Abstracts

Measurements of Noise in Josephson-Effect Mixers

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We present new heterodyne receiver results obtained at 100 GHz using resistively-shunted Nb and NbN tunnel junctions. In addition, we have carried out accurate measurements of the available noise power of these devices at the L-band (1.5 GHz) IF frequency. Both the heterodyne and the output noise measurements show that the noise of these devices can be a factor of five or more higher than that predicted by the simple current-biased RSJ model. The noise approaches the appropriate thermal or thermal and shot noise limits for bias voltages where the nonlinearity is not strong (i.e., V > I/sub C/R/sub N/), but as expected from the RSJ model, can be significantly higher at the low voltages where the mixers are typically biased. The bias voltage dependence of the noise shows structure which is associated with resonances in the RF embeddhg circuit. Surprisingly, we find that changes in the high-frequency (100 GHz) impedance presented to the junction can dramatically affect the magnitude and voltage dependence of the low-frequency (1.5 GHz) noise. This emphasizes the necessity of very closely matching the junction to free space over a wide frequency range.

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