

## Latest Noise Temperature Measurements of p-HEB Mixer

585 GHz p-HEB Mixer on Ultra-Thin Si with Beam Leads  
Designed and Built by Robert B. Bass

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Our work using the SSNaPS process to fabricate HEB mixers builds upon earlier research on ultra-thin Si HEB mixer technology. Robert Bass designed and built our first set of mixers, using e-beam lithography to pattern the nanoscale features. His revolutionary combination of ultra-thin Si, beam leads, and HEBs has led the way to our current developments in this field. Recently, collaboration with the National Radio Astronomy Observatory (NRAO) has produced encouraging noise temperature test results for these early devices. Devices were tested in a custom designed waveguide block, cryogenically cooled to helium temperature in a cryostat, and tested with a Gunn diode source.

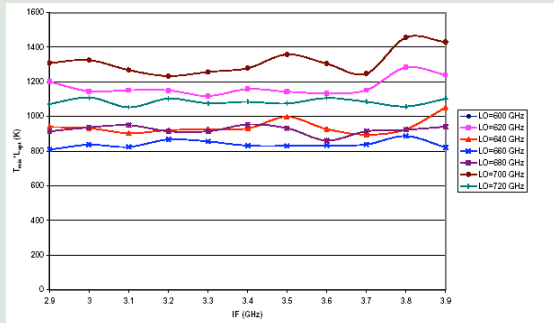


Fig. 1. Measured receiver noise temperature with measured IF noise temperature contribution removed. To find intrinsic mixer noise temperature, the loss of the optics in front needs to be known or estimated.

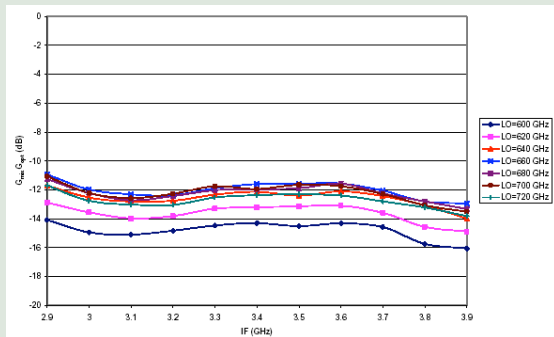
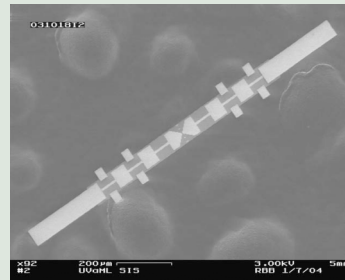


Fig. 2. Measured conversion gain of mixer and optics (IF contribution removed).



The ultra-thin (3 μm) Si mixer with integrated beam leads, incorporating a phonon-cooled HEB fabricated using e-beam lithography.

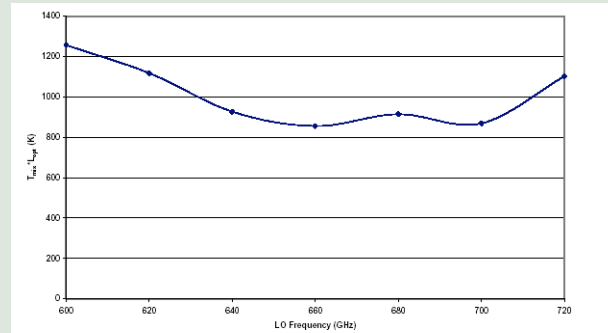


Fig. 3. Measured receiver noise temperature (with IF contribution removed) as a function of LO frequency at IF=3.3 GHz. (Martin-Pulpett interferometer was tuned for this IF.)

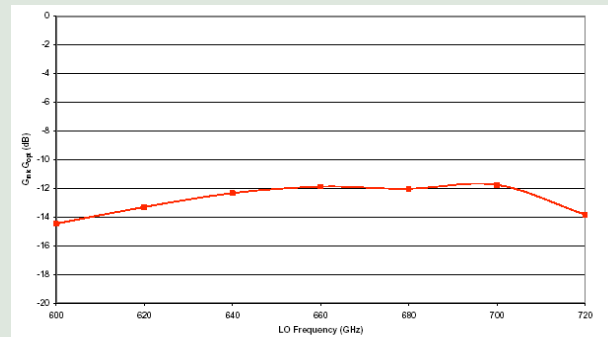


Fig. 4. Measured conversion gain of receiver (with IF contribution removed) at IF=3.3 GHz.

Robert B. Bass was with the Department of Electrical and Computer Engineering at the University of Virginia in Charlottesville.  
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