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A Real-Time Antenna Verification System

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1 Extended Abstract

The Low-Frequency Aperture Array (LFAA) and the Mid-Frequency Aperature Array (MFAA) elements of the Square Kilometre Array (SKA) will be made up of thousands of antennas spread over thousands of metres in Western Australia [1]. These distances make it difficult to study these antennas within an-echoic chambers. Furthermore, an-echoic chamber studies neglect any effects that the surrounding environment, such as the soil and the background RFI, have on the instrument. Thus, alternative methods were developed to study an antenna's radiation pattern in-situ.

Traditionally, the study and beam calibration of antennas was achieved through the use of known radio sources such as Cassiopeia A, Taurus A, Cygnus A, and Virgo A [2]. However, the number of available strong radio sources is limited and not readily available. Thus, the use of artificial RF sources from high-altitude balloons [3] or helicopters [4] has been investigated. Unfortunately, such techniques are often difficult to set up and expensive.

In recent years, in-expensive solutions as in [5] and [6] have been introduced which use commercial Unmanned Aerial Vehicles (UAVs) as RF sources. There have been a number of studies detailing the results obtained when using an UAV as an RF source. The position of the drone is usually obtained using a portable total station, or more recently, through accurate GNSS GPS. These studies combine the output signal from the antenna under test (AUT) with the position of the GPS at a final post-processing stage once the drone lands. This is often a time consuming campaign where the drone has to be flown several times over the antenna.

In order to cater for these issues and improve on existing systems, this work introduces a new control system capable of testing the far-field of an antenna. The system makes use of an UAV equipped with a test source and a commercial spectrum analyzer to determine the power received by the antenna. Unlike existing techniques, this novel system is capable of determining the far-field of the antenna in real-time, drastically decreasing the time required to obtain the radiation pattern for the AUT.

References

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