Dual-Linear Polarized UWB Imbedded Section for Tapered Chambers

Ryan A. Chilton*, Chi-Chih Chen and Robert Lee
The Ohio State University ElectroScience Laboratory,
1320 Kinnear Road, Columbus OH, 43212,
http://esl.eng.ohio-state.edu

Antenna pattern and target RCS measurements are commonly performed in large anechoic chambers, compact ranges or ground bounce ranges. A tapered chamber is a smaller and cheaper alternative for such measurements provided that the size of the target or antenna under test is not too large. A typical commercial chamber consists of a conical tapered section where a separate antenna launches waves towards a rectangular test zone. Microwave absorbers cover both the tapered section and the test zone to suppress reflections off the walls. Log-periodic dipoles and horns are commonly placed within the feed section acting as the wave launcher. However, the physical size of the antenna prohibits placing it directly at the desired cone apex, shifting the phase center forward and introducing waves impinging upon absorber walls which result in poorer quiet-zone field performance. The common cone geometry in the feed section also prevents operation at lower frequencies due to cutoff. Furthermore, to test both horizontal and vertical polarizations the feed antenna must be physically rotated.

We introduced a novel feed section with imbedded wave launcher and have designed, fabricated and tested several prototypes. This feed consists of a circular cylindrical section sized to match the existing circular aperture of the main chamber. Within this section, two orthogonal pairs of Vivaldi-like launcher arms are mounted to produce dual linear polarized fields, allowing for collection of fully polarimetric RCS or antenna data. A recent prototype has demonstrated good frequency coverage from 200MHz to 3GHz. Polarization can be selected by an electrically controlled switch.

The discussion will focus on a few steps of the design process. First, the feed response was evaluated numerically over a wide frequency range using FDTD. Numerical simulation permitted the evaluation of numerous blade shapes and absorber configurations. Once a suitable geometry was established, the antenna was fabricated, measured and installed for the client. A comparison of measured in situ antenna performance to the FDTD simulations will be presented, and a discussion about balance requirements of such an antenna will be explored as well.