SIS FOCAL-PLANE ARRAY RECEIVER FEATURING SIDEBAND SEPARATION MIXERS

Narayanan, G., Erickson, N. R., Grosslein, R. M.
, Deshpande, P., Fath, V.
Department of Astronomy, University of Massachusetts, Amherst, MA 01003

Abstract Submission Form

2006 National Radio Science Meeting

Abstract: narayanan18322

Date Received: September 18, 2005

A dual polarization 16-pixel heterodyne focal-plane array receiver is proposed to be built to operate in the 210 – 275 GHz ($\sim$ 1mm wavelength band) atmospheric window for use on the Large Millimeter Telescope (LMT). The LMT is a 50 m diameter millimeter-wavelength telescope being built in Mexico as a joint project between UMass and Instituto Nacional de Astrofisica, Optica, y Electronica (INAOE) in Mexico. Each pixel of the proposed focal-plane array receiver will feature SIS mixers operated in a novel sideband-separation mode with wideband low-noise IF amplifiers (4 – 12 GHz). In this paper, we will present design details, test results, and characterization of the components that make up the novel array mixer-block.

The array mixer-block is a highly integrated assembly, that has been optimized for use and integration into a 4×4 array. The heart of each pixel in the array is mixer-preamplifier (MPA) block. The MPA is a split-block machined component, that consists of a input RF 90° waveguide hybrid, a dual-directional LO coupler, two SIS junctions, two hybrid IF LNAs (Low-Noise Amplifiers) with a IF 3dB 90° Lange coupler interspersed between the stages. Two SMA outputs from the mixer block bring out the separated upper and lower sidebands. Two magnetic coils that are used to suppress Josephson noise are also embedded in this integrated mixer-preamplifier (MPA) block. A new hybrid IF LNA with a discrete JFET followed by a MMIC amplifier has been designed, fabricated and tested. The integrated IF LNA which is well-matched to the IF output of the SIS mixer eliminates the need for wideband cryogenic isolators. The integrated implementation of the IF Lange hybrid coupler between the stages of the hybrid IF LNAs considerably eases the amplitude and phase balance requirements of components in the rest of the IF chain.

1. (a)
   Gopal Narayanan
   Department of Astronomy
   Lederle GRC B628
   710 N Pleasant Street
   Amherst, MA
   01003 USA
   gopal@astro.umass.edu
   (b) 413-545-0925
   (c) 413-545-4223
2. J - Radio Astronomy
3. (a) S-J/B2
4. I - Invited Paper, Program chair: Chris Walker and Y. Rahmat-Samii
5. No special instructions