

Ultra Low Noise Amplifier for SKA

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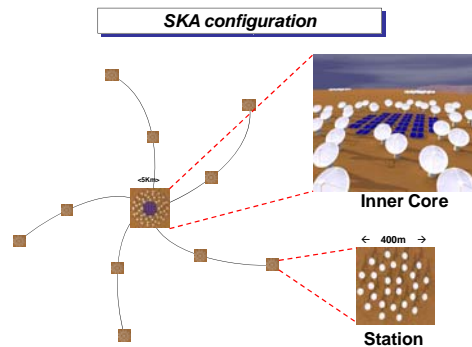
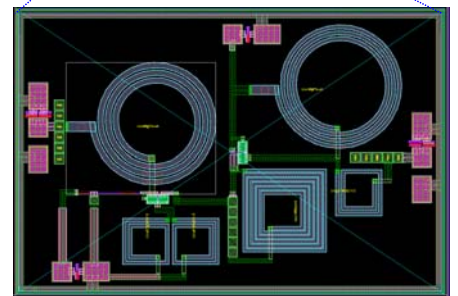
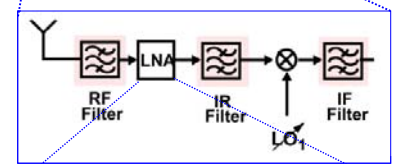
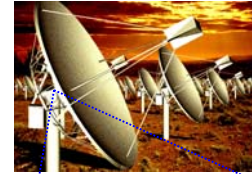
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OVERVIEW

Square kilometre array (SKA) is the next generation radio telescope, which offer two orders of magnitude increase in sensitivity over existing facilities at meter to centimetre wavelengths. This system will probe the gaseous component of the early universe using interferometric array of individual antennas, in an aperture of several thousand kilometres.

The SKA project is the future telescope system that involves 17 nations (inc. Australia & NZ), with the design/construction cost of approximately AU\$1.8 Billion and the operation maintenance of about AU\$170 Million per year. Australia is one of the two countries short-listed to host the SKA project. Such SKA system would significantly enhance the capability of study/research of the universe and improve the human perception of the universe.


PROJECT DESCRIPTION

SKA system requires a large number of modest-sized dishes with focal plane phased array receivers (FPAs): each array will comprise individual 200 receiver systems. The receiver systems will be implemented on System on a Chip.

Radio astronomy demands receiver systems of exquisite sensitivity to detect the faint signals emitted by distant astronomical objects. This sensitivity is achieved by building low-noise, low-system temperature receivers.

There are a number of issues/challenges that need to be addressed in the implementation of the telescope receivers. One of the major problems is to design & implement a low noise amplifier (LNA) with very low noise figure for the entire operating band from 700 MHz to 1.8GHz, so that the system contributes a minimum noise to signals from the cosmos. The amplifier needs to consume low power, as a huge number of receivers will be required in the SKA

The LNA had been successfully designed and implemented by our team at the Centre for Technology Infusion and is being fabricated by Peregrine Semiconductor in Silicon-on-Sapphire (SOS) technology. The LNA design employed a cascode architecture and an intermediate LC circuit to improve the reverse isolation and enhance its broadband performance. The design also included:

- High Q inductor required for input matching and low NF
- Low Ls required for smaller NF
- External Cgs added to reduce NF
- Broadband design

RESULTS

The following table presents the performance summary of the LNA.

Parameter	Result
Freq band	700MHz to 1.8GHz
NF	0.561dB to 0.670dB
S11	-4.7dB to -17.1 dB
S21	14.9dB to 18.3 dB
S12	<-25.82 dB
S22	-3.6dB to -4.6 dB
Power	40.78mW
1dB-CP	-9.47dB
Die Size	2.3mm x 1.9mm

FURTHER INFORMATION

For more information, please contact
 Email: CTI@latrobe.edu.au
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