



**KEYSIGHT
WORLD 2020**

Innovate Next

Keysight Taiwan Country Manager

Allen Chang



Keysight's Priorities for Managing Through Coronavirus

1. Supporting the health and safety of employees and their families
2. Keeping Keysight strong to provide for employees and serve customers over the long-term
3. Helping communities around the world battle this challenge





Change is constant

But technology is changing the
world more than ever before

Technology Innovation is Driving Perpetual Change

Keysight is accelerating innovation to connect and secure the world



KEYSIGHT
TECHNOLOGIES



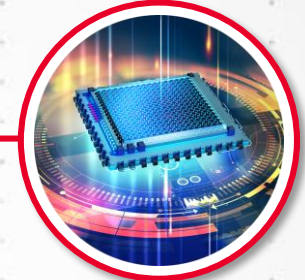
WIRELESS

\$3.6T 5G mobile value chain by 2035¹



AUTOMOTIVE

70% of new vehicles and trucks shipped will be connected by 2023²



QUANTUM

Nations investing >\$10B through 2024 for leadership³



NETWORKING / CLOUD

Data center capacity expected to grow 4X by 2022⁴



IOT

127 new IoT devices connected to the internet every second⁵



AEROSPACE / DEFENSE

New satellite launches could grow 3X by 2025⁶

Complete Solutions End-to-End Spanning Industries and Full Workflow

Markets



**Commercial
Communications**



**Network Applications
& Security**



**Automotive
& Energy**



**Aerospace
Defense**



IoT

Workflow

Simulate

Prototype

Validate

Manufacture

Optimize

Differentiated, Market-Leading Solutions

Hardware



Software



Services



Our Unique Innovation Engine Is a Competitive Advantage

Difficult-to-Replicate Approach
Delivers First-to-Market Solutions

Partner with leading customers to create high-value **solutions** with faster time-to-market than previously possible

Develop hardware and software **products** to address many applications, applying deep competencies in areas such as High Frequency Measurements and Digital & Photonics Measurements

Innovate game-changing technology **components** – breakthroughs created for maximum impact and scale

Solutions
Groups

Centers of Excellence

Keysight Labs Central Teams



Example: *Over-The-Air (OTA) Test – A Must for mmWave Applications*

OTA Measurement – A Realm that Requires Significant Innovation



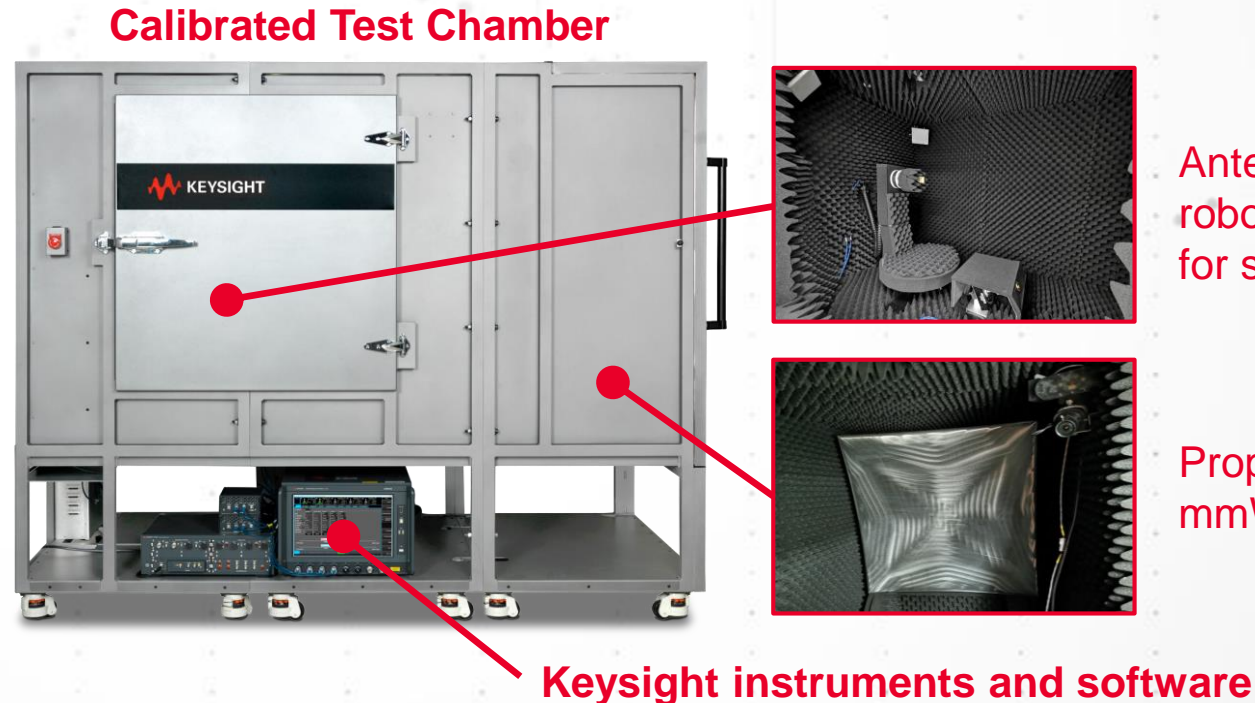
Compared to cabled measurements, requires new specifications, calibration procedures, and measurement software



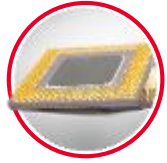
Keysight solution originally developed for early validation of mobile devices, since extended to other segments such as Automotive

Compact Antenna Test Range

- Innovated by Keysight Labs and brought to market by Keysight's Solutions Groups
- Initial prototypes sold to customers who needed to be first
- Full solution includes chamber plus advanced instruments and software
- Just one aspect of our total solution portfolio for the 5G workflow



New 5G Keysight Solutions Enabled by Acquisition



COMPONENTS &
CHIPSETS



DEVICES



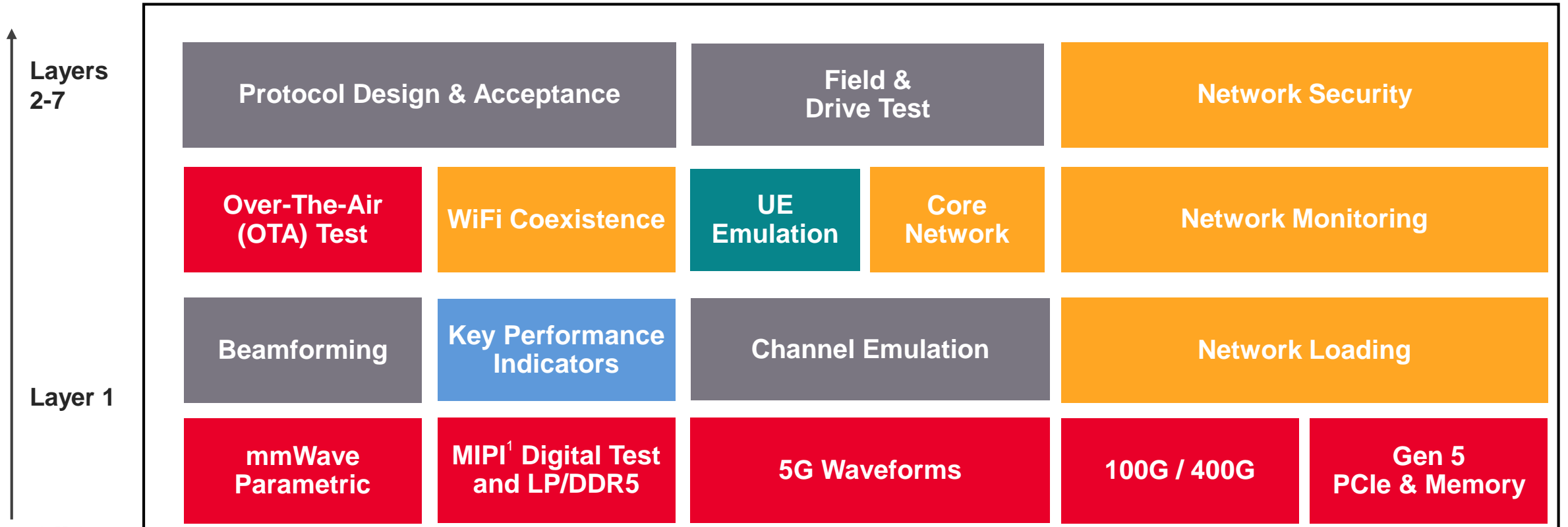
BASE STATIONS



HYPERSCALE AND
DATA CENTERS



ENTERPRISE

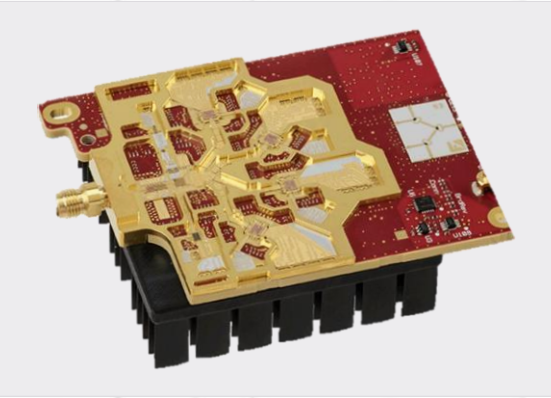


Solutions: ■ Keysight Classic ■ Ixia ■ Anite ■ AT4 ■ Prisma

Proprietary Hardware and Software Capabilities that Go Well Beyond Commercially-Available Technology

Keysight Fab

Santa Rosa, CA



- Proprietary chips, modules, and interconnects, purpose-built for advanced solutions such as 5G and Automotive radar test
- Optimized with hundreds of years of expertise
- Innovating for even more usage across Keysight and preparing for next performance upgrades

Delivers
performance, cost,
and **time-to-market**
benefits for Keysight
and our customers

Software Design Center

Atlanta, GA



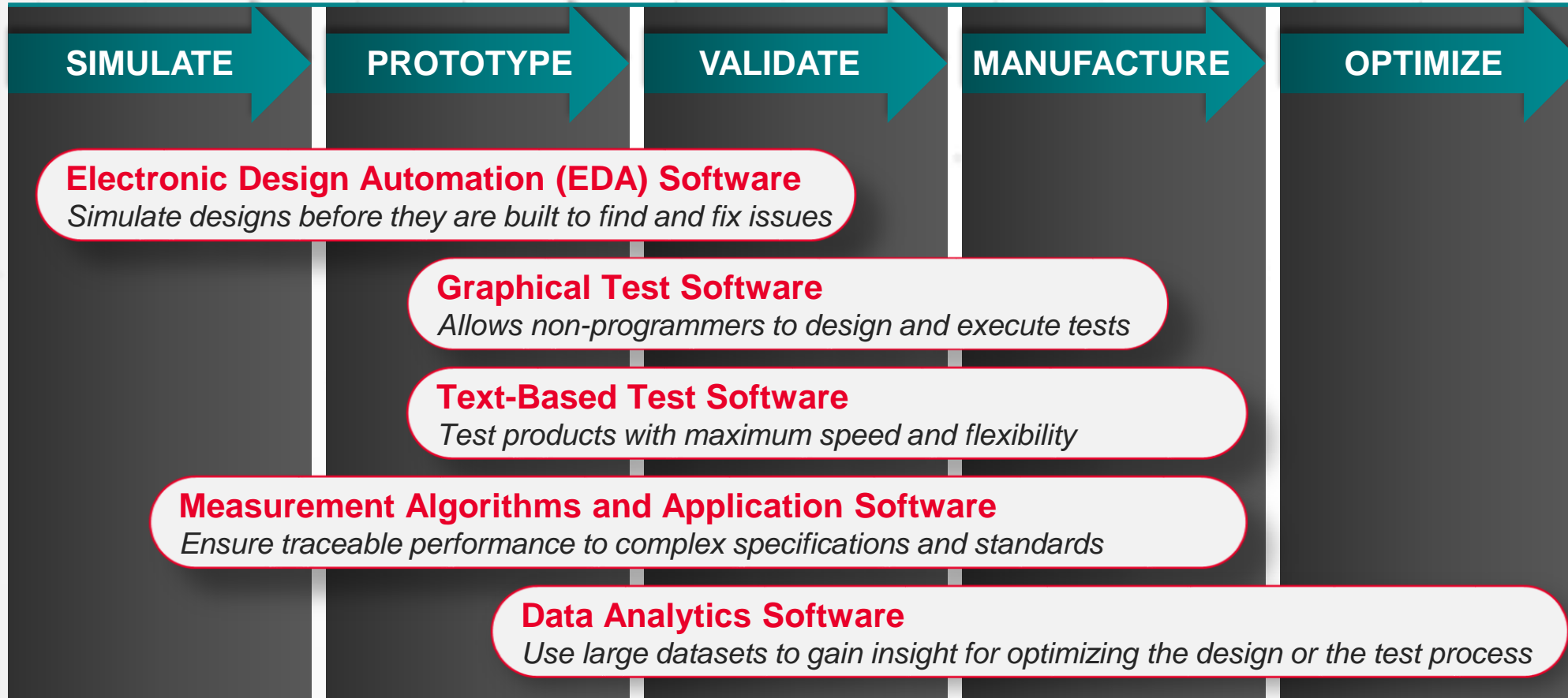
- **Platform software** developed with Agile methods to support electronic design and test solutions
- 60+ developers focused on:
 - ✓ Cloud-first design and deployment
 - ✓ Data management and analysis
 - ✓ Modern, consistent user experience
- In partnership with Georgia Tech

Accelerates
Keysight's software
transformation
and platform
development

VERTICALLY INTEGRATED FOR DIFFERENTIATED TECHNOLOGIES

Next Opportunity: Unify Fragmented Design and Test Software for Faster Time-to-Market and Lower Costs

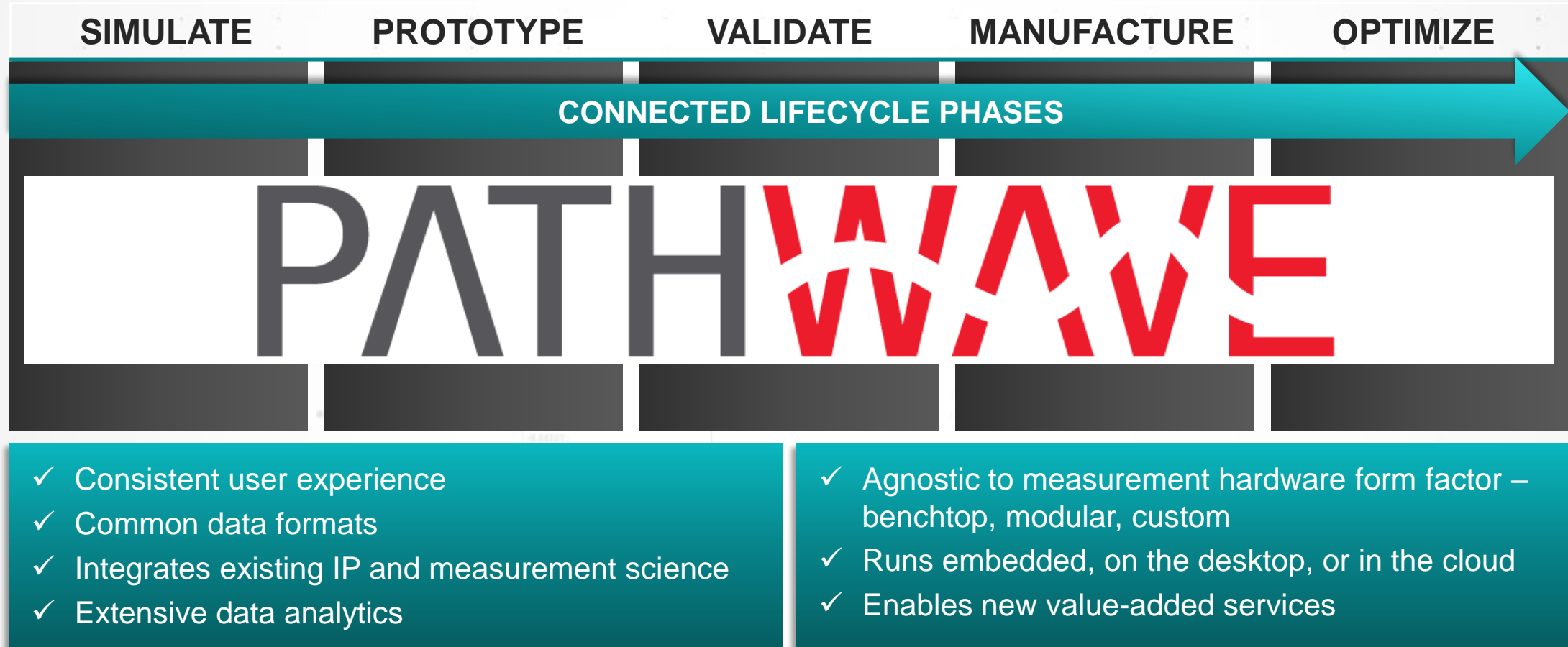
LIFECYCLE PHASES



Customer Pain Point:

Inability to share specifications, test software, and results across lifecycle phases, leading to costly and time-consuming duplicate work

PathWave: A Superior Software Platform that Increases Productivity Across the Overall Workflow



OPEN, SCALABLE, PREDICTIVE PLATFORM

Seeding the Next Growth Opportunities

Selected focus areas – executed in partnership with universities and industry consortia

6G

- Joined 6G Flagship Program at University of Oulu in Finland
- Assigned program leader (proven technical manager who led Keysight's 5G efforts)
- Assessing core technology requirements in Keysight Labs

Quantum Computing

- Acquired Signadyne and Labber to gain quantum control expertise and application insights
- Staffing quantum-focused R&D team located near MIT and Lincoln Labs
- Joined MIT Center for Quantum Engineering, initiated strategic partnership for qubit control research
- Engaged in Quantum Economic Development Consortium led by National Institute of Standards and Technology

+

- Autonomous drive emulation – prototyping breakthrough approach with lead OEM customer
- Next-Generation Network Visibility – new capabilities being explored as the network transforms
- Artificial Intelligence and Machine Learning – multiple opportunities for domain-specific contributions across Keysight's market segments



Sporton International Inc.

Joe Yang

General Manager, WBU

The World RF /Mobile Test & Certification Leader



The 1st Lab for NPI and NTI

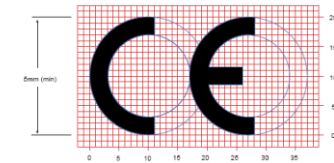
- The 1st Lab to certify WiMAX phone, for FCC
- **The 1st Lab to certify LTE mobile phone, for FCC**
- The 1st Lab to certify Tablet, for FCC
- **The 1st Lab to certify IEEE 802.11ac, for FCC and Japan**
- **The 1st Lab to certify IEEE 802.11ax and 802.11ay, for FCC**

- The 1st Lab to certify 5G NR sub-6GHz (FR1) of Qualcomm platform, for CE RED
- The 1st Lab to certify 5G NR mmWave (FR2) with smart phone usage, for FCC
- The 1st Lab to certify 5G NR mmWave (FR2) with tablet PC usage, for FCC



The Challenge on 5G Test and Certification

- Regulatory: FCC+CE+Japan
 - Product spec.
 - 5G NR FR1+FR2
 - HAC and SAR/PD, CBRS
 - Multiple WWAN TX antennas; WWAN and WLAN power management
 - **Challenge:**
 - How to optimize EIRP performance and band edge
 - How to optimize antenna performance and SAR/PD
 - SAR and semi-anechoic chamber capacity issue
- GCF/PTCRB:
 - Product spec:
 - 5G NR FR1+FR2: more than 1,500 hours
 - 4Rx ; 2CA+3CA+4CA+5CA : more than 3,000 test hours
 - **Challenge**
 - Capacity and multi-platform issue
 - Experiences



Sporton 5G NR Test Platform

Scope	Location
5G NR FR1 RF/RRM/Performance (Sub-6GHz, FR1)	Taiwan
	SZ, China
	Taiwan
	Taiwan
	SZ, China
	SZ, China
5G NR FR2 RF/RRM/Performance (<u>mmWave</u> , FR2)	Taiwan
	SZ, China
5G NR Protocol (Sub-6GHz, <u>mmWave</u>)	Taiwan
	SZ, China





Accton
Making Partnership Work

Accton Technology Corp

Weyden Wang

Director, Wi-Fi BU

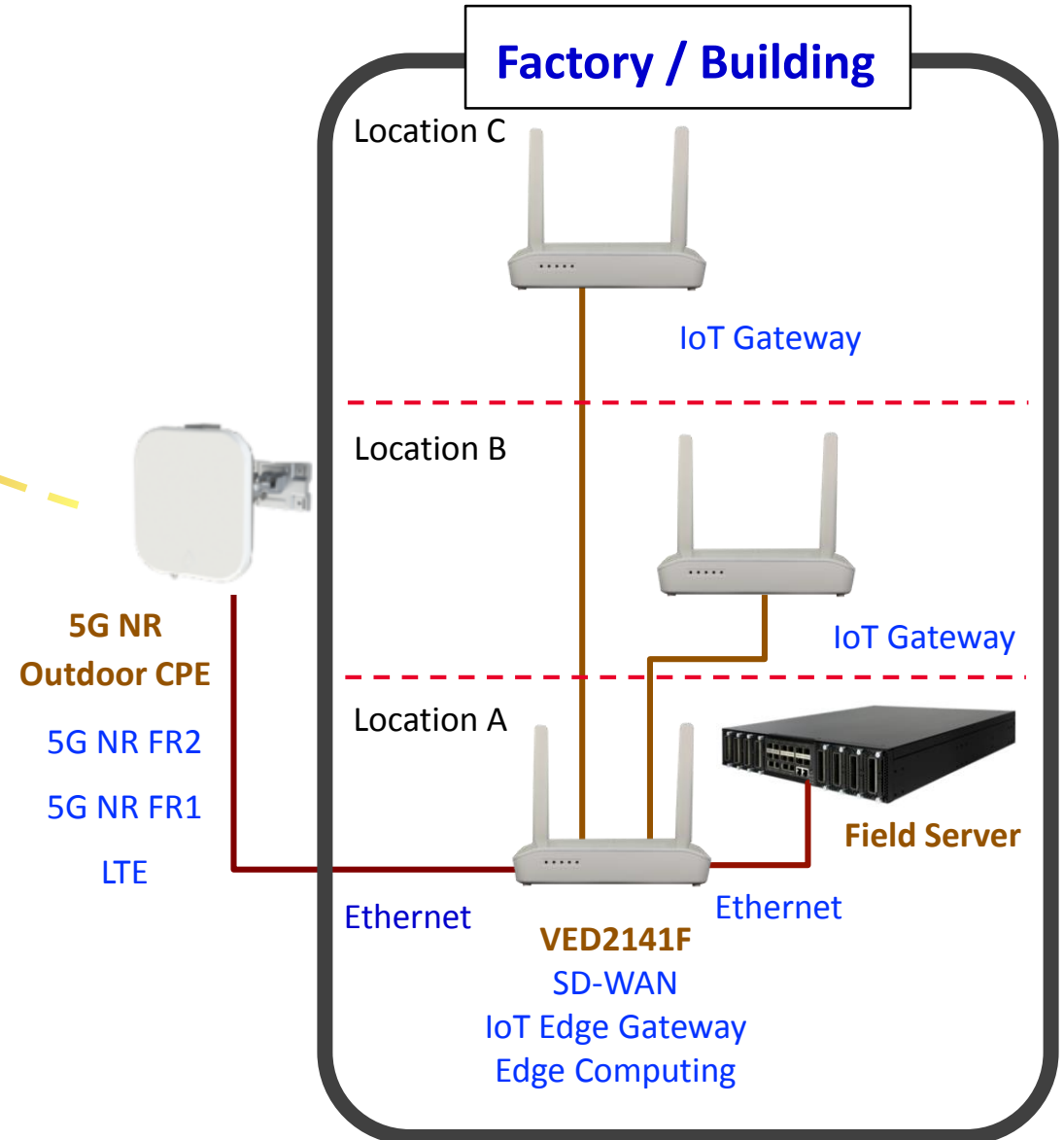


5G NR Outdoor CPE/RU Application



Small-Cell/Base Station

5G NR mmWave/Sub-6GHz/LTE



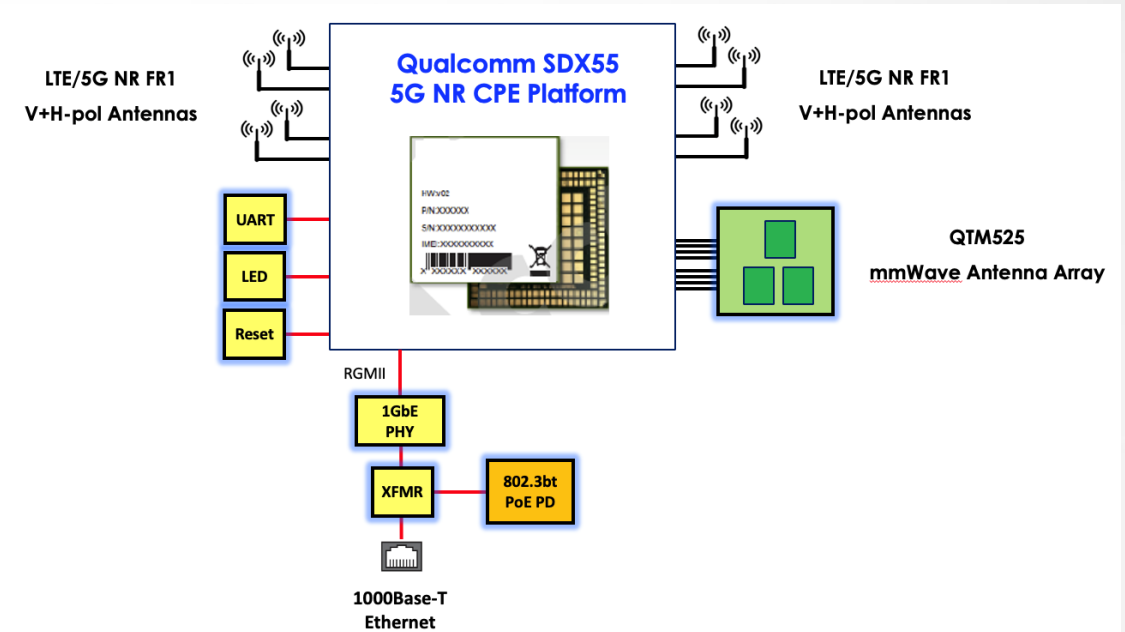
Qualcomm SDX55 Base Outdoor 5G NR CPE Brief

- 3GPP Release 15 compliant
- 5G NR FR2 (mmWave), 5G NR FR1 (Sub-6GHz) and 4G/LTE support
- Optional GPS
- Network Interface: 1-port 1000Base-T RJ45
- Power Source: IEEE 802.3bt PoE PD compliant
- Lightning Protection: +/-4kV
- ESD: Level III +/-8kV(contact); +/-15kV(air) on all 8 PoE lines
- Weather Proof: IP66
- Operating Temperature: -40°C ~ + 55°C

Operating Bands*

FR1 (Sub-6GHz)	<ul style="list-style-type: none"> • New: n77, n78, n79 • Re-farmed: n1, n2, n3, n5, n7, n8, n12, n20, n25, n28, n38, n40, n41, n66, n71
FR2 (mmWave)	n257, n258, n260, n261
4G/LTE	<ul style="list-style-type: none"> • TDD : B34, B38, B39, B40, B41, B42, B46, B48 • FDD : B1, B2, B3, B4, B5, B7, B8, B11, B12, B13, B14, B17, B18, B19, B20, B21, B25, B26, B28, B29, B30, B32, B66, B67, B71

* Country regulatory dependent (Japan and outside Japan SKU option)



(ID concept for reference only)

Testing Automatic

Efficiency

- Reduce UXM manually configuration redundancy time.
- Simplify manual operation steps

High availability

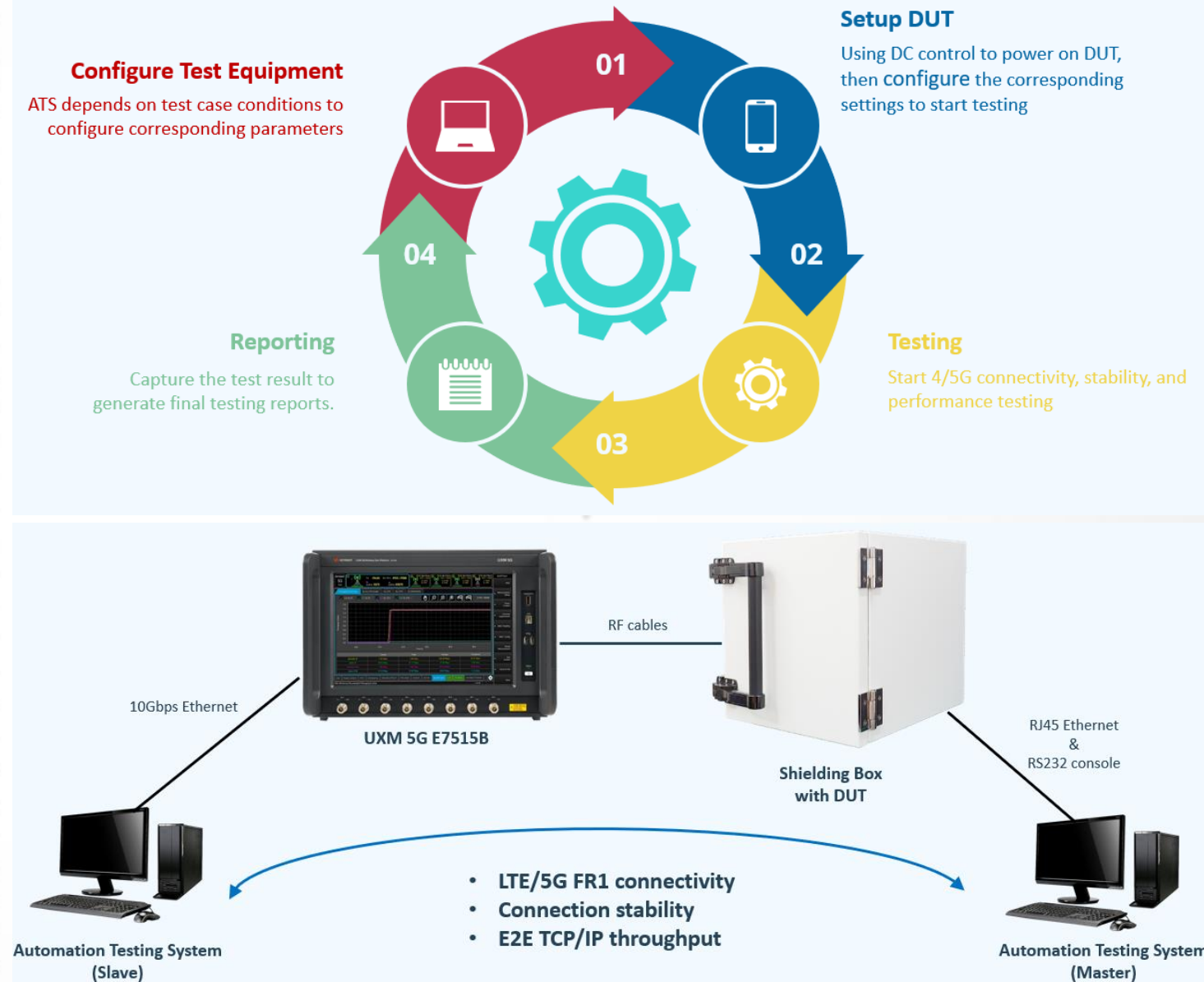
- Tester only fill LTE/5G CA combination settings to complete whole testing.
- Flexible for various LTE/5G product testing.

Reliability

- Avoid unintentional mistakes by tester
- Handle complex tasks dynamically and intelligently, based on predefined parameters

Reports

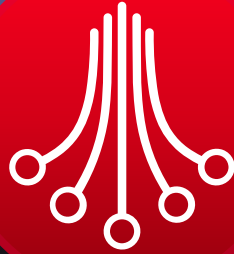
- Test reports include connectivity, stability, and performance.
- According to generated test report, we can easily figure out the product capability.



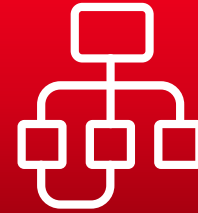
Let's Get Started at Keysight World!



First to Market
Solutions



A Wide Range of
Test Capability



One Architecture to
Connect your
Lifecycle



Access to the best
calibration and
support services



KEYSIGHT
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