



Experiment No.: 1

Amplitude Modulation & Demodulation (AM)

Part 1/ Modulation

Amplitude modulation is a process by which the wave signal is transmitted by modulating the amplitude of the signal. It is often called AM and is commonly used in transmitting a piece of information through a radio carrier wave. Amplitude modulation is mostly used in the form of electronic communication. Currently, this technique is used in many areas of communication such as in portable two-way radios; citizens band radios, VHF aircraft radios, and in modems for computers. Amplitude modulation is also used to mention mediumwave AM radio broadcasting.

What is Modulation?

Basically, it is a process in a communication system. For communication, we need some fundamental elements. One is the high-frequency carrier wave, and the other is the information that has to be transmitted (modulating signal) (or) input signal. These are essential for communication which is done using a device from one place to another. All in all, we need the help of the communication system.

Why Do We Need Modulation?

Practically speaking, modulation is required for;

- High-range transmission
- Quality of transmission
- To avoid the overlapping of signals.

Modulation Index

Is the ratio of the Amplitude of the modulating signal to the amplitude of the carrier wave.

$$\mu = \frac{A_m}{A_c}$$

The modulation index or modulation depth is often denoted in a percentage called the Percentage of Modulation. We will get the **percentage of modulation**, just by multiplying the modulation index value by 100.

For a perfect modulation, the value of the modulation index should be 1, which implies the percentage of modulation should be 100%.

For instance, if this value is less than 1, i.e., the modulation index is 0.5, then the modulated output is called **Under-modulation**. Such a wave is called an **under-modulated wave**.

If the value of the modulation index is greater than 1, i.e., 1.5 or so, then the wave will be an **over-modulated wave**.

Circuit diagram and its output:

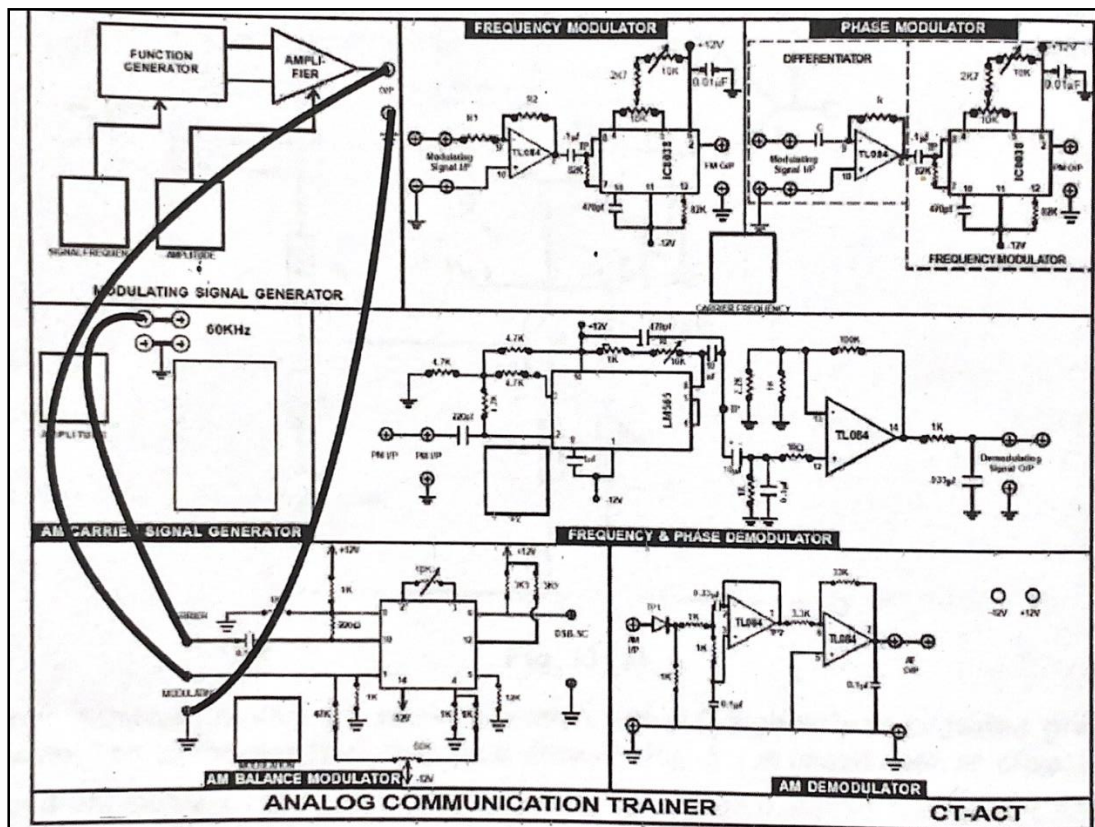


Fig. 1: Connection diagram of Amplitude Modulation.

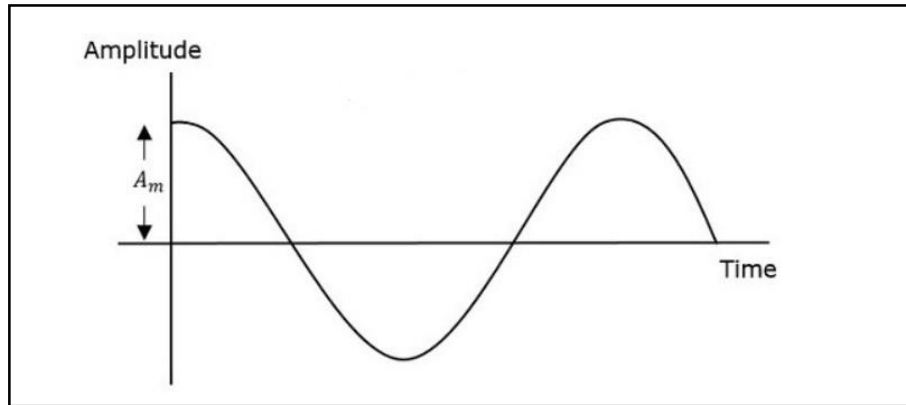


Fig. 2 The Input Signal.

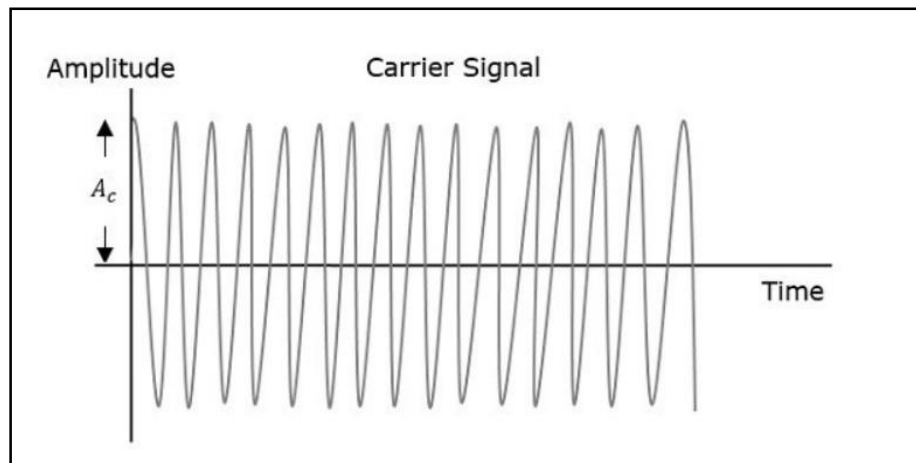


Fig. 3 Carrier wave.

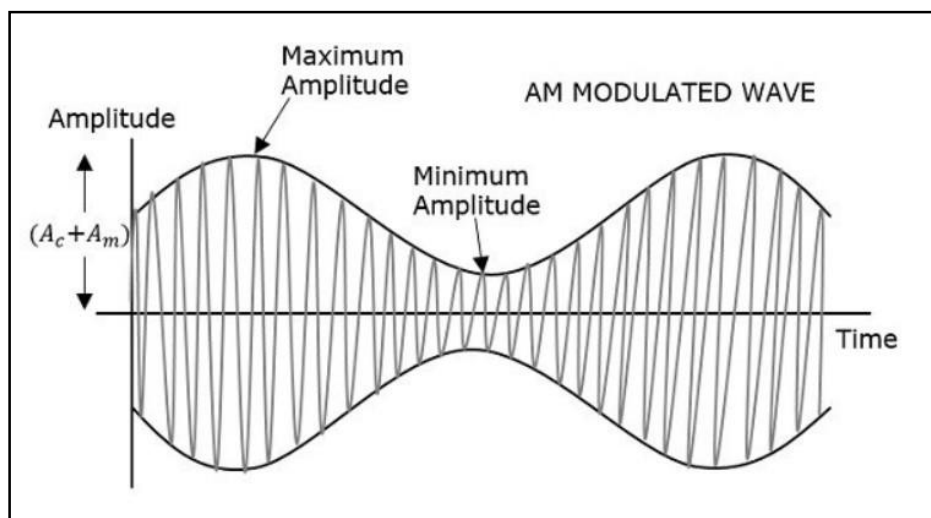


Fig. 4 Amplitude modulated wave ($\mu=1$).

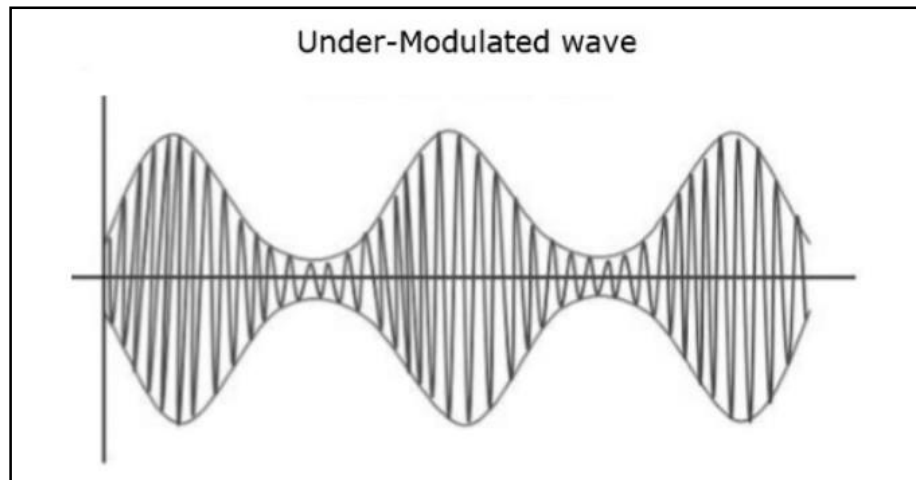


Fig. 5 Amplitude modulated wave ($\mu < 1$).

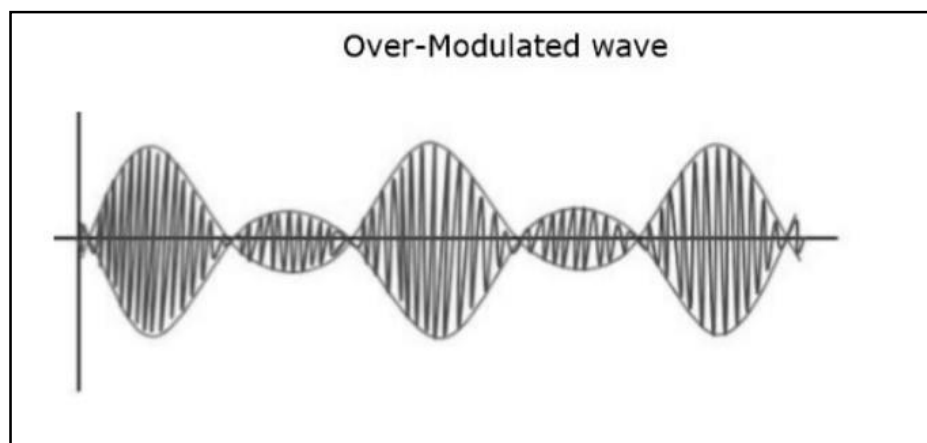


Fig.6 Amplitude modulated wave ($\mu > 1$).

Part 2/ Demodulation

Demodulation is a key process in the reception of any amplitude-modulated signals whether used for broadcast or two-way radio communication systems. Demodulation is the process by which the original information-bearing signal, i.e. the modulation is extracted from the incoming overall received signal.

Circuit diagram and its output:

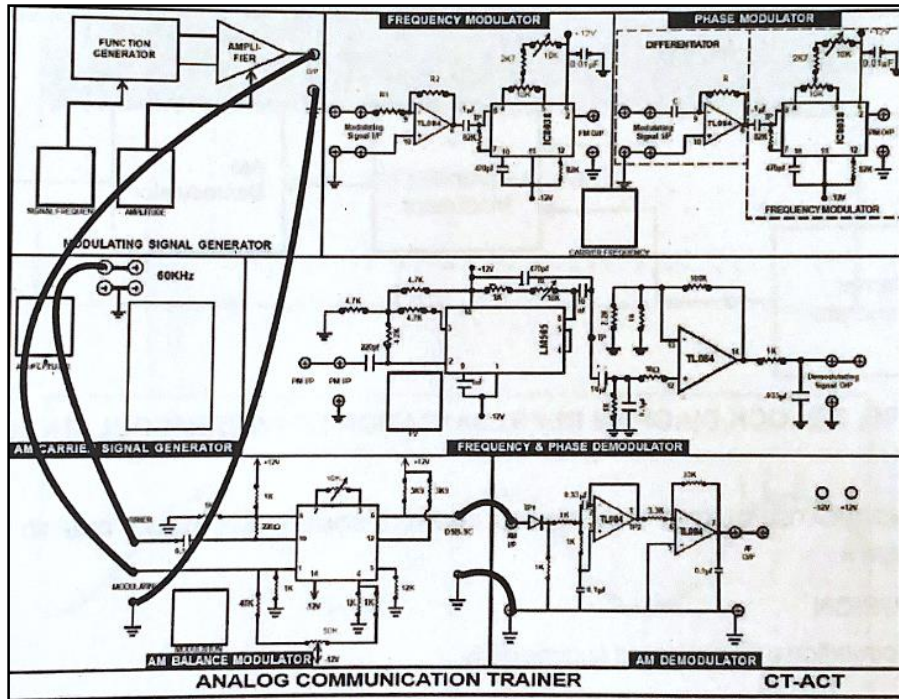


Fig. 7 Connection diagram of Amplitude Demodulation.

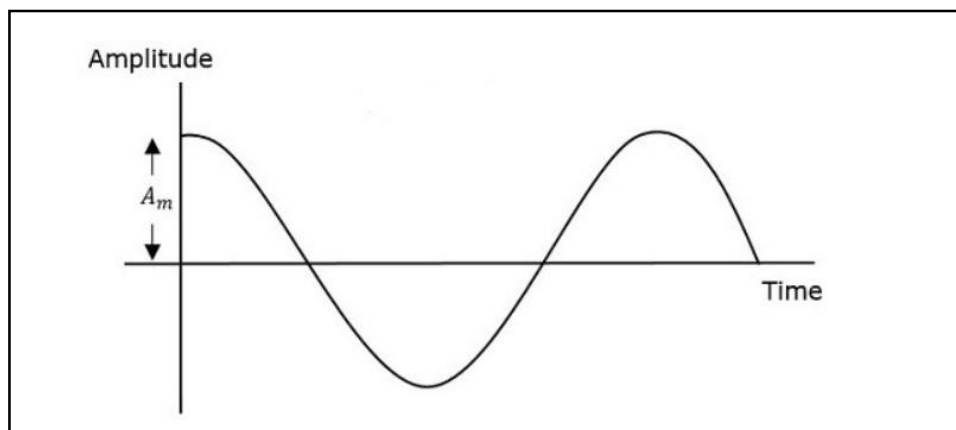


Fig. 8 Demodulation Output.