Product Brochure

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Azimuth

ACE RNX Channel Emulator

ACE-RNX

ACE RNX Channel Emulator Features

Purpose-Built RF Environment Emulator for LTE-A, HetNet, and Beyond

Consumers increasingly demand ubiquitous high-speed access to feed their bandwidth and data-hungry applications. The industry is addressing this through LTE-Advanced (LTE-A), which takes the following new approaches to meet this demand:

- HetNet to improve capacity
- Small cells to expand coverage
- Carrier aggregation to boost data rates

Channel emulation is fine for testing single-link, planned environments with controlled interference, but it's inadequate for testing HetNet — a dynamic, multilink, interference-dominated, and increasingly dense network. For that, you need HetNet environment emulation. Only Azimuth's ACE RNX, with its unique built-in Virtual Network Environment™ (VNE™), fully addresses the technical and logistical challenges of LTE-A testing:

- Testing ICIC, eICIC, FeICIC, NAICS, and advanced interference cancellation receivers
- Prelaunch testing of small cells
- Recreating field environments for debugging
- Regression testing
- Testing builds/configurations before going to the field

ACE RNX: Optimized for LTE-A, HetNet, and Beyond

- Multilink support for CA, HetNet, and MU-MIMO
- Addresses technical and logistical challenges of LTE-A testing

Industry's Best RF Emulation

- 1 ms playback rate
- Lowest insertion delay
- Highest output power
- Widest dynamic range
- Dynamic uplink noise
- Internal splitting and combining

Most Powerful Test Executive

- Optimized for multilink testing
- Intuitive GUI to develop complex test scenarios and scenarios
- Cloud architecture to maximize testbed utilization

ACE RNX Channel Emulator Functions

Virtual Network Environment (VNE™)

The Industry's First — and Only — HetNet Environment Emulation Capability

Consumers demand ubiquitous high-speed access to feed their bandwidth and data-hungry applications. LTE-A uses network densification/HetNet (a network of cells of different sizes) to meet this demand. One consequence of network densification is increased interference. LTE-A offers many complex and advanced mechanisms (e.g., ICIC, eICIC, FeICIC, NAICS, and advanced receivers) to handle this interference. While these mechanisms and techniques help, they also increase the overall complexity of the system. HetNet fundamentally changes how networks must be tested.

Testing HetNet in the lab requires (1) creating a HetNet environment, and (2) controlling the HetNet environment to run specific test cases. Doing this through traditional means — for example, by using real eNBs or signal generators as interferers — is rarely practical due to costs and the complexity of the test-bed.

Virtual Network Environment™ (VNE™), available within the RNX platform, is the first and only solution capable of creating and controlling a complete HetNet radio environment in the lab. VNE™ provides a configurable, synchronized* LTE downlink (i.e., eNB) interferer within the RNX. Designed to include a fading channel, each interferer can be configured to be independent of the others.

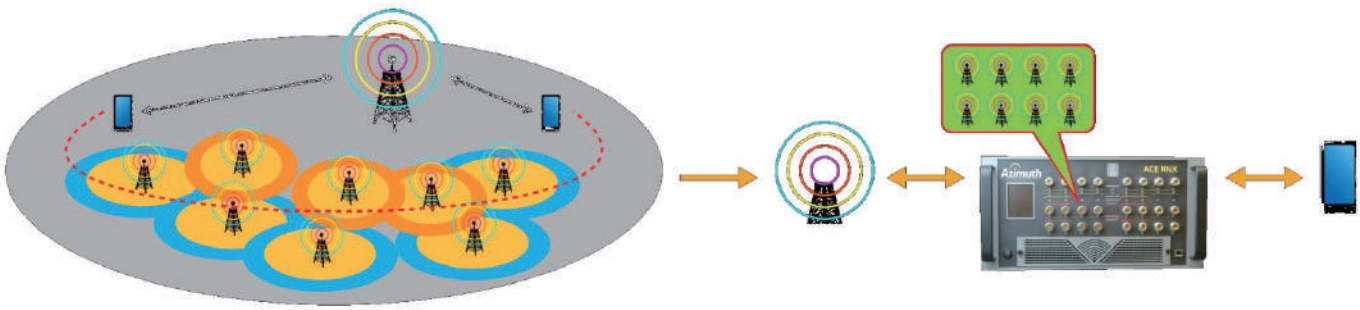
*: Synchronization is critical since testing time-based mitigation schemes such as ABS (almost blank subframes) requires subframe-level synchronization.

VNE™

- Industry's first advanced environment emulation
- Fully configurable downlink interferers
- Synchronized with serving cell
- Includes a controllable fading environment and AWGN
- Logistically and technically feasible

Use Cases

- Testing ICIC, eICIC, FeICIC, NAICS, and advanced interference cancellation receivers
- Pre-launch testing of small cells
- Device qualification, interoperability testing (with device, macro)
- Recreating field environments for debugging
- Regression testing
- Testing builds/configurations before going to the field



ACE RNX Channel Emulator Functions

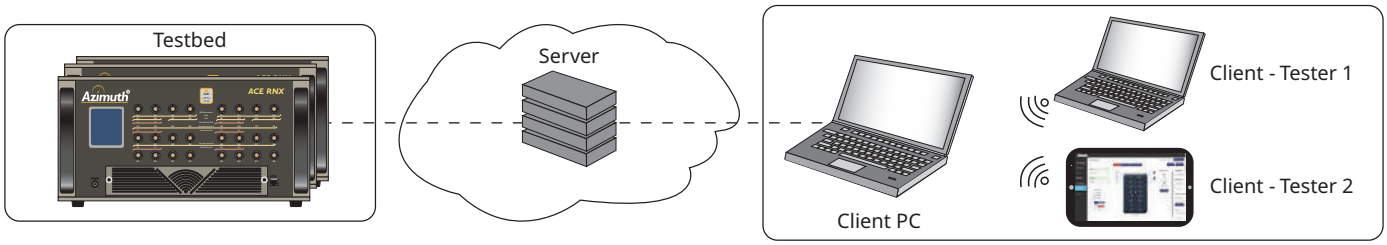
Director 3 Test Executive (D3)

Cloud based Test Executive for ease of use

D3 provides a cloud-ready, server-client architecture that facilitates a single server, and multi-client setup. D3 doesn't require desktop software on dedicated PCs, and it's possible to access from any web browser. It means it's possible to access the test bed from anywhere and anytime globally, and it should be better to build test bed and lab space utilization.

The server consists of the following:

- **Server Component** — hosts a responsive and easy to use HTML5 single page application that enables you to create, run and analyze test cases with the ACE-RNX. It also serves as the endpoint for all of the Azimuth SOAP API.
- **Node (Slave) Component** — hosts a dedicated set of engines that stream real-time information to multiple ACE-RNXs.
- **Database Component** — all test cases created are stored in a database that pushes updates to clients and nodes in real time.



The GUI is comprised of user selectable tabs that indicate the states of the test equipment, allow for setup of testbeds, allow for creation of testcases, and let the user run tests with their hardware. Simple operation based GUI should bring efficiency as easy-to-follow and easy-to-use to setup of testbeds, to make scenarios, and to playback testcases. Especially, Scenario Builder is a powerful wizard to graphically create the complex scenarios needed for LTE-A, HetNet, and has following features;

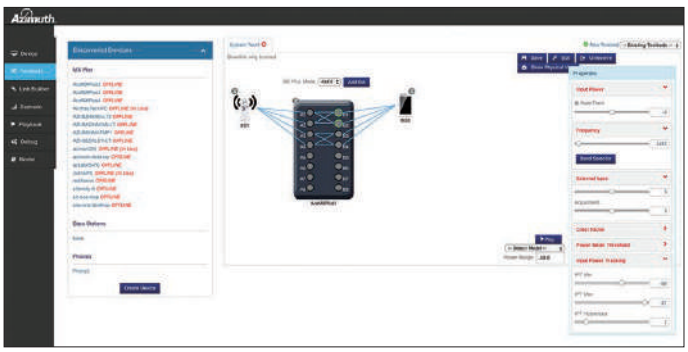
- Drag, drop and design that allows creation of complex scenarios
- Seamless, automatic computation of RF environment (power, channel conditions, etc.) for the defined scenario
- Automatic configuration of the RNX testbed to map to the scenario at hand

Server Requirements

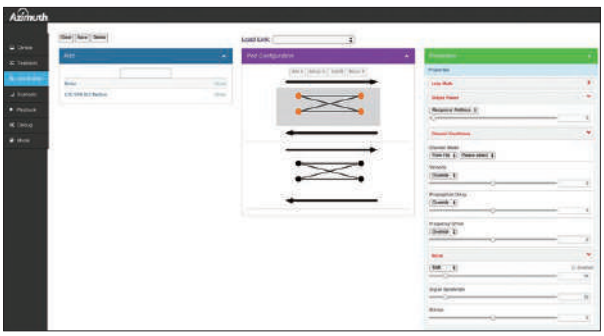
- Desktop PC or server hardware
- Processor: Intel Core i5 64-bit processor or better
- Memory: 8 GB RAM minimum (16 GB recommended)
- Hard Drive: 10 GB free space minimum
- Operating System: the following OS that meets the 64 bit, and English version
  Windows 10 Pro, Windows 10 Enterprise, Windows 7 Professional or Windows 7 Enterprise SPI
- Network: Ethernet 10/100/1000 Adapter
- .NET Framework 3.5 (Windows 10) or .NET Framework 3.5.1 (Windows 7)
- .NET framework 4.6.2
- Microsoft AppFabric 1.1
- Microsoft SQL Server Express 2014

Client Requirements

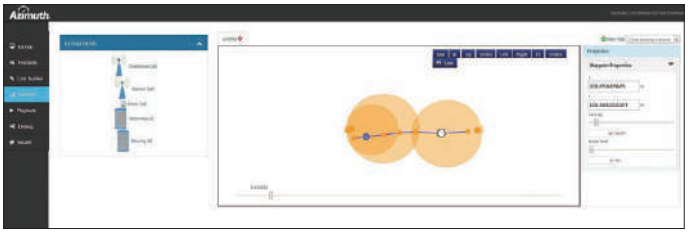
- Microsoft Edge, Microsoft Internet Explorer 11, Google Chrome, Safari 10.0 or later
- Video Resolution: 1600 × 1200 or better (1920 × 1080 recommended)



Testbed Config.



Link Builder



Scenario Builder

Playback

ACE RNX Channel Emulator Functions

Field-to-Lab™ (FTL)

Roam Globally…In Your Lab

Field testing is the final test for mobile devices prior to deployment to subscribers. It enables validation of the device in real world conditions in the environments where subscribers actually use them. However, field testing of devices in diverse conditions of terrain, population density, physical location and motion is extremely time-consuming and costly. The Azimuth Field-to-Lab (FTL) solution is a unique and effective solution that allows service providers and equipment manufacturers to take real world channel conditions collected from drive testing and re-create the same channel conditions in the lab using the ACE RNX Channel Emulator.

The need for a tightly knit end-to-end progression with significant synergy between one stage and the next has never been more relevant. A key enabler of this new testing paradigm is the ability to reliably and repeatedly recreate dynamic field environments in the lab.

Field-to-Lab Testing Has Never Been Easier or More Cost-Effective

Standard channel models are often used for standards-based testing. Although these statistical representations of channel conditions are very useful in equipment testing, certification and benchmarking, they do not represent the full range of dynamic field conditions experienced by a device in the real world. The Azimuth Field-to-Lab solution easily integrates actual drive test scan logs into the testbeds used in carrier and equipment vendors' labs. "Golden drive test routes" can be driven virtually, whenever needed.

Field-to-Lab Integration with Azimuth's Solution Portfolio

The core functionality for Field-to-Lab, integrated with Azimuth's scalable solutions, delivers unrivaled device testing.

- Real-World Applications — With real infrastructure (eNB or BSE), re-creates external conditions in the lab; enables interoperability, regression, network optimization, and performance testing across the full spectrum of dynamic radio environments
- Reciprocal Path Loss (RPL) — With dynamic RPL, FTL allows users to assess the impact of dynamic uplink channel conditions on overall device performance using current drive test scanner logs
- Device Automation and Control — FTL integrates Azimuth DAC for fully automated device application testing and performance benchmarking — including video streaming such as YouTube — while other apps run concurrently
- Can automate different test-bed components, including logging tools, emulators, and results analysis to re-create a complex field environment in the lab

AzMapper

The mapping function is a crucial component of the Field-to-Lab solution. Various field data of different qualities and accuracy are analyzed and used to generate a playback file. First, the field data is filtered to extract the useful and significant data from the mass of collected information. Next, the data is smoothed, making sure the playback faithfully imitates the time-varying nature of the real world. Finally, the data is analyzed for missing segments; these can be filled or closed with interpolated data to ensure continuity. All the parameters of the filtering and mapping are configurable to the user's preference.

Playback

The most important part of the FTL solution is ensuring that the playback data is regenerated in the channel emulator in a way that authentically re-creates real-world conditions. The ACE-RNX supports real-time streaming of playback files for unlimited playback to channels on one or more ACE RNXs. Easy-to-use controls allow the data to be played back, paused, looped, and even coupled with other playback files, using both the graphic user interface or the programmable scripting interface.

Sourcing Field Data

Traditionally, drive tests are performed with commercial products that use real handsets and radios to collect field condition data and analyze the scenario through postprocessing. The raw data collected contains detailed information that can be used to map the conditions in time and, using the Azimuth AzMapper application, re-create these conditions for playback. Azimuth FTL interfaces with a wide range of commercial scanners.

Supported Technologies

LTE (FDD, TDD), TD-SCDMA, UMTS (W-CDMA, HSPA+), CDMA (CDMA2000, EVDO), GSM

Supported Scanners/DM

Hardware Scanner:

JDSU E6474A-W1314A

Software Scanners/Diagnostic Monitors:

QXDM
Accuver XCAL

ACE RNX Channel Emulator Specifications

ACE RNX Channel Emulator

Channel Emulation Specifications

Digital Channels	32
Taps per Channel	24
Max Doppler Rate	2.0 kHz
Playback Rate	1 ms
Doppler Profiles	Classical
AWGN	+35 to –30 dB SNR, 0.1 dB
Channel Models: Model Packs	Industry standards models: • 3GPP/3GPP2 5G/LTE/3G/2G channel models • WiMAX Forum channel models based on ITU M.1225 • 3GPP, SCM (spatial channel model for MIMO simulations) and TDL channel models • SCME channel models for linklevel extended SCM modes • IMT-A and SCME-A spatial channel models • High-speed train model scenarios • Moving propagation scenarios
Custom Model Mode	User-defined custom models
Bypass Mode (Identity Matrix)	No correlation, no fading, no multipath
Butler Mode (Butler Matrix)	No correlation, no fading, no multipath

Configurations

Test Configurations	• 1×1, 2×2, 4×4, 8×4U*1 subsets of these • 8×4B*2, 8×8 subsets of these on 2 ACE-RNX with License • Carrier aggregation

*1: U = Unidirectional
*2: B = Bidirectional

RF Specifications

RF Channels per RNX	8
RF Bandwidths	100 MHz
RF Input Range	+23 to –50 dBm, with 13 dB Crest factor
RF Input Peak Power	+36 dBm
RF Output Range	–25 to –120 dBm
RF Output Peak Power	0 dBm
RF Tuning Range	380 MHz to 6050 MHz
Insertion Delay	1.1 µs
EVM	< –40 dB typical
Noise Floor, Output	< –166 dBm/Hz @ –40 dBm output power

Director 3 Test Executive

Scenario Builder	Drag-and-drop wizard to design and execute multilink tests
Link Builder	Link-level GUI to create and run tests
Cloud Architecture	• Global access to the test-bed • No desktop software • Centralized test cases and results

Physical Specifications

Dimensions	17.45 (W) × 8.75 (H) × 28.5 (D) [44.32 (W) × 22.23 (H) × 72.39 (D) cm]
Mass	98 lb. (44.5 kg)
Power	100 V(ac) to 240 V(ac), 50 Hz to 60 Hz, 8.0/4.0 amps

Virtual Network Environment (VNE™)

Capabilities

Interferer	LTE downlink (no uplink)
Unique Interferers Per RNX	12
Interferers Per Link	3
Types of Interferers	Any LTE cell (macrocell, small cell)
Sync Receiver	
Mode	Synchronized (to eNB) or unsynchronized
Input Signal	Nonfaded Power range: –50 to +23 dBm
Capability	Can decode up to 4 eNBs

VNE™ unlocks repeatable, scalable HetNet testing by

(1) defining interfering cells (through the signal generation tool in Director 3)

(2) creating a HetNet environment that uses those cells

(3) developing test scenarios specifically for that environment

VNE™ is integrated into the Director 3 test executive. Users can start with a pre-existing interferer or create an interferer signal with ease, using the signal generation tool. Once the interferer has been created, it can be added to any specific scenario and configured relative to the serving signal (e.g., SIR, delay, frequency offset, etc.).

Interferer Signals-Link-Level Parameters

Interferer proportion (SIR)	–15 to +40 dB (0.1 dB resolution)
Delay	–1 to 1 s (100 ns resolution)
Frequency	Anywhere within the channel bandwidth
Frequency offset	–100 kHz to +100 kHz (10 Hz resolution)

Interferer Parameters

Bandwidth	1.4, 3, 5, 10, 20 MHz (or 6, 15, 25, 50, 75, 100 RBs)
Cyclic prefix	Normal, extended
PHICH duration	Normal
Number of eNB antennas	1, 2, 4
Type of eNB array	Uniform linear
PCI (cell ID)	0 to 503
PDSCH	
Transmission mode	1, 3, 4
Traffic loading	0 to 100%
Rank proportion	0 to 100%
ABS pattern	Standard: Patterns 1–7, as per 3GPP 36.101 Custom: User-defined patterns
CFI value	1, 2, 3
Propagation Conditions	
Channel model	Butler, LTE EVA, EPA, ETU
Correlation	Low, medium, high
Doppler/velocity	5, 70, 300 Hz

EU Standards (CE Marking)

EMC	2014/30/EU, EN61326-1, EN61000-3-2
LVD	2014/35/EU, EN61010-1
RoHS	2011/65/EU

Ordering Information

ACE RNX Channel Emulator

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
ACE-RNX	ACE RNX Channel Emulator
ACE-RNX-6GHZ	ACE RNX Channel Emulator
	Upgrade Option
UPG-RNX-6GHZ	ACE RNX Channel Emulator 6GHz Upgrade Kit
	Standard Accessories
ACC-293	ACE MX/MX2 2×2 Connection Pack (×2)
ACC-234	Power Cable - US, Canada, Mexico
ACC-235	Power Cable - Japan, Taiwan
ACC-236	Power Cable - United Kingdom
ACC-237	Power Cable - Hong Kong, Singapore, Malaysia
ACC-238	Power Cable - Continental Europe
ACC-239	Power Cable - Korea
ACC-240	Power Cable - China
ACC-241	Power Cable - Australia, New Zealand
ACC-242	Power Cable - Switzerland
ACC-243	Power Cable - Italy
ACC-244	Power Cable - Israel
	Hardware Option
RNX-1200	Advanced Capabilities Expansion Card
	Software Module
D3-1001	Director 3 Test Executive
D3-1002	Remote Client License
	Software Options
D3-1003	Director 3 Scenario Builder
D3-1004	3D Geometric Modeling Tool
D3-1005	3GPP TR38.900 5G RAN1 Geometric Stochastic Channel Model Pack
D3-1006	3GPP TS38.141-1 5G TDL Channel Model Pack
D3-1201	Director 3 Signal Generation & Management Tool
RNX-2201	LTE DL Signal Generation/Playback License
RNX-2202	8×8 MIMO License
RNX-3201	8×4 Bi-Directional License
	Application Parts
DIR-601	AzMapper
RPE-401L/AC	RadioProof Enclosures
RPE-402	RadioProof Enclosures
ACC-261	RadioProof - MIMO AP Cable Kit
ACC-262	RadioProof - MIMO Laptop Cable Kit
ACC-284	2:1 Combiner
ACC-295	ACE MX/MX2 Cable Starter Kit
ACC-308	MIMO Amplifier
ACC-312	MIMO Connectivity Unit
ACC-315	Field To Lab Multi-Unit Connection Kit
ACC-506	CLK Synch Cable
	Support Services
SVC-101	Engineering and/or Training Service per hour
SVC-701	Annual Software Maintenance and System Technical Support
SVC-703	HW Advanced Replacement Service
SVC-710	Return To Factory Repair Evaluation
SVC-613	ACE-RNX Calibration Fee

Please contact our sales representative for more details.

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Specifications are subject to change without notice.

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