

## Section A: Overview of the Research Project Proposal

- 1) **Title of research project:** Wide-band antenna design for time-domain measurements in a reverberation chamber
- 2) **Broad area of research:** Engineering
- 3) **Academic Level of research project:** Masters
- 4) **Research project abstract/summary (max 250 words):**

Currently, the antenna being used in the SARA0 reverberation chamber for RFI qualification is a Log-periodic Dipole Array (LPDA). While this design is very well suited for use in frequency-domain measurements, the inherent phase delay (time-delay) introduced as a function of frequency render LPDA's unsuitable for use in time-domain measurements. This project aims to design a wide-band antenna that can efficiently handle pulsed signals as that will simplify time-domain measurements for RFI qualification.

- 5) **Primary supervisor's details:**
  - a. **Full name:** Dr Jacki Gilmore
  - b. **Email address:** jackivdm@sun.ac.za
  - c. **University:** Stellenbosch University

## Section B: Details of the Research Project Proposal

- 1) **Scientific/Engineering merit: describe the objectives of the research project, placing them in the context of the current key questions and understanding of the field.**

Measuring the shielding effectiveness of enclosures plays a vital role in the battle against radio frequency interference (RFI). These measurements are typically conducted inside a reverberation chamber in the frequency domain. Some of the drawbacks of frequency-domain measurements are that they time consuming, and information is needed about the antennas being used to conduct the measurements. One of the main advantages of time-domain measurements using pulsed signals is that a wide frequency range can be covered with a single measurement, which considerably speeds up the measurement process. Another advantage is that the time-gating can be used to remove the antennas' effect on the measurement without requiring knowledge of the antennas.

This project aims to design and build a wide-band antenna for time-domain measurements using pulsed signals. Since pulsed signals are inherently wide-band, an antenna is required that offer a flat gain and group delay to minimize distortion of the pulse.

- 2) **Feasibility: outline the methods that will be used to achieve the objectives. Provide details on the availability of required data / access to required equipment / availability of research facilities and other resources required. Include any relevant expected intermediate milestones and associated timeframes towards attaining the overall objectives of the project.**

The antenna will be designed with the aid of commercial electromagnetic simulation software, and manufactured and measured at in-house facilities.

A well-equipped antenna test range and all the required software tools, and an established workshop with qualified technical staff are available in-house at Stellenbosch University.

**Timeframe and intermediate milestones:**

**Semester 1:** The first semester of the project will be dedicated to some advanced course work on fundamental antenna theory, electromagnetics, high-frequency measurements and microwave systems.

**Semester 2:** The student will complete a thorough literature study on wide-band antenna designs, time-domain measurement techniques in reverberation chambers.

**Semester 3:** The main part of the antenna design and testing will take part in this semester.

**Semester 4:** Testing will be wrapped up in the fourth semester, but the largest proportion of time will be spent writing up the thesis.

**3) Link the proposed project to one or more of the SRAO research priority areas for 2021 (refer to Section 5 of the Application Guide), and explain in some detail how the proposed research will contribute to the priority area(s).**

Research priority area: 5.2.3 Hardware and data analysis systems for detecting, monitoring and identifying Radio Frequency Interference (RFI), including the use of telescope data (e.g. using MeerKAT visibilities to locate RFI sources).

The aim of the project is to design an antenna for use in Shielding Effectiveness measurements for RFI research and qualification purposes.

**4) If relevant, describe any particular qualifications, academic abilities, skills and/or experience that a student should have in order to successfully deliver on the objectives of the research proposed.**

Not relevant