



Antenna Systems Technologies for SKA MID : From Indian Industries Perspective

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Extended Abstract

The SKA is coming up as the largest radio telescope in the world. This telescope brings several technological advancements and it also requires continuous support of RnD institutes and industries across the globe to truly achieve its goals.

This paper talks about the technological aspects of SKA mainly around broadband antenna systems, feed technologies, RF digitizer technologies and gives views on the preparedness of Indian industries to absorb such technologies for bulk productions.

The SKA requires construction of several antenna technologies from lower frequencies (100MHz) to microwave frequencies upto 15 GHz. The SKA frequencies are divided into various bands and this paper would focus on antenna technologies for ‘Band 5’ which covers frequencies between 4.6 to 15.4 GHz.

The antenna technologies required for ‘Band-5’ are of cryogenic nature and requires feed systems to be cryo cooled at about 10K. Furthermore, the amplified RF needs to be digitized at an instantaneous bandwidth of 2.5 GHz. Both these aspects bring significant engineering challenges. This paper describes these engineering challenges in detail and comments on related competence in Indian industries to carryout production of technically challenging engineering items.

This paper elaborates in depth various engineering areas of SKA MID namely Horn Feeds, OMTs, InP based Cryo LNAs, Thermal Shielding of Horns, EMI shielding of the electronics, FPGA based control and monitoring of the feed systems as well as required cryo coolers, vacuum pumps. All these components by large extent could be fabricated by various Indian industries.

The paper described preparedness of Indian industries in doing precision machining to fabricated feed structures and required mechanical assembly components. It would be shown that precision machining of OMTs down to $\pm 10\mu\text{m}$ tolerance is now feasible in India.

Furthermore, the RF digitization requirements for SKA MID are also explained in this paper. The paper describes possible implementation architecture of RF digitizer along with choice of COTS components such as FPGAs and high-speed ADCs to achieve RF digitization at 5 GSPS or more with ENoB of 3 to 4. The paper also addresses the key challenges in such digitization which is LO stability and clock distribution.

The paper concludes with a positive note that several Indian industries are technically capable in design as well as production of SKA MID systems or sub-systems and given the chance they could leave a strong footprint of Indian contribution in realizing a MEGA Science Project such as SKA.