ALL-NbN SIS MIXERS USING A TUNING CIRCUIT WITH TWO HALF-WAVELENGTH DISTRIBUTED JUNCTIONS

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Abstract A tuning circuit with two half-wavelength distributed junctions has been tested in quasi-optical mixers using epitaxial NbN/MgO/NbN trilayers at frequencies above 700 GHz. The tuning circuit consisted of two half-wavelength distributed NbN/MgO/NbN tunnel junctions connected in parallel by a half-wavelength NbN/MgO/NbN microstrip line at a design center frequency of 870 GHz. The circuit was connected to the feed point of a center-fed twin-slot antenna by a quarter-wavelength impedance transformer. The mixer chips were installed in our quasi-optical receiver system and their performances were measured. Preliminary results showed double-side-band receiver noise temperatures of 6-9 hf/k_B from 675 to 810 GHz for a mixer with the current density of only 6 kA/cm^2 (estimated $\omega C_J R_N$ product was about 30 at 750 GHz). The RF bandwidth was broader than that of a conventional full-wavelength distributed SIS mixer with the same current density. We are now redesigning and fabricating all-NbN SIS mixers to improve the performance at higher frequencies.

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