1. What is modulation?

- Modulation is the process of putting information onto a high frequency carrier for transmission **(frequency translation).**

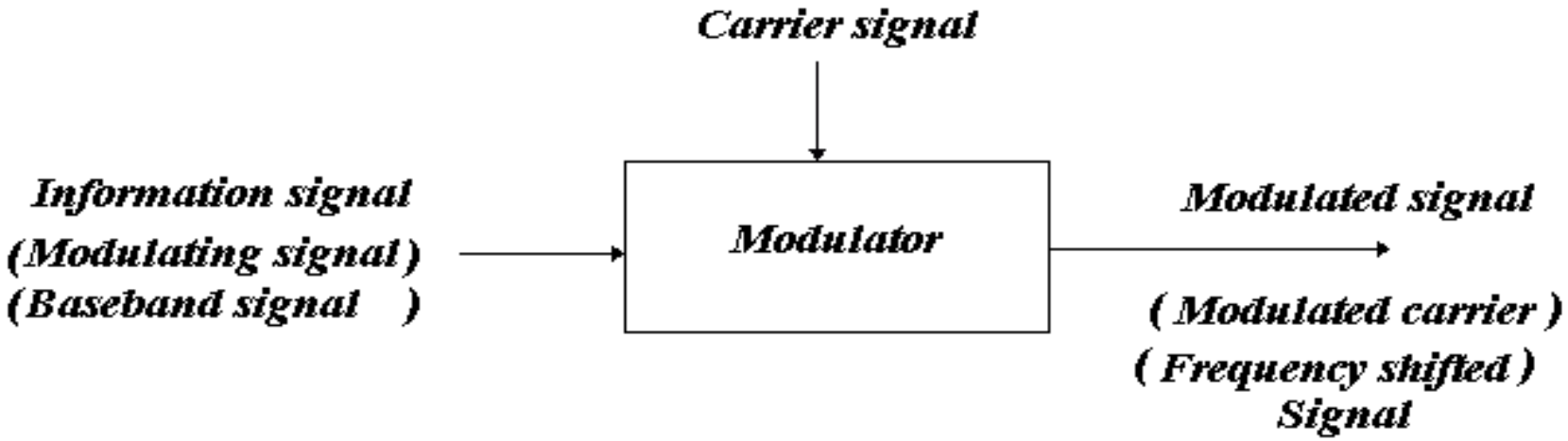
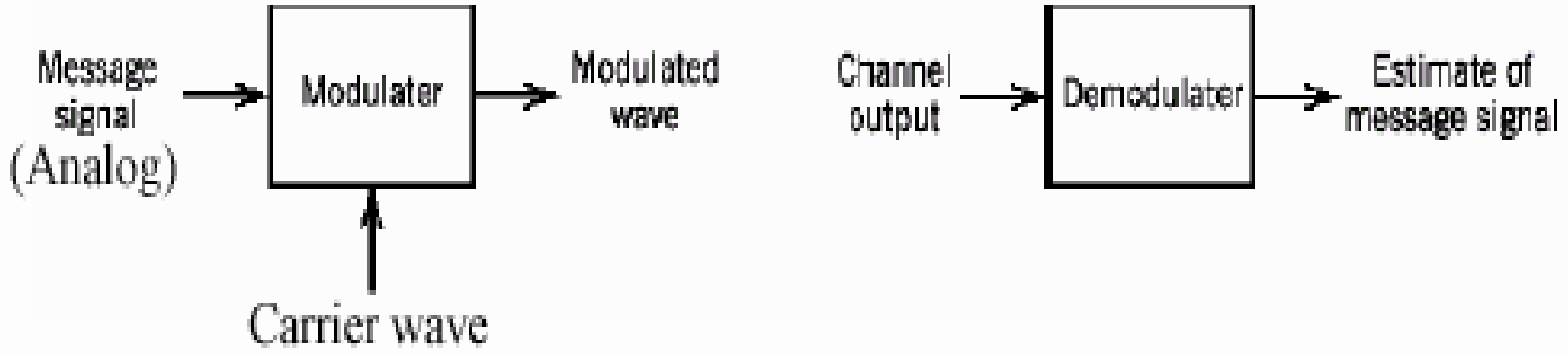


Fig. Process of Modulation

- Once this information is received, the low frequency information must be removed from the high frequency carrier. This process is known as **" *Demodulation* ".**

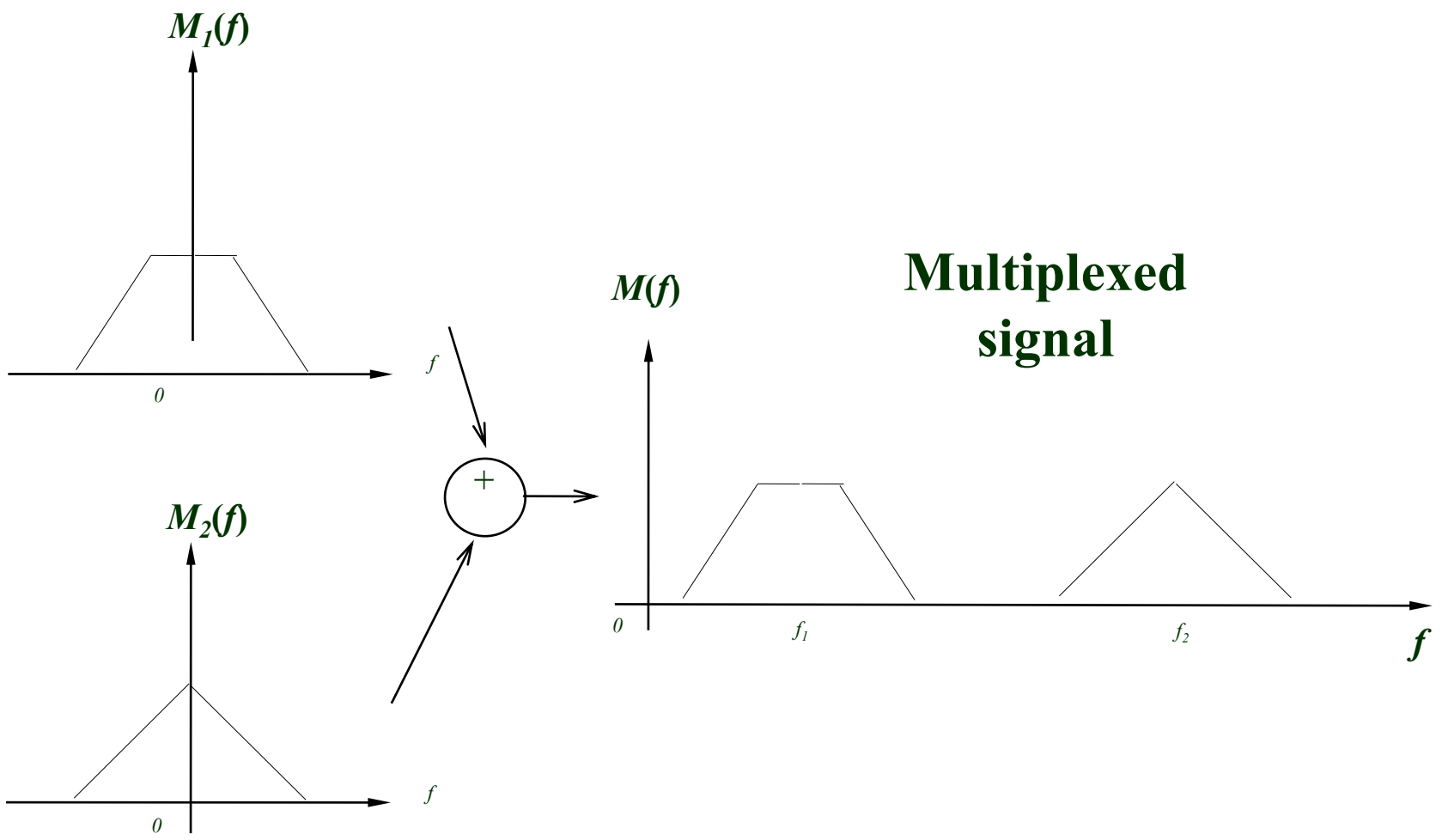

Message signal
(Analog)
Modulater
Modulated wave
Carrier wave
Channel output
Demodulater
Estimate of message signal

2. What are the reasons for modulation?

2. What are the reasons for modulation?

1. **Frequency division multiplexing** (To support multiple transmissions via a single channel)

   To avoid interference


M1(f)
0
f
M2(f)
0
f
+
M(f)
Multiplexed signal
0
f1
f2
f

2. Practicality of Antennas

Transmitting very low frequencies require antennas with miles in wavelength

3. What are the Different of Modulation Methods?

1. **Analogue modulation**- The modulating signal and carrier both are analogue signals

   Examples: Amplitude Modulation (AM) , Frequency Modulation (FM) , Phase Modulation (PM)

2. **Pulse modulation-** The modulating signal is an analogue signal but Carrier is a train of pulses

   Examples : Pulse amplitude modulation (PAM), Pulse width modulation (PWM), Pulse position modulation (PPM)

3.What are the Different of Modulation Methods?

3. **Digital to Analogue modulation-** The modulating signal is a digital signal , but the carrier is an analogue signal.

   Examples: Amplitude Shift Keying (ASK), FSK, Phase Shift Keying (PSK)

4. **Digital modulation -**

   Examples: Pulse Code Modulation, Delta Modulation,Adaptive Delta Modulation

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 *Types of analog-to-analog modulation*

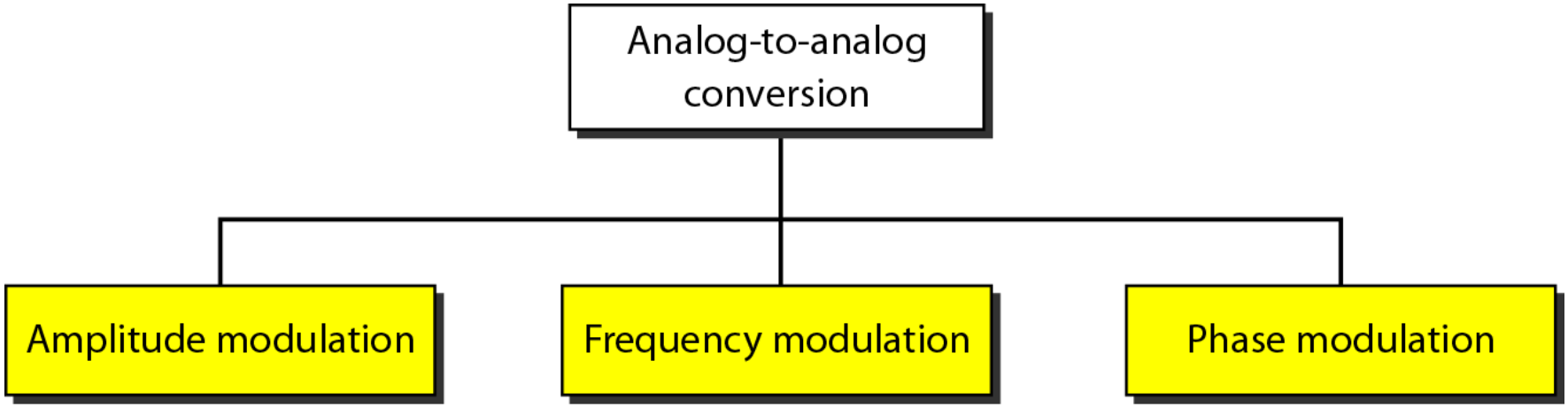
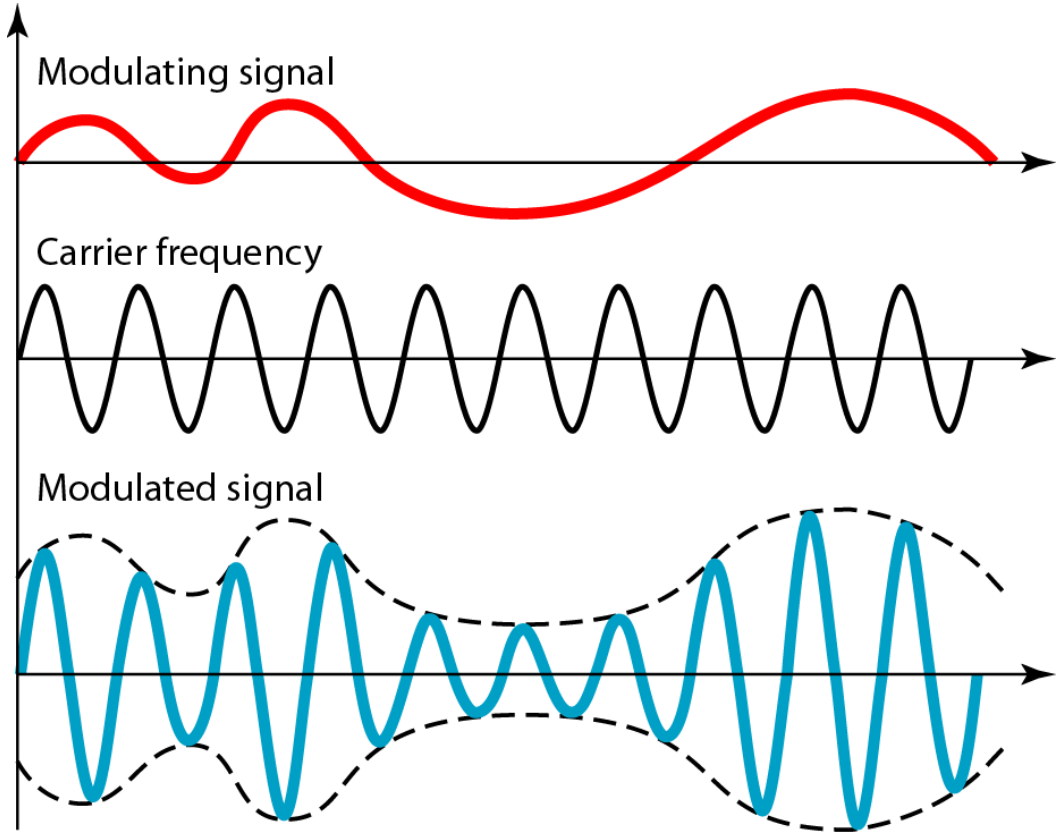
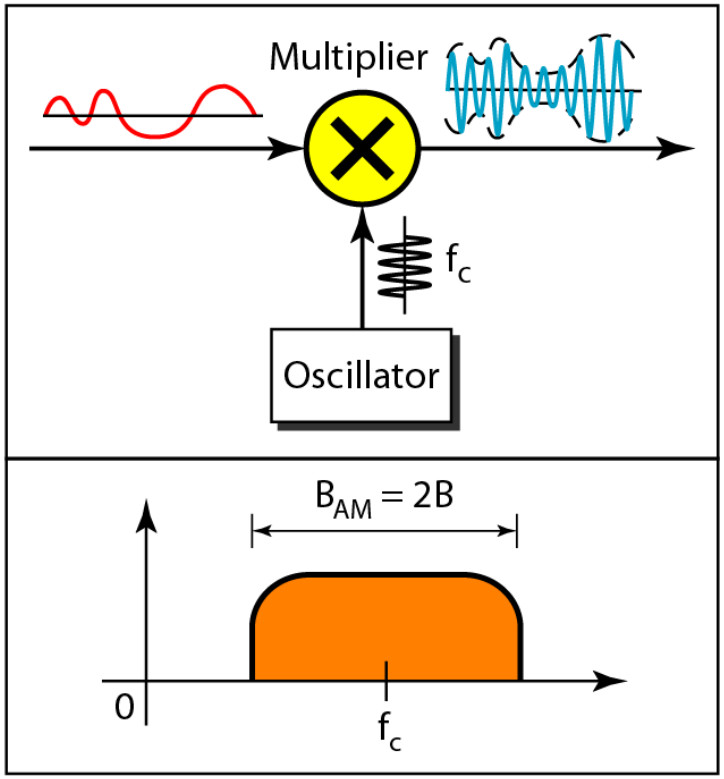


Figure *Amplitude modulation*

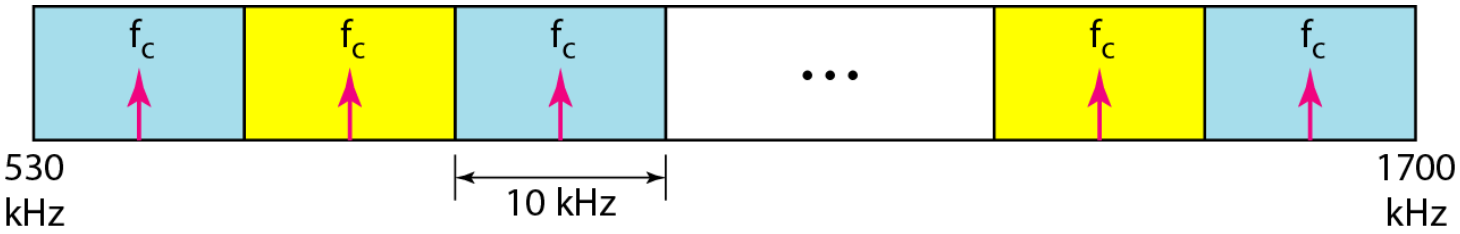




Note

The total bandwidth required for AM can be determined from the bandwidth of the audio signal: $B_{AM} = 2B$.

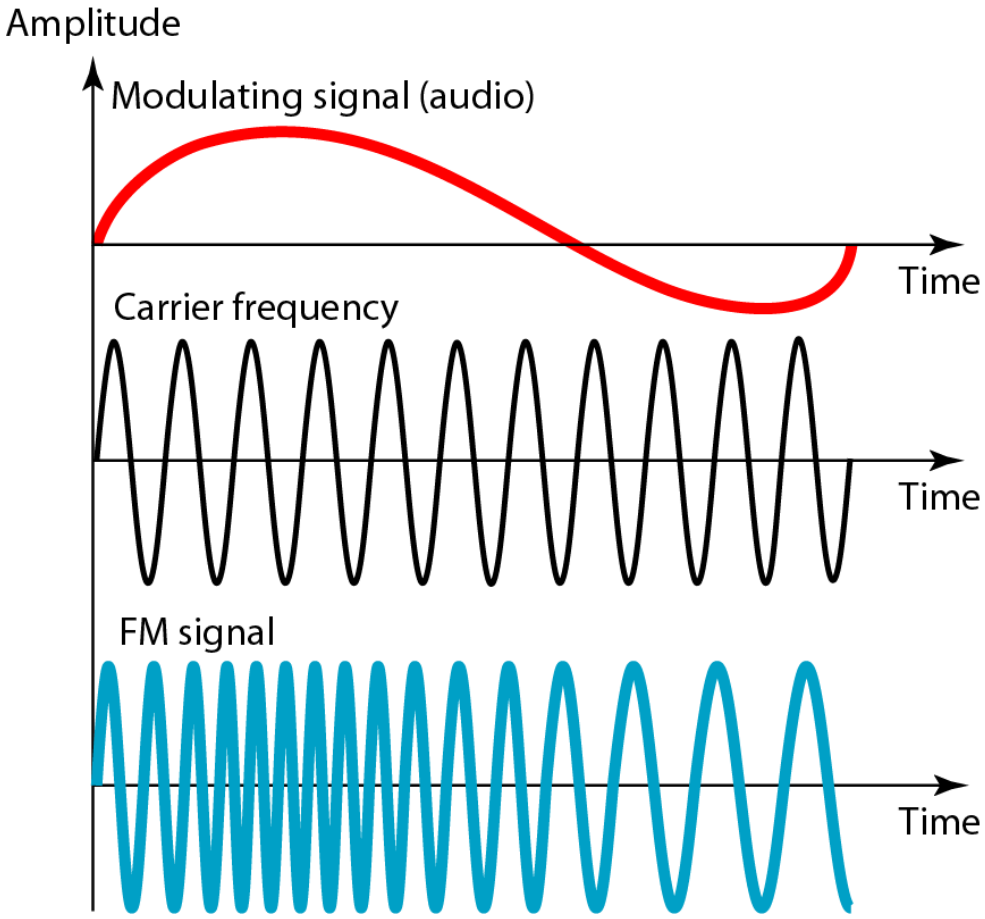
Figure *AM band allocation*



Note

The total bandwidth required for FM can be determined from the bandwidth of the audio signal: $B_{FM} = 2(1 + \beta)B$.

Figure *Frequency modulation*



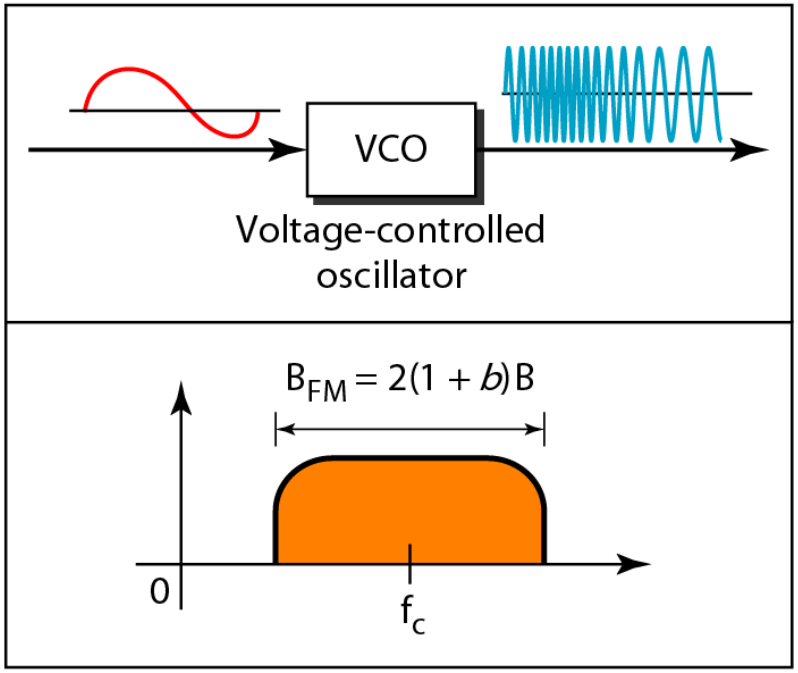


Figure *FM band allocation*

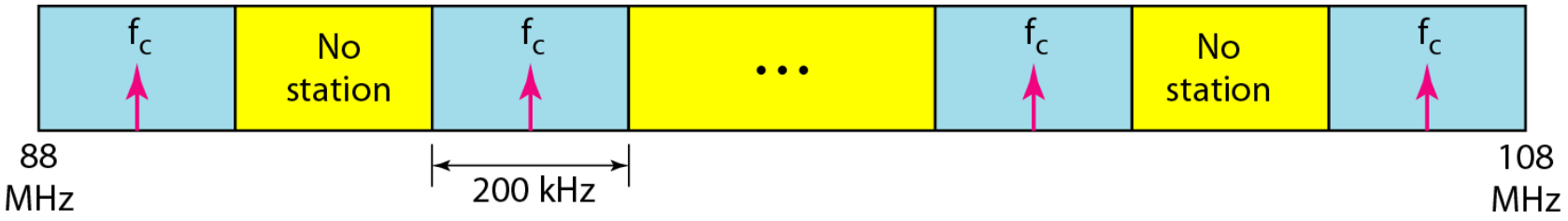
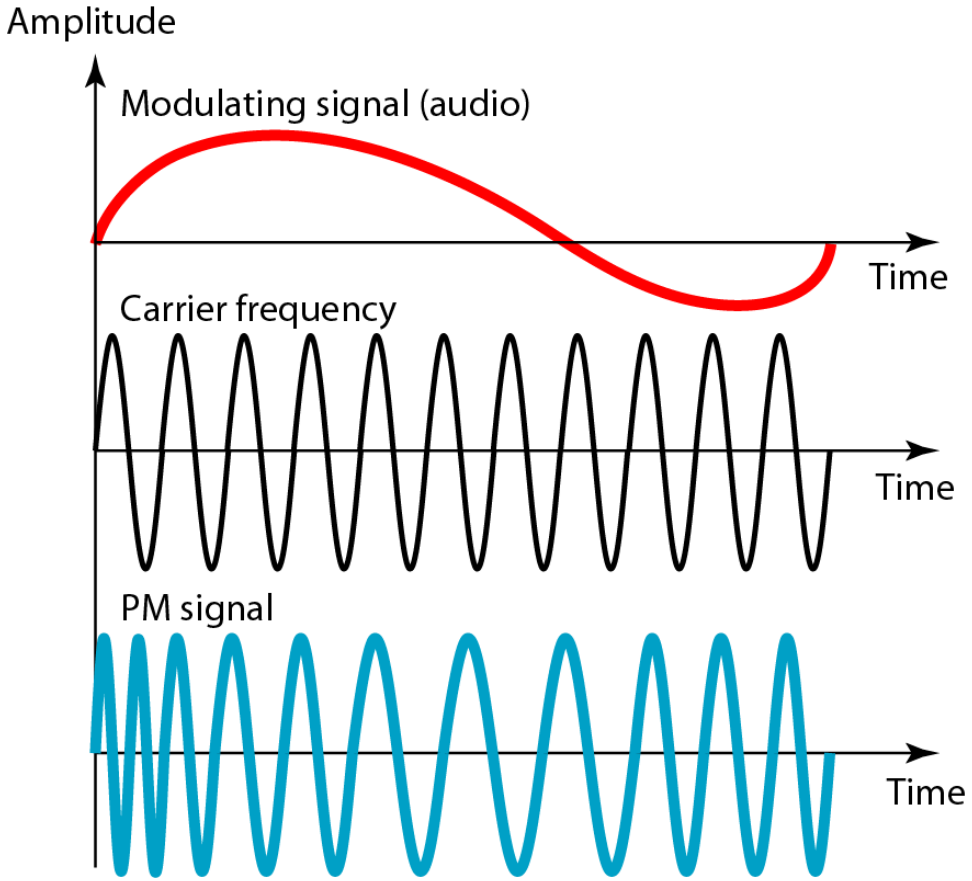
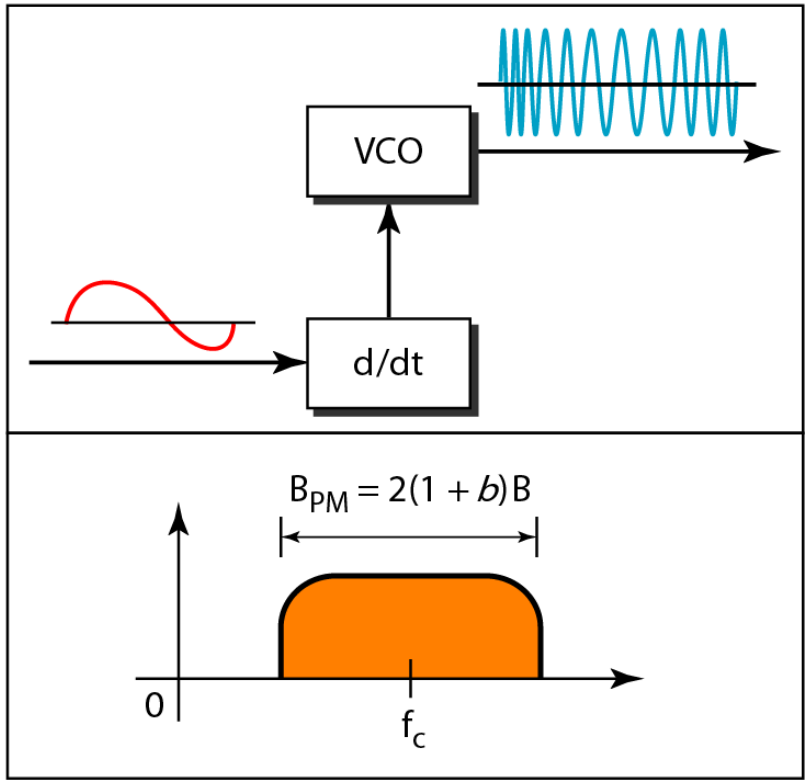


Figure *Phase modulation*





Note

The total bandwidth required for PM can be determined from the bandwidth and maximum amplitude of the modulating signal:

$$B_{PM} = 2(1 + \beta)B.$$