

QUANTUM-LIMITED MIXING IN A TRANSFORMER-COUPLED SIS RESONATOR FOR THE 600 GHz FREQUENCY BAND

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Transformer-coupled full-wave Superconductor-Insulator-Superconductor (SIS) resonators have already been used in low-noise receiver development in the 600 – 700 GHz frequency range [1]. In this paper, we report quantum-limited sensitivity with this type of mixer. Our mixer design employs a single full-wave Nb/AlN/Nb tunnel junction, fed by a quarter-wave transformer with niobium wiring layer. The devices have been fabricated using e-beam lithography and their target dimensions are 0.5 x 25 μm . These junctions have fairly low critical current density. The measured RnA product is around 40 ohms- μm^2 . The mixer chip is installed in our fixed-tuned waveguide mixer mount. Double-side-band receiver noise temperatures of $4 - 6 hf/k$ have been measured in the frequency range 580 – 720 GHz for a number of different devices. In one device, a Y-factor of 2 was recorded at an LO frequency of 700 GHz. These devices also have fairly wide RF bandwidth: the noise temperature of one mixer remains below 200 K over the frequency range of 580 – 690 GHz. The details of design will be discussed in our presentation.

[1] T. Matsunaga, C.-Y. E. Tong, T. Noguchi, R. Blundell, “Fabrication and Characterization of a 600 GHz Resonant Distributed SIS Junction for Fixed-tuned Waveguide Receiver”, Proc. 12th Int. Sym. Space THz Tech. pp. 571-580.