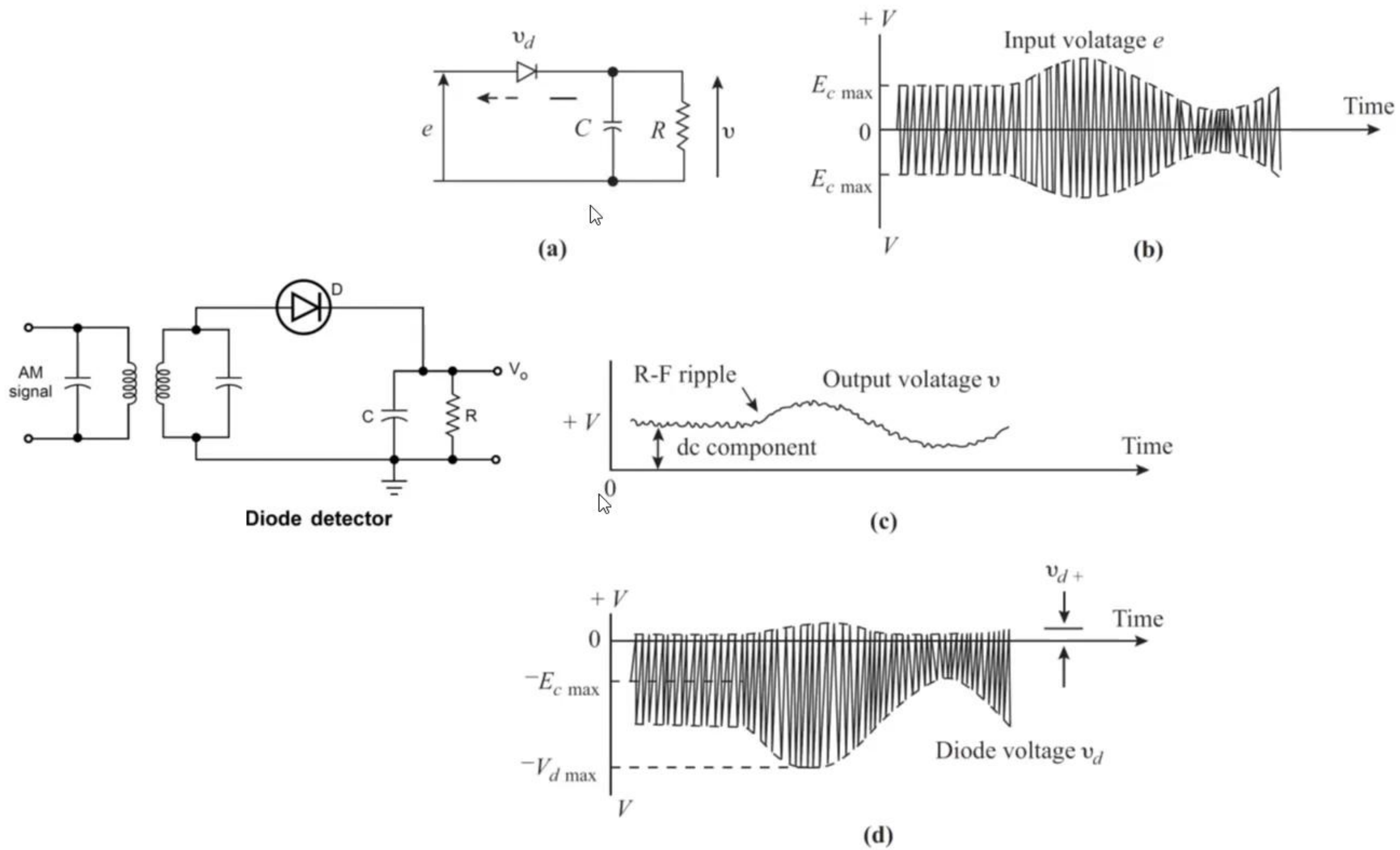
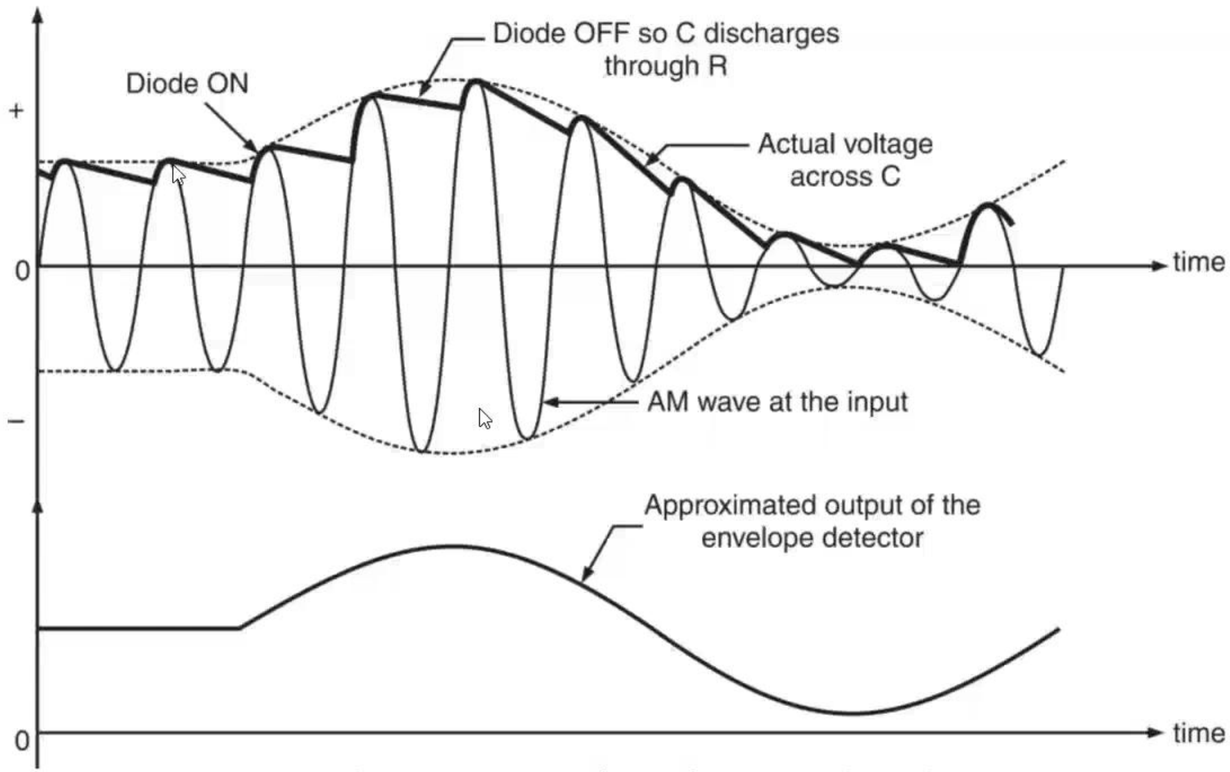
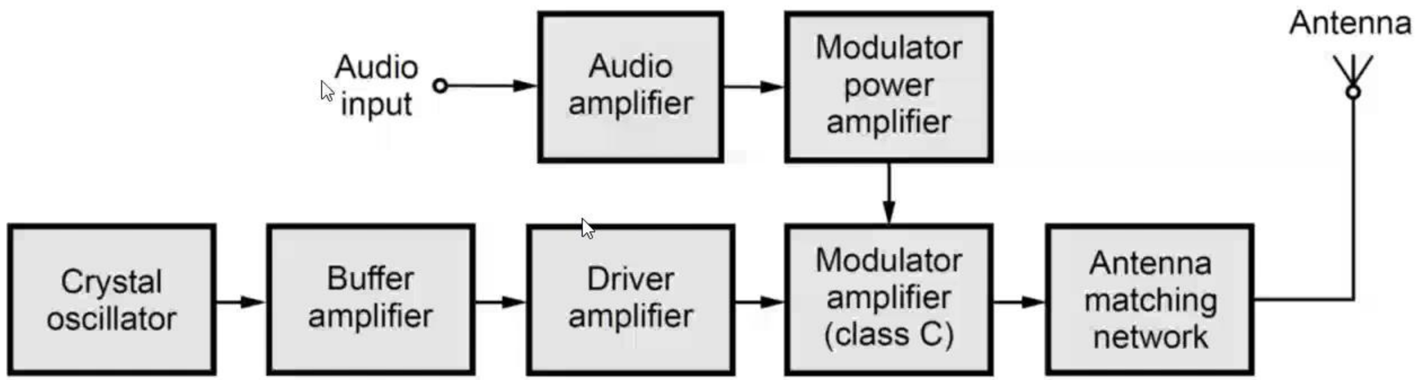
Amplitude Demodulator – Basic Diode Envelope Detector





Input-output waveforms for an envelope detector

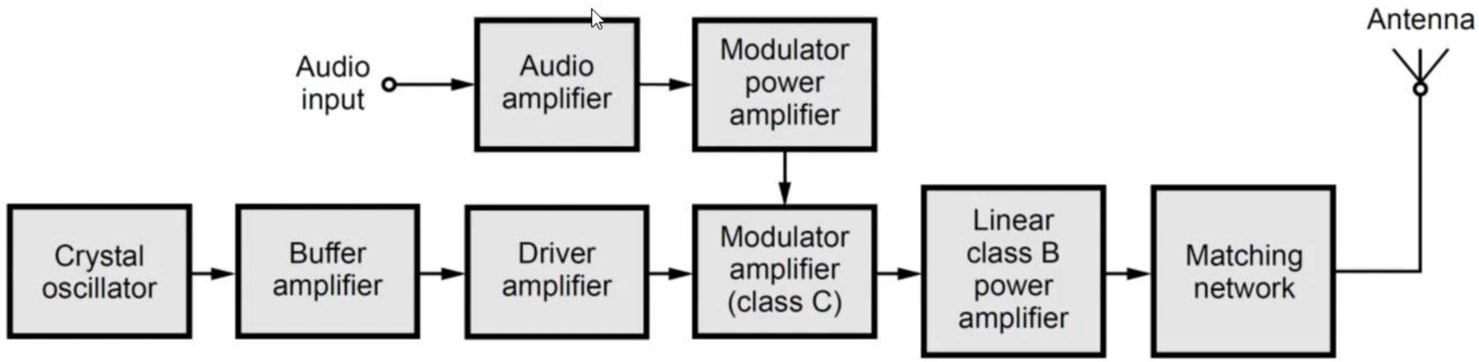
High Level Transmitter



High level AM transmitter block diagram

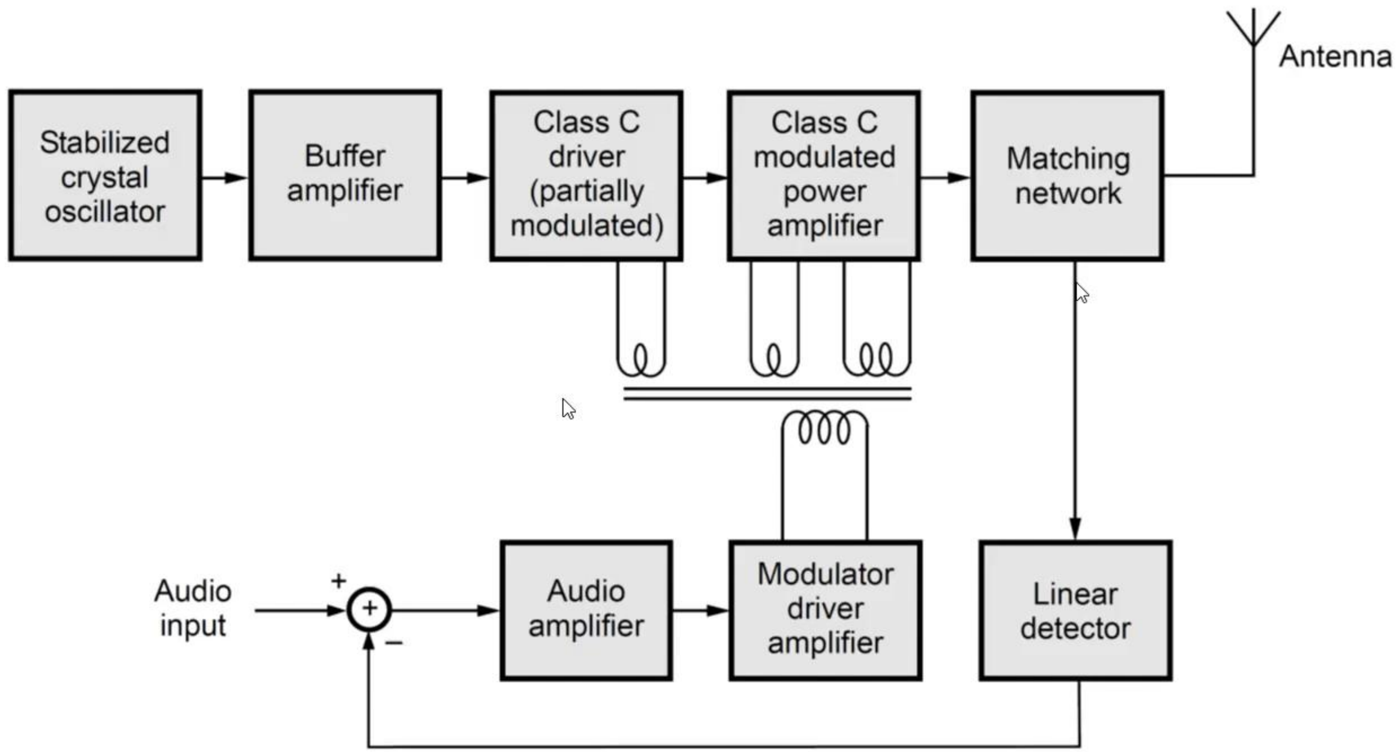
Low Level Transmitter

Fig. shows *Low level* modulated AM transmitter block diagram. In this block diagram, observe that a linear class B power amplifier is used after class C modulator amplifier. The linear class B power amplifier performs the major power amplification and feeds the amplified AM signal to antenna. In this block diagram, the modulator amplifier performs modulation at relatively low power levels. Hence this is called low level modulated AM transmitter. The modulated AM signal is amplified by class B power amplifier to avoid distortion in the output.



Low level modulated AM transmitter block diagram

AM Broadcast Transmitter using Partially Modulated Driver Stage



AM broadcast transmitter using partially modulated driver stage

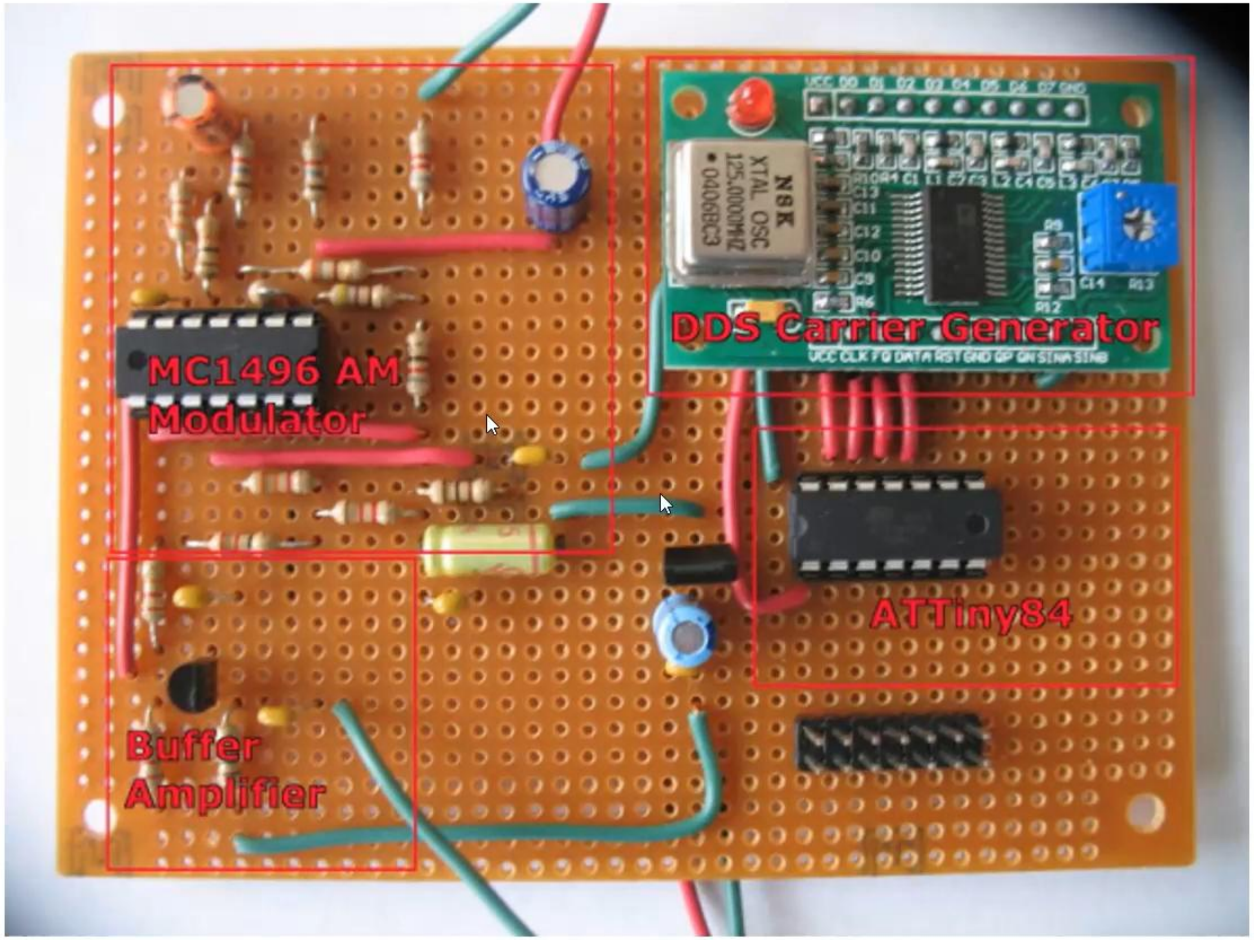
Fig.   shows the block diagram of AM broadcast transmitter. The crystal oscillator generates carrier signal. The buffer amplifier raises the power level of this carrier. The driver stage is class C modulator amplifier. It is partially modulated. This signal is further modulated at high power levels by class C modulated power amplifier. This type of modulation has two advantages -

i) If one or more tubes in main amplifier fails, the driver stage still provides modulated output which can be transmitted. This avoids total shut down of transmitter.

ii) The total power is distributed in driver and main amplifier.

The audio modulating signal is amplified and fed to modulator driver amplifier. This modulating signal is coupled to class C driver and modulator through transformer coupling. The part of transmitted signal is demodulated by the linear detector and given as feedback to audio amplifier. This negative feedback linearizes the modulation characteristic.

Figure (a) shows the block diagram of a typical AM transmitter. The carrier source is a crystal controlled oscillator at the carrier frequency or a submultiple of it. This is followed by a tuned buffer amplifier and a tuned driver, and if necessary frequency multiplication is provided in one or more of these stages.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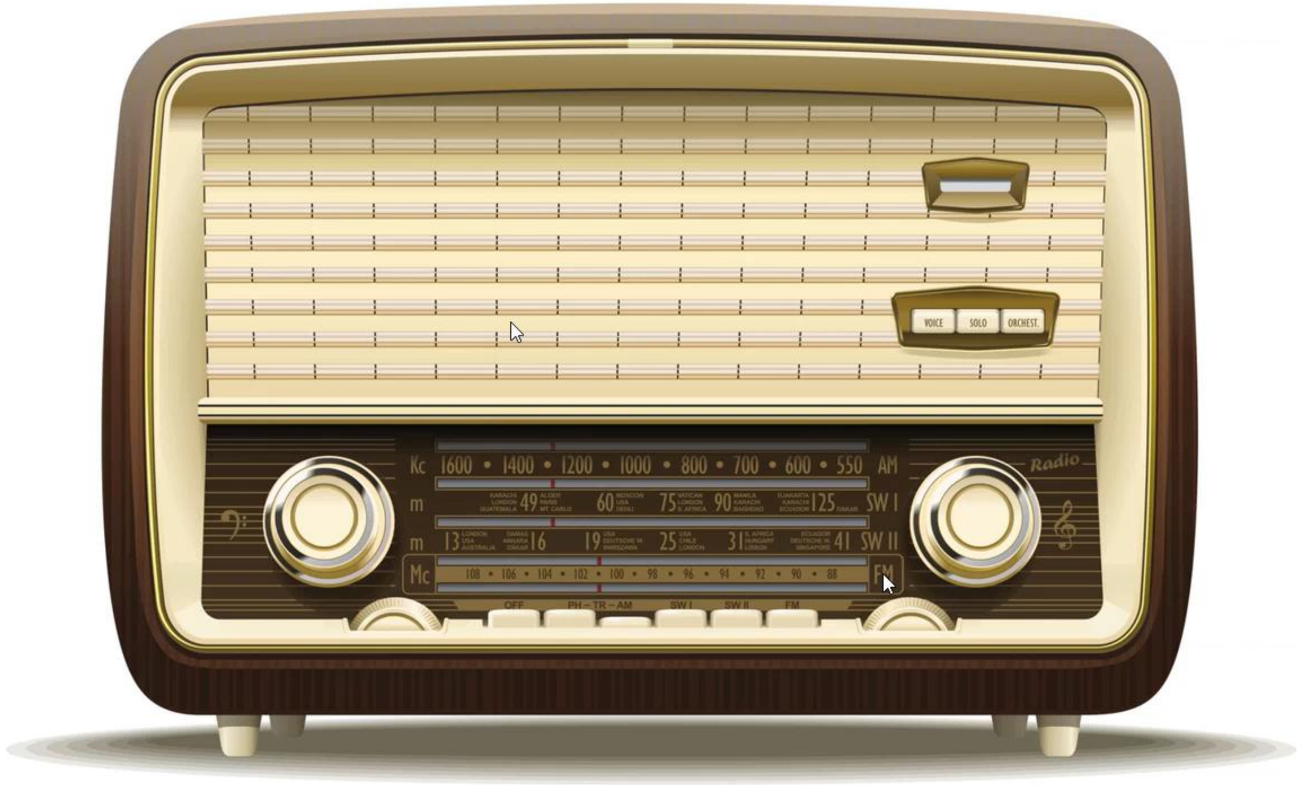
Modulator
DDS Carrier Generator
ATTiny84
Buffer
Amplifier


VOICE
SOLO
ORCHEST.
Radio
Kc 1600 • 1400 • 1200 • 1000 • 800 • 700 • 600 • 550 AM
SW I
SW II
Mc
FM

AM Broadcast Transmitter Description

Most domestic AM broadcast services use the medium-wave band from 550 to 1600 kHz. International AM broadcasts take place in several of the HF bands scattered from 1600 kHz up to about 15 MHz. The mode of transmission in all cases is double-sideband full carrier, with an audio baseband range of 5 kHz. Station frequency assignments are spaced at 10 kHz intervals, and power outputs range from a few hundred watts for small local stations to as much as 100 kW in the MW band and even higher for international HF transmitters.

A main requirement of an AM broadcast transmitter is to produce, within the limits of the 5-kHz audio bandwidth available, the highest possible fidelity. The modulator circuits in the transmitter must produce a linear modulation function, and every trick available is used to accomplish this. A typical AM broadcast transmitter is shown in Fig. The crystal oscillator is temperature-controlled to provide frequency stability. It is followed by a buffer amplifier and then by tuned class C amplifiers that provide the necessary power gain to drive the final power amplifier. For high power output, vacuum tubes would be used as described next. The modulator system is the *triple equilibrium* system, in which the main part of the modulation is performed by plate-modulating the final class C power amplifier. Secondary modulation of both the final grid and the plate of the driver stage is also included to compensate for bias shift in the final amplifier that results from the nonlinear characteristic of the amplifier.

The final power amplifier is a push–pull parallel stage in which each side of the push–pull stage is composed of several vacuum tubes operating in parallel, to obtain the power required. A further advantage of this system is that, if one or more of the tubes in the system should fail, the remaining tubes will provide partial output until repairs can be made, thus making a more secure system. Power dissipation in these final tubes can be as high as 50 kW, in addition to several kilowatts of heater power. Water cooling systems are used to dissipate the large quantities of heat produced.

The modulator amplifier is an audio-frequency push–pull parallel amplifier, which is transformer-coupled to the modulator. The audio preamplifier stage includes a difference amplifier and an envelope detector that demodulates a sample of the transmitter output and uses the signal to provide negative feedback. This feedback further linearizes the modulation characteristic of the system.

Antenna systems for AM transmitters are large and usually must be located at some point remote from the studio operations. All the studio signal operations are performed at relatively low levels and transmitted to the main transmitter location, either over telephone wire lines or a radio link such as a microwave system.