Keysight
Radio Test, Reference Solution
Oct, 2015
Agenda

– Radio Test Trends
– Traditional Radio Test Solution
– What is Radio Test, Reference Solution
– The Hardware and Software
Radio Test Market Trends – Observations

Technology Dynamics
- Radio Technology fragmentation drives test equipment proliferation
- Commercial standards added to portfolio
- Higher frequencies and wider bandwidths
- Multi-channel capabilities
- Voice + data

Business Challenge
- Increase capability to test changing requirements
- Increase test speed (permutations)
- Reduce test Equipment inventory
- Reduce Operation/ Support /Training Costs
- Obsolescence management

Emerging needs
- Need flexibility & new measurements capabilities on top of traditional Radio Test features
- Need general purpose capabilities for troubleshooting
- Headroom for future needs
# Keysight in Modular - A Growing Portfolio

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<th>Functional Test</th>
<th>Digital Comms</th>
<th>A/D</th>
<th>Wireless</th>
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<td>Logic analyzers</td>
<td>uW VSA</td>
<td>M9391A RF VSA</td>
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<td>Low frequency switching</td>
<td>PCI express</td>
<td>M9290A CXA-m PXie signal analyzer</td>
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<td>M8195A AWG</td>
<td>PXI 10 &amp; 15-bit AWG</td>
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<td>PXI dual channel VSA</td>
<td>PXI wideband MIMO VSA</td>
<td>Chassis &amp; controller</td>
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## Chassis, Controllers and IO

- AXIe
- PXI
- M940xA PXI optical extenders
- TS-8889 Functional Test Platform

- M9037A Controller
Leverage Our Commitment to Measurement Integrity

Gain confidence
- Common measurement IP & algorithms in instruments & software
  - Count on truly specified performance from the recognized RF & microwave metrology experts
  - Gain greater freedom in managing measurement uncertainty with best-in-class accuracy

Optimize test solutions
- Address crucial objectives—performance, throughout, & more—across the product lifecycle
  - Rely on metrology-grade benchtop, modular and handheld instrumentation
  - Remove custom code uncertainty with shared measurement science that extends across hardware platforms

Achieve greater efficiency, minimize development time, & reduce risk
- Measurement integrity ensures consistent, reliable results that correlate across the product lifecycle
  - Pinpoint & solve problems faster knowing discrepancies likely reside in DUT, not test hardware
  - Leverage software across test hardware: X-Series measurement applications, 89600 VSA software, Signal Studio software
Typical Radio Test Hardware Configuration

Common architecture and building blocks for different radio tests:

- Audio Generator / Analyzer
- Signal Generator
- Data Generator/receiver / BER
- Spectrum Analyzer
- DC power Analyzer
- One-Box Tester
- Digital Multimeter

Modulated Signal to/from antenna
Radio Test, Reference Solution

Key Features
- RF and audio signal generation and analysis
- Analog, APCO P25, Tetra
- RF/AF Spectrum
- Tx and Rx measurements: hum and noise, harmonics and spur, SINAD and THD, sensitivity, modulation quality

Personality
- High Density, High Throughput
- All in one single, flexible and scalable chassis
- Complete, efficient, cost-effective test development & execution
- Open architecture for programing
- GP measurement capabilities for troubleshooting
- Same look & feel as benchtop instrumentation
## Radio Test Reference Solution Measurements and Standards Support*

**Available in Jan 2016**

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<th><strong>Transmitter Test</strong></th>
<th><strong>Receiver Test</strong></th>
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<tr>
<td><strong>AM</strong></td>
<td>• AM Deviation</td>
<td>• Audio distortion (SINAD, THD, etc.)</td>
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<tr>
<td></td>
<td>• AM Hum and Noise Ratio</td>
<td>• Rx Displacement BW</td>
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<td></td>
<td>• Harmonics</td>
<td>• sensitivity</td>
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<tr>
<td><strong>FM</strong></td>
<td>• FM Deviation</td>
<td>• RF output power</td>
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<td>• RF frequency (carrier frequency stability)</td>
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<td>• Spurious emissions</td>
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<td>• Tx tests with sub-audible signaling</td>
<td>• ACPR</td>
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<td>• Attack and transient behavior</td>
<td>• Harmonics</td>
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<td>• OBW</td>
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<td>• Pseudo-Voice Signal generation</td>
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<td><strong>APCO P25</strong></td>
<td>• Modulation quality (See X-apps)</td>
<td>• Generation APCO P25 Phase 1</td>
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<tr>
<td>P1/P2</td>
<td>• Burst rise/fall time</td>
<td>• CQPSK/C4FM</td>
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<td>• User-defined payload</td>
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<td>• User-defined filters</td>
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<td><strong>APCO P25</strong></td>
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<td><strong>TETRA 1 / 2</strong></td>
<td>TETRA 1**</td>
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* The features support may change later

**M9064A VXA supports TETRA1.0, 89600 VSA supports TETRA2.0**
Radio Test, Reference Solution PXI Hardware Platforms

Signal Generators

M9381A
Vector
1 MHz – 6 GHz

M9380A
CW
1 MHz – 6 GHz

M9391A
Mid-range RF
1 MHz – 6 GHz

Signal Analyzers

M9393A
High performance
9 kHz – 27 GHz

M9290A
Mid-range uW
10 Hz – 26.5 GHz

Audio Generation/Analysis

Adlink PXI 9527
2-ch In/ 2-ch Out
Designed for audio testing
M9380A PXIe CW Signal Generator

Keysight Quality with high power levels giving you accurate measurements

Description:
• PXIe Signal Generator
• 1 MHz to 3 or 6 GHz
• Ideal for interference injection and LO substitution

Key Features:
• Better than ± 0.4 dB absolute amplitude accuracy
• Output power of +18 dBm across the frequency range
• Generate CW and Pulse signals
• Soft front panel, IVI-COM drivers, LabVIEW, and MATLAB drivers
M9381A PXIe Vector Signal Generator

Reduces test time with fast amplitude and frequency switching

Description:
• PXIe Vector Signal Generator
• 1 MHz to 3 or 6 GHz
• Modulation bandwidth: 40 std. or 100, 160 MHz (optional)

Key Features:
• Output Power +19 dBm to -120 dBm
• Phase Noise (10 kHz offset @ 1GHz carrier) -125 dBc/Hz typical
• Frequency Settling Time to within 1kHz <220 us
• Amplitude Settling Time <120 us
• RF Flatness Corrected <0.4 dB (140 MHz BW)
• Real-time corrections
• Modulation AM, FM, PM, pulse, and multitone all standard
• Standard IVI-COM, IVI-C, LabVIEW, MATLAB drivers
• Supported Software includes Waveform Creator, Signal Studio and SystemVue
Description:

- PXIe CXA-m Signal Analyzer
- 10 Hz to 3.0, 7.5, 13.6, or 26.5 GHz
- 10 MHz Modulation Bandwidth standard, 25 MHz optional

Key Features:

- Very fast Power Measurements
- Baseband tuning for fast ACPR Measurements
- PXIe (PCIe) data bus for fast data transfer and test execution
- Supports X-Apps Measurement Software
- Phase Noise at 1.0 GHz CF, 10 kHz offset: -106 dBc/Hz; 100 Hz offset: -90 dBc/Hz nominal
- -160 dBm/Hz displayed average noise level (DANL) with preamplifier on @ 10 MHz to 1.5 GHz
- Soft front panel, IVI-COM drivers, and connectivity to 89600 VSA software and SystemVue
- Code compatible with X-Series and ESA signal analyzers
M9391A PXIe Vector Signal Analyzer
Keysight Quality & Performance Vector Signal Analyzer in PXI

Description:
• PXIe Vector Signal Analyzer
• 1 MHz to 3 GHz or 6 GHz
• Modulation bandwidth: 40 standard; 100 or 160 MHz (optional)

Key Features:
• Extremely fast Power Measurements
• Baseband tuning for fast ACPR Measurements
• PXIe (PCIe) data bus for fast data transfer and test execution
• Phase Noise at 1.1 GHz CF, 10 kHz offset: -120 dBc/Hz
• -157 dBm/Hz displayed average noise level (DANL) with preamplifier on @ <1.1 GHz
• Soft front panel, IVI-COM drivers, and connectivity to 89600 VSA software and SystemVue
Description:
- PXIe Performance Vector Signal Analyzer
- 9 kHz to 8.4, 14, 18, or 27 GHz
- Modulation bandwidth: 40 standard; 100 or 160 MHz (optional)

Key Features:
- Extremely fast Power Measurements
- Baseband tuning for fast ACPR Measurements
- PXIe (PCIe) data bus for fast data transfer and test execution
- Phase Noise at 1.0 GHz CF, 10 kHz offset: -107 dBC/Hz; 100 Hz offset: -88 dBC/Hz typ.
- -168 dBm/Hz displayed average noise level (DANL) with preamplifier and noise correction on @ 51 MHz to 2.8 GHz
- Soft front panel, IVI-COM drivers, and connectivity to 89600 VSA software and SystemVue
Radio Test, Reference Solution PXI Software Package

Waveform Creator + X-Apps + Radio Test Library

Demonstration Automation

Presentation

Measurement

Drivers

Hardware

Signal Conditioning +

Radio Test

Control

Audio

RF

Cabling Fixture

Customer's Test Executive

Presentation Insight

Radio Test Library

Audio Spectrum

Audio Quality

Audio Time Domain

Audio Signal Creation

Audio Generation

Audio Acquisition

Audio Signal

Audio Time Domain

RF Quality

RF Time Domain

Demod Spectrum

RF Spectrum

Acquire IQ

Play waveform

Filter (LPF, HPF)

(THD, SINAD)

Distortion

Filter (LPF, HPF)

Demod Quality (const>)

Demod Time Domain

Demod Spectrum

Demod

Analog X-apps

Digital X-apps

Waveform Creator Plugin

Example UI

Test plan

Test Executive

Report

Customer's Test Executive

Driver

Driver

Driver

Driver

PXI VSG

PXI VSA

PXI Audio

PXI Switch

PXI Module

PXI

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Audio
Measurement Applications for various radios formats

- AM, FM, analog modulation
  - Measurement application
  - N9063A, M9063A X-series

- APCO, Tetra, Digital Modulation
  - Measurement application
  - N9064A, M9064A X-Series

- Commercial standards LTE
  - Measurement application
  - N9080A, M9080A X-series

- 89600 for deep R&D tool

- Waveform generation

- Signal Studio

* The support of software building blocks may change later
Radio Test, Reference Solution Measurement
Example

Radio Test Demo Software

FM demodulation

Audio Measurements
Radio Test Evaluation GUI

– Easy HW configuration and control

– Quick selection for available measurements

– Simple and clear test results

– Good and quick way to demonstrate solution
Automation & Integration

Reference Software

Radio Test Evaluation GUI

Radio Test Program
Xmit test, Rcv Test, Audio Gen, Aud...

Radio Test Library: Init_Instruments
setupVsgVsa measPout
Close_Instruments
setupVsgVsaFixedPin measStdAcpr
Load Waveforms measSpecHarms

WFC, X-Apps, Audio Library

Customer’s Test Executive

Hardware

M938xA IVI-COM Driver

AgModularVsa IVI-COM Driver
Radio Test, Reference Solution – One page

RF and audio signal generation and analysis with a combination of PXI hardware and software in a single, flexible, scalable chassis.

- Open modular platform to accelerate automation and integration special for customized request
- Keysight recognized expertise and trusted stable and repeatable measurements
- General purpose capabilities for troubleshooting and commercial standard LTE support for next generation tactical and public safety radios

• RF VSA/VSG 27 GHz
• RF/AF Spectrum
• Analog/Digital modulation
• Audio Measurements
• BER Measurements
• APCO P25 /Tetra
• GP measurements
• Same look&feel as benchtop
Questions ?