

Image Rejection Ratio of 2SB SIS Receivers

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A number of sub-mm sideband-separating (2SB) SIS (superconductor-insulator-superconductor) receivers have been developed in the past few years [1-6]. ALMA Bands 3 to 8 are equipped with receivers of this type. Image Rejection Ratio (IRR) is one of the key parameters of any 2SB mixer. Achieving IRR better than 10dB in total RF band is a challenging technical problem [1-4].

We have developed a 2SB SIS receiver for the frequency range 600-720 GHz (ALMA Band 9) [5] and found that IRR dependence on frequency is strongly determined by standing waves in the RF waveguide structure, which are caused by reflections from the SIS mixers and the RF absorption load. Analyzing results of different 2SB receivers [2-5] we find similar periodic structures in the IRR pattern.

Reduction of these standing waves, without modifying the RF and IF hybrids and SIS mixers, leads to significant improvement of IRR level. In this report we present an effective method to estimate the standing wave amplitudes in an operating receiver using the SIS junction properties. Moreover, we describe a mechanism of standing wave contribution to the final IRR. In addition, an investigation concerning IRR pattern in the ALMA Band 5 receiver will be presented.

References

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