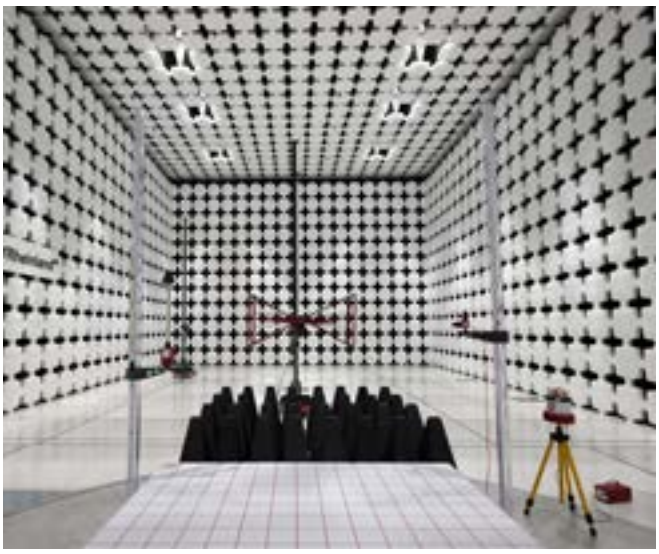
# CASE STUDY CUSTOM EMC CHAMBER SOLUTION FOR TÜV RHEINLAND - BOXBOROUGH, MASSACHUSETTS



TÜV Rheinland, an authority in testing and certification, required an EMC chamber meeting precise specifications, including a 3- and 10-meter range distance, 5-meter quiet zone, and adherence to ±3.0 dB NSA performance over a defined frequency range. ETS-Lindgren, leveraging decades of expertise in EMC test solutions, engineered a custom 10-meter chamber to fulfill these requirements. Auxiliary rooms were also provided including control and amplifier rooms, plus two RF shielded support rooms.

ETS-Lindgren's ISO 9001 certified manufacturing processes ensured high quality products and sophisticated capabilities such as Building Information Modeling (BIM) facilitated seamless integration with mechanical, electrical, and plumbing systems during design and construction phases. With ETS-Lindgren's adept factory-trained installation teams, optimal performance and longevity was achieved, thus exceeding TÜV Rheinland's exacting standards and reinforcing their position as a premier provider of EMC testing solutions.

### RF Shielded Anechoic Chamber

- Model FACT™ 10-5.0 Plus EMC Chamber:
  - Constructed with Series 81 Modular RF Shielding
  - Overall chamber dimensions are 21.8 m L x 13.9 m W x 9.6 m H (71.42 ft x 45.67 ft x 19.5 ft), including support structure
- Series 81 RF Shielding provides excellent RFI and EMI shielding effectiveness and is the most commonly specified shielding for NSA 65-6/NSA 94-106 testing requirements. Series 81 delivers high-performance attenuation over a broad frequency range.
- Turntable at 6-meter (19.6 ft) diameter has a load rating of 10 tons (20,000 lb)

### RF Shielded Doors

- Chamber:
  - Model RFSD-F/A-100 fully automatic pneumatic sliding equipment door measuring 4.6 m W x 3.7 m H (15 ft x 12 ft) with automatic ramp / lift system providing a zero-threshold transition into the chamber (9,000 kg [20,000 lb] load rating)
  - Model RFD-F/A-100 manual single-leaf door measuring 1.2 m x 2.1 m (4 ft x 7 ft) with double-knife-edge and limit switch, including two-piece removable ramp set
- Control Room, Amplifier Room, and Two RF Shielded Support Rooms:
  - Model RFD-60 manual single-leaf door with single-knife-edge and limit switch measuring 1.2 m x 2.1 m (4 ft x 7 ft) provided per room

### Anechoic Absorber

- Full coverage of ceiling and walls of FACT chamber with Model DSH-1250H 1250 mm (4 ft) DuraSorb™ Hybrid (Polystyrene + Ferrite) Absorber and "white caps" for interior brightness
- Personnel door coverage with Model FS-300 FerroSorb™ Hybrid Absorber (FlexSorb™ coated)
- Floor absorber:
  - Immunity testing: Model DSH-600H on removable absorber floor carts
  - CISPR 16-1-4 sVSWR testing: Model EHP-12PCL removable FlexSorb coated (including bottoms) pyramidal microwave absorber placed in front of the quiet zone and six rolling fiberglass platforms with integrated casters

### Power and Signal Line Filters

Power line filters are crucial for maintaining the integrity of electrical systems. Models LFPRX-4x200 (4x200 Amp) and LRW-2080 (2x80 Amp) cater to diverse EUT power requirements while providing exceptional shielding effectiveness and insertion loss, ensuring EMI protection. In the control room, Models ELUL-2030 (2x30 Amp) and EQ-2010-NR (2x10 Amp) stabilize power for outlets and LED lighting. In the amplifier room, Models LFPRX-4x100 (4x100 Amp) and ELUL-2030 (2x30 Amp) provide clean power for sensitive equipment. Signal line filter LTC-24640-GPIB and GigaFOIL™ converters minimize noise interference for fire horns, warning lights, and other low power applications. These filters are indispensable for maintaining operational efficiency and equipment longevity.

### Chamber Test Validation Requirements

- Shield Verification Testing:
  - Chamber: Shield verification test in general accordance with the test methods of MIL-STD-285/ IEEE-299 at 1 GHz, 6 GHz, 10 GHz and 40 GHz
  - Control, Amplifier, and Support Rooms: Shield verification test in accordance with the test methods of MIL-STD-285/ IEEE-299 at 1 GHz and 10 GHz
- Chamber Anechoic Testing:
  - Normalized Site Attenuation (NSA) test for one 3-meter and two 10-meter ranges per ANSI C63.4 from 30 MHz to 40 GHz
  - Field uniformity calibration per IEC 61000-4-3 from 1 to 18 GHz
  - sVSWR per CISPR 16-1-4 from 1 to 40 GHz at 3-meter range at two ranges/axis
  - Ambient emissions from 150 kHz to 40 GHz
  - Modeled long wire validation (0.15 MHz to 1GHz)

### Industry Standards

Model FACT™ 10-5.0 Plus EMC Chamber and RF shielded chambers support testing to a wide range of commercial, automotive, and aerospace industry standards, including:

- ANSI C63.4 (FCC Part 15)
- SAE J 1113/J 5551
- CISPR 11/12/22/25
- EN 55022/50147 2/50140/61000-4-3
- MIL-STD-220-A, UL 1283
- ASTM E-84-81A
- VCCI V-3/99.05/V-3/ 97.04
- IEEE STD 299; MIL-STD-285/461
- RTCA / DO 160
- DC-11224; ISO 11452-2; and others.

### Turnkey Project

ETS-Lindgren offered a complete EMC Test and Measurement Solution as the manufacturer of virtually 97% of the total project. In addition to the products listed above, ETS-Lindgren provided a camera and monitoring system, isotropic probes, transmit and emission antennas, LED lighting, positioning equipment, and a removable copper top test bench. With a single point of contact for a turnkey project, TÜV Rheinland was assured of coordinated deliveries and scheduling, in addition to convenient access to ETS-Lindgren project management for construction updates.

### About ETS-Lindgren

ETS-Lindgren is an international manufacturer of components and systems that measure, shield, and control electromagnetic and acoustic energy. The company's products are used for electromagnetic compatibility (EMC), microwave and wireless testing, electromagnetic field (EMF) measurement, radio frequency (RF) personal safety monitoring, magnetic resonance imaging (MRI), and control of acoustic environments. Headquartered in Cedar Park, Texas, ETS-Lindgren has manufacturing facilities in North America, Europe, and Asia. Additional information about ETS-Lindgren is available at www.ets-lindgren.com. Additional information about ETS-Lindgren's parent company ESCO and its subsidiaries is available at www.escotechnologies.com.





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