Abstracts

Conversion Gain and Noise of Niobium Superconducting Hot-Electron-Mixers

H. Ekstrom, B.S. Karasik, E.L. Kollberg and K.S. Yngvesson. "Conversion Gain and Noise of Niobium Superconducting Hot-Electron-Mixers." 1995 Transactions on Microwave Theory and Techniques 43.4 (Apr. 1995, Part II [T-MTT] (Special Issue on Space Terahertz Technology)): 938-947.

A study has been done of microwave mixing at 20 GHz using the nonlinear (power dependent) resistance of thin niobium strips in the resistive state. Our experiments give evidence that electron-heating is the main cause of the nonlinear phenomenon. Also a detailed phenomenological theory for the determination of conversion properties is presented. This theory is capable of predicting the frequency-conversion loss rather accurately for arbitrary bias by examining the I--V-characteristic. Knowing the electron temperature relaxation time, and using parameters derived from the I--V-characteristic also allows us to predict the -3-dB IF bandwidth. Experimental results are in excellent agreement with the theoretical predictions. The requirements on the mode of operation and on the film parameters for minimizing the conversion loss (and even achieving conversion gain) are discussed in some detail. Our measurements demonstrate an intrinsic conversion loss as low as 1 dB. The maximum IF frequency defined for -3-dB drop in conversion gain, is about 80 MHz. Noise measurements indicate a device output noise temperature of about 50 K and SSB mixer noise temperature below 250 K. This type of mixer is considered very promising for use in low-noise heterodyne receivers at THz frequencies.

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