A-M, P-M, and F-M Transmitters

a. General. All f-m transmitters use either direct or indirect methods for producing f-m. The modulating signal in the direct method has a direct effect on the frequency of the carrier; in the indirect method, the modulating signal uses the frequency variations caused by phase-modulation. In either case, the output of the transmitter is a frequency-modulated wave, and the f-m receiver cannot distinguish between them.

b. A-M Transmitter.

(1) In the block diagram of the a-m transmitter (A of fig. 17), the r-f section consists of an oscillator feeding a buffer, which in turn feeds a system of frequency multipliers and/or intermediate power amplifiers. If frequency multiplication is unneccessary, the buffer feeds directly into the intermediate power amplifiers which, in turn, drive the final power amplifier. The input to the antenna is taken from the final power amplifier.

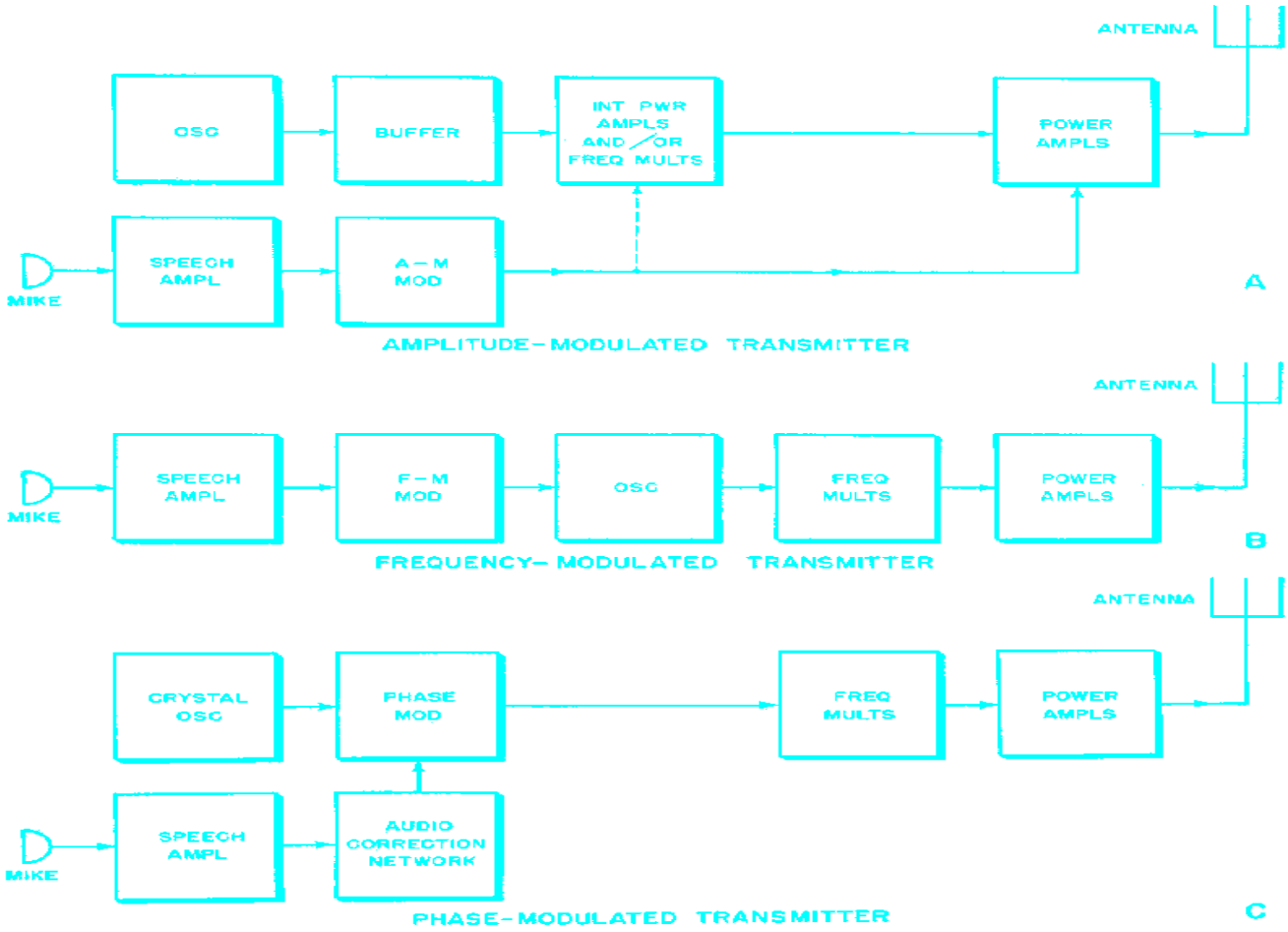

Figure 17. Basic a-m, p-m, and f-m transmitters.

(2) The audio system consists of a microphone which feeds a speech amplifier. The output of this speech amplifier is fed to a modulator. For high-level modulation, the output of the modulator is connected to the final amplifier (solid arrow), where its amplitude modulates the r-f carrier. For low-level modulation, the output of the modulator is fed to the intermediate power amplifier (dashed arrow). The power required in a-m transmission for either high- or low-level modulation is much greater than that required for f-m or p-m.

c. P-M Transmitter. In the p-m, or indirect f-m, transmitter, the modulating signal is passed through some type of correction network before reaching the modulator, as in

C. When comparing the p-m to the f-m wave, it was pointed out that a phase shift of 90° in the p-m wave made it impossible to distinguish it from the f-m wave (fig. 16). This phase shift is accomplished in the correction network. The output of the modulator which is also fed by a crystal oscillator is applied through frequency multipliers and a final power amplifier just as in the direct f-m transmitter. The final output is an f-m wave.

d. F-M Transmitter. In the f-m transmitter, the output of the speech amplifier usually is connected directly to the modulator stage, as in B. The modulator stage supplies an equivalent reactance to the oscillator stage that varies with the modulating signal. This causes the frequency of the oscillator to vary with the modulating signal. The frequency-modulated output of the oscillator then is fed to frequency multipliers which bring the frequency of the signal to the required value for transmission. A power amplifier builds up the signal before it is applied to the antenna.

e. Comparisons.

(1) The primary difference between the three transmitters lies in the method used to vary the carrier. In a-m transmission, the modulating signal controls the amplitude of the carrier. In f-m transmission, the modulating signal controls the frequency of the oscillator. In f-m transmission, the modulating signal controls controls the frequency of the oscillator output. In p-m, or indirect f-m, transmission, the modulating signal controls the phase of a fixed-frequency oscillator. The r-f sections of these transmitters function in much the same manner, although they may differ appreciably in construction.

(2) The frequency multipliers used in a-m transmitters are used to increase the fundamental frequency of the oscillator. This enables the oscillator to operate at low frequencies, where it has increased stability. In f-m and p-m transmitters, the frequency multipliers not only increase the frequency of transmission, but also increase the frequency deviation caused by the modulating signal.

(3) In all three transmitters, the final power amplifier is used chiefly to increase the power of the modulated signal. In high-level a-m modulation, the final stage is modulated, but this is never done in either f-m or p-m.