IX. MODULATION THEORY AND SYSTEMS

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A. FM RECEPTION WITH COHERENT INTERFERENCE AND RANDOM NOISE

A preliminary experimental investigation was conducted to examine the behavior of a feedforward signal-cancellation system under conditions of interference from random noise and interference from noise plus a coherent signal. The main purpose was to determine whether or not interference from a weaker or a stronger coherent cochannel signal in an FM system could be suppressed with a feedforward circuit without increasing the vulnerability of the system to random noise.

The capture performance of the experimental receiver is illustrated in Fig. IX-1. Measurements were made by establishing a fixed signal input level to the system, injecting random noise of controllable level, and observing the effects of different input S/N ratios on the demodulator output for various circuit adjustments.

When the feedforward circuit was adjusted for best capture of the stronger of two

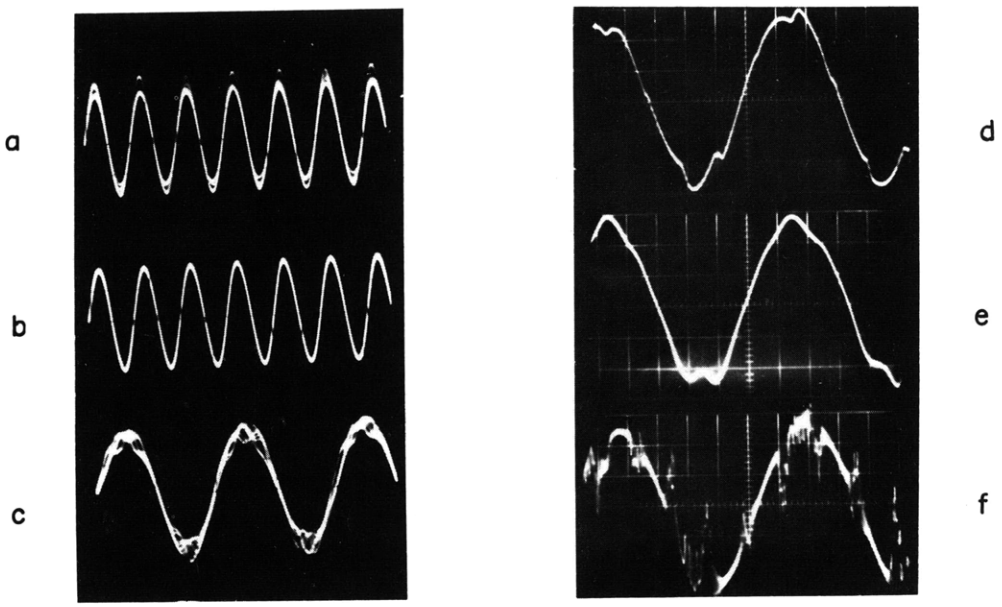

Fig. IX-1. (a) Detected stronger-signal modulation with interference from weaker signal, with no feedforward. (b) Detected stronger-signal modulation, with feedforward adjusted for stronger-signal capture. (c) Detected weaker-signal modulation, with feedforward adjusted for weaker-signal capture (a=0.7). (d), (e), and (f) Detected weaker-signal modulation (a=0.6) after being passed through: 750-μsec de-emphasis filter (d); 750-μsec de-emphasis filter plus a 3-kc lowpass filter (e); and 7.5-μsec de-emphasis filter (f). Notice details of the capture-transition distortion in (f).

cochannel coherent signals, the random-noise performance of the system was not noticeably affected by the introduction of the feedforward amplifier. This result agrees with Helgesson's theoretical results (1).

When the feedforward circuit was adjusted for best capture of the weaker of two cochannel coherent signals, the random-noise performance of the system was not noticeably affected by the introduction of the feedforward amplifier, although theoretical predictions indicate that deterioration could be expected if the input noise level is sufficiently high. This experiment has shown conclusively that an FM signal can be captured in the presence of a stronger cochannel interfering signal plus a moderate amount of random noise, even when the input weaker-signal is at or below the random-noise threshold.

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References

1. A. L. Helgesson, Signal-to-noise ratios in a limiter with feedforward, Quarterly Progress Report No. 56, Research Laboratory of Electronics, M.I.T., Jan. 15, 1960, p. 113.