

LOW NOISE CRYOGENIC IF-AMPLIFIERS FOR SUPER HETERODYNE RADIOASTRONOMY RECEIVERS

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Abstract

As part of GARD instrumentation activities, a 3.4-4.6 GHz cryogenic low noise amplifier was developed and a 4-8 GHz LNA is under development. These amplifiers will be used as cold IF amplifier for mm and sub-mm wave receivers with SIS and HEB mixer. At the time of writing this abstract, the 2-stage 3.4-4.6 GHz amplifier was fabricated in 3 copies with very regular performance as follows: gain 28 dB with 2.5 K noise temperature at 12K ambient temperature (see details in the Plot A below) and the total power consumption can be adjusted in a wide range depending on the transistors used. The performance is very consistent with simulations and is believed to be among the best-reported using GaAs transistors [1]. By the time of the conference we will also present measurement results for the 4-8 GHz LNA, which is under assembling at the moment. Simulated results for it predict a noise temperature of 5 K with GaAs transistor, 1.5-3.5 K for InP transistors (Plot B). We will also present gain-stability comparison between GaAs and InP transistor [2] based amplifiers.

The amplifiers' design was carried using Agilent ADS, HFSS and Momentum software simulators. The amplifier input circuitry was measured separately and optimised for the best noise performance, while special care was taken about accurate modelling of passive components, bond wires and having accurate S parameters at cryogenic temperature for the transistor [3].

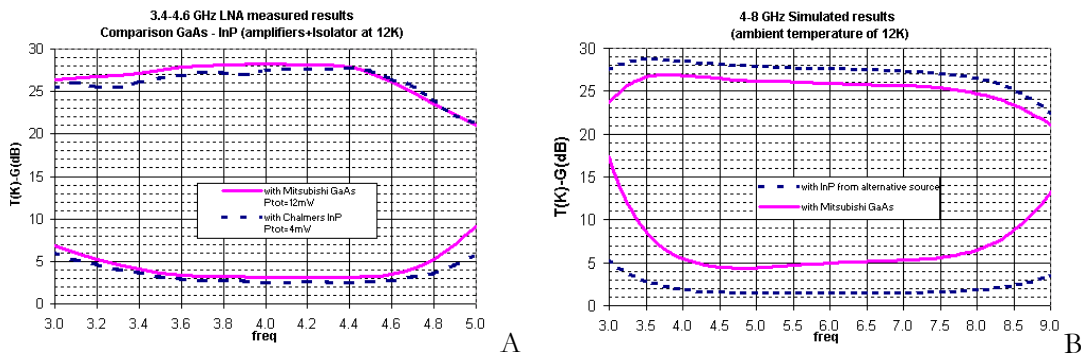


Figure capture. Plot A depicts measured performance of the 3.4-4.6 GHz amplifier at 12 K ambient temperature for GaAs and InP transistors. Plot B shows simulated performance of 4-8 GHz amplifier for GaAs and InP transistors (measurements to be presented at the Conference)

Acknowledgements. We would like to thank deeply I. Angelov, N. Rorsman, N. Wadefalk and H. Zirath from Microwave Electronic Laboratory, Chalmers University for very useful discussions and possibility to test Chalmers InP HEMTs in the amplifiers.

[1] C.Risacher, M. Dahlgren, V.Belitsky, "A 3.4-4.6 GHz Low Noise Amplifier" in Proceedings of Gigahertz 2001 Symposium, Lund, Sweden, November 26-27, 2001.

[2] I. Angelov, N. Wadefalk, J. Stenarson, E. Kollberg, P. Starski, and H. Zirath, "On the Performance of Low noise Low DC Power Consumption Cryogenic Amplifiers", Presented at IEEE MIT-S 2000

[3] I. Angelov and N. Wadefalk, private communication