Experiment 10: Amplitude Shift Keying (ASK) and Frequency Shift Keying (FSK)

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SECTION: P1

Aim: This experiment is intended to make the student perform experiments on ASK and FSK and their demodulations using MATLAB.

A – Generation of Amplitude Shift Keying (ASK) signal

ASK is a continuous-wave digital modulation scheme, wherein digital data represented in its NRZL form modulates the amplitude of a continuous-time high frequency carrier signal.

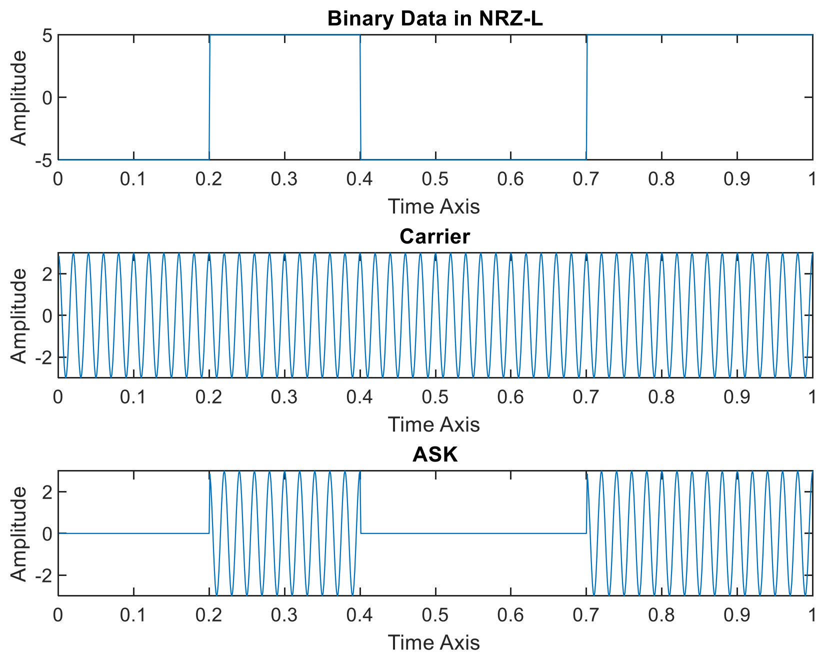
First, we will generate an ASK signal.

a) Generate 10 bits of data randomly. To do this, you may use the ***randi*** MATLAB command. Use a bit rate (R_b) of 10 bits per second.

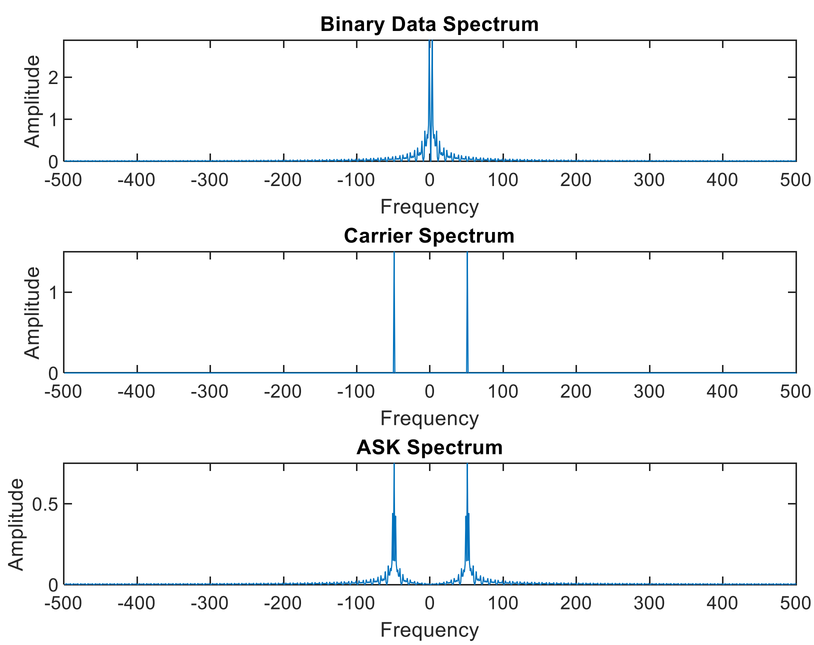
b) Similar to Experiment 8, represent these data bits using NRZ-L format with 5 V and – 5 V as the levels.

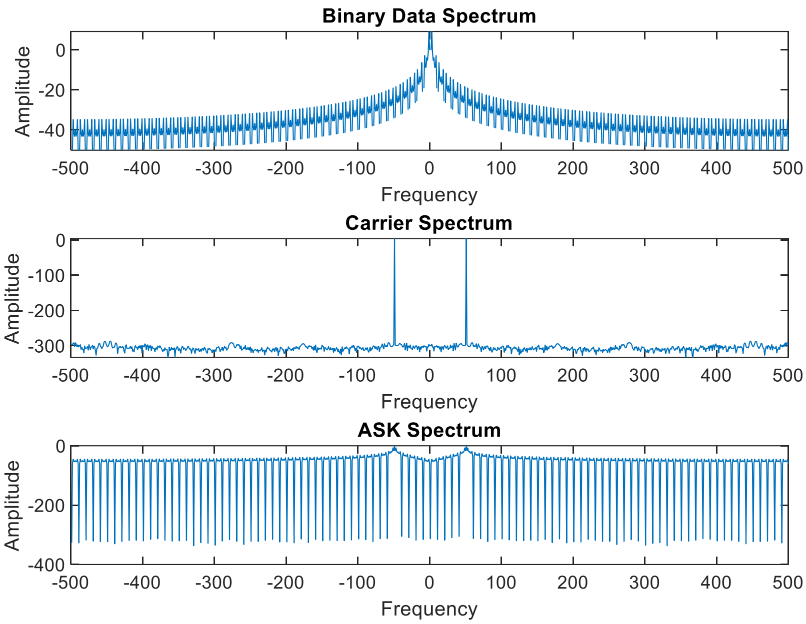
c) Generate a sinusoidal carrier signal of 3 V peak-to-peak value such that exactly 5 cycles of the carrier fit into one bit period (T_b).

d) The ASK modulated signal is equal to the carrier signal when the data is ‘1’ and 0 V when the data is ‘0’. Plot the data, the carrier and the ASK modulated signals one below the other in a single figure.



e) Obtain and plot the spectra of the data, the carrier and the ASK modulated signals one below the other, both in ratio form and in the decibel scale.





f) Vary the bit rate and the carrier frequency, one at a time, while ensuring that an integral number of complete cycles of the carrier fit into one bit period and observe the spectrum of the modulated signal. What do you observe?

The peaks in the spectrum of the modulated signal go closer to 0 as the number of cycles decreases, and vice versa. The distance between the peaks in the spectrum rises when the bitrate is increased, and vice versa.

B – Demodulation of an ASK signal

ASK signal can be demodulated using coherent detection. The modulated signal is multiplied with the carrier signal. If the product is a non-negative number, it is detected as a '1,' and if not, it is decoded as a '0'.

Sequence = 0 0 1 1 1 0 1 0 0 0

Demodulated Sequence = 0 0 1 1 1 0 1 0 0 0

C– Generation of Frequency Shift Keying (FSK) signal

FSK is also a continuous-wave digital modulation scheme. However, unlike in ASK, the digital data represented in its NRZ-L form modulates the frequency of a continuous-time high frequency carrier signal.

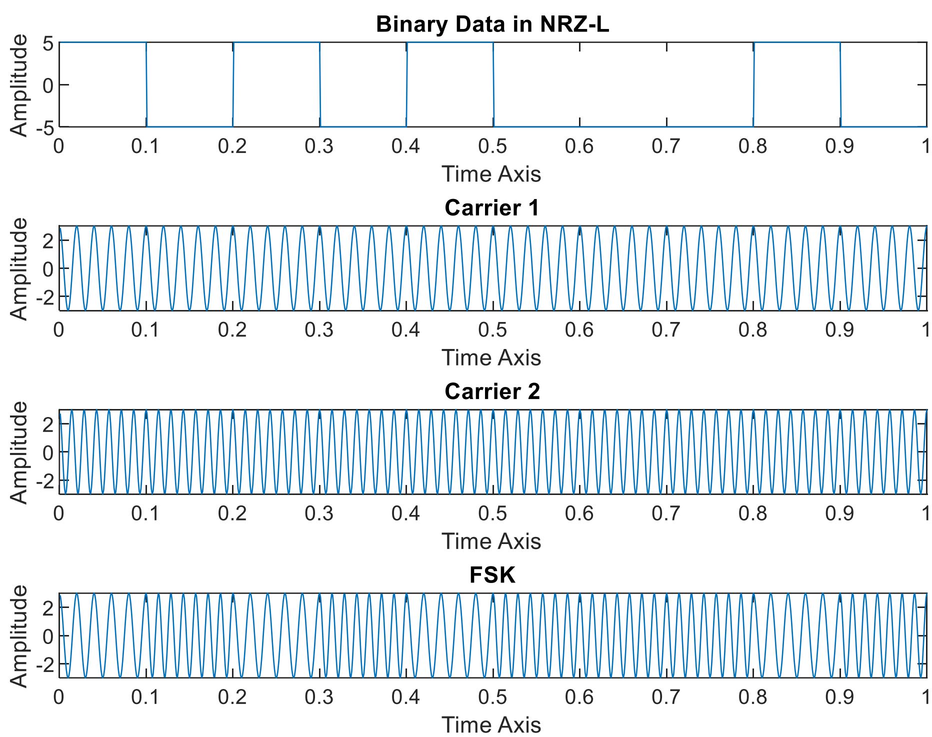
First, we will generate an ASK signal.

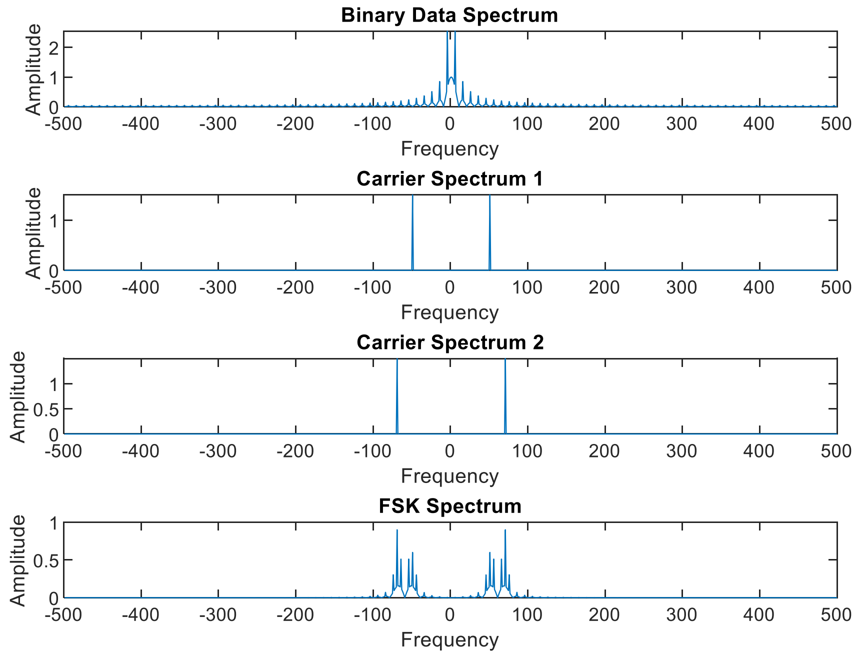
a) Generate 10 bits of data randomly. To do this, you may use the ***randi*** MATLAB command. Use a bit rate (R_b) of 10 bits per second.

b) Similar to Experiment 8, represent these data bits using NRZ-L format with 5 V and – 5 V as the levels.

c) Generate two sinusoidal carrier signals of 3 V peak-to-peak value such that exactly 5 and 7 cycles of the carriers fit into one bit period (T_b). Note that the number of carrier cycles that fit in one bit period are co-prime number.

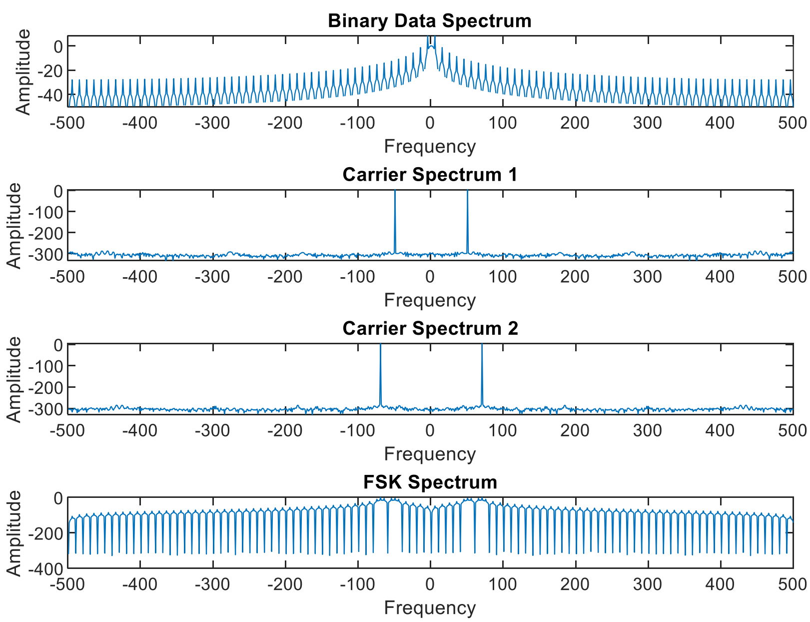
d) The FSK modulated signal is equal to the first carrier signal when the data is '1' and it equals the second carrier signal when the data is '0'. Plot the data, the carrier and the ASK modulated signals one below the other in a single figure.





e) Obtain and plot the spectra of the data, the carrier and the ASK modulated signals one below the other, both in ratio form and in the decibel scale.

Vary the bit rate and the carrier frequencies, one at a time, while ensuring that an integral number of complete cycles of the carriers fit into one bit period (while maintaining the coprime property) and observe the spectrum of the modulated signal. What do you observe?



D – Demodulation of an FSK signal

Similar to ASK, the FSK signal is also decoded using coherent detection. In each bit period, the modulated signal is multiplied by both carrier signals. Depending on which of these outputs yield a non-negative number, it is decoded as a '0' and a '1' appropriately.

Sequence = 0 1 1 1 1 0 1 1 0 1

Demodulated Sequence 1 = 0 1 1 1 1 0 1 1 0 1

Demodulated Sequence 2 = 0 1 1 1 1 0 1 1 0 1

E –Conclusions:

List out your learnings from the experiments :

We have plotted the arbitrary pieces created and furthermore the transporter signals. We have regulated the produced bits utilizing Amplitude Shift Keying and Frequency Shift Keying adjustment methods. We have additionally noticed the progressions in the recurrence range when the bitrate and transporter recurrence change freely. At last we have likewise demodulated the above adjusted signs utilizing the intelligible identification strategy and plotted the demodulated signals.