MODULATION SYSTEMS FOR AMPLITUDE MODULATION

By the time commercial broadcast transmtters came to market the preferred method of modulation was by the original Heising (AT&T) patent. The modulation factor attainable by this method with acceptable modulation quality was less than 80% and 60% may be taken as a typical value. The amplifier (or oscillator is earliest times) and the modulator were in series fed from the same anode source.

By putting a dropping resistor with a very low reactance (capacitive) in parallel, both in series with the PA dc feed but beyond the modulator, the PA plate voltage could be reduced to equal the peak audio output from the modulator, thus getting 100% modulation but with a loss of efficiency overall. This method was prohibitive at high powers, but acceptable at low power. This was the method used as a modulated exciter when the class-B linear amplifiers began to be used (1928) for high power broadcast transmission. The RCA 5-B modulated at the ¼ kw level followed by a 5 KW linear amplifier. This in turn became the exciter for the 50 WK linear amplifier (RCA 50-B). Other companies at the time followed the same principle.

About 1936 Wm. Doherty of Bell Telephone Labs. invented a clever circuit known as the high efficiency linear amplifier. At unmodulated carrier output, the PA efficiency became 55-60% instead of the former 30-35% with Class-B linear. A modification of this circuit was used in the RCA-50-D transmitter, 1937; and Western Electric transmitters also used it. By this means, the total power input to a complete 50-KW transmitter without modulation came down from 220 KW to around 180 KW.

During these same years experience of importance was being gained with the application of the Loy E. Barton patent by returning to direct anode modulatio of the final power amplifier with the modulator operating in balanced Class-B mode, using transformer coupling to the power amplifier. In fact, this method was used in the RCA-500 KW transmitter in 1936. It had been used successfully in lower power transmitters since about 1933.

The sales popularity of the Doherty principle faded rather rapidly and we all were back to Class-B high-level modulation in many succeeding designs until around 1952 when RCA, influenced by the Marconi Co. in England's venture, turned to the old (Ca. 1926) Chiriex (France) outphasing modulation system and applied it to the RCA 50-G 50 KW transmitter; also to several 100 KW high frequency broadcast transmitters. The outphasing modulation system eliminated all high power audio equipment, including the expensive modulation transformer. Marconi never marketed their outphasing modulation equipment but RCA developed the technique to high acceptability. Its main advantage was that the input to the 50-KW transmitter with unmodulated carrier came down to 145 KW.