

XIV. NOISE IN ELECTRON DEVICES*

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RESEARCH OBJECTIVES

We shall continue development of the theory and practice of ultralow noise mixers. Recent theoretical developments, together with some experimental evidence, indicate that balanced mixers are fundamentally different from single-ended (one-device) mixers. Some of the fundamental limits on balanced mixer performance have been developed and indicate, for example, that properly operated, high-quality, Schottky-barrier diodes should be capable of giving noise figures in balanced mixers commensurate with those obtainable (at the same frequency with the same diodes) in an uncooled parametric amplifier.

Experimental circuits are being constructed, according to the new theory, at 300 MHz, 3 GHz, 7 GHz, and 60 GHz. Conversion losses and noise figures expected at 300 MHz and 3 GHz are below 1 db; at 7 GHz we expect to realize less than 3 db, and at 60 GHz less than 5 db. Unanswered problems of bandwidth and optimum local-oscillator source impedance (including harmonics) will receive experimental and theoretical attention during the design of the various mixers. At the same time, experimental and theoretical evidence will be sought to determine the fundamental limits placed by p-n junction theory on the ability of the p-n junction to be driven as a square-wave switch at microwave frequencies.

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