency domain:



$\mu = \frac{|x(t)_{min}|}{A}$

The maximum value of modulation index is 1.

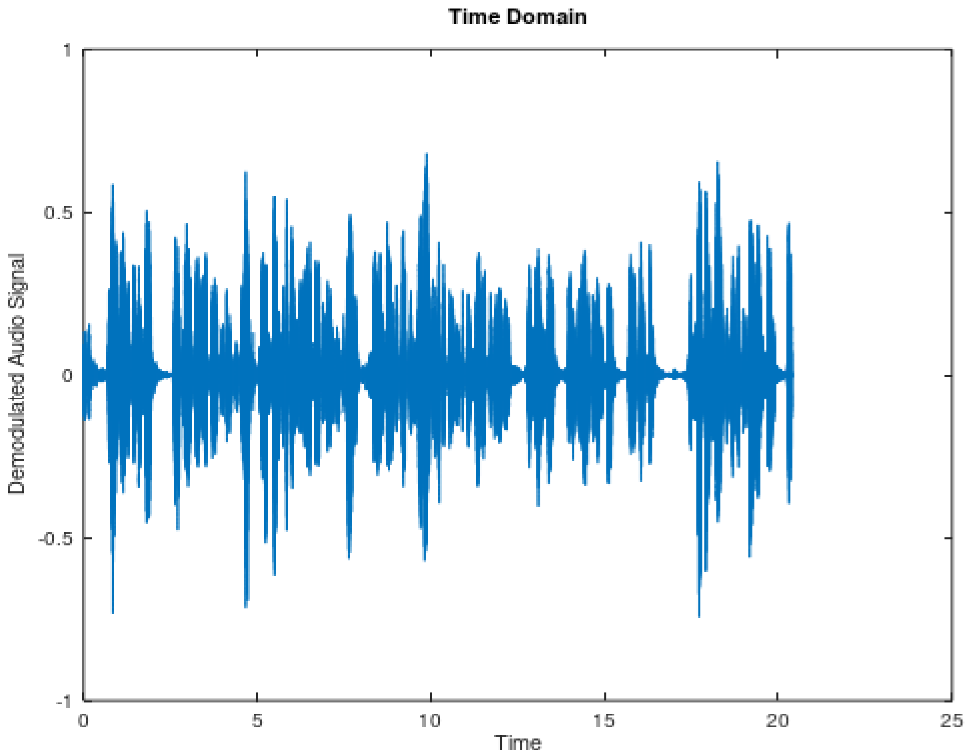
If modulation index is larger than 1, this is called over modulation, which means that $|x(t)_{min}| > A$ and no envelope detector can be used in the demodulation process.

Bandwidth of the audio signal (baseband signal): B

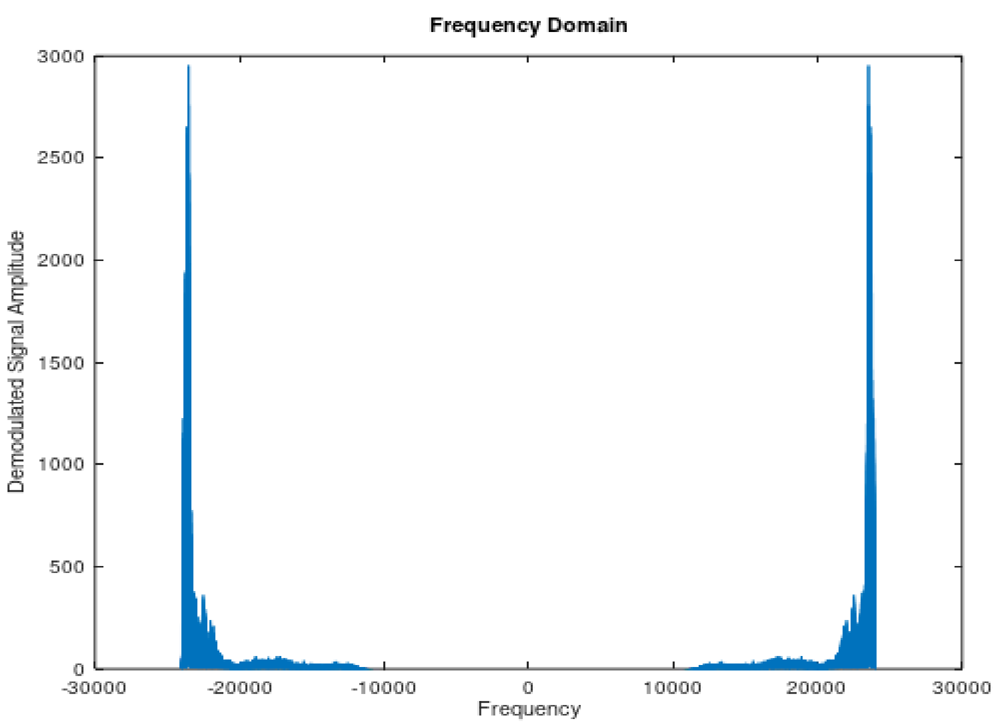
Bandwidth of the modulated signal: 2B

Requirement 3

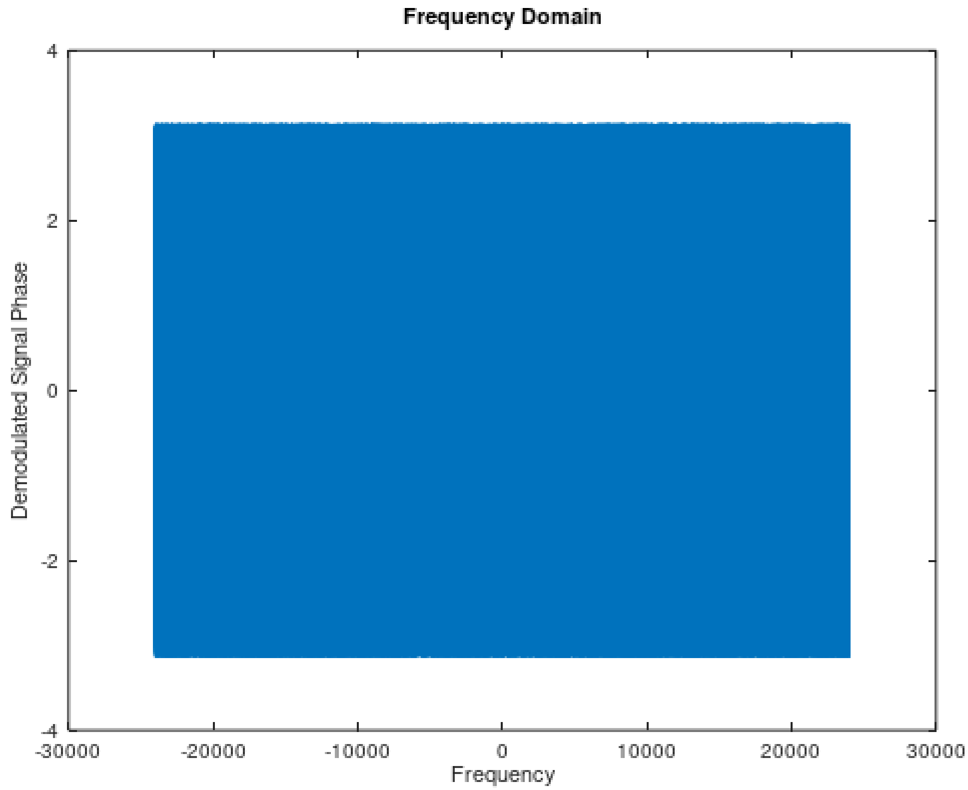
Demodulated audio signal in time domain:



The demodulated signal's amplitude in frequency domain:



The demodulated signal’s phase in frequency domain:



The two audio files (original file and the demodulated signal’s file) are exactly the same, this is due to the use of synchronous demodulation and the local carrier at the receiver is completely synchronized in frequency and phase with the incoming carrier in the received modulated signal (there is no frequency or phase error therefore, the is no attenuation or distortion in the demodulated signal).