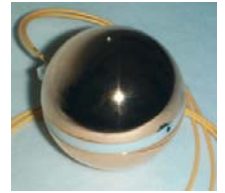


The Precision Spherical Dipole Source



**Freedom to make
accurate
and
repeatable
measurements!!**

Presented by:

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Partner / Technical Director

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Applied Electromagnetic Technology, LLC. (AET)



- **Mission:** Advance Technology for Accurate Electromagnetic Measurements for the EMC, RF and Antenna Communities
- **Vision:** As a Company Always Interested in Building Strong Partnerships With Government and Industry Research, Development, Test and Evaluation Organizations, AET Will Provide Your Organization With a Unique Test and Measurement Tool That Is Our Standard Product
- **Goal:** Our Precision Spherical Dipole Source (PSDS) Product is a Real-World Industry Standard - the Most Accurate Electromagnetically-Isolated and Repeatable Electric Field Source Available On the Market Today

History of the Precision Spherical Dipole



1990

1995

2000

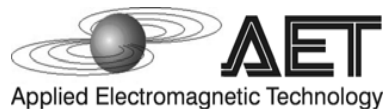


- **The Spherical Radiator was developed by NIST and Digital Equipment Corp. (DEC)**
 - B. Archambeault/DEC deeply involved with NIST in developing the system
 - Major funding from NAVY
 - Naval Air Test Center EMI Team
- **SETH Corp. re-designed original NIST Spherical Radiator**
 - B. Archambeault leaves DEC for SETH Corp.
- **SETH makes Spherical Radiator a product**
 - B. Archambeault leaves SETH Corp.
- **AET, LLC. Established**
 - Dr. Archambeault and Partners Start-up AET
 - Redesign of the 3rd Generation Spherical Radiator as PSDS with all New Circuits
 - Build and sell PSDS products and options.

AET Business Info.



- Applied Electromagnetic Technology, LLC. (AET)
- Founded in June 2000
- Small Business with Offices in Maryland and North Carolina
 - Advanced RF Technology Product Design and Development
- Unique Niche Product Has Low Volume Production
 - Outsource Fabrication and Production
 - In-house Final Assembly and Test
 - In-House Customer Service
- Dunn & Bradstreet Number: 10-347-5369
- Contact Info:
 - P.O. Box 1437
 - Solomons, Maryland, USA 20688-1437
 - Tel: (410) 326-6728 / Fax: (410) 326-6728
 - E-mail: info@appliedemtech.com
 - Web Site: www.appliedemtech.com



Applied Electromagnetic Technology

Applied Electromagnetic Technology, LLC.

Advanced technology for accurate electromagnetic measurements

Precision Spherical Dipole Source

- a highly accurate electromagnetically-isolated and repeatable Electric field source.



Precision Spherical Dipole Source

- a highly accurate electromagnetically-isolated and repeatable Electric field source.



- Ideal for
 - Precise and NIST-Traceable RF Emissions
 - Highly Accurate Antenna Measurements
 - Ultra-Repeatable Shielding Measurements
 - Ideal for Complex Site Calibration
- Features
 - Radiating Spherical Dipole Frequency Ranges:
 - 15 KHz to 50 MHz = Low Frequency Sphere
 - 10 MHz to 2.5 GHz = High Frequency Sphere
 - Dipole Antenna is Optically Isolated from Control Unit
 - Rechargeable Battery-Powered Dipole Antenna
 - RF Level Monitoring at Dipole Output
 - Temperature Controlled Laser Source
 - Output Levels above FCC/CISPR Limits at 10 m.

The Real-World Industry Standard



- PSDS is the Most Versatile, Accurate and Repeatable, Electric Field Source Available!
- The PSDS is a Unique Product, a Radiated E-field Source That Addresses Many Requirements in Both the Research and Test Community
- This RF Signal is Optically Transmitted to the Spherical Antenna, Re-converted to RF, and Radiated From the Spherical Dipole Antenna
- The Antenna's Gap Voltage is Monitored Within the Sphere and Fed Back Via an Optical Fiber Cable and Displayed on the Control Unit's Front Panel
- The Radiated E-field Level Can Be Adjusted Using the Gap Voltage Measurement to Create a Highly Repeatable (0.2 - 0.5 dB) and Accurate E-field Source

PSDS General Description



- The PSDS Consists of Two Major Parts; A Control Unit and the Spherical Dipole Radiating Antenna
- All Interfaces Between These Two System Components is by a Duplex Fiber Optic Cable
- The Main Subsystem of the PSDS is the RF Subsystem
 - In This Subsystem, the RF Input is Fed to a High Performance Laser and Modulates the Laser Signal
 - The Laser's Output is Fed to the Spherical Dipole Through One of the Fibers in the Duplex Fiber Optic Cable
 - Once Inside the Spherical Dipole, the Laser Signal is Demodulated
 - The Restored RF Signal is Amplified and Fed to the Spherical Dipole Hemispheres and Radiated Into the Local Environment.
- The Second Major Subsystem is the Spherical Dipole Gap Voltage Sensor Downlink
 - This Subsystem Senses the Level of the RF Signal Just Before it is Applied to the Spherical Dipole Hemispheres
 - This Is Proportional to the RF Voltage That Exists at the Gap Between the Dipole Hemispheres
 - The Gap Voltage is Converted to an Optical Signal, Transmitted Via a Fiber in the Duplex Fiber Optic Cable Down to the Control Unit
 - Once in the Control Unit, the Original Gap Voltage is Recovered From the Optical Signal and Displayed on the Front Panel of the Control Unit
 - The Gap Voltage Indication is Also Available at the BNC Connector on the Front Panel for Remote Measurement

PSDS System Block Diagram



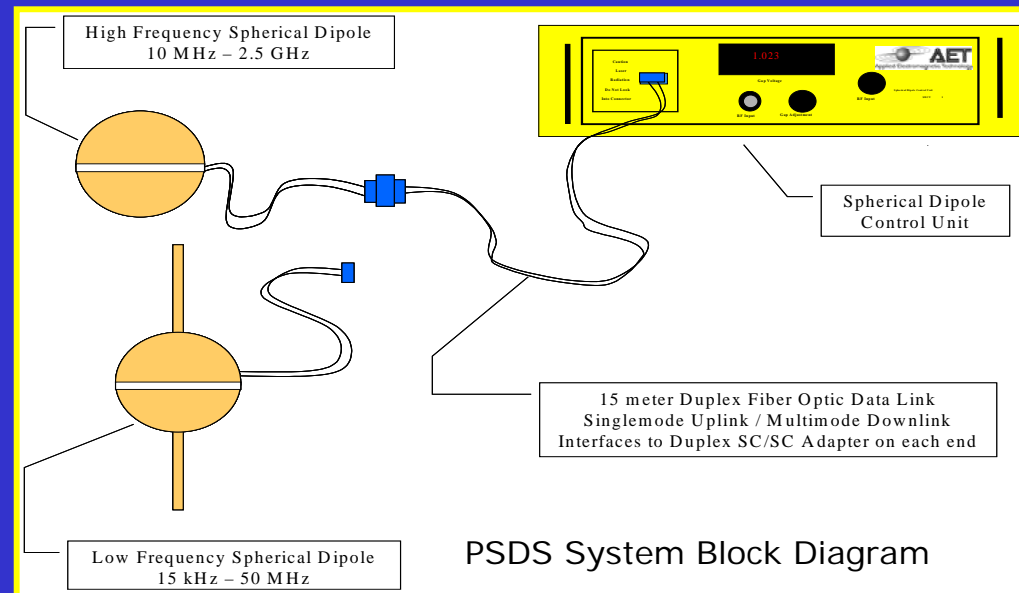
Control Unit

- Wide RF Input Frequency and Power Range
- Duplex Optical Fibers to Sphere for Total Isolation
- Monitored and Adjustable Output RF Power



Spherical Dipole Antenna

- Two PSDS Radiating Elements; High and Low Frequency Ranges
- Battery Operated for RF Isolation; 6 Hours of Operating Time
- Spheres Are Interchangeable With Same Control Unit



Batteries

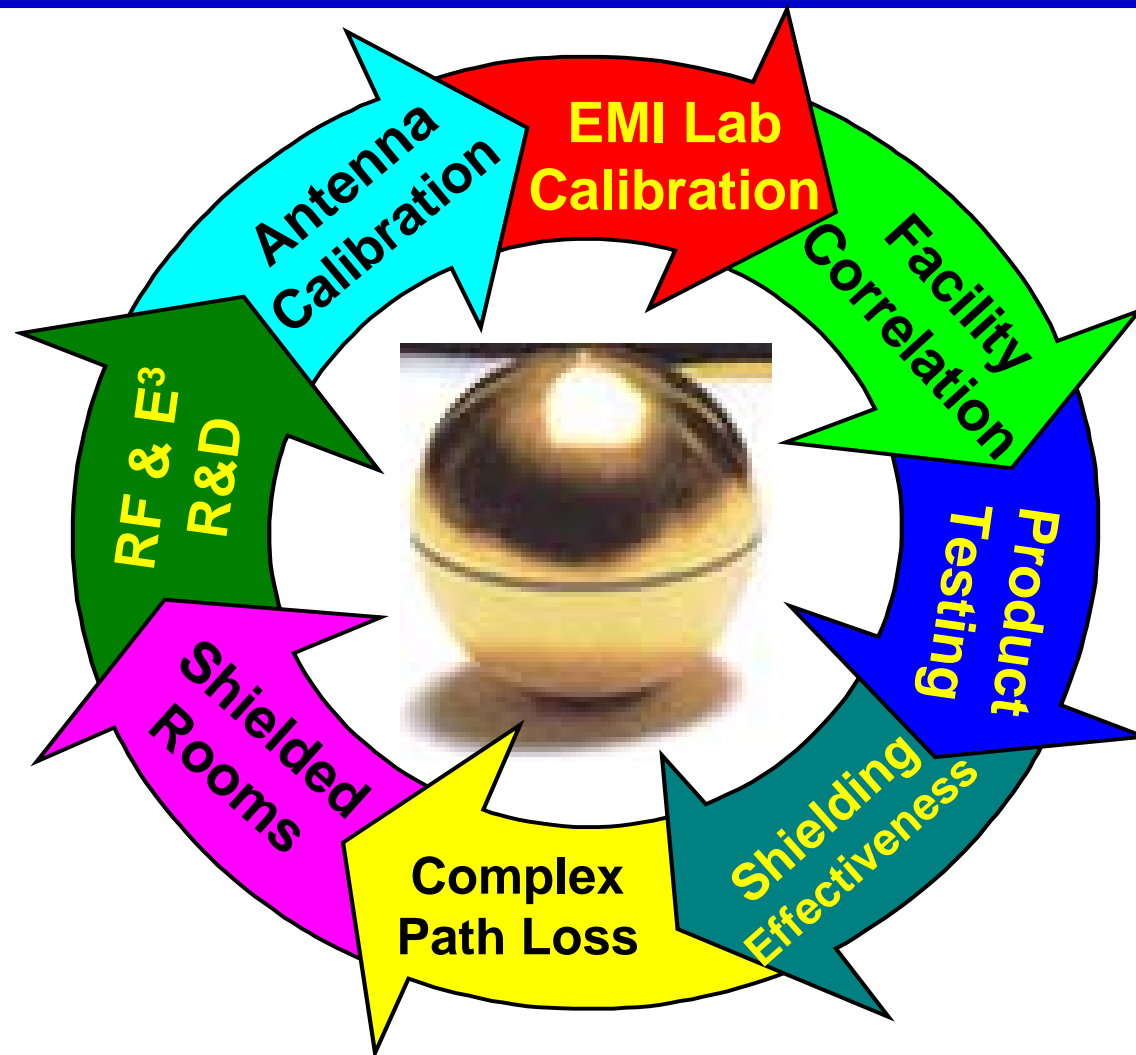
- Two NiMH Rechargeable Battery Boards Inside the Sphere
- Designed to Provide Extra Long Spherical Dipole Operating Time
- Easy In-Sphere & External Charging for Real-World Applications

Benefits of Using the PSDS



- Using Our Precise and Highly Repeatable Very Broadband RF Source in Your Electromagnetic Research and Testing Provides These Benefits:
 - Provide Significant Improvements in EMC/EMI and RF Measurement Data Quality and Accuracy
 - Because Our Source is a Highly Predictable Spherical Dipole and Because it is a Battery Operated Antenna Using a Fiber Optically Isolated RF Feed, We Achieve an Unprecedented Level of Electromagnetic Test Equipment Purism Beyond That Found in Any Other Product on the Market
 - As Our Antenna is Extremely Small, Substantially Smaller in Scale Than Other Competitive Antennas, the PSDS Can Be Used to Measure Shielding Effectiveness and Other Electromagnetic Phenomenon in Very Small Spatially Confined Areas Without Compromising the Standard Concern of Antenna Loading Effects in Close Proximity to Metal Walls and Screens

Typical Applications



Sample PSDS Applications



- Calibration Standard
 - Ideal as a Calibrated Reference Source for Daily Equipment Checks
 - Uniquely fit for Inter-laboratory and/or a Multiple Site Transfer Standard
 - Applicable to OATS, GTEMs, Semi-anechoic or Shielded Rooms, and any Standard RF Test Site or Complex Test Environment
- Shielding Effectiveness Testing
 - The Small Radiating Element (10cm. Diameter) Makes the PSDS Source Ideal for Inside Very Small (or Large) Enclosures for Shielding Effectiveness Measurements
 - The Gap Voltage Adjustment Ensures the Same Radiating Source Electric Field As in the Open Calibration Characterization
- Antenna Calibration
 - Extremely Stable and Repeatable E-field Source, and also Electrically Small, Providing an Accurate “Point Source” for Antenna Calibration.
 - Fiber Optic Cables and Battery Isolation Allow a Repeatable Test Set-up, Removing Unwanted Effects From Cables and Ground Loops

High & Low Frequency Bundled System



- Model PSDS-HL; Precision Spherical Dipole Source (PSDS) High & Low Frequency Bundled System, P/N 90001, includes:
 - High Frequency Spherical Dipole SD-2500, range: 10 MHz to 2.5 GHz
 - Low Frequency Spherical Dipole SD-50, range: 15 kHz to 50 MHz
 - Spherical Dipole Control Unit (SDCU)
 - 15 Meter Duplex Fiber Optic Patch Cable
 - Rechargeable NiMH Battery Boards with Removable AAA Battery Cells
 - Wall-Mount Power Supply for Battery Charging
 - Spherical Dipole Dielectric Mounting Stand
 - PSDS Users Manual
 - Hard Plastic Rolling Carrying / Shipping Container for PSDS-HL

High Frequency Bundled System and Spherical Dipoles



- Model PSDS-H; Precision Spherical Dipole Source (PSDS) High Frequency Bundled System, P/N 90002, includes:
 - High Frequency Spherical Dipole SD-2500, range: 10 MHz to 2.5 GHz
 - Spherical Dipole Control Unit (SDCU)
 - 15 Meter Duplex Fiber Optic Patch Cable
 - Rechargeable NiMH Battery Boards with Removable AAA Battery Cells
 - Wall-Mount Power Supply for Battery Charging
 - Spherical Dipole Dielectric Mounting Stand
 - PSDS Users Manual
 - Hard Plastic Rolling Carrying / Shipping Container for PSDS-H
- SD-2500; High Frequency Sphere, Range: 10 MHz to 2.5 GHz, P/N 20020
- SD-50; Low Frequency Sphere, Range: 15 kHz to 50 MHz, P/N 20021
 - Both are Compatible with PSDS SDCU and Duplex Fiber Optic Cable

New & Improved Spherical Dipole Design



- The Benefits of our Latest Spherical Dipole Design Provides:
 - Higher Radiated Output Power
 - Increased Dynamic Range
 - Increased Stability and Reliability
 - Increased Usable Frequency Range
 - Improved Analog Circuits and Eliminates False Battery Alarm
 - Improved Control Circuitry
 - Reduced Circuitry Load to Extend Battery Life
 - New Voltage Supervisory Circuit to Protect Battery From Damage
 - Simpler Fiber Optic Cable Connections for User

PSDS Options



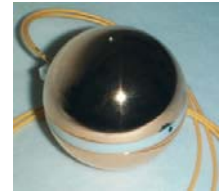
- **Benchtop PSDS Calibration Assembly, P/N 20055:**
 - Spherical Dipole's RF Interface to RF Spectrum Analyzer
- **Spherical Dipole Tripod Adapter Assembly, P/N 20019:**
 - Dielectric Mechanical Interface to Mounting Spherical Dipole to Tripod
- **Spherical Dipole Battery Boards, P/N 20028-01:**
 - Spare Set of Battery Boards Compatible With Either Spherical Dipole
- **Thin Duplex Fiber Optic Patch Cable and Adapters, P/N 20039:**
 - Fiber Optic Patch Cables With Miniature Connectors to Fit Through 0.25 in. Hole
- **1 Year Extended Warranty, Provides:**
 - Annual or Premium Extended Parts and Labor Warranty on Select Items
- **Annual Calibration Service, Provides:**
 - Annual Calibration Service for Spherical Dipole(s) and Control Unit
 - Optional Spherical Dipole Measurement Service by NIST RF Laboratory

Warranty Plans



- Standard Warranty Plan: Included in Each Purchase for 90-days After Receipt of Product; Which Provides Standard Parts and Labor Warranty for 90 Days After Receipt of PSDS Product.
- Annual Warranty Plan: Provides Limited Parts and Labor Warranty for 1 Year After Plan Is Purchased, With No Return Timeframe Guarantee.
- Platinum Warranty Plan: Provides Standard Parts and Labor Warranty, Provides Notices of Latest Product Options and Upgrades, Guarantees Urgent Repairs Are Performed on a 2 Week Problem Notice to Solution Turn-around, Provides for Annual Battery Board Reconditioning, and Provides Annual PSDS System Realignment and Bench Calibration, All for 1 Year After This Plan Is Purchased

PSDS Spherical Dipole Specifications



- High Frequency Range:
 - 10 MHz – 2.5 GHz
- Low Frequency Range:
 - 15 kHz – 50 MHz
- RF Output Power Level:
 - Above FCC/CISPR Limits at 10 m
- Sphere Size: 10 cm Diameter
- Fiber Optic Cable Interfaces:
 - RF Signal Uplink Interface; Simplex Single-Mode Patch Cable
 - Gap Voltage Monitoring Downlink: Simplex Multi-Mode Patch Cable
- 6 VDC NiMH Battery Isolated Power, Rechargeable
 - On/Off Push Button Switch Controls Spherical Dipole Battery Power
 - Green LED on Sphere White Ring Is Illuminated When the Power Is ‘On’



The Spherical Dipole Antennas

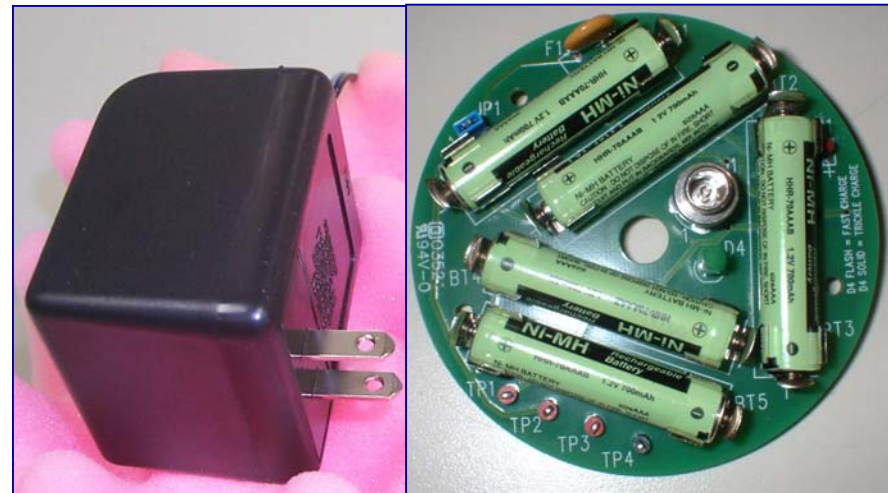


- The Radiating Spherical Dipole Provides a Reliable, Electrically Isolated, and –Most Importantly- Repeatable and Accurate Signal Test Source for Technical Applications
- The Spherical Dipole Is Comprised of Two Hemispheres, Which Form the Radiation Element of a Spherical Dipole Antenna
- Operation of the Spherical Dipole, and Functional Status, Is Provided Through Optical Fiber Interconnections Back to the Control Unit
- Both Spherical Dipoles Available With the PSDS Are Interchangeable and Operate With the Same Control Unit
- With the Combination of Two Interchangeable Spherical Dipole Antennas, the PSDS Covers the Frequency Range of 15 KHz to 2.5 GHz
- The SD-50 Covers the Frequency Range of 15 KHz to 50 MHz, and the SD-2500 Covers the Frequency Range of 10 MHz to 2.5 GHz

Rechargeable 6 VDC NiMH Batteries



- Specially Designed 6 VDC NiMH Battery Boards are Installed Inside the Spherical Dipole Antenna So No Metal Wires or Conductors Can Interfere With the Repeatability and Accuracy of the PSDS
- Each Battery Board Supplies 1000 mAH and Operated in Parallel to Provide An Extra Long Operating Time During Real-world Testing
- Boards Are Fully Rechargeable While Installed Inside the Sphere Using a Wall-plug Power Supply
 - Domestic or European AC Voltages



- Each Board Can Be Recharged Externally From the Sphere During Testing
- Each AAA Battery Cell is Easily Removed and Replaced as Needed
- 2 Battery Boards Are Provided with Each Spherical Dipole Antenna

PSDS Control Unit Specifications



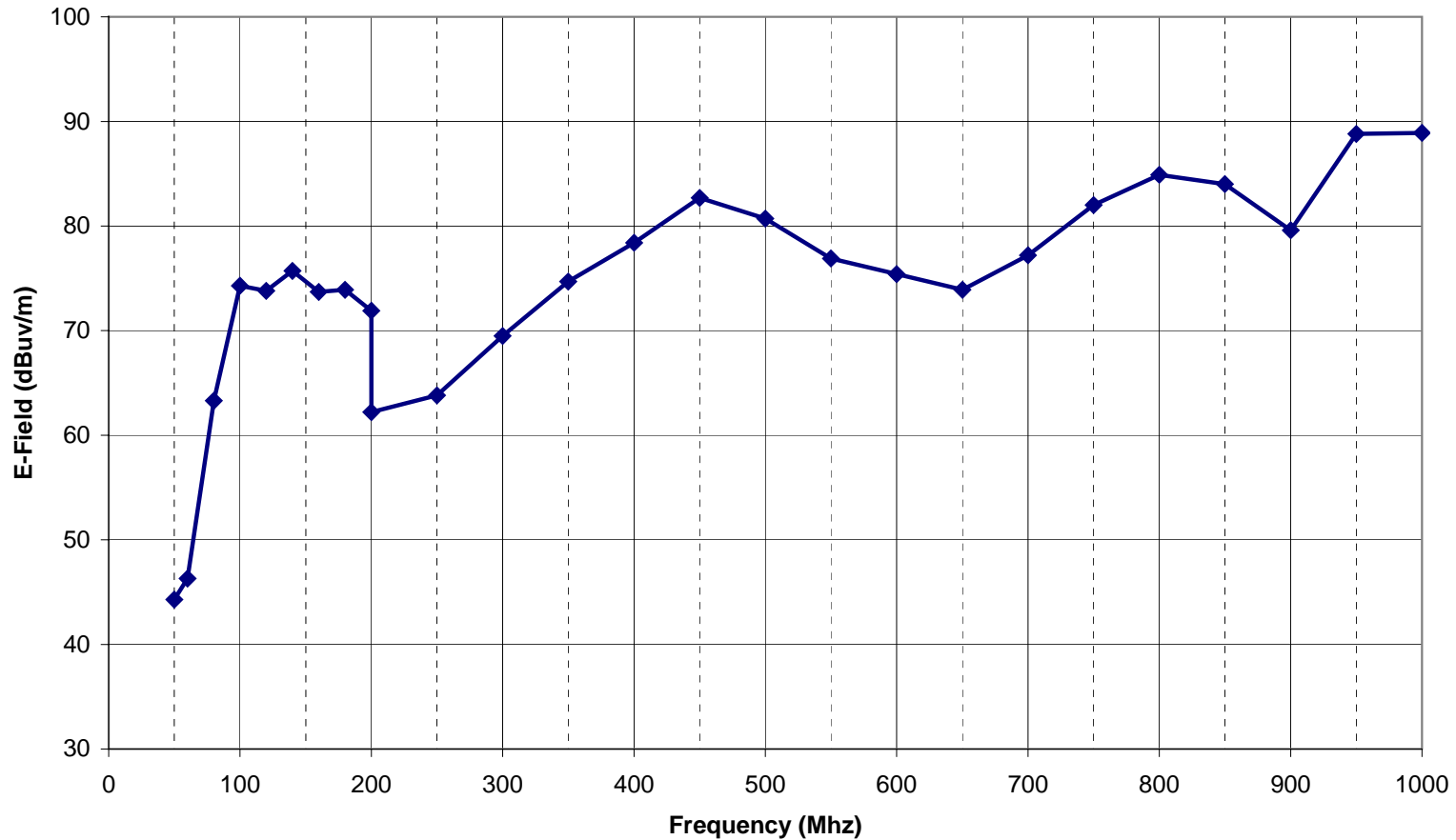
- Rack / Bench Top Unit
 - 19 in. Rack Mount, 3U Height
- RF Input
 - N-Type Connector
 - RF Input Power: < 20 dBm (Max.)
- Front Panel LED Warnings: Sphere Power Off & Battery Low
- Rear Panel Audible Alarm: Whenever Warning Level Exceeded
- Dipole RF Gap Voltage Monitoring
 - 3-1/2 Digit LCD Display
 - BNC-Type Connector for Automated or Remote Monitoring
- Dipole RF Gap Voltage Adjustment: 10-turn Potentiometer
- Fiber Optic Isolation: Between Control Unit And Radiating Sphere
- Laser Source: Ultra-Stable and Temperature Controlled
- Input Power Requirement: 120 /240 VAC, 50/60 Hz, < 1A



Typical Radiated E-Field at 1.5 m Horizontal Polarization (Gap Voltage = 1.0 v)

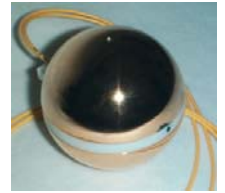


Receive Antenna 1m Above Ground -- Sphere 0.8m Above Ground

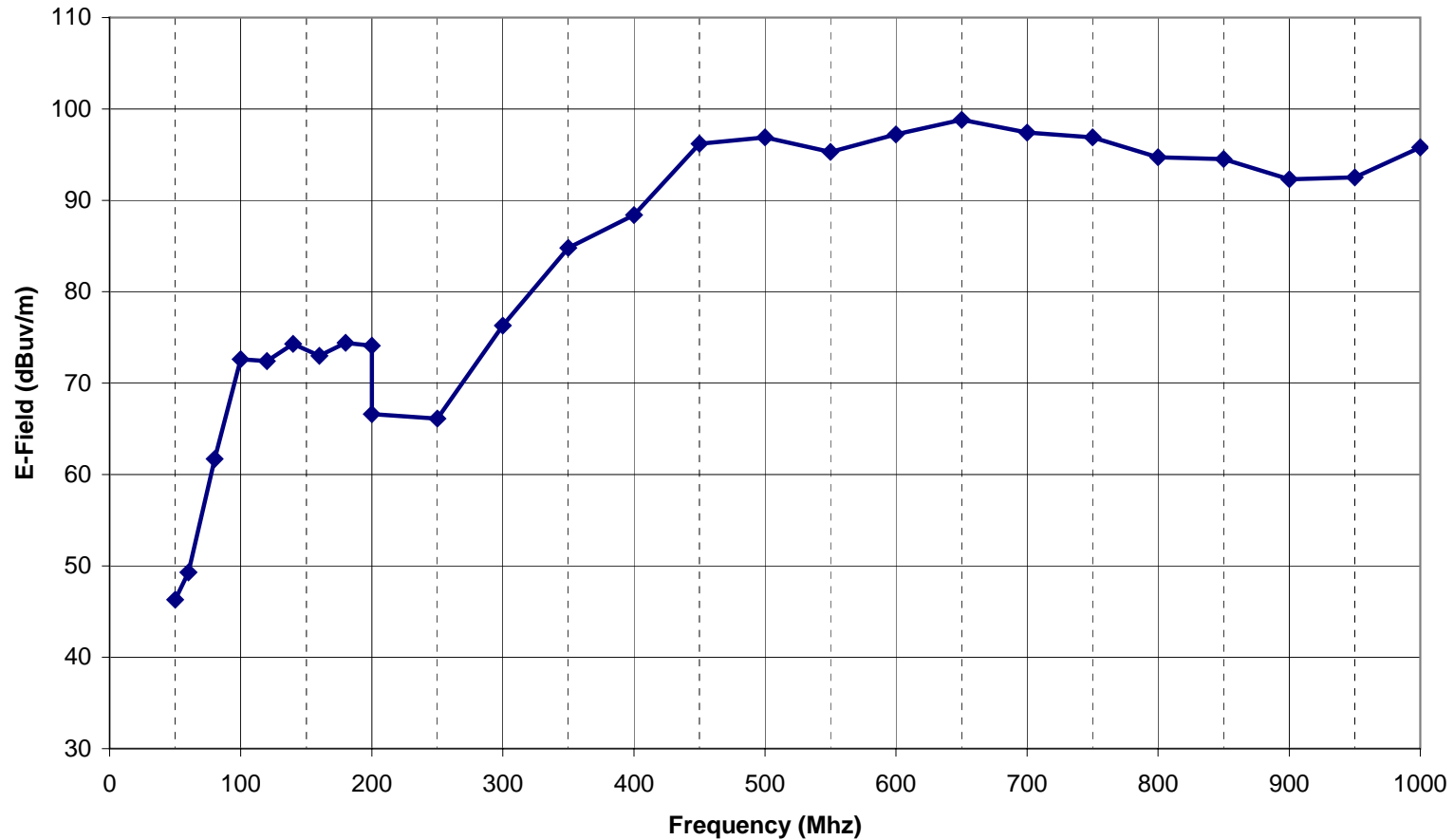


Typical Radiated E-Field at 1.5 m

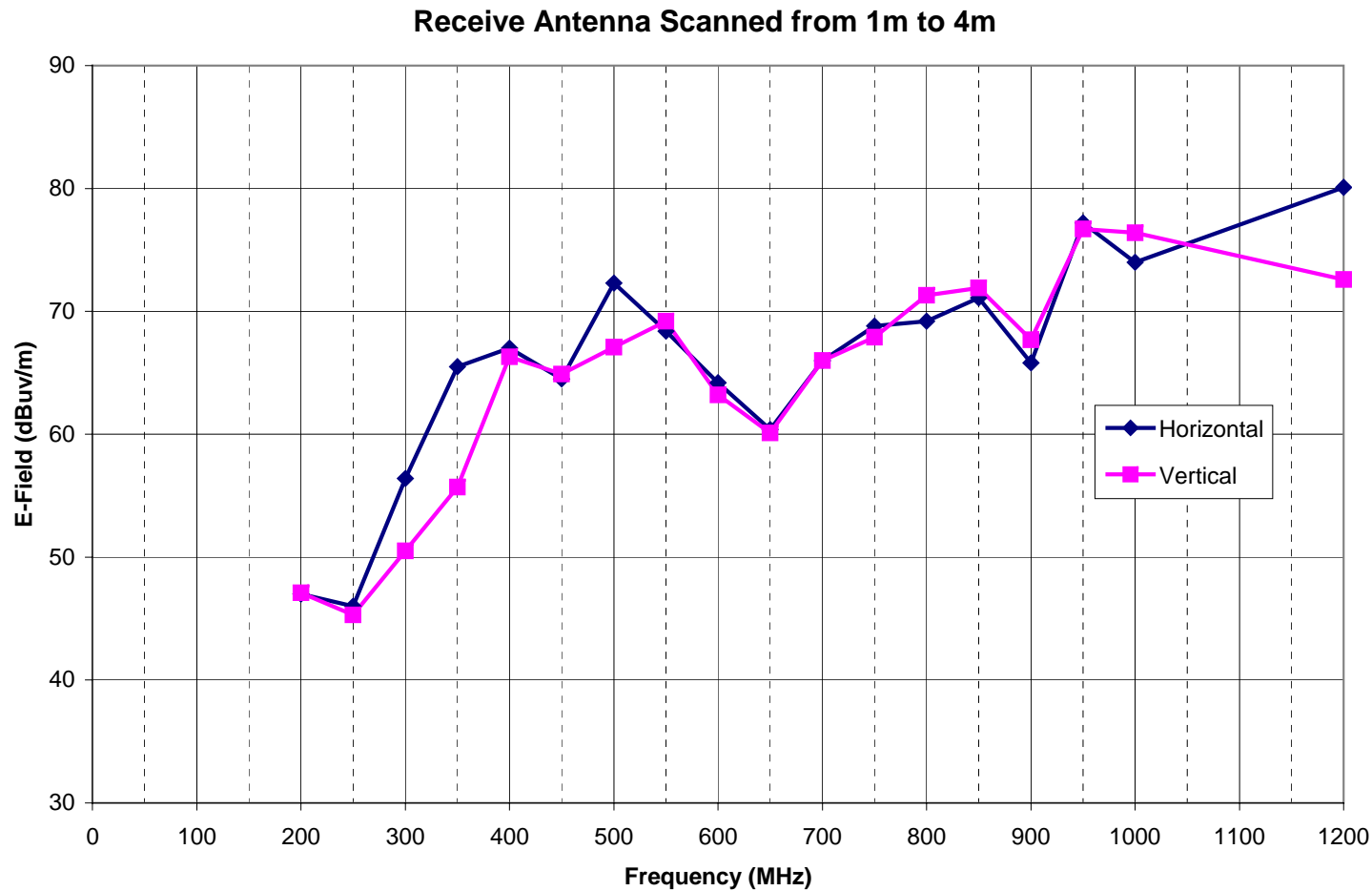
Horizontal Polarization (RF Generator = +10 dBm)



Receive Antenna 1m Above Ground -- Sphere 0.8m Above Ground



Typical Radiated E-Field at 10 m Both Polarizations (Semi-anechoic Chamber)



Conclusions



- The Precision Spherical Dipole Source (PSDS) is Unique Because it Allows Users to Create Accurate and Repeatable Electric Fields.
- The PSDS is Based on Original Work Performed at National Institute for Standards and Technology (NIST), but Our Design Provides Improved Radiated Field Performance, Increased Frequency Range, Easier Usability, Improved Robustness, and Longer Operational Utility
- The Original Design Was Well Tested, Both in the NIST Laboratories and by Comparison to the Theoretical Performance of a Spherical Dipole Radiator
- The PSDS Has No Antenna Factors
- The Performance of the PSDS Is Completely Independent of the Calibration of the Signal Source
- The PSDS Accuracy is Traceable to NIST and is Typically +/- 0.5 dB.
- The PSDS Repeatability of the PSDS is Typically +/- 0.25 dB.
- This Level of Accuracy and Repeatability is Far Beyond What Can Be Achieved With Conventional Radiating Antennas.

Contact Us



- For More Information and a Price Quote:
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