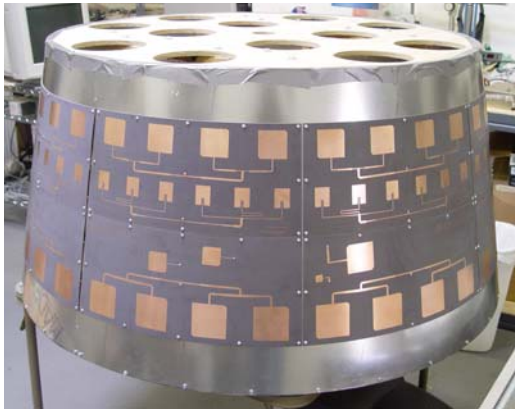


Antenna Development Corporation

151 S. Walnut St. #B-6, Las Cruces, NM 88001

Cylindrical-Array Missile, Rocket and Artillery Shell Antennas



Multi-frequency Conical Antenna (without integral radome cover)
Mounted on a non-flight Test mockup.

Antenna Development Corporation, Inc. (*AntDevCo*) employees have designed and manufactured cylindrical array antennas for many successful rockets and launch vehicles. Based on this experience and *AntDevCo's* continued development of spacecraft antennas, *AntDevCo* is able to offer these well-proven launch and reentry vehicle antennas. In addition, artillery shell antennas are also available.

The cylindrical arrays are capable of supporting high data rates with transmit power to at least 10 Watts CW. The antennas can be manufactured for either circular or linear polarization and with multiple center frequencies. The antennas incorporate an integral radome and are very robust assemblies. An internal cable/power splitter network is used between each microstrip patch array antenna segment and is located internal to the vehicle but separate from the antenna.

All antennas are supplied with extensive testing data including principal plane radiation pattern plots, gain bounds plots, and coverage statistics. Simulations of the expected performance on specific vehicles can also be ordered.

Specifications

- Frequency: L to X-band center frequencies. Includes GPS, down link telemetry, SGLS, NASA SN & TDRSS, test range radar, and DSN frequencies.

Typical Frequencies: 1227, 1575, 2050, 2211, 2250, 5700, and 8500 MHz. Other custom frequencies are available.

Note that the customer must specify the center frequencies desired at the time of order – these are narrow band antennas and a single antenna array cannot cover an entire band.

- Bandwidth: ~ 10 MHz about the center frequency typical. 100 MHz BW versions are also available.
- Polarization: Circular or linear (customer spec.).
- Power: 10 Watts CW (previous tests, not the ultimate power limit).
- HPBW: See patterns.
- Impedance: 50 Ohms nominal.
- VSWR: < 1.5 over RX and TX bandwidths
- Magnetic: Antenna materials are non-magnetic: Low magnetic stainless steel connector bodies are standard. (Non-magnetic brass connectors are optional.)
- Connector: SMA female.
- Dimensions: Diameters from 6.5 inches up. Antenna length depends on the numbers of channels and their center frequencies. Typical diameters: 14, 17, 22, and 50 inches.
- Temperature: -100 C to +100 C. Reentry vehicle and antennas for silo-launched missiles are also available.

Mechanical and Thermal Design

The antenna elements that form the arrays are multi-layer bonded cylindrical circuit board structures and are essentially monolithic. They use flight proven and robust connector mounting arrangements. Various mounting arrangements are available for attachment of the antenna to the vehicle. Antenna materials used are stable over temperature and designs are available to match thermal requirements.

Shock and Vibration Testing

Launch and separation shocks, in addition to random vibration, present the highest mechanical stresses to the systems. *AntDevCo* shock testing uses a pneumatic cannon system to subject the antennas to shock levels simulating the flight requirements. Antennas designed by *AntDevCo* personnel have also been tested with random and sine wave vibration using standard electrodynamic

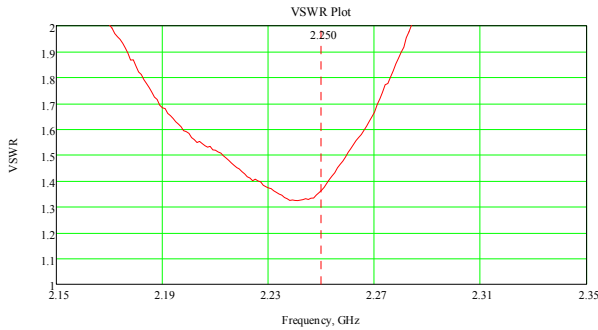
Antenna Development Corporation

151 S. Walnut St. #B-6, Las Cruces, NM 88001

shaker systems. Test levels closely simulated the actual launch loads. Analysis shows that these antennas have significant mechanical safety factors.

Antenna Impedance and Bandwidth

The typical impedance performance of the antenna array is shown in the next plot.



Typical Impedance Performance

Testing and Simulations

AntDevCo offers acceptance testing, simulations, and measurements of antenna performance on electromagnetic mockups as options. Please contact us for quotes that address specific requirements.

Contact Information

See our website, www.AntDevCo.com, for further information:

AntDevCo is ISO 9001-2008 certified.



Antenna Development Corporation

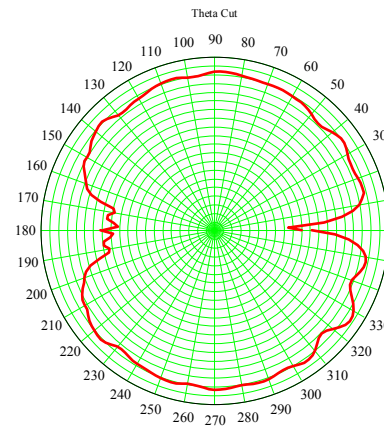
Cage Code: 46ER1

NAICS Code: 334220

www.AntDevCo.com (575) 541-9319 (main)
BBlevins@AntDevCo.com (575) 635-3528
TGreenling@AntDevCo.com (575) 644-1527

Radiation Patterns

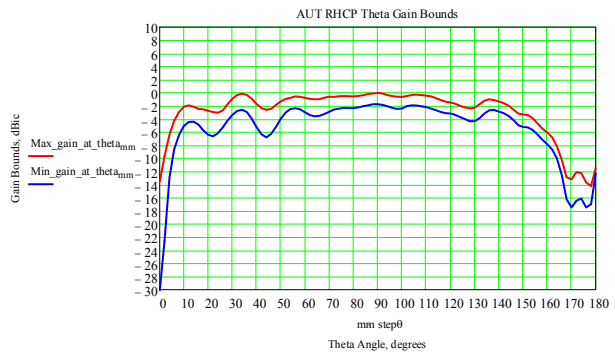
Exact radiation patterns are dependant on the particular frequency of operation, vehicle diameter, desired phase, polarization, and other factors. Measurements are customarily taken with the axis of the vehicle coincident with the measurement system's Z axis. Typical radiation patterns are shown in the next plots.



Typical L1 Elevation (theta cut) Pattern

(Maximum gain on the plot grid is +2 dBic. Pattern is to RHCP radiation. 2 dB per division)

The next plot summarizes the antenna's gain performance over all view angles. The antenna provides a highly symmetric pattern over rotation about the axis of the main beam. In the test configuration, the gain is measured over 360° of roll angles (\emptyset) for each value of θ (2° steps). The plot shows the limits of the gain as a function of θ over these full \emptyset rotations:



Example θ Gain Bounds Plot

AntDevCo Copyright © 2012 All Rights Reserved Cylindrical Array Antenna
Precision Antennas for Spacecraft, Rockets, and Missiles
Page 2 of 2