Technician License Course

Chapter 5

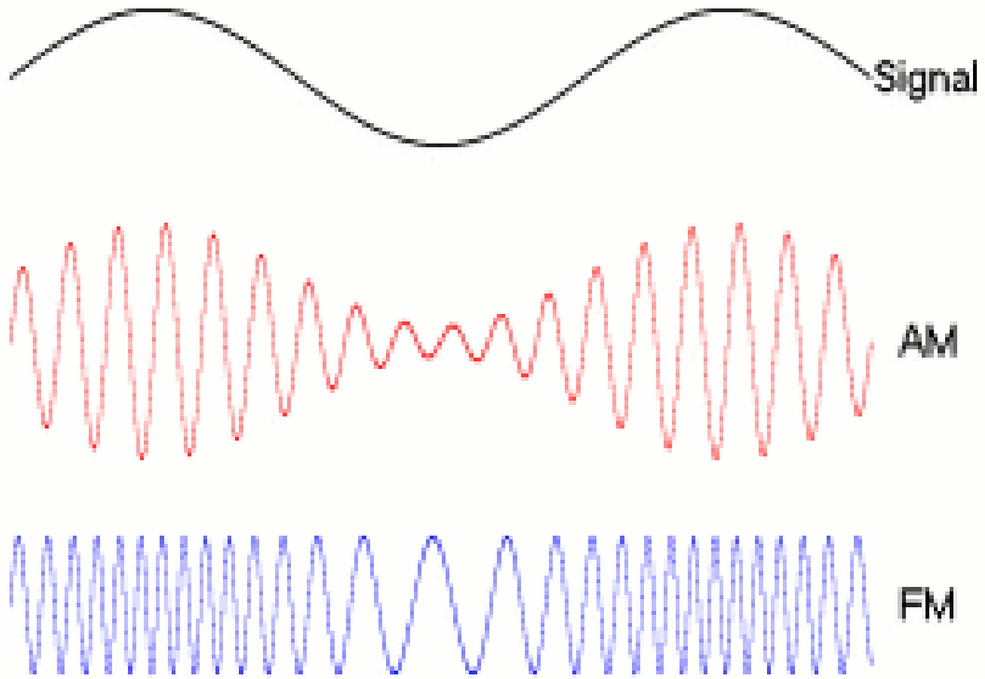
Section 5.1

Modulation

Modulation

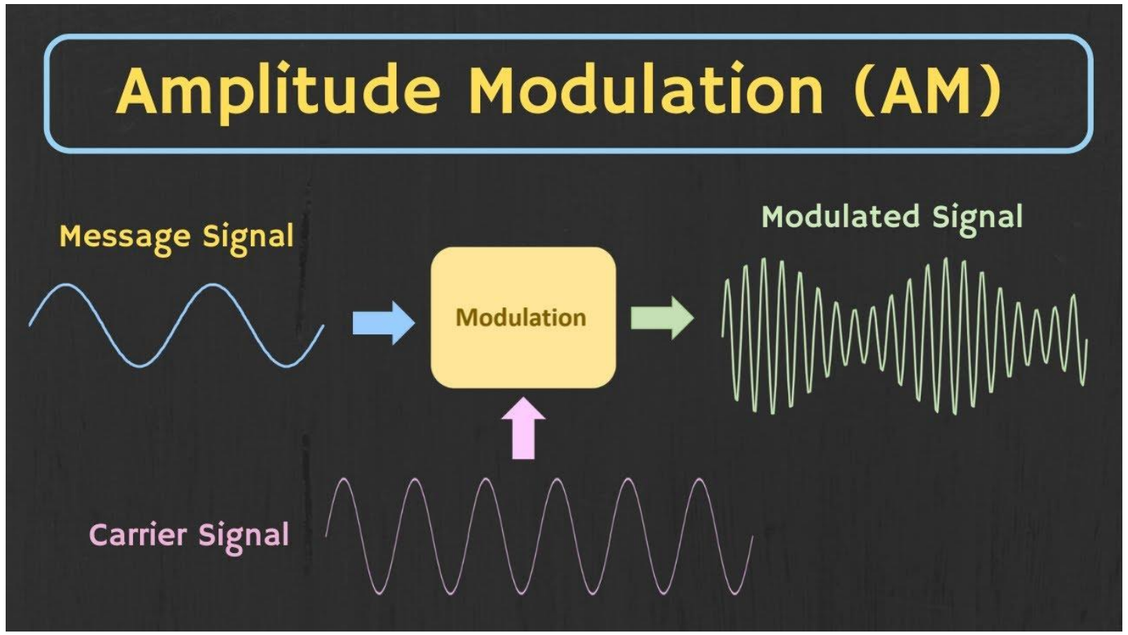
When we add some information to the radio wave, (the *carrier*) we *modulate* the wave.

- Turn the wave on and off (Morse code)
- Speech or music
- Data



Modulation

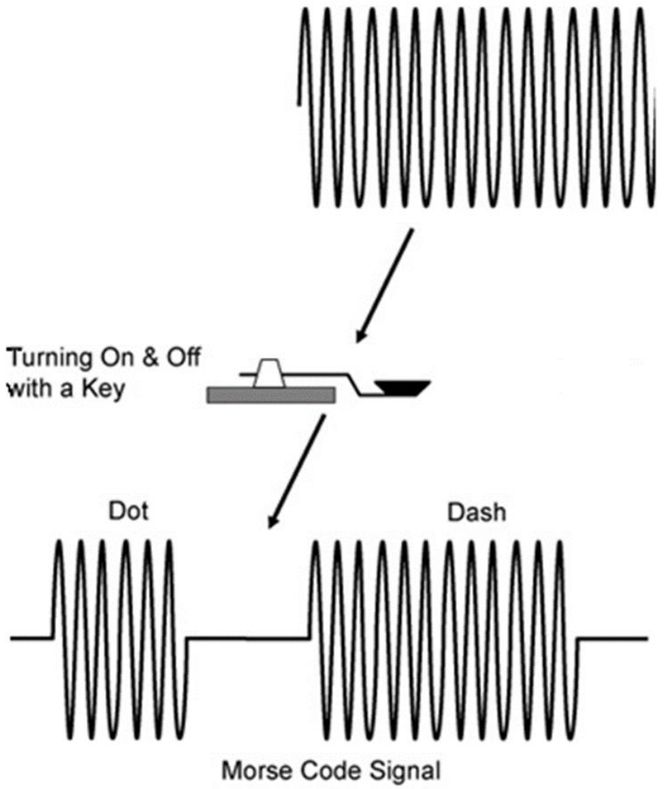
- Different modulation techniques vary different properties of the wave to add the information:
  - Continuous Wave (CW)
  - Amplitude
  - Single Side Band (SSB)
  - Frequency or Phase



Modulation

Continuous Wave (CW)

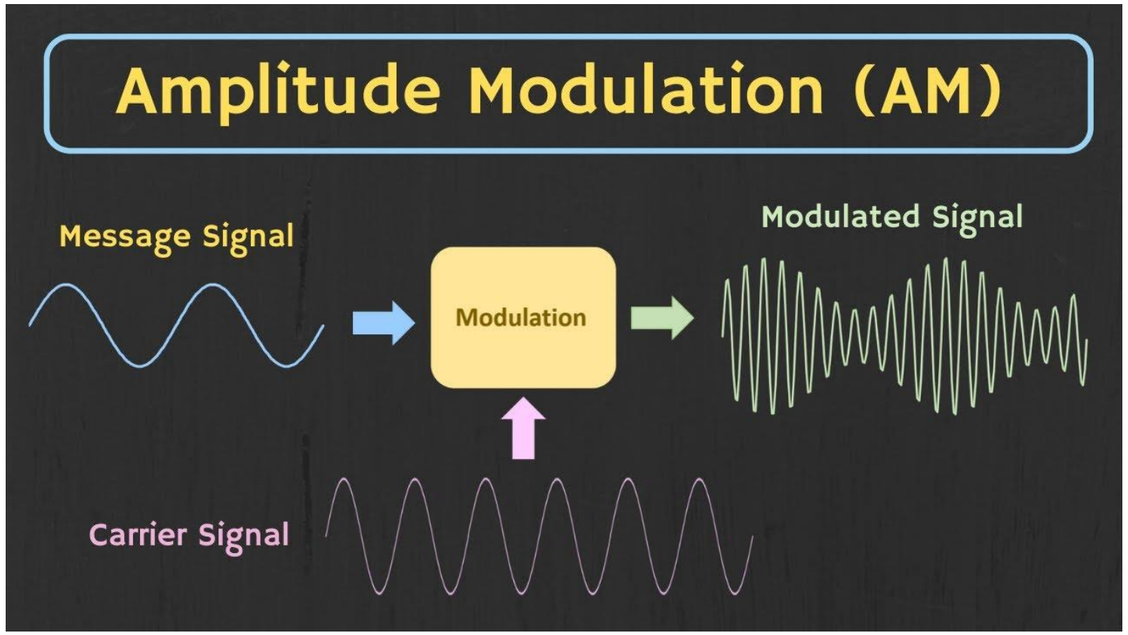
- Morse Code
- Turning Carrier On/Off
- Simple Tx & Rx
- Narrow Bandwidth, 500 Hz
- High energy density signal



Modulation

Amplitude Modulation (AM)

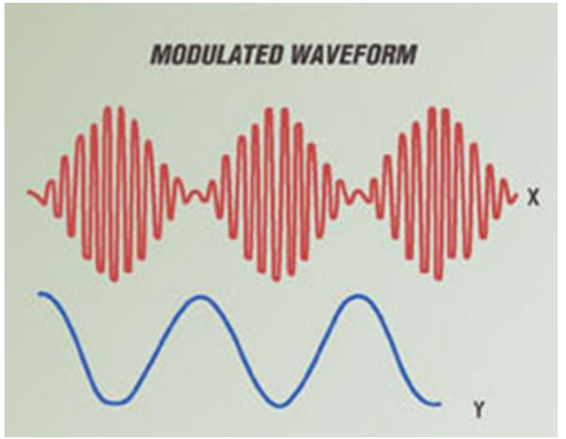
- Varies the Power of the carrier
- Simple Tx & RX
- First Radios were AM
- Wide Bandwidth, 6,000 Hz
- Low energy signal

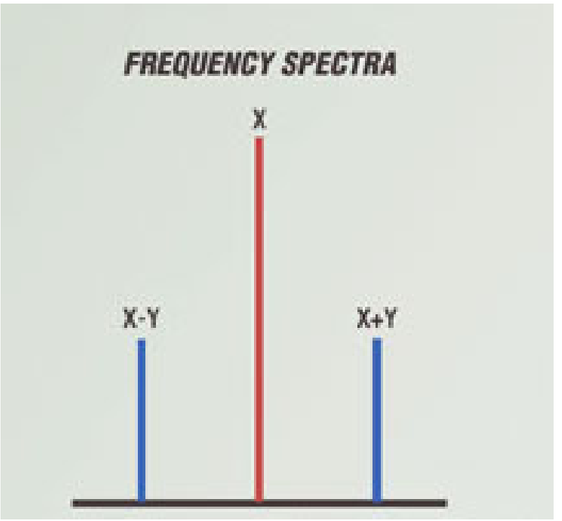


Modulation

Single Side Band (SSB)

- Variation of AM
- More complicated Tx/Rx
- Suppress Carrier & One Side Band
- LSB vs USB
- Bandwidth, 3,000 Hz or 3 kHz
- Higher energy signal
- Common on HF

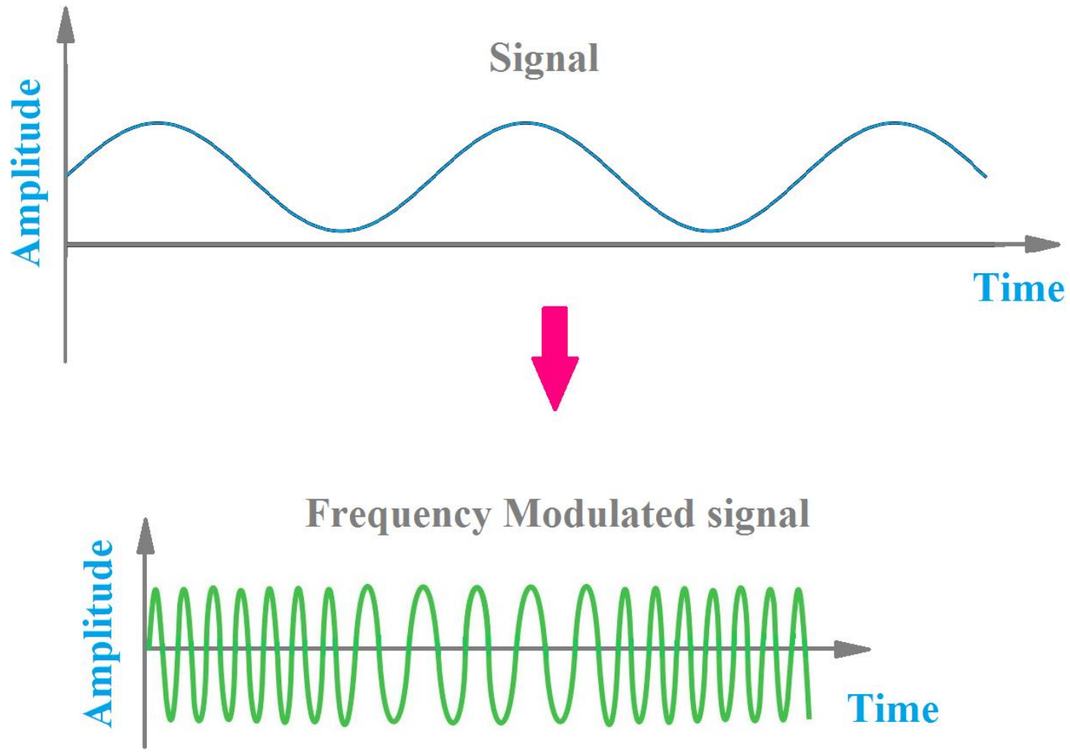




Modulation

Frequency & Phase Modulation (FM / PM)

- FM varies frequency
- PM varies Phase
- They look the same
- Bandwidth, 5 – 15 kHz
- Excellent Noise-rejection



Bandwidth

- The carrier and sidebands have different frequencies, occupying a range of spectrum space.
- The occupied range is the composite signal's *bandwidth*.
- LSB or USB?
  - LSB below 10 MHz
  - USB Above 10 MHz
- Different types of modulation and information result in different signal bandwidths.

Typical Signal Bandwidths

Signal Bandwidths

Type of Signal	*Typical Bandwidth*
CW	150 Hz (0.15 kHz)
SSB digital	500 to 3000 Hz (0.5 to 3 kHz)
SSB voice	2 to 3 kHz
AM voice	6 kHz
AM broadcast	10 kHz
FM voice	10 to 15 kHz*
FM broadcast	150 kHz
Commercial video broadcast	6 MHz

*On 10 meters below 29.0 MHz, FM voice must be narrowband (6 kHz max). As of early 2018, most VHF/UHF FM voice repeater signals are approximately 15 kHz wide although there is some narrowband equipment using 5-6 kHz.

Are there any questions?