SERVICE SOLUTIONS

FIELD SERVICES
CALIBRATION AND REPAIR
ENGINEERING AND CONSULTING
IN-HOUSE ACOUSTIC PRODUCT TESTING
ETS-U™ EDUCATION

COMMITTED TO A SMARTER, MORE CONNECTED FUTURE

ETS·LINDGREN®
An **ESCO Technologies** Company

ETS-LINDGREN IS AN EXPERIENCED PARTNER YOU CAN TRUST

THE LEADER IN THE TEST AND MEASUREMENT AND SHIELDING INDUSTRY IS ALSO THE EXPERT IN TEST AND MEASUREMENT AND SHIELDING SERVICES

From education to consulting and product testing to calibration, ETS-Lindgren has dedicated experts committed to the success of our customers. ETS-Lindgren understands how downtime can impact our customers' development, production, and testing schedules. Let ETS-Lindgren assist in maintaining your chambers and training your employees to ensure optimal utilization of your assets.

ETS-Lindgren employs more than 750 professionals at locations in the Americas, Europe, the Middle East, and Asia. Our global network of independent representatives and distributors provide local service and support backed by the global resources of ETS-Lindgren.

Whether your chambers and shielding products are from ETS-Lindgren or another manufacturer, our Service Experts can address your service needs. ETS-Lindgren is committed to meeting your service needs to minimize downtime and maximize your output.

FIELD SERVICES

ETS-Lindgren's Field Services provide a wide range of services related to electromagnetic compatibility (EMC), wireless, automotive, radio frequency (RF) microwave, and acoustic testing, as well as overall chamber and shielding maintenance. These services help businesses optimize the performance of their test and measurement equipment and shielding products, thereby improving testing accuracy, reducing the risk of costly errors, and maximizing operational throughput.

Within the EMC testing field, ETS-Lindgren offers services such as:

- NSA (Normalized Site Attenuation) Testing – measures the ability of a chamber to attenuate radio signals and evaluates the reflection level of the chamber quiet-zone for less than 1 GHz
- SVSWR (Site Voltage Standing Wave Ratio) Testing – evaluates the reflection level of a chamber quiet-zone for greater than 1 GHz measurement
- Field Uniformity Testing – measures the uniformity of the electric field in a measurement plane in a chamber
- Reverb Testing – evaluates the performance of chambers that will be used for EMC immunity, emission, and shielding effectiveness measurements, as well as those used for wireless device performance evaluation

Wireless Testing Services offered by ETS-Lindgren include testing for a variety of different wireless technologies, such as cellular handsets and base stations, Wi-Fi, Bluetooth, and many more. These services help businesses to ensure that their products meet regulatory requirements and perform optimally in a wireless environment.

In addition to testing services, ETS-Lindgren also provides Maintenance and Repair Services, including component repairs and replacements, turntable repairs, door repairs, and installation, as well as overall chamber maintenance. These services help extend the life of testing equipment while reducing the risk of costly downtime due to equipment failure. ETS-Lindgren's Technical Services Team is comprised of highly trained technicians with extensive experience in the field of EMC and RF testing. They have access to the latest test and measurement equipment and are committed to helping businesses optimize their testing processes and outcomes.

ETS-Lindgren also provides Shielding Services including shielding and door repairs, relocations, modifications, general maintenance, and shielding effectiveness testing. ETS-Lindgren can service and repair most shielding systems.

By providing a wide range of options, ETS-Lindgren's Field Services can help businesses save time and money while ensuring accuracy and reliability of chamber and shielding solutions.

CALIBRATION AND REPAIR SERVICES

At ETS-Lindgren, we take pride in providing Calibration and Repair Services of testing equipment for precise and consistent measurements every time. The company's calibration lab operates in accordance with ISO 17025 standards, assuring customers that their testing equipment is calibrated to a high degree of accuracy. Furthermore, our Calibration Services support a wide range of EMC and EMI testing equipment, from antennas and probes to field probes and receivers. Customers can choose from on-site or lab calibration services, with an electronic format signed certificate and correction factors (where applicable) provided for each calibrated item.

Calibration Service Plus!™ takes the uncertainty out of calibration and repair. With this program, ETS-Lindgren coordinates the scheduling and logistics involved with calibrating your antennas, probes, LISNs, current clamps, couplers, and attenuators.
An added bonus... discounted and locked pricing for those with a multi-year program!

ETS-Lindgren has an A2LA-accredited calibration laboratory (Lab Cert #1207.01) equipped with calibrated instrumentation traceable to global National Metrology Institutes (NMI). This calibration laboratory also houses several anechoic chambers, test cells, and a large 80 m x 50 m (262.47 ft x 164.04 ft) welded steel ground plane for antenna calibration. With this setup, ETS-Lindgren can calibrate all brands of EMC antennas and often make basic, pre-approved repairs. The services offered by the lab include repair of components including antennas, probes, and current clamps. ETS-Lindgren also offers the Calibration Service Plus! program to assist our customers in their planning and budgeting needs.

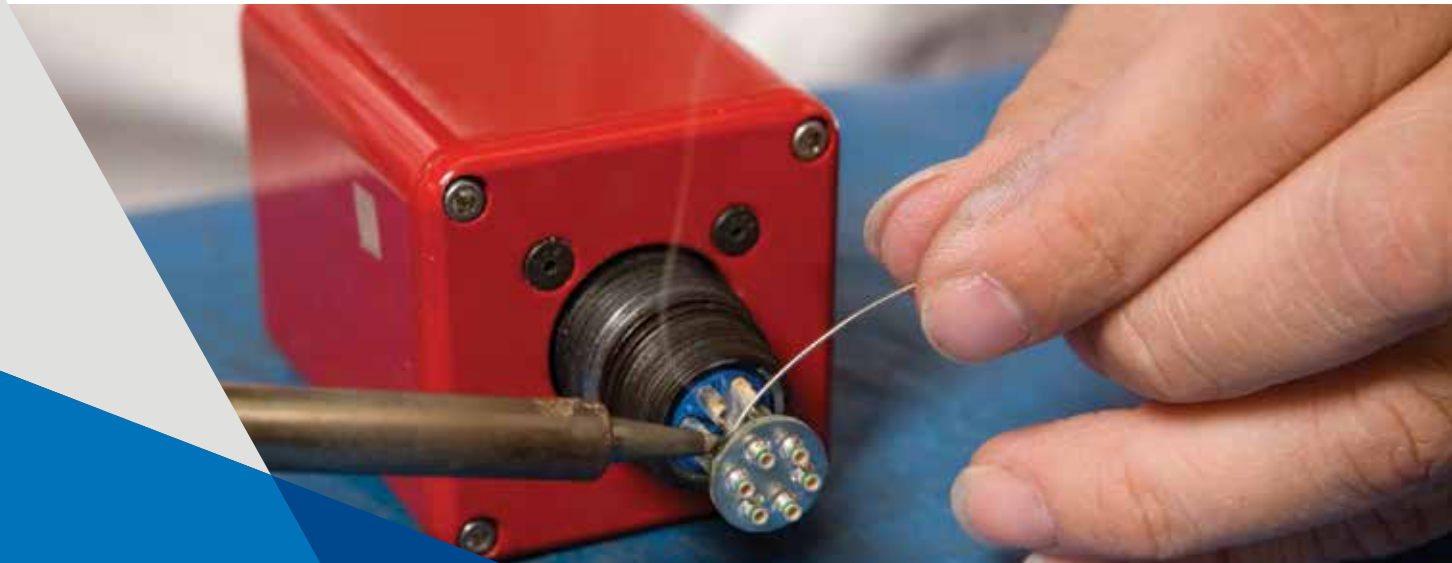
On-Site Calibration Services

- Normalized Site Attenuation (NSA)
- Normalized Site Insertion Loss (NSIL)
- Site Voltage Standing Wave Ratio (SVSWR)
- Time Domain SVSWR
- Field Uniformity
- Quiet Zone Accuracy Testing
- Ripple Testing (CTIA)
- Shielding Effectiveness

Lab Calibration Services (including Repair Services)

- Antennas
- Field Probes
- LISNs
- Current Clamps

Don't see a calibration service you require? Contact your local ETS-Lindgren Representative for a customized services package.



ENGINEERING AND CONSULTING SERVICES

At ETS-Lindgren, we understand that each customer's needs are unique, and we strive to provide tailored Solutions to meet those needs. Our range of Engineering and Consulting Services exemplifies this commitment to individualized service. We understand that time and money are critical considerations, so we work hard to deliver our services quickly and within budget.

We have in-house experts who specialize in designing integrated systems for EMC, wireless, acoustic, healthcare, security, general shielding, and audiometric applications. Our team can also design and manufacture custom components, ensuring that the customer receives the most intelligent and effective Solutions for their needs. In addition, we offer a variety of site surveys, including electromagnetic interference (EMI), vibration, and acoustic assessments, to provide information for planning purposes, pinpoint noise issues, and offer intelligently designed Solutions.

At ETS-Lindgren, we supply an assortment of design and site planning services. We have extensive experience in magnetic and shielding design, and collaborate with owners, architects, and contractors, assuring our Solutions seamlessly integrate into any construction project. Our design team understands the importance of controlling electromagnetic interference (EMI), radio frequency interference (RFI), sound, and vibrations in sensitive settings, which is why we offer customized Solutions for each application. Finally, our Building Information Modeling (BIM) capabilities allow for precise planning of complex construction projects, reducing errors and rework.

Whether you need assistance designing a new wireless, EMC, or acoustic lab; state-of-the-art research facility; government installation; or healthcare imaging center, ETS-Lindgren is your trusted partner to achieve your design requirements and ensure you realize your objective.

IN-HOUSE ACOUSTIC PRODUCT TESTING SERVICES

ETS-Lindgren provides high-quality in-house acoustic product testing services in Cedar Park, Texas, to help businesses consistently meet quality and compliance standards. ETS-Lindgren's testing facility uses the latest equipment and technology to conduct a wide range of product tests.

ETS-Lindgren's team of experienced engineers and technicians work closely with customers to ensure testing is on time and cost-effective with accurate and reliable results. This makes it easier for businesses to bring products to market quickly and confidently, knowing that their products meet regulatory requirements and are of high quality. Our Testing Services make it easier for businesses to bring high-quality products to market — faster.

Hemi-Anechoic Chamber Test Services

ETS-Lindgren offers a precision-grade, double-walled Hemi-Anechoic Chamber for product noise emission and other testing requiring an acoustic free-field environment over a reflecting plane. Equipment available for use in our chamber includes a multiple-channel data acquisition system, high accuracy microphone and specimen positioning systems, signal generators, and reference sound sources. The chamber is qualified to ISO 26101 (Acoustics – test methods for the qualification of free-field environments). The qualified frequency range is 63 Hz to 20 kHz to a distance of 2.5 m (8.2 ft).

Testing commonly performed in our Hemi-Anechoic Chamber includes product noise emission testing, waveform recording, and waveform analysis. The extremely low-noise free-field environment also allows for testing audio component frequency response, source directionality, and signal fidelity. Aural non-detectability of Department of Defense devices (per MIL-STD-1474E) is also available. The Hemi-Anechoic Chamber is configurable for client testing requirements, including data lines, electric power, air supply/exhaust, etc.. A large acoustically isolated control room adjacent to the chamber allows incorporation of any client-supplied equipment into the test program as needed.

Types of Products We Test

- Information Technology Equipment
- Motorized Equipment
- Health and Medical Devices
- Automotive Components
- Military Hardware

Acoustic Reverberation Test Suite

The Acoustic Reverberation Test Suite is comprised of a 408 m^3 chamber (the receive room), and a 208 m^3 chamber (the source room). These rooms are connected by an operable tunnel that accommodates a single 2.67 m wide x 2.67 m tall (8.75 ft x 8.75 ft) test fixture, capable of supporting items under test up to 2.44 m wide x 2.44 m tall x .41 m deep (8 ft x 8 ft x 1.33 ft). Deeper items can be contained provided each item is broken down to less than .41 m (1.33 ft) before placing it between the reverberation chambers. The Acoustic Reverberation Test Suite includes a five-ton capacity overhead bridge crane that allows for a wide variety of equipment to be transported into and out from the test area rapidly and efficiently.

ETS-Lindgren's Acoustic Reverberation Test Suite is fully accredited to perform testing in accordance with ASTM E90 and ASTM C423; it is also one of four laboratories in the United States accredited by NVLAP to perform ASTM E596 testing using our state-of-the-art data acquisition systems. Our labs are capable of executing test programs with single or multiple test items, with data for each item obtained and delivered, at minimum, in the format required by the test method utilized; additional data will be provided by request. Standard data furnished include one-third octave band spectrum, sound transmission class (STC), outdoor-indoor transmission class (OITC), airborne sound reduction index (Rw), noise reduction coefficient (NRC), sound absorption average (SAA), and noise isolation class (NIC), each based on the appropriate measurements for the test method employed.

Types of Products We Test

- Windows and Doors
- Window Glass
- Transportation Noise Barriers
- Generator Housing Sections
- Construction, Oil, and Gas Noise Barriers
- Fabrics and Insulation Materials
- Ceiling Tiles and Sections
- Building Wall and Medical Wall Sections
- Sound Absorption Panels
- Sound Control Products
- Machinery Enclosures
- Small Acoustic Testing Enclosures
- Audiometric Testing Booths

NVLAP®
TESTING
NVLAP LAB CODE 100286-0

Normal Incidence Sound Absorption Testing

Normal Incidence Sound Absorption Testing utilizes the ARL's 61 cm (24 in), 31 cm (12 in), 20 cm (8 in), and 5 cm (2 in) impedance tubes. Unlike the Sound Absorption Testing conducted in our Reverberation Chambers that utilize a diffuse, random incidence field to determine the sound absorption properties of a specimen, Normal Incidence Sound Absorption Testing uses a long tube driven in at one end by a broadband noise source — in this case pink noise. Planar waves, or sound waves with relatively flat wave fronts, are produced in the tube, and our data acquisition system measures the difference between the incident wave — the sound wave traveling from the source to the object — and any reflected sound waves from the object to calculate the normal incidence sound absorption properties of the object.

The quality of sound found in spaces from concert halls to movie theaters is controlled by sound absorption. Acousticians have several criteria they strive to regulate in many kinds of spaces, one of which is reverberation time (RT60). RT60 is a measure of the time it takes for a sound to reduce, or decay, by 60 dB in a space. Typically, the longer this period is, the more difficult it becomes to discern details in the audio, whether it be speech, music, or a mixture of both. To control RT60, we generally add absorptive materials into the space. However, most reverberation times are not consistent over the audible frequency range.

Similar to Random Incidence Absorption Testing, Normal Incidence Sound Absorption Testing affords the observation of the article's absorption across the frequency range. This type of testing determines if a certain material would work well for a specific application. Random Incidence Absorption Testing completed in a Reverberation Chamber provides data within the one-third octave band frequency range, while Normal Incidence Sound Absorption Testing provides data at discrete frequency steps, offering greater detail.

MIL-STD-1474E Testing

The Acoustic Research Laboratory at ETS-Lindgren is the only testing laboratory in North America accredited by NVLAP to perform MIL-STD-1474E tests for aural non-detectability. The United States Department of Defense (DoD) has strict requirements for devices used by soldiers, including the aural non-detectability requirement that safeguards a soldier's position will not be given away by the tools they use to monitor, report, and react to situations in the field.

The design and construction of our Hemi-Anechoic Chamber ensures the ambient noise levels inside the test chamber remain well below 0 dB from 100 Hz to 20 kHz. Moreover, the latest revision of MIL-STD-1474E requires chambers be qualified to ISO 26101 as well as meet the ambient noise levels described in the standard. Our Hemi-Anechoic Chamber is tested regularly to verify performance compliance with the standard. We take great pride in helping to keep our soldiers out of harm's way in the field by maintaining our accreditation to perform this vital test.

NVLAP Accreditation by Testing Standard (NVLAP Lab Code 100286-0)

- ASTM C423, Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
- ASTM E596, Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures
- ASTM E90, Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
- MIL-STD 1474E, Department of Defense; Design Criteria Standard Noise Limits (Appendix C)
- ANSI S12.10 / ISO 7779 / ECMA 74, Measurement and Designation of Noise Emitted by Computer and Business Equipment
- ANSI S12.54 / ISO 3744, Determination of Sound Power Levels of Noise Sources - Engineering Methods for Free-Field Conditions Over a Reflecting Plane
- ISO 11201, Noise Emitted by Machinery and Equipment - Measurement of Emission Sound Pressure Levels at a Work Station and at Other Specified Positions - Engineering Method in an Essentially Free Field Over a Reflecting Plane
- ISO 9296 / ECMA 109, Declared Noise Emission Values of Information Technology and Telecommunications Equipment

ETS-U EDUCATION

One of ETS-Lindgren's most popular offerings is the ETS-U Education Service. ETS-U equips professionals with the technical knowledge and skills necessary to excel in various categories including EMC, RF, antennas, and acoustics.

ETS-U offers courses ranging from fundamental to advanced level and covering topics that include EMC, MIL-STD, wireless OTA testing, and EMP protection. Such variety makes ETS-U suitable for professionals at all degrees of expertise. Each course provides practical, hands-on demonstrations using ETS-Lindgren's state-of-the-art equipment and software tools. Participants have access to experienced trainers who guide them in the application of theoretical knowledge in practical design/measurement scenarios. Through this program, ETS-Lindgren actively contributes to the development of skilled and knowledgeable professionals, advancing the development of critical technologies.

ETS-Lindgren is committed to your success. Whether your employees need a refresher or a deep dive into an emerging technology, ETS-U can play an integral part in educating your staff, driving your asset effectiveness, and increasing productivity.

YOUR SERVICE PARTNERS

Whether you need assistance designing your next project, educating staff, or ensuring that your lab or equipment remains operational and productive, ETS-Lindgren Services are integral to our customer's success. Our Design Services assist customers in developing facilities that are effective well into the future, while our Field Services and Calibration Services assist customers with maintaining an efficient and productive facility limiting expensive downtime. ETS-U provides training and education to refresh staff, bringing them up to speed quickly for increased productivity and output.

Our accredited Acoustic Lab Services quantify product performance, confirm products meet industry standards, and test developing products, giving insight on potential product improvement as well as determining whether or not the product satisfies design requirements. Our knowledgeable staff will be there to assist you throughout the process to ensure products are properly tested.

Contact your local Sales Representative about any of our Services. Our team can assist with your technical staff development, maintain the effectiveness of your assets, and bring the next generation of products to market.

At ETS-Lindgren, we remain ***Committed to a Smarter, More Connected Future***.

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