

A large, colorful, 3D visualization of a wireless signal field, showing concentric, overlapping wave-like patterns in shades of green, yellow, and orange, set against a dark blue background. The visualization is positioned on the left side of the page, extending diagonally from the top left towards the center.

# WIRELESS SOLUTIONS

5G, OVER-THE-AIR (OTA),  
ANTENNA PATTERN MEASUREMENT (APM),  
MULTIPLE INPUT-MULTIPLE OUTPUT (MIMO),  
SINGLE INPUT-SINGLE OUTPUT (SISO)

TEST SYSTEMS  
TEST SOFTWARE  
COMPONENTS  
SERVICES

**BEYOND MEASURE™**



# AN EXPERIENCED PARTNER YOU CAN TRUST.

## THE EXPERT IN WIRELESS TEST AND MEASUREMENT

ETS-Lindgren is the proven expert in test and measurement solutions. Our ability to create real-life test scenarios and solutions enables customers around the globe to verify, measure, isolate, contain, and ultimately bring life-changing products to their markets – faster. Every day, when people use cell phones, drive a car, type on a computer, or listen to music, more than likely they are benefitting from the technological investments and innovative systems and components developed by ETS-Lindgren.

As much as we're recognized for our technology, innovation, and engineering, ETS-Lindgren is very much a people company. Across the globe we bring an understanding that the most effective solutions begin with something far more basic than the products and technology we develop – a partnership between people.



## ANTICIPATING THE NEEDS OF AN EVOLVING UNIVERSE

ETS-Lindgren helped develop the industry's first Over-the-Air (OTA) measurement plan along with pioneering the world's first CTIA Authorized Test Lab for mobile station OTA performance testing. Our unparalleled expertise and our full line of solutions for the entire wireless product cycle is why ETS-Lindgren has designed and built a staggering 80 percent of the CTIA OTA labs that exist today.

With this experience, ETS-Lindgren is uniquely qualified to address the emerging 5G and mmWave test requirements. Not only do we have the proven technical depth expected of an industry leader, we also have the capability to work with our customers to provide the optimal test and measurement solution for their specific performance metrics, budget objectives, and/or space constraints. Since each wireless device manufacturer or carrier will have its own specific performance metrics, ETS-Lindgren offers customized solutions to meet these unique requirements.

Having the proven technical depth expected of an industry leader, we can guide our customers to an optimal OTA test and measurement solution for their specific product applications including:

- 2G/3G/4G/Wi-Fi SISO OTA
- 4G/Wi-Fi MIMO OTA
- 5G Sub-6 GHz SISO/MIMO OTA
- 5G mmWave OTA
- Radiated Spurious Emissions (RSE)
- Passive Antenna Pattern Measurement (APM)

For a complete list of test applications, please see pages 8 and 9 of this brochure.





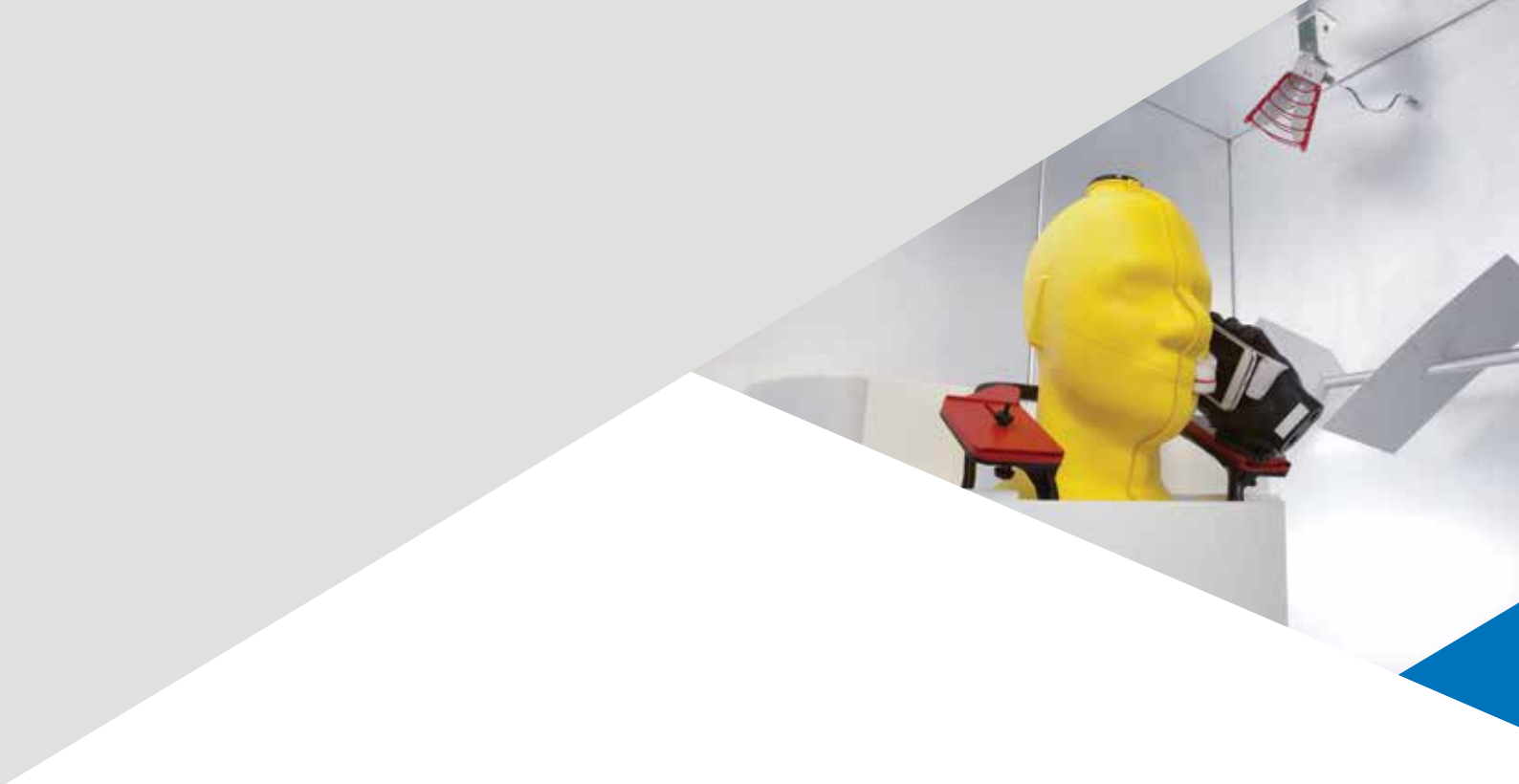
ETS-Lindgren is an active contributor to many of the device certification standards for the wireless industry and has first-hand knowledge of the recent changes to the over-the-air performance requirements and standards development work in the 3GPP, CTIA, and Wi-Fi Alliance. Our customers can be assured that an ETS-Lindgren test and measurement solution will prepare them for meeting current and future requirements.

CERTIFIED COMPANY  
**ISO 9001:2015**  
CEDAR PARK • BEIJING • DURANT  
EURA • MINOCQUA • WOOD DALE

CERTIFIED COMPANY  
**ISO 9001:2008**  
BANGALORE



Products with this logo meet 3GPP requirements for 5G. See individual products for details.



## FLEXIBLE SOLUTIONS FOR ALL OF YOUR TESTING NEEDS



ETS-Lindgren offers testing solutions covering the entire product cycle.

Because our customers' requirements vary greatly, so do ETS-Lindgren's testing solutions. We offer systems and products for each point in a product testing cycle and the flexibility to choose from several scan methods (see pages 6 and 7 for more information).

To assist you in your testing requirements, ETS-Lindgren offers standard and custom test components to meet your project needs, including:

- RF Shielding, Shielded Test Enclosures, and Shielded Doors
- RF Absorber
- Measurement and Reference Antennas
- Hand, Head, and Device Under Test (DUT) Mounts

For information on ETS-Lindgren wireless components, please see pages 32 and 33 of this brochure, visit our website at [www.ets-lindgren.com](http://www.ets-lindgren.com), or contact your local ETS-Lindgren representative.

In addition to our products, ETS-Lindgren experts are qualified to perform a wide range of services, including:

- Engineering and Design
- Calibration and Repairs
- Field Services
- In-house Testing
- ETS-U Educational Programs

For information on ETS-Lindgren services, please see pages 34 and 35 of this brochure, visit our website, or contact your local ETS-Lindgren representative.



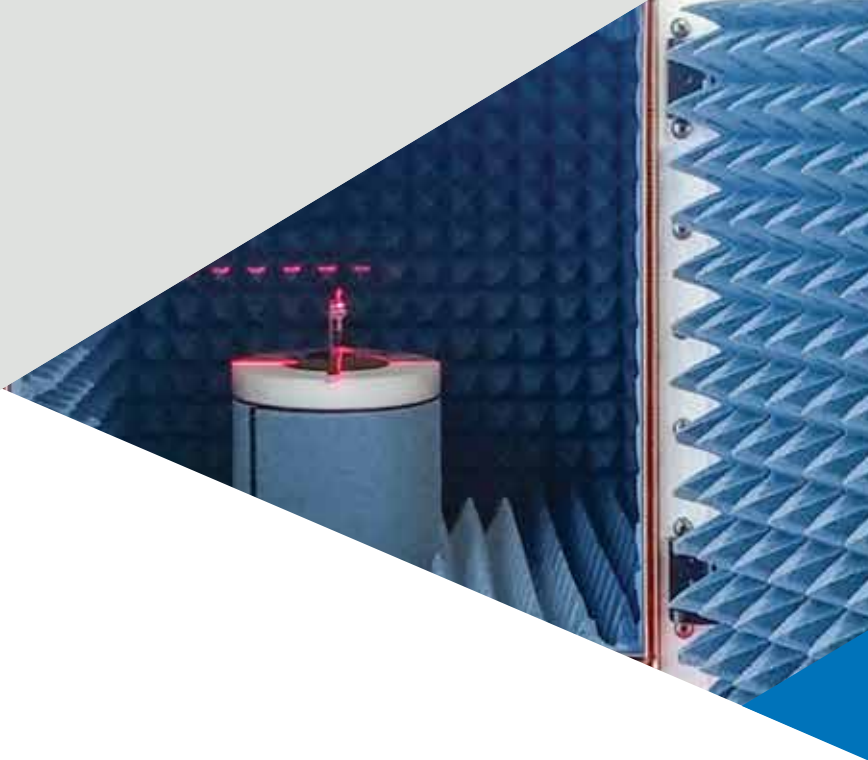
ETS-Lindgren recognizes that every project has specific requirements. Because of this, we offer multiple types of scanning methods for 5G, OTA, APM, MIMO and SISO testing. If you are unsure which scanning method is suitable for your project, let the experts at ETS-Lindgren assist you in selecting the best method for your testing needs.

## MORE SCANNING SOLUTIONS THAN ANYONE ELSE

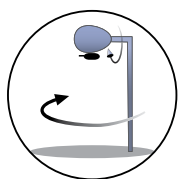
ETS-Lindgren offers the following types of scanning for wireless systems:

- Combined Axis
- Theta Arm Distributed Axis
- Multi-Antenna Distributed Axis
- Reverberation Distributed Axis

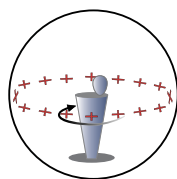
Please see the following page for illustrations of these scanning methods.



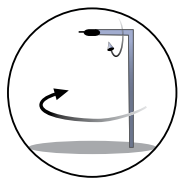
# SCANNING METHODS



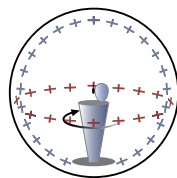
**Combined Axis Scanning Method**  
*Shown with Optional Phantom Head*



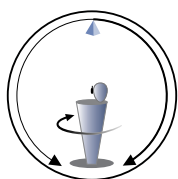
**Multi-Antenna Distributed Axis Scanning Method**



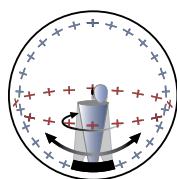
**Combined Axis Scanning Method**



**Multi-Antenna Dual-Ring Distributed Axis Scanning Method**  
*Shown with Optional Dual-Ring*



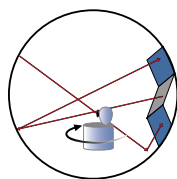
**Theta Arm Distributed Axis Scanning Method**



**Multi-Antenna Dual-Ring Distributed Axis Scanning Method**  
*Shown with Optional Dual-Ring and Optional Goniometer*



**Multi-Antenna Distributed Axis Scanning Method**



**Reverberation Distributed Axis Scanning Method**



**Multi-Antenna Distributed Axis Scanning Method**  
*Shown with Optional Goniometer*

# WIRELESS SOLUTIONS SELECTOR

	AMS-5700	AMS-5701	AMS-5702	AMS-5703	AMS-5704	AMS-5705	AMS-7000	AMS-8040
<i>Page Number</i>	14	14	15	15	15	15	20	21
<b>5G NR Sub-6 GHz SISO</b>							X	X
<b>5G NR mmWave SISO</b>	X	X	X	X		X		
<b>2G/3G/4G SISO</b>							X	X
<b>Wi-Fi SISO</b>							X	X
<b>4G/Wi-Fi MIMO</b>							X	
<b>5G NR Sub-6 GHz MIMO</b>							X	
<b>4G Carrier Aggregation</b>							X	X
<b>A-GNSS</b>								X
<b>Standalone GNSS</b>								X
<b>Bluetooth</b>							X	X
<b>W-IoT</b>							X	X
<b>RSE</b>	X	X	X	X	X	X	X	X
<b>Automotive Radar</b>								
<b>Passive Antenna Pattern</b>	X	X	X	X	X	X		X

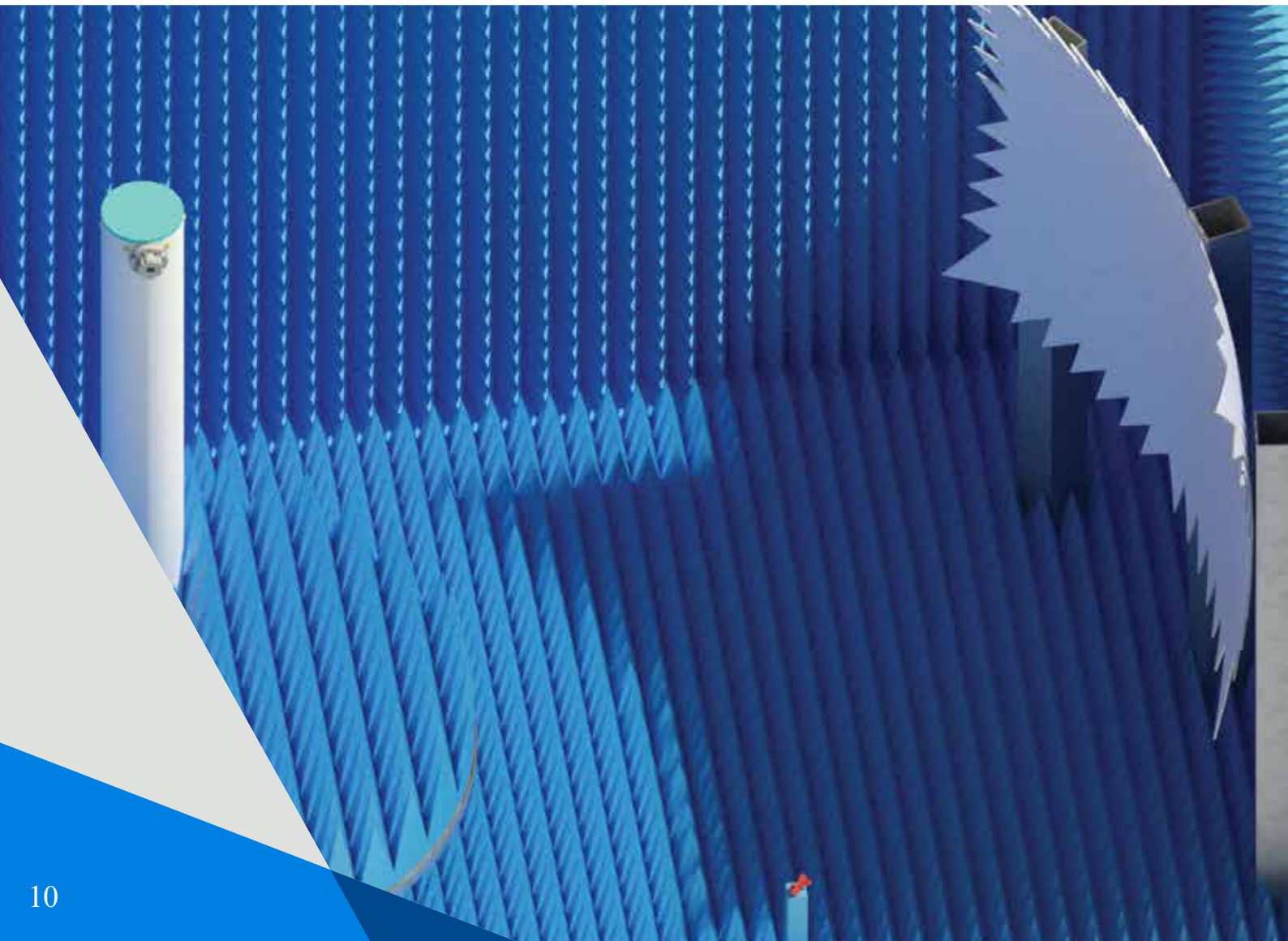


AMS-8041	AMS-8042	AMS-8050	AMS-8055	AMS-8100	AMS-8500	AMS-8600	AMS-8700	AMS-8800	AMS-8900
22	23	24	25	26	27	28	29	30	31
X		X	X	X	X	X		X	X
X		X	X	X	X	X		X	X
X		X	X	X	X	X		X	X
							X		X
							X		X
X		X	X	X	X	X		X	X
X		X	X	X	X	X		X	X
X		X	X	X	X	X		X	X
X		X	X	X	X	X		X	X
X		X	X	X	X	X		X	X
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	X								
X		X	X	X	X	X	X	X	X



## 5G mmWAVE SOLUTIONS

Existing OTA test techniques were developed to address situations where interactions between the radio, antenna, and their embedded platform prevent their performance from being evaluated independently. However, as we move towards fifth generation (5G) wireless networks, the use of advanced adaptive antenna system (AAS) techniques including beam forming, as well as the expected move to millimeter wave (mmWave) frequencies, will have an unprecedented impact on existing RF testing of wireless devices. Since most of these 5G radio access technologies rely on integrated active antenna elements, the overall radio performance cannot be dissociated from the antenna performance. Thus, while OTA testing will face its own challenges in adapting to 5G NR and mmWave devices, test techniques that traditionally relied on direct cabled connector access to the radio will now face a complete paradigm shift in the way testing must be performed. Common conformance and production line tests that are normally performed with a direct cable connection become impractical if not impossible when there are possibly hundreds of integrated antenna elements to be tested. Even electromagnetic compatibility (EMC) testing is impacted by the ever present active radio signal.





## 5G mmWAVE SOLUTIONS: TEST SYSTEMS

### STANDARD SYSTEM SOLUTIONS

The AMS-5700 series test solutions includes test chambers designed specifically for 5G testing in the mmWave spectrum (3GPP FR2). There are different test solutions available for 2D and 3D testing, depending upon the test requirements. The basic solutions can characterize the performance of the radio against the 3GPP FR2 test specifications where the antenna pattern is locked into a static mode. Traditional Antenna Under Test (AUT) manipulation techniques are used to obtain the required test parameters from the resulting pattern. In the User Equipment (UE) adaptive systems, the environment will introduce a series of signals-of-interest (SOI) and signals-of-no interest (SONI) or interference to evaluate how well the device can maintain the connection in the changing environment. The resulting antenna pattern in this adaptive environment can then be probed to understand how high the peaks and how deep the nulls are.

The adaptive test system for 5G Base Transceiver Station (BTS) or gNodeB (gNB according to the 3GPP New Radio 'NR') is designed to evaluate the Massive MIMO performance in gNB units. In the Massive MIMO test solution, the gNB is placed in a controlled test environment containing multiple antennas or antenna arrays emulating multiple UEs active in the gNB field-of-view. In this test solution, the UEs can be stationary or moving in accordance with a predetermined path, and the performance of the gNB is measured by its capability to provide a certain level of data throughput for all the different UEs emulated. This test solution can also be equipped with one or more interference or SONI signals to try to interfere with the gNB's performance.

See pages 14 and 15 for full-size model information.

### CUSTOM SYSTEM SOLUTIONS

5G test requirements are still evolving and while we have several standard solutions to satisfy multiple levels of testing, we understand that our customers may have unique requirements not met by our standard solutions. ETS-Lindgren is well equipped to create custom solutions with a unique set of requirements to meet your specific needs.

For more information on our custom design capabilities please see pages 34 and 35 of this brochure, visit our website, or contact your local ETS-Lindgren representative.



# 5G mmWAVE SOLUTIONS: PORTABLE TEST ENCLOSURES

## 5700 SERIES PORTABLE TEST ENCLOSURES

In addition to full-sized chambers, the 5700 series also includes several portable test enclosures designed specifically for 5G testing in the mmWave spectrum (3GPP FR2). There are different test solutions available for 2D and 3D testing, depending upon the test requirements. The basic solutions can characterize the performance of the radio against the 3GPP FR2 test specifications where the antenna pattern is locked into a static mode. Traditional AUT manipulation techniques are used to obtain the required test parameters from the resulting pattern.

Other model-specific features include frequency range, physical format (tabletop, movable enclosures), and rotation axis.

Please see pages 14 and 15 for portable model information.







## 5G mmWAVE SOLUTIONS: SOFTWARE

### EMQUEST™ EMQ-100 ANTENNA MEASUREMENT SOFTWARE

ETS-Lindgren's EMQuest EMQ-100 Antenna Measurement Software offers a wide range of fully parameterized test methods for measuring basic antenna performance metrics, as well as testing both radiated and conducted performance of various wireless devices. Whether you're designing antennas for stand-alone applications, or testing an embedded antenna system and radio module against any of the industry standard OTA radiated performance test requirements, EMQuest EMQ-100 provides the flexibility to meet your testing needs. Using appropriate wireless communication testers and power measurement devices from an extensive listing of optional test equipment drivers, OTA performance can be evaluated for a broad range of wireless technologies.

### EMQUEST EMQ-118 EXECUTIVE DATABASE OPTION

EMQuest EMQ-118 can boost productivity by providing the ability to export and store data results in a relational database, such as PostgreSQL or Microsoft SQL servers. This includes the SQL DDL commands to create the database tables for either of these databases. Additional tools are provided to select and pull the data back out again for further analysis.

This database system is further beneficial by allowing queries from customer-created applications written in the language of the customer's choosing, such as Python or Microsoft Excel, to query EMQuest results. The data can be automatically inserted into the database if EMQuest-118 is used to run the EMQuest test, or results can easily be dragged and dropped into EMQuest-118 manually. EMQ-118 provides simple data extractions and report creation, though the standard EMQuest viewer can still be utilized to extract the raw data files (RAWX2 format), which can then be loaded and analyzed by EMQuest.

# 5G TEST SYSTEMS

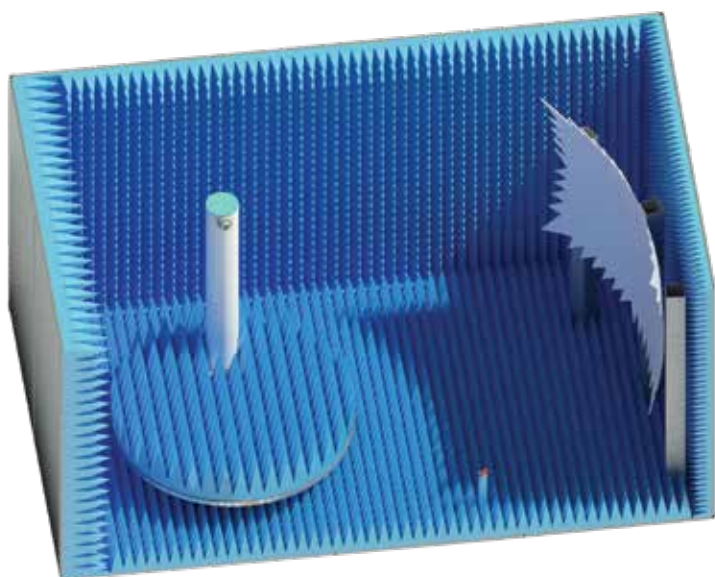


	AMS-5700	AMS-5701
<b>Target/Optimum Application</b>	Manufacturing QA, Receiver/Transmitter Calibration, 2D or Fixed Beam Applications	5G Conformance and Performance Testing (EIRP, TRP, EIS, TIS), Radio Interoperability
<b>Description</b>	Azimuth Axis Antenna Measurement System	Distributed Axis Antenna Measurement System
<b>Typical Test Device Type</b>	Module, Phone	Module, Phone
<b>Compliance Standard/Technology</b>	R & D	3GPP
<b>Frequency Range</b>	5G FR2 / 24 GHz to 44 GHz	5G FR2 / 24 GHz to 44 GHz
<b>Physical Format</b>	Tabletop	Mobile/Wheels
<b>Testing Methodology</b>	Direct Far-Field (DFF)	Direct Far-Field (DFF)
<b>Rotation Axis</b>	Single Axis Turntable	Single Axis Turntable with Theta Arm (Spherical)
<b>Maximum Antenna Array Size</b>	24 GHz = 7.8 cm 28 GHz = 7.2 cm 39 GHz = 6.2 cm 44 GHz = 5.8 cm	24 GHz = 6.8 cm 28 GHz = 6.2 cm 39 GHz = 5.2 cm 44 GHz = 5.0 cm
<b>Exterior Chamber Nominal Size</b>	1.5 m x 0.7 m x 0.9 m (4.9 ft x 2.3 ft x 3.0 ft)	2.1 m x 1.4 m x 2.2 m (6.9 ft x 4.6 ft x 7.2 ft)

The AMS-5700 tabletop enclosure is suitable for manufacturing QA, receiver/transmitter calibration, and 2D or fixed beam applications.



AMS-5702	AMS-5703	AMS-5704	AMS-5705
5G Conformance and Performance Testing (EIRP, TRP, EIS, TIS), Radio Interoperability. Flexible System with Variable Path Length to Adjust for Wide Range of Array Sizes and Optimized Dynamic Range	5G Conformance and Performance Testing (EIRP, TRP, EIS, TIS), Radio Interoperability	60 GHz Device/Antenna Performance Testing	5G Conformance and Performance Testing (EIRP, TRP, EIS, TIS), Radio Interoperability
Combined Axis Antenna Measurement System	Compact Range (CATR), Combined Axis Antenna Measurement System	Distributed Axis Antenna Measurement System	Compact Range (CATR), Combined Axis Antenna Measurement System
Module, Phone	Phone, Tablet, Small Cells, CPE, Laptop, gNB Base Station	Module, Phone, Computer Peripherals	Module, Phone, Tablet, Small Cells
3GPP	3GPP	WiGig, 802.11ad, 802.11ay	3GPP
5G FR2 / 24 GHz to 44 GHz	5G FR2 / 24 GHz to 44 GHz	50 GHz to 75 GHz	5G FR2 / 24 GHz to 44 GHz
Mobile/Wheels	Chamber/Non-mobile	Mobile/Wheels	Mobile/Wheels
Direct Far-Field (DFF)	Indirect Far-Field (IFF)	Direct Far-Field (DFF)	Indirect Far-Field (IFF)
Dual Axis Positioner (Spherical) with Variable Range Length Linear Slide	Dual Axis Positioner (Spherical)	Single Axis Turntable with Theta Arm (Spherical)	Dual Axis Positioner (Spherical)
24 GHz = 5.6 cm - 9.6 cm 28 GHz = 5.0 cm - 8.8 cm 39 GHz = 4.4 cm - 7.6 cm 44 GHz = 4.0 cm - 7.0 cm	24 GHz = 60.0 cm 28 GHz = 60.0 cm 39 GHz = 60.0 cm 44 GHz = 60.0 cm	50 GHz = 4.7 cm 60 GHz = 4.3 cm 70 GHz = 4.0 cm 75 GHz = 3.8 cm	24 GHz = 30.0 cm 28 GHz = 30.0 cm 39 GHz = 30.0 cm 44 GHz = 30.0 cm
2.5 m x 1.4 m x 1.8 m (8.2 ft x 4.6 ft x 5.9 ft)	4.3 m x 2.4 m x 2.4 m (14.0 ft x 8.0 ft x 8.0 ft)	2.1 m x 1.4 m x 2.2 m (6.9 ft x 4.6 ft x 7.2 ft)	2.5 m x 1.5 m x 2.2 m (8.2 ft x 4.9 ft x 7.2 ft)



The AMS-5703 is ideal for 5G conformance and performance testing (EIRP, TRP, EIS, TIS) and radio interoperability testing.



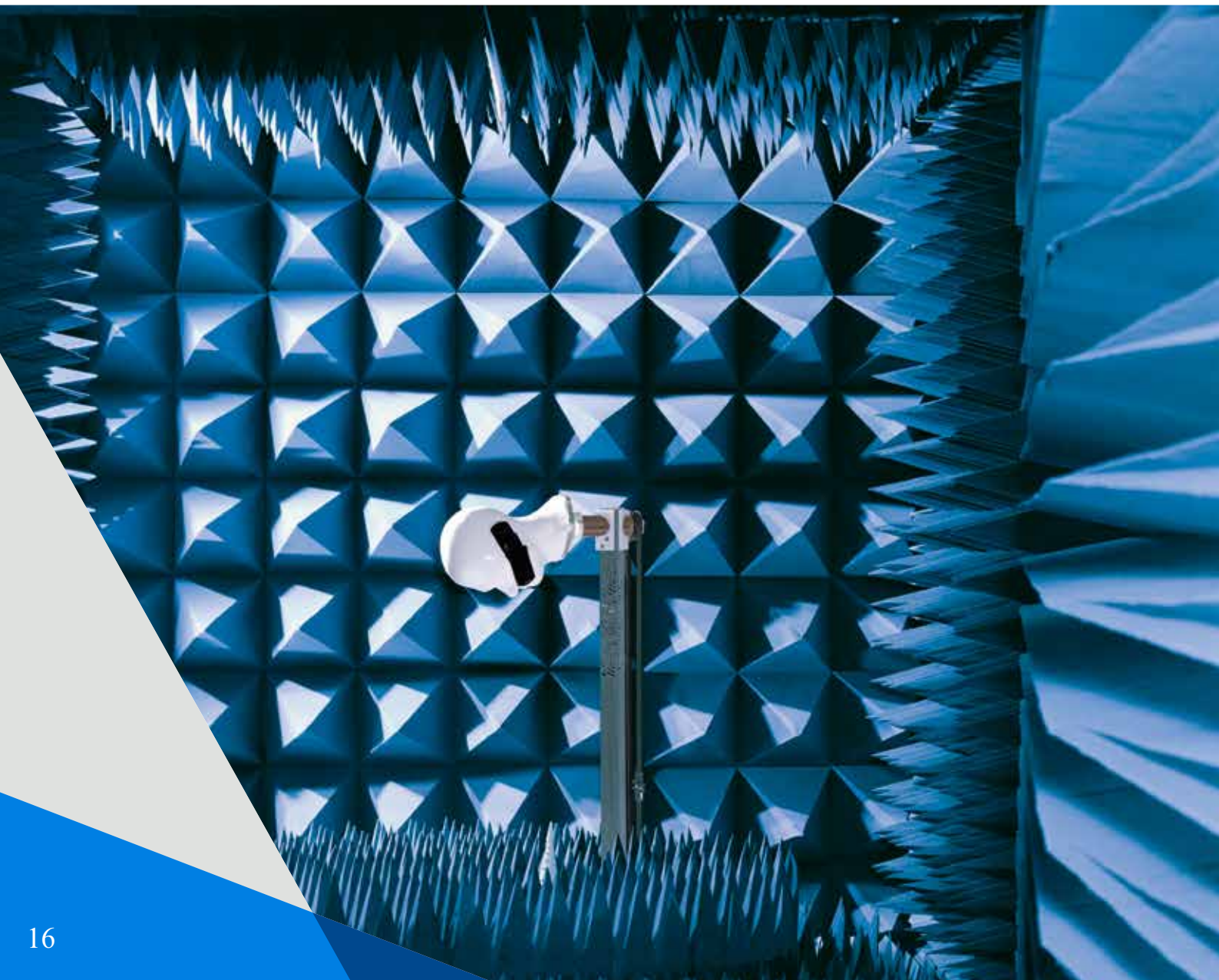


## 5G CAPABLE WITH SUB-6 UPGRADE SOLUTIONS: TEST SYSTEMS

*5G Sub-6 GHz test solutions are now available!*

If you currently own an ETS-Lindgren OTA system and are exploring options for 5G, we offer a turnkey upgrade package for most models. This upgrade adds value to the original test system investment by adding support for 5G New Radio (NR) devices operating in non-standalone (NSA) mode. Support for stand-alone (SA) mode devices operating in frequency range 1 (FR1), also called the Sub-6 GHz band, is also available.

As the leader in RF, EMC, and OTA test and measurement solutions, ETS-Lindgren is uniquely qualified to address the emerging 5G and mmWave test requirements. Not only do we have the proven technical depth expected of an industry leader, but we also have the capability to work with our customers to provide the optimal test and measurement solution for their specific product application. For more information, visit our website, or contact your local ETS-Lindgren representative.







## OTA, APM, MIMO, AND SISO SOLUTIONS: TEST SYSTEMS

### STANDARD SYSTEM SOLUTIONS

ETS-Lindgren offers full integration of OTA, APM, MIMO, and SISO test systems with our AMS-8000 series, designed to meet the rigorous requirements of wireless device testing. ETS-Lindgren also offers numerous scanning methods to meet your specific testing needs.

ETS-Lindgren has a long history in wireless testing. Not only did we help develop the industry's first OTA measurement plan, we pioneered the world's first CTIA Authorized Test Lab for mobile station OTA performance testing. Our unparalleled expertise and our full line of solutions for the entire wireless product cycle is why ETS-Lindgren has designed and built a staggering 80 percent of the CTIA OTA labs that exist today.

Please see pages 26 to 31 for full-size model information.

### CUSTOM SYSTEM SOLUTIONS

Though we have a wide variety of solutions for wireless testing, we understand that our customers may have unique requirements not met by our standard solutions. ETS-Lindgren is well equipped to create custom solutions with a unique set of requirements to meet your specific needs. For more information on our custom design capabilities please see pages 34 and 35 of this brochure, visit our website, or contact your local ETS-Lindgren representative.

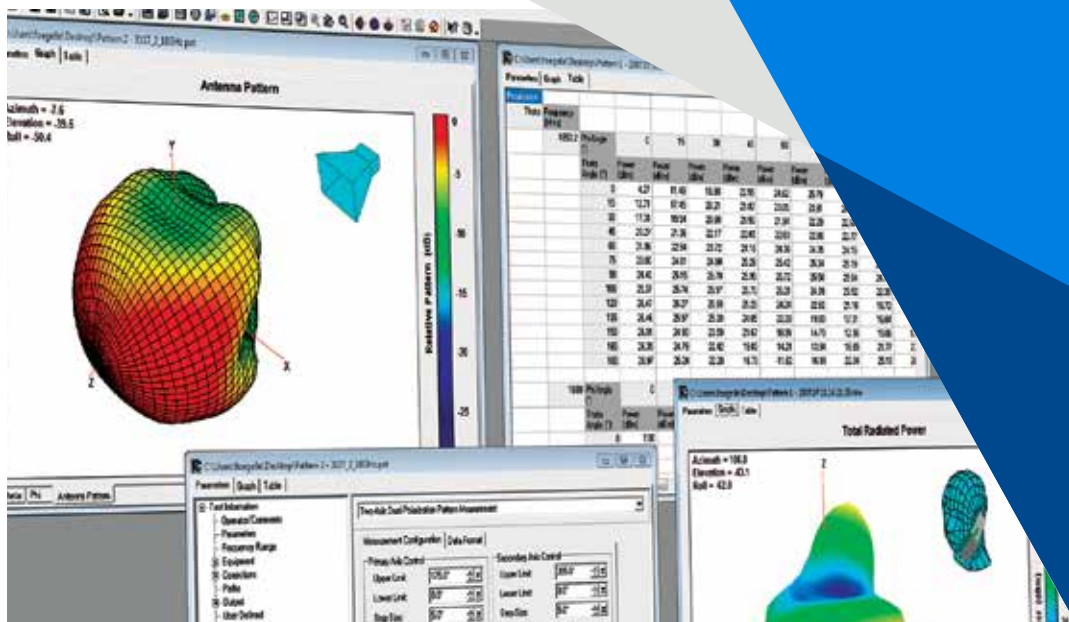
# OTA, APM, MIMO, AND SISO SOLUTIONS: PORTABLE TEST ENCLOSURES

## 7000 AND 8000 SERIES PORTABLE TEST ENCLOSURES

In addition to wireless test chambers, ETS-Lindgren also offers numerous portable RF shielded test enclosures. Each test enclosure offers the same rigorous design as our full-sized chambers with the added flexibility of resource sharing between labs. Additional features include frequency range, physical format (tabletop, wheeled enclosures), and rotation axis.

Please see pages 20 to 25 for portable model information.





## OTA, APM, MIMO, AND SISO SOLUTIONS: SOFTWARE

### EMQUEST™ EMQ-100 ANTENNA MEASUREMENT SOFTWARE

ETS-Lindgren's EMQuest EMQ-100 Antenna Measurement Software offers a wide range of fully parameterized test methods for measuring basic antenna performance metrics, as well as testing both radiated and conducted performance of various wireless devices. Whether you're designing antennas for stand-alone applications, or testing an embedded antenna system and radio module against any of the industry standard OTA radiated performance test requirements, EMQuest EMQ-100 provides the flexibility to meet your testing needs. Using appropriate wireless communication testers and power measurement devices from an extensive listing of optional test equipment drivers, OTA performance can be evaluated for a broad range of wireless technologies.

### EMQUEST EMQ-118 EXECUTIVE DATABASE OPTION

EMQuest EMQ-118 can boost productivity by providing the ability to export and store data results in a relational database, such as PostgreSQL or Microsoft SQL servers. This includes the SQL DDL commands to create the database tables for either of these databases. Additional tools are provided to select and pull the data back out again for further analysis.

This database system is further beneficial by allowing queries from customer-created applications written in the language of the customer's choosing, such as Python or Microsoft Excel, to query EMQuest results. The data can be automatically inserted into the database if EMQuest-118 is used to run the EMQuest test, or results can easily be dragged and dropped into EMQuest-118 manually. EMQ-118 provides simple data extractions and report creation, though the standard EMQuest viewer can still be utilized to extract the raw data files (RAWX2 format), which can then be loaded and analyzed by EMQuest.

# AMS-7000 PORTABLE ANTENNA MEASUREMENT SYSTEM

Frequency: 690 MHz to 6 GHz

The AMS-7000 Reverberation Antenna Measurement System is a compact reverb enclosure for antenna measurements.

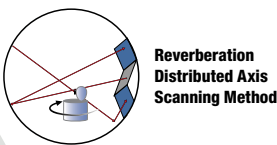
ETS-Lindgren’s AMS-7000 Wireless OTA Reverb Antenna Measurement System is designed to perform accurate and repeatable SISO TRP, TIS and Throughput measurements. This system is based on the company’s long-standing line of SMART™ reverberation chambers, and proven EMQuest antenna measurement automation software.

The AMS-7000 uses two Z-fold tuners, a DUT turntable, and a measurement antenna turret to improve isotropicity and homogeneity. These features allow the system to make measurements at different speeds and levels of accuracy.

Although reverb based measurements have not been accepted by CTIA at this time, the reverb chamber method is a fast, accurate and repeatable alternative to any facility using the well-established anechoic chamber methods. While the reverberation method cannot provide antenna pattern information, results for TRP and TIS measurements in the AMS-7000 correlate to the ranges shown in the Measurement Accuracy table.



**5G** 5G capable with SUB-6 upgrade available.  
Contact your ETS-Lindgren representative for details.



Measurement Accuracy (stir)

	Highest Accuracy	Faster Testing
TRP	0.3 dB SD	0.5 dB SD
TIS	0.3 dB SD	0.5 dB SD
Repeatability	0.2 dB SD	0.3 dB SD

Typical TRP Test Times (in minutes, per frequency)

Test Configuration	GSM, GPRS, EDGE	CDMA, 1xEVDO	WCSMA, HSDPA	CTIA Approved Method
Stepped	1.5	1.5	1.5	No
Stirred	0.5	0.7	0.5	No

Typical TIS Test Times (in minutes, per frequency)

Test Configuration	GSM, GPRS, EDGE	CDMA, 1xEVDO	WCSMA, HSDPA	CTIA Approved Method
Stepped	10	10	10	No
Stirred	3	3	3	No



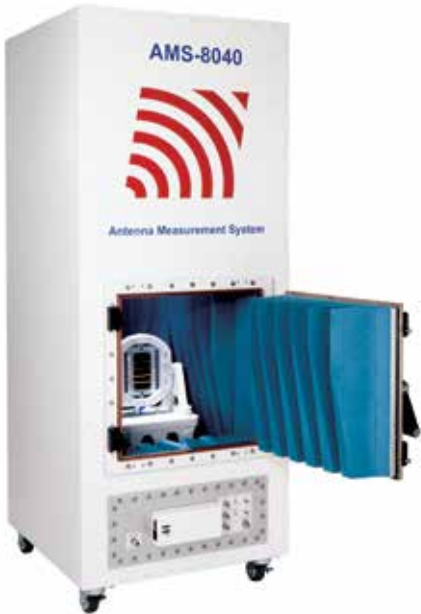
# AMS-8040 PORTABLE, COMPACT ANTENNA MEASUREMENT SYSTEM

Frequency: 400 MHz to 6 GHz

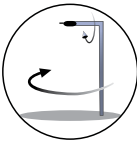
The AMS-8040 is a portable, compact, and fully-anechoic RF test enclosure featuring an integrated 3D positioner.

ETS-Lindgren’s AMS-8040 Antenna Measurement System is a self-contained enclosure for performing over-the-air testing of wireless devices in free-space. The AMS-8040 Antenna Measurement System supports over-the-air testing of mobile handsets in free-space. It is ideal for wireless device measurements including pre-certification, design verification, production sample, desense and regression testing.

It can also be used to measure approximate EIRP, EIS, or RSSI in a given direction and polarization. These results can be used to compare the behavior of multiple identical devices, or the same device under different conditions such as external interference or desensitization due to other platform components or radios.



**5G** *5G capable with SUB-6 upgrade available.  
Contact your ETS-Lindgren representative for details.*



Combined Axis  
Scanning Method

Typical TRP Test Times (in minutes, per frequency)

Test Configuration	GSM, GPRS, EDGE	CDMA, 1xEVDO	WCSMA, HSDPA	LTE
Optimized	2:30	3:15	3:30	3:30

# AMS-8041 PORTABLE, COMPACT ANTENNA MEASUREMENT SYSTEM

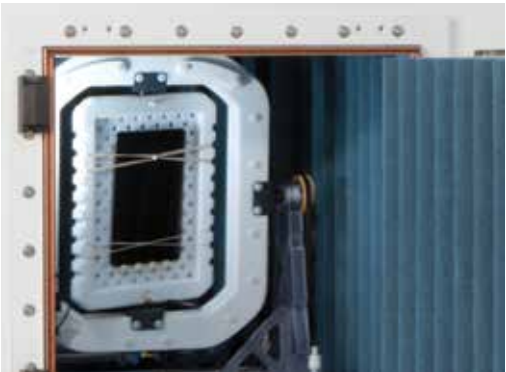
Frequency: 400 MHz to 6 GHz

The AMS-8041 is a portable, compact, and fully-anechoic RF test enclosure featuring an integrated 3D positioner.

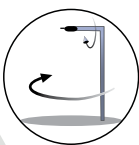
ETS-Lindgren’s AMS-8041 Antenna Measurement System is a self-contained enclosure for evaluating wireless device over-the-air performance. Similar to the AMS-8040, the AMS-8041 has a larger test volume and performs both active and passive antenna pattern measurements. The unit is ideal for design verification, pre-certification, production sample, desense and regression testing.

The system is an ideal solution when space is a limitation as it is a self-contained, freestanding test chamber. Its portable chassis makes it an excellent choice for multiple research and development groups since it is designed to fit through a typical 0.9 m x 2.1 m (3 ft x 7 ft) personnel door and can be easily moved from one test group to another.

It can also be used to measure approximate EIRP, EIS or RSSI in a given direction and polarization. These results can be used to compare the behavior of multiple identical devices, or the same device under different conditions such as external interference or desensitization due to other platform components or radios.



**5G** *5G capable with SUB-6 upgrade available.*  
*Contact your ETS-Lindgren representative for details.*



Combined Axis  
Scanning Method

Typical TRP Test Times (in minutes, per frequency)

Test Configuration	GSM, GPRS, EDGE	CDMA, 1xEVDO	WCSMA, HSDPA	LTE
Optimized	2:30	3:15	3:30	3:30

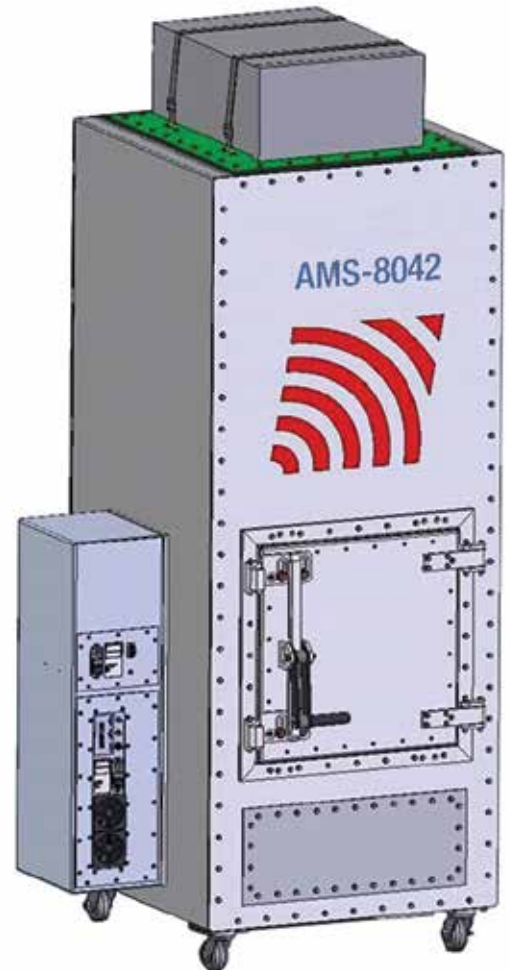
## AMS-8042 PORTABLE, COMPACT ANTENNA MEASUREMENT SYSTEM

Frequency: 10 GHz to 81 GHz

The AMS-8042 mmWave Measurement System is a self-contained enclosure intended for performing evaluation and antenna measurement of RADAR modules.

ETS-Lindgren's AMS-8042 Antenna Measurement System supports short range length over-the-air testing of RADAR and other wireless and mmWave components in a production or R&D environment. It is ideal for device measurements including pre-certification, design verification, production sample, and antenna pattern testing.

With the addition of a Radar Target Simulator (RTS), the performance of RADAR modules can be evaluated under a number of different simulated target conditions. These results can be used to compare the behavior of multiple identical devices, or the same device under different conditions such as external interference or desensitization due to the presence of noise or other interfering sources.



# AMS-8050 PORTABLE ANTENNA MEASUREMENT SYSTEM

Frequency: 690 MHz to 10 GHz

The AMS-8050 Antenna Measurement System is a portable, fully-anechoic RF enclosure for antenna measurements.

ETS-Lindgren’s AMS-8050 Antenna Measurement System is a freestanding, cart configuration; it fits into parent buildings without special installation or construction. This OTA test system may be used for rapid prototyping, design validation, pre-certification testing, performance measurement, and production sampling.

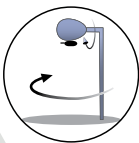
If you’re using an external test lab for certification testing, our system can help you go fully prepared. OTA performance measurements made in the AMS-8050 have shown good correlation to measurements made in larger, fully-compliant chambers.

This unit is an ideal solution when space is a limitation. It can be used as a self-contained test lab for making fast OTA performance measurements of small wireless devices and mobile handsets.

The AMS-8050 can be easily installed into new or existing construction. Additionally, the movable cart assembly allows for the system to be easily relocated within a test facility.



**5G** *5G capable with SUB-6 upgrade available.*  
*Contact your ETS-Lindgren representative for details.*



**Combined Axis Scanning Method**  
*Shown with Optional Phantom Head*

**Typical SISO Test Times (in minutes)**

Test Configuration	GSM, GPRS, EDGE	CDMA, 1xEVDO	WCSMA, HSDPA	LTE	CTIA Approved Method
15° Stepped	21	21	21	21	Yes
Theta Optimized	18	18	18	18	Yes
Spiral Optimized	4	6	6	6	Yes



# AMS-8055 PORTABLE ANTENNA MEASUREMENT SYSTEM

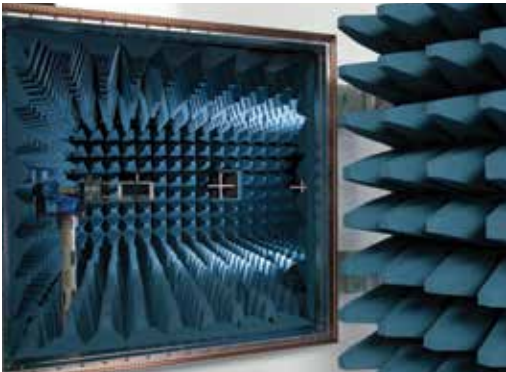
Frequency: 690 MHz to 6 GHz

The AMS-8055 Antenna Measurement System is a compact, portable, and fully-anechoic RF enclosure, capable of single cluster MIMO/SISO measurements.

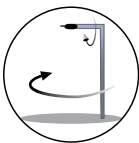
ETS-Lindgren’s AMS-8055 Antenna Measurement System is a compact, fully-anechoic RF test enclosure for making single cluster MIMO/SISO OTA performance measurements. The AMS-8055 is freestanding and built on a portable cart configuration; it fits into parent buildings without special installation or construction.

This OTA test system may be used for rapid prototyping, design validation, pre-certification testing, performance measurement, and production sampling. The AMS-8055 has all of the capabilities of the AMS-8050, plus the ability to perform single cluster MIMO measurements.

MIMO OTA performance measurements made in the AMS-8055 have shown good correlation to measurements made in larger, fully-compliant chambers. The AMS-8055 is ideal for making fast MIMO OTA performance measurements of small devices and mobile handsets.



**5G** *5G capable with SUB-6 upgrade available.*  
*Contact your ETS-Lindgren representative for details.*



Combined Axis  
Scanning Method

### Typical MIMO Test Times (in minutes)

Test Configuration	LTE 2x2 MIMO	CTIA Approved Method
30° Stepped	45	No

### Typical SISO Test Times (in minutes)

Test Configuration	GSM, GPRS, EDGE	CDMA, 1xEVDO	WCSMA, HSDPA	LTE	CTIA Approved Method
15° Stepped	21	21	21	21	Yes
Theta Optimized	18	18	18	18	Yes
Spiral Optimized	4	6	6	6	Yes

# AMS-8100 COMPACT CHAMBER ANTENNA MEASUREMENT SYSTEM

Frequency: 800 MHz to 6 GHz

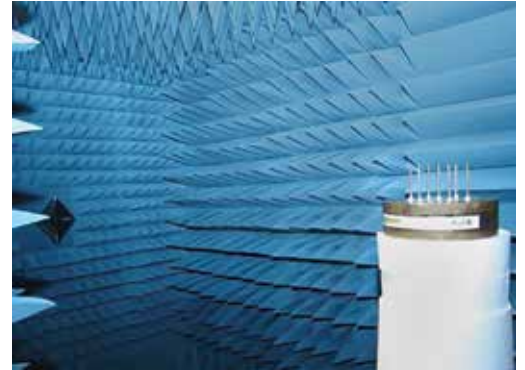
Optional Frequency: 700 MHz to 10 GHz

The AMS-8100 Antenna Measurement Systems include a compact rectangular test chamber designed for test and measurement of wireless devices.

ETS-Lindgren's AMS-8100 Antenna Measurement Test Systems are designed for test and measurement applications of small antenna products over the frequency range from 800 MHz to 6 GHz. These systems are designed for passive testing of antennas including low-directivity communication antennas used in various devices such as Wi-Fi interfaces and mobile handsets.

AMS-8100 systems include a compact, rectangular chamber, fully-lined with anechoic absorber and designed to provide far-field measurements at a nominal separation distance of 2.74 m (9 ft). For 2D passive testing, a model 2006 single-axis positioning system is standard for the AMS-8100. An optional Multi-axis Positioning System (MAPS) can be ordered for DUT rotation around two orthogonal axes for full spherical coverage.

AMS-8100 systems also include an ETS-Lindgren 3164-08 open-boundary quad-ridged horn antenna and associated RF cabling. Extension to higher frequencies is possible by adding optional antennas. Extension of the lower frequency range is possible using other ETS-Lindgren antenna measurement systems and configurations.



AMS-8100 Test System shown with optional equipment, including MAPS positioner upgrade.



**5G capable with SUB-6 upgrade available.**

**Contact your ETS-Lindgren representative for details.**



**Combined Axis  
Scanning Method**

*Shown with Optional Phantom Head*

# AMS-8500 MULTI-AXIS ANTENNA MEASUREMENT SYSTEM

Frequency: 690 MHz to 10 GHz

The AMS-8500 Multi-Axis Antenna Measurement Systems are ideally suited for the measurement of antenna performance of wireless devices.

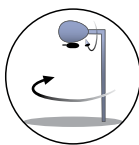
ETS-Lindgren’s AMS-8500 Antenna Measurement Test Systems are fully configured to perform both research and development and type approval according to CTIA Test Plan for Wireless Device Over-the-Air Performance for Radiated RF Power and Receiver Performance. These systems can also be used to perform antenna measurements in near- and far-field test distances for more generic antenna properties.

AMS-8500 systems are designed to have better than –25 dB in Quiet Zone (QZ) reflectivity, with a 0.5 m Quiet Zone size. Additionally, ETS-Lindgren can produce customized chambers, designed to fit your specific requirements.

Designed to operate over the frequency range of 690 MHz to 10 GHz, the AMS-8500 includes a full-sized rectangular chamber and offers additional frequency range coverage as an option.



**5G** *5G capable with SUB-6 upgrade available.  
Contact your ETS-Lindgren representative for details.*



**Combined Axis  
Scanning Method**  
*Shown with Optional Phantom Head*

Typical SISO Test Times (in minutes)

Test Configuration	GSM, GPRS, EDGE	CDMA, 1xEVDO	WCSMA, HSDPA	LTE	CTIA Approved Method
15° Stepped	21	21	21	21	Yes
Theta Optimized	18	18	18	18	Yes
Spiral Optimized	4	6	6	6	Yes

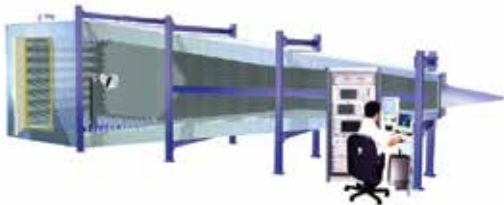
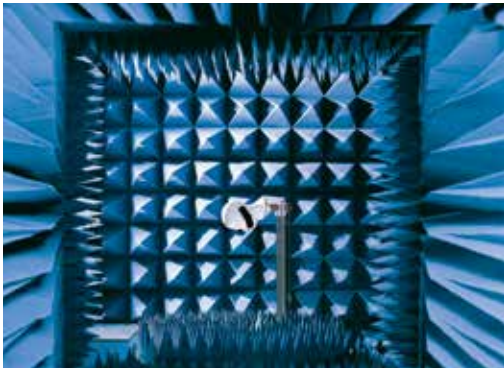
# AMS-8600 MULTI-AXIS ANTENNA MEASUREMENT SYSTEM

Frequency: 400 MHz to 6 GHz

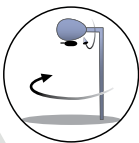
The AMS-8600 Tapered Chamber, Multi-Axis Antenna Measurement Systems are ideally suited for the measurement of antenna performance of wireless devices.

ETS-Lindgren’s AMS-8600 Tapered Antenna Measurement Test Systems are fully configured to perform both research and development and type approval according to the CTIA Test Plan for Wireless Device Over-the-Air Performance for Radiated RF Power and Receiver Performance. These systems can also be used to perform antenna measurements in near- and far-field test distances for more generic antenna properties.

AMS-8600 systems are designed to have better than –25 dB in Quiet Zone (QZ) reflectivity, with a 0.6 m Quiet Zone size. Additionally, ETS-Lindgren can also produce customized chambers designed to fit your specific requirements.



**5G** *5G capable with SUB-6 upgrade available.  
Contact your ETS-Lindgren representative for details.*



**Combined Axis Scanning Method**  
*Shown with Optional Phantom Head*

**Typical SISO Test Times (in minutes)**

Test Configuration	GSM, GPRS, EDGE	CDMA, 1xEVDO	WCSMA, HSDPA	LTE	CTIA Approved Method
15° Stepped	21	21	21	21	Yes
Theta Optimized	18	18	18	18	Yes
Spiral Optimized	4	6	6	6	Yes



# AMS-8700 MULTI-ANTENNA ARRAY ANTENNA MEASUREMENT SYSTEM

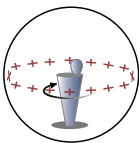
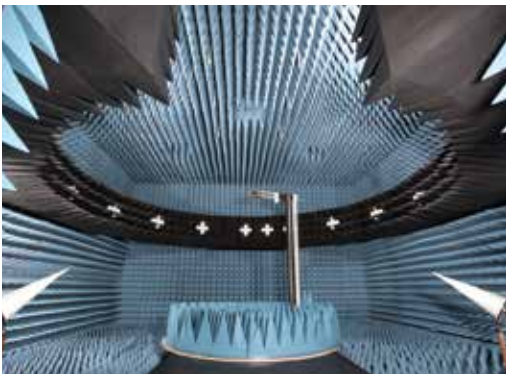
Frequency: 690 MHz to 6 GHz  
Optional Frequency: 400 MHz to 6 GHz

The AMS-8700 MIMO/SISO OTA Test Systems allow repeatable measurement of radiated performance of wireless devices in a simulated multi-path environment.

ETS-Lindgren’s AMS-8700 MIMO/SISO OTA Test Systems are compliant in accordance with the CTIA Test Plan for 2x2 Downlink MIMO and Transmit Diversity Over-the-Air Performance Testing. These fully-anechoic, multi-probe systems allow for repeatable measurement of radiated performance of wireless devices in a simulated multi-path environment, and acts as an RF environment simulator that can generate spatial field structures similar to those seen in a wide range of real-world scenarios.

Standard conducted channel models can be adapted to equivalent radiated spatial channel models for evaluation of the entire device signal chain, including antennas, device platform, and near field phantom (head, hands, etc.) impact on device performance.

AMS-8700 systems consist of a dual-polarized antenna array in a fully-anechoic chamber, connected to technology specific communication test equipment through a spatial channel emulator. Standard frequency range is 690 MHz to 6 GHz, with an optional frequency range of 400 MHz to 6 GHz.



Multi-Antenna  
Distributed Axis  
Scanning Method

### Typical MIMO Test Times (in minutes)

Test Configuration	LTE 2x2 MIMO	CTIA Approved Method
30° Stepped	45	Yes

### Typical SISO Test Times (in minutes)<sup>1</sup>

Test Configuration	GSM, GPRS, EDGE	CDMA, 1xEVDO	WCSMA, HSDPA	LTE	CTIA Approved Method
15° Stepped	21	21	21	21	Yes
Theta Optimized	18	18	18	18	Yes
Spiral Optimized	4	6	6	6	No

<sup>1</sup> Times representative when system is equipped with optional MAPS positioner.

# AMS-8800 THETA ARM ANTENNA MEASUREMENT SYSTEM

Frequency: 400 MHz to 10 GHz

The AMS-8800 Theta Arm Distributed Axis Antenna Measurement Systems are ideally suited for the measurement of antenna performance of wireless devices.

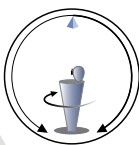
ETS-Lindgren’s AMS-8800 Theta Arm Distributed Axis Antenna Pattern Measurement Test Systems consist of an azimuth rotator for rotating the DUT and a separate theta arm positioner for moving the measurement antenna around the DUT.

The theta rotational arm scanning system provides a quick, convenient and accurate test method for wireless devices. It is a good choice for larger, heavier DUTs, especially those which may be gravity dependent. A table-top mount is included for testing portable computing devices, desktop computing devices, and small appliances.

The dual-polarized quad-ridged antenna on the theta arm provides broadband measurement in both polarizations.



**5G** *5G capable with SUB-6 upgrade available.  
Contact your ETS-Lindgren representative for details.*



Theta Arm  
Distributed Axis  
Scanning Method

Typical SISO Test Times (in minutes)

Test Configuration	GSM, GPRS, EDGE	CDMA, 1xEVDO	WCSMA, HSDPA	LTE	CTIA Approved Method
15° Stepped	25	28	28	28	Yes
Theta Optimized	20	22	22	22	Yes
Spiral Optimized	3	4	4	4	Yes

# AMS-8900 MULTI-ANTENNA ARRAY ANTENNA MEASUREMENT SYSTEM

Frequency: 690 MHz to 6 GHz  
Optional Frequencies: 400 MHz to 6 GHz and 690 MHz to 10 GHz

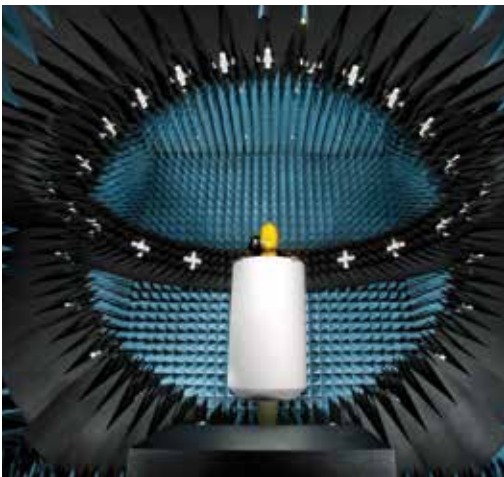
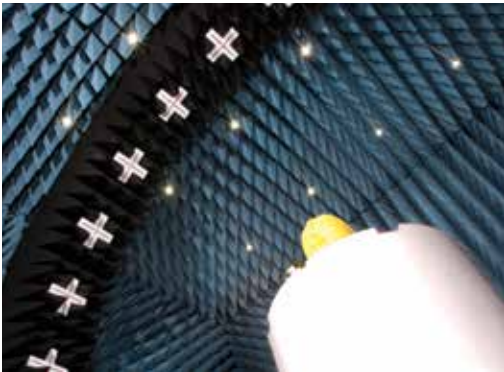
The AMS-8900 Multi-Antenna, High-Speed Distributed Axis Antenna Measurement Systems are ideally suited for the measurement of antenna performance of wireless devices.

ETS-Lindgren’s AMS-8900 Multi-Antenna Distributed Axis Test Systems are fully configured to perform both research and development and type approval measurements. These systems can also be used to perform antenna measurements in both near- and far-field test distances for more generic antenna properties.

AMS-8900 systems include a custom multi-antenna array ring that houses a system of dual-polarized antennas. These antennas support testing between 690 MHz and 6 GHz, with an optional frequency range down to 400 MHz. An integrated laser alignment system assists with DUT positioning.

A switch control box integrated on the ring provides fast switching between antennas for high speed testing. Its centralized system configuration supports easy maintenance and superior reliability.

An optional goniometer is available for finer angular resolution measurements. Additionally, an optional MIMO ring can be added to include all capabilities of the AMS-8700 MIMO OTA solution (see photo right).



AMS-8900 Series Test System shown with optional MIMO ring.

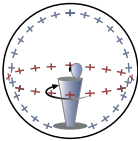
**5G** 5G capable with SUB-6 upgrade available.  
Contact your ETS-Lindgren representative for details.



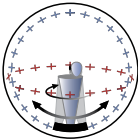
**Multi-Antenna  
Distributed Axis  
Scanning Method**



**Multi-Antenna  
Distributed Axis  
Scanning Method**  
*Shown with Optional Goniometer*



**Multi-Antenna Dual-Ring  
Distributed Axis  
Scanning Method**  
*Shown with Optional Dual-Ring*



**Multi-Antenna Dual-Ring  
Distributed Axis  
Scanning Method**  
*Shown with Optional Dual-Ring  
and Optional Goniometer*

### Typical Test Times (in minutes)

Test Configuration	GSM, GPRS, EDGE	CDMA, 1xEVDO	WCSMA, HSDPA	LTE	CTIA Approved Method
15° Stepped	9	11	11	11	Yes
Triggered Mode	1:35	3:05 <sup>1</sup>	3:10 <sup>1</sup>	3:10	Yes

<sup>1</sup> CDMA Test Plan requires 100 ms dwell time for each position which increases the fully-compliant test time.

# WIRELESS COMPONENTS

In addition to being the leader in test systems, ETS-Lindgren is also the leader in wireless components. From shielding to antennas and beyond, we offer a wide selection of components to complete your test lab. If your testing requires a specialized solution, we have the ability to design and produce exactly what you require.

## SHIELDING, SHIELDED TEST ENCLOSURES, AND SHIELDED DOORS

We are the proven experts in shielding, with thousands of shielded enclosures installed worldwide. As the in-house manufacturer of Series-81 and Series-101 shielding, we ensure that all ETS-Lindgren shielding meets our stringent performance demands. We use this same expertise on all of our test enclosures, from our tabletop models up to large shielded enclosures. Additionally, we have a wide variety of standard shielded doors so regardless of your requirements, we have a solution that meets your needs.







## RF MICROWAVE ABSORBER

ETS-Lindgren is also the in-house manufacturer of the RF microwave absorber material we use. Workstations running advanced numerical modeling software are used to develop our absorber products, which are then prototyped and tested to validate predicted results. Absorber solutions include wall, ceiling, and walkway. Custom solutions are also available.

## POSITIONING SYSTEMS

With ETS-Lindgren's positioning systems, the AUTs can be repeatedly positioned within a fraction of a degree to capture the small intricacies of the antenna patterns. ETS-Lindgren's single-axis (2D pattern) and dual-axis (3D pattern) positioners are designed to test a wide range of devices, from small chipset size AUTs to large base station size AUTs. As an option, positioners can be designed to allow control signals to pass through them which allows control of the AUT during the test as needed.

## MEASUREMENT AND REFERENCE ANTENNAS

ETS-Lindgren has a broad line of antennas suitable for all types of wireless testing. ETS-Lindgren's antennas are considered the benchmark within the industry. From innovative designs leading to the development of standards to defining the calibration procedures of antennas, measurements performed with ETS-Lindgren antennas can be trusted to be both accurate and repeatable.

## PHANTOM HAND, PHANTOM HEAD, AND DUT MOUNTS

ETS-Lindgren offers phantom head and hand kits to complete your test environment, including phantom hand only, phantom head only, and phantom head with integrated hand. Additionally, we offer multiple DUT mounts to accommodate your device under test.

## CUSTOM COMPONENT SOLUTIONS

We understand that our customers may have unique requirements not met by our standard solutions. For more information on our custom design capabilities please see pages 34 and 35 of this brochure, visit our website, or contact your local ETS-Lindgren representative.

# WIRELESS SERVICES SOLUTIONS

From education to consulting, 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 800 professionals at locations in the Americas, Europe, the Middle East, and Asia. In addition, we have a global network of independent representatives and distributors. Our customers benefit with local service and support from specialists who are backed by the global resources of ETS-Lindgren.

## PRODUCT CALIBRATION AND REPAIR

Our A2LA-accredited Calibration Laboratory (Lab Cert #1207.01) is equipped with calibrated instrumentation traceable to National Metrology Institutes (NMI), several anechoic chambers, test cells, and a 80 m x 50 m (262 ft x 164 ft) welded steel ground plane for antenna calibration. ETS-Lindgren can calibrate all brands of wireless antennas and can often make basic repairs when needed and pre-approved. Calibrations are accompanied with a signed certificate and can be supplied with correction factors (where applicable) in electronic format.





## ENGINEERING AND CONSULTING

ETS-Lindgren has in-house experts that can design integrated systems for wireless applications, design and manufacture custom components, perform site surveys (including EMI, vibration, and acoustic), and oversee project management. ETS-Lindgren also provides an assortment of design and site planning services including magnetic and RF shielding design, acoustic design, and Building Information Modeling (BIM) capabilities.

## FIELD SERVICES

ETS-Lindgren's Field Services consist of a global network of field installation teams and customer service personnel, available for on-location services. These services include chamber maintenance and repair, positioner maintenance and repair, on-site chamber testing and calibration, as well as training.

## IN-HOUSE PRODUCT TESTING SERVICES

Wireless product testing is available at ETS-Lindgren's corporate headquarters in Cedar Park, Texas. In 2002, we became the first CTIA Authorized Test Lab (CATL) for mobile station OTA performance testing. We also offer A-GPS and MIMO testing.

## REFURBISHMENT AND RELOCATION SERVICES

In addition to the aforementioned field services, ETS-Lindgren can help you move, upgrade, or refurbish your existing wireless chambers. This type of activity can often save you money and increase the return on your investment. Talk with our experts about how we can assist you in achieving your refurbishment/relocation project goals.

## ETS-U EDUCATION SERVICES

From basic to more advanced topics, ETS-U offers classes for wireless OTA testing, in addition to EMC and MIL-STD. Our classes are taught by industry experts and offer our students a low student-to-teacher ratio, which provides attendees with a better learning experience. A lab component offered with several ETS-U classes provides a unique opportunity for hands-on demonstration of the material presented.

# Sales and Support Offices

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## BEYOND MEASURE

