Antenna Development Corporation – AntDevCo

Electromagnetic/Environmental Tests and Analysis/Simulations

Introduction:

*A*ntenna *D*evelopment *C*orporation, Inc. (*AntDevCo*) engineers have significant experience in both the testing and simulations of antennas, coupler, and antenna hats for Cubesat and larger spacecraft applications. We offer testing and simulation services with specialization in low-gain antenna systems.

Environmental and Electromagnetic Test Facilities:

We are experienced with and have conducted many tests to NASA and other space agency specifications. This includes the development of and the conduction of the test procedures from start all the way through the formal End Item Data Package.

AntDevCo test capabilities include:

- *Atmospheric Pressure Thermal Test* In-house tests (-65 to +200 º C) with antenna hats and in-chamber monitoring of antenna electromagnetic performance.
- *Thermal Vacuum Testing* In-house (-115 to +115 º C, vacuum to about 10^{-6} Torr) with antenna hats and in-chamber monitoring of antenna electromagnetic performance. The chamber has an interior volume that can accommodate antennas up to 8 inches tall and about 10 by 10 inch base dimensions. The system does not use silicones.
- *Multipaction Testing:* In-house power testing capabilities to 35 Watts CW 1000 to 2500 MHz range and to 75 Watts, 7.5 – 10 GHz. That is, testing over the entire NASA Space Network, USAF SGLS, and DSN transmit bands. We have developed a high-speed detection system to capture multipaction events both in antennas and in other devices such as diplexers and power dividers.
- *Vector Network Analyzers* (VNA) In-house– HP 8510C VNAs (3) with option 10, S-parameter test sets (HP 8514A&B, HP 8515A) and an HP 8752C VNA. All systems are interfaced to computerized data recording system. Multiple test articles may be simultaneously exposed to test environments using RF matrix switching units. Impedance measurements are included in the standard product delivery and are not separately charged.
- *Sources –* Synthesized and phase locked up to 26.5 GHz. Sweeper 26.5 to 40 GHz.
- *Antenna Radiation Pattern Testing* –Tapered anechoic chamber with a 1 to 12+ GHz response and computerized roll-over-azimuth positioning system. The system uses polarimetry measurements to determine the antenna response to right hand, left hand, and linear polarizations as well as the axial ratio of the radiation. All data is recorded by a computer system and analyzed by *AntDevCo* proprietary software to generate the radiation patterns, percent coverage calculations, and two and three-dimensional graphical representations of the radiation patterns. These radiation pattern tests are usually included in the costs for the antenna systems and are not separately charged.
- *Vibration Test* – External access to a nearby electrodynamic shaker system capable of testing small antennas to levels commensurate with spacecraft launch environments. Shaker capabilities: 1 inch peak to peak displacement, 17,500 lb-force, 5 Hz to 3000 Hz, maximum acceleration 150 g (bare table), maximum velocity 70 inches/second. Tests on operating electromagnetic systems are an option.

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- *Mechanical Shock Test* – In-house capability to perform mechanical shock tests to simulate the environments associated with stage separation and other launch vehicle mechanical shock stresses. Digitization rate 250 kHz, 16 bit A/D. Up to four channels of simultaneous digitization.

Electromagnetic Simulation:

AntDevCo uses several computer-based analysis and simulation software programs. The software is verified by comparison with physical measurements and provides good predictions of system performance. The simulation programs include:

- *Microstrip Patch Antennas and Circuits and Stripline Circuits* – AntDevCo maintains a license for Ansoft Designer/HFSS – one of the industry standard simulation systems.
- *Wire Antennas* – *AntDevCo* has had long experience with using the Numerical Electromagnetic Code (NEC) for simulations of wire antennas. We have performed many successful simulations of these types of antennas and have verified the simulations with subsequent measurements of actual systems. The results of the simulations are analyzed with our proprietary software (also used for anechoic chamber measurement analysis) and the coverage, polarization, axial ratio, and antenna pattern plots can be directly compared with actual measurements of physical antennas.
- *Spacecraft-mounted Antennas* – AntDevCo has realized very good results simulating the performance of low gain antennas on electrically large structures by using the NEC-BSC program from Ohio State's Electroscience Laboratory. This software can use results from the wire program NEC and has been interfaced to AntDevCo's proprietary post simulation/measurement analysis programs. Detailed simulations provide coverage computations, shadowing computations, and other outputs.

Hardware Manufacture and Testing Charges:

Spacecraft antennas are usually custom items. Exact charges the hardware manufacture and for environmental tests are critically dependent on the specifics of the individual customer/mission requirements.

Simulation Analysis Charges:

Exact charges for analysis and simulations are also critically dependent on the specifics of the individual design and mission requirements.

Contact us for budgetary estimates and firm fixed price proposals for your antenna and testing needs.

AntDevCo is ISO 9001-2008 registered.

Antenna *D*evelopment Corporation:

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