

Anechoic Chambers

High Frequency and EMC Shielded Test Facilities

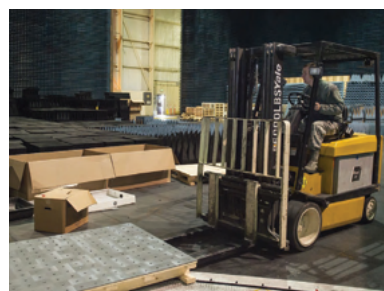
Manufacturing Equipment Supplier

CUSTOM-MADE to your specifications

TURNKEY: engineering through construction

DESIGN AND BUILD proven technology

RESIDENT PROJECT MANAGEMENT on-site



PPG PPG Aerospace
Cuming-Lehman Chambers

PPG Aerospace
Cuming-Lehman Chambers

Cuming Lehman Chambers

Together, PPG – Aerospace Cuming Lehman Chambers and PPG – Aerospace Cuming Microwave have over 75 years of valuable experience in the design, manufacture, and construction of RF shielded anechoic chambers. We view a successful project as one that surpasses the customer’s expectations, is completed on time, and finishes under budget.

Turnkey Single-Source Project Team...

As a turnkey general contractor and construction management group for commercial and industrial facilities, we utilize pre-engineered steel construction, masonry and wood construction.

From Shielded Chambers to Complete Host Buildings...

Specializing in anechoic RF shielded chamber facilities for both high frequency and EMC related testing, our highly acclaimed shielded panel construction for the discrete chambers can be augmented with integrated diverse requirements. They include complete host buildings, fire protection, HVAC, plumbing and electrical - all managed completely on-site by our experienced project teams.



Cuming Lehman Chambers, Inc.

Resident Project Managers...

What really makes us different? Each project is constructed under the careful guidance of one of our Resident Project Managers... on-site, in control, and fully responsible. We are committed to this concept. Our consistency in quality is based on the combination of craftsmanship and state-of-the-art equipment. As suppliers to industries where quality is paramount, we can assure you of facilities made to the most exacting tolerances.

Integrity, Moral Values...

We are proud of our reputation – through hard work and dedication, every project is seen through to a successful completion. Accordingly, we have developed a long list of references and examples of our work which can speak for themselves. Please feel free to inquire about previous work that may be associated with your requirements.

Index

Markets Served/Upgrades, Retrofits, Relocations, Repairs 1

High Frequency Chambers

 Compact Range 2

 Antenna Measurement 3

 Near-Field 4

EMC Chambers

 Pre-Scan 5

 3-Meter 6

 10-Meter 7

 MIL-STD 8

 CISPR 25 9

 PIM Chambers & Specialty Boxes 10

 Shielded Medical Facilities 11

 Options 11

Anechoic & EMC Chambers/RF Absorber Materials 12

High Frequency and EMC RF Shielded Chambers

High Frequency RF Shielded Test Chambers

Antennas used in today's base stations and earth stations require exacting characterization due to their narrow beam widths and multi-sector specifications. Accuracy and repeatability are essential; however, the decisions affecting the selection of an antenna test chamber are dependent on the directivity of the AUT, frequency range and test parameters as well as the antenna size.



Our past project history includes a full array of test chambers with very precise requirements.

Types of Chambers

- Antenna measurement - rectangular, tapered
- Near-field - planar, cylindrical, spherical
- Compact ranges

Base Stations and Earth Stations...

- Government
- Military
- Communications OEM's

EMC Shielded Test Chambers

For all electronic products targeted at the American, Canadian, European, Pacific Rim or other international markets, compliance with regulatory agencies regarding RFI standards is necessary. Our complete range of EMC test chambers covers all product needs – commercial and military.



- Information technology equipment
- Telecommunications
- Industrial, scientific, medical, multimedia
- General electronically controlled products

Every area of the electronics markets is in some way affected by FCC regulatory mandates (and military standards, as applicable).

- Manufacturers
- Service providers
- Engineering consultants

Upgrades, Retrofits, Relocations, Repairs

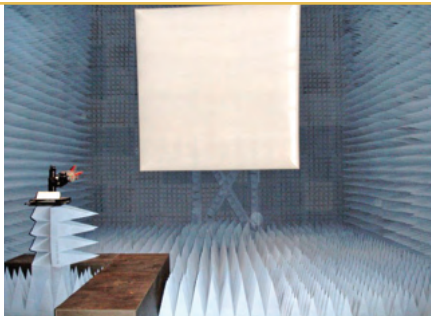
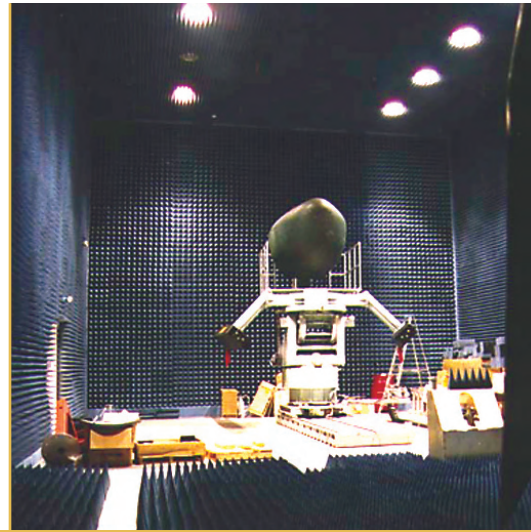
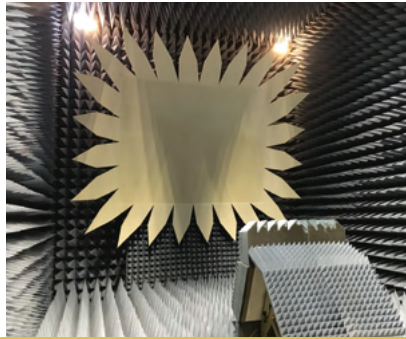
When an old chamber is no longer performing to specifications, or needs an upgrade for a new assignment, we can bring it up to the required standards. Typically, we will review the following areas for your consideration:



- Structure
- Shielding, absorbers, ferrite tiles
- Door repairs
- Electrical, fire protection, HVAC
- Testing and FCC filing

High Frequency Anechoic Chambers

Compact Range



Compact Range Chambers

- Products: For accurate, indoor antenna and radar cross section (RCS) measurements
- AUT size: Various
- Construction: Modular preassembled panels, or stick-built depending on overall size and shielding requirements
- Chamber size: Determined by frequency range and quiet zone size

Baseline Chamber Design and Components

Design

- Chamber design & structural engineering
- Hybrid absorber optimization
- Design reviews
- Submittal drawings
- As-built drawings

Shielded Enclosure

- RF shielded enclosure
- Free standing design - structural support system
- Modular wood-core panel construction utilizing standard construction materials and techniques
- Waveguide ventilation panels
- Bulkhead connector panels
- RF shielded lighting system
- RF shielded doors
- Power line filters
- Conduit, switches, and receptacles, as needed

Anechoic Absorber - Ferrite Tile

- Optimized proprietary absorber

Testing

- Shielding effectiveness testing - IEEE-STD-299/MIL-STD 285 compliance test to 1 GHz
- Probe quiet zone for performance

General Provisions

- 1 year warranty on materials and workmanship
- 5 year warranty on RF shielding effectiveness

Before any antenna or RCS measurements begin, the right facility must be selected, designed and built. Both the facility and the compact range selected depend on your testing objectives. You'll want to address questions concerning test requirements, frequency range, test article dimensions, accuracy specifications, and desired budget during the design phase.

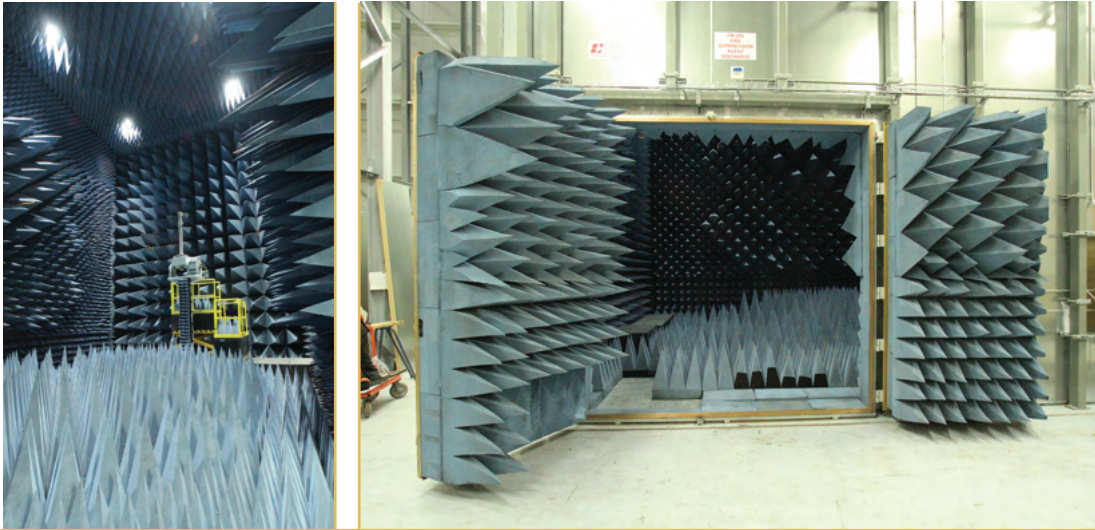
Compact Range Chambers are designed in conjunction with compact ranges to provide far-field measurements of larger test articles in a much smaller area than what is typically required for standard far-field environments. Any far-field range tests can be accomplished in this chamber.

Commonly used to eliminate the need for an outdoor site in lieu of an expensive, larger test chamber, test plans and productivity are not affected by weather, time of day, or security concerns. With properly tuned absorber material, a 20:1 test distance compression is typical; i.e., 180 feet to 18 feet. (x band 2000 ft range in 70' 5708 chamber)

Based on the principles of geometrical optics, diverging spherical waves from the source antenna located at the focal point of a paraboloid surface are collimated into a plane wave which is incident on the AUT. The resultant plane wave has a very flat phase front and small amplitude taper over the test zone.

High Frequency Anechoic Chambers

Antenna Measurement



High Frequency Antenna Measurement Chambers are utilized to make far-field antenna pattern measurements. They are designed either in a rectangular or tapered configuration depending on the frequency range of interest. Size and specifications are determined by the quiet zone size and frequency range of interest.

Rectangular shapes are very versatile and roomy. Measurements as low as 700 MHz are practical.

Tapered shapes, while sometimes less convenient to work in, are less expensive. Measurements as low as 70 MHz are practical.

In order to satisfy the system requirements and choose a suitable antenna, system engineers must evaluate an antenna's performance. Typical metrics used in evaluating an antenna includes the input impedance, polarization, radiation efficiency, directivity, gain and radiation pattern.

By definition, all of today's wireless communication systems contain one key element, an antenna of some form. This antenna serves as the transducer between the controlled energy residing within the system and the radiated energy existing in free space. In designing wireless systems, engineers must choose an antenna that meets the system's requirements to firmly close the link between the remote points of the communications system. While the forms that antennas can take on to meet these system requirements for communications systems are nearly limitless, most antennas can be specified by a common set of performance metrics.

Antenna Measurement Test Range Chambers

- Products: Antenna input impedance, polarization, radiation efficiency, directivity, gain and radiation pattern
 AUT size: Various
 Construction: Modular preassembled panels, or stick-built depending on overall size and shielding requirements.

Baseline Chamber Design and Components

Shielded Enclosure

- RF shielded enclosure
- Free standing design - structural support system
- Modular wood-core panel construction utilizing standard construction materials and techniques
- Waveguide ventilation panels
- Bulkhead connector panels
- RF shielded lighting system
- RF shielded doors
- Power line filters
- Conduit, switches, and receptacles, as needed

Design

- Chamber design & structural engineering
- Hybrid absorber optimization
- Design reviews
- Submittal drawings
- As-built drawings

Anechoic Absorber - Ferrite Tile

- Optimized proprietary absorber

Testing

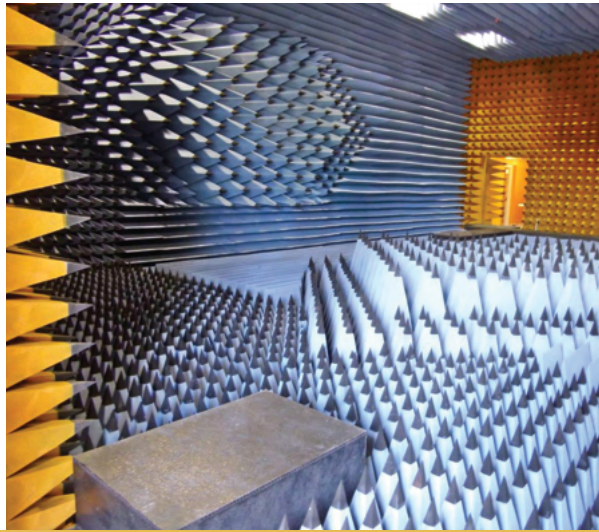
- Shielding effectiveness testing - IEEE-STD-299/MIL-STD 285 compliance test to 1 GHz
- VSWR testing at quiet zone performance

General Provisions

- 1 year warranty on materials and workmanship
- 5 year warranty on RF shielding effectiveness

High Frequency Anechoic Chambers

Near-Field



Near-Field Chambers are designed in conjunction with planar, spherical or cylindrical near-field measurement systems to provide far-field extrapolation of test data taken in the near-field. This approach requires less space than what is typically required for standard far-field environments, or even compact ranges for a given antenna size.

Because of exacting narrower beam widths and multiple beams associated with large phased array antennas, more complete and accurate antenna characterization is essential; such as, polarization, gain, sidelobe and multiband performance.

The test procedure uses a small RF probe antenna which is moved over a surface surrounding the AUT at a separation distance of 4 to 10 wavelengths. Near-field phase and amplitude data is gathered from a select number of positions and is converted via Fourier techniques to the far-field. Planar, cylindrical and spherical scanning methods may be used to evaluate AUT's.

Near-Field Antenna Test Range Chambers

- Planar
- Cylindrical
- Spherical

Products: Base station, earth station, antennas and satellites
AUT size: Various
Construction: Modular preassembled panels, or stick-built depending on overall size and shielding requirements.

Baseline Chamber Design and Components

Design

- Chamber design & structural engineering
- Hybrid absorber optimization
- Design reviews
- Submittal drawings
- As-built drawings

Shielded Enclosure

- RF shielded enclosure
- Free standing design - structural support system
- Modular wood-core panel construction utilizing standard construction materials and techniques
- Waveguide ventilation panels
- Bulkhead connector panels
- RF shielded lighting system
- RF shielded doors
- Power line filters
- Conduit, switches, and receptacles, as needed

Anechoic Absorber - Ferrite Tile

- Optimized proprietary absorber

Testing

- Shielding effectiveness testing - IEEE-STD-299/MIL-STD 285 compliance test to 1 GHz
- Probe quiet zone for performance

General Provisions

1 year warranty on materials and workmanship
5 year warranty on RF shielding effectiveness

3m Pre-Scan Emissions/Immunity Chamber

Inside Clear Dimensions*: 22'-0" (L) x 10'-0" (W) x 10'-0" (H)
 Outside Clear Dimensions**: 23'-8" (L) x 11'-8" (W) x 10'-10" (H)
 Operating Frequency Range: 26 MHz - 1 GHz
 Anechoic Absorber Type: optimized dielectric/ferrite
 Shielding Effectiveness: 100 dB to 1 GHz, electric, planewave
 (IAW IEEE-STD-299/Mil-Std 285)

Radiated Immunity Test Capability

- IEC 1000-4-3 compliance
- Uniform Field Area: 1.5m x 1.5m
- Field Uniformity Performance: -0 to +6 dB (IAW IEC 1000-4-3)

Radiated Emissions Test Capability: pre-scan w/ limited scan height

- Site Attenuation Performance: + / -6 dB 30-300 MHz, + / -4 dB 300-1000 MHz
- Test Volume Size: 1.0 meter
- Maximum Scan Height: 2 meters

Baseline Chamber Design and Components

Design:

- Chamber design & structural engineering
- Hybrid absorber optimization
- Design reviews
- Submittal drawings (3 copies)
- As-built drawings (3 copies)

Shielded Enclosure

- RF shielded enclosure
- Free standing design - structural support system
- Modular wood-core panel construction
- Waveguide ventilation panels - (2) 12" x 12"
- Bulkhead connector panels - (2) 12" x 18"
- RF shielded lighting system - (4) spot-type fixtures
- RF shielded door - (1) 4' x 7' single leaf access door, low threshold
- Power line filters - (2) 2 x 30 amp
- Conduit, switches, and (2) receptacles

Anechoic Absorber

- Optimized proprietary dielectric/ferrite absorber
- Quality control of ferrite absorber manufacture

Testing

- Shielding effectiveness testing - IEEE-STD-299/MIL-STD 285 compliance test to 1 GHz
- Field uniformity testing - IEC 1000-4-3 compliance
- Normalized site attenuation testing for pre-scan emissions - ANSI C63.4-1992
- Detailed test plans and reports

1.2 Meter Diameter Turntable (Optional)

- Sunol Sciences SM46C-1.2 meter diameter turntable-surface mount, low profile. 800 lb. running load

Antenna Tower (Optional)

- Sunol Sciences TWR95-4 antenna tower-scans from 1-2 meters, pneumatic polarization standard w/fiber optic interface

Dual Channel System Controller (Optional)

- Sunol Sciences SC99V-2 dual channel controller-variable speed control through front panel or GPIB interface
- Fully IEEE 488.2 compatible, as well as with industry standard automation software.

*Inside Clear Dimensions are calculated to the inside face of the shielded enclosure

**Maximum Outside Dimensions are calculated to the outside of the structural steel members supporting the RF shielded enclosure.



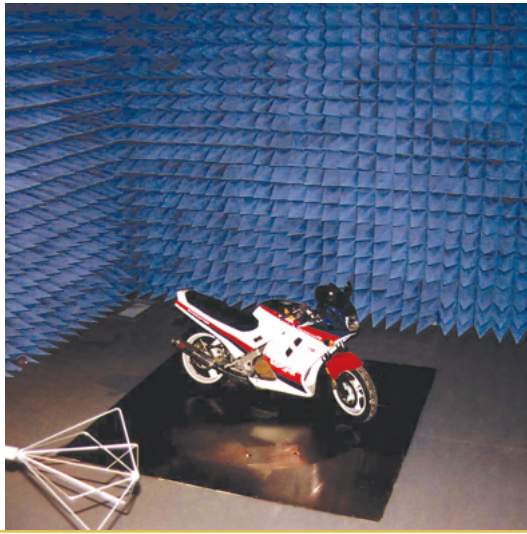
EMC Pre-Scan Chambers can be utilized as an engineering or pre-compliance chamber for making emissions measurements in accordance with ANSI C63.4 and for immunity compliance testing in accordance with IEC 1000-4-3.

Tests are made at 3-meters with great repeatability and straightforward correlations to an Open Area Test Site, OATS.

This is not a do-it-yourself mini-room. There is plenty of space to work around the EUT for mitigations while leaving the setup untouched.

General Provisions

- 1 year warranty on materials and workmanship
- 5 year warranty on RF shielding effectiveness



The 3-meter Semi-anechoic Chamber is the perfect solution when full compliance 3-meter testing is required. It provides a truly state-of-the-art, indoor, ambient-free EMC test site which meets or exceeds the site-attenuation requirements specified in ANSI C63.4:1992 and EN 55022:1998, (CISPR 22-1998), at the 3 meter distance.

Immunity testing is accommodated at a distance of 3 meters as specified in IEC 61000-4-3:1995. A removable ferrite pad, approximately 100 square feet in size is positioned between the source antenna and the uniform field area for immunity testing.

General Provisions

- 1 year warranty on materials and workmanship
- 5 year warranty on RF shielding effectiveness

3-meter Certified Emissions Chamber

- Inside Clear Dimensions*: 28'-0" (L) x 18'-0" (W) x 19'-0" (H)
- Outside Clear Dimensions**: 29'-8" (L) x 19'-8" (W) x 19'-10" (H)
- Operating Frequency Range: 26 MHz - 40 GHz
- Anechoic Absorber Type: optimized ferrite/urethane foam hybrid
- Shielding Effectiveness: 100 dB, electric, planewave
(IAW IEEE-STD-299/Mil-Std 285)
- Radiated Immunity Test Capability: Class B
 - IEC 1000-4-3 Compliance
 - Uniform Field Area: 1.5m x 1.5m
 - Field Uniformity Performance: -0 +6dB (IAW IEC 1000-4-3)
- Radiated Emissions Test Capability
 - ANSI C63.4 compliance
 - Site Attenuation Performance: + or - 4 dB (IAW ANSI C63.4-1992)
 - Antenna Calibrations: free space antenna factors (IAW ANSI C63.5-1998)
 - Test Volume Size: 2.0 meters (dia.) x 2.0 meters (high)
 - Maximum Scan Height: 4 meters

Baseline Chamber Design and Components

Design:

- Chamber modeling analysis/optimization
- Chamber design & structural engineering
- Hybrid absorber optimization
- Design reviews
- Submittal drawings
- As-built drawings (3 copies)

Shielded Enclosure

- RF shielded enclosure
- Free standing design - structural support system
- Modular wood-core panel construction
- Raised access floor (12" deep w/ removable panels)
- Waveguide ventilation panels - (4) 12" x 24"
- Bulkhead connector panels - (2) 12" x 24"
- RF shielded lighting system - (4) corner spotlight fixtures, (4) 250 watt metal halide high hat light fixtures
- RF shielded door - (1) 4' x 7' double leaf access door, low threshold
- Power line filters - (2) 2 x 30 amp
- 2" Dia. threaded brass pipe
- (1) Brass ground stud
- Conduit, switches, and (2) receptacles

Anechoic Absorber - Ferrite Tile

- Optimized proprietary dielectric/ferrite absorber

Anechoic Absorber - Urethane Foam

- Optimized proprietary urethane foam absorber

Testing

- Shielding effectiveness testing - IEEE-STD-299/MIL-STD 285 compliance test to 1 GHz
- Field uniformity testing - IEC 1000-4-3 compliance
- Normalized site attenuation testing - ANSI C63.4 compliance
- Detailed test plans and reports

1.5 Meter Diameter Turntable (Optional)

- Sunol Sciences FM 2022-2.0 meter diameter turntable-supports a 4,400 lb. distributed load, minimum pit depth of 12" required

Antenna Tower (Optional)

- Sunol Sciences TWR95-4 antenna tower-scans from 1-4 meters, pneumatic polarization standard w/fiber optic interface

Dual Channel System Controller (Optional)

- Sunol Sciences SC99V-2 dual channel controller-variable speed control through front panel or GPIB interface. Fully IEEE 488.2 compatible, as well as with industry standard automation software

*Inside Clear Dimensions are calculated to the inside face of the shielded enclosure

**Maximum Outside Dimensions are calculated to the outside of the structural steel members supporting the RF shielded enclosure.

EMC Anechoic Chambers

10-Meter

10-meter Certified Emissions Chamber

Inside Clear Dimensions*: 62'-0" (L) x 40'-0" (W) x 30'-0" (H)
 Outside Clear Dimensions**: 63'-8" (L) x 41'-8" (W) x 31'-0" (H)
 Operating Frequency Range: 26 MHz - 40 GHz
 Anechoic Absorber Type: optimized ferrite/urethane foam hybrid
 Shielding Effectiveness: 100 dB, electric, planewave
 (IAW IEEE-STD-299/Mil-Std 285)

Radiated Immunity Test Capability

IEC 1000-4-3 Compliance: class A
 Uniform Field Area: 1.5m x 1.5m
 Field Uniformity Performance: -0 +6 dB (IAW IEC 1000-4-3)

Radiated Emissions Test Capability

ANSI C63.4 Compliance
 Site Attenuation Performance: + or - 4 dB (IAW ANSI C63.4-1992)
 Antenna Calibrations: free space antenna factors (IAW ANSI C63.5-1998)
 Test Volume Size: 3.0 meters (dia.) x 3.0 meters (high)
 Maximum Scan Height: 4 meters

Baseline Chamber Design and Components

Design

- Chamber modeling analysis/optimization
- Chamber design & structural engineering
- Hybrid absorber optimization
- Design reviews
- Submittal drawings
- As-built drawings (3 copies)

Shielded Enclosure

- RF shielded enclosure
- Free standing design - structural support system
- Modular wood-core panel construction
- Raised access floor (16" deep w/ removable panels)
- Waveguide ventilation panels - (4) 12" x 24"
- Bulkhead connector panels - (2) 12" x 24"
- RF shielded lighting system - (8) 250 watt metal halide high hats
- RF shielded door - (1) 8' x 8' double leaf access door, low threshold
- Power line filters - (4) 1x100 amp, (2) 2x30 amp
- 2" Dia. threaded brass pipe
- (1) Brass ground stud
- Conduit, switches, and (2) receptacles

Anechoic Absorber - Ferrite Tile

- Optimized proprietary dielectric/ferrite absorber

Anechoic Absorber - Urethane Foam

- Optimized proprietary urethane foam absorber

Testing

- Shielding effectiveness testing - IEEE-STD-299/MIL-STD 285 compliance test to 1 GHz
- Field uniformity testing - IEC 1000-4-3 compliance
- Normalized site attenuation testing - ANSI C63.4 compliance
- Detailed test plans and reports

3-meter Diameter Turntable (Optional)

- Sunol Sciences FM 3044-3.0 meter diameter turntable-supports a 8,800 lb. distributed load, minimum pit depth of 16" required.

Antenna Tower (Optional)

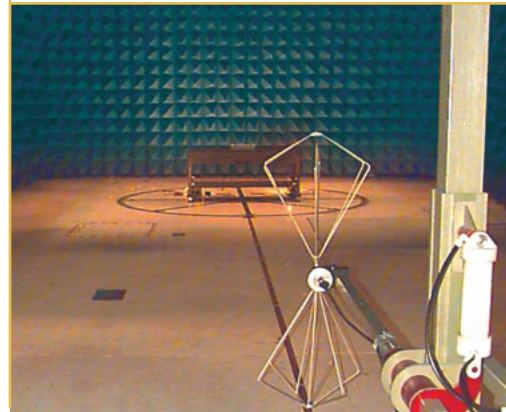
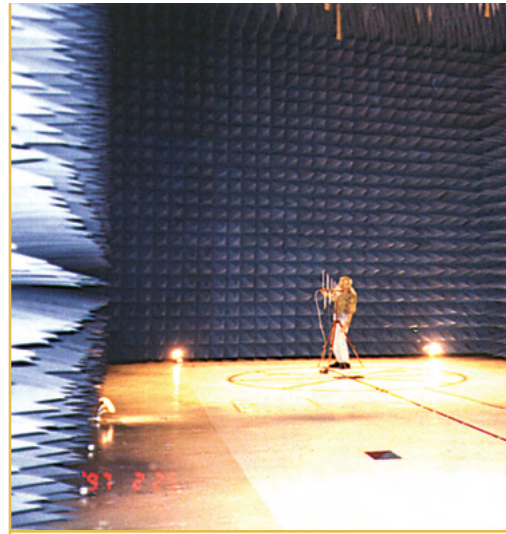
- Sunol Sciences TWR95-4 antenna tower-scans from 1-4 meters, pneumatic polarization standard w/fiber optic interface.

Dual Channel System Controller (Optional)

- Sunol Sciences SC99V-2 dual channel controller-variable speed control through front panel or GPIB interface. Fully IEEE 488.2 compatible, as well as with industry standard automation software.

*Inside Clear Dimensions are calculated to the inside face of the shielded enclosure

**Maximum Outside Dimensions are calculated to the outside of the structural steel members supporting the RF shielded enclosure.

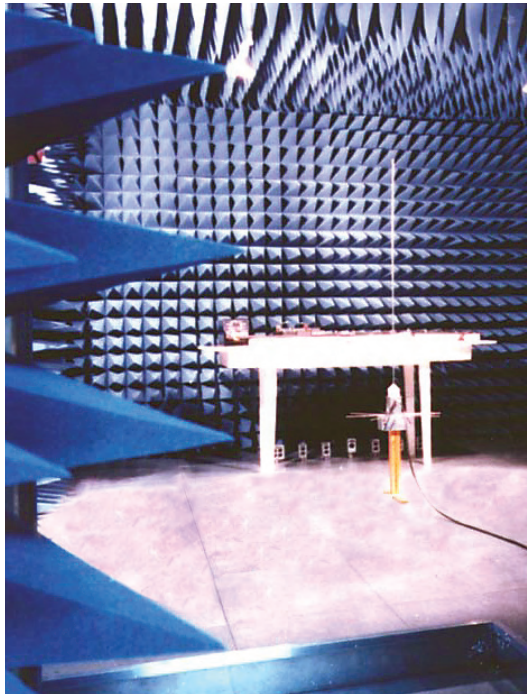


The 10-meter Semi-anechoic Chamber is the perfect solution when full compliance 10 meter or 3-meter testing is required. It provides a truly state-of-the-art, indoor, ambient free EMC test site which meets or exceeds the site-attenuation requirements specified in ANSI C63.4:1992 and EN 55022:1998, (CISPR 22-1998), at both the 3 and 10 meter distances.

Immunity testing is accommodated at a distance of 3 meters as specified in IEC 61000-4-3:1995. A removable ferrite pad, approximately 100 square feet in size is positioned between the source antenna and the uniform field area for immunity testing.

General Provisions

- 1 year warranty on materials and workmanship
- 5 year warranty on RF shielding effectiveness



MIL-STD Chamber

Inside Clear Dimensions*: 20'-0" (W) x 20'-0" (L) x 12'-0" (H)
 Outside Clear Dimensions**: 21'-0" (W) x 21'-0" (L) x 13'-0" (H)
 Absorber Frequency Range Performance: 80 MHz - 1 GHz
 Anechoic Absorber Type: 24" broadband pyramidal absorber
 Shielding Effectiveness: 100 dB to 1 GHz, electric, planewave
 (IAW IEEE-STD-299/Mil-Std 285)

Conducted/Radiated Emissions & Immunity Test Capability: per Mil-STD 461E
 MIL-STD-461E 24" Urethane Absorber Configuration:***
 Absorber on front and back wall: full coverage
 Absorber on side walls: partial; from back wall behind test setup & out 10'
 Absorber on ceiling: partial; from back wall behind test setup & out 10'
 Absorber on floor: six (6) pieces

Baseline Chamber Design and Components

Design

- Chamber design & structural engineering
- Hybrid absorber optimization
- Design reviews
- Submittal drawings
- As-built drawings

Shielded Enclosure

- RF shielded enclosure
- Free standing design - structural support system
- Modular wood-core panel construction
- Waveguide ventilation panels - (2) 12" x 24"
- Bulkhead connector panels - (2) 12" x 24"
- RF shielded lighting system - (4) spot-type fixtures
- RF shielded door - (1) 4' x 7' single leaf
- Power line filters - (2) 2x30 amp
- (1) Brass ground stud
- Conduit, switches, and (2) receptacles

Anechoic Absorber - Urethane Foam

- Optimized proprietary urethane foam absorber

Testing

- Shielding effectiveness testing - IEEE-STD-299/MIL-STD 285 compliance test to 1 GHz
- Detailed test plans and reports



EMC MIL-STD Chambers are utilized primarily for the radiated emissions and immunity testing of electronic equipment and subsystems for commercial, DoD and other related government agencies. The chambers can be used for radiated emissions, radiated immunity, conducted emissions, and conducted immunity testing.

In accordance with MIL-STD-461E, the chamber must be sufficiently large to permit EUT and antenna position requirements per paragraph 4.3.8. Typically, the clear work area dimensions are: 16'-0" (W) x 16'-0"(L) x 10'-0"(H).

General Provisions

1 year warranty on materials and workmanship
 5 year warranty on RF shielding effectiveness

*Inside Clear Dimensions are calculated to the inside face of the shielded enclosure

**Maximum Outside Dimensions are calculated to the outside of the structural steel members supporting the RF shielded enclosure.

EMC Anechoic Chambers

CISPR 25

CISPR 25 Certified Emissions Chamber

Inside Clear Dimensions*: 22'-0" (W) x 20'-0" (L) x 13'-0" (H)
 Exterior Dimensions: 23'-2" (W) x 21'-2" (L) x 14'-0" (H)
 Operating Frequency Range: 30 MHz - 1 GHz
 Anechoic Absorber Type: hi. perf. broadband pyramidal RF absorber
 Shielding Effectiveness: 100 dB, electric, planewave, microwave
 Radiated Immunity Test Capability
 IEC 1000-4-3 Compliance
 Uniform Field Area: 1.5m x 1.5m
 Field Uniformity Performance: -0 to +6 dB
 Radiated Emissions Test Capability: Pre-scan w/ limited scan height
 CISPR 25 Compliance
 Site Attenuation Performance: + or - 6 dB
 Test Volume Size: 1.0 meter
 Maximum Scan Height: 2 meters



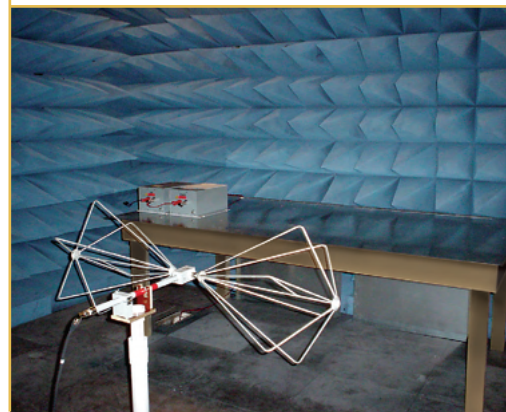
Baseline Chamber Design and Components

Design

- Chamber design & structural engineering
- Hybrid absorber optimization
- Design reviews
- Submittal drawings
- As-built drawings

Shielded Enclosure

- RF shielded enclosure
- Free standing design - structural support system
- Modular wood-core panel construction
- Raised access floor (12" deep w/ removable panels)
- Waveguide ventilation panels - (2) 12" x 12"
- Bulkhead connector panels - (2) 12" x 18"
- RF shielded lighting system - (4) spot-type fixtures
- RF shielded door - (1) 3' x 7' single leaf
- Power line filters - (2) 2x30 amp
- 2" Dia. threaded brass pipe
- (1) Brass ground stud
- Conduit, switches, and (2) receptacles



Anechoic 36" High Performance Pyramidal RF Absorber

- Optimized proprietary urethane foam absorber
- Quality control of absorber manufacture
- Quality control of installation

Testing

- Shielding effectiveness testing - IEEE-STD-299/MIL-STD 285 compliance test to 1 GHz
- Normalized site attenuation testing for emissions
- Detailed test plans and reports

1.22-meter Diameter Turntable (Optional)

- Sunol Sciences SM 46C 1.22-meter diameter turntable-supports a 800 lb. running load, surface mount low profile

Antenna Tower (Optional)

- Sunol Sciences TWR95-4 antenna tower-scans from 1-2 meters, pneumatic polarization standard w/fiber optic interface.

Dual Channel System Controller (Optional)

- Sunol Sciences SC99V-2 dual channel controller-variable speed control through front panel or GPIB interface. Fully IEEE 488.2 compatible, as well as with industry standard automation software.

*Inside Clear Dimensions are calculated to the inside face of the shielded enclosure

CISPR 25 Chambers are designed for RF tests of the limits and methods of radio disturbance characteristics for electronics which are installed on vehicles.

The CISPR 25 Standard is established to protect receivers from disturbances produced by conducted and radiated emissions arising in a vehicle.

General Provisions

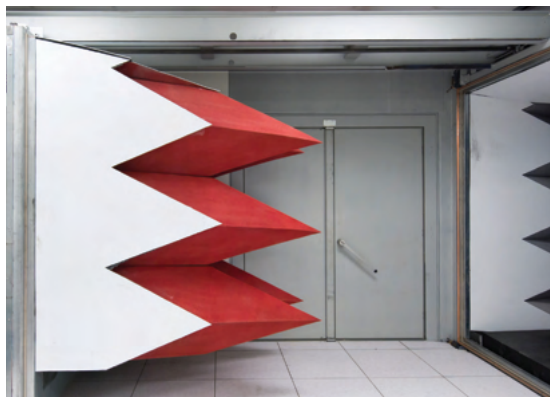
- 1 year warranty on materials and workmanship
- 5 year warranty on RF shielding effectiveness

PIM Chambers & Specialty Boxes

Pocket Door



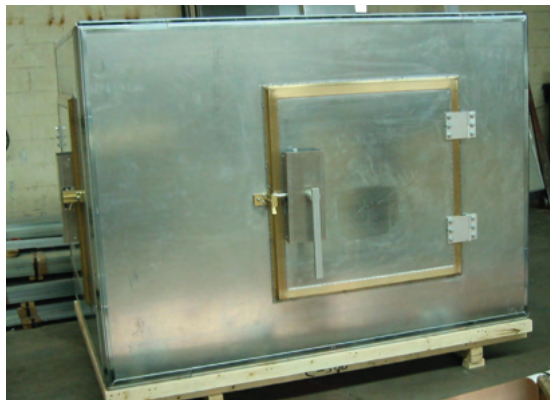
Plug Door



High Power Test Box



RFID Test Box



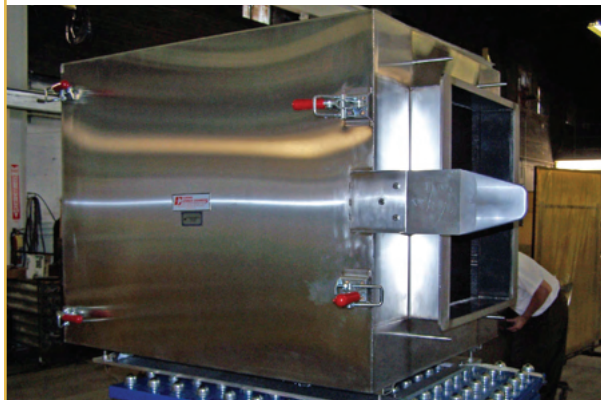
PIM Chamber



PIM Ceiling



Welded Stainless Test Box





Options



Higher Performance

Any of our chambers can be engineered to more exacting field uniformity, more demanding attenuation and higher frequency specifications. This is always a trade-off with budget considerations; however, we are willing to demonstrate various iterations for your consideration.

Measurement Systems

Along with each of the different types of chambers we offer, we can put together complete measurement systems appropriate to the assignments of your chamber including instrumentation and software. We provide overall system compatibility and complete responsibility for the chamber and all of its instrumentation.

Control Rooms

When planning the functional use of your chamber, we can also provide complete design and build services for your control room and all of its support infrastructure interface to your host building.

Ancillary Items

Your chamber design may include any of the following operational items on a turnkey installation basis:

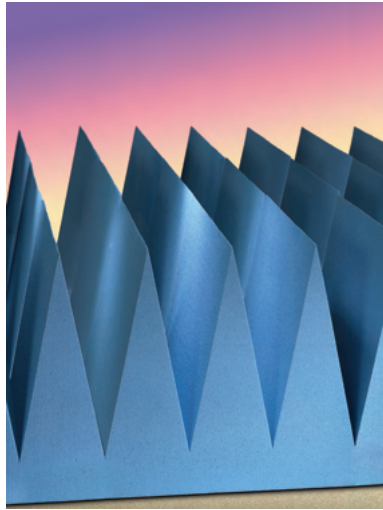
- Raised access floors
- CCTV
- Intercoms
- Ramps
- Metal topped test tables
- Welded chambers
- Complete host facilities
- Turntables
- Antenna Towers
- Controllers
- Complete test systems
- Testing from an independent test house
- HVAC
- Fire protection
- Protective absorber caps
- Seismic structural support systems
- Modeling analysis/optimization

Anechoic and EMC Chambers/RF Absorber Materials

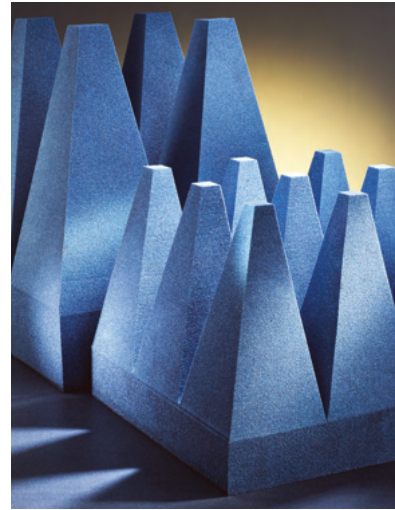
C-RAM SFC – TB 390-1



C-RAM SFC WEDGE – TB 390-2



C-RAM SFC-EM – TB 390-3



C-RAM SFC – TB 390-1 and C-RAM SFC WEDGE – TB 390-2 Comprise a full product line of premium-grade, pyramidal and wedge shaped absorbers for anechoic chambers and laboratory test setup.

A full complement of matching absorbers: C-Ram EVA (TB390-9) and walkaway absorbers C-RAM SFC Walk Way (TB 390-14) are available.

C-RAM SFC and associated products cover the frequency range from low MHz through millimeter wave.

The SFC-EM products are optimized for low frequency performance. C-Ram SFC-EM are truncated to save space and yield a rugged product. Ideal for MIL SPEC 462–C, D, and E and CISPR-25 chambers. Also a low cost solution for EN 1000-4-3 and derivative specifications from 80 MHz through 40 GHz.

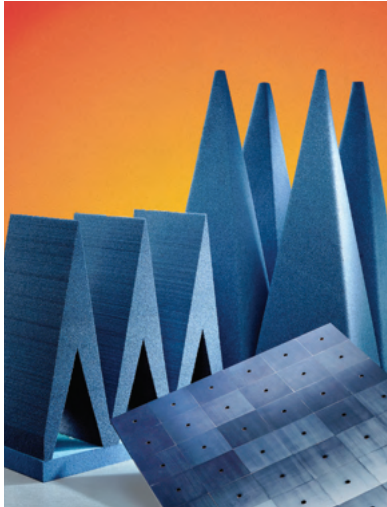
| Product | C-RAM SFC | C-RAM SFC Wedge | C-RAM SFC-EM | C-RAM FT | C-RAM HFP | C-RAM FAC | C-RAM EVA | C-RAM CFC |
|---------------------|---|---------------------------------|-------------------------------------|---------------------------------|-------------------------------|--------------------------------------|---|---------------------------------------|
| TB Number | 390-1 | 390-2 | 390-3 | 390-5 | 390-6 | 390-7 | 390-9 | 390-10 |
| Function | high performance pyramidal absorber | high performance wedge absorber | truncated pyramidal EMC absorber | low frequency ferrite absorber | low frequency hybrid absorber | high performance convoluted absorber | open cell absorber for outdoor & ventilation applications | clean room absorbers high performance |
| Operating Frequency | 100 MHz & up | 100 MHz & up | 70 MHz & up | 20 MHz to 1.5 GHz | 20 MHz to 40 GHz | 2 GHz & up | 100 MHz & up | 100 MHz to 30 GHz |
| Thickness | 2.0" to 72" | 6.0" to 24" | 12" and 36" | 0.25" | 12" through 48" | 0.75" to 4.0" | 2.0" to 72" | 4.0" to 36" |
| Benefits | Broadband high performance pyramidal absorber | broadband wedge absorber | space saving low profile and rugged | ceramic (ferrite) tile absorber | very broadband EMC absorber | high performance high frequency | high power & ventilation applications outdoor pyramidal | clean room environment |
| Relative Cost | low to moderate | low to moderate | low cost | moderate to high | moderate to high | low | moderate | average |

Cuming Microwave, Inc.

225 Bodwell Street
 Avon, MA 02322
 Phone: (800) 263-4101
 Fax: (508) 584-2309
www.cumingmw.com

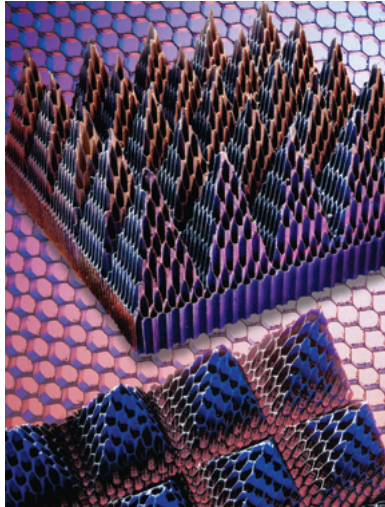
Anechoic and EMC Chambers/RF Absorber Materials

C-RAM FT & HFP – TB 390-5 and -6



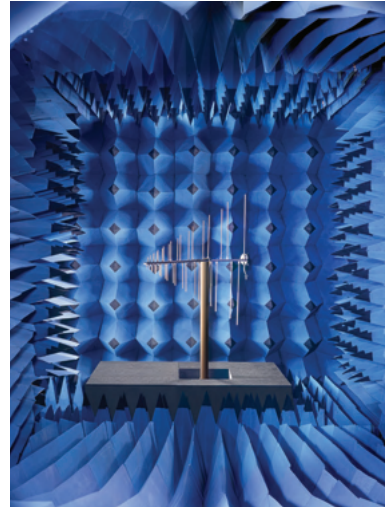
A full product line for treatment of EMC test chambers – both for emissions testing and susceptibility testing. C-RAM FT, ceramic ferrite tiles and C-RAM HFP, hollow impedance-matched hybrid absorbers for 26 MHz through 40 GHz performance, meeting all the prevailing U.S. and European specifications.

C-RAM SFC-HC/HP – TB 390-16



A product line of pyramidal-shaped, high-power absorbers, based on a fiber-reinforced, phenolic honeycomb structure and phenolic binder of the lossy coating. Power ratings of 10 W/in² - C.W. without forced air cooling. Can handle almost a decade higher power density with adequate air cooling. Standard sizes are 4" through 24" and in increments matching standard SFC absorber.

C-RAM CFC – TB 390-10



A fire-retardant, anti-static, clean room absorber ideal for clean room testing of satellites and other very sensitive, electric components. Six standard grades from 4" through 36" tall are available. Taller units may be supplied as custom parts.

Absorber Installation

Adhesive Bonding: Most common installation technique and most cost effective. Involves the use of a solvent based rubber contact adhesive for reliable mounting.

Velcro™ Fastening System: Ideal for small absorbers (SFC-18 or less) on ceilings and walls. Allows for easy dismounting and relocation. Can be used for wall mounting 24" and 36" absorber.

Clip and Rail Mounting: This is a mechanical fastening system ideal for large absorbers. It also allows for removal and relocation of absorber with little or no damage.

Power Handling

| | | |
|--------------------------------|--|--|
| Standard Power Handling | 0.8 W/in ² 1.25 W/in ² | C-RAM SFC, RFC, and Corner Block with forced ventilation |
| Medium Power Handling | 2.0 W/in ² 3.0 W/in ² | C-RAM EVA, RFA and HPA with adequate forced ventilation |
| High Power Handling | 10.0 W/in ² 80.0 W/in ² | C-RAM SFC-HCHP Phenolic Comb Absorber with adequate forced ventilation |



**TAILOR MADE SOLUTIONS FOR
YOUR UNIQUE APPLICATION**

Advanced EMI/RFI Absorber Materials and Anechoic Chambers

From the formulation of advanced materials in our laboratory to the design and construction of test facilities in the field, we are one of the world leaders in technology development pertaining to anechoic chambers, microwave and EMC absorbers, dielectrics and suppression materials.

PPG PPG Aerospace
Cuming Microwave

Pyramidal & Specialty
Absorber Materials
T 508.521.6700
Avon, MA 02322
CumingMicrowave.com

PPG PPG Aerospace
Cuming-Lehman Chambers

Anechoic Chamber Design,
Engineering and Construction
T 717.263.4101
Chambersburg, PA 17202
CumingLehman.com

