4 Kelvin cryogenic characterization of commercial pHEMT transistors at 9 kHz to 8.5 GHz range

Main author:

IBARRA-MEDEL Eduardo

Co-authors:

Ferrusca Daniel, National Institute of Astrophysics, Electronics and Optics

Gómez-Rivera Victor, National Institute of Astrophysics, Electronics and Optics

Ibarra-Medel Eduardo, National Institute of Astrophysics, Electronics and Optics

Velázquez Miguel, National Institute of Astrophysics, Electronics and Optics

Ventura Salvador, National Institute of Astrophysics, Electronics and Optics

Nowadays, the technology innovation in large format array detectors at low temperature for millimeter astronomy observations demands the development of electronics capable to keep their functionality at cryogenic temperatures. On kinetic inductance detectors (KIDs) the first stage of electronics readout requires high bandwidth low-noise amplifiers (LNA). These devices are commonly fabricated in monolithic microwave integrated circuit (MMIC) processes which commercially achieve a noise temperature level ~ 5 K. An alternative approach to the MMIC are the hybrid microwave circuit which mixes RF lumped elements and discrete electronic components.

This paper describes the characterization of six commercial pHEMT transistors tested at cryogenic temperatures. DC properties such as I-V curves and transconductance were measured for each transistor; these measurements allow us to calculate the best bias point vs gain, with lowest noise figure and power consumption within the range of 9 kHz to 8.5 GHz at the operating temperature of ~4 K. Experimental results suggest that the characterized pHEMTs have a noise figure that allows them to be used in a hybrid LNAs arrange with a comparable MMIC performance.