# Q1

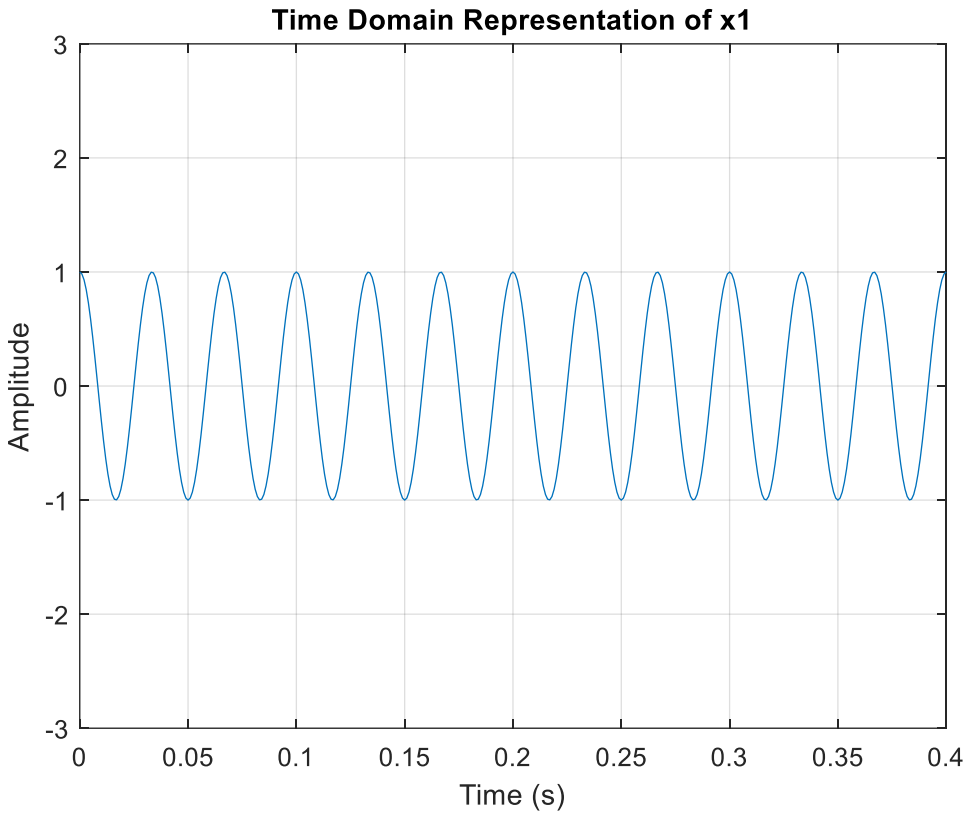


*Figure 1 - Time Domain Representation of x1 (30 Hz)*

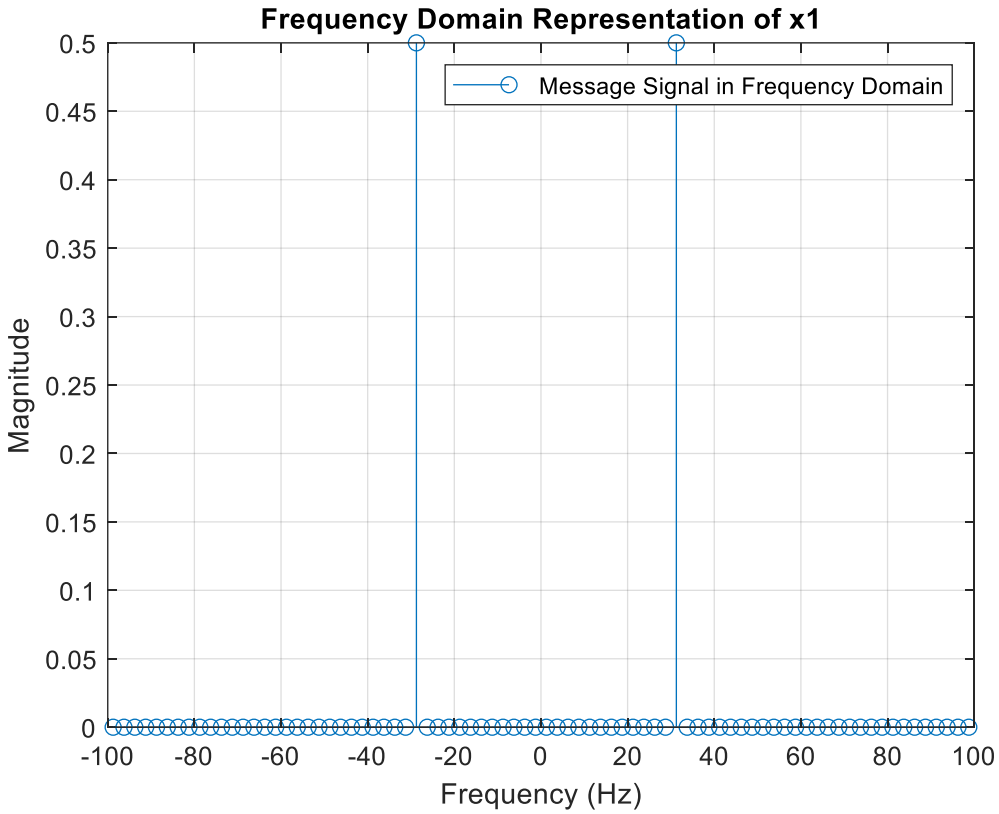


*Figure 2 - Frequency Domain Representation of x1*

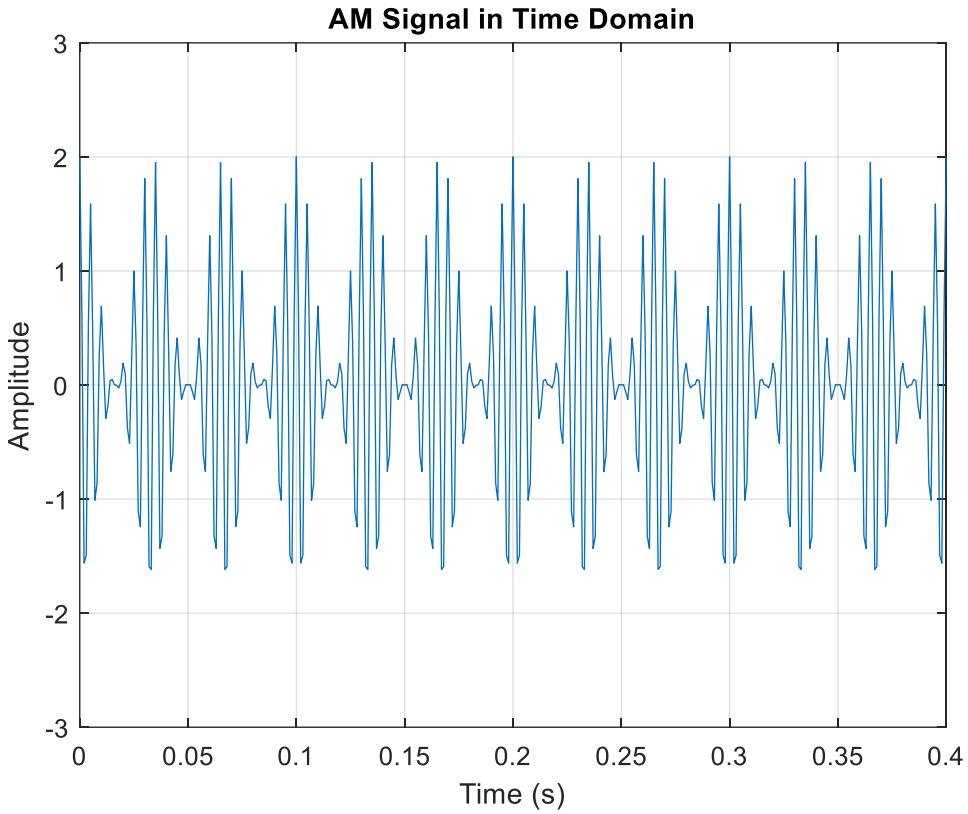


*Figure 3 - AM Signal in Time Domain (200 Hz and index 1)*

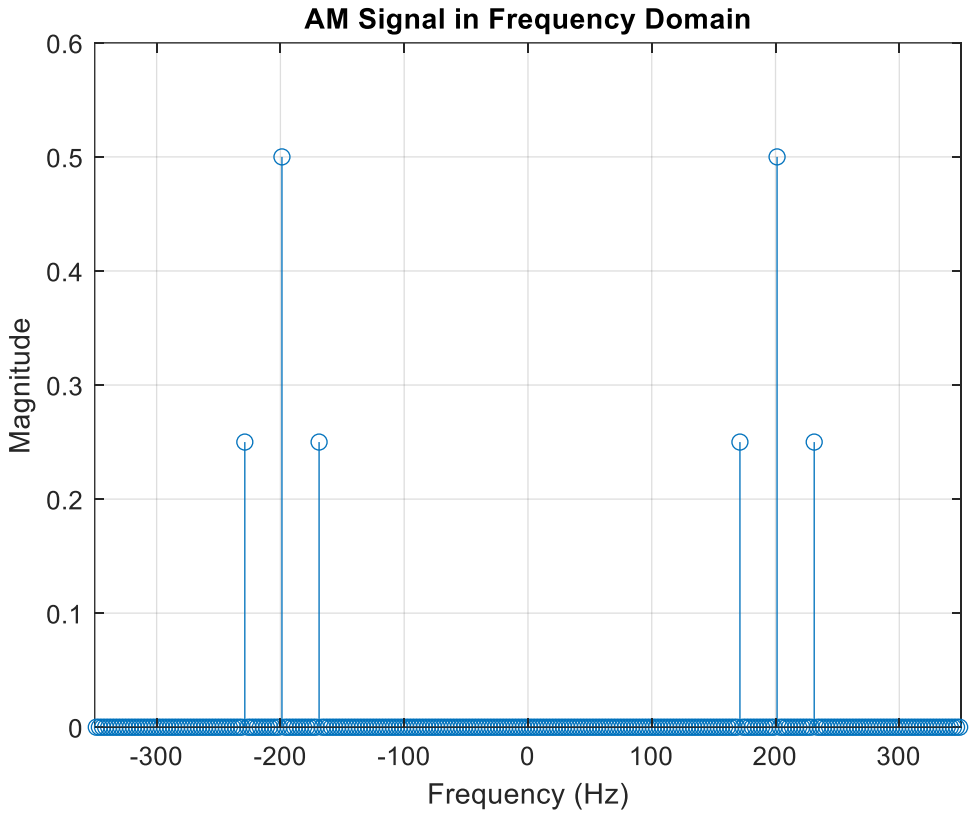


*Figure 4 - AM Signal in Frequency Domain (200 Hz and index 1)*

When the message signal we have is combined with the specified carrier frequency values, our message is shifted to around 200 Hz. We can observe this situation more clearly in both the time and frequency domains in Figure 3 and Figure 4.

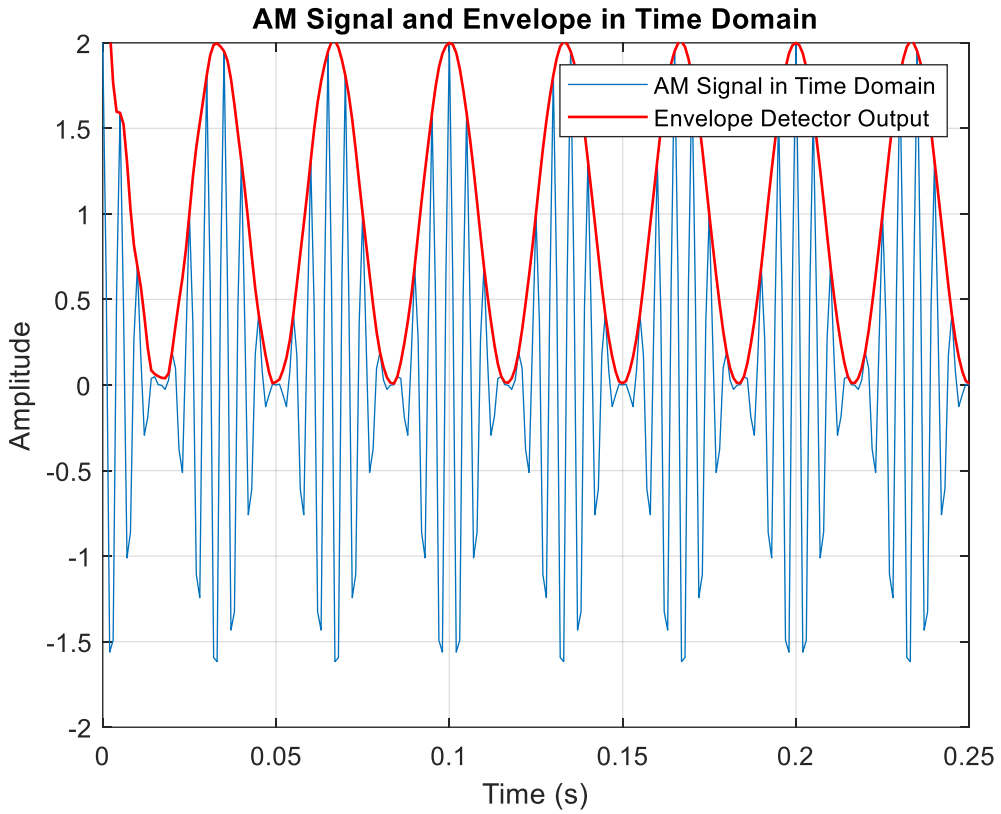


*Figure 5 - AM Signal and Envelope in Time Domain (200 Hz and index 1)*

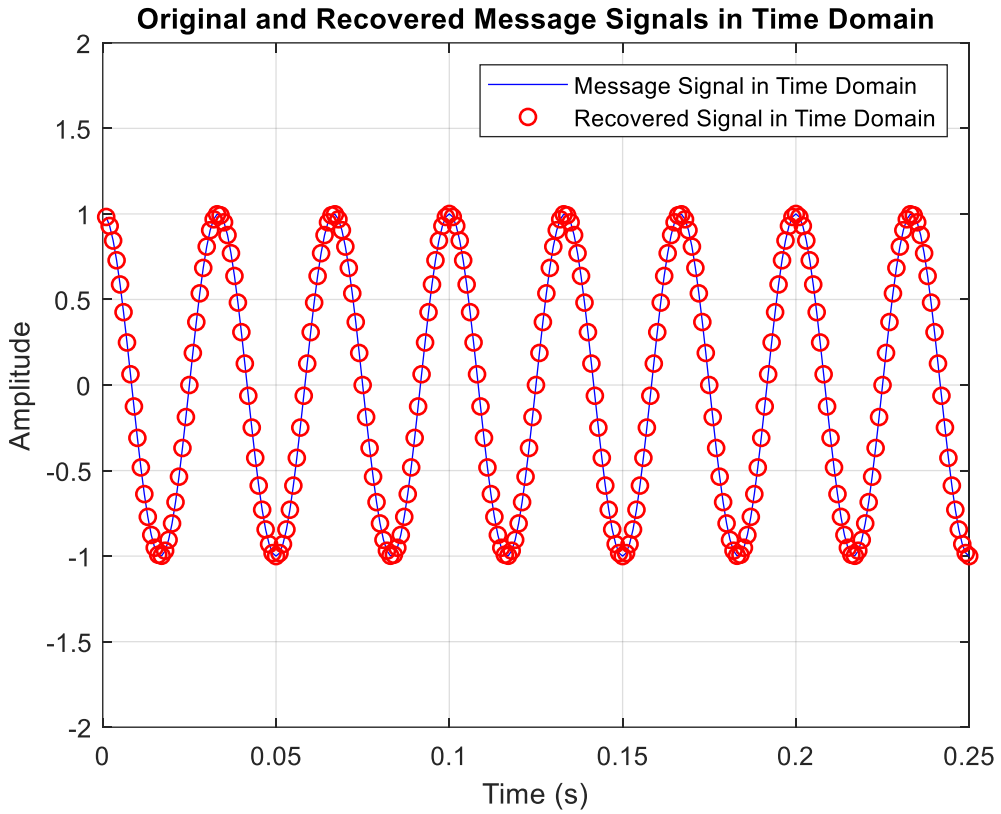


*Figure 6 - Original and Recovered Message Signals in Time Domain (200 Hz and index 1)*

If our index is 1, meaning our modulation coefficient is 1, the recovered signal obtained after the envelope detector process will be the same as our original signal. This similarity will remain the same even if the carrier frequency changes, and we can prove this by looking at Figure 6 and Figure 10.

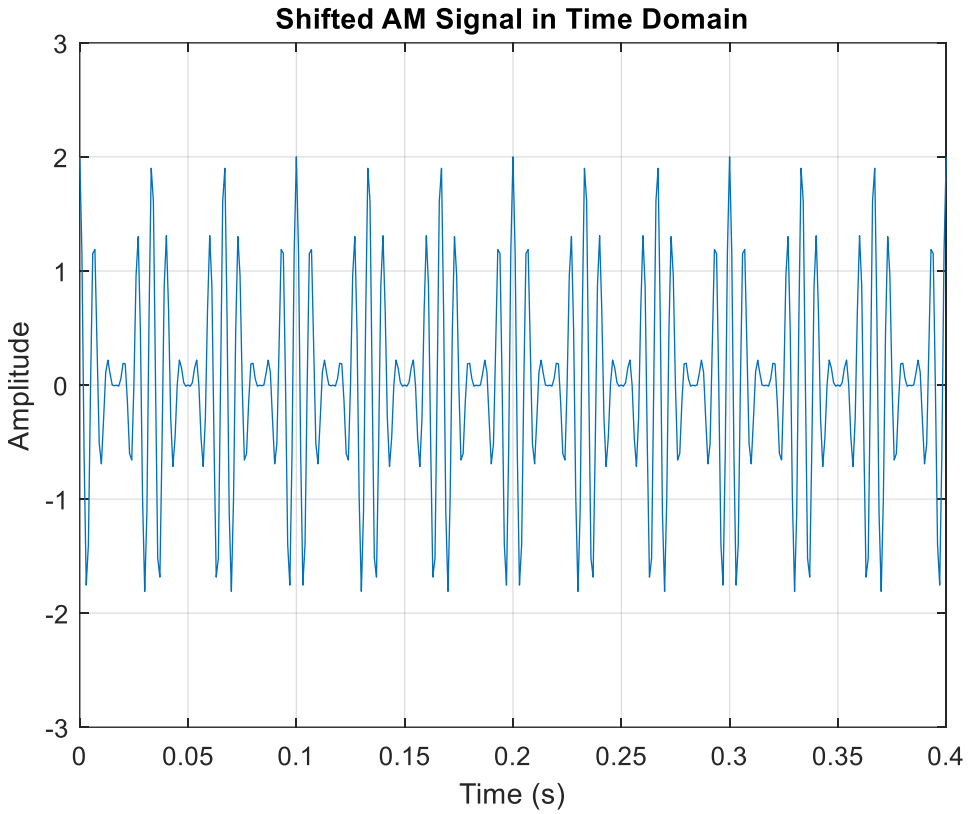


*Figure 7 - Shifted AM Signal in Time Domain (150 Hz and index 1)*

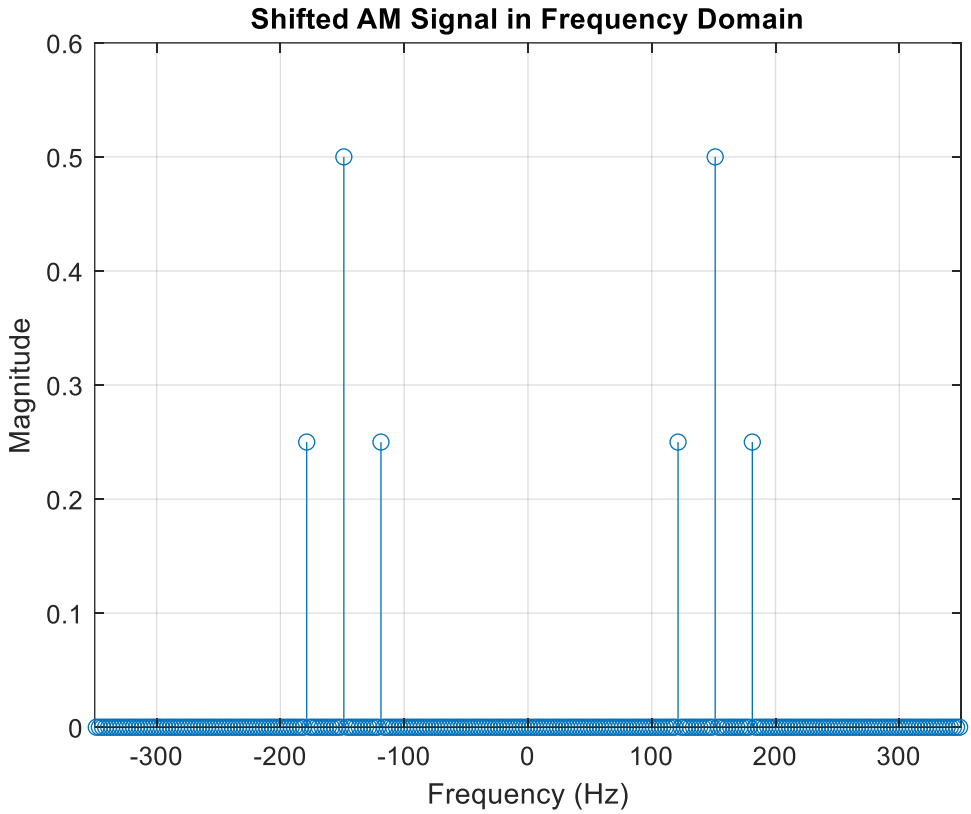


*Figure 8 - Shifted AM Signal in Frequency Domain (150 Hz and index 1)*

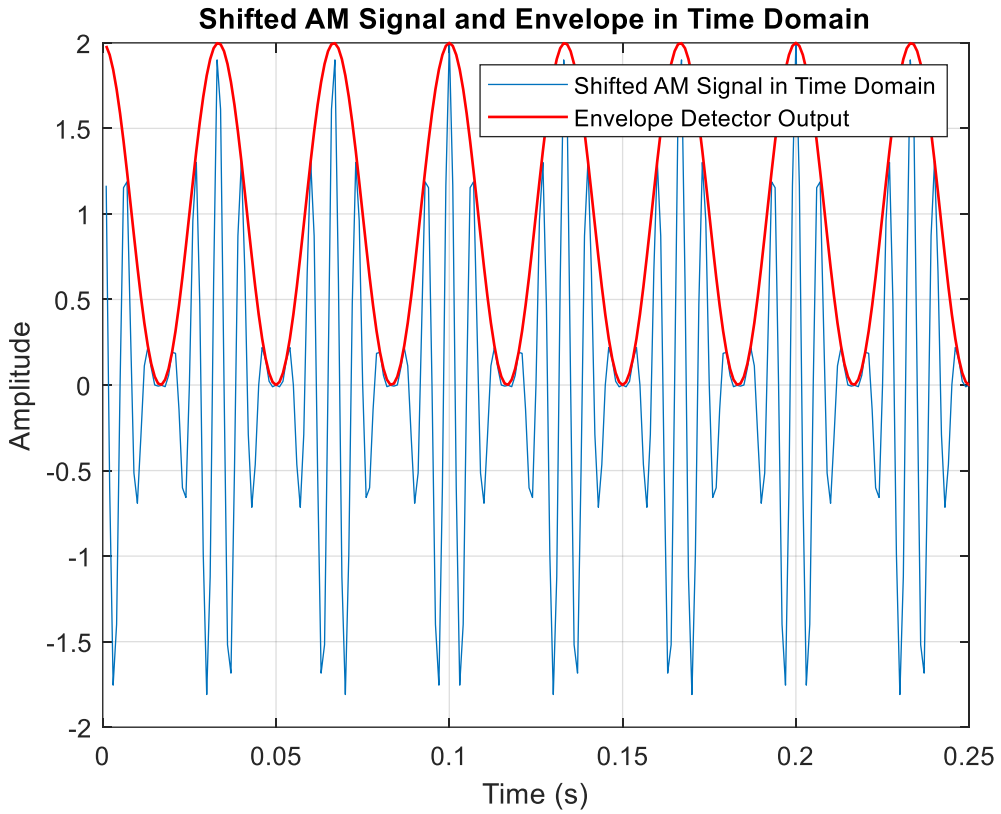


*Figure 9 - Shifted AM Signal and Envelope in Time Domain (150 Hz and index 1)*

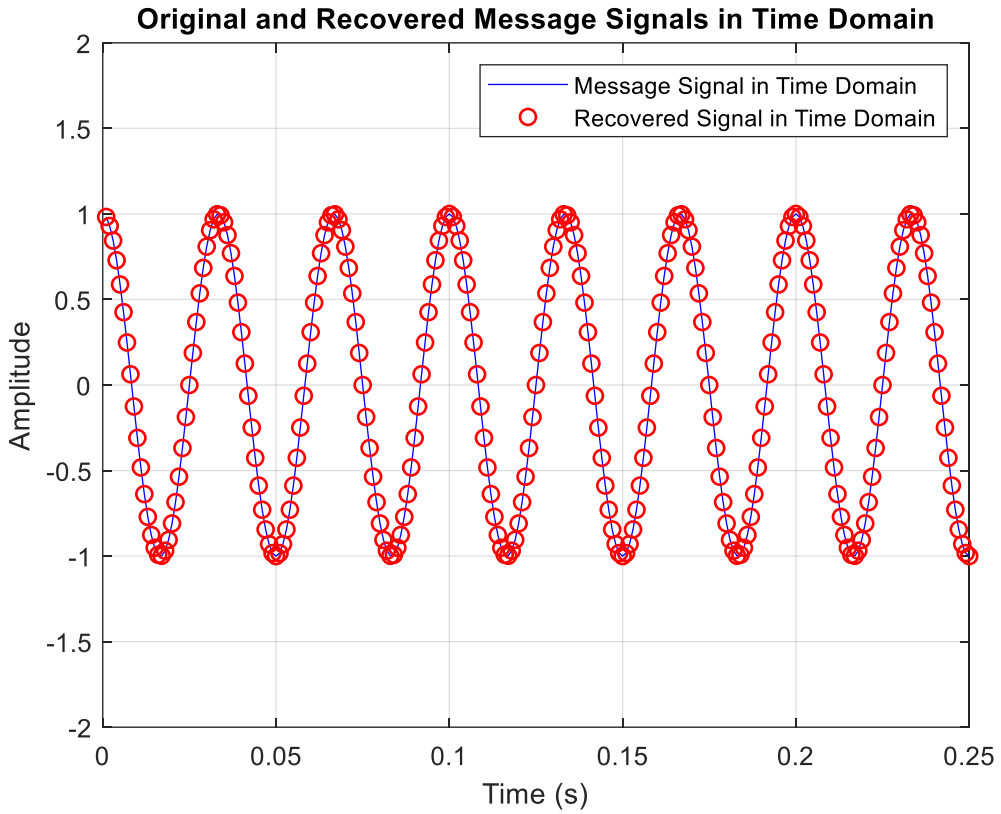


*Figure 10 - Original and Recovered Message Signals in Time Domain (150 Hz and index 1)*

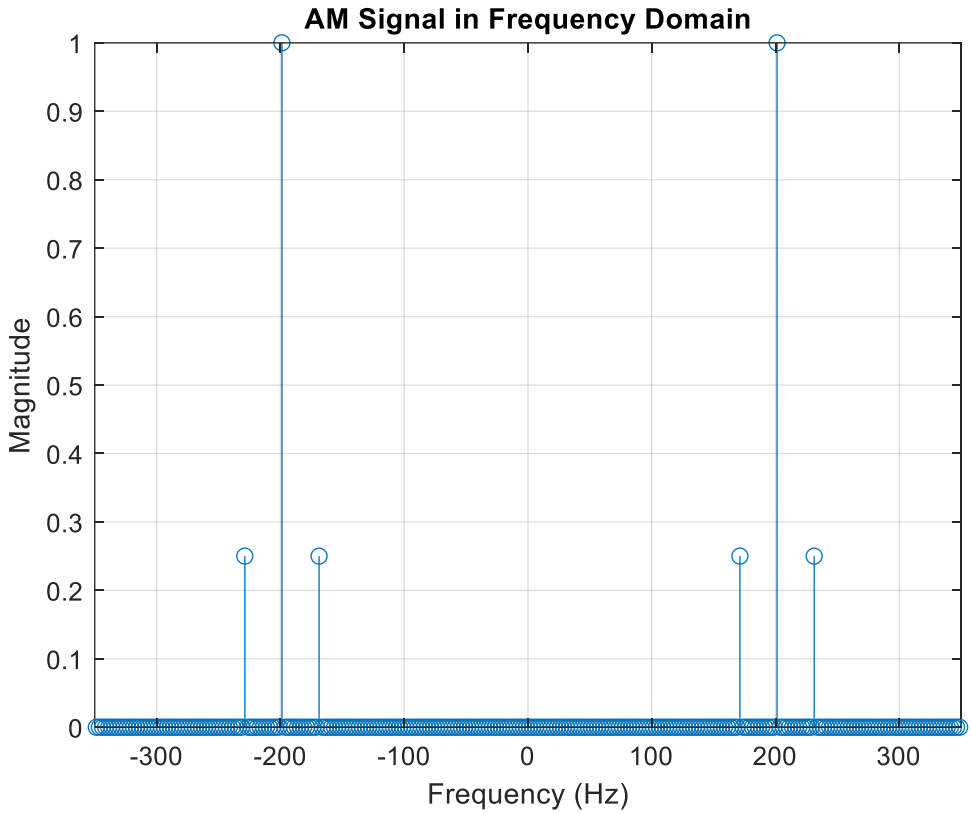


*Figure 11 - AM Signal in Frequency Domain (200 Hz and index 0.5)*

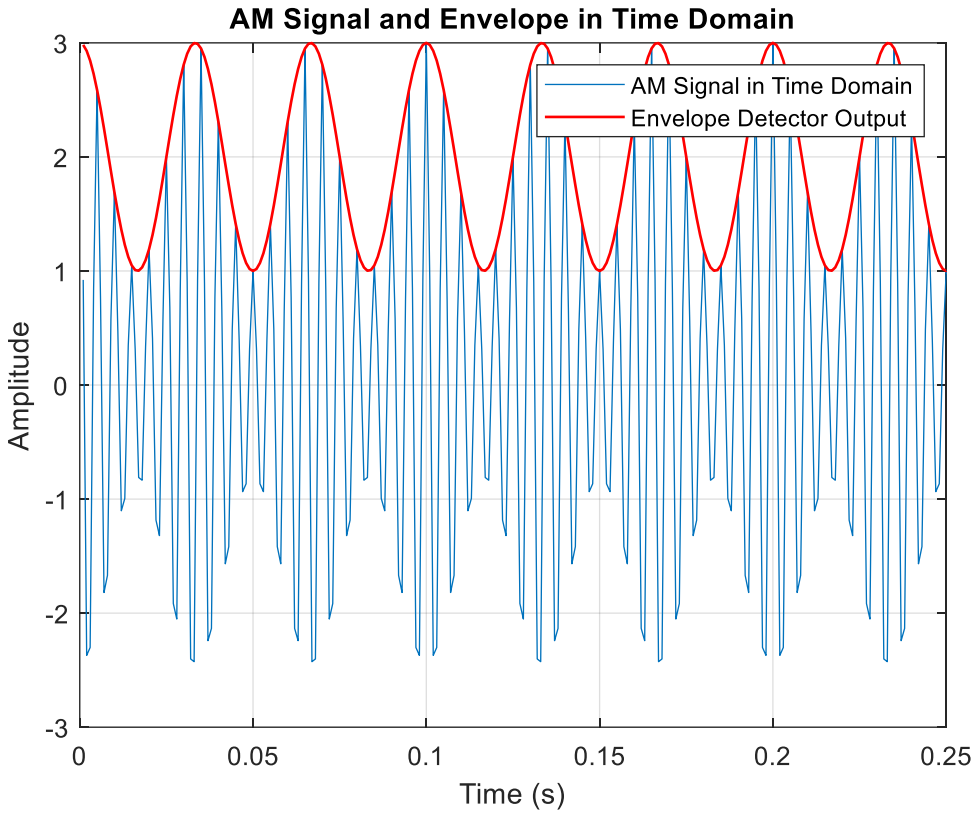


*Figure 12 - AM Signal and Envelope in Time Domain (200 Hz and index 0.5)*

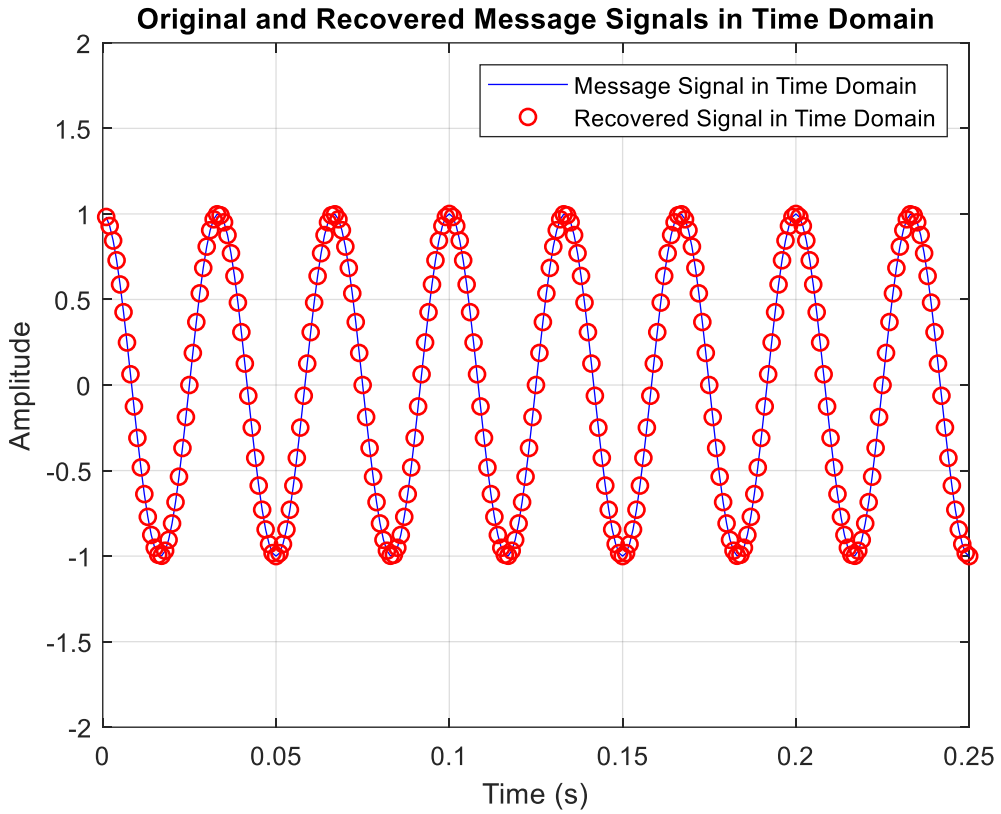


*Figure 13 - Original and Recovered Message Signals in Time Domain (200 Hz and index 0.5)*

Due to the change in the modulation coefficient, the similarity of the recovered signal hasn't been altered. Because the condition still remains valid.

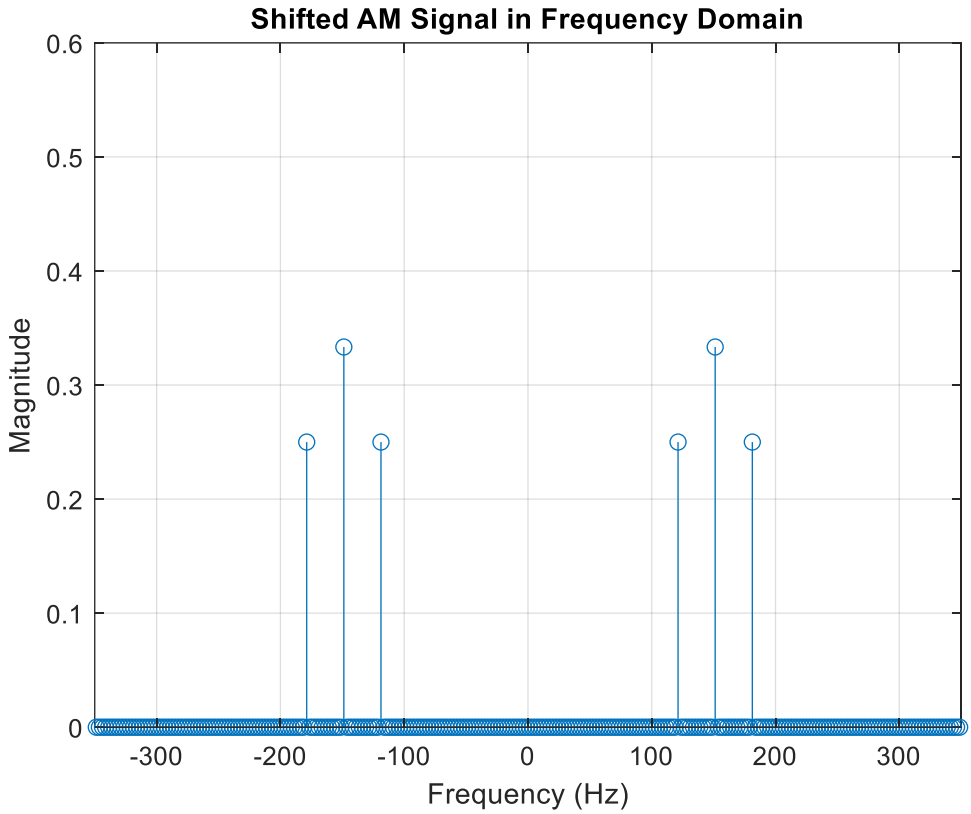


*Figure 14 - Shifted AM Signal in Frequency Domain (150 Hz and index 1.5)*

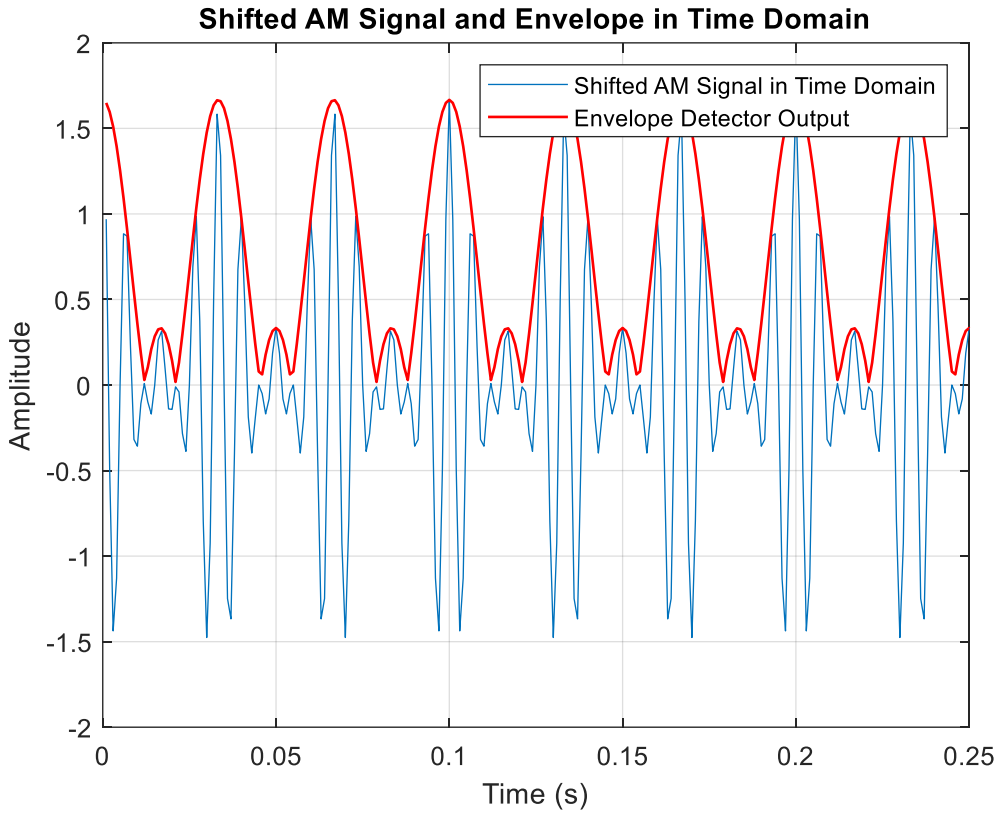


*Figure 15 - Shifted AM Signal and Envelope in Time Domain (150 Hz and index 1.5)*

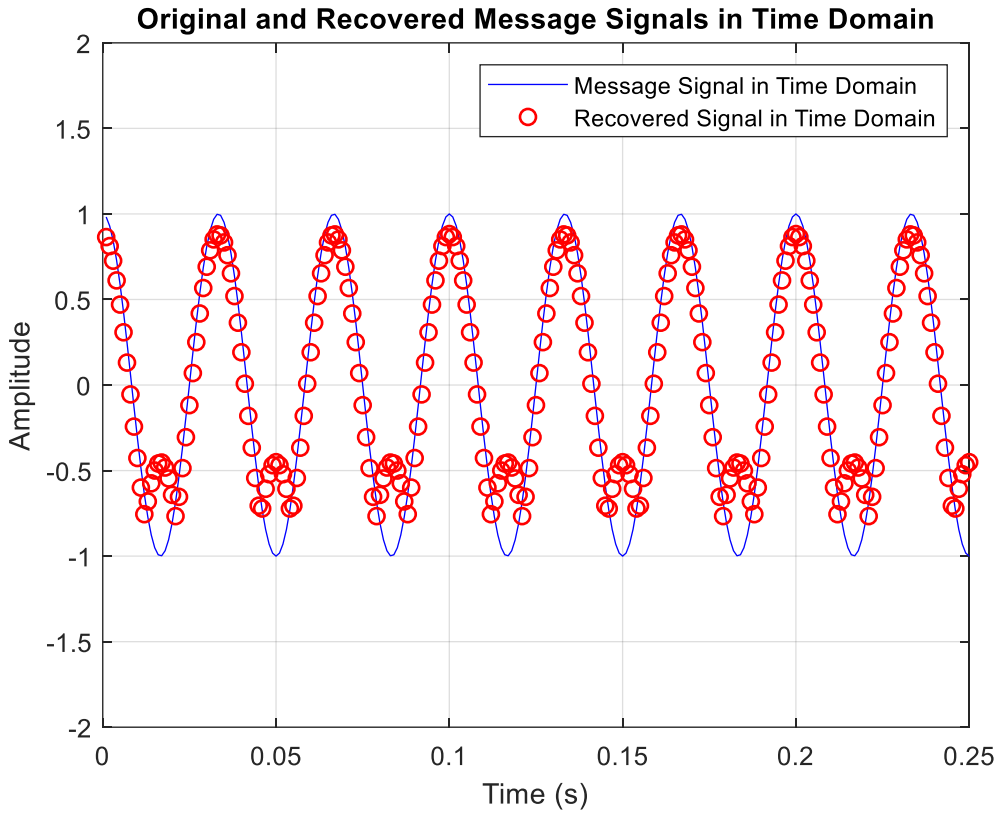


*Figure 16 - Original and Recovered Message Signals in Time Domain (150 Hz and index 1.5)*

Due to the change in the modulation coefficient, the similarity of the recovered signal has been altered. We are unable to retrieve our original message with envelope detector.

# Q2

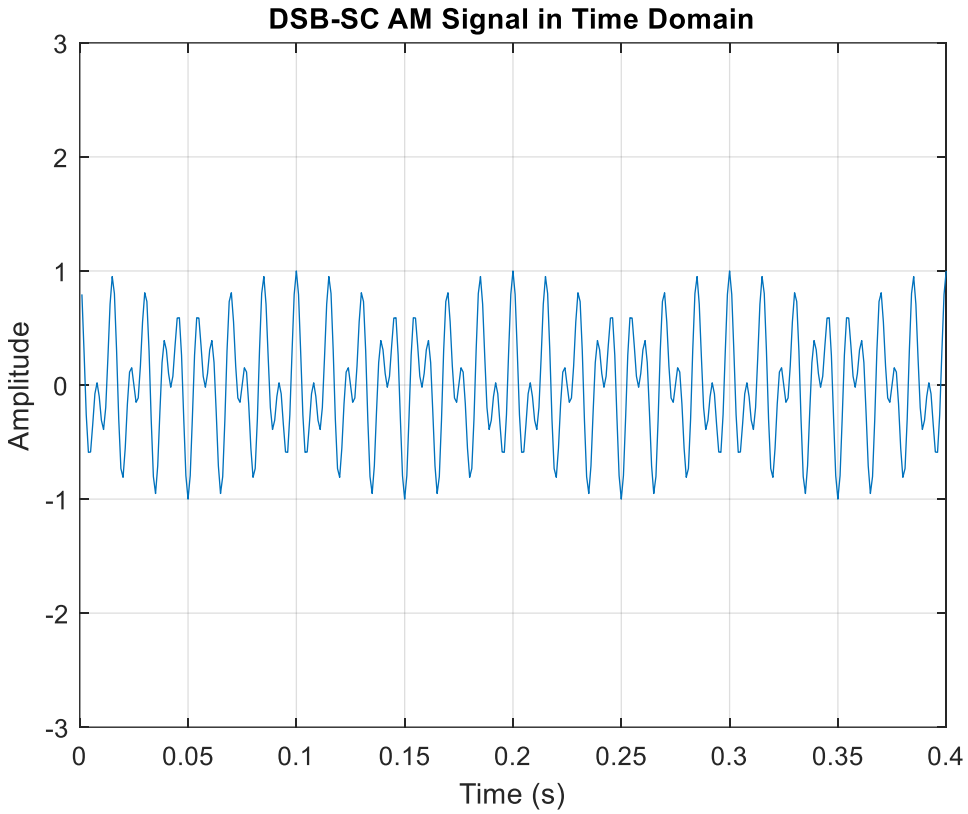


*Figure 17 - DSB-SC AM Signal in Time Domain (200 Hz)*

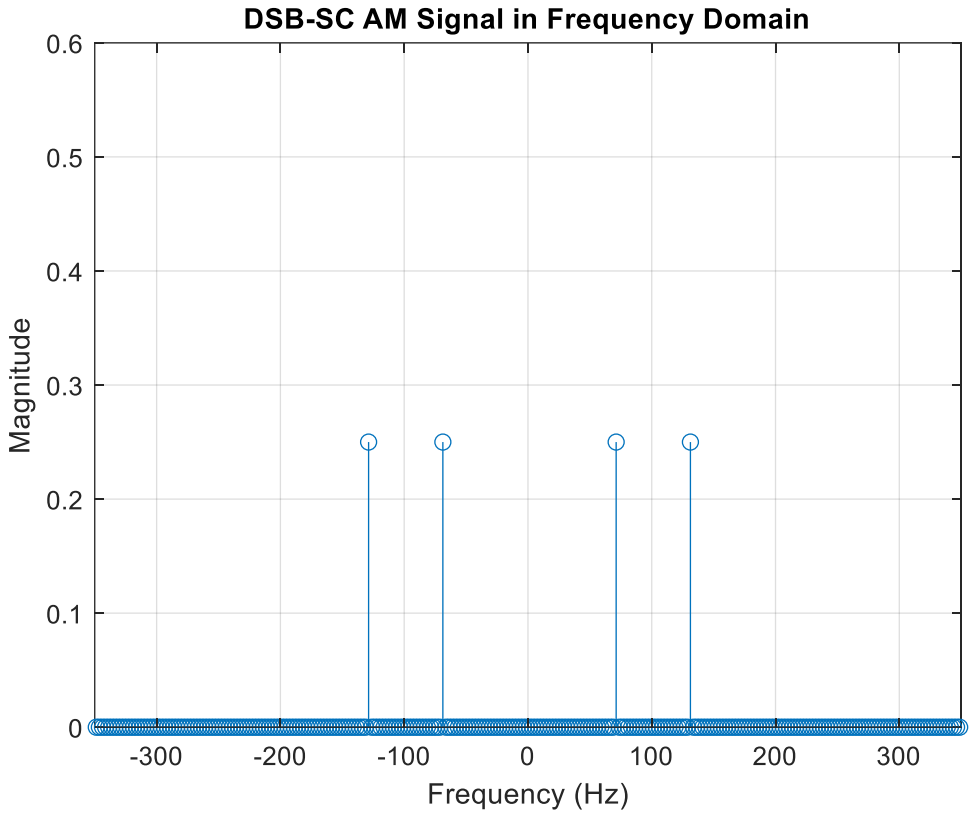


*Figure 18 - DSB-SC AM Signal in Frequency Domain (100 Hz)*

When compared to the AM spectrum, it is observed that there is no value at the carrier frequency located at 100 Hz. This allows for a reduction in the power allocated to the carrier frequency during signal transmission, thus enabling power conservation.

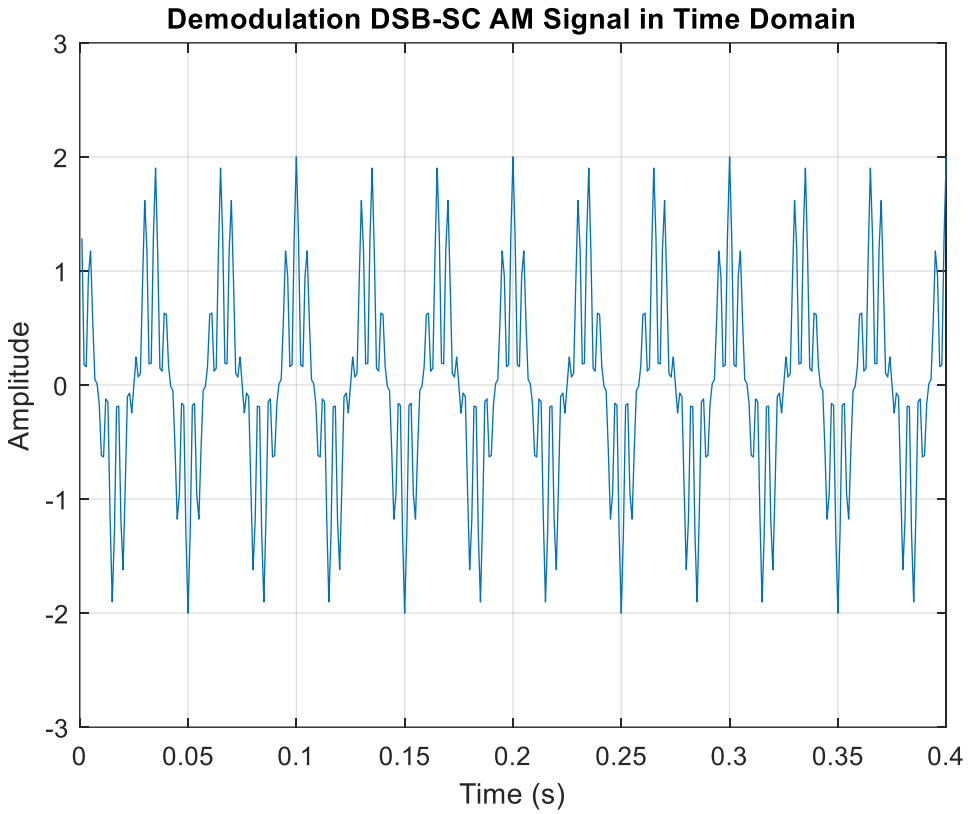


*Figure 19 - Demodulation DSB-SC AM Signal in Time Domain (100 Hz)*

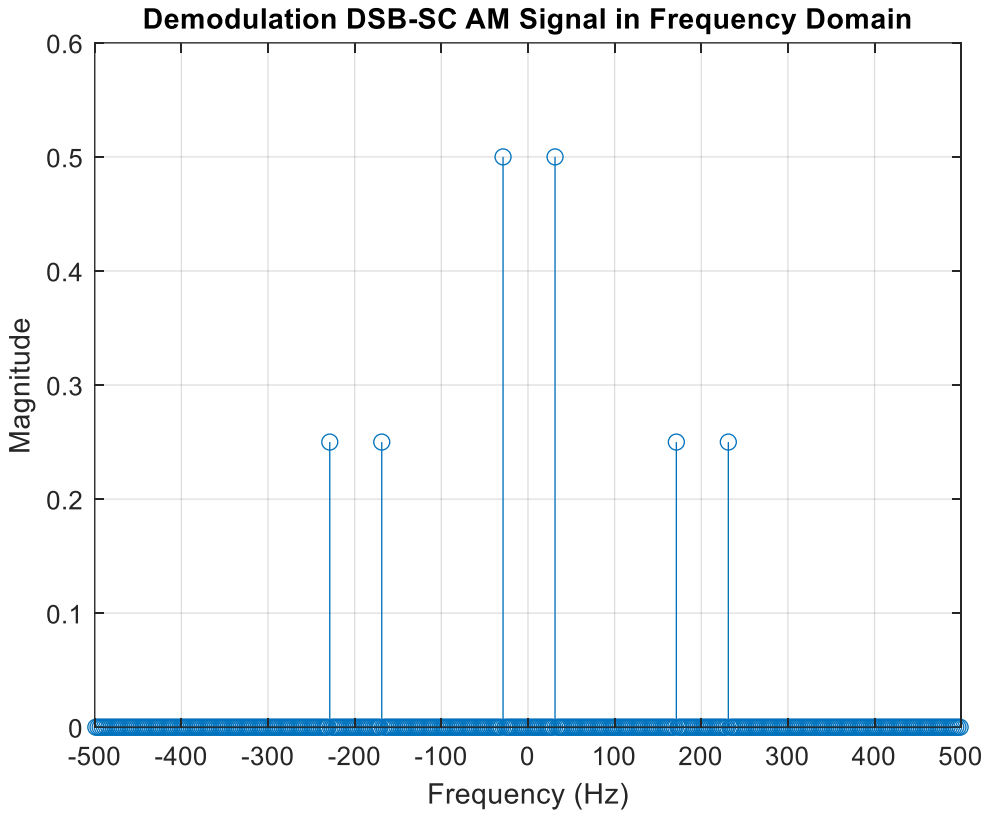


*Figure 20 - Demodulation DSB-SC AM Signal in Frequency Domain (100 Hz)*

When we perform modulation with our original signal, both the frequencies of the DSB-SC AM signal and the frequencies of the original signal are displayed in the frequency domain.

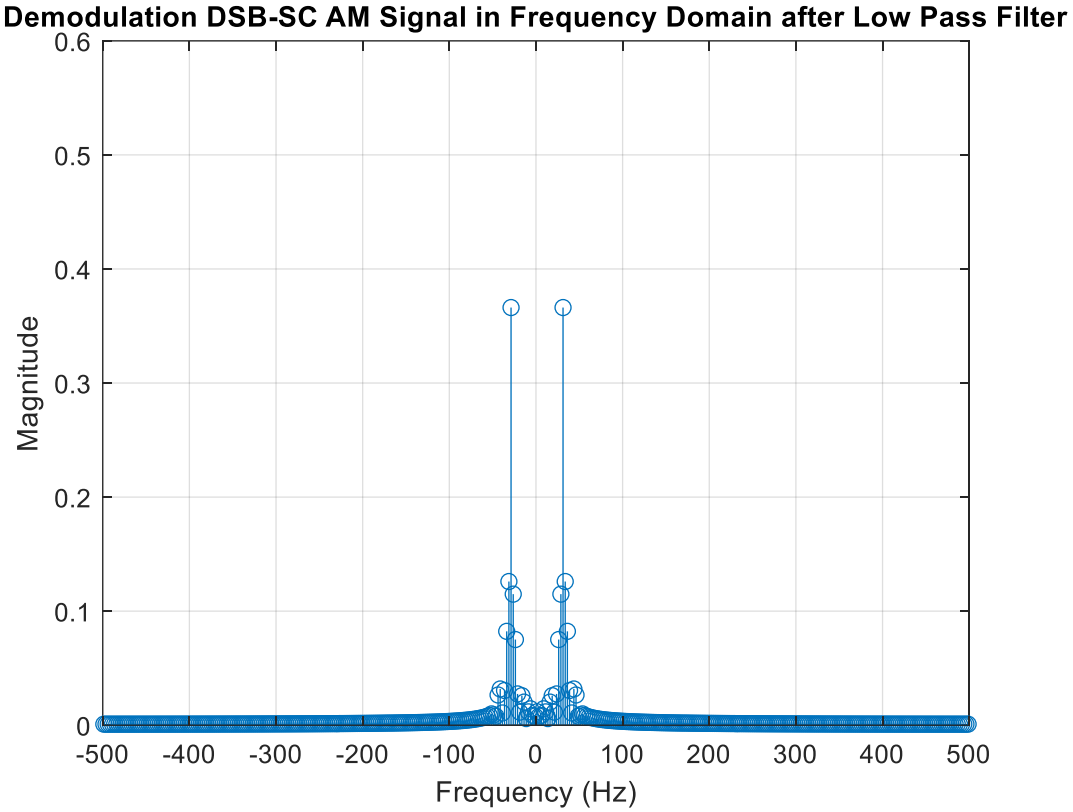


*Figure 21 - Demodulation DSB-SC AM Signal in Frequency Domain after Low Pass Filter (100 Hz)*

After passing through the low pass filter (with a cutoff of 45 and a stop at 55), our signal ultimately returns to the frequency values of our original signal. Thus, we can state that our signal has been preserved during the transfer.

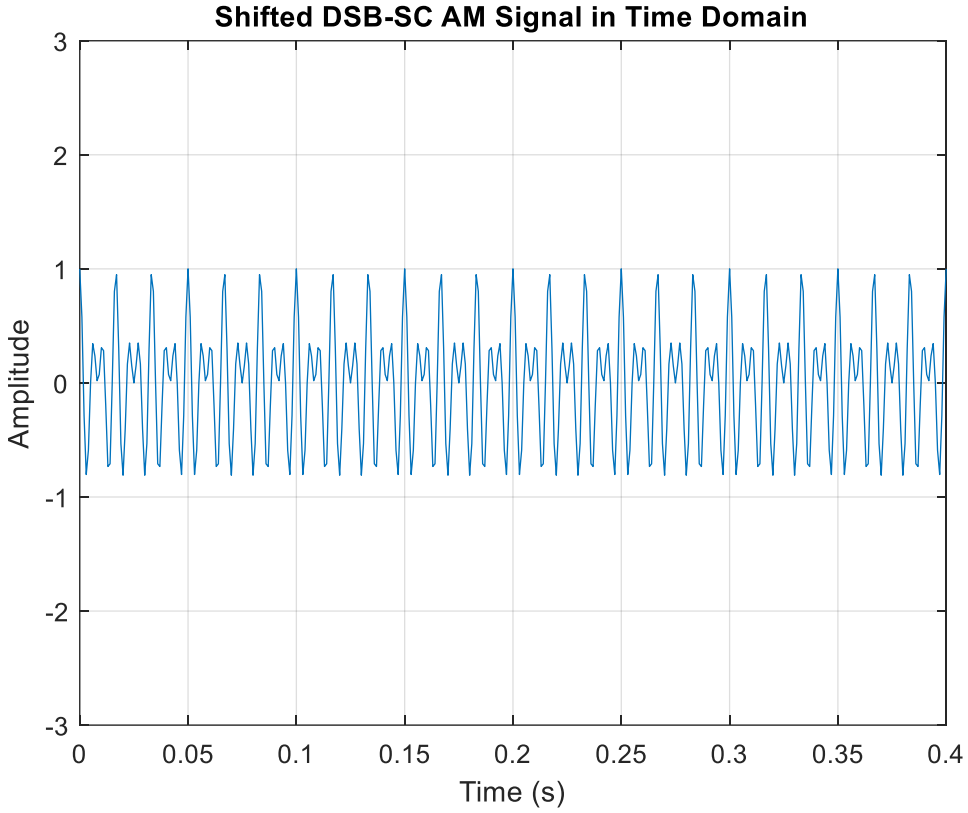


*Figure 22 - Shifted DSB-SC AM Signal in Time Domain (150 Hz)*

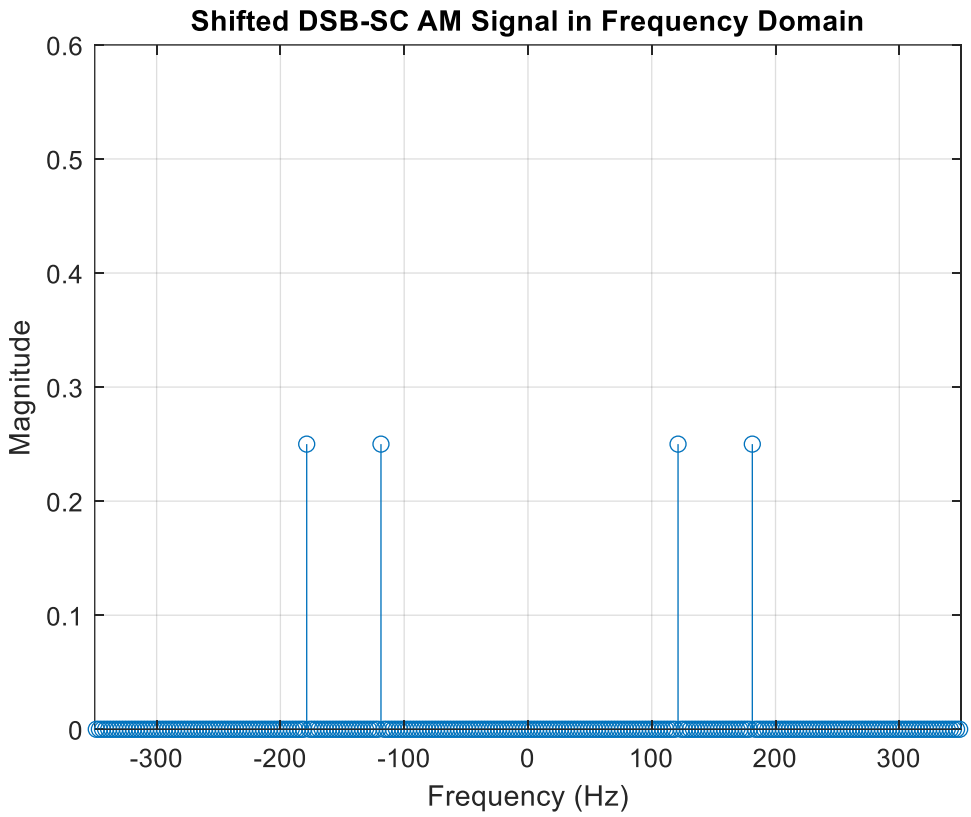


*Figure 23 - Shifted DSB-SC AM Signal in Frequency Domain (150 Hz)*

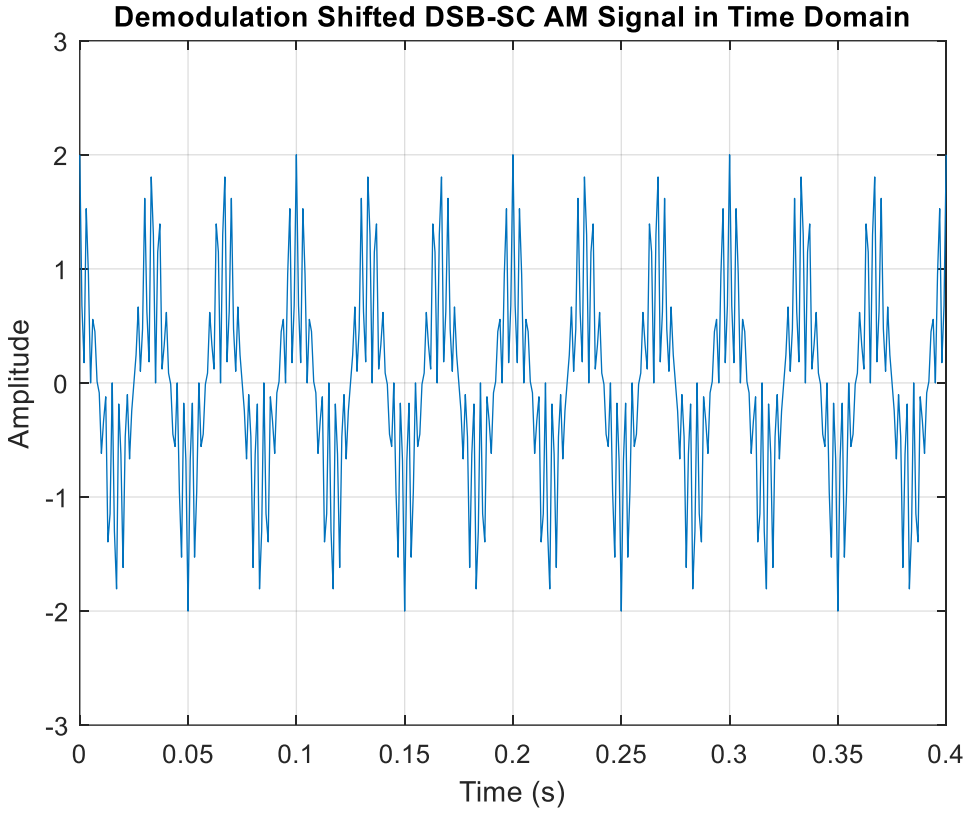


*Figure 24 - Demodulation Shifted DSB-SC AM Signal in Time Domain (150 Hz)*

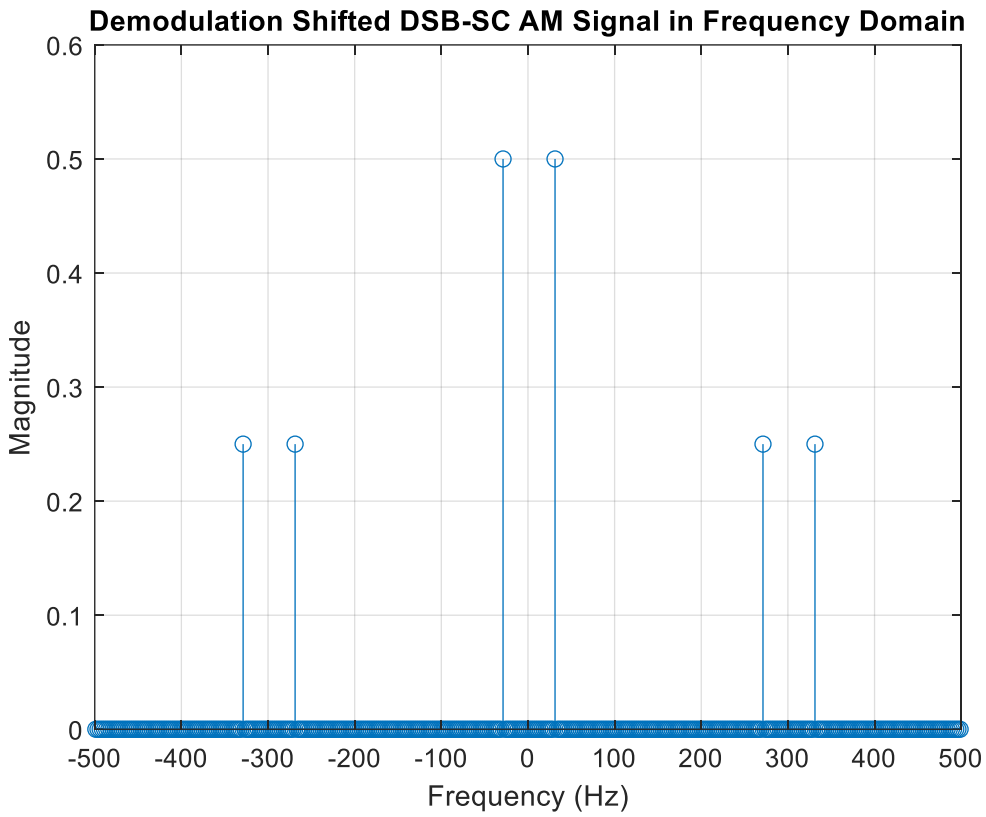


*Figure 25 - Demodulation Shifted DSB-SC AM Signal in Frequency Domain (150 Hz)*

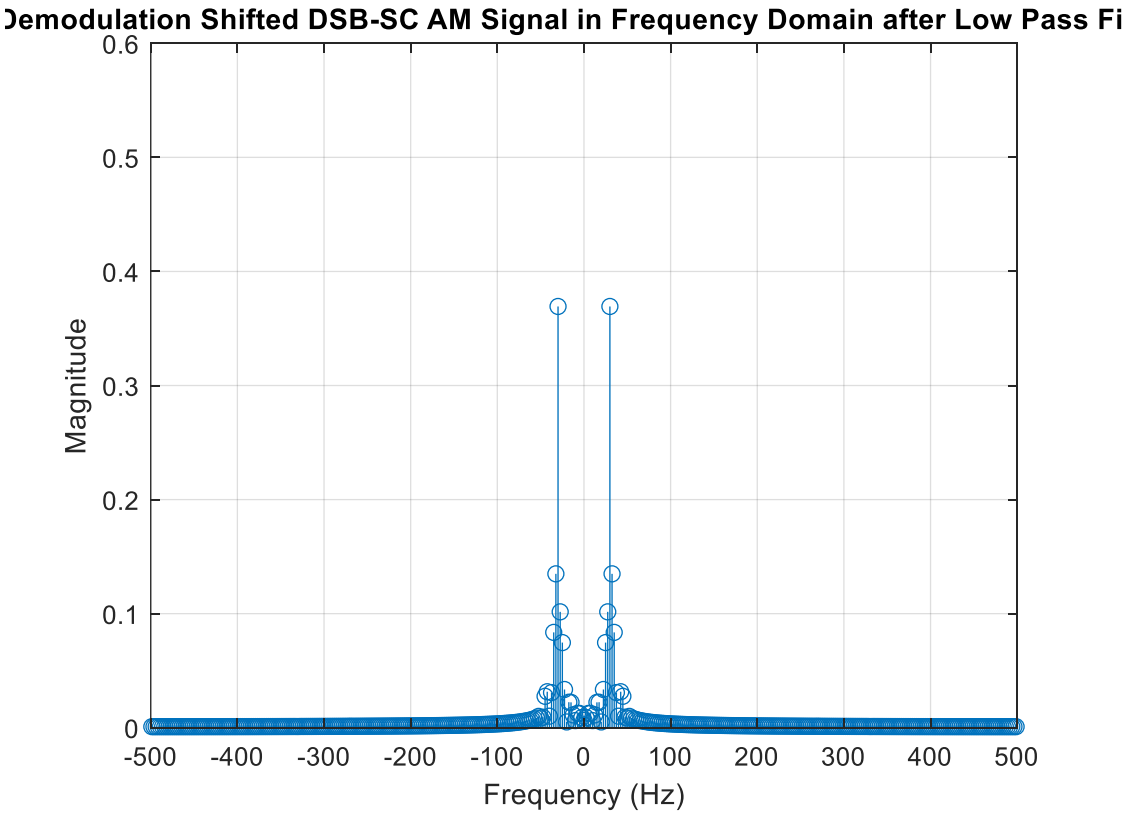


*Figure 26 - Demodulation Shifted DSB-SC AM Signal in Frequency Domain after Low Pass Filter (150 Hz)*