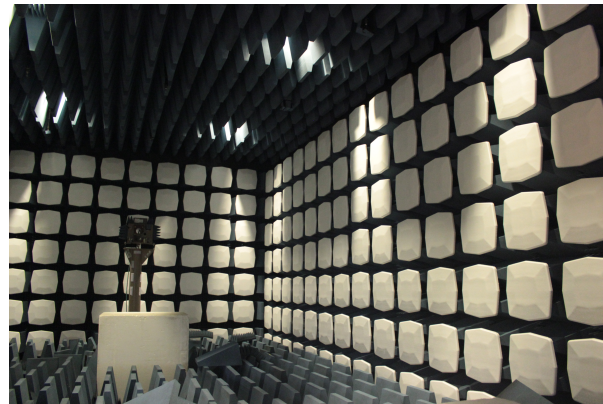


Richmond Hill Research Complex – Electromagnetics Research

The School of Electrical and Computer Engineering's Robust Electromagnetic Field Testing and Simulation (REFTAS) Laboratory provides staffing and resources for test facilities at the Richmond Hill Research Complex (RHRC). The major features of the RHRC are a Smart 80 reverberation chamber and a fully absorber lined anechoic chamber (FALC) with a 3 axis positioner (MTI).



The reverberation chamber is an ETS-Lindgren SMART-80 providing a reliable test and research platform from 80 MHz to 18GHz. The reverberation chamber approach is especially useful for measuring the susceptibility level of equipment under test by exposing the equipment in the unique field environment of the chamber. The total radiated power of devices can also be measured during an emission test, without the need to rotate the object, scan antenna, change polarity or lay cables in any particular orientation. The reverberation chamber is also useful to evaluate the relative performance of different designs of the same device.

The SMART 80 is primarily designed for testing in accordance with standards: DO160G, MIL-STD-461E, and IEC 61000-4-21 from 80 MHz to above 18 GHz. Although primarily intended to create an electromagnetic environment (EME) for electromagnetic compatibility (EMC) assessment of immunity and emissions the reverberation chamber is also useful in the assessment of communication system performance in a wide range of channel characteristics.

The internal dimensions of the SMART 80 reverberation chamber are: 44' × 20' × 16'. These dimensions are particularly useful for the large working volumes needed to assess EMC and communication performance of large devices. With a wide selection of signal generators, network analyzers, and spectrum analyzers, we are able to validate designs for antennas and other RF devices to precise standards.

The REFTAS Laboratory also has a 8.5m fully anechoic chamber (FALC) with a 2 m turntable adjacent to the reverberation chamber with test frequency capabilities from 30 MHz to 18 GHz. The FALC is useful in determining the directional emissions spectrum from the UAS and all of its sensors. Example applications include shielding effectiveness of devices, antenna pattern and radar cross section (RCS) measurements.

Additional resources/equipment include RF characterization tools including Vector Network Analyzers (VNAs, up to 40GHz), Spectrum Analyzers (up to 40 GHz), Vector Signal Analyzers, Signal Generator (4 GHz), PSG Analog Signal Generator (20 GHz). Many in house computational codes: FEM, 3D Modal/MoM, MLFMA and commercial EM packages: SuperNEC (MoM), EZ-EMC (FDTD), WinFEKO (MoM with AWE), COMSOL Multiphysics, COSMOS (geometry modeling), Sonnet (Full version), Advanced Design System (Agilent).

Previous research projects:

- Measuring the Shielding Effectiveness of Surrogate Samples, Applied Research Associates (ARA)
- Innovative Physics-based Modeling Tool for Application to Passive Radio Frequency Identification System on Rotorcraft. Delcross Technologies, STTR Ph 1
- Tool to Predict High-Power Electromagnetic Effects on Mobile Targets, ANDRO Computational Solutions, LLC, STTR Phase 1
- Characterization of the Space Power Facility Reverberation Chamber
- New Methodologies for System-Level Electromagnetic Compatibility (EMC) Analysis of Electronic Systems, National Science Foundation, Division of Civil, Mechanical, and Manufacturing Innovation
- Stochastic Characterization of Naval Aircraft Electromagnetic Vulnerability: ElectroMagnetic Susceptibility Threshold Analysis Techniques by Estimation and Statistics (EMSTATES), Phase I and II, STTR Topic N08-T006
- Operational Process for Ensuring Below Deck Electromagnetic Compatibility due to Commercial Wireless Systems, SPAWAR Systems Center San Diego



Current and Pending Projects:

- HIRF Assessment of a KA band data link (at L band), Boeing
- Statistical Characterization of Electromagnetic Cavities - Validation Study, NASA
- Assessment of EME for a tractor cavity, Ditch Witch

Additional resources/equipment:

- Vector Network Analyzer (Agilent 8722ES, 50 MHz - 40 GHz)
- Vector Network Analyzer (HP 8753ES, 50 MHz - 6 GHz)
- Spectrum Analyzer (Agilent 4407B, 9 kHz – 40 GHz)
- Vector Signal Analyzer (Agilent 89441A DC-2650 MHz)
- Signal Generator (Agilent E4437B 250KHz – 4 GHz)
- PSG Analog Signal Generator (Agilent E8257D, 250 kHz – 20 GHz)
- In house computational codes: FEM, 3D Modal/MoM, MLFMA
- Commercial EM packages: SuperNEC (MoM), EZ-EMC (FDTD), WinFEKO (MoM with AWE), COMSOL Multiphysics, COSMOS (geometry modeling), Sonnet (Full version), Advanced Design System (Agilent)

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