

## A Fixed Tuned Broadband Matching Structure for Submillimeter SIS Receivers

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We have designed, fabricated and tested a quasi optical spiral antenna mixer with a Nb/AlO<sub>x</sub>/Nb tunnel junction. This design incorporates a hybrid antenna fed by a planar logarithmic spiral antenna to couple to the radiation field, as previously done with Pb based devices, as well as a newly designed matching circuit. This matching circuit is a relatively complex structure requiring several layers of photolithographic processing on top of the actual tunneling device. Computer modeling of the device predicted the measured bandwidth to within 8%, making scale model measurements unnecessary. We have obtained a good match from 210 GHz to 460 GHz between the antenna and a relatively large area (1.25 by 1.25 μm<sup>2</sup>) tunnel junction with  $\omega R_N C \approx 2 - 4.4$ . This compares to simple inductive stubs that attain only a few percent of total bandwidth in the submillimeter band or inductively tuned SIS arrays with an upper limit of operating frequencies well below the submillimeter band. Noise temperatures were measured at 345 GHz, 426 GHz and 492 GHz yielding double sideband noise temperatures at 200 K, 220 K and 500 K, respectively.

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