



**Diamond Engineering**  
Automated Measurement Systems

**4TECT**

ООО «4ТЕСТ»

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## DAMS Antenna Measurement Systems Guide

SOLUTIONS FOR LEADING TECHNOLOGIES

5G • WiGig • mmW • Automotive Radar • Pre-Compliance • Wireless Research

## Product Overview

### **LOW COST**

Outsourcing your antenna measurement needs to an outside lab can become very costly over time. By using our system, you can design and measure your own antennas or devices in-house quickly and efficiently, using your own instruments. We currently support a wide range of VNA's, signal generators, power meters, voltmeters, and spectrum analyzers. With systems starting around 14K we have a solution to fit most needs.

### **INSTRUMENT COMPATIBILITY**

Our software supports many common instruments from Anritsu, Keysight / Agilent /HP, Copper Mountain, Rohde & Schwarz, and Advantest. Visit [www.DiamondEng.net](http://www.DiamondEng.net) for a complete list of supported instruments. If your instrument is not listed but has a GPIB or Ethernet Port, contact us for more information.

### **ADVANCED SOFTWARE**

Our measurement systems feature our advanced Antenna Measurement Studio which is multi-frequency capable and offers multiple display and export formats including 2D / 3D and Spherical 3D

### **90% TURN-KEY PACKAGE**

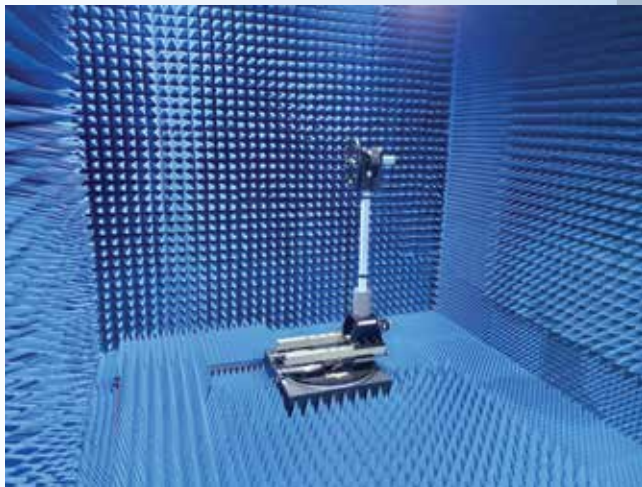
Our systems are complete with most items necessary to accurately measure most types of antennas. includes positioner, cables, software and accessories.



*All necessary components included!*

## Turn-Key Systems w/ Chamber

We now offer complete turn-key measurement systems including chamber, positioner and software. From MHz to mmW we can deliver a complete solution for your testing needs. Our chambers are custom designed to fit your requirements and feature double knife edge doors with high quality shielding and honeycomb vents. A comprehensive system training session completes the installation and commissioning process.



# Typical Measurement Layout

Below is a typical measurement setup using a Vector Network Analyzer (VNA) and a stationary calibrated horn with the basic DAMS System.

**Reference/TX Antenna**



**DAMS Positioner / AUT**



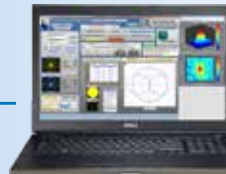
Scalar or Vector\* Calibration  
(\* Requires VNA)

Precision RF Cables



VNA, Rec. Only or  
Source/Receiver

**DAMS Antenna  
Measurement Studio**



USB / RS232 / FIBER

GPIB / Ethernet / USB

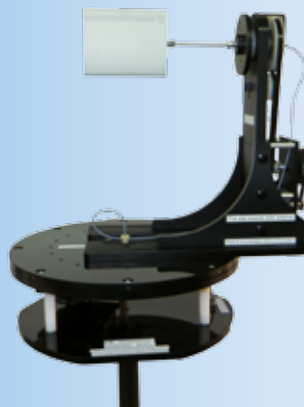
# Positioner Configurations

**D6050 Multi-Axis  
3D ready**



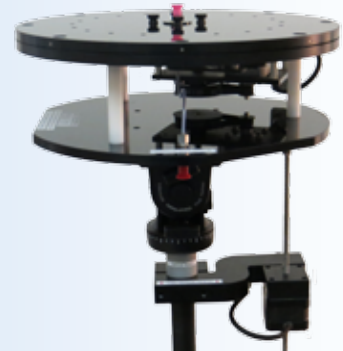
- Az 0-360 El +/- 180
- Phi over Theta configuration
- 5 Axis Option (AZ, EL, X, Y, Z)
- Keeps AUT Centered
- Optimal AUT->Positioner space
- Full 3D spherical measurements for Efficiency, TRP, TIS, etc.

**DAMS w/ FSM Mount**



- Az 0-360 El +/-180
- Phi over Theta configuration
- Carbon Fiber Tripod
- Keeps AUT Centered
- Full 3D spherical measurements for Efficiency, TRP, TIS, etc.

**Standard DAMS**



- Az 0-360 El +/- 45 or +/- 90
- Ideal for Single Cuts
- Semi-Spherical Measurement capable
- Upgradable to 3D Spherical

# D6050 Multi-Axis Positioner

**NEW!**

## Positioner Features:

- Configurable up to 67 GHz coax and 110 GHz WR10 Waveguide
- Adjustable Z axis for precision AUT Centering
- High Resolution
  - .020 Deg - Theta / Turntable
  - .05 or .025 Deg - Phi/Roll
- Weight Capacity - Turntable- 250 Lb., Phi/Roll- 35 Lb.
- Low-noise coaxial and/or waveguide rotary joints
- Precision Stepper motors
- Upgradable to 4-5 Axis for automated phase measurements
- Includes 2 x 15' RF Cables
- 24" Diameter turntable plate, 10" diameter roll plate
- Leveling casters for mobility and stable setup
- 3 year parts & labor warranty

## Available Models and Options:

- D6050-6 DC-6 GHz
- D6050-18 DC-18 GHz
- D6050-40 DC-40 GHz
- D6050-50 DC-50 GHz
- OPT 67G DC-67 GHz (ADD-ON)
- OPT MMW - Configured for mmW waveguide modules from all major manufacturers
- OPT 3A Automated Z axis
- OPT 4A Automated Z and X axis with pseudo Y axis

### Non-Metallic Belt Drive Head (Standard)

98% non-metallic construction for better transparency and lower reflections. up to .05 deg. native resolution



### Hi-Res Worm Drive Head (Optional)

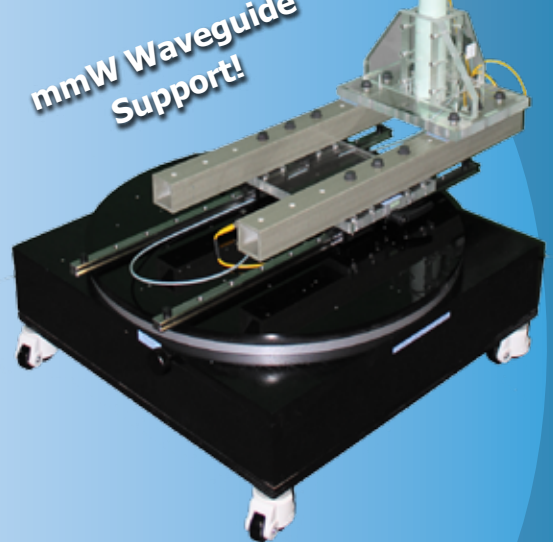
Resolutions to .025 deg. ideal for linear and circularly polarized directional antennas. Shown with waveguide mmW components



Waveguide Rotary Joint Option



mmW Waveguide Support!



**Supports most GPIB, Ethernet, PC Based Test Equipment**

# DAMS x000 Standard Measurement Series

## Positioner Features:

- Up to .125 degree azimuth resolution (DAMS 5000)
- Up to .0625 degree azimuth resolution (DAMS 6000/7000)
- 360 degree continuous azimuth range
- +/- 45 degree elevation range @ .10 degree per step
- DC -6 GHz measurement range (DAMS 5000)
- DC-18 GHz measurement range (DAMS 6000)
- DC-40 GHz measurement range (DAMS 7000)
- DC-50 GHz measurement range (DAMS 7000-50)
- DC-67 GHz measurement range (DAMS 7000-67)
- Waveguide Models (D7000-WG) V through W Band
- Low-noise rotary joint (SMA, 2.92mm, 2.4mm, 1.85mm, waveguide)
- 85% Acrylic / Delrin® construction for minimal reflections
- Up to 3 year warranty on parts and labor

## Optional Accessories:

- FSM Spherical Mount (for 3D , Efficiency, TRP/TIS)
- Laser tool for accurate alignment\*
- Digital level for precise setup\*
- Advanced processing module\*

\* Included with DAMS 6x00/7x00 systems

20 Pound  
Capacity!



## FSM-5 Full Spherical Mount Add-on

For small antennas and devices up to 5 lb. (2.3 kg)

### Features:

- Available for x000, x100, and x250 positioners
- Frequencies up to 67 GHz coax / 110 GHz waveguide
- 6" azimuth adjustment for centering
- 12" elevation height
- 0.062 degree movement resolution
- 5 lb. (2.3 kg) load capacity
- DAMS pro software license key



## FSM-10 Full Spherical Mount Add-on

For medium antennas and devices up to 10 lb. (4.5 kg)

### Features:

- Available for x000, x100, and x250 positioners
- Frequencies up to 67 GHz coax / 110 GHz waveguide
- 12-15" azimuth adjustment for centering
- 16" elevation height
- 0.062 degree movement resolution
- 10 lb. (4.5 kg) load capacity
- 12" Aut plate and support rollers for heavy loads
- DAMS pro software license key



## DAMS x100 Heavy Duty Measurement System

### Positioner Features:

- 0.25 degree azimuth resolution (DAMS 5100)
- 0.10 degree azimuth resolution (DAMS 6100/7100)
- 360 degree rotation
- +/- 90 degree elevation range @ 0.1 degree per step
- DC-6 GHz measurement range (DAMS 5100)
- DC-18 GHz measurement range (DAMS 6100)
- DC-40 GHz measurement range (DAMS 7100)
- DC-50 GHz measurement range (DAMS 7100-50)
- Low-noise rotary joint (SMA, 2.92mm, 2.4mm)
- Aluminum construction with steel gears and precision bearings for long life and reliability
- Quick and efficient technical support
- Includes all accessories
- 24" acrylic or aluminum thrust plate
- Ultra heavy-duty tripod for maximum stability
- 3 year parts & labor warranty

150 Pound  
Capacity!



## DAMS x250 Ultra-Heavy-Duty Measurement System

### Positioner Features:

- 250 ft-lb elevation torque
- 0.01 degree azimuth / elevation resolution
- 360 degree azimuth rotation
- +/- 90 degree elevation range
- Ultra-high torque stepper drive system
- Encoded position feedback
- DC-6 GHz measurement range (DAMS 5250)
- DC-18 GHz measurement range (DAMS 6250)
- DC-40 GHz measurement range (DAMS 7250)
- DC-50 GHz measurement range (DAMS 7250-50)
- Low-noise rotary SMA joint
- Aluminum construction with steel gears and precision bearings for long life and reliability
- Includes all accessories
- 30" aluminum or acrylic AUT mounting plate
- Ultra-heavy-duty tripod for maximum stability
- 3 year parts & labor warranty

250 Pound  
Capacity!



# Ultra Broadband Calibrated Antennas

## Horn Features

- Ultra-broadband design
- Special lens for broadband high gain
- Silver plated elements
- Low VSWR
- Monotonically increasing gain
- Constant phase center
- Light Weight Construction
- Built-in alignment laser
- Individual calibration data
- Custom calibration distances up to 3m
- 2 year Warranty

**Ultra Broadband!**  
500 MHz - 40 GHz!

## Ideal For

- Antenna Gain Measurements
- 5G Testing
- RCS / Time Domain
- Material Measurement
- SigInt



## Available Models and Options

### 18 GHz

- DE0518 500 MHz to 18 GHz
- DE0718 700 MHz to 18 GHz

### 26 GHz

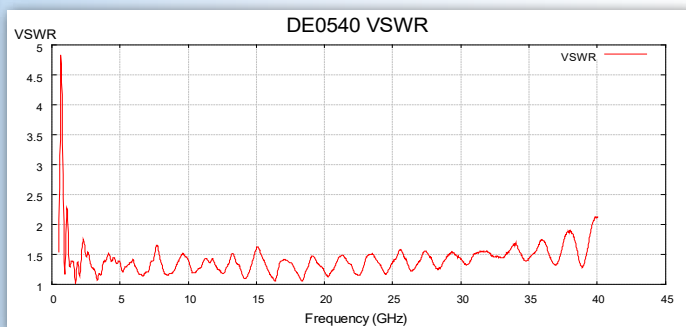
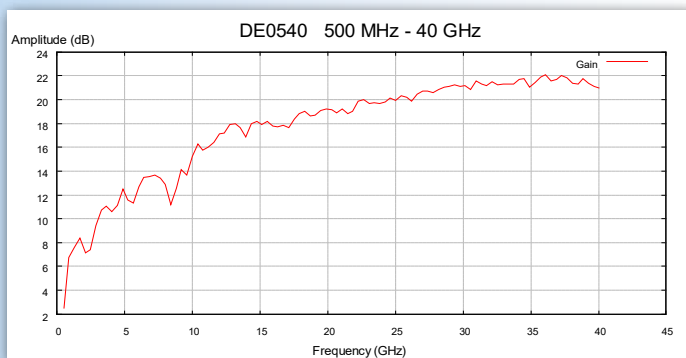
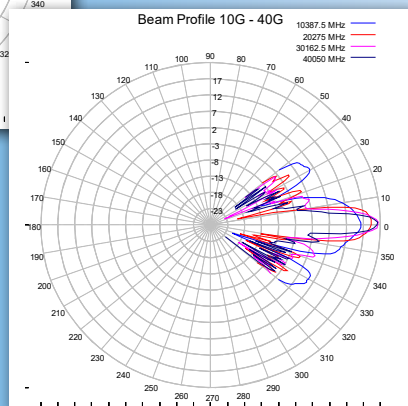
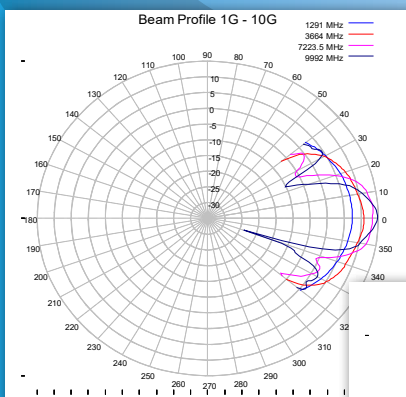
- DE0526 500 MHz to 26 GHz
- DE0726 700 MHz to 26 GHz

### 30 GHz

- DE0530 500 MHz to 30 GHz
- DE0730 700 MHz to 30 GHz

### 40 GHz **NEW!**

- DE0540 500 MHz to 40 GHz
- DE0740 700 MHz to 40 GHz



# Powerful Measurement Software

Download our fully functional demo software at [www.DiamondEng.net](http://www.DiamondEng.net)

Antenna Measurement Studio is our powerful software that can thoroughly characterize any antenna using a wide variety of processing and display features.

## Standard Features:

- One-touch antenna profiling
- Multiple S-parameters (S21, S11, etc.)
- Multiple trace plots
- Automatic polarization switching option
- Basic 3D plots
- Data export / import function
- Exportable vector plots
- Over frequency measurements
- Various calibration methods
- Fully configurable positioner settings
- External triggering
- Data set manipulation

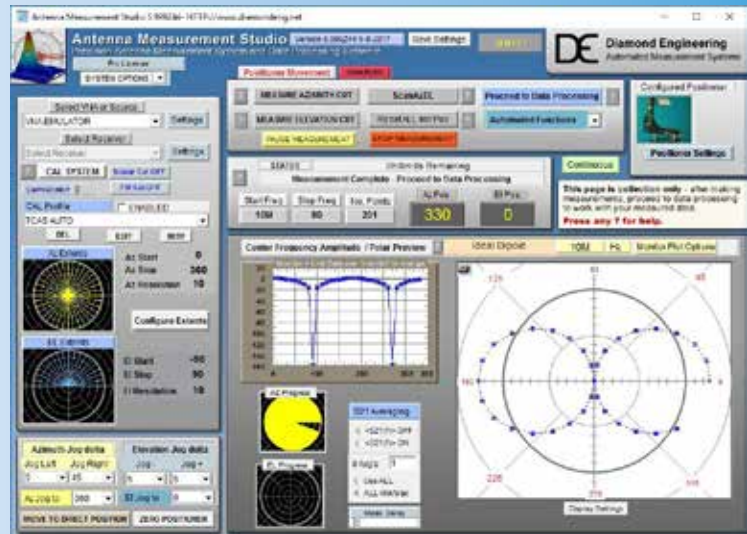
## Advanced Processing Modules:

- Efficiency / TRP calculation
- RCS calculation
- Phase center
- TIS / TRS (Total Isotropic Sensitivity)
- Advanced spherical 3D plots
- MSI/Planet export

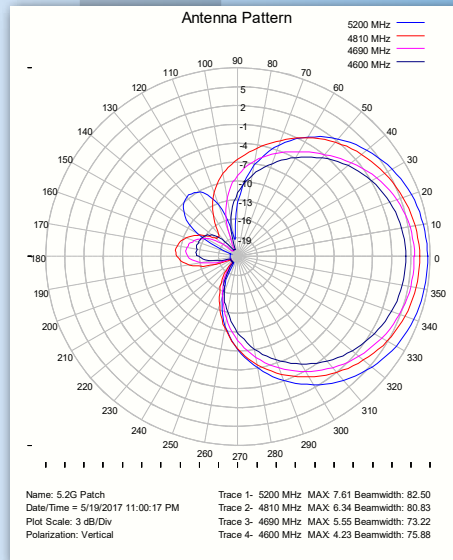
## Supported Instrument Configurations:

- VNA up to 4 ports
- Receive only for self generating sources\*
- Separate source and receive instruments\*

\* Supported receivers: spectrum analyzer, power meter or voltmeter with detector diode.



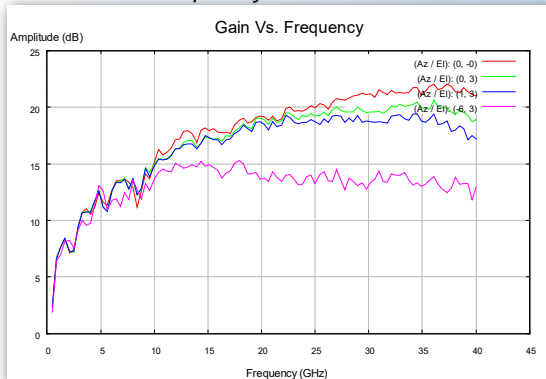
Multi-Trace Vector Plots



Excel Export

Trace Data
Trace1 1405 MHz
0 -17.2299 177.5048
15 -18.1906 171.7011
30 -18.9444 163.9343
45 -40.3096 158.2648
60 -41.9215 153.8587
75 -43.2861 147.6673
90 -44.5955 132.9351
105 -44.7738 160.4573
120 -44.9808 170.1201
135 -43.7391 -179.8332
150 -42.7079 -173.1121
165 -40.5314 -163.59
180 -38.8676 -157.665
195 -37.5324 -153.1113
210 -36.7321 -145.111
225 -35.8956 -140.481
240 -35.4421 -140.53
255 -35.3265 -140.488
270 -34.9052 -141.213
285 -35.1565 -144.624
300 -35.4592 -132.212
315 -35.5977 -159.31
330 -36.0928 -168.532
345 -36.7746 -177.066
360 -37.6857 178.7483

Over Frequency Measurements



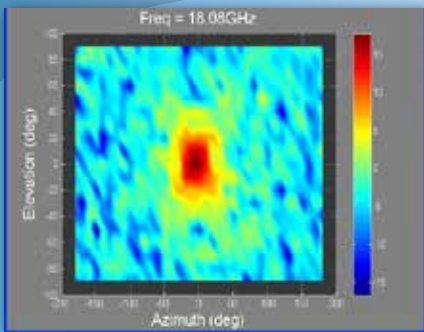
## New Features

- Automatic polarization switching using USB switch or multi-port VNA
- 3rd party near-field processing support
- Remote triggering
- Automatic gain calculation with circular polarization support
- LTE 3GPP TIS/TRS measurements
- Mechanical polarization axis support
- 2nd motion controller support

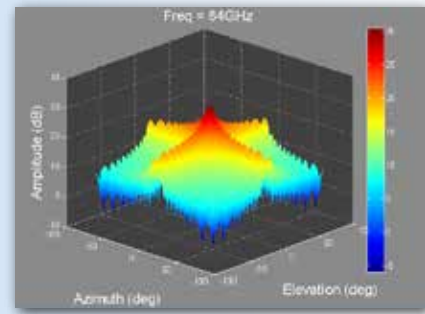


## 3D / SPHERICAL PLOTTING

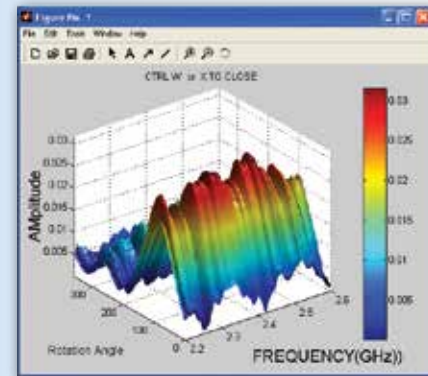
Built in MatLab Runtime to generate powerful 3D Plots



Color map Plot



3D Az/El Plot



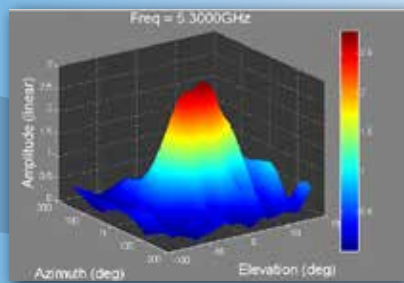
3D Amplitude Plot

## GAIN CALCULATION FEATURES

A number of gain calculation modules are provided from linear gain transfer to remove path loss and reference antenna gain to the 3-point method using the FRIIS transmission formula.

### Modules:

- Linear gain transfer
- Circular gain via linear H-V
- Gain substitution
- Total power factor
- 3 point method



## DATA EXPORT

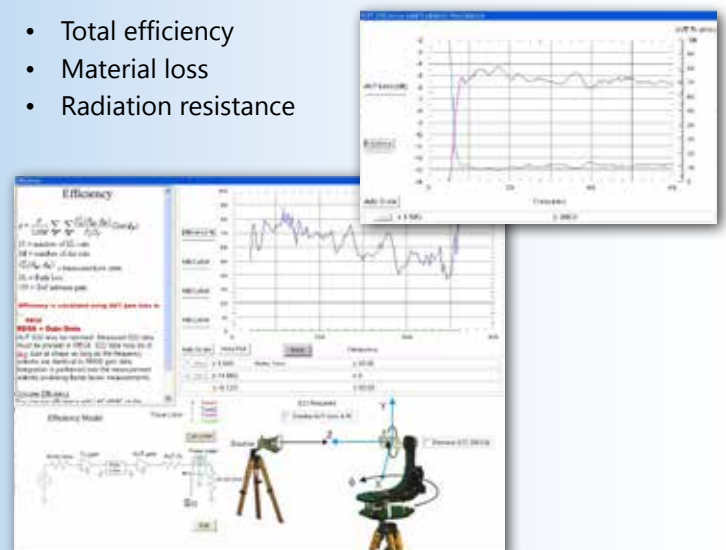
Export single cuts or entire data sets in multiple formats

- Direct to Microsoft Excel
- .TXT / .S1P
- MSI / Planet for site planning

## ANTENNA EFFICIENCY

Complete antenna efficiency module includes:

- Total efficiency
- Material loss
- Radiation resistance



# Advanced Software Features and Options

## AUTO POLARIZATION

Make automatic dual polarization measurements using a rotary positioner with single polarization source, or a USB switch/multiport VNA and dual polarized antenna to **reduce measurement time by 50%**! In addition, automatic gain calculation for linear or circular polarization measurements are also provided.

## LTE OTA PRE-COMPLIANCE



Make LTE Pre-Compliance radiated measurements of Total Radiated Power (TRP) and Total Receiver Sensitivity (TRS) using communications analyzers from Anritsu and Rohde Schwarz. Intelligent search algorithms bring total measurement time as low as 30 minutes per frequency for sensitivity measurements.

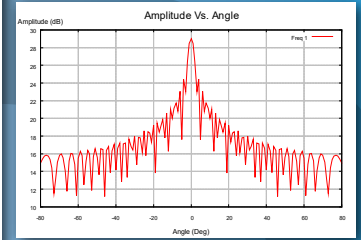
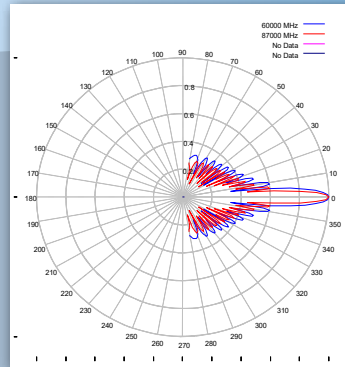
## 3RD PARTY POSITIONER SUPPORT

Features expanded support for 3rd party positioners and controllers. Don't see your's listed? Contact us for more details!

- Sunol AZEL2B Positioner
- Sunol SC110V Controller
- Frankonia EMC Turntables
- M2 RC2800
- INNCO CO3000 Controller
- Scientific Atlanta 2012 / 4139
- Galil Motion Controllers
- Custom Applications - Ask us!

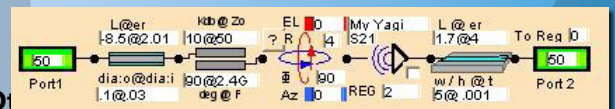
## RCS MEASUREMENT MODULE

Process measured RCS data using direct or gated S11/S21. Compare measured data against simulated ideal structures such as spheres and plates.

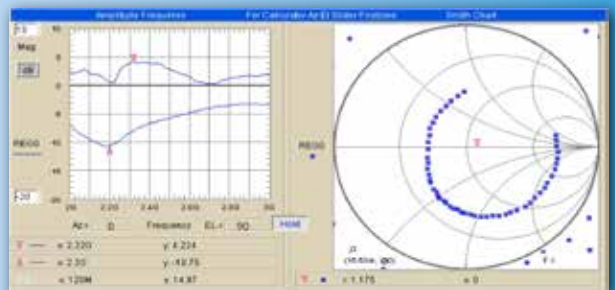


## ANTENNA NETWORK SIMULATOR

A full feature two-port simulator with wave analysis. Fully customize-able drag-and-drop elements enable users to create diversified simulations. Three main objects include schematic, amplitude (or Smith chart) and an array calculator.



- Analyze networks, including path-loss or phase
- Create phased arrays or sector arrays
- Create matching circuits for measured antennas
- Use the antenna emulation library for ideal networks



# Supported Instruments

All DAMS Systems and software support a wide-array of Vna's, PNA's, signal generators, power meters and spectrum analyzers. If your instrument has a GPIB or Ethernet port, it will most likely work. USB compatibility is device specific.

Popular instruments compatible with DAMS:

## **VECTOR NETWORK ANALYZERS**

Anritsu Sitemaster / VNA Master / S820E  
Anritsu 46xx Series VNA  
(VectorStar, Shockline, and Scorpion)  
Anritsu 37xx Series Analyzers (Lightning)  
Copper Mountain Planar Series (804/304)  
Copper Mountain TR5048 / S5048 Series  
Copper Mountain Cobalt / Cobalt FX  
HP / Agilent 8510x Series  
HP / Agilent 8714 Series  
HP / Agilent 8720 Series  
HP / Agilent 8753 Series  
Keysight 507x Series ENA's  
Keysight N52xx/836x Series PNA's  
Keysight N99xx Fieldfox  
Rohde & Schwarz ZVx, ZNx Series

## **SIGNAL GENERATORS**

Keysight Agilent/HP Models  
Anritsu Models  
R&S SMP/SML Series

## **POWER METERS**

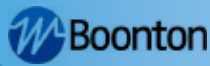
Elva DPM-10  
HP 436A / 437B Series  
Keysight EPM Series  
Anritsu ML2438A / Others  
Boonton USB

## **SPECTRUM ANALYZERS**

Anritsu Sitemaster  
Anritsu MS27xx Series  
Anritsu MT82xx Series  
Keysight N99XX Fieldfox  
Agilent E440x Series  
HP856x Series  
Rohde & Schwarz FSx Series



Scan me for a complete list of supported instruments.



## **Featured Customers**

U.S. Army, Navy, and USAF  
Northrop Grumman  
L3 Communications  
Honeywell  
Harris Corporation  
Aptiv  
Ball Aerospace  
Microsoft  
Penn State University



TDK (Ireland)  
Boeing  
Ubiquity Networks  
Arris  
Lockheed Martin  
Samsung  
Denso  
GE Research  
Qualcomm

# Product List

## Standard x000 Series - Up to 20 lb capacity (9 kg)



<u>Product Code</u>	<u>Frequency</u>
D5000	DC-6 GHz
D6000	DC-18 GHz
D7000	DC-40 GHz
D7000-50	DC-50 GHz

## Floor Mount D6050-x - Up to 250 lb\* capacity (114kg)



<u>Product Code</u>	<u>Frequency</u>
D6050-6	DC-6 GHz
D6050-18	DC-18 GHz
D6050-40	DC-40 GHz
D6050-50	DC-50 GHz
D6050-OPT-mmW	Milimeter Wave

## Heavy Duty x100 Series - Up to 150 lb capacity (90 kg)



<u>Product Code</u>	<u>Frequency</u>
D5100	DC-6 GHz
D6100	DC-18 GHz
D7100	DC-40 GHz
D7100-50	DC-50 GHz

## Heavy Duty x250 Series - Up to 250 lb capacity (113 kg)



<u>Product Code</u>	<u>Frequency</u>
D5250	DC-6 GHz
D6250	DC-18 GHz
D7250	DC-40 GHz
D7250-50	DC-50 GHz

## Full Spherical Mount Option- Up to 10 lb capacity (4.5 kg)



<u>Product Code</u>	<u>Frequency</u>
DFSM5-18/40/50	DC-18/40/50 GHz
DFSM10-18/40/50	DC-18/40/50 GHz
DFSM25-18/40/50	DC-18/40/50 GHz

## Ultra Broadband Reference Antenna - Up to 40 GHz



<u>Product Code</u>	<u>Frequency</u>
DE 0518 / 0718	500 / 700 MHz - 18 GHz
DE 0526 / 0726	500 / 700 MHz - 26 GHz
DE 0530 / 0730	500 / 700 MHz - 30 GHz
DE 0540 / 0740	500 / 700 MHz - 40 GHz

## Company Headquarters

### Diamond Engineering Inc.

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Diamond Springs, CA 95619

Telephone: 530-626-3857  
Fax: 530-626-0495

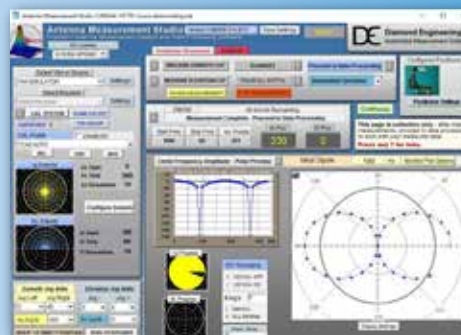
## Optional Accessories

Pre-Configured Desktop PC  
Pre-Configured Laptop PC  
DAMS Simulator Addon  
DAMS P100 Polarizer  
Automated Z Slide (x100+FSM)  
Platform Development Kit

## Product Code

DEPC-D  
DEPC-L  
SIMULATOR  
P100

Contact us about your custom application!



Your representative:

# 4TECT

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