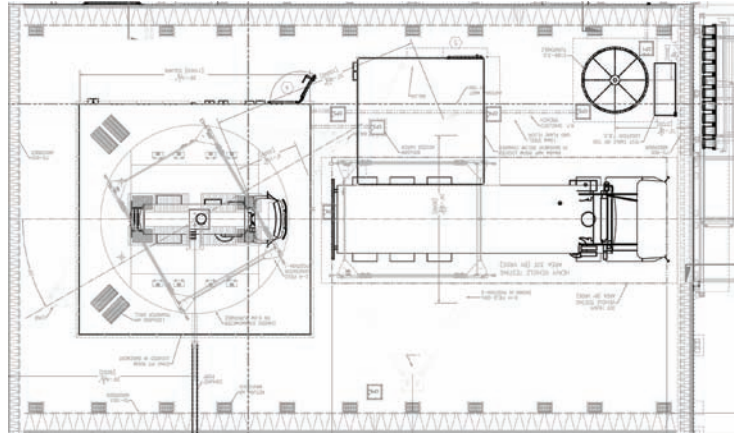


EMC Automotive Test Facility Government of India Vehicle Research & Development Establishment (VRDE)

The new multi-chamber turnkey automotive electromagnetic compatibility (EMC) test facility at VRDE in Ahmednagar, India features precision automotive test capabilities and automated test functions for both small and large military and commercial vehicles. The purpose of this test facility is for VRDE to perform electromagnetic interference (EMI) and electromagnetic simulation (EMS) for full vehicle and component level type approval testing in accordance with commercial and military national and international standards.

ETS-Lindgren designed, manufactured, and installed the state-of-the-art RF shielded test facility which includes a full vehicle chassis dynamometer and turntable system as well as an automated EMC instrumentation system. As the prime contractor, ETS-Lindgren assembled a team of key partners to complement its expertise and support the overall mission of the project. ETS-Lindgren's experienced project management staff acted as the customer's main point of contact for all aspects of project execution.

The high-performance, RF shielded automotive EMC test facility consists of a semi-anechoic test chamber, a chassis dynamometer turntable (CDM/TT) positioning system with 9m diameter turntable surface, a CDM/TT room under the main



test chamber, an amplifier room underneath the main chamber, and two control rooms that accommodate the test and measurement equipment.

Impressive features of the project include an E/H field generator system for performing vehicle EMS immunity measurements from 100 kHz to 30 MHz and the large, 6m x 6m, automatic vehicle door providing flush access into the test chamber and allowing push button entry/egress for the full vehicles tested in the main chamber.

VRDE Project Technical Features

- RF Shielded Automotive Chamber, 32.8m length x 20.5m width x 9.3m height, nominal dimensions; designed primarily for radiated emissions and radiated immunity testing over the frequency range from 9 kHz to 40 GHz.
- Two RF Shielded Control Rooms each sized at 8m length x 4m width

x 3m height, nominal dimensions.

- Chamber performance verified using RF shield attenuation testing per IEEE 299 at 400 MHz, 1 GHz, 10 GHz, and 40 GHz.
- Free space transmission loss testing from 1 GHz to 18 GHz.
- Seismic construction provided in accordance with 2005 AISC seismic provisions.
- Series 81™ RF shielded modular galvanized steel panel construction.
- ETS-Lindgren RF swinging and sliding doors of various sizes are provided in all chambers. The large (6m x 6m) sliding equipment door is designed to accommodate the entry of trucks and buses. This sliding door features fully automatic and pneumatically operated actuation with the capability of supporting both foam and ferrite absorbers; it is flush with the parent building and chamber floor to accommodate seamless heavy vehicle traffic.

- Anechoic chamber performance was verified using ANSI C63.4 from 30 MHz to 1 GHz and IEC 61000-4-3 from 26 MHz to 18 GHz.
- A unique cable management system easily supports the vehicle weight inside the chamber. Cabling and communication between the enclosures is handled through RF shielded cable troughs built into the concrete underneath the chambers.
- The custom, heavy-duty 3m diameter turntable features a distributed load rating of 3,992 kg, electric drive, metal construction, and a bolted sectional surface. A smaller wooden table is provided for smaller component testing per ISO 11452-2 and has a metallic ground plane on top. This turntable is located in the corner of the large EMC chamber to perform component level tests.
- ETS-Lindgren Model 4340 digital CCTV color system with direct digital feed allows the viewing of many cameras on a single PC. Features pan/tilt, focus, zoom, and fiber optic interface for control and video signals. EMI shielded to 200 V/m; standard operating frequency is from DC to 18 GHz.
- Fire detection provided in all chambers is a Very Early Smoke Detection and Alarm (VESDA) air sampling fire system.
- The chamber floor consists of a welded conductive ground plane designed to meet NSA requirements per ANSI C63.4-2001. The chamber has a recessed floor design in order to accommodate the basement housing the chassis-dynamometer and subterranean amp room. The floor of the chamber

is flush with the floor of the parent building and constructed of 13mm thick continuously welded, non-galvanized, steel panel construction. A heavy load area is capable of supporting a maximum load of 30,000 kg between the large 6m x 6m sliding door and turntable.

- Accessories provided include RF filters, connector panels, air vents and lighting.

Absorber

Absorber includes ETS-Lindgren Models FS-1001 and FS-600, a polyurethane and ferrite hybrid absorber with performance from 30 MHz to 18 GHz and above. ETS-Lindgren utilized its considerable absorber and chamber modeling capabilities, verified by countless actual measured data from previous chamber installations, to successfully predict the optimal absorber for this application.

E/H High Field Generator System

Immunity applications in automotive EMC standards call for the generation of very high fields. ETS-Lindgren developed a series of high power antennas to address these requirements suitable for the 100 kHz to 30 MHz range. The main standards applicable are ISO 11451-2, SAE J551-11, and 95/54 EC Annex VI.

- The E/H field generator system was provided with relocation capability from the large turntable to vehicle area.
- A custom dual lift system conveniently accommodates the E/H field generator over the dynamometer and over a second location for larger vehicles.

Training

ETS-Lindgren organized a training course for VRDE's scientists and technicians related to EMC testing per international organizations such as NVLAP, UTAC, and TUV Rheinland. The training consisted of theoretical lectures followed by "hands on" actual testing of the vehicles and subsystems per the VRDE used test standards.

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, wireless, and magnetic resonance imaging (MRI) testing, electromagnetic field (EMF) measurement, radio frequency (RF) personal safety monitoring, and control of acoustic environments.

Headquartered in Cedar Park, Texas, ETS-Lindgren has manufacturing facilities in North America, Europe and Asia. The company is a wholly owned subsidiary of ESCO Technologies, a leading supplier of engineered products for growing industrial and commercial markets. ESCO is a New York Stock Exchange listed company (symbol ESE) with headquarters in St. Louis, Missouri. Additional information about ETS-Lindgren is available at www.ets-lindgren.com. Additional information about ESCO and its subsidiaries is available at www.escotechnologies.com.