AN IMPROVED 1 THZ WAVEGUIDE MIXER.

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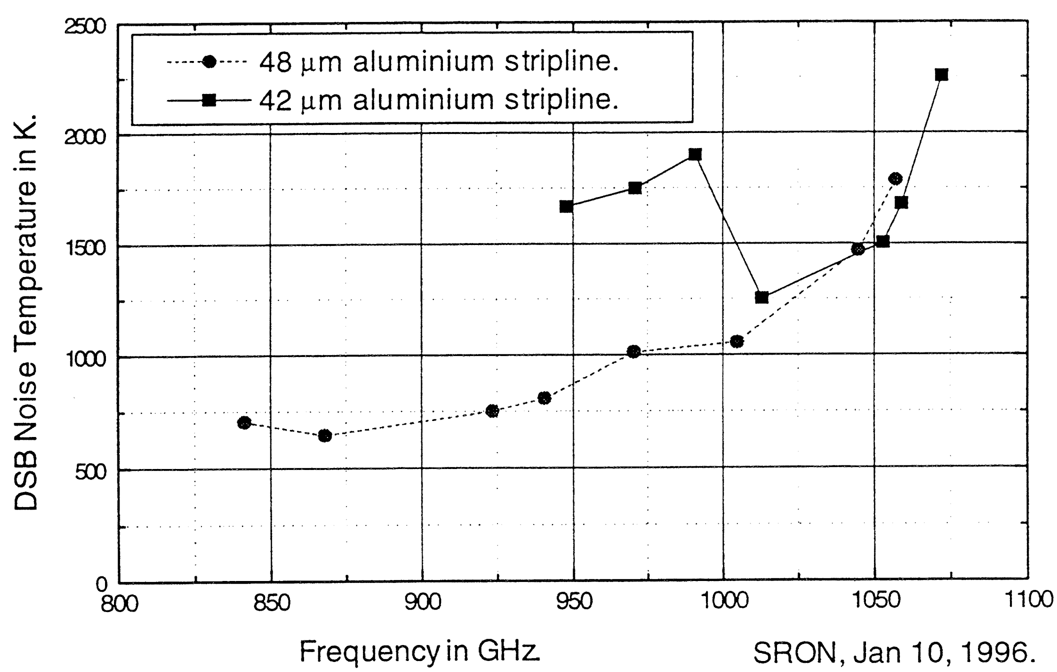
In our experiments we use a classical waveguide mixer with a diagonal horn, a contacting, adjustable backshort and 95 x 190 and 90 x 75 μm^2 crosssections of waveguide and substrate channels, as described in [1]. Measured DSB noise temperatures have recently been improved due to better optical coupling and improved fabrication processes. Results are given in the figure below for two junctions with different length of microstrip lines. The data are corrected for the reflection losses of our 20 μm thick mylar beamsplitter. No correction for the Planck radiation law has been applied. As an example we mention that the Y-factor for 1005 GHz was measured to be 0.58. This corresponds to an uncorrected DSB noise temperature of 1460 K and a corrected value of 1055 K.

1.0 THz waveguide mixer at 4.2 K.



Nb SIS junctions of 1 μm^2 area on fused quartz substrates are used with tuning elements made of aluminium. The tuning consists of 10 μm wide, so-called end-loaded microstriplines of different lengths. Above the gap frequency of Nb (700 GHZ) the use of normal metals provides lower losses than the use of Nb. First results at high frequencies with striplines made of aluminum were reported in ref [1], and their use is now reported by several other groups [2,3] as well. The present results are improved with respect to the previous ones by using optical elements (dewar window, heat filter and lens) with higher transmission. Another improvement is the application of evaporated aluminium instead of sputtered aluminium. This may reduce the loss due to a decrease of the surface impedance of the stripline. In both cases we apply a thin Nb layer underneath the bottom Al layer as well as on top of the upper Al layer in order to decrease the series resistance seen by the DC and IF signals.

As local oscillator (LO) we use two Backward Wave Oscillators (BWO's), one tunable from 840 to 940 GHz, the other from 927 to 1085 GHz. The increase in Noise temperature above 1060 GHz is partly because of the limited bandwith of our tuning circuit, but also because of strongly increasing atmospheric absorption due to water vapour lines at frequencies of 1097, 1113 and 1154 GHz.

A paper with more detailed information is in preparation.

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References:

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[3] M. Bin et al. "THz SIS Mixers with Normal Metal Al Tuning Circuits", Extended Abstracts of the Intl. Superconductive Electronics Conf. (ISEC '95), September 1995, Nagoya, Japan.