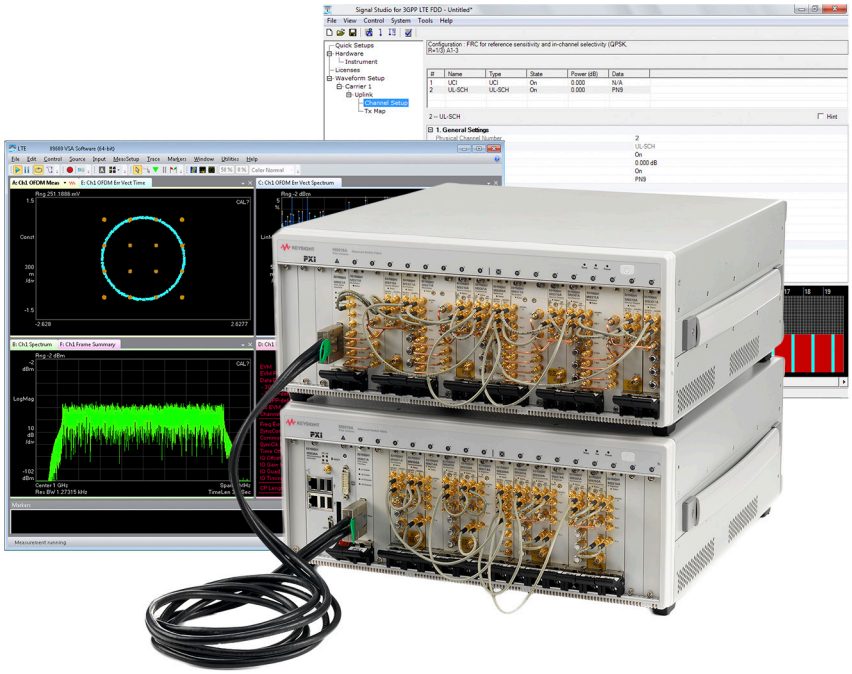
Keysight Technologies
Quickly Gain Insight into LTE/LTE-A Multi-Channel Designs



Technical Overview

KEYSIGHT TECHNOLOGIES

Gain greater insight faster with a compact, multi-channel PXI test solution that has proven performance with industry standard Signal Studio and 89600 VSA/WLA software.

Introduction

LTE deployments in over 95 countries worldwide with over 1,200 LTE capable devices make LTE the fastest developing mobile technology in the history of cellular communications. LTE-Advanced was developed to meet the requirements of 4G technology, mainly to provide much needed spectral efficiency of up to 30 b/s/Hz and increased data rates of up to 1 Gbps, as well as interoperability with legacy wireless formats.

This technical overview describes Keysight Technologies, Inc. PXI-based multi-channel test solution-hardware and world class signal generation and analysis software which provide greater insight into complex LTE/LTE-A designs. The test solution also includes a convenient GUI for quick implementation of LTE/LTE-A multi-channel signal analysis and signal generation systems.

LTE/LTE-A multi-channel test challenges

Basestation, microcell, picocell, repeater, UL components, and RF subsystem designs are becoming more complex as engineers implement new LTE-Advanced features. These devices need to support multi-radio formats and include multiple antennas to support new carrier aggregation and spatial multiplexing MIMO enhancements. As the number of antennas increase, the design and test become more complicated, requiring better channel-to-channel correlation and more equipment in order to test multiple channels. Engineers need the right tools to gain deeper insight into measurement data. And when MIMO is implemented with carrier aggregation, the test is even more complicated. Further complicating matters, engineers need to design while the wireless standards continue to evolve.

LTE/LTE-A multi-channel test solution

The LTE/LTE-A multi-channel test solution is a combination of time synchronized hardware, software, and set up tools providing the essential components of a multi-channel test system. This enables engineers to quickly set up, measure, visualize and characterize their most complicated multi-channel and MIMO designs. Keysight's Signal Studio software allows for easy generation of the most complex LTE/LTE-A multi-channel and MIMO waveforms. For signal analysis, Keysight's 89600 VSA software provides analysis of multiple channels in the frequency and modulation domains simultaneously.

To enable faster multi-channel and MIMO analysis, the MIMO toolkit provides a GUI for easy generation and download of LTE-A waveforms and VSA software state files to accelerate your measurement set ups.

A typical multi-channel or MIMO configuration includes two to four individual PXI VSGs with the Signal Studio software for waveform generation and two to four PXI VSAs with the 89600 VSA software for simultaneous channel decoding and analysis. These are combined into one or two M9018A PXIe 18-slot chassis. For two-chassis configurations, the M9037A PXIe embedded controller connects to the M9021A PCIe cable interface in the second chassis for routing of the backplane triggers.

Hardware

Signal Generation Hardware

Use the PXI VSGs to generate spectrally correct LTE/ LTE-A multi-carrier and time synchronized MIMO RF signals. Up to 160 MHz bandwidth supports intra-band carrier aggregation applications. With independent sources, each channel can be configured separately with cross-carrier scheduling for inter-band carrier aggregation. Provides < 20 nsec channel-to-channel synchronization for spatial multiplexing MIMO applications. In addition, the fast download of waveforms through the PXIe backplane accelerates multi-channel test.

Signal Analysis Hardware

The PXI VSAs are used to analyze multi-carrier and time synchronized LTE/LTE-A MIMO signals. The 160 MHz bandwidth provides enough analysis bandwidth for the widest LTE-A carrier aggregated signals. The independently tuned analyzers allow for simultaneous analysis of component carriers in different frequency bands. In addition, the M9391A's fast frequency and amplitude settling times combined with the VSA software provide for very fast decoding of signals for visualization, EVM and timing measurements.

Test solution features & benefits

Features	Benefits
< 5 ns PXI VSA and <20 ns PXI VSG ch/ch time synchronization	Time synchronization for spatial multiplexing MIMO
Independently tuned channels	Tune to different frequencies for inter-band carrier aggregation and simultaneous UL & DL measurements
Up to 160 MHz signal generation and analysis bandwidth	Generate and analyze multiple LTE channels in intra-band carrier aggregation

Key specifications for multi-channel carrier aggregation and spatial multiplexing MIMO
M9381A PXIe vector signal generator: 1 MHz to 6 GHz
2x2 or 4x4 time synchronized MIMO
Up to 160 MHz modulation bandwidth per channel
< 0.33% LTE EVM (4x4, 10 MHz BW, 2 GHz)
M9391A PXIe vector signal analyzer: 1 MHz to 6 GHz
2x2 or 4x4 time synchronized MIMO
Up to 160 MHz analysis bandwidth per channel
< 0.36% LTE EVM (4x4, 10 MHz BW, 2 GHz)

For phase coherent signal analysis, replace the M9391A PXIe VSA with the N7109A Multi-channel signal analyzer. The N7109A provides up to 8x8 phase coherent channels, and can be used with 89600 VSA software for advanced MIMO beamforming analysis.

- 40 MHz analysis bandwidth per channel
- < 0.8% LTE EVM (4x4, 20 MHz BW, 2 GHz)
- View beam magnitude and directional patterns for each channel

Software—multi-channel signal generation and analysis

With the provided configuration and test solution MIMO toolkit, engineers can gain deeper insight into their multi-channel designs much faster.

Signal Studio signal generation software

Create fully-coded LTE-Advanced compliant downlink and uplink signals. As shown in Figure 1, you may configure up to 5 component carriers (CC) through pre-defined scenario setups. The software is flexible to allow independent setup parameters like bandwidth and modulation type for each CC. Create waveforms for 2x2 or 4x4 MIMO or LTE-Advanced inter-band configurations with cross-carrier scheduling.

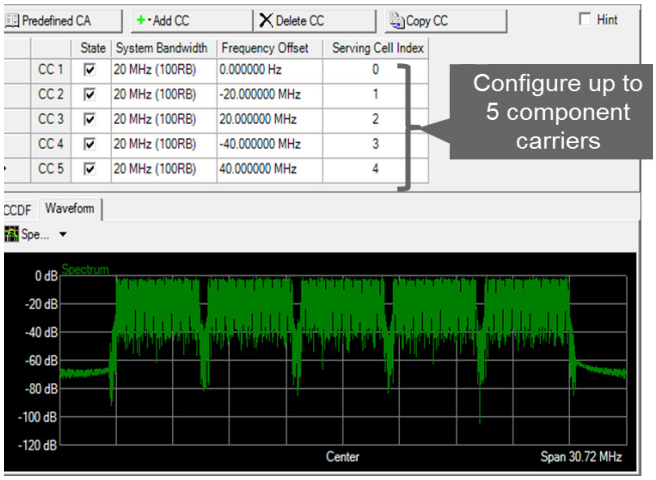


Figure 1. N7624B Signal Studio software for LTE-Advanced FDD.

89600 signal analysis software

89600 VSA software can connect to multiple instruments in a single instance to provide simultaneous measurements enabling visualization and RF analysis. View key frequency, modulation IQ constellation and EVM, and time alignment measurements side-by-side. As shown in Figure 2, the 89600 VSA software can be used for inter-band carrier aggregation. It enables acquisition of all five component carriers simultaneously, demodulates the captured signals and measures the time alignments.

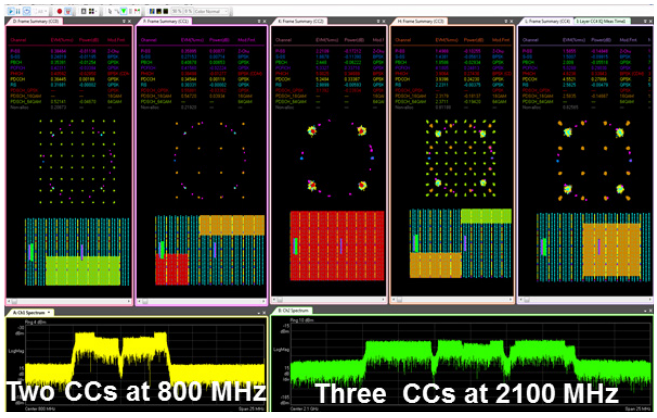


Figure 2. 89600 VSA software for inter-band carrier aggregation analysis.

89620B WLA software

WLA software is an add-on to the 89600 VSA software and provides for MAC, RRC, RLC multi-frame and multi-layer analysis for UL & DL LTE FDD.

Y1299A PXI multi-channel/MIMO test solution kit

This test solution includes a MIMO toolkit with backplane trigger routing tools and multi-carrier and MIMO sample waveforms. You can load pre-configured Signal Studio waveforms (license required) and play these waveforms as is or sequence multiple waveforms. VSA setup files are provided for easy analysis and faster time to measurements.

This test solution is scalable. Buy what you need today and as your requirements change, add more channels, frequency or bandwidth to meet your new requirements.

X-Series measurement application software

Optional X-series measurement application software for LTE/LTE-Advanced FDD/TDD, as shown in Figure 3, provides one-button measurements that can be used in conjunction with your VSA measurement analysis software.

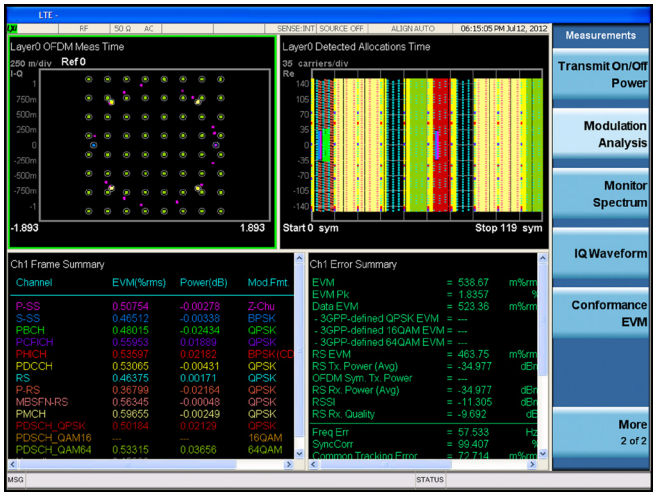


Figure 3. LTE-FDD X-series measurement application for modular instruments.

Recommended Test Solution Configuration

See LTE/LTE-Advanced Multi-Channel Test Solution configuration guide, literature number 5991-4647EN for more options.

Model	Description
M9381A	**PXIe vector signal generator**
M9381A-F06	1 MHz – 6 GHz frequency range
M9381A-B10	100 MHz modulation bandwidth
M9381A-M05	512 MSa memory
M9391A	**PXIe vector signal analyzer**
M9391A-F06	1 MHz – 6 GHz frequency range
M9391A-B10	100 MHz analysis bandwidth
M9391A-M01	128 MSa memory
M9300A	**PXI frequency reference**
PXIe chassis and controllers	
M9018A	PXIe 18-slot chassis
M9037A	**PXIe embedded controller**
M9037A-M08	Memory upgrade from 4 GB to 8 GB RAM
M9037A-WE6	Windows embedded standard 7 (64-bit)
Y1299A-001	**PXI multi-channel/MIMO test kit**
N7624B	**Signal Studio for LTE/LTE-Advanced FDD** [1]
N7624B-HFP	Basic LTE FDD R9
N7624B-SFP	Advanced LTE FDD R9
N7624B-JFP	Basic LTE-Advanced FDD R10
N7624B-TFP	Advanced LTE-Advanced FDD R10
N7624B-9FP	Connect to PXI VSG (M9381A)
89601B-200	**89600 VSA software–basic vector signal analysis**
89601B-300	Hardware connectivity
89601B-BHD	LTE-FDD [1]
89601B-BHG	LTE-Advanced FDD [1]
89620B-001	**89600 WLA software–basic wireless link analysis**
89620B-002	LTE analysis
89620B-003	LTE-Advanced analysis

Optional Software

M9080B	X-Series measurement application for LTE/LTE-Advanced FDD [1]
M9080B-1TP	LTE FDD [1]
M9080B-2TP	LTE-Advanced FDD [1]

1. LTE/LTE-Advanced TDD versions of this software are also available. Please see the *LTE Multi-Channel Test Solution Configuration Guide* 5991-4647EN, for more configuration options.

myKeysight

www.keysight.com/find/mykeysight
A personalized view into the information most relevant to you.

www.pxisa.org
PCI eXtensions for Instrumentation (PXI) modular instrumentation delivers a rugged, PC-based high-performance measurement and automation system.

Three-Year Warranty

www.keysight.com/find/ThreeYearWarranty
Keysight's commitment to superior product quality and lower total cost of ownership. The only test and measurement company with three-year warranty standard on all instruments, worldwide.

Keysight Assurance Plans

www.keysight.com/find/AssurancePlans
Up to five years of protection and no budgetary surprises to ensure your instruments are operating to specification so you can rely on accurate measurements.

www.keysight.com/quality
Keysight Technologies, Inc.
DEKRA Certified ISO 9001:2008
Quality Management System

Keysight Channel Partners

www.keysight.com/find/channelpartners
Get the best of both worlds: Keysight's measurement expertise and product breadth, combined with channel partner convenience.

www.keysight.com/find/modular
www.keysight.com/find/solution-LTE

KEYSIGHT TECHNOLOGIES

Published in USA, August 4, 2014
5991-4684EN
www.keysight.com