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Title:The design of a 230GHz unilateral finline SIS mixer.
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Source title: Journal Terahertz & Technology
Volume:4
Publication year:2011
Pages:95-98
Document type:Journal Online
Abstract: We present the design and the testing results of a broadband Superconducting-Insulating-Superconducting (SIS) unilateral finline mixer operating across 185*GHz*~275*GHz*. The mixer will be employed by a single baseline interferometer [1](Gubbins -200*GHz* Ultra-BroadBand Interferometer for Sunyaev-Zel ' dovich), aiming to detect the Sunyaev-Zel'dovich effect [2][3] in bright galaxy clusters. A key feature of the design is the ultra-wide instantaneous bandwidth of 3-13 *GHz*. It provides heterodyne interferometeric operation with high brightness sensitivity, which enables the instrument to observe the continuous source precisely. The mixer chip has been carefully designed to present low parasitic reactance, in order to realize the wide IF bandwidth. A unilateral finline [4] has been used as the efficient transition between the waveguide mode and the slotline quasi-TEM mode over wide RF bandwidth. A direct coupling slotline-to-microstrip transformer is then used to couple the RF signal from the narrow slotline to the microstrip line, where the Nb-AlOx-Nb SIS junction is fabricated. A silicon substrate was chosen to decrease the impedance of the slotline. The material of silicon enables easier extraction of devices from the substrate, by creating trenches around the individual devices using RIE etching. The hot/cold measurement of the mixer gave a DSB noise temperature of 90*K* over the bandwidth 200*K*-250*K*. In this paper we shall describe the design of the mixer and report the experimental results.
Keywords: Heterodyne Detector, Unilateral finline, SIS junction