Chapter 5

Analog Transmission

5-1 DIGITAL-TO-ANALOG CONVERSION

Digital-to-analog ***conversion is the process of changing one of the characteristics of an analog signal based on the information in digital data.***

Topics discussed in this section:

Aspects of Digital-to-Analog Conversion
Amplitude Shift Keying
Frequency Shift Keying
Phase Shift Keying
Quadrature Amplitude Modulation

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Phase Shift Keying

Quadrature Amplitude Modulation

Figure 5.1 *Digital-to-analog conversion*

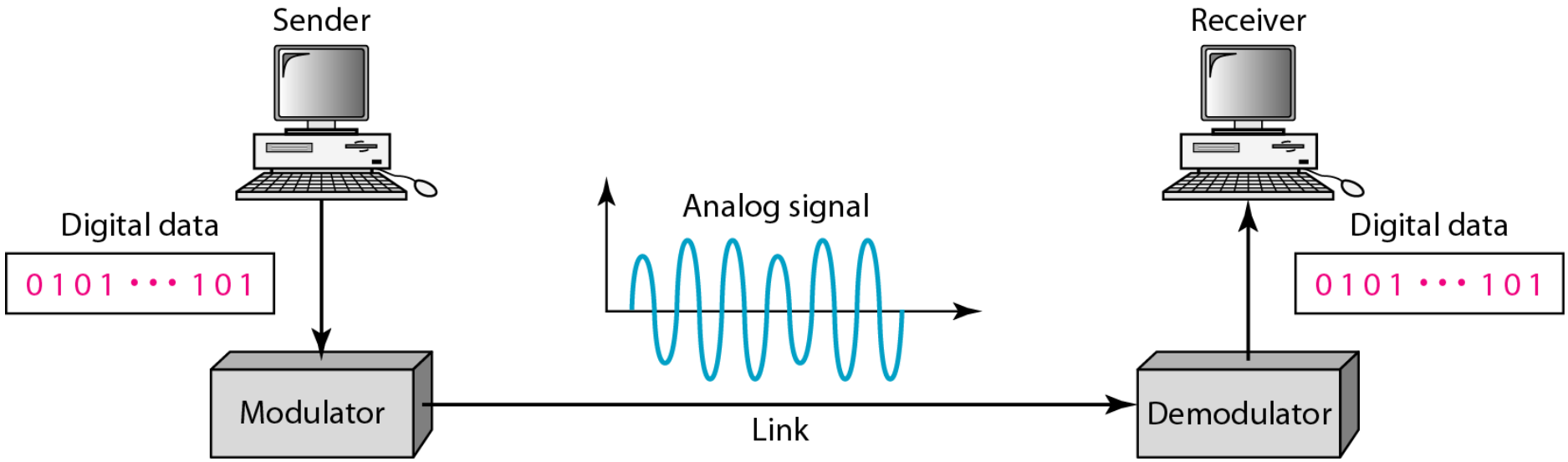
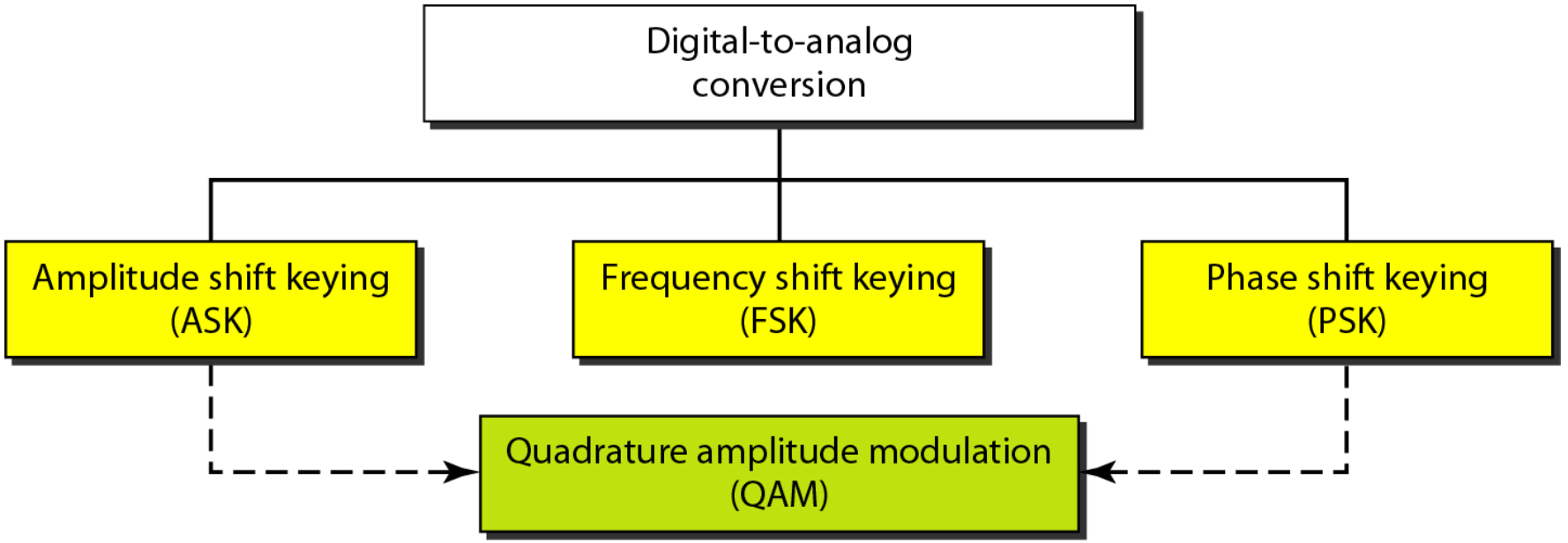


Figure 5.2 *Types of digital-to-analog conversion*



Note

Bit rate is the number of bits per second. Baud rate is the number of signal elements per second.

In the analog transmission of digital data, the baud rate is less than or equal to the bit rate.

Example 5.1

An analog signal carries 4 bits per signal element. If 1000 signal elements are sent per second, find the bit rate.

Solution

In this case, r = 4, S = 1000, and N is unknown. We can find the value of N from

$$S = N \times \frac{1}{r} \qquad \text{or} \qquad N = S \times r = 1000 \times 4 = 4000 \text{ bps}$$

Figure 5.3 *Binary amplitude shift keying*

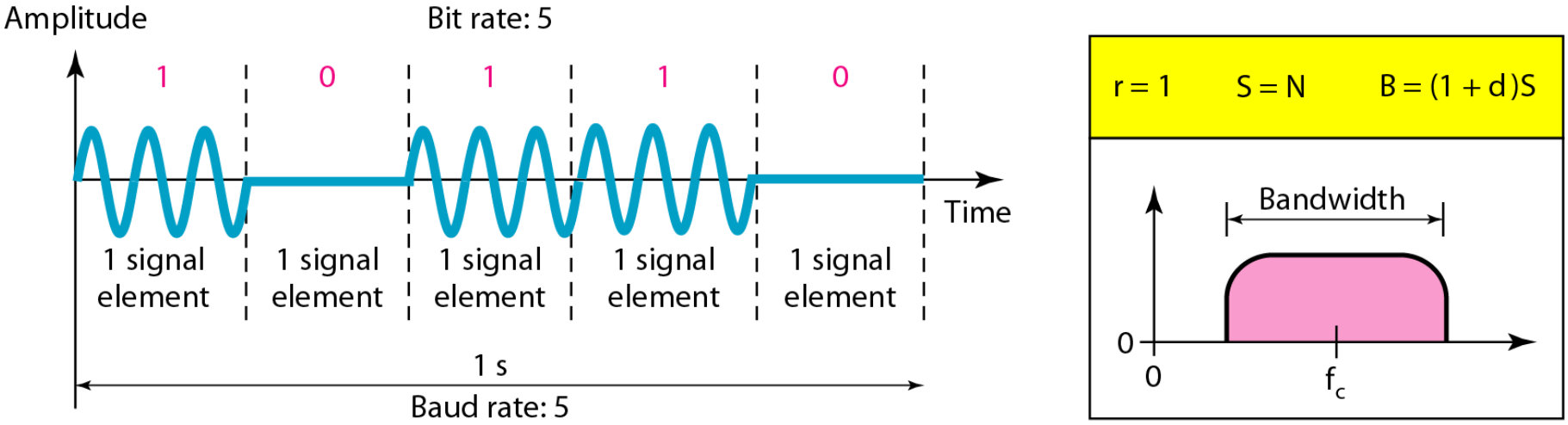


Figure 5.4 *Implementation of binary ASK*

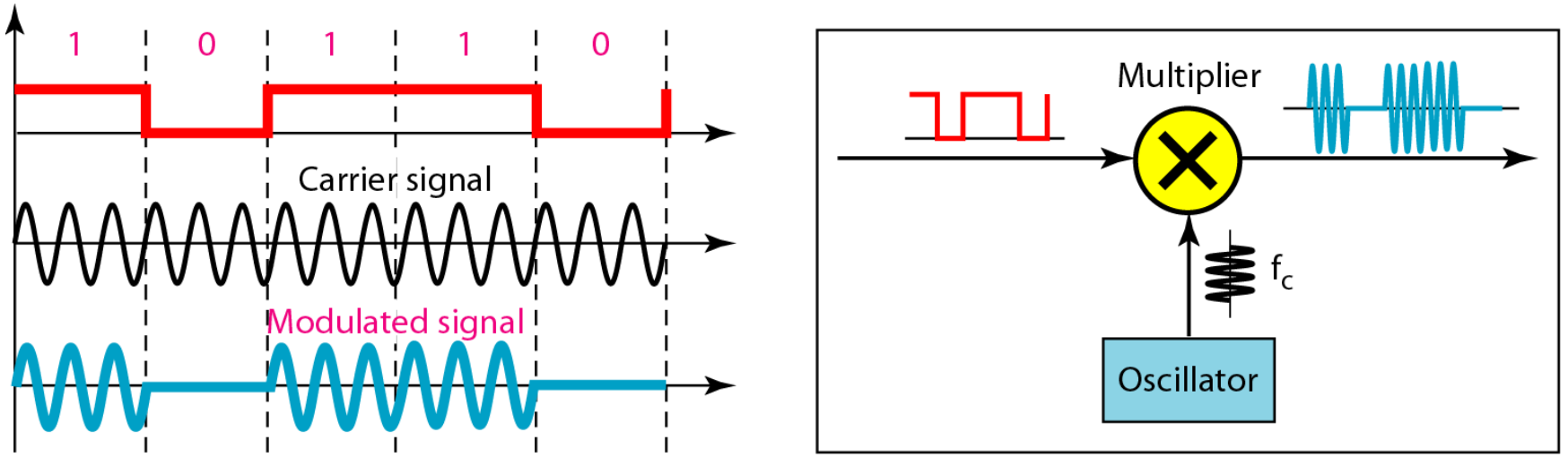
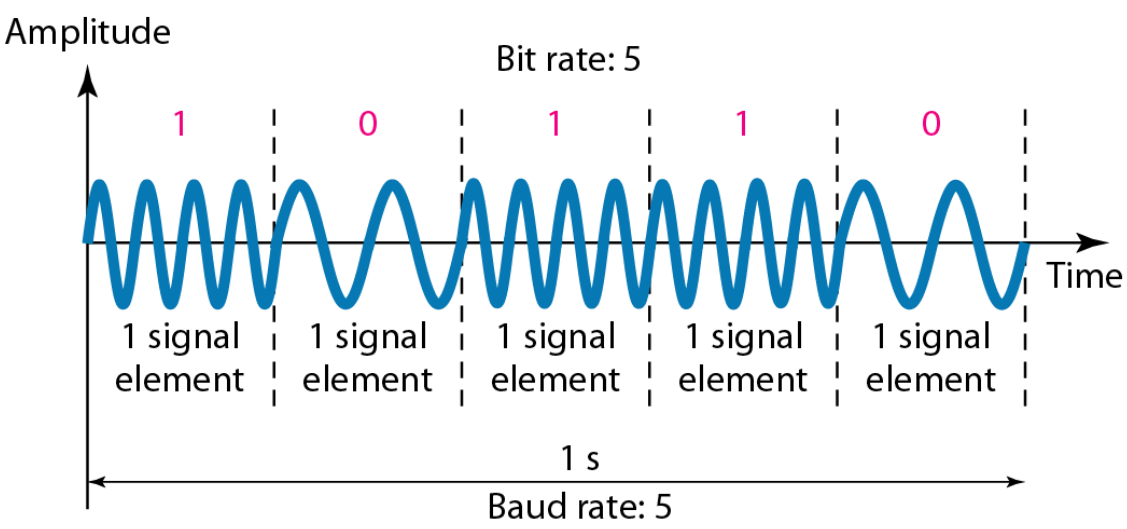


Figure 5.6 *Binary frequency shift keying*



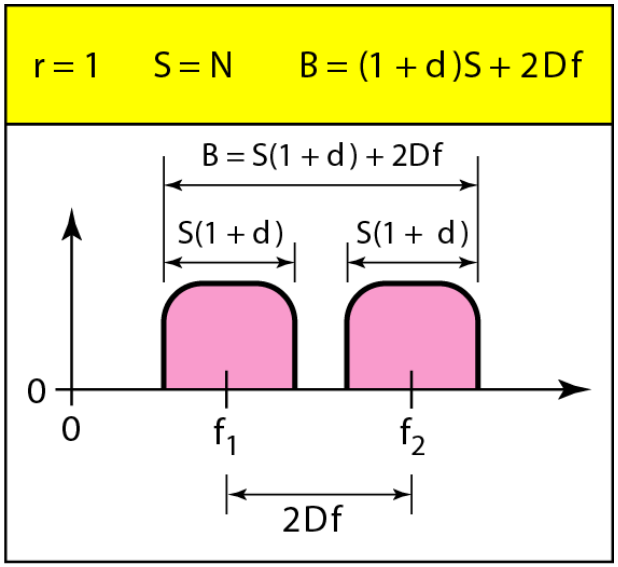


Figure 5.7 *Bandwidth of MFSK used in Example 5.6*

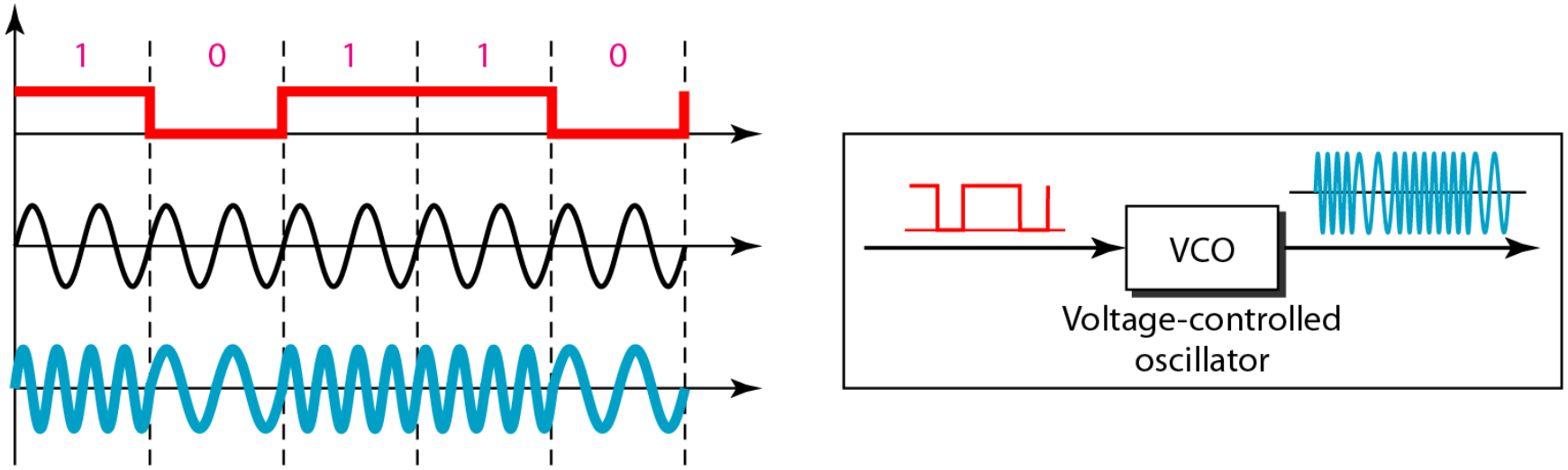
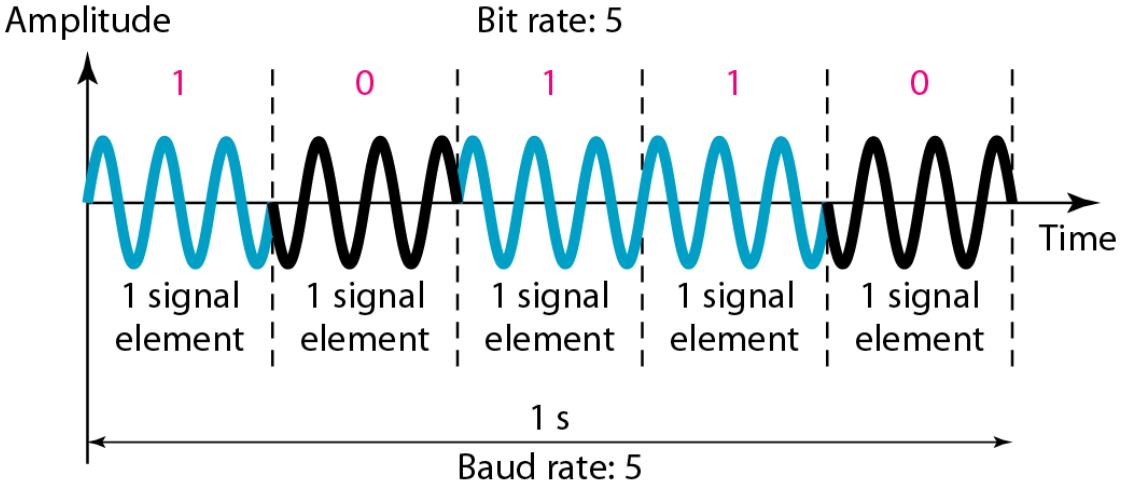


Figure 5.9 *Binary phase shift keying*



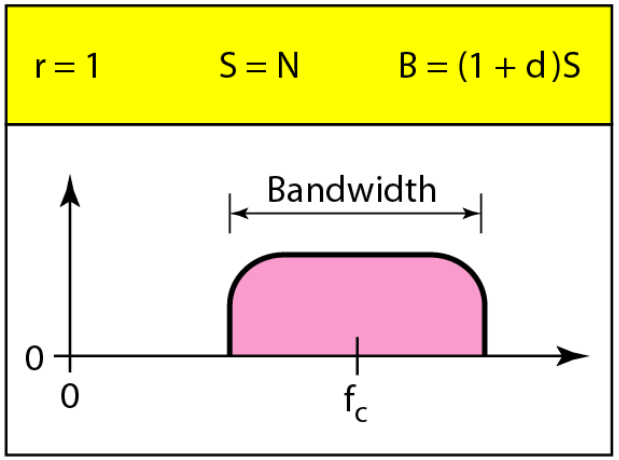
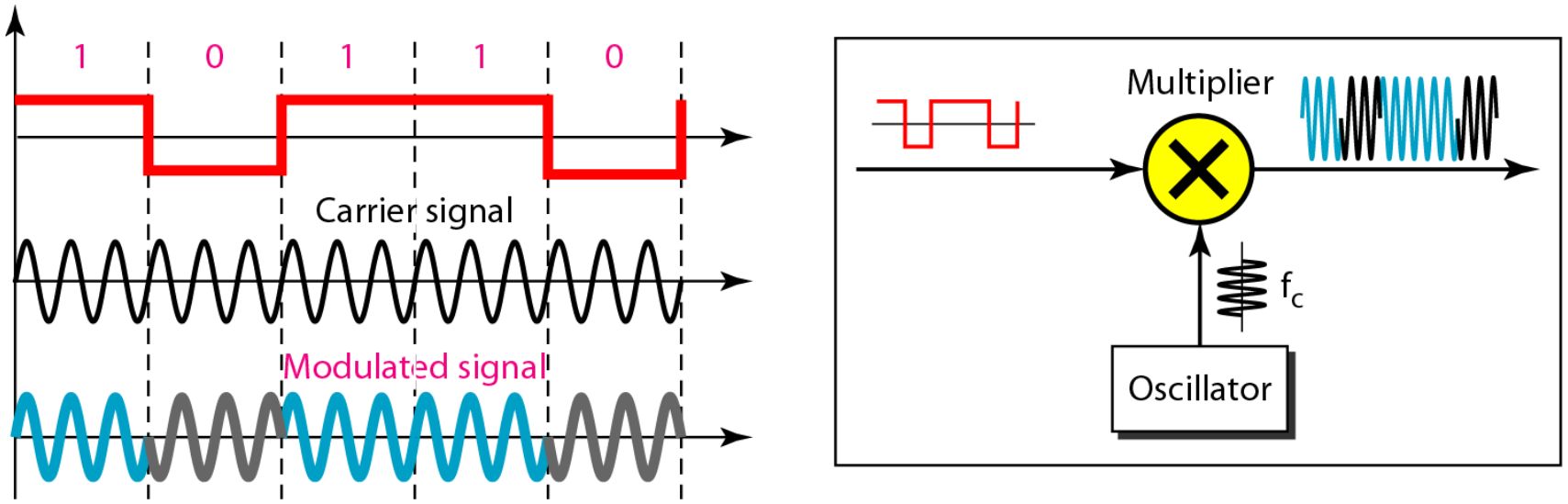


Figure 5.10 *Implementation of BASK*



5-2 ANALOG AND DIGITAL

Analog-to-analog conversion is the representation of analog information by an analog signal. One may ask why we need to modulate an analog signal; it is already analog. Modulation is needed if the medium is bandpass in nature or if only a bandpass channel is available to us.

Topics discussed in this section:

Amplitude Modulation
Frequency Modulation
Phase Modulation

Figure 5.15 *Types of analog-to-analog modulation*

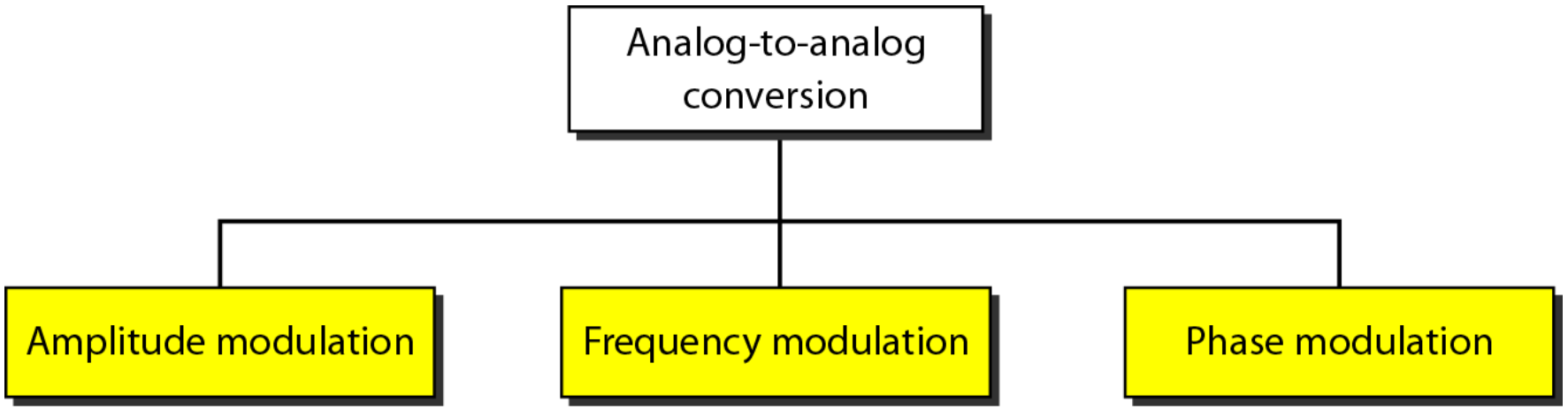
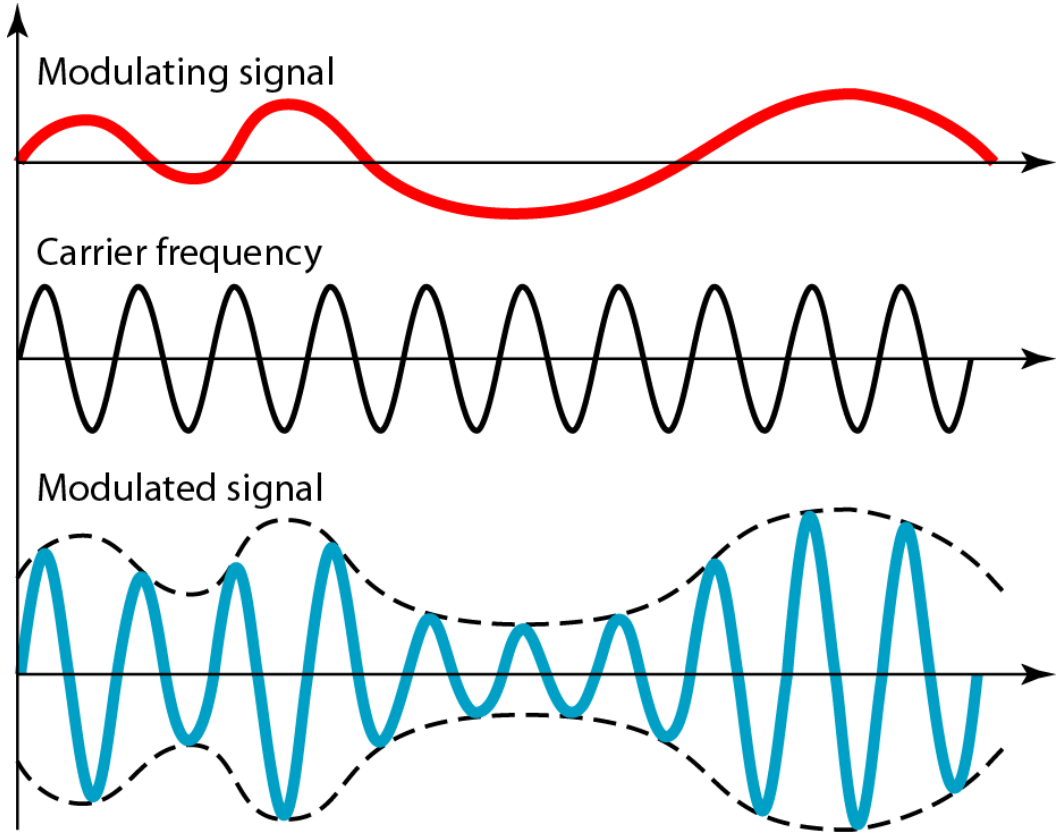


Figure 5.16 *Amplitude modulation*



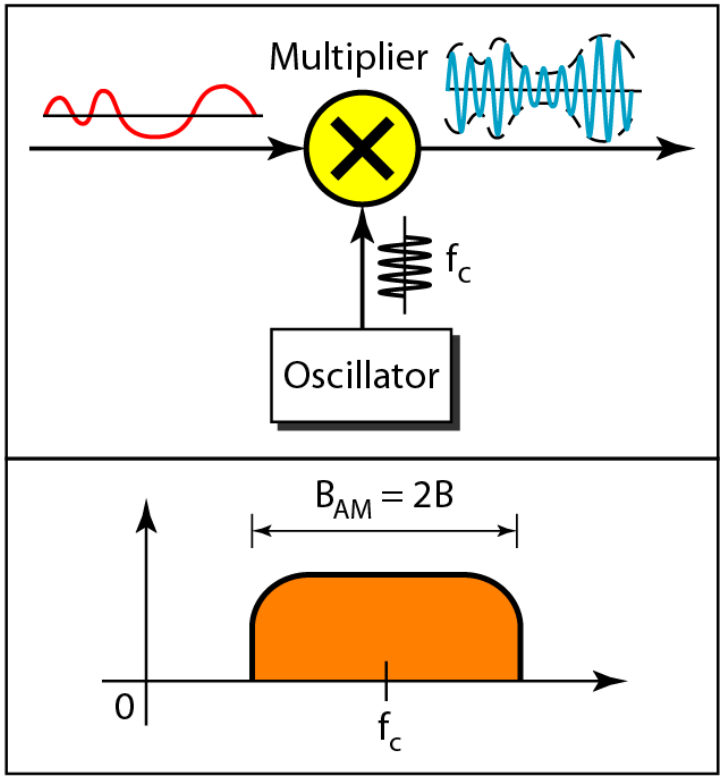


Figure 5.17 *AM band allocation*

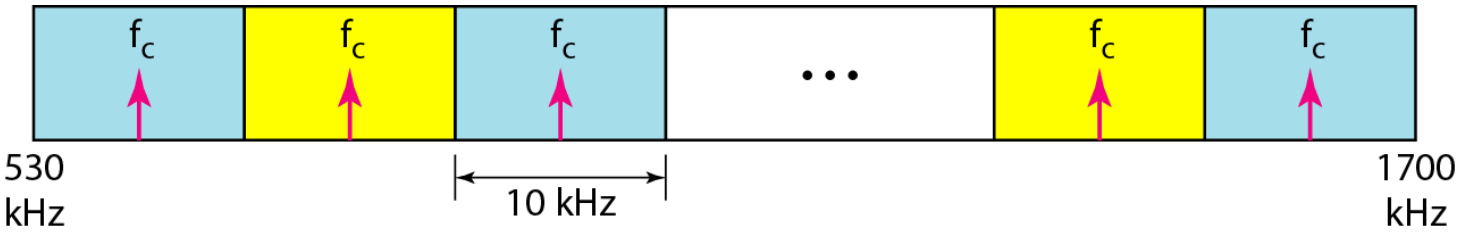


Figure 5.18 *Frequency modulation*

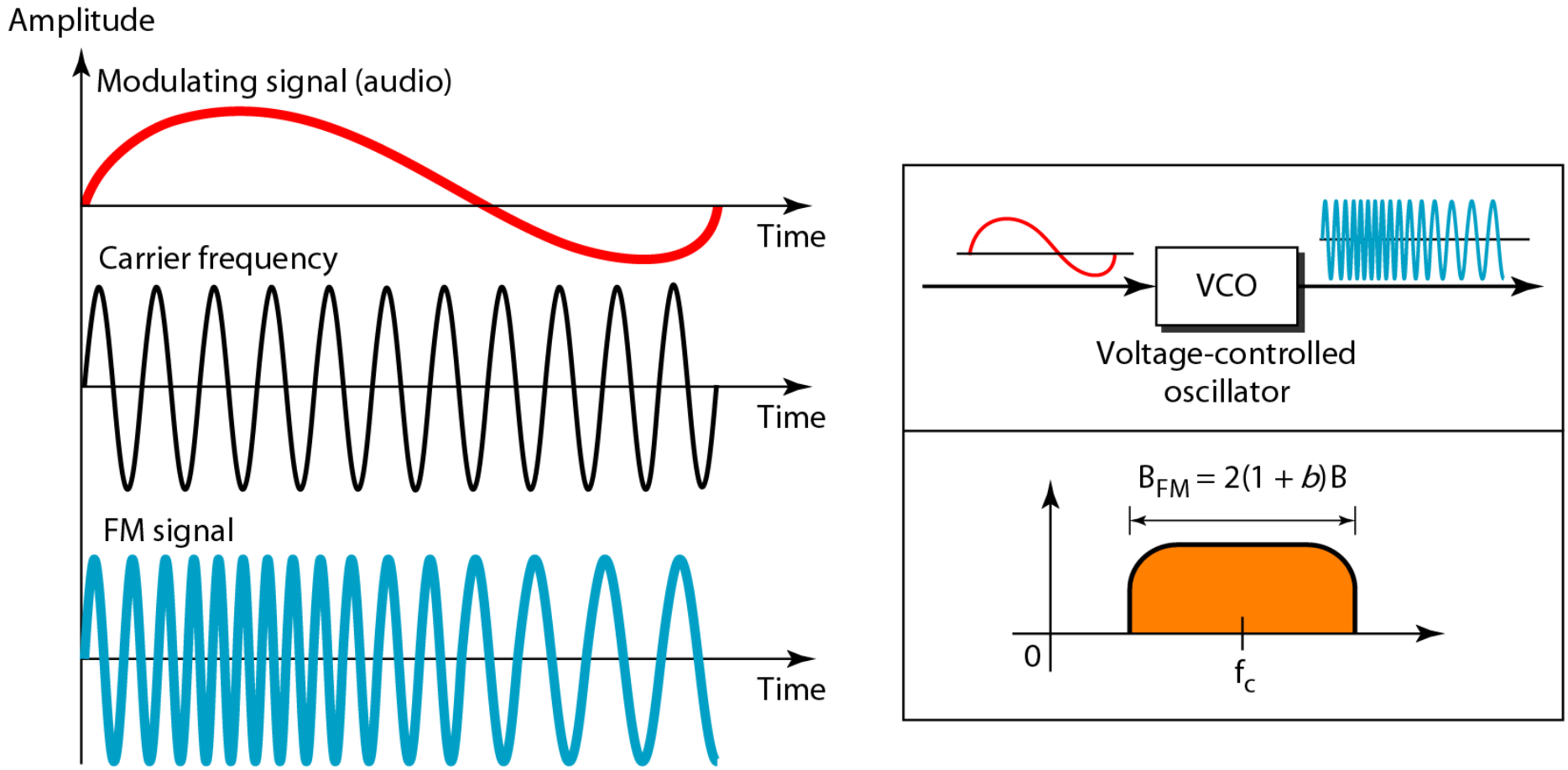


Figure 5.19 *FM band allocation*

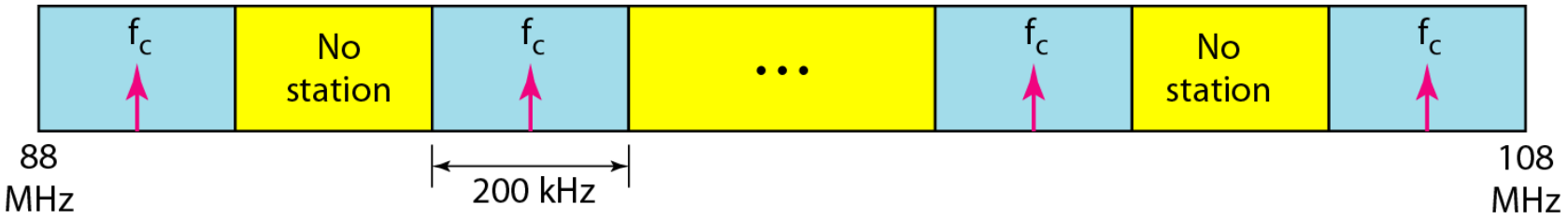


Figure 5.20 *Phase modulation*