Advances in an 8 to 50 GHz Cryogenic Low Noise Amplifier for the Next Generation Very Large Array
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Low Noise Amplifier (LNA) performance is one of the key factors determining the sensitivity of a radio astronomy instrument. Wide bandwidth LNAs form a unique challenge in achieving the lowest achievable noise, but also provide opportunities for simultaneous observing and lower system operating costs. Current work is in progress developing an improved 8-50 GHz LNA with both improved noise and manufacturability. Our most recent results highlight Monolithic Microwave Integrated Circuit (MMIC) designs from both Northrop Grumman Corporation (NGC) and OMMIC. To improve LNA manufacturability and noise performance, a well-characterized, low loss universal chassis has been designed. Challenges, tradeoffs, and current status will be presented. Results will be presented in three key areas of development: improve MMIC designs, improved universal chassis, and test and measurement results from an improved LNA.

MMIC design improvements have been completed for NGC and are currently in progress for OMMIC. For the NGC design, simulated improvements in noise, gain, and input and output return loss were achieved due to several key modifications. OMMIC MMIC development is currently in progress.

Chassis design will focus on the design of a revised enclosure which will be universally applicable for LNA designs up to 50 GHz. In many cases the chassis can add a significant fraction of noise to that of the MMIC and this is especially true at 50 GHz. The chassis has been designed for mode free operation up to 50 GHz with low loss 50 ohm microstrip lines, and has been designed with assembly and manufacturability in mind.

Test and measurement results obtained using two improved instruments for wideband LNA measurement will be discussed: a cryogenic probe station upgrade for MMIC noise measurement up to 50 GHz, and an improved wideband noise measurement setup for packaged LNAs. These setups were used to better characterize MMIC performance and to confirm LNA noise temperature results. Measured LNA performance will be presented and discussed.