5G - Chances and Challenges from Test & Measurement Perspective

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5G Industry Activities and Upcoming NR Deployments

5G Challenges

Component Testing @ cm/mm-wave

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- OTA Testing
- Security

Summary





Rohde & Schwarz: Deep & Broad Test Expertise Exemplary leading edge solutions



R&S®CMW500 Universal test platform for all common mobile communications and wireless technologies



R&S®RTO Fastest oscilloscope on the market with the world's first digital trigger



R&S[®]CLIPSTER Mastering station for video postproduction



R&S®QPS200 Latest generation millimeterwave security scanner for airports



R&S®ARDRONIS R&S®SDTR Drone detection and Military radio location system software def

R&S[®]SDTR Military radio based on state-of-the-art software defined radio (SDR) technology



R&S[®]SITLine ETH40G Fastest Ethernet encryptor (40 GBit/s)





2 specific use cases: → Fixed Wireless Access (FWA) → eMBB for Olympics

The Triangle of 5G Use Cases eMBB remains Priority 1

Massive IoT

- A diverse ecosystem (operators, manufacturers, local authorities, certification only for some technologies)
- Mix of technologies (GSM, Lora, Zigbee, WLAN, Bluetooth, Cat M, NB-IoT,...)
- It's all about cost efficiency and massive connectivity

eMBB Massive IoT Ultra reliable & low latency communication

eMBB - the known playground

- Established ecosystem (operators, manufacturers, certification of devices)
- Evolution from existing technologies (LTE-A, 802.11 ad) and revolutionary additions (cm- / mm-wave)
- I It's all about data (speed and capacity)

URLLC

- A significantly enhanced and diverse ecosystem (operators (?), manufacturers, verticals, certification not existing (yet))
- Existing technologies do not provide sufficient performance
- It's all about reliability and security (data and capacity)



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LTE provides the foundation on the way to 5G



Additionally a large variety of IoT applications with quite different communication requirements emerge



Automotive





eHealth

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5G Key Technology Components NR is build on four main pillars











5G Challenges

Example: PA Implementation Challenge

- Existing power amplifier designs need to be adapted
 - changed bandwidth requirements below 6 GHz
 - new design for broadband support at cm-/mm-wave frequencies (e.g. 28 GHz)
- Demanding requirements for T&M instruments (f, BW, EVM, flatness, ...)



General Purpose Test Solution User-Defined Frequency Response Correction



5G Challenges

Characterizing Massive MIMO / Beamforming Systems



Development challenges: Phase shifter tolerances, thermal effects of the PAs, frequency drifts between modules, desired beam patterns, ...

Test challenges:

OTA testing becomes the default use case, increased measurement uncertainty, 3D channel models, ...



Massive MIMO Drives OTA Test Solution Development





5G Challenges

cm-/mmWave spectrum requires new test solutions

- Vivaldi antenna with integrated diode detector for power measurements directly on the antenna
- Absolute power measurement
- Frequency range: 27.5 75 GHz
- Will be extended to 22 81 GHz





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5G Challenges Security is a major concern

CISCO Products & Services Support How to Buy Training & Events Partners

Service Provider / Network Intelligence /

5 key requirements for a secure 5G network



- · AT&T currently sees 11 billion security incidents each day
- As architecture evolves to support 5G networks it will open more vulnerabilities
- · A multi-layered and proactive approach is vital to minimize these threats

Carriers Navigate 5G, Mobile Security at Mobile World Congress While the latest and greatest smartphones and mobile consumer technology typically take

While the latest and greatest smartphones and mobile consumer technology typically take center stage at Mobile World Congress, this year was different.

With the pending transition from 4G to 5G and the rise of Internet of Things (IoT) security threats, carriers were focused squarely on ensuring their networks and service offerings were fortified against the evolving threat landscape.

All Eyes on Security

Ericsson: Tech Talk: 5G Security



against 5G networks could have severe consequences for society.

HDE&SCHWARZ

R&S Cybersecurity Solution



- CybersecurlTy is needed in processes, systems & components.
- Through the Digitalization in Industries there is no safety without security.

Detect

- Deep Packet Inspection delivers high accuracy application and protocol detection
- Early detection of problems that result from infected machine controls, misconfigurations or cyberattacks

Analyze

- Analysis of network and machine communication, correlation of data to visualize anomalies
- Event monitoring pinpoints issues for proactive troubleshooting without interfering with production processes



Endpoint security and trusted

Network analysis

Protect

- Allows only fully validated data traffic to enter the network
- All other data traffic is blocked from entering or leaving the industrial network environment



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End-to-end IoT Application Testing – Including Security



Summary

OTA testing is key to 5G and requires throughout integrated solutions including chambers, test instrumentation and coverage of LTE-A Pro

Security plays a vital role in vertical industries and is missing a test requirement and certification framework



Rohde & Schwarz is committed to supporting the industry with the T&M and security solutions needed to standardize, develop and implement 5G products



"Doing the right thing is more important than doing the thing right!" Peter Drucker



Typical test setup for 5G RF parametric measurements up to 40 GHz

