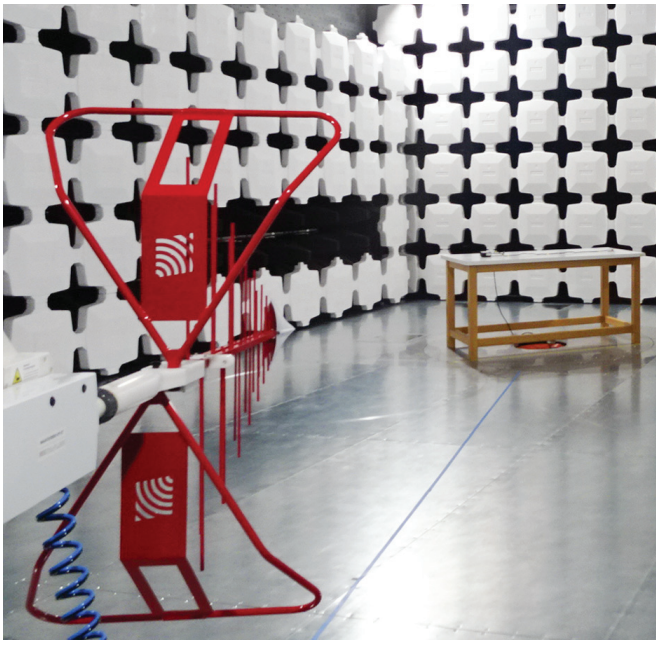
CASE STUDY ALTER TECHNOLOGY (TÜV NORD GROUP) - SPAIN



When ALTER TECHNOLOGY (TÜV NORD Group) decided to expand their EMC test capabilities in Spain, they faced a huge challenge. Their goal was to provide test services for a wide variety of small to large products for their growing customer base. However, the size of the test chamber was constrained by the existing facility. The experts at ETS-Lindgren proposed a solution to maximize the chamber size and performance. Using proprietary modeling tools (numerical simulations to predict RF performance) along with Building Information Modeling (BIM) during the design phase, ETS-Lindgren optimized the chamber configuration not only to fit perfectly into the limited space, but also to maximize the chamber performance beyond the specified requirements. The new chamber's increased capacity enables EMC and radio testing with measurements at 5 meters. Larger devices may be tested, such as satellite equipment as well as space and railway control stations, with desired cleanliness conditions due to the absorber capabilities. Now, ETS-Lindgren's unique, outsized 5 meter chamber provides greater flexibility for ALTER's customers.

Chamber Overview

ETS-Lindgren designed and manufactured a FACT™ (Free-space Anechoic Chamber Test-site) 5 meter EMC Test Chamber with auxiliary combined Amplifier and Control Rooms. Wavecontrol, ETS-Lindgren's partner in Spain, installed the chambers. FACT 5 Chambers offer the semi-anechoic radiated emissions (RE) and fully anechoic radiated immunity (RI) compliance test capability for most international EMC compliance regulations.

Key Features:

- FACT 5 Chamber with nominal internal shield-to-shield dimensions of 11.6 m L x 7.3 m W x 5.6 m H (38 ft L x 24 ft W x 18 ft H) - prior to absorber installation.
- RF Shielded Control Room with external shield-to-shield dimensions of 2.56 m L x 3.12 m W x 2.64 m H (8 ft L x 10 ft W x 9 ft H).
- Amplifier Room with external shield-to-shield dimensions of 2.56 m L x 3.12 m W x 2.64 m H (8 ft L x 10 ft W x 9 ft H).
- Constructed of Series S101 RF shielded enclosure "pan" type panels with a single layer of 2 mm (.07 in) galvanized steel. Panels are bolted together with superior gasket to ensure high RF conductivity – no welding is required. Series S101 offers the highest shielding attenuation available on the market when combined with the RFD-100 series doors provided.
- The FACT 5 RF shielding system contains no wood components that could be adversely affected by variations in temperature or moisture in an uncontrolled environment. The panels maintain electrical continuity and are resistant to corrosion.
- RF Shielded Doors provided for personnel and equipment access, in single and dual door configurations.
- A manual door ramp system at 2.0 m (6 ft) wide and rated for 1,000 kg (2200 lb) load allows smooth transition to the chamber from the lab.

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Components and Services

ETS-Lindgren is the most vertically-integrated test solution supplier in the industry with six factories worldwide that design and manufacture over 90% of the key chamber components including absorbers, shielding, doors, waveguide air vents, power filters, connector panels, and positioning systems - nearly eliminating reliance on third parties. Control over manufacturing allows ETS-Lindgren to tailor product performance to specific test applications and efficiently support ALTER's current and future operational requirements. ETS-Lindgren also supervised the electrical and HVAC installation to ensure the RF shielding performance of the chambers was maintained during construction.

Key Features:

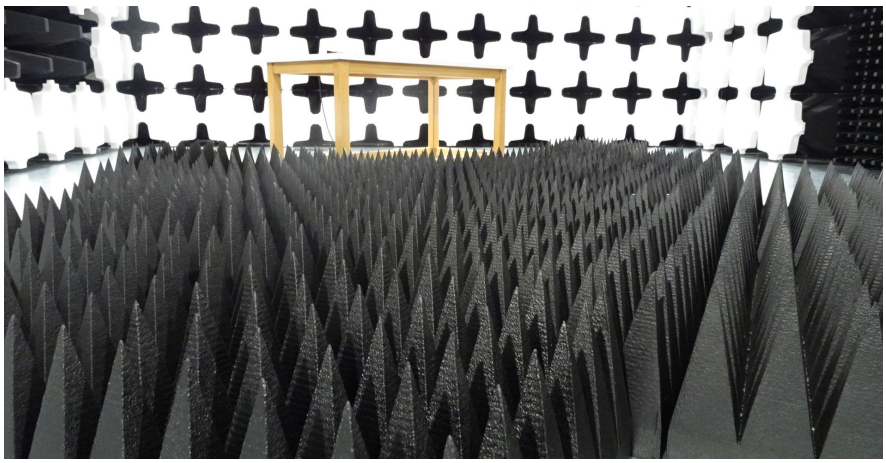
- Model 2171B Boresight Antenna Mast, compliant with the latest requirements of ANSI C63.4.
- Model 3142E BiConiLog™ antenna.
- Model HI-6105 E-Field Probe.
- Model LDT Low Dielectric Turntable, compliant with the latest requirements of CISPR 16-1-4 Section 5.5, with a load handling of 200 kg (440 lb) evenly spread.
- Versatile EMCenter™ RF measurement platform that offers flexibility for future upgrade of the EMC systems.
- CISPR 25 Test Table for the Chamber or Shielded Room.
- Galvanized steel ground plane.
- All electrical, including LED lighting, and HVAC services for a turnkey installation.

EMC Absorbers

ETS-Lindgren lined the FACT 5 EMC Test Chamber with DuraSorb™ hybrid broadband absorber materials. DuraSorb is manufactured in-house at ETS-Lindgren under a strict ISO 9001 Quality Management System. It is constructed using substrates with rigid, closed cell foams, which are loaded volumetrically and uniformly throughout each absorber. Each piece of absorber is serialized and factory tested before shipment. DSH-600H provides a smooth transition from free space impedance to the lossy ferrite tile base. As a result of its optimized design, high performance is guaranteed not only at the lower frequency band, but also at above 1 GHz. It has a reflectivity better than 17 dB from 60 MHz to 3 GHz, and better than 20 dB at above 4 GHz. At frequencies above 8 GHz, the reflectivity exceeds 35 dB. In addition, DSH-600 absorber is made of expanded polystyrene, which is a close cell structure; there is no possibility for particles to leak out from inside. Due to the close cell nature of the material, DSH-600 absorber has the capability to achieve ALTER's desired cleanroom level requirement (ISO7).

Key Features:

- Full coverage on four side walls and ceiling with ferrite tiles (individually screwed to under-construction, so these can be dismounted for future chamber transfer).
- Optimized coverage with 600 mm (2 ft) DuraSorb volumetrically loaded polystyrene absorbers, including white end caps.
- Model DSH-600H provided on walls and ceiling.
- Model DSH-600 provided on movable floor carts for convenience during test set up.
- Model EHP-12PCL provided in the Quiet Zone.



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Automated Test Software

In order to automate and expedite testing for ALTER's commercial as well as automotive test applications, ETS-Lindgren provided VisionTRX™ Visual Monitoring System software. The software redefines automated movement based analysis of Equipment Under Test (EUT) during EMC testing.

Key Features:

- In order to verify EUT behavior, the software allows automated visual monitoring of relevant parameters during exposure to the required electromagnetic field strengths.
- EUT may include speedometer needles, dash lights, LEDs, radios, heads up displays, etc.
- Flexible software enables testing for ALTER's varied commercial and automotive test requirements

Performance

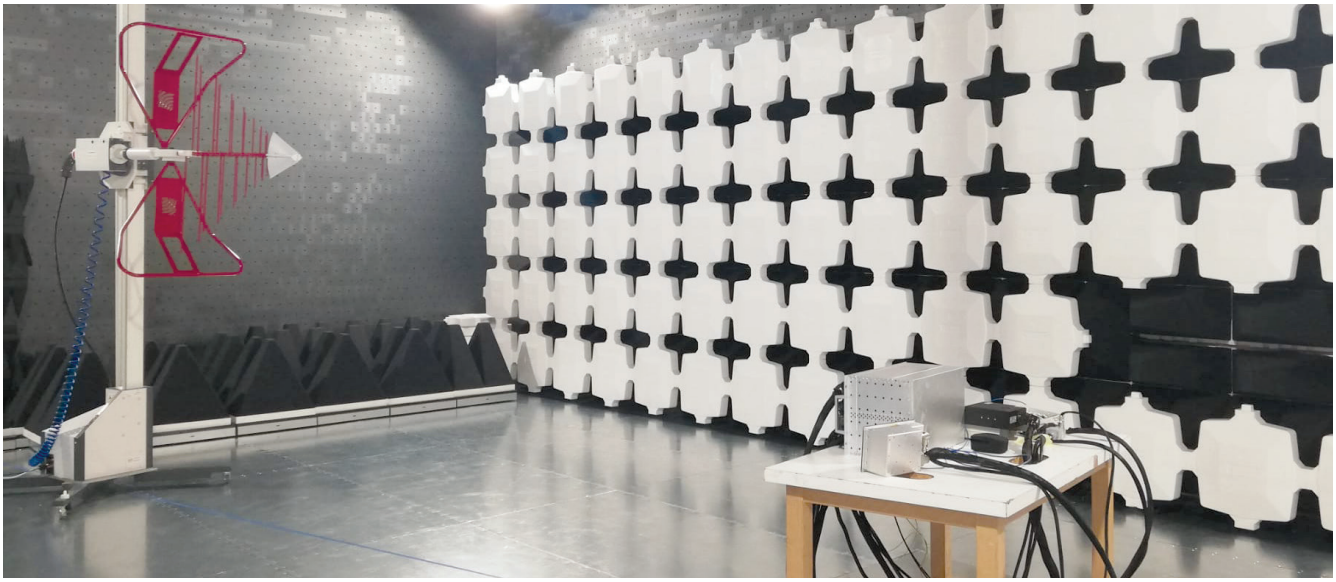
ALTER's EMC Test Chamber provides NSA and sVSWR performance exceeding basic expectations at ±4.0 dB NSA from 30 MHz to 1 GHz and sVSWR ≤ 6.0 dB from 1 GHz to 18 GHz.

Testing is offered in accordance with the requirements specified in Automotive, Commercial, Industrial, Military, and Aerospace Standards such as MIL-STD-461F, MIL-STD-464C, RTCA-DO-160G, CISPR 16, CISPR 25, ANSI C63.4 and IEC 61000-4-3.

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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