

Performance of the ALMA Band 10 SIS Receiver Prototype Model

Yasunori Fujii, Matthias Kroug, Keiko Kaneko, Alvaro Gonzalez, Yoshinori Uzawa,
Takafumi Kojima, Koich Kuroiwa, Akihira Miyachi, Kazumasa Makise,
Zhen Wang, and Wenlei Shan, Member, IEEE

Abstract - We have developed a dual polarization prototype model of the Atacama Large Millimeter/submillimeter Array (ALMA) Band 10 (787–950 GHz) receivers. The front-end optics comprises a pair of ellipsoidal mirrors, a wire grid, and two corrugated feed horns. A waveguide mixer block is attached to each feed horn in which an NbTiN-based superconductor-insulator-superconductor (SIS) mixer chip is mounted to a WR-1.2 full-height waveguide. A local oscillator (LO) signal receiving horn and a waveguide 10-dB LO coupler are integrated in the block to provide the LO signal to the mixer chip. A fixed-tuned multiplier with a diagonal horn located at the 110-K stage is used to transmit the LO power. The LO signal is then quasi-optically coupled to the mixer receiving horn. A very wide intermediate frequency (IF) system with a bandwidth of 4–12 GHz is employed. The receiver demonstrated double sideband (DSB) noise temperatures of about 160 K (4 quanta) without any correction for loss in front of the receiver at the LO frequency of 834 GHz at an operating physical temperature of 4 K.

Index Terms - Atacama large millimeter/submillimeter array, niobium titanium nitride, SIS device (superconductor), submillimeter wave mixers, waveguide coupler.

IEEE/CSC & ESAS European Superconductivity News Forum (ESNF), No. 14, October 2010

The published version of this manuscript appeared in *IEEE Transactions on Applied Superconductivity* 21, Issue 3, 606 - 611 (2011)