equipment. Larger tubes or transistors must be used that are capable of dissipating the additional heat generated.

The output of the final amplifier is passed through an impedance-matching network that includes the tank circuit of the final amplifier. The Q of this circuit must be low enough so that all the sidebands of the signal are passed without amplitude/frequency distortion, but at the same time must present an appreciable attenuation at the second harmonic of the carrier frequency. The bandwidth required in most cases is a standard 3 dB at ± 5 kHz around the carrier. For amplitude-modulation broadcast transmitters, this response may be broadened so that the sidebands will be down less than 1 dB at 5 kHz where music programs are being broadcast and very low distortion levels are desired, or special sharp-cutoff filters may be used. Because of the high power levels present in the output, this is not usually an attractive solution.

Negative feedback is quite often used to reduce distortion in a class C modulator system. The feedback is accomplished in the manner shown in Fig. 8.12.1(c), where a sample of the RF signal sent to the antenna is extracted and demodulated to produce the feedback signal. The demodulator is designed to be as linear in its response as possible and to feed back an audio signal that is proportional to the modulation envelope. The negative feedback loop functions to reduce the distortion in the modulation.

AM Broadcast Transmitters

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. 8.12.2. 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