Abstracts

Theoretical and Experimental Studies of Gain Compression of Millimeter-Wave Self-Oscillating Mixers

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A general theory for a heterodyne Gunn self-oscillating mixer is developed to explain the experimentally observed phenomenon of "beat output power compression," i.e., an increase of down conversion gain with a decrease of millimeter injected power. Adler's general differential equation has been used, with some pertinent modifications and proper boundary conditions. This differential equation has been modified to allow the self-oscillating mixer to be frequency modulated. The solution of the new equation has been obtained through a perturbational technique, where the frequency of the self-oscillating mixer is assumed to be outside the locking range of the injected signal. The theory has been based on the fact that, owing to the bias perturbation of the (voltage tunable) self-oscillating mixer, the oscillator is modulated, both in amplitude and in angle. The functional dependence obtained depends, primarily, on the order of magnitude of the "induced" frequency of modulation. This semi-quantitative theory agrees quite well with experiments performed with both InP and GaAs Gunn diodes in the frequency range 75-100 GHz.

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