Wide Band Fixed Tuned and Tuneable SIS Mixers For 230 GHz and 345 GHz Receivers

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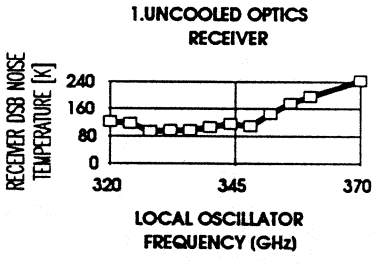
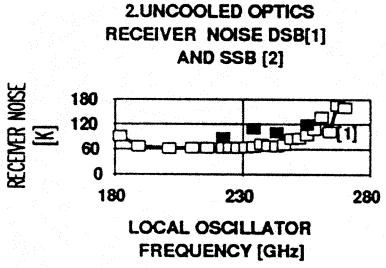
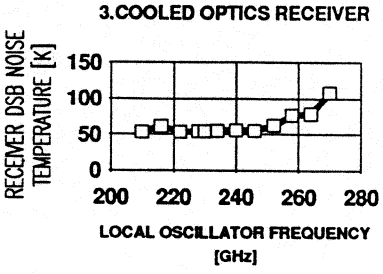
Single backshort waveguide mixers using SIS junctions have been developed for radioastronomy in the 180-270 GHz (1.3mm) and 300-370 GHz (0.8mm) bands. They use a series array of two Nb/Alox/Nb junctions. Parallel inductive tuning with quasi-lumped elements is optimized and allows to use the same junction area and current density for the submillimetre wavelength as for the millimetre band. Experimental measurements agree with model predictions. In particular, the same mixer can be used either in fixed-tuned, DSB mode, having an instantaneous bandwidth covering most of the band, or tuned to image-rejection (SSB) mode at each frequency.

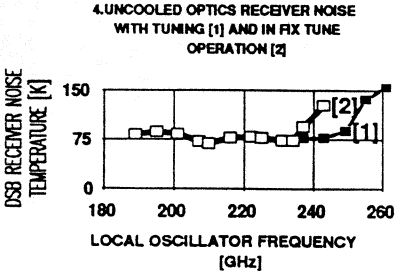
The DSB receiver noise temperature of the 0.8 mm mixer (measured with room-temperature optics) is about 95K in the 330-340 GHz band, and remains below 120K in the 320-350 GHz band (Fig. 1). For the 1.3 mm mixer, the receiver noise temperature is about 65K in the 190-245 GHz band (Fig. 2). Using cold optics and LO injection through a cold waveguide coupler, the receiver temperature drops to 50K (Fig. 3). Fix-tuned operation is demonstrated in the 1.3 mm band: the DSB noise temperature is nearly the same as with tuning over most of the band (Fig. 4). According to the model moving the backshort away from the junction at the 6th backshort peak allows one to reject the USB by more than 15 dB (using a 4 GHz IF). The resulting SSB noise temperature is only 1.5 times the DSB value, showing a clear advantage over external filtering of the image band.

The present mixers operating in the 1.3 mm and 0.8 mm bands, are developed for operation on the 30-M IRAM radiotelescope at Pico Veleta in Spain. The first 1.3 mm mixer (Fig. 4) was installed in December 1992; the first telescope tests of the 0.8 mm mixer are planned in March 1993. New versions of both mixers are under development, with the aim of improving further frequency coverage in agreement with the atmospheric transmission windows.









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