Platform Based Design Accelerates 5G Test

Jin Bains
Vice President | RF and Wireless R&D

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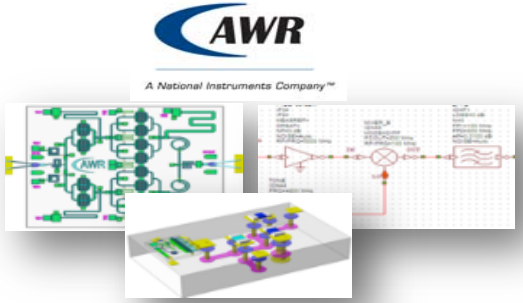
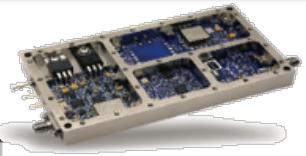
NI RF Solutions: Research ←→ Volume Production



Research | Prototyping | Design & Characterization | Automated Test | Volume Production



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MicroPROSS
TESTING YOUR FUTURE

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Industry Leaders Choose NI for 5G Research

NTT docomo

NOKIA

intel

SAMSUNG

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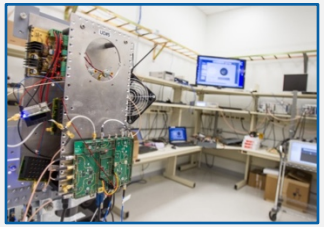

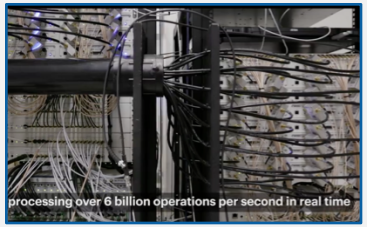

LUND UNIVERSITY

TECHNISCHE UNIVERSITÄT DRESDEN

University of BRISTOL

NYU WIRELESS

YONSEI UNIVERSITY

UTD

KU LEUVEN

Texas A&M

UT ECE

RUTGERS SCARLET KNIGHTS

WNCG

STANFORD UNIVERSITY

Berkeley UNIVERSITY OF CALIFORNIA

Georgia Tech

SOUTHEAST UNIVERSITY

wico

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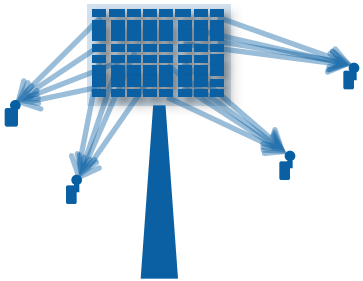
Technologies Driving 5G

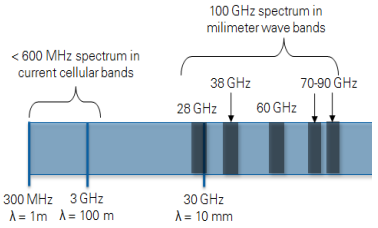
Massive MIMO

Dramatically increased number of antenna elements on base station enabling beamforming.



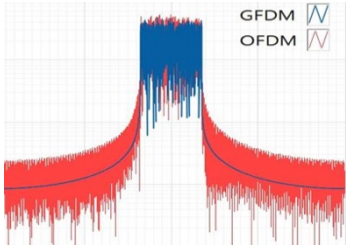
mmWave

Utilize potential of extremely wide bandwidths at frequency ranges once thought impractical for commercial wireless.



Multi Radio Access Technologies (RAT)

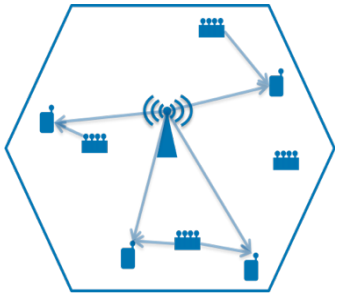
Improve bandwidth utilization through evolving PHY Level and flexible numerology



Wireless Networks

Consistent connectivity meeting the 1000x traffic demand for 5G

- Densification
- NFV
- SDN
- CRAN



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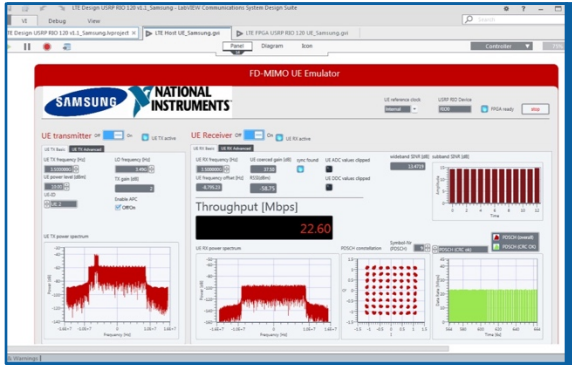
Massive MIMO Demonstrations

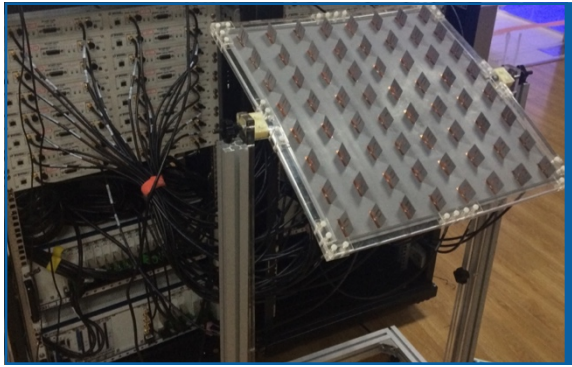


Samsung

Full Dimension MIMO, LTE UE Emulation

Intel

CRAN-Massive MIMO

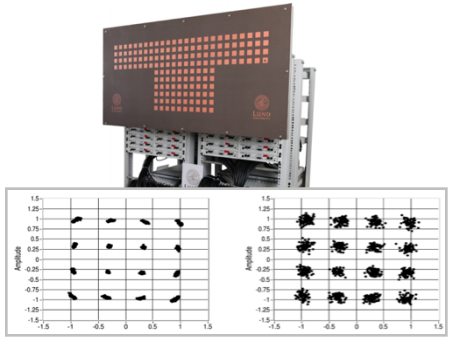


Southeast University

100-Antenna Massive MIMO System

Lund University

100-Antenna Massive MIMO System



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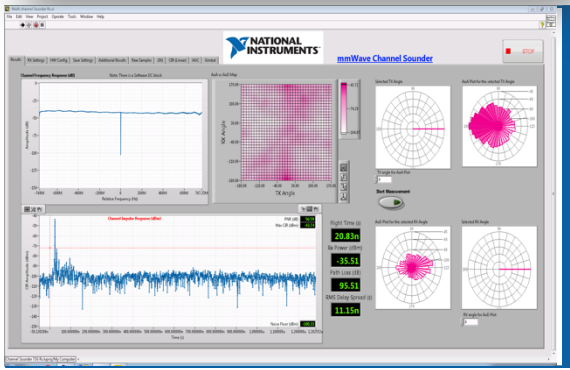
mmWave Demonstrations

NYU Wireless
mmWave
Channel Sounding

NTT Docomo
73 GHz
BW = 1 GHz



AT&T
Channel Sounding

Nokia
Multiple Prototypes

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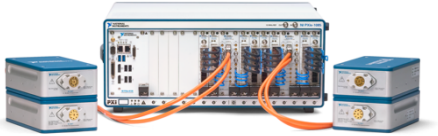
Nokia Timeline with NI Platform

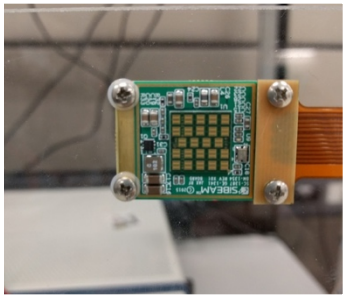


NOKIA

	Brooklyn 5G Summit 2014	NIWeek 2015	MWC 2016
Frequency	73 GHz	73 GHz	73 GHz
Bandwidth	1 GHz	2 GHz	2 GHz
Streams	1x1	2x2	2x2
Modulation	16 QAM	16 QAM	64 QAM
Peak rate	**2.3 Gbps**	**>10 Gbps**	**>14.5 Gbps**

mmWave System Flexibility

RFIC & Phased Array



Integrate 3rd party RFIC

- Hardware integration done by customer
- Ex: SiBeam RFIC

3rd Party RF

Integrate 3rd party RF

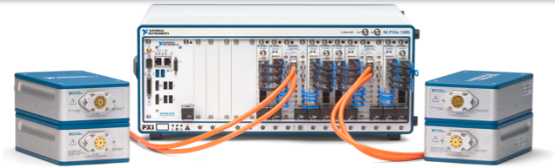
- User must develop digital control of RF
- Ex: Virginia Diodes radio head

High Quality RF

28 GHz, 60 GHz, 73 GHz

Complete system from NI

- Tested, proven configuration
- Technical support available



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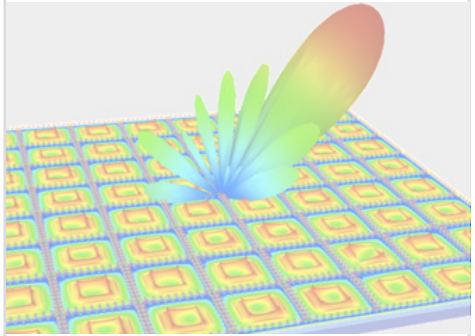
5G Test Challenges

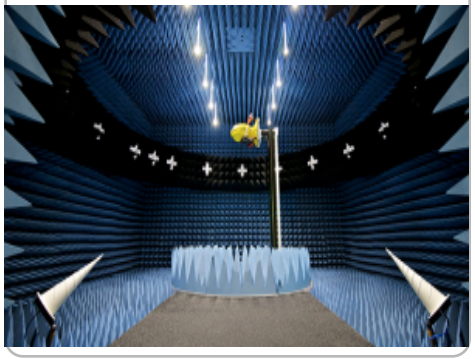
MIMO Systems

- Antenna array validation
- Channel modeling
- Beamforming



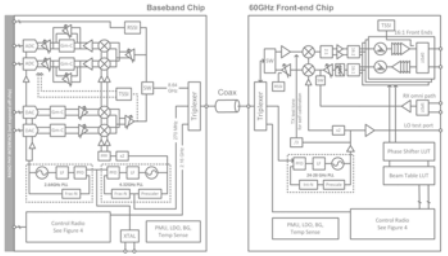
Over-the-Air Testing

- Measurement plane extension
- Air interface de-embedding
- System calibration



mmWave Architectures

- In-house Expertise
- Scalability for multiple bands
- Fast, high performance measurement



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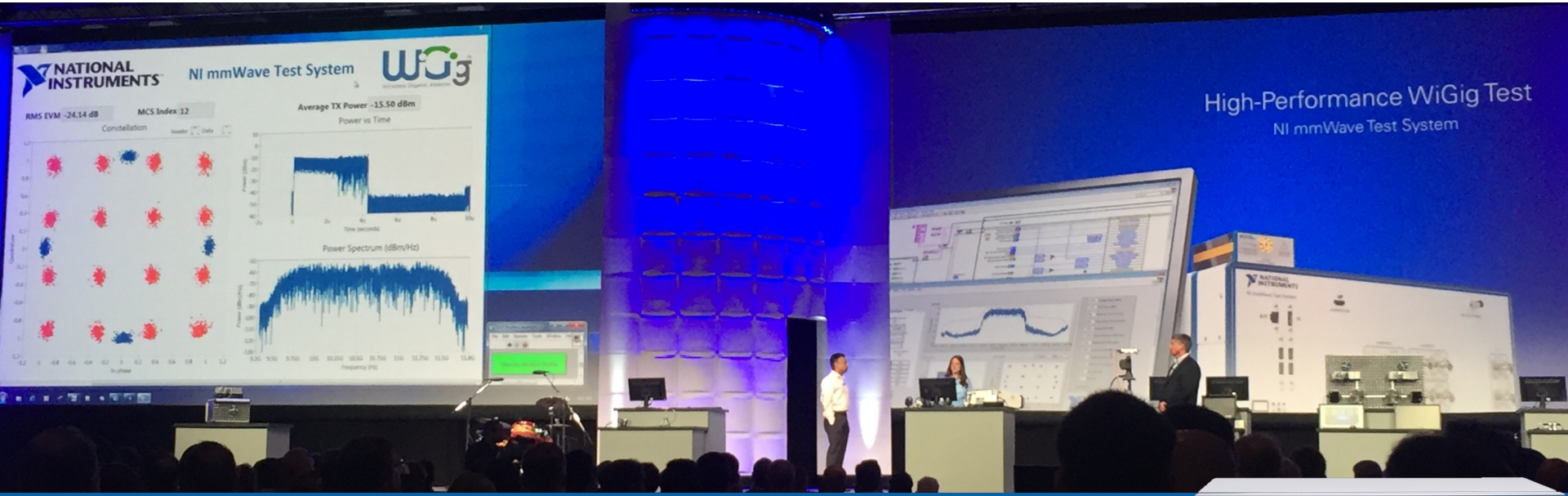
NI Demonstrates mmWave 802.11ad Test at NIWeek 2016



"NI's developments in mmWave test solutions have allowed us to address various testing challenges like…over-the-air test capabilities."…said Anand Iyer, director of mmWave product marketing at Broadcom Limited.

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Future Opportunities

Visit:
ni.com/rf/5g

Contact:
jin.bains@ni.com

Connect:
linkedin.com/in/jin-bains-1758471

NI USRP RIO based UE Emulator

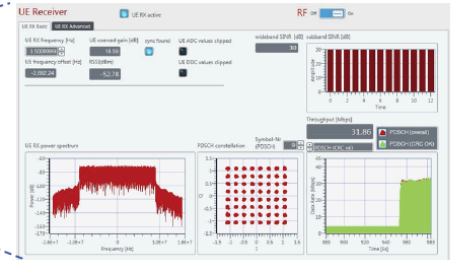
SAMSUNG

UE Emulator Hardware

- USRP-RIO programmable RF with 20MHz BW
- Fully programmable using FPGA
- Portable platform and easy to deploy multi-user test

Labview Communications Software

- LTE reference design with pre-release FD-MIMO features
- DSP algorithms that support synchronization and automatic gain control for over-the-air test
- Visibility of the source code and clean GUI interface



Laptop for control & UI

NI USRP RIO UE Emulator

Labview debug display for constellation, throughput, BLER

We are looking forward to continued collaboration in both Design and Test.

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