A WIDEBAND MMIC LNA FOR THE 11 TO 34 GHZ BAND

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The concept proposed by the United States for the Square Kilometer Array consists of a large number of small diameter paraboloidal dishes. Among the many advantages of this so-called Large-N/Small-D (LNSD) array over other proposed designs is the ability to reach higher frequencies. However, a key element to the success of any large-N architecture is minimizing the replication cost of the electronics.

The combined requirements of extending the SKA frequency coverage up to the low millimeter-wave band and minimizing the global cost of the array lead us to two immediate conclusions. First we must reduce the number of independent receivers needed by developing very wideband receivers, and second we must optimize the tradeoff between cost and performance by selecting a MMIC approach for as many elements of the receiver as possible. Efforts are underway to develop MMIC components for many key areas, but potentially the most beneficial receiver component to be realized in MMIC form is the LNA. It determines the ultimate sensitivity of the array elements, and could be the linchpin of an all-MMIC solution to the analog portion of the receivers.

This paper reports on progress in the design of a wideband cryogenic low-noise amplifier for the US SKA concept. The MMIC amplifier is targeted for the upper frequency band of 11 to 34 GHz. It is to have a flat small-signal gain of 34 dB with equivalent noise temperature of 12 K over the entire frequency range. The chip has been fabricated by Northrop Grumman in their proven cryogenic low-noise InP pHEMT MMIC process. If successful, this design would represent a significant head start on the challenging electronics development task for the SKA.

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