In the Name of God

Report of Communication System I Project

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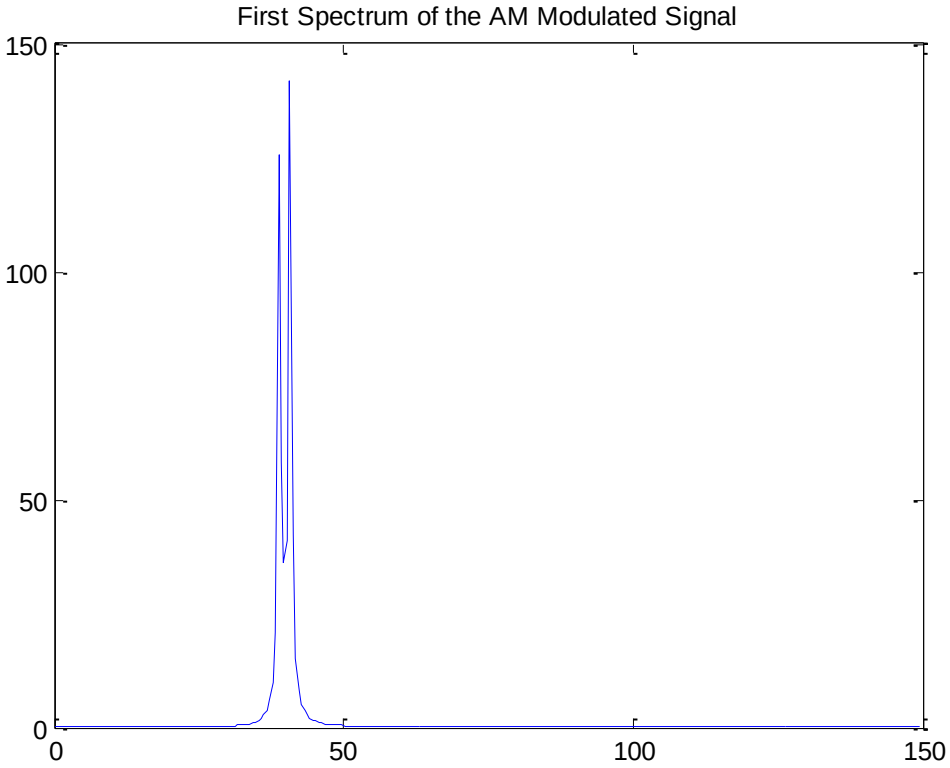
First Part:

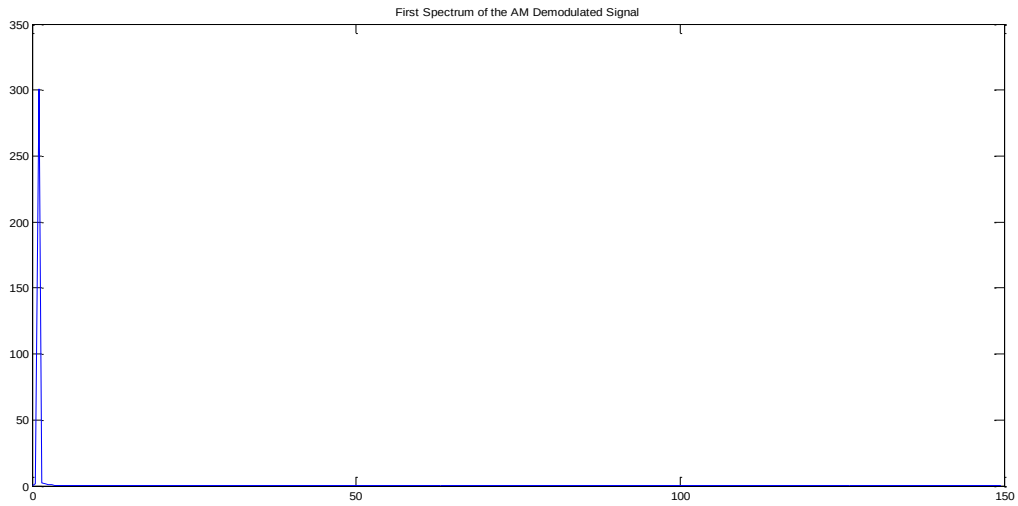
Applying functions on a sinusoidal waveform to see the output signal spectrum:

Imagine our initial (Message) signal is $\sin(2\pi t)$

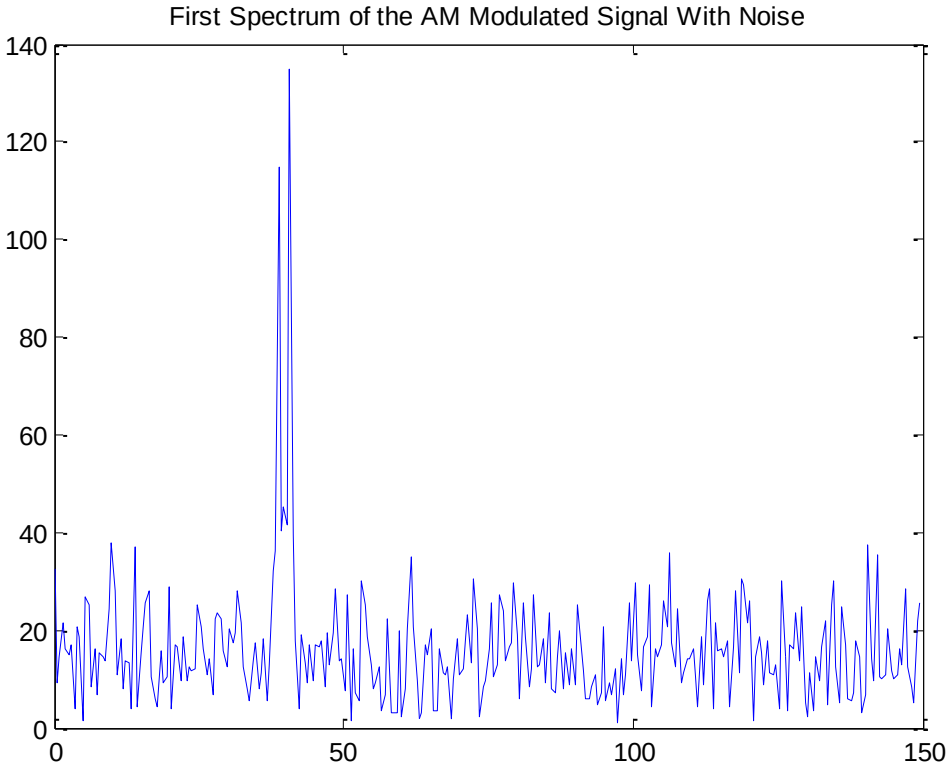
A) AM Modulation and AM Demodulation:

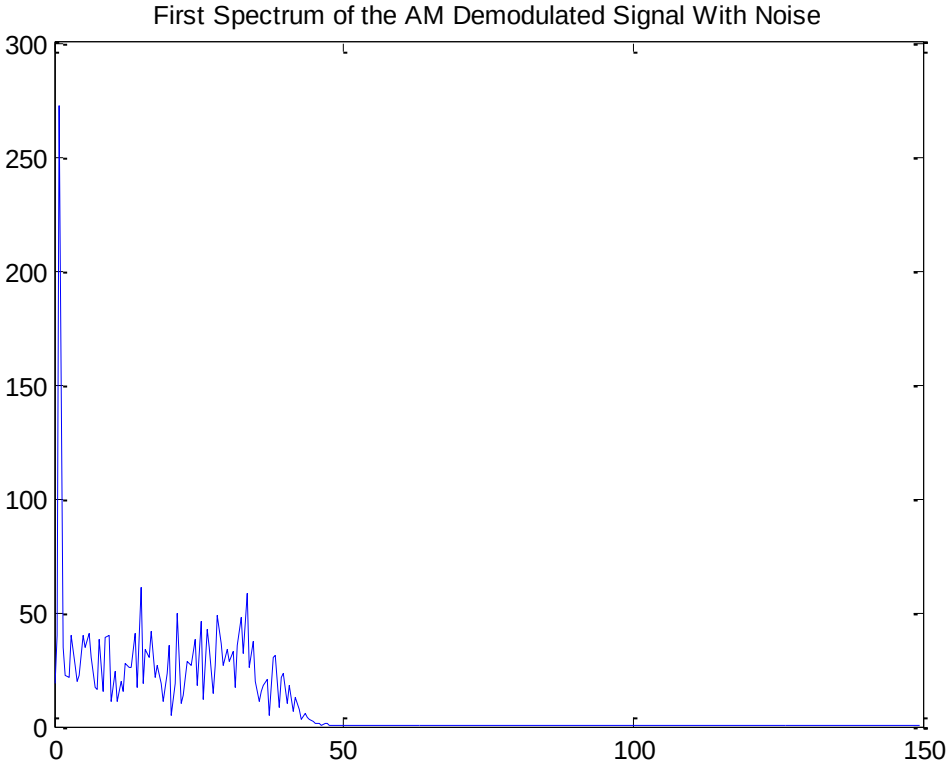
Sampling rate = 300 sample per second
Carrier signal Frequency = 40 Hz
Without Noise:



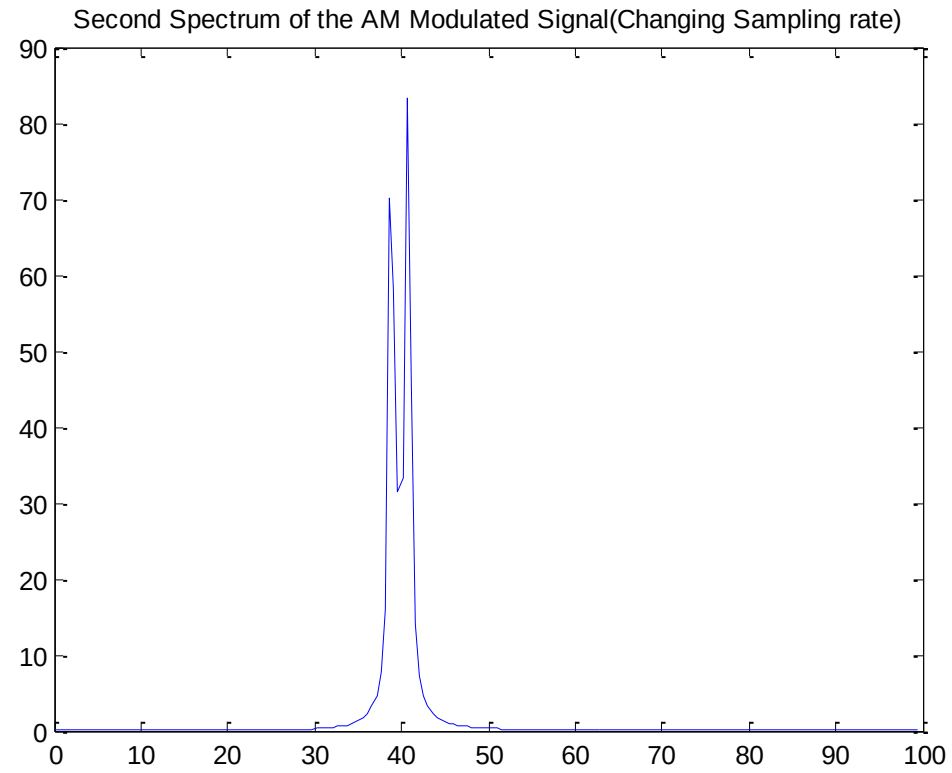


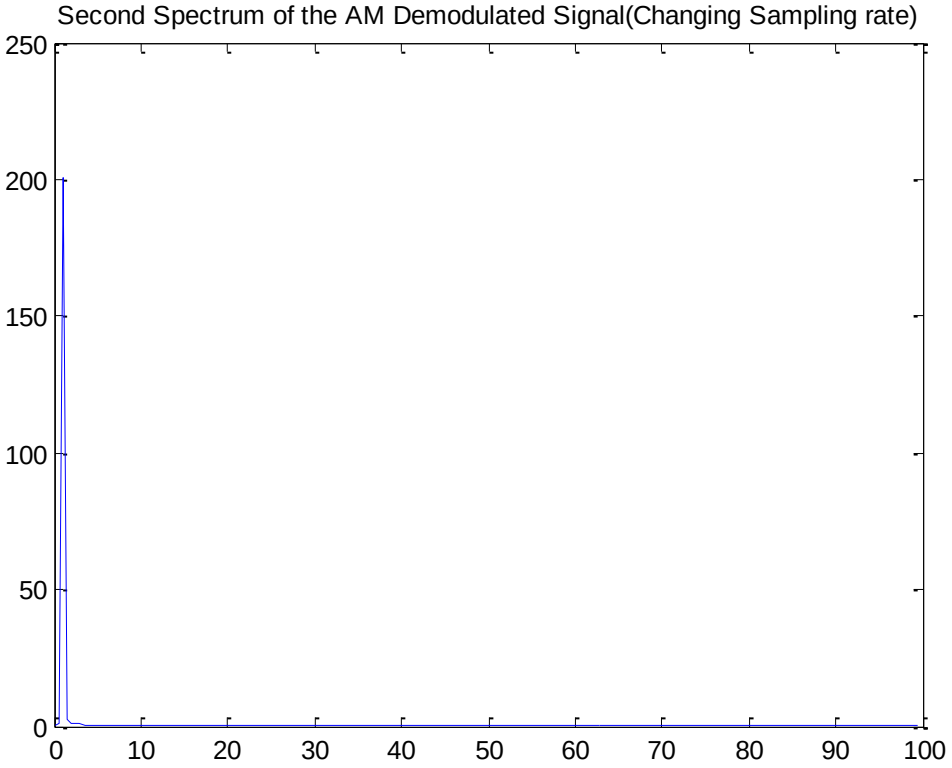
Sampling rate = 300 sample per second
Carrier signal Frequency = 40 Hz
With Noise:



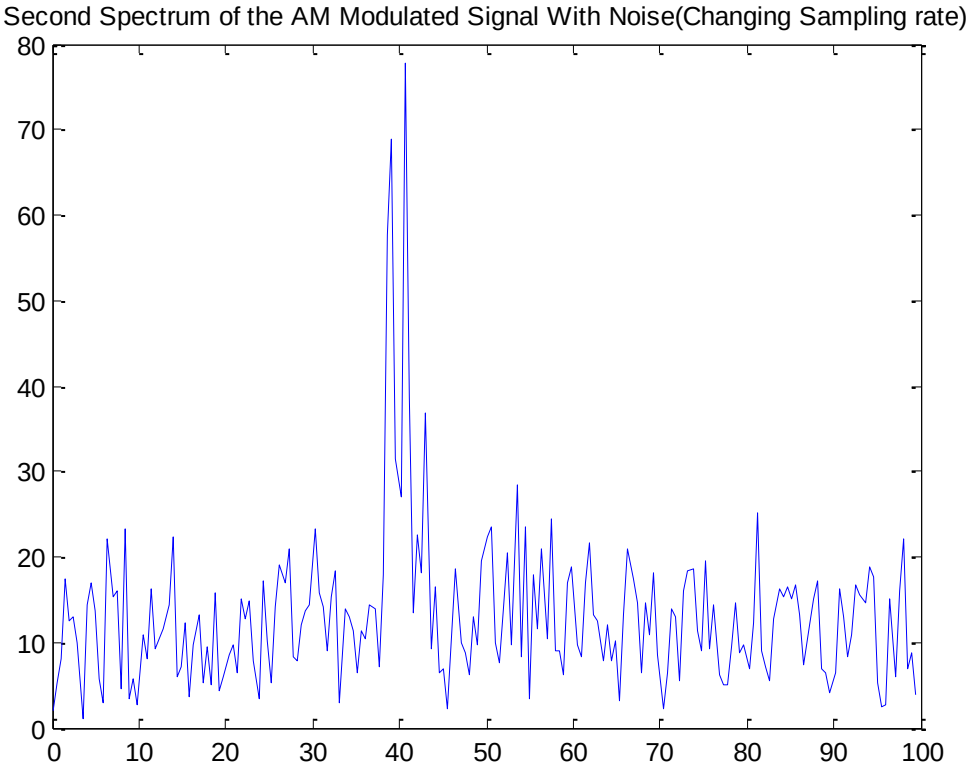


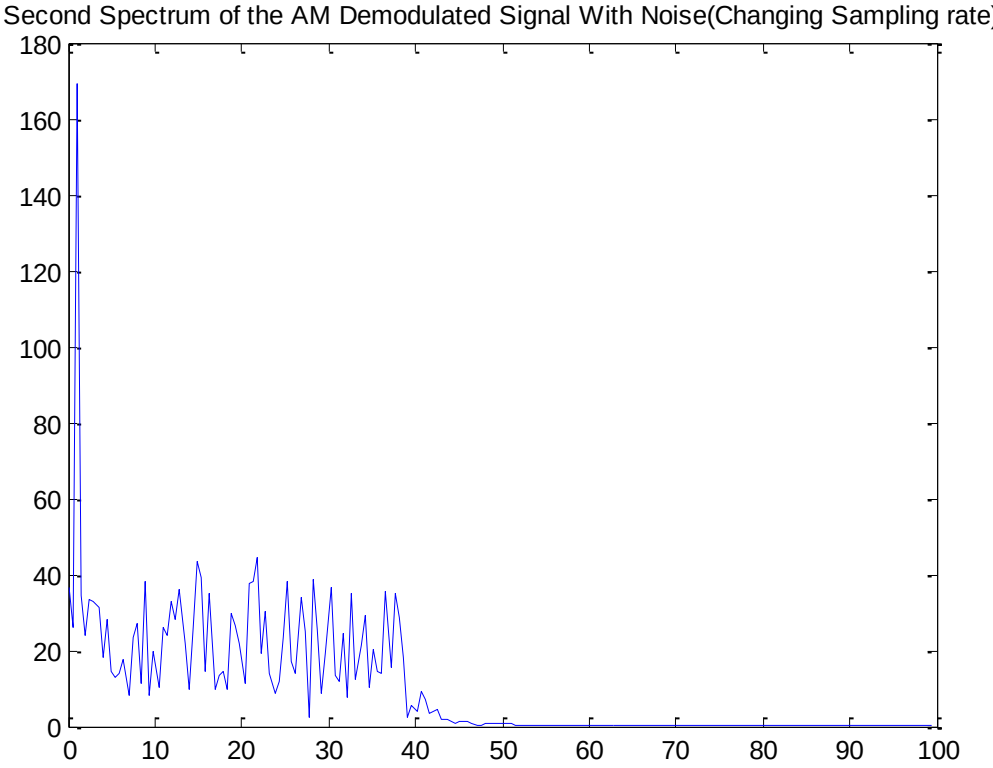
Sampling rate = 200 sample per second
Carrier Frequency = 40 Hz
Without Noise:



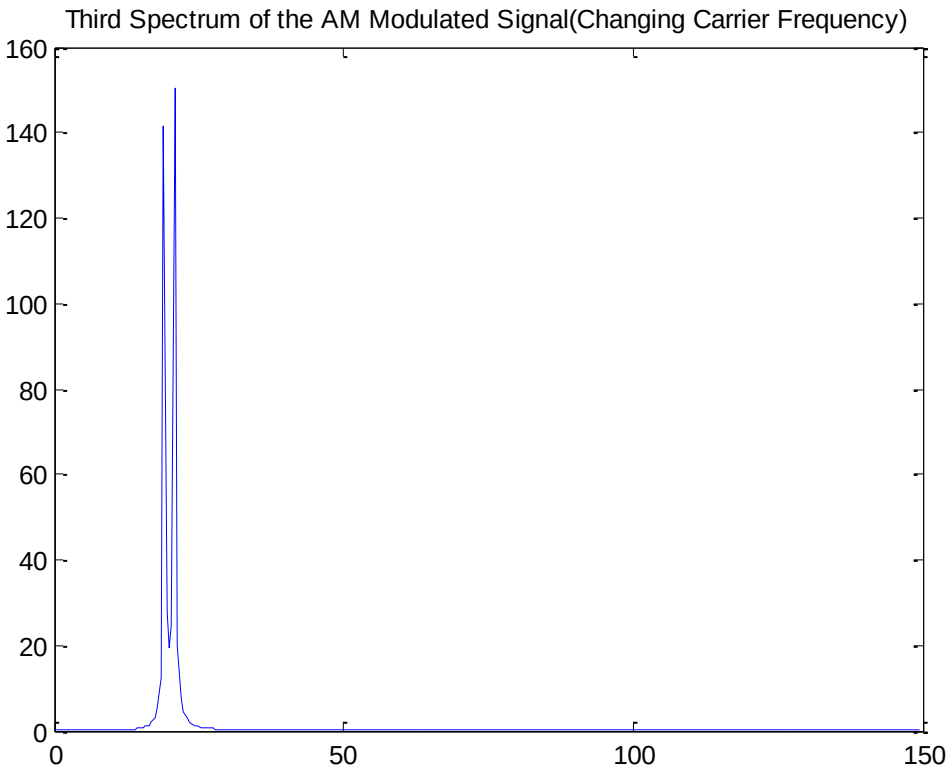


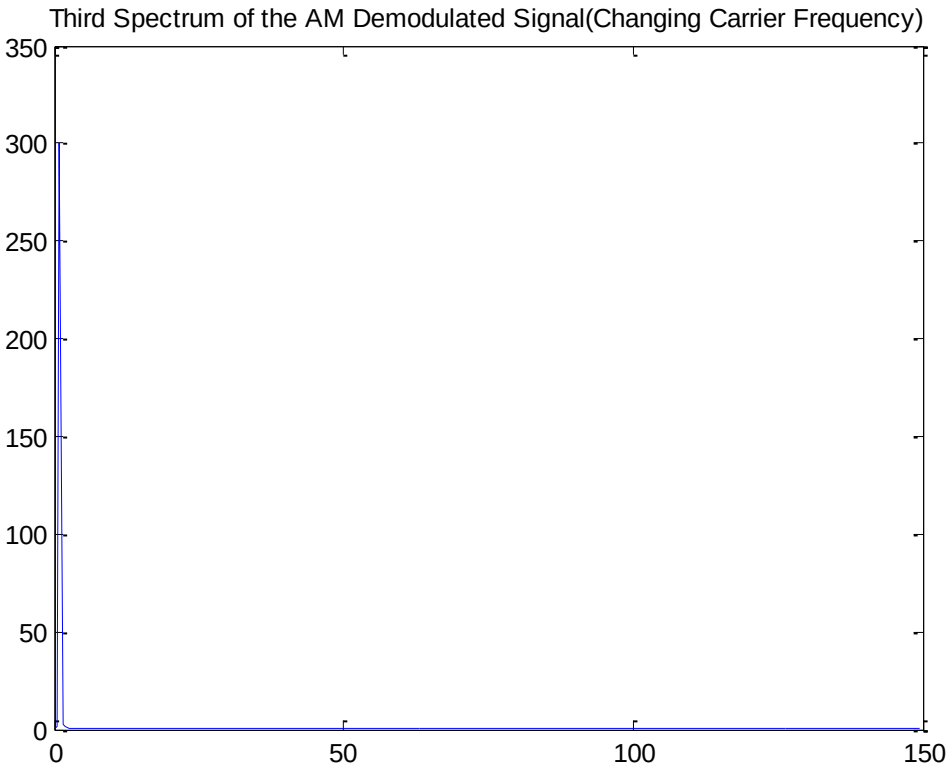
Sampling rate = 200 sample per second
Carrier Frequency = 40 Hz
With Noise:



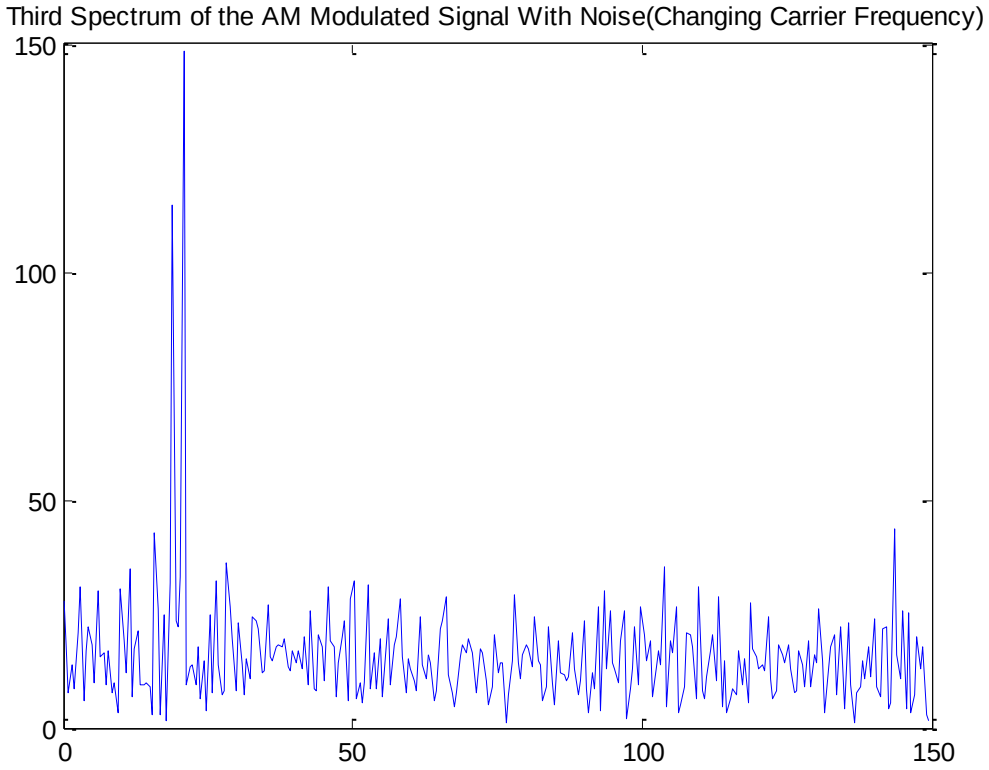


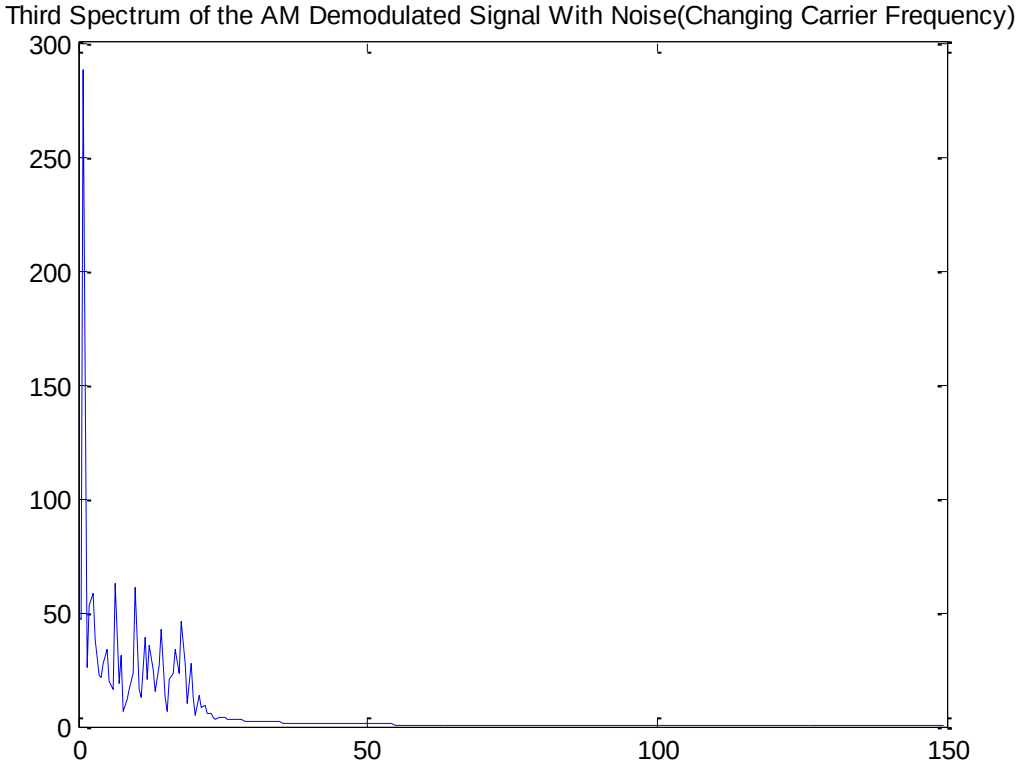
Sampling rate = 300 sample per second
Carrier frequency = 20 Hz
Without Noise:



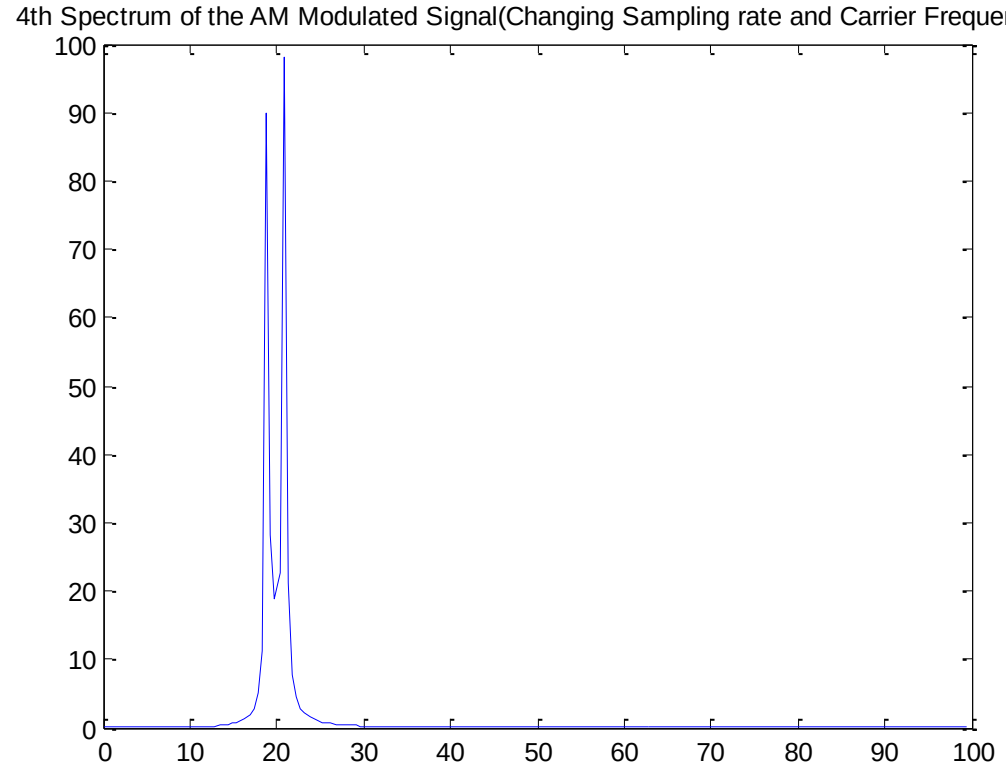


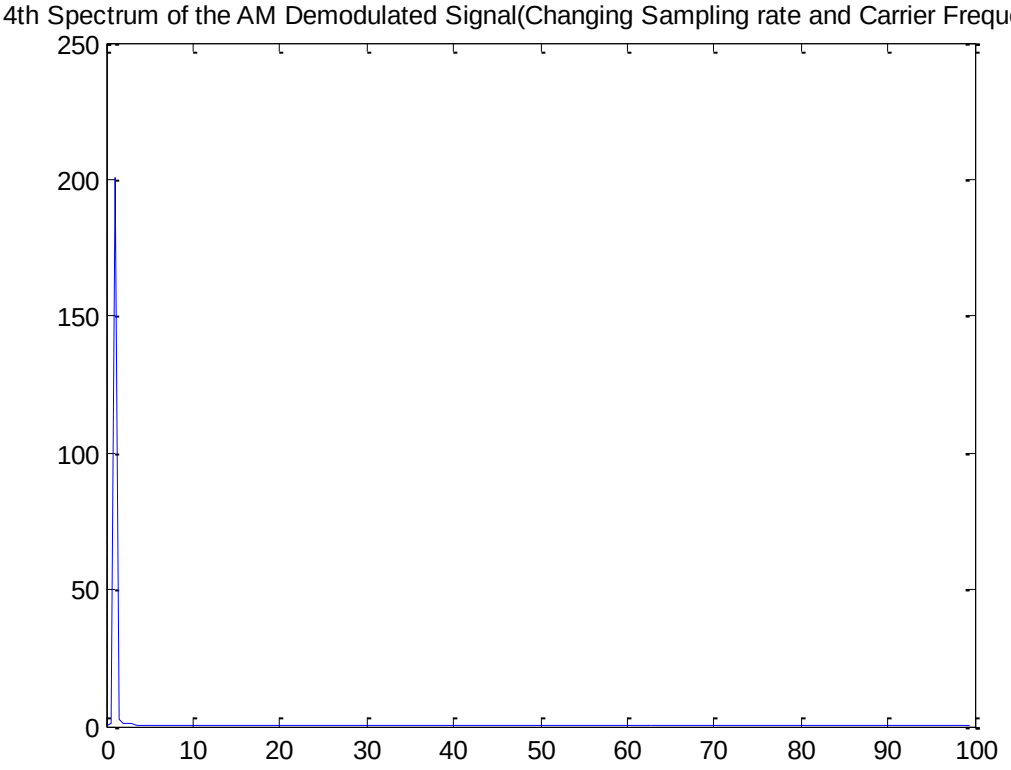
Sampling rate = 300 sample per second
Carrier frequency = 20 Hz
With Noise:



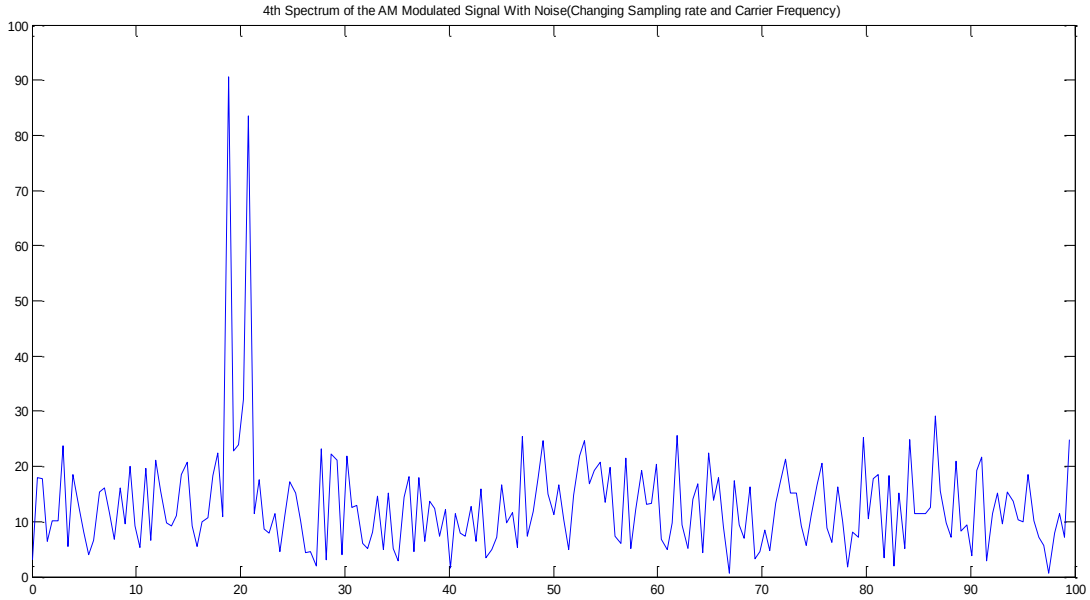


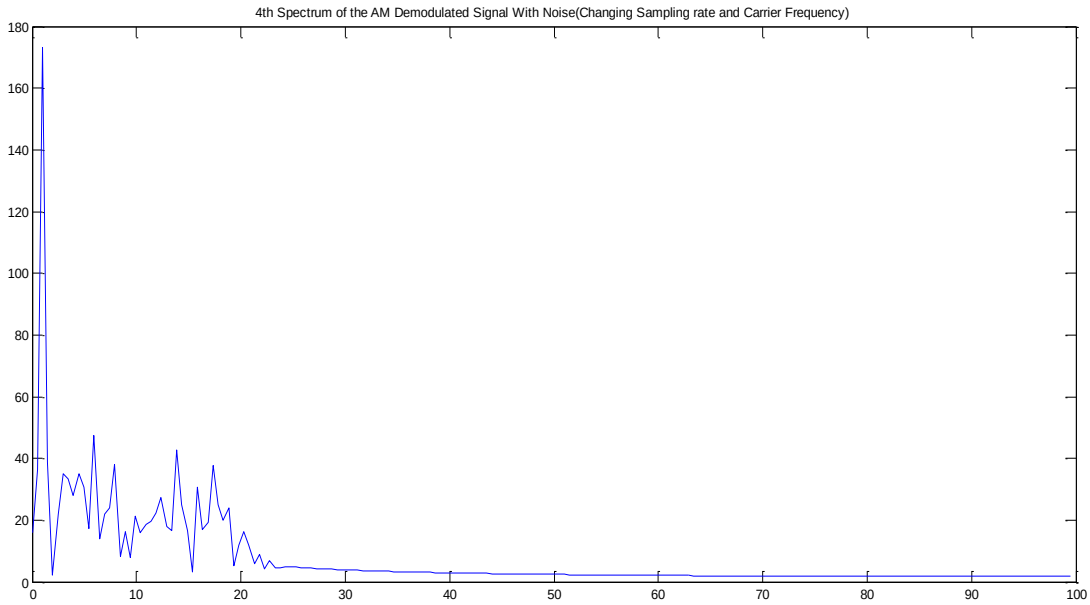
Sampling rate = 200 sample per second
Carrier frequency = 20 Hz
Without Noise:



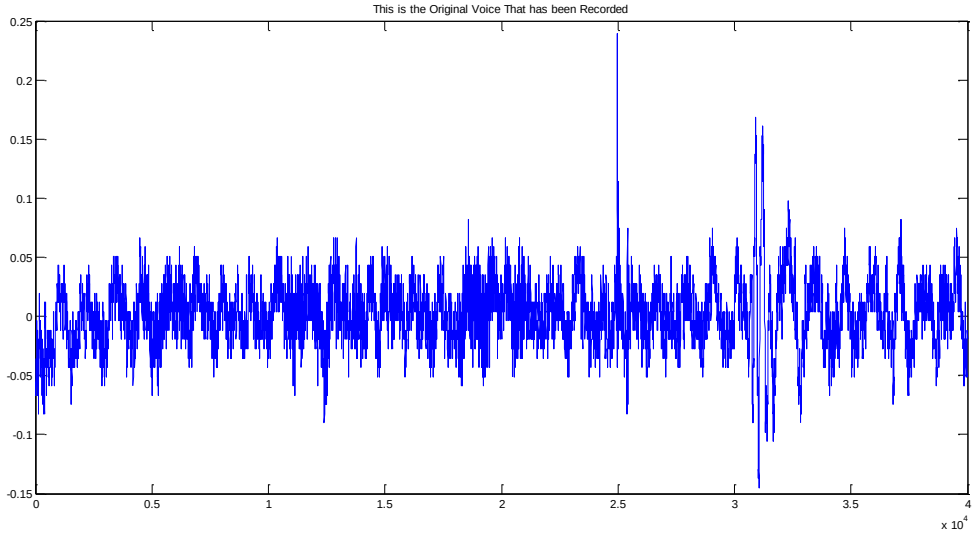


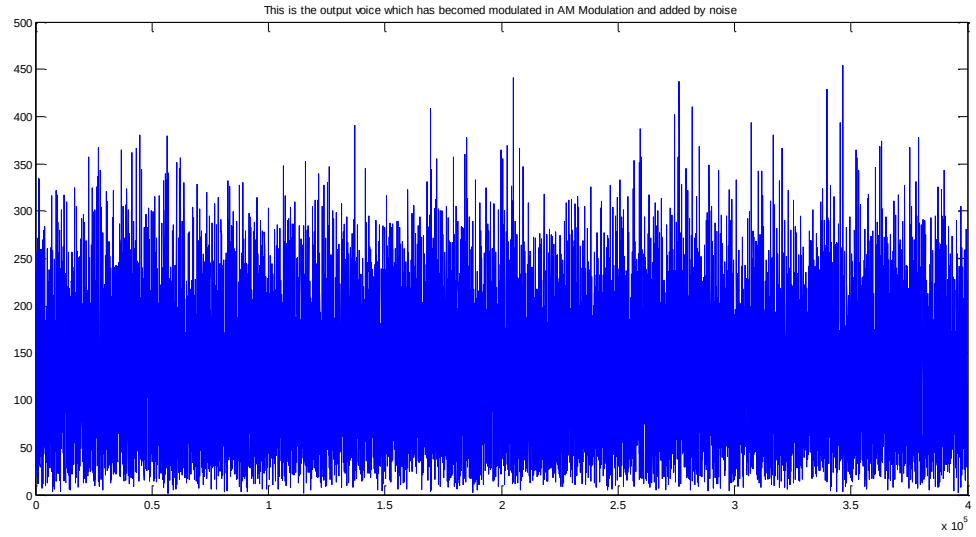
Sampling rate = 200 sample per second
Carrier frequency = 20 Hz
With Noise:

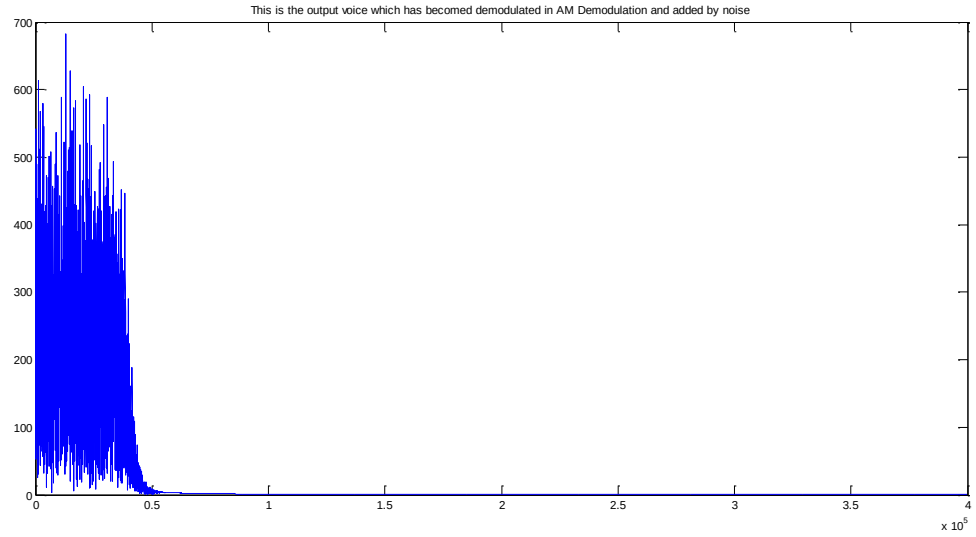




Recorded Voice with Noise and $f_c = 40KHz$ and $f_s = 800KHz$
This is the original signal (message signal that we want to send it)

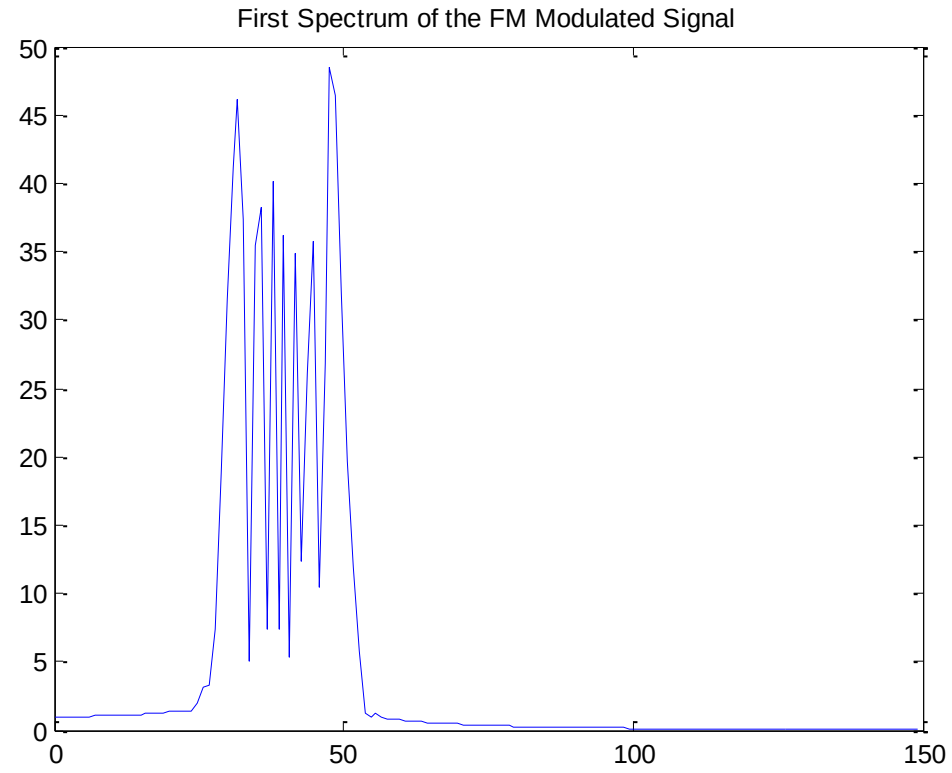


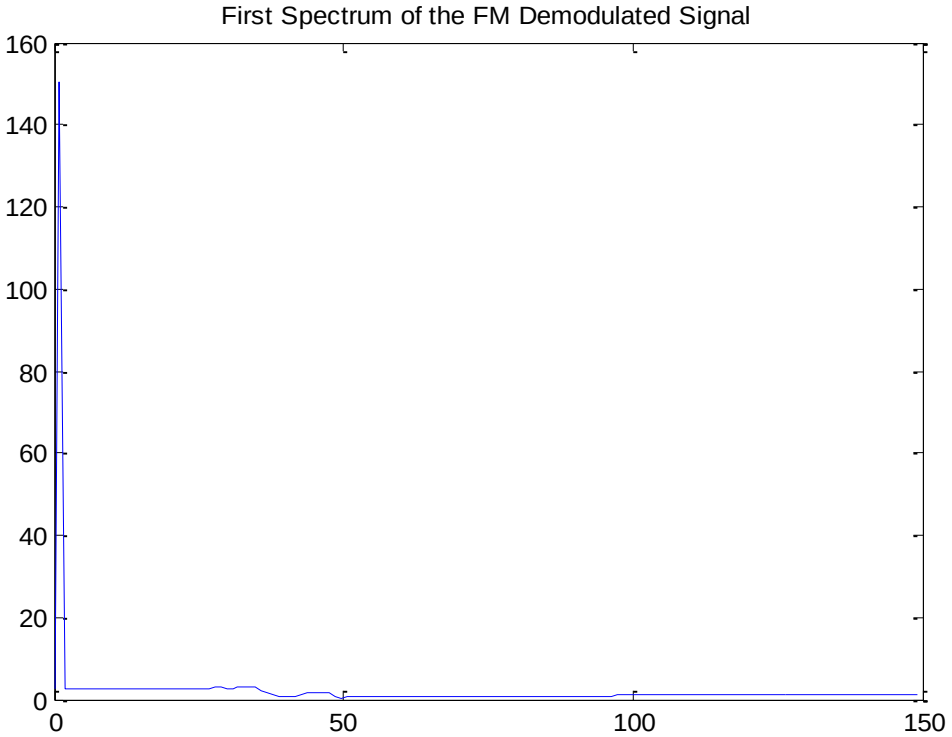




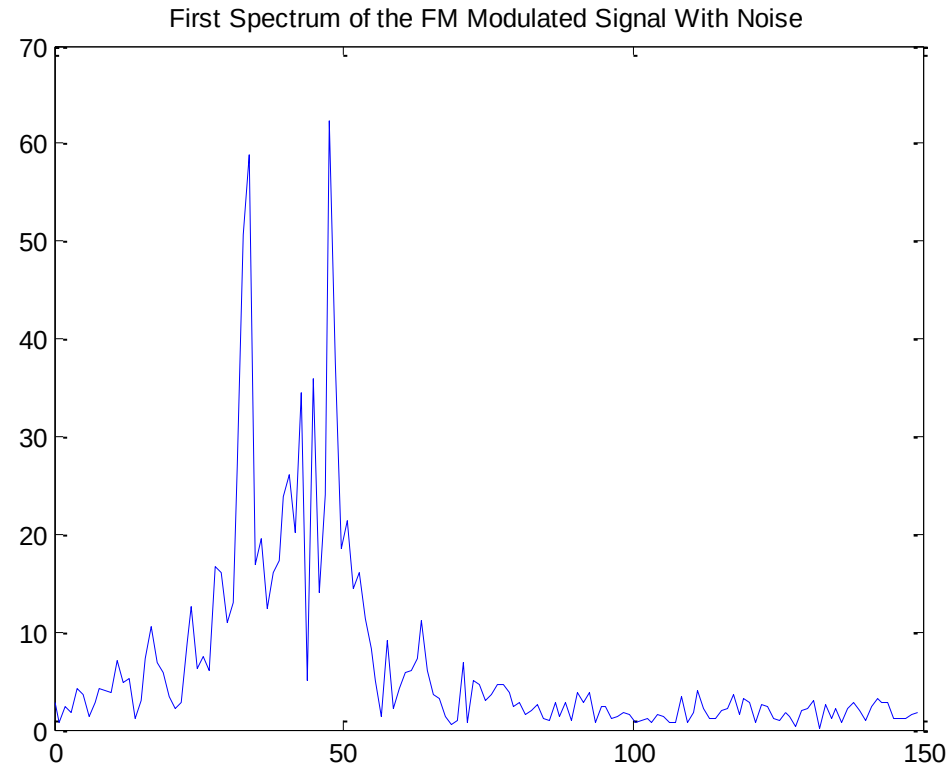
B) FM Modulation and Demodulation

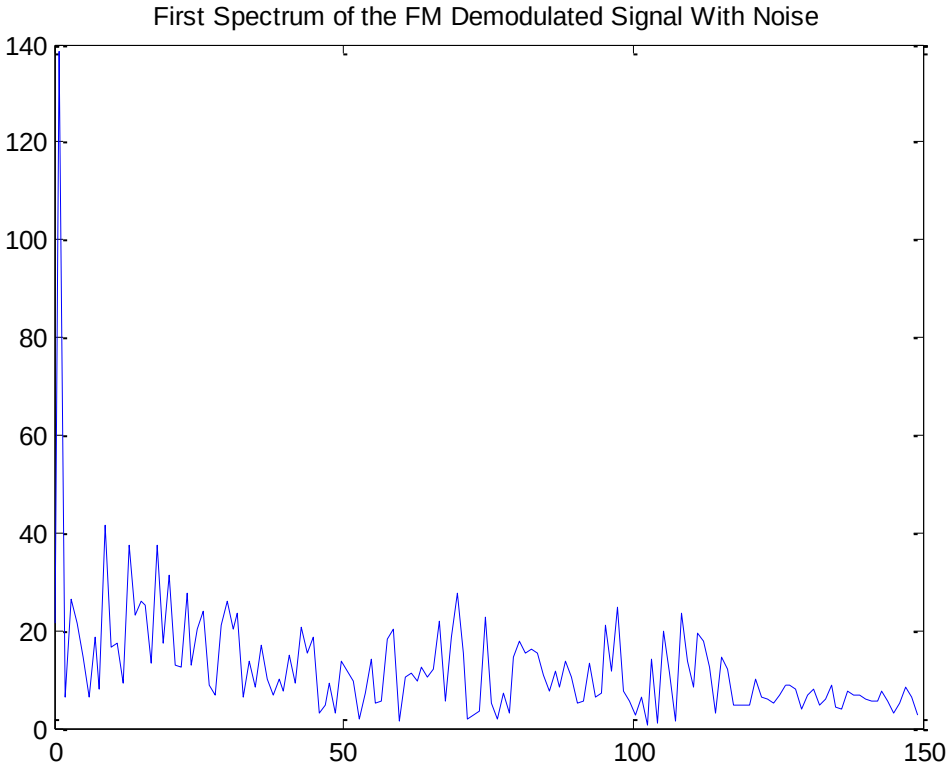
Sampling rate = 300 sample per second
Carrier Frequency = 40 Hz
Frequency Deviation = 10
Without Noise:



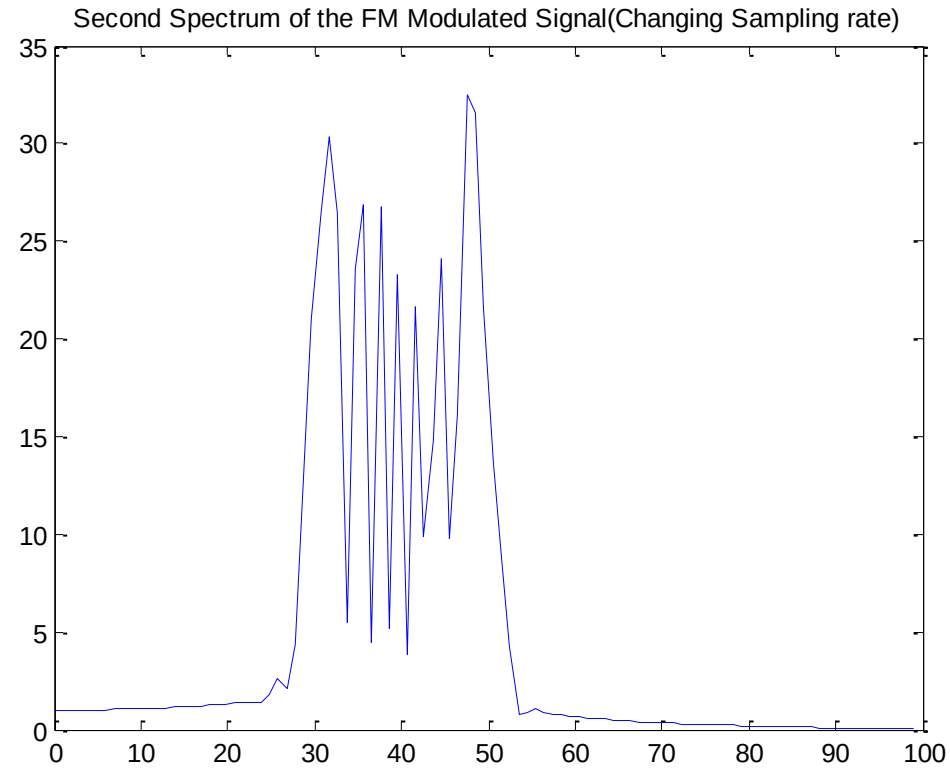


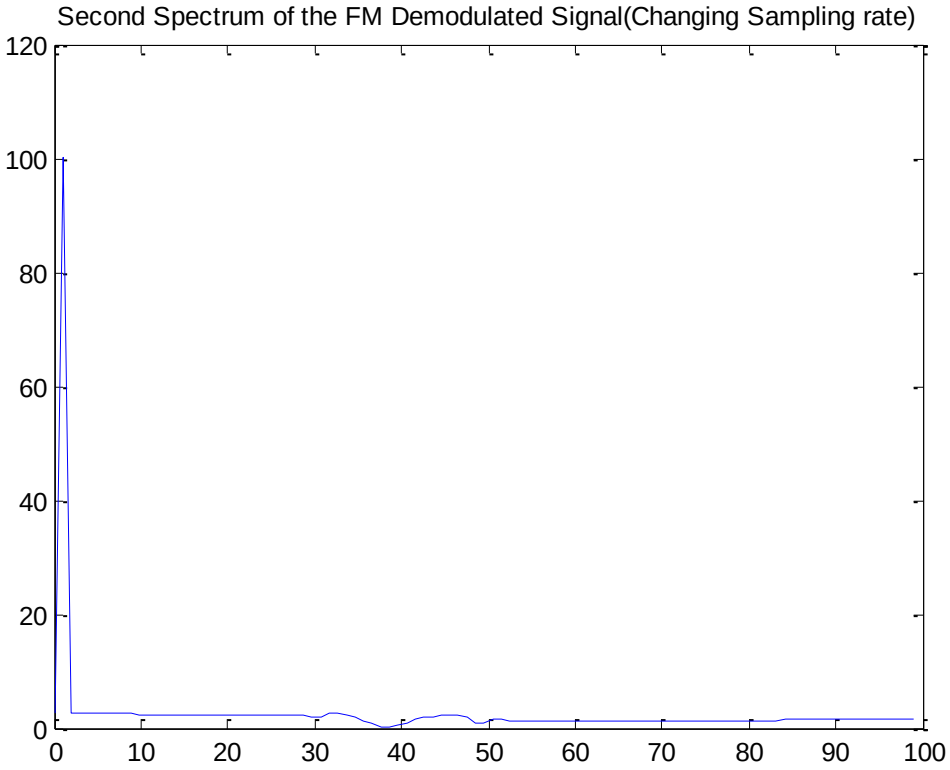
Sampling rate = 300 sample per second
Carrier Frequency = 40 Hz
Frequency Deviation = 10
With Noise:



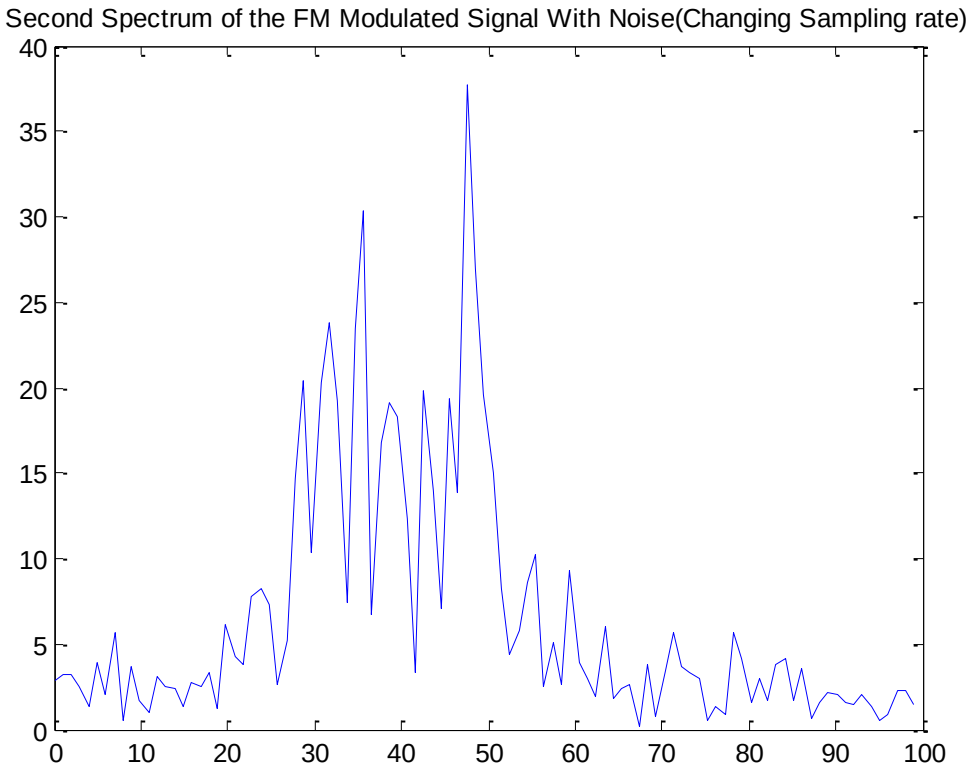


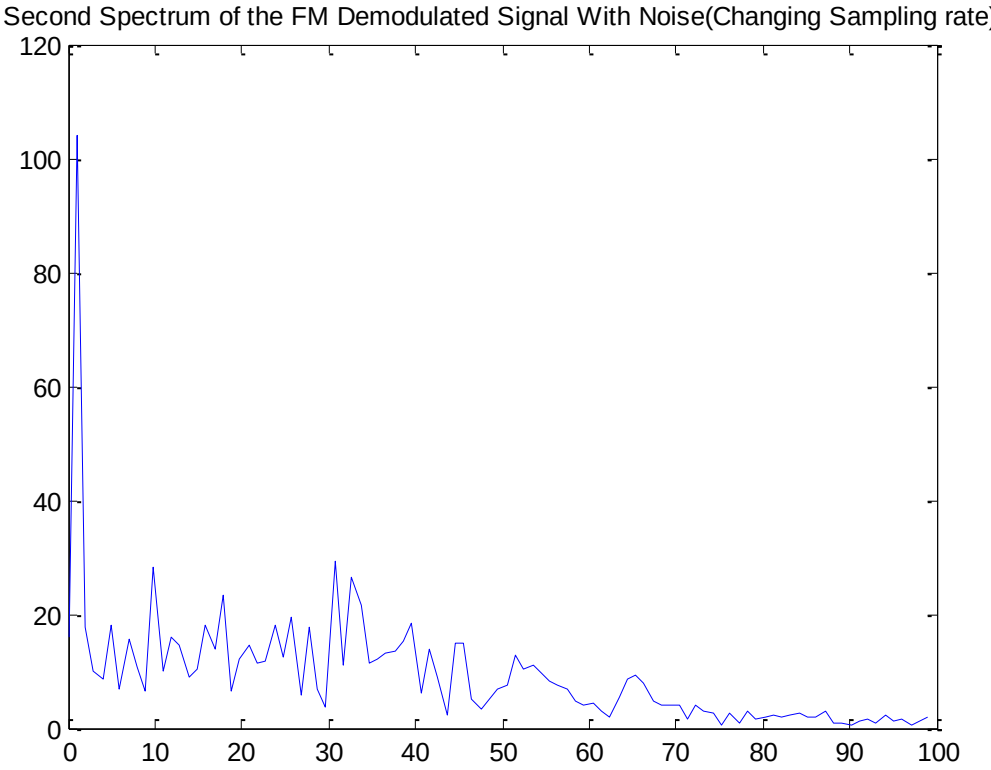
Sampling rate = 200 sample per second
Carrier Frequency = 40 Hz
Frequency Deviation = 10
Without Noise:



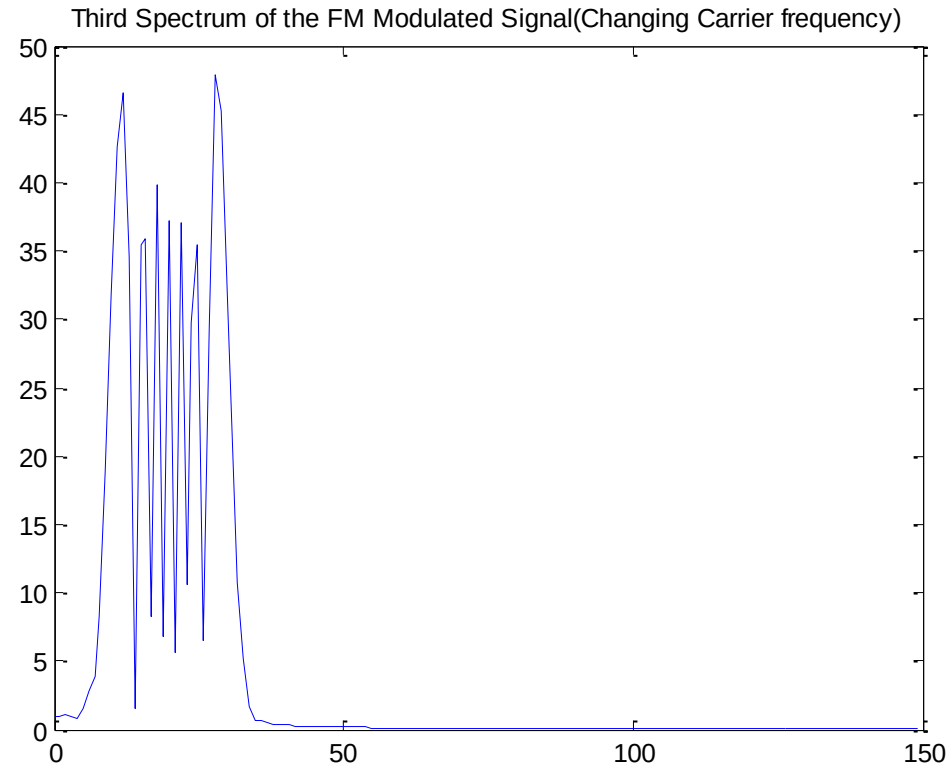


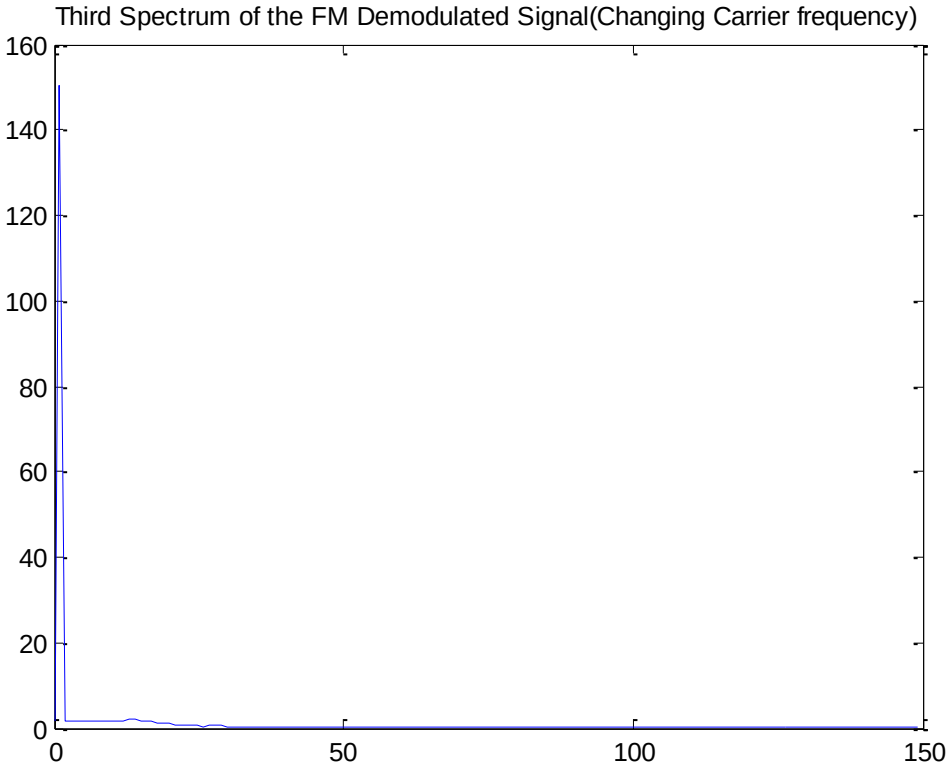
Sampling rate = 200 sample per second
Carrier Frequency = 40 Hz
Frequency Deviation = 10
With Noise:



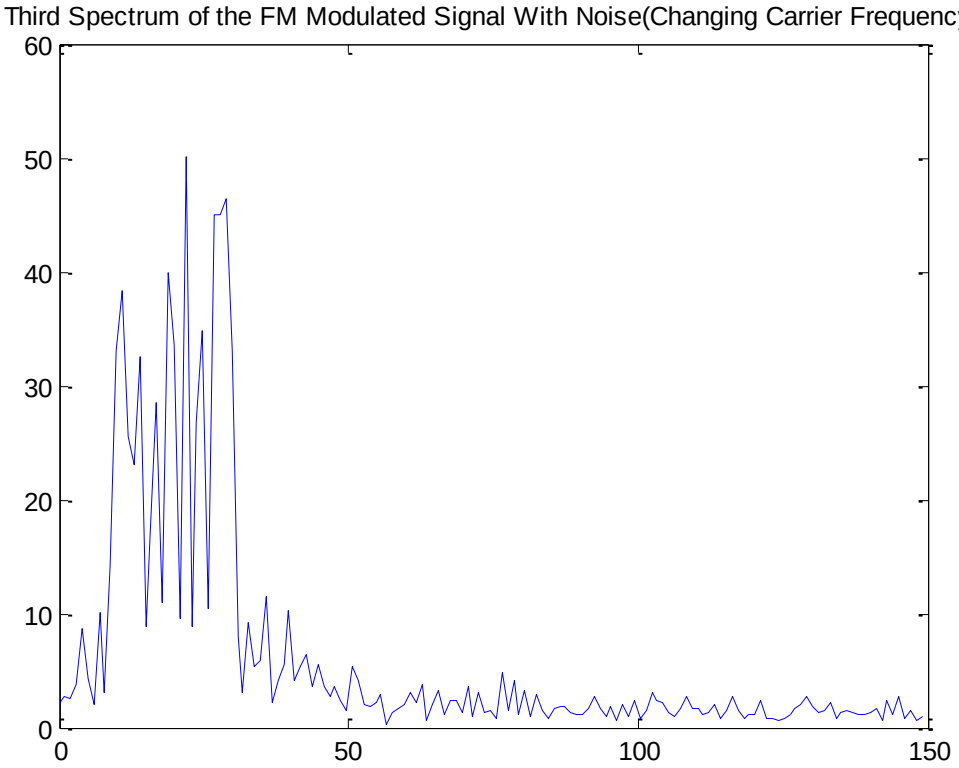


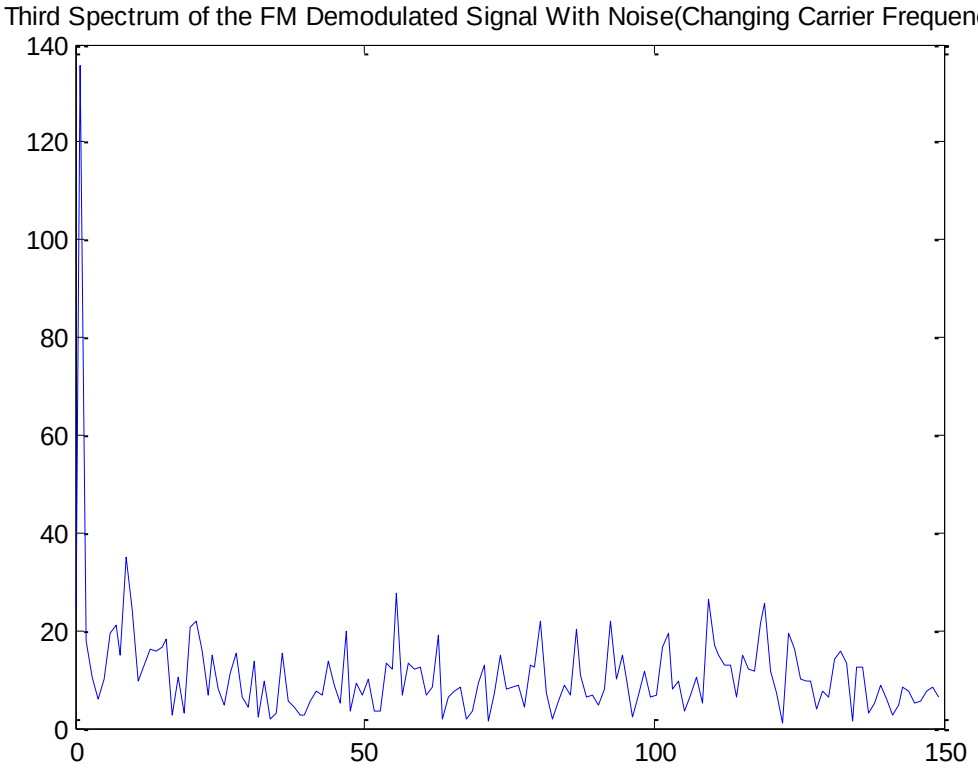
Sampling rate = 300 sample per second
Carrier Frequency = 20 Hz
Frequency Deviation = 10
Without Noise:



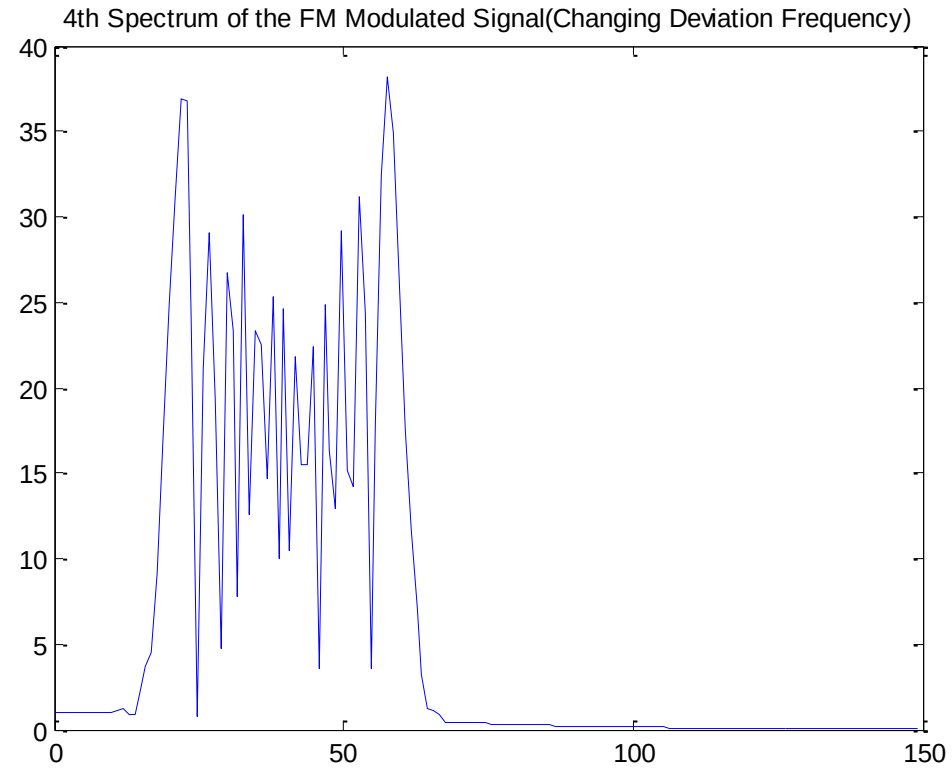


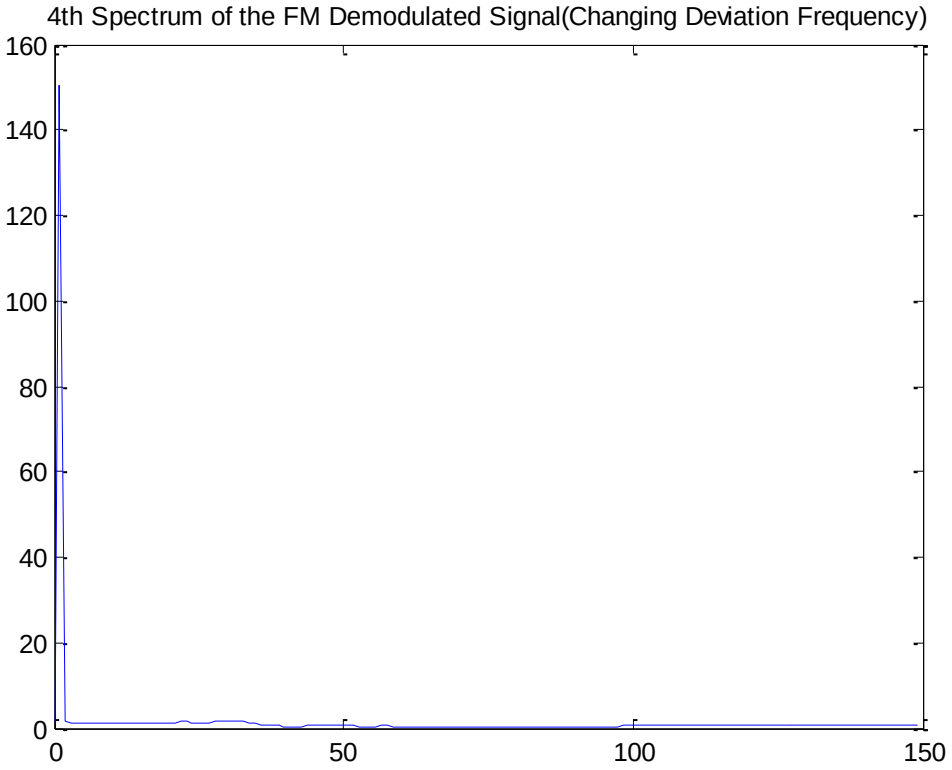
Sampling rate = 300 sample per second
Carrier Frequency = 20 Hz
Frequency Deviation = 10
With Noise:



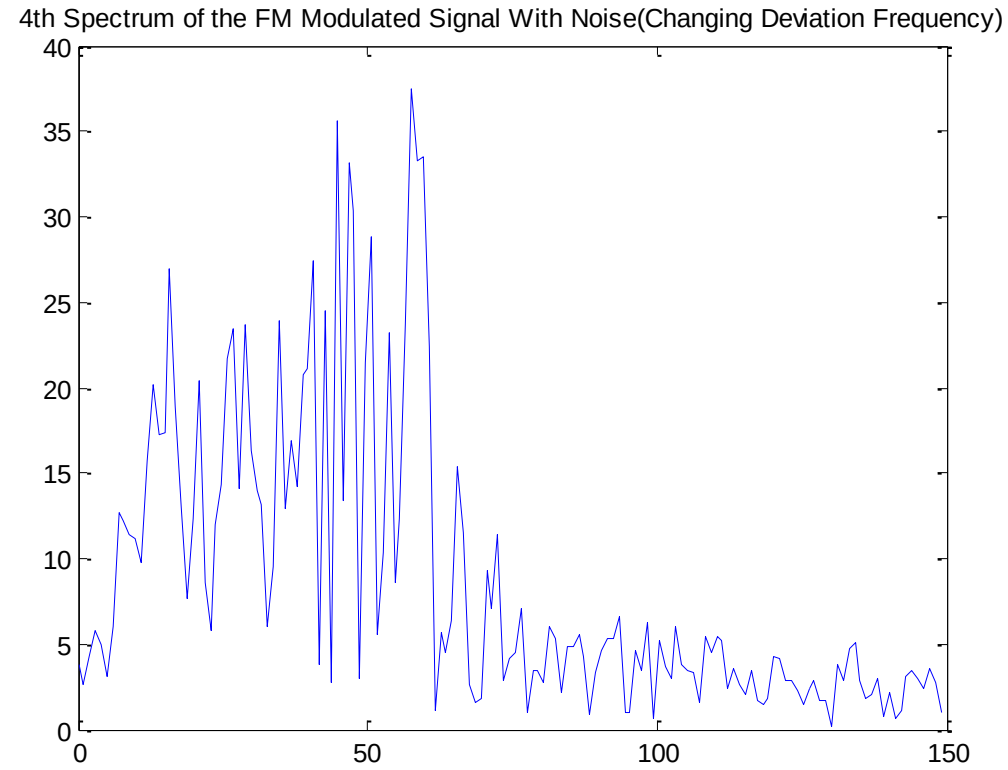


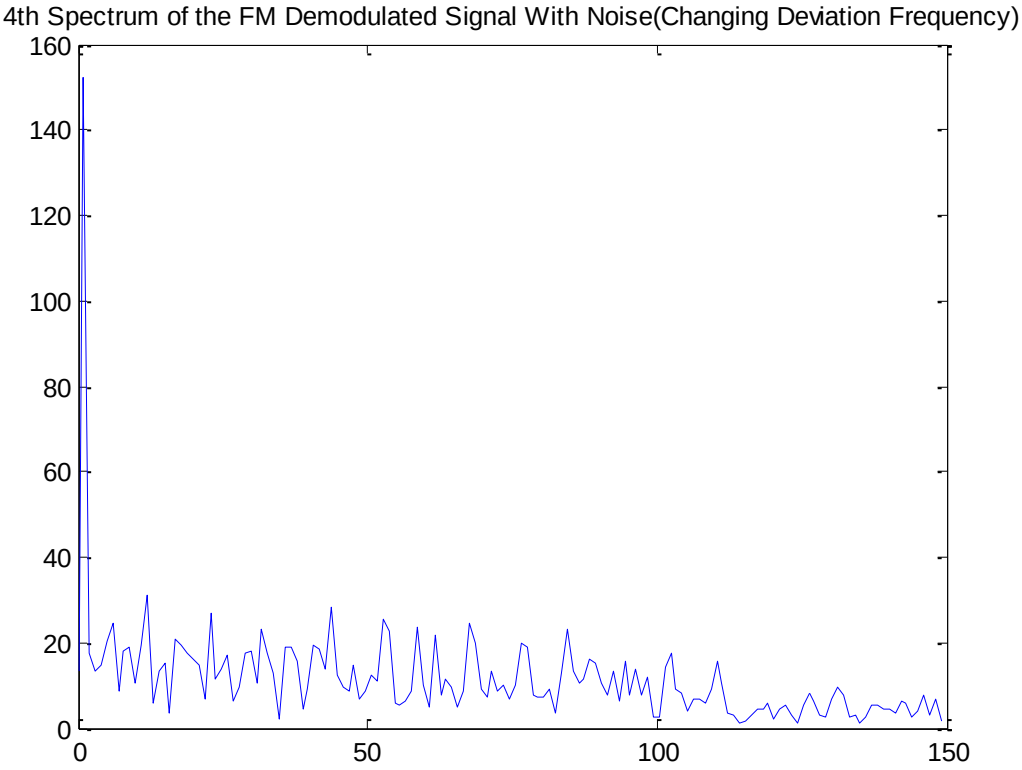
Sampling rate = 300 sample per second
Carrier Frequency = 40 Hz
Frequency Deviation = 20
Without Noise:



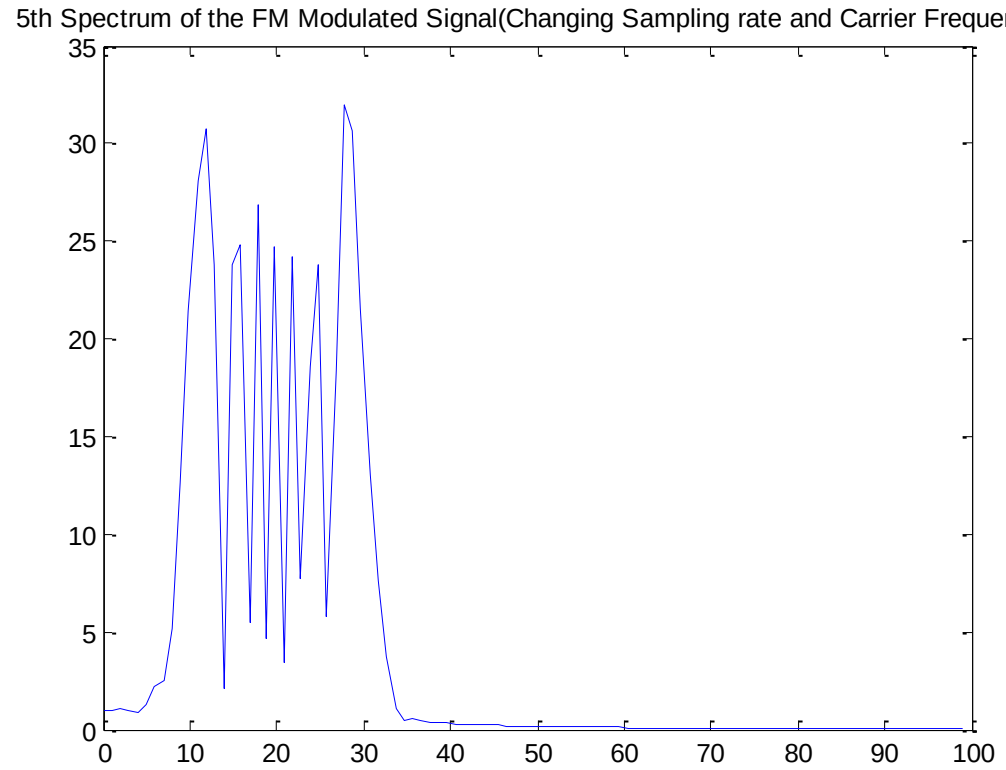


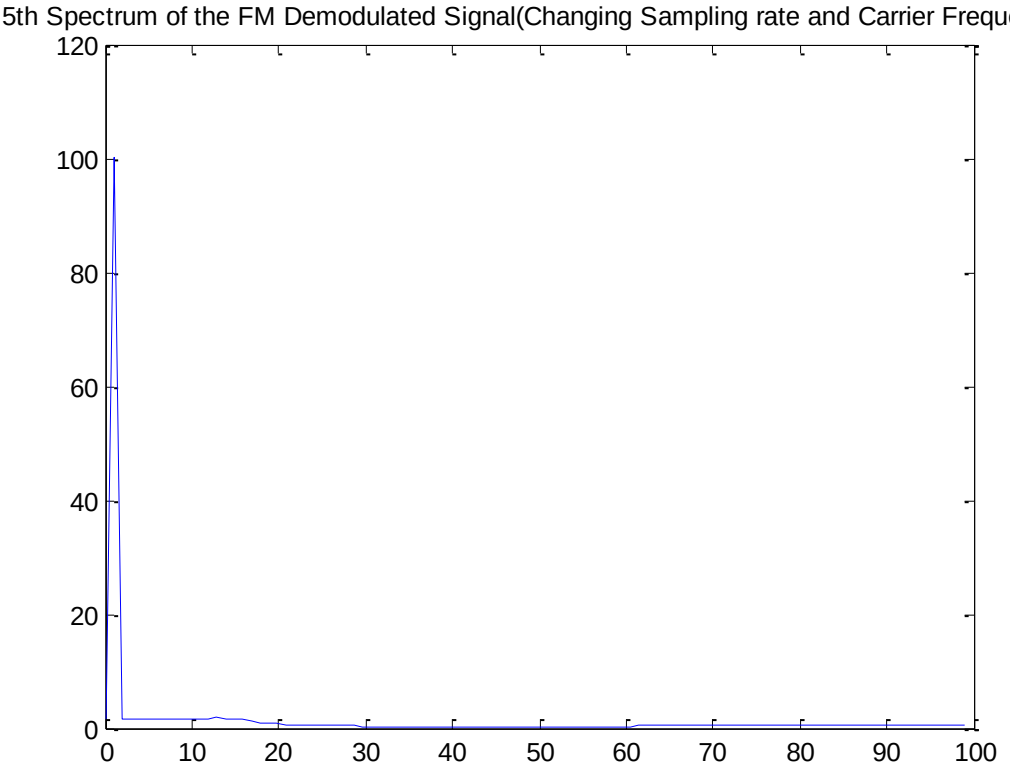
Sampling rate = 300 sample per second
Carrier Frequency = 40 Hz
Frequency Deviation = 20
With Noise:



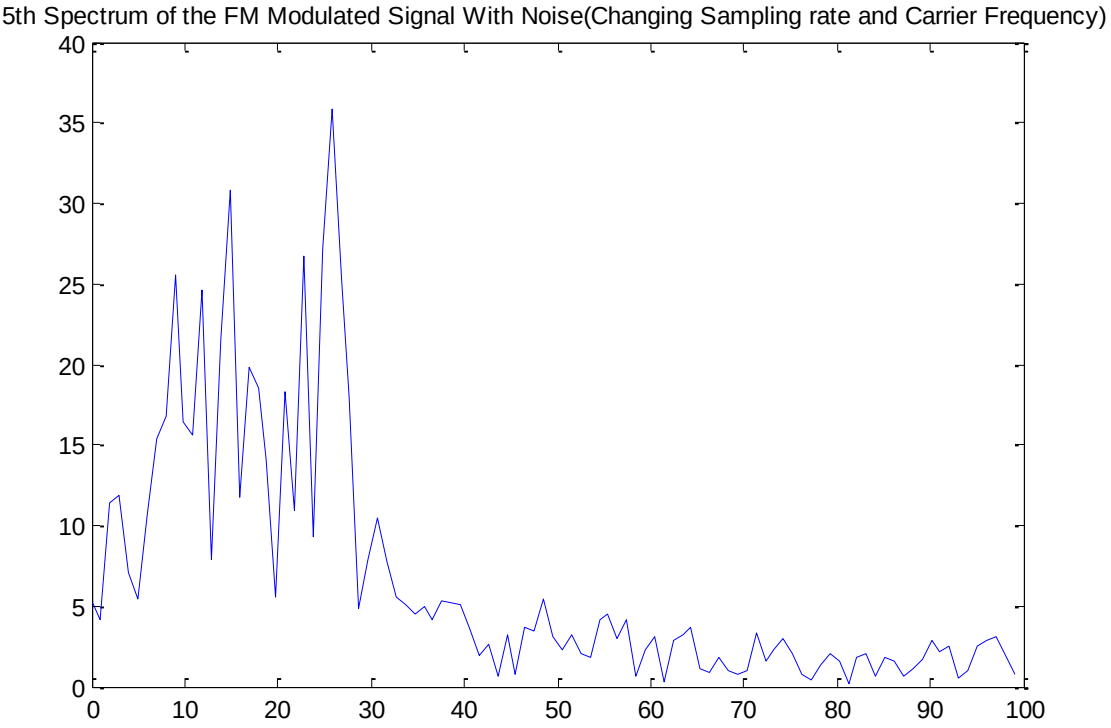


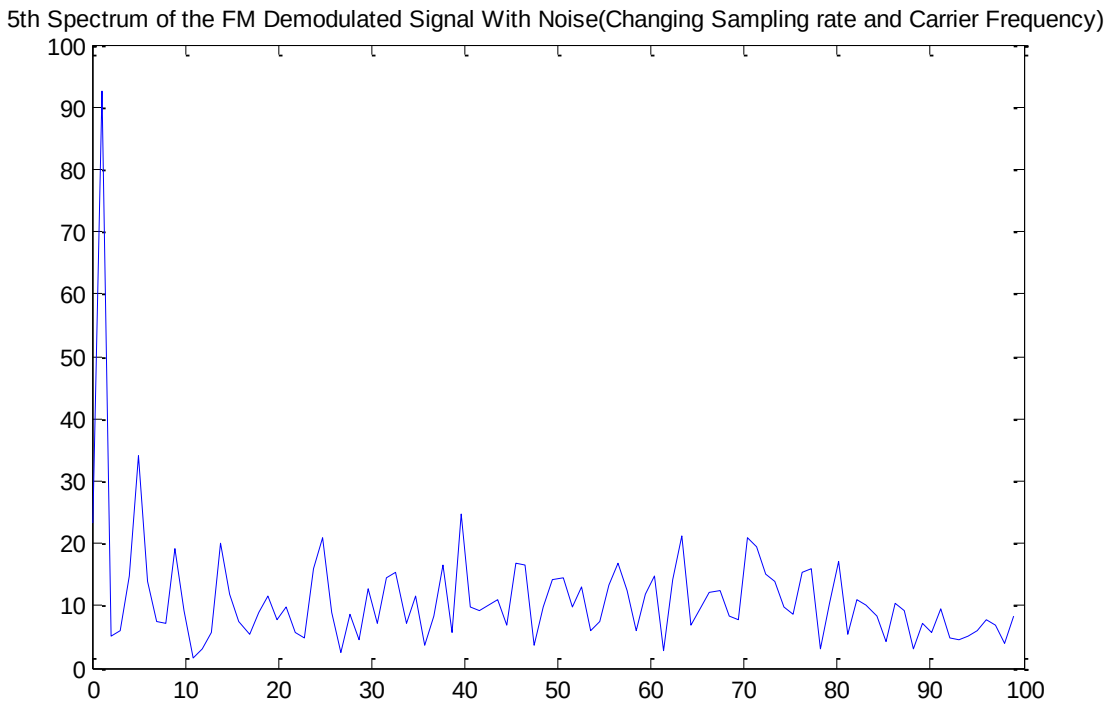
Sampling rate = 200 sample per second
Carrier Frequency = 20 Hz
Frequency Deviation = 10
Without Noise:



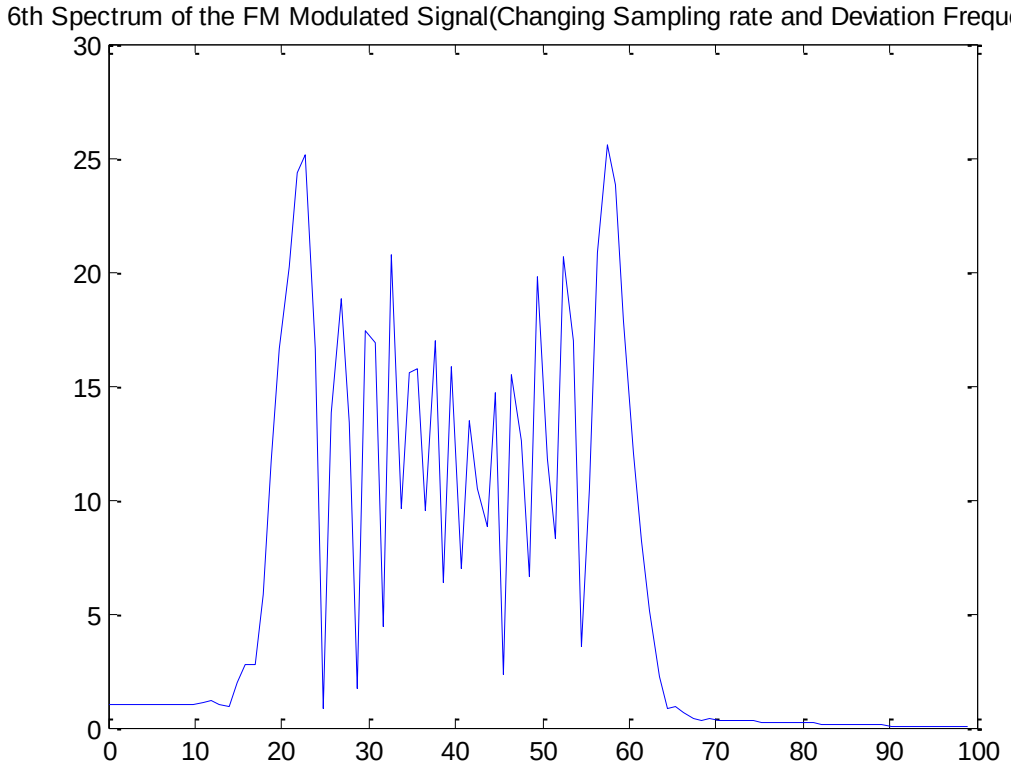


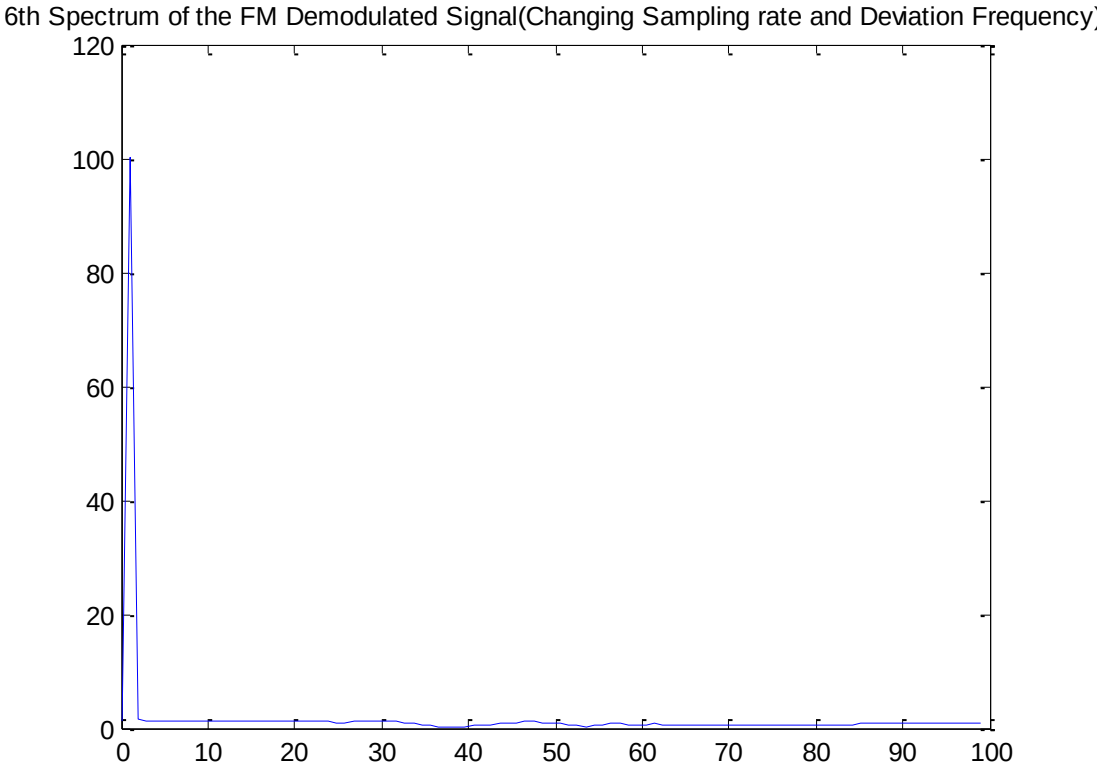
Sampling rate = 200 sample per second
Carrier Frequency = 20 Hz
Frequency Deviation = 10
With Noise:



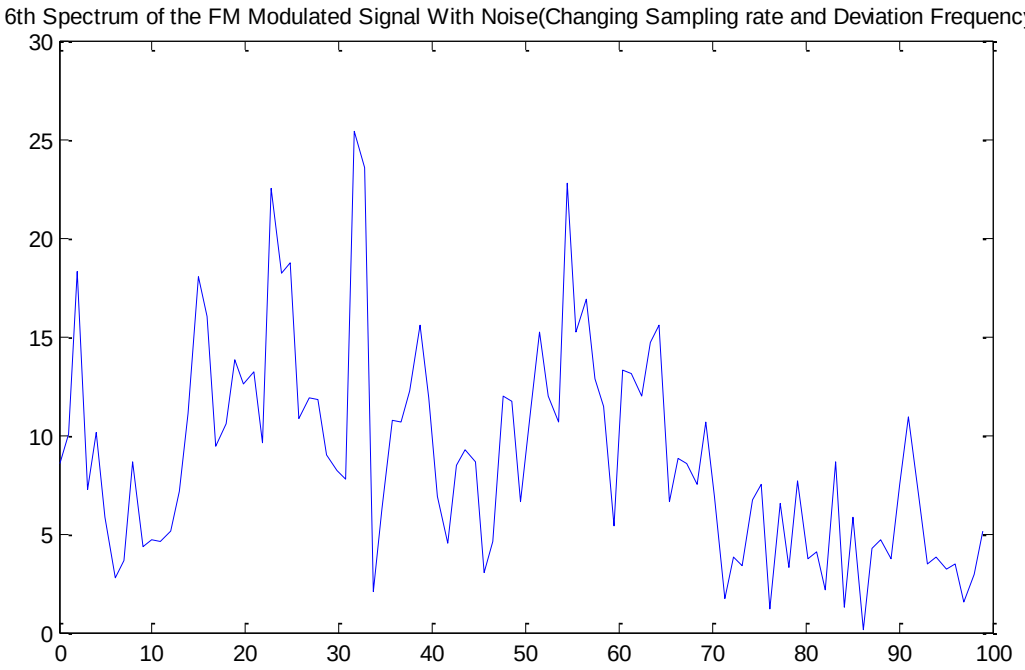


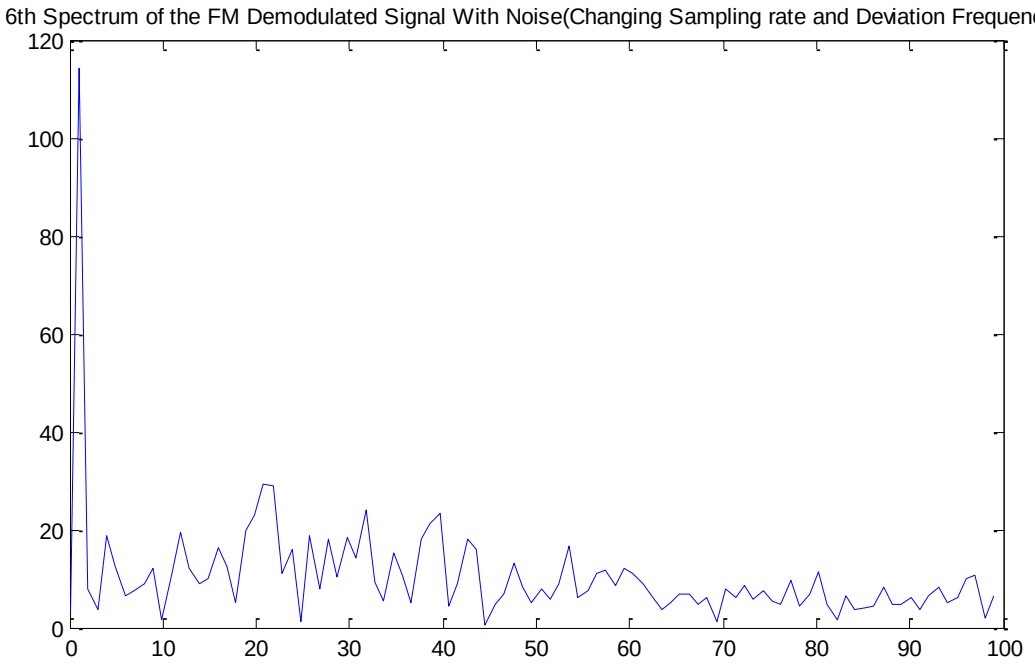
Sampling rate = 200 sample per second
Carrier Frequency = 40 Hz
Frequency Deviation = 20
Without Noise:



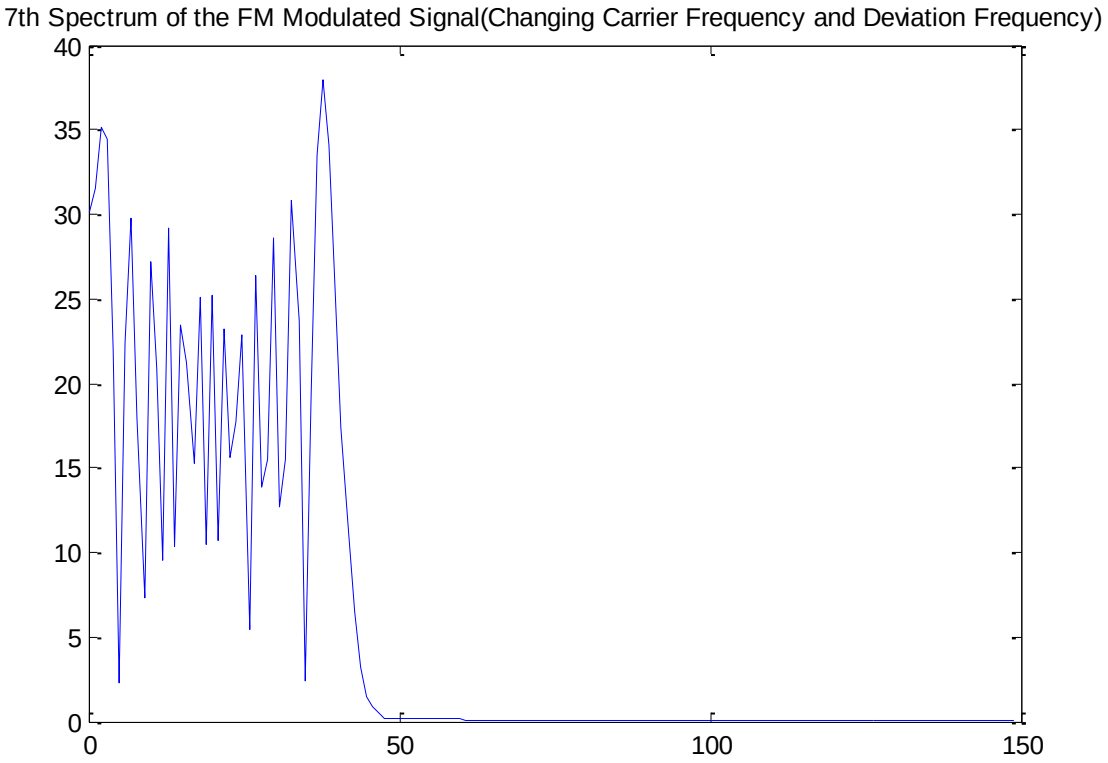


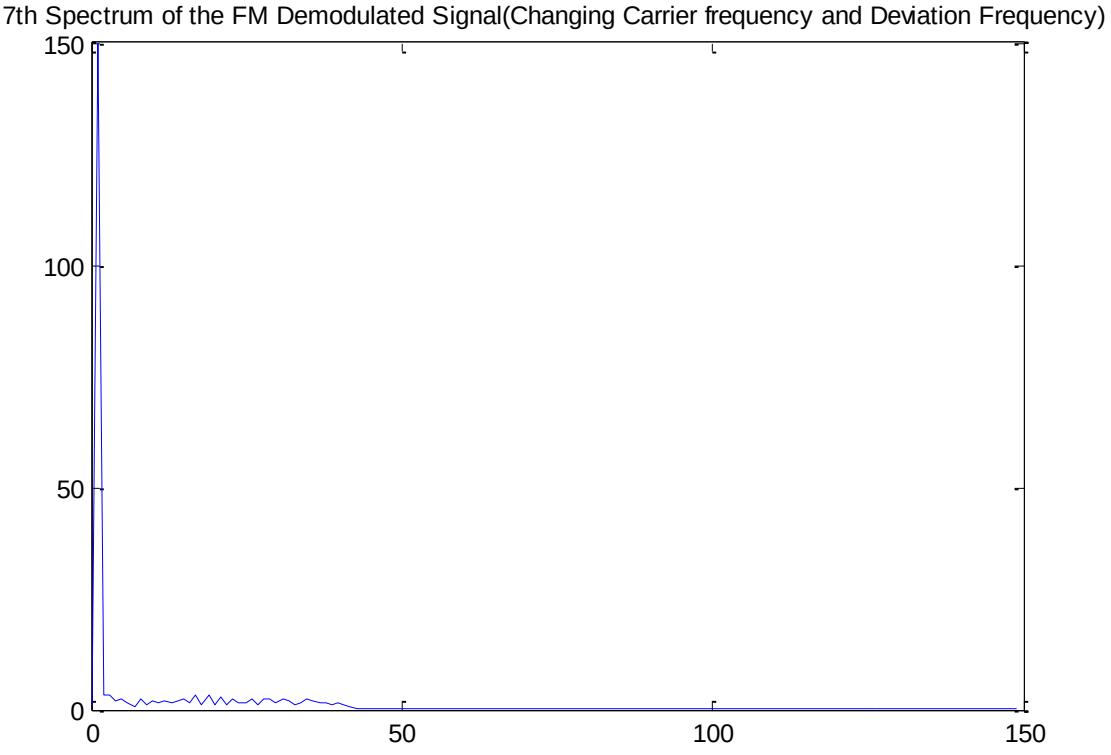
Sampling rate = 200 sample per second
Carrier Frequency = 40 Hz
Frequency Deviation = 20
With Noise:



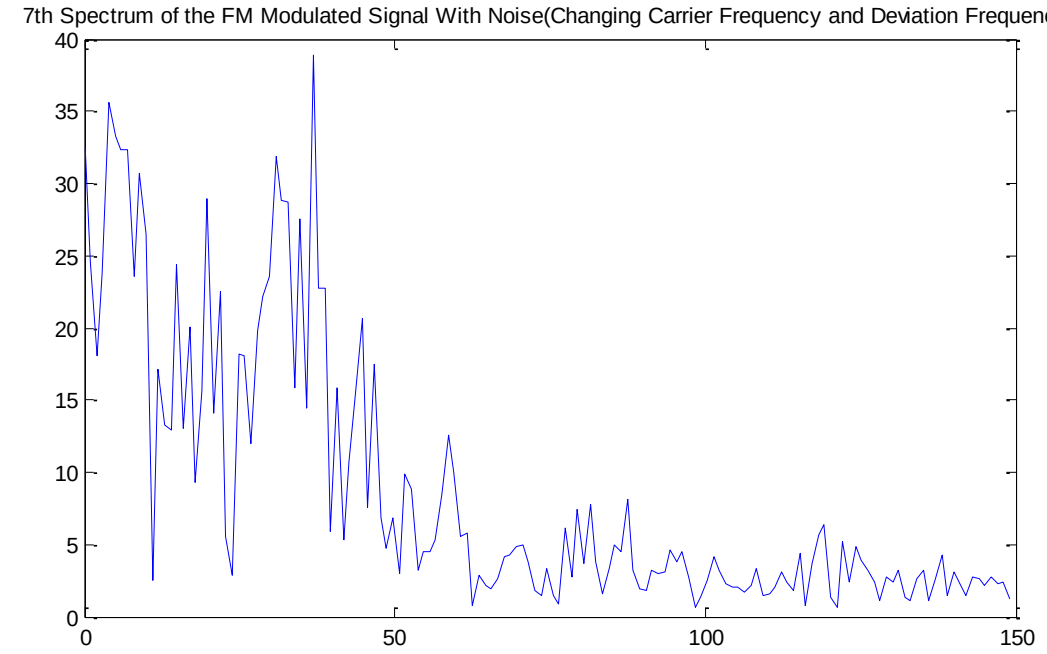


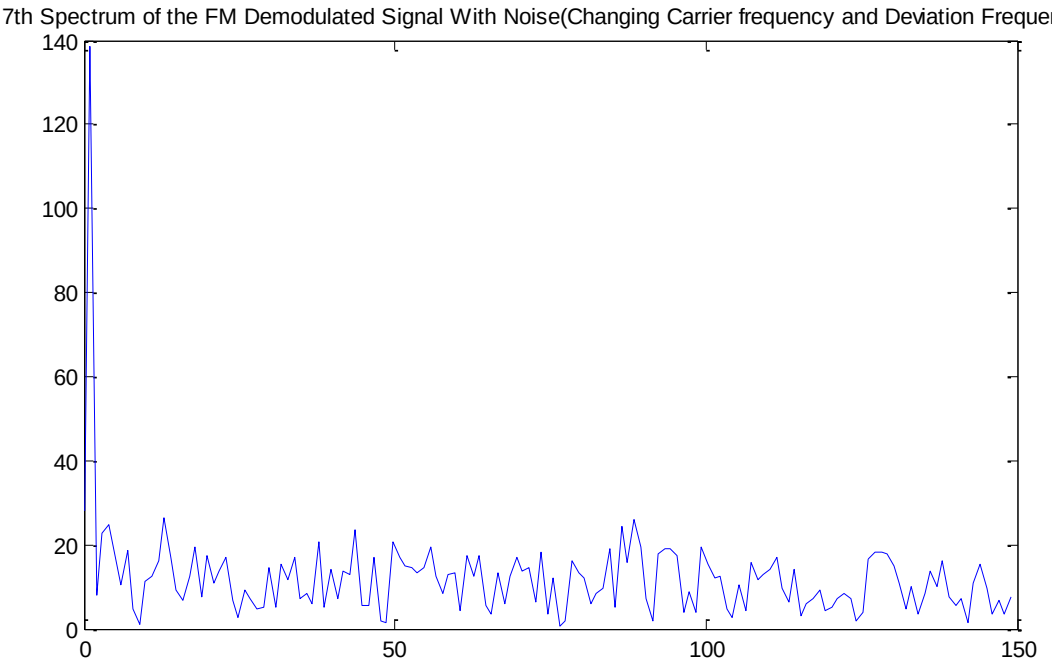
Sampling rate = 300 sample per second
Carrier Frequency = 20 Hz
Frequency Deviation = 20
Without Noise:



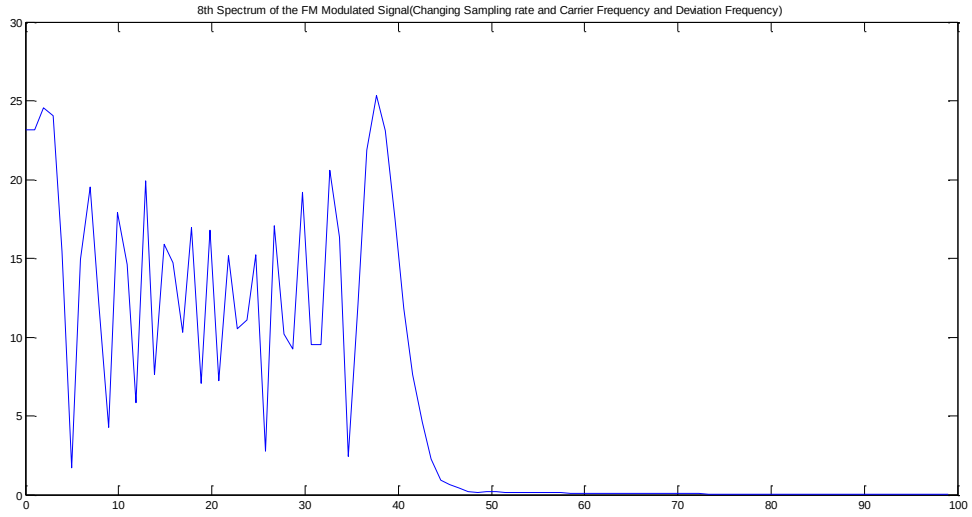


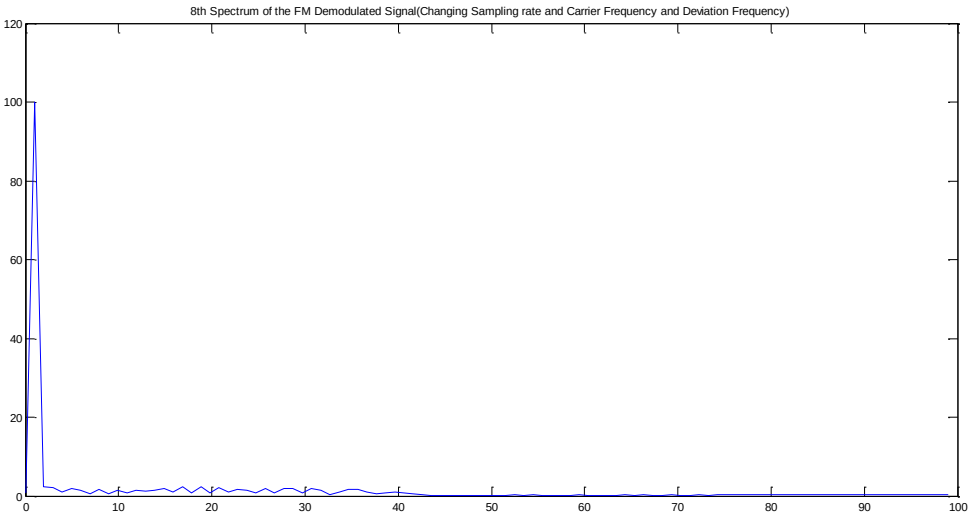
Sampling rate = 300 sample per second
Carrier Frequency = 20 Hz
Frequency Deviation = 20
With Noise:



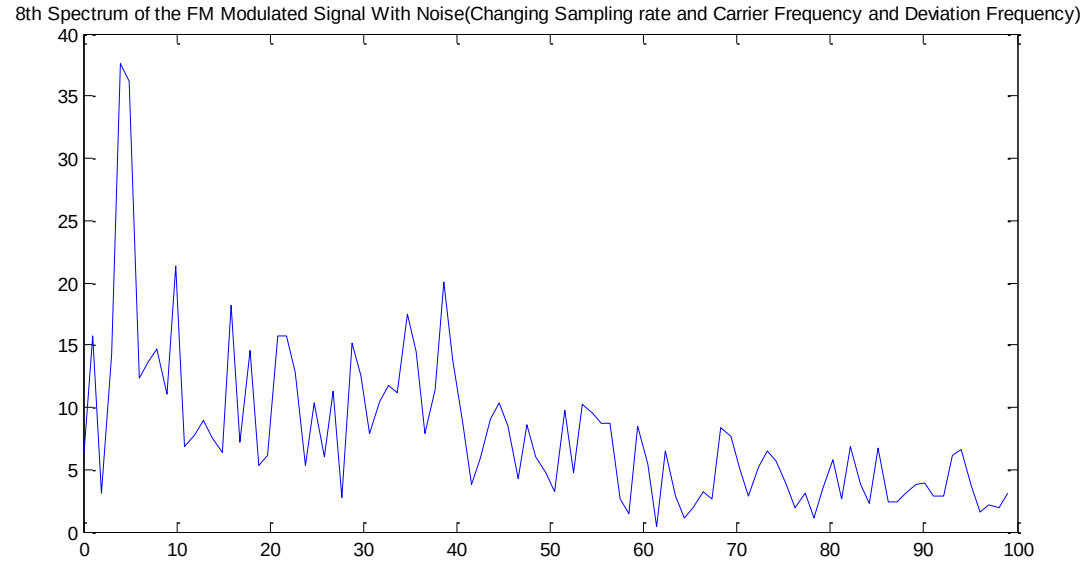


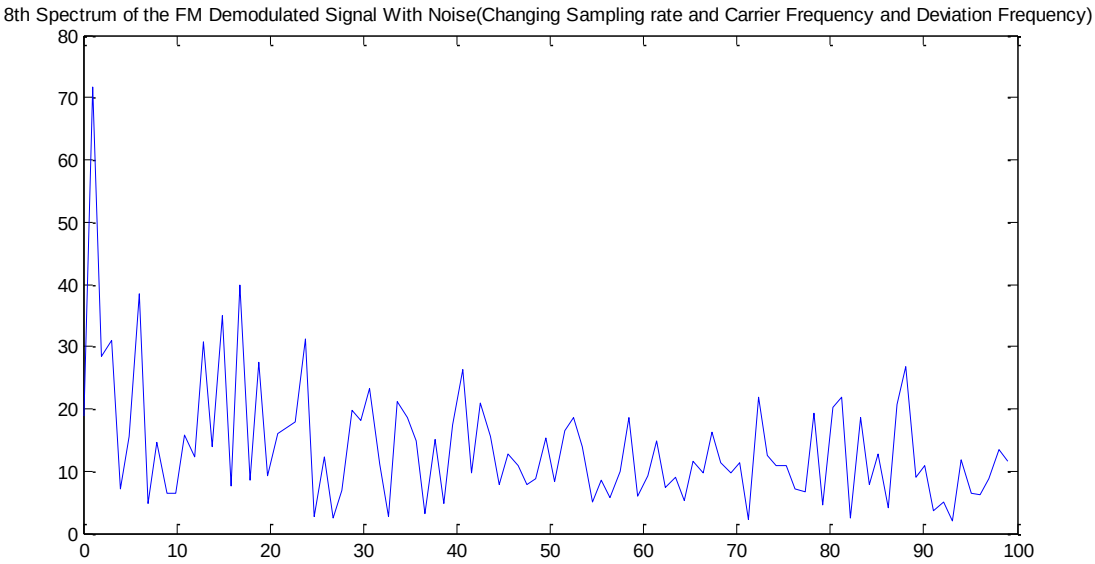
Sampling rate = 200 sample per second
Carrier Frequency = 20 Hz
Frequency Deviation = 20
Without Noise:



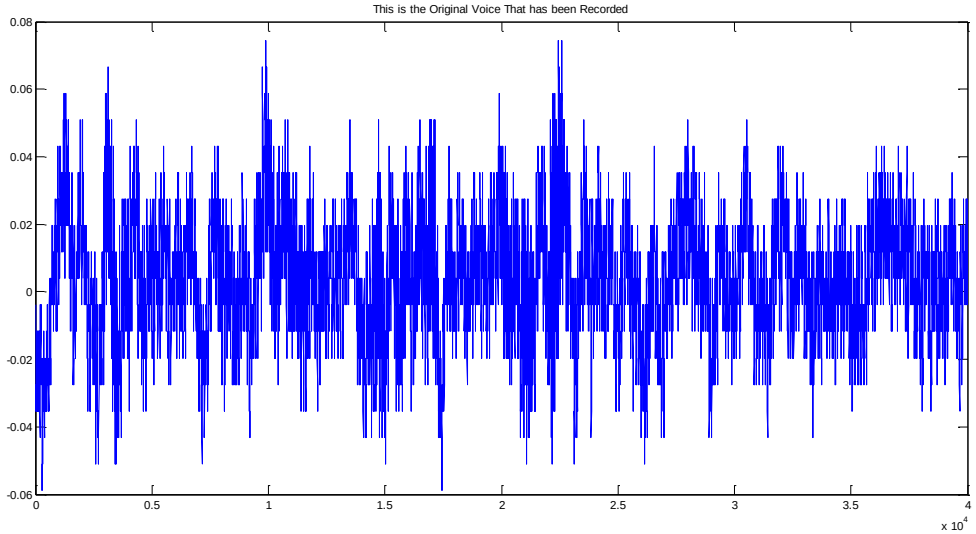


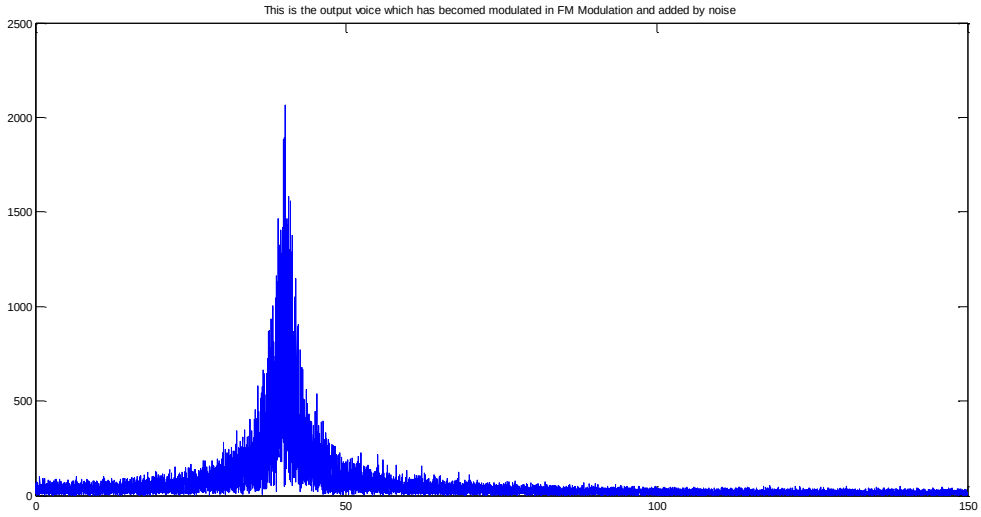
Sampling rate = 200 sample per second
Carrier Frequency = 20 Hz
Frequency Deviation = 20
With Noise:

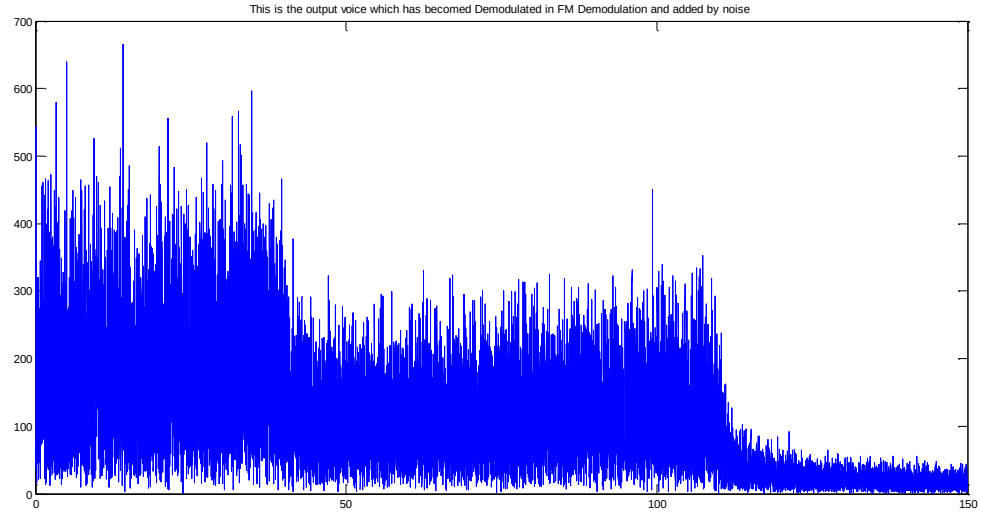




Recorded Voice with Noise and $f_c = 40\ Hz$ and $f_s = 300\ sample\ per\ second$ And $Frequency\ Deviation = 10$

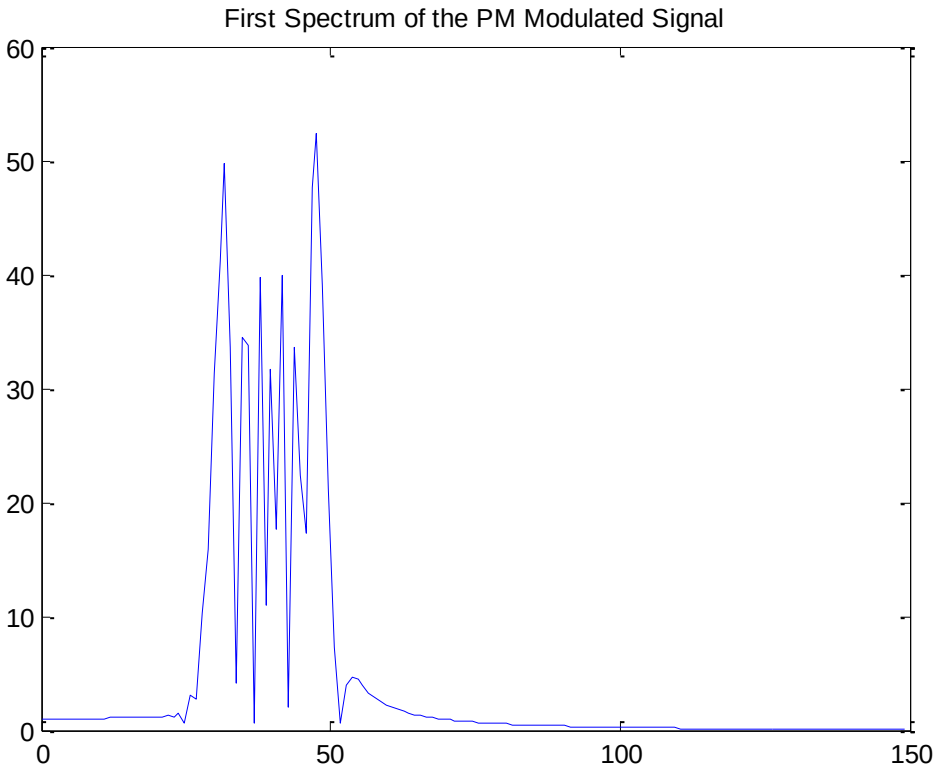


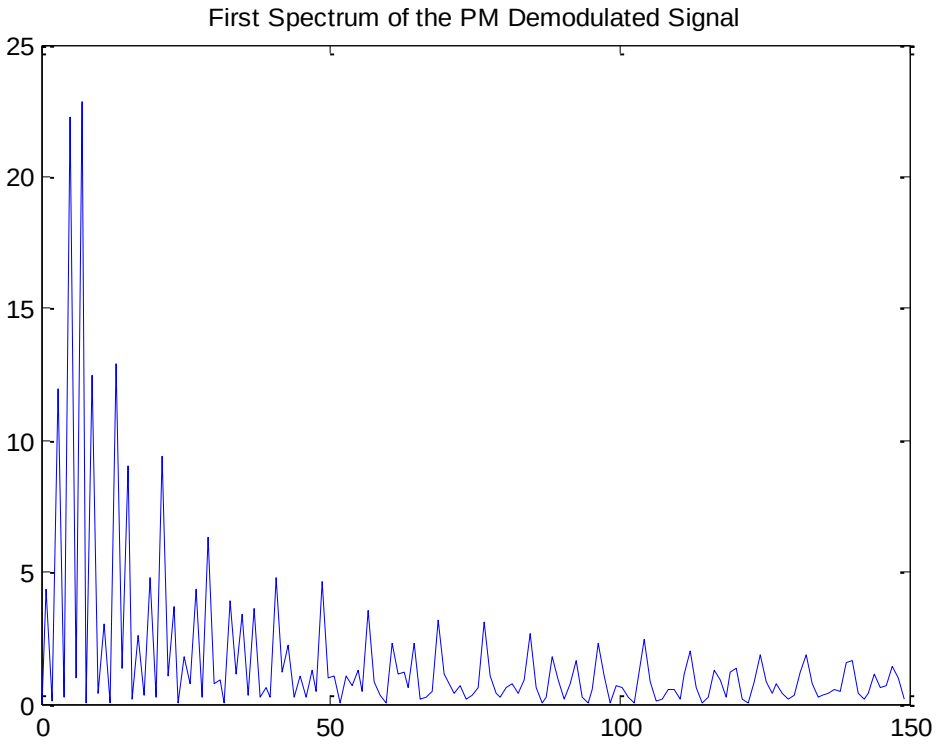




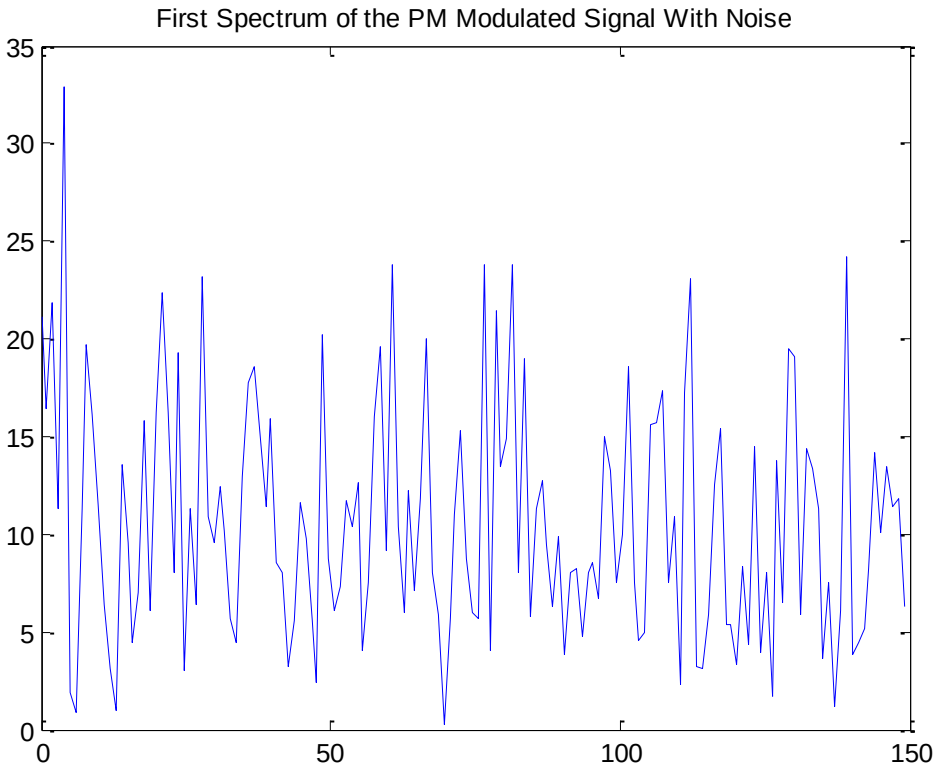
C) PM Modulation and Demodulation

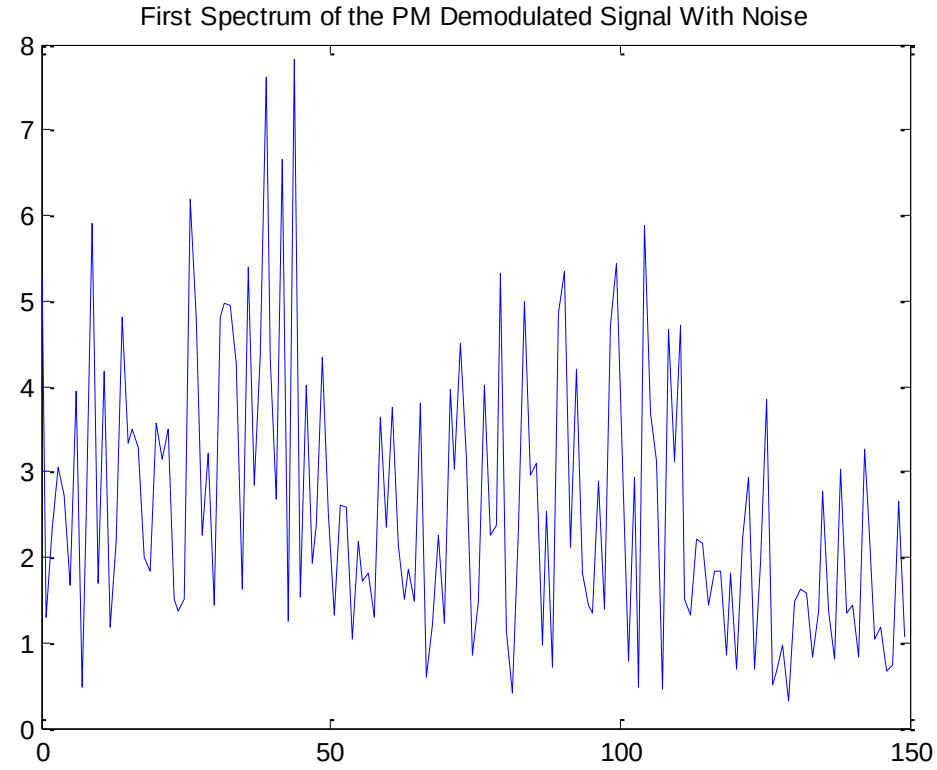
Sampling rate = 300 sample per second
Carrier Frequency = 40 Hz
Phase Deviation = 10
Without Noise:



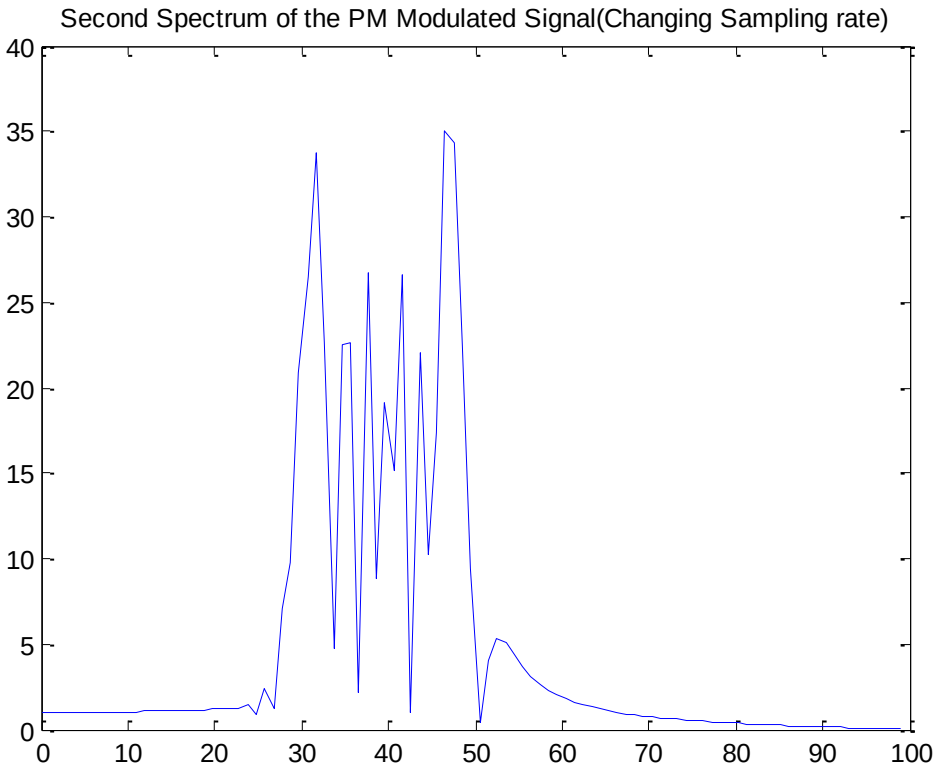


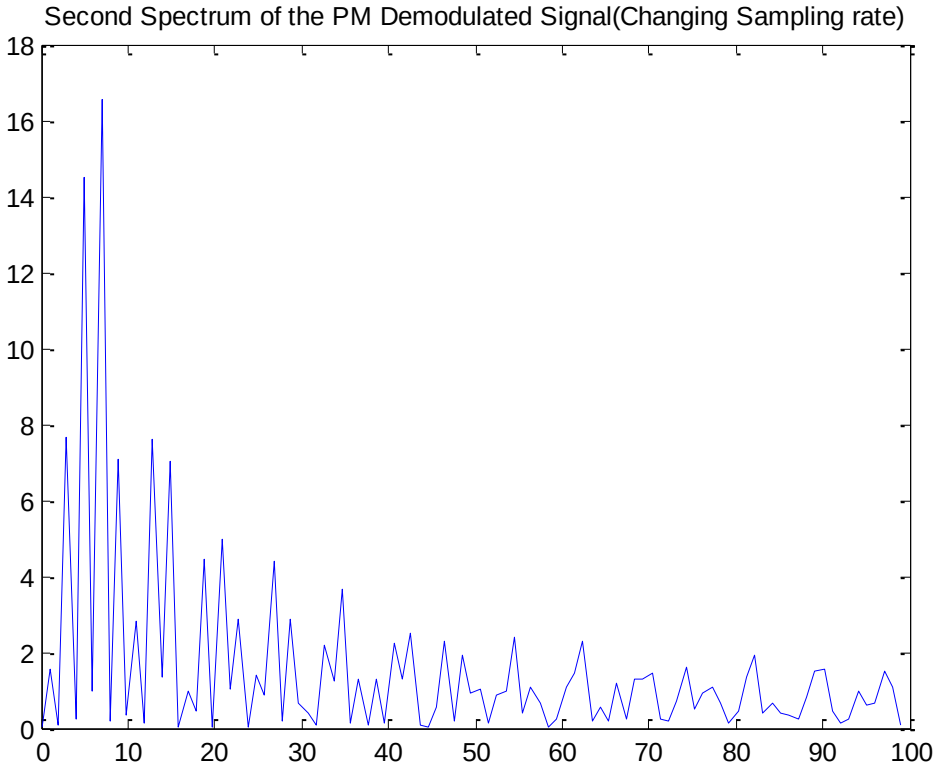
Sampling rate = 300 sample per second
Carrier Frequency = 40 Hz
Phase Deviation = 10
With Noise:



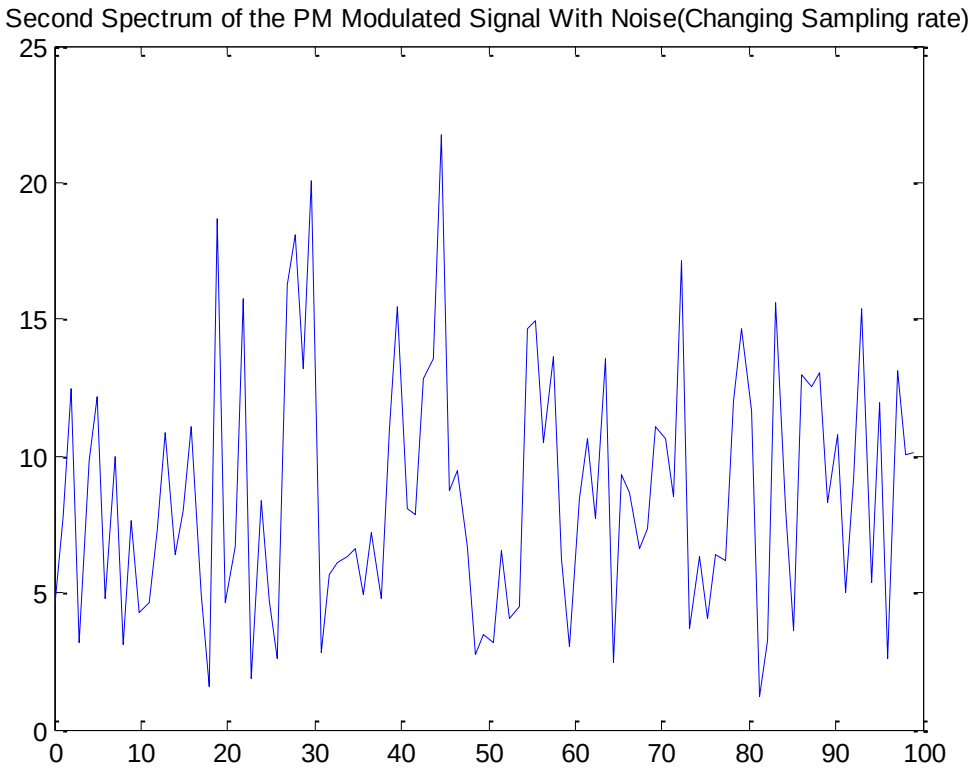


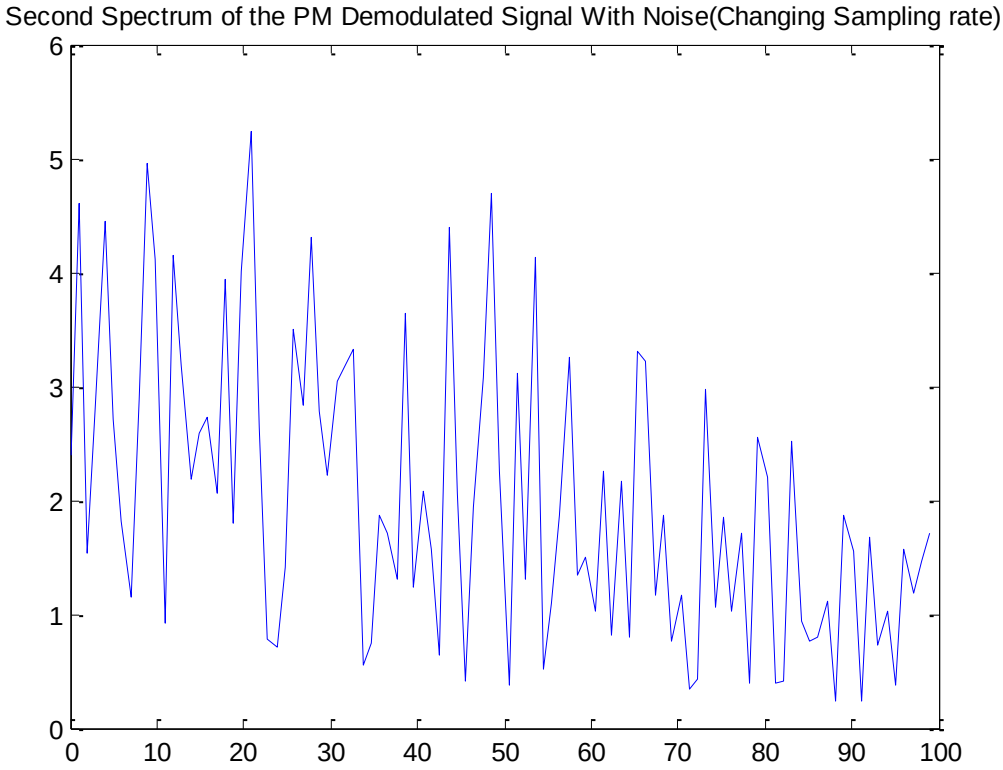
Sampling rate = 200 sample per second
Carrier Frequency = 40 Hz
Frequency Deviation = 10
Without Noise:



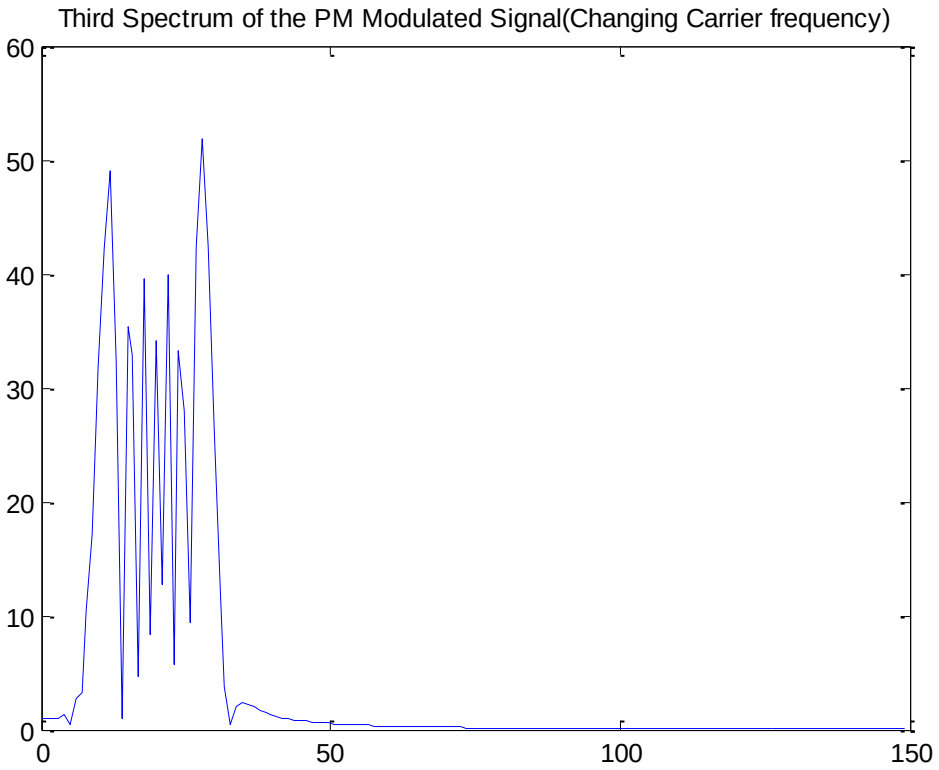


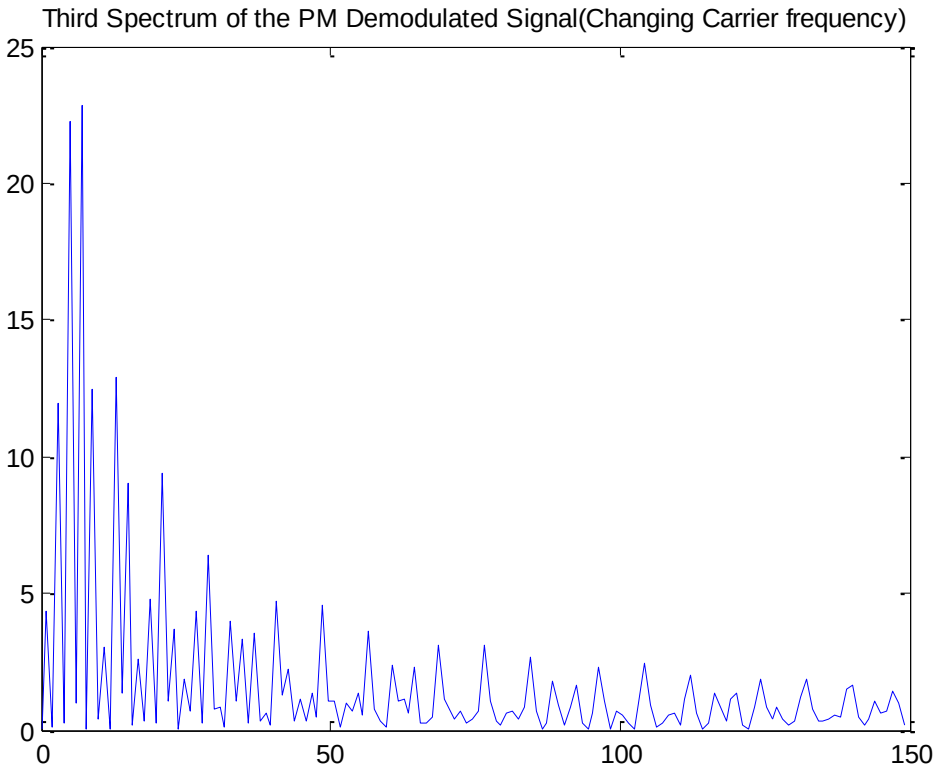
Sampling rate = 200 sample per second
Carrier Frequency = 40 Hz
Frequency Deviation = 10
With Noise:



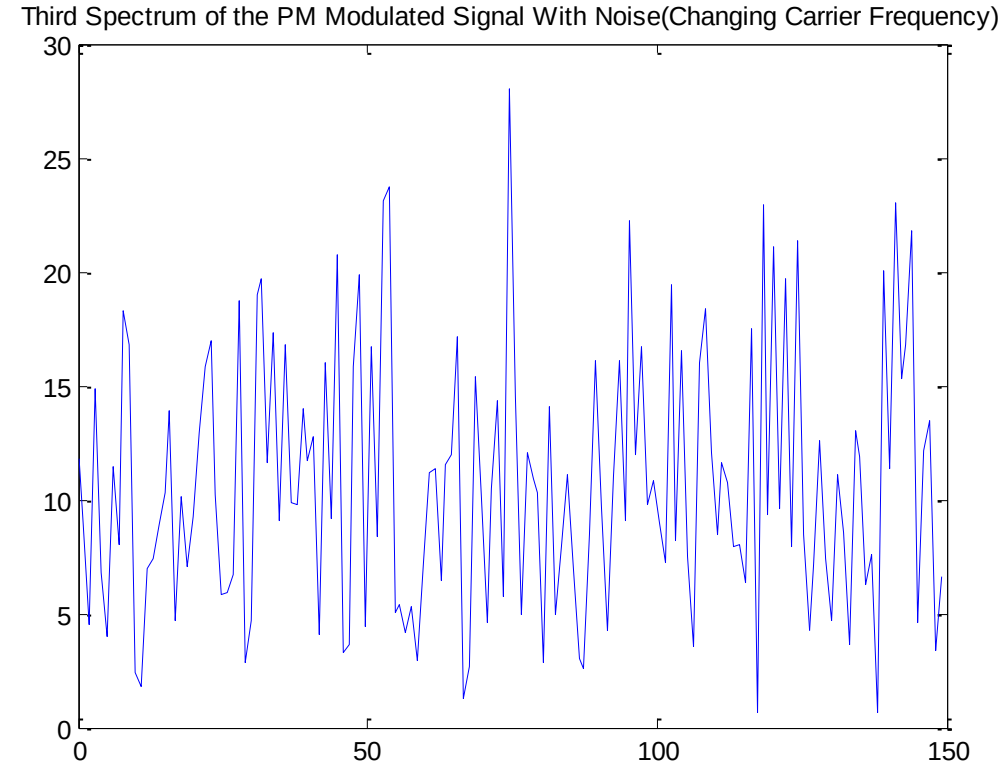


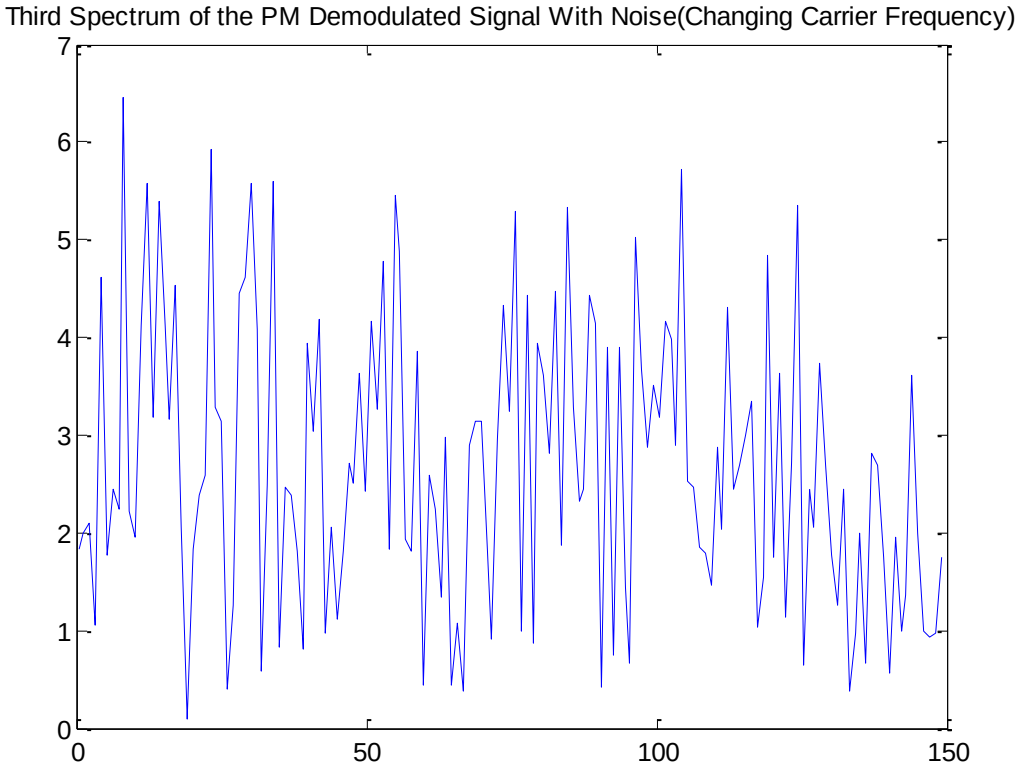
Sampling rate = 300 sample per second
Carrier Frequency = 20 Hz
Frequency Deviation = 10
Without Noise:



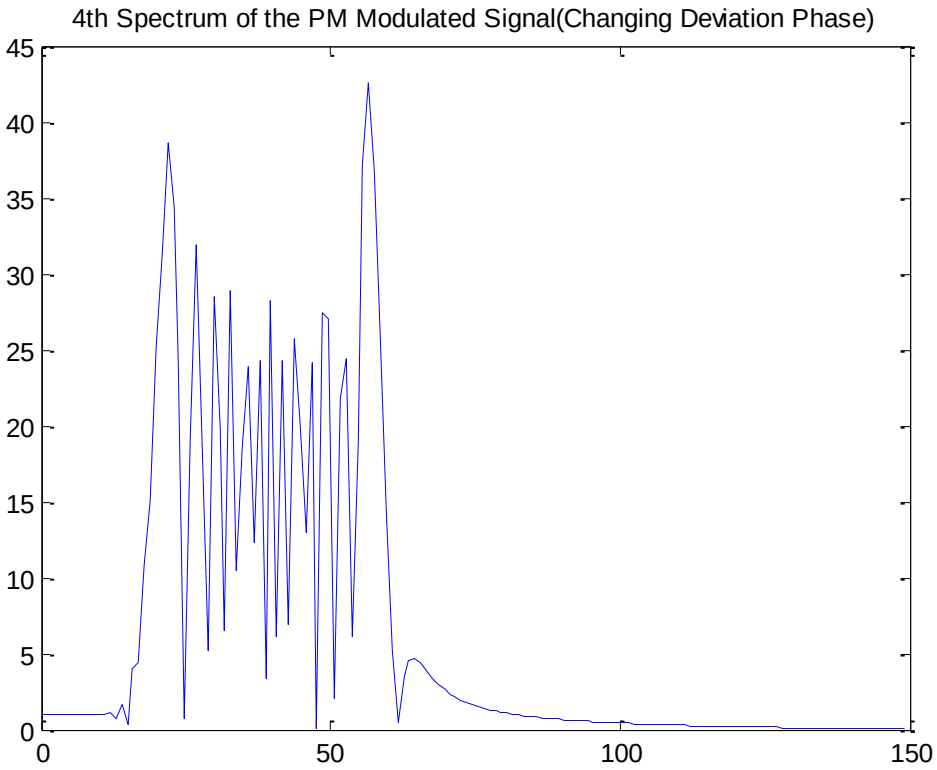


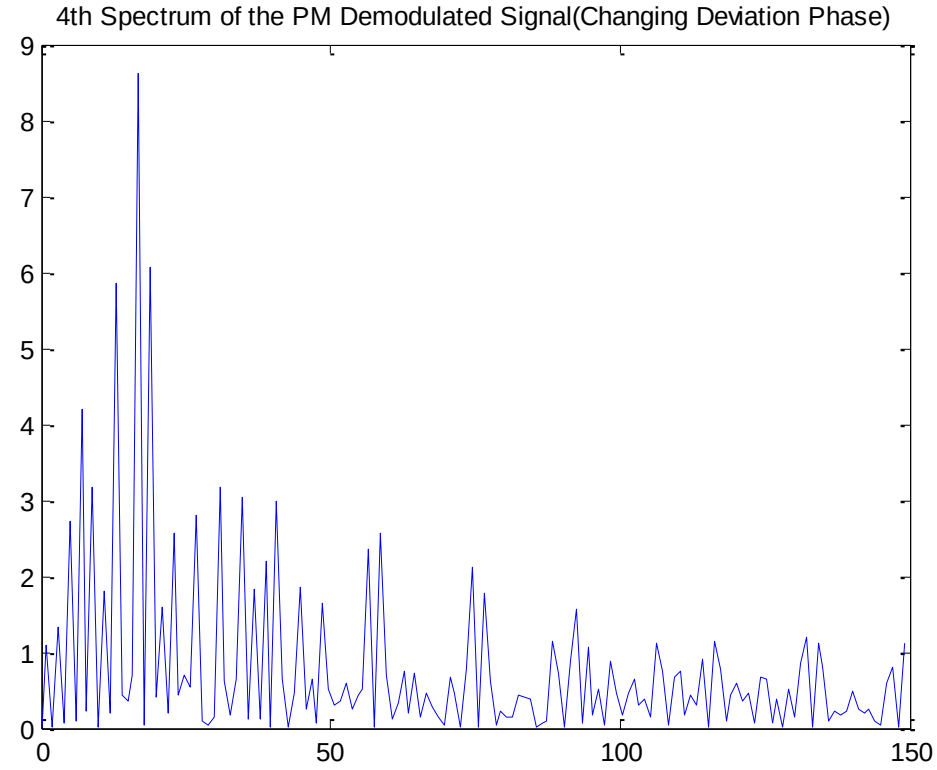
Sampling rate = 300 sample per second
Carrier Frequency = 20 Hz
Frequency Deviation = 10
With Noise:



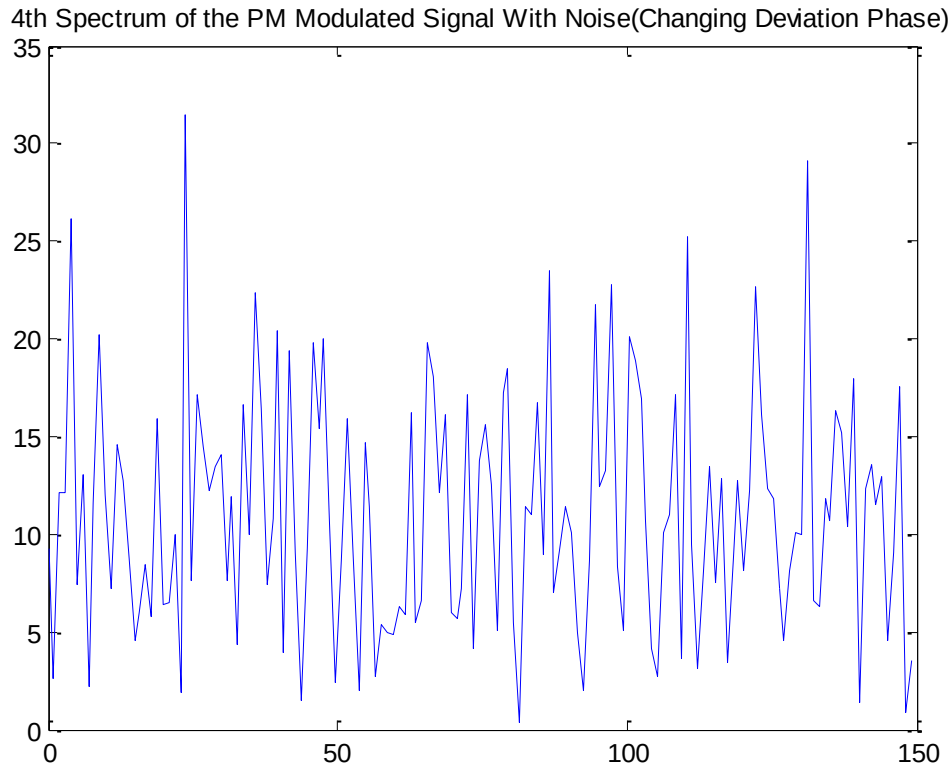


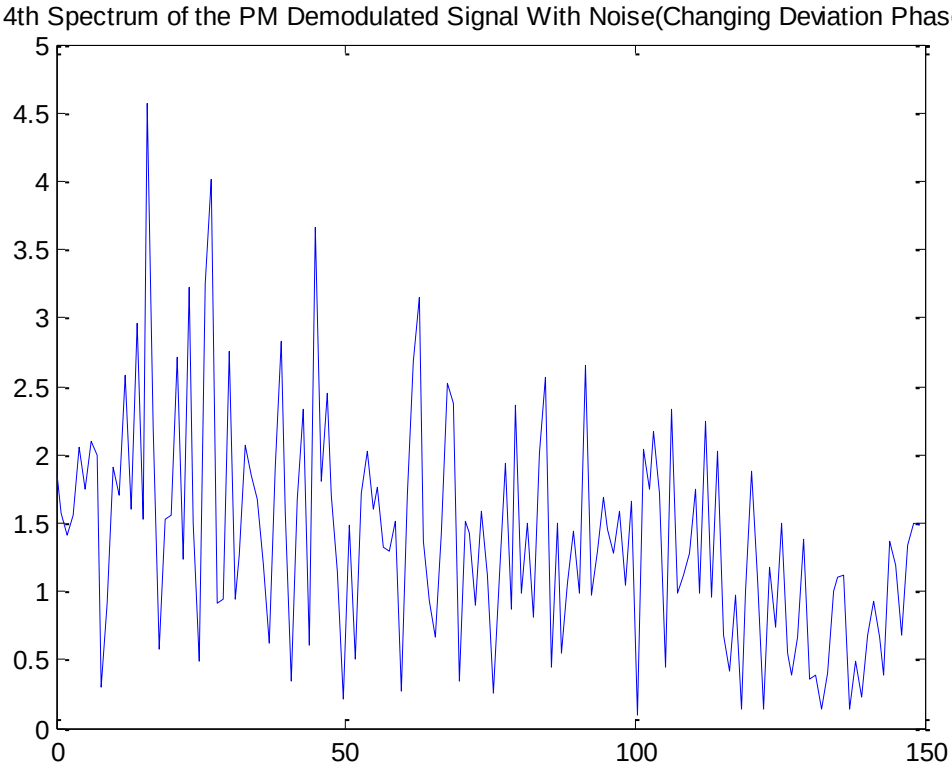
Sampling rate = 300 sample per second
Carrier Frequency = 40 Hz
Frequency Deviation = 20
Without Noise:



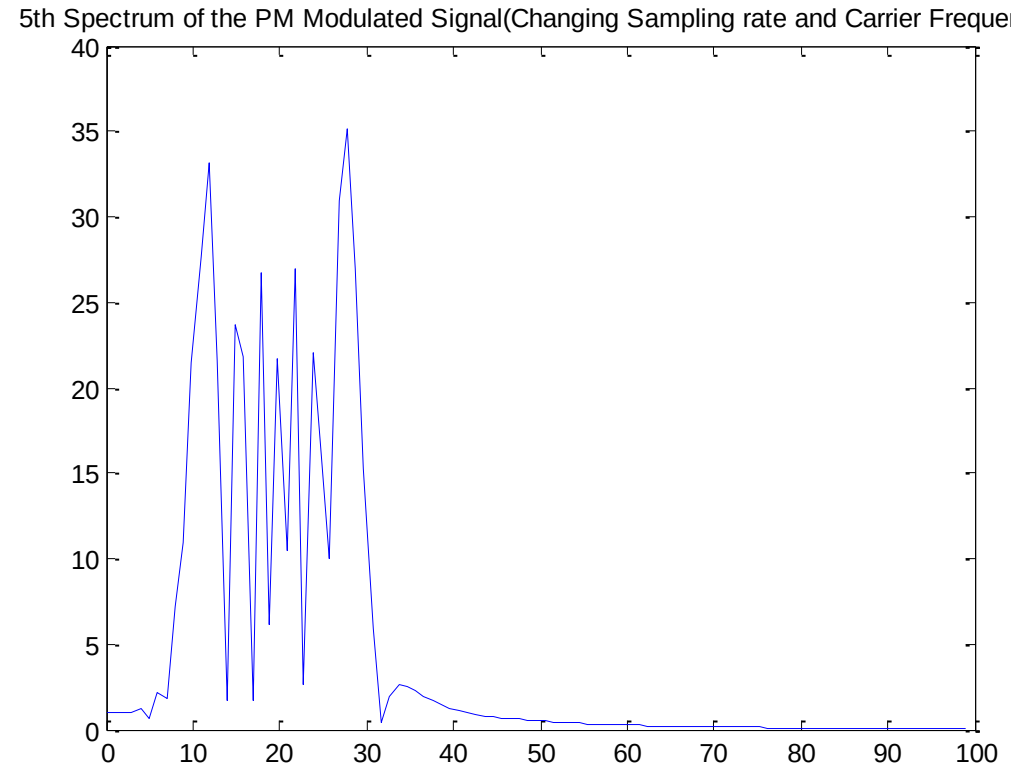


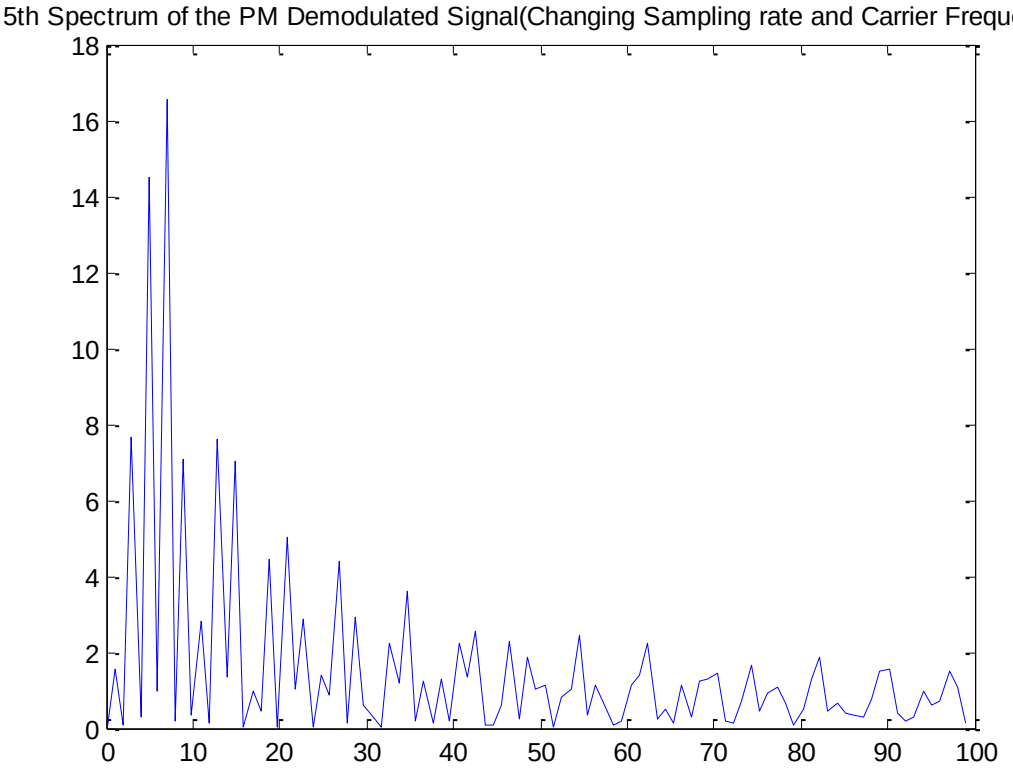
Sampling rate = 300 sample per second
Carrier Frequency = 40 Hz
Frequency Deviation = 20
With Noise:



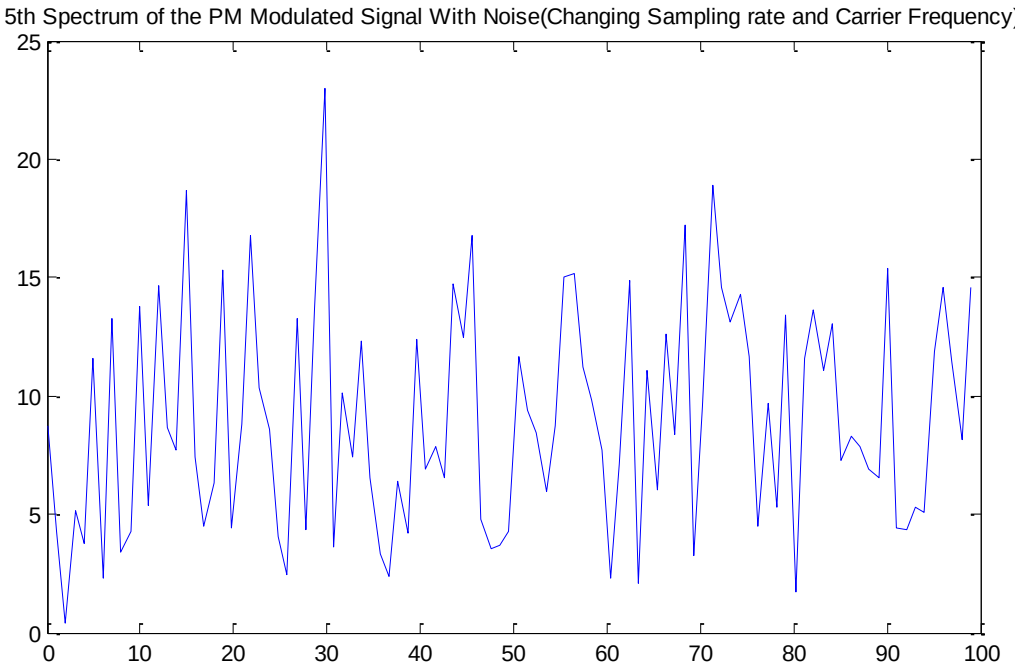


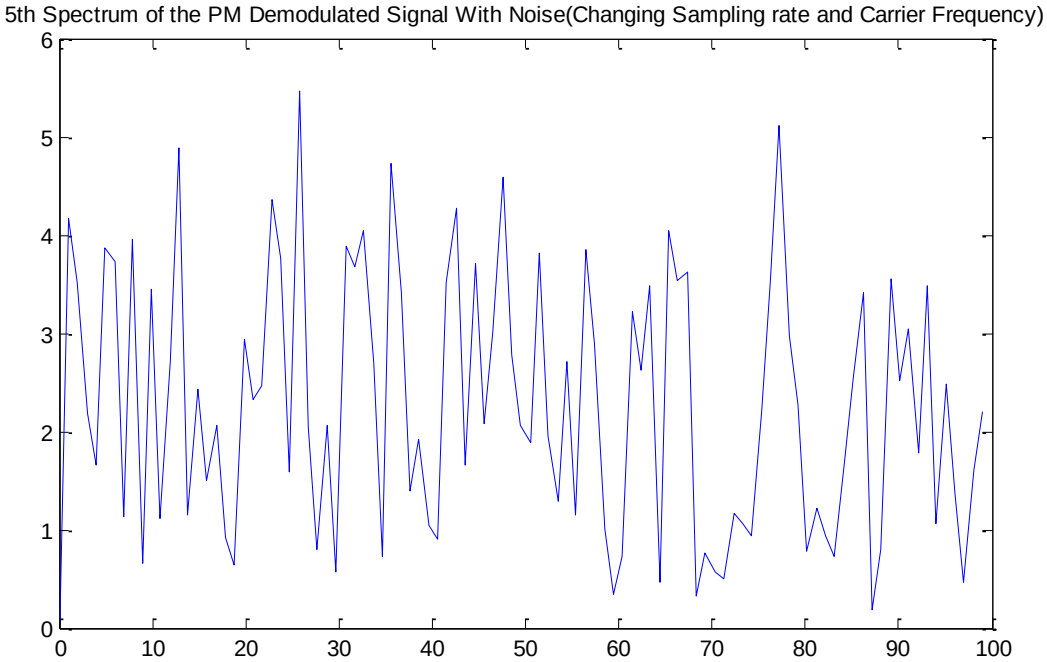
Sampling rate = 200 sample per second
Carrier Frequency = 20 Hz
Frequency Deviation = 10
Without Noise:



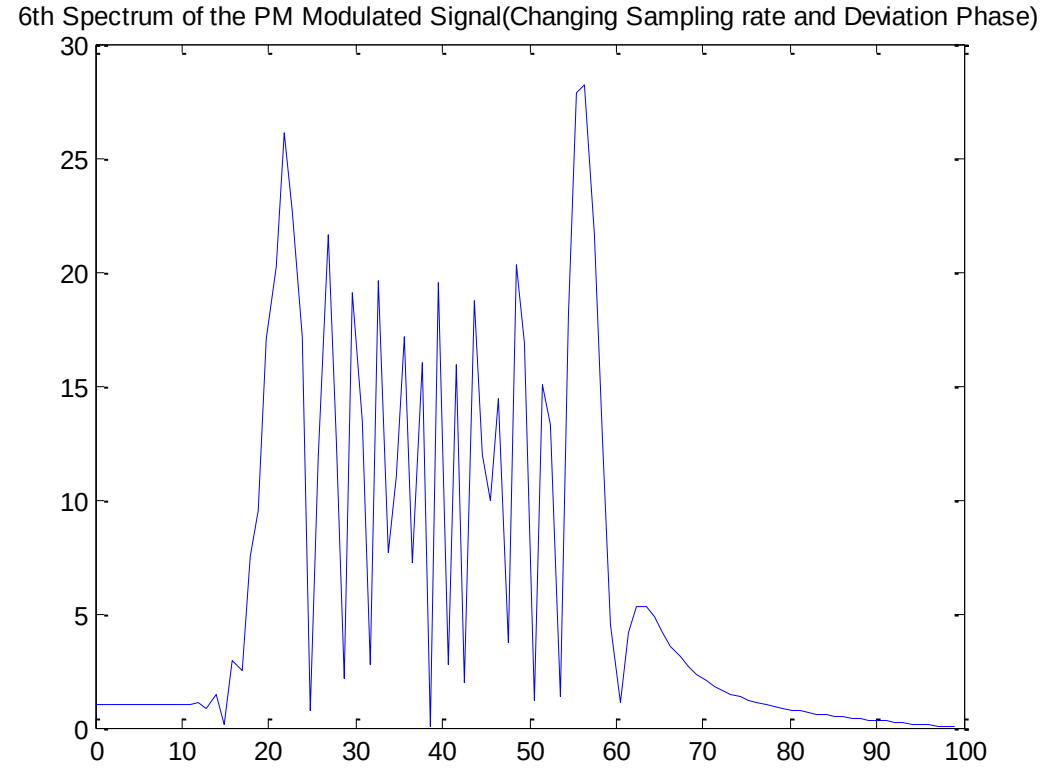


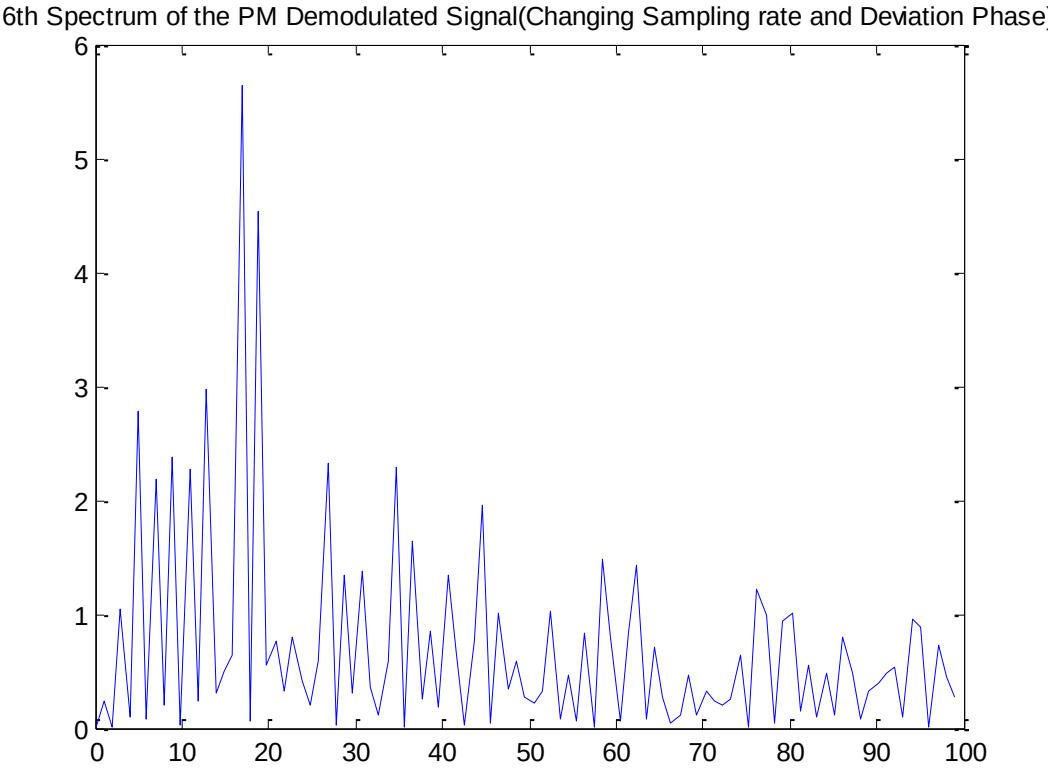
Sampling rate = 200 sample per second
Carrier Frequency = 20 Hz
Frequency Deviation = 10
With Noise:



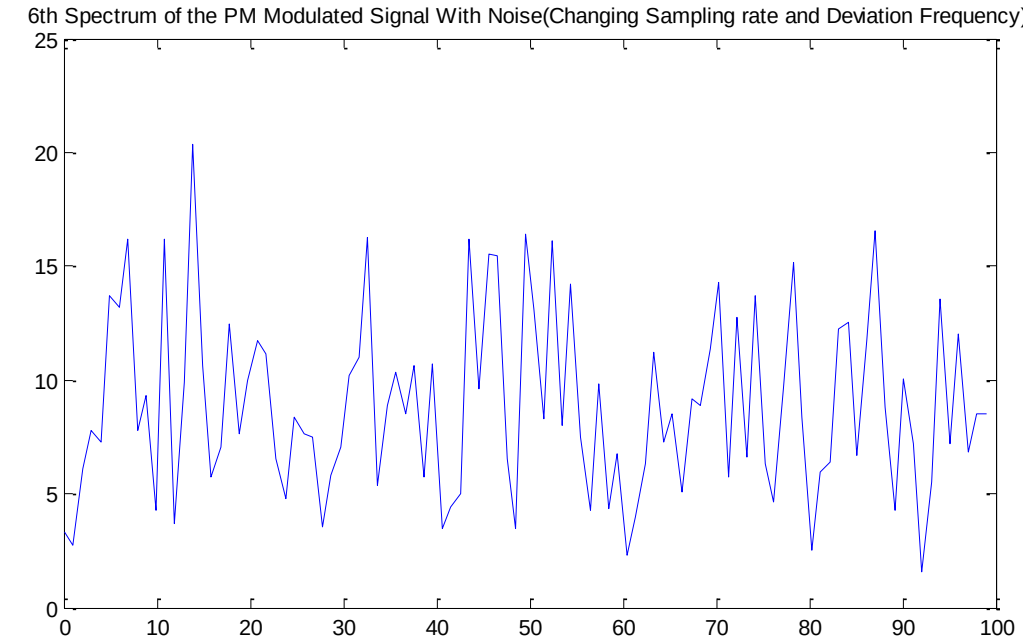


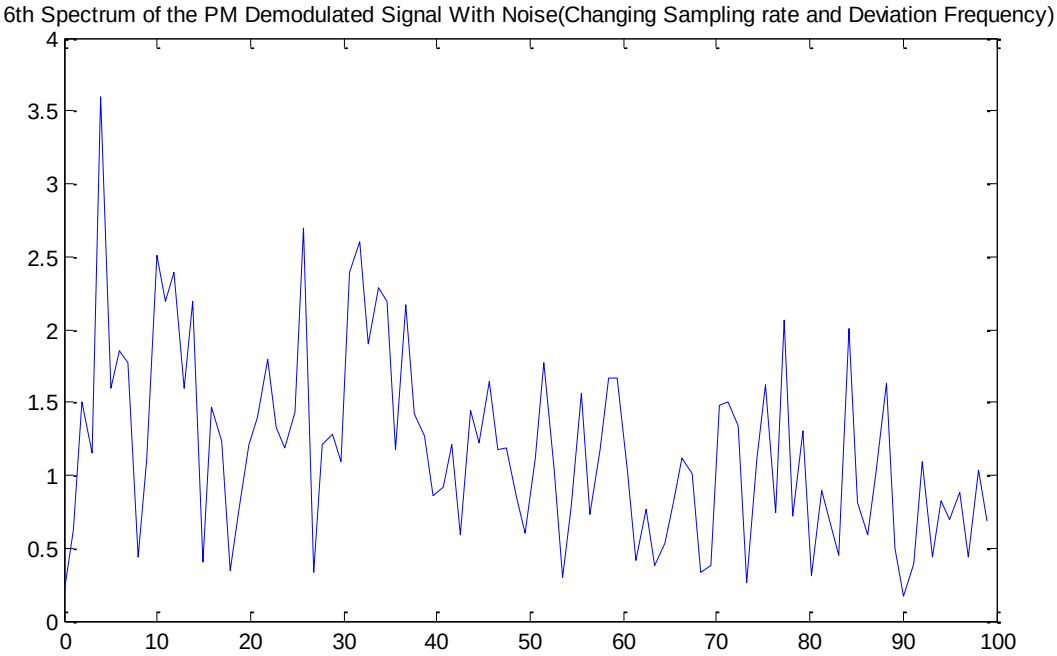
Sampling rate = 200 sample per second
Carrier Frequency = 40 Hz
Frequency Deviation = 20
Without Noise:



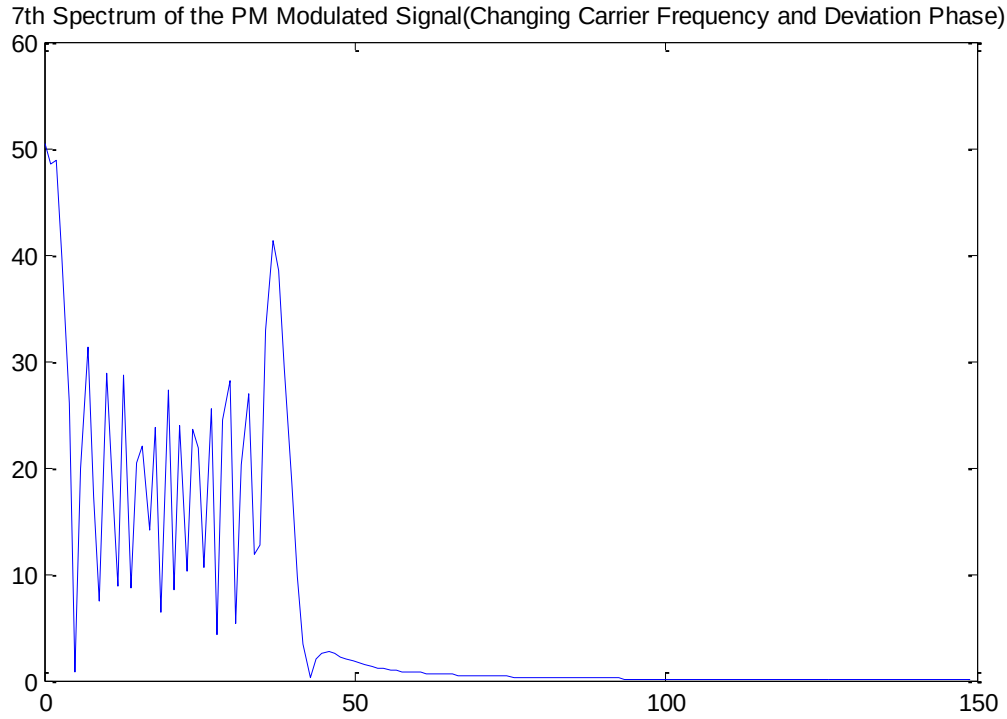


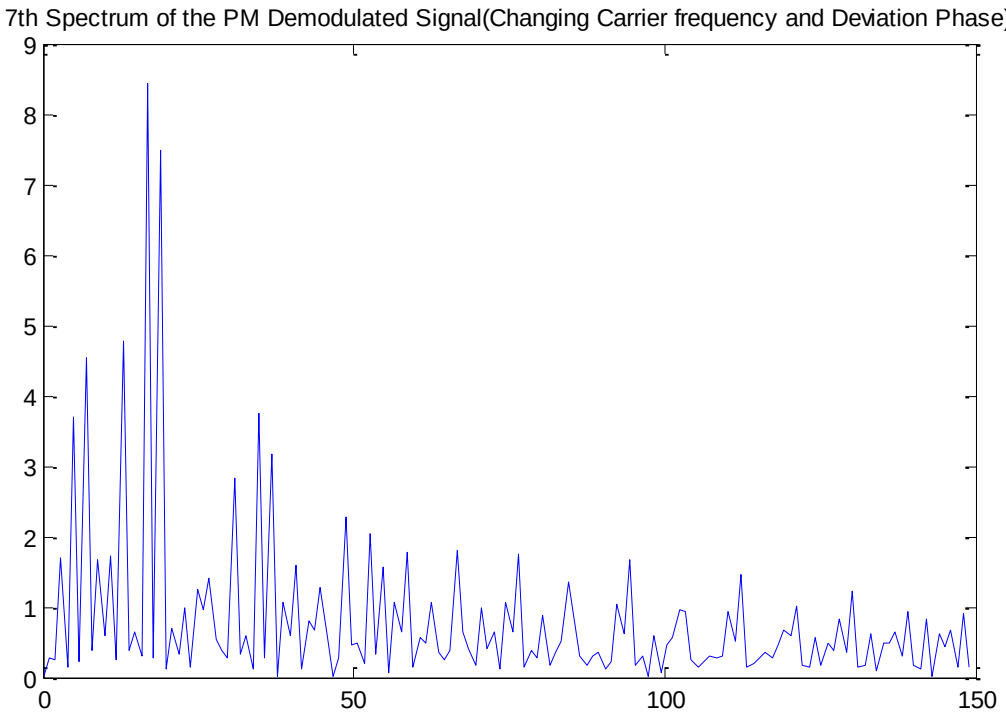
Sampling rate = 200 sample per second
Carrier Frequency = 40 Hz
Frequency Deviation = 20
With Noise:



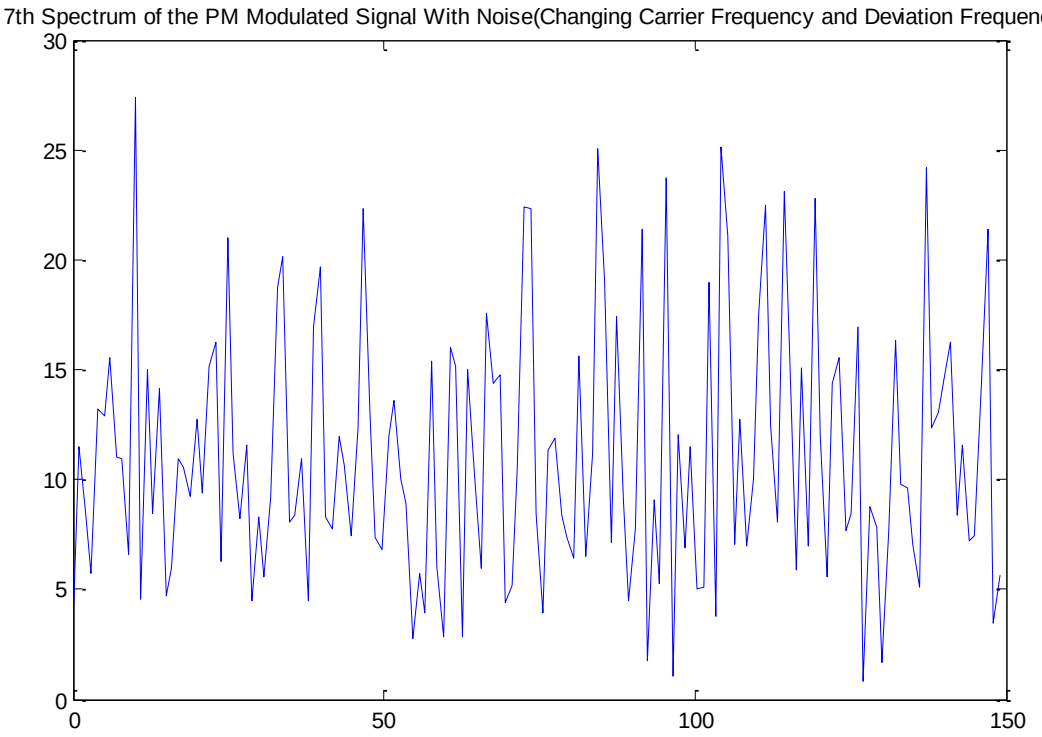


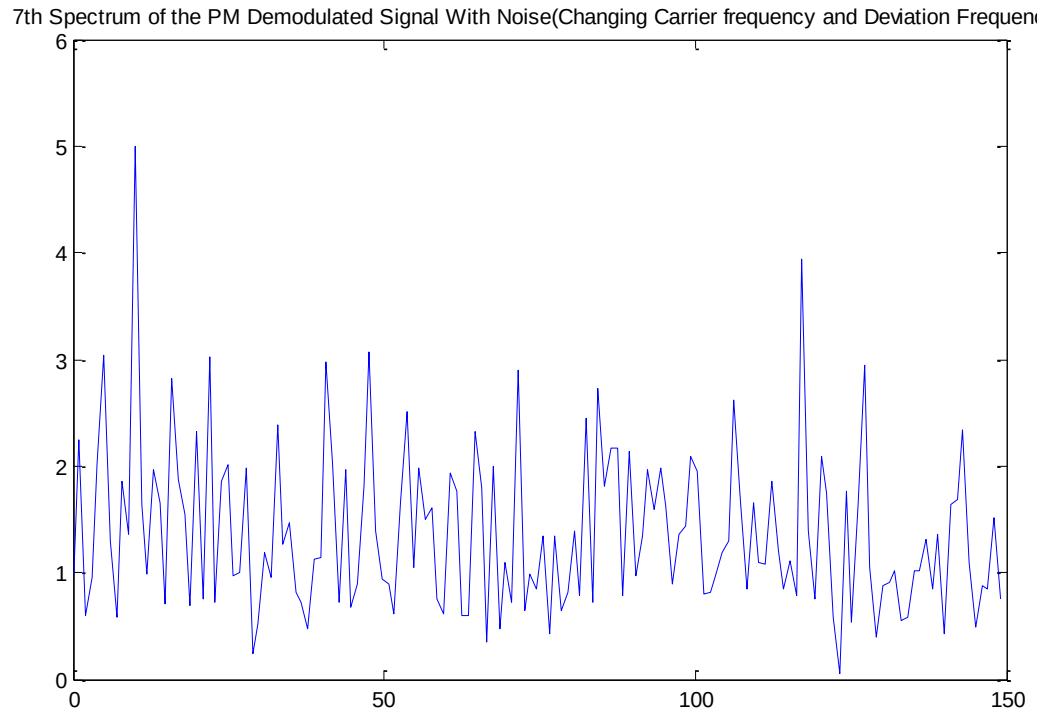
Sampling rate = 300 sample per second
Carrier Frequency = 20 Hz
Frequency Deviation = 20
Without Noise:



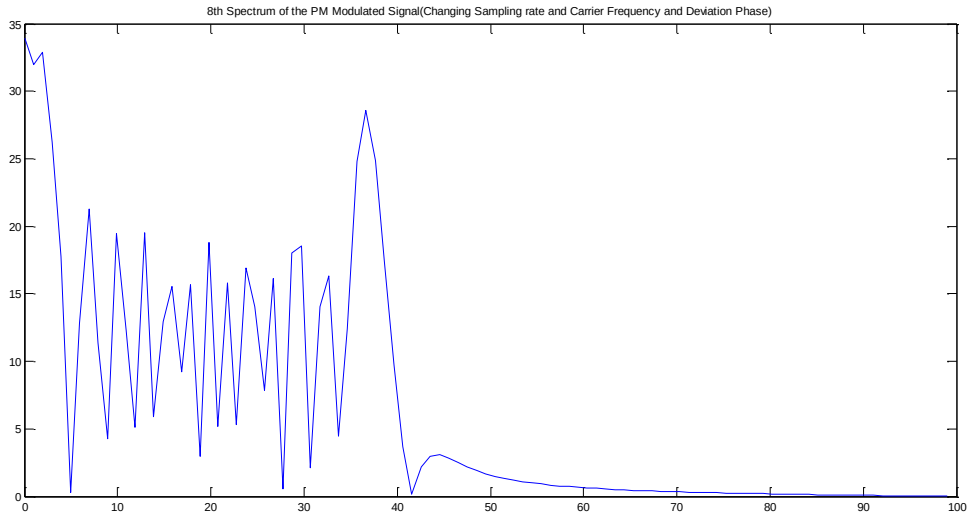


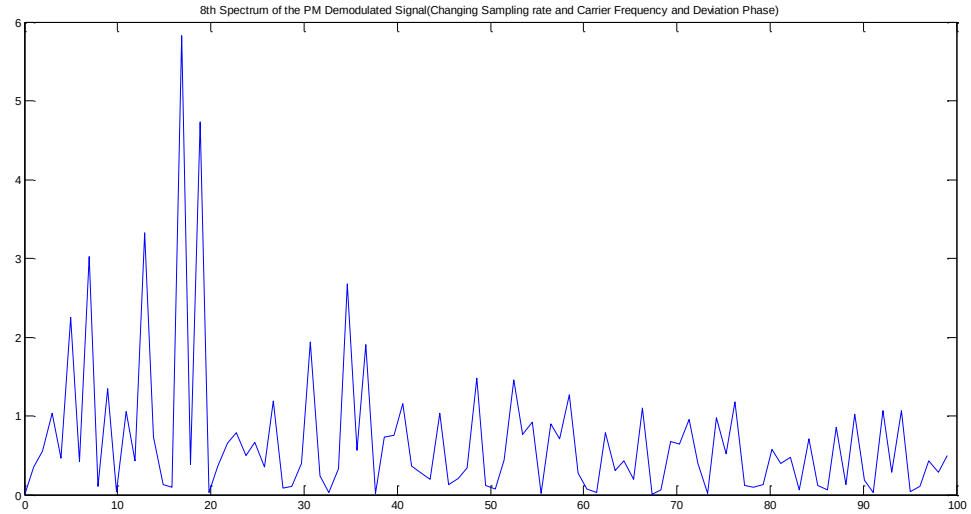
Sampling rate = 300 sample per second
Carrier Frequency = 20 Hz
Frequency Deviation = 20
With Noise:



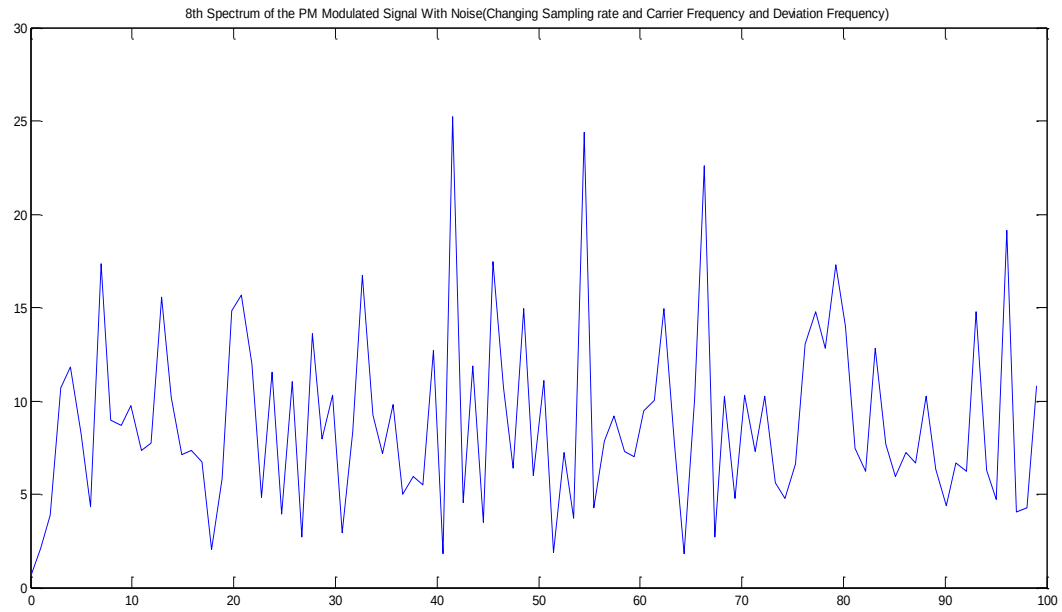


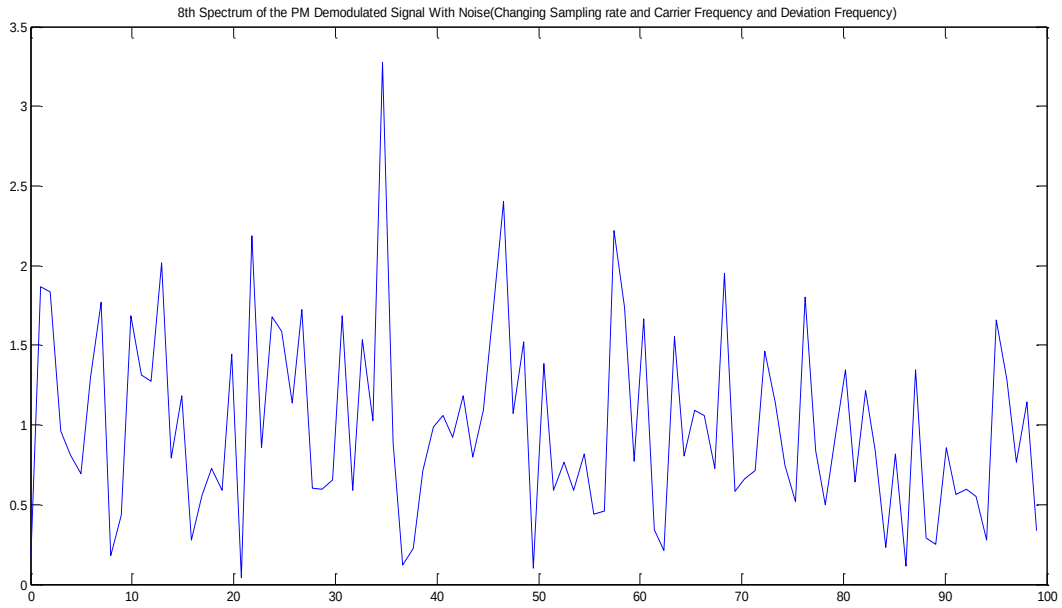
Sampling rate = 200 sample per second
Carrier Frequency = 20 Hz
Frequency Deviation = 20
Without Noise:



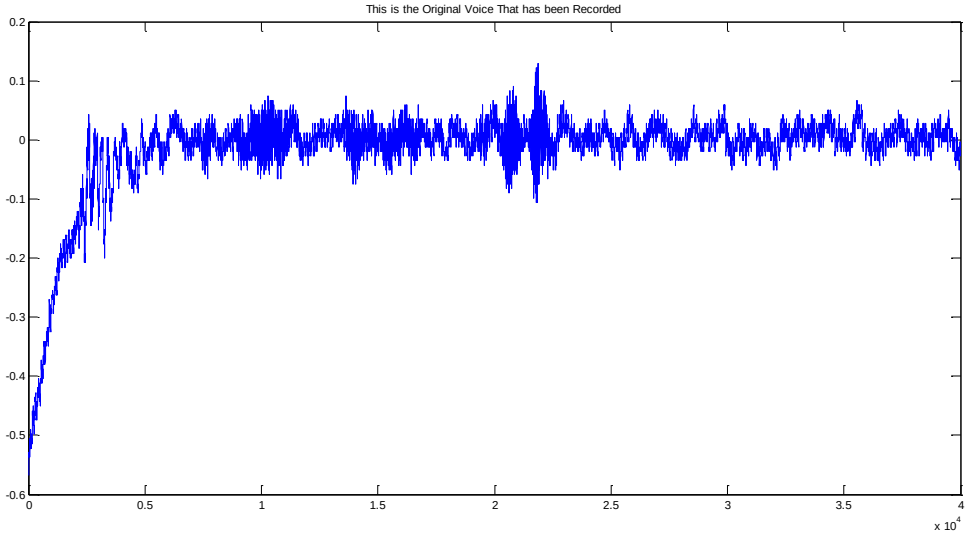


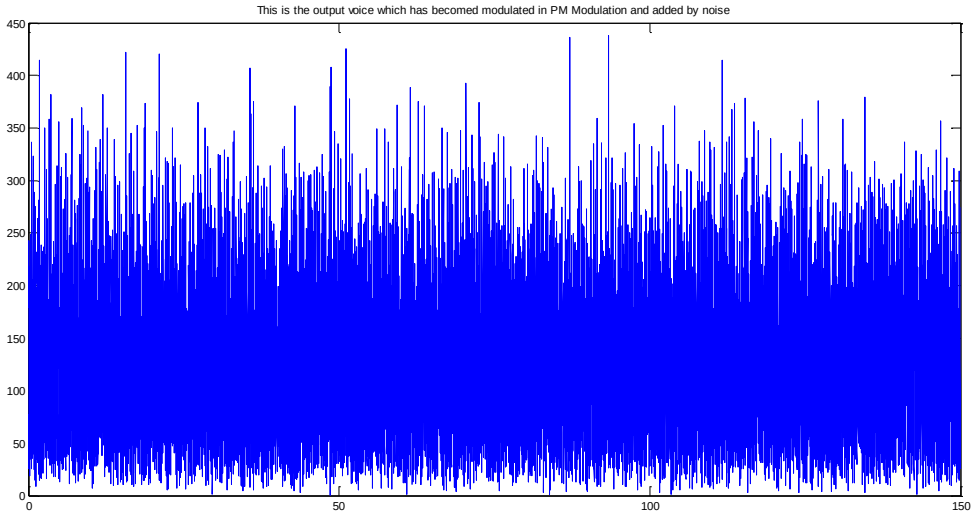
Sampling rate = 200 sample per second
Carrier Frequency = 20 Hz
Frequency Deviation = 20
With Noise:

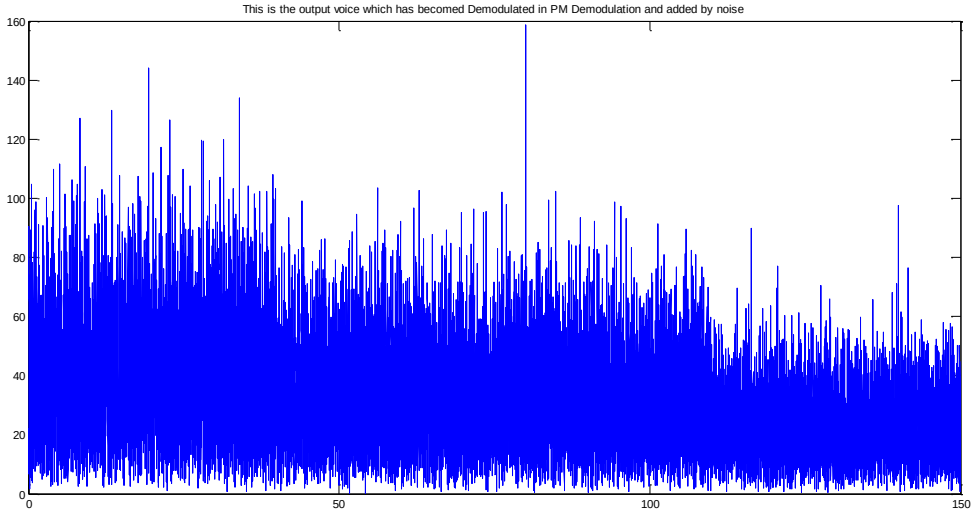




Recorded Voice with Noise and $f_c = 40\ Hz$ and $f_s = 300\ sample\ per\ second$ And $Phase\ Deviation = 10$





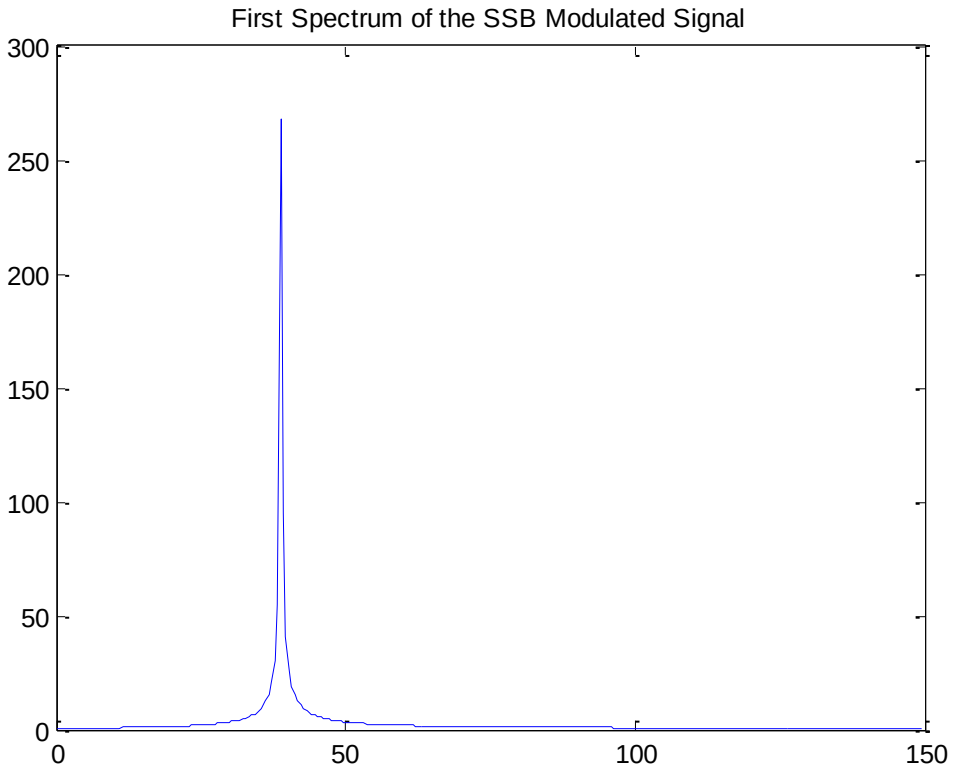


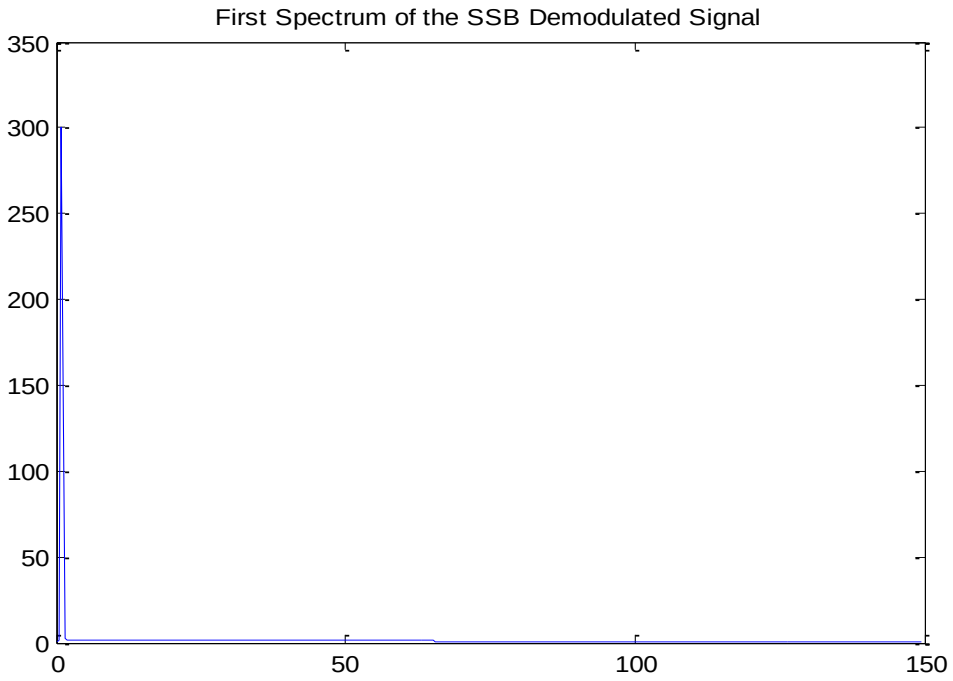
D) SSB Modulation and Demodulation

Our initials assumptions are:

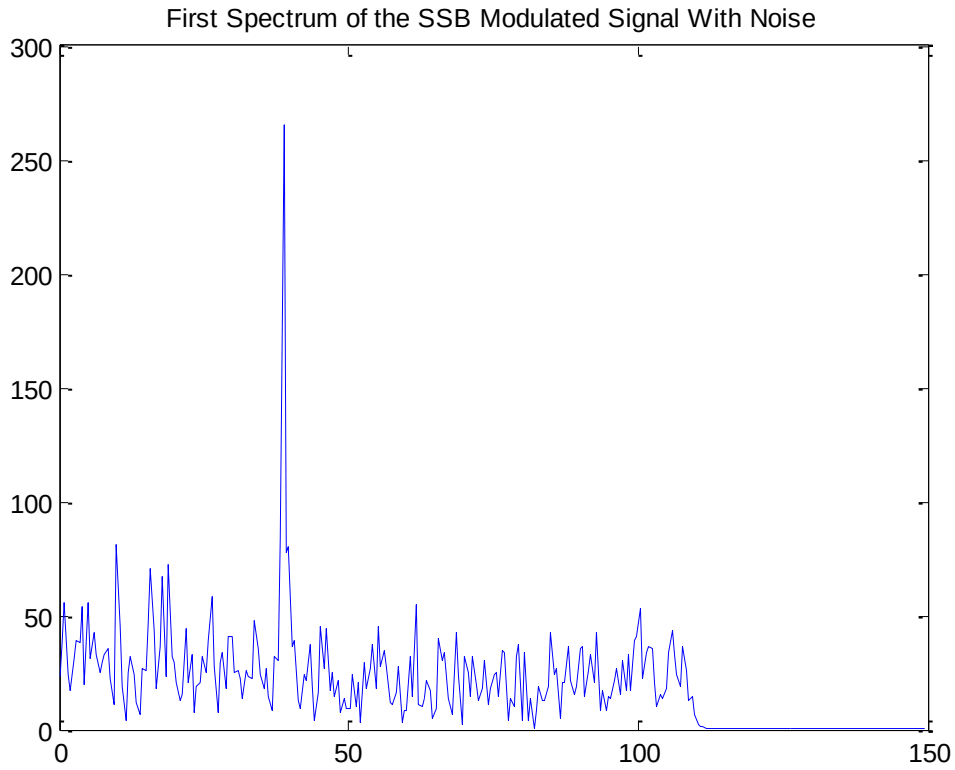
1- **We send our signal in Lower Band SSB and receive it respectively**
2- **Our initial sampling rate is 300 sample per second**
3- **Our initial carrier frequency is 40 Hz**
4- **Our initial phase is zero**

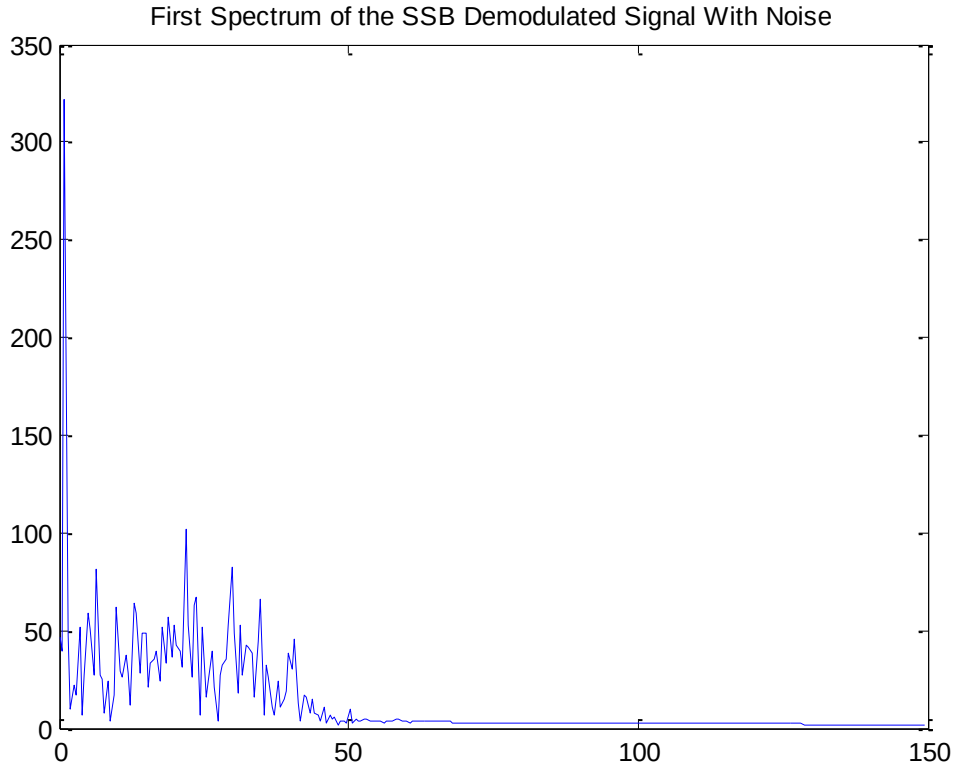
Without Noise:



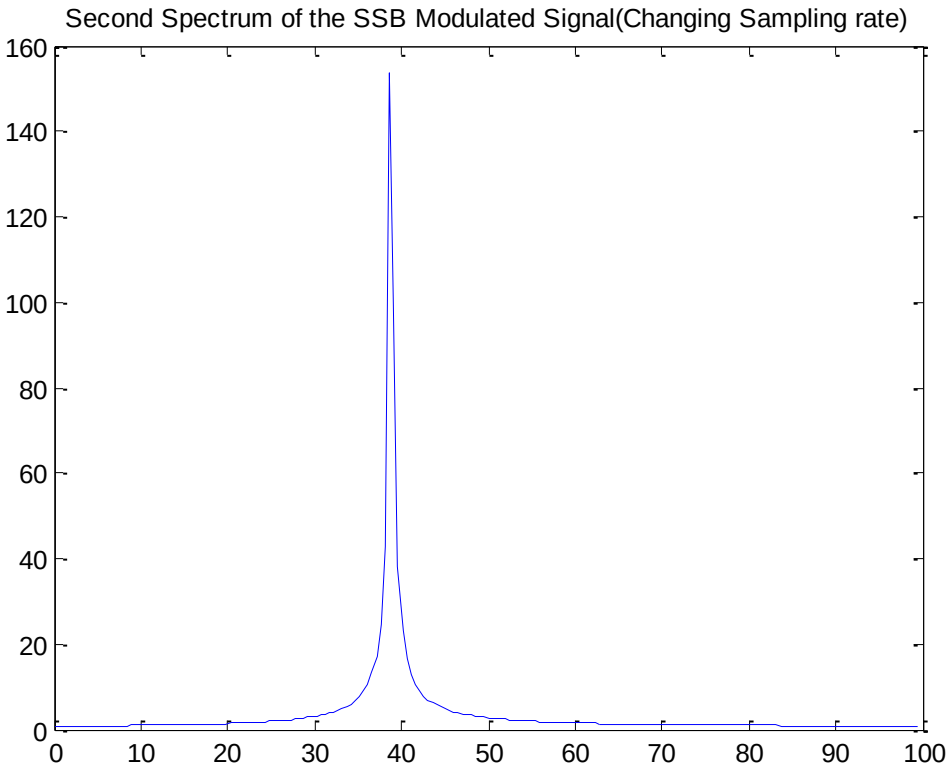


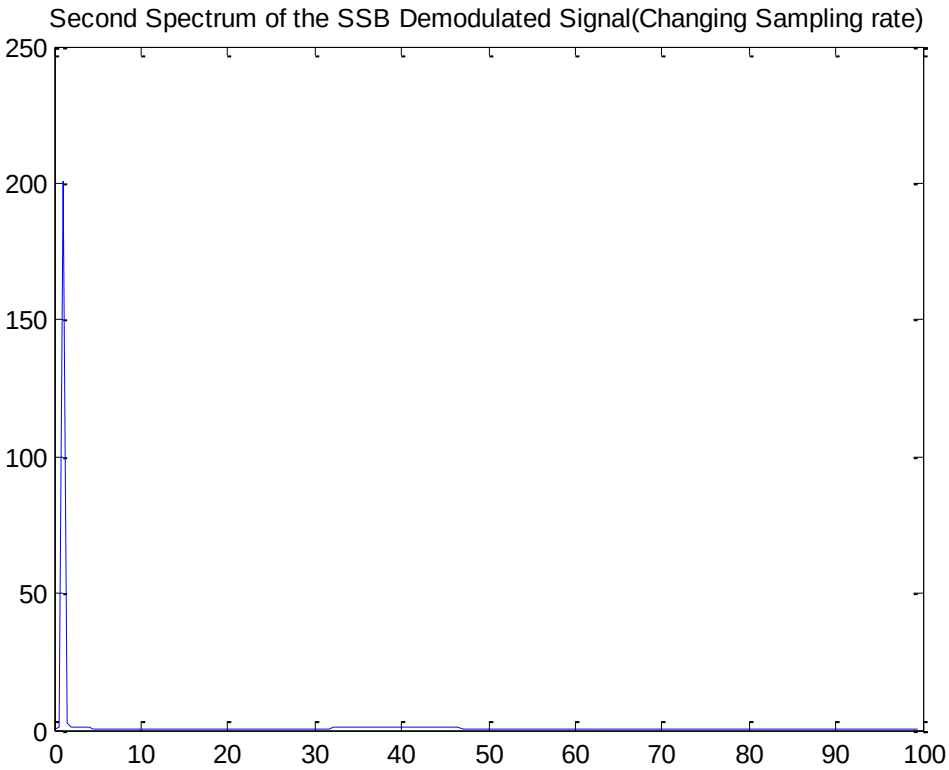
Lower SSB
Sampling rate = 300 sample per second
Carrier Frequency = 40 Hz
With Nosie:



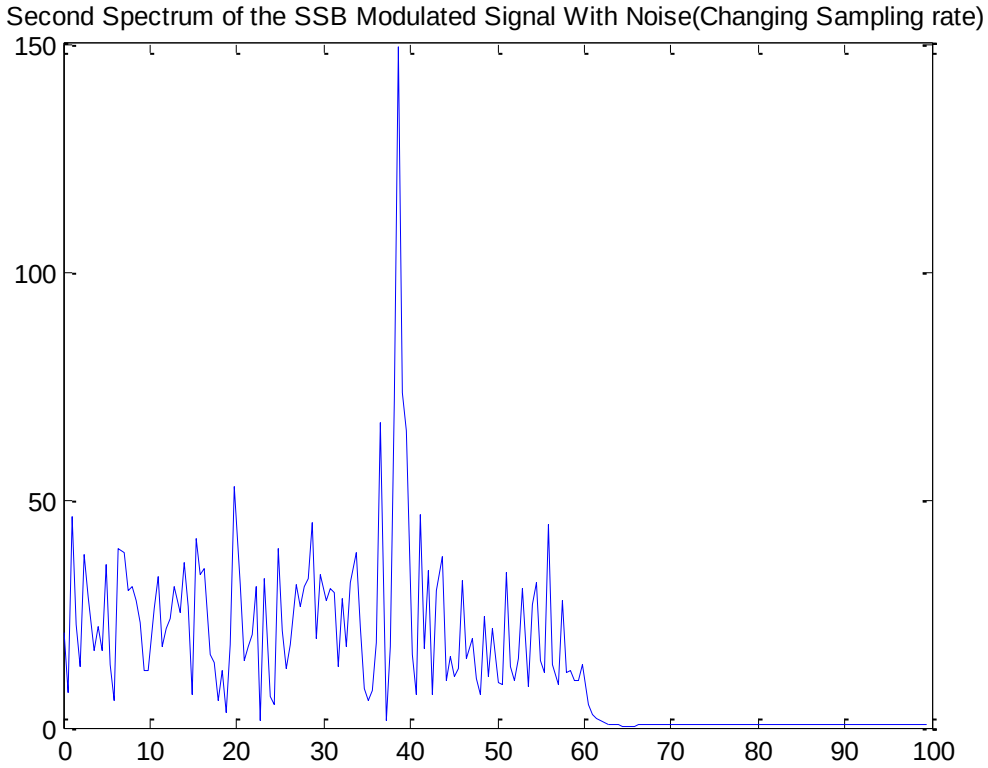


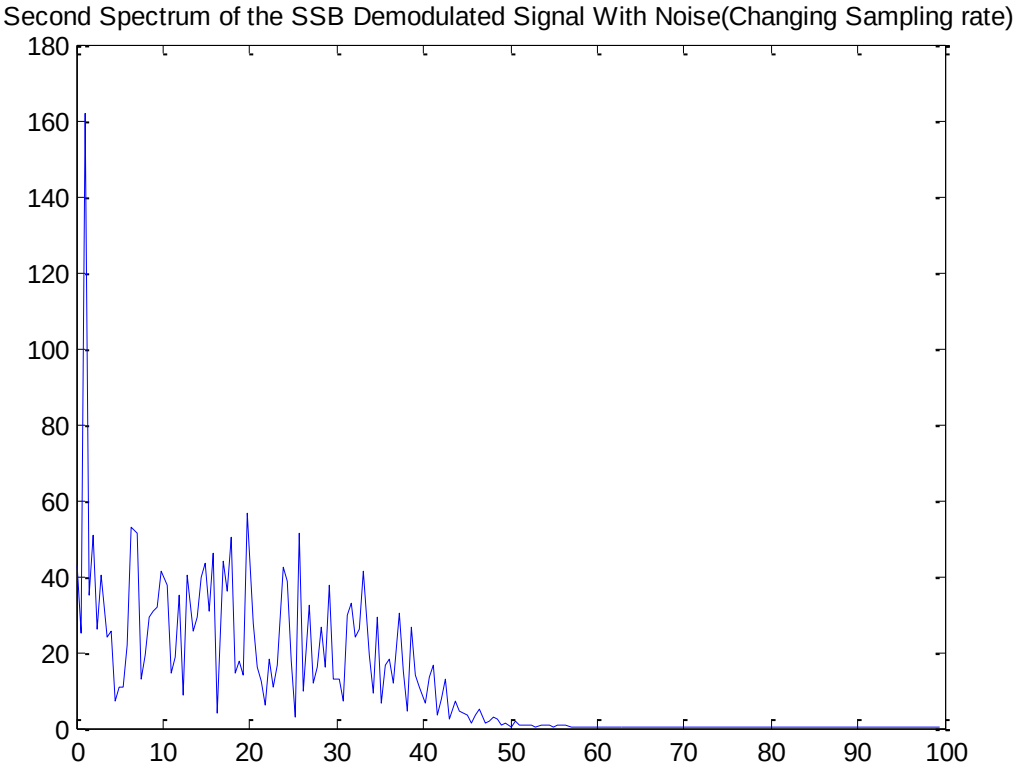
Lower SSB
Sampling rate = 200 sample per second
Carrier Frequency = 40 Hz
Without Noise:



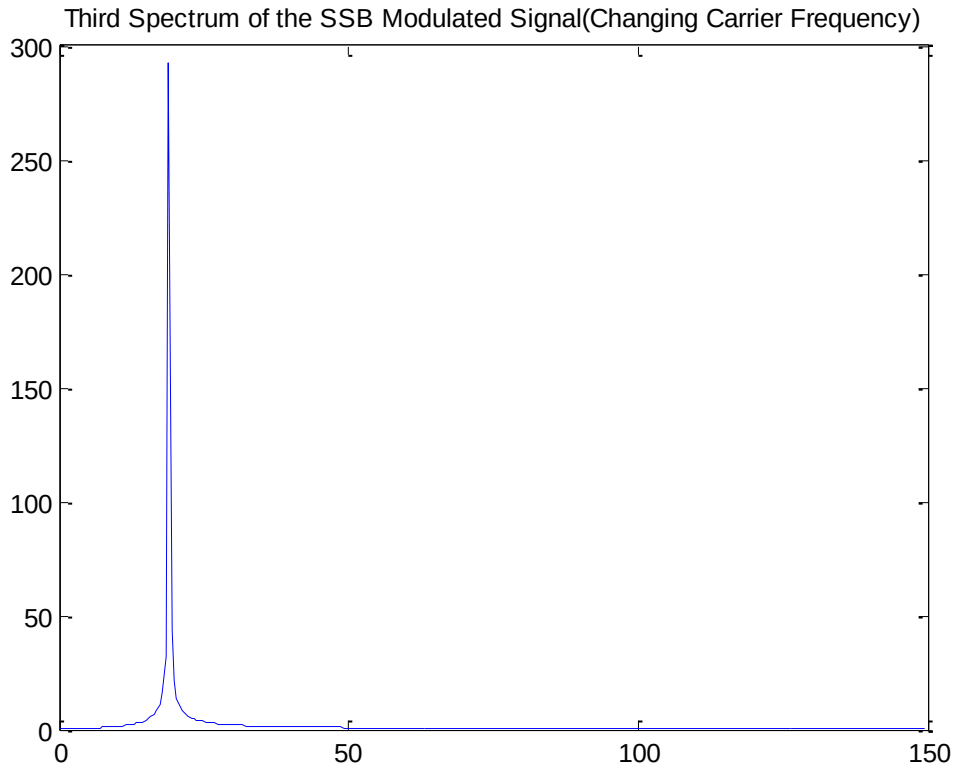


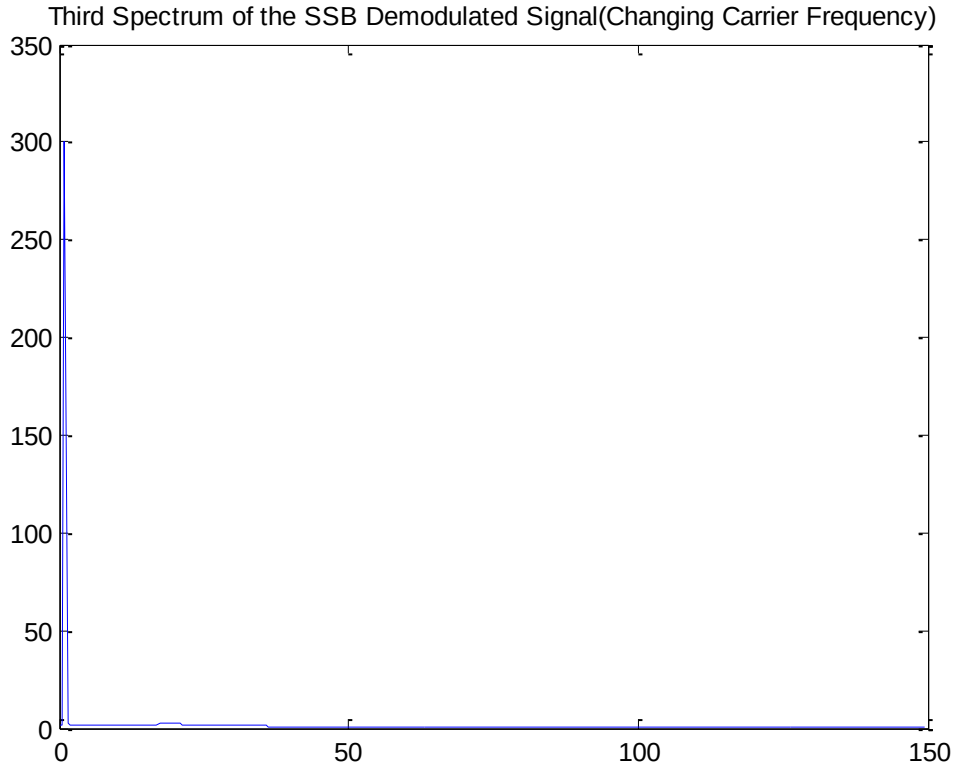
Lower SSB
Sampling rate = 200 sample per second
Carrier Frequency = 40 Hz
With Noise:



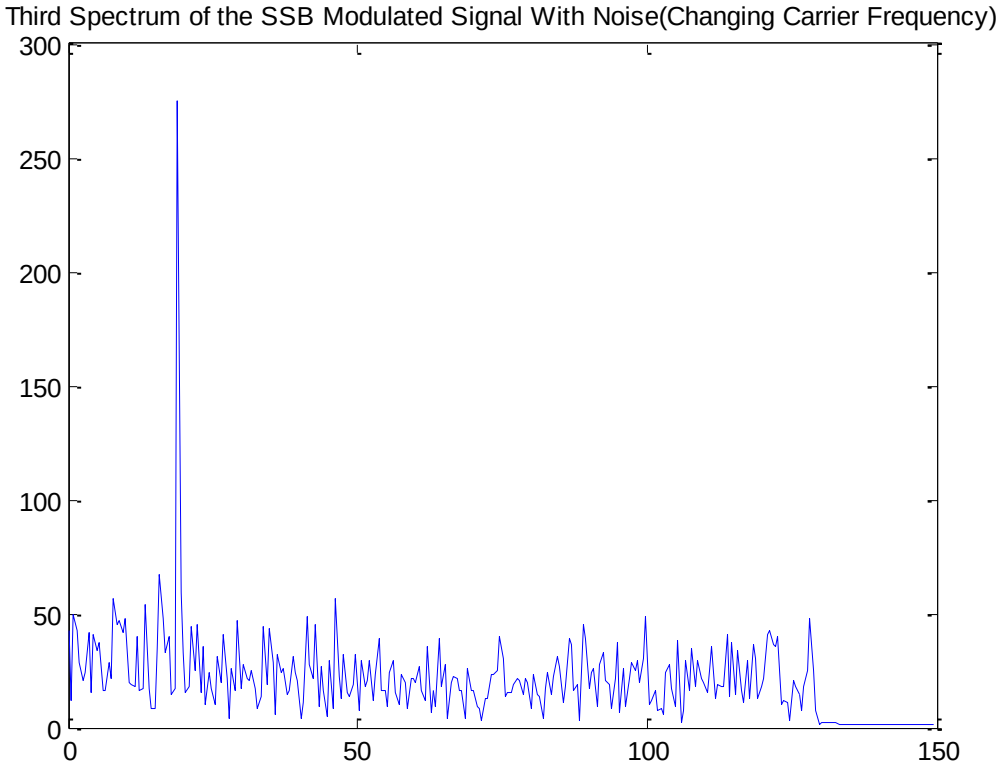


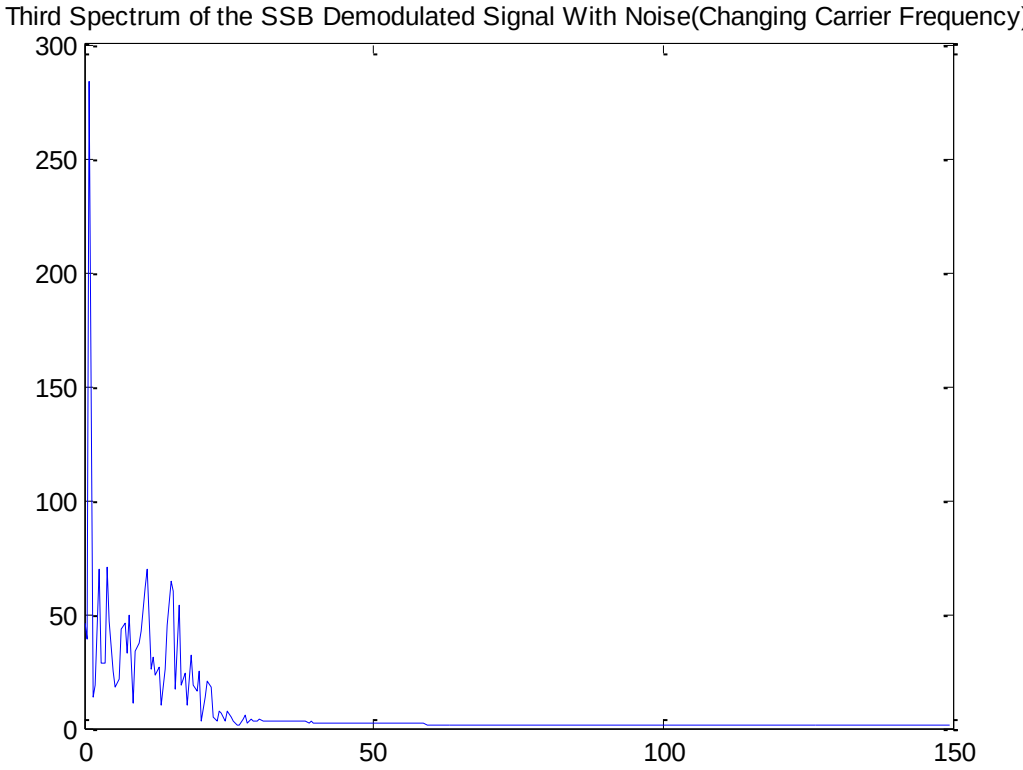
Lower SSB
Sampling rate = 300 sample per second
Carrier frequency = 20 Hz
Without Noise:



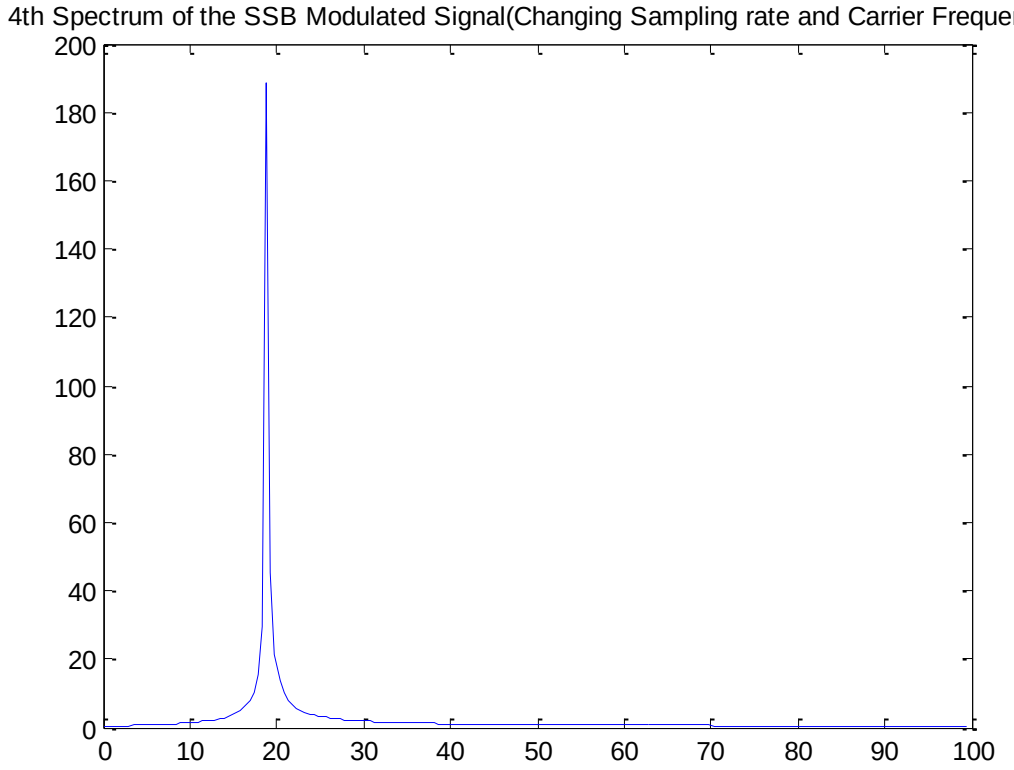


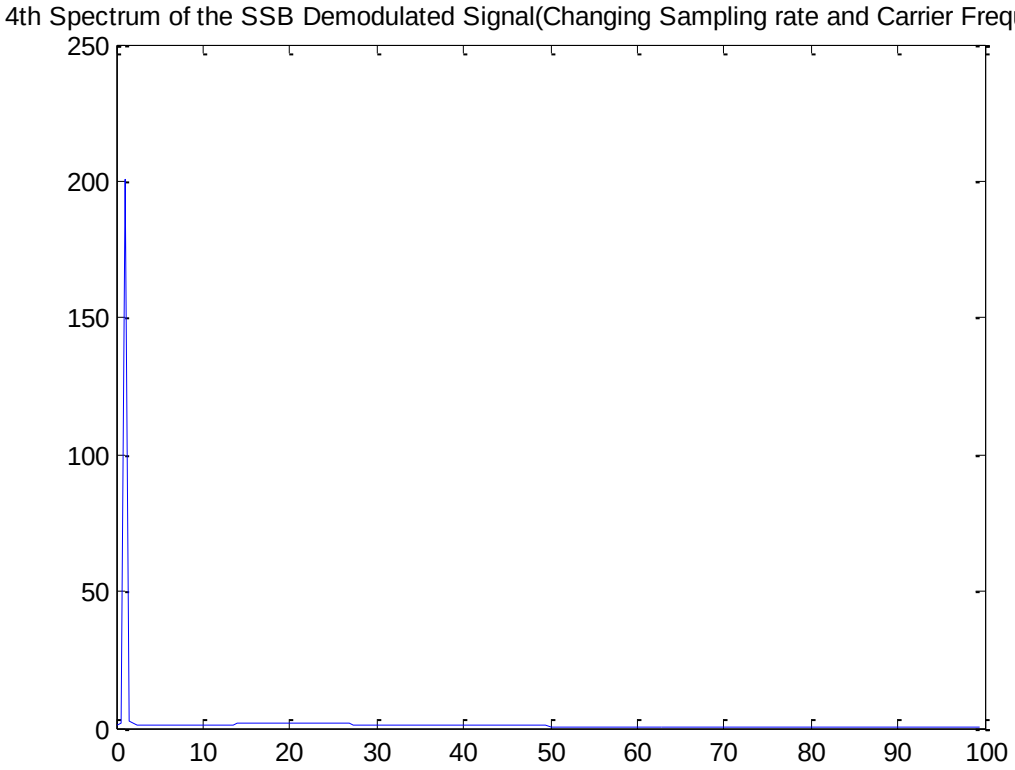
Lower SSB
Sampling rate = 300 sample per second
Carrier frequency = 20 Hz
Without Noise:



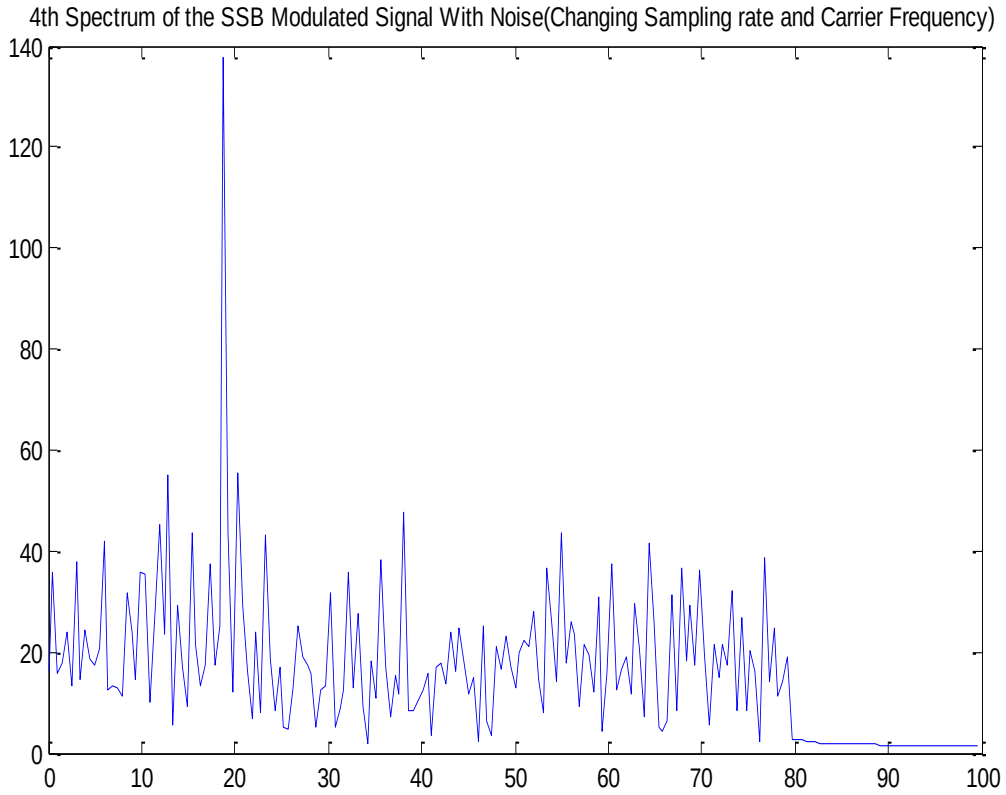


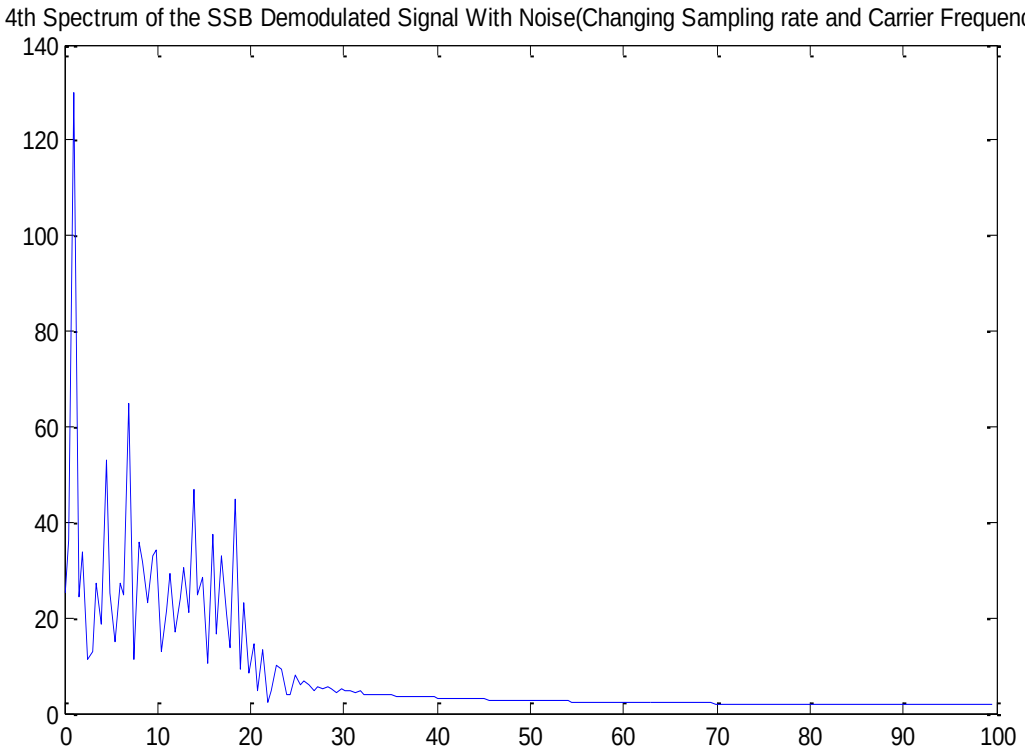
Lower SSB
Sampling rate = 200 sample per second
Carrier frequency = 20 Hz
Without Noise:



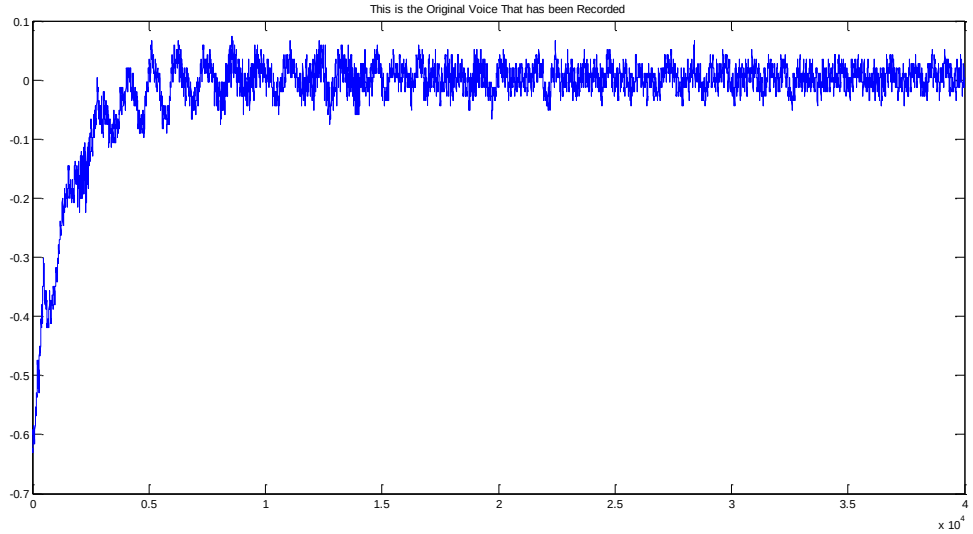


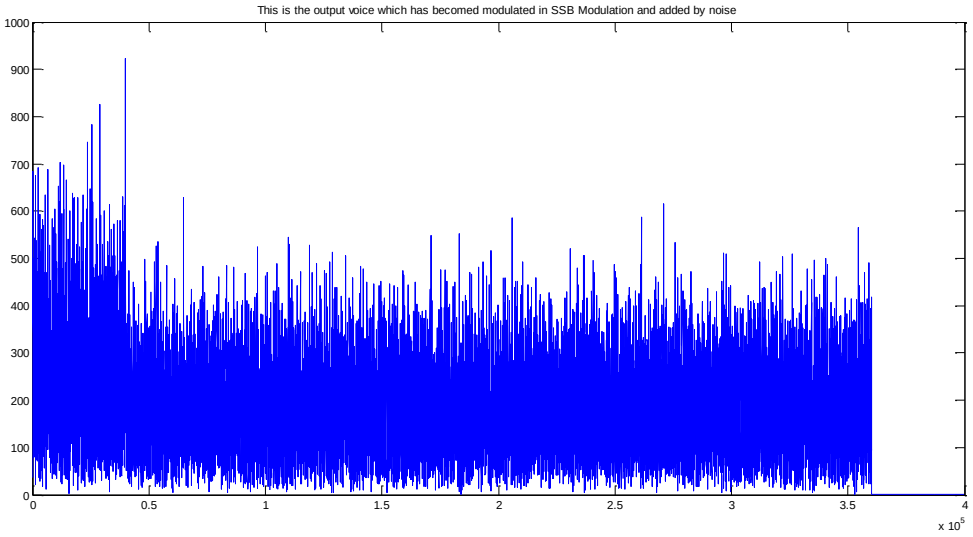
Lower SSB
Sampling rate = 200 sample per second
Carrier frequency = 20 Hz
Without Noise:

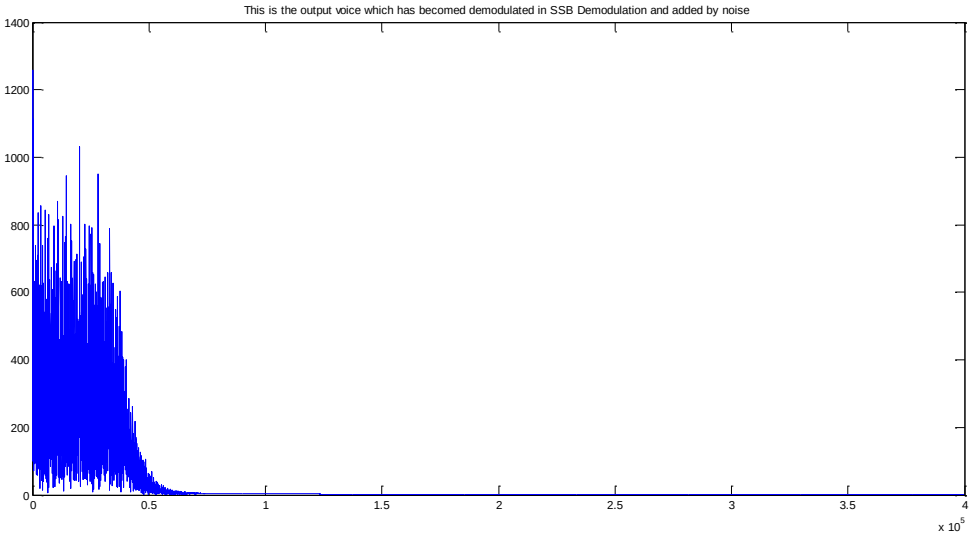




Recorded Voice with Noise and $f_c = 40KHz$ and $f_s = 800KHz$
This is the original signal (message signal that we want to send it)

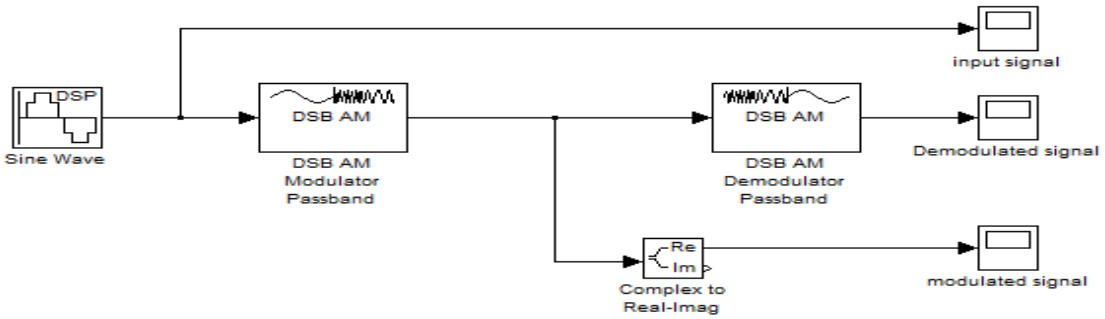


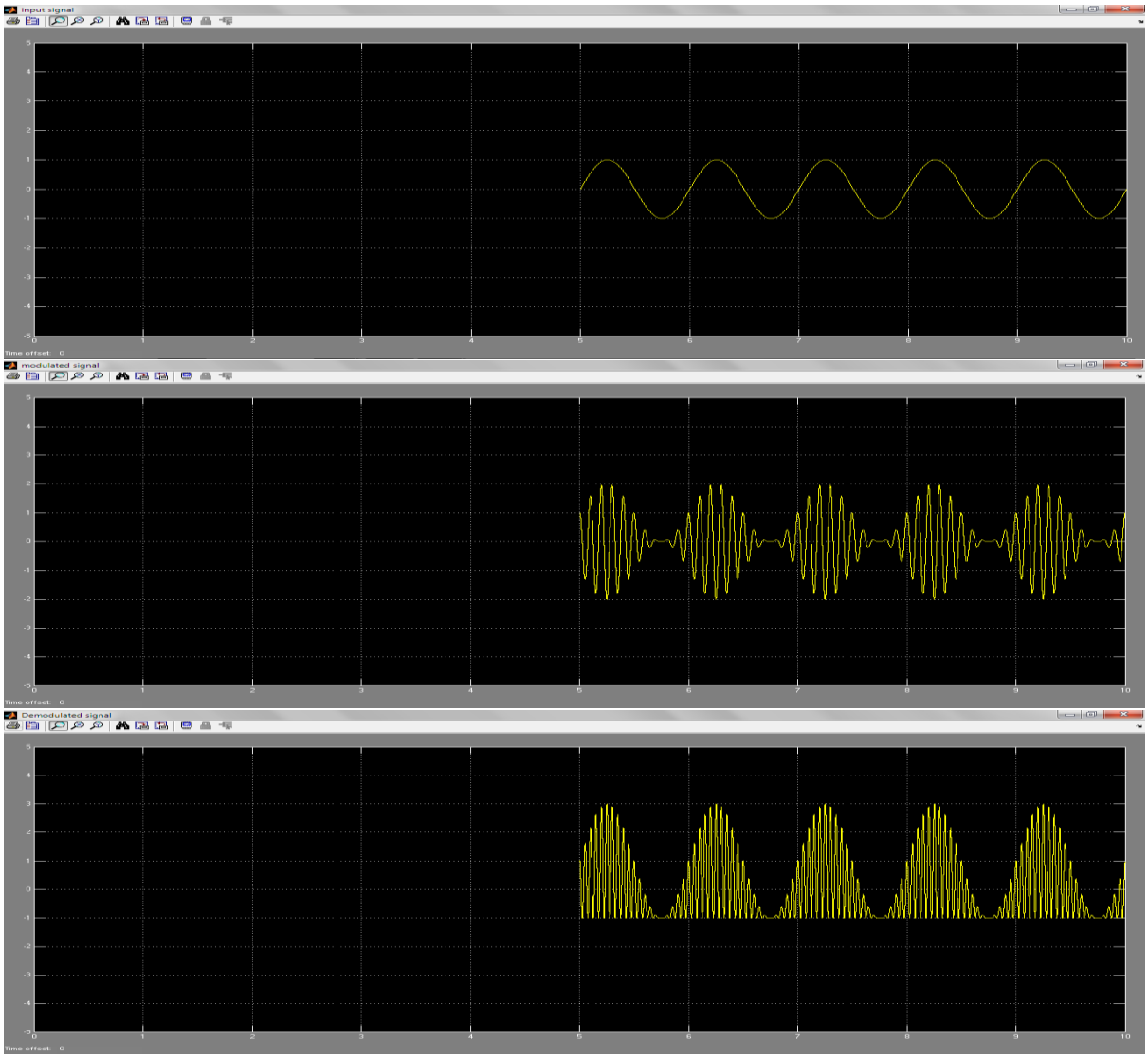




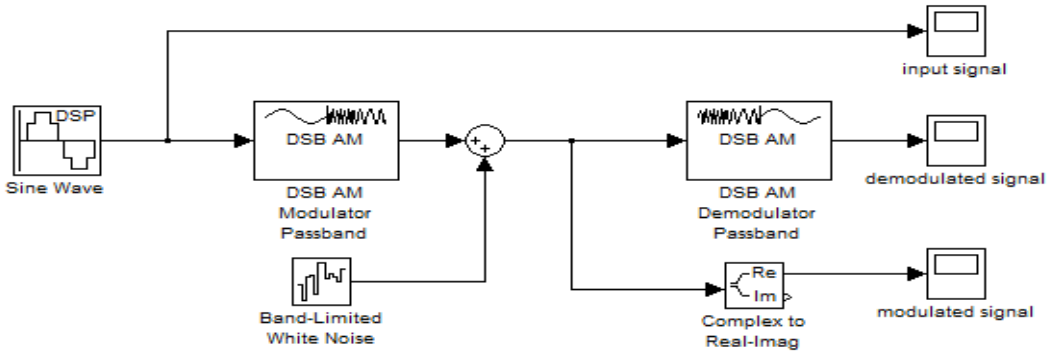
Second Part:
Simulink
Our initial waveform is sinusoidal waveform with 1 Hz frequency and our carrier frequency is 10 Hz

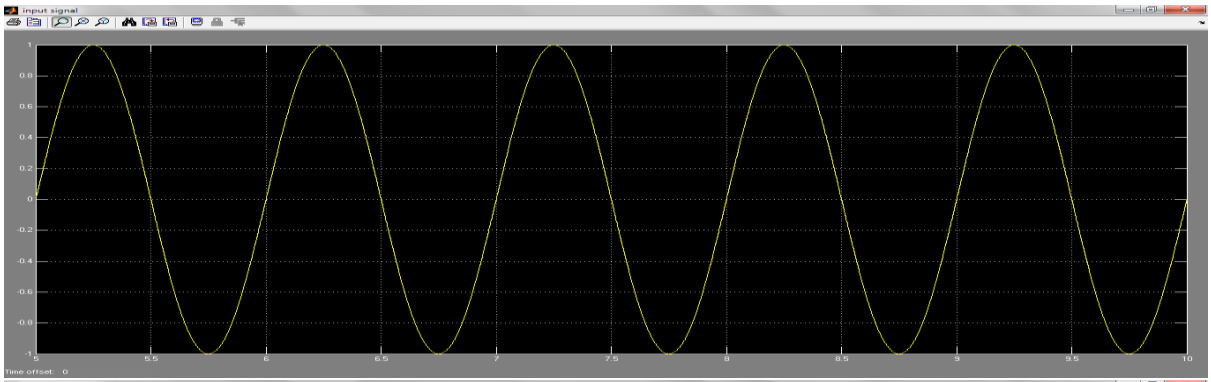
DSB AM Modulators and Demodulators (Without Noise):

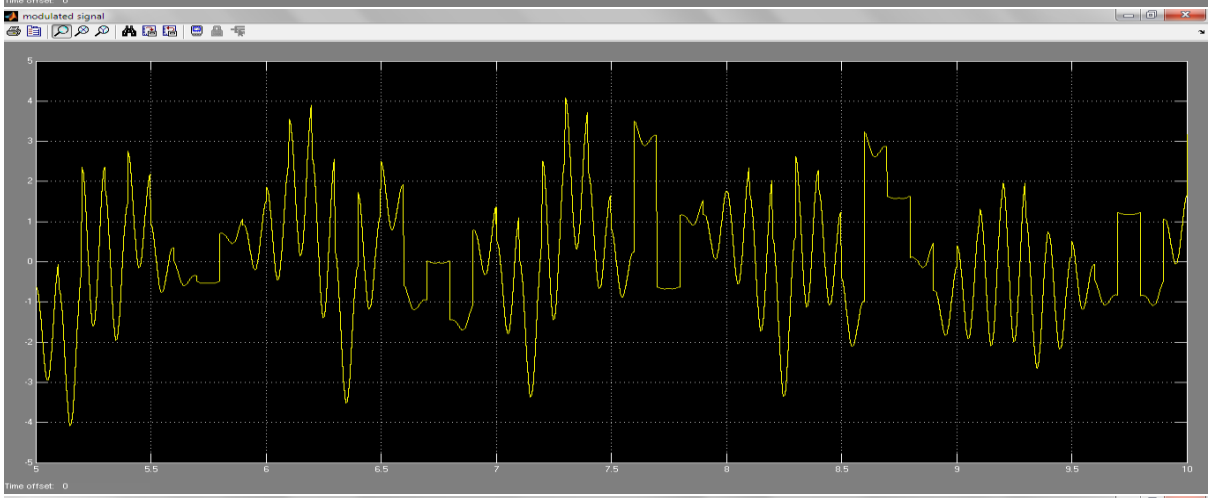


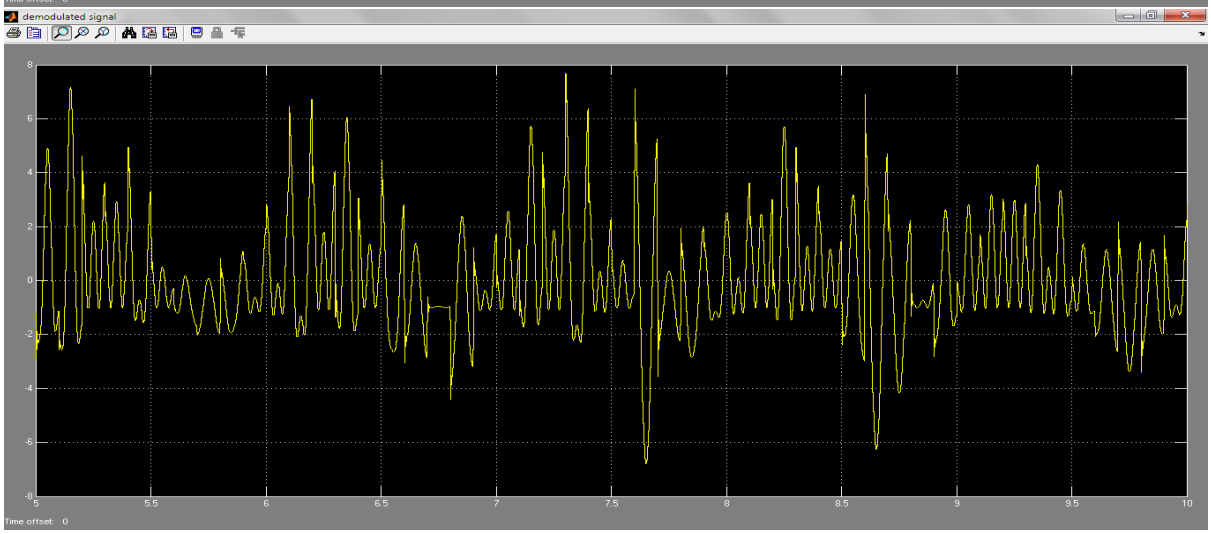


DSB AM Modulators and Demodulators (With Noise):

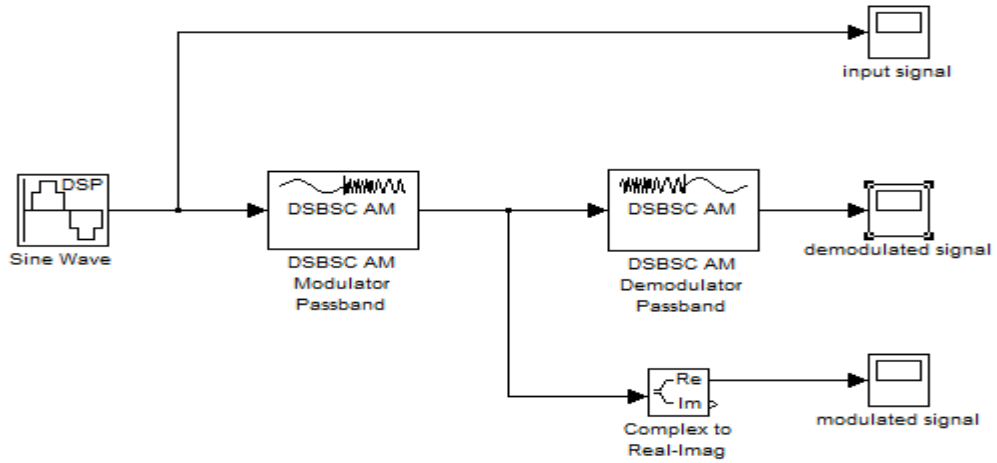


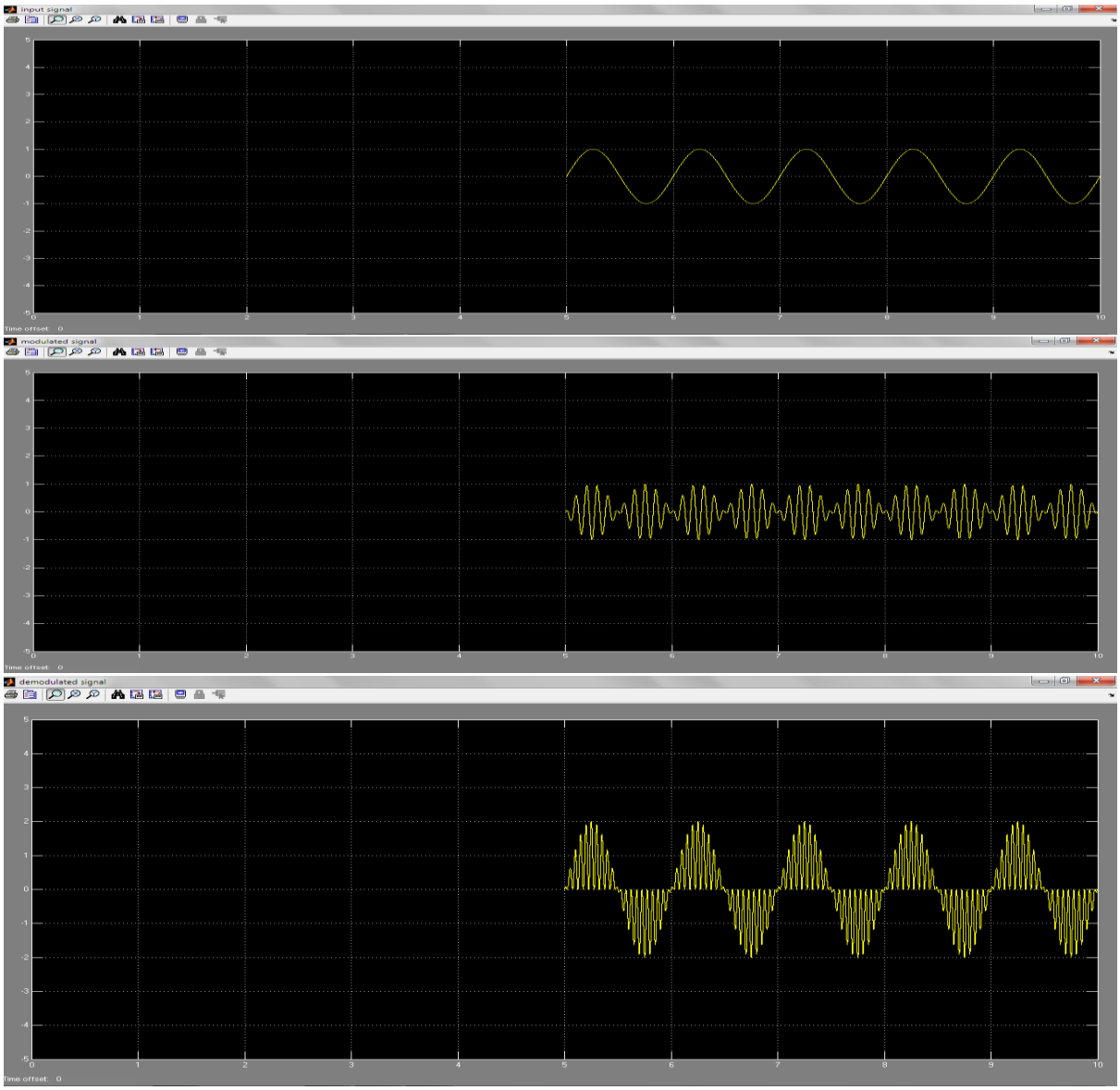




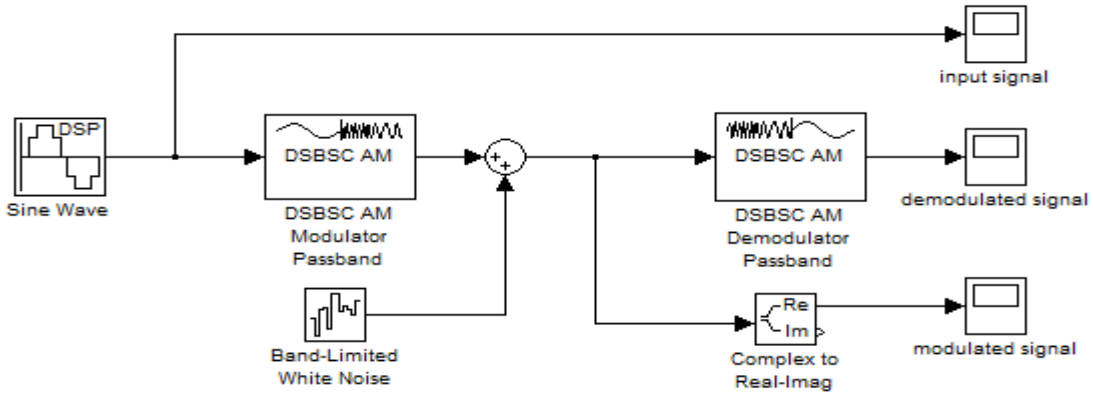


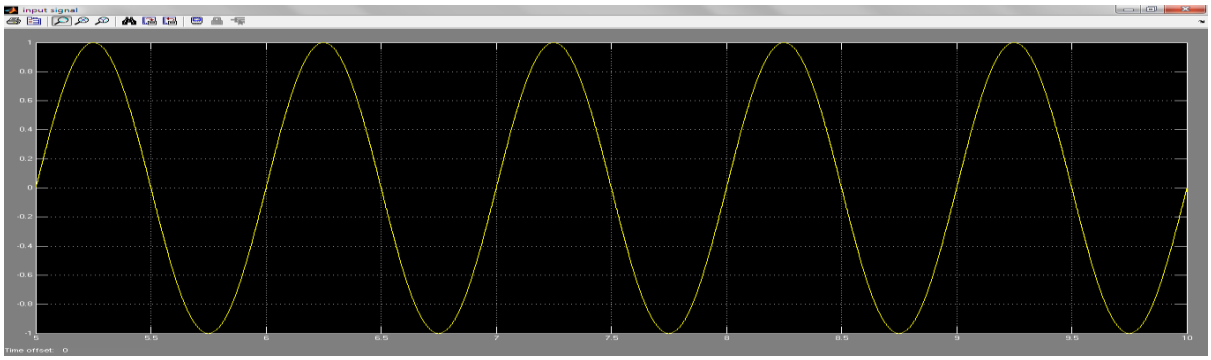
DSBSC AM Modulator and Demodulator (Without Noise):

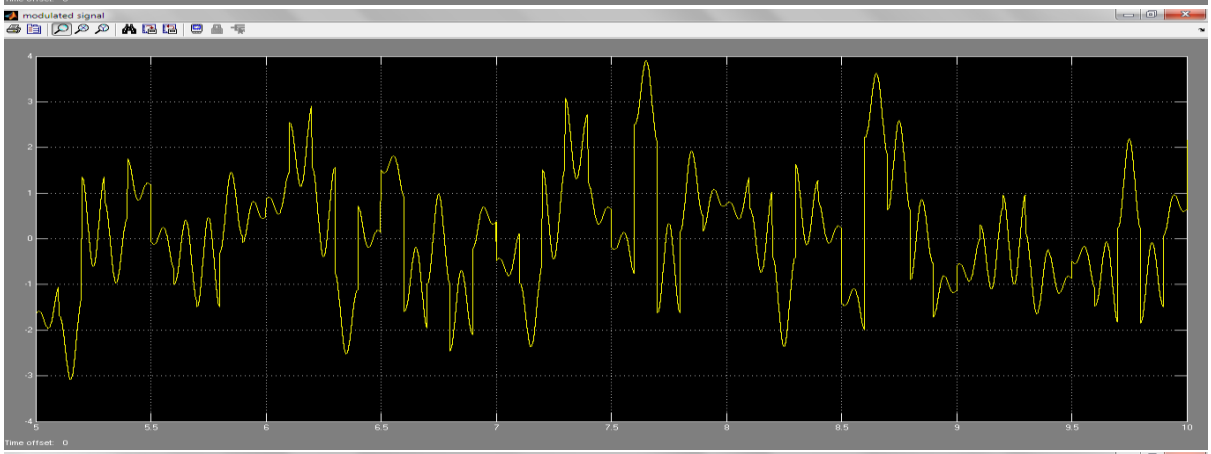


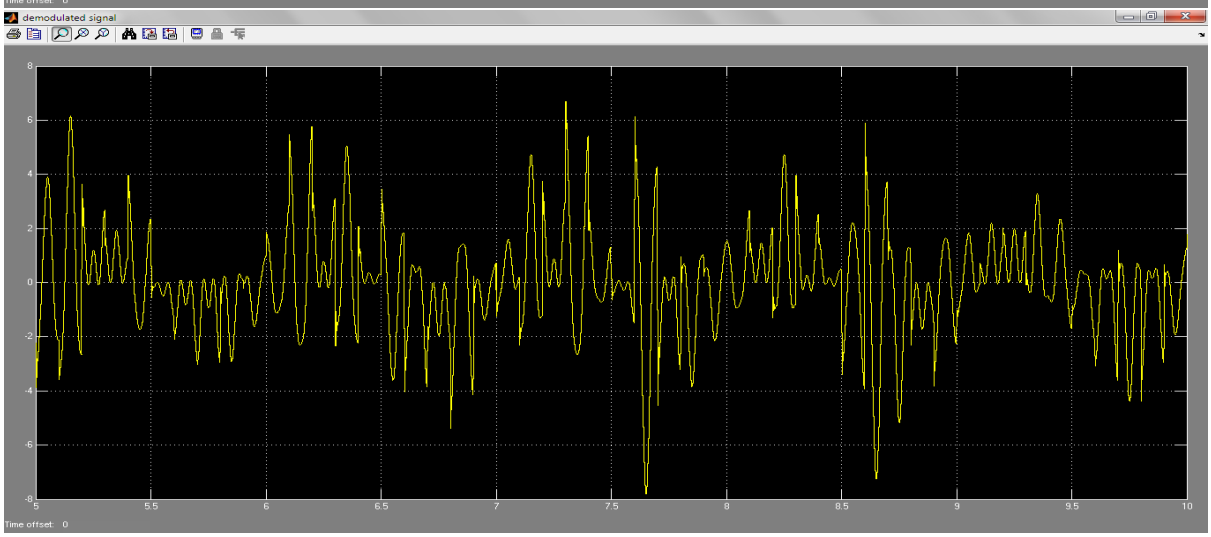


DSBSC AM Modulator and Demodulator (With Noise):

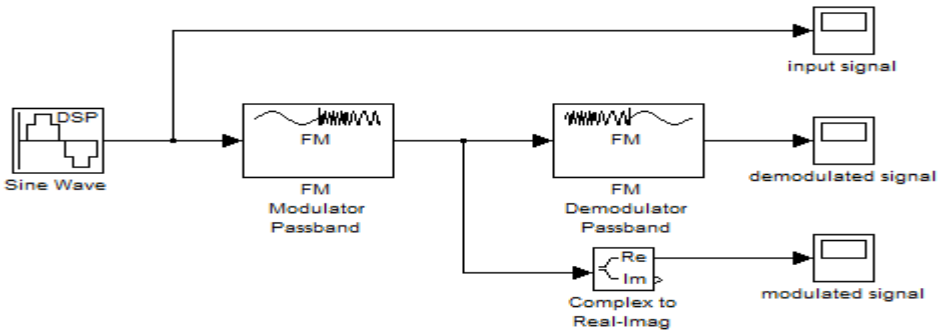


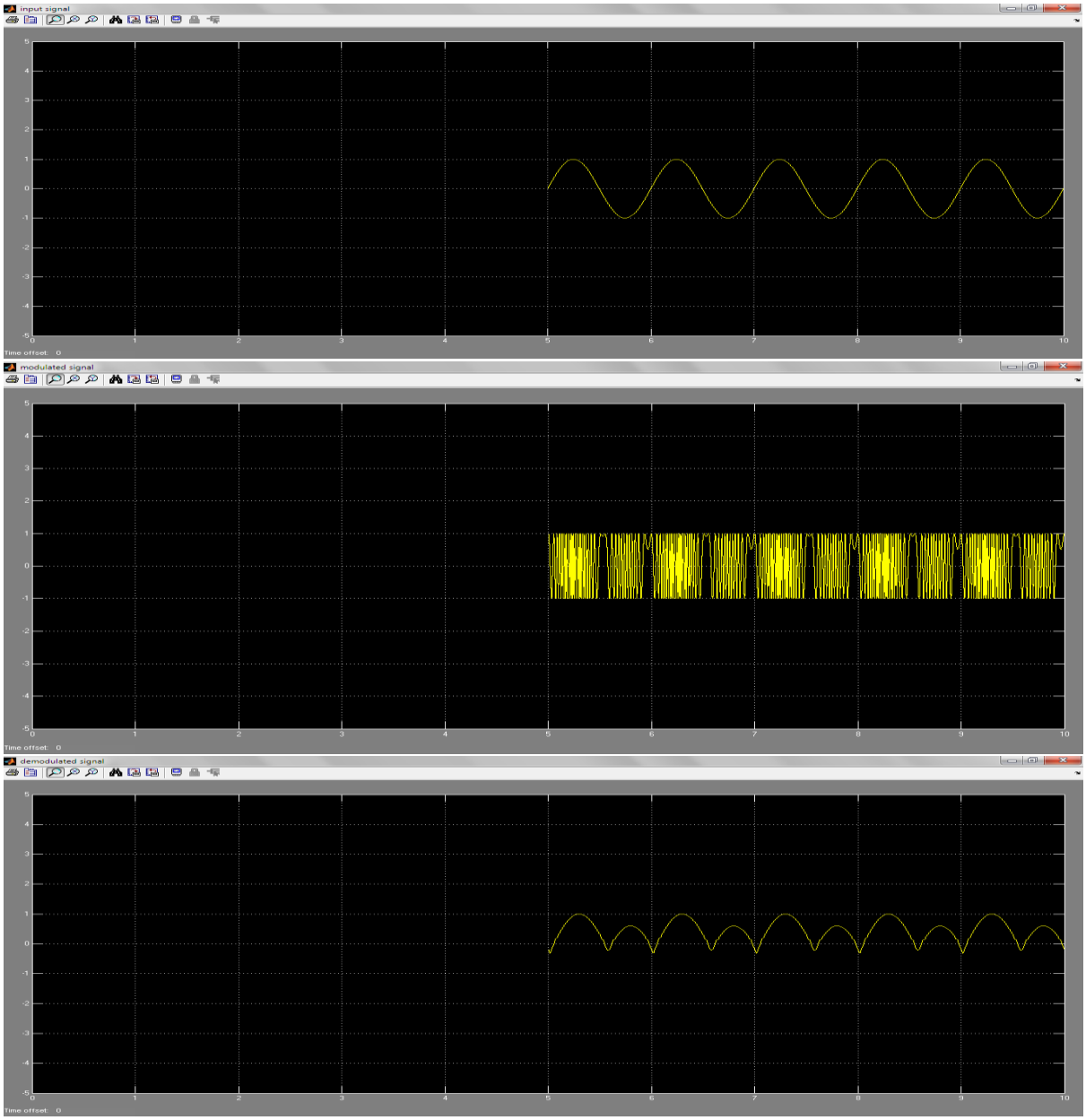




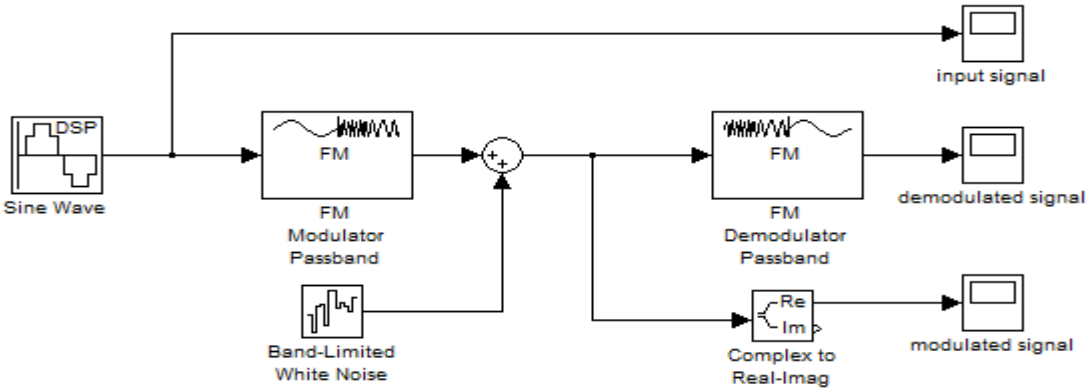


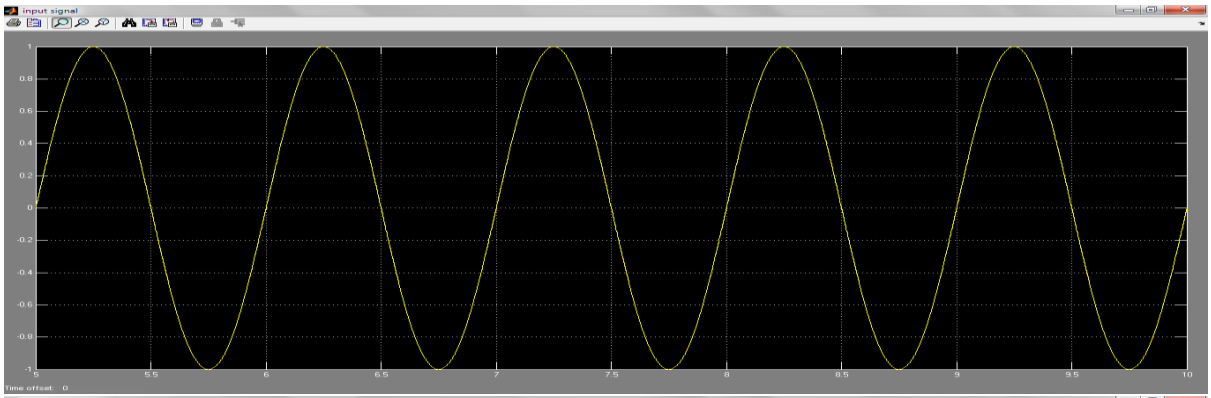
FM Modulator and Demodulator (Without Noise):

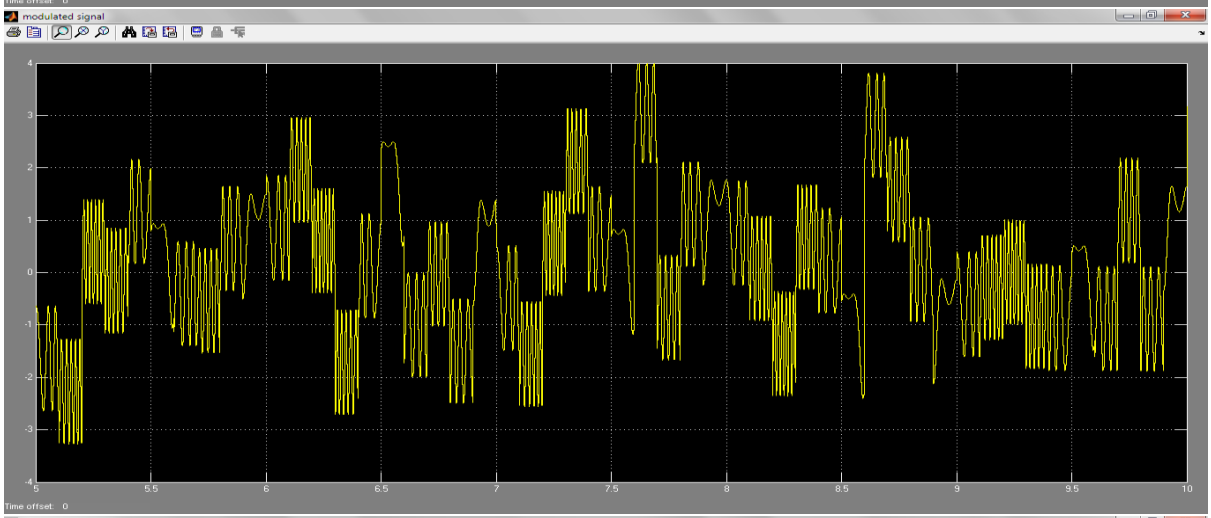


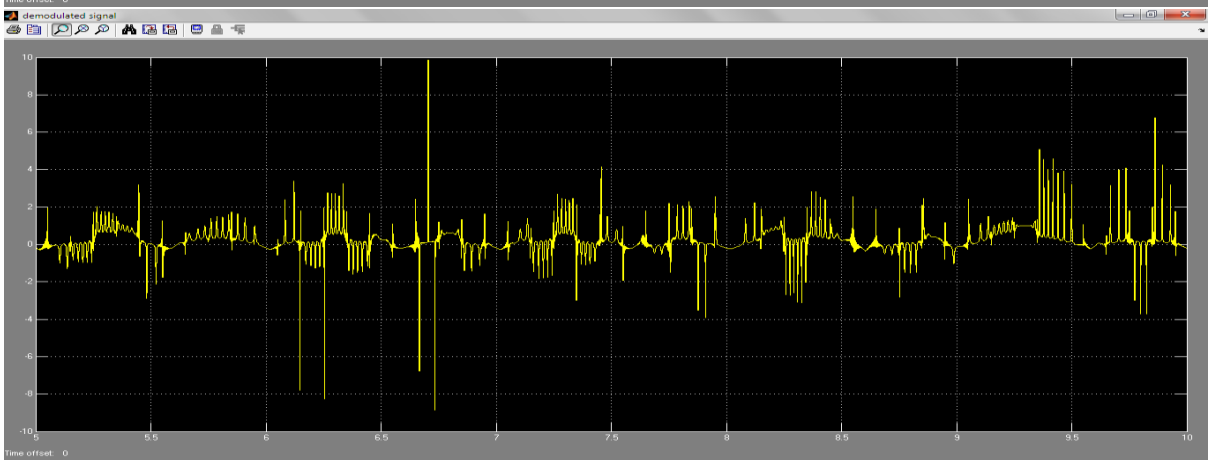


FM Modulator and Demodulator (With Noise):

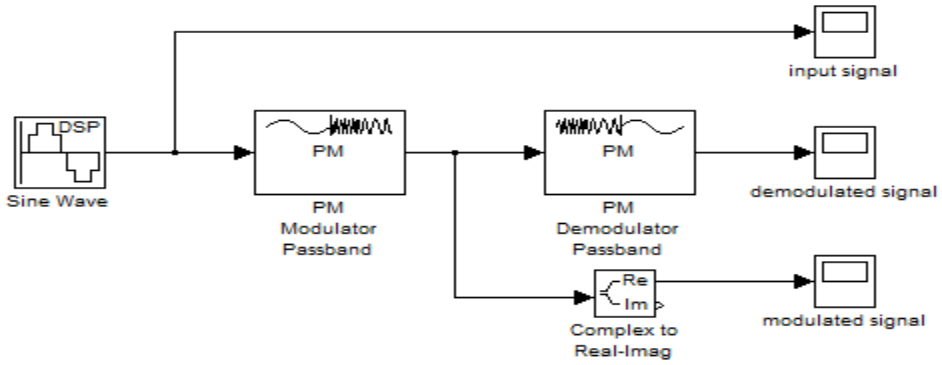


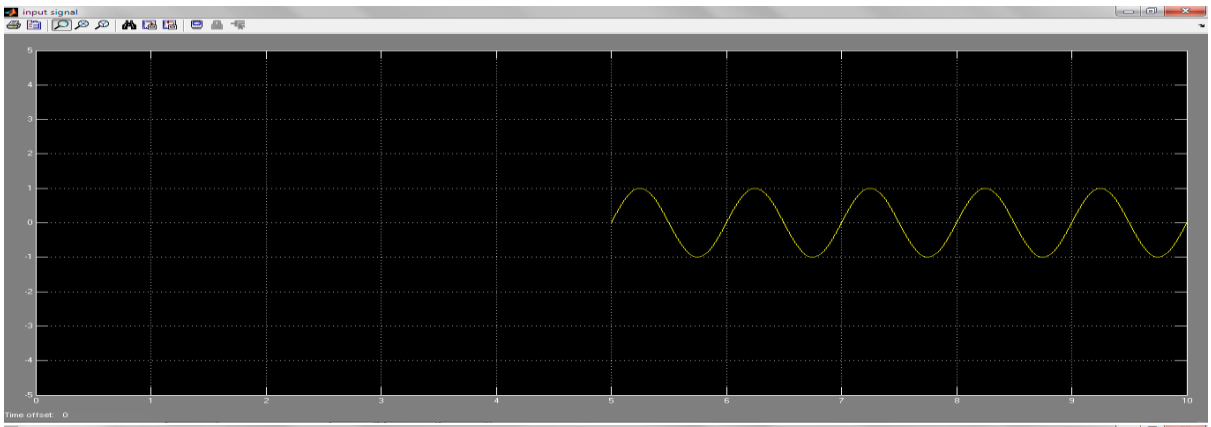


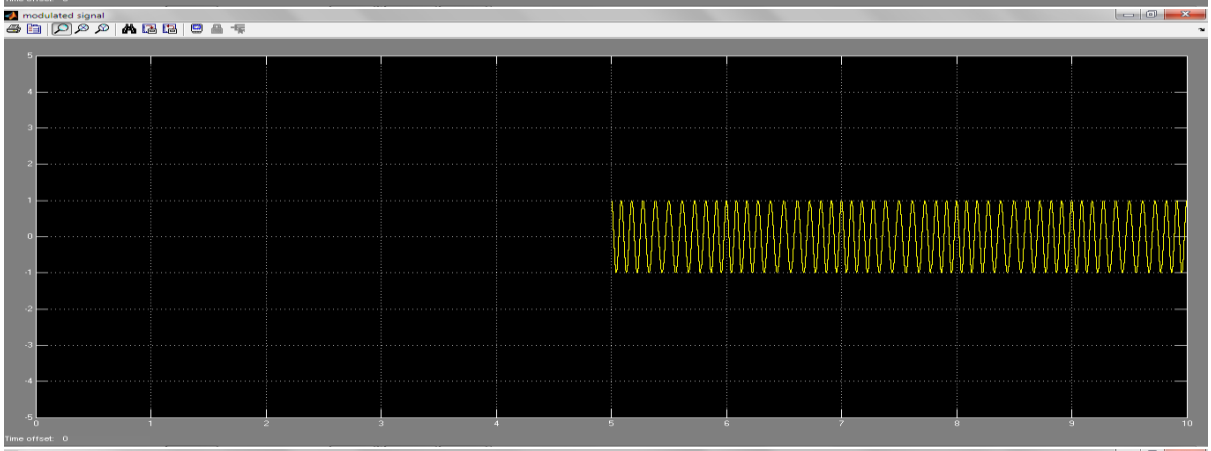


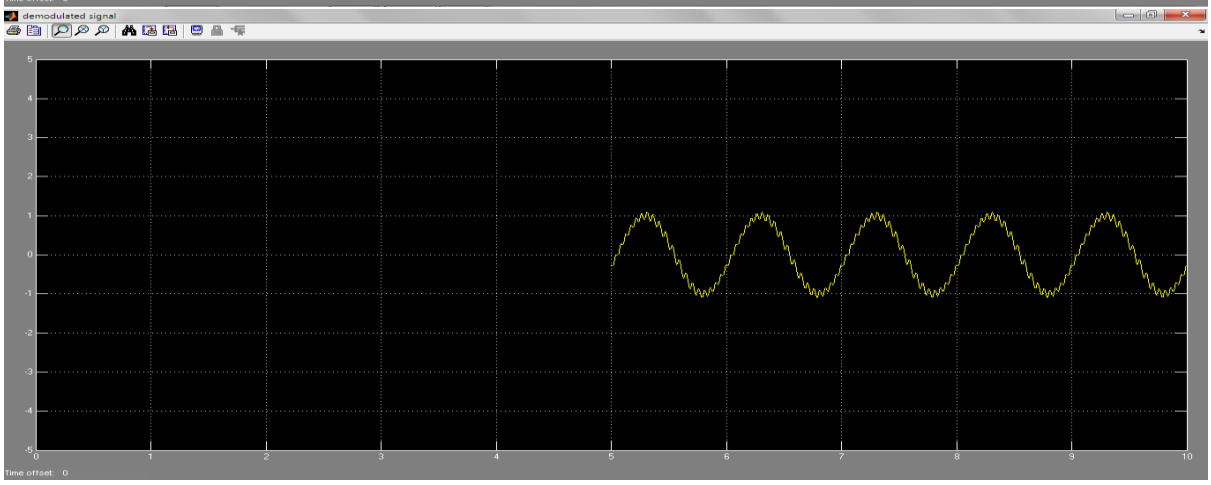


PM Modulator and Demodulator (Without Noise):

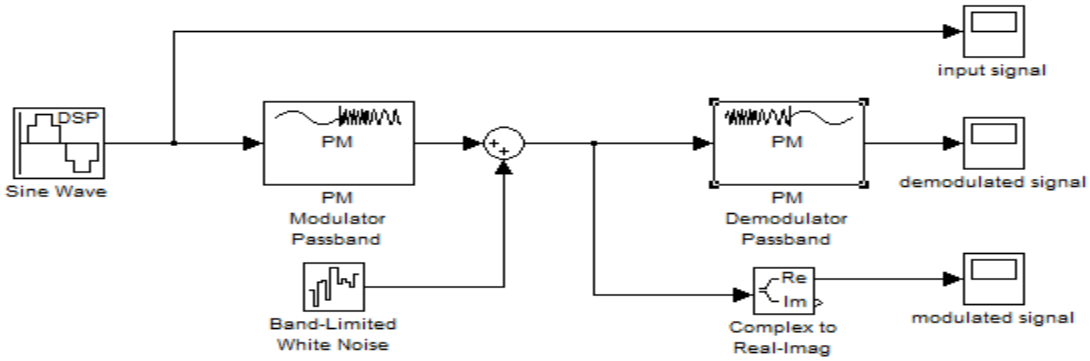


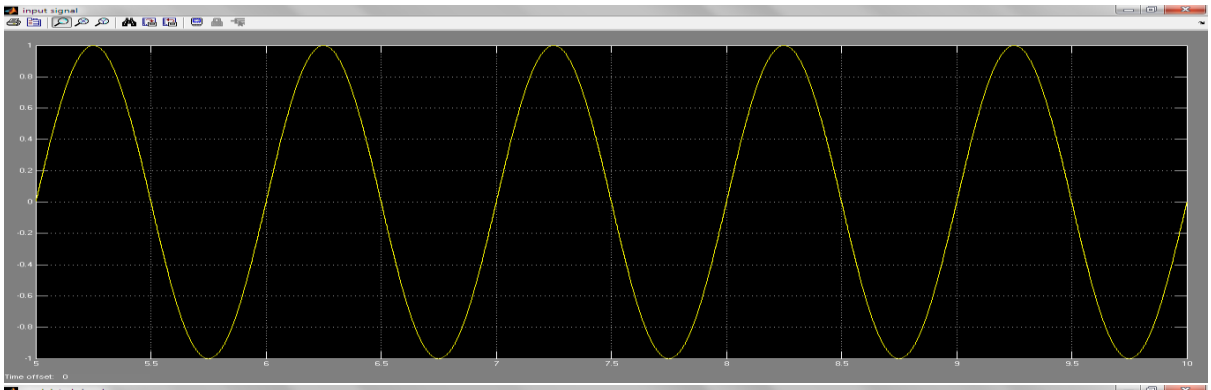


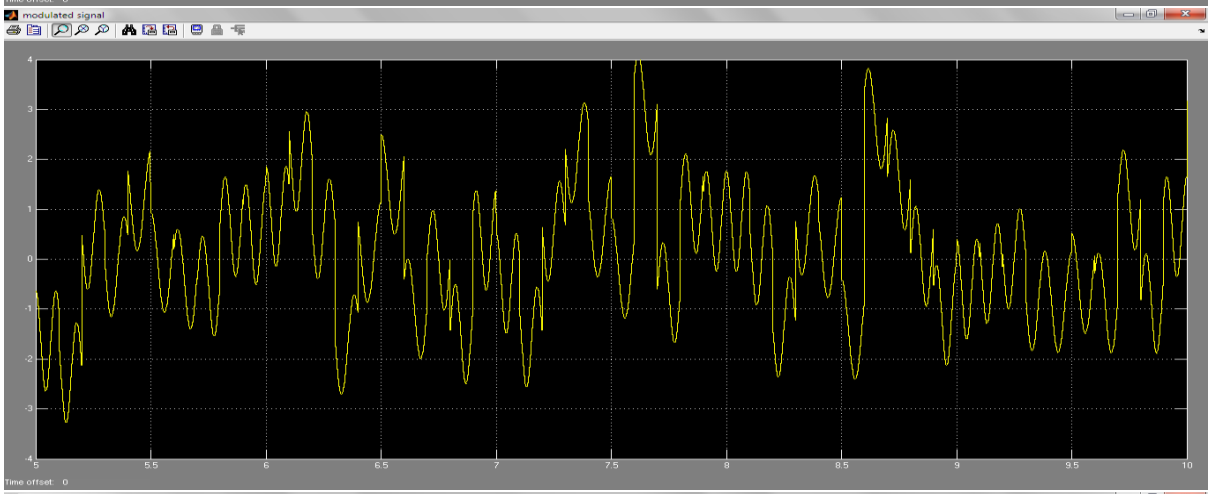


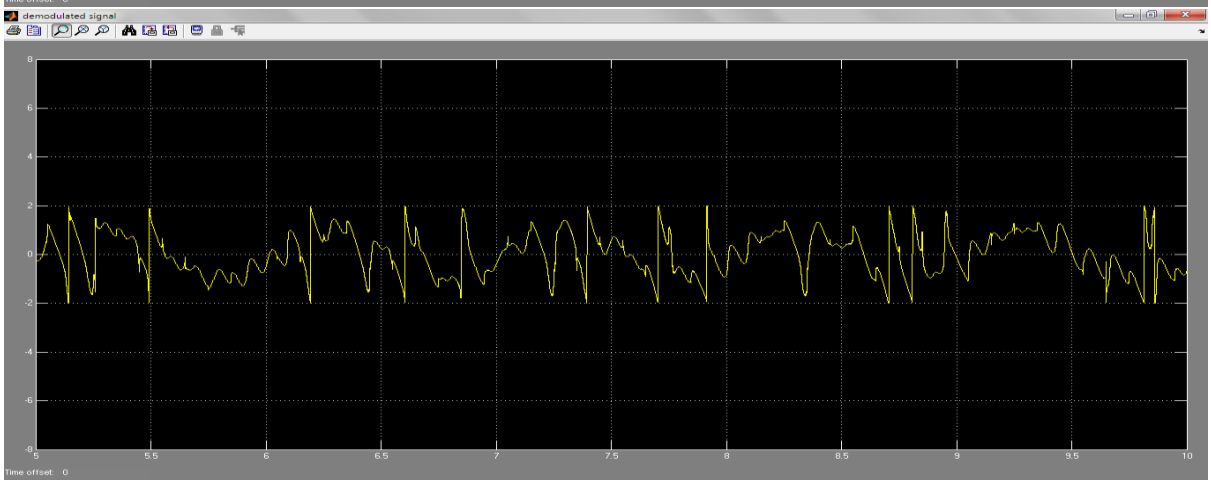


PM Modulator and Demodulator (With Noise):

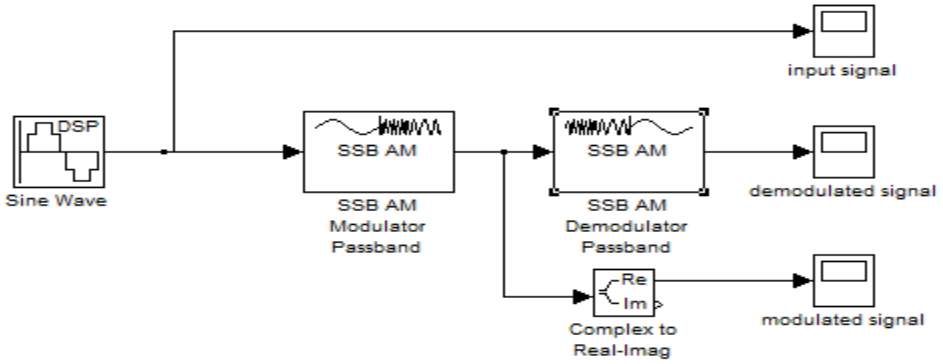


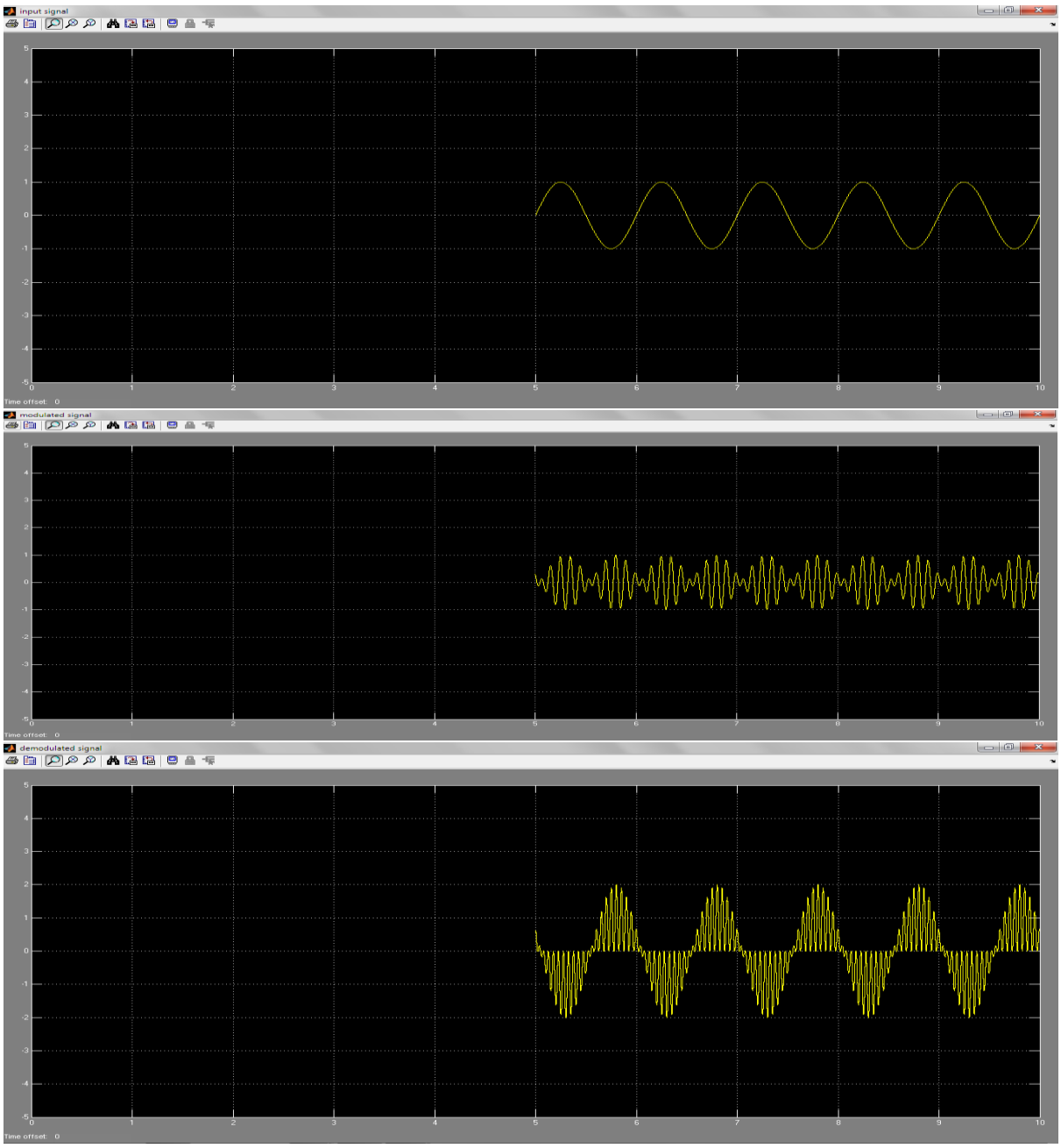






SSB AM Modulator and Demodulator (Without Noise):





SSB AM Modulator and Demodulator (With Noise):