An SIS-based Sideband-Separating Heterodyne Mixer Optimized for the 600 to 720 GHz Band.

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Abstract **-** The Atacama Large Millimeter Array (ALMA) is the largest radio astronomical enterprise ever proposed. When completed, each of its 64-constituent radio-telescopes will include 10 heterodyne receivers covering the spectral windows allowed by the atmospheric transmission at ALMA's construction site, the altiplanos of the northern Chilean Andes. In contrast to the sideband-separating receivers being developed at low frequencies, double-sideband receivers are being developed for the highest two spectral windows (bands 9 and 10). Despite the well-known advantages of sideband-separating mixers over their double-sideband counterparts, they have not been implemented in the highest-frequency bands, because of the very small dimensions required for some of the radio frequency components. However, advances in state-of-the-art micromachining technology now allow the structures necessary for this development to be realized. Here we report the design, modelling, realization, and characterization of a sideband-separating mixer for band 9 of ALMA (600 to 720 GHz). At the heart of the mixer, two superconductor-insulator-superconductor junctions are used as mixing elements. The constructed mixer yields excellent performance as shown by two important figures of merit: the system noise temperature and the side band ratio, both of which are within ALMA specifications at most operating frequencies.

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