

EMQuest™

Data Acquisition and Analysis Software



Enabling Your Success™

 **ETS-LINDGREN**™
An ESCO Technologies Company

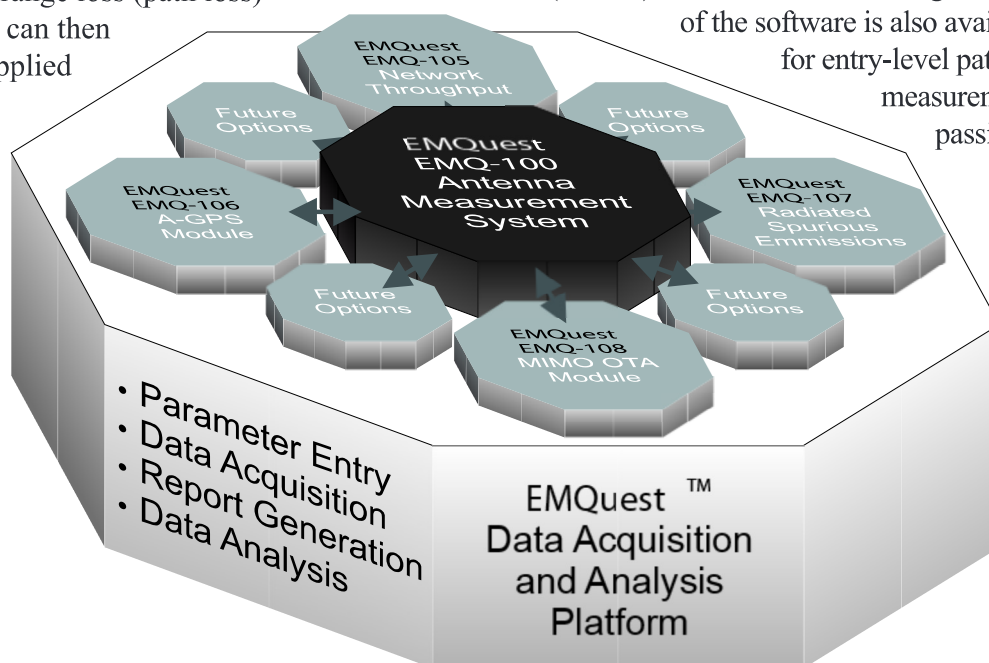
ETS-Lindgren's EMQuest EMQ-100 Antenna Measurement Software offers a wide range of fully parameterized test methods for measuring basic antenna performance metrics as well as testing both radiated and conducted performance of various wireless devices. Whether you're designing antennas for stand-alone applications, or testing an embedded antenna system and radio module against any of the industry standard over-the-air (OTA) radiated performance test requirements, EMQuest EMQ-100 provides the flexibility to meet your testing needs.

Expandable Test Package

The baseline test suite includes fully automated 2D (polar) and 3D (spherical) pattern measurement capabilities as well as various frequency response measurements for both passive antennas and active wireless devices in either transmit or receive mode. Vector versions of the tests allow detailed evaluation of antenna parameters, including left/right-hand circular polarization, elliptical polarization, and antenna correlation, all from the same vector pattern data. Scalar and vector response tests can be used to perform cable and range loss (path loss) measurements that can then be automatically applied as corrections to any subsequent measurement.

General post-processing capabilities include calculation of antenna properties such as half power beam-width, directivity, gain, radiation efficiency, total radiated power, and total isotropic sensitivity, as well as various partial surface performance metrics required by the various OTA test requirements.

Optional add-on modules expand the core functionality, including measurement capabilities for wireless throughput measurements, pre-compliant radiated spurious emissions (RSE), Assisted GPS (A-GPS), and MIMO OTA testing. A Lite version of the software is also available for entry-level pattern measurement of passive devices.



Testing Capabilities

Wireless Performance Testing

EMQ-100 application supports fully compliant OTA radiated performance testing to industry standard requirements such as:

- CTIA
Test Plan for Mobile Station Over-the-Air Performance
- CTIA/Wi-Fi Alliance
Test Plan for RF Performance Evaluation of Wi-Fi Mobile Converged Devices
- WiMAX Forum
Radiated Performance Tests for Subscriber and Mobile Stations
- 3GPP
TS 34.114 Technical Specification Group Radio Access Network User Equipment (UE)/Mobile Station (MS) Over-The-Air (OTA) Antenna Performance Conformance Testing

OTA Evaluation

Using appropriate wireless communication testers and power measurement devices from the list of optional test equipment drivers, OTA performance can be evaluated for a broad range of wireless technologies, including:

- GSM, GPRS
EGPRS (EDGE)
- WCDMA, HSDPA
HSUPA, HSPA+
- LTE
- CDMA, 1xEV-DO
- TDMA
- TD-SCDMA
- AMPS
- Wi-Fi
- WiMAX
- Bluetooth

TRP/TIS Testing

For TRP testing, the device is configured to transmit full power while the effective isotropic radiated power (EIRP) is measured at each point on the surface of a sphere around the device, generating a radiated power pattern.

The suite of tests includes spherical pattern measurements for determining transmit and receive total power metrics, including:

- TRP
Total Radiated Power
- TIS/TRS
Total Isotropic/Radiated Sensitivity (TIS/TRS)

For TIS testing, the digital error rate is evaluated as a function of downlink signal level at each point around the device to determine effective isotropic sensitivity (EIS) and produce a sensitivity pattern.

The resulting EIRP/EIS patterns are then integrated to determine TRP/TIS as well as partial surface metrics such as:

- NHPRP/NHPIS/
NHTRP/NHTIS
Near-Horizon Partial, Total Radiated Power Sensitivity
- Upper/Lower Hemisphere
Partial Power/Sensitivity
- and More!

A number of optimizations and industry firsts are provided to accelerate testing, including theta-dependent phi optimization, where the angular resolution is reduced near the “poles” of the pattern to reduce the required test time and maintain a more even surface resolution, and received signal strength (RSS) based sensitivity measure-

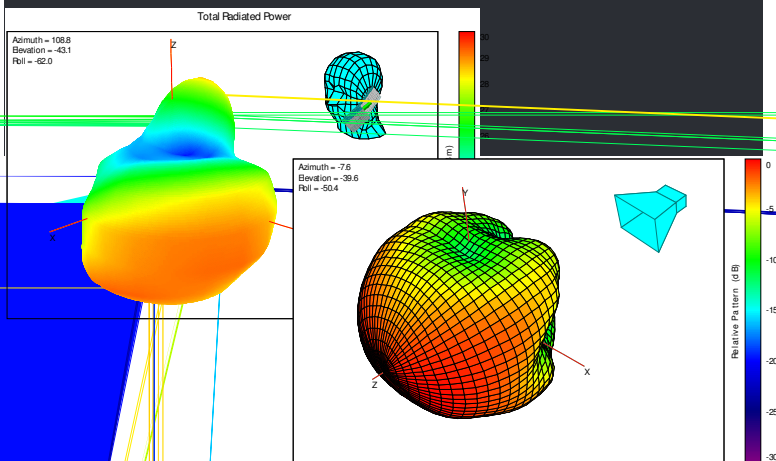
ments that use RSSI reports from the mobile device to capture receive pattern information and greatly improve TIS test times. When used in conjunction with appropriate test systems, special test modes including high speed triggered acquisition and spiral data acquisition allow for extremely fast compliant and pre-compliant testing of TRP and transmit antenna patterns. Specialized tests for measuring intermediate channel sensitivity, interference, or degradation are included to determine the potential self-interference on all wireless channels where total surface testing would be impractical and time consuming. In addition, wireless desensitization testing is provided to evaluate the impact of one interfering embedded radio on the performance of another. Using appropriate optional test equipment, this test meets the requirements of the CTIA/Wi-Fi Alliance Converged Devices Test Plan.

With the addition of the optional EMQ-106 A-GPS Test Module and appropriate optional equipment drivers, TIS testing of A-GPS equipped mobile stations may be performed in accordance with V3.1 of the CTIA OTA Test Plan. For emerging wireless technologies that use multiple antenna technologies, the EMQ-108 MIMO OTA Performance package provides the ability to control optional RF channel emulators for OTA environment simulation and includes a suite of tests for measuring throughput vs. power/pattern at both the physical layer (communication tester) and application layer (TCP/IP throughput with appropriate optional throughput tester).

Site Validation and Calibration

Antenna Measurements

For passive and active (amplified) antenna testing, EMQ-100 provides scalar and vector pattern measurement capabilities for full spherical and polar antenna pattern measurement. Post processed results include estimated TRP/NHPRP/NHTRP numbers (based on specified input power levels) as well as more basic antenna parameters such as peak gain, directivity, efficiency, beamwidth, front-to-back ratio, and more. Using vector pattern data, additional post processed information is available, including real/imaginary and magnitude/phase/linearized phase patterns for each linear polarization, as well as equivalent quantities for left and right-hand circularly polarized (LHCP/RHCP) patterns, and elliptical polarization pattern quantities including major and minor axes. Optional support for evaluation of multiple-antenna technologies provides antenna correlation calculations using either pre-defined parameterized receive power distributions (uniform, normal/Gaussian, or Laplacian), or user supplied power distribution information.



EMQ-100 provides a complete system software solution including capabilities for calibration and validation of the test system. A variety of test methods are provided for performing the CTIA test, as well as the WiMAX Forum and 3GPP field probe test and validation methods. Range calibration can be performed using basic site path loss measurements or more advanced efficiency (antenna) and ripple based calibrations. Specialized calibration and validation methods are supported for MIMO OTA testing and other specialized tests.

Application Interface

The EMQ-100 package is based on our EMQuest Data Acquisition and Analysis Software. The EMQuest core provides all of the functionality required for parameter entry, data acquisition, data analysis, and report generation. This Windows™ based platform provides a powerful, easy to navigate environment. A modular data acquisition system makes this system continually expandable. Test

and equipment modules provide the required data acquisition capability. New modules can be added to enhance the data acquisition functionality as needed.

Parameter Entry and Data Acquisition

A convenient tree-view structure organizes input parameters in an easily navigated hierarchy, allowing modification of any parameter with only a few mouse clicks. Parameters, graphs, and tables are displayed on separate tabs to allow maximized viewing area while still providing quick access to any piece of information. Running a test is as simple as loading a pre-saved parameter file and pressing the “Run” button. All acquired data is automatically stored in a raw format data file, insuring that preprocessed data can always be recovered. Data can be located quickly by model, serial number, test date, etc.

Graphing and Report Generation

Advanced graphing capabilities allow acquired data to be displayed in both 2D and 3D formats. Built-in 3D visualization icons provide a reference for the orientation of the DUT relative to the pattern information. Tabular data can be exported to Microsoft Excel™ spreadsheets and reports can be saved in RTF format for import to Microsoft Word™ or exported to PDF files. The report generator uses a powerful document style template scheme to allow automatic generation of output without the limitations of “banding” type report generators. A template editor links to existing data sets for editing in a “What You See Is What You Get” (WYSIWYG) environment. Multiple data sets, tests parameters, and templates can be manipulated in memory at once with the Multiple Document Interface (MDI).

Test Packages

The EMQ-100 Software provides test functionality for single and dual axis (2D and 3D)

antenna pattern measurements and the associated post-processing, for vector, scalar (relative or absolute power), and receiver sensitivity measurements. It also contains a response calibration package for capturing frequency response and VSWR curves from supported test equipment. Optional expansion packages are available to increase the testing capability, adding features like wireless throughput testing, A-GPS testing, MIMO performance testing, and pre-compliant RSE testing.

Equipment Drivers

Equipment drivers are included to control ETS-Lindgren Positioning Equipment through the Model 2090 controller, as well as the Model 2005 Light Duty Azimuth Positioner. The base configuration includes a choice of three optional equipment drivers from the standard list of available drivers, with additional drivers available at a nominal fee. Standard drivers are available for most frequently used vector or scalar network analyzers, spectrum analyzers, power meters, and communication analyzers for single and/or dual channel data acquisitions. Hybrid drivers allow combining two or more dissimilar devices to function as another more complex device. For example, two power meters, or a power meter and a spectrum analyzer could be used in place of a dual channel receiver.

Test Application Configurations

EMQuest EMQ-100 Antenna Measurement Software	Fully automated 2D (polar/linear) and 3D (spherical/cylindrical/planar) pattern measurement capabilities as well as frequency response measurements for passive antennas and active wireless devices. This full-featured package includes all of the functionality of the core package listed above, including a customizable report generator, advanced graphing and data acquisition capabilities, and various tools for an enhanced user experience.
EMQuest EMQ-100 Lite Antenna Pattern Measurement Software	Fully automated 2D (polar) and semi-automated 3D (spherical) pattern measurement capabilities for passive antennas only. This entry-level package includes only a small subset of the tests and features offered in the full EMQ-100 package. It does not support automation of multi-axis positioning systems or active antenna measurements. No optional expansions are available for EMQ-100 Lite. Addition of unsupported features requires an upgrade to the full EMQ-100 package.

Optional Expansion Package Configurations

EMQ-100 can be extended to provide A-GPS, RSE and MIMO testing capabilities with the addition of optional test packages.

EMQ-105 Network Throughput Test Package	Optional expansion to the EMQ-100 package application that adds automated 2D and 3D pattern and attenuation response testing of the network throughput of wireless networking components.
EMQ-106 A-GPS Test Package	Optional expansion to the EMQ-100 application package that adds automated 2D and 3D sensitivity pattern measurements and intermediate channel degradation tests for mobile devices with assisted GPS (A-GPS) capabilities.
EMQ-107 RSE Test Package	Optional expansion to the EMQ-100 application package that adds automated pre-compliant radiated spurious emissions (RSE) measurements.
EMQ-108 MIMO Test Package	Optional expansion to the EMQ-100 application package that adds a suite of MIMO test capabilities to the EMQuest EMQ-100 Antenna Measurement Software. Included are specialized tests for evaluating the throughput of a wireless device in the simulated environment, as well as R&D tests to allow evaluation of antenna correlation, along with system calibration and validation tests.

Recommended System Requirements

- ☐ Intel® Pentium® 4, 2.4 GHz or Greater
- ☐ Microsoft Windows XP Professional or Windows 7 Operating System
- ☐ 2 GB RAM or Greater
- ☐ 60 GB Free Hard Drive or Greater
- ☐ DVD/CD-ROM Drive
- ☐ National Instruments GPIB card or USB
- ☐ 20-inch or Greater Monitor
- ☐ Speakers, Keyboard, Mouse



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