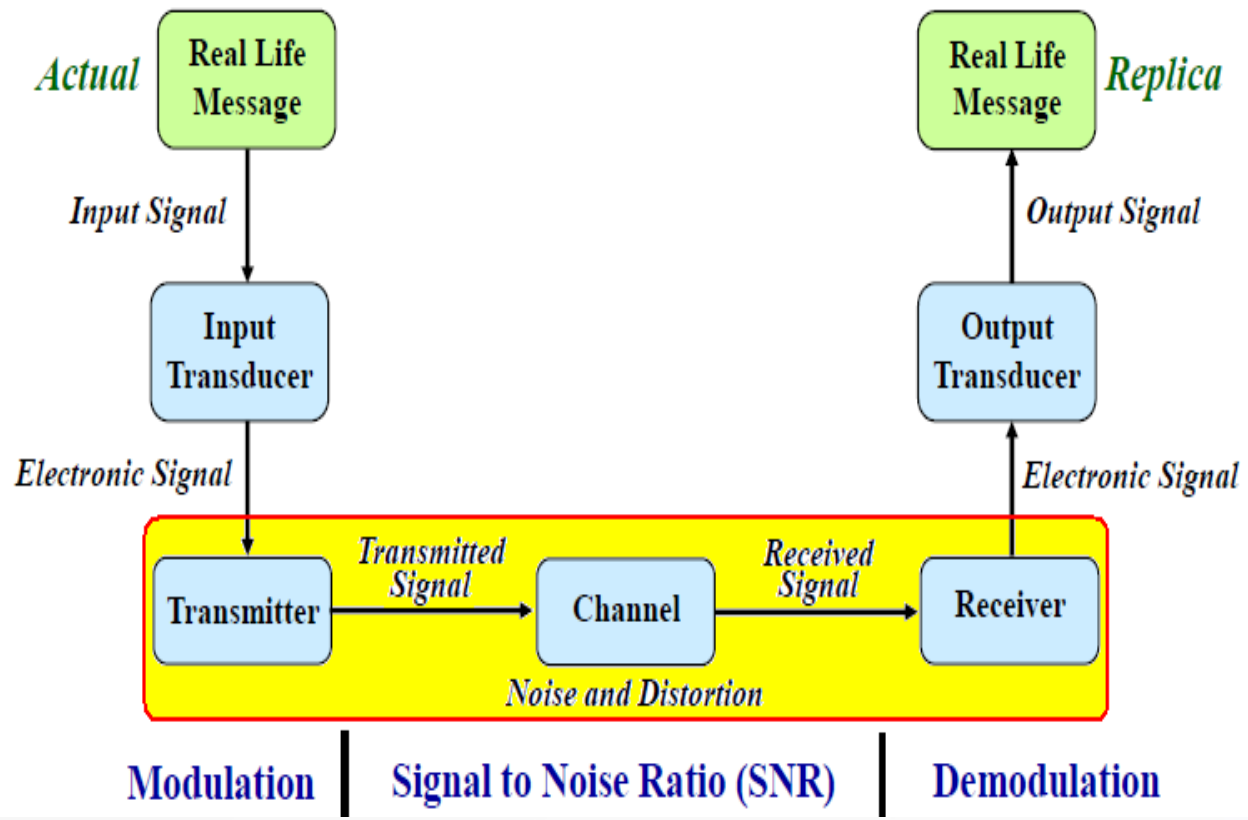
Communication
Module-7
EC-10001

Communication System

A “communication system” is an apparatus that conveys information from a source (the transmitter) to a destination (the receiver) over a channel (the propagation medium carrying the signal).



Transmitter will . . .

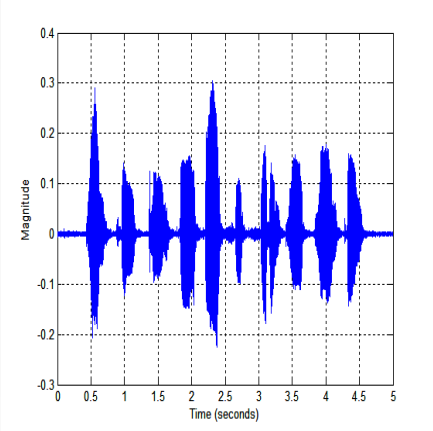
- **Encode message data**
- **Add a carrier signal (modulation)**
- **Set signal parameters for channel transmission and transmit**

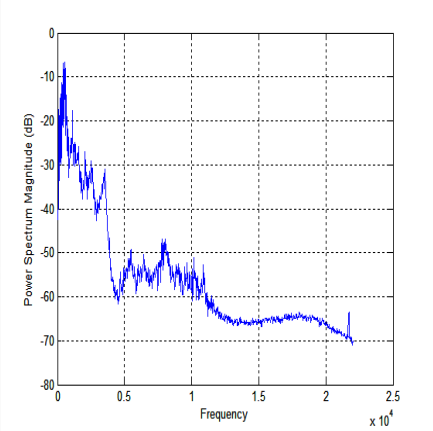
Receiver will . . .

- **Receive signal**
- **Remove the carrier signal (demodulation)**
- **Decode the data to put it into format for destination**

Baseband vs Passband Transmission

- Baseband signals:
  - Voice (0-4kHz)
  - TV (0-6 MHz)
- A signal may be sent in its baseband format when a dedicated wired channel is available.
- Otherwise, it must be converted to passband.

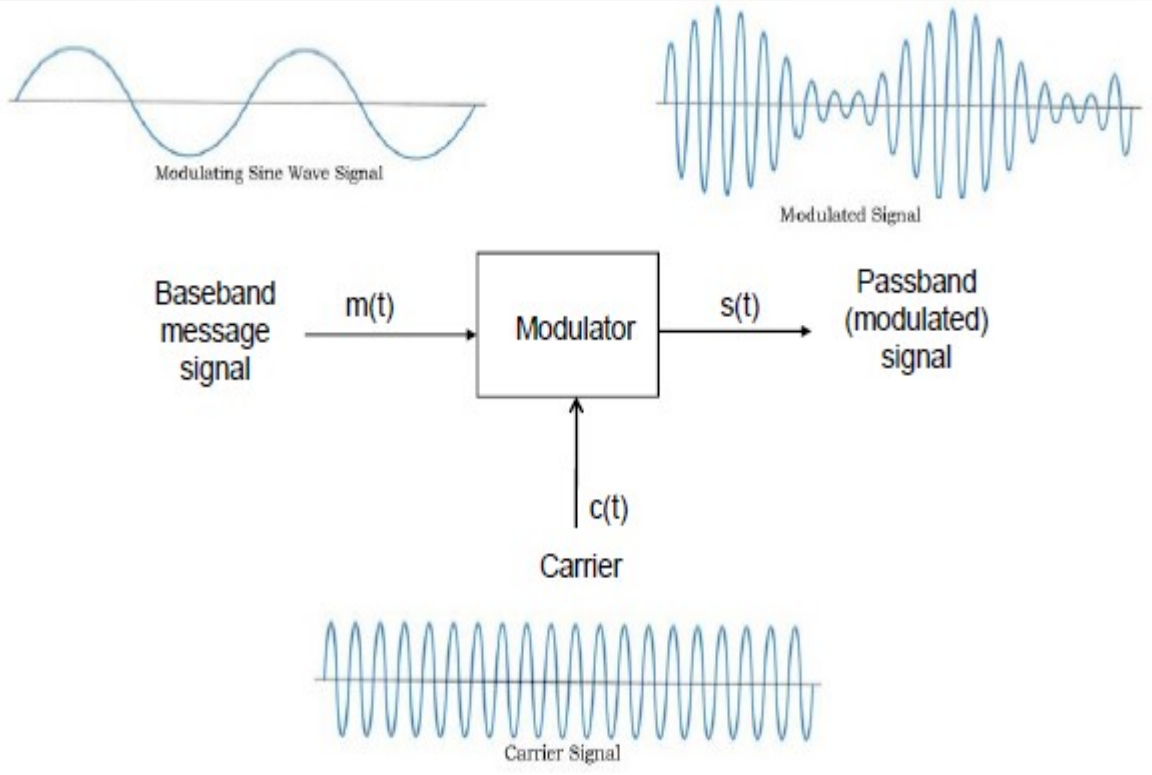




Modulation

Modulation is a process that convert a message signal into a suitable form to transmit over a long distance through a communication channel.

- This is necessary because the message signal being a low frequency signal, that cannot be tra nnel dir



What is Modulation?

- The process of shifting the baseband signal (low frequency signal) to passband range or high frequency is called *Modulation*.

- In the modulation process, some characteristic of a high-frequency carrier signal (bandpass), is changed according to the instantaneous value of the information (baseband) signal.

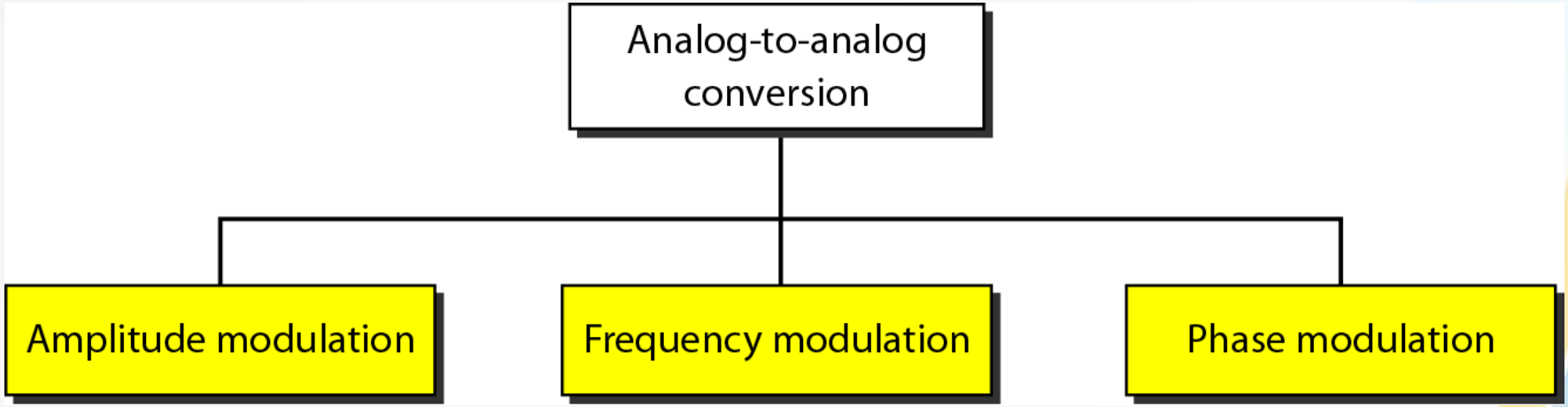
- The process of shifting the passband signal to baseband frequency range is called *Demodulation*.

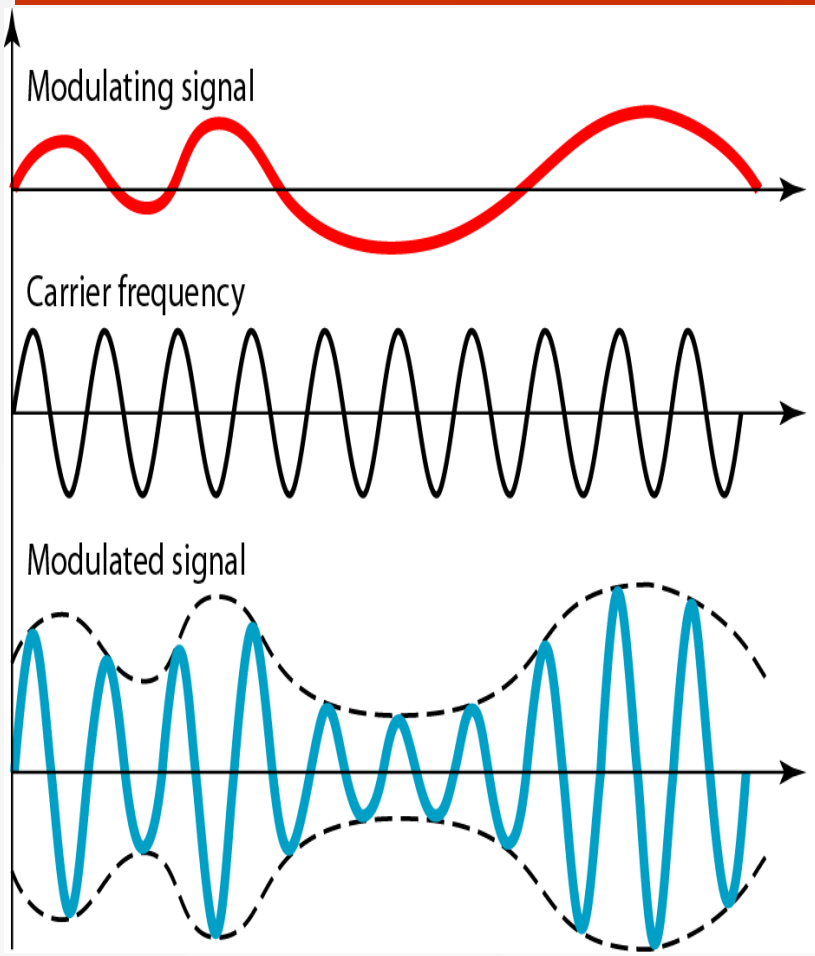
Modulation

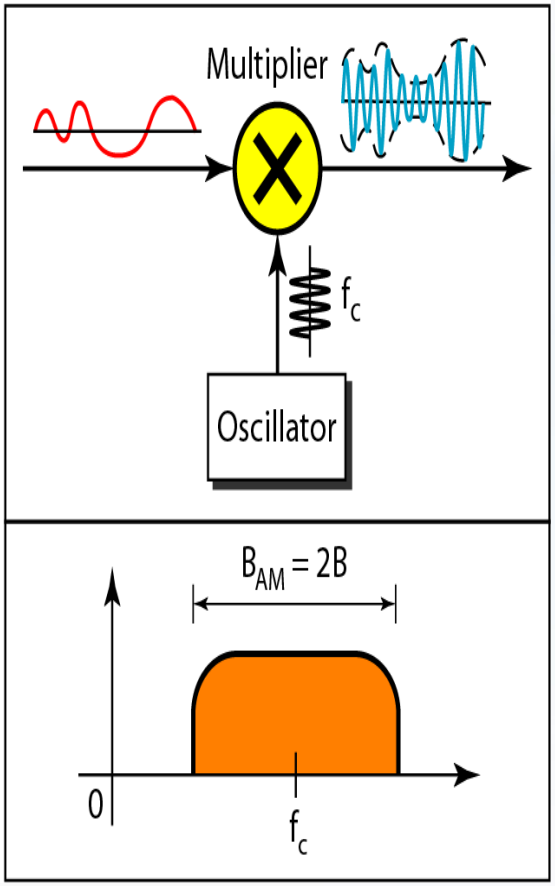
Topics discussed in this section:

- **Amplitude Modulation**
- **Frequency Modulation**
- **Phase Modulation**

Types of analog-to-analog modulation



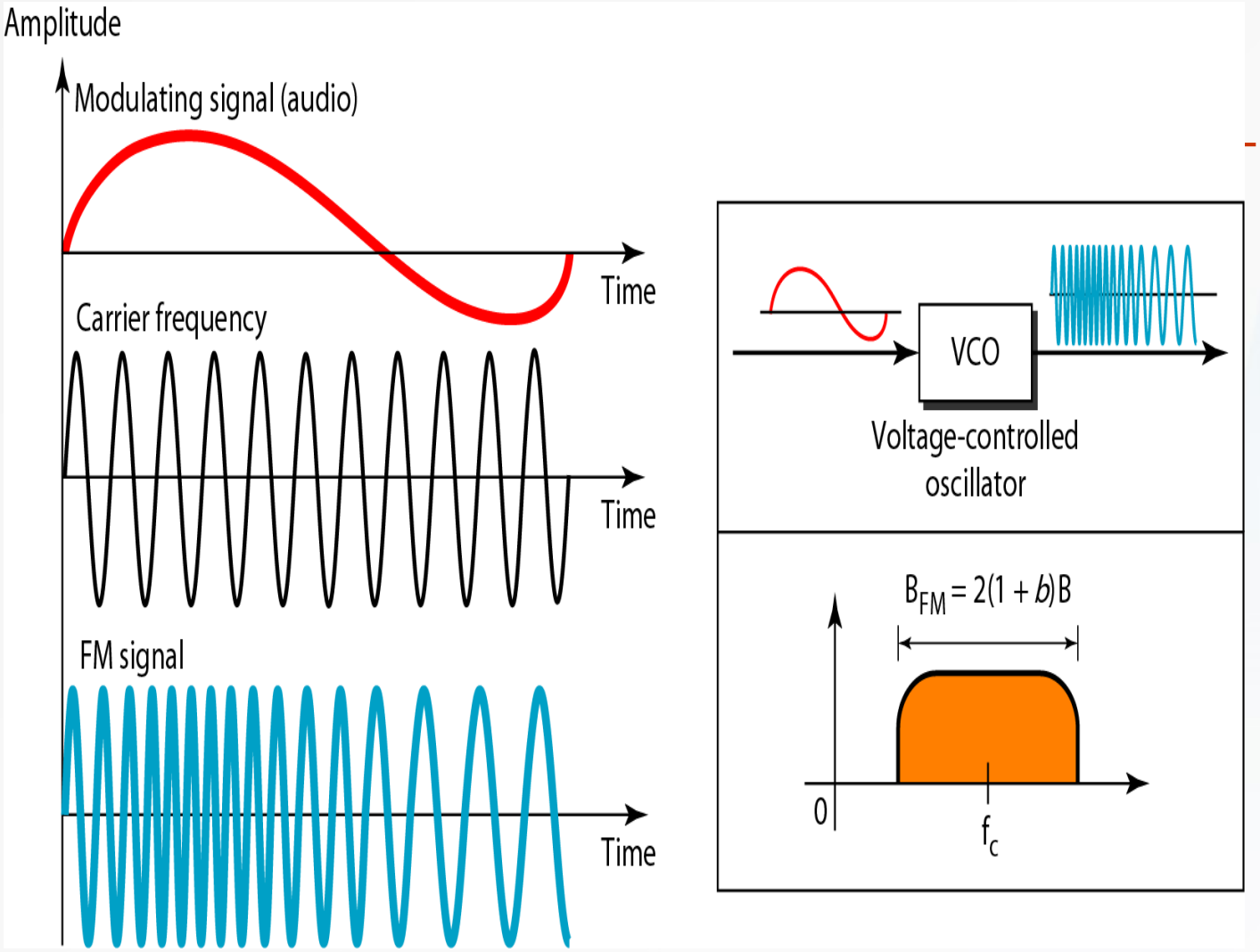




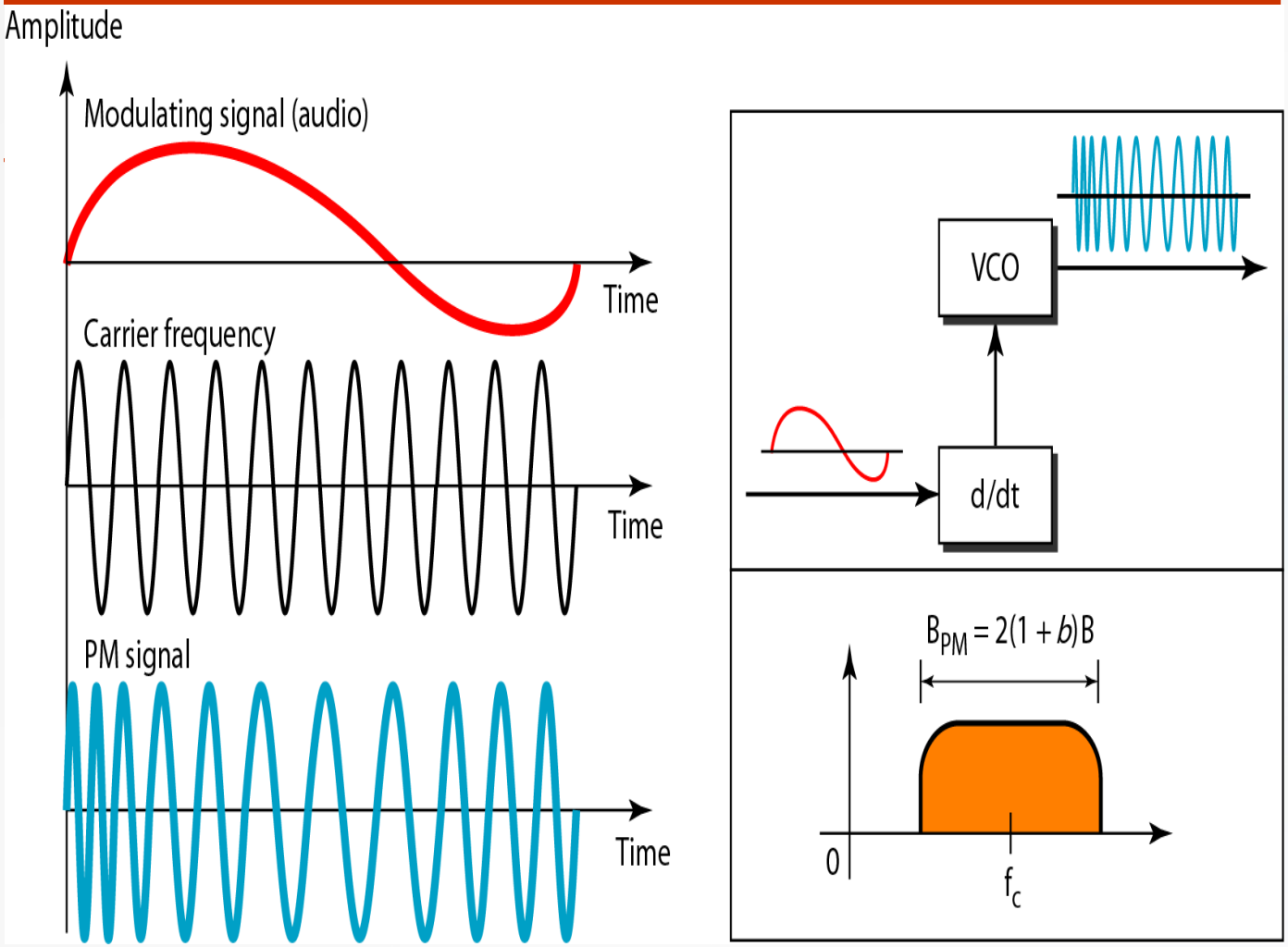
Amplitude modulation

Frequency Modulation

- The modulating signal changes the frequency ‘fc’ of the carrier signal.
- FM is defined as the process of changing the frequency of the carrier signal w.r.t. the instantaneous values of the message or modulating signal.
- The bandwidth for FM is high
- It is approxmately 10x the signal frequency

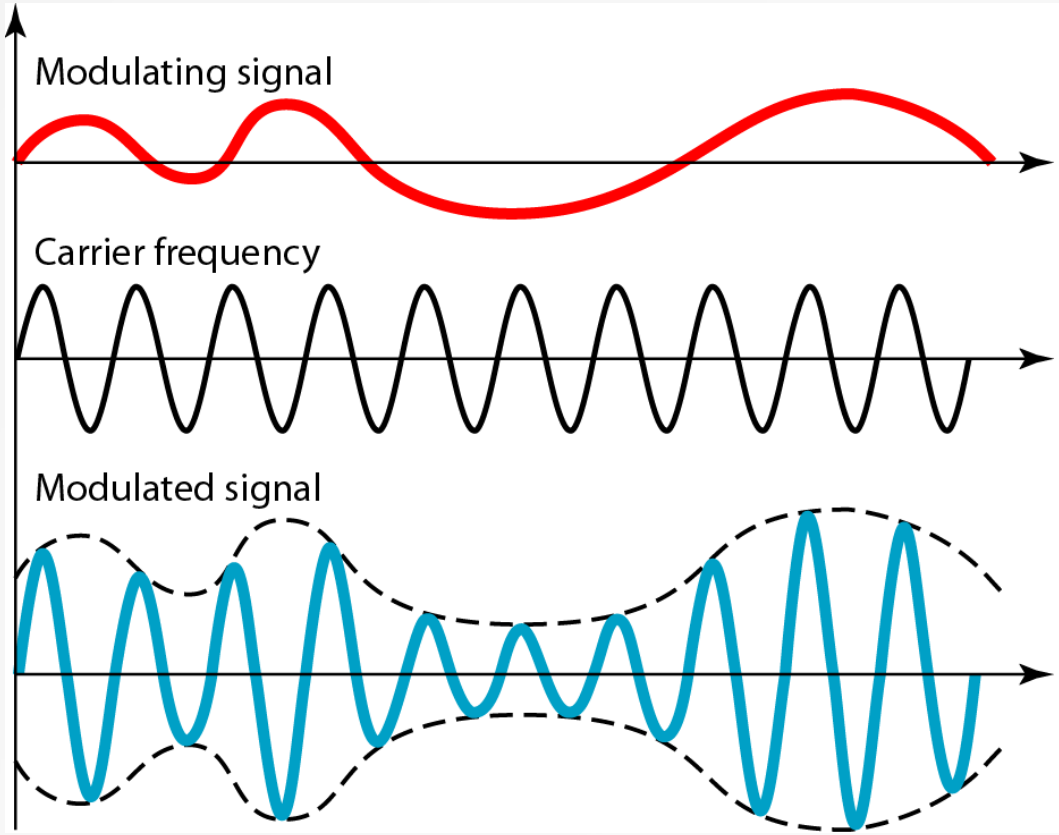


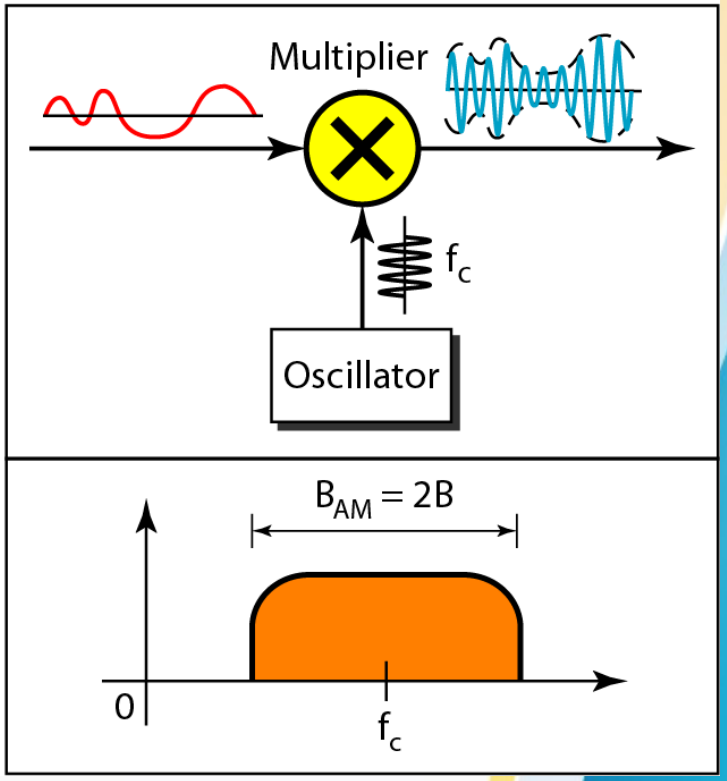
Frequency modulation



Phase modulation

Amplitude modulation





Comparison

Amplitude Modulation (AM)	Frequency Modulation (FM)
Frequency and phase remain the same	Amplitude and phase remain the same
Can be transmitted over a long distance but has poor sound quality.	Better sound quality with higher bandwidth.
The frequency range varies between 535 to 1705 kHz	For FM it is from88 to 108 MHz mainly in the higher spectrum
Signal distortion can occur in AM	Less instances of signal distortion
Circuit design is simple and less expensive	Circuit design is intricate and more expensive
Easily susceptible to noise	Less susceptible to noise

Phase Modulation (PM)

- The modulating signal only changes the phase of the carrier signal.
- The phase change manifests itself as a frequency change but the instantaneous frequency change is proportional to the derivative of the amplitude.
- The bandwidth is higher than for AM.

Phase modulation