Abstracts

Frequency Multiplication by a P-I-N Diode when Driven into Avalanche Breakdown

P.L. Ntake and D.R. Conn. "Frequency Multiplication by a P-I-N Diode when Driven into Avalanche Breakdown." 1975 Transactions on Microwave Theory and Techniques 23.6 (Jun. 1975 [T-MTT]): 477-485.

An investigation of frequency multiplication using a step-recovery diode (SRD) driven into avalanche breakdown is presented. This mode of operation, which is called the "breakdown mode," consists of a reverse-biased p-n junction, SRD, or IMPATT diode driven into reverse breakdown by an ac signal source. As the diode voltage passes from reverse bias to reverse breakdown and avalanche, the state of the diode switches quickly from a depletion-layer capacitance to an avalanche inductance; hence the production of strong harmonics. A theoretical analysis and experimental investigation of a coaxial/waveguide 2-6-GHz frequency multiplier using HP5082-0320 step-recovery diodes, [R/sub s/ = 0.75 Omega, C/sub d/(-6v) = 1.0 pF] shows that the breakdown-mode frequency multiplier has a higher conversion efficiency than the conventional "charge-storage" multiplier. A measured conversion efficiency of 73 percent was achieved while the same circuit configuration produced 52 percent for the same diode used as a charge-storage multiplier under optimum forward-drive and tuning conditions. Also the theory developed in this paper indicates a maximum possible conversion efficiency of 80 percent for the breakdown-mode multiplier, which corresponds closely with the measured results, and a maximum theoretical efficiency for a forward driven diode of 64 percent. The performance of an FM microwave system was monitored using the breakdown multiplier as a LO in which a baseband SNR of 59 dB was recorded.

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