A Time Domain Measurement Approach for Shielding and Shielding Material Evaluation

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1. Introduction

Effective shielding is pivotal for the South African MeerKAT project as well as to the Square Kilometer Array (SKA) in radio astronomy. Due to highly sensitive instrumentation, electromagnetic compatibility (EMC) and protection against interference is essential for the success of the project. We use different time domain (TD) measurement techniques for the evaluation of large structure shielding, as well as evaluating different shielding materials using a nested reverberation technique. These TD techniques provide benefits of reduced measurement time and better frequency resolution compared to conventional frequency domain (FD) measurements.

2. Impulse Radiating Antenna for Large Structure Shielding Measurements

A low-power impulse radiating antenna (IRA) was designed and successfully used in [1] to aid measurements for Karoo signal propagation [2] and shielding properties of a large soil berm [3]. Using a sharp-rising pulse together with a real-time transient analyzer (RTA) developed in [4], a wide frequency spectrum result could be obtained in a fairly short time. A second iteration of the IRA is currently being designed to improve matching and reduce back-scattering for use in more complex environments. The high dynamic range and large instantaneous bandwidth (800 MHz) of the following design of RTA will aid in more detailed characterization of the Karoo environment shielding and propagation. The progress and results of this part of the project will be discussed in more detail at the conference.

3. Nested Reverberation Chamber Measurements for Shielding Material Evaluation

A TD approach to nested reverberation chamber measurements in [5] describes the evaluation of shielding effectiveness of an enclosure. We build on this study by using an aperture on one side of the nested chamber to measure the shielding effectiveness of different materials which can be used for shielding. A similar approach in FD was done in [6] to evaluate the shielding effectiveness of energy-saving glass panes. Our approach aims to effectively measure a frequency range from the lowest usable frequency (LUF) of the larger chamber (240MHz) – where the nested chamber or is in an under-moded condition – to the highest frequency of the RTA receiver (2.6 GHz).

4. References

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