**Source and Boundary Fields in Reverberation Chambers**

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The use of reverberation chambers (also called mode-stirred chambers) for electromagnetic compatibility (EMC) measurements has increased rapidly during the past decade. Reverberation chambers are electrically large, multimoded cavities that use either mechanical stirring or frequency stirring to create statistically uniform fields. The interpretation of reverberation chamber measurements requires a thorough knowledge of the electric and magnetic fields throughout the chamber.

At the source antenna, the scattered fields have been found to have an ensemble average intensity that is twice the average intensity throughout most the chamber where the fields are statistically uniform (the test volume). The doubling of the average intensity at the source is due to enhanced backscatter where reciprocal rays add coherently as compared to the test volume where only incoherent addition occurs. Consequently, experimental results comparing the power reflected back to the source antenna and the power received by the reference antenna in the test volume have verified that $<|S_{11}|^2>= 2<|S_{21}|^2>$, where $< >$ represents an ensemble average obtained by rotating the mechanical stirrer through a large number of positions and $S_{11}$ and $S_{12}$ are scattering parameters for the source and reference antennas measured with a network analyzer. Enhanced backscatter in a reverberation chamber is completely analogous to enhanced backscatter (P. Phu, A. Ishimaru, and Y. Kuga, *Radio Sci. 28*, 533-548, 1993) observed in scattering from random rough surfaces. Enhanced backscatter can be analyzed by either geometrical optics or a plane-wave integral method that shows that the enhanced backscatter is restricted to a small region of approximately a half wavelength in extent.

The boundary condition at the chamber wall (tangential electric field equals zero) results in a boundary region where the fields are not spatially uniform. This region (which includes corners as well as planar walls) has been analyzed using multiple image theory and a plane-wave field integral representation (D.A. Hill, *IEEE Trans. Electromag. Compat. 40*, 209-217, 1998). Analytical expressions have been obtained for the boundary region fields, and they evolve to spatially uniform fields within approximately a half wavelength from the walls. This result is important in determining the useful test volume of the chamber.