Abstracts

Transistor Oscillators with Impedance Noise Matching

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In the past noise optimization of HF and microwave transistor oscillators has usually been achieved experimentally. In this work a theory is derived which makes it possible to predict the carrier-to-noise ratio of a transistor oscillator with real components depending on parameters of the active element and the oscillator circuit which can be easily measured. The theory leads to new aspects of low-noise oscillator design which include the use of a multiple-stage active element and an impedance condition for noise matching. In this context the conditions for the use of GaAs FET's in low-noise oscillators are investigated. A consequent application of this theory in the design of oscillators can improve the carrier-to-noise ratio substantially. According to examples shown in this paper, an improvement of more than 50 dB may be reached over a nonoptimized oscillator. A verification by measurement has been made for seven single-transistor oscillators around 150 MHz. The measured values of the carrier-to-noise ratio show very good agreement with the values derived from theory. The differences between measured and calculated values are smaller than the measurement uncertainty of 3 dB.

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