Faculty of Engineering and Technology

Electrical and Computer Engineering Department

ENEE4113

Communications Lab

PreLab No.6

Frequency and Phase Shift keying

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Section: 5.

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Block Simulation (using Matlab Simulink)

The prelab consists of two part, the first one the frequency shift keying (FSK), and the second one is the phase shift keying. The block diagrams of modulation and demodulation block diagram will be simulated using matlab for both types.

1. Frequency Shift Keying (FSK)

1.1 Modulation Block Diagram

The first step was building the block diagram using the Matlab Simulink, and assigning the required configuration to the components. The following figures shows the frequency shift keying modulation (FSK):

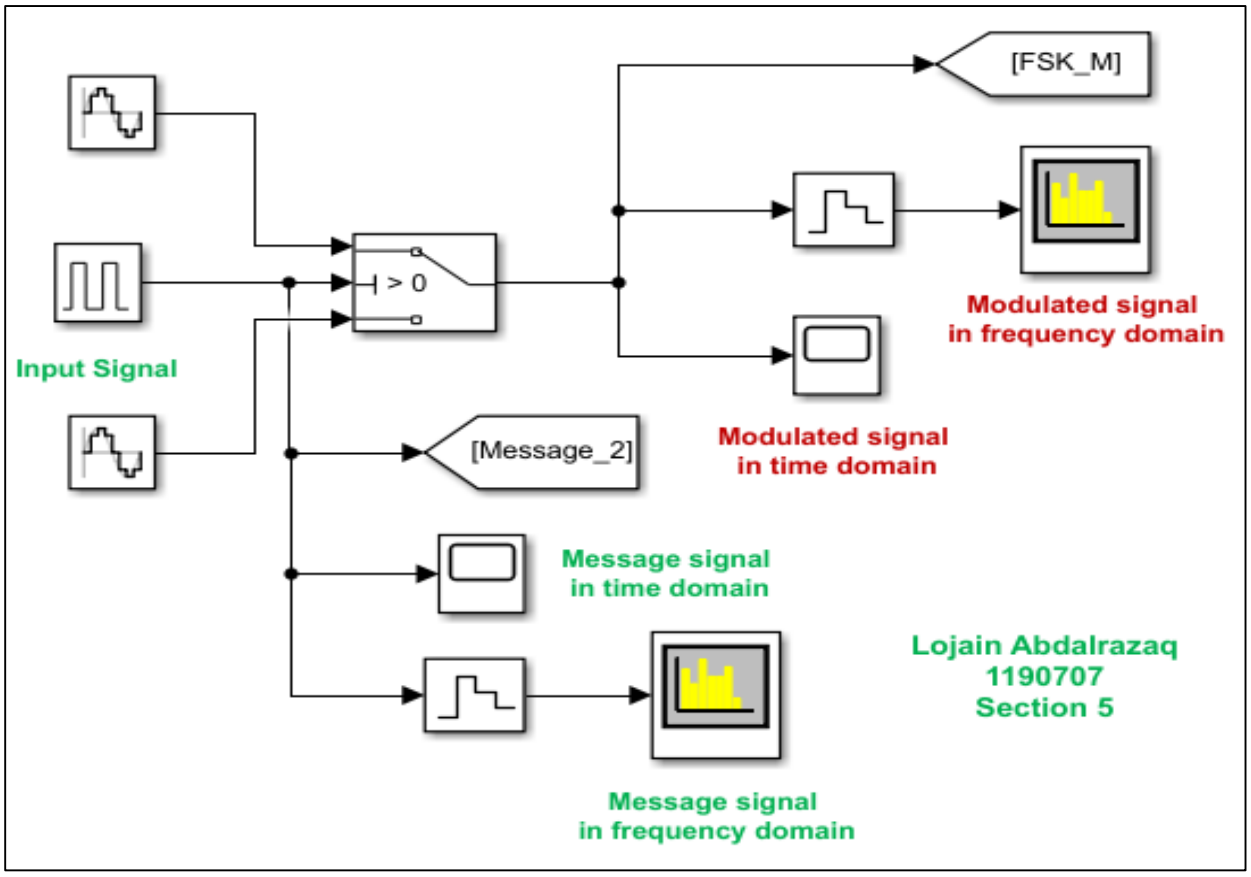

Figure 1 FSK modulation block diagram.

- **Message Signal in time and frequency:**

Firstly, the input message signal which is square wave signal in time and frequency domain.

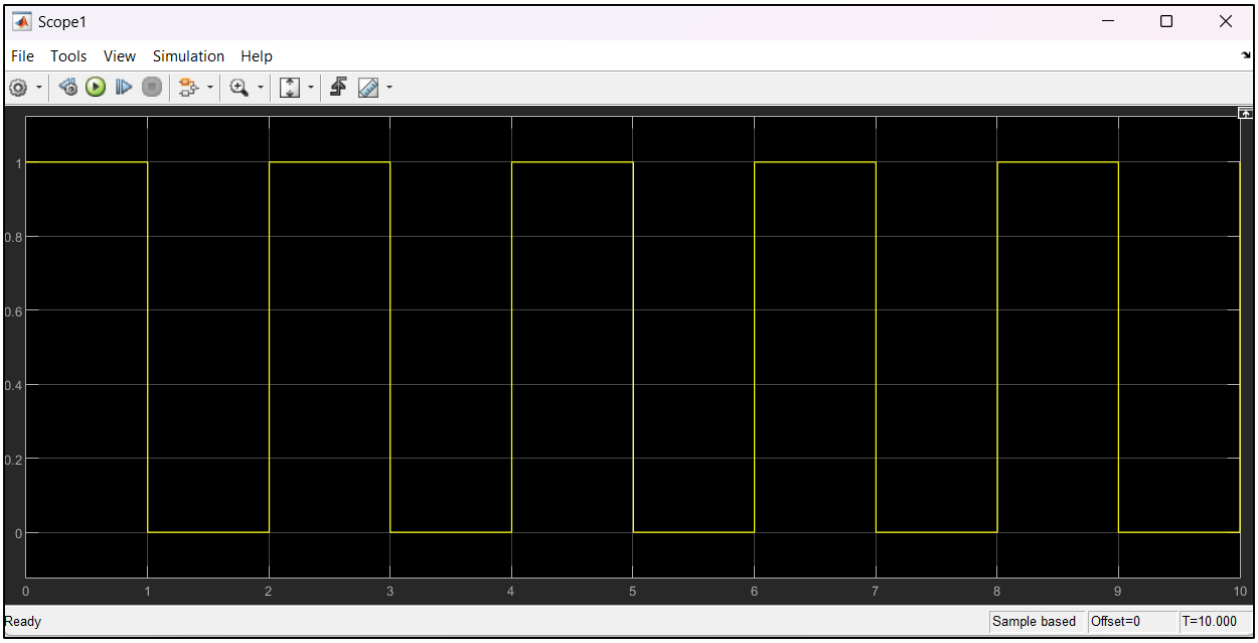

Figure 3 Input message signal in time domain.

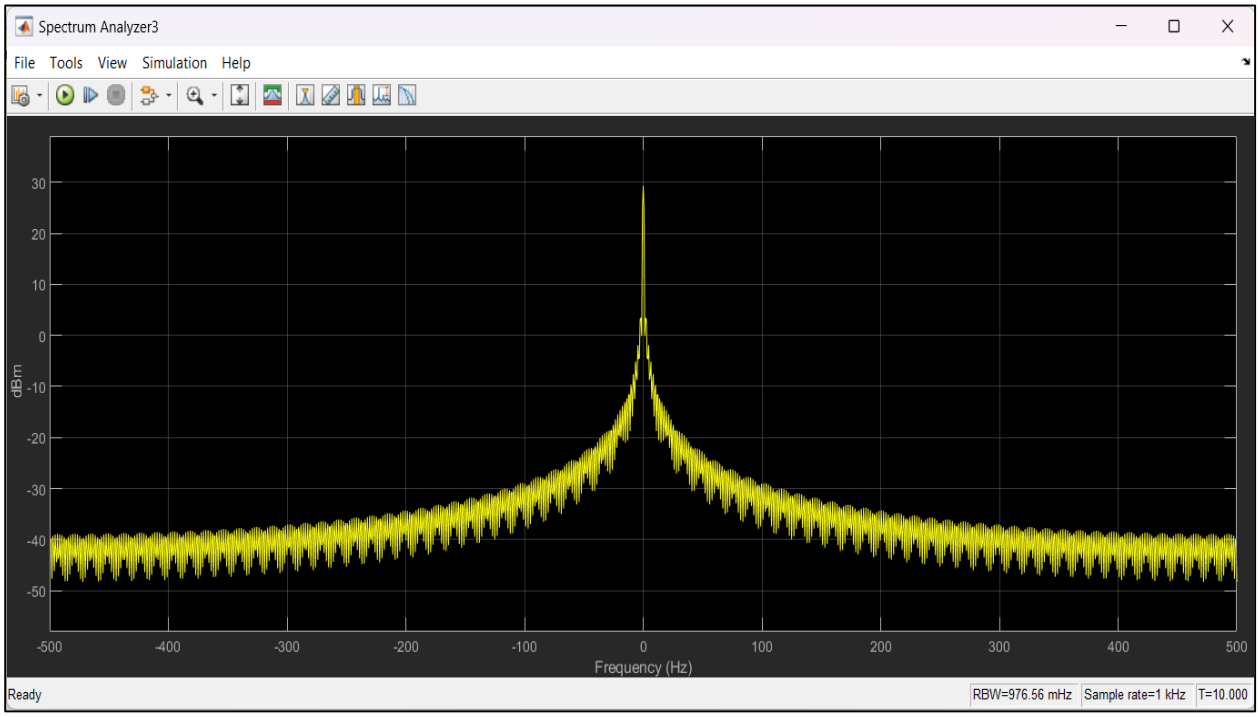

Figure 2 input message signal in frequency domain.

- **Carrier Signal in time and frequency:**

In this modulation, two carrier signals were use with different frequencies.

$$\textit{Use two sinusoidal signals: } c_1(t) = Cos(2\pi(15k)t)$$

$$c_2(t) = Cos(2\pi(25k)t)$$

The first carrier $\boldsymbol{c1(t) = \cos(2\pi(15k)t)}$signal in time and frequency domains is as the following:

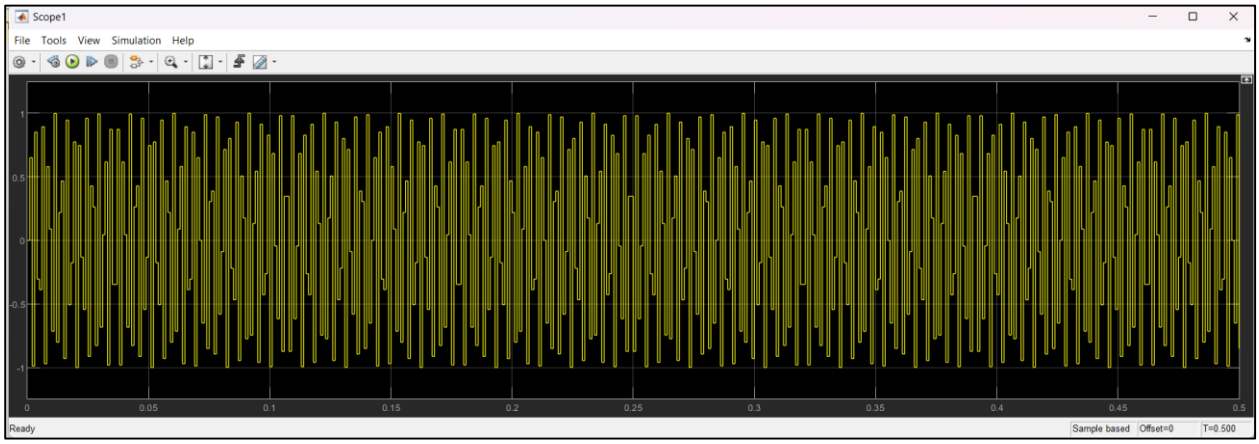

Figure 4 first carrier signal in time domain.

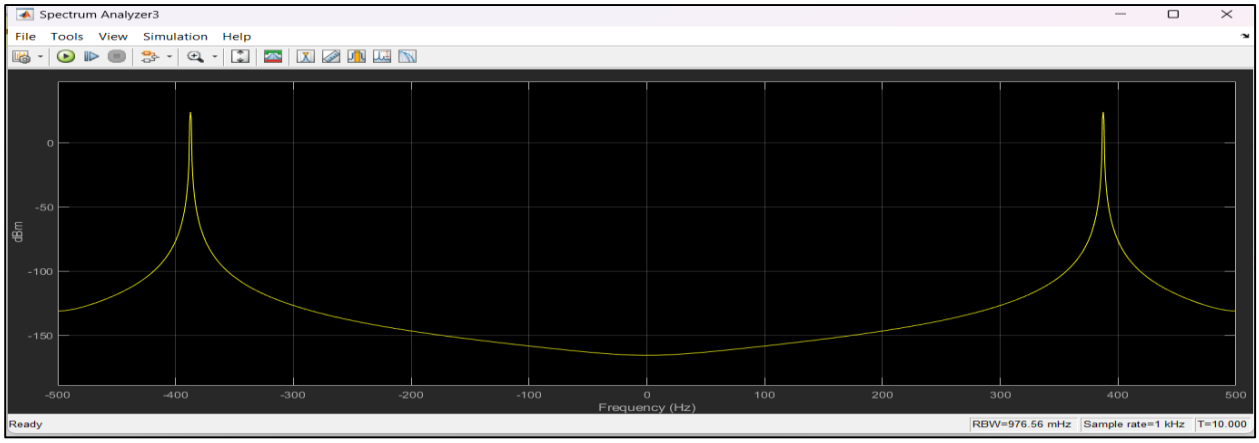

Figure 5 first carrier signal in frequency domain.

The second carrier $\boldsymbol{c1(t) = \cos(2\pi(25k)t)}$ signal in time and frequency domains is as the following:

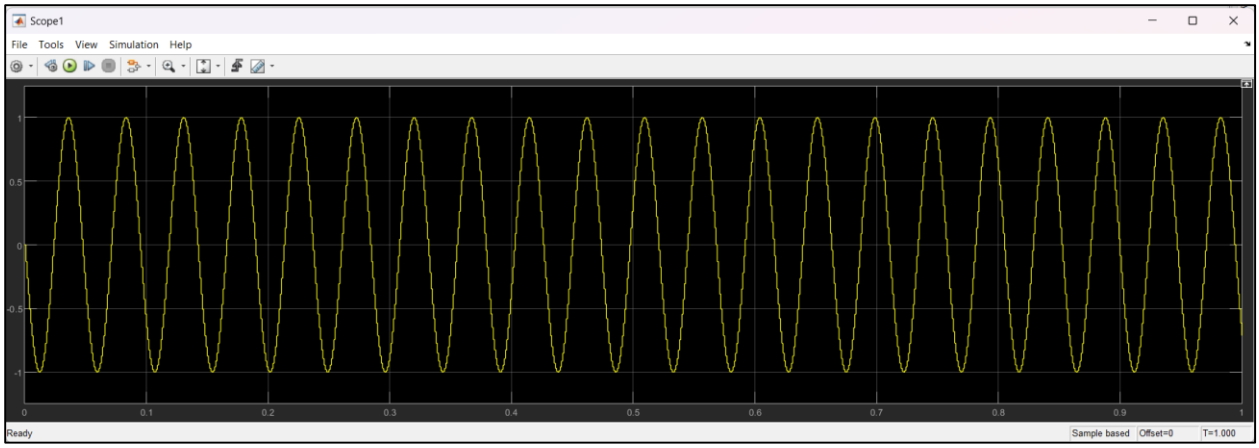

Figure 7 The second carrier signal in time domain.

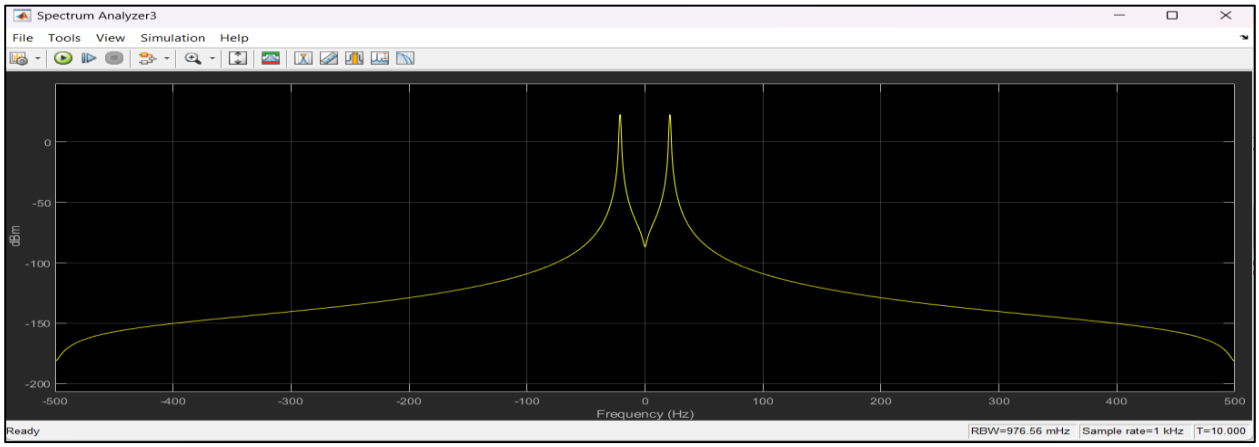

Figure 6 The second carrier signal in frequency domain.

- **Modulated signal in time and frequency:**

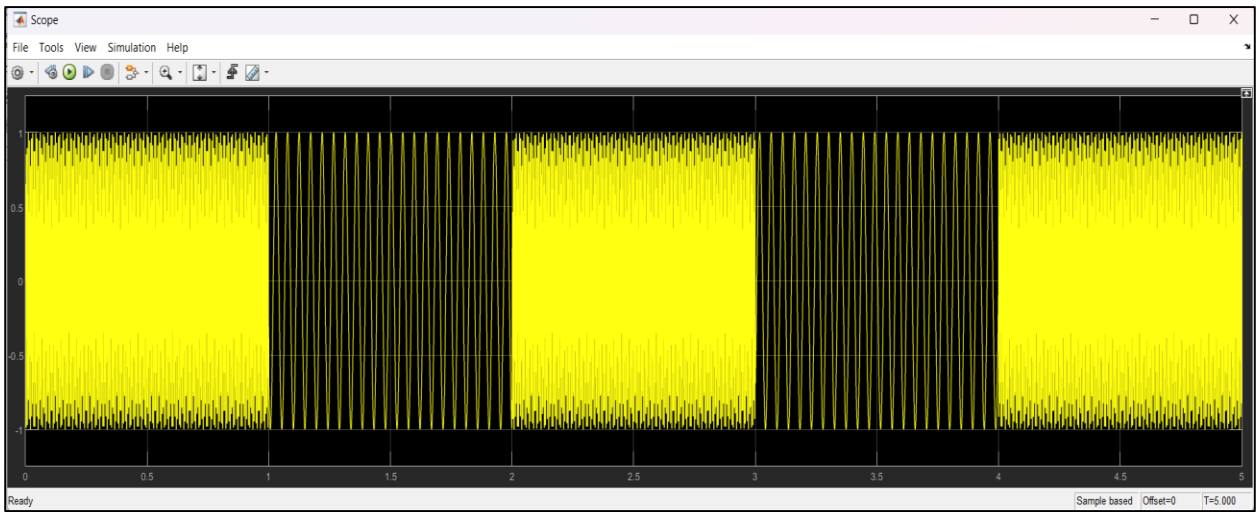

Figure 8 The modulated signal in time domain.

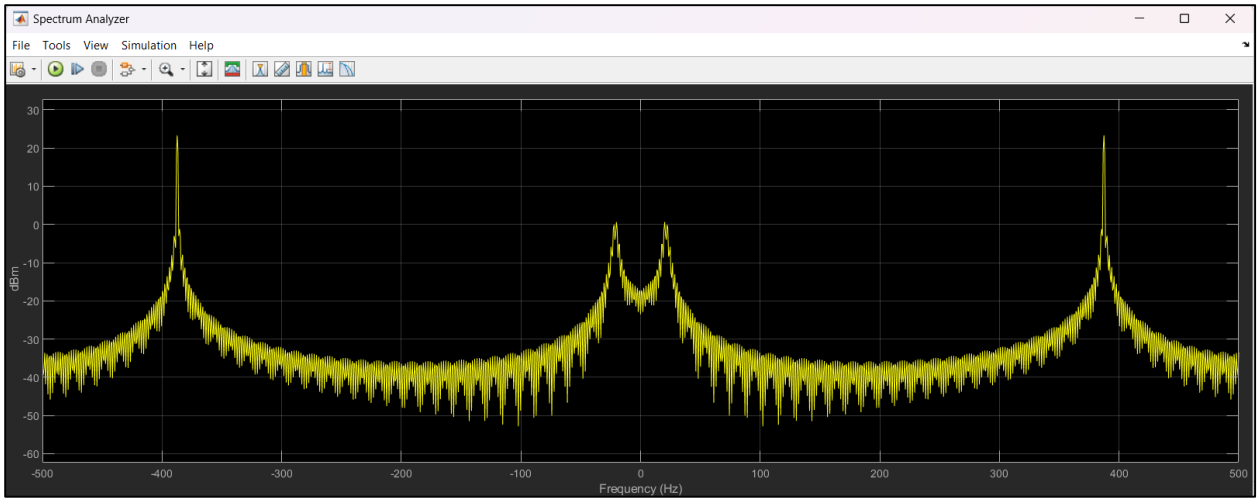

Figure 10 Modulated signal in frequency domain.

From the above results, it is noticed that when the input signal has a high value(1), the modulated signal will be with higher frequency value. While when the input signal is (0), we have the smaller value of frequency. The following figures shows the frequency shift keying:

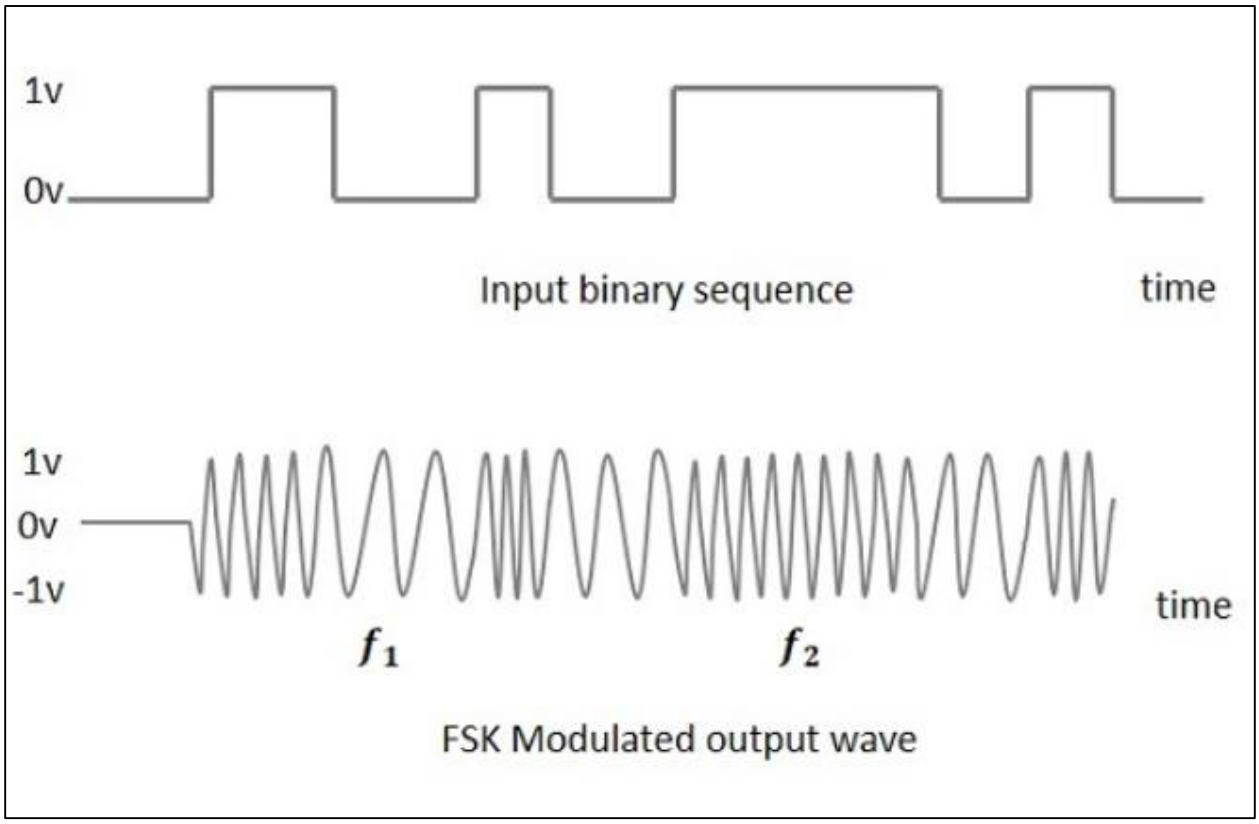

Figure 9 Frequency shift keying (FSK) modulation concept.

1.2 Demodulation Block Diagram

In this part, the block diagram of demodulation process in two methods was implemented. The following figure shows the demodulation operation block diagram in two methods:

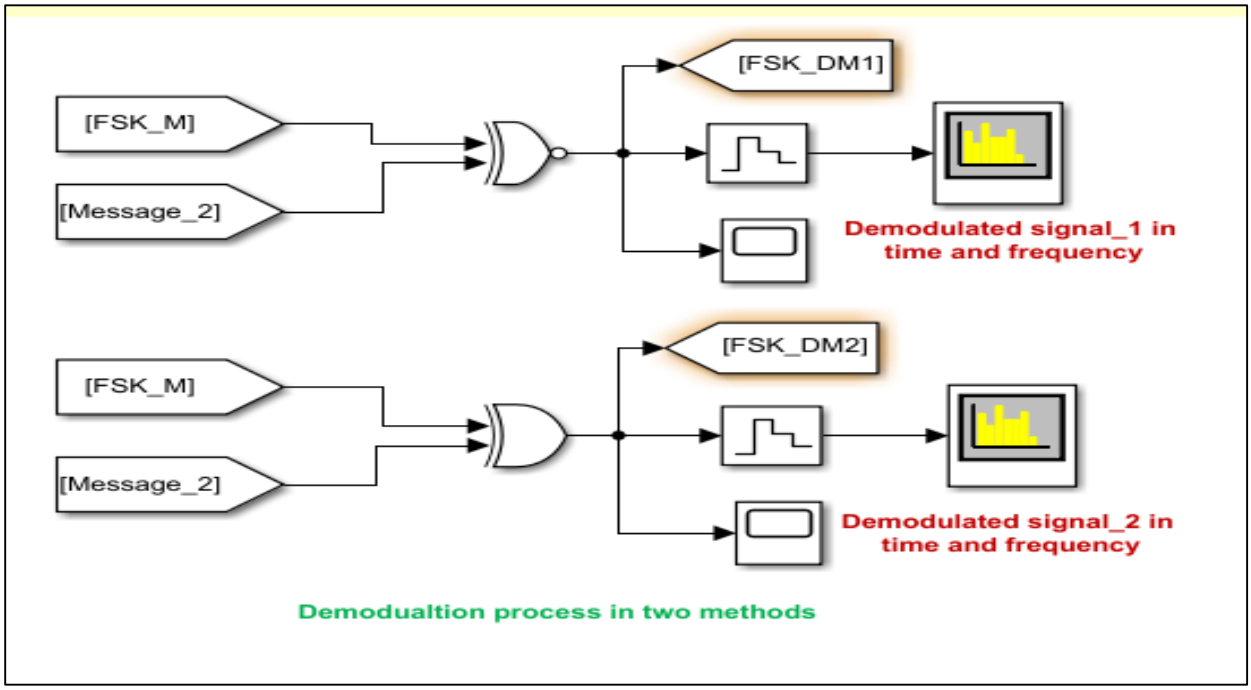

Figure 11 Frequency shift keying demodulation process.

- **Demodulation method I in time and frequency domain:**

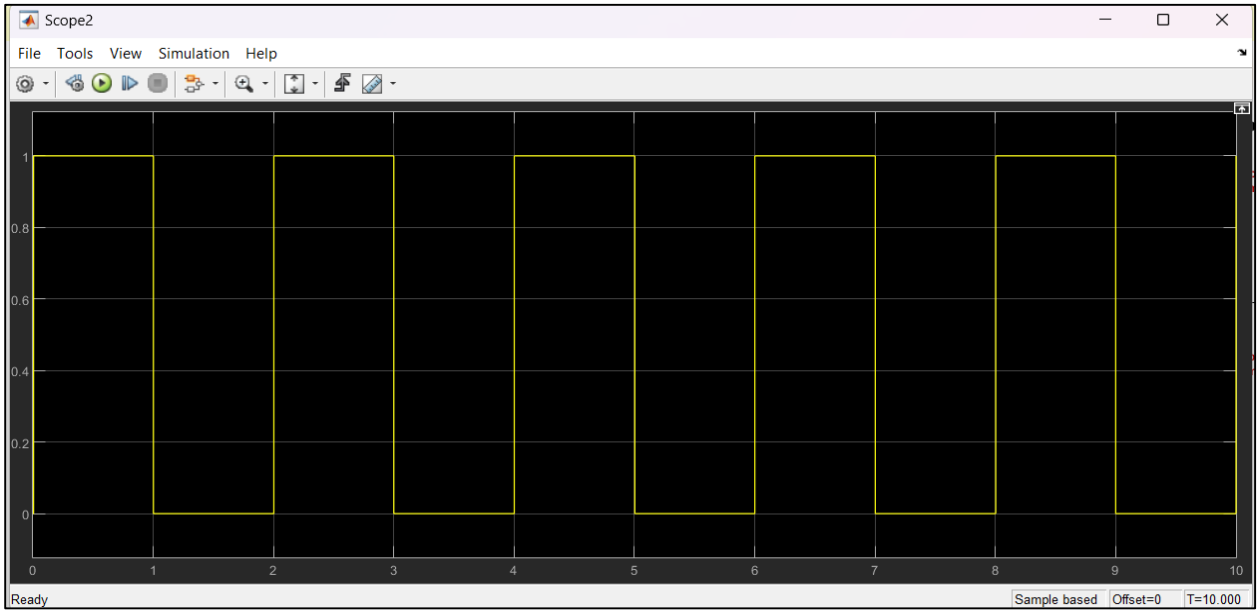

Figure 12 Demodulated signal in time domain.

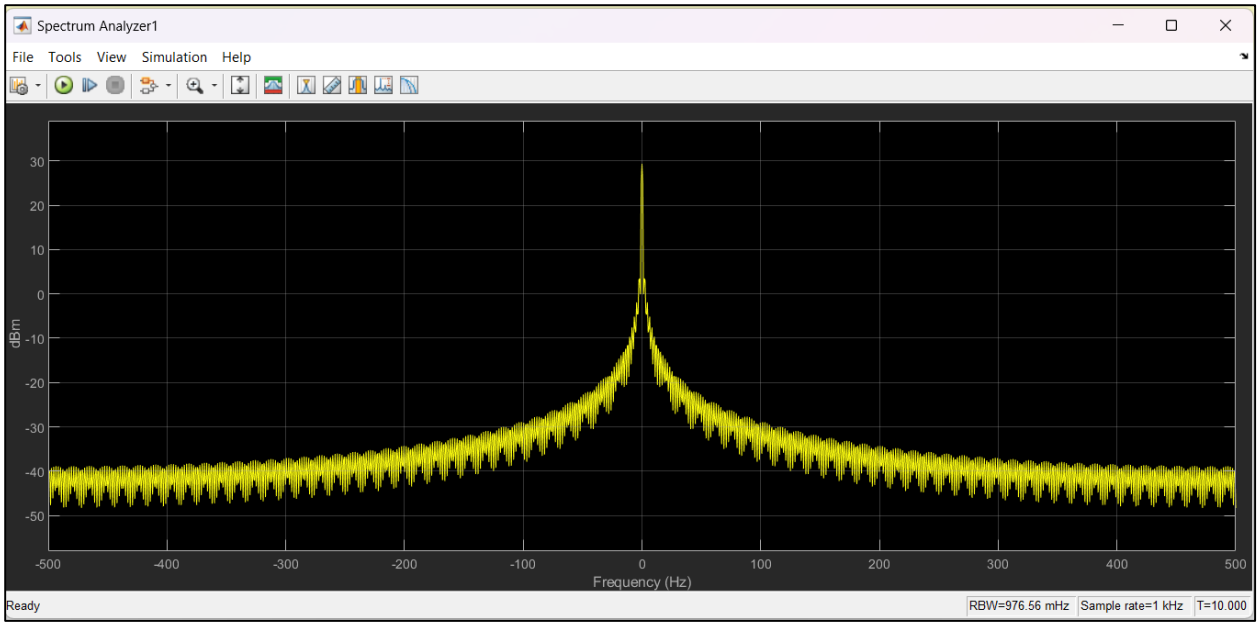

Figure 13 Demodulated signal in frequency domain.

- **Demodulation method II in time and frequency domain:**

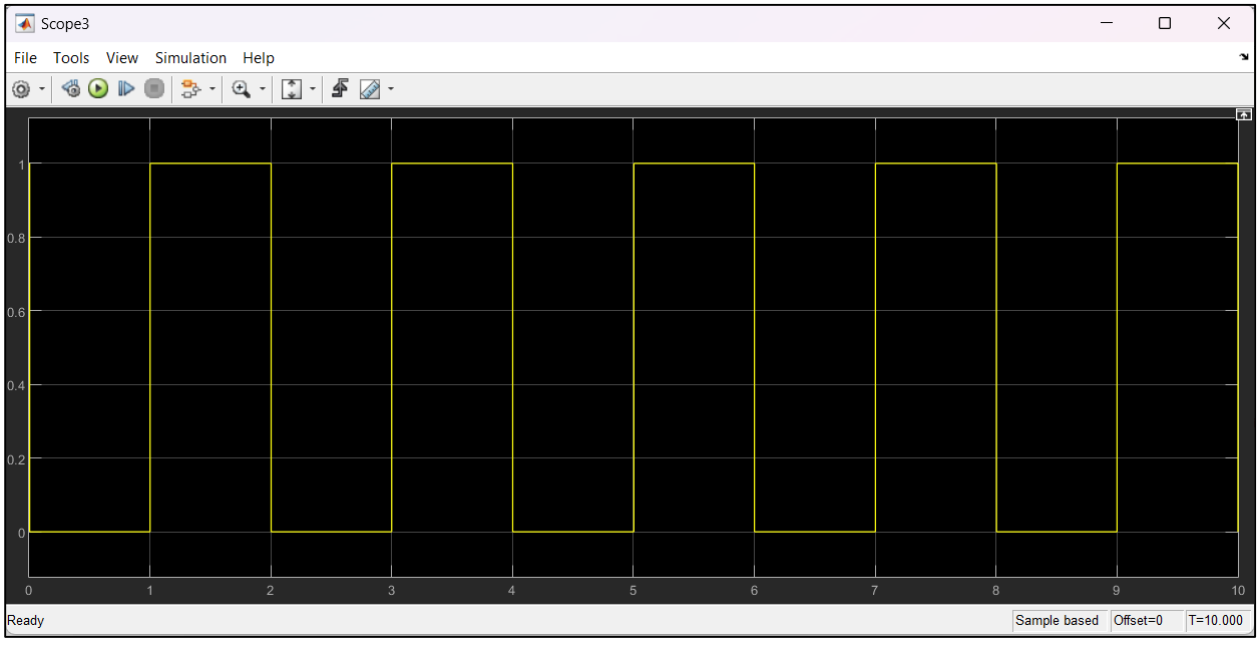

Figure 14 Demodulated Signal in time domain.

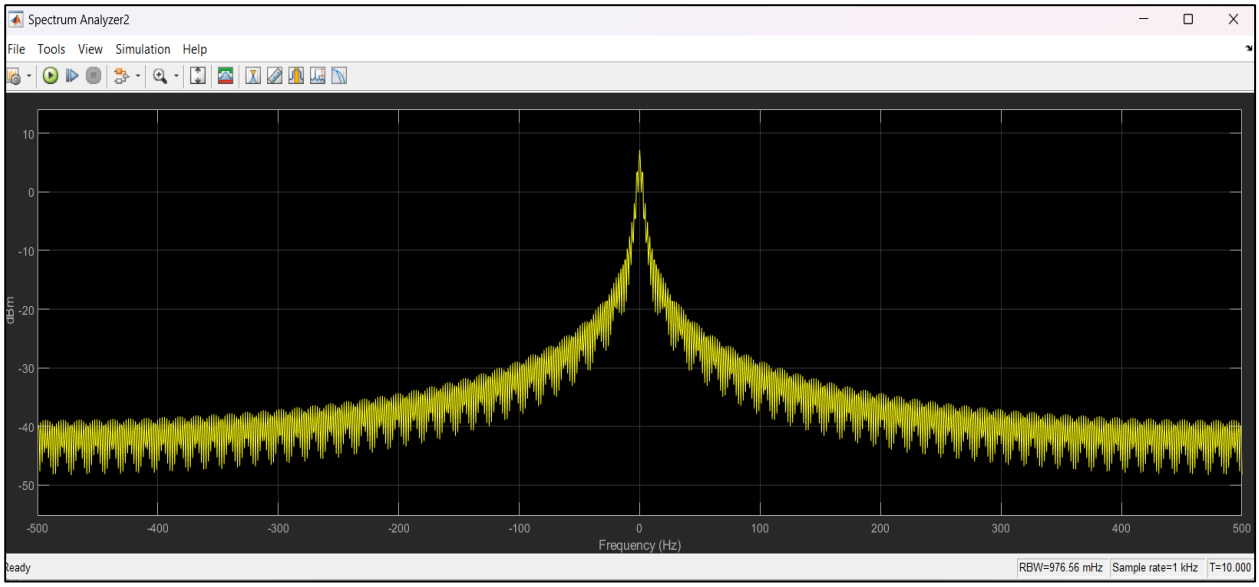

Figure 15 Demodulated Signal in frequency domain.

It is noticed that the demodulated signal is the same as the input pulse signal. In other words, the demodulation process was correctly applied and the required results retrieved successfully.

2. Phase Shift Keying (PSK)

2.1 Modulation Block Diagram

- **Message signal in time and frequency:**

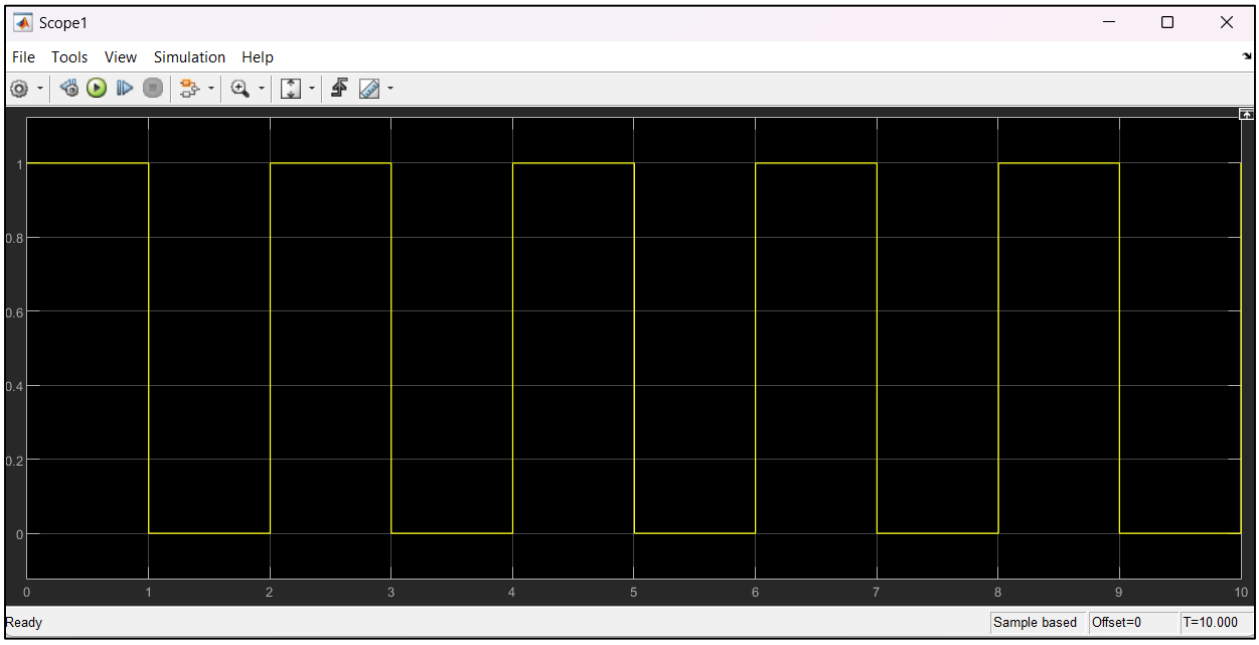

Figure 16 Message signal in time domain.

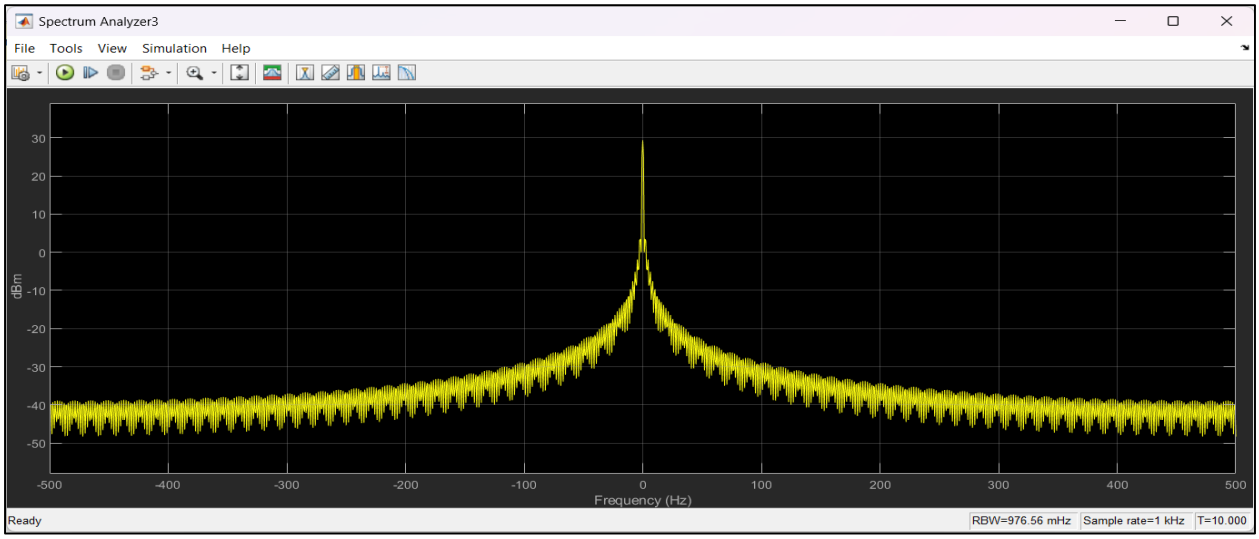

Figure 18 Message signal in frequency domain.

- **Modulated Signal in time and frequency domain:**

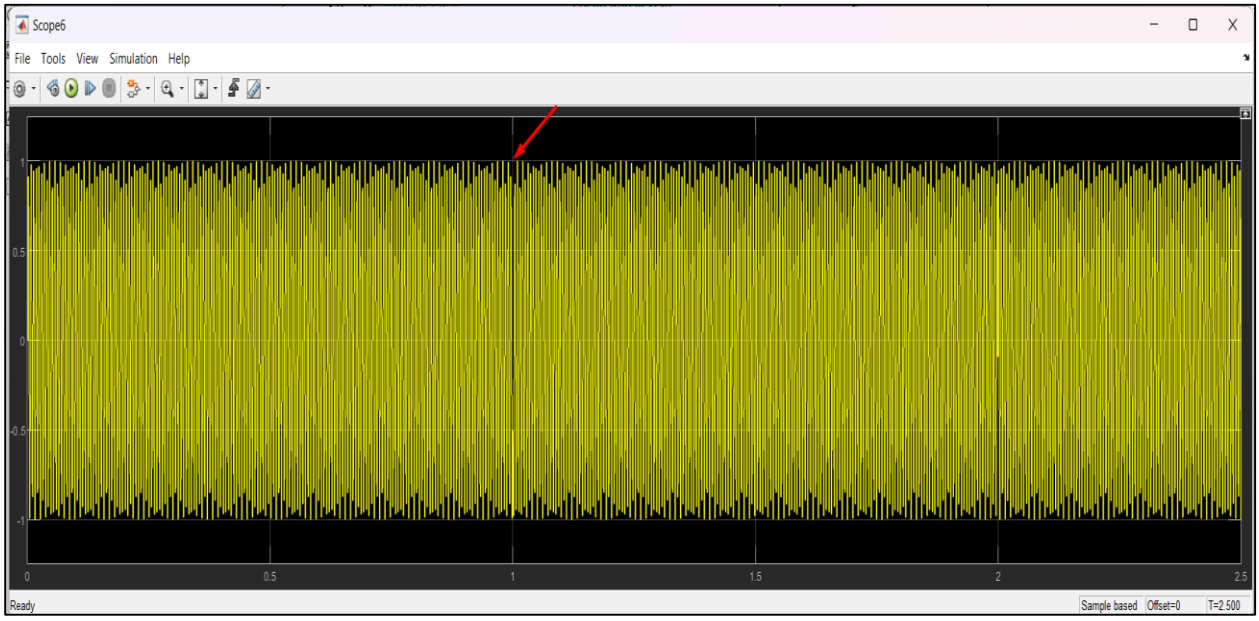

Figure 17 Modulated signal using phase shift keying in time domain.

According to the above figure, is noticed that when the time =1, the amplitude of the signal was switched (-A). This is happened because when the input pulse signal has ON value (1), the modulated signal will be the same as the carrier signal c(t), while when switching to the 0 value, the modulated signal will be –c(t), in other words in the negative amplitude as shown in Fig 17.

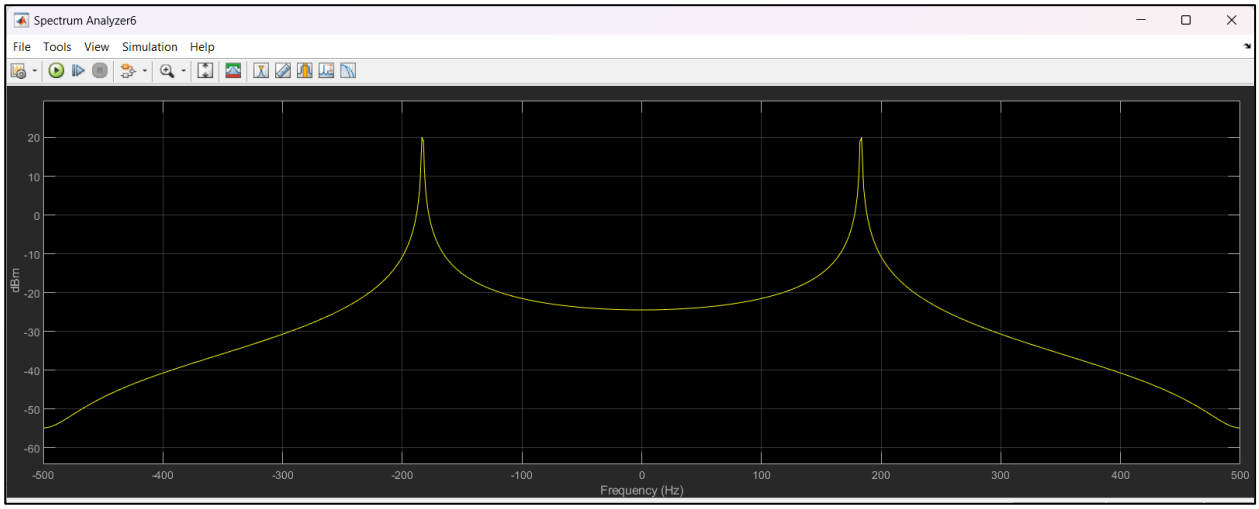

Figure 19 Modulated signal in frequency domain.

Finally, the block diagram of the Phase shift keying (PSK) nodulation block diagram:

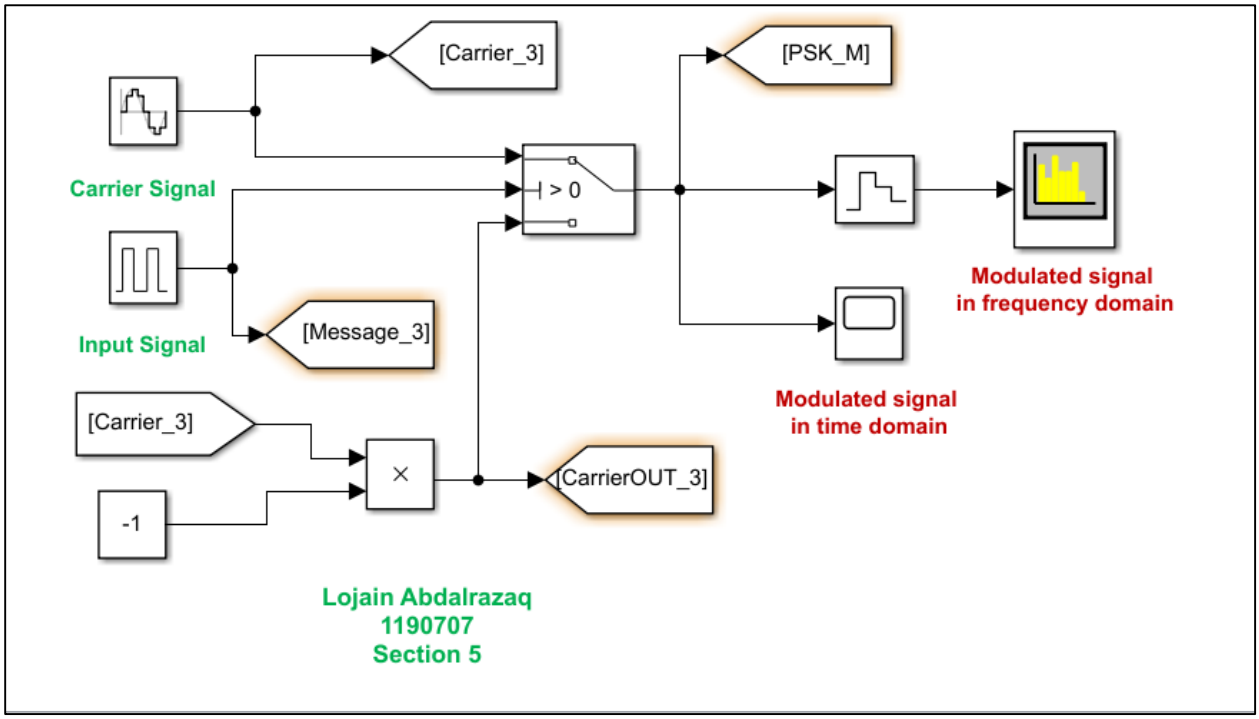

Figure 20 Phase shift keying (PSK) block diagram.

2.2 Demodulation Block Diagram

Firstly, the following figure shows the block diagram of the first method of the demodulation process of the phase shift keying (PSK).

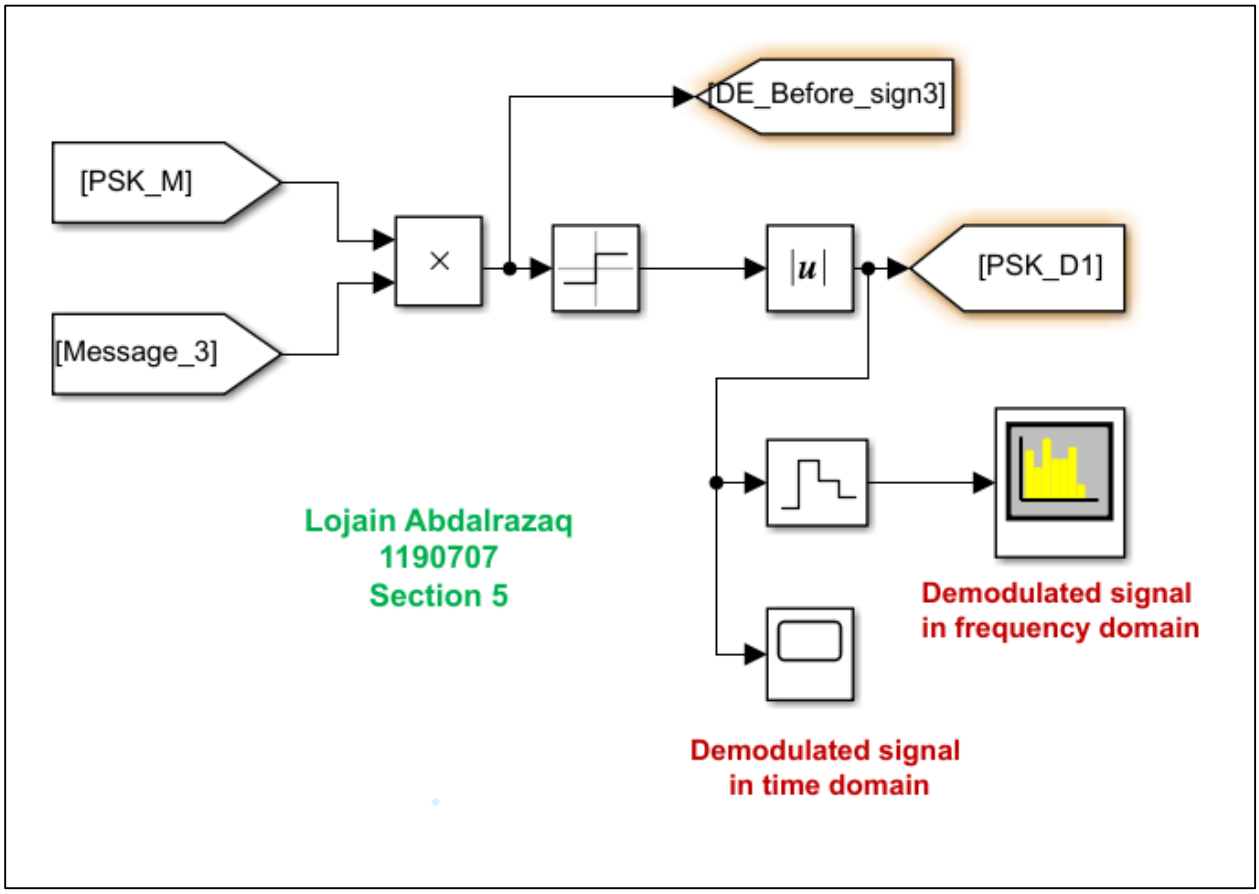

Figure 21 Phase Shift Keying Demodulation block diagram.

- **Demodulation method I in time and frequency domain:**

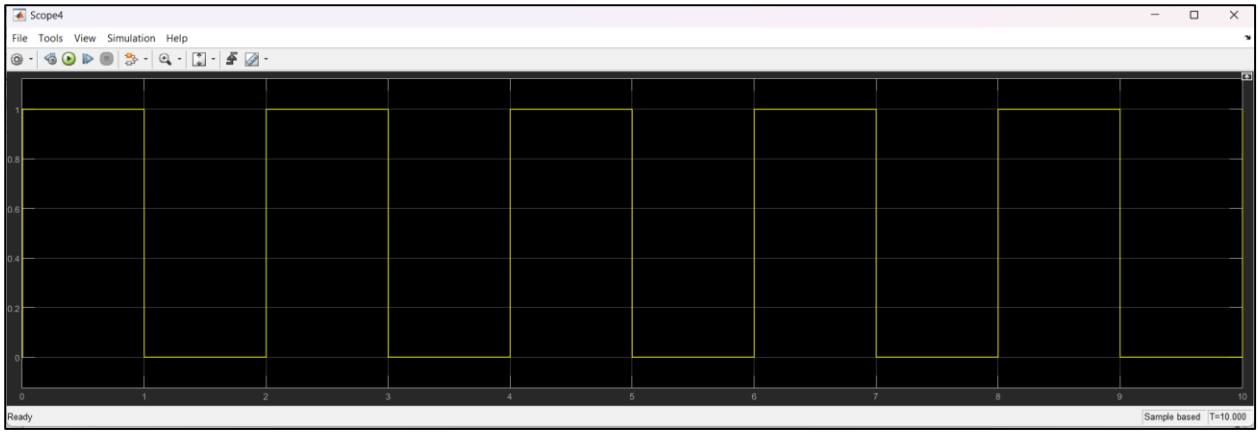

Figure 22 Demodulated signal in time domain.

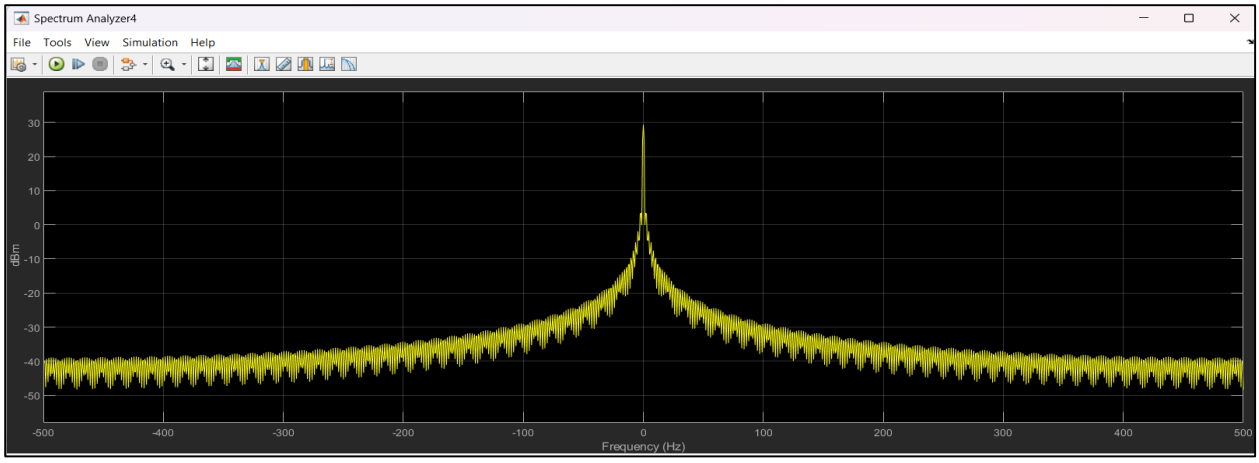

Figure 23 Demodulated signal in frequency domain.

- **Demodulation method II in time and frequency domain:**

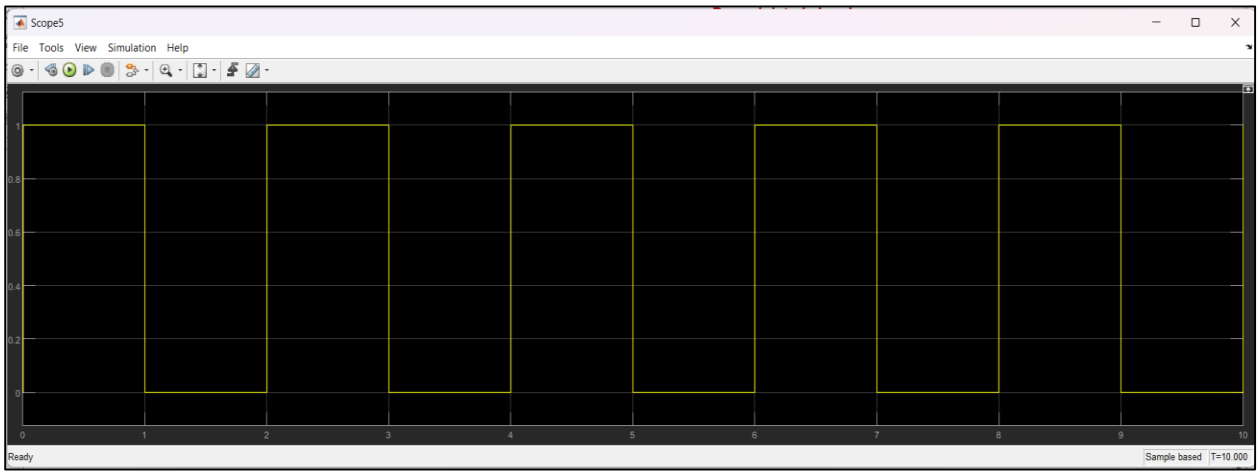

Figure 25 Demodulated signal in time domain.

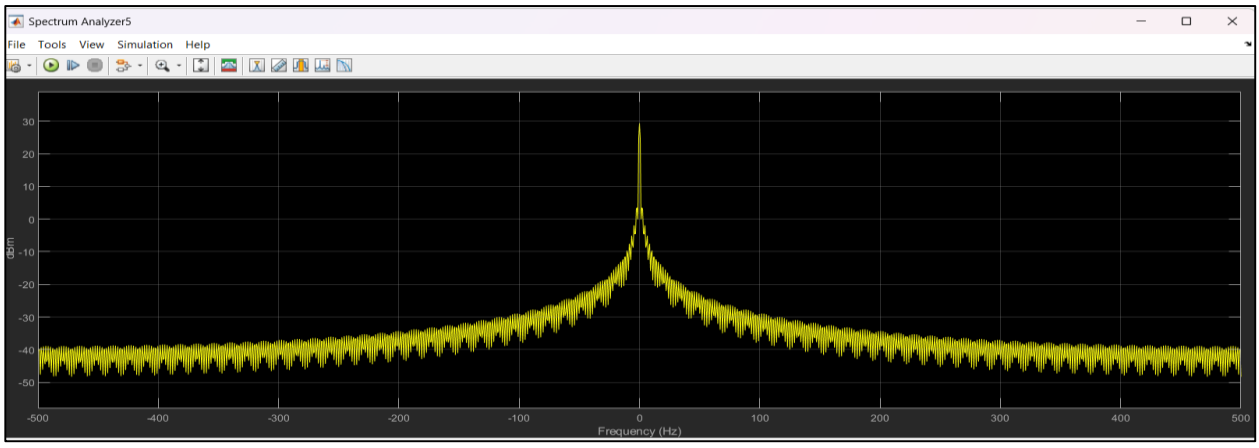

Figure 24 Demodulated Signal in frequency domain.

It is noticed that the demodulated signal is the same as the original message signal. And here is the block diagram of the second method of the demodulation.

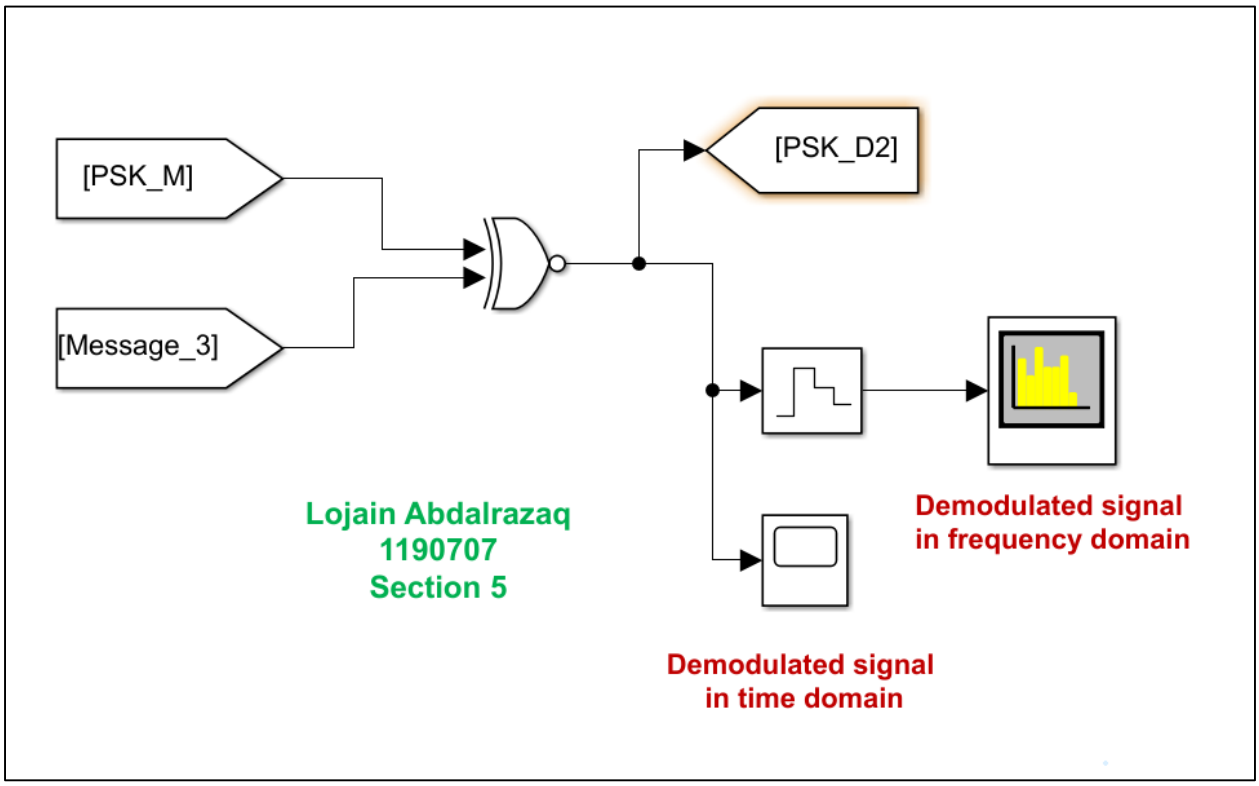

Figure 26 Phase Shift Keying Demodulation block diagram.