

1.4 THz SIS mixer using Nb and Al tuning circuit

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Abstract

The 1.4 THz SIS mixer is prepared for a heterodyne spectrometer CASIMIR aimed for the stratospheric observatory SOFIA. One of goals of this work is to supply a low noise spectrometer for the studies of the H₂D⁺ 101 - 000 line around 1370 GHz.

We report on the development of a new version of a THz band SIS mixer. In order to reduce the loss in the matching circuit of the mixer we are using Nb/Al microstrip circuit with the Silicon dioxide dielectric layer. The low loss in the circuit using SiO₂ dielectric layer should provide a significant improvement compared to the previously used mixer circuits with SiO dielectric. The mixer is using a quasi optical design in order to couple the SIS junctions with the telescope beam. The mixer chip with a planar double-slot antenna is mounted at the back side of a Silicon lens. The SIS junction normal resistance to the area product RNA is about 6 Ohm per micron square. At the target frequency of about 1.4 THz the on-chip coupling is expected to be better than 70%. With this level of the circuit loss the expected receiver noise may be close to 4-5 hv/k. The receiver design bandwidth is 1300 – 1500 GHz, about 200 GHz wide.

The mixer test with SiO and SiO₂ dielectric in the circuit will be reported.

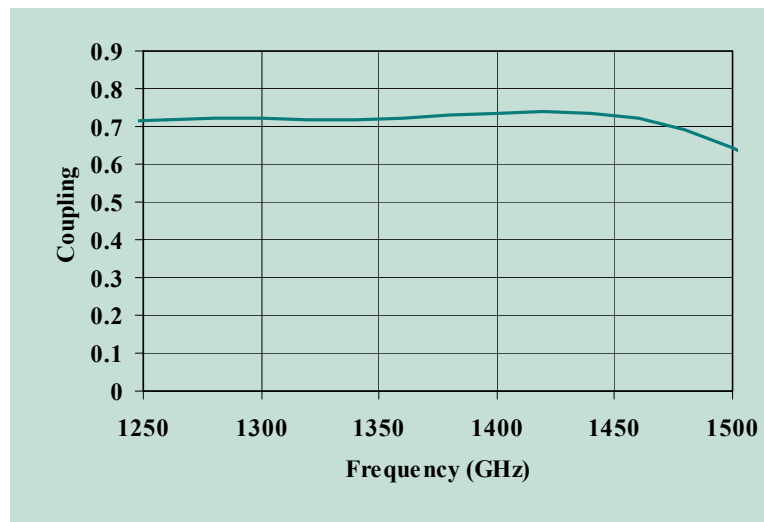


Figure 1. The expected SIS mixer coupling to the signal source in the 1.3-1.5 THz range is better than 70%.