Antenna Gain Measurement Report CE4046B, for Customer Supplied PCB Antenna

This report contains 3D gain pattern swept frequency results and setup documentation.

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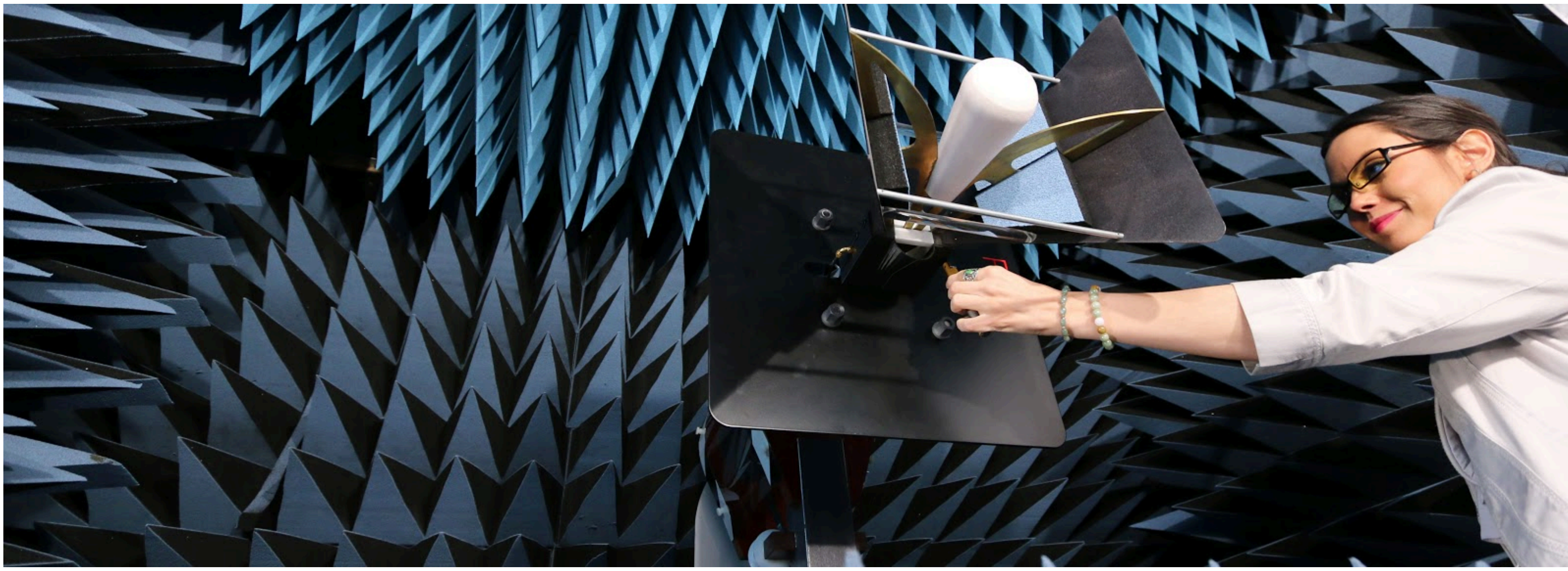


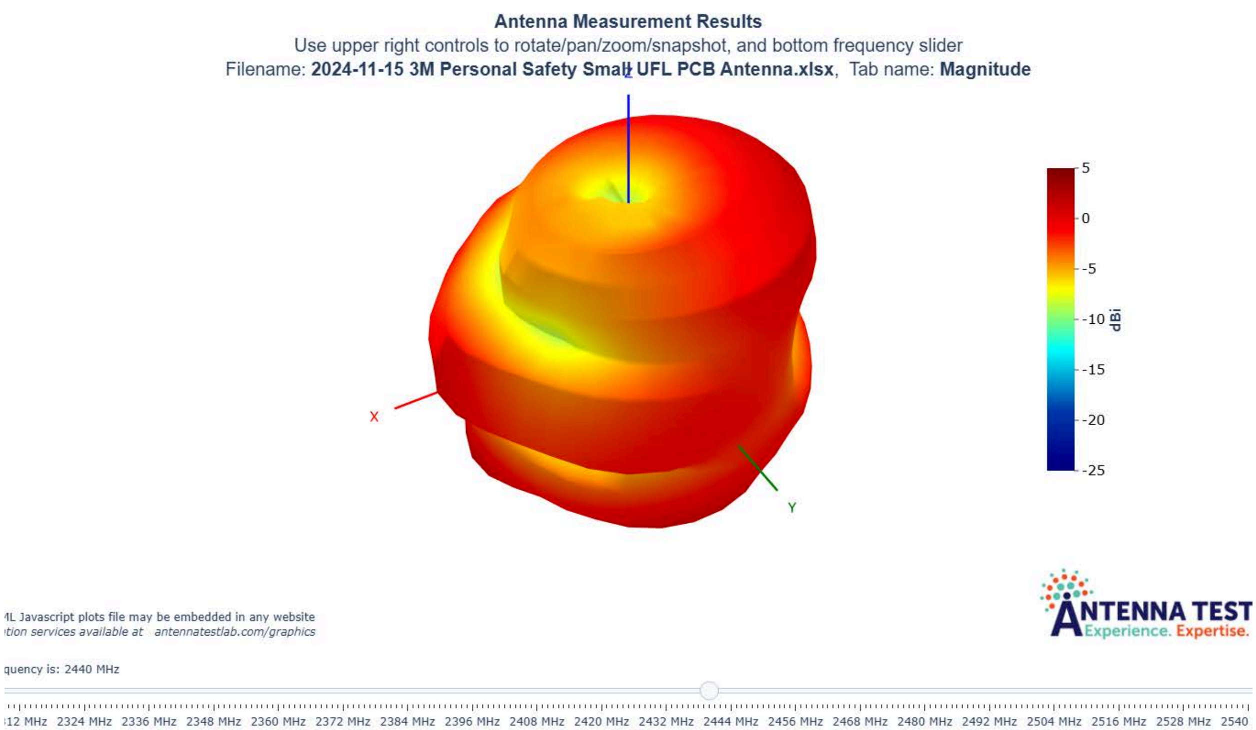
Testing Summary

On November 15, 2024, a sample antenna was evaluated for gain vs frequency. In the 2400 to 2480 MHz band, the antenna's peak observed gain was +2.83 dBi. The model number of the submitted antenna was unknown with no serial number.

Detailed Test Results

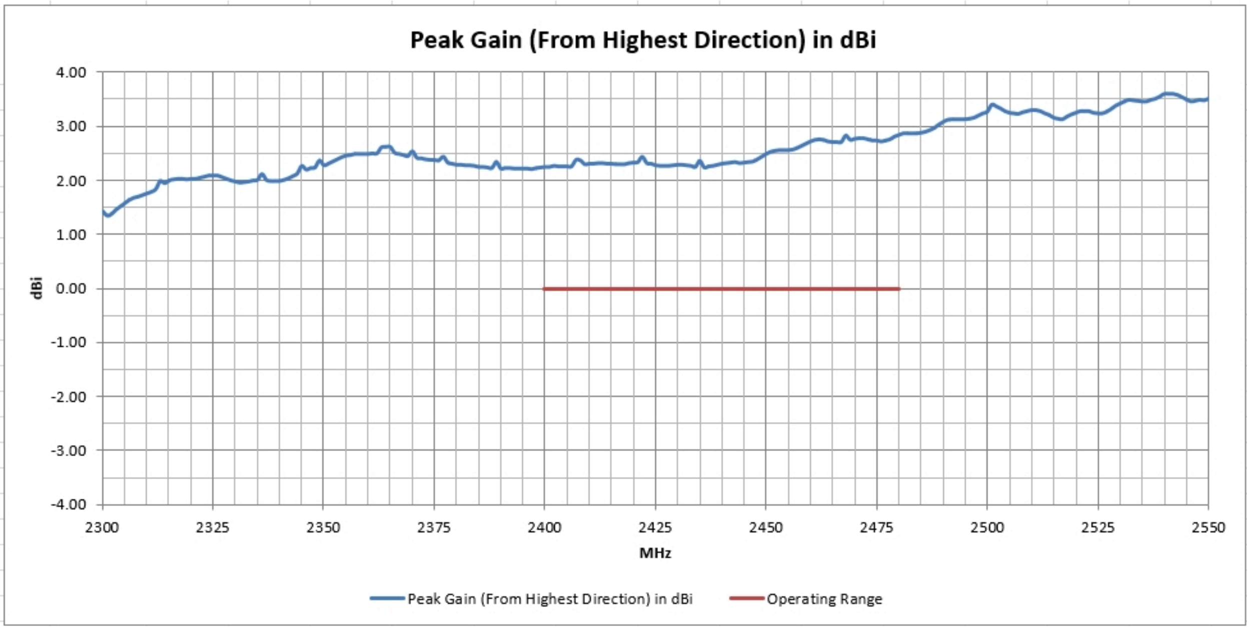
3D Gain Patterns

The antenna was evaluated from 2300 to 2550 MHz in 1 MHz steps (251 data points). Absolute gain was measured on a spherical grid of 10 degree steps (in both theta and phi), or approximately 650 directions. The diagram below shows the antenna's 3D gain pattern at 2440 MHz.



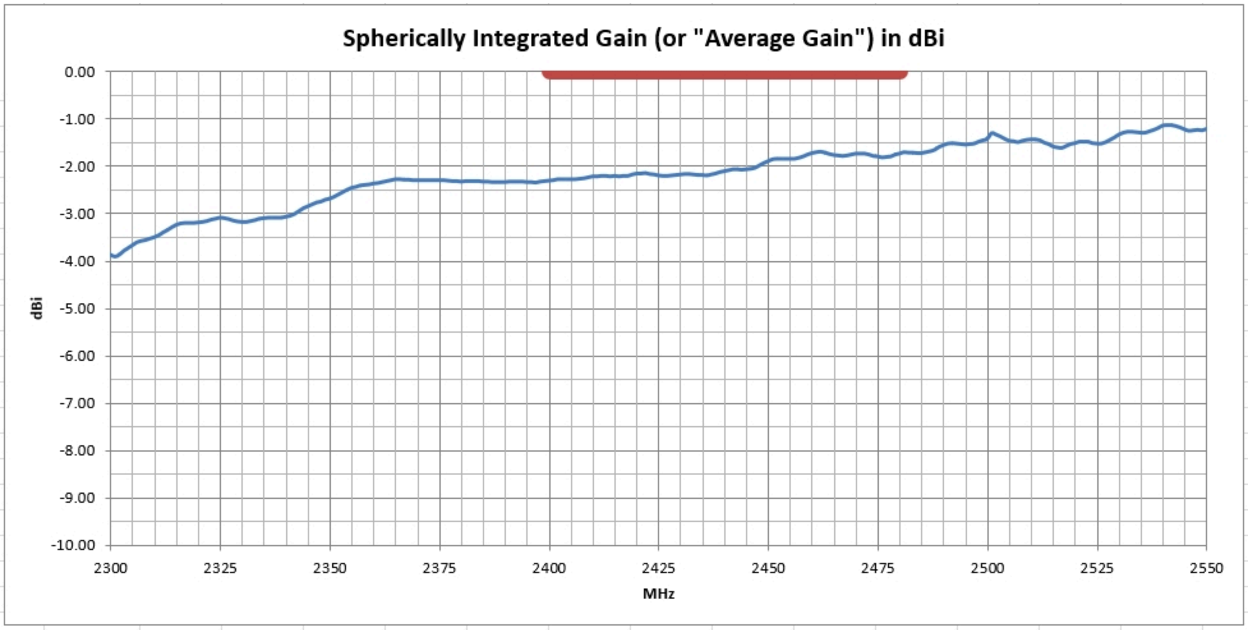
Peak Gain vs Frequency Graph

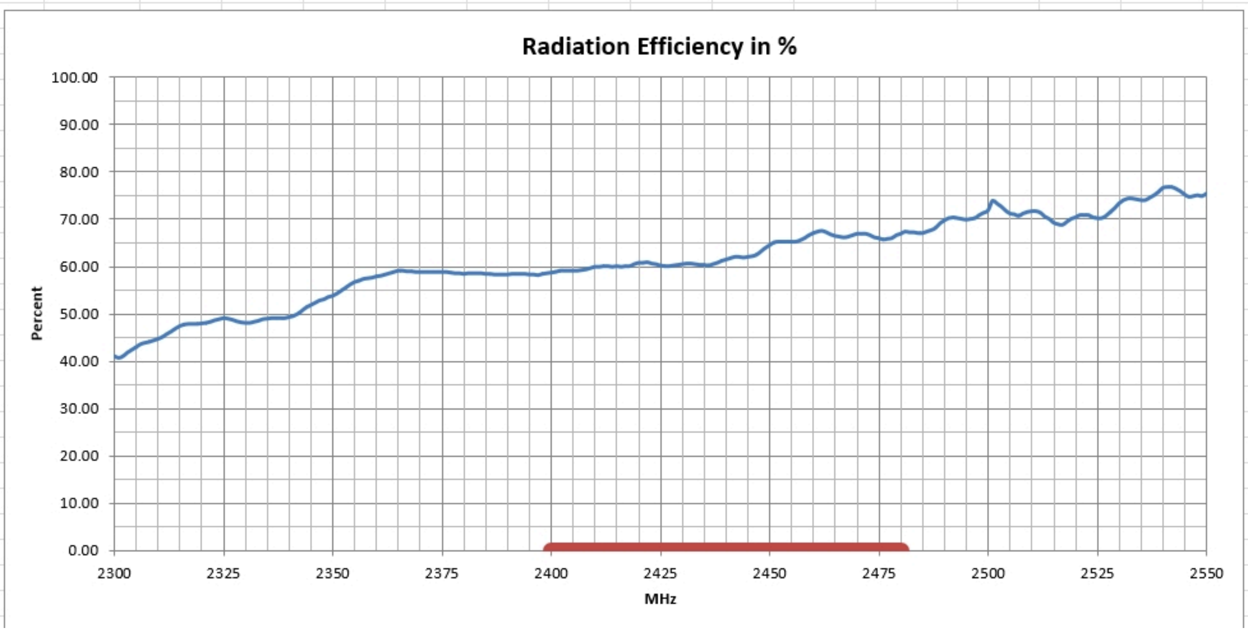
The diagram below shows the antenna's peak observed gain at each test frequency. In the 2400 to 2480 MHz band, the antenna's peak observed gain was +2.83 dBi.



Average Gain vs Frequency Graph

The diagram below shows the antenna's calculated average gain at each test frequency. Average gain is reported in dBi and as a linear percentage (equivalent to radiation efficiency).

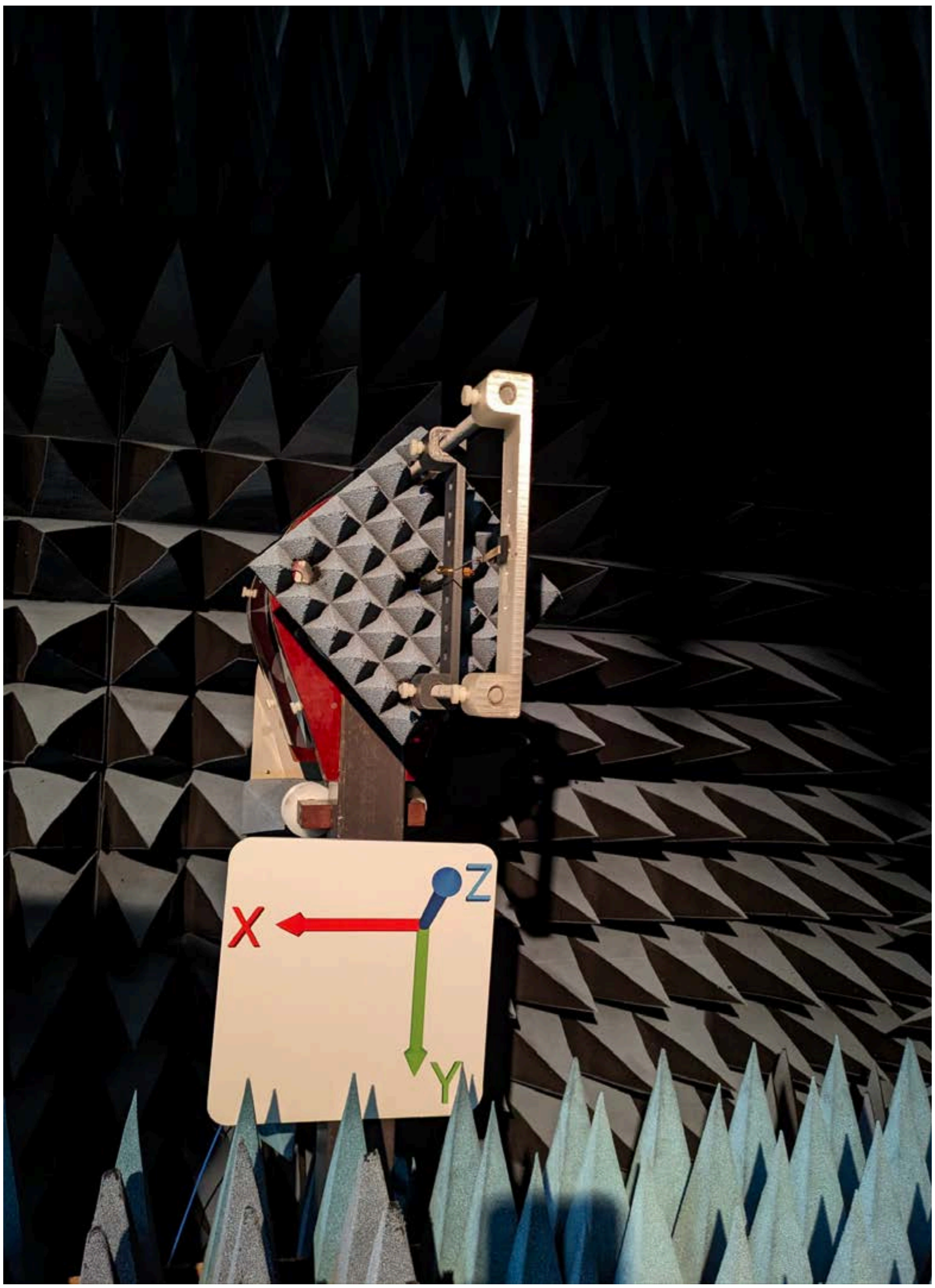


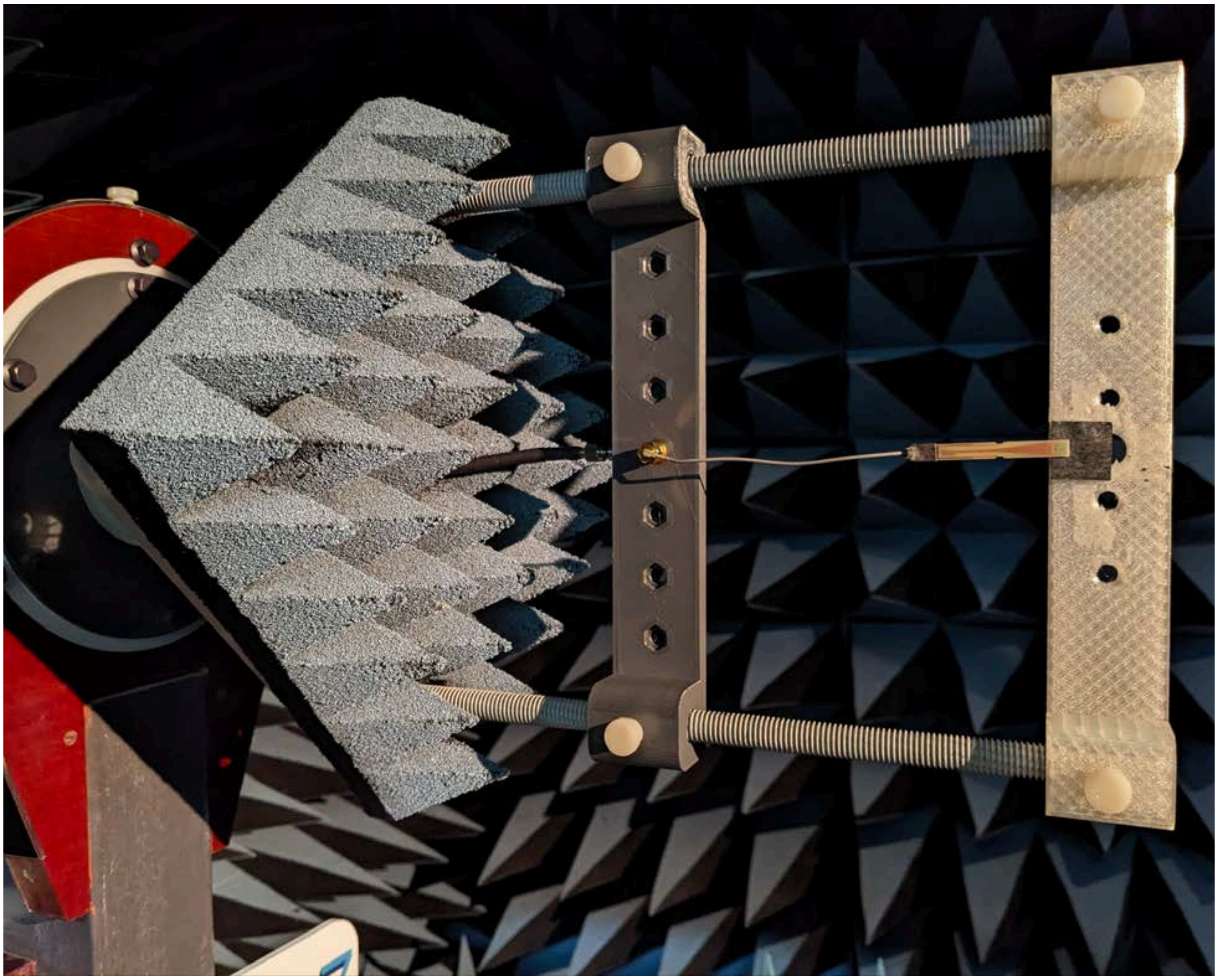


Testing Details

Photographs

The following photos depict the Antenna's test orientation and installation on the laboratory positioner.



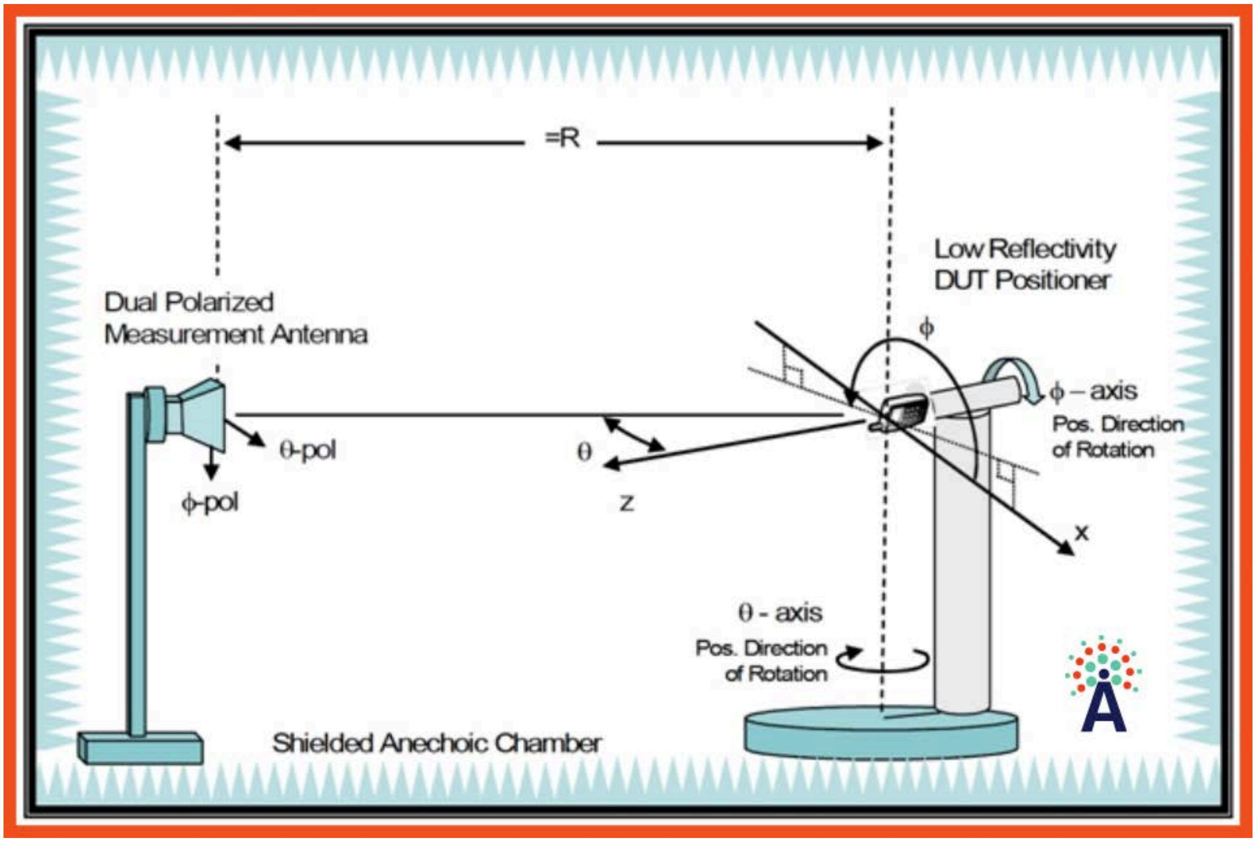


Test Procedure Reference

This evaluation followed IEEE Std 149-2021, IEEE Recommended Practice for Antenna Measurements, more commonly called "Substitution Method Testing". Please refer to section 8.4 Gain-transfer measurements, subsection 8.4.1 Measurement of linearly-polarized antennas, within IEEE 149-2021.

Test Procedure Summary, In "Plain English"

An unknown antenna's gain is measured by exciting the AUT (Antenna Under Test) with a swept RF signal in our anechoic chamber. The substitution method involves setting up the known calibrated laboratory reference antenna over a radiated path in the chamber, then normalizing (or "zeroing") that path loss to 0 dB. Then normalizing the received phase to zero degrees. In other words, the signal level (magnitude) and relative delay time are normalized ("zeroed") as a starting point for comparison measurements.



The Quad Ridge Chamber Antenna

The "chamber antenna", sometimes called the "Source Antenna" is an open boundary quad-ridge Vivaldi horn antenna. It is actually two antennas that occupy the same space. The gain/phase normalization described above is done twice. Once for the vertical ridges, and again for the horizontal ridges, since they are different antennas with slightly different gain and phase.

The Substitution

Then the laboratory reference antenna is exchanged for the customer's Antenna Under Test (AUT), and the path gain/loss and phase changes are measured relative to the previously normalized reference path. In other words, the AUT will have gain higher, the same, or lower than our reference antenna (a relative measurement).

By simply adding the reference antenna's calibrated gain (in dBi) to these path change measurements, we determine the AUT's gain in dBi.

Test Equipment Used

The following laboratory equipment was used during this antenna evaluation. Please note that this equipment is NOT under any calibration program. The results presented here are not certified or traceable to any calibrated reference standard or laboratory accreditation.

Vector Network Analyzer	Rohde & Schwarz ZVA40
Positioner	Az/El by Sunol Sciences model ELAZ75
Anechoic chamber	Rectangular (22 feet long) with 18-inch pyramidal absorber over ferrite tile, sized to allow a 3 meter test range
Broadband Reference Horn Antenna 300 MHz to 30 GHz	Open-boundary dielectric lens mode-suppressed double ridge guide horn antenna, custom made and similar to Diamond Engineering model DE0530
Broadband Reference Horn Antenna 18 to 40 GHz	Double ridge guide horn by Q-par, model WBH18-40K
Chamber Source Horn 300 MHz to 6 GHz	Fei Teng Wireless Technology Co Model HR-03M06G01-NF
Chamber Source Horn 1.5 to 18 GHz	EDO model AS-48461
Chamber Source Horn 18 to 40 GHz	A-INFOMW p/n LB-SJ-180400
Other RF Hardware	All other items such as cables and LNAs in the test chain are simply "normalized" as part of the reference-antenna substitution process, and are not relevant to measurement accuracy

Contact Us

All antennas are evaluated by Glenn Robb of Antenna Test Lab Co, located at 2210 E Millbrook Rd, STE 113, Raleigh NC, 27604.

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