THE ROLE OF A COMPACT ANTENNA TEST RANGE IN RESEARCH OF THE CENTRE FOR ELECTROMAGNETISM

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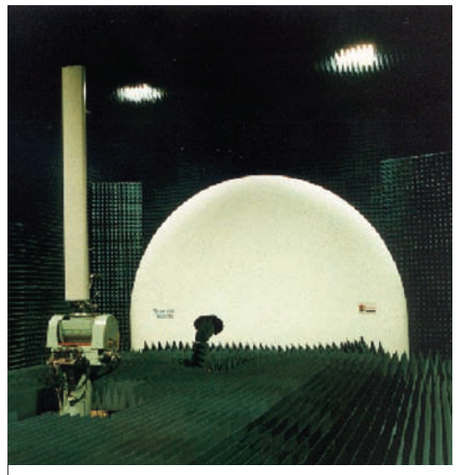
The University of Pretoria's Compact Antenna Test Range (CATR) was completed in 1990 and is a unique facility in Southern Africa. There are only a few universities in the world with such a facility. The compact range and anechoic chamber is housed in a specially designed building on the South Campus of the University of Pretoria and as a national measurement facility is providing free-field traceability to the South African industry (in partnership with the National Metrology Laboratory at the Council for Scientific and Industrial Research, the CSIR).

The CATR, which produces far field conditions in a limited indoor space, enables users to characterise antennas that would normally need hundreds of meters of space in an equivalent outdoor range to properly measure. The facility is used to measure antenna characteristics, such as beam width, gain, sidelobe levels and polarisation of various size antennas or antenna subsystems over a frequency range from 750 MHz to 40 GHz. The range can also be reconfigured to measure the Radar Cross Section (RCS) of antennas or other targets.

The focus of the Centre for Electromagnetism (CEM) in the Department of Electrical, Electronic and Computer Engineering is education and research in electromagnetism, development of electromagnetic antennas and subsystems in partnership with industry, research on free-space measurement techniques and the provision of independent and internationally recognised development and verification measurements to the South African industry.

As an example one of the recent research projects on free-space measurement techniques completed by the CEM involved the analysis of horn antennas as applied to the evaluation of the gain-transfer method. An important condition that has to be satisfied when implementing the gain-transfer method for gain measurements of antennas is that the fields in the test zone of the measurement facility should be as close to a perfect plane wave as possible. In this work[1,2] the effect of amplitude and phase deviation from a perfect plane wave, on gain measurements for microwave aperture antennas, conducted via the gain-transfer method, was determined and quantified. The pyramidal horn antenna is used as a basis for all calculations as it is the universal standard for microwave antenna gain measurements.

A recent antenna research project was on the development of single-layer capacitive feeds for wideband probe-fed microstrip antenna elements. In this work[3,4] it was shown how a single-layer capacitive feeding mechanism, consisting of a small rectangular probe-fed patch, which is capacitively coupled to the radiating element, can be used to obtain wideband operation for probe-fed microstrip antennas on thick substrates. The main advantages of this feeding mechanism are that all the elements reside on a single layer and that it is very easy to fine-tune the input impedance. Calculated and measured results were shown to correspond well for rectangular, circular and annular-ring geometries.



→ *A cellular base station antenna being characterised inside the University of Pretoria's Compact Antenna Test Range.*

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