

IX. MULTIPATH TRANSMISSION

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A. SUPERREGENERATIVE FM DETECTION

A study was made of a single-tube superheterodyne superregenerative circuit that detects FM signals by slope tuning. The circuit is commercially known as the Fremodyne detector. An attempt was made to bring out its basic limitations and to prescribe a systematic procedure for its analysis and design. Standard computations were made and measurements were carried out on a low-frequency model of the commercial circuit. The following conclusions were checked. Although cheap, mildly sensitive, and possessed of a good superregenerator design, the circuit suffers from basic limitations. It is highly sensitive to random noise. The discriminator action is unbalanced. The FM-to-AM conversion efficiency is very poor, although better than that usually achieved by a comparable parallel-tuned circuit. The inherent amplitude limiting qualities of the circuit (logarithmic limiting) are not of sufficient caliber to meet any but the very weakest interferences. The circuit has virtually no significant capture qualities, aside from its relative insensitivity to impulsive interferences.

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B. A SYNCHRONIZED FM DETECTOR

An experimental study was made of the circuit shown in Fig. IX-1. The oscillator and input signals are mixed and fed through a lowpass filter to extract the difference frequency component. This component, essentially a dc term, biases the reactance tube in such a way that it locks the oscillator to the frequency of the input signal.

Under proper conditions, the oscillator frequency is linearly controlled by the signal that is fed into the reactance tube. Let E_{dc} be the incremental dc voltage impressed upon the reactance tube. Assuming a linear reactance tube, this voltage will cause a susceptance jKE_{dc} across the oscillator tank circuit. In the neighborhood of resonance of the tank circuit, the change of admittance for small deviations in frequency is $j2C\Delta\omega$.

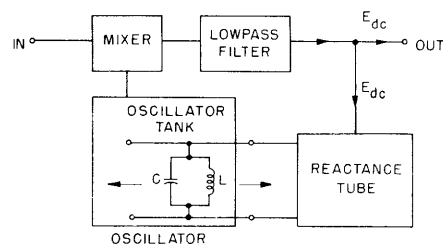


Fig. IX-1

Block diagram of synchronized FM detector.

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For proper oscillator locking we must have jKE_{dc} equal to $j2C\Delta\omega$

or

$$E_{dc} = \frac{2C}{K} \Delta\omega$$

Proper operation is dependent upon the design of a reactance tube circuit that will be linear in a way that insures that K is a constant in the equation given above.

It was found that this basic unit lacks two important prerequisites of a good FM detector: a wide, linear bandwidth and insensitivity to the amplitude modulation of the input signal. An ultra linear reactance tube circuit would solve the first consideration. Though a conventional limiter can be employed to eliminate AM problems, it is believed that a study of the characteristics of a class C multiplier might reveal that with appropriate overdriving and grid biasing, the tube could be made to act as its own limiter.

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