

(AN ISO 9001:2008 & ISO 14001:2004 Certified Company)

Radio Frequency - Microwave Products / Measurement Solutions Design, Installation, Services, AMC, Training and Testing

Product Range

- RF-Microwave Absorber
- Shielded Chamber
- RF Anechoic Chamber
- EMI/EMC Chamber
- RF Shield Box
- RF Anechoic Box
- Faraday Cages
- Radiation Protection Dress
- RF Shield Tents & Curtains
- MRI Shielded Chamber
- Shielded Door
- Shielded Windows
- ❖ 3-D Radiation Pattern Measurement Setup
- Positioner System
- Turn Table
- Microwave Components
- Shielding Accessories



Microwave Absorbers



Walkon Absorbers



Radio Frequency Absorbers



Wedge Absorbers



Shielded Chamber



Shield Screen Chamber



RF / Microwave Anechoic Chamber



Semi Anechoic Chamber EMI / EMC Chamber



Magnet Free Shielded Chamber



RF / MW Anechoic Box Lab Measurements



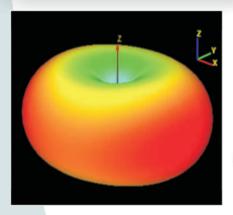




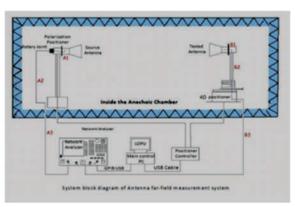
Antennas, Couplers, Splitters, RF Cables Waveguide Adapters, etc.



Shield Pouches / Bags









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About us

- * ESPL manufactures complete range of high performance Microwave Absorbers available in wide range of thicknesses & absorption.
- Experience & success has allowed Envirotech systems to grow and expand its core capabilities to include full scale design and manufacture of innovative products and components. Founded in 1997, now transforming into a growing organization that readily responds to client needs.
- ❖ ESPL is continuously growing in domestic & overseas market.
- We manufacture and distribute a broad range of high performing products and structures required to solve the most common to the most Unusual, complex and interesting RF control application that occur in the defense units, industrial, commercial, and environmental markets we serve.
- Employing over 150 people, we also have a large network of technical sales engineers, agents and distributors.

Quality Assurance

- ❖ In order to innovate new design and cost-effectiveness, we have a well-grown R&D facility empowered with computer-aided tools.
- This department is manned by efficient personnel's, which ensures in the continual product development so as to offer complete satisfaction to our clients.

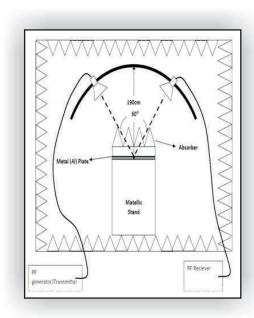
PRODUCT RANGE

Radio Frequency / Microwave Absorbers

- RAM is designed and shaped to absorb incident RF Radiation.
- Comprised of fireproofed urethane foam loaded with carbon.
- lacktriangle The more effective the RAM is the less will be the level of reflected RF radiation.
- ❖ Available with wide range of thicknesses and absorbencies.
- ♦ Meets the fire retardant requirements of NRL specification 8093 tests 1, 2 and 3.

Features of RF Absorbers

- Quite Zone better then 52 dB
- Cost Effective
- Temperature resistant
- 0.5 Watt/in² or 775 Watt/m² Power Handling
- Long performance warranty
- Tested as per IEEE standards
- Fire retardant as per NRL 8093
- Long product life up to 25 years
- ROHS compliance for safety.





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Performance of Absorbers

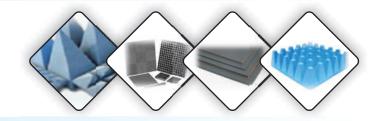
- The lowest test frequency of operation, at which measured reflections from the internal surfaces will be the most significant compared to higher frequencies.
- Pyramidal RAM is at its most absorptive when the incident wave is at normal incidence to the internal chamber surface when the pyramid height is approximately equal to $\lambda/4$, where λ is the free space wavelength.
- Accordingly, increasing the pyramid height of the RAM for the same square base size improves the effectiveness of the chamber at low frequencies

Absorber Size vs Frequency

- **The size of the absorber determines its lowest frequency operation.**
- ❖ At lower frequencies, the wavelength is larger. Therefore, a larger absorber must be used.
- ❖ Usually absorbers that perform well at low frequencies, perform well at high frequency as well.

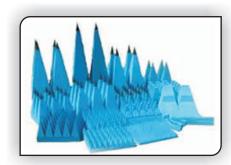
Types of RAM

- ❖ PU Foam base absorbers 500Mhz to 40Ghz
- ❖ Ferrite tiles absorbers − 30Mhz to 1Ghz
- ❖ Hybrid Absorbers 30Mhz to 40Ghz
- ❖ Ecosorb Absorber Sheets − 100 MHz to 18 GHz



Types of PUFoam based Absorbers

- Pyramidal Absorbers
- Wedge Absorbers
- Convoluted Absorbers
- Multilayer Broadband Absorbers
- **❖** *Flat Sheet Absorbers*
- Weather Proof Absorbers
- Walk on Absorbers.



Applications

- ❖ Used in Making RF / Microwave Chambers for performing RCS, Antenna parameters measurements etc.
- Used as moving screens for hiding areas of maximum reflections.
- For obtaining Quiet Zones in wide frequency range.
- Used in reducing crosstalk between Antennas.
- Shrouding Antennas to improve back lobes.
- ❖ To cover selective reflective parts inside the chamber.
- As absorbing blankets for testing radar Systems.
- Walk on Used in chamber area on floor to walk inside.



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Shielded Chamber

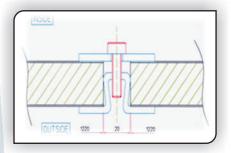
❖ Shielding effectiveness up to & Better than -100 dB. ❖ Pan Modular Self Supporting Structure. ❖ Panels bolted together & Gasket is used to avoid any RF Leakage between two panels. ❖ Shields a test setup from RF noise from external environment.

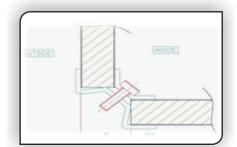
Features

❖ Design to achieve shielding effectiveness of-100 dB. ❖ Customized size as per our client's suggestions. ❖ Easy to dismantle & relocate. ❖ Availability of portable shielded Chambers.

Applications

- **♦** RF shield data center (MER Room). **♦** Conference hall and crisis control centers. **♦** Amplifier & Control rooms of Test. **♦** In Reverberation chambers.
- ❖ Semi Anechoic chambers. ❖ MRI Shield Rooms.









RF Anechoic Chamber

- ❖ An Anechoic Chamber generally consists of an RF shielded room which is either partially or fully lined with RF absorber material. ❖ It is used to perform several types of testing and measurements. ❖ Absorbs reflected signals generated inside the chamber.
- ❖ An RF anechoic chamber is usually built into a screened room, designed using the Faraday cage principle. ❖ Modular self supported structure. ❖ Manual Access Door of size -7 ft x 3 ft with triple latch mechanism. ❖ Power line filter for power provision, Honey comb air vents for air ventilation & Access panel for Signal access inside the chamber.



Features

♦ 0.5 Watt/in² or 775 Watt/m² Power Handling. ♦ Tested as per IEEE Standards. ♦ Fire Retardant as per NRL 8093. ♦ Temperature resistant. ♦ Long performance. ♦ ROHS Compliance for safety.

Applications

- ❖ Antenna Parameters Testing like Radiation pattern, Gain etc. ❖ Remote Sensing.
- * Radar Signature Measurement.





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EMI / EMC Chamber

EMC testing are often carried out in validated test sites including: OATS (Open Area Test Site); Fully Anechoic Chamber; Semi-Anechoic Chamber; and Shielded Enclosures

3m, 5m & 10m - Semi Anechoic Chamber

- Purpose of semi anechoic chamber is to perform measurements of radiated emission and/or immunity at particular test distance.
- ❖ For radiated emission: 30 MHz to 18 GHz/40 GHz
- For radiated immunity: 80 MHz to 6 GHz/40 GHz

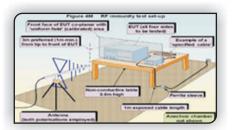
Design Parameters

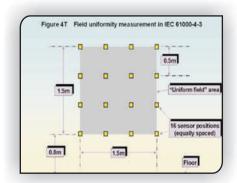
- ❖ Normalized Site Attenuation (NSA): +/- 4.0dB
- \diamond Site VSWR (SVSWR):=6dB
- ❖ Field Uniformity (FU): 75% of 16 points = 6dB at 3m test distance.
 (For 3 meter Model chamber)

Features & Test

❖ Full compliance emission test site for frequency range of 30MHz to 18GHz as per CISPR 16-1-4 ❖ Full compliance immunity test site for frequency range of 80MHz to 6GHz as per IEC/EN 61000-4-3 ❖ Shielding effectiveness according to STD-IEEE-299 (>80dB).







Applications

The semi anechoic chamber is a multifunctional EMC test facility for commercial, military & automotive testing.

RF Anechoic Box

- ❖ Modular shielded cabinet for measurements ❖ Inner lining of RF absorbers & clamp arrangement will provide environment to test antennas
- * Access door / window for fixing & arrangements * Outer finish will be wooden laminated board or Paint of desired shade.

Features

- ❖ Easy to use & Install ❖ Low Cost solution to carry out Measurements
- ❖ Durable & highly efficient ❖ High Shielding & Reflectivity.

Applications

❖ Anechoic boxes are cheapest solution for engineering institutions.





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RF Shield Box

♦ Modular shield cabinet designed to attenuate waves ♦ Shielding effectiveness up to 100 dB ♦ Power line filter, honey comb air vents, pipe penetration & access panel for signal access ♦ Easy top loading / front opening access door with gasket in between frame & body to avoid any leakage ♦ Customized as per client's specifications.

Features

- ❖ Attenuate Radio waves / Microwaves & provide attenuation of 100 dB
- * Bolted self supported structure with provision of easy re-assembly
- ❖ Provision of wheels on base for easy movement ❖ Power provision for equipments through EMI filter ❖ Honey comb air vents for air ventilation inside the Box ❖ Connector access panel with connectors as specified ℰ demand by client.





Applications

For handheld wireless devices such as pagers, Instruments & cellular phones.

Faraday Cages

- ❖ Enclosure created by conducting materials that blocks electric fields
- Protect different types of electronic equipment from electrostatic discharges
- ❖ These protect Interior from Electromagnetic Radiations coming from outside
- Separate construction will be provided both electric as well as magnetic shielding.

Type I – See-through Chamber

- ❖ Modular Self supported shielded structure ❖ Lumber skeleton sandwiched between two copper screens
- ❖ Frequency range of working 30 MHz to 10 GHz ❖ Shielded door of 3x7 ft (WH) size provided for entry in the room ❖ EMI Filter, Waveguide pipe penetration, Honeycomb Air vents will be provided for Provision of air,

electric & Cables / Pipes Withstand to block electric fields (Both static & Non – static) Designed for applications like cordless & Wireless, Cellular System, Security Systems, EMI / RFI testing & Calibration.

Features

❖ Advantage of See-Through applications to monitor internal working ❖ High Shielding Performance using copper & brass combination & provides high level of EMI / RFI Shielding ❖ Modular Enclosure i.e. durable & Easy to move ❖ Available in wide range & customized manufacturing based on client requirements ❖ Provides a quiet & Secure Environment.





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Type II – EMI / RFI / MRI – Aluminum Chamber

❖ Modular Self supported shielded Aluminum structure ❖ Insulating layer sandwiched between two Aluminum screens bolted /overlapped � Frequency range of working 5 MHz to 40 GHz Shielded door of 3 X 7 ft (WH) size provided for entry in the room ❖ Observation Window will be *provided as per client's location* ❖ EMI Filter, Waveguide pipe penetration, Honeycomb Air vents will be provided for Provision of air, electric & Cables / *Pipes* ❖ *Designed for applications like MRI, Magnetic Shielding, cordless &* Wireless, Cellular System, Security Systems, EMI / RFI testing & *Calibration* ***** *Withstand with electric as well as magnetic shielding.*



Features

❖ Advantage of MRI applications ❖ High Shielding Performance using Aluminum & Copper combination & provides high level of EMI / RFI / MRI Shielding & Modular Enclosure i.e. durable & Easy to move & Available in wide range & customized mfg. based on client requirements ❖ Provides a quiet & Secure Environment.

Performance

♦ Magnetic (14 kHz): 80 dB ♦ Electric (14kHz): 120 dB ♦ Plane wave 450 MHz: 110 - 120 dB ♦ Plane wave 1 GHz: 90 - 110 dB ❖ Microwave 1 GHz to 40 GHz: 80 dB

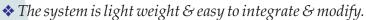
Applications

❖ Designed for applications like MRI, Magnetic Shielding, Cordless & Wireless, Cellular System, Security *Systems*, *EMI/RFI testing* & *Calibration*.

MRI Shielded Chambers

❖ MRI Shielding is required to block waves from distorting images created by MRI ❖ 100 dB of RF Attenuation at the sense Frequency & Thin layer of Copper shield material utilized in case of MRI Shielding & RF Shielding will be made of copper sheeting wrapped around wooden frames bolted together. All joints & Seams will be soldered � MRI /EMI Filters will be used for electric point's access in the MRI Room � Waveguide pipe penetrations will be used to allow the fluid flow (air conditioning, water, and medical gases) into MRI Room 💠 One access door of size 4 x 7 ft (WH) provided at the entrance with cylindrical lever lock � Honey comb grill will be provided for air ventilation � Windows are provided for vision / monitoring activities in MRI room. They are

constructed using thin shield mesh between two pieces of glass that connects peripherally with the RF enclosure walls * For acoustic insulation wooden panels periphery will be filled high density sound insulation material. Extra layer & treatment will be done on windows & penetration panels ***** Floor will be moisture resistant and consist of same construction symmetry to walls & ceiling



Performance (Testing as per MIL-STD-285; MIL-STD-220-A)

❖ RFI Shielding attenuation: 100 dB (5 MHz to 1 GHz range) ❖ Magnetic (14 kHz): 80 dB ❖ Electric (14kHz): 120 dB ❖ Plane wave 450 MHz: 110 - 120 dB ❖ Plane wave 1 GHz: 90 - 110 dB ❖ Sound attenuation: 35 STC.





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Modular RF Shield Tents & Curtains

- Shielding effectiveness of-100 dB.
- EMI/RFI Shield modular tents / canopies used for Site testing.
- ❖ One shielded entry door of 3 X 7 ft size provided in the Tent / room.
- EMI Filter, Waveguide pipe penetration, Honeycomb Air vents will be provided for Provision of air, electric & Cables / Pipes.
- ❖ Modular Self Supporting Structure & easy to relocate.
- Have necessary ventilation.

Features

- Easily shifted by dismantling the same. Polyester with nickel plating.
- Shields a test setup from RF noise from external environment.
- ❖ High attenuation & Protection from EM radiations from mobile towers.
- Long performance warranty.

Applications

- Equipment testing at remote areas.
- Quick access to sensitive communications.
- Act as enclosure for device generating / radiating signals.
- Suitable for any customized testing.

Radiation Protection Dress

- Use of international quality standards & cutting edge technology.
- Protective cloth when working in high electromagnetic radiations environment.

Features

- ♦ High EMI shielding effectiveness- 99% in the frequency range of 800 MHz to 18 GHz.
- Highly strong & easily washed.

Applications

- Aprons / Body covers to shield body against harmful radiation.
- ❖ Shielded Tents & curtains to shield particular region from radiations.







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3D – Radiation Pattern Measurement System

❖ Synchronization with VNA and Antenna Positioning system for Automatic Measurements ❖ 5 Axis / 2 Axis positioning system Control with PC ❖ Controlling the VNA with PC ❖ Synchronization of Positioner and VNA with PC ❖ Measuring the S-Parameters(S11,S12,S21 and S22) ❖ Draw E/H Plots using S- Parameter Value for different angles ❖ Draw 3D Pattern

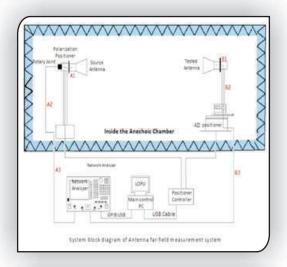
Calculation of Gain.

VNA Interfacing

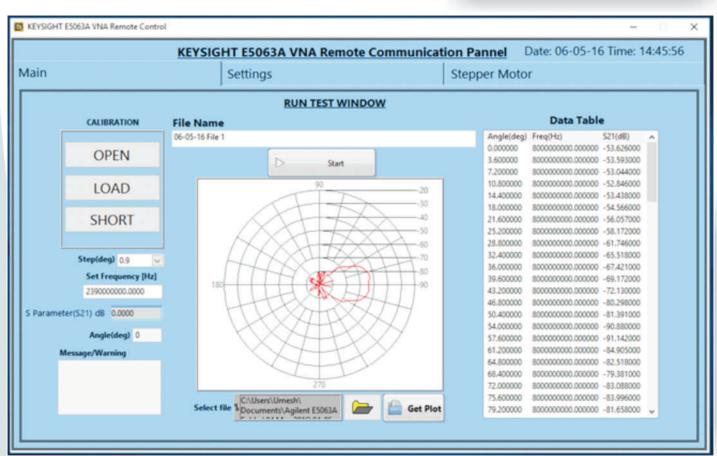
❖ Connectivity of the VNA by USB/GPIB/Ethernet ❖ The VNA can be controlled by the PC ❖ Automatic Measurement of S-Parameters ❖ Generate E/H plot and 3D pattern.

Report & Data Analysis

- ❖ The data will be saved in excel format in the PC
- * The Plots can also be saved in Desired format
- ❖ User can retrieved the past data on the software for analysis.









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Positioner – Transmitter & Receiver Positioner System

Receiver Positioner System – 5 Axis Positioner Systems

- ❖ The System has the ability to adjust the antenna position in X,Y and Z, Azimuthal & elevation directions ❖ Synchronized with VNA for automatic measurements ❖ Feature /software E & H Pattern combined to give 3D pattern
- ❖ Angular Motion can be done in different step sizes and it is user selectable
- \clubsuit Wide range of step sizes like from 0.225 deg to 1, 2, 5, 10 ... any angle in multiple of 0.225 deg \diamondsuit X, Y & Z axis span is of 500 mm \diamondsuit Elevation Movement will be +90 degree.

Receiver Positioner System - 2 Axis Positioner Systems

- ❖ The System has the ability to adjust the antenna position in Y and Azimuthal directions only ❖ Synchronized with VNA for automatic measurements
- Angular Motion can be done in different step sizes and it is user selectable
- \clubsuit Wide range of step sizes like from 0.225 deg to 1, 2, 5, 10 ... any angle in multiple of 0.225 deg \diamondsuit Y axis span is of 500 mm.

Transmitter Positioner System – Fixed System

❖ Mechanical/Laser alignment ❖ Height same as Receiver centre. Centrally located. Height adjustable ❖ Maximum load Capacity: 5kg Self supported shielded Aluminum structure



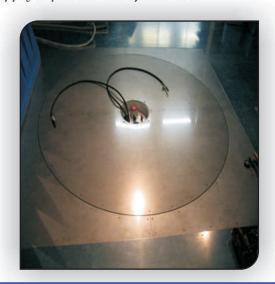




Turn Table

❖ Turn Table size depends on EUT Size ❖ Clock wise & Anti-clockwise rotation handled through PC ❖ Table top Turn table will be constructed with wooden laminated board, motor & gear mechanism ❖ Provision to have manual or automatic measurement as per clients specific requirements ❖ Generally dia of table varies from 0.5 to 2 meters ❖ Weight bearing capacity from several Kgs to tones ❖ Found applications in MW test bench measurements; EMI/EMC measurements ❖ Customized supply as per clients requirement.







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RF/Microwave Components

- High Microwave Test Bench
- Antennas
- ❖ Waveguide Components & Adapters
- RF Cables.



Microwave Test Benches

❖ Microwave test benches are designed to train students on Microwave measurements ❖ These kits offer measurements accuracy ❖ Customized as per clients requirement.

Types of Microwave Test Benches

- ❖ Klystron Test bench ❖ Gunn Diode Test bench ❖ Test bench to Measure Dielectric constant of Solid & Liquid
- ❖ Test bench for Gain & Radiation Pattern Measurement ❖ Test bench Universal Model

List of Measurements

❖ Measurement of Klystron characteristics ❖ Measurement of Freq. and wavelength ❖ Measurement of Dielectric constant Of Solid & Liquid ❖ Radiation Pattern of Antennas ❖ Gain of Antennas

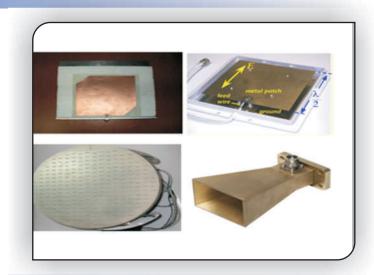




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Antennas

- Antennas are selected on basis of gain, directionality & Bandwidth.
- These are categorized as dipole, monopole, patch, center-fed, end-fed.
- ❖ It is a device which converts electric currents into electromagnetic waves for transmission & reception.
- ❖ Antennas Types Patch Antennas; Array Antennas; Omni directional Antennas; Yagi Uda Antennas; Dual Band Antennas; Horn Antennas



Waveguide Components & Adapters

- We supply Waveguide Attenuators, Flexible Waveguides, Waveguide Terminations, Tee Junctions, Flanges, Waveguide couplers & all similar.
- ❖ Found applications in Aerospace & communication Industries & Military Radars.
- Customized as per clients requirement.



RF Cables

- ❖ RF Cables assemblies include BNC, SMA, TNC, N type, SMB, MCX, UHF connectors & adapters.
- Used where demand of low signal loss.
- ❖ Applicable in aerospace, Instrumentation & communication industries.
- Customized as per clients requirement.





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Shielded Doors – Single Leaf & Double Leaf Doors

- It's available to design according to our customer's special requirement.
- * RF shielding door compliance MIL-STD-285:1956 Standards.

Single Leaf door

- **♦** *Standard Size*: 1000 x 2100 mm (WH)
- Copper fingers / Gasket will be sandwiched / lined to avoid leakage.
- ❖ Shielding effectiveness of 100 dB from 5 KHz to 2 GHz & 80 dB from 2 GHz to 40 GHz.
- ❖ Triple latch mechanism —lever pull mechanism for ease & high performance.
- Heavy duty hinges & handles utilized.
- ❖ Metallic / Powder coated finish with desired shade.

Double Leaf door

- **♦** *Standard Size*: 1200 x 2100 mm (WH)
- Copper fingers / Gasket will be sandwiched / lined to avoid leakage.
- ❖ Shielding effectiveness of 100 dB from 5 KHz to 2 GHz & 80 dB from 2 GHz to 40 GHz.
- ❖ Triple latch mechanism −lever pull mechanism for ease & high performance.
- Heavy duty hinges & handles utilized.
- Metallic / Powder coated finish with desired shade.

Shielded Windows – Aluminum Frame with Flange

- Material: EMI Mesh between 2 Polycarbonate sheets
 Core material: EMI Mesh
 Dimensions: 1000 x 1200 mm (WH)
- ❖ Attenuation: 100 dB up to 2 GHz & 80 dB from 2 to 40 GHz
- ❖ Frequency Range: 500 KHz to 40 GHz ❖ Resistance: Less than 100 ohm-cm ❖ Thickness of Sheet: 6 mm ❖ Total Thickness: 15 mm
- * Application: Used as Window with Aluminum Frame with flange to mount on chamber wall. To shield From EMI Environment.









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Shielding Accessories



Shield Puches / Bags



Copper Fingers



EMI Gaskets



Honey Comb Air Vents



EMI / MRI Power Line Filters



Waveguide Penetration

Design, Installation & Testing

Design

- ESPL have ability to create customized absorbers and meet unique requirements with wide range of thicknesses and absorbencies.
- Absorbers are designed on basis of their reflectivity, Magnitude & Phase.
- ❖ Each product get designed based on client's customize requirement & also comply necessary standards.

Installation

- Variety of product list has Customized installation.
- Depending on application use & customer requirement we provide solutions.
- ❖ Modular assembly of enclosures enables quick installation & dismantling to shift to another location.

Testing

- All products are tested as per International standards.
- ❖ RF Absorbers are tested as per NRL 8093 Sr.No. 1, 2 & 3.
- Shielding Effectiveness is tested as per MIL STD 285 / IEEE 299.
- Quiet Zone will be tested as per Free Space VSWR Method.
- Provides solution to all customized requirements.



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AMC, Consultancy & Training

- ESPL manufactures and distributes a broad range of high performing products and structures required to solve the most common to the most complexRF control application that occurin the defense units, industrial and commercial markets.
- * Experience & success has allowed Envirotech systems to grow and expand its core capabilities which include full scale design and manufacture of innovative products and components.
- Founded in 1997, now transforming into a growing organization that readily responds to client needs.
- Employing over 150 people, we also have a large network of technical & sales engineers, agents and distributors, offering advice and assistance to customers.
- We undertake the projects on turnkey basis, including design of chambers, supply of absorbers, installation & characterization of the chambers for specific applications.
- ❖ Besides that ESPL also provides AMC, consultancy and training services.

AMC

We as quality manufacturers provide AMC on the following:

- Anechoic Chambers Replacement of Absorbers, Accessories replacement / Maintenance, Chamber shifting, Testing & validation.
- ❖ EMI / EMC Chambers Replacement of Ferrite tiles, Absorber Cones, Re-Installation, Testing & validation.
- * RF Absorber Screens Replacement of Absorbers.

Consultancy

 $We \ as \ RF/Microwave \ solution \ provider \ also \ deals \ with \ consultancy \ online/offline. \ It \ includes \ following:$

- * RF / Microwave Instruments working / functions like VNA, Spectrum, OSA, Signal Generator & many more.
- * RF / Microwave components testing like Radiation pattern, S parameters, VSWR, gain & other related parameters.
- Tower Radiation Exposure Survey & Protection from their effects.
- Anechoic Chambers validation, Testing of Quiet Zone, Shielding effectiveness.
- ❖ EMI / EMC Chambers Installation & Testing.
- ❖ Institutional Lab measurements Microwave test benches, Parameters testing.

Training

- ❖ Anechoic Chamber Quiet Zone measurement, Antenna Parameters measurement.
- RF / Wireless concepts.
- Institutional /College Lab measurements / Demo presentations for RF / Microwave products / supplies.



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Our Clients





RADIO FREQUENCY TECHNOLOGIES PVT. LTD.

















For further information and details, contact:

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