RESULTS FROM PROTOTYPING OF THE SKA SIGNAL AND DATA TRANSPORT SYSTEMS

Keith J. B. Grainge[1] on behalf of the SKA SADT Consortium
(1) University of Manchester, Manchester, UK, M13 9PL, http://www.jb.man.ac.uk

The Square Kilometre Array (SKA) will be a transformative radio telescope that will address fundamental unanswered questions about our Universe. Key science projects include testing General Relativity, detecting gravitational waves, exploring the formation of the first stars and galaxies in the Universe, measuring how dark energy is accelerating the expansion of the Universe, investigating the role of magnetism in the cosmos, and searching for life beyond the Earth.

The SKA will require high precision timing in order to address these questions and will then generate unprecedented volumes of data. The role of the Signal and Data Transport (SADT) Consortium is to design the systems that address these requirements. SADT is therefore designing three separate networks:

- A network to transport the astronomical data, first from the receivers to a Central Signal Processor (CSP) where correlation, beam-forming and pulsar search are performed and then secondly transport the resultant data out of the telescope site to the Science Data Processor. The data rates are tens of Terabits per second.
- A clock ensemble that provides a high accuracy timescale that can be tied to global UTC and a network that then distributes a reference frequency and absolute time to each antenna. The reference frequency is required to have accuracy equivalent to 1 picosecond and the timescale is required to be accurate to 10 nanoseconds over periods of 10 years.
- A network that passes control, monitor and service data throughout the telescope.

Implementing each of these networks pose different challenges.

The various designs that SADT has been developing have now successfully passed Preliminary Design Review and we are now working towards Critical Design Review for the end of this year. As part of this work we have performed various prototyping tests of critical aspects of the design to verify that they meet the stringent SKA specifications. In particular, Electromagnetic Compatibility (EMC) of all areas of the SKA design is critical, since there is a significant risk that self-induced radio frequency interference (RFI) might otherwise limit the performance of the SKA. In this paper we discuss the requirements of the SKA, the designs that we have developed to meet these, and we present the results of the tests that we have performed.